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Coal Combustion Residue Impoundment
Round 9 - Dam Assessment Report

H.F. Lee Steam Electric Plant

Active Ash Pond; Ash Pond 1; Ash Pond 2; Ash Pond 3
Progress Energy Carolinas, Inc.
Wayne County, North Carolina

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

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

This assessment of the stability and functionality of the H.F. Lee Steam Electric Plant's CCR management system encompasses the Active Ash Pond and three inactive ash ponds (Ash Pond 1, Ash pond 2, and Ash Pond 3). The discussion and conclusions are based on a review of available documents and on the site assessment conducted by Dewberry personnel on February 18, 2011. We found the supporting technical documentation adequate (Section 1.1.3). As detailed in Section 1.2.5, there are three recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Lee Ash Pond 1 (inactive) and Ash Pond 3 (inactive) are SATISFACTORY. The Active Ash Pond and Ash Pond 2(inactive) are FAIR for continued safe and reliable operation, with no recognized existing or potential management unit safety deficiencies.

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 (See Appendix C).

The purpose of this report is **to evaluate the condition and potential of residue release from management units that have or have not been rated for 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 H.F. Lee Steam Electric Plant that were reviewed and used in preparation of this report.

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

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

LIMITATIONS

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

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit, February 18, 2011, and review of technical documentation provided by Progress Energy.

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

The dike embankments and spillway on the Active Ash Pond appear to be structurally sound based on a review of the engineering data provided by the owner's technical staff and Dewberry engineers' observations during the site visit. It is noted that, one section of the embankment (AB-1) did not meet the minimum required standards for factors of safety. This embankment has cohesionless soils that will lead to surficial failures, but not deep-seated failures that could produce a dike breach.

Also, Pond 2 of the three inactive Ash Ponds was observed to have a significant area of scarp at the toe of the downstream embankment caused by erosion from the adjacent creek. Stabilization and protection against future erosion is recommended.

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

Adequate capacity & freeboard exists to safely pass the design storm.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The slope stability analysis provided adequate results for factors of safety for static and seismic loading conditions. All additional technical documentation appeared to be adequate. Engineering documentation reviewed is referenced in Appendix A.

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

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

1.1.5 Conclusions Regarding the Field Observations

The overall assessment of the ash pond embankment system was that it was in fair condition; however, on the Active Ash Pond the discharge showed a slight grey color against the silty orange flow in the river which Progress Energy Carolinas Inc. (PEC) stated they were monitoring and meeting discharge criteria. Embankments appear structurally sound.

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 active fly ash management unit. However, there were areas of seepage evident at the time of assessment along the eastern embankment of the active ash pond. According to documentation provided by the owner this seepage was repaired in 2009 by placement of geosynthetic liner and riprap on the face of the slope. The repair was expanded to adjacent areas in 2010. A plan to expand the repair again to adjacent side slopes was approved by North Carolina Department of Environment and Natural Resources (NCDENR) Dam Safety Division in March 2011. Repairs were made in May 2011.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate. The management unit dikes are instrumented. Six piezometers were installed in December 2007 for measuring ground water levels along the active ash pond.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

Ash Pond 1 (inactive) and Ash Pond 3 (inactive) are **SATISFACTORY;** the Active Ash Pond and Ash Pond 2 (inactive) are **FAIR for continued safe and reliable operation due to marginaly sufficient safety data.** The classification of FAIR means minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

Implementation of the following recommendations would help improve the rating. It is anticipated that the Active Ash Pond and Ash Pond 2 (inactive) would be considered satisfactory for continued safe and reliable operation upon two actions. One is remediation of the severe undercutting on Inactive Ash Pond 2. The second is periodic monitoring and testing to confirm stability of the Active Ash Pond embankment, and developing an action plan to buttress the AB-1 embankment to increase surficial factors of safety to meet all applicable standards and requirements. At the time of the site visit, repairs were planned to address seepage along the downstream slope of the Active Ash Pond. Since the visit, those repairs have been made and NCDENR has provided an Approval to Impound (Appendix A, Doc 11: Approval to Impound and Doc 12: Seepage Repair As-builts).

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

Periodic monitoring and testing consistent with the 2010 Limited Field Inspection, Lee Plant, dated 12/3/2010 (Appendix A, Doc 04: 2010 Inspection Report) is recommended for the Active Ash Pond. The proposed expanded seepage stabilization measures have been completed. After the initial site visit, an as-built drawing and NCDENR approval have been provided by PEC (Appendix A, Doc 11: Approval to Impound and Doc 12: Seepage Repair As-built).

Stabilization and protection against future erosion is recommended for Ash Pond 2 (in-active). No recommendations appear warranted at this time for Ash Pond 1 (in-active) and Ash Pond 3 (in-active).

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

No recommendations appear warranted at this time.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

Provide analysis of potential for liquefaction in Active Ash Pond embankment.

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

The following issues need to be addressed with routine maintenance:

- Remove woody vegetation along downstream slope of the Active Ash Pond;
- Properly fill one bore hole along crest;
- Repair, stabilize and protect from future erosion undercutting (scarp) along downstream slope of Ash Pond 2 (in-active);

1.2.6 Recommendations Regarding the Maintenance and Methods of Operation

No recommendations appear warranted at this time.

1.2.7 Recommendations Regarding the Surveillance and Monitoring Program

No recommendations appear warranted at this time.

1.2.8 Recommendations Regarding Continued Safe and Reliable Operation

- Analysis for potential of liquefaction should be performed.
- Develop an action plan to increase the factors of safety for the ash pond embankments at all locations to meet or exceed the minimum requirements for factors of safety for steady state (normal) and seismic loading conditions.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

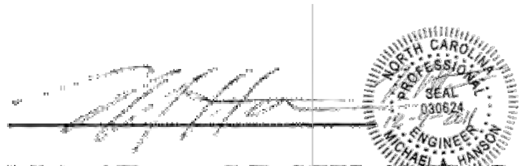
1.3.1 List of Participants

Fred Holt, Progress Energy
Julie Turner, Progress Energy
Robert Miller, Progress Energy
Bill Forster, Progress Energy
Wes Hare, NCDENR-DWM
Shawn McKee, NCDENR-DWM
Elizabeth Werner, NCDENR-DWM
Andy Schneider, NCDENR-Dam Safety

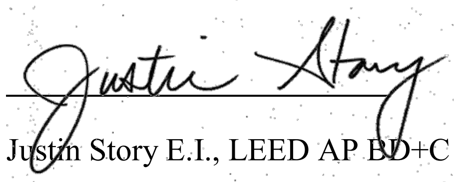
Robert Belvin, NCDENR-LQ
Pat McClain, NCDENR-LQ
Al Tice, MACTEC Engineering and Consulting, Inc. (MACTEC)
Michael Hanson, Dewberry
Justin Story, Dewberry

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on February 18, 2011.



Michael Hanson, P.E., LEED AP BD+C



Justin Story E.I., LEED AP BD+C

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

2.1 LOCATION AND GENERAL DESCRIPTION

The Lee Plant is located near the Neuse River approximately 3 miles west of Goldsboro, NC. Figure 2.1a depicts a vicinity map around the H.F. Lee Steam Electric Plant while Figure 2.1b depicts an aerial view of the Lee Plant.

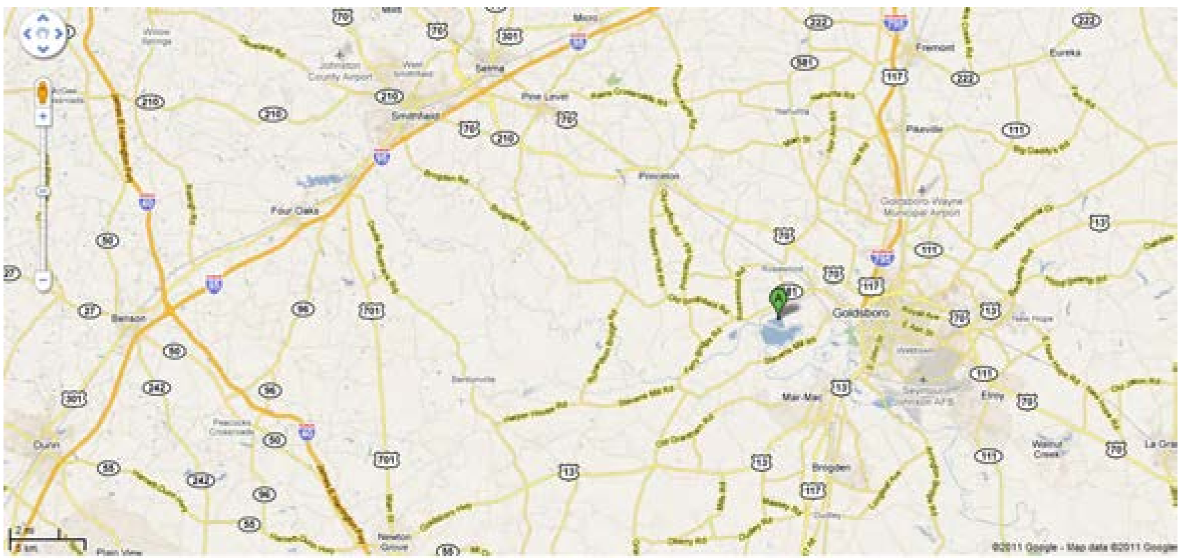


Figure 2.1 a: Lee Steam Power Station Vicinity Map

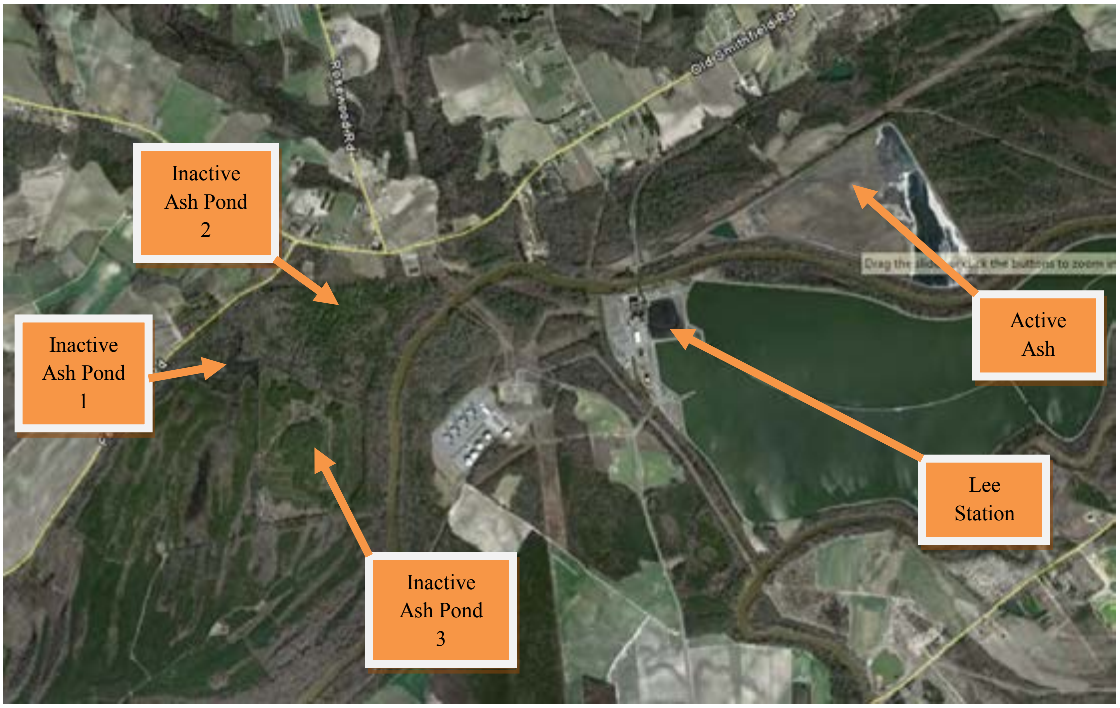


Figure 2.1 b: Lee Steam Power Station Aerial View

Table 2.1: Summary of Dam Dimensions and Size				
	Active Ash Pond	**Inactive Ash Pond 1**	**Inactive Ash Pond 2**	**Inactive Ash Pond 3**
Dam Height (ft)	20	5-7	12-15	8-10
Crest Width (ft)	12	14-20	14-20	12
Length (ft)	10,560	5,200	6,700	8,000
Side Slopes (upstream) H:V	2:1	2:1 to 3:1	2:1 to 3:1	2:1 to 3:1
Side Slopes (downstream) H:V	2:1	1.5:1 to 2:1	1.5:1 to 2:1	2:1 to 3:1

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is collected at the base of the stack by an electrostatic precipitator. The collected ash is stored in hoppers and conveyed pneumatically to a silo (see photo below). From the silo it is conveyed hydraulically in a pipe to the ash pond. The discharge into the ash pond is continuous. A flowchart for handling the fly ash is shown in Appendix A. (Doc 01 – Ash Handling System Overview).

Hopper and fly ash sluice line

2.2.2 Bottom Ash

Bottom ash is collected from the furnace and conveyed through the same pipe as the fly ash into the ash pond.

2.2.3 Boiler Slag

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

Boiler where boiler slag is discharged

2.2.4 Flue Gas Desulfurization Sludge

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

2.3 SIZE AND HAZARD CLASSIFICATION

The ash pond is impounded by an earthen embankment system consisting of a dike configuration. There is one active ash pond and three inactive ash ponds. Reference Table 2.1 for dam height, crest width, length and side slopes of all ponds. The maximum storage volume corresponding to the top of the embankment for the active ash pond is 1,980 acre feet and there is an estimated 6' of freeboard that currently exists before overtopping the crest (See Appendix A: Doc 02 – Ash Pond Summary). Per Table 2.3a the Size Classification of the active ash pond is Intermediate. No impoundment capacity information was provided for the inactive ash ponds, but as far as height classification they would all be in the small category. Ash Pond 1 (in-active), Ash Pond 2(in-active) and Ash Pond 3 (in-active) are mostly vegetated and Progress Energy is in the process of determining how to permanently close these ponds. Based on the height information provided Per Table 2.3a the Size Classification of the inactive ash ponds is Small.

Table 2.3a: USACE ER 1110-2-106
Size Classification

Category	Impoundment 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

A Hazard Classification of 'High' has been assigned by NCDENR to the Active Ash Pond. No Hazard Classification has been assigned by a regulatory agency for Ash Pond 1 (in-active), Ash Pond 2 (in-active) and Ash Pond 3 (in-active). Based on our observations, a Federal hazard classification of **Significant** appears to be appropriate for the Active Ash Pond and a Federal hazard classification of **Low** appears to be appropriate for the three inactive ash ponds.

Table 2.3b: FEMA Federal Guidelines for Dam Safety Hazard Classification		
	Loss of Human Life	**Economic, Environmental, Lifeline Losses**
Low	None Expected	Low and generally limited to owner
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

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

The active ash pond contains fly ash, bottom ash, pyrites and boiler slag. The inactive ash ponds no longer receive coal combustion residuals, but permanently contain the same materials. The drainage area is assumed to be the surface area of the ponds.

Table 2.4: Maximum Capacity of Unit	
Active Ash Pond	
Surface Area (acre)	143
Current Storage Capacity (cubic yards)	1,613,333
Current Storage Capacity (acre-feet)	1,000
Total Storage Capacity (cubic yards)	3,194,400
Total Storage Capacity (acre-feet)	1,980
Crest Elevation (feet)	90.0
Normal Pond Level (feet)	84.0

Based on report from 1999 prepared by Law Engineering and Environmental Services, Inc. (Appendix A: Doc 10 – Lee Plant Historical Document).

Capacity information for Ash Pond 1 (in-active), Ash Pond 2(in-active) and Ash Pond 3 (in-active) was not provided.

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The original material of the active Ash Pond embankment appears to be native soils based on Progress Energy's supplied Geotechnical data (Appendix A, Doc 06: Stability and Seepage Analysis).

No geotechnical data was provided for the three inactive ash ponds.

2.5.2 Outlet Structures

The outlet works consists of a 15-inch diameter vertical reinforce concrete pipe (RCP) riser with 15-inch diameter RCP pipe under the dike into secondary settling basin. A second 15-inch RCP riser and outlet pipe provide release to the Neuse River. Neither of the outlet pipes have seepage collars. (Appendix A, Doc 02: Ash Pond Summary)

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

All critical structures were located by using aerial photography which might not accurately represent what currently exists down-gradient of the site. The City of Goldsboro is approximately 3-4 miles. There are multiple churches, schools and other critical infrastructure within 5 miles down gradient. There is an additional critical infrastructure that can be found in Appendix A: Doc 03 – Lee 5 Mile Map.

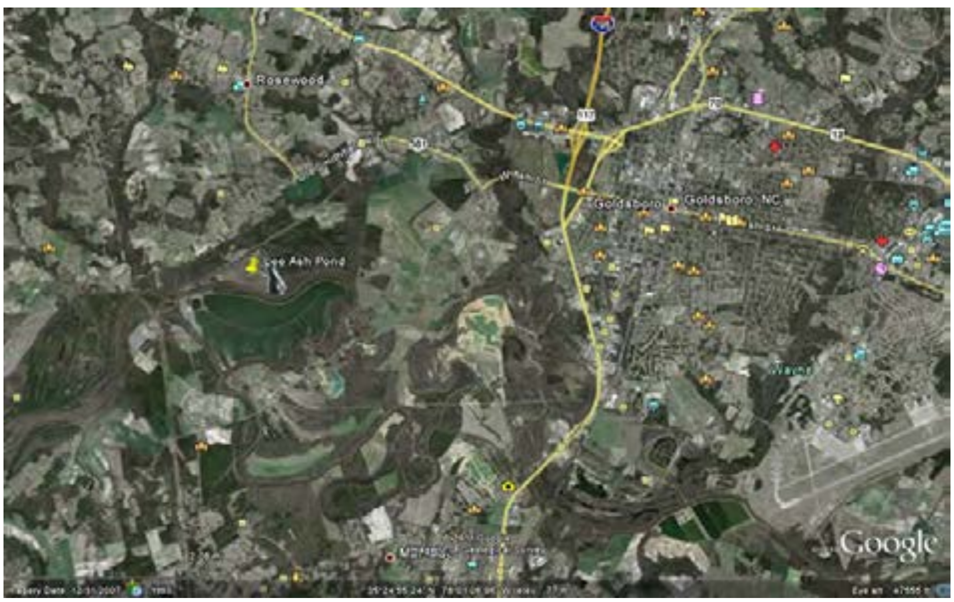


Figure 2.6: Critical Infrastructure Downstream of Lee Plant

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNIT

2010 Limited Field Inspection, Lee Plant, dated 12/3/2010. (Appendix A, Doc 04: 2010 Inspection Report)

- Drainage channels adjacent to the interior containment berms should be maintained by removal of vegetation and other obstructions to flow;
- Follow-up inspection should be provided during dry conditions at the site to confirm the extent of any additional seepage along the outside toe of the secondary settling basin. Extending the riprap slope stabilization may be warranted based on follow-up inspection;
- Continue to check the toe of the dike on the east side for beaver activities that could create ponding against the toe;
- Inspected recommended revisiting the site during a period with drier conditions to check seepage;
- Riprap stabilization should be extended at one location per an old inspection report.

Five-Year Independent Consultant Inspection, Lee Plant, dated 12/30/2009. (Appendix A, Doc 05: Five-Year Independent Consultant Inspection)

- Brushy vegetation and small trees on the lower parts of the slopes that were not cut by the spring mowing should be cut;
- Mowing to control vegetation growth in the riprap blanket repair areas on the interior slopes should continue on a regular schedule;
- The 1989 Dam Safety inspection report recommended that the perimeter dike be raised or the maximum pond operating level be adjusted downward to elevation 87.5 feet to safely accommodate the design storm. Progress energy has adopted the elevation 87.5 feet as the maximum operating level, and has typically operated the pond at elevations of about 83 to 85 feet in response to the 1989 recommendations;
- If the operating conditions arise such that the pond level needs to be raised to the maximum level of elevation 87.5 feet, at least four piezometers should be installed on the south dike to monitor changes in the phreatic surface as

the pond level rises. When the pond operating level is raised, water level readings should be obtained weekly for the first month after the raise, monthly for the next three months and quarterly for the next year. Readings should be furnished to Progress Energy engineers for review;

- Modify piezometer data sheets to include elevations of the water level.

3.2 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The dam is inspected by NCDENR Dam Safety and Division of Water Quality and the impoundment.

Discharge from the impoundment is regulated by the Federal National Pollutant Discharge Elimination Program (NPDES) and the impoundment has been issued a National Pollutant Discharge Elimination System Permit, Permit No. NC0003417.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry did not indicate any spills, unpermitted releases, or other performance related problems with the dam over the last 10 years.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

Construction began on September 1, 1978 and was completed in April of 1980 for the Active Ash Pond. Garrison Grading performed the construction work and testing during construction was performed.

The three inactive ponds were constructed in the 1950's and 1960's. No construction details were provided.

4.1.2 Significant Changes/Modifications in Design since Original Construction

No documentation for significant changes/modifications since original construction was provided.

The last of the three inactive ponds was taken out of service in 1980, when the Active Ash Pond was put into service.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

In 2000, intense rain, wind and flooding during Hurricane Floyd caused significant interior slope slumping and distress along part of the exterior slope. Repairs were made in 2000 based on a design by LAW with Allen Grading performing the construction.

No documentation was provided for significant repairs/rehabilitation for the three inactive ponds.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The ash ponds were designed and operated for sedimentation and sediment storage of fly ash. Plant process waste water, coal combustion waste, and minimal stormwater runoff around the Ash Pond facility are discharged into the Active Ash Pond. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff is discharged through an unregulated type overflow outlet structure. There is a cooling lake adjacent to the plant, but no direct waste streams that would carry coal combustion products are discharged into the cooling lake.

4.2.2 Significant Changes in Operational Procedures and Original Startup

In 1989 it was recommended that Progress Energy consider raising the perimeter dike 0.5 feet or lowering the operating level to 87.5 feet msl to allow safe accommodation of the design storm. Progress Energy has adopted the lower maximum operating level of elevation 87.5 feet (Appendix A: Doc 05 – Five-Year Independent Consultant Inspection).

The three inactive ponds were taken out of service in 1980 and have not been used since.

4.2.3 Current Operational Procedures

To the best of our knowledge, since Progress Energy lowered the maximum operating level of the pool to elevation 87.5 feet, the operating procedures have not changed.

4.2.4 Other Notable Events since Original Startup

No additional information was provided.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Michael Hanson, P.E., LEED AP BD+C and Justin Story E.I., LEED AP BD+C performed a site visit on Friday, February 18, 2011 in company with the participants.

The site visit began at 10:00 AM. The weather was cloudy and cool in the morning. Photographs were taken of conditions observed. Please refer to the Dam Inspection Checklist in Appendix B. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit.

The overall assessment of the dam was that it was in fair condition and only non-critical findings were noted.

5.2 ACTIVE ASH POND (WAYNE-022)

5.2.1 Crest

The crest had no signs of depressions, tension cracking, or other indications of settlement or shear failure and appeared to be in satisfactory condition. Filling of one bore hole was noted as being needed during field visit.

5.2.2 Upstream/Inside Slope

The upstream slopes are mostly vegetated with tall grasses and other wetland vegetation. The upstream slope is also embedded with stone/riprap held down by a geotextile fabric. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

Riprap and geotextile fabric along upstream slope

5.2.3 Downstream/Outside Slope and Toe

There were no signs of surficial sloughing, rill erosion or cause for concerns along the downstream slope and toe. The repair from 2000 due to seepage is complete and is being monitored. Repairs were made after the initial site visit that addressed seepage along the downstream slope (Appendix A, Doc 11: Approval to Impound and Doc 12: Seepage Repair As-builts). There were areas where a concrete buttress was along the downstream sloped, which was explained by Progress Energy to be a part of the original design. There were wetlands and drainage channels along the toe of the slope in areas.

Wetlands along downstream toe

Riprap at seepage location that was repaired

5.2.4 Abutments and Groin Areas

The ash pond embankment consists of a dike system completely surrounding the pond, therefore the earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features.

5.3 INACTIVE ASH POND 1 (WAYNE-031)

5.3.1 Crest

The crest had no signs of depressions, tension cracking, or other indications of settlement or shear failure and appeared to be in satisfactory condition.

Typical view of crest, upstream and downstream slope

5.3.2 Upstream/Inside Slope

The upstream slopes were heavily vegetated. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

5.3.3 Downstream/Outside Slope and Toe

The downstream slopes were heavily vegetated. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

5.3.4 Abutments and Groin Areas

The ash pond embankment consists of a dike system completely surrounding the pond, therefore the earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features.

5.4 INACTIVE ASH POND 2(WAYNE-032)

5.4.1 Crest

The crest had no some minor depressions, but no tension cracking, or other indications of settlement or shear failure and appeared to be in satisfactory condition.

5.4.2 Upstream/Inside Slope

The upstream slopes were heavily vegetated. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

5.4.3 Downstream/Outside Slope and Toe

The downstream slopes were heavily vegetated. There were 2 areas observed showing significant undercutting along the east side of the embankment where an active stream flows at the toe.

Significant erosion was occurring downstream of this picture

5.4.4 Abutments and Groin Areas

The ash pond embankment consists of a dike system completely surrounding the pond, therefore the earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features.

5.5 INACTIVE ASH POND 3 (WAYNE-033)

5.5.1 Crest

Several areas along the crest will hold 6-12" of runoff which should be remediated and monitored. Other than that, the crest had no significant signs or other indications of settlement or shear failure and appeared to be in satisfactory condition. The entire embankment was not observed because inaccessibility due to dense vegetation.

5.5.2 Upstream/Inside Slope

The upstream slopes were heavily vegetated. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed. The entire embankment was not observed because inaccessibility due to dense vegetation.

5.5.3 Downstream/Outside Slope and Toe

The downstream slopes were heavily vegetated. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed. The entire embankment was not observed because inaccessibility due to dense vegetation.

5.5.4 Abutments and Groin Areas

The ash pond embankment that we were able to visually observe consists of a dike system completely surrounding the pond, therefore the observed earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features. However, it was noted that the side that we were unable to observe is a small rise (hillside).

5.6 OUTLET STRUCTURES

5.6.1 Overflow Structure

The outlet works consist of a 15-inch diameter vertical reinforced concrete pipe (RCP) riser with 15-inch diameter RCP pipe under the dike that discharges into the secondary settling basin. A second 15-inch RCP riser and outlet pipe provides release to the Neuse River. Neither of the outlets have seepage collars.

No information was provided on the three inactive ponds, but the riser structures are not being maintained and appear to be clogged with debris. The actual discharge capacity of each outfall is unknown.

5.6.2 Outlet Conduit

The visual portion of the outlet conduit was functioning properly with no apparent deterioration. Progress energy reported having lined the discharge pipe due to a joint failure exterior to the Ash Pond (date was not provided). The discharge water appeared grey against the background orange silt coloration of the Neuse River. When questioned on this Progress Energy indicated they were monitoring and meeting discharge quality criteria.

The three inactive ponds are no longer in service and should only be discharging stormwater runoff. No discharge was observed during the site visit.

5.6.3 Emergency Spillway

No emergency spillway is present.

5.6.4 Low Level Outlet

No low level outlet is present.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the flood of record. The Ash Pond is a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore the impounded pool would not be anticipated to experience significant flood stages. It was noted that during 2000 when Hurricane Floyd hit, some significant slope failure occurred without release of ash or water. Repairs were enacted and monitoring continues.

6.1.2 Inflow Design Flood

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

Table 6.1.2: USACE Hydrologic Evaluation Guidelines Recommended Spillway Design floods

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

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

The 24 hour 10 square mile PMP depth is 41 inches. Since the facility has a contributing drainage area equal to the surface area of the impoundment, it is anticipated adequate freeboard exists so the facility would not experience significant flood states.

For the inactive ash ponds, no estimated storage capacity was provided.

6.1.3 Spillway Rating

No spillway rating was provided. The Ash Ponds are a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore the impounded pool would not be anticipated to experience significant changes in elevation. The outlet structure type is unregulated and, given little change in the normal pool elevation, the resulting discharge rate is expected to be relatively constant.

6.1.4 Downstream Flood Analysis

A dam breach analysis and inundation map development was performed for the site and the result was that there could potentially be two bridges and a mobile home community that could be affected if a breach occurred on the eastern side of the ash ponds. It was determined that a breach along the western side would result in a discharge into the cooling lake, which would have very little effect in the water level of the lake. (See Appendix A, Doc 10: Lee Ash Pond Inundation Report).

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry is adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Adequate capacity and freeboard exists to safely pass the design storm.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

A stability analysis report for the ash pond dated February, 2011 by MACTEC Engineering and Consulting, Inc. provides information on the stability analysis results and is presented in Section 7.1.4 Factors of Safety and Base Stresses. Steady state (normal) and seismic loading conditions were analyzed. See Appendix A (Doc 06 - Stability and Seepage Analysis) for the complete report.

No documentation was provided for the three inactive ponds.

7.1.2 Design Parameters and Dam Materials

A report for the ash pond was prepared by MACTEC Engineering and Consulting, Inc. in 2011. The report includes documentation of the shear strength design properties and dam materials for the ash pond embankments, which is included in this report and is presented in the following section; see Appendix A (Doc 06 - Stability and Seepage Analysis.pdf) for the complete report.

Test results showing the strength parameters of the embankments are presented below. The results present generally acceptable values for these types of materials.

No documentation was provided for the three inactive ponds.

Table 4a
Soil Properties for Stability Analysis (Section AB-1)

Soil Description (USCS Classification)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion (psf)	Fiction Angle (degrees)
Sedimented Ash	100	105	0	30
Dike Fill: (SM)	120	125	0	32
Dike Fill: (CH)	120	125	10	36
Dike Fill: (SC)	120	125	10	37
Foundation Soil: Clay (CL)	120	125	0	35
Foundation Soil: Sand (SP)	120	120	0	31
Foundation Soil: Sand (SM)	120	120	0	36

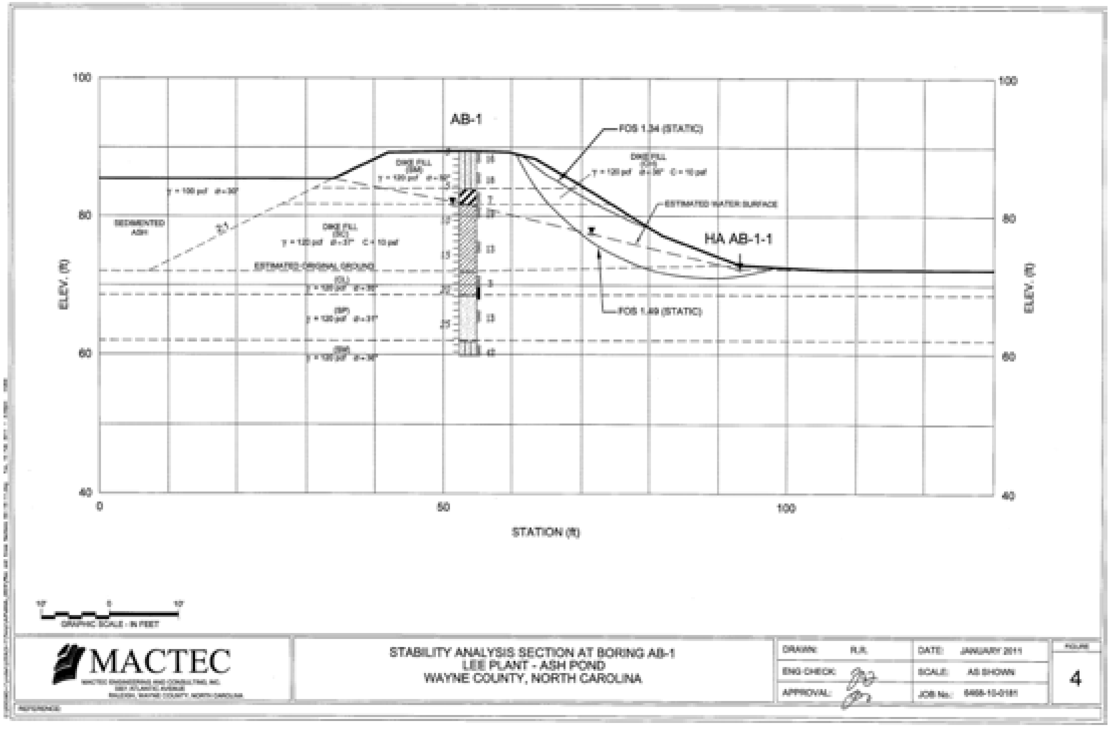


Figure 7.1.2a: Stability Analysis Section (AB-1)

Table 4b **Soil Properties for Stability Analysis (Section AB-2)**				
Soil Description (USCS Classification)	**Moist Unit Weight (pcf)**	**Saturated Unit Weight (pcf)**	**Cohesion (psf)**	**Fiction Angle (degrees)**
Sedimented Ash	100	105	0	30
Dike Fill: (SC)	120	125	10	37
Dike Fill: (CL-CH, CL)	120	125	10	37
Dike Fill: (SC)	120	125	10	37
Foundation Soil: Clay (CL)	120	125	0	35
Foundation Soil: Sand (SP)	120	120	0	33

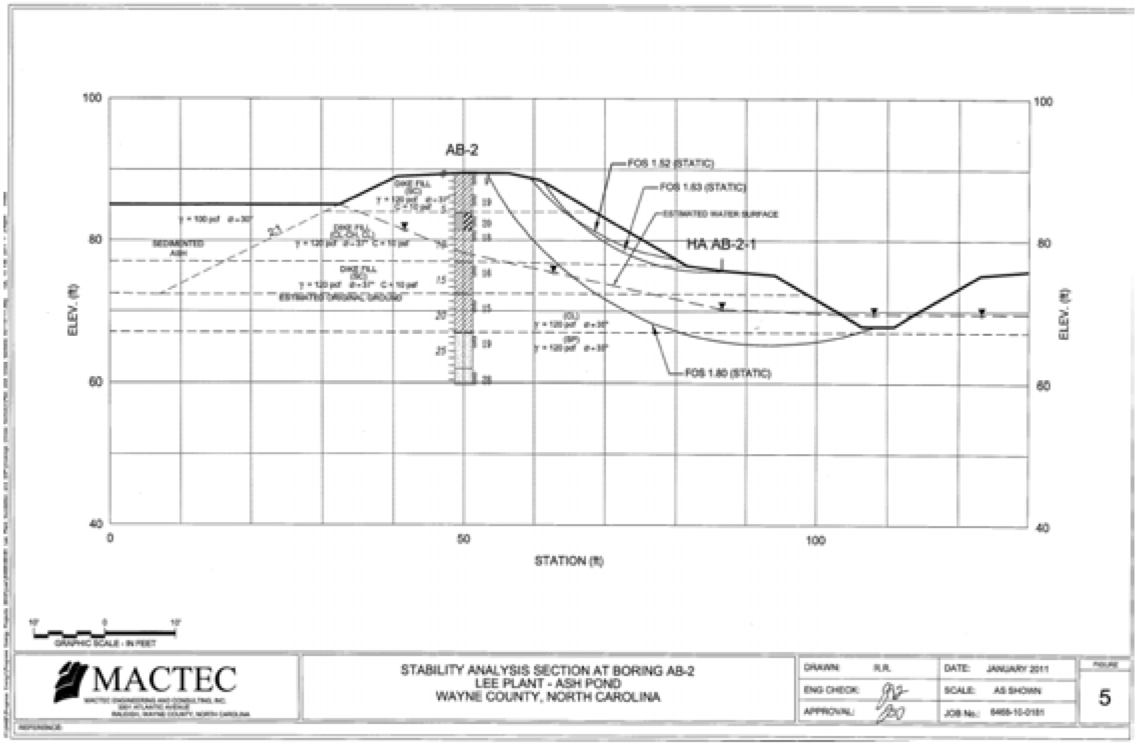


Figure 7.1.2b: Stability Analysis Section (AB-2)

Table 4c Soil Properties for Stability Analysis (Section AB-3)				
Soil Description (USCS Classification)	**Moist Unit Weight (pcf)**	**Saturated Unit Weight (pcf)**	**Cohesion (psf)**	**Fiction Angle (degrees)**
Sedimented Ash	100	105	0	30
Dike Fill: (CL)	120	125	10	37
Foundation Soil: Clay (CL-CH)	120	125	0	35
Foundation Soil: Clay (CL)	120	125	0	30
Foundation Soil: Sand (SP)	120	120	0	33

FINAL

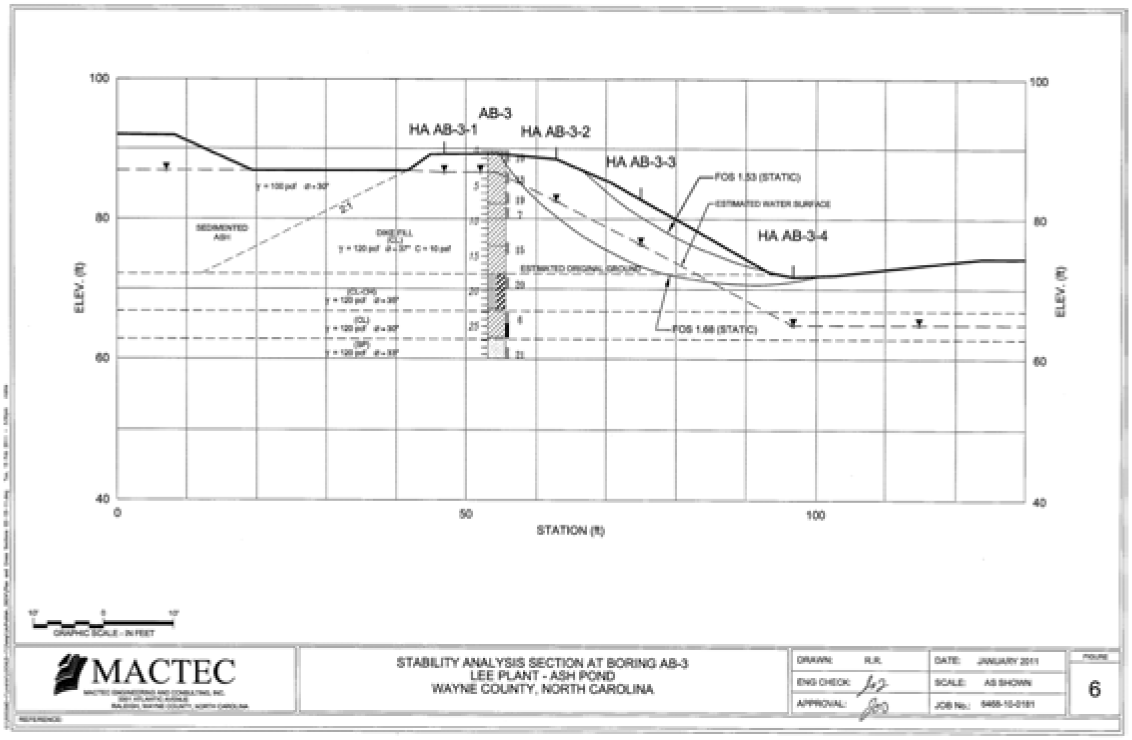


Figure 7.1.2c: Stability Analysis Section (AB-3)

Table 4c Soil Properties for Stability Analysis (1999 Section)				
Soil Description (USCS Classification)	**Moist Unit Weight (pcf)**	**Saturated Unit Weight (pcf)**	**Cohesion (psf)**	**Fiction Angle (degrees)**
Dike Fill	130	135	200	30
Coastal Plain Sediments	115	120	100	32

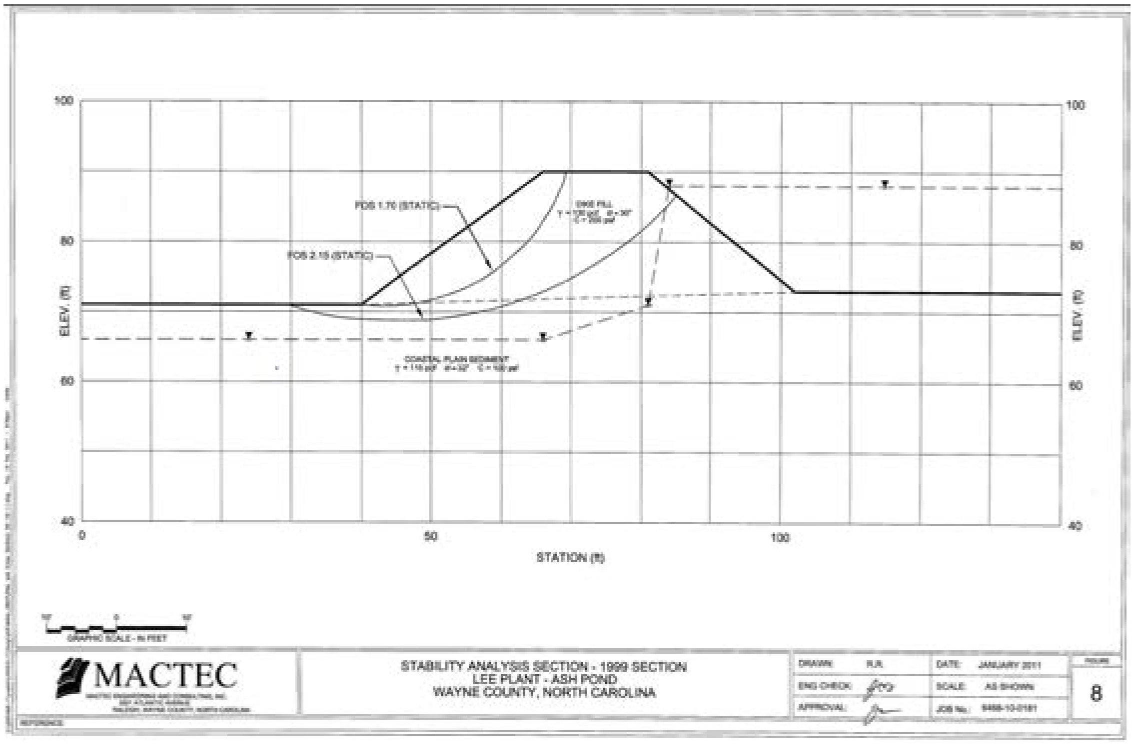


Figure 7.1.2d: Stability Analysis Section (1999 Section)

7.1.3 Uplift and/or Phreatic Surface Assumptions

Monitoring instrumentation devices have been installed to verify water levels within the embankment. The assumed phreatic surfaces are shown on the figures in section 7.1.2 above and the depiction seems appropriate for these types of structures. A full summary of the phreatic surface analysis can be found in Appendix A. (Doc 06 - Stability and Seepage Analysis). The water level of the Active Ash Pond was stated to be 84.0'. This elevation was not verified.

No documentation was provided for the three inactive ponds.

7.1.4 Factors of Safety and Base Stresses

Table 7.1.4 – FACTORS OF SAFETY AGAINST SLOPE FAILURE		
	Factor of Safety	
	Static	Seismic
Ash Pond – Section AB-1	1.49	1.23
Ash Pond – Section AB-1	1.34	1.13
Ash Pond – Section AB-2	1.80	1.45
Ash Pond – Section AB-2	1.52	1.29
Ash Pond – Section CB-3	1.68	1.39
Ash Pond – Section CB-3	1.53	1.29
Ash Pond – 1999 Section	2.15	1.77
Ash Pond – 1999 Section	1.70	1.49

Section AB-1's factor of safety does not meet the minimum standard of 1.5, but in the report by MACTEC it states that this section was analyzed for failure surfaces constrained within the dike. This failure surface is a result of very shallow-depth circles and does not represent a potential for deep seated failures that would lead to a breach of the dike (Appendix A: Doc 06 – Stability and Seepage Analysis).

No documentation was provided for the three inactive ponds.

7.1.5 Liquefaction Potential

No liquefaction potential documentation was provided.

7.1.6 Critical Geological Conditions

The site is located in a transition from the Piedmont to Coastal Plain. It is in a Seismic Zone 1 according to the Corp of Engineers with a design earthquake of ah=0.025g.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate based on MACTEC's explanation of the failure and our independent review of their analysis..; Due to the surficial nature of the failures we would not recommend further buttressing of Section AB-1.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the dam appears to be Fair given the lack of liquefaction analysis and the surficial failures under static load identified by the MACTEC analysis.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

Operational procedures are adequate.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

The maintenance of the dam and project facilities was adequate.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on the assessments of this report, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Discussion of maintenance procedures

Based on the assessments of this report, operation procedures seemed to be adequate.

Based on the assessments of this report, maintenance procedures appear to be adequate.

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Surveillance procedures appear to be adequate.

Monthly Inspections:

Monthly inspections were provided by Progress Energy and can be found in Appendix A: Doc 07 & 08

Annual Inspections:

Annual inspections were provided by Progress Energy and can be found in Appendix A: Doc 04: 2010 Inspection Report

Five-Year Inspections:

Five-Year inspections reports were provided by Progress Energy and can be found in Appendix A: Doc 05: Five-Year Inspection

9.2 INSTRUMENTATION MONITORING

Water level observation casings installed are adequate for monitoring the phreatic surface. Hand auger bores to check for presence of water or wet soils at the toe of the slope is also used.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

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

9.3.2 Adequacy of Instrumentation Monitoring Program

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

APPENDIX A

Document 1

Ash Handling System Overview

System Purpose

The ash handling system consists of two major components: the bottom ash conveyor and the fly-ash conveyor. Because the characteristics of ash are very different from the front to the back of the boiler, the collection and transport are separate for the furnace bottom ash and collection points downstream. Both systems are essential in complying with air emission permits and eliminating river water pollution. Without effective ongoing removal of ash, the boiler unit would require outages to remove the ash. A wet bottom ash system collects and removes ash from the furnace. Bottom ash is a mixture of slag, clinkers and coarse granular ash. Bottom ash is produced during combustion by impurities contained within coal. The system uses water impounding for the following reasons:

· To break up large pieces of slag by thermal shock as they fall into the pool of ambient temperature water.
· To keep the ash and slag submerged so that they do not fuse into large unmanageable masses that would result if they were exposed to furnace heat

The fly-ash system collects ash particles that drop out of the flue gas when the gas changes direction abruptly in the back pass and air heater ducts and is collected in hoppers along the flue gas outlet passage and precipitator. If this ash were allowed to exit at the stack, opacity readings would be out of compliance.

System Flow Path

Bottom Ash Removal : The bottom ash system begins in the furnace. Ash continuously falls into a water impounded ash hopper from the furnace above. The bottom ash hopper, which is designed with sloped sides for gravity flow, collects the ash. Water jets assist the removal of ash deposits from the ash hopper. The ash is changed to slurry form during the ash removal process. A manually operated vertical lifting door (inner door) in the dog house is opened to allow removal of bottom ash. During ash removal operations, the inner door and a pneumatically operated bottom ash supply valve are opened and the ash slurry is drawn from the hopper through the clinker grinder using a jetpulsion pump. High-pressure water from the ash pumps flows through the jetpulsion pump. The jet pump acts as a nozzle, increasing the velocity and creating a vacuum inside the jet pump nozzle. The vacuum draws the bottom ash slurry from the clinker grinder through the jet pump and discharges to the ash pond. The clinker grinder reduces any lumps or clinkers to a size, which will pass through the jetpulsion pump, and into the ash sluice line. The ash sluice line, located in a concrete trench below plant grade level, transports the ash away from the plant to the ash pond area.

Fly Ash Removal - This system consists of precipitator hoppers, economizer hoppers and air heater hoppers. The economizer hoppers are set directly beneath the economizer where the flue gas is exiting the boiler. They are located in a space where the flue gases change direction. This change in direction of the gas flow causes large particulates to fall out of the gas and accumulate in the hoppers. The air heater hoppers beneath the air pre-heaters have been disconnected from the fly ash system. The discharge from the air heater hoppers is piped to the bottom ash and is only set-up when washing the air heaters. The precipitator collects ash on the electrically charged plates and electrodes. Rappers and vibrators knock the dust off the plates and electrodes where it is collected in the hoppers. Fly ash is pneumatically conveyed from each hopper. The airflow necessary for conveying the ash is created by a hydroveyor

exhauster and air intake valves on each of the lines serving the dust hoppers. The fly ash and conveying air mix with water in the
inlet section of the hydroveyor exhauster and are discharged into an air separator tank. Conveying air after being separated from the fly ash is vented to the atmosphere. The ash-water slurry discharges by gravity from the air separator to a common header with Unit 2. The ash-slurry mixture is pumped through a jet pump to the ash pond. Figure 1 below is an illustration of the fly ash removal system.

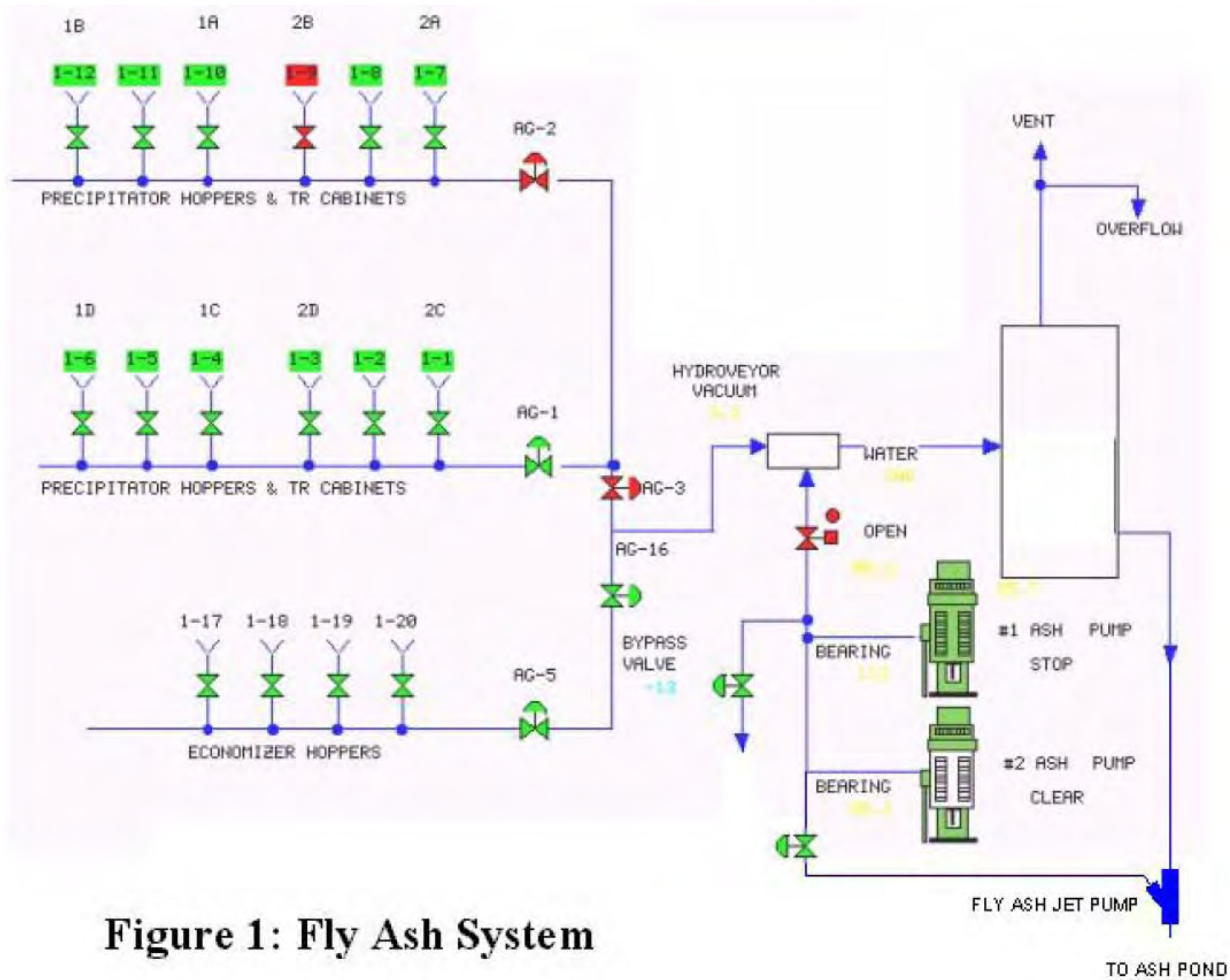


Figure 1: Fly Ash System

APPENDIX A

Document 2

Ash Pond Summary

DAM INFORMATION SUMMARY
H. F. Lee Steam Electric Plant
Ash Pond
Wayne County, North Carolina

1. Location

Located across Neuse River from plant

Latitude:	N3.37915
Longitude:	W78.0698°
NC Dam Number:	Wayne-022

2. Size and Dimensions

Length:	2 miles
Maximum Structural Height:	20 feet
Surface Area:	143 acres
Storage capacity:	1,980 acre feet
Size Classification:	Medium
Hazard Classification:	High
(Based on NC Dam Safety Inventory and Regulations)	
Regulatory Design Storm	½ PMP*
US Slope:	2.0(H):1(V)
DS Slope:	2.0(H):1(V)
Crest Width:	12 feet
Crest Elevation:	90.0 feet
Normal Pool Elevation:	84.0 feet in 2010
Maximum Design Level:	88.0 feet
Instrumentation:	None

*Probable Maximum Precipitation (PMP) is 41 inches over 24 hours. ½ PMP is 20.5”. 100-year storm is 8.5” over 24 hours.

3. Geology and Seismicity

Located in transition from Piedmont to Coastal Plain

Zone 1 seismic zone according to Corps of Engineers with
Design Earthquake: $a_h = 0.025$ g

4. Design Information

Design plans prepared by CP&L. Subsurface exploration performed. Stability analyses performed by CP&L in 1989 using soil properties measured from original explorations

Steady State Seepage with pool elev. at 88 feet:	FS = 1.77
Steepest slopes:	FS = 1.34

Additional evaluation by LAW in 1999 concluded FS of 1.57 to 2.25 based on new field data.

Seepage analysis performed with indicated negligible amount. No internal drainage provided.

MACTEC
3301 Atlantic Avenue, Raleigh, NC 27604

Updated 1-25-11

Outlet works consist of 15-inch diameter vertical reinforced concrete pipe (RCP) riser with 15-inch diameter RCP pipe under dike into secondary settling basin. A second 15-inch RCP riser and outlet pipe provide release to the Neuse River. Neither of the outlet pipes have seepage collars.

With pond at design level, outlet works can pass a storm of ½ PMP, but water level rises to within 3 inches of crest. Progress Energy has made a decision to not raise the pond level above its present elevation, which provides up to 5 feet of storage for the design flood.

5. Construction History

1978-1980: Construction started on September 1, 1978 and completed April, 1980. Construction was done by Garrison Grading. Testing during construction was performed.

1984, 1994: Repairs to local sloughs on interior slopes.

2000: Intense rain and wind during Hurricane Floyd accompanied by record floods on Neuse River caused significant interior slope slumping and distress along part of exterior slope. Repairs were made in 2000, designed by LAW and constructed by Allen Grading.

2004: The riser in the main pond fell over in 2004 and was replaced with a new riser. No impacts on the dam occurred.

2006-2007: Progress Energy completed work on providing additional ash storage capacity within the existing ash pond area.

2009: Repairs made to local seepage area on secondary settling pond exterior dike. Major clearing of brush and trees on exterior dike slopes.

2010: Additional rip rap added to area of local seepage on secondary settling pond exterior dike, adjacent to 2009 area.

6. Inspection History

The dam is inspected on 5-year intervals. Since 2002, yearly site visits have been made for limited visual observations.

William Wells:	*1979*
Ralph Fadum:	*1984*
LAW/MACTEC:	*1989*, *1994*, *1999*, 2000, 2002, 2003, *2004*, 2005, 2006, 2007, 2008, *2009*, 2010. Italics indicate 5-year inspections.

7. Current Issues

The 2010 annual inspection noted no significant issues were noted.

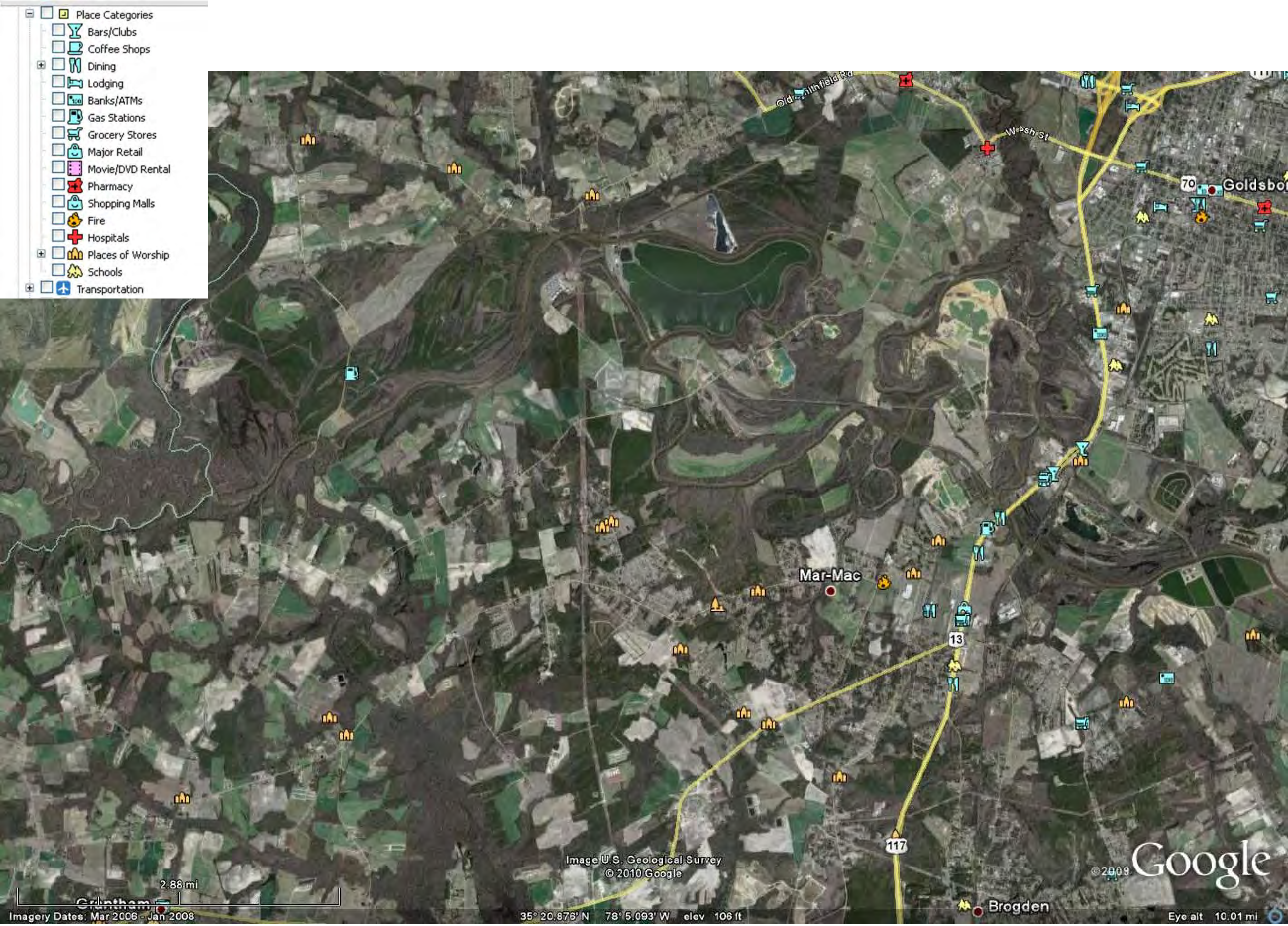
8. Overall Condition

The 2009 5-year inspection indicated the ash pond dikes were in satisfactory condition. The 2010 inspection found no significant change in condition of the ash pond dikes from the 2009 five-year inspection..

APPENDIX A

Document 3

Lee 5-Mile Map


Place Categories
Bars/Clubs
Coffee Shops
Dining
Lodging
Banks/ATMs
Gas Stations
Grocery Stores
Major Retail
Movie/DVD Rental
Pharmacy
Shopping Malls
Fire
Hospitals
Places of Worship
Schools
Transportation
Old Smithfield Rd
W Ash St
70
Goldsbo
Mar-Mac
13
117
Brogden
Image U.S. Geological Survey
© 2010 Google
©2009
Google
2.88 mi
Imagery Dates: Mar 2006 - Jan 2008
35° 20.876' N 78° 5.093' W elev 106 ft
Eye alt 10.01 mi

APPENDIX A

Document 4

2010 Inspection Report

MACTEC
engineering and constructing a better tomorrow

December 3, 2010

Mr. Bill Forster
Progress Energy
7001 Pinecrest Road
Raleigh, North Carolina 27613

**Subject: REPORT OF 2010 LIMITED FIELD INSPECTION (2010)
COOLING LAKE DIKE AND ASH POND DIKES
LEE PLANT, WAYNE COUNTY, NORTH CAROLINA
MACTEC PROJECT NO. 6468-10-0025 (07)
H. F. LEE COOLING LAKE DAM – STATE ID NO. WAYNE-009
H. F. LEE ACTIVE ASH POND – STATE ID NO. WAYNE-022**

Dear Mr. Forster:

On February 16, 2010, Mr. Scott Auger and James Schiff of MACTEC Engineering and Consulting, Inc. (MACTEC) visited the Lee Plant to perform a limited field inspection of the Ash Pond Dike and the Cooling Lake Dike. Mr. Dennis Cole and Mr. Ricky Miller served as the primary contacts and coordinated inspection activities during the visit. Representatives from the North Carolina Department of Environment and Natural Resources, Division of Land Resources, Dam Safety Program, were on site to assess the dikes at the time of this inspection. Prior to the inspection, we reviewed the 2009 5-year Independent Consultant Inspection Report to confirm observations from previous inspections.

Effective January 1, 2010, regulatory oversight was transferred from the North Carolina Utilities Commission (NCUC) to the North Carolina Department of Environment and Natural Resources, Division of Land Quality, Land Quality Section, Dam Safety Program (NCDENR Dam Safety). The dams and dikes covered by this inspection report are included in the NCDENR Dam Safety inventory as follows:

State ID No.	State Dam Name	State Hazard Potential Description
WAYNE-009	H.F. Lee Power Station Cooling Lake Dam	High
WAYNE-022	H. F. Lee Active Ash Pond	High

The field inspection included a discussion of plant inspection and maintenance activities since the last inspection visit, review of available records and a driving/walking reconnaissance tour of the dikes. The weather conditions during the inspection were generally clear and cool. Some slight precipitation had occurred the day before, and the ground conditions were generally wet from recent heavy rainfall. We observed that the Neuse River was at a fairly high stage. This letter report summarizes the observations during the current inspection and provides our recommendations for follow-up actions. Photographs of selected conditions and updated Progress Energy condition assessment forms are also included with this report by attachment.

The last 5-year Independent Consultant Inspection was performed by MACTEC in 2009 and the next is scheduled for 2014.

The results for follow-up site visits by MACTEC are included in this report as follows:

- On August 30, 2010, Mr. J. Allan Tice of MACTEC performed a follow-up site visit to check for seepage conditions associated with the area of previous riprap stabilization provided for the toe of the Cooling Pond dike.

- On October 10, 2010, MACTEC performed a follow-up site visit to check seepage conditions for the Ash Pond secondary settling basin under dry site conditions.

- On November 10, 2010, Mr. Scott Auger of MACTEC performed a follow-up site visit to update plant response to recommendations identified from the annual inspection. The results for this follow-up site visit are noted with the recommendations in this report. Contact was made with Mr. Dennis Cole for discussion and review of status.

SUMMARY

Based on the field observations noted in this report, the Ash Pond Dike and Cooling Lake Dike generally appear to be stable and in satisfactory condition. For this inspection, we observed a significant improvement in maintenance of vegetation growing on the dikes.

During 2009, riprap was placed along the outside toe of slope for the secondary settling basin.

The recommendations that require follow-up action from the current inspection are summarized as follows:

Reference No.	2010 Inspection Recommendations	Recommended Implementation Schedule	
AP-2010-1	Drainage channels adjacent to the interior containment berms should be maintained by removal of vegetation and other obstructions to flow.	Channels should be cleared as frequently as necessary to maintain flow	Reviewed during follow-up visit on 11/10/10. No maintenance performed during 2010. Plant will address this as a routine maintenance activity.
AP-2010-2	Follow-up inspection should be provided during dry conditions at the site to confirm the extent of any additional seepage along the outside toe of the secondary settling basin. Extending the riprap slope stabilization may be warranted based on follow-up inspection.	Engineering plan to be completed during 2010. Recommend implementation with dry weather in 2011.	MACTEC provided a follow-up inspection 10/10/10. Authorization provided to prepare engineering plan for extending riprap.
AP-2010-3	Continue to check the toe of the dike on the east side for beaver activities that could create ponding against the toe.	During dryer season of the year in 2010	Reviewed during follow-up visit on 11/10/10. Plant reported that there is active beaver activity and plans to address as routine maintenance activity.
CP-2010-1	MACTEC should provide a follow-up inspection to check the seepage for the riprap		MACTEC (Al Tice) provided a follow-up

	blanket at the toe of the north dike during a period with drier conditions at the site.		inspection on 8/30/10 and the report is included as Appendix B.
CP-2010-2	The MACTEC inspection report for the follow-up inspection on 8/30/10 indicates that riprap stabilization should be extended.	Riprap has been extended as maintenance activity.	Reviewed during follow-up visit on 11/10/10. Confirmed that additional riprap has been placed as recommended by Tice.

RECORDS

The plant is continuing to perform routine driving inspections of the ash pond and cooling reservoir areas on a weekly basis. Plant environmental personnel also check the ash piping and discharge at the ash pond on a daily basis.

We confirmed with plant personnel that routine inspections are being performed consistent with the Lee Plant Dam and Dike Inspection Procedure, EXEV-LEEC-00033, Revision 0, dated September, 2009. Plant inspection reports from November 2009 to February 2010 were reviewed. No significant concerns for the condition of the dikes were noted from review of these reports.

Ash Pond Piezometers

In December 2007, MACTEC installed six piezometers for monitoring groundwater level for the ash pond secondary containment in the area where seepage and slope stability concerns have been identified by inspection. The water level readings since initial installation have been recorded by the plant consistent with discussion for the Cooling Lake.

The locations for the Ash Pond piezometers are shown on Exhibit 6 from the 2009 5-year inspection report (included in Appendix C) and further described as follows:

- Piezometers No. P1 and P4 are located along the crest of the dike.
- Piezometers No. P2 and P5 are located on the exterior slope of the dike.
- Piezometer No. P3 and P6 are located at the toe of the dike.

For this report, the most current data is compared to the selected previous readings for review in Appendix C, Table C1. We have also included a plot of the data with Table C1 to facilitate review and assessment of any apparent trends. The plotted data indicates that the piezometer water levels were elevated around the time of the inspection but have returned to a more normal level based on review of readings obtained after the annual inspection.

Cooling Lake Piezometers

In December, 2002, eight piezometers were installed on the north side of the Cooling Lake Dike in the area where seepage and boils had been observed (near dike Station 154). Piezometer readings are obtained by the plant on a quarterly basis in conjunction with the documented inspection. During the current inspection visit, plant personnel obtained readings for these piezometers which appeared to be elevated. We have also included piezometer readings obtained by the plant on 5/6/10 and 8/30/10 for this report.

The locations for the Cooling Lake piezometers are shown on Exhibit 13 from the 2009 5-year inspection report (included in Appendix C) and further described as follows:

- Piezometers No. P1, P2, P3 and P7 are located along the crest of the dike.
- Piezometers No. P4 and P5 are located on the exterior slope of the dike.
- Piezometer No. P6 is located in the rip rap near the toe of the dike.
- Piezometer No. P8 is located at the toe of the dike near the riprap.

The plant maintains a record of the Cooling Lake piezometer data for comparison of the current readings with the previous readings. For this report, the most current Cooling Lake piezometer data is provided in Appendix C, Table C2. We have also included a plot of the data with Table C2 to facilitate review and assessment of any apparent trends. From our review of the data, we noticed a trend toward slightly elevated water levels over the period of record for piezometer P6, located in the rip rap at the toe of the dike. The trend line is included with the data plot for piezometer P6 based on linear regression of the data. We also noticed that the water levels for piezometers located on the crest of the dike (P1, P2, P3, and P7) were elevated around the time of the inspection and have since returned to more normal levels.

<u>Cooling Lake Discharge Structure Monitoring</u>

Monitoring points are provided to check for movement of the concrete discharge structure at the Cooling Lake in conjunction with the 5-year dam safety inspections. The last readings were recorded by McKim and Creed in July, 2009. The discharge structure showed no visible change from previous inspections.

ACTIVITIES SINCE 2009 INSPECTION

Removal of trees on the exterior slopes of the dikes was performed in late 2009 and early 2010. We observed significant improvement in maintenance efforts for controlling vegetation, brush and tree growth for the dikes. We recommend that this maintenance cutting of grass and brush should continue.

Additional gravel has been placed on the crest of the ash pond dike along with limited placement for the crest of cooling pond dike.

No additional work appears to have been performed since the last inspection to seal cracks in the asphaltic liner for the Cooling Lake. The cracks did not appear to have changed from previous site inspections and reports. We have previously determined that the cracks did not present a significant problem to the overall dike stability.

As confirmed during the follow-up site visit on November 10, 2010, plant personnel have extended the riprap at the toe of the Cooling Pond dike consistent with recommendations provided by MACTEC report in Appendix C.

FIELD OBSERVATIONS

Ash Pond Dike

The crest, interior slopes and exterior slopes of the dike generally appear to be stable. We did not observe ruts or standing water on the crest. As previously noted, the crest was recently stabilized with crushed stone for the entire perimeter. Representative views of conditions observed during the inspection of the dike are included in Appendix A as follows:

- Photographs 1, 2, and 3 are representative for the south dike;
- Photograph 4 is representative for the east dike;
- Photograph 5 is representative for the north dike.

Ash material continues to be discharged within the horseshoe-shaped interior containment area. We understand that the existing interior containment area is not considered to be jurisdictional by NCDENR Dam Safety. During our inspection, we observed that the drainage channels adjacent to the containment were partially blocked by vegetation and other obstructions. The channels should be maintained to assure free flowing conditions for drainage purposes.

The plant has cut brush and trees from the exterior slope to the toe for the entire dike. The slope surfaces are somewhat uneven but appeared to be stable. Standing water was observed at a low spot along the toe on the south side of the pond. The standing water did not appear to be associated with active seepage. This condition has been observed previously and appears to be associated with flooding from the adjacent Neuse River. The riprap material placed for stabilization of the exterior slope on the south dike appeared to be in good condition.

The outside toe of the secondary settling basin was inspected by walking for the entire length. The riprap material placed on the exterior slope for seepage control was in good condition . Seepage was observed emerging from the slope beyond the existing limits of the riprap for the secondary settling basin. The plant requested direction on whether the riprap stabilization should be extended to address the apparent seepage. Because of recent rainfall and wet site conditions, we recommended a follow-up visit to confirm the extent of any additional seepage prior to proceeding with further remedial work. The current condition appears to be consistent with previous observations of seepage. Photograph 6 provides a representative view of the current condition for the riprap material at the toe of slope.

On October 10, 2010, MACTEC performed a follow-up site visit to check seepage conditions for the Ash Pond secondary settling basin under dry site conditions. Based on this site visit, MACTEC recommended extending the riprap provided for stabilization. Progress Energy has authorized preparation of an engineering plan for extending the riprap slope protection.

Dennis Cole accompanied the inspection team and attempted to locate an area of new seepage reported for the exterior slope of the east dike. The seepage was apparently noticed by the crew cutting brush and trees on the slope. We were unable to locate any indication of seepage during the current inspection. We did observe evidence of beaver activity in the drainage channel running along the toe of the east dike. Mr. Cole indicated that efforts have been made to remove beavers from this area in the past.

The discharge riser appeared to be clear of and free flowing. We have previously recommended periodically inspecting the riser by boat to confirm condition of structure. The discharge into the secondary containment area was boiling consistent with previous inspections and the outlet appeared to be free flowing. The discharge pipe at the river appeared to be free flowing. High water was observed for the river at the time of the inspection. Representative views of the discharge features are provided by Photographs 7, 8 and 9.

For the Ash Pond Dike, the status for addressing previous recommendations dating from the last (2009) 5-year independent consultant inspection is as follows:

Ref No.	Recommendations	Recommended Time for Implementation	Current Status
AP-2009-1	Brushy vegetation and small trees on the lower parts of the slopes that were not cut by the spring mowing should be cut during the 2009 mowing. Progress Energy has accomplished this work.	Completed during 2009	Reviewed during follow-up visit on 11/10/10. Plant will continue to monitor and provide maintenance cutting as needed.
AP-2009-2	Control vegetation growth in the riprap blanket repair areas on the interior slopes should continue on a regular schedule.	Routine maintenance	Reviewed during follow-up visit on 11/10/10. Plant intends to spray as needed to control growth. Check during 2011 inspection.
AP-2009-3	The 1989 Dam Safety inspection report recommended that raising the perimeter dike or lowering the maximum pond operating level to Elevation 87.5 feet to safely accommodate the design storm.	To be reviewed for change in operating water level.	The plant is currently operating the pond between Elevation 83 and Elevation 85. No action currently required.
AP-2009-4	If operating conditions arise such that the pond levels need to be raised to the maximum level of 87.5 feet, at least four piezometers should be installed on the south dike to monitor changes in the phreatic surface as the pond rises.	To be reviewed for change in operating water level.	No action currently required.
AP-2009-5	Modify piezometer data sheets to provide indication of water level elevations.		Piezometer water level elevation is included in the attached data summary.

<u>Cooling Lake Dike</u>

The water level observed on the staff gage was at Elevation 79.4.

The downstream spillway channel was mostly submerged at the time of inspection from high water conditions in the Neuse River. We did not observe cracking or other conditions that would indicate concern for the structure. Representative views of the conditions observed for the spillway area are provided by Photographs 10 and 11.

The intake area appeared to be in good condition. We did not observe unusual settlement or other conditions that might indicate a problem with this structure.

The asphaltic liner near the spillway appeared to be in satisfactory condition and effective for slope protection (Photograph 12).

The crest of the dike generally appeared to be stable with minimal rutting. The exterior slopes were generally observed to be in good condition. Trees and brush have been cut for the exterior slope to the toe of the dike. We observed a tree root ball at the toe in vicinity of Reference Station 22-23 on the south dike. The root ball did not appear to be causing seepage or slope stability problems. We also observed a smaller root ball at the toe near the drain gate at Reference Station 11-12. This smaller root ball also appeared to not be a concern for the dike stability. We do not consider maintenance work is required for these root balls at this time. Representative views of conditions observed during the inspection of the Cooling Lake dike are included in Appendix A as follows:

- Photographs 13 and 14 for the north dike;
- Photographs 15 for the south dike.

We walked along the toe of the riprap blanket placed to control seepage on north dike in the vicinity of Reference Station 31. Seepage flow was observed to be emerging from the riprap approximately in line with piezometer P6. The plant obtained piezometer water level readings during the site visit which were reviewed and compared with past readings. As previously noted, we have observed a trend toward slightly elevated water levels for piezometer P6 over the period of record.

There was also some standing water observed near the toe of the riprap. The seepage flow appeared to be clear and did not appear to be carrying fine material. There was no indication of slope stability problems associated with the observed seepage. The plant requested guidance on the need for placement of additional riprap for stabilization. In follow-up to the current inspection, we recommended inspection for the toe of the dike at a time when the site conditions were generally drier. We believe the existing riprap continues to be effective in containing the seepage and protecting the toe of the dike. A representative view of the riprap placed along the toe of the dike is shown in Photograph 13.

On August 30, 2010, Mr. J. Allan Tice of MACTEC performed a follow-up site visit to check for seepage conditions associated with the area of previous riprap stabilization provided for the toe of the Cooling Pond dike. Mr. Tice provided a letter report on August 31, 2010, that summarized the results of the inspection and included recommendations for extending the riprap provided for stabilization purposes included in Appendix B. Progress Energy has extended the riprap as a maintenance activity consistent with MACTEC recommendations.

The riprap provided for protection of the interior slope generally appeared to be in satisfactory condition. We observed riprap that was missing or has slipped down slope at a limited number of locations and extent of slope (noted on south dike between Reference Stations 13 – 16). This does not currently appear to be contributing to slope damage but should continue to be checked during routine inspections.

We observed growth of small trees in the riprap that should be removed.

The two abandoned drain gates on the south dike were checked and appeared to be in good conditions consistent with past inspections. Standing water along the toe prevented inspection of the outlet for the drain gate near Reference Station 25-26. The abandoned drain gates are shown in Photographs 17 and 18.

The recirculation structure appeared to be in satisfactory condition with no indication of significant movement or new cracks (Photograph 19).

For the Cooling Lake Dike, the status for addressing previous recommendations dating from the last (2009) 5-year inspection report is as follows:

Ref No.	Recommendations	Recommended Time for Implementation	Current Status
CL-2009-1	The seepage control blanket at the toe of the north dike should be observed by the plant personnel for signs of increase in volume, appearance of boils or accumulation of soil fines.	Routine inspection activity.	Riprap extended during 2010
CL-2009-2	Survey readings for the recirculation structure and soundings in the outlet channel should be obtained as part of the next Independent Consultant Inspection in 2014, or sooner if plant observations suggest changes in conditions.	To be scheduled in 2014	No action currently required.
CL-2009-3	Continue obtaining water levels in piezometers installed in the north dike seepage area on quarterly intervals. Additional reading should be taken if the seepage appears to increase in volume and if the lake level rises to a point that it begins flowing over the spillway. Modify piezometer data sheets to include elevations of the water level.	Check with plant during annual inspections.	Piezometer water level elevation is included in the attached data summary.
CL-2009-4	Vegetative growth in open cracks in the asphaltic concrete wave protection blanket near the spillway should be sprayed. Open cracks within the range of normal pond level fluctuations should be observed during regular inspections to check for evidence of erosion under the liner.	Check with plant during annual inspections.	Dennis Cole reported that spraying performed annually.
CL-2009-5	Maintenance cutting and spraying to control trees and vegetative growth should be continued. Fallen trees and trees growing in the asphalt liner of the exterior slope should be cut and removed at least to the toe of the dike.	Check with plant during annual inspections.	Progress Energy completed this work in December 2009.
CL-2009-6	Provide permanent marking as reference station for ease in identifying specific features during inspection.	Check with plant during annual inspection.	Progress Energy is currently reviewing alternatives for providing reference markings. No action taken in 2010.

CLOSING

MACTEC is pleased to continue assisting Progress Energy with inspections of the dams at the Lee Plant.

Please contact us if you have any questions about this report.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

NORTH CAROLINA PROFESSIONAL SEAL 8169 ENGINEER RICHARD S. AUGER 12-3-10

J. Allan Tice, P.E. (Reviewer)
Senior Principal Engineer
Registered, North Carolina 6428

Richard S. Auger, P.E. (Responsible Engineer)
Principal Engineer
Registered, North Carolina 8169

RSA/rsa

APPENDICES

APPENDIX A

- (A1) Photograph Location Plan – Ash Pond
- (A2) Photograph Location Plan – Cooling Lake
- Photographs

APPENDIX B

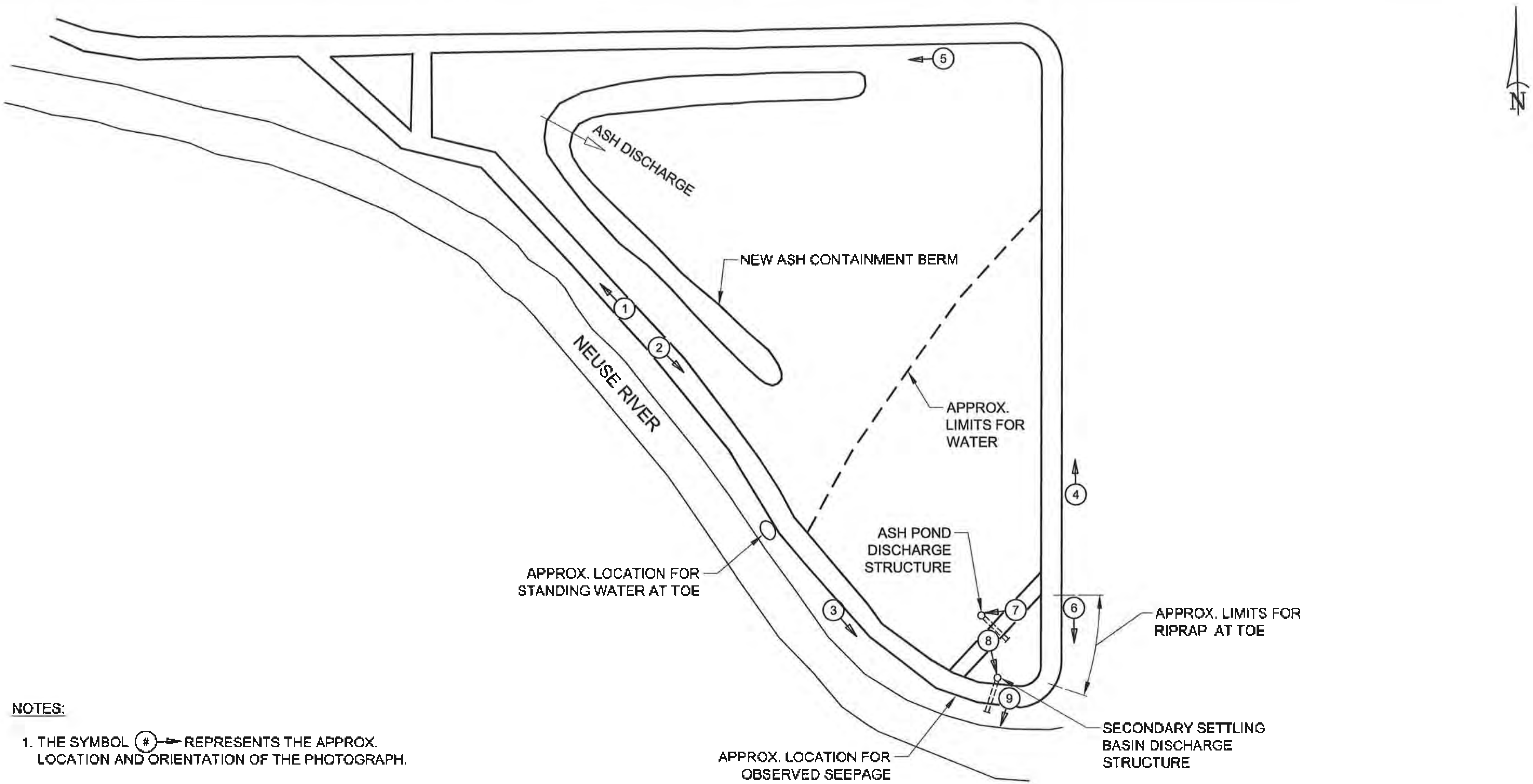
- MACTEC Report dated August 31, 2010, prepared by J. Allan Tice, P.E., for the follow-up inspection for the toe of the Cooling Lake dike on August 30, 2010.

APPENDIX C

- Table C1 – Lee Ash Pond Secondary Settling Basin Piezometer Data Summary
- Table C2 – Cooling Lake Piezometer Data Summary
- Reference Exhibit 6 showing the location of the Ash Pond piezometers
- Reference Exhibit 13 showing location of Cooling Lake piezometers

APPENDIX A

- (A1) Photograph Location Plan – Ash Pond
- (A2) Photograph Location Plan – Cooling Lake
- Photographs



NOTES:

1. THE SYMBOL (#)→ REPRESENTS THE APPROX. LOCATION AND ORIENTATION OF THE PHOTOGRAPH.

2. PHOTOGRAPHS TAKEN FEBRUARY 16, 2010.

P:\6468\Progress Energy\Progress Energy Projects 2010\0025 – Dam Inspections 2010\Lee\Lee Ash Pond Loc Plan 12-10.dwg Tue, 30 Nov 2010 - 2:03pm rrohle

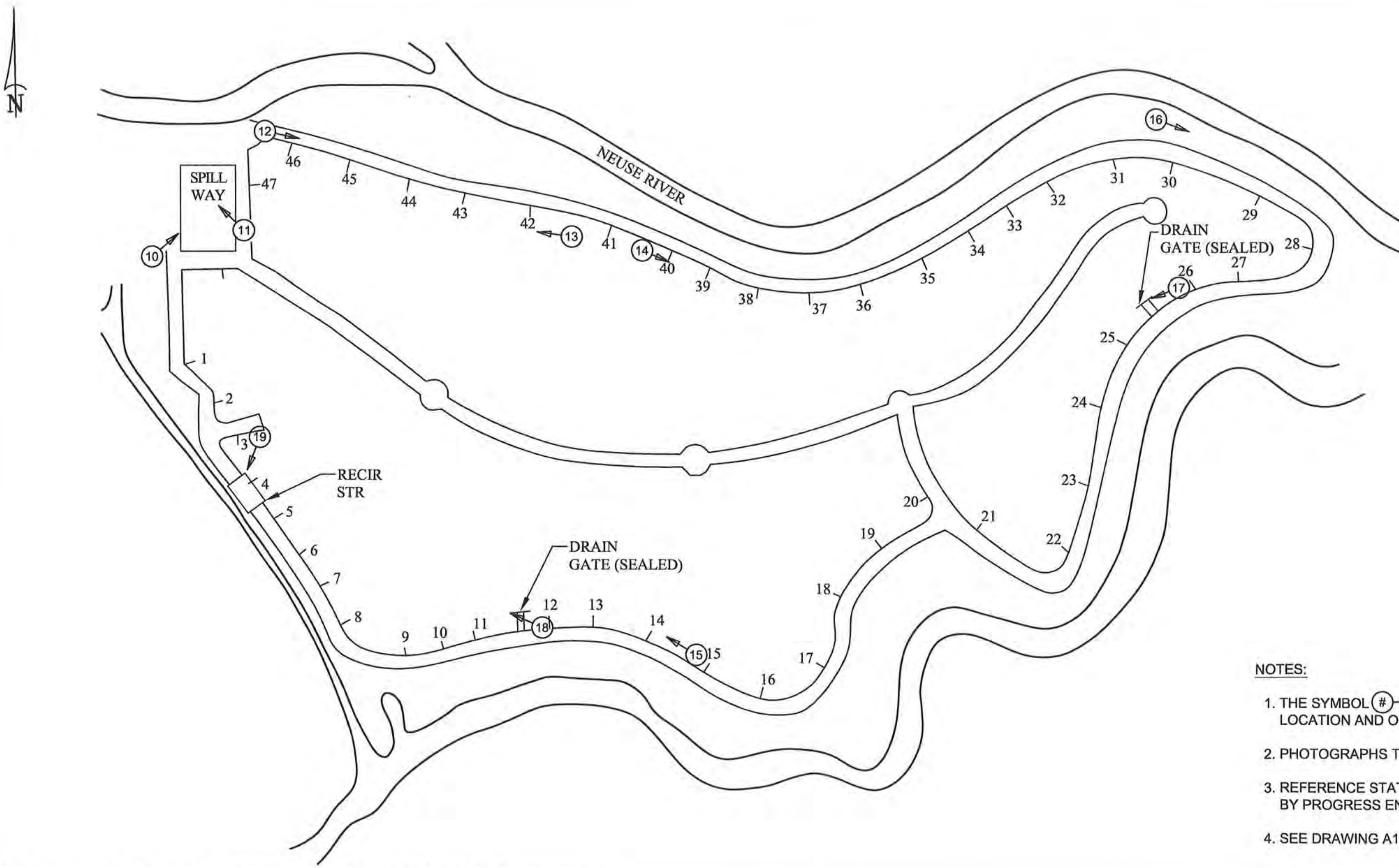
MACTEC

MACTEC ENGINEERING AND CONSULTING OF GEORGIA INC
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

PHOTOGRAPH LOCATION PLAN
H.F. LEE STEAM ELECTRIC PLANT
ASH POND DIKE

DRAWN: R.R.	DATE: NOVEMBER 2010	DRAWING
DFT CHECK:	SCALE: N.T.S.	A1
APPROVAL:	JOB: 6468-10-0025(07)	

REFERENCE: DRAWING PROVIDED BY CP&L, DWG. NO. D-4013.



NOTES:

1. THE SYMBOL (#)→ REPRESENTS THE APPROX. LOCATION AND ORIENTATION OF THE PHOTOGRAPH.
2. PHOTOGRAPHS TAKEN FEBRUARY 16, 2010.
3. REFERENCE STATION IDENTIFICATION USED BY PROGRESS ENERGY.
4. SEE DRAWING A1 FOR PHOTOS 1-9.

P:\5468\Progress Energy\Progress Energy Projects 2010\0025 - Dam Inspections 2010\Lee\Lee Cooling Pond Loc Plan 12-10.dwg Tue, 30 Nov 2010 - 2:01pm rrohie

MACTEC MACTEC ENGINEERING AND CONSULTING OF GEORGIA INC. 3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA	PHOTOGRAPH LOCATION PLAN H.F. LEE STEAM ELECTRIC PLANT COOLING LAKE DIKE	DRAWN: R.R. DFT CHECK: APPROVAL:	DATE: NOVEMBER 2010 SCALE: N.T.S. JOB: 6468-10-0025(07)

DRAWING A2

REFERENCE: DRAWING PROVIDED BY CP&L, DWG. NO. D-4014, DATED 11-19-84.

Appendix A – Photographs
2010 Lee Limited (Annual) Field Inspection

1. Ash Pond Dike – View of crest for south dike looking toward west.

2. Ash Pond Dike – View of crest for south dike looking toward east.

3. Ash Pond Dike – View of crest and outside slope on south dike.

4. Ash Pond Dike – View of crest for east dike.

5. 5 Ash Pond Dike – View of crest for north dike.

6. 6 Ash Pond Dike – View of riprap placed along toe of outside slope for secondary settling basin.

7. Ash Pond Dike – View of skimmer for ash pond discharge.

8. Ash Pond Dike – View of secondary settlement basin and skimmer for discharge riser. Turbulence is from ash pond discharge

9. Ash Pond Dike – View of discharge from secondary settling basin at Neuse River.

10. Cooling Lake Dike – View of spillway.

11. Cooling Lake Dike – View of energy dissipation blocks and downstream spillway channel with high tailwater conditions.

APPENDIX B

- MACTEC Report dated August 31, 2010, prepared by J. Allan Tice, P.E., for the follow-up inspection for the toe of the Cooling Lake dike on August 30, 2010.

MACTEC

engineering and constructing a better tomorrow

August 31, 2010

Progress Energy Carolinas, Inc.
7001 Pine Forest Road
Raleigh, NC 27613

Attention: Mr. Bill Forster

SUBJECT: FIELD VISIT 8-30-10
LEE PLANT
MACTEC JOB No. 6468-10-0025, Task 07

Dear Mr. Forster:

On August 30, 2010, Mr. Al Tice of MACTEC visited the Lee Plant Cooling Lake at the request of Mr. Ricky Miller, Plant Environmental Coordinator. Mr. Bill Forster and Mr. Dennis Cole were also present. The purpose of the visit was to observe conditions at the seepage area adjacent to the toe of the dike on the north side of the lake.

The seepage area was noted in 1998 and a weighted filter consisting of geotextile fabric and stone was placed on the area. Several expansions of the weighted filter have been placed subsequently. Clear water typically continues to emerge from the edges of the weighted filter in one or two spots. Plant personnel regularly observe the area for signs of changes. Approximately three weeks ago, plant personnel noticed an apparent presence of silt in the flow from one of the normal exit points of water. A small accumulation of silt was also seen. MACTEC was asked to observe the conditions and recommend appropriate actions.

The water exit point is at the outer edge of the previously placed weighted filter and is approximately 50 feet west of piezometer P-6. Water was emerging from the underside of the filter. Water was also emerging from a small diameter boil located a few inches north of the filter edge. The boil had a slight roiling appearance and traces of silt or fine sand were observed in the flow. A small delta of fine sand was present at the boil. Photograph 1 shows the area. Photograph 2 shows the boil. Probing of the boil found an approximate 1-inch diameter opening 4 to 6 inches deep. The exit flow was estimated at less than 1gallon per minute.

At the other normal water exit point, near the edge of the weighted filter and piezometer P-6, clear flow was emerging in a diffuse pattern from underneath the edge of the filter. No indications of accumulated silt or fine sand were noted.

The observed conditions were less severe than those seen at other boil areas observed prior to placing the weighted filter over the area. The boil does represent a condition that should be addressed. A recommended expansion of the weighted filter is show on the attached sketch. The current conditions do not indicate a need for emergency response; however, the recommended expansion should be implemented within the next six weeks.

In the interim, we recommend the area be observed daily by the same plant person who can note if changes are occurring. Observation on weekends is not necessary.

Please contact the writer if there are any questions.

Sincerely,
MACTEC Engineering and Consulting, Inc.

J. Allan Tice, P. E.
Senior Principal Engineer
Registered, North Carolina 6428

Jeffrey A. Mann, P.E.
Chief Engineer

JAT/jat

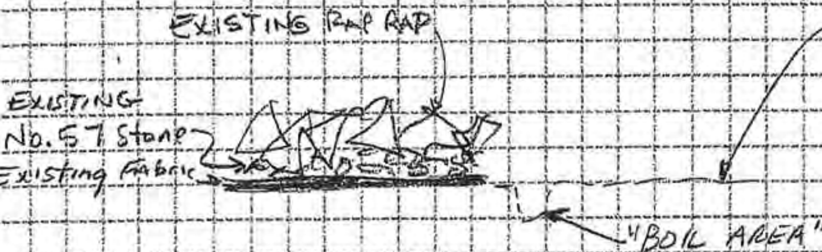
Attachments
Cc: Ricky Miller, w/att

MACTEC

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, NC 27604

JOB NO. 6468-10-0025 SHEET 1 OF 1
PHASE N/A TASK 07
JOB NAME LEE COOLING LAKE INSPECTION
BY JAT DATE 8-30-10
CHECKED BY JAM DATE 8-31-10

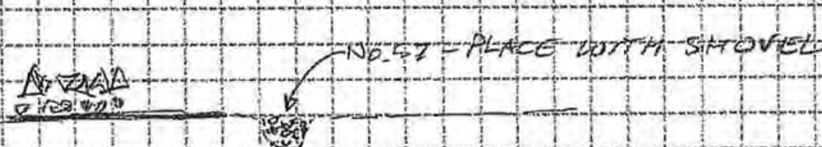
LEE COOLING LAKE NORTH DIKE
SEEPAGE AREA - REPAIR RECOMMENDATIONS
FOR SMALL BOIL AREA
OBSERVED 8-30-10



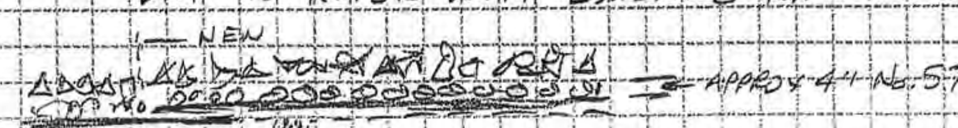
NORTH CAROLINA PROFESSIONAL SEAL 6428 ENGINEER J. ALLAN TICE 8/31/10

STEP 1 - PEEL BACK RIPRAP & No. 57 STONE TO EXPOSE 12" OF FABRIC

STEP 2 - PLACE No. 57 STONE IN BOIL AREA UP TO GROUND SURFACE - WILL NOT NEED MUCH

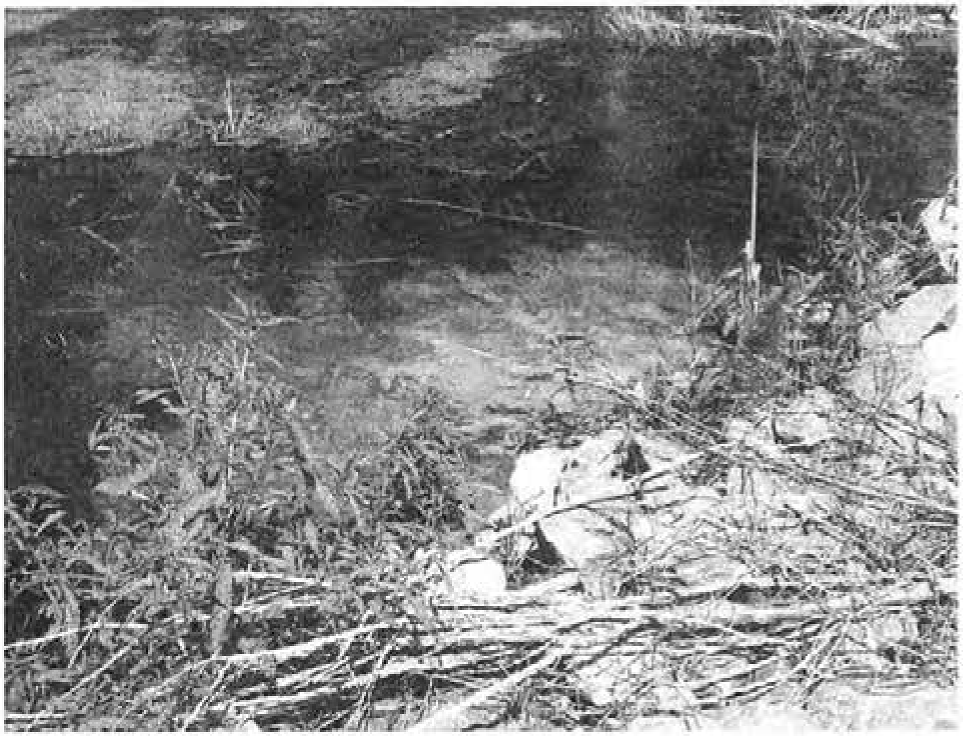


STEP 3 ADD NEW FABRIC, No. 57 AND RIP RAP OUT TO ALIGN WITH EXISTING RIPRAP AREA TO EAST

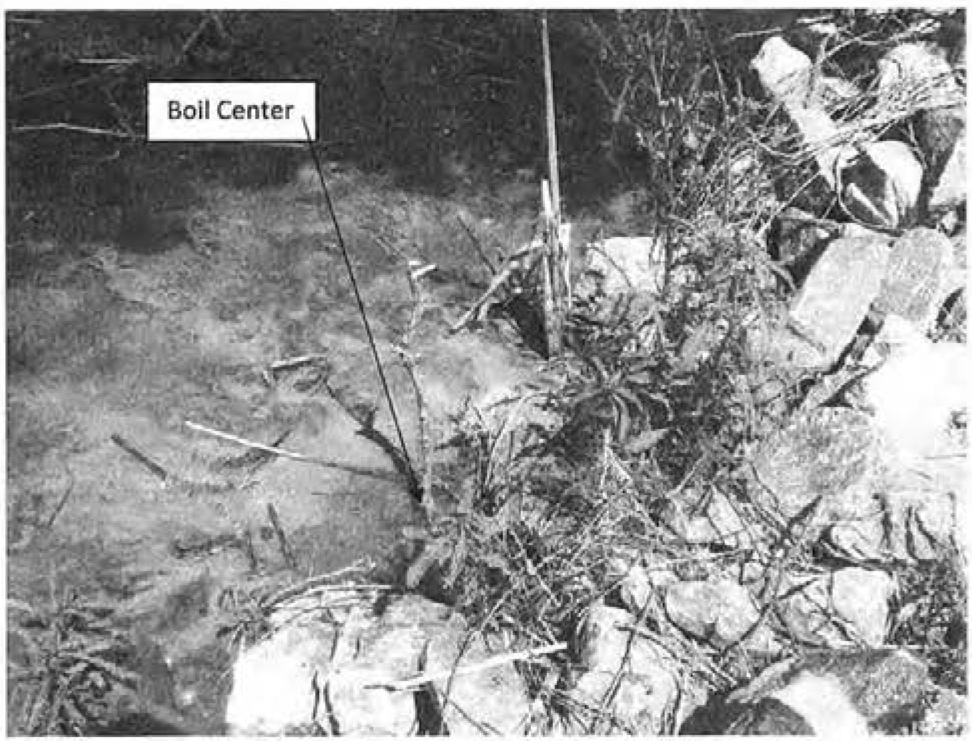


STEP 4 (OPTIONAL)

PLACE NO. 57 STONE ON TOP OF RIPRAP LAYER TO FILL VOIDS



Photograph 1. Area of sediment deposit around small boil.



Photograph 2. Boil area (stick is in boil).

APPENDIX C

- Table C1 – Lee Ash Pond Secondary Settling Basin Piezometer Data Summary
- Table C2 – Cooling Lake Piezometer Data Summary
- Reference Exhibit 6 showing the location of the Ash Pond piezometers
- Reference Exhibit 13 showing location of Cooling Lake piezometers

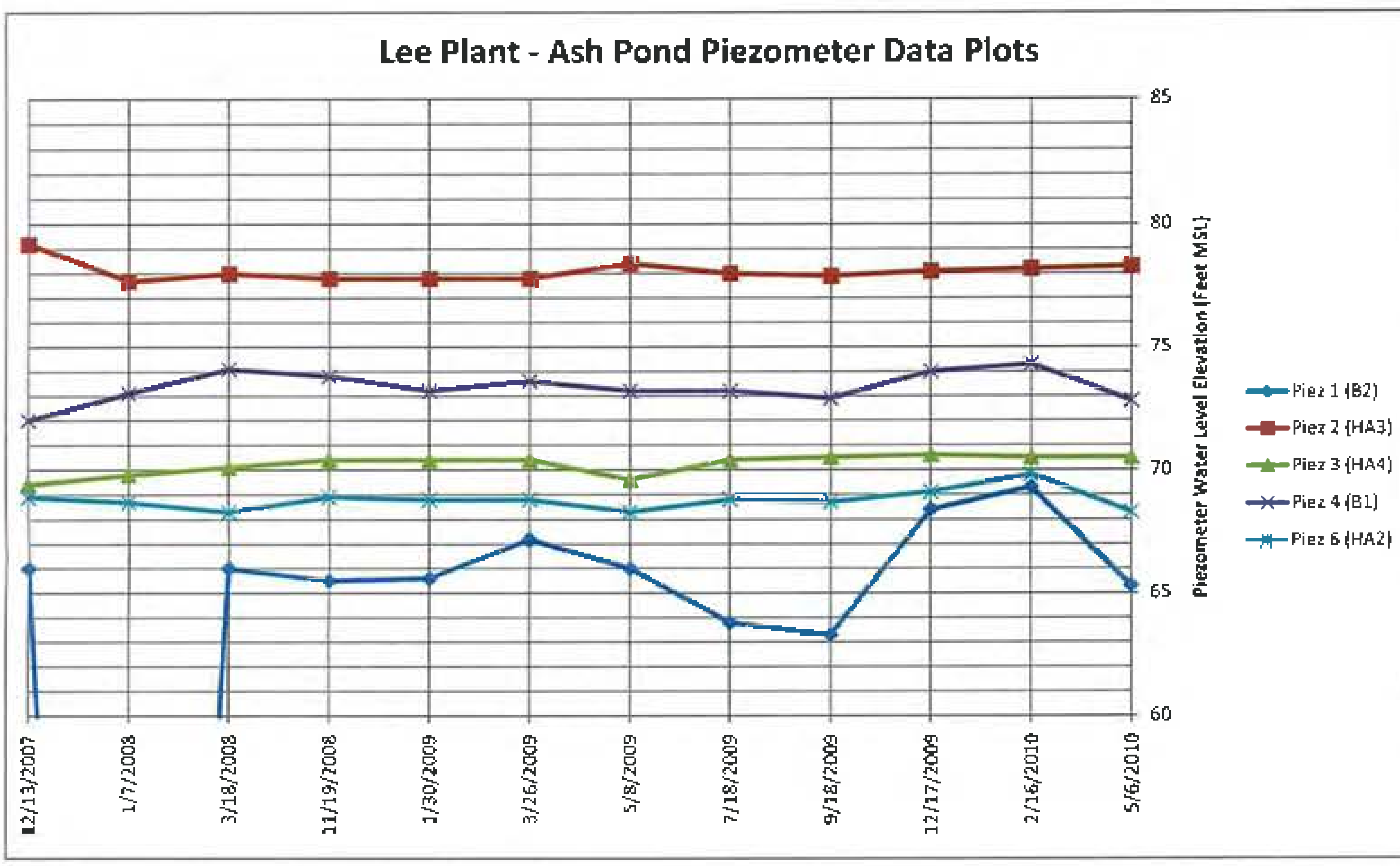
APPENDIX C

TABLE C1 - LEE ASH POND SECONDARY SETTLING BASIN PIEZOMETER DATA SUMMARY

Date	Piez 1 (B2)		Piez 2 (HA3)		Piez 3 (HA4)		Piez 4 (B1)		Piez 5 (HA 1)		Piez 6 (HA2)		
	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	Depth	Elevation	
5/6/2010	23.7	65.3	8.3	78.3	2.6	70.5	16.2	72.8	6.5	78.3	5.8	68.3	
2/16/2010	19.7	69.3	8.3	78.2	2.6	70.5	14.7	74.3	6.4	78.4	4.3	69.8	
12/17/2009	20.6	68.4	8.4	78.1	2.5	70.6	15	74	6.5	78.3	5	69.1	
9/18/2009	25.7	63.3	8.6	77.9	2.6	70.5	16.1	72.9	6.7	78.1	5.4	68.7	
7/18/2009	25.2	63.8	8.5	78	2.7	70.4	15.8	73.2	7.6	77.2	5.3	68.8	
5/8/2009	23	66	8.1	78.4	3.5	69.6	15.8	73.2	6.1	78.7	5.8	68.3	
3/26/2009	21.8	67.2	8.7	77.8	2.7	70.4	15.4	73.6	6.9	77.9	5.3	68.8	
1/30/2009	23.4	65.6	8.7	77.8	2.7	70.4	15.8	73.2	6.8	78	5.3	68.8	
11/19/2008	23.5	65.5	8.7	77.8	2.7	70.4	15.2	73.8	6.8	78	5.2	68.9	
3/18/2008	23	66	8.5	78	3	70.1	14.9	74.1	7	77.8	5.8	68.3	
1/7/2008	9 *	*	8.8	77.7	3.3	69.8	15.9	73.1	7.1	77.7	5.4	68.7	
12/13/2007	23	66	7.3	79.2	3.7	69.4	17	72	6.5	78.3	5.2	68.9	Initial reading
**TOC - Top of Casing Elevation (Ft MSL)	89		86.5		73.1		89		84.8		74.1		

* Reading believed to be unreliable based on consistency of readings before and after

**Elevations are estimated based on assumed top of dike Elevation 89 and casing stickup above ground.

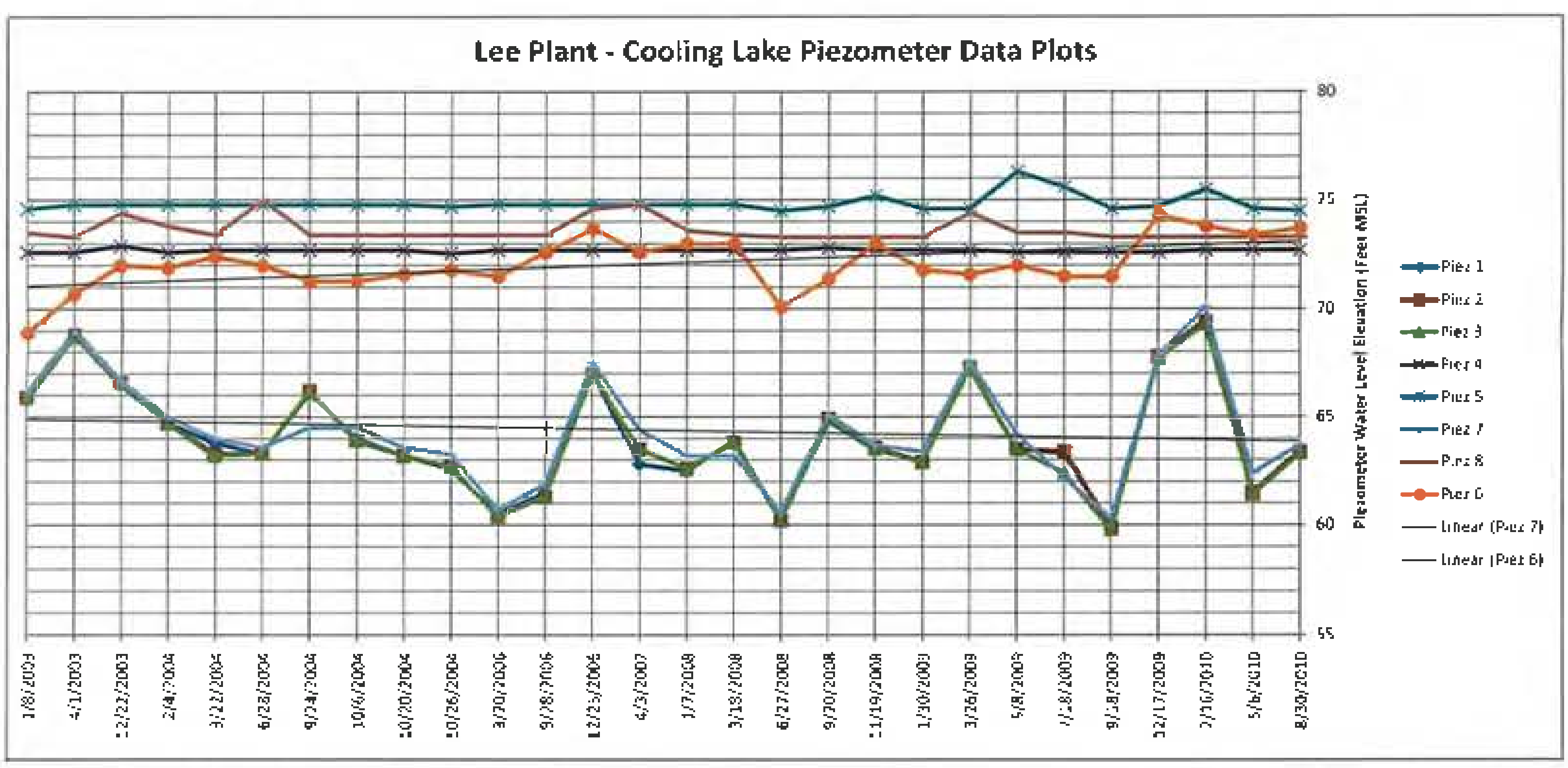


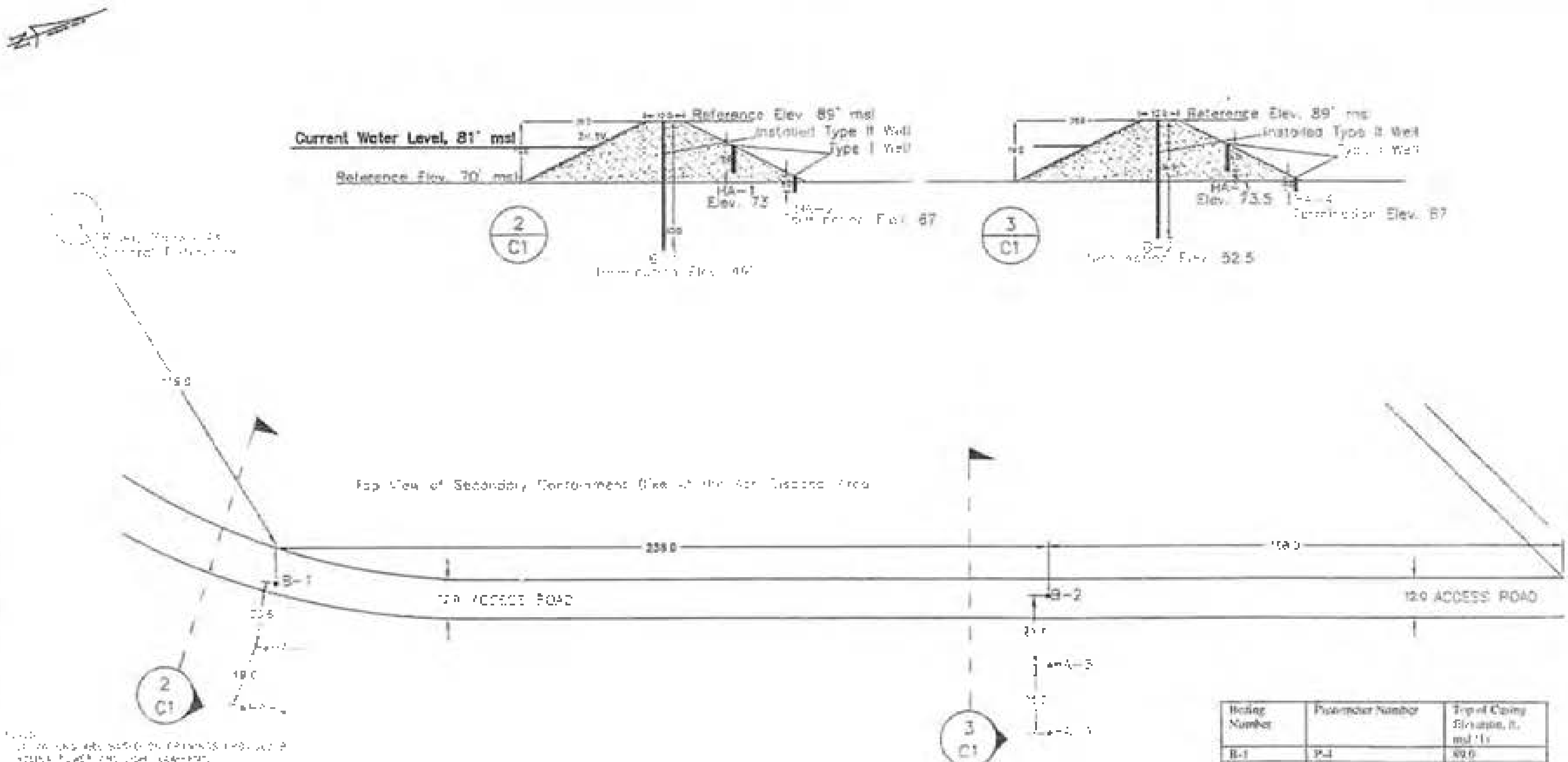
APPENDIX C

TABLE C2 - LEE COOLING LAKE PIEZOMETER DATA SUMMARY

Date	Piez 1		Piez 2		Piez 3		Piez 4		Piez 5		Piez 6		Piez 7		Piez 8		
	Depth, ft	Elev.	Depth, ft	Elev.	Depth, ft	Elev.	Depth, ft	Elev.	Depth, ft	Elev.	Depth, ft	Elev.	Depth, ft	Elev.	Depth, ft	Elev.	
8/30/2010	19.4	63.4	19.3	63.4	19.3	63.3	10.0	72.7	5.3	74.5	8.1	73.7	19.2	63.7	5.3	73.3	
5/6/2010	21.4	61.4	21.2	61.5	21.2	61.4	10.0	72.7	5.2	74.6	7.4	73.4	20.5	62.4	5.3	73.3	
2/16/2010	13.3	69.5	13.3	69.4	13.3	69.3	10.0	72.7	4.3	75.5	7.0	73.8	12.8	70.1	5.3	73.3	
12/17/2009	15.1	67.7	14.9	67.8	14.9	67.7	10.1	72.6	5.1	74.7	6.5	74.3	15.1	67.8	5.3	73.3	
9/18/2009	22.9	59.9	22.8	59.9	22.8	59.8	10.1	72.6	5.2	74.6	9.3	71.5	22.6	60.3	5.3	73.3	
7/18/2009	19.5	63.3	19.3	63.4	20.3	62.4	10.1	72.6	4.2	75.6	9.3	71.5	20.7	62.2	5.1	73.5	
5/8/2009	19.3	63.5	19.2	63.5	19.2	63.5	10.1	72.6	3.5	76.3	8.8	72	18.7	64.2	5.1	73.5	
3/26/2009	15.6	67.2	15.4	67.3	15.5	67.2	10	72.7	5.2	74.6	9.2	71.6	15.3	67.6	4.2	74.4	
1/30/2009	19.9	62.9	19.8	62.9	19.8	62.9	10	72.7	5.2	74.6	9	71.8	19.5	63.4	5.3	73.3	
11/19/2008	19.3	63.5	19.1	63.6	19.2	63.5	10	72.7	4.6	75.2	7.8	73	19.2	63.7	5.3	73.3	
9/20/2008	18	64.8	17.8	64.9	17.8	64.9	9.9	72.8	5.1	74.7	9.4	71.4	17.8	65.1	5.3	73.3	
6/27/2008	22.6	60.2	22.5	60.2	22.5	60.2	10	72.7	5.3	74.5	10.7	70.1	22.3	60.6	5.3	73.3	
3/18/2008	18.9	63.9	18.9	63.8	18.9	63.8	10	72.7	5	74.8	7.8	73	19.7	63.2	5.2	73.4	
1/7/2008	20.3	62.5	20.1	62.6	20.1	62.6	10	72.7	5	74.8	7.8	73	19.7	63.2	5	73.6	
4/3/2007	20	62.8	19.2	63.5	19.2	63.5	10	72.7	5	74.8	8.2	72.6	18.5	64.4	3.5	74.5	
12/25/2006	15.8	67	15.7	67	15.7	67	10	72.7	5	74.8	7.1	73.7	15.4	67.5	4	74.6	
9/28/2006	21.3	61.5	21.4	61.3	21.4	61.3	10	72.7	5	74.8	8.2	72.6	21	61.9	5.2	73.4	
3/20/2006	22.3	60.5	22.3	60.4	22.3	60.4	10	72.7	5	74.8	9.3	71.5	22.2	60.7	5.2	73.4	
10/26/2004	20.2	62.6	20	62.7	20	62.7	10.15	72.55	5.1	74.7	9	71.8	19.65	63.25	5.2	73.4	
10/20/2004	19.6	63.2	19.5	63.2	19.5	63.2	10	72.7	5	74.8	9.2	71.6	19.3	63.6	5.2	73.4	
10/6/2004	18.8	64	18.8	63.9	18.8	63.9	10	72.7	5	74.8	9.5	71.3	18.4	64.5	5.2	73.4	
9/24/2004	16.7	66.1	16.5	66.2	16.5	66.2	10	72.7	5	74.8	9.5	71.3	18.4	64.5	5.2	73.4	
6/28/2004	19.5	63.3	19.4	63.3	19.4	63.3	10	72.7	5	74.8	8.8	72	19.3	63.6	3.6	75	
3/22/2004	19	63.8	19.4	63.3	19.5	63.2	10	72.7	5	74.8	8.4	72.4	18.9	64	5.2	73.4	
2/4/2004	18.1	64.7	18	64.7	18	64.7	10.1	72.6	5	74.8	8.9	71.9	17.9	65	4.8	73.8	
12/22/2003	16.3	66.5	16.1	66.6	16.1	66.5	9.8	72.9	5	74.8	8.8	72	16.2	66.7	4.2	74.4	
4/1/2003	14.1	68.7	13.9	68.8	14	68.7	10.1	72.6	5	74.8	10.1	70.7	13.9	69	5.3	73.3	
1/8/2003	17	65.8	16.8	65.9	16.8	65.9	10.1	72.6	5.2	74.6	11.9	68.9	16.8	66.1	5.3	73.5	Initial read

TOC - Top of Casing Elevation (Ft MSL)	82.8		82.7		82.6		82.7		79.8		80.8		82.9		78.6	
									5.2=dry						5.2=dry	





Boring Number	Piezometer Number	Top of Casing Elevation, ft. msl (1)
B-1	P-4	89.0
HA-1	P-5	84.8
HA-2	P-6	74.1
B-2	P-1	89.0
HA-3	P-2	86.5
HA-4	P-3	73.1

(1) Elevations are estimated using top of dike.

EXHIBIT 6

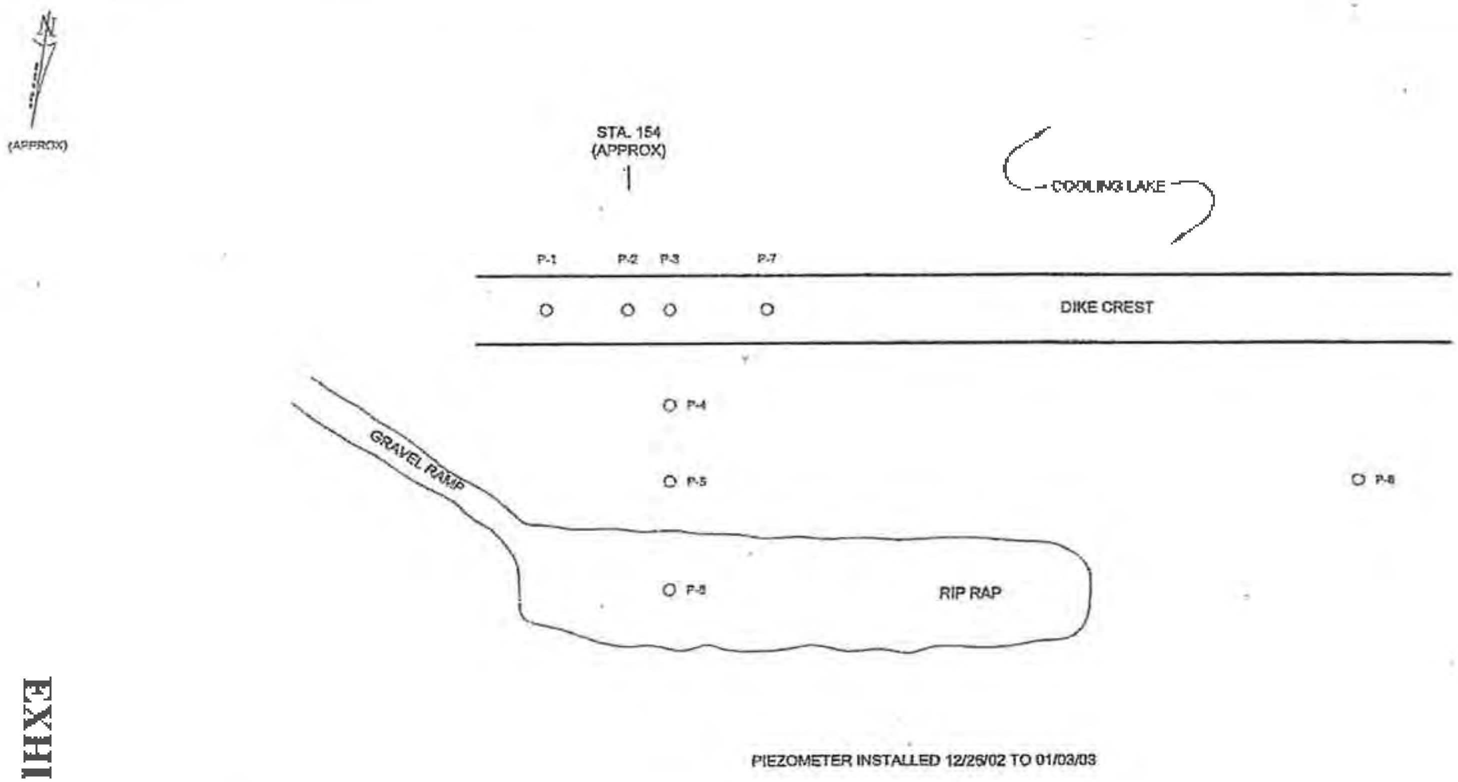
MACTEC

Borings and Well Placement at Secondary Containment Dike
H.F. Lee Steam Electric Plant
Goldsboro, N.C.

DRAWN:	CJF	DATE:	[illegible]	FIGURE
ENG CHECK:		SCALE:	As Shown	C1
APPROVAL:		JOB No:	[illegible]	

EXHIBIT 6

EXHIBIT 13



MACTEC	PLAN OF PIEZOMETER INSTALLATION COOLING LAKE NORTH DIKE LEE PLANT	DRAWN: R.R.	DATE: JUNE 2003	DRAWING
		DFT CHECK:	SCALE: N.T.S.	1
		APPROVAL:	JOB: 30720-2-5445	

REFERENCE: FIELD NOTES.

APPENDIX A

Document 5

Five-Year Independent Consultant Inspection

FIVE-YEAR INDEPENDENT CONSULTANT INSPECTION
COOLING POND DIKE, ASH POND DIKE
H. F. LEE ELECTRIC GENERATING PLANT
WAYNE COUNTY, NORTH CAROLINA

Prepared For:

PROGRESS ENERGY
Raleigh, North Carolina

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
Raleigh, North Carolina

December 30, 2009

Mactec Project No. 6468-09-2351

MACTEC

PROGRESS ENERGY CAROLINAS
H. F. LEE ELECTRIC GENERATING PLANT

COOLING POND DIKE
ASH POND DIKE
WAYNE COUNTY, NORTH CAROLINA

MACTEC PROJECT NO. 6468-09-2351

FIVE-YEAR INDEPENDENT CONSULTANT INSPECTION AS REQUIRED BY NORTH CAROLINA UTILITIES COMMISSION

December 30, 2009

BY MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

REPORT PREPARED BY

J. Allan Tice, P.E.
Senior Principal Engineer
Assistant Vice President
Registered, North Carolina 6428

NORTH CAROLINA PROFESSIONAL SEAL 6428 ENGINEER J. ALLAN TICE

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H. F. LEE STEAM ELECTRIC PLANT

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1.0 SUMMARY

1.1 General

This report presents the results of an independent consultant inspection of the Cooling Pond Dike and Ash Pond Dike at Progress Energy H. F. Lee Steam Electric Plant near Goldsboro, North Carolina. The independent inspection is performed at five-year intervals as required by the North Carolina Utilities Commission (NCUC) for facilities in North Carolina owned by Progress Energy and not licensed by the Federal Energy Regulatory Commission (FERC). The inspection was performed in accordance with U.S. Army Corps of Engineers guidelines(1)**.

Previous independent inspections were made in 1979 by William L. Wells, in 1984 by Ralph E. Fadum, and by Law Engineering and Environmental Services, Inc. (now known as MACTEC Engineering and Consulting, Inc.) in 1989, 1994, 1999 and 2004(2). The results of these inspections were presented in written reports. During the 1999 inspection, a historical volume was prepared containing information about the site geology, engineering data, design, construction and operations of the dikes and ponds. The historical volume (3) serves as a background document for the present inspection.

1.2 Purpose and Scope

The purpose of this dam safety inspection and report is to identify, within the limitations of surficial field inspection and office review of available data, records and operating history, any actual or potential deficiencies related to the maintenance, operation, or surveillance of the dikes and other water control structures of the plant in order to protect the public's safety and property. The objective is to recommend immediate action for public protection where necessary, further studies and analyses where required, and acceptance of the present condition of the dam if justified by the engineering data and inspections.

This report, prepared for Progress Energy, is concerned with a safety evaluation of the Cooling Pond

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∗ Numbers in parentheses refer to references listed in Section 5.0.

Dike and the Ash Pond Dike for the H. F. Lee Steam Electric Plant. These water-retaining structures were constructed in 1960 and 1978, respectively. The last 5-year independent consultant was in 2004 by MACTEC.

This investigation has been conducted in general conformity with the guidelines for Phase I inspections outlined in the USACOE publication, "Recommended Guidelines for Safety Inspection of Dams"[(1)]. It encompassed a review of the 2004 safety inspection report including a description of the geologic and engineering data relative to site conditions, as well as the design, construction, and operational features of the dikes and appurtenant structures. Maintenance history and plans for future maintenance activities were reviewed in consultation with maintenance and operations personnel at the H. F. Lee Plant.

Site visits were made on June 4, 2009 and July 7, 2009 for the purpose of inspecting features relating to the safety and integrity of the dikes and appurtenant structures. These features included evidence of leakage, erosion, seepage, slope instability, settlement, and conditions of protective vegetation. Photographs were obtained to document the general condition of the dike and significant features observed during the field inspection. A third site visit was made December 3, 2009 to observe clearing of trees on the ash pond exterior slopes.

1.3 Conclusions

Based upon a review of the pertinent data in the manner described above, the following conclusions were reached:

1. The Cooling Pond Dike, Ash Pond Dike and appurtenant structures are judged to have been adequately designed and generally well constructed.

2. At the time of our inspection, no deficiencies were noted which constitute a concern for near-future safety of the structures.

3. No significant deficiencies were found in the maintenance practices for these structures. A review of the inspection reports indicates that inspections and maintenance were carried out

conscientiously.

4. Seepage noted in the 2004 Five-Year Independent Consultant Inspection Report has been addressed satisfactorily. Dike slope improvements were made at an area of seepage observed at the ash pond secondary stilling basin exterior dike.

5. Seepage at the toe of the cooling pond north dike is controlled by a drainage blanket underlain by geotextile filter material. This area is monitored by plant personnel for signs of change.

6. Review of monitoring records indicates that the 1993 remediation work to minimize deformation of the recirculation discharge structures has been effective.

7. Excessive vegetation continues to be observed in a few locations on the lower sections of portions of the Cooling Pond Dike and the Ash Pond Dike. Clearing of excess brush and trees on the lower portion of the Cooling Pond Dike and theAsh Pond Dikes was completed during the time frame of this report.

8. Open cracks were observed in the asphaltic concrete wave protection blanket adjacent to the spillway entrance at the cooling pond.

9. Damage to the lower part of the asphaltic concrete slope protection layer at two locations on the Cooling Pond Dike from trees uprooted during Hurricanes Dennis and Floyd has not progressed or caused a danger to the dike.

10. Repairs to the damage caused by Hurricane Floyd in 1999 on the interior and exterior slopes of the Ash Pond Dikes are in good condition.

1.4 Recommendations

Based on the field inspection and review of available data, the recommendations listed below are made. The recommended remedial activities/repairs generally fall under the category of normal maintenance and are not considered emergency actions.

1.4.1 Cooling Pond

1. The seepage control blanket area at the toe of the north dike should be observed by plant personnel weekly for signs of increase in volume, appearance of boils or accumulation of soil fines.

2. Survey readings for the recirculation discharge structure and channel soundings should be obtained again as part of the next Independent Consultant Inspection in 2014, or sooner if plant observations suggest changes in conditions.

3. Continue obtaining water levels in piezometers installed in the north dike seepage area on quarterly intervals. Additional readings should be taken if the seepage appears to increase in volume and if the lake level rises to a point that it begins flowing over the spillway. Modify piezometer data sheets to include elevations of the water level.

4. Vegetative growth in open cracks in the asphaltic concrete wave protection blanket near the spillway should be sprayed. Open cracks within the range of normal pond level fluctuations should be observed during regular inspections to check for evidence of erosion under the liner.

5. Maintenance cutting and spraying to control trees and vegetative growth should be continued. Fallen trees and trees growing in the asphalt liner of the exterior slope should be cut and removed at least to the toe of the dike. Progress Energy completed this work in late December, 2009, and MACTEC has been requested to review for suitability in early 2010.

6. Provide permanent markings of dike reference stations on the interior slope liner or by signs for ease in identifying specific features during inspections.

1.4.2 Ash Pond

1. Brushy vegetation and small trees on the lower parts of the slopes that were not cut by the spring mowing should be cut. Progress Energy has accomplished this work as discussed in

Section 4.3.3.

2. Mowing to control vegetation growth in the riprap blanket repair areas on the interior slopes should continue on a regular schedule.

3. The 1989 Dam Safety inspection report recommended that the perimeter dike be raised or the maximum pond operating level be adjusted downward to elevation 87.5 feet to safely accommodate the design storm. Progress Energy has adopted elevation 87.5 feet as the maximum operating level, and has typically operated the pond at elevations of about 83 to 85 feet in response to the 1989 recommendations.

4. If operating conditions arise such that the pond level needs to be raised to the maximum level of elevation 87.5 feet, at least four piezometers should be installed on the south dike to monitor changes in the phreatic surface as the pond level rises. When the pond operating level is raised, water level readings should be obtained weekly for the first month after the raise, monthly for the next three months and quarterly for the next year. Readings should be furnished to Progress Energy engineers for review.

5. Modify piezometer data sheets to include elevations of the water level.

2.0 DIKE DESCRIPTIONS

Brief descriptions of the Cooling Pond Dike and Ash Pond Dike are presented in this section. Further details about the design and construction of the structures are contained in the Historical Volume[(3)].

2.1 Location

The H. F. Lee Steam Electric Plant and the cooling pond are located on a peninsula formed by a large U-shaped bend (Quaker Neck) in the Neuse River in Wayne County, about 4.5 miles west of Goldsboro, North Carolina. The ash pond is located on the north side of the bend, across the river from the cooling pond. Access to the plant is by means of State Road 1007 and Carolina Power & Light's road connecting thereto. Exhibit 1 shows the location of the plant, cooling pond and ash pond on the Northwest Goldsboro and Southwest Goldsboro USGS 7-1/2 minute quadrangle maps. The latitudes and longitudes of the cooling pond and ash pond are as follows:

Cooling Pond	N 35° 22' 28",	W 78° 4' 30"
Ash Pond	N 35° 22' 58",	W 78° 4' 24"

2.2 Cooling Pond Dike

Ebasco Services, Inc. designed the Cooling Pond Dike and appurtenant structures in 1960. Subsurface explorations were conducted by Eustis Engineering Company of Metairie, Louisiana under the supervision of Ebasco. Construction of the pond was done under the direction and supervision of Ebasco Services, Inc. The construction was completed in 1961 and the pond was first filled in December 1961. Exhibit 2 is a general plan of the cooling pond. Sections and details of the dike and appurtenant structures are shown on Exhibit 3.

The total length of the outer dike is 4.6 miles and the volume of water stored at the design normal water level, elevation 80.0 feet mean sea level (msl), is 3,808 acre-feet with a corresponding surface area of 545 acres. The maximum and minimum depths of the pond are 15 feet and 4 feet, respectively. The dike crest has a 10-foot width at elevation 83.0 feet msl.

The pond contains internal diversion and skimmer dikes to increase circulation of cooling water and aid in temperature control. The length of the diversion dike is 1.6 miles and that of the skimmer dike is 0.17 miles. These dikes have 3(H):1(V) side slopes and asphaltic concrete protection on both sides. An earthen dike that impounds the coal storage runoff for release into the cooling pond is located on the western side of the cooling pond north of the discharge structure. These dikes are not of concern with respect to the safety of the Cooling Pond Dike.

The perimeter dike is constructed of compacted sand with an interior slope facing of compacted clay topped by an asphaltic concrete wave protection blanket. Design slopes are 3(H):1(V) on both interior and exterior slopes.

In 1986, broken or damaged sections of the asphaltic concrete wave protection blanket were repaired by placing a blanket of rip-rap underlain by a filter fabric on the interior slope from the toe to approximate elevation 80 feet msl. Repairs continued between 1990 and 1992, ultimately creating a wave protection zone of fabric and rip-rap along the entire length of the perimeter, diversion and skimmer dikes.

Water is pumped from the Neuse River into the cooling pond by two pumps located at the reservoir make-up structure. A recirculation system constructed in 1973 takes water directly from the pond to the river intake distribution structure, so that the pond operates as a closed-cycle circulating water system with a normal pond level typically maintained between elevations 78.5 and 79.9 feet msl.

The original construction included a gated concrete spillway and two discharge structures discharging to the Neuse River. The two discharge structures are now sealed to prevent leakage from the pond into the river, which would violate Progress Energy's NPDES permit. The gated spillway is operational but has only been used during severe flood events since construction of the recirculation system in 1973.

Two recirculating water discharge structures are located at the west end of the cooling pond. Cooling water pumped from the plant discharges into the cooling pond from these structures. The two structures are concrete boxes, side by side, with each structure approximately 17 feet across the face, 14 feet high and extending 21 feet into the bank of the cooling pond. The structures were constructed of cast-in-place reinforced concrete. A 66-inch diameter reinforced concrete pipe penetrates the rear wall of each structure.

In 1993, CP&L personnel noticed tension cracks and subsidence of soil behind the two recirculating water discharge structures. Subsequent inspection by divers revealed a large void beneath the structures. Repairs to the structures included installing inclined columns with screw-jacks for temporary support of the structures, placing a rip-rap berm in the pond to cross in front of the structures, and pumping concrete into voids beneath and along the sides of the structures. A monitoring program was also setup to check for future movements.

The cooling pond is operated as recirculating closed system. Hydrologic evaluations conducted as part of the 1989 dam safety inspection concluded that the pond has sufficient freeboard to retain the design storm without overtopping the dikes, although only minimal freeboard would be available.

2.3 Ash Pond Dike

The Ash Pond Dike was designed by Carolina Power & Light (CP&L), which also provided supervision of construction. Earthwork construction was provided by Garrison Grading Company. Subsurface investigation and soil testing during construction were provided by Law Engineering Testing Company. Construction began on September 1, 1978 and was completed in April 1980. Exhibit 4 is a general plan of the ash pond. Typical sections are shown on Exhibit 5.

The total length of the dike is 2.0 miles. The water level of the pond is constantly maintained by a metal skimmer type spillway that discharges into a small secondary settling basin. A second skimmer spillway discharges from the settling pond into the Neuse River. The dike was designed for an ultimate operating level of elevation 88.0 feet msl which provides storage of 1980 acre-feet. The dike crest is 12 feet wide at elevation 90.0 feet msl. Design side slopes are 2(H):1(V).

At the design operating level, 88 feet msl, the design storm (1/2 PMP) would come within three inches of overtopping the perimeter dike and would overtop the slightly lower separating dike between the pond and the secondary settling basin. As discussed in the 2004 inspection report[2], it was recommended that Progress Energy consider raising the perimeter dike 0.5 feet or lowering the operating level to 87.5 feet msl to allow safe accommodation of the design storm. Progress Energy has adopted the lower maximum operating level of elevation 87.5 feet.

2.4 Size Classification

2.4.1 Cooling Pond Dike

The Corps of Engineers (Reference 1) uses both height of dike and storage capacity in their size classification system. Based on the maximum dike height of 17 feet as determined from information on Exhibit 2, and a storage capacity at the top of dike of 5446 acre-feet, the cooling pond dike classifies as an intermediate size dike (based on storage capacity). The comparable size classification under the North Carolina Dam Safety Guidelines[4] would be "medium".

2.4.2 Ash Pond Dike

The ash pond dike has a maximum height of 20 feet and a storage capacity at the top of dike of about 2020 acre-feet as determined from information on Exhibit 4. The storage capacity places the dike in the intermediate size classification in the Corps of Engineers' system. The comparable size classification under the North Carolina Dam Safety Guidelines[4] would be "medium".

2.5 Hazard Classification

2.5.1 Cooling Pond Dike

The Corps of Engineers (Reference 1) considers potential for loss of life and damage to downstream features in evaluating hazard potential of a dam. In the event of a dike failure, water would flow directly into the Neuse River and its flood plain or the discharge channel leading to the river.

There are a few residential structures across the river, south of the pond, along S.R. 1008. These structures appear to be above elevation 75 feet. In the event of a dike failure during a time of normal river flow, there is adequate storage in the river flood plain below elevation 75 feet to accommodate all the cooling pond water. The flood wave could cause temporary flooding over S.R. 1008 at the bridge across the Neuse River about 3/4 mile below the junction of the discharge canal and the dike. The potential for loss of life appears minimal.

If a dike failure were to occur at a time when the Neuse River was flooding, the additional water would not be noticeable. Past work (Reference 3) has found that even a 10 year frequency flood would be at elevation ranging from 73.8 feet to 78.2 feet around the dike. The effects of a dike failure are not likely to have any greater impact than potential natural events.

Because of the negligible potential for loss of life but because some damage to downstream features could occur, MACTEC considers a "significant" hazard classification appropriate for the Cooling Pond Dike under the Corps of Engineers referenced document(1). The comparable hazard classification under the North Carolina Dam Safety Guidelines(4) is interpreted as “Class B, intermediate” prior to consideration of potential for environmental damage.

2.5.2 Ash Pond Dike

A failure of the ash pond dike would also release water directly into the Neuse River and the adjacent flood plain. The entire contents of the ash pond can be stored in the flood plain below elevation 75.0 feet. There are no residences in the area of likely inundation. Based on the limited potential for damage, MACTEC considers a hazard classification of "low" appropriate under the Corps of Engineers' guidelines. The comparable hazard classification under the North Carolina Dam Safety Guidelines(4) is interpreted as “Class A, low” prior to consideration of potential for environmental damage.

3.0 ACTIVITIES SINCE 2004 INSPECTION

3.1 Maintenance Activities

Tree and brush removal along exterior slopes of the Cooling Pond Dike has been performed at periodic intervals during the past 5 years. Plant growth protruding through the exterior asphaltic-concrete protection liner has been sprayed or cut. Vegetation control has not been fully effective as discussed in Section 4.2.3.

The drainage blanket at the seepage area at the toe of the north dike of the cooling pond was expanded in 2004 to cover more wet areas, and the surrounding vegetation was cut back to allow better observation of the area by plant personnel during regular inspections.

Routine removal of brush and small trees along portions of the interior and exterior slopes of the Ash Pond Dike has been performed since the 2004 inspection. The lower sections of the Ash Pond Dike exterior slopes need additional vegetation removal as discussed in Section 4.3.3.

3.2 Engineering Studies and Inspections

Engineering evaluations and inspections have been performed or initiated since the 2004 inspection as described below.

3.2.1 Ash Pond Secondary Settling Pond Dike Review and Repairs

Wet surface conditions observed at the base of the eastern dike of the secondary settling pond during past inspections were evaluated as part of the 2008 inspection activities. Geotechnical borings were performed and piezometers were installed. Exhibit 6 shows locations of the borings and piezometers. Information on the piezometer readings is discussed in Section 4.4.

The geotechnical studies concluded the dike was safe against a significant stability failure, but that the softened surface soils in the toe area should be stabilized. Progress Energy implemented slope improvements in April, 2009. Vegetation was cleared by hand methods to approximately five feet outside the dike toe and up to about the midpoint of the slope. Geotextile fabric and rip rap were placed by hand methods. Exhibit 7 describes the improvements.

3.2.2 Site Visits

MACTEC conducted limited field inspections of the Cooling Pond Dike and Ash Pond Dike in 2005, 2006, 2007, and 2008. Reports (References 5, 6, 7 and 8) summarizing the observations and providing recommendations were furnished to Progress Energy.

4.0 FIELD INSPECTION OBSERVATIONS

4.1 Method of Inspection

Initial visual inspection of the dikes, and appurtenant structures, was made on June 4, 2009, by Mr. Al Tice and Mr. James Schiff of MACTEC Engineering and Consulting, Inc. Mr. Dennis Cole, who is in charge of dam inspections and maintenance at the Lee Plant, was also interviewed during the site visit and accompanied MACTEC on portions of the site walkover. The dike crest and side slopes were inspected on foot and from a slowly moving vehicle. A visual inspection of the river banks and discharge canal banks was made from a boat accompanied by Mr. David Daughtry of Progress Energy.

A second site visit was made by Mr. Tice on July 7, 2009 to complete observations of the Ash Pond Dike. Following the commencement of vegetation clearing on the Ash Pond Dike in December, 2009, Mr. Tice made a final site visit to check on the approach to clearing. The clearing was satisfactory.

Photographs to show conditions existing at the time of the site visits are included in Appendix C. The locations and orientation of the photographs are shown on Photograph Location Maps 1 and 2, inserted in a pocket in front of the photographs as Appendix B. In general, a comparison of the present photographs with comparable 2004 photographs showed no significant changes.

The inspection discussions presented in the following sections are based on the field visits.

4.2 Cooling Pond Dike

The cooling pond level at the time of the June 4, 2009 inspection visit was at elevation 79.3 feet msl. The river level was lower than normal. In this report, station references used are taken from inspection reference stations designated by Progress Energy and shown on their inspection reference maps. These stations do not correspond to original plan station references that have been used in previous reports. The reference stations are not well marked on the dike; we recommend that permanent markings be established by paint or signs for ease of identifying inspection notations.

4.2.1 Crest

The crest of the dike has a gravel surface and is in good condition. Photographs 1 through 4 show the typical appearance. No significant rutting or settling was seen.

4.2.2 Interior Slopes

The interior slope has a protective blanket of asphalt from below the pond level to the dike crest. For most of the pond geotextile and rip-rap have been placed on the asphalt to combat wave-induced erosion. The riprap is in good condition (Photographs 2, 5 and 6). The riprap has slid down the asphalt in a few places (Photograph 7); no actions are needed, observe for further slippage.

No indications of slope slumping, slides or excessive erosion were seen on the interior slopes of the dike. The asphalt blanket above the riprap has joints with some form of filling or caulking on a regular spacing. These joint fill materials are deteriorating. No action is needed at this time; however, repairs may become necessary within the next five years. Loss of the joint filler material could allow wave action to cause local undermining of the asphalt liner. Continued observation and repairs as needed is recommended.

A small portion of the interior slope, near the spillway, does not have the rip-rap. The asphalt from the spillway to approximately the start of the rip-rap has some open cracks that appear to extend through the asphalt (Photograph 8). The 2004 report recommended providing repairs to seal cracks in the asphalt liner on the interior slope near the spillway entrance. The asphalt liner is more vulnerable to degradation from weathering effects and wave action if the cracks are not repaired. Some repair work was accomplished in 2004 and 2005. No further repair work has been completed.

The observed cracks above the water level do not pose a significant stability issue; in many spots the natural ground beyond the exterior slope is above the pond level. Continued rises and falls of the pond could create local loss of ground below the asphalt liner and lead to local potholes in the liner. Observation for such conditions and repair as they are found is a reasonable future course of action.

Many of the observed cracks in the asphalt liner or deteriorated joint filling have grass or weed growth (Photograph 8). As part of the regular maintenance program, the vegetation should be sprayed to prevent roots from causing disruption of the liner.

4.2.3 Exterior Slopes

The exterior slopes are in satisfactory visual condition. Photographs 1, 9 and 10 illustrate the typical conditions.

The slopes on the north side of the lake are well vegetated with grass. The grass is well maintained to a reasonable distance beyond the toe. No indications of slumping or seepage emerging from the slope face were seen. At approximately station 31, where the drainage blanket has been placed, no signs of boils were seen. A very slight outflow (1/2 to ¾ gallons per minute) of clear water was seen emerging from the edge or the blanket about 15 feet west of Piezometer 6; this area is typically a point of slight seepage. The vegetation has been cut back to allow clear views for inspection (Photograph 11). Standing water was observed to cover more area than usual. The area is topographically low and the cut vegetation may be contributing to some of the standing water by inhibiting outflow along the relatively flat drainage swales.

The two pipes leading under the dike from the sealed discharge structures were inspected and appeared to be in satisfactory condition. There was no indication of seepage or leakage observed at the discharge ends (Photographs 12 and 13).

The toe area along the dike (except for the drainage blanket area) is dry. Some standing water was observed near station 27, a typical condition due to the relatively flat topography. Most of the area beyond the dike toe on the south side was dry. It is not unusual to see standing water in low spots in this section. Normally this water is 40 to 50 feet beyond the dike toe. No signs of boils or seepage related to the dike were seen.

Vegetation has crept up the asphalt exterior slope liner to a point that it needs maintenance. Some small trees growing in joints were seen (Photographs 10 and 14). Vines and other brush are starting to encroach into joints as well. Removal of vegetation from the liner and to a distance of five feet beyond the toe is recommended; however there are some large trees growing just beyond the toe of the dike whose removal could damage the liner. Such trees could be left in place. Subsequent to the field visits, Progress Energy reported that vegetation removal was completed in late December, 2009.

4.2.4 River Banks

The general condition of the river banks and the rip rap areas were observed from a boat during the June 4 site visit. Photographs 15 and 16 show typical conditions. The river level at the time of our observation was lower than normal. No significant losses of riprap or significant bank failures were observed. The river bank area adjacent to the north part of the dike does not have riprap. A small amount of seepage was observed in this area, near the end of the riprap. This condition was also noted in the 1999 and 2004 5-year inspections, and the conditions seen in 2009 appeared similar.

The river bank areas without rip rap show occasional presence of low height vertical banks and some oozing of seepage but no signs of major slumping. The Cooling Pond Dike is more than 200 feet from the river banks. Local slumps at the river bank would not raise concern for the dike stability. The original riprap placement was done because progression of erosion was noted in inspections shortly after the dikes were completed. The riprap has controlled progression of the erosion.

4.2.5 Structures

The concrete spillway entrance, bottom slab, outflow chute and energy dissipation blocks appeared to be in good condition (Photographs 17 and 18). There is a very minor amount of leakage under the seals of the concrete gates; no repairs are necessary. Some vegetative growth is present in bottom slab joints that should be removed (Photograph 17). The spillway exit walls are concrete that transition to steel sheet piling for the last 100± feet. The concrete portions are in good visual condition. There are a few vertical cracks and widened vertical joints. There is a small amount of seepage through the lower part of some of the joints, but no apparent loss of ground behind the walls. No action appears necessary. The amount of seepage observed during the current inspection visit was less than in the past.

The steel sheet piles show corrosion consistent with their age. Even if the sheet piles experience failure, the remainder of the spillway would not likely be impacted.

Vegetation along both sides of the spillway was cut several years ago. The cut vegetation has been left on the slopes as directed by the Corp of Engineers. Removal of the cut vegetation is not allowed due to environmental restrictions. A sand bar with vegetation was observed near the junction of the spillway outfall and the Neuse River (Photograph 19). Discussions with Progress Energy personnel indicate that the sand bar has been present for some time. Removal of the sand bar would be difficult to permit, and the flow patterns in the river would likely recreate a sand bar. Because the spillway is not activated except in a flood condition when the river level would be above the sand bar, flows should not be affected significantly by the sand bar. Removal of the vegetation should be done so future flooding of the Neuse River may reduce or remove the sand bar by erosion.

The recirculating water discharge structure consists of two concrete boxes (Photograph 20). Severe undermining of the structures and erosion in the intake channel occurred in 1993. Repairs were made as described in Reference 4, and movements of the intake boxes and profile of the channel in front of the boxes have been monitored since. The concrete and steel of the discharge structures appears to be in good condition. No change in the appearance of the structures has been noticed during annual site visits since the 2004 inspection in terms of displacement. The southern structure is slightly higher than the northern structure, but this condition has been noted in prior inspections. There were no signs of further void or tension crack development in the soils around the structure. The monitoring will be discussed in section 4.4.

4.3 Ash Pond Dike

At the time of the field inspection, the ash pond had water in about 1/3 of the original area; the remainder was filled with sedimented ash. The water level was at about elevation 81 feet, about 7 feet below the design maximum elevation. Since the 2004 inspection, Progress Energy has been placing ash in the western end of the ash pond which had not had ash placed in it for at least 15 years. The placement is designed to create a horseshoe-shaped low-height dike area with the ash discharged at the west end of the horseshoe and allowed to flow out the east (open) end of the horseshoe. The concept is to promote more ash sedimentation in old, unused portion of the pond.

The field inspection was performed by driving around the entire dike and performing walking inspections at selected locations. The crest, interior slopes and exterior slopes of the dam generally appeared to be stable.

4.3.1 Crest

The crest of the dike is in satisfactory condition with no areas of concern noted. Photographs 21 through 24 are overviews of the dike showing the crest. The roadway along the crest is mostly gravel with a moderate grass cover between traveled paths. No significant deformations or ruts were observed.

4.3.2 Interior Slopes

The interior slopes are in good condition (Photographs 22, 25 and 26). Areas repaired in 2000 are performing well (Photographs 25 and 26). Vegetation has covered much of the riprap and rock blankets. This vegetation should be controlled by annual spraying to prevent large root development that can disrupt the blankets. In the areas with impounded water, there is a good growth of reeds and cattails at the water edge that serves to reduce wave impacts. No significant erosion areas were noted.

There is a separator dike between the ash pond and the secondary settling pond. The slopes of the separator dike are in fair condition (Photograph 23). Excess vegetation on the slopes should be cut.

4.3.3 Exterior Slopes

Photographs 24 and 27 through 30 show typical views of the exterior slopes of the dike. The slopes on the southern dike have some locations where small scarps are present near the crest. These appear old, and they have been seen in past inspections. No signs of recent movement were seen. The areas repaired in 1996 and 2000 show no visual signs of further movement. The toe of the dike along the south side is dry, with no apparent seepage. Near the western end of the south dike, an area of ponded water was observed in a topographic low area that begins about 100 feet outside the dike toe. Water in this area appears to be from rainfall and from river over-bank flooding. The observed conditions pose not concern for dike stability.

The eastern and northern parts of the dike have a generally flatter slope than other sections. Vegetation on the slopes had been cut with a mower shortly before this site visit. In areas where the dike height was too great for the mower to reach the lower sections of the slope, vegetation was not cut.

Subsequent to the field inspections, Progress Energy contracted with a tree cutting firm to remove brush and trees on the exterior slope around the entire ash pond. The work was observed in progress by Mr. Tice on December 3, 2009 and, with very minor local concerns, was proceeding satisfactorily. Discussions were held with Progress Energy personnel and the tree cutter to address the minor concerns. Photograph 31 shows a portion of the north dike where clearing had been completed.

During past inspections, the exterior slope of the secondary settling basin dike on the east side has been noted to have soft and wet soils with occasional slight ooze of seepage. The area affected gradually enlarged both laterally and upslope. There has been little seepage flow and no signs of boils or soil particle movement. Due to the proximity of the area to a creek and the Neuse River, the area beyond the dike toe is also marshy. As discussed in section 3.2.1 improvements to the worst of the slope areas were made in spring, 2009. The improvements included clearing, placing geotextile fabric and placing riprap. The improvements were in good condition (Photograph 32).

Additional toe and slope wet areas were noted to extend from the north end of the improvements to the north end of the secondary settling pond dike with the worst spot associated with a fallen tree (Photograph 33). These areas should be observed for signs of increasing seepage or local surface movement. If such are noted, the improvement concept should be extended over this area.

An existing creek runs parallel to the dike toe along the north dike (Photograph 34). The creek is 20 to 50 feet beyond the dike toe. Beavers live along the creek and build dams that block creek flow (Photograph 35). The blockages generally do not impound water against the dike. Progress Energy continues to remove the dams and is working on a plan to remove the beavers. A walk along the north and east dike toe did not find evidence for any seepage out of the ash pond dike. Local water ooze spots were seen along the creek bank on both sides of the creek. These spots are interpreted as groundwater or bank storage release, not as seepage from the ash pond. Continued maintenance to remove beaver dams is necessary, as Progress Energy is doing.

4.3.4 Outlet Structures

The vertical riser in the ash pond fell over in 2004 and was repaired. The skimmer structure on top of the riser appears to have a slight vertical tilt; otherwise, the skimmer structure is in good condition (Photograph 36).

Water leaving the pond vertical riser flows through a horizontal pipe into the secondary settling basin. The discharge of the flow creates a "burping" effect at times due to unbalanced hydraulic head and air becoming trapped in the discharge stream. This condition does not appear to affect the operation of the structures, and the conditions have been noted in the past.

The secondary settling pond skimmer is in good condition. Outflow from the secondary settling basin exits at the Neuse River through a concrete pipe with riprap as an energy dissipation method. The outlet was flowing nearly full at the time of the inspection, and no indications of water flowing underneath the pipe were seen. The riprap in the outlet channel was visible due to the lower river level. The riprap appeared in good condition (Photograph 37).

4.4 Monitoring Program

Until September, 2009, the plant personnel conducted visual observations of the Cooling Pond Dikes and Ash Pond Dikes weekly during a preventive maintenance ride around the dike. Inspections were made quarterly using a check list. Review of these forms found them to be satisfactory. Progress Energy implemented a new procedure for dam and dike inspections in September, 2009 (Exhibit 9). The new procedure establishes a monthly schedule for inspection of the Cooling Pond Dikes and the Ash Pond Dikes. Checklists are furnished in the new procedure for guiding the inspection. Training of inspectors is also required. Information at the plant from the first inspections conducted under the new procedure was reviewed during the December 3, 2009 site visit and found satisfactory.

Originally, there was no safety or performance instrumentation in the dikes. As discussed earlier, piezometers have been added at selected areas on both ponds, and survey monitoring points have been established on the Cooling Pond recirculation discharge structure.

4.4.1 Cooling Pond Dike

Soundings of the cooling pond bottom in front of the structures and elevations on monitoring points on the structures were taken in May 1993, October 1993, July 1994, July, 1999 and June, 2004 by Smith & Smith Surveyors. Based on the evaluation of the results of the monitoring during the 1994 inspection, annual monitoring was discontinued. Soundings in front of the structures and elevations on most of the monitoring points were taken for the 2009 inspection by McKim and Creed in July, 2009.

Exhibit 10 shows the 2009 bottom sounding readings. The results of the 2009 bottom soundings were reviewed with respect to past readings. Exhibit 11 compares present sounding results to readings reported in October, 1993, soon after the rip rap was placed. Present readings are typically a foot or two above previous readings. Problems with turbulence and irregularities in the rip rap shapes make point to point comparisons questionable. MACTEC interprets the present readings as showing no significant loss of rip rap. Soundings should be planned as part of the next 5-year inspection.

Exhibit 12 shows the 2009 survey elevations of the monitoring points on the discharge structure compared to the 2004 readings. Two of the monitoring points were not surveyed in 2009 due to their markings being obscured by wear. The 2009 readings indicate settlements of about 1 inch or less with about the same change at all but one of the monitoring points compared. The visual observations do not suggest movements of the magnitude calculated. It is possible use of a different surveyor or even changes in the reference point benchmark could account for the differences. Progress Energy may desire to have the points re-surveyed earlier than the normal 5-year interval to check changes against the 2009 readings.

In December, 2002, eight piezometers were installed on the north side of the Cooling Pond Dike in the area where seepage and boils had been observed. Piezometer locations are shown on Exhibit 13, and information on the piezometers is contained in Exhibit 14. Piezometers readings have been are obtained by the plant on a generally quarterly basis. Exhibit 15 shows the results of the readings.

Based on review of the readings, elevations of water in the in the piezometers on the crest of the dike fluctuate much more than elevations in piezometers on the slope or at the toe. Fluctuations on the order of 7 feet have been recorded. Because the cooling pond level fluctuation is about 1 to 2 feet, the large fluctuation in the crest piezometers may be related to variations in the Neuse River water levels. Readings in the crest piezometers in September, 2009 were near the historical low elevation, and the river level was low. In contrast, readings in the crest piezometers in December, 2009, after a period of heavy rains in November and December, were at the historical high, suggesting a close association of piezometer levels with changes in river levels. Even at the highest elevations recorded, the water level indicated at the crest is below the base of the dike fill, indicating the seepage at the toe drainage blanket is not a result of seepage through the dike. Water elevations in piezometers at the toe of the dike are five to 10 feet below the drainage blanket. Piezometer #8 is located outside the main seepage area and typically reflects presence or absence of standing water in the topographic low areas near the toe of the dike.

4.4.2 Ash Pond Dike

A previously discussed, MACTEC installed piezometers in December, 2007 for monitoring groundwater levels in the ash pond secondary containment dike in the area where seepage along the exterior slope toe and beyond had been identified by inspections. Exhibit 6 shows the locations and installation information for the piezometers. Exhibit 16 shows water level readings made by Progress Energy personnel since the installation. Water levels in the dike slope and toe have shown very little fluctuation. Water levels in the piezometers at the dike crest are near or below the base of the dike, and have shown fluctuations of about 2 feet around a typical value of 23 feet depth at Piezometer 1 and about 1 foot around a typical value of 15.5 feet depth at Piezometer 4. Water levels in the toe area are within a foot of the original ground surface at the north end and about three feet below the original ground surface at the south end. MACTEC recommends water level readings continue on a quarterly schedule. Water levels are currently being reported by the plant as depths below the top of the piezometer. Elevations for the tops of the piezometer casings as estimated by MACTEC from installation information are included in Exhibit 6. Reporting sheets should provide depth and elevation readings.

Progress Energy is currently operating the ash pond with the riser elevation at approximately 83 feet msl. Past plans to raise the level of the riser have not been implemented. If the riser is to be raised in the future, MACTEC recommends four piezometers be installed along the south dike for monitoring the phreatic surface in the dike as the pond water level is raised. The piezometers should be installed beginning about 100 feet west of the separator dike and then at about 200-foot intervals to the west. Flush-mounted covers can be used to avoid interference with traffic and maintenance activities. When the pond operating level is raised, water level readings should be obtained weekly for the first month after the raise, monthly for the next three months and quarterly for the next year. Piezometer readings should be furnished to Progress Energy engineers for review.

5.0 REFERENCES

1. "Recommended Guidelines for Safety Inspection of Dams", Department of Army, Office of the Chief of Engineers, Washington, D.C., November, 1976.

2. "Five-Year Independent Consultant Inspection, Progress Energy Carolinas H. F. Lee Electric Generating Plant, Cooling Pond Dike, Ash Pond Dike", MACTEC Engineering and Consulting, Inc., December 16, 2004.

3. "Independent Consultant Inspection, Cooling Pond Dike and Ash Pond Dike, H. F. Lee Electric Generating Plant, Historical Volume", Law Engineering and Environmental Services, Inc., December 22, 1999.

4. "Dam Safety", North Carolina Administrative Code, Title 15A, Department of Environment and Natural Resources, Subchapter 2K, April 1995.

5. "Report of Limited Field Inspection, Ash Pond Dike and Cooling Lake Dike, Lee Plant", MACTEC Engineering and Consulting, Inc., 2005.

6. "Report of Limited Field Inspection, Ash Pond Dike and Cooling Lake Dike, Lee Plant", MACTEC Engineering and Consulting, Inc., December 27, 2006.

7. "Report of Limited Field Inspection, Ash Pond Dike and Cooling Lake Dike, Lee Plant", MACTEC Engineering and Consulting, Inc., June 1, 2007.

8. "Report of Limited Field Inspection, Ash Pond Dike and Cooling Lake Dike, Lee Plant", MACTEC Engineering and Consulting, Inc., December 29, 2008.

9. "Report of Repair Activity, Circulating Water Discharge Structures, H. F. Lee Steam Electric Plant, Goldsboro, North Carolina", Law Engineering, June 25, 1993.

APPENDIX A

EXHIBITS

EXHIBITS

1. Site location map (taken from USGS 7-1/2 minute quadrangle maps).
2. Cooling Pond, General Plan – Ebasco Drawing G-164890.
3. Cooling Pond Dam, Sections and Details – Ebasco Drawing G-164891.
4. Ash Pond Area Plan – CP&L Drawing RCD-372.
5. Ash Disposal Area – Sections & Details – CP&L Drawing RCD-373.
6. Plan and Sections for Piezometers at Secondary Settling Pond Dike – MACTEC Drawing No. C1, December, 2007.
7. Field Observations, Repairs of Lee Ash Pond Dike Slope, MACTEC letter dated April 27, 2009.
8. As-built Drawing of Ash Pond Dike Flood Damage Repairs – Law Engineering Drawing No. 5 dated January 5, 2001.
9. Lee Plant Dam and Dike Inspection Procedure, Progress Energy Procedure EVC-LEEC-00033, Rev. 0, September, 2009.
10. Results of Bottom Sounding Survey at Recirculating Discharge Structure – McKim and Creed, July, 2009.
11. Comparison of Soundings at Recirculating Discharge Structure.
12. Comparison of Elevations at Recirculating Discharge Structure.
13. Plan of Piezometer Installation, Cooling Pond North Dike, Lee Plant – MACTEC Drawing No. 1, June, 2003.
14. Summary of Piezometer Installations, Cooling Pond North Dike..
15. Summary of Piezometer Readings, Cooling Pond North Dike.
16. Summary of Piezometer Readings, Ash Pond Secondary Settling Pond

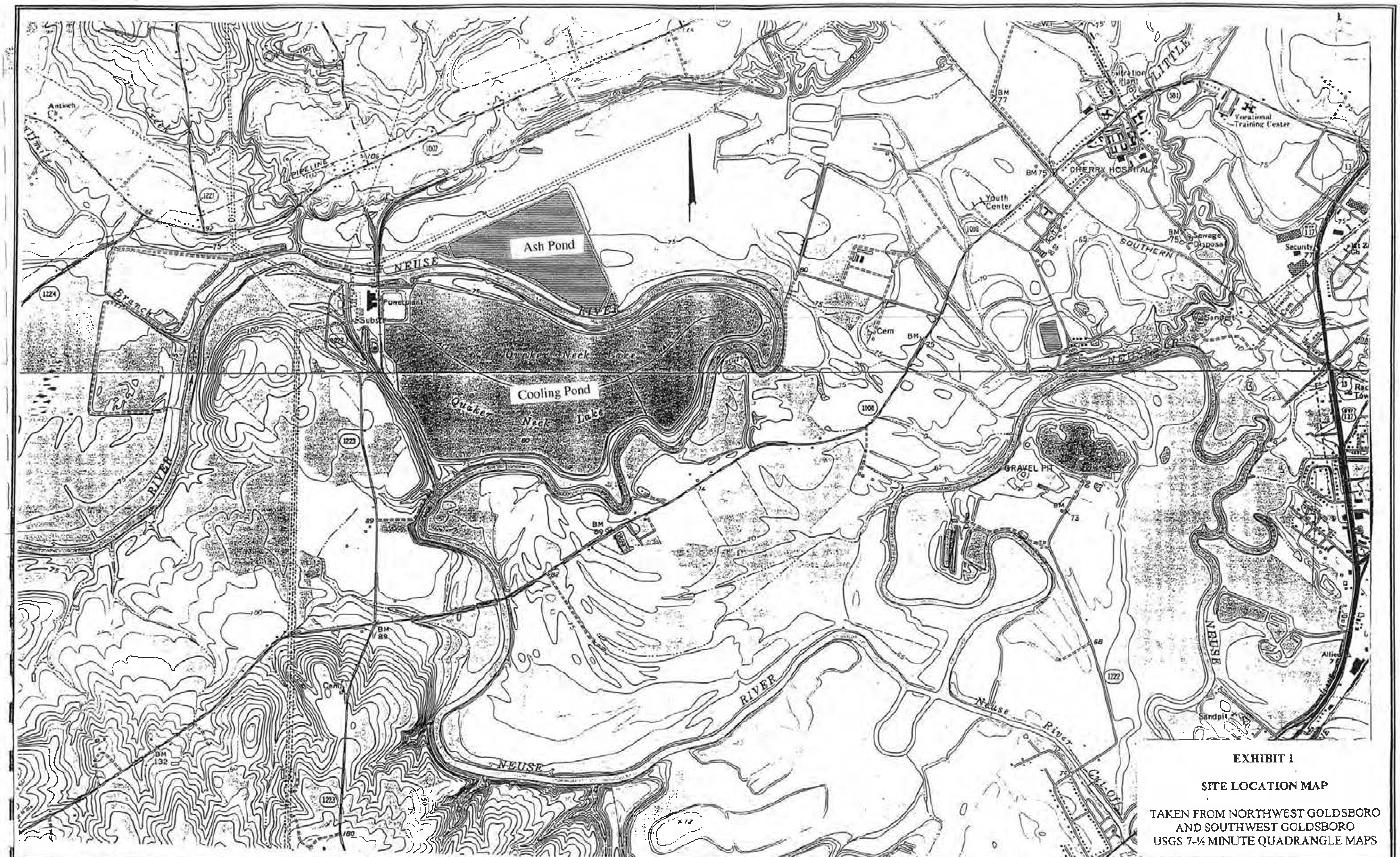
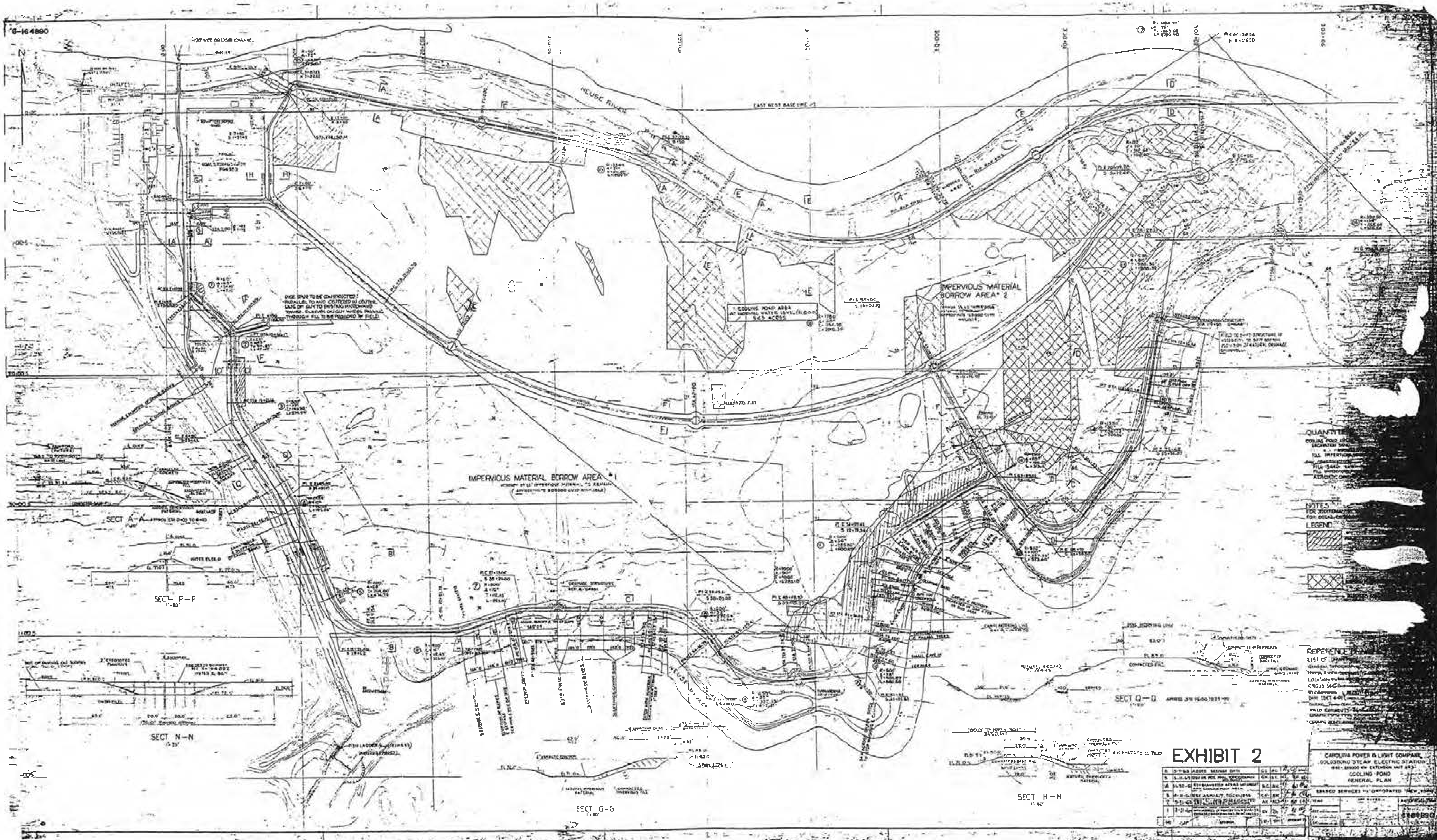


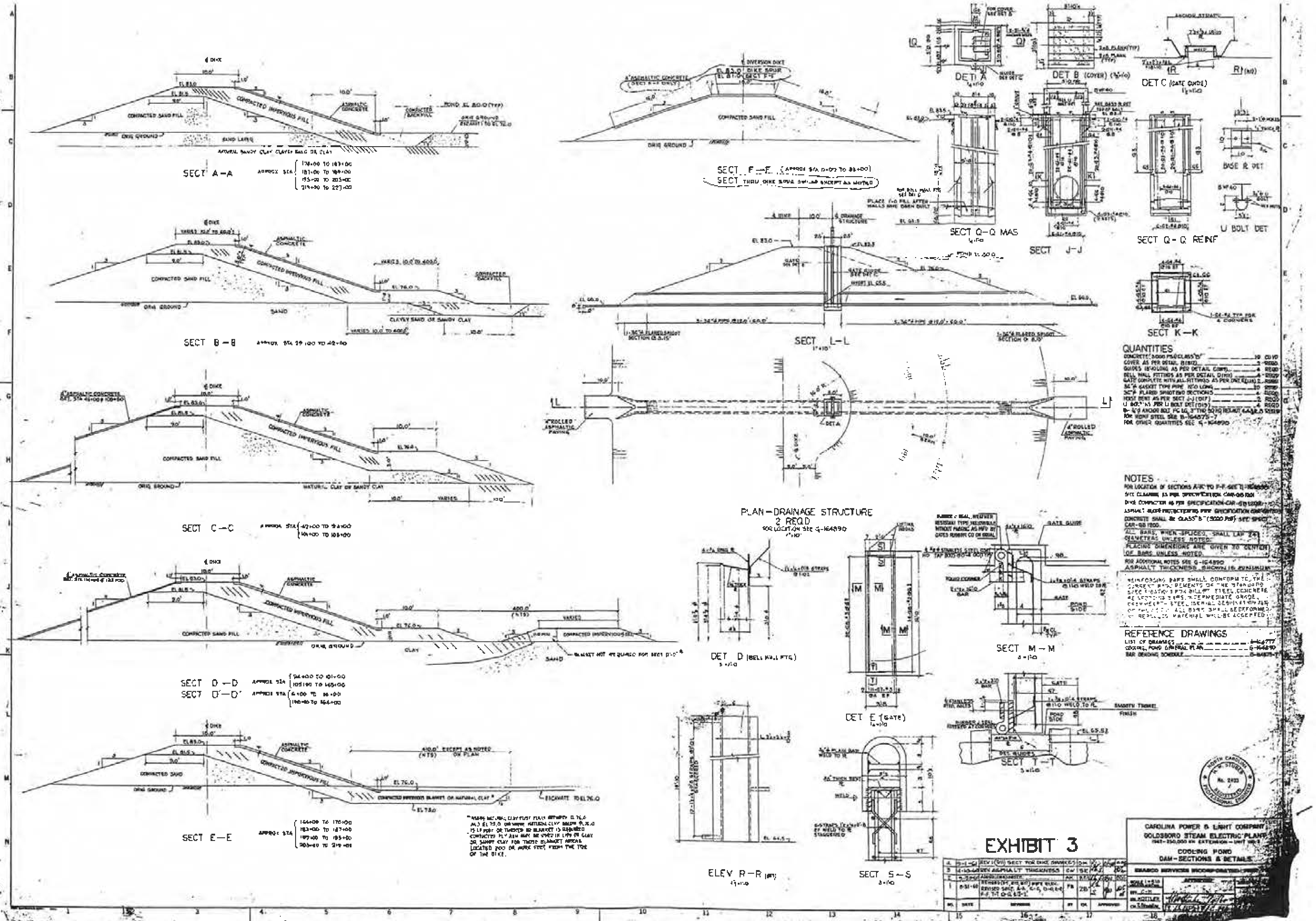
EXHIBIT 1

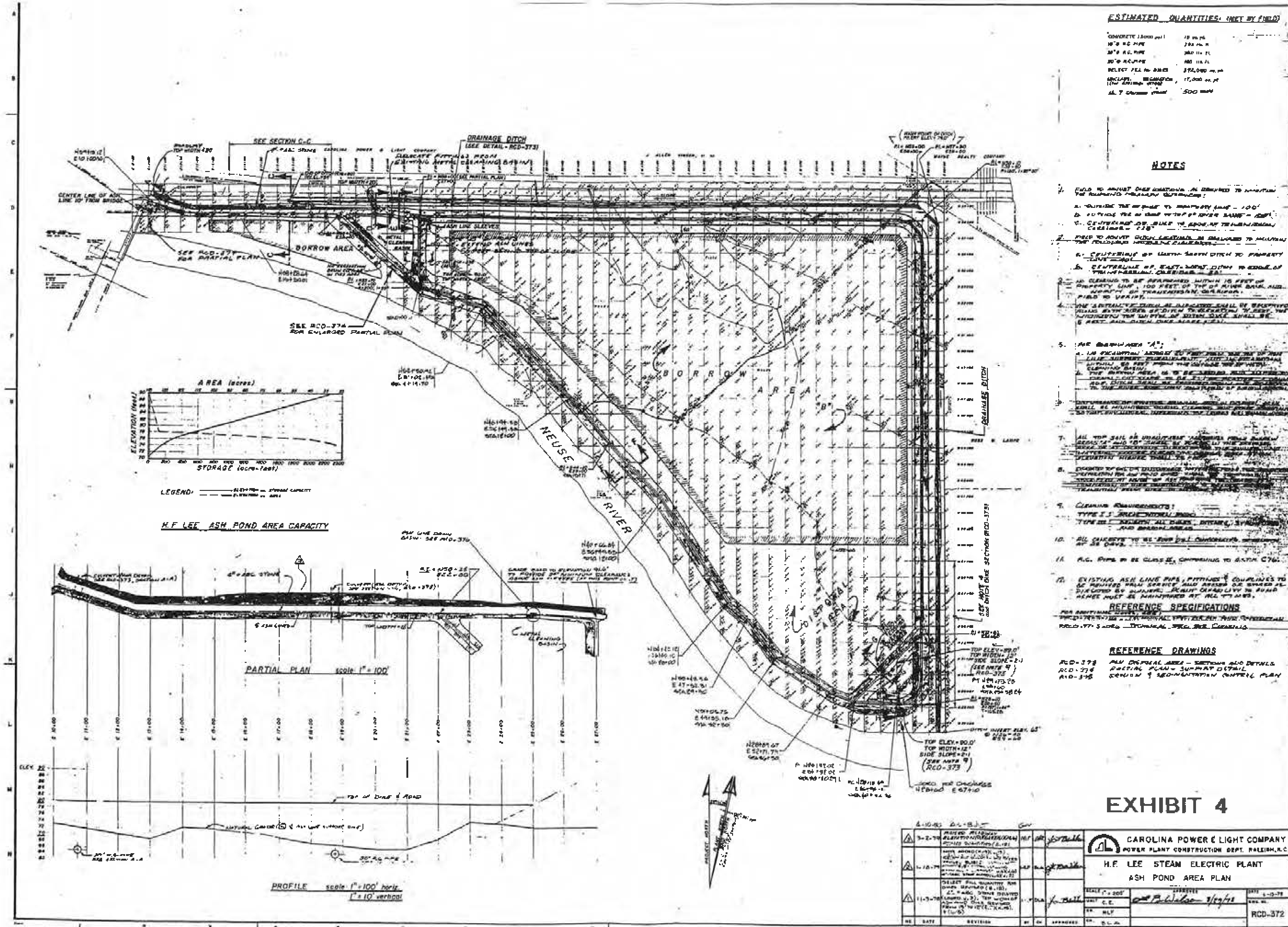
SITE LOCATION MAP

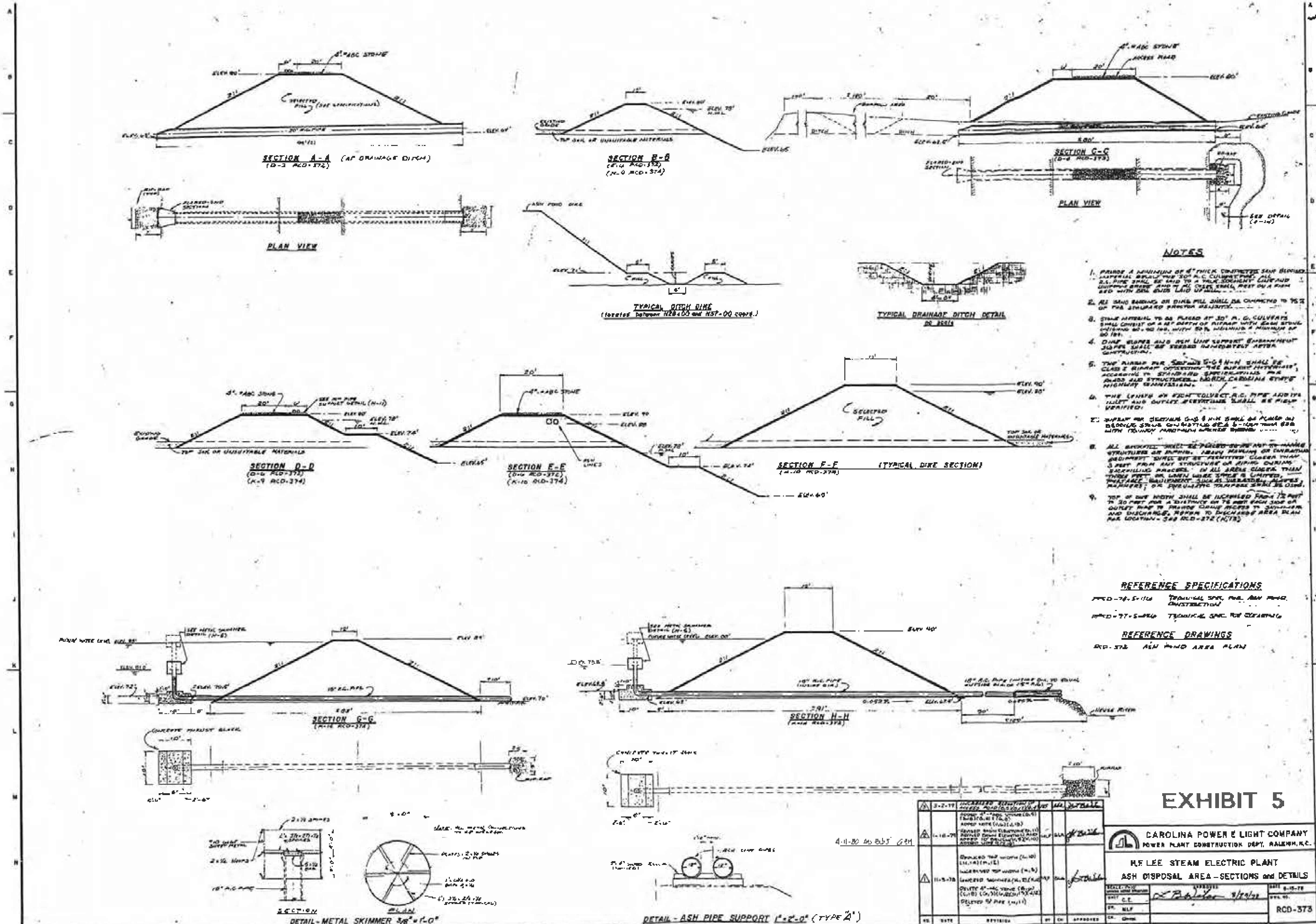
TAKEN FROM NORTHWEST GOLDSBORO AND SOUTHWEST GOLDSBORO USGS 7-½ MINUTE QUADRANGLE MAPS

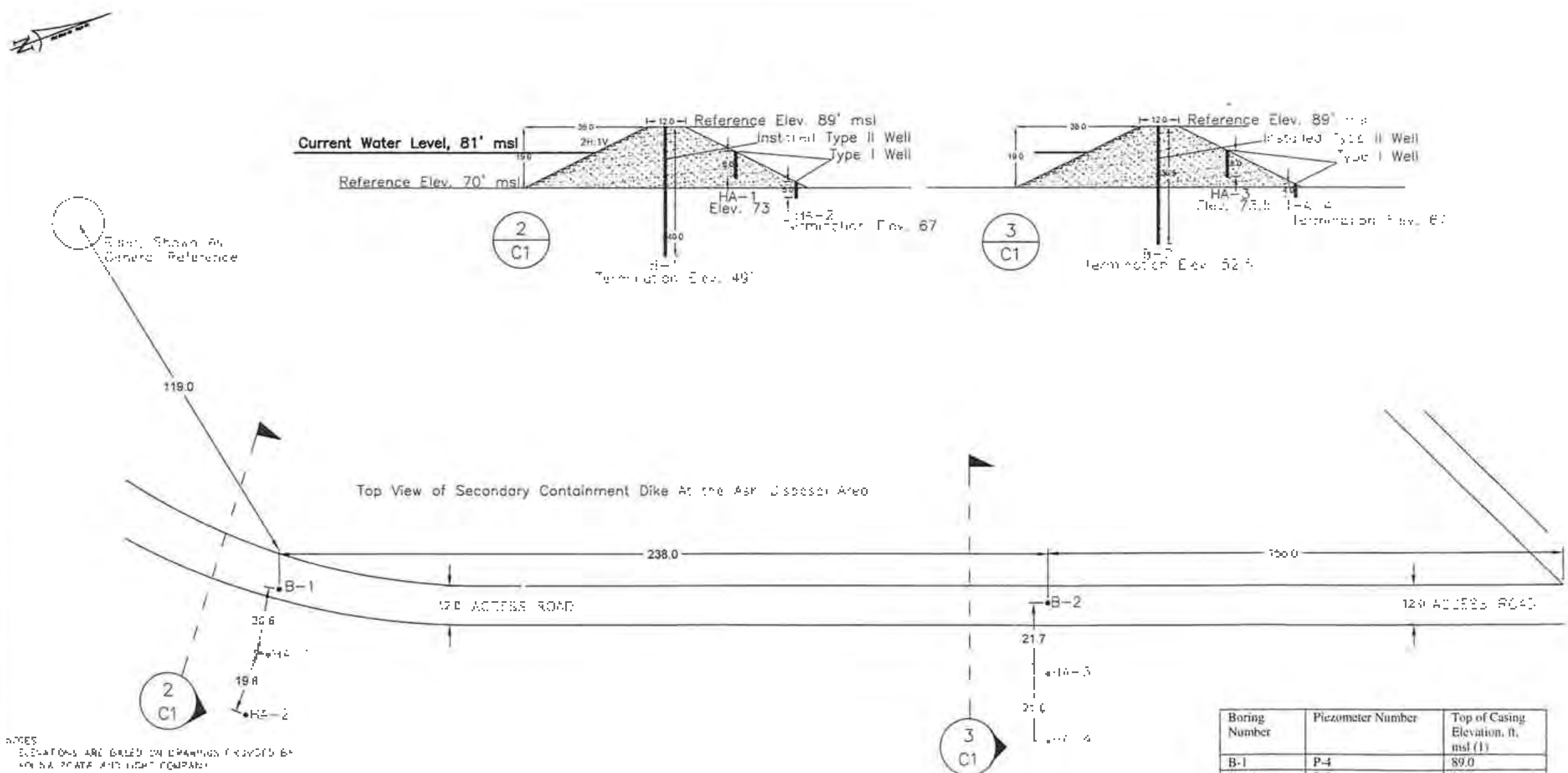


NEUSE RIVER
EAST WEST BASE LINE
IMPERVIOUS MATERIAL BORROW AREA 1
IMPERVIOUS MATERIAL BORROW AREA 2
COOLING POND AREA
SECT A—A
SECT P—P
SECT N—N
SECT G—G
SECT H—H
SECT Q—Q
QUANTITIES
NOTES
LEGEND
REFERENCE DRAWINGS
EXHIBIT 2
CAROLINA POWER & LIGHT COMPANY
GOLDSBORO STEAM ELECTRIC STATION
COOLING POND
GENERAL PLAN
EBASCO SERVICES INCORPORATED NEW YORK


SECT A—A
SECT B—B
SECT C—C
SECT D—D
SECT D'—D'
SECT E—E
SECT F—F
SECT L—L
PLAN—DRAINAGE STRUCTURE
2 REQ'D
DET A
DET B (COVER)
DET C (GATE GUIDE)
SECT Q—Q MAS
SECT J—J
SECT Q—Q REINF
U BOLT DET
BASE & DET
SECT K—K
QUANTITIES
NOTES
REFERENCE DRAWINGS
DET D (BELL WALL FTG)
DET E (GATE)
SECT M—M
SECT T—T
ELEV R—R
SECT S—S
COMPACTED SAND FILL
COMPACTED IMPERVIOUS FILL
ASPHALTIC CONCRETE
ORIG GROUND
EXHIBIT 3
CAROLINA POWER & LIGHT COMPANY
GOLDSBORO STEAM ELECTRIC PLANT
COOLING POND
DAM—SECTIONS & DETAILS


ESTIMATED QUANTITIES
NOTES
11. R.C. PIPE TO BE CLASS III, CONFORMING TO ASTM C76.
REFERENCE SPECIFICATIONS
REFERENCE DRAWINGS
SEE SECTION C-C
DRAINAGE DITCH
BORROW AREA
NEUSE RIVER
DISPOSAL AREA
AREA (acres)
ELEVATION (feet)
STORAGE (acre-feet)
LEGEND:
H.F. LEE ASH POND AREA CAPACITY
PARTIAL PLAN scale: 1" = 100'
PROFILE scale: 1" = 100' horiz. 1" = 10' vertical
EXHIBIT 4
CAROLINA POWER & LIGHT COMPANY
POWER PLANT CONSTRUCTION DEPT. RALEIGH, N.C.
H.F. LEE STEAM ELECTRIC PLANT
ASH POND AREA PLAN
NO.
DATE
REVISION
BY
CH.
APPROVED
RCD-372


SECTION A-A (AT DRAINAGE DITCH)
PLAN VIEW
SECTION B-B
TYPICAL DITCH DIKE
SECTION C-C
PLAN VIEW
TYPICAL DRAINAGE DITCH DETAIL
NOTES
SECTION D-D
SECTION E-E
SECTION F-F (TYPICAL DIKE SECTION)
REFERENCE SPECIFICATIONS
REFERENCE DRAWINGS
SECTION G-G
SECTION H-H
DETAIL - METAL SKIMMER
DETAIL - ASH PIPE SUPPORT
EXHIBIT 5
CAROLINA POWER & LIGHT COMPANY
POWER PLANT CONSTRUCTION DEPT. RALEIGH, N.C.
H.F. LEE STEAM ELECTRIC PLANT
ASH DISPOSAL AREA - SECTIONS and DETAILS
RCD-373



NOTES

ELEVATIONS ARE BASED ON DRAWINGS PROVIDED BY CAROLINA POWER AND LIGHT COMPANY.

DIMENSIONS SHOWN IN TOP VIEW SECTION ARE APPROXIMATE MEASURED IN THE FIELD BY TAPE AND REFERENCE POINTS.

[illegible]

LOCKING CAPS WERE PLACED ON ALL WELLS.

Boring Number	Piezometer Number	Top of Casing Elevation, ft. msl (1)
B-1	P-4	89.0
HA-1	P-5	84.8
HA-2	P-6	74.1
B-2	P-1	89.0
HA-3	P-2	86.5
HA-4	P-3	73.1

(1) Elevations are estimated using top of dike elevation.

EXHIBIT 6

MACTEC
MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

Borings and Well Placement at Secondary Containment Dike
H.F. Lee Steam Electric Plant
Goldsboro, N.C.

DRAWN:	CJF	DATE:	DECEMBER, 2007	FIGURE
ENG CHECK:		SCALE:	As Shown	C1
APPROVAL:		JOB No.:	6458-07-1864	

REFERENCE: Carolina Power and Light DWG No. [illegible]

EXHIBIT 6

MACTEC

engineering and constructing a better tomorrow

April 27, 2009

Mr. Bill Forster
Progress Energy
7001 Pinecrest Road
Raleigh, North Carolina 27613

Subject: **FIELD OBSERVATIONS**
REPAIRS OF LEE ASH POND DIKE SLOPE
MACTEC PROJECT NO. 6468-09-2397

Dear Mr. Forster:

As authorized by Progress Energy Work Authorization 2720-167, MACTEC Engineering and Consulting, Inc. (MACTEC) has observed the repair work at the exterior slope of the secondary settling basin of the Lee Ash Pond. This letter summarizes our observations.

REPAIR PLAN

The repair intent was to provide a surficial layer of rip rap placed over geotextile in an area that has seepage. The seepage was noticed during dam inspections as early as 1997. Seepage has very gradually become more extensive and greater in volume, but flowing seeps are rare. No loss of soil or presence of boils has been noted. Due to the general increase in seepage extent and volume, the repair measures were instituted to provide protection against local surface slides or loss of ground.

The area for the rip rap was planned as the lower third of the dike slope and five feet outside the toe of the slope covering a length of about 300 feet. The general plan included the following:

- Clearing vegetation in the repair area.
- Placing a Mirafi geotextile (Type 116-N) on the cleared area with minimum 12-inch overlap and securing to the slope using pins.
- Placing a layer of NC DOT Class B rip rap about 12 inches thick on the geotextile using methods that minimize potential for damage to the rip rap.

MACTEC OBSERVATIONS

Progress Energy contracted with TransAsh for the repairs. A two-man crew from TransAsh led by Mr. Cecil Wilson performed the work beginning April 6, 2009 and ending April 17, 2009. MACTEC participated in a conference call on April 6, 2009 with TransAsh and Progress Energy to review the planned work. In this call, it was agreed that two existing trees near the base of the slope having diameters of about 18 inches could be left in place. Also, removal of root systems of trees removed should be avoided. The trees should be cut flush with the ground. Where necessary, soil or gravel could be placed around cut tree stumps so they would not create potential puncture hazards for the geotextile.

MACTEC visited the site on the dates shown below. The purposes of the visits and associated observations are stated.

EXHIBIT 7
1 of 6

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue • Raleigh, NC 27604 • Phone: 919.876.0416 • Fax. 919.831.8136
www.mactec.com

- April 9, 2009 – Site visit by Al Tice and Mark Blackley (MACTEC senior technician) to check status of clearing and to orient Mr. Blackley as to observation needs. Mr. Tice left after the orientation. Clearing done was not satisfactory (Photograph 1). Additional recommendations for clearing were given to Mr. Wilson. Mr. Blackley remained on site and observed continued clearing work, reporting that it was achieving desired results.
- April 14, 2009 – Blackley observed clearing completion and accepted slope for placement of geotextile. Geotextile was placed with minimum of 12 inches overlap and staked using long pins. Geotextile placement was satisfactory. The amount of geotextile obtained was not sufficient to fully cover the repair area. Additional geotextile was ordered by TransAsh.

- April 15, 2009 – Blackley arrived to observe placement of rip rap. Rip rap delivery was delayed due to problems with the order, and no rip rap was placed.

- April 16, 2009 - Blackley observed placement of rip rap. Work was satisfactory and was completed up to the area where additional geotextile was to be placed. The additional geotextile was expected to arrive April 17.

- April 17, 2009 – Tice visited to observe completed work. Geotextile had not arrived at time of visit, but TransAsh was expecting it between 1 and 4 PM. Completed work observed was generally satisfactory with exception of local spots where additional rip rap was needed because the original placement did not fully cover the geotextile (Photographs 2-4). Tice also noticed an area adjacent to the planned eastern end of the rip rap where more geotextile and rip rap needed to be placed. The area was marked in the field and consisted of about a 5-foot eastward extension at the top of the area, tapering to the planned edge at the base of the area. The crest of the dike was observed to have excess rip rap, and some rutting was observed (Photograph 5). Also, excess rip rap was placed on the interior slope and upper portion of the exterior slope. The observations were discussed with Mr. Wilson who had already noted the areas needing more rip rap, and planned to use the excess rip rap on the interior slope to fill in the spots.

  Mr. Tice left the site prior to arrival of the needed geotextile. Mr. Wilson called Mr. Tice at 6:45 PM to report that the geotextile had arrived and he had completed the work.

- April 20, 2009 - Tice visited the site to meet with Dennis Cole of the Lee Plant and Mr. Forster for a final inspection. The final placement of rip rap had been completed satisfactorily. The recommended area for additional rip rap had also been completed satisfactorily. Most of the local areas needing additional rip rap had been filled, but there were still a few spots needing more rip rap (Photograph 6). Mr. Cole stated these could be handled by plant staff by hand placement using excess rip rap that had been left on the exterior slope above the repair area. The crest of the slope had been smoothed some, but Progress Energy noted a need for more work which could be handled by plant personnel.

Based on our observations and the commitment from Mr. Cole to cover the few areas where additional rip rap is needed, MACTEC considers the repairs have been completed satisfactorily.

MACTEC is pleased to provide these comments. Please contact us if there are any questions.

Sincerely
MACTEC Engineering and Consulting, Inc.

J. Allan Tice, P. E.
Senior Principal Engineer
Registered, North Carolina 6428

Attachment – Photographs

JAT/jat

cc: Ricky Miller, Lee Plant Environmental Coordinator

Attachment - Photographs
Lee Dike Slope Rip Rap Addition

1. Initial slope clearing 4-9-09 – Not accepted; additional clearing done by TransAsh prior to geotextile installation and reviewed by MACTEC.

2. Final area for geotextile and riprap placement 4-17-09. Note satisfactory clearing.

Attachment - Photographs
Lee Dike Slope Rip Rap Addition

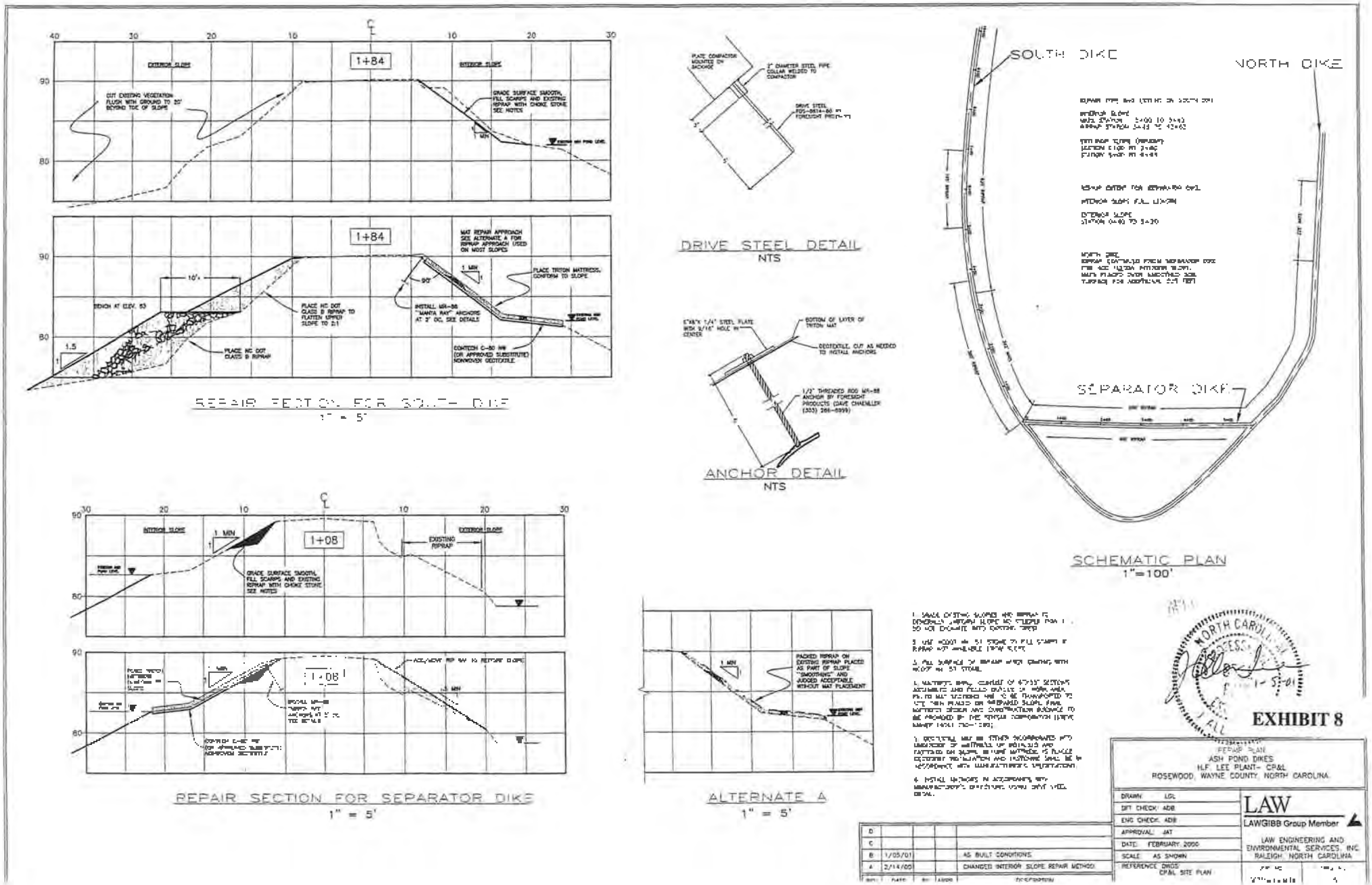
3. Areas within completed rip rap blanket where additional rip rap is needed 4-17-09.

4. Overview of completed blanket 4-17-09.

EXHIBIT 7
5 of 6

5. Crest condition 4-17-09. Additional cleanup of rip rap needed.

6. Overview 4-20-09. Note a few remaining spots that need more rip rap.



1+84
EXTERIOR SLOPE
INTERIOR SLOPE
CUT EXISTING VEGETATION FLUSH WITH GROUND TO 20' BEYOND TOE OF SLOPE
GRADE SURFACE SMOOTH, FILL SCARPS AND EXISTING RIPRAP WITH CHOKE STONE SEE NOTES
1 MIN
MAT REPAIR APPROACH SEE ALTERNATE A FOR RIPRAP APPROACH USED ON MOST SLOPES
PLACE TRITON MATTRESS, CONFORM TO SLOPE
BENCH AT ELEV. 83
PLACE NC DOT CLASS B RIPRAP TO FLATTEN UPPER SLOPE TO 2:1
INSTALL MR-88 "MANTA RAY" ANCHORS AT 3' OC, SEE DETAILS
PLACE NC DOT CLASS B RIPRAP
CONTECH C-80 NW (OR APPROVED SUBSTITUTE) NONWOVEN GEOTEXTILE
1.5
REPAIR SECTION FOR SOUTH DIKE
1" = 5'
1+08
EXISTING RIPRAP
REPAIR SECTION FOR SEPARATOR DIKE
1" = 5'
DRIVE STEEL DETAIL
NTS
ANCHOR DETAIL
NTS
ALTERNATE A
1" = 5'
PACKED RIPRAP ON EXISTING RIPRAP PLACED AS PART OF SLOPE "SMOOTHING" AND JUDGED ACCEPTABLE WITHOUT MAT PLACEMENT
SOUTH DIKE
NORTH DIKE
SEPARATOR DIKE
SCHEMATIC PLAN
1"=100'
EXHIBIT 8
REPAIR PLAN
ASH POND DIKES
H.F. LEE PLANT- CP&L
ROSEWOOD, WAYNE COUNTY, NORTH CAROLINA
DRAWN: LGL
DFT CHECK: ADB
ENG CHECK: ADB
APPROVAL: JAT
DATE: FEBRUARY 2000
SCALE: AS SHOWN
REFERENCE DWGS: CP&L SITE PLAN
LAW
LAWGIBB Group Member
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC. RALEIGH, NORTH CAROLINA
B 1/05/01 AS BUILT CONDITIONS
A 2/14/00 CHANGED INTERIOR SLOPE REPAIR METHOD

Document title

Lee Plant Dam and Dike Inspection Procedure

Document number

EVC-LEEC-00033

Applies to: Lee Fossil Plant - Carolinas

Keywords: environmental, dam inspection

Legend:
OPS Operations
ENG Engineering
WMT Work Management
TRN Training
ENV Environmental
FIN Financial
ICT Combustion Turbine
ADM Administrative

Organizational Applicability							
OPS	ENG	WMT	TRN	ENV	FIN	ICT	ADM
X	X			X			X

1.0 PURPOSE

1.1 The purpose of this program is to implement a dam and dike inspection procedure that effectively identifies any signs of potential problems that may require a repair or special attention. This procedure is also intended to comply with the requirements specified in corporate document - Non-Hydroelectric Facility Dam and Dike Inspection Program Manual.

2.0 TERMS AND DEFINITIONS

2.1 Breach – An opening or a breakthrough of a dam sometimes caused by rapid erosion of a section of earth embankment by water.

2.2 Dam – An artificial barrier constructed to impound or divert water or liquefied material.

2.3 Dam Emergency Notification – A document that identifies potential emergency conditions at a dam or dike and specifies preplanned actions to be followed to minimize impacts to the environment.

2.4 Dike/levee – Any artificial barrier that will divert or restrain the flow of a stream or other body of water for the purpose of protecting an area from flooding by flow waters.

2.5 Distress – A condition of severe stress, strain, or deterioration indicating possible or potential failure.

2.6 Embankment – Fill material placed with sloping sides and usually with a length greater than its height. An "embankment" is a part of a dam.

2.7 Freeboard – The vertical dimension between the crest of the dam at its lowest point and the reservoir water surface.

2.8 Riprap – A layer of large stones, broken rock, or precast blocks placed in random fashion on the upstream slope of an embankment dam.

2.9 Seepage – The slow oozing of a fluid through a permeable material. A small amount of seepage will normally occur in any dam or embankment that retains water. The rate will depend on the relative permeability of the material in and under the structure, the depth of water behind the structure, and the length of the path the water must travel through or under the structure.

2.10 Spillway/weir – A passage to conduct excess water or other liquid safely through, over, or around a dam or other artificial barrier that impounds the liquid.

3.0 RESPONSIBILITIES

Dam safety issues at Lee Plant fall under the regulatory jurisdiction of the North Carolina Utilities Commission (NCUC). This procedure specifies how the Lee Plant completes and documents dam and dike inspections. In the event of an ash pond release, all employees shall reference EMG-LEEC-00001 Lee Plant Ash Pond Dam Emergency Notification.

3.1 Plant Manager

The plant manager is the person responsible for implementing the dam and dike inspection procedure. Implementation includes ensuring that inspections are completed on the specified frequency and that appropriate funding is available to correct any identified problems or deficiencies.

3.2 Plant Environmental Coordinator

The plant environmental coordinator has the primary responsibility of updating the dam and dike inspection procedure. The procedure shall be updated every two years or in the event that inspection procedures and/or practices need to be added and/or modified.

The plant environmental coordinator will assist in ensuring that the dam and dike inspections are completed by the specified frequency. The plant environmental coordinator will review the inspection reports and file in the appropriate file point location of 13580C.

The plant environmental coordinator will assist in ensuring that inspection recommendations and deficiencies are addressed in a timely manner. The plant environmental coordinator will contact the Dam and Dike Program Manager – Field Engineering of conditions found during inspection (including construction on or in close proximity to dams) and if inspection results indicate any significant problem(s).

The plant environmental coordinator will assist in scheduling annual inspection training. The inspection training will be conducted by a third party contractor after the third party contractor conducts the annual dam and dike inspection.

3.3 Fuel Handling Personnel

The plant fuel handling personnel are responsible for conducting the dam and dike inspections. The plant fuel handling personnel shall receive annual inspection training.

The plant fuel handling personnel will use and fill out FRM-LEEC-00091 Lee Plant Active Ash Pond Monthly Inspection Form, FRM-LEEC-00092 Lee Plant Inactive Ash Pond Monthly Inspection Form, and FRM-LEEC-00093 Lee Plant Cooling Pond Monthly Inspection Form while conducting the dam and dike inspections. The plant fuel handling personnel will give the completed inspection forms to the fuel handling Supervisor for review and the Supervisor will then give the forms to the plant environmental coordinator for review and filing. If the inspection indicates issues and or problems with the dam and/or dikes, the plant fuel handling Supervisor will generate a work order to address the problem when appropriate.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 The Monthly Dam and Dike Competent inspector should have annual training. The training is to be provided by the technical consultant that is performing the annual inspection. The training is to occur during the annual inspection filed data gathering, and will be scheduled through the facility environmental coordinator and the technical consultant. The plant manager is responsible for assuring that designated personnel are available for the training.

In the event the designated personnel is not able to attend the training, a special training session will be provided in which the facility environmental coordinator will provide the training to the individual. This is for special circumstances only, and should not be a normal training situation.

4.2 Train the Trainer - Monthly Dam and Dike Inspection Inspector

4.2.1 The Environmental Coordinator will be trained as a train the trainer at each facility as part of the ongoing ORC contact hours of training required by to be an NPDES facility representative. The training shall be coordinated between the ORC coordinator and technical consultant that are performing the annual inspection to provide the training and resources needed to be considered competent to be able to train the designated plant employees on how to perform the monthly dam and dike inspections.

The program manager will attend the training to audit the course, and determine if additional information is required to satisfy the individual aspects of the inspection program.

5.0 PREREQUISITES

5.1 Annual dam and dike inspection training provided by a third party contractor. (Lee Dam Inspection Training Materials)

6.0 MATERIAL AND SPECIAL EQUIPMENT

NONE

7.0 PROCEDURE

7.1 Active Ash Pond

7.1.1 The overall structural integrity of the Active Ash Pond shall be inspected on a monthly basis. The Active Ash Pond was built in 1980. The total length of the dike is 2 miles and the volume of water or ash stored at the water elevation of 81.0 ft., is 1000 acre-feet with a surface area of 143 acres. The water level in the pond is maintained by a metal skimmer type spillway that discharges into a small secondary settling basin. A second skimmer spillway discharges from the settling pond into the Neuse River. The dike crest is 12 ft. wide at elevation n 90.0ft. msl.

In 2005, an interior berm was installed to increase the storage capacity. This berm is not considered to be a dike. The original pond's exterior dike is still the primary ash impoundment.

7.1.2 The Active Ash Pond shall be inspected on a monthly basis and if possible the inspection shall take place during periods of dry weather. The desirable inspection condition is at least two days without rainfall so the ground is dry.

7.1.3 Use and complete FRM-LEEC-00091 Lee Plant Active Ash Pond Monthly Inspection Form while conducting the monthly inspection.

7.1.4 Return completed inspection form to the plant fuel handling Supervisor and the environmental coordinator and discuss any noted issues or areas of concern.

7.1.5 Based on discussion with the plant environmental coordinator, the fuel handling Supervisor will submit work orders to address issues or concerns as appropriate.

7.2 Inactive Ash Pond

7.2.1 The overall structural integrity of the Inactive Ash Pond shall be inspected on a monthly basis. For the purposes of this procedure all Inactive Ash Ponds will be referred to as Inactive Ash Pond and will encompass all prior used ponds. The Inactive Ash Ponds between 1953 and 1980 and are comprised of three different ponds. All ponds were built close to one another and two share connecting dikes. All inactive Ash Ponds now have trees that were either planted or free growing. These Inactive Ash Ponds have no water added other than rain water and the outlet structures have been closed.

7.2.2 The Inactive Ash Pond shall be inspected on a monthly basis and if possible the inspection shall take place during periods of dry weather. The desirable inspection condition is at least two days without rainfall so the ground is dry.

7.2.3 Use and complete FRM-LEEC-00092 Lee Plant Inactive Ash Pond Monthly Inspection Form while conducting the monthly inspection.

7.2.4 Return completed inspection form to the fuel handling Supervisor and plant environmental coordinator and discuss any noted issues or areas of concern.

7.2.5 Based on discussion with the plant environmental coordinator, the fuel handing Supervisor will submit work orders to address issues or concerns as appropriate.

7.3 Cooling Pond

7.3.1 The Cooling Pond construction was completed in 1961 and was first filled in December 1961. The total length of the outer dike is 4.6 miles and the volume of water stored at the design normal water elevation (80.0 ft. mean sea level) is 3,808 acre ft. with a corresponding surface area of 545 acres. The maximum and minimum depths of the pond are 15 ft. and 4 ft. respectively. The Cooling Pond is located on a peninsula formed by a large U-shaped bend (Quaker Neck) in the Neuse River in Wayne County 4.5 miles west of Goldsboro, North Carolina. The Pond contains internal diversion dikes to increase circulation and aid in temperature control. These dikes are not of concern with respect to the safety of the Cooling Pond dikes. The perimeter dike is constructed of compacted sand with an interior slope facing of compacted clay topped by an asphaltic concrete wave blanket. In 1986 broken and damaged asphaltic concrete wave protection blankets were repaired by placing a filter fabric and rip-rap on the interior slope from the toe to approximately elevation 80 ft. msl. Repairs have been made to the entire length of the perimeter dike. Water is pumped from the Neuse River into the Cooling Pond by two pumps located at the reservoir make-up structure. The original construction included a gated concrete spillway and two discharge structures discharging to the Neuse River. The two discharge structures are now sealed to prevent leakage from the pond and the gated spillway is operational but is only used during severe flood events.

7.3.2 The Cooling Pond shall be inspected on a **monthly** basis and if possible the inspection shall take place during periods of dry weather. The desirable inspection condition is at least two days without rainfall so the ground is dry. On an **annual** basis the Cooling Pond Dikes shall be inspected by placing a boat in the Neuse River. Then by either going upstream or downstream the condition of the Cooling Pond dikes shall be inspected. Use and complete FRM-LEEC-00093 Lee Plant Cooling Pond Monthly Inspection Form for this inspection and clearly note this is an annual inspection.

7.3.3 Use and complete FRM-LEEC-00093 Lee Plant Cooling Pond Monthly Inspection Form while conducting the monthly inspection.

7.3.4 Return completed inspection form to the fuel handling Supervisor and the to the plant environmental coordinator and discuss any noted issues or areas for concern.

7.3.5 Based on discussion with the plant environmental coordinator, the fuel handling Supervisor submits work orders to address issues or concerns as appropriate.

8.0 **RETURN TO NORMAL**

NONE

9.0 **DOCUMENTATION**

NONE

10.0 **REFERENCES**

10.1 EMG-LEEC-00001 Lee Plant Ash Pond Dam Emergency Notification

10.2 Non-Hydroelectric Dam and Dike Inspection Program Manual

10.3 Lee Dam Inspection Training Materials

11.0 **ATTACHMENTS/FORMS**

11.1 FRM-LEEC-00091 Lee Plant Active Ash Pond Monthly Inspection Form

11.2 FRM-LEEC-00092 Lee Plant Inactive Ash Pond Monthly Inspection Form

11.3 FRM-LEEC-00093 Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): ____________________ Inspected by: ____________________

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

____

Was previous monthly report reviewed? ________________________________

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees					
Overall condition of pond (overflow likely)					
Erosion control of exterior slopes					
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)					
Seepage control of embankment/slopes					
Any beaver dams blocking flows at toes drains					
Pipe from primary basin to secondary basin operating correctly					
Pond Spillway (blocked or plugged)					
Comments					

File No. 13580-C

Date inspected (Month/Day/Year): ____________________ Inspected by: ________________________

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

____

Was previous monthly report reviewed? ____

Inactive Ash Pond:

Parameter to be Inspected	**Condition**		**Location of Problem**	**Corrective Action Taken (i.e., work order submitted)**	**Comments - Any early warning signs?**
	No Issues	**Issues Exist**			
Vegetation Growth, including trees					
Overall condition of embankment/slopes					
Erosion control of exterior slopes					
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)					
Erosion control below outlet pipe in to discharge canal					
Outlet discharge pipe to canal (corroded)					
Seepage control of embankment/slopes (in particular along base of north dike)					
Ensure the old pond spillways are blocked and not discharging					
Dike Cap (cracks)					
Comments:					

File Point: 13580-C

Date inspected (Month/Day/Year): ____________________ Inspected by: ________________________

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

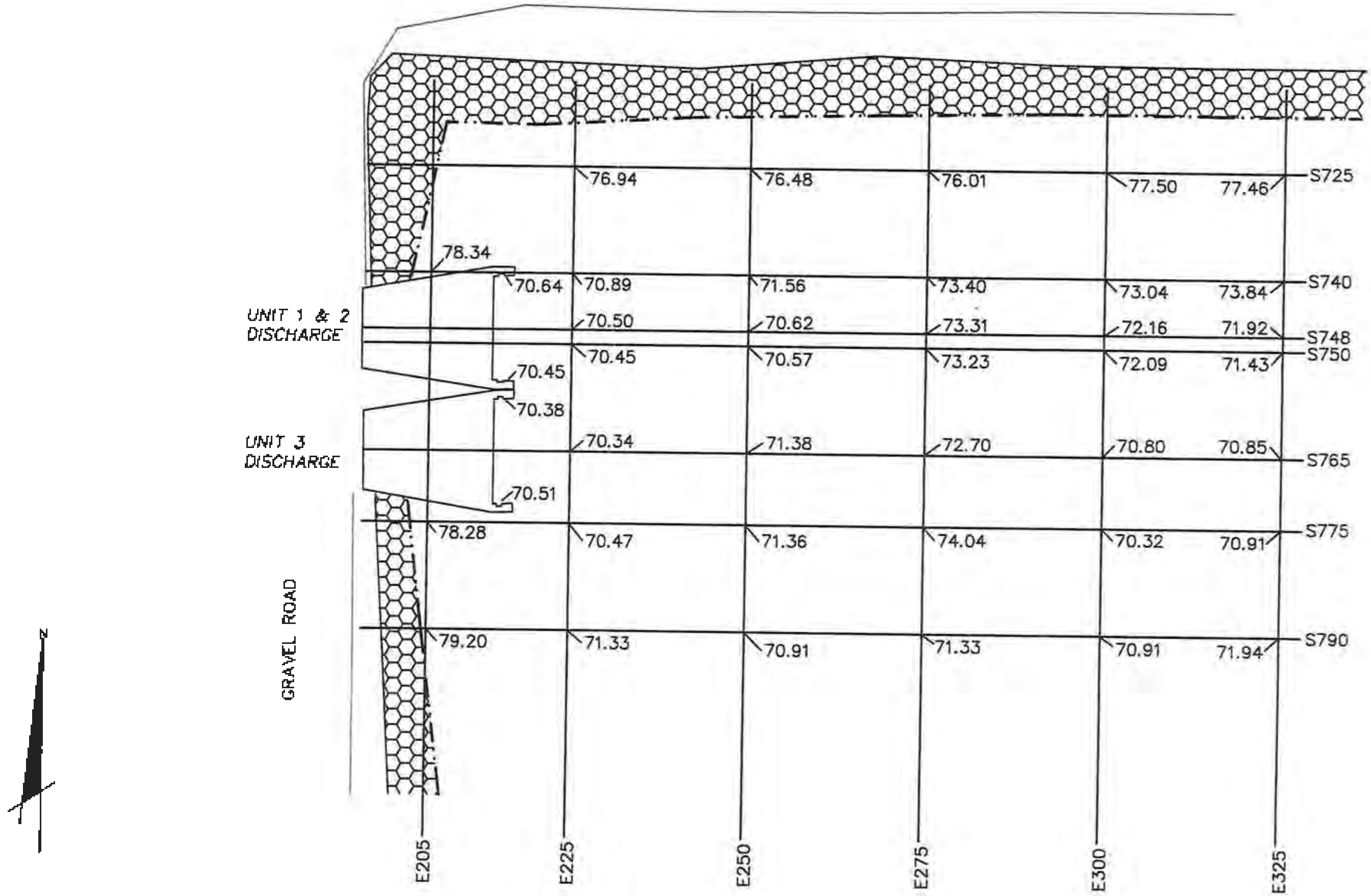
____

Was previous monthly report reviewed? ____

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees					
Overall condition of pond (overflow likely)					
Erosion control of exterior slopes					
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)					
Seepage control of embankment/slopes					
Any beaver dams blocking flows at toes drains or other areas					
Discharge structures to ensure no leakage					
Pond Spillway (blocked or plugged)					
Comments:					

EXHIBIT 10



.ES:

1) SURVEY PERFORMED BY MCKIM & CREED ON 7/23/09 AND 7/30/09.
2) VERTICAL DATUM BASED ON LAKE SURFACE ELEVATION OF 79.58' (OFFICE READING, 7/23/09).
3) HORIZONTAL DATUM BASED ON PREVIOUS DISCHARGE SURVEYS PERFORMED BY OTHERS.

SCALE: 1" = 20'

0 10 20 40 60

EXHIBIT 11

COMPARISION OF BOTTOM SOUNDINGS AT RECIRCULATION DISCHARGE STRUCTURE

STATION	Initial Elevation, ft. (1)	Current Elevation, ft. (2)	Difference
E325/S725	75.2	77.46	+2.26
E325/S740-S745	72.6	73.84	+1.24
E325/S750	70.0	71.43	+1.43
E325/S765	71.0	70.85	-0.15
E325/S775	71.0	70.91	-0.09
E325/S790-S800	73.4	71.94	-1.46
E300/S725	75.0	77.50	+2.50
E300/S740-S745	71.2	73.04	+1.84
E300/S750	70.8	72.09	+1.29
E300/S765	70.0	70.80	+0.80
E300/S775	70.0	70.32	+0.32
E300/S790-S800	72.8	70.91	-1.89
E275/S725	74.4	76.01	+1.61
E275/S740-S745	70.8	73.40	+2.60
E275/S750	69.0	73.23	+4.23
E275/S765	69.4	72.70	+3.30
E275/S775	69.0	74.04	+5.04
E275/S790-S800	73.2	71.33	-1.87
E250/S725	72.8	76.48	+3.68
E250/S740-S745	69.8	71.56	+1.76
E250/S750	69.8	70.57	+0.77
E250/S765	71.0	71.38	+0.38
E250/S775	69.2	71.36	+2.16
E250/S790-S800	71.8	70.91	-0.89
E225/S725	76.0	76.94	+0.94
E225/S740-S745	71.0	70.89	-0.11
E225/S750	70.0	70.45	+0.45
E225/S765	68.4	70.34	+1.94
E225/S775	69.8	70.47	+0.67
E225/S790-S800	71.0	71.33	+0.33

(1) From soundings in October, 1993, about 5 months after riprap placed.

(2) From soundings in July, 2009.

EXHIBIT 12

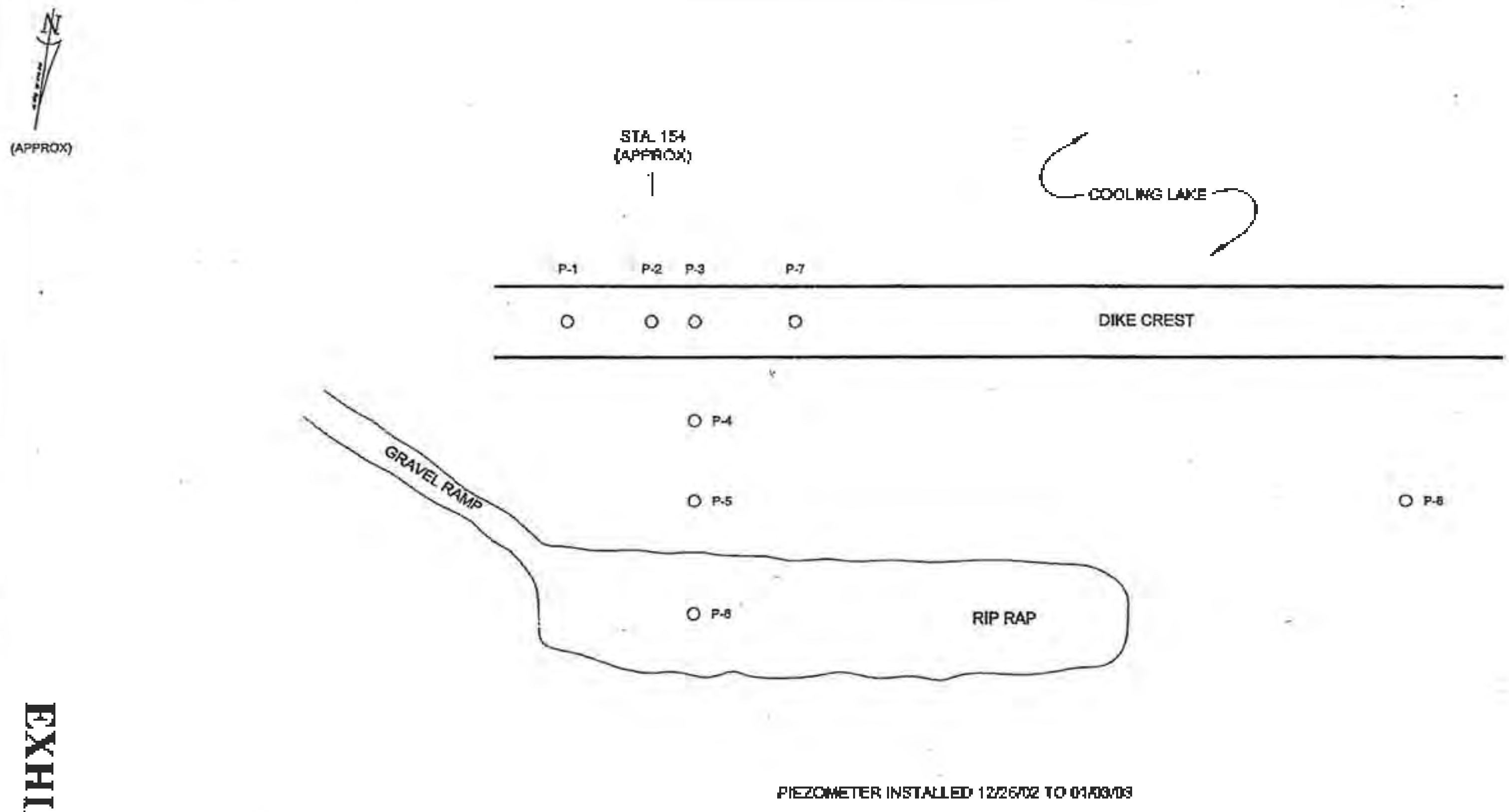
COMPARISON OF ELEVATIONS AT RECIRCULATING DISCHARGE STRUCTURE

MONITORING POINT NUMBER	2009 ELEVATION, FT.	2004 ELEVATION, FT.	DIFFERENCE, FT.
1003	82.59	82.58	-0.01
1004	82.48	82.46	-0.02
1005	82.62	82.605	-0.015
1007	86.38	86.365	-0.015
1008	86.49	86.48	-0.01
1009	86.47	86.47	0

NOTES:

1. 2009 survey by McKim and Creed 7/23/09 and 7/30/09
2. Vertical datum based on lake surface elevation of 79.58' (office reading, 7/23/09)
3. 2004 survey data taken from 2004 survey by Smith and Smith as shown in 2004 5-year inspection report, Exhibit 13.

EXHIBIT 13



MACTEC MACTEC ENGINEERING AND CONSULTING OF GEORGIA INC. 3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA	PLAN OF PIEZOMETER INSTALLATION COOLING LAKE NORTH DIKE LEE PLANT	DRAWN: R.R. DFT CHECK: APPROVAL:	DATE: JUNE 2003 SCALE: N.T.S. JOB: 30720-2-5445

DRAWING 1

REFERENCE: FIELD NOTES.

APPENDIX C

PHOTOGRAPHS

21. ASH POND- Crest of north dike.

22. ASH POND- Crest and interior slope-east dike. Note good conditions of rip rap repair.

23. ASH POND- Crest of separator dike.

24. ASH POND- Crest and exterior slope of south dike.

25. ASH POND- Interior slope repair-south dike

26. ASH POND- Interior slope of south dike. Note vegetation on erosion matting.

27. ASH POND- Exterior slope of south dike.

28. ASH POND- Exterior slope south dike.

29. ASH POND- Crest and exterior slope-north dike.

30. ASH POND- Exterior slope - east dike.

31. ASH POND-Cleared north dike exterior slope (12-3-09).

32. ASH POND- Drainage blanket at secondary settling pond-east slope
.

33. ASH POND-Fallen tree and slight seepage at toe of secondary settling pond-north of repair area.

34. ASH POND-Small creek beside north dike.

35. ASH POND-Small beaver dam on creek beside north dike.

36. ASH POND-Skimmer structure on ash pond riser.

37. ASH POND-Discharge point for secondary settling pond outfall.

APPENDIX A

Document 6

Stability and Seepage Analysis

Stability and Seepage Analysis
Lee Plant Ash Pond Dikes
Wayne County, North Carolina

- Prepared By -

MACTEC ENGINEERING AND CONSULTING, INC.
3301 Atlantic Avenue
Raleigh, North Carolina 27604

February, 2011

MACTEC Job No. 6468-10-0181

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ASH POND

ASSESSMENT OF DIKE STRUCTURAL STABILITY

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WAYNE COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

MACTEC Engineering and Consulting, Inc. (MACTEC) was retained by Progress Energy to provide an assessment of dike structural stability for the Ash Pond Dikes located at the H.F. Lee Steam Electric Plant in Wayne County, North Carolina. The location of the Ash Pond is shown on Figure 1. The services provided are based on the scope of work contained in Work Authorization No. 2720-203 dated September 20, 2010. This report presents the results of the subsurface investigation, laboratory testing and stability analysis for the Ash Pond dikes.

1.1 PROJECT BACKGROUND

The H.F. Lee Steam Plant Ash Pond is located northeast of the power plant (Figure 1). The Ash Pond was formed by constructing a perimeter dike above natural ground adjacent to the north bank of the Neuse River. There were no existing streams entering the area. The Ash Pond has a transmission line on the north side, and a swampy area that drains to the Neuse River is present east of the dike.

The Ash Pond was designed in 1978 by the Power Plant Construction Department of Progress Energy (then known as Carolina Power & Light Company). Reduced copies of the design plan (Drawing RCD-372) and design sections (Drawing RCD-373 are included in Appendix A. A subsurface exploration of materials within the proposed impoundment area was conducted by Law Engineering of Raleigh, NC to provide information on characteristics of the borrow material.

The Ash Pond includes a secondary settling basin in the southeast corner that is separated from the main pond by a separator dike. Water from the main pond is released into the secondary settling basin through a vertical riser pipe connected to a horizontal outflow pipe. The water level in the secondary settling basin is maintained at elevation 78.5 feet. A second vertical riser connected to a horizontal outflow pipe releases water into the Neuse River. The design drawings in Appendix A indicate the dike was to be constructed of "selected fill" and reference technical specification PPCD-78-5-116 for construction. Construction was completed in April, 1980. General information on the Ash Pond dike is presented below.

- Design crest elevation - 90 feet (MSL)
- Dike crest width – 12 feet
- Design interior and exterior slopes – 2(H) : 1(V)
- Perimeter Dike Length – 2 miles

- Design maximum water level elevation – 88 feet. Pond has never operated at design maximum level.
- Current water level elevation in main pond - approximately 84.5 feet; plant reports no plans to operate at a higher level for remaining life of the pond.
- Spillway type – Vertical riser pipe connected to horizontal outflow that releases water into the secondary settling basin. A second vertical riser pipe connected to a horizontal discharge outflow pipe leads to the Neuse River.
- Current water level elevation in secondary settling basin – 78.5 feet
- Maximum structural height – 20 feet
- Surface area – 143 acres at design dike crest
- Storage capacity – Approximately 1,980 acre-feet (as designed)
- Regulatory Design Storm – ½ Probable Maximum Precipitation (PMP). The ½ PMP is 20.5 inches over 24 hours.
- Current size classification (NCAC 15A.2K.0205) - Medium
- Current hazard classification (NCAC 15A.2K.0105; NC Inventory of Dams) - High

1.2 SCOPE OF ANALYSIS

For the present study, MACTEC performed soil test borings with laboratory testing of selected samples and installed temporary casings for water level observation at four locations on the perimeter dike. Hand auger borings were performed at the toe of the slope at each location to help evaluate the phreatic water level in the dike. Additional hand auger borings were performed along the crest and slope of the dike at the location of boring AB-3 to better evaluate the phreatic water level in the dike. The additional hand auger borings were performed at this location due to shallow water measured in the well casing at boring AB-3. Information from this exploration was used to perform the detailed stability analysis of the Ash Pond dikes. The boring locations are shown on Figure 2. Dike cross-sections at boring locations are shown in Figures 4 through 9.

In addition to our current activities, borings and stability analyses were performed on the dike during past geotechnical studies by Law Engineering/MACTEC in 1999 and 2009. The locations of the previous borings are also shown on Figure 2. Boring records and other information from the past studies are included in Appendices B, C and F. The stability analyses are discussed in Section 8.

2.0 SUMMARY

This report presents results of a geotechnical study of the stability of existing dikes at the Lee Plant Ash Pond. The study included review of past dam inspection reports and existing geotechnical information and performing additional geotechnical borings and laboratory testing. Topographic information was obtained from an aerial topographic map prepared in 2010 as part of other plant studies.

Slope stability analyses were performed for cross sections considered representative of the dike conditions. Results of the analyses found factors of safety for dikes to be greater than regulatory requirements. At one section, a factor of safety less than 1.5 was found for a very shallow-depth pathway; however, satisfactory factors of safety exist for pathways that are deeper within the dike.

Seepage conditions were reviewed. Neither past dam inspections nor observations from the present study indicate seepage is emerging on the exterior slopes of the dikes with one exception. An area of the secondary settling pond exhibits surface wetness conditions and local seepage oozing both on the lower portion of the dike slope and in the toe area. The conditions have existed for many years with little change observed. Riprap slope protection has been placed over the affected area.

On the basis of the current study and past information, MACTEC concludes the Lee Plant Ash Pond dikes are in satisfactory condition and no structural repairs are necessary. Inspection for changes in conditions combined with maintenance of vegetation should continue.

3.0 FIELD INVESTIGATION

The field investigation program was performed from October 27 through November 11, 2010 and included the following:

- Advancing four soil test borings with standard penetration sampling from the crest of the existing dikes. Boreholes were sealed with cement-bentonite grout to the surface at completion of drilling.
- Obtaining intact samples of the soft cohesive soils using hydraulically pushed Shelby-tubes.
- Performing eight shallow-depth hand auger borings along the dike toe and on the dike slopes to check for shallow water or soft soils.
- Installing temporary water level observation casings adjacent to the boreholes to allow checks of water levels over time.
- Determining slope geometry by collecting elevations with a level and grade rod at selected points. The crest of the dike was used as a temporary benchmark with the elevations taken from an aerial topographic survey performed in 2010.

EXPLORATORY METHODS

The boring locations were identified in the field by MACTEC personnel utilizing a Trimble GPS unit. The soil borings were performed by a trailer mounted CME 45C drill rig. Mud-rotary drilling procedures were used. Standard penetration testing (SPT) was performed at 2.5 to 5-foot intervals by driving a 1-3/8 inch ID split-spoon sampler in general accordance with ASTM D 1586. The split-spoon sampler is driven into the soil a distance of 18 inches by a manual hammer weighing 140-pounds from a free fall height of 30 inches. The number of blows required to drive each 6-inches of the sampler were noted, and the number of blows from the last two increments are added to obtain the Standard Penetration Resistance (N-Value).

Samples were taken from the split-spoon sampler, described and identified based on visual-manual procedures. A representative portion of each sample was sealed in a glass jar with a moisture tight lid, labeled and returned to MACTEC's laboratory for further visual-manual identification and/or laboratory testing. Intact samples were obtained at targeted depth intervals based on the SPT work and field observations of the samples. An adjacent borehole was drilled for the intact sampling. The methods described in ASTM D 1587 for thin walled tube sampling were used.

Hand auger borings were advanced at locations shown on Figure 2 to supplement the machine-drilled borings. The hand auger borings were advanced to depths of four to seven feet below the ground surface and were stopped just beneath the depth groundwater was encountered. The hand auger boreholes were left open for a short time to allow for stabilized water levels to be measured, then the boreholes were closed by filling with bentonite chips.

A field geologist observed all drilling operations, logged all recovered soil samples, recorded SPT blow counts and measured groundwater levels if encountered. Each of the soil samples was described in general accordance with the Unified Soil Classification System (USCS). Detailed descriptions of the soil samples recovered from the borings are presented on the boring logs in Appendix B-1. The stratification lines indicated on the boring logs represent the approximate boundaries between soil types; in-situ, the transitions may be gradual. Variations in soil conditions between borings can also occur.

To allow checks for water levels over time, 1-inch diameter PVC pipes with slotted sections were installed with a GeoProbe adjacent to the soil test borings. The PVC pipes were set in the open hole, a sand pack placed to within 2 feet of the ground surface and a bentonite seal was used to fill the remainder of the borehole. Steel protective covers were installed flush with the dike crest. Hand auger boreholes were left open to allow for water checks over time, then filled with bentonite chips.

4.0 LABORATORY TESTING

Soil samples were re-examined in the laboratory by an experienced engineer/geologist to confirm field classifications and were revised where necessary. Soil samples were grouped into major strata based on visual-manual identification procedures. Laboratory testing was conducted on representative soil samples to aid in classification. Laboratory tests performed included natural moisture contents, particle size analysis, Atterberg Limits and consolidated undrained triaxial shear tests. All testing was done in general accordance with applicable ASTM specifications. A summary of laboratory results and test results is included in Appendix C-1. Strength test results from previous studies are also included in Appendices C-2 and C-3.

5.0 SUBSURFACE CONDITIONS

Subsurface conditions are illustrated on Figures 4 through 8; a legend for the symbols used is on Figure 3. Based on borings performed for this exploration and previous explorations, the dike fill materials typically consist of layers of medium stiff to very stiff fine sandy and silty clay (CL, CH) and loose to medium dense clayey and silty fine to medium sands (SC, SM). N-values within the fill range from 7 to 20 blows per foot (bpf) in the clays and from 9 to 19 bpf in the sands. The average N-values within the fill are 14 bpf in the upper clays and 15 bpf in the sands. Values in this range are indicative of fills that have received a reasonable amount of compaction. Material properties of the fill are discussed further in Section 5.

Beneath the fill, Coastal Plain soils were encountered to the termination depth of the borings. Based on the borings, the original ground surface in the locations of borings AB-1, AB-2 and AB-3 consists of fine sandy and silty clay (CL, CL-CH). The original ground surface in the location of boring AB-4 consists of medium dense fine to coarse sand (SP). Coastal Plain soils encountered in borings AB-1, AB-2 and AB-3 typically consist of a 3.5 to 9 feet thick layer of soft to stiff fine sandy and silty clays (CL, CL-CH) underlain by medium dense to dense silty and relatively "clean" sands (SM, SP) to the depth of boring termination. Coastal Plain soils encountered in boring AB-4 consists of layers of medium dense to dense slightly silty and clayey fine sands (SP,SC) to the depth of boring termination. N-values within the Coastal Plain soils range from 3 to 44 bpf indicating a soft to very stiff consistency for the clays and medium dense to dense relative density for the sands. The average N-values in the foundation soils are 11 bpf in the clays and 25 bpf in the sands. Material properties of these soils are discussed further in Section 5.

A review of borings performed by Law Engineering and MACTEC in previous explorations indicates similar materials within the dike and foundation soils to those encountered in this exploration. Boring logs from the previous explorations are in Appendices B-2 and B-3.

6.0 MATERIALS PROPERTIES

DIKE FILL

Based on previous information, borrow material for the ash pond dikes was obtained by excavating natural soils located within the ash pond. No specifications have been located that indicate a degree of compaction required. Based on the generally moderate to high N-values, MACTEC concludes the dike fill did receive reasonable compaction. The strength properties for the dike fill consisting of clayey sand (SC) and silty and sandy clay (CL) were assigned based on a consolidated undrained triaxial test performed within the dike fill soils during a previous exploration. Correlations of N-values with friction angle were used to estimate a friction angle for the sand portion of the dike fill. Because the dike has been in place for approximately 50 years, pore water pressures are stabilized. Thus, effective stress (drained) parameters were used in the analysis to assess the static stability. The parameters used in the analysis are summarized in Table 1. The results of the triaxial test are presented in Appendix C-1.

FOUNDATION SOILS

This layer typically extends from the dike-natural soil interface to a depth of 30 feet below the dike crest and is comprised of silty and sandy clay, clayey sand, silty sand and relatively "clean" sand. The SPT data indicate soft to very stiff consistencies and medium dense to dense relative densities for the foundation soils. As mentioned above, the dike has been in place for more than 50 years, therefore pore water pressures are stabilized in the foundation soils and the soils are fully consolidated. Thus, effective stress (drained) parameters were used in the analysis to assess the static stability. The parameters used in the analysis are summarized in Table 1.

Strength parameters for the foundation soil sandy and silty clays were assigned based on consolidated undrained triaxial tests performed during this exploration and on a consolidated undrained triaxial test performed on a similar material during a 2007 exploration for the secondary settling pond dike. The test results are provided in Appendix C. Atterberg Limit test results are included in Appendix C of this report. The Plasticity Index (PI) value of the clays within the project site varies between 12 and 26. Based on the empirical relationship between effective stress friction angle (Φ`) and PI proposed by Terzaghi, Peck and Mesri, 1996 (as contained in Reference 3), Φ' is between 24 and 32^{o}. A soft clay layer was encountered in boring AB-1 from approximately 17.5 to 21 feet below the crest of the dike. Based on strength test results, an effective friction angle of 35 degrees was assigned to this layer. Values within this range or values determined from strength tests were used in analysis as shown on Table 1. Correlations of N-values with friction angle were used to estimate a friction angle for the sand portion of the foundation soils.

TABLE 1: MATERIAL PROPERTIES FOR ANALYSIS – SUMMARY

ID	Description	Moist Unit Weight	Saturated Unit Weight	Effective Cohesion	Effective Friction Angle
#		pcf	pcf	psf	Deg
Section AB-1					
1	Sedimented Ash	100	105	0	30
2	Dike Fill: (SM)	120	125	0	32
3	Dike Fill: (CH)	120	125	10	36
4	Dike Fill: (SC)	120	125	10	37
5	Foundation Soil: Clay (CL)	120	125	0	35
6	Foundation Soil: Sand (SP)	120	120	0	31
7	Foundation Soil: Sand (SM)	120	120	0	36
Section AB-2					
1	Sedimented Ash	100	105	0	30
2	Dike Fill (SC)	120	125	10	37
3	Dike Fill(CL-CH,CL)	120	125	10	37
4	Dike Fill: (SC)	120	125	10	37
5	Foundation Soil: Clay (CL)	120	125	0	35
6	Foundation Soil: Sand (SP)	120	120	0	33
Section AB-3					
1	Sedimented Ash	100	105	0	30
2	Dike Fill (CL)	120	125	10	37
3	Foundation Soil: Clay (CL-CH)	120	125	0	35
4	Foundation Soil: Clay (CL)	120	125	0	30
5	Foundation Soil: Sand (SP)	120	120	0	33
1999 Section					
1	Dike Fill	130	135	200	30
2	Coastal Plain Sediments	115	120	100	32

7.0 PHREATIC SURFACES

The normal water level in the Ash Pond is controlled by the top of the vertical riser which is at approximately elevation 84.5 feet. Much of the pond has filled in with sedimented ash, and plant re-stacking operations have resulted in levels of sedimented ash in the western area of the pond that are higher than the normal pond water level. Based on field measurements at the time of field investigation, the water level or the level of ash sediments in the ash pond was approximately 1 to 4 feet below the top of the dike (approximately elevation 85 to 87.5 feet). For purposes of the stability analysis, a water level within the sedimented ash was assumed to be at the top of the ash. For sections adjacent to the water area of the pond, the present pond water level was used in the stability analysis.

Water level observation casings were installed adjacent to the geotechnical borings to allow checks of water levels over time. In addition, hand auger borings were performed at the toe of the dike at each boring location and along the slope at boring AB-3 to check for presence of water or wet soils. Stabilized water levels measured in hand auger borings ranged from 0.6 to 6.9 feet below the ground surface. Hand auger HA-AB-2-1 did not encounter water and was observed dry at 5.5 feet below the existing ground surface approximately 12 days after completion. The measured water levels are summarized in Table 3 following the text.

There were no signs of water emerging on the slope or at the dike toe at the locations of boring AB-1, AB-2, AB-3 and AB-4 at the time of the exploration. Past dam inspections have not identified seepage along the toe of the dike except at the secondary settling pond dike. That area was the subject of a previous study (2009), and placement of riprap for control of seepage effects has been done. There are existing small streams and wet areas present on the north and east sides of the ash pond located several feet distant from the dike toe except in the vicinity of the secondary settling pond east side dike.

For analysis purposes, a phreatic surface passing from the pond water or saturated ash level at its intersection with the dike interior slope, through the measured water level in the observation casings and at the measured water level in the hand auger borings performed along the slope and at the toe was used to represent the static conditions. Short-term rises in the pond level due to occurrence of the design storm would not impact the phreatic surface due to the low permeability of the asphalt slope protection and a short duration of the increased water level. The phreatic lines for each geotechnical section are shown on Figures 4 through 9.

8.0 SEISMIC LOADS

No additional load on the ground surface is considered for static slope stability analysis. For an earthquake analysis, seismic design parameters were obtained using American State Highway Transportation Officials software program AASHTO GM 2-1[(4)] which is based on based on 5% in 50 year probabilistic data from the United States Geological Survey (USGS). The program inputs include project site location information (Latitude: 35.591 and Longitude: -079.042) and the "Site Class" determined in accordance with the International Building Code 2006[5].

The site class is based on average soil properties in Top 100 feet. Based on the current and historic borings the site class for the project site is a D. For analysis purposes a site class D is used which corresponds to stiff soil profile ($15 \leq N_{avg} \leq 50$). Using the site coefficients from the AASHTO GM 2-1 program output, the Peak Ground Acceleration (PGA) is calculated in accordance with section 1802.2.7 of International Building Code 2006[5] and is included in Appendix E of this report. A PGA of 0.08 g is applicable to structures in this zone. Therefore, for a pseudo-static representation of earthquake effects, a seismic coefficient of 0.08 g is used to scale the horizontal component of earthquake force relative to the sliding mass. It is also assumed that earthquake force does not change the pre-earthquake static pore pressure in the slope.

9.0 SLOPE STABILITY ANALYSIS

Under the agreement between the North Carolina Utilities Commission and Progress Energy, the guidelines of the United States Army Corps of Engineers (USACOE) were applicable to evaluations of the dam safety. Effective January 1, 2010, state regulation of utility company dams was transferred to the North Carolina Department of Environment and Natural Resources (NCDENR), Land Quality Section, Dam Safety Program. For this study, the requirements from both agencies pertaining to slope stability factors of safety have been considered:

NCDENR

Based on North Carolina Administrative Code (NCAC) - Title 15A Department of Environment and Natural Resources of Subchapter 2K - Dam Safety

- Minimum factor of safety for steady state conditions at current pool or design flood elevation is 1.5.
- Minimum factor of safety for rapid draw-down conditions from current pool elevation is 1.25.

USACOE

Based on USACOE Engineering Manual (EM) 1110-2-1902[6]

- Minimum factor of safety for maximum surcharge pool (design flood) is 1.4
- Minimum factor of safety for seismic conditions from current pool elevation is 1.0

Slope stability analysis performed for the exterior slopes of the Ash Pond dikes considered both static and seismic loading conditions. The analyses were conducted for the normal operating level of the pond. Hydraulic and hydrologic analyses performed in a parallel study found that the design storm rainfall would be impounded and not result in outflow over the spillway structure or overtopping of the dikes. The impounded water would gradually drop back to normal pond operating levels. Rapid drawdown conditions were not evaluated because in order to have a rapid drawdown condition, a breach of the dam would be needed.

Examination of the geotechnical cross sections at the boring locations performed for this exploration indicates very similar embankment configurations, soil characteristics and phreatic levels. However, the phreatic level in Section AB-3 is at a higher elevation than the other sections. Three sections were selected for slope stability analyses – at boring AB-1 (Figure 4), at boring AB-2 (Figure 5), and at AB-3

(Figure 6). These three sections represent the highest dike fill areas and spots where groundwater is nearest the ground surface at the dike toe or where the phreatic surface is at a higher elevation within the dike.

The section of the dike located just west of the settling pond has a steeper embankment configuration than the sections evaluated during this exploration. Historically, two small portions of this section experienced local surface cracking along the crest at the exterior edge and had stability berms placed as a protection against possible movement. This section was analyzed in 1999 by Law Engineering. An analysis was performed on the same embankment section evaluated in the 1999 report. Soil properties used in the 1999 report were used in this analysis. The exterior slope of the embankment was measured to be approximately 1.4(H): 1(V).

The computer program PCSTABL5M with Windows based interactive STEDwin software was used for analysis. The Modified Bishop's method was used in calculating the factor of safety for circular arc failure surfaces. For each section, separate analyses were performed to consider two cases - circular arcs constrained to be within the dike and circular arcs penetrating into the foundation. The minimum factors of safety are provided in the Table 3 below. Analyses were performed for exterior slopes. Plots of critical surfaces with factors of safety and the summary of input data are included in Appendix D.

TABLE 2: FACTORS OF SAFETY AGAINST SLOPE FAILURE

Description of Analysis	Factor of Safety	
	Static	Seismic
Ash Pond – Analysis Section AB-1		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	1.49	1.23
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface constrained to be within the dike. Result shown is for shallow depth surface near face of slope.	1.34	1.13
Ash Pond – Analysis Section AB-2		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	1.80	1.45
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface constrained to be within the dike	1.52	1.29
Ash Pond – Analysis Section CB-3		
Exterior Slope, Phreatic Surface developed from measured water level. Failure Surface extending into the foundation.	1.68	1.39
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface constrained to be within the dike.	1.53	1.29

Ash Pond – 1999 Analysis Section		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	2.15	1.77
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface constrained to be within the dike	1.70	1.49

For Sections AB-1, AB-2, AB-3 and the 1999 section, at static conditions, the lowest factor of safety for sliding surfaces that are constrained to stay within the dike was 1.34. Considering sliding surfaces that extend into the foundation soils, the lowest factor of safety for these two sections was 1.49. The factor of safety of 1.34 indicated in Section AB-1 was analyized or failure surfaces constrained within the dike. This failure surface is a result of very shallow-depth circles and does not represent a potential for deeper seated failures.

10.0 SEEPAGE CONDITIONS

Areas along the toe of the dikes have been observed for indications of seepage during dam inspections by MACTEC since 1989. The toe of the dike along the south side has been noted as dry, with no apparent seepage. Near the western end of the south dike, an area of ponded water is normally present in a topographic low area that begins about 100 feet outside the dike toe. Water in this area appears to be from rainfall and from river over-bank flooding. The standing water was observed during the present geotechnical study. The observed conditions pose not concern for dike stability.

The exterior slope of the secondary settling basin dike on the east side has been noted to have wet soils with occasional slight ooze of seepage. Little seepage flow and no signs of boils or soil particle movement have been reported. Due to the proximity of the area to a creek and the Neuse River, the area beyond the dike toe is also marshy. A riprap layer was placed on this section in 2009, and additional riprap placement has been designed for placement in 2011.

An existing creek runs parallel to the dike toe along the north dike. The creek is 20 to 50 feet beyond the dike toe. Beavers live along the creek and build dams that block creek flow (Photograph 35). The blockages generally do not impound water against the dike. Progress Energy continues to remove the dams and is working on a plan to remove the beavers. Observations along the north and east dike toe during recent dam inspections have not found evidence for seepage out of the ash pond dike. Local water ooze spots are present along the creek bank on both sides of the creek. These spots are interpreted as groundwater or bank storage release, not as seepage from the ash pond.

11.0 CONCLUSIONS

The stability analysis results for the Ash Pond dikes indicate the dikes are in satisfactory structural condition with respect to potential for structural failure. Observations made during inspections since

1989 have not noted indications of slope or foundation distress that would suggest potential failure concerns.

Inspections and observations of conditions on the slopes and the exterior toes of the dikes should be continued. The planned placement of additional riprap along the secondary settlement pond dike will assist in protecting that section from surficial soil movement related to seepage. No structural remedial activities are recommended.

12.0 REFERENCES

1. U.S. Army Corps of Engineers, "Recommended Guidelines for Safety Inspection of Dams," Department of Army, Office of the Chief Engineers, Washington, D.C., 1976

2. MACTEC Engineering and Consulting, Inc. , Five-Year Independent Consultant Inspection, Cooling Pond Dike, Ash Pond Dike, H. F. Lee Electric Generating Plant, Wayne County, North Carolina, December, 2009.

3. U.S. Department of Transportation, Geotechnical Engineering Circular No. 5, "Evaluation of Soil and Rock Properties", Report No. FHWA-IF-02-034, Washington, D.C., 2002, p. 165.

4. AASHTO Ground Motion Software Program, Version 2.1 "Seismic Design Parameters for 2007 AASHTO Seismic Design Guidelines" downloaded from USGS Earthquakes Hazards Program.

5. "International Building Code" (2006), International Code Council, Inc., USA

6. "Slope Stability" Engineering Manual, EM 1110-2-1902, Department of Army, U.S. Army Corps of Engineers,, Washington, D.C., October 2003

13.0 CLOSING

MACTEC appreciates the continued opportunity to provide engineering and consulting services to Progress Energy. If you have any questions or need any additional information, please do not hesitate to contact us.

Sincerely,

MACTEC Engineering and Consulting, Inc.

J. Shane Johnson, P.G., P.E. (Preparer)
Project Geotechnical Engineer
Registered, North Carolina

J. Allan Tice, P.E. (Responsible Engineer)
Senior Principal Engineer
Registered, North Carolina 6428

Prepared By: JST

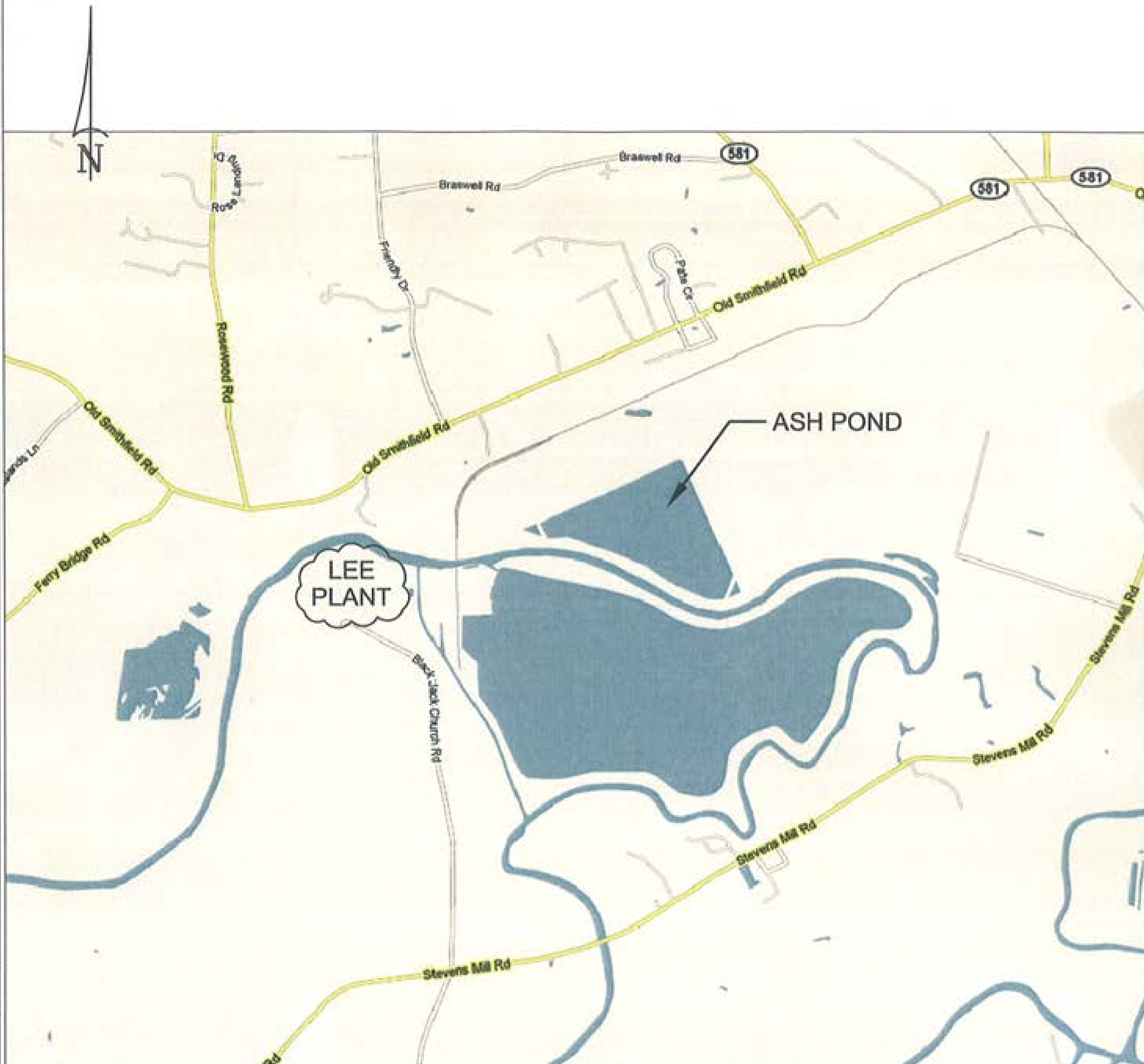
Checked By: [signature]

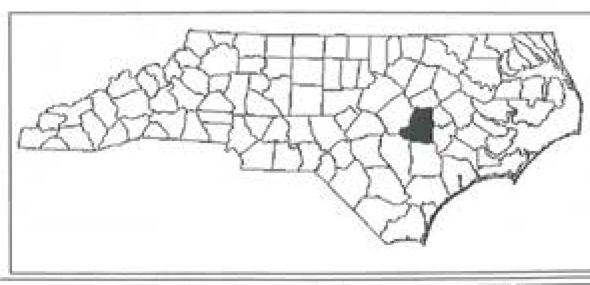
Table 3
Summary of Measured Water Levels

				Depth to Groundwater			Groundwater Elevation		
Location	Ground Surface Elevation	Casing Depth	Screen Interval	11/3/2010	11/11/2010	11/15/2010	11/3/2010	11/11/2010	11/15/2010
AB-1	89.5	17.2	12.2-17.2	7.70	7.85	7.95	81.80	81.65	81.55
AB-2	89.5	18.5	13.5-18.5	15.55	11.55	11.35	73.95	77.95	78.15
AB-3	89.3	11.5	6.5-11.5	3.00	2.95	2.95	86.30	86.35	86.35
AB-4	89.4	18.3	13.3-18.3	13.55	13.65	13.75	75.85	75.75	75.65

			Depth to Groundwater			Groundwater Elevation		
Hand Auger	Ground Surface Elevation	Hand Auger Performed	11/3/2010	11/11/20110	11/15/2010	11/3/2010	11/11/20110	11/15/2010
HA-AB-1-1	72.94	11/3/2010	1.8	0.5	0.6	71.1	72.4	72.3
HA-AB-2-1	75.75	11/3/2010	Dry @ 5.5	Dry @ 5.5	Dry @ 5.5	Dry @ 70.3	Dry @ 70.3	Dry @ 70.3
HA-AB-3-1	89.23	11/11/2010		3.8	2.6		85.4	86.6
HA-AB-3-2	88.51	11/11/2010		wet @ 7	6		wet @ 81.5	82.5
HA-AB-3-3	82.75	11/11/2010		wet @7	6.4		wet @ 75.8	76.4
*HA-AB-3-4	71.75	11/3/2010	Dry @ 4	6.8	6.9	Dry @ 67.8	65.0	64.9
HA-AB-4-1	73.72	11/3/2010	2.0	0.7	0.8	71.7	73.0	72.9
HA-AB-4-2	78.40	11/11/2010		4.0	3.5		74.4	74.9

*Hand augered from 0 to 4 feet on 11/3/2010 and from 4 to 7 feet on 11/11/2010





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SITE LOCATION MAP
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

DRAWN: R.R.	DATE: JANUARY 2011	FIGURE
ENG CHECK:	SCALE: N.T.S.	1
APPROVAL:	JOB No.: 6468-10-0181	

REFERENCE:

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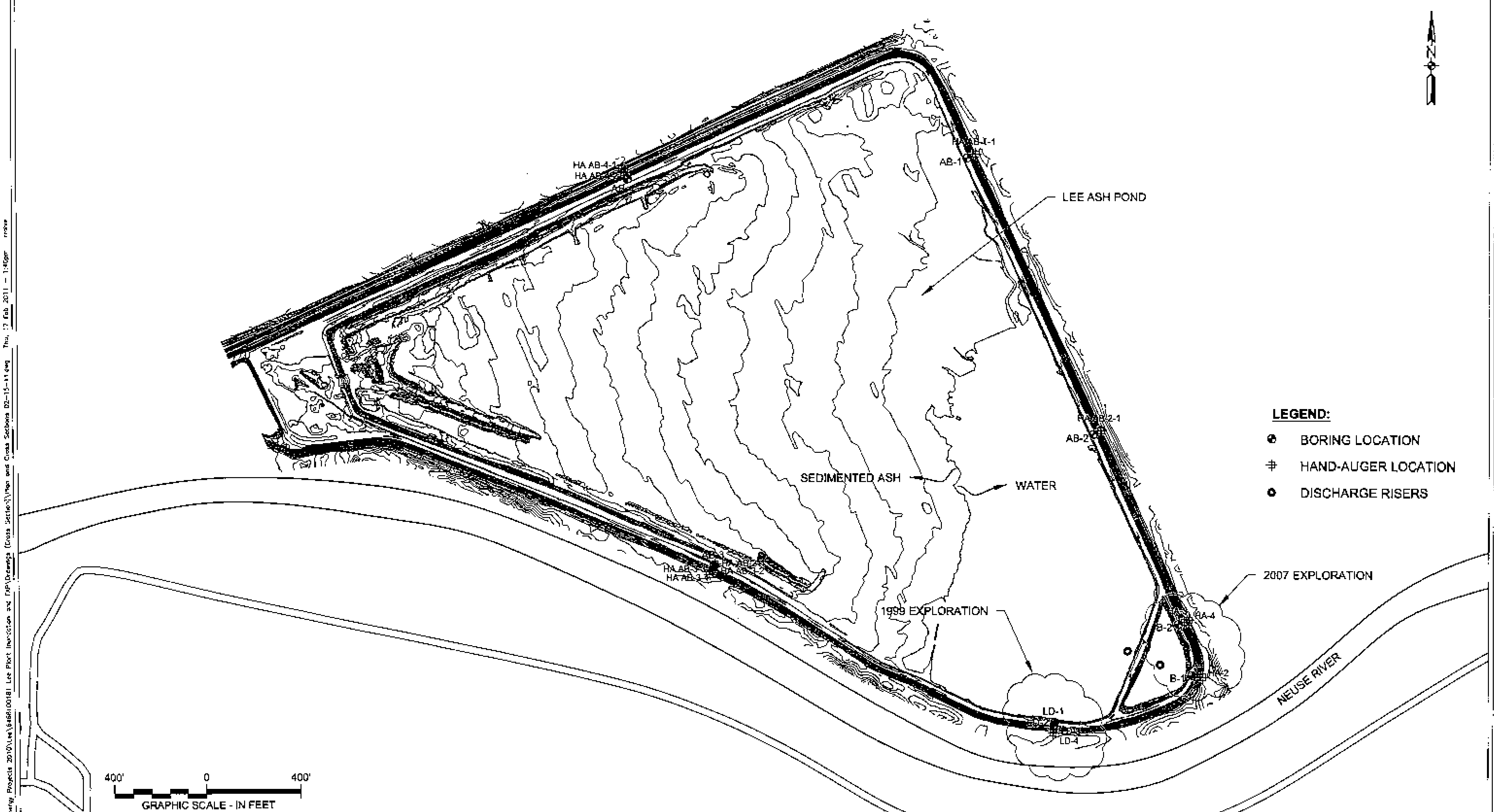

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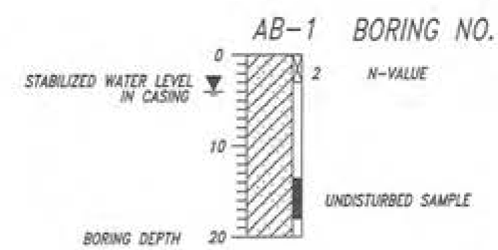
BORING LOCATION PLAN
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

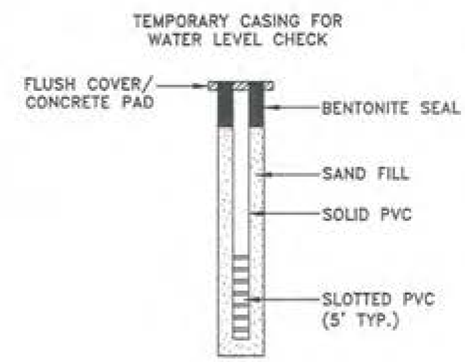
DRAWN:	R.R.	DATE:	JANUARY 2011	FIGURE
ENG CHECK:		SCALE:	AS SHOWN	2
APPROVAL:		JOB No.:	6468-10-0181	

REFERENCE: TOPOGRAPHIC MAPPING PREPARED BY MCKIM & CREED FROM AERIAL PHOTOGRAPHY TAKEN APRIL 12, 2010.

MATERIAL LAYERING CODES

- FILL
- Low Plasticity Inorganic Clays (CL)
- High Plasticity Inorganic Clays (CH)
- Low Plasticity Inorganic Silts (ML)
- High Plasticity Inorganic Silts (MH)
- Peat/Organic Muck
- Topsoil
- Poorly Graded Sand (SP)
- Well Graded Sand (SW)
- Silty Sand (SM)
- Clayey Sand (SC)
- Moderate to high Plasticity Clay (CL-CH)
- Poorly Graded Sand with Clay (SP-SC)
- Poorly Graded Sand with Silt (SP-SM)
- Silty Clayey Sand (SC-SM)
- Low PLasticity Organic Soils (OL)
- High Plasticity Organic Soils (OH)
- Pavement section





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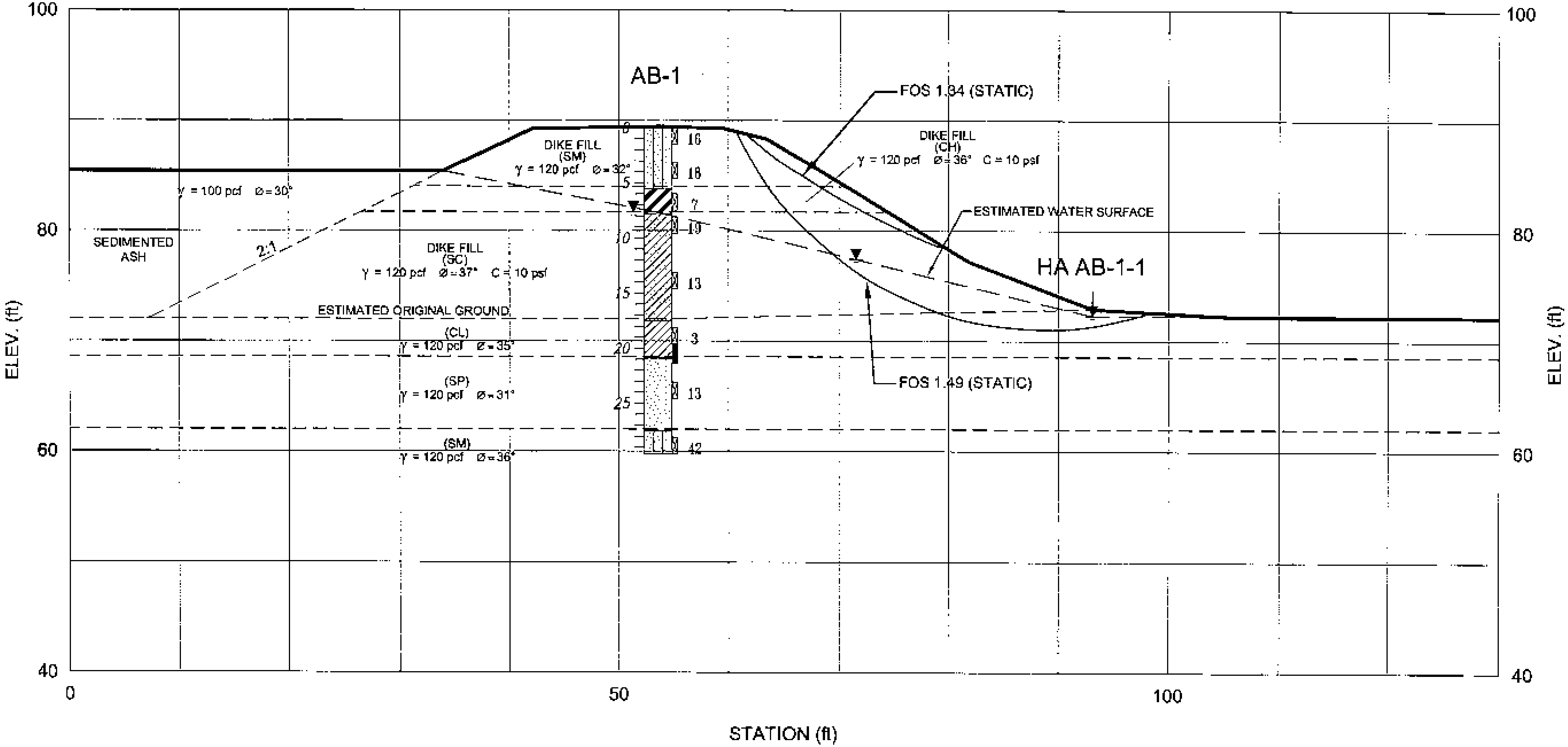
LEGEND FOR SECTIONS
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

DRAWN: R.R.	DATE: JANUARY 2011	FIGURE	
ENG CHECK:	SCALE:	3	
APPROVAL:	JOB No.: 6468-10-0181		

REFERENCE:



10' 0 10'

GRAPHIC SCALE - IN FEET

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STABILITY ANALYSIS SECTION AT BORING AB-1
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

DRAWN:	R.R.	DATE:	JANUARY 2011
ENG CHECK:		SCALE:	AS SHOWN
APPROVAL:		JOB No.:	6468-10-0181

FIGURE 4

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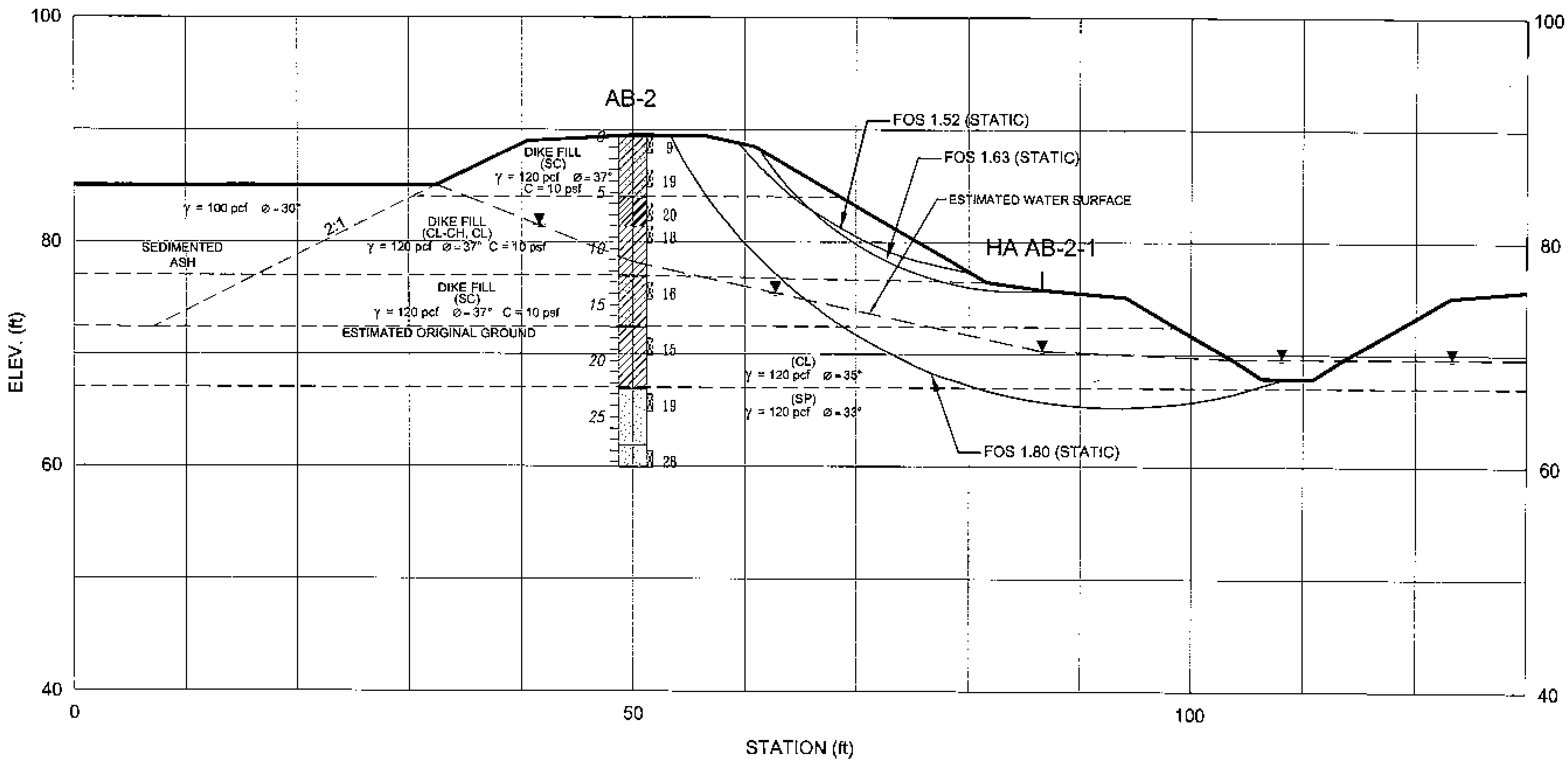

10' 0 10'
GRAPHIC SCALE - IN FEET

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STABILITY ANALYSIS SECTION AT BORING AB-2
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

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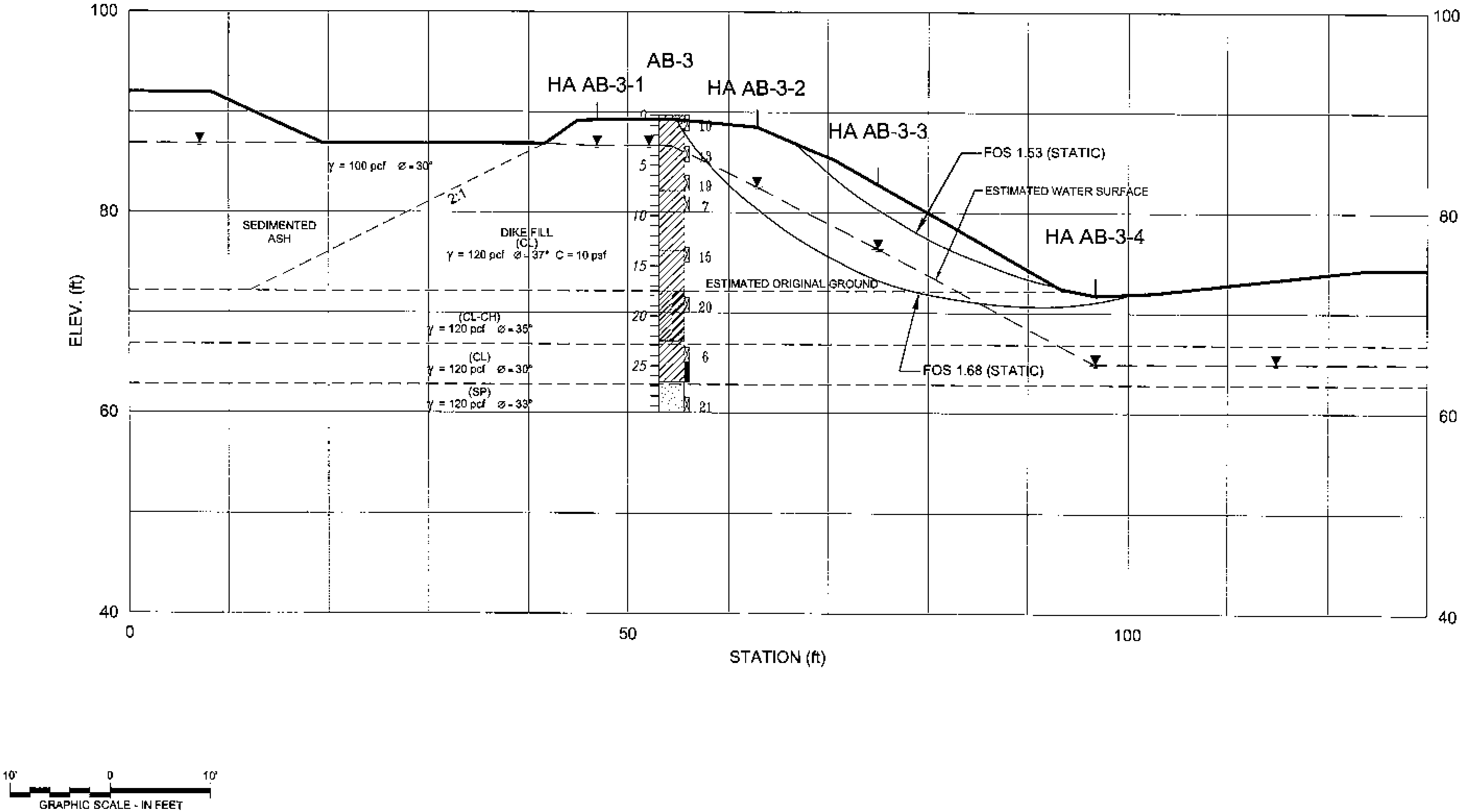
FIGURE 5

REFERENCE:



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STABILITY ANALYSIS SECTION AT BORING AB-3
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

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ENG CHECK:	[signature]	SCALE:	AS SHOWN
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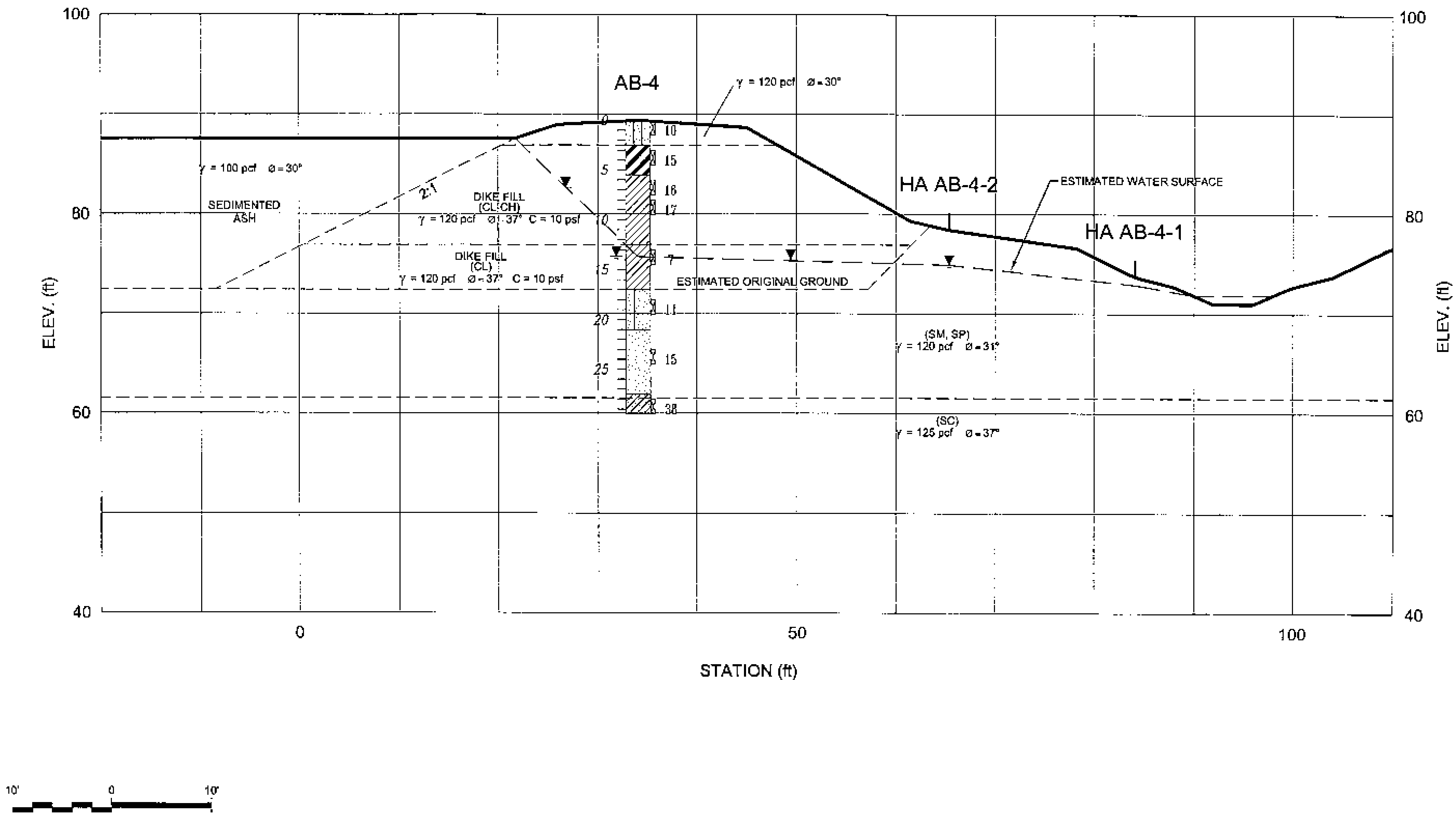
FIGURE 6

REFERENCE:



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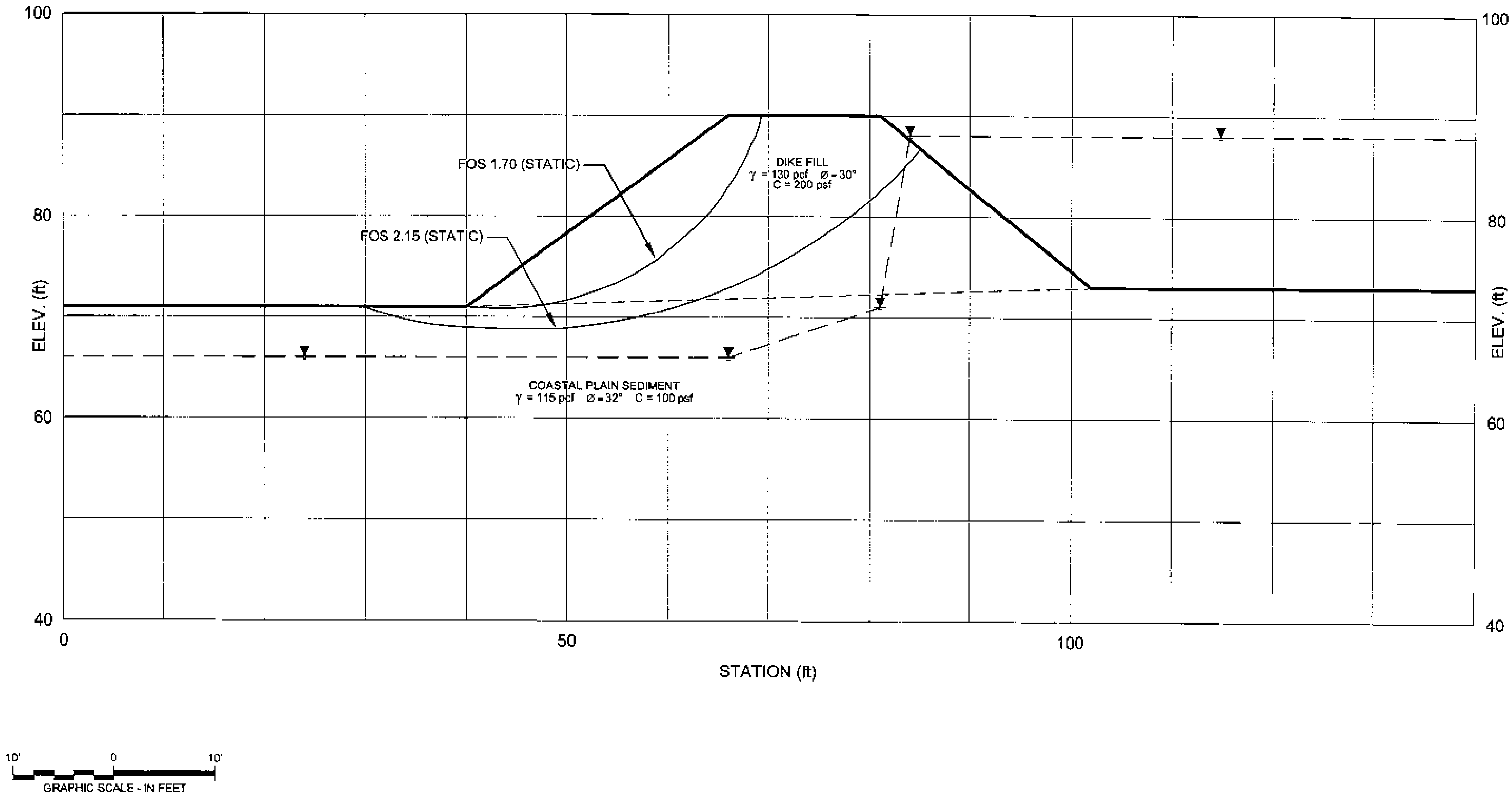
GEOTECHNICAL SECTION AT BORING AB-4
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

DRAWN:	R.R.	DATE:	JANUARY 2011
ENG CHECK:	JR	SCALE:	AS SHOWN
APPROVAL:	JR	JOB No.:	6468-10-0181

FIGURE 7

REFERENCE:



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STABILITY ANALYSIS SECTION - 1999 SECTION
LEE PLANT - ASH POND
WAYNE COUNTY, NORTH CAROLINA

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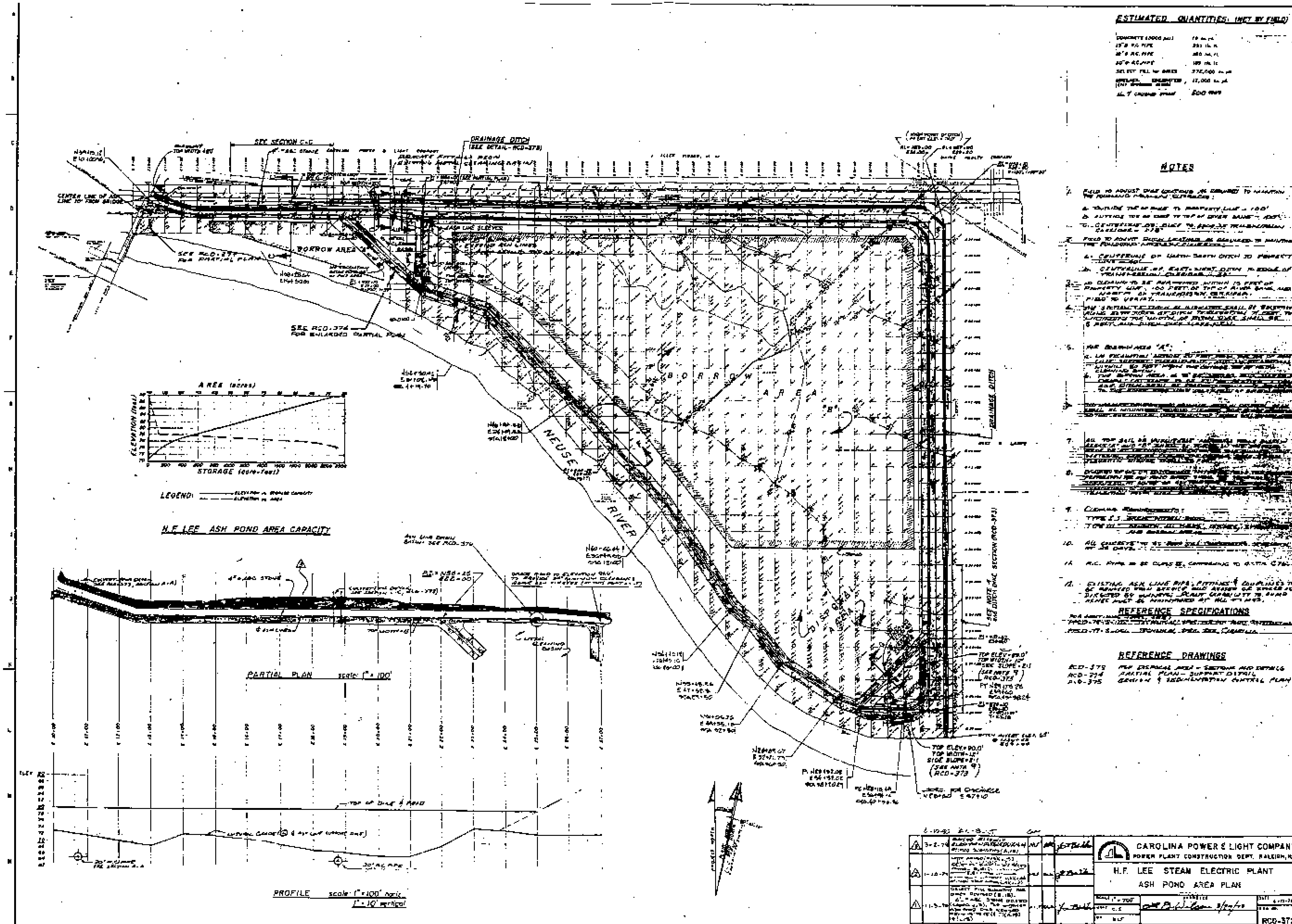
ENG CHECK:	[signature]	SCALE:	AS SHOWN
APPROVAL:	[signature]	JOB No.:	6468-10-0181

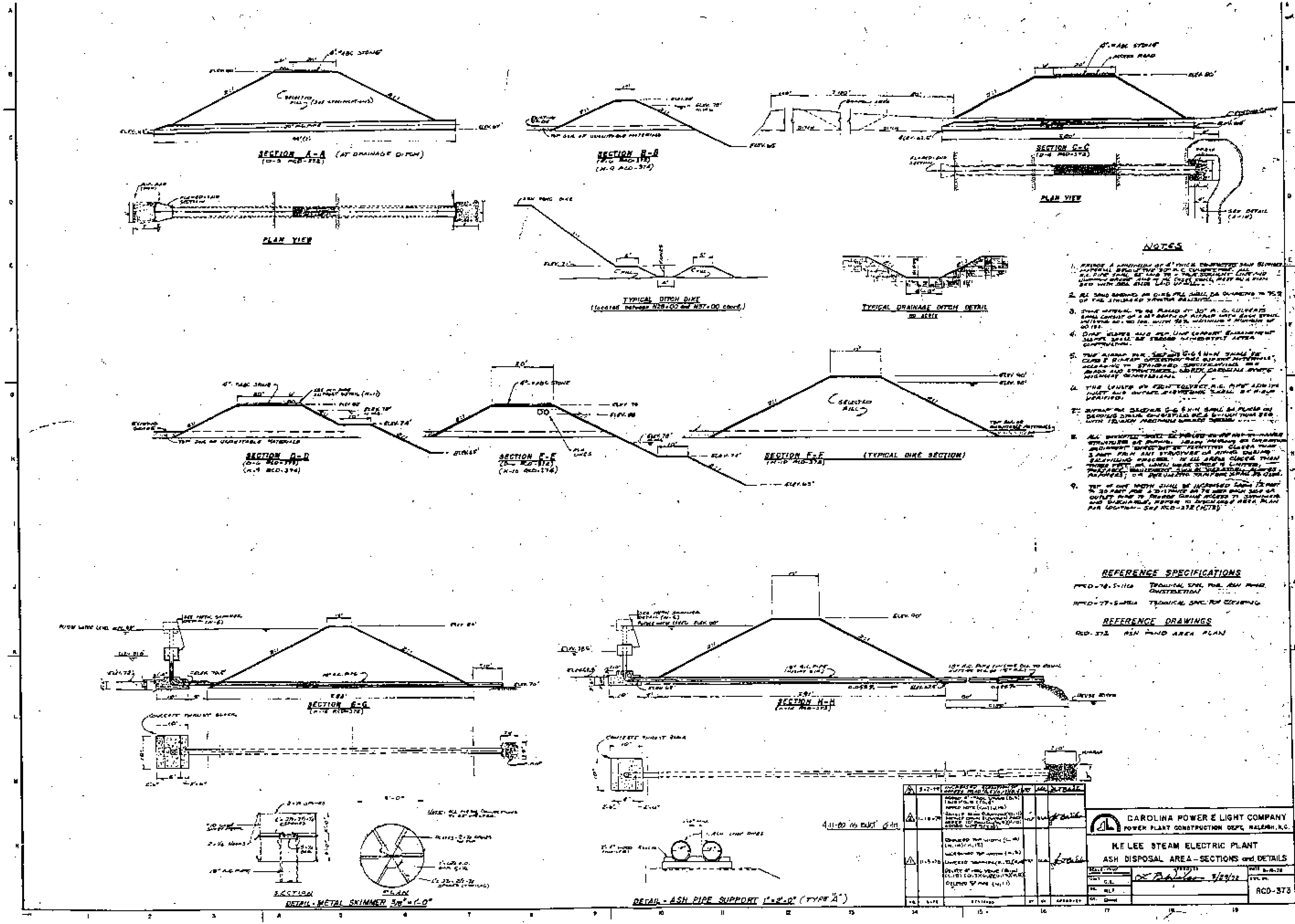
FIGURE 8

REFERENCE:

APPENDIX A

Design Drawings


ESTIMATED QUANTITIES (NET BY FIELD)
NOTES
REFERENCE SPECIFICATIONS
REFERENCE DRAWINGS
RCD-373
RCD-374 PARTIAL PLAN
RCD-375
BORROW AREA
DRAINAGE DITCH
NEUSE RIVER
DISPOSAL AREA
SEE RCD-374 FOR ENLARGED PARTIAL PLAN
AREA (acres)
ELEVATION (feet)
STORAGE (acre-feet)
LEGEND:
H.F. LEE ASH POND AREA CAPACITY
PARTIAL PLAN scale: 1" = 100'
PROFILE scale: 1" = 100' horiz.
1" = 10' vertical
TOP ELEV = 90.0'
TOP WIDTH = 12'
SIDE SLOPE = 2:1
(SEE NOTE 9 RCD-373)
CAROLINA POWER & LIGHT COMPANY
POWER PLANT CONSTRUCTION DEPT. RALEIGH, N.C.
H.F. LEE STEAM ELECTRIC PLANT
ASH POND AREA PLAN
RCD-372


SECTION A-A (AT DRAINAGE DITCH)
PLAN VIEW
SECTION B-B
TYPICAL DITCH DIKE
(located between N28+00 and N57+00 coord.)
SECTION C-C
PLAN VIEW
TYPICAL DRAINAGE DITCH DETAIL
SECTION D-D
SECTION E-E
SECTION F-F (TYPICAL DIKE SECTION)
NOTES
REFERENCE SPECIFICATIONS
REFERENCE DRAWINGS
SECTION G-G
SECTION H-H
SECTION
PLAN
DETAIL - METAL SKIMMER 3/8" = 1'-0"
DETAIL - ASH PIPE SUPPORT 1" = 2'-0" (TYPE "A")
CAROLINA POWER & LIGHT COMPANY
POWER PLANT CONSTRUCTION DEPT. RALEIGH, N.C.
H.F. LEE STEAM ELECTRIC PLANT
ASH DISPOSAL AREA - SECTIONS and DETAILS
RCD-373

APPENDIX B

Test Boring Records and Hand Auger Records

B-1 Records from current study

B-2 Boring Logs from 2007

B-3 Boring Logs from 1999

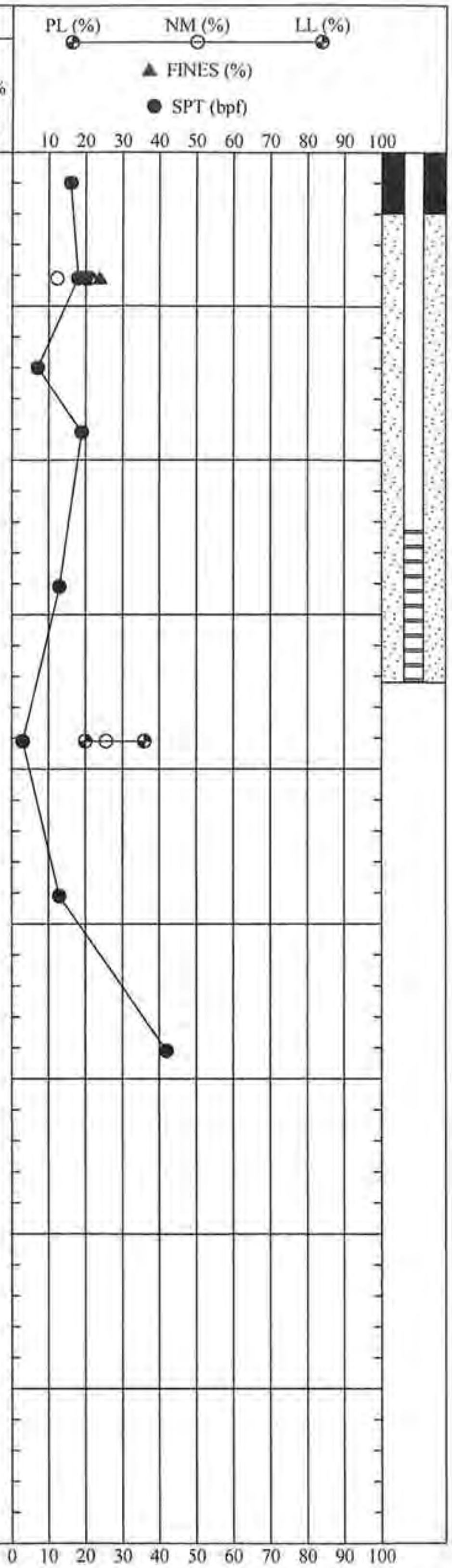
APPENDIX B-1

Records from current study

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)
0	Fill: Medium dense, tan to orange and brown-gray, silty fine to coarse SAND (SM), moist to wet	89.5
5	Fill: Medium stiff, gray-brown, silty CLAY (CH), wet	84.5
	Fill: Medium dense, orange-brown to gray, clayey fine to medium SAND (SC), wet	
10		79.5
15		74.5
	Soft, gray and brown, silty CLAY (CL), with trace of organic matter, wet	
20		69.5
	Medium dense, gray-brown, fine to coarse SAND (SP) with trace of silt, saturated	
25		64.5
	Dense, gray, silty fine to medium SAND (SM), saturated	
30	Boring terminated at 29.6 feet.	59.5
35		54.5
40		49.5
45		44.5

SAMPLES

IDENT	TYPE	N-COUNT or Rec%/RQD% (1st 6", 2nd 6", 3rd 6", 4th 6")
SS-1	☒	8-8-8
SS-2	☒	7-8-10
SS-3	☒	2-3-4
SS-4	☒	7-10-9
SS-5	☒	7-5-8
SS-6	☒	1-1-2
ST-1	■	
SS-7	☒	5-5-8
SS-8	☒	9-22-20



DRILLER: G. Bridger
EQUIPMENT: CME-45C
METHOD: Mud Rotary
HOLE DIA.: 3 inch
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed adjacent to boring. A groundwater level of 8.0 feet was measured in the casing on 11/15/10

REVIEWED BY: [signature]

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Lee Plant - Ash Pond Dike Stability

Boring No.: AB-1

Location: Goldsboro, North Carolina

Drilled: October 27, 2010

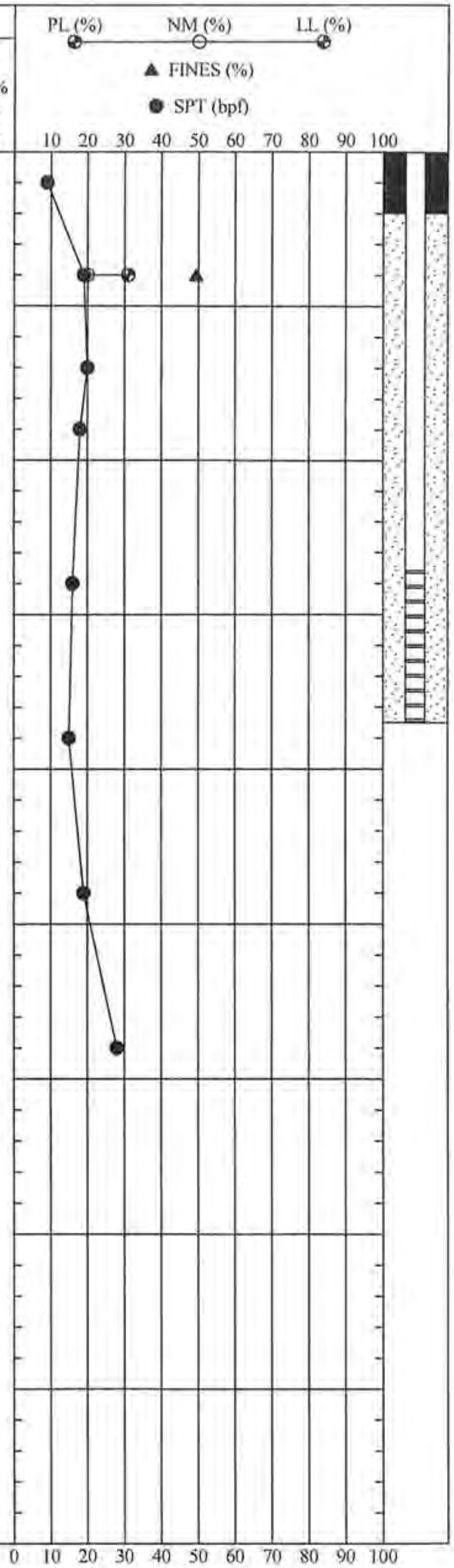
Project #: 6468-10-0181

MACTEC

SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)	SAMPLE IDENT	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
0	Fill: Loose to medium dense, orange-brown, clayey fine to medium SAND (SC), moist	89.5	SS-1	6-4-5
			SS-2	4-8-11
5		84.5		
	Fill: Very stiff, gray-brown, silty CLAY (CL-CH), wet		SS-3	7-8-12
	Fill: Very stiff, light brown, fine sandy, silty CLAY (CL), wet		SS-4	5-7-11
10		79.5		
	Fill: Medium dense, brown-gray, clayey fine to medium SAND (SC), wet		SS-5	2-7-9
15		74.5		
	Stiff, gray and brown, fine sandy CLAY (CL), with sand layers, wet		SS-6	2-5-10
20		69.5		
	Medium Dense, tan to gray, fine to coarse SAND (SP), with trace silt, saturated		SS-7	5-8-11
25		64.5		
	Medium dense, gray, fine to coarse sand (SP), with trace silt and gravel, saturated		SS-8	11-12-16
30	Boring terminated at 29.5 feet.	59.5		
35		54.5		
40		49.5		
45		44.5		



DRILLER: G. Bridger
EQUIPMENT: CME-45C
METHOD: Mud Rotary
HOLE DIA.: 3 inch
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed adjacent to boring. A groundwater level of 11.4 feet was measured in the casing on 11/15/10.

REVIEWED BY:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Lee Plant - Ash Pond Dike Stability
Boring No.: AB-2
Location: Goldsboro, North Carolina
Drilled: October 27, 2010
Project #: 6468-10-0181
Page 1 **of** 1

MACTEC

SOIL TEST BORING RECORD

Project: Lee Plant - Ash Pond Dike Stability
Boring No.: AB-3
Location: Goldsboro, North Carolina
Drilled: October 27, 2010
Project #: 6468-10-0181
Page 1 **of** 1

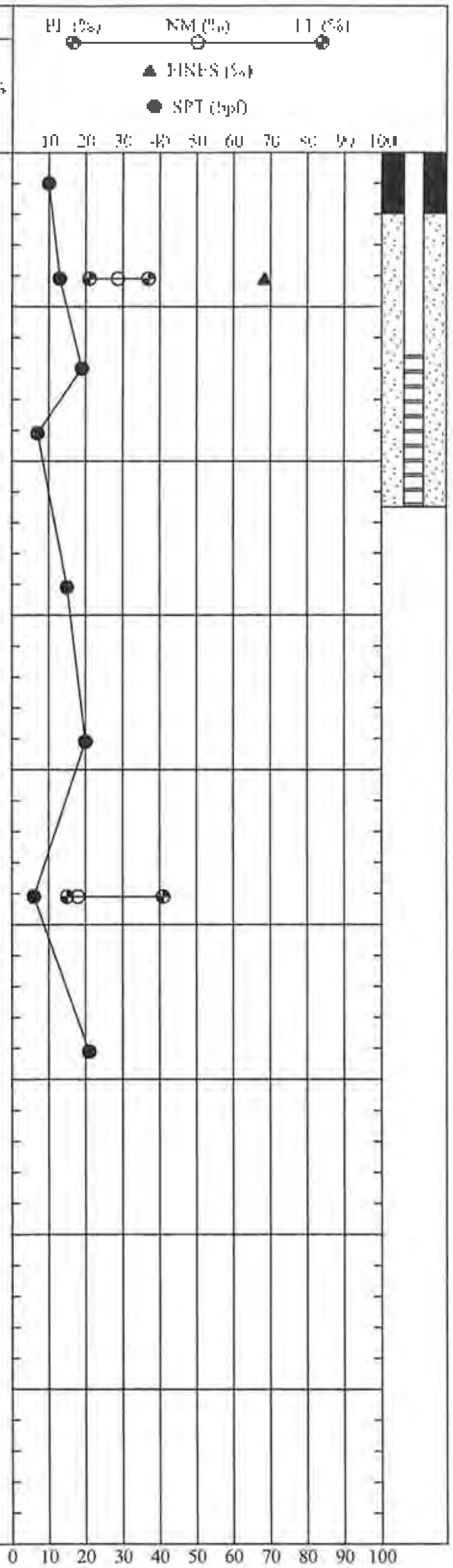
SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	Fill: Stiff to very stiff, brown-orange, red-orange and gray-brown, fine to medium sandy, silty clay (CL), moist	89.3
	Trace of organic matter at 6 feet.	
	Fill: Medium stiff, dark gray, fine sandy, silty CLAY (CL), moist	
	Fill: Stiff, gray, fine sandy CLAY (CL), moist	
	Very Stiff, brown and gray, silty CLAY (CL-CH), wet	
	Medium stiff, brown-gray, silty CLAY (CL), wet	
	Medium dense, brown-gray, fine to coarse SAND (SP), saturated	
	Boring terminated at 29.6 feet.	
5		84.3
10		79.3
15		74.3
20		69.3
25		64.3
30		59.3
35		54.3
40		49.3
45		44.3

SAMPLES

IDENT	N-COUNT or Rec%/RQD% (1st 6" / 2nd 6" / 3rd 6" / 4th 6")
SS-1	2-3-7
SS-2	3-4-9
SS-3	6-9-10
SS-4	3-4-3
SS-5	4-7-8
SS-6	5-6-14
SS-7	2-3-3
ST-2	
SS-8	11-10-11



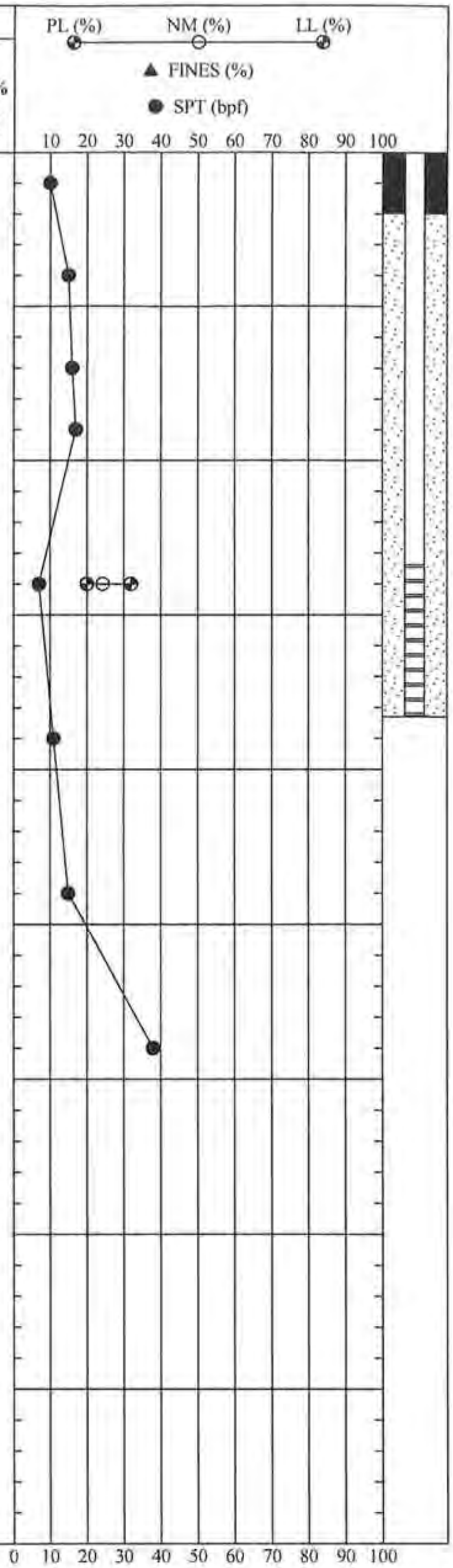
DRILLER	G. Bridger
EQUIPMENT	CME-450
METHOD:	Mud Rotary
HOLE DIA.:	3 inch
REMARKS:	Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed adjacent to boring. A groundwater level of 3 feet was measured in the casing on 11-15/10

REVIEWED BY: [signature]

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.)	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT or Rec%/RQD% (1st 6" / 2nd 6" / 3rd 6" / 4th 6")
0	Fill: Loose, orange, silty fine to medium SAND (SM), with trace gravel, moist	89.4	SS-1	⊠	4-5-5
	Fill: Stiff, gray, silty CLAY (CH), with trace organic matter, moist		SS-2	⊠	4-4-11
5	Fill: Very stiff, gray, fine sandy CLAY (CL), moist to wet	84.4	SS-3	⊠	3-5-11
			SS-4	⊠	10-8-9
10		79.4			
	Fill: Medium Stiff, orange-gray, fine sandy, silty CLAY (CL), wet		SS-5	⊠	4-3-4
15		74.4			
	Fill: Medium dense, gray to tan, silty fine to medium SAND (SM), wet		SS-6	⊠	5-5-6
20	Medium dense, gray, fine to coarse SAND (SP), with trace of silt, saturated	69.4	SS-7	⊠	7-6-9
25		64.4			
	Dense, gray, clayey fine to coarse SAND (SC)		SS-8	⊠	16-18-20
30	Boring terminated at 29.5 feet.	59.4			
35		54.4			
40		49.4			
45		44.4			



DRILLER: G. Bridger
EQUIPMENT: CME-45C
METHOD: Mud Rotary
HOLE DIA.: 3 inch
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed adjacent to boring. A groundwater level of 13.8 feet was measured in the casing on 11/15/10.

REVIEWED BY: [signature]

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Lee Plant - Ash Pond Dike Stability
Boring No.: AB-4
Location: Goldsboro, North Carolina
Drilled: October 27, 2010
Project #: 6468-10-0181
Page 1 **of** 1

MACTEC

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/03/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-1	**Boring Location: Near Toe of Slope at AB-1**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 4	NA	Gray Silty Clay (CH), with Trace of Sand, wet
		Groundwater at 1.8 feet at completion of hand auger.
		Groundwater at 0.5 feet on 11/11/10
		Groundwater at 0.6 feet on 11/15/10

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/03/10**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-2	**Boring Location: Near Toe of slope at AB-2**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 2	NA	Brown Fine Sandy Silt (ML), Moist
2 - 5	NA	Orange and Gray Silty Clay (CL) moist
5 – 5.5	NA	Orange and Gray Fine Sandy Clay (CL), wet
		Boring dry at completion of hand auger.
		Borehole dry cave at 5.5 feet on 11/11/10
		Borehole dry cave at 5.5 feet on 11/15/10

Prepared by: JJJ Reviewed by: JB

MACTEC

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/11/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-3-1	**Boring Location: Top of Dike Near AB-3**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 1.5	NA	Gray Silty Fine Sand (Ash) (SM), moist
1.5 - 4	NA	Orange-Brown Fine Sandy Silty Clay (CL), moist
4 - 5.5	NA	Orange-Brown clayey Fine Sand (SC), wet
5.5 – 7.0	NA	Orange-Brown to Gray Fine Sandy Clay (CL) with Sand Seams, wet
		Groundwater at 3.8 feet at hand auger completion.
		Groundwater at 2.6 feet on 11/15/10

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/11/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-3-2	**Boring Location: Top of Dike Near AB-3**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 3	NA	Brown-Orange Fine Sandy Silty Clay (CL), moist
3 - 4	NA	Orange-Brown Clayey Fine Sand (SC), moist to wet
4 - 5.5	NA	Brown-Orange Silty Clay (CL), moist
5.5 - 6	NA	Brown to Gray Clayey Silty Fine to Coarse Sand (SM), wet
6 - 7	NA	Brown to Gray Fine Sandy Silty Clay (CL), moist
		Borehole wet at 7 feet at hand auger completion.
		Groundwater at 6 feet on 11/15/10

Prepared by: TJT Reviewed by: [signature]

MACTEC

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/11/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-3-3	**Boring Location: On Slope near AB-3**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 2.5	NA	Tan-Orange Fine Sandy Clay (CL) with Clayey Sand Layers, moist
2.5 - 6.0	NA	Brown-Orange to Gray Fine Sandy Clay (CL) with Clayey Sand Layers, Moist
6.0 – 6.7	NA	Gray Silty Fine SAND (SM), wet
6.7 – 7.0	NA	Gray Silty Clay (CL-CH), wet
		Borehole wet at 7 feet at hand auger completion.
		Groundwater at 6.4 feet on 11/15/10

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/03/2010, 11/11/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-3-4	**Boring Location: Near Toe of slope at AB-3**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 – 1.5	NA	Tan Fine Sandy Silt (ML), moist
1.5 - 4	NA	Brown-Orange Silty Clay (CL), moist
4 - 6	NA	Red-Brown Fine Sandy Silty Clay (CL-CH), moist to wet
6 6.5	NA	Brown-Orange Clayey Fine Sand (SC), wet
6.5 - 7	NA	Brown fine Sandy Clay (CL), wet
		Groundwater at 6.8 feet at hand auger completion (11/11/10).
		Groundwater at 6.9 feet on 11/15/10
		*Hand auger advanced to 4 feet on 11/3/2010 and from 4 to 7 feet on 11/11/2010.

Prepared by: JJJ Reviewed by: [signature]

MACTEC

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/03/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-4-1	**Boring Location: Near Ditch at AB-4**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 3	NA	Gray Slightly Clayey Silty Fine to Coarse Sand (SM), wet
3 - 4	NA	Gray Silty Clay (CH), wet
		Groundwater at 2.0 feet at hand auger completion.
		Groundwater at 0.7 feet on 11/11/10
		Groundwater at 0.8 feet on 11/15/10

Hand Auger Log		
Job Name: Lee Ash Pond Stability		**Date: 11/11/2010**
Client: Progress Energy		**MACTEC Job No. 6468-10-0181**
Boring No. HA-AB-4-2	**Boring Location: Near Toe of slope at AB-4**	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 2	NA	Tan Silty Fine Sand (SM), moist
2 - 3	NA	Gray Silty Fine Sand (SM), wet
3 - 4	NA	Tan-Orange Clayey Fine Sand (SC), wet
4 - 4.5	NA	Gray Clayey Fine to Coarse Sand (SC), saturated
		Groundwater at 4.0 feet at hand auger completion.
		Groundwater at 3.5 feet on 11/15/10

Prepared by: JJT Reviewed by: [signature]

MACTEC

APPENDIX B-2

Boring Logs from 2007

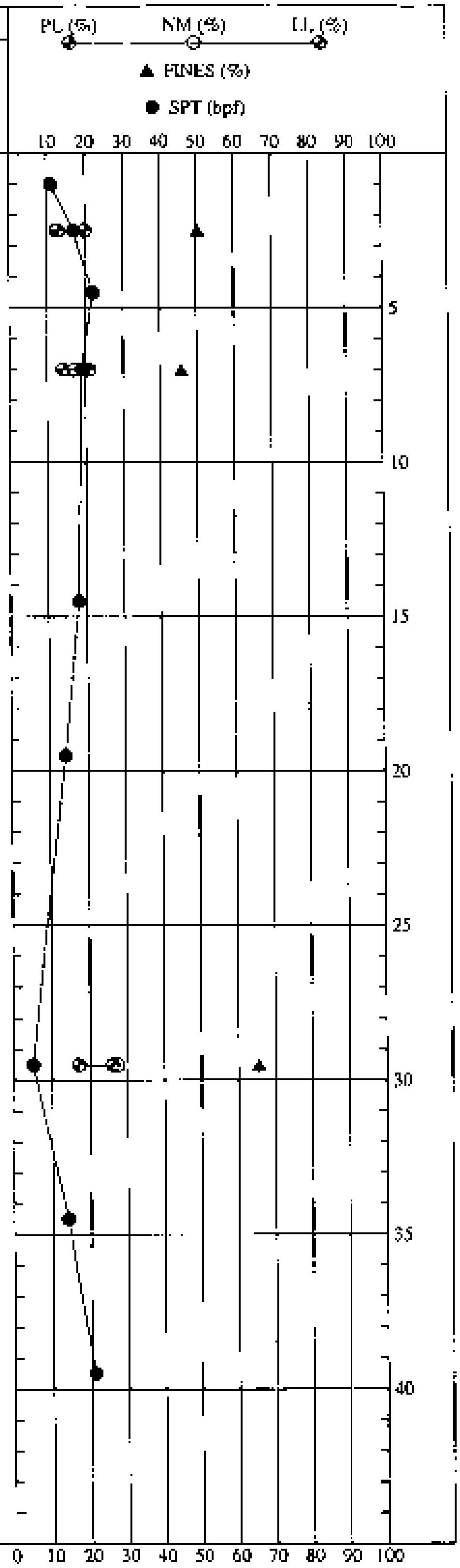
SOIL CLASSIFICATION AND REMARKS

SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS	ELEV (ft)
0	Gravel road with topsoil	89.0
	Fill - Medium dense, dry, grey-brown, slightly clayey fine to coarse SAND (SC)	
	Fill - Very stiff, moist, reddish-brown, fine sandy CLAY (CL)	
	Fill - Medium dense, moist to wet, grey, clayey to silty fine SAND (SC-SM)	
5		84.0
10		79.0
15		74.0
	Medium stiff to stiff, moist, grey, reddish-brown, slightly fine sandy, silty CLAY (CL)	
20		69.0
25		64.0
30		59.0
	Medium dense, wet, grey-brown, slightly clayey fine to coarse SAND (SC) with rock fragments	
35		54.0
40	Boring terminated at 40 feet.	49.0
45		44.0

SAMPLES

IDENT	TYPE	N-COUNT or Rec%/RQD% (1st 6" / 2nd 6" / 3rd 6" / 4th 6")
SS-1		6-5-6
SS-2		4-7-10
SS-3		8-9-13
SS-4		7-9-10
ST-1		
SS-5		10-10-8
SS-6		7-7-7
ST-2		
SS-7		2-3-2
SS-8		6-6-8
SS-9		10-12-9



DRILLER: Greg Coumbe
EQUIPMENT: D-50, manual hammer
METHOD: Mud Rotary
HOLE DIA.: 6" WELL: Stickup 0' Size 2"
REMARKS: A 2" I.D. water monitoring well was installed. Water level 4/17/09 was 15.6 feet below the dike crest.

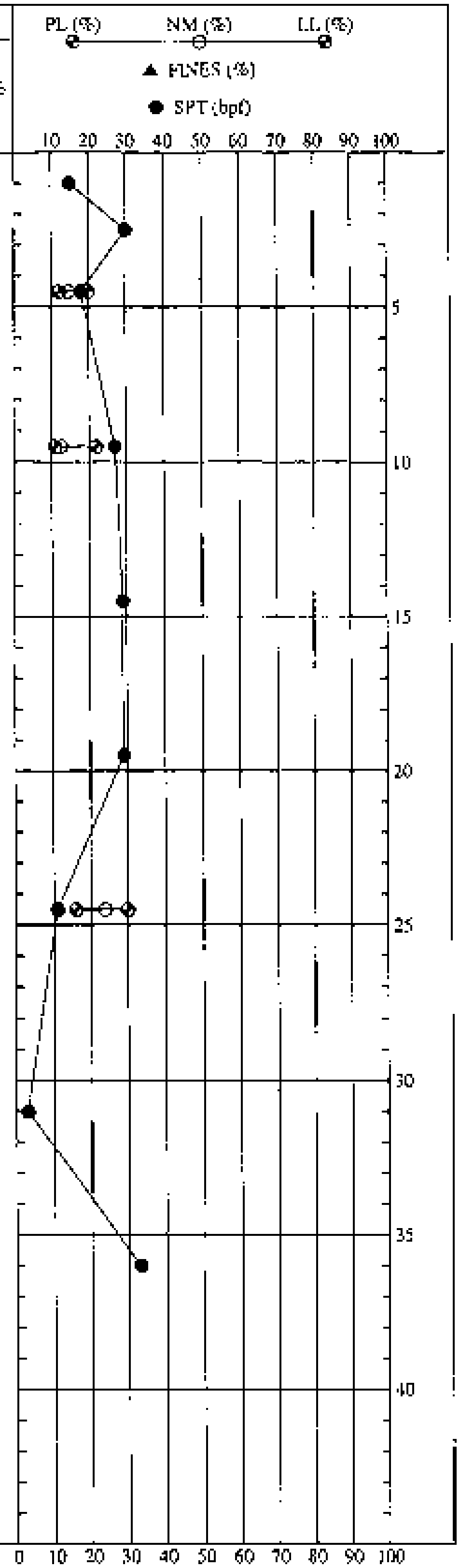
REVIEWED BY: ______

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Project: PGN - Lee Plant, Secondary Containment Dike
Boring No.: B-1
Location: Goldsboro, North Carolina
Drilled: December 11, 2007
Project #: 6468-07-1884
Page 1 of 1

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	N-COUNT or Rec%/RQD% (1st 6", 2nd 6", 3rd 6", 4th 6")
0	Gravel road with topsoil	89.0		
	Fill - Medium dense, moist, grey-brown, clayey fine SAND (SC)		SS-1	5-7-8
			SS-2	13-16-14
5		84.0	SS-3	11-8-10
			ST-1	
	Fill - Medium dense, moist, reddish-brown with grey, very clayey fine to coarse SAND (SC)		SS-4	13-15-12
10		79.0		
	Fill - Medium dense, moist, reddish-brown with grey, slightly clayey fine to coarse SAND (SC)		SS-5	14-15-14
15		74.0		
	Medium dense, moist, clayey fine SAND (SC)		SS-6	14-14-15
20		69.0		
	Stiff to soft, moist to wet, grey, slightly fine sandy, silty CLAY (CL)		SS-7	6-4-7
25		64.0		
			ST-2	
30		59.0		
	Very loose to dense, wet to saturated, grey-brown, very clayey fine to coarse SAND (SC)		SS-8	2-1-2
35		54.0	SS-9	14-13-20
	Boring terminated at 36.5 feet.			
40		49.0		
45		44.0		



DRILLER: Greg Coombes
EQUIPMENT: D-50, manual hammer
METHOD: Mud rotary
HOLE DIA.: 6" WELL: Stickup 0' Size 2"
REMARKS: A 2" I.D. water monitoring well was installed. Water level 4/17/09 was 22.3 feet below the dike crest.

REVIEWED BY: ________

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

Project: PGN - Lee Plant, Secondary Containment Dike

Boring No.: B-2

Location: Goldsboro, North Carolina

Drilled: December 12, 2007

Project #: 6468-07-1884

Page 1 of 1

MACTEC

Hand Auger Log

Job Name: Lee Steam Electric Plant, Secondary Containment Dike at the Dry Ash Storage Pond	**Date:** 12/11/2007
Client: PGN	**MACTEC Job No.** 6468-07-1884
Boring No. HA-1	**Boring Location:** Slope on east side of dike

Depth (feet)	Blow Counts	Visual Soil Description
-1	N/A	Moist, brown, slightly clayey fine to medium SAND (SC)
-2	N/A	Moist, reddish-brown, slightly clayey fine to medium SAND (SC)
-3	N/A	Moist, reddish-brown, slightly clayey fine to medium SAND (SC)
-4	N/A	Moist, reddish-brown, slightly clayey fine to medium SAND (SC)
-5	N/A	Moist to wet, reddish-brown, slightly clayey fine to coarse SAND (SC)
-6	N/A	Saturated, reddish-brown, slightly clayey fine to coarse SAND (SC)
-7	N/A	Saturated, reddish-brown, slightly clayey fine to coarse SAND (SC) – water observed
-8	N/A	Saturated, reddish-brown, slightly clayey fine to coarse SAND (SC) – water observed
		Boring terminated at 8 feet.

Hand Auger Log

Job Name: Lee Steam Electric Plant, Secondary Containment Dike at the Dry Ash Storage Pond	**Date:** 12/11/2007
Client: PGN	**MACTEC Job No.** 6468-07-1884
Boring No. HA-2	**Boring Location:** Slope on east side of dike

Depth (feet)	Blow Counts	Visual Soil Description
-1	N/A	Saturated, black, slightly fine sandy CLAY (CH)
-2	N/A	Saturated, brown, very clayey fine to medium SAND (SC)
-3	N/A	Saturated, grey, slightly fine to medium sandy CLAY (CH) – water observed
-4	N/A	Saturated, grey, slightly fine to medium sandy CLAY (CH) – water observed
-5	N/A	Saturated, brown, very clayey fine to medium SAND (SC) – water observed
		Boring terminated at 5 feet.

Prepared by: CF Reviewed by: [signature]

MACTEC

Hand Auger Log		
Job Name: Lee Steam Electric Plant, Secondary Containment Dike at the Dry Ash Storage Pond		**Date:** 12/11/2007
Client: PGN		**MACTEC Job No.** 6468-07-1884
Boring No. HA-3	**Boring Location:** Slope on east side of dike	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
-1	N/A	Moist, reddish-brown, clayey fine to coarse SAND (SC)
-2	N/A	Moist, reddish-brown, slightly clayey fine to coarse SAND (SC)
-3	N/A	Moist, reddish-brown, slightly clayey fine to coarse SAND (SC)
-4	N/A	Moist, reddish-brown, slightly clayey fine to coarse SAND (SC)
-5	N/A	Moist to wet, reddish-brown, slightly clayey fine to coarse SAND (SC)
-6	N/A	Wet, brown, very clayey fine to coarse SAND (SC)
-7	N/A	Saturated, brown with grey, very clayey fine to coarse SAND (SC) - water observed
-8	N/A	Saturated, brown with grey, very clayey fine to coarse SAND (SC) – water observed
		Boring terminated at 8 feet.

Hand Auger Log		
Job Name: Lee Steam Electric Plant, Secondary Containment Dike at the Dry Ash Storage Pond		**Date:** 12/11/2007
Client: PGN		**MACTEC Job No.** 6468-07-1884
Boring No. HA-4	**Boring Location:** Slope on east side of dike	
Depth (feet)	**Blow Counts**	**Visual Soil Description**
-1	N/A	Saturated, black, slightly silty, fine to medium sandy CLAY (CL-CH) – water observed
-2	N/A	Saturated, black with brown, slightly silty, very clayey fine to medium SAND (SC) – water observed
-3	N/A	Saturated, black with brown, slightly silty, very clayey fine to medium SAND (SC) – water observed
-4	N/A	Saturated, black with brown, slightly silty, very clayey fine to medium SAND (SC) – water observed
		Boring terminated at 4 feet.

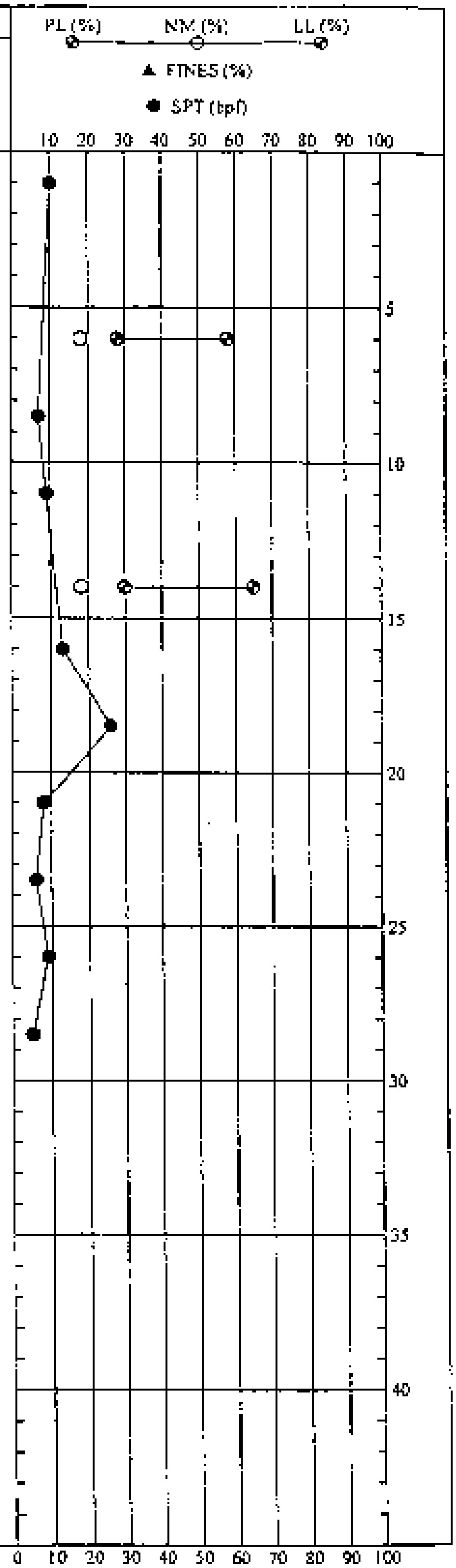
Prepared by: CF Reviewed by: [signature]

MACTEC

APPENDIX B-3

Boring Logs from 1999

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT (1st 6" / 2nd 6" / 3rd 6")
0	TOPSOIL				
	FILL: Firm to stiff, moist, brown, some gray, sandy, silty clay (CH)		SS	▨	4-4-6
5			UD	■	
			SS	▨	1-2-5
10					
	FILL: Loose, moist, gray and brown, silty, fine to medium sand (SM) trace fine gravel		SS	▨	3-5-4
	Possible FILL: Stiff to very stiff, moist, brown and gray, sandy, silty clay (CH) (Trace fine roots at 15.0 feet)		UD	■	
15			SS	▨	6-6-7
			SS	▨	8-10-16
20	Loose, moist, tan, silty, fine SAND (SM)		SS	▨	4-4-4
			SS	▨	3-3-3
25			SS	▨	3-4-5
	∇				
	Firm, wet, gray and brown, sandy SILT (ML)		SS	▨	1-2-3
30	Boring terminated at 29.5 feet. 2" diameter PVC piezometer installed at 29.0 feet.				
35					
40					
45					



SOIL 352503CP.GPJ LAW GIBB.GDT 6/21/99

DRILLER: T.Hahn
EQUIPMENT: Diedrich D-50
METHOD 2-1/4" ID HSA
HOLE DIA.:
REMARKS: Groundwater measured at 27.2 feet at boring termination.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

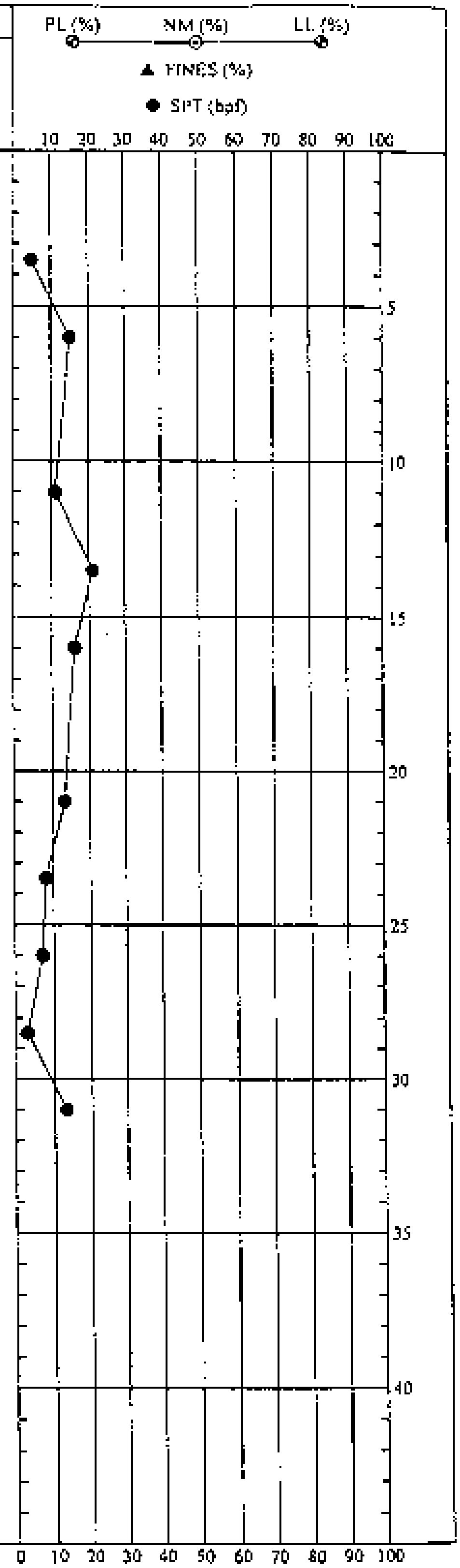
SOIL TEST BORING RECORD

Project: Lee Dike Stability **Boring No:** LD- 1
Coord N:
Coord E:
Drilled: May 26, 1999
Project #: 30720-9-3525.03 **Page 1 of 1**

LAW
LAWGIBB Group Member

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.
0	TOPSOIL
	FILL: Moist, brown, sandy clay (CL)
	FILL: Stiff to very stiff, moist, mottled brown and gray, silty clay (CH)
15	FILL: Moist, dark gray, some black, clayey sand (SC)
	Stiff, moist, dark gray, silty CLAY (CL), trace organics
20	Stiff, moist, brown and gray, sandy SILT (ML)
	Loose, moist to wet, tan, silty, fine SAND (SM)
30	Firm, wet, brown, fine to coarse SAND (SP)
	Boring terminated at 31.5 feet.
35	2" diameter PVC piezometer installed at 29.5 feet.

SAMPLES IDENT	TYPE	N-COUNT (1st 6" - 2nd 6" - 3rd 6")
SS		3-3-2
SS		4-5-10
UD		
SS		3-4-7
SS		7-9-12
SS		5-7-9
UD		
SS		5-7-6
SS		3-4-4
SS		3-3-4
SS		2-2-1
SS		5-5-8



SOIL 352503CP.GPJ LAW_GIBB.GDT 6/21/99

DRILLER: T.Hahn
EQUIPMENT: Diedrich D-50
METHOD: 2-1/4" ID HSA
HOLE DIA.:
REMARKS: Groundwater measured at 27.9 feet at boring termination

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Lee Dike Stability **Boring No:** LD- 2
Coord N:
Coord E:
Drilled: May 25, 1999
Project #: 30720-9-3525.03 **Page** 1 **of** 1

LAW
LAWGIBB Group Member

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6"	2nd 6"	3rd 6"	PL (%) / NM (%) / LL (%) ▲ FINES (%) ● SPT (bpf)
0	TOPSOIL								
	FILL: Moist, mottled brown and gray, sandy clay (CL)								
5									
	Very moist, brown, silty, fine SAND (SM) ▽								
10	Hand auger terminated at 10.0 feet 2" diameter PVC piezometer installed at 10.0 feet.								
15									
20									
25									
30									
35									
40									
45									

SOIL 3525SCP.GPJ LAW GIBB.GDT 6/2/99

DRILLER: T.Hahn
EQUIPMENT: Diedrich D-50
METHOD: Hand Auger
HOLE DIA.:
REMARKS: Groundwater measured at 9.0 feet at boring termination.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Lee Dike Stability **Boring No:** LD-3
Coord N:
Coord E:
Drilled: May 25, 1999
Project #: 30720-9-3525.03 **Page** 1 **of** 1

LAW
LAWGIBB Group Member

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.)	LEGEND	ELEV (ft)	SAMPLES IDENT	TYPE	N-COUNT 1st 6"	2nd 6"	3rd 6"
0	TOPSOIL							
	Moist, brown, some gray, fine sandy SILT (ML)							
5								
	Moist to very moist, tan and brown, silty, fine to medium SAND (SM) ▽							
	Hand auger terminated at 8.0 feet.							
10	2" diameter PVC piezometer installed at 8.0 feet							
15								
20								
25								
30								
35								
40								
45								

PL (%) NM (%) LL (%)
▲ FINES (%)
● SPT (bpf)
0 10 20 30 40 50 60 70 80 90 100

SOIL 35250CP.GPJ LAW_GIBB.GDT 6/1/99

DRILLER: T.Hahn
EQUIPMENT: Diedrich D-50
METHOD: Hand Auger
HOLE DIA.:
REMARKS: Groundwater measured at 7.0 feet at boring termination.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

Project: Lee Dike Stability **Boring No:** LD- 4
Coord N:
Coord E:
Drilled: May 25, 1999
Project #: 30720-9-3525.03

LAW
LAWGIBB Group Member

APPENDIX C

Laboratory Test Results

C-1 Results from Current Study

C-2 Results from 2007

C-3 Results from 1999

APPENDIX C-1

Results from Current Study

Summary of Laboratory Test Results-Seepage and Stability Evaluation-Ash Pond Dikes-Lee Plant, Goldsboro, North Carolina

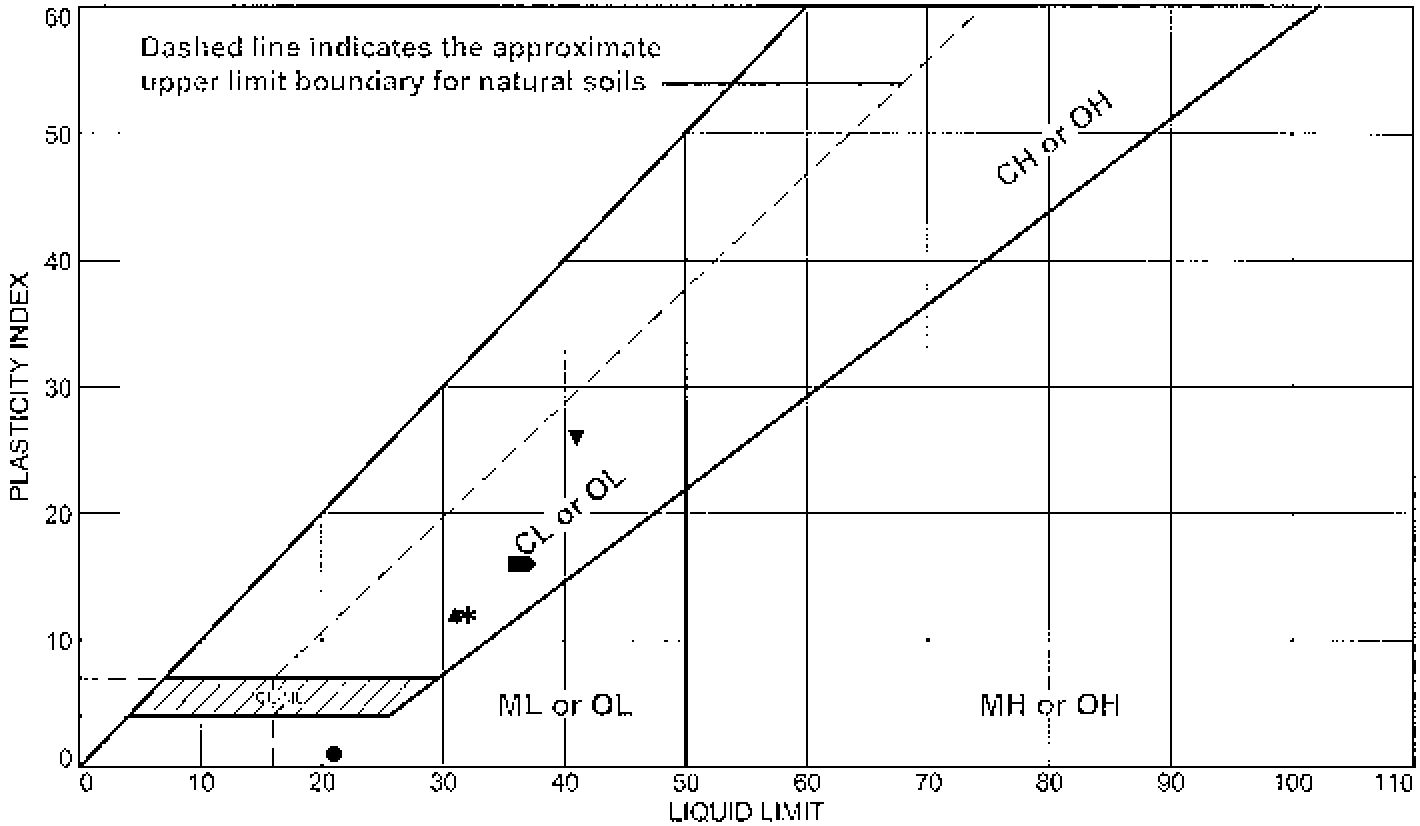
Boring No.	Sample No.	Sample Depth (ft)		Natural Moisture Content (%)	Grain Size	Atterberg Limits			USCS	Visual Description/Comments
		From	To		# 200	PL	LL	PI		
AB-1	SS-2	3.1	4.6	12.3	23.8	20	21	1	SM	Tan to orange and brown-gray, silty fine to coarse SAND
AB-1	SS 6	18.1	19.6	25.6	ND	20	36	16	CL*	Gray and brown, silty CLAY
AB 2	SS-2	3.0	4.5	19.9	49.4	19	31	12	SC	Orange-brown, clayey fine to medium SAND
AB-3	SS-2	3.1	4.6	28.7	68.4	21	37	16	CL	Gray-brown, fine to medium sandy, silty CLAY
AB-3	SS-7	23.1	24.6	18.0	ND	15	41	26	CL*	Brown-gray, silty CLAY
AB-4	SS-5	13.0	14.5	24.3	ND	20	32	12	CL*	Orange-gray, fine sandy, silty CLAY

USCS – Unified Soil Classification System Group Symbol
PL – Plastic Limit
LL – Liquid Limit
P.I. – Plasticity index
NP – Non Plastic
ND = Not Determined
*Visual Classification

Prepared By: ______

Checked By: ______

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D2216-10, D4318-10 Method A



	SOIL DATA							
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring AB-1	SS-2	3.1-4.6'	12.3	20	21	1	SM
■	Boring AB-1	SS-6	18.1-19.6	25.6	20	36	16	(CL) visual
▲	Boring AB-2	SS-2	3.0-4.5	19.9	19	31	12	SC
◆	Boring AB-3	SS-2	3.1-4.6	28.7	21	37	16	CL
▼	Boring AB-3	SS-7	23.1-24.6	18.0	15	41	26	CL (visual)
✱	Boring AB-4	SS-5	13.0-14.5	24.3	20	32	12	CL (visual)

MACTEC, Inc.

Raleigh, North Carolina

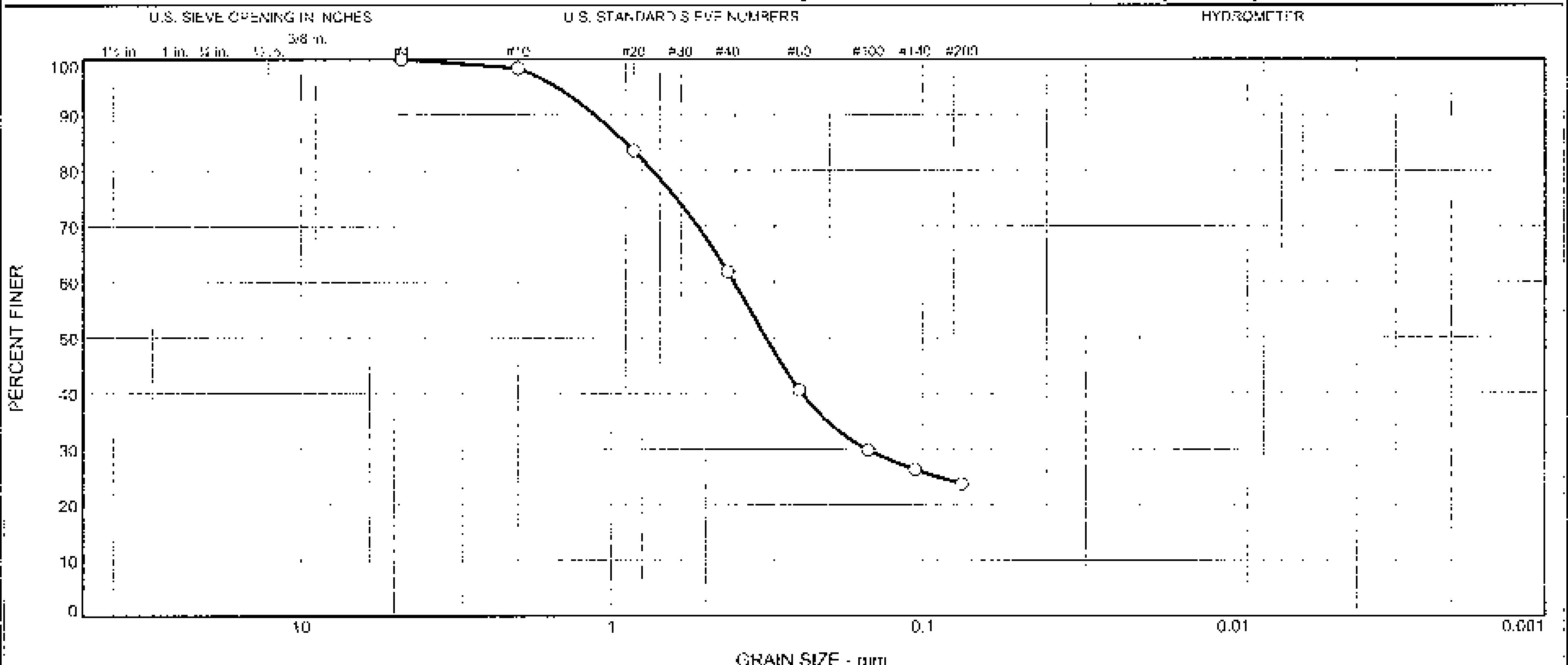
Client: Progress Energy

Project: Lee Plant Ash Pond Dike Stability

Project No.: 6468100181 **Figure**

Tested By: CS **Checked By:** IAM

Particle Size Distribution Report ASTM D 422-63 (2007)



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.6	36.4	38.2	23.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring AB-1	SS-2	3.1-4.6'	10/27/10	SM	Tan To Orange and Brown-Gray Silty Fine to Coarse SAND	12.3	21	20

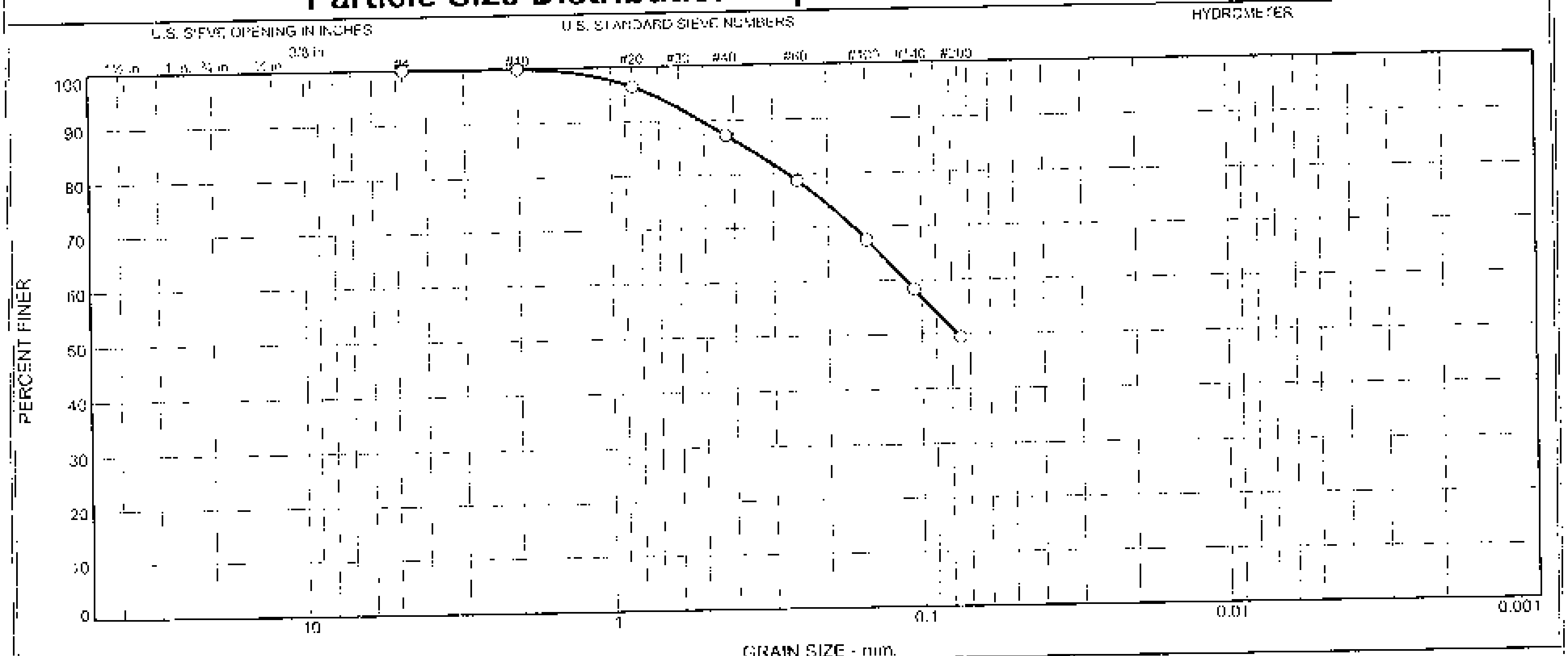
Client: Progress Energy
Project: Lee Plant Ash Pond Dike Stability
Project No. 6468100181 | Figure

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

○ ND – Not Determined

Tested By: CS

Particle Size Distribution Report ASTM D 422-63 (2007)



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
O	0.0	0.0	0.1	12.6	37.9	49.4	

	Source	Sample #	Depth/Elev	Date Sampled	USCS	Material Description	NM %	LL	PL
O	Boring AB-2	SS-2	3.0-4.5	10/27/10	SC	Orange-Brown Clayey Fine-Medium SAND	19.9	31	19

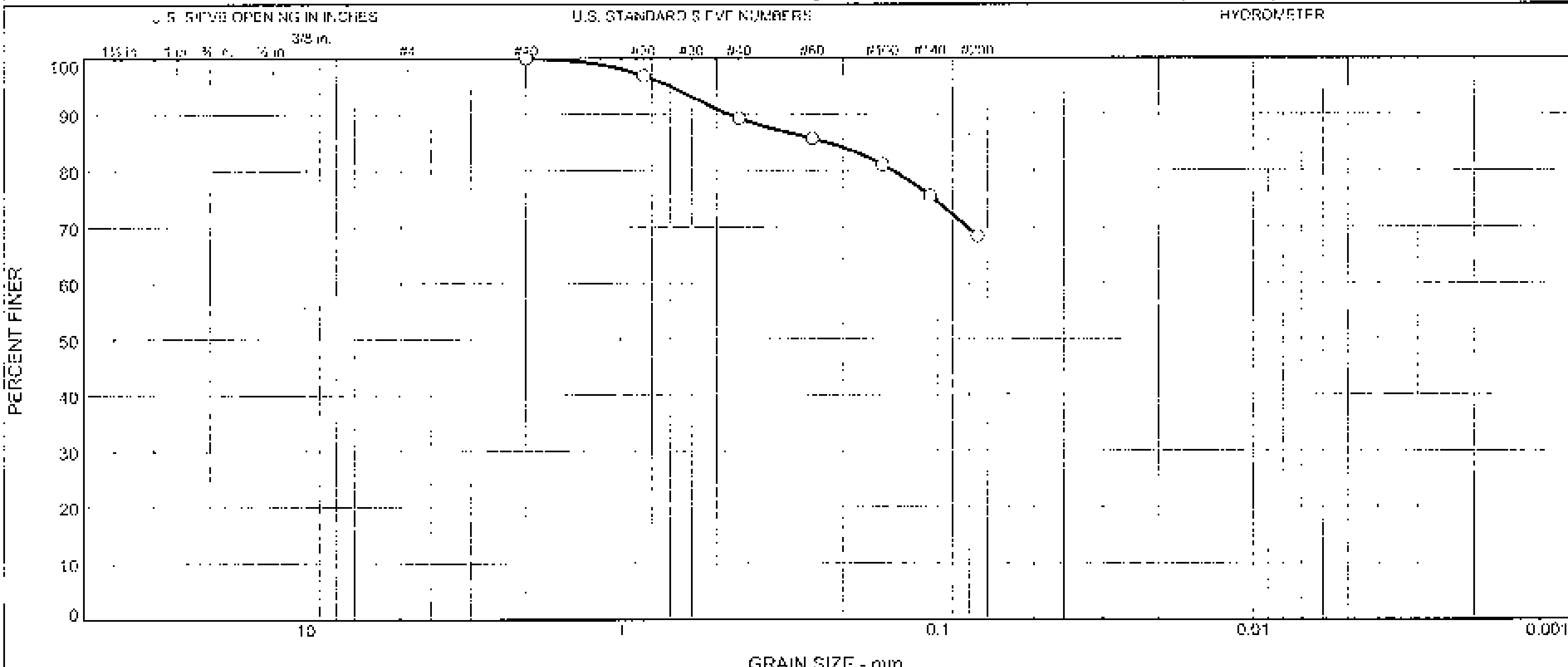
Client Progress Energy
Project Lee Plant Ash Pond Dike Stability
Project No. 6468100181 Figure

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

O ND Not Determined

Tested By: CS

Particle Size Distribution Report ASTM D 422-63 (2007)



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	10.7	20.9	68.4	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring AB-3	SS-2	3.1-4.6	10/27/10	CL	Gray-Brown Fine to Medium Sandy Silty CLAY	28.7	37	21

Client Progress Energy

Project Lee Plant Ash Pond Dike Stability

Project No. 6468100181 Figure

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Raleigh, North Carolina

○ ND = Not Determined

Tested By: CS

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

ASTM D4767-04 / AASHTO T297-94 (SOP-S28)

Client	MACTEC		
Client Reference	LEE PLANT 6468-10-0181		
Project No.	2011-716-01		
Lab ID	2011-716-01-01	Specific Gravity (assumed)	2.7

Visual Description: GRAY BROWN FAT CLAY WITH SAND

SAMPLE CONDITION SUMMARY

Boring No.	AB-1	AB-1
Depth (ft)	19.7-20.2	20.2-20.7
Sample No.	ST-1	ST-1
Test No.	T1	T2
Deformation Rate (in/min)	0.0004	0.0004
Back Pressure (psi)	50.4	40.4
Consolidation Time (days)	3	3
Initial State (w%)	29.7	33.3
Total Unit Weight (pcf)	122.5	123.5
Dry Unit Weight (pcf)	94.4	92.6
Final State (w%)	25.3	24.9
Initial State Void Ratio,e	0.785	0.820
Void Ratio at Shear, e	0.612	0.690

Tested By SD Date 2/1/2011 Input Checked By *[illegible]* Date *2-8-11*

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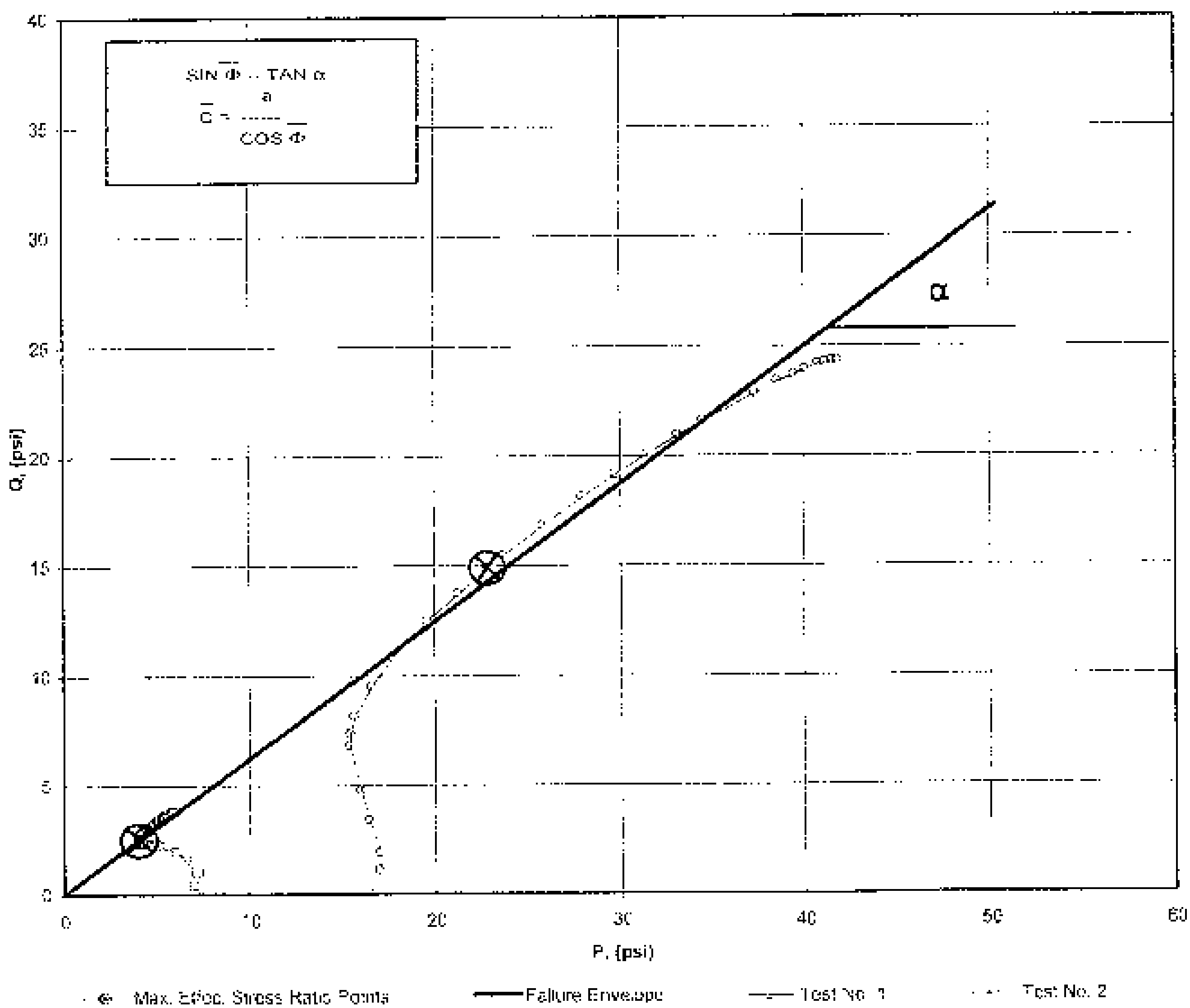
CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	MACTEC	Boring No.	AB-1
Client Reference	LEE PLANT 6468-10-0181	Depth(ft.)	19.7-20.7
Project No.	2011-716-01	Sample No.	ST-1
Lab ID	2011-716-01-01		

Consolidated Undrained Triaxial Test with Pore Pressure



a	=	0.00	$\overline{C}$	=	0.00
α	=	31.9	$\overline{\Phi}$	=	38.54

Tested By MPS Date 2/7/2011 Approved By [signature] Date 2-8-11

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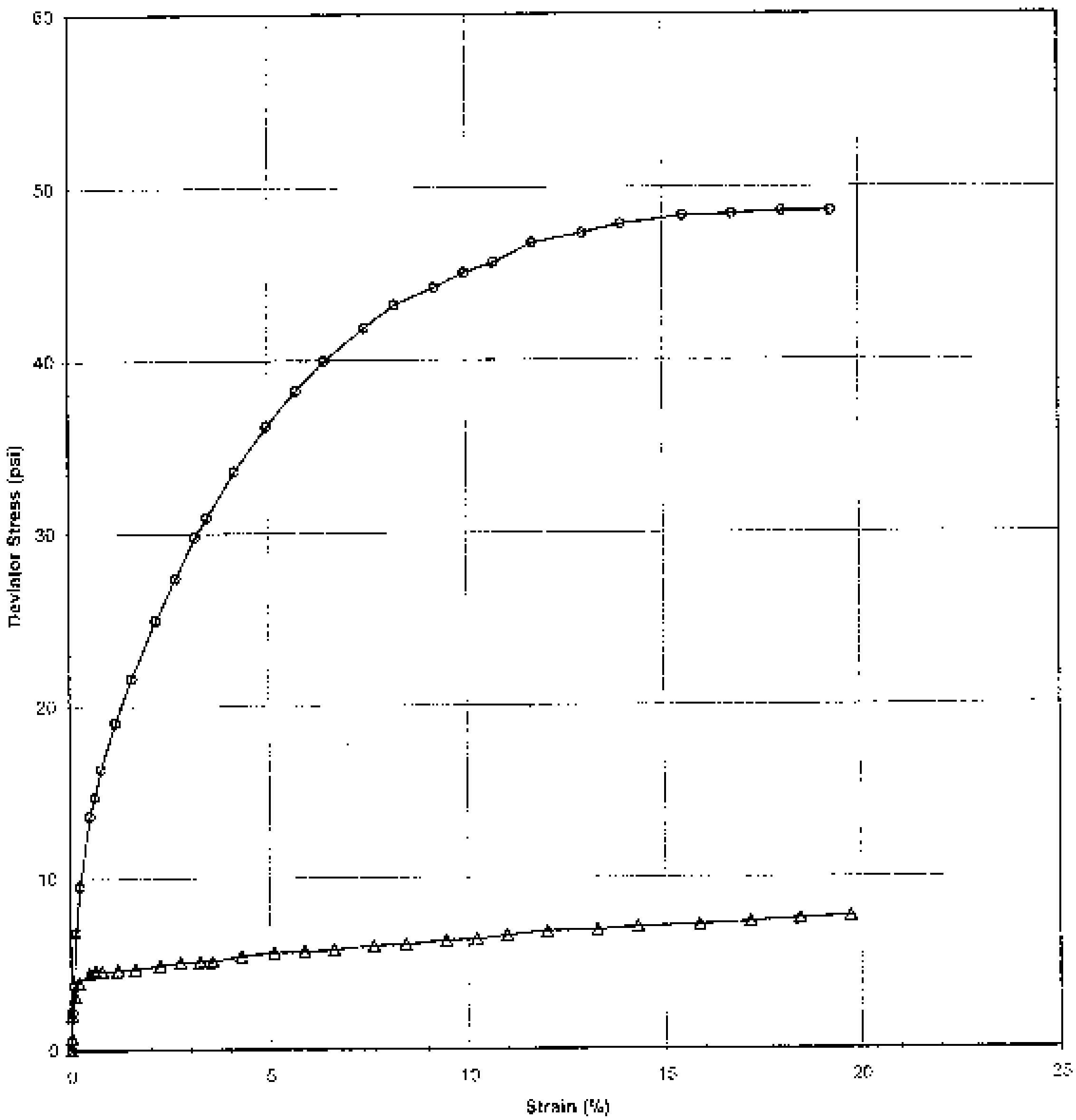
CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	MACTEC	Boring No.	AB-1
Client Reference	LEE PLANT 6468-10-0181	Depth(ft.)	19.7-20.7
Project No	2011-716-01	Sample No	ST-1
Lab ID	2011-716-01-01		
Visual Description:	GRAY BROWN FAT CLAY WITH SAND		



Tested By MPS Date 2/7/2011 Approved By MM Date 2-8-11

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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D4767-95 / AASHTO T297-94 (SOP-S26)

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INTEGRITY IN TESTING

Client	MACTEC	Boring No.	AB-1
Client Reference	LEE PLANT 6468-10-0181	Depth(ft.)	19.7-20.2
Project No.	2011-716-01	Sample No.	ST-1
Lab ID	2011-716-01-01		

Visual Description: GRAY BROWN FAT CLAY WITH SAND

Stage No.	1
Test No	1

INITIAL SAMPLE DIMENSIONS (in)

Length 1	6.057	Diameter 1	2.860
Length 2	6.061	Diameter 2	2.851
Length 3	6.061	Diameter 3	2.679
Avg Leng.=	6.060	Avg. Diam.=	2.797

PRESSURES (psi)

Cell Pressure(psi)	57.6
Back Pressure(psi)	50.4
Eff. Cons. Pressure(psi)	7.2
Pore Pressure Response (%)	97

VOLUME CHANGE

Initial Burette Reading (ml)	14.2
Final Burette Reading (ml)	0.0
Final Change (ml)	14.2

Initial Dial Reading (D.R.), mils	178
D.R. After Saturation, mils	327
D.R. After Consolidation, mils	368

MAXIMUM OBLIQUITY POINTS

$\overline{P}$	=	4.00
Q	=	2.49

LOAD (LBS)	DEFORMATION (INCHES)	PORE PRESSURE (PSI)
9.8	0.000	50.4
13.9	0.001	50.9
21.2	0.002	51.4
27.5	0.006	52.6
32.0	0.012	53.5
34.9	0.029	54.6
35.8	0.036	54.8
35.9	0.047	55.1
36.2	0.070	55.5
36.8	0.094	55.7
37.9	0.131	56.0
39.2	0.160	56.1
39.6	0.189	56.1
39.6	0.207	56.1
41.7	0.249	56.1
43.1	0.297	56.2
43.7	0.342	56.1
44.7	0.386	56.1
46.6	0.445	56.1
47.3	0.491	56.1
49.2	0.551	56.0
49.7	0.595	56.0
51.5	0.640	55.9
53.6	0.701	55.9
54.6	0.775	55.9
56.3	0.834	55.8
58.0	0.924	55.7
59.8	0.999	55.6
62.0	1.073	55.5
63.6	1.148	55.5

Tested By MPS Date 2/1/2011 Input Checked By JRS Date 2-[illegible]

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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

geotechnics
INTEGRITY IN TESTING

Client	MACTEC	Boring No.	AB-1
Client Reference	LEE PLANT 6468-10-0181	Depth(ft.)	19.7-20.2
Project No.	2011-716-01	Sample No.	S1-1
Lab ID	2011-716-01-01		

Visual Description: GRAY BROWN FAT CLAY WITH SAND

Effective Confining Pressure (psi)	7.2	*Stage No.*	1
		Test No	1

INITIAL DIMENSIONS

Initial Sample Length (in.)	6.06
Initial Sample Diameter (in.)	2.80
Initial Sample Area (in^2)	6.14
Initial Sample Volume (in^3)	37.22

VOLUME CHANGE

Volume After Consolidation (in^3)	33.61
Length After Consolidation (in)	5.87
Area After Consolidation (in^2)	5.726

Strain (%)	Deviation Stress	ΔU	$\overline{\sigma}_1$	$\overline{\sigma}_3$	Effective Principle Stress Ratio	$\overline{A}$	$\overline{P}$	Q
0.01	0.71	0.53	7.37	6.7	1.106	0.78	7.02	0.35
0.03	1.98	1.05	8.13	6.2	1.322	0.55	7.14	0.99
0.11	3.09	2.25	8.04	5.0	1.624	0.75	6.50	1.54
0.21	3.86	3.07	7.98	4.1	1.934	0.82	6.06	1.93
0.49	4.36	4.20	7.36	3.0	2.453	0.99	5.18	2.18
0.62	4.51	4.44	7.27	2.8	2.635	1.02	5.01	2.25
0.80	4.51	4.74	6.97	2.5	2.833	1.08	4.72	2.26
1.19	4.55	5.14	6.62	2.1	3.208	1.16	4.34	2.28
1.61	4.62	5.33	6.49	1.9	3.472	1.19	4.18	2.31
2.23	4.80	5.60	6.40	1.6	3.993	1.20	4.00	2.40
2.73	4.99	5.69	6.50	1.5	4.305	1.18	4.00	2.49
3.22	5.03	5.67	6.56	1.5	4.291	1.16	4.04	2.51
3.53	5.01	5.69	6.52	1.5	4.320	1.17	4.02	2.51
4.24	5.32	5.73	6.79	1.5	4.629	1.11	4.13	2.66
5.07	5.52	5.81	6.91	1.4	4.968	1.08	4.15	2.76
5.83	5.57	5.75	7.02	1.5	4.842	1.06	4.24	2.79
6.58	5.69	5.71	7.17	1.5	4.829	1.04	4.33	2.84
7.58	5.93	5.71	7.42	1.5	4.981	0.99	4.46	2.97
8.37	5.99	5.66	7.53	1.5	4.883	0.97	4.54	2.99
9.39	6.22	5.64	7.79	1.6	4.986	0.93	4.67	3.11
10.14	6.26	5.55	7.91	1.6	4.798	0.91	4.78	3.13
10.90	6.48	5.53	8.14	1.7	4.889	0.88	4.91	3.24
11.94	6.72	5.52	8.40	1.7	4.998	0.85	5.04	3.36
13.20	6.79	5.48	8.50	1.7	4.951	0.83	5.11	3.39
14.21	6.97	5.36	8.80	1.8	4.792	0.79	5.32	3.48
15.74	7.09	5.31	8.98	1.9	4.752	0.77	5.43	3.54
17.01	7.24	5.25	9.19	2.0	4.709	0.75	5.57	3.62
18.28	7.44	5.09	9.54	2.1	4.533	0.71	5.82	3.72
19.56	7.55	5.09	9.66	2.1	4.569	0.69	5.89	3.77

Tested By MPS Date 2/1/2011 Input Checked By [illegible] Date [illegible]

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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

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Client:	MACTEC	Boring No.	AB-1
Client Reference	LEE PLANT 6468-10-0181	Depth(ft.)	20.2-20.7
Project No.	2011-716-01	Sample No.	ST-1
Lab ID	2011-716-01-01		

Visual Description: GRAY BROWN FAT CLAY WITH SAND

Stage No.	1
Test No	2

PRESSURES (psi)

Cell Pressure(psi)	57.1
Back Pressure(psi)	40.4
Eff. Cons. Pressure(ps	16.7
Pore Pressure Response (%)	98

MAXIMUM OBLIQUITY POINTS

$\overline{P}$	=	22.89
Q	=	14.89

INITIAL SAMPLE DIMENSIONS (in)

Length 1	6.084	Diameter 1	2.838
Length 2	6.092	Diameter 2	2.844
Length 3	6.097	Diameter 3	2.851
Avg Leng.=	6.091	Avg. Diam.=	2.844

VOLUME CHANGE

Initial Burette Reading (ml)	21.1
Final Burette Reading (ml)	0.0
Final Change (ml)	21.1

Initial Dial Reading (D.R.), mils	243
D.R. After Saturation, mils	321
D.R. After Consolidation, mils	359

LOAD (LBS)	DEFORMATION (INCHES)	PORE PRESSURE (PSI)
7.5	0.000	40.4
20.7	0.003	41.2
30.3	0.004	42.0
48.6	0.009	44.1
64.9	0.015	45.9
89.9	0.031	48.5
96.8	0.038	49.0
106.6	0.048	49.6
123.3	0.070	50.1
139.5	0.094	50.2
161.0	0.130	50.0
176.9	0.160	49.6
192.5	0.190	49.1
200.1	0.207	48.8
218.2	0.248	48.0
236.4	0.297	47.2
251.5	0.342	46.5
264.2	0.386	45.7
279.4	0.447	44.8
290.4	0.492	44.1
300.2	0.552	43.4
308.4	0.597	42.9
314.9	0.641	42.5
326.1	0.701	41.9
334.7	0.777	41.3
342.1	0.836	40.9
351.6	0.928	40.4
357.4	1.002	40.1
364.1	1.076	39.8
369.5	1.153	39.5

Tested By MPS Date 2/1/2011 Input Checked By JFG Date 2.8.11

DOC: CT-S28 DATE 6-25-98 REV 9/8/04

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CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

geotechnics INTEGRITY IN TESTING

Client	MACTEC	Boring No.	AB-1
Client Reference	LEE PLANT 6468-10-0181	Depth(ft.)	20.2-20.7
Project No.	2011-716-01	Sample No.	ST-1
Lab ID	2011-716-01-01		

Visual Description: GRAY BROWN FAT CLAY WITH SAND

Effective Confining Pressure (psi)	16.7	*Stage No.*	1
		Test No	2

INITIAL DIMENSIONS

Initial Sample Length (in.)	6.09
Initial Sample Diameter (in.)	2.84
Initial Sample Area (in^2)	6.35
Initial Sample Volume (in^3)	38.70

VOLUME CHANGE

Volume After Consolidation (in^3)	35.93
Length After Consolidation (in)	5.98
Area After Consolidation (in^2)	6.013

Strain (%)	Deviation Stress	Δ U	$\bar{\sigma}_1$	$\bar{\sigma}_3$	Effective Principle Stress Ratio	$\bar{A}$	$\bar{P}$	Q
0.05	2.19	0.84	18.06	15.9	1.139	0.39	16.96	1.10
0.07	3.78	1.60	18.88	15.1	1.251	0.43	16.99	1.89
0.14	6.82	3.69	19.83	13.0	1.524	0.55	16.42	3.41
0.25	9.52	5.46	20.74	11.2	1.849	0.59	15.98	4.76
0.52	13.63	8.09	22.25	8.6	2.583	0.61	15.43	6.82
0.64	14.76	8.61	22.84	8.1	2.825	0.60	15.46	7.38
0.81	16.34	9.22	23.83	7.5	3.184	0.58	15.66	8.17
1.17	19.04	9.66	26.08	7.0	3.705	0.52	16.56	9.52
1.57	21.61	9.60	28.51	6.9	4.130	0.46	17.71	10.80
2.18	24.96	9.56	32.10	7.1	4.496	0.39	19.62	12.48
2.68	27.42	9.16	34.95	7.5	4.637	0.34	21.25	13.71
3.18	29.78	8.71	37.78	8.0	4.725	0.30	22.89	14.89
3.47	30.91	8.36	39.26	8.3	4.705	0.28	23.80	15.46
4.16	33.57	7.64	42.64	9.1	4.704	0.23	25.85	16.79
4.97	36.18	6.80	46.08	9.9	4.654	0.19	27.99	18.09
5.73	38.25	6.07	48.88	10.6	4.599	0.16	29.75	19.12
6.46	39.93	5.33	51.30	11.4	4.513	0.14	31.33	19.97
7.48	41.84	4.40	54.13	12.3	4.402	0.11	33.21	20.92
8.24	43.18	3.72	56.15	13.0	4.327	0.09	34.56	21.59
9.23	44.18	2.97	57.91	13.7	4.218	0.07	35.82	22.09
9.99	45.04	2.51	59.23	14.2	4.174	0.06	36.71	22.52
10.73	45.64	2.07	60.27	14.6	4.120	0.05	37.45	22.82
11.74	46.76	1.46	62.01	15.2	4.068	0.03	38.62	23.38
13.01	47.33	0.87	63.16	15.8	3.991	0.02	39.49	23.67
14.00	47.85	0.51	64.04	16.2	3.956	0.01	40.12	23.93
15.53	48.33	0.02	65.02	16.7	3.897	0.00	40.85	24.17
16.77	48.44	-0.31	65.44	17.0	3.848	-0.01	41.23	24.22
18.04	48.60	-0.56	65.86	17.3	3.816	-0.01	41.56	24.30
19.29	48.59	-0.86	66.15	17.6	3.767	-0.02	41.86	24.30

Tested By MPS Date 2/1/2011 Input Checked By JAB Date 2.5.11

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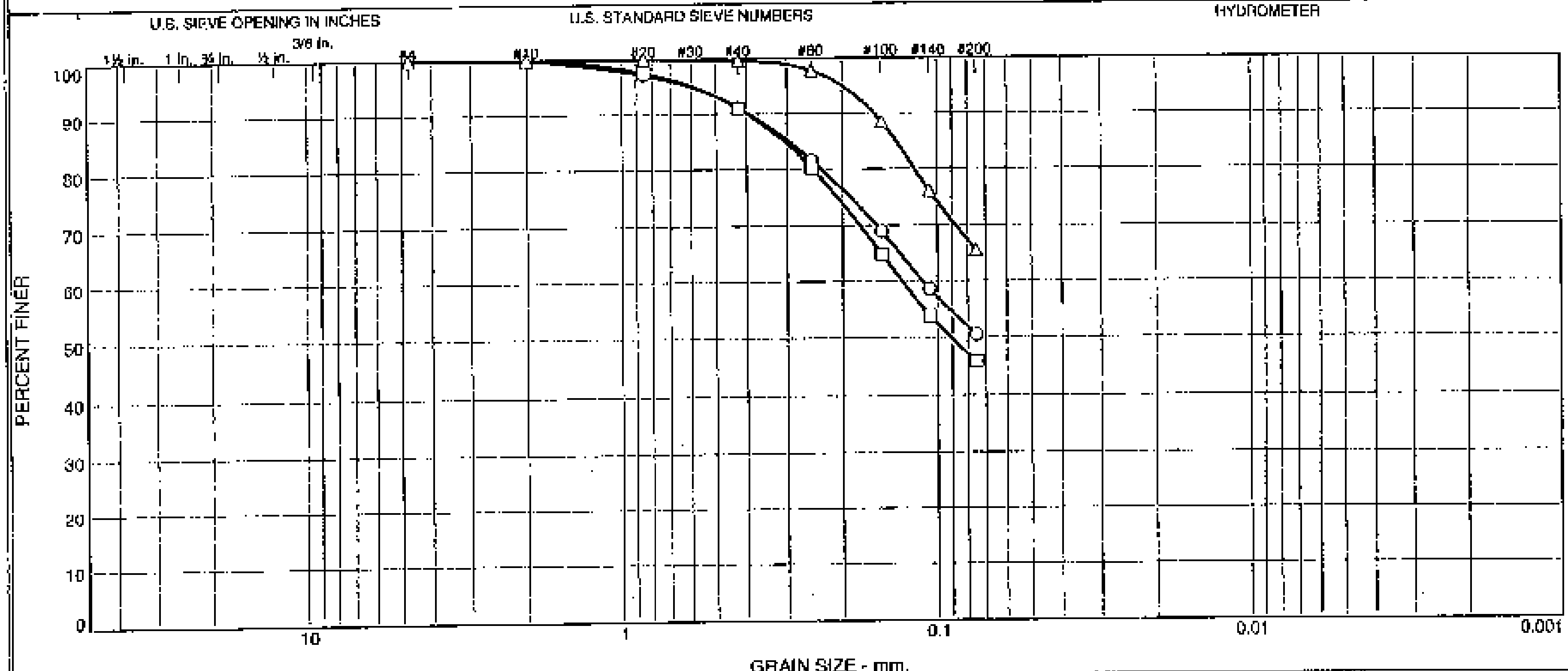
APPENDIX C-2

Results from 2007

Particle Size Distribution Report ASTM D 6913-04e1



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	8.8	40.8	50.4	
□	0.0	0.0	0.1	8.9	45.2	45.8	
△	0.0	0.0	0.1	0.3	34.0	65.6	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-1	SS-2	1.5-3	12/17/07	CL-ML	Brown Sandy Clayey- Silty SAND	12.6	20	13
□	Boring B-1	SS-4	6-7.5	12/17/07	SC-SM	Olive Brown Clayey Silty SAND	16.9	21	14
△	Boring B-1	SS-7	28.5'-30.0'	12/17/07	CL	Olive Gray Lean CLAY with Sand	27.4	26	17

Client Progress Energy

Project Lee Plant

Project No. 6468071884

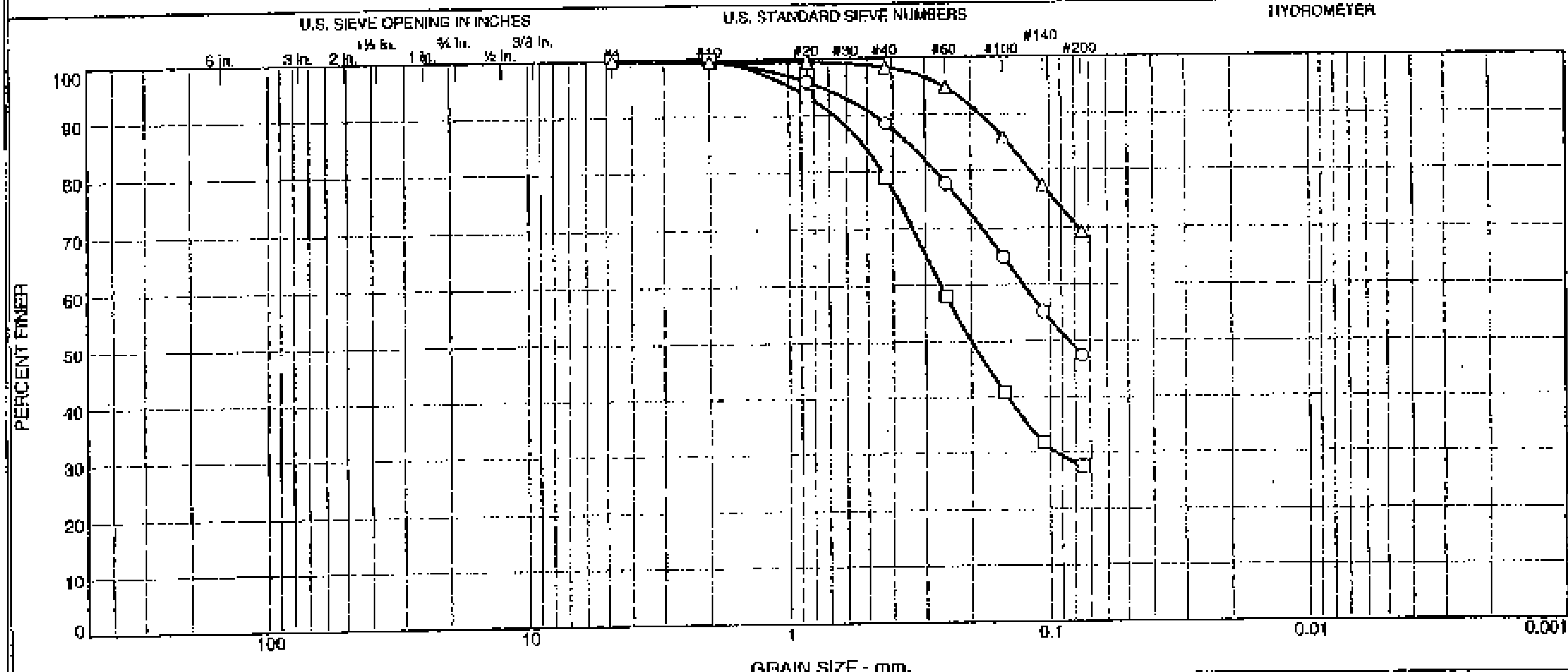
Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS **Checked By:** LBJ

Particle Size Distribution Report



	% +3"	% Gravel Coarse	% Gravel Fine	% Sand Coarse	% Sand Medium	% Sand Fine	% Fines Silt	% Fines Clay
○	0.0	0.0	0.0	0.3	11.3	41.0	47.4	
□	0.0	0.0	0.0	0.0	21.1	51.4	27.5	
△	0.0	0.0	0.0	0.4	1.2	29.1	69.3	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-2	SS-3	3.5-5	12/17/07	SC	Olive Clayey SAND	14.5	20	12
□	Boring B-2	SS-4	8.5-10	12/17/07	SC	Yellowish Brown Clayey SAND	12.5	22	11
△	Boring B-2	SS-7	23.5-25	12/17/07	CL	Yellowish Gray Lean CLAY	23.8	30	16

Client Progress Energy

Project Lee Plant

Project No. 6468071884 Figure

MACTEC, Inc.

Raleigh, North Carolina

Tested By: CS **Checked By:** LBJ

geotechnics INTEGRITY IN TESTING

CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS

ASTM D - 4767 (SOP-S28)

Client	MACTEC		
Client Reference	PGN-LEE PLANT 6468-07-1884		
Project No.	2007-738-01		
Lab ID	2007-738-01-03	Specific Gravity (assumed)	2.70

Visual Description: BROWN CLAYEY SAND (UNDISTURBED)

SAMPLE CONDITION SUMMARY

Boring No.	B-2	B-2	B-2
Depth (ft)	7.4-7.9	6.2-6.7	6.8-7.3
Sample No.	ST	ST	ST
Test No.	T1	T2	T3
Deformation Rate (in/min)	0.002	0.00008	0.00008
Back Pressure (psi)	60	50	49.9
Consolidation Time (days)	1	4	4
Initial State (w%)	10.2	12.7	12.7
Total Unit Weight (pcf)	121.8	128.5	140.2
Dry Unit Weight (pcf)	110.5	114.0	124.4
Final State (w%)	17.1	16.5	15.0
Initial State Void Ratio,e	0.526	0.478	0.355

Tested By TMS Date 12/18/07 Input Checked By [signature] Date 1-17-08

DCN: CT-S28 DATE 6-25-98 REVISION Lab1\c\2007 PROJECTS\2007-738 MACTEC\[2007-738-01-03 Triax Summary.XLS]Sheet1

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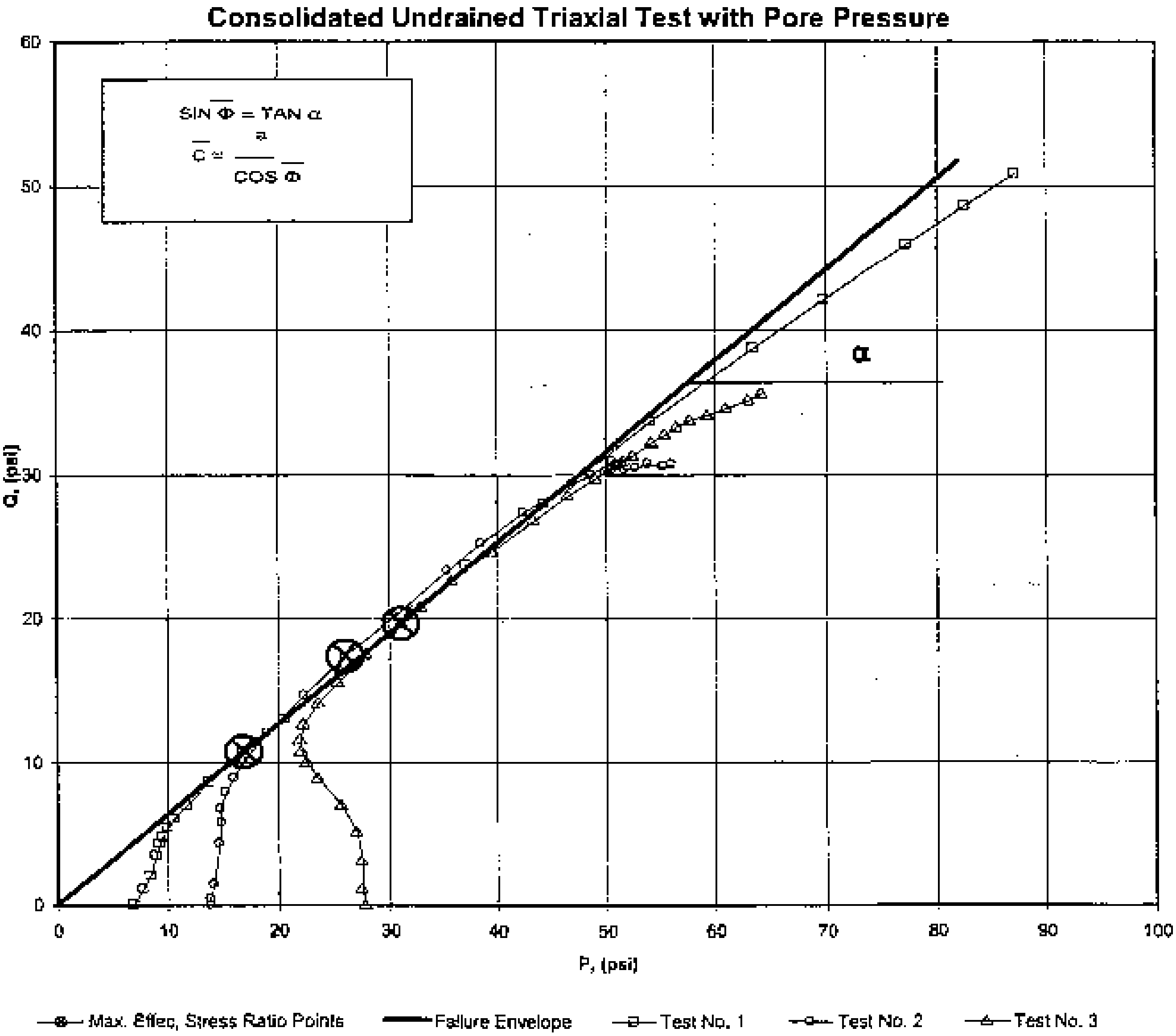
CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	MACTEC	Boring No.	B-2
Client Reference	PGN-LEE PLANT 6468-07-1884	Depth(ft.)	6.2-7.9
Project No.	2007-738-01	Sample No.	ST
Lab ID	2007-738-01-03		



a	=	0.06	$\overline{C}$	=	0.08
α	=	32.2	$\overline{\Phi}$	=	39.09

— 12 psf

Tested By TMS Date 12/18/2008 Approved By [signature] Date 1-13-09

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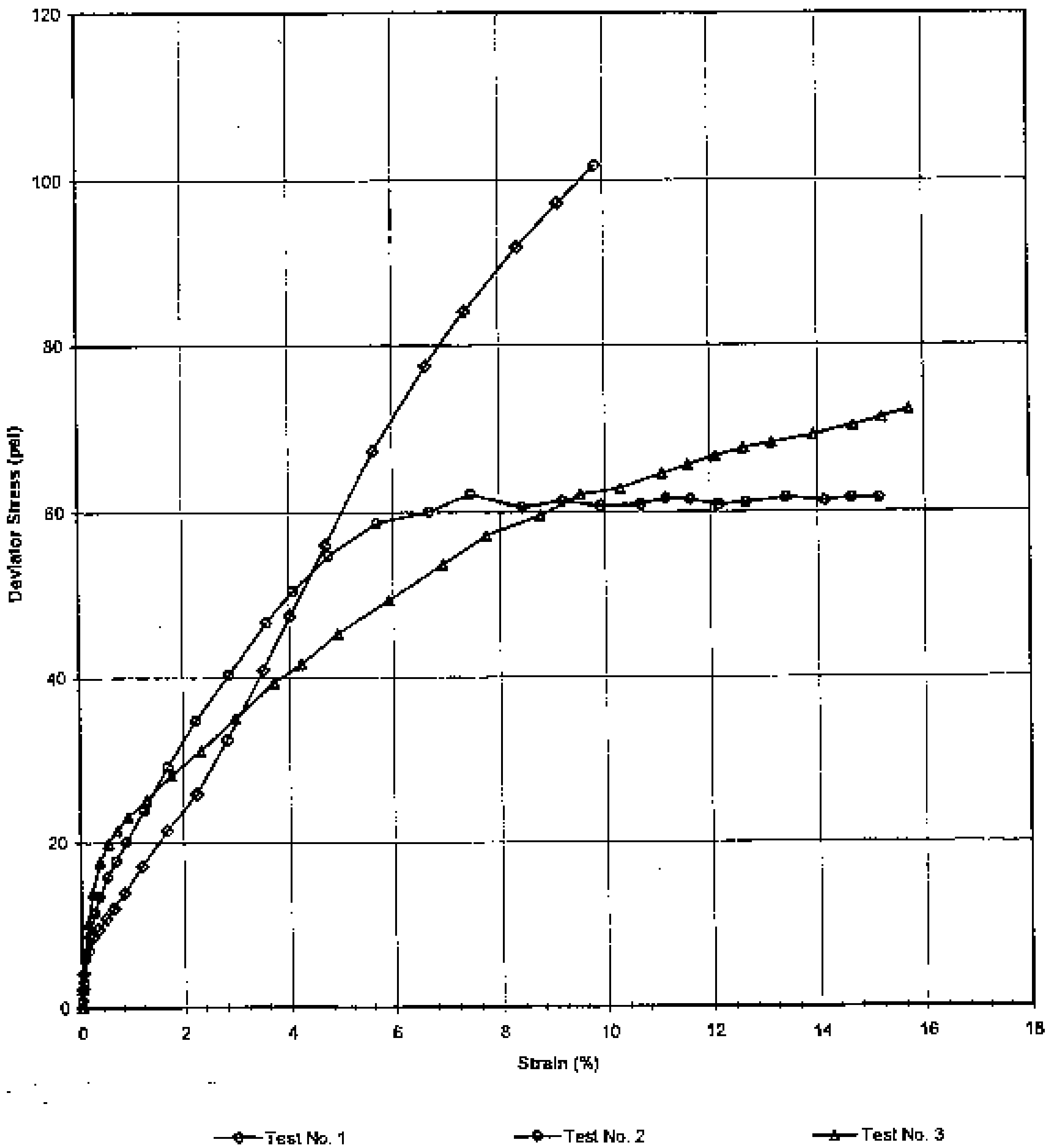
CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	MACTEC	Boring No.	B-2
Client Reference	PGN-LEE PLANT 6468-07-1884	Depth(ft.)	6.2-7.9
Project No.	2007-738-01	Sample No.	ST
Lab ID	2007-738-01-03		
Visual Description:	BROWN CLAYEY SAND (UNDISTURBED)		



Tested By TMS Date 12/18/2007 Approved By M3 Date 1-14-08

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CONSOLIDATED UNDRAINED TRIAXIAL TEST WITH PORE PRESSURE READINGS

ASTM D - 4767 (SOP-S28)

Client	MACTEC		
Client Reference	PGN-LEE PLANT 6468-07-1884		
Project No.	2007-738-01		
Lab ID	2007-738-01-02	Specific Gravity (assumed)	2.70
Visual Description:	BROWN SANDY CLAY (UNDISTURBED)		

SAMPLE CONDITION SUMMARY

Boring No.	B-1	B-1	B-1
Depth (ft)	24.4-24.9	23.9-24.4	23.3-23.8
Sample No.	ST	ST	ST
Test No.	T1	T2	T3
Deformation Rate (in/min)	0.00005	0.00005	0.002
Back Pressure (psi)	50.1	50	50.1
Consolidation Time (days)	3	3	1
Initial State (w%)	41.4	41.4	18.5
Total Unit Weight (pcf)	126.5	131.9	127.8
Dry Unit Weight (pcf)	89.4	93.3	107.9
Final State (w%)	20.5	23.7	19.4
Initial State Void Ratio,e	0.885	0.807	0.562

Tested By TMS Date 12/17/07 Input Checked By MJS Date 1-4-07

DCN: CT-S28 DATE 6-25-98 REVISION1 \\b1\\2007 PROJECTS\2007-738 MACTEC\[2007-738-01-02 Triax Summary.XLS]Sheet1

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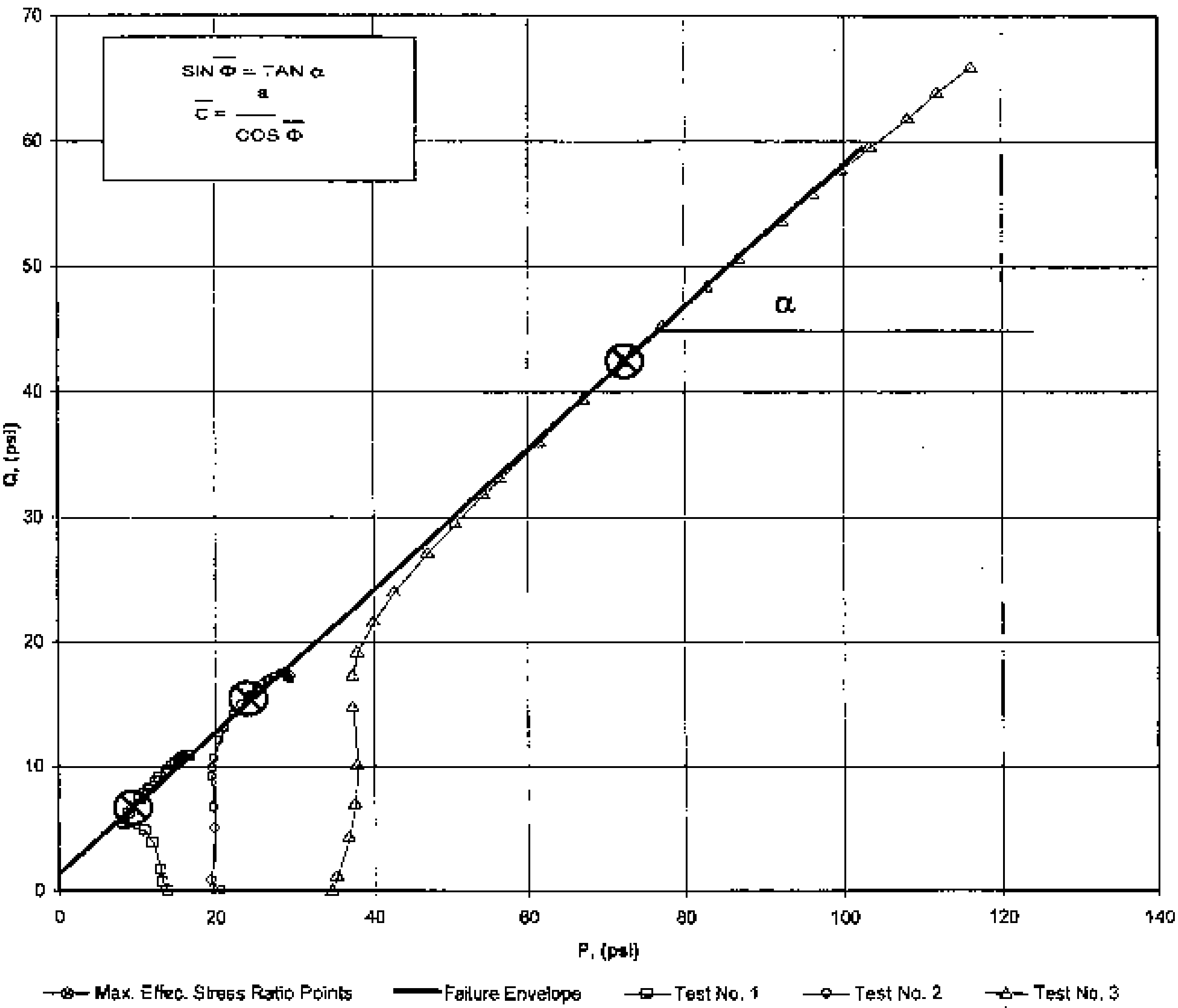
CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

geotechnics
INTEGRITY IN TESTING

Client	MACTEC	Boring No.	B-1
Client Reference	PGN-LEE PLANT 6468-07-1884	Depth(ft.)	23.3-24.9
Project No.	2007-738-01	Sample No.	ST
Lab ID	2007-738-01-02		

Consolidated Undrained Triaxial Test with Pore Pressure



a =	1.36	$\overline{C}$ =	1.65
α =	29.6	$\overline{\Phi}$ =	34.60

237 psf

Tested By TMS Date 12/17/07 Approved By [illegible] Date 1-4-08

DCN: CT-S28 DATE 6-25-98 REVISION 1
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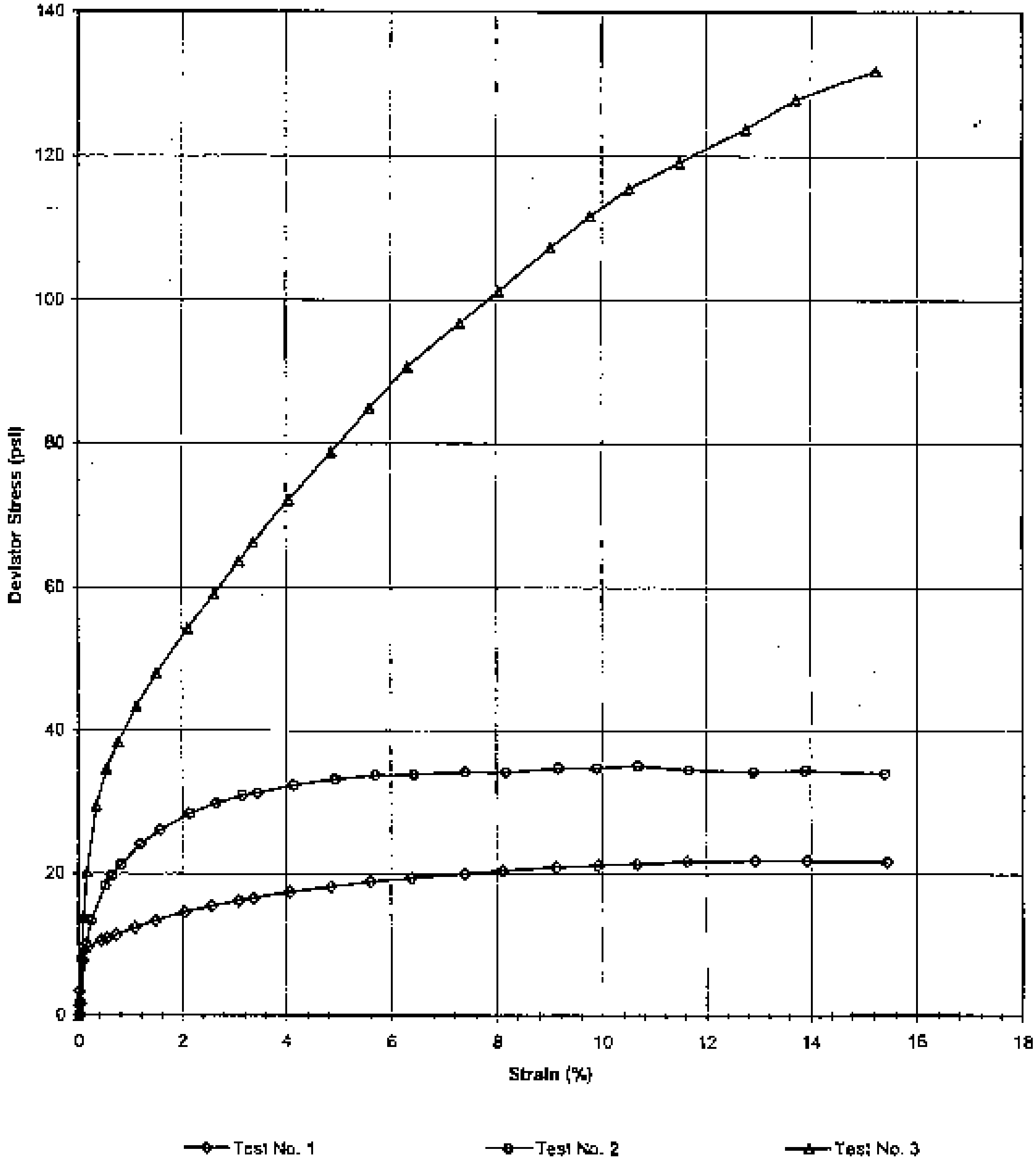
CONSOLIDATED UNDRAINED TRIAXIAL TEST
WITH PORE PRESSURE READINGS
ASTM D4767-95 / AASHTO T297-94 (SOP-S28)

Client	MACTEC	Boring No.	B-1
Client Reference	PGN-LEE PLANT 6468-07-1884	Depth(ft.)	23.3-24.9
Project No.	2007-738-01	Sample No.	ST
Lab ID	2007-738-01-02		
Visual Description:	BROWN SANDY CLAY (UNDISTURBED)		

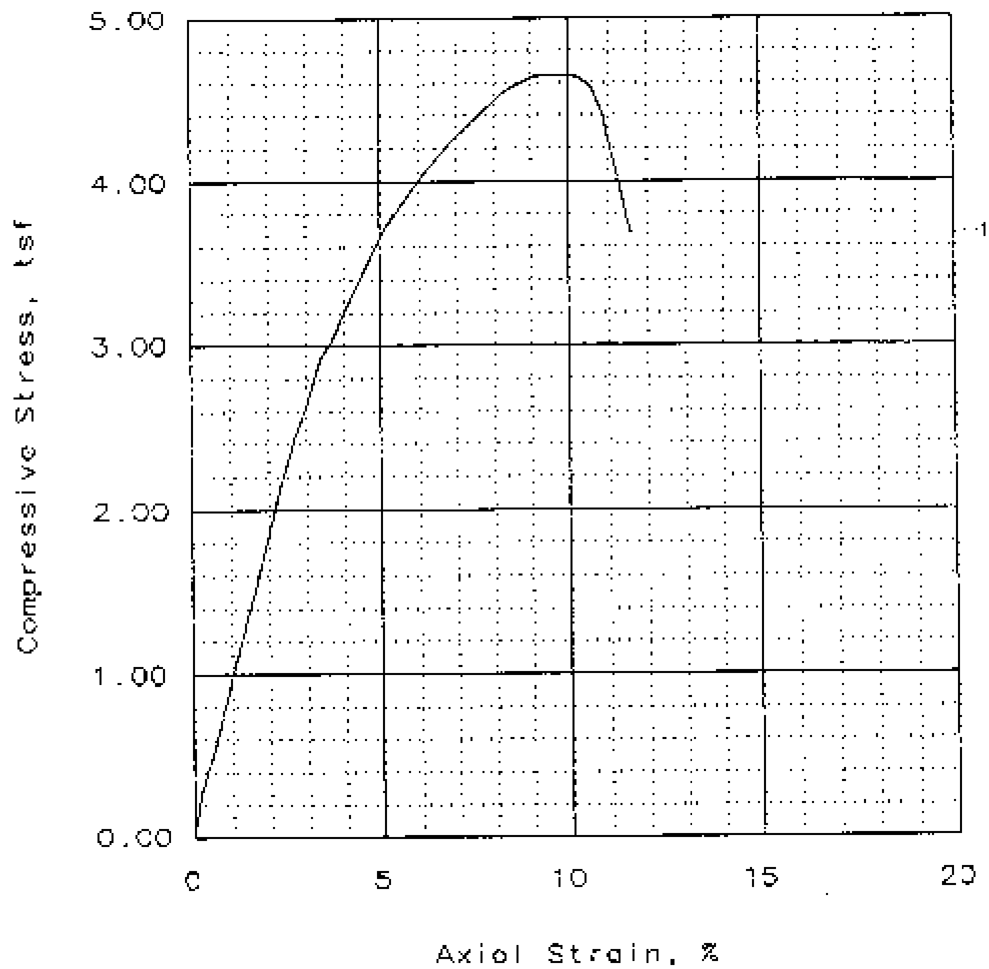


Tested By TMS Date 12/17/07 Approved By [signature] Date 1-4-08

APPENDIX C-3

Results from 1999

UNCONFINED COMPRESSION TEST



Sample number:	1			
Unconfined strength, tsf	4.65			
Undrained shear strength, tsf	2.32			
Rate of strain, %/min	0.803			
Water content, %	18.2			
Void ratio	0.4838			
Saturation, %	99.9			
Dry density, pcf	111.9			
Specimen diameter, in	2.84			
Specimen height, in	5.61			

Description: (VISUAL)RED YELLOW AND OLIVE CLAY

LL = 58	PL = 28	PI = 30.0	GS = 2.66	Type: UNDISTURBED

Project No.: 3072093525
Date: JUNE 10, 1999
Remarks:
SPECIFIC GRAVITY IS ASSUMED.

Fig No. LD1-1

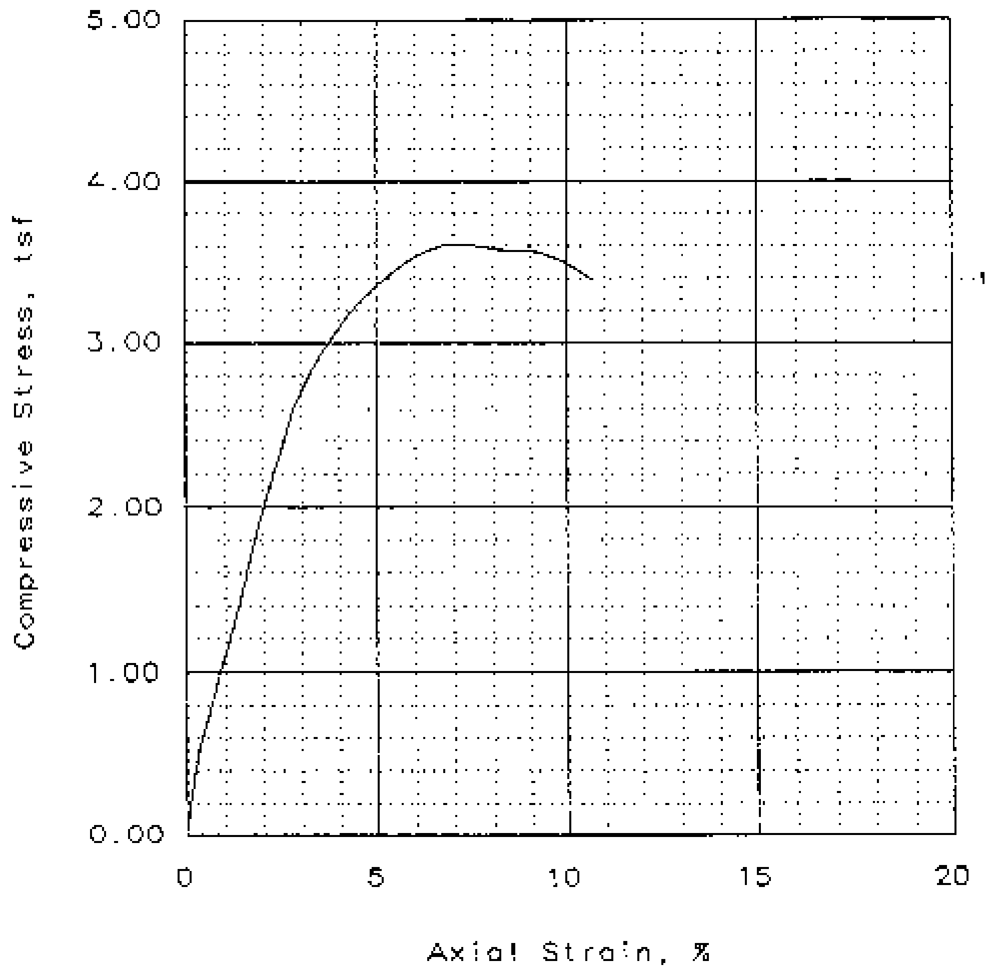
Client:

Project: ASH POND DIKE STABILITY
H.F. LEE PLANT
Location: LD-1, ST-1, 5'-7'

UNCONFINED COMPRESSION TEST
LAW ENGINEERING

REVIEWED BY:

UNCONFINED COMPRESSION TEST



Sample number:	1			
Unconfined strength, tsf	3.61			
Undrained shear strength, tsf	1.80			
Rate of strain, %/min	0.802			
Water content, %	17.9			
Void ratio	0.4751			
Saturation, %	100.0			
Dry density, pcf	112.6			
Specimen diameter, in	2.84			
Specimen height, in	5.61			

Description: (VISUAL)OLIVE CLAY WITH GRAY CLAY LENSES

LL = 65	PL = 30	PI = 35.0	GS = 2.66	Type: UNDISTURBED

Project No.: 3072093525
Date: JUNE 10, 1999
Remarks:
SPECIFIC GRAVITY IS ASSUMED.

Fig No. LD1-2

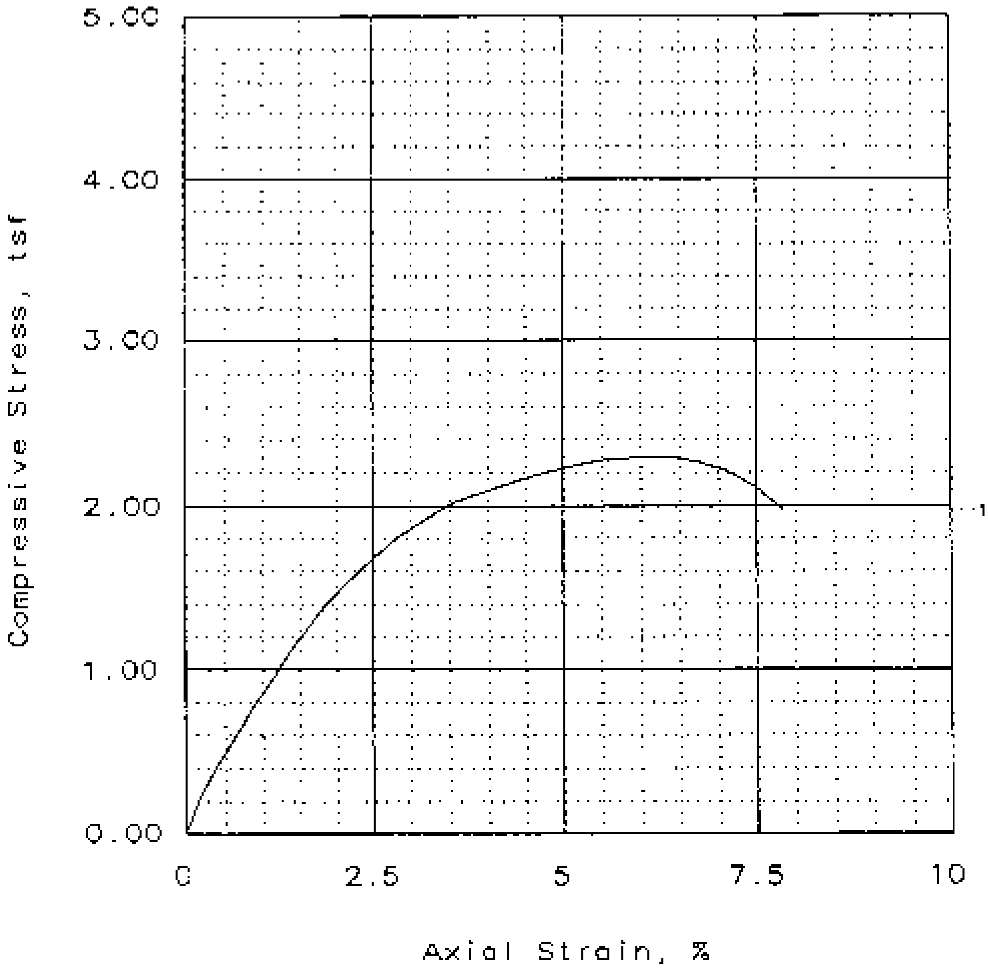
Client:

Project: ASH POND DIKE STABILITY
H.F. LEE PLANT
Location: LD-1, ST-2, 13'-15'

UNCONFINED COMPRESSION TEST
LAW ENGINEERING

REVIEWED BY: [signature]

UNCONFINED COMPRESSION TEST



Sample number:	1			
Unconfined strength, tsf	2.30			
Undrained shear strength, tsf	1.15			
Rate of strain, %/min	0.802			
Water content, %	22.0			
Void ratio	0.5849			
Saturation, %	99.7			
Dry density, pcf	104.4			
Specimen diameter, in	2.85			
Specimen height, in	5.61			

Description: (VISUAL) YELLOW BROWN AND GRAY MOTTLED CLAY

LL = ND	PL = ND	PI =	GS = 2.65	Type: UNDISTURBED

Project No.: 3072093525
Date: JUNE 10, 1999
Remarks:
ND=NOT DETERMINED.

SPECIFIC GRAVITY IS ASSUMED.

Fig No. LD2-1

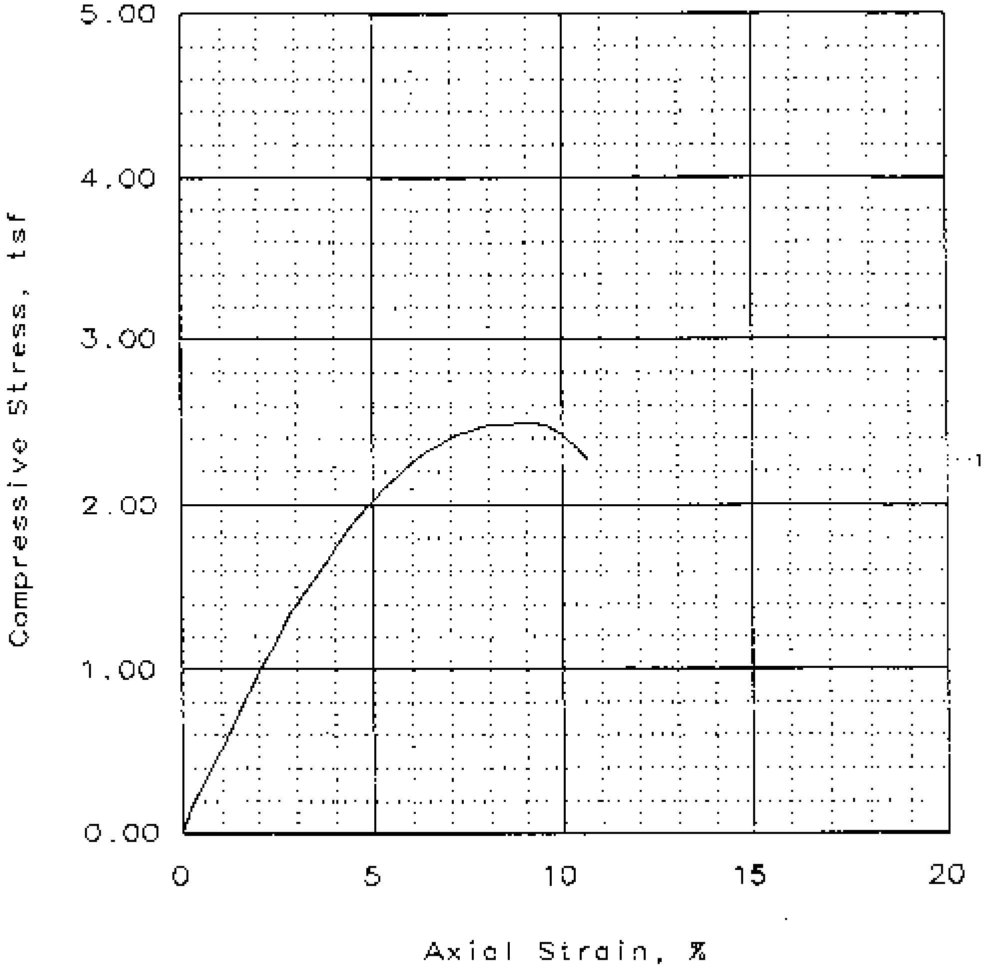
Client:

Project: ASH POND DIKE STABILITY
H.F. LEE PLANT
Location: LD-2, ST-1, 8'-10'

UNCONFINED COMPRESSION TEST
LAW ENGINEERING

REVIEWED BY: [signature]

UNCONFINED COMPRESSION TEST



Sample number:	1			
Unconfined strength, tsf	2.50			
Undrained shear strength, tsf	1.25			
Rate of strain, %/min	0.802			
Water content, %	21.9			
Void ratio	0.6220			
Saturation, %	93.2			
Dry density, pcf	102.0			
Specimen diameter, in	2.84			
Specimen height, in	5.61			

Description: (VISUAL) OLIVE AND GRAY CLAY WITH ORGANIC LAYERS

LL = ND	PL = ND	PI =	GS = 2.65	Type: REMOLDED

Project No.: 3072093525

Date: JUNE 10, 1999

Remarks:

ND=NOT DETERMINED.

SPECIFIC GRAVITY IS ASSUMED.

Fig No. LD2-2

Client:

Project: ASH POND DIKE STABILITY
H.F. LEE PLANT

Location: LD-2, ST-2, 18'-20'

UNCONFINED COMPRESSION TEST

LAW ENGINEERING

REVIEWED BY:

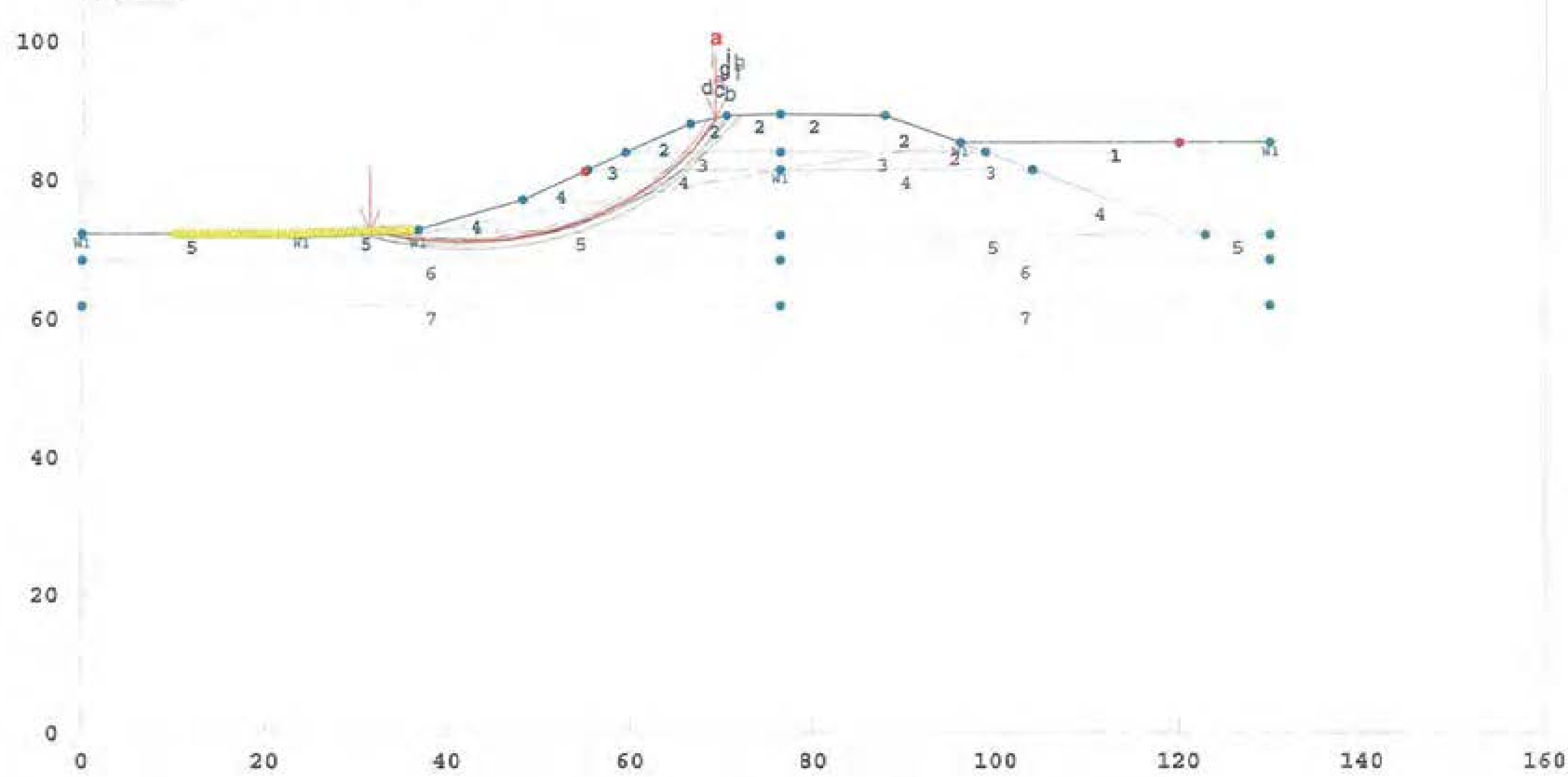
APPENDIX D

Stability Analysis Plots

Lee Ash Pond Stability Analysis AB-1 (Deep)

#	FS
a	1.49
b	1.49
c	1.49
d	1.49
e	1.49
f	1.49
g	1.50
h	1.50
i	1.50
j	1.50

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Dike SM	2	120.0	125.0	0.0	32.0	W1
Dike CH	3	120.0	125.0	10.0	36.0	W1
Dike SC	4	120.0	125.0	10.0	37.0	W1
CL	5	120.0	125.0	0.0	35.0	W1
SP	6	120.0	120.0	0.0	31.0	W1
SM	7	120.0	120.0	0.0	36.0	W1



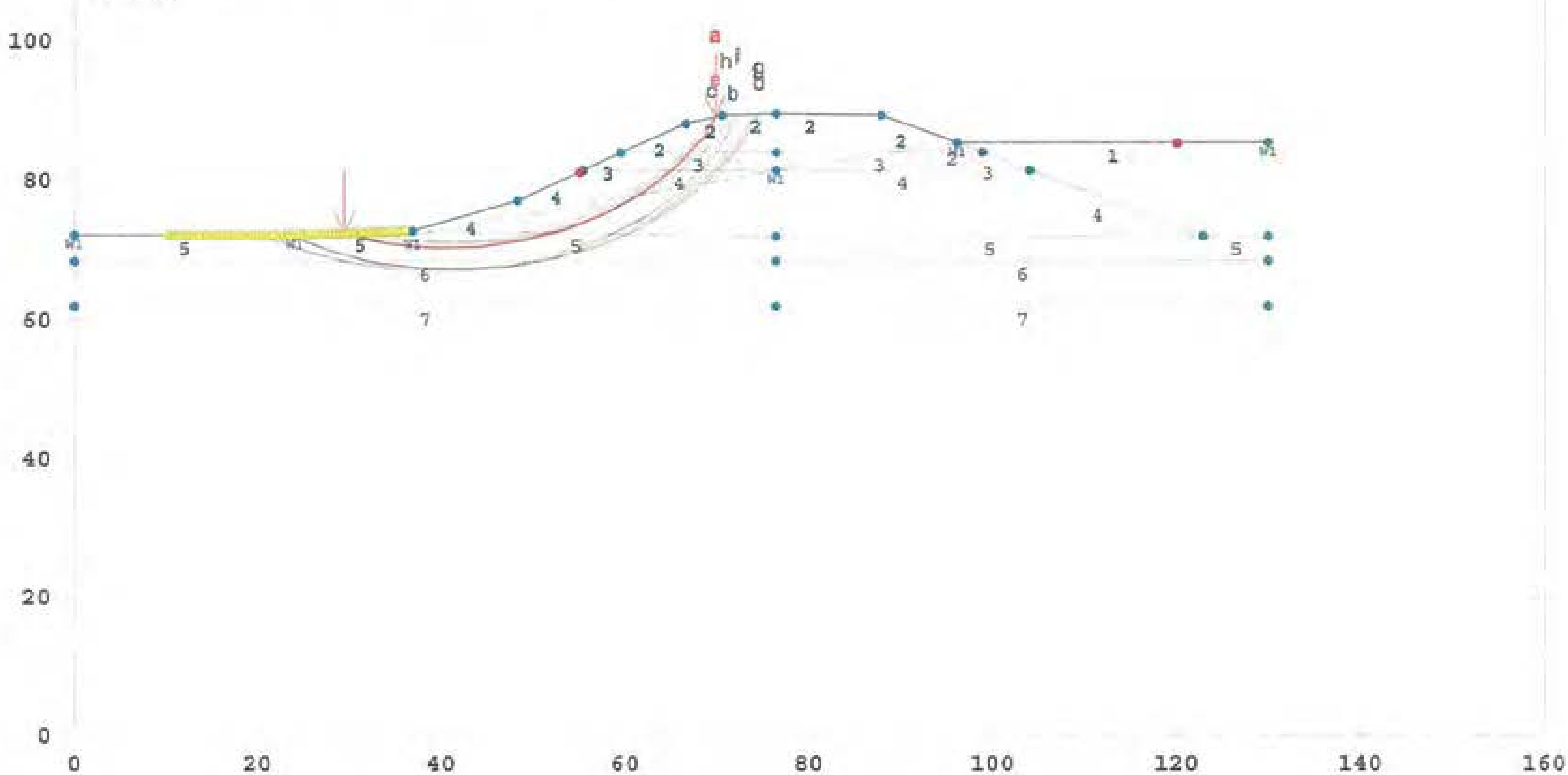
PCSTABL5M/si FSmin=1.49

Safety Factors Are Calculated By The Modified Bishop Method

Lee Ash Pond Stability Analysis AB-1 (Deep) (Seismic)

#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
a	1.23	Ash	1	100.0	105.0	0.0	30.0	W1
b	1.23	Dike SM	2	120.0	125.0	0.0	32.0	W1
c	1.23	Dike CH	3	120.0	125.0	10.0	36.0	W1
d	1.23	Dike SC	4	120.0	125.0	10.0	37.0	W1
e	1.23	CL	5	120.0	125.0	0.0	35.0	W1
f	1.23	SP	6	120.0	120.0	0.0	31.0	W1
g	1.23	SM	7	120.0	120.0	0.0	36.0	W1
h	1.24							
i	1.24							
j	1.24							

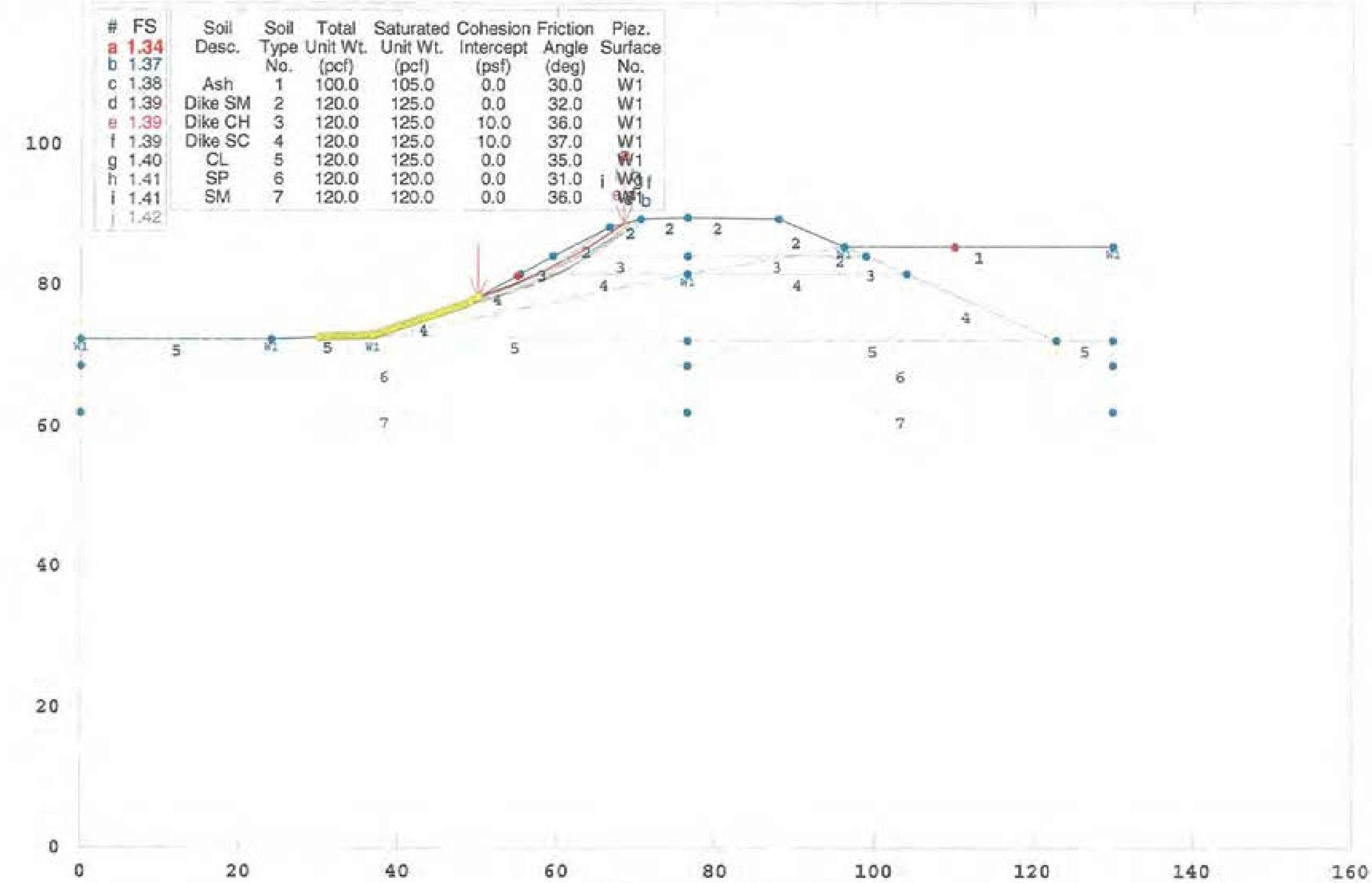
Load	Value
Horiz Eqk	0.080 g<



PCSTABL5M/si FSmin=1.23
Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Ash Pond Stability Analysis AB-1 (Shallow) Run 1



#	FS
a	1.34
b	1.37
c	1.38
d	1.39
e	1.39
f	1.39
g	1.40
h	1.41
i	1.41
j	1.42

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Dike SM	2	120.0	125.0	0.0	32.0	W1
Dike CH	3	120.0	125.0	10.0	36.0	W1
Dike SC	4	120.0	125.0	10.0	37.0	W1
CL	5	120.0	125.0	0.0	35.0	W1
SP	6	120.0	120.0	0.0	31.0	W1
SM	7	120.0	120.0	0.0	36.0	W1

PCSTABL5M/si FSmin=1.34

Safety Factors Are Calculated By The Modified Bishop Method

STED

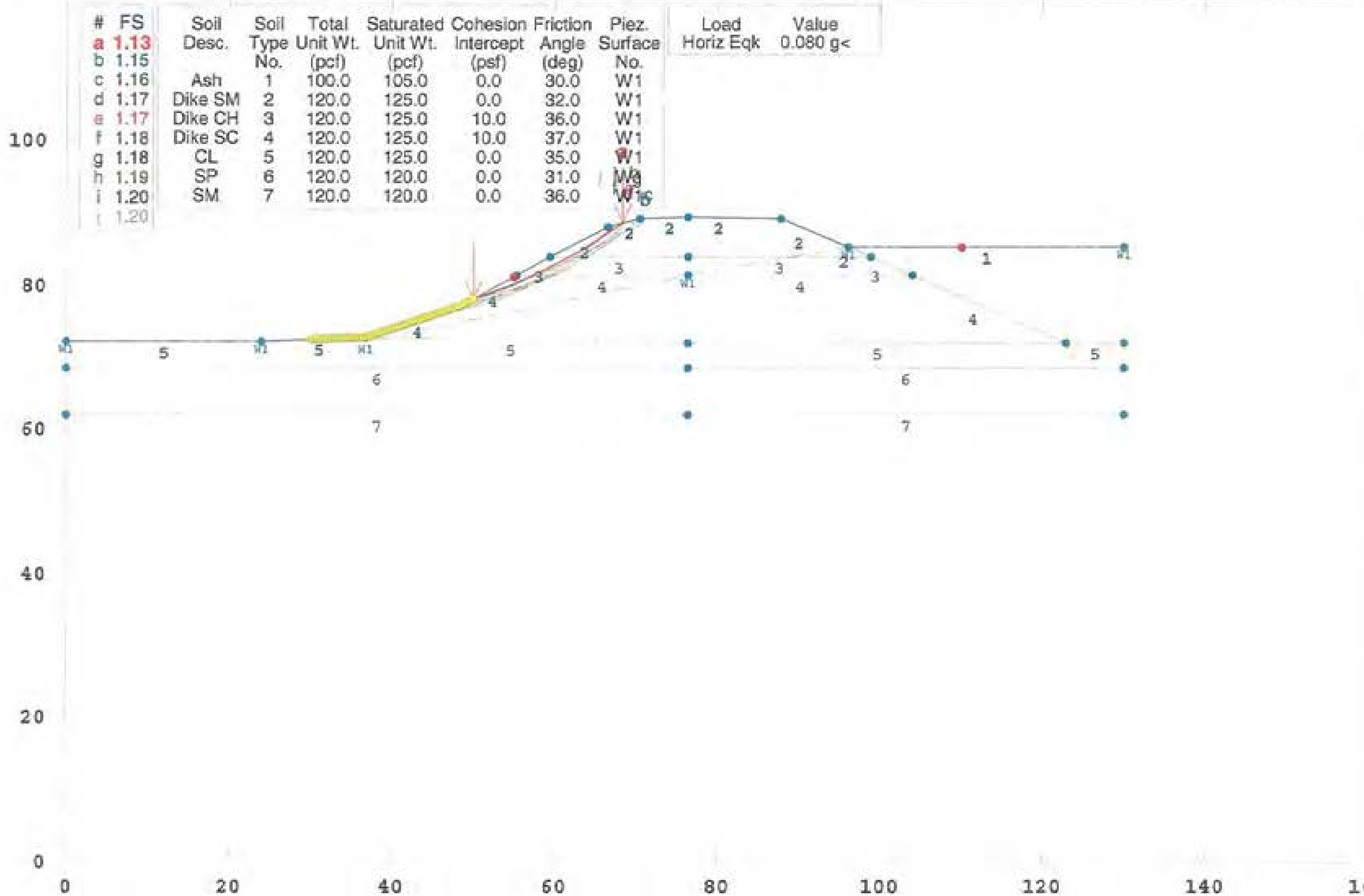
Lee Ash Pond Stability Analysis AB-1 (Shallow) (Seismic) Run 1

p:\6468\progress energy\progress energy projects 2010\lee\6468102181 lee plant inundation and map\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-lee.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/11/2011

#	FS
a	1.13
b	1.15
c	1.16
d	1.17
e	1.17
f	1.18
g	1.18
h	1.19
i	1.20
j	1.20

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Dike SM	2	120.0	125.0	0.0	32.0	W1
Dike CH	3	120.0	125.0	10.0	36.0	W1
Dike SC	4	120.0	125.0	10.0	37.0	W1
CL	5	120.0	125.0	0.0	35.0	W1
SP	6	120.0	120.0	0.0	31.0	W1
SM	7	120.0	120.0	0.0	36.0	W1

Load	Value
Horiz Eqk	0.080 g<

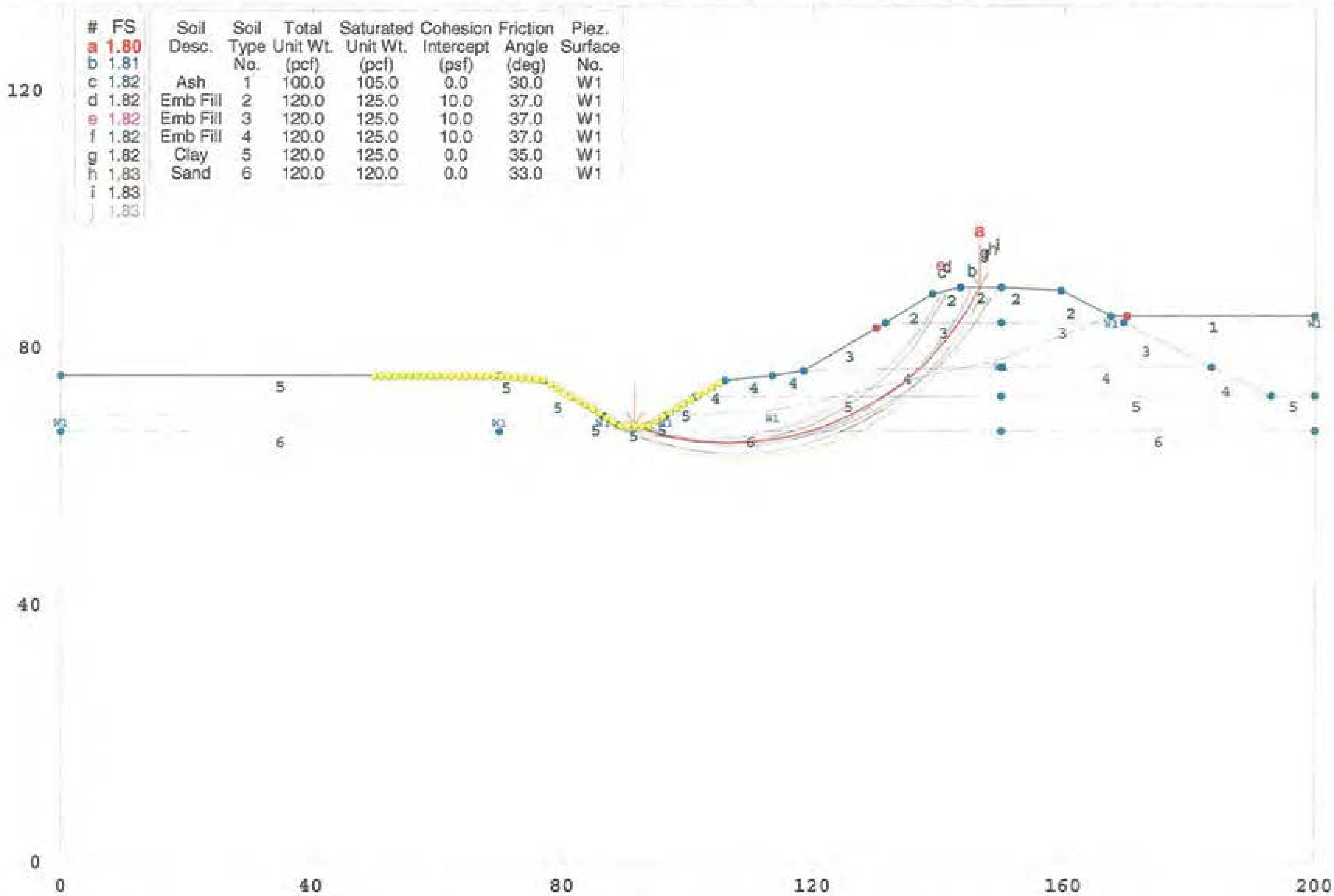


PCSTABL5M/si FSmin=1.13
Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Plant Ash Pond Stability Analysis AB-2 (Deep)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-2d.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/13/2011



#	FS
a	1.80
b	1.81
c	1.82
d	1.82
e	1.82
f	1.82
g	1.82
h	1.83
i	1.83
j	1.83

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Emb Fill	3	120.0	125.0	10.0	37.0	W1
Emb Fill	4	120.0	125.0	10.0	37.0	W1
Clay	5	120.0	125.0	0.0	35.0	W1
Sand	6	120.0	120.0	0.0	33.0	W1

PCSTABL5M/si FSmin=1.80
Safety Factors Are Calculated By The Modified Bishop Method

STED

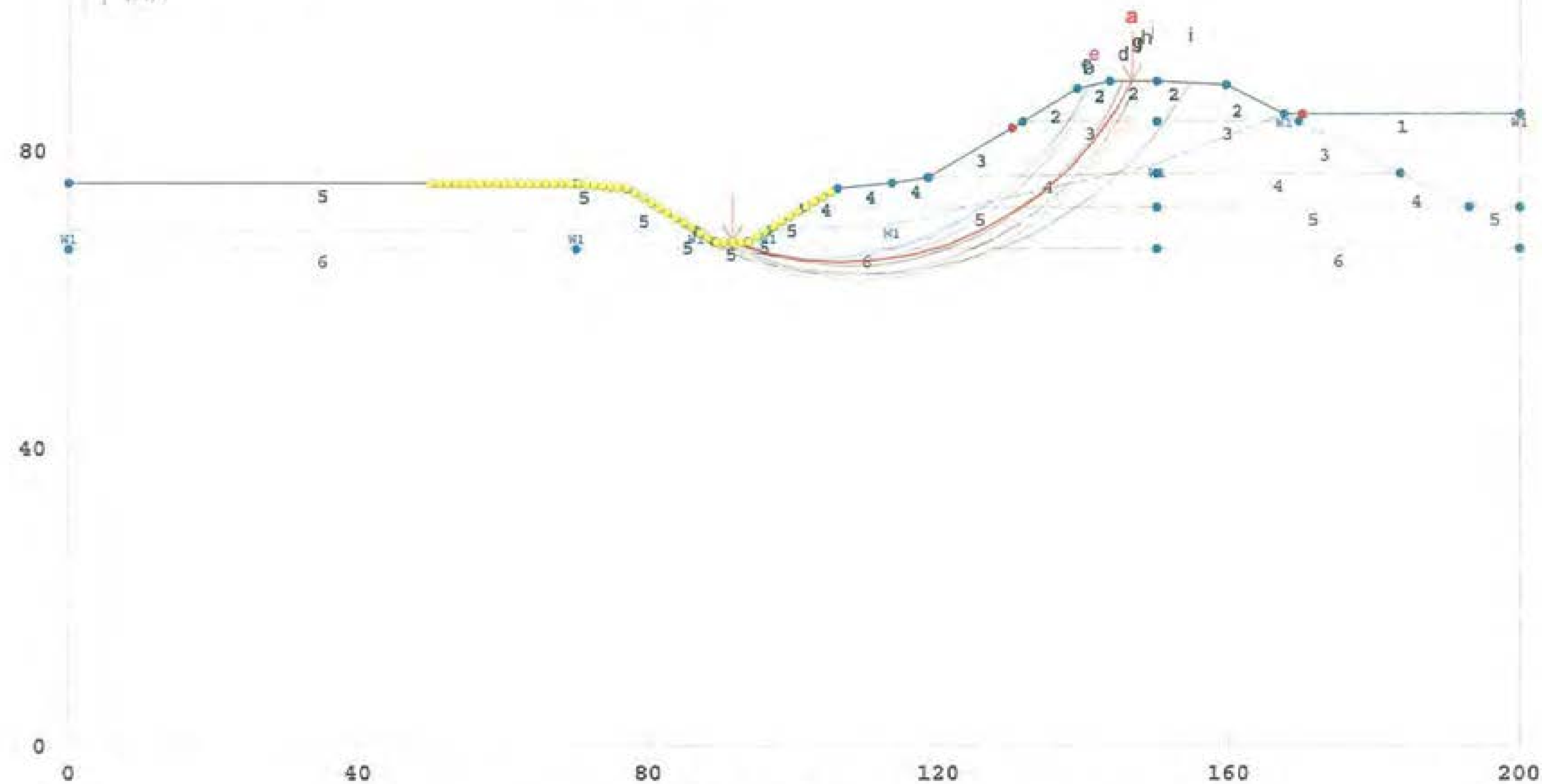
Lee Plant Ash Pond Stability Analysis AB-2 (Deep) (Seismic)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-2ds.pl2 Run By: J. Shane Johnson, MACTEC, Inc 3/13/2011

#	FS
a	1.45
b	1.46
c	1.46
d	1.46
e	1.46
f	1.46
g	1.46
h	1.47
i	1.47
j	1.47

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Emb Fill	3	120.0	125.0	10.0	37.0	W1
Emb Fill	4	120.0	125.0	10.0	37.0	W1
Clay	5	120.0	125.0	0.0	35.0	W1
Sand	6	120.0	120.0	0.0	33.0	W1

Load	Value
Horiz Eqk	0.080 g<

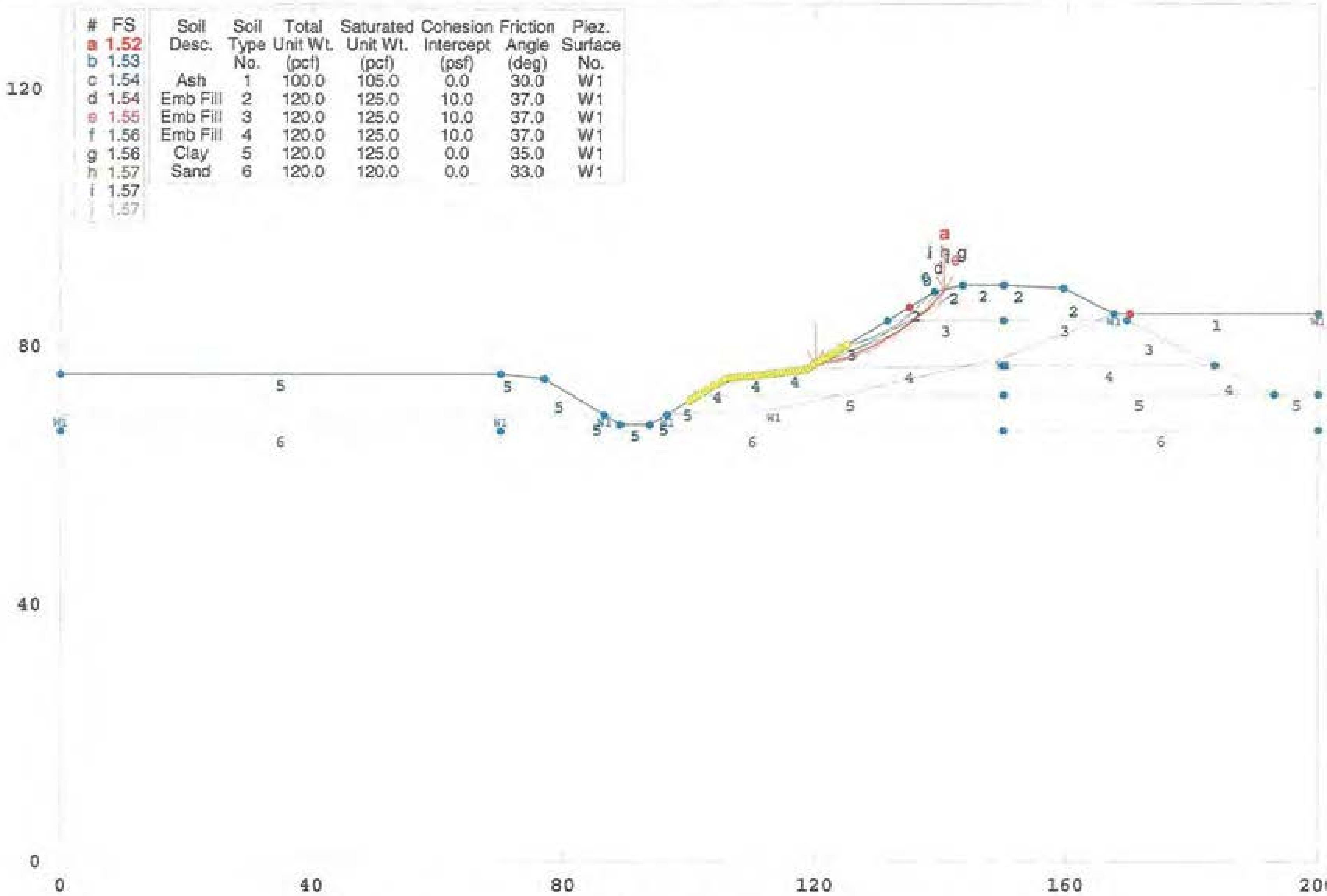


PCSTABL5M/si FSmin=1.45

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Plant Ash Pond Stability Analysis AB-2 (Shallow)



PCSTABL5M/si FSmin=1.52

Safety Factors Are Calculated By The Modified Bishop Method

STED

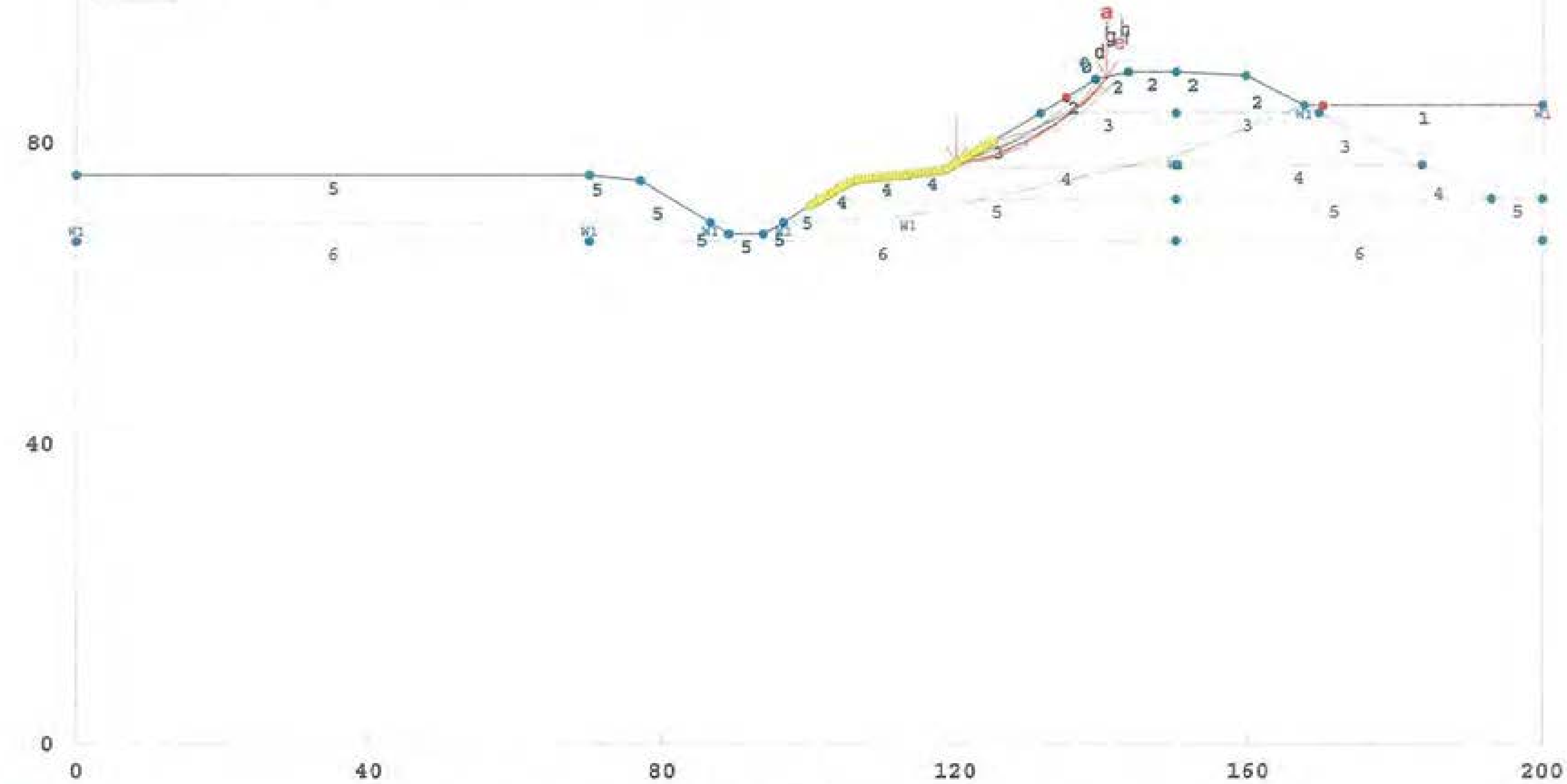
Lee Plant Ash Pond Stability Analysis AB-2 (Shallow) (Seismic)

p:\6469\progress energy\progress energy projects 2010\lee\6468100191 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-2ss.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/11/2011

#	FS
a	1.29
b	1.30
c	1.30
d	1.30
e	1.31
f	1.31
g	1.32
h	1.32
i	1.33
j	1.33

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Emb Fill	3	120.0	125.0	10.0	37.0	W1
Emb Fill	4	120.0	125.0	10.0	37.0	W1
Clay	5	120.0	125.0	0.0	35.0	W1
Sand	6	120.0	120.0	0.0	33.0	W1

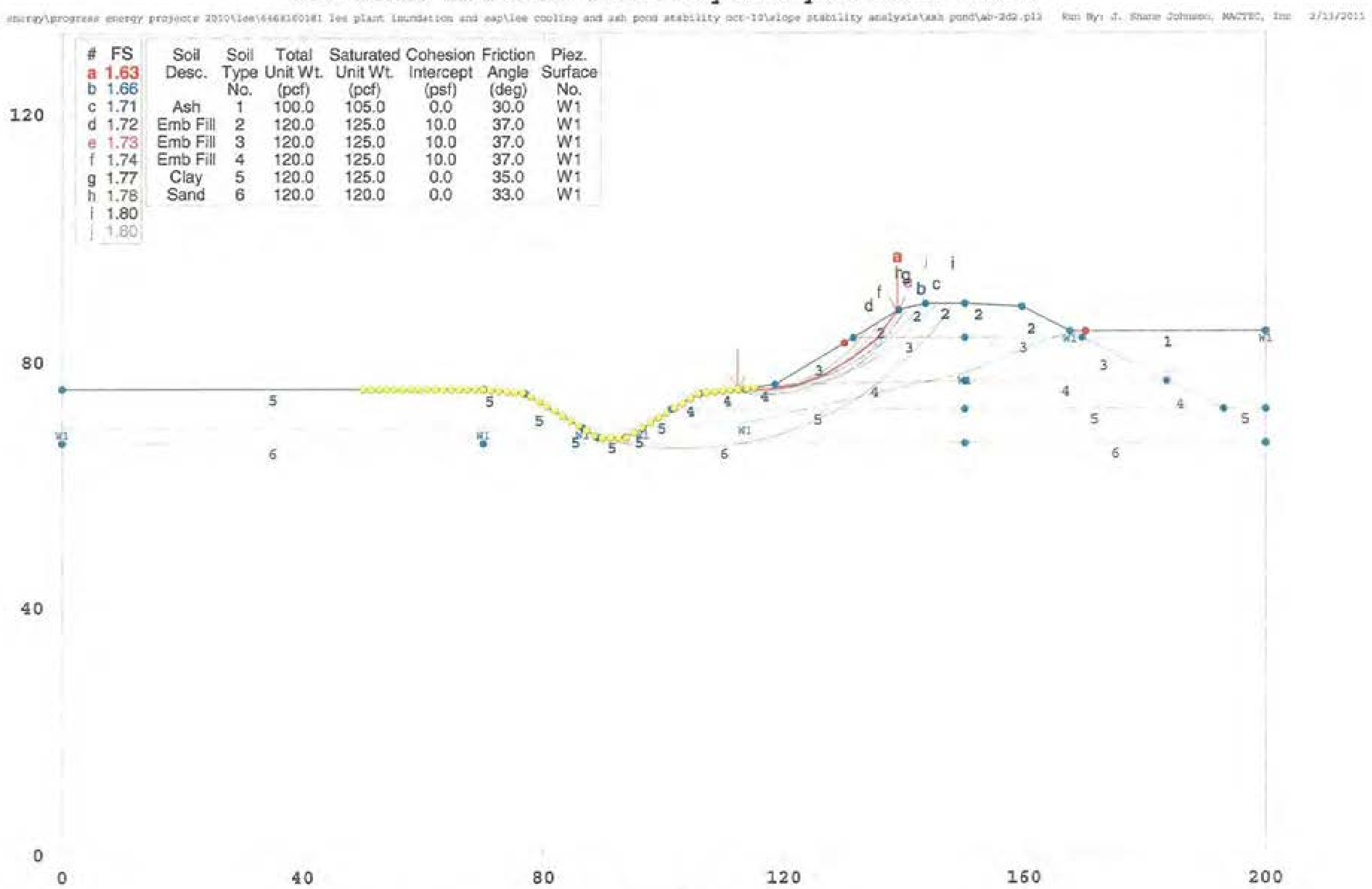
Load	Value
Horiz Eqk	0.080 g<



PCSTABL5M/si FSmin=1.29
Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Plant Ash Pond Stability Analysis AB-2 Run 3



PCSTABL5M/si FSmin=1.63
Safety Factors Are Calculated By The Modified Bishop Method

STED

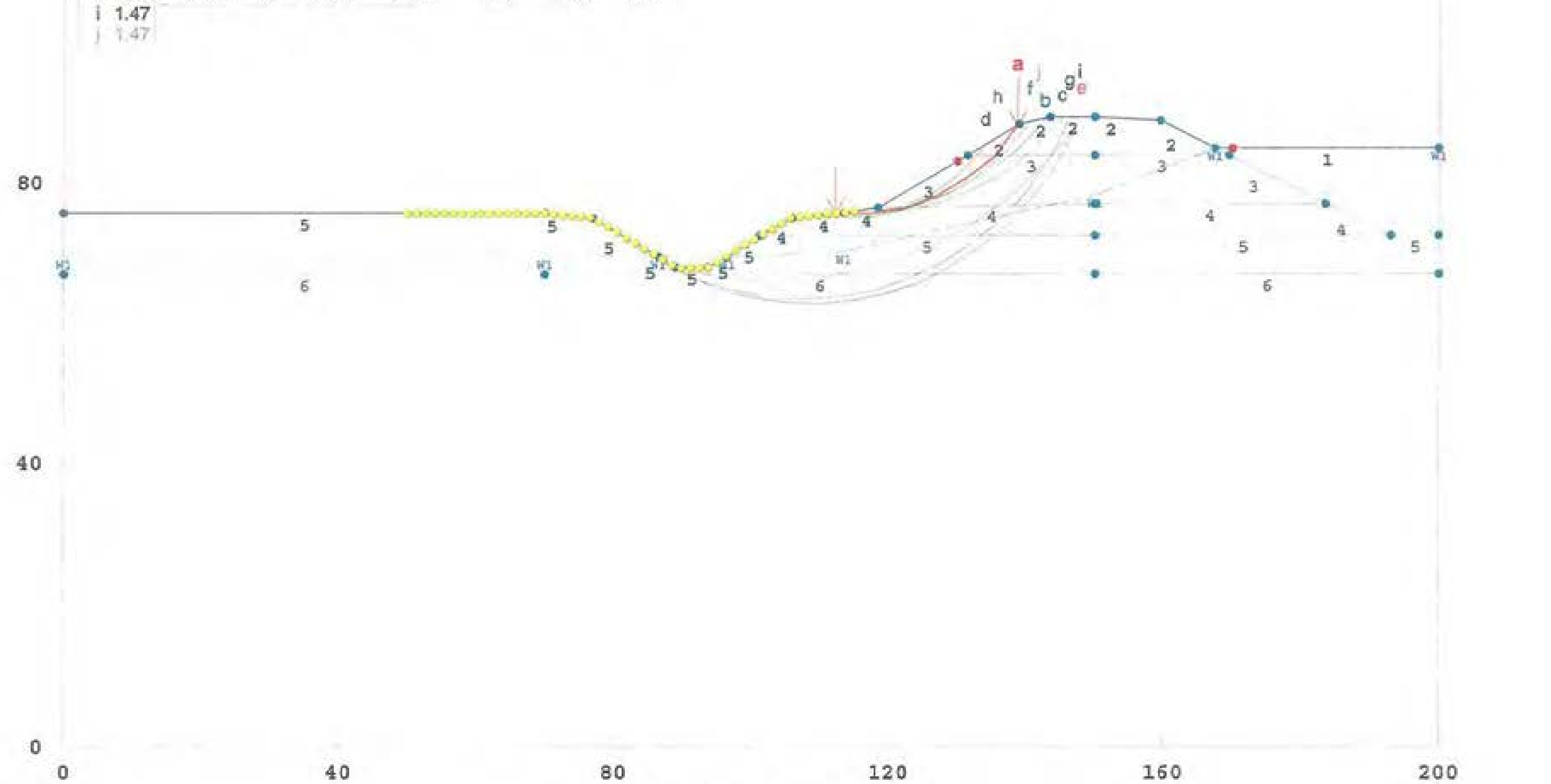
Lee Plant Ash Pond Stability Analysis AB-2 Run 3 (Seismic)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-2d2s.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/13/2011

#	FS
a	1.38
b	1.40
c	1.44
d	1.45
e	1.45
f	1.45
g	1.47
h	1.47
i	1.47
j	1.47

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Emb Fill	3	120.0	125.0	10.0	37.0	W1
Emb Fill	4	120.0	125.0	10.0	37.0	W1
Clay	5	120.0	125.0	0.0	35.0	W1
Sand	6	120.0	120.0	0.0	33.0	W1

Load	Value
Horiz Eqk	0.080 g<



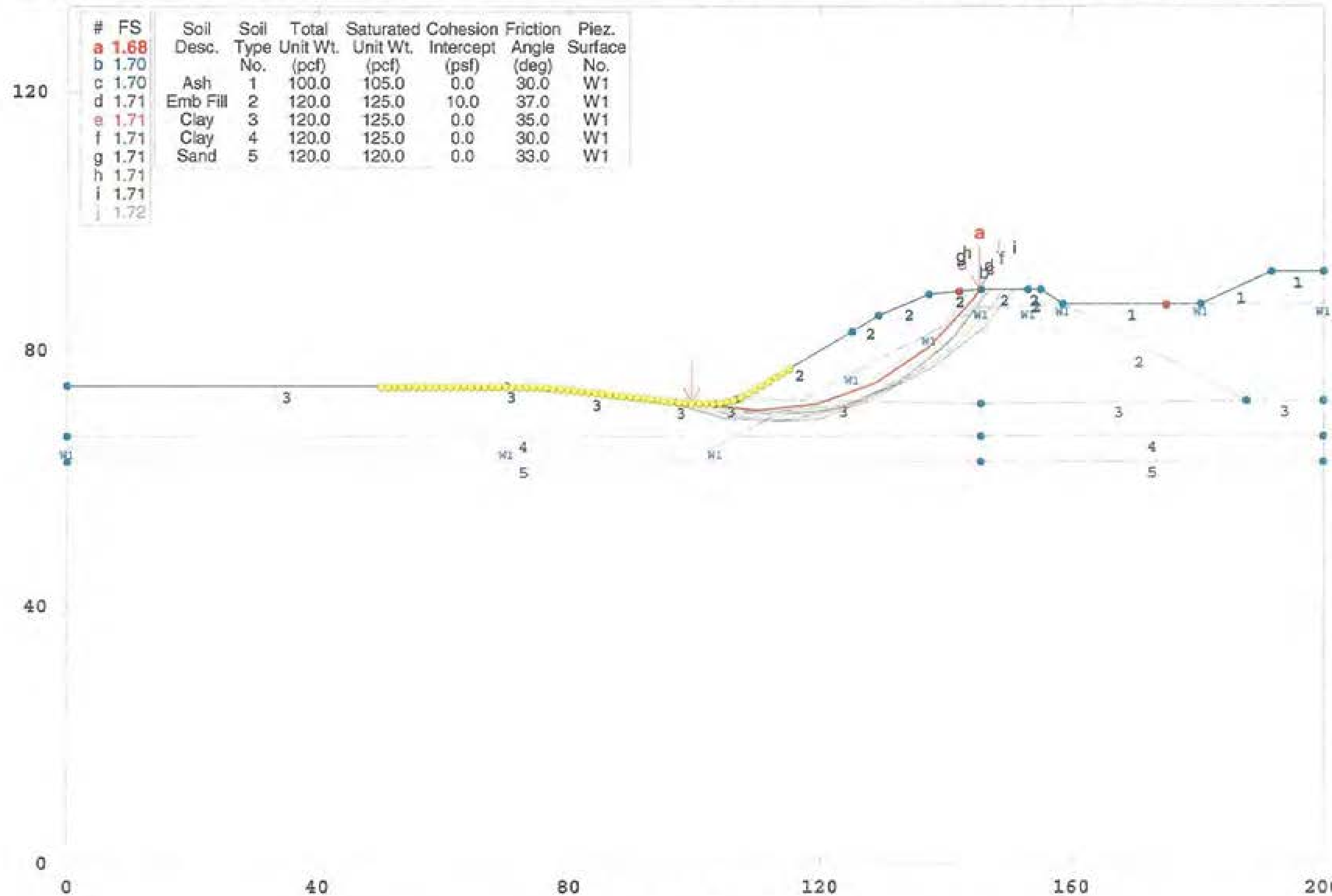
PCSTABL5M/si FSmin=1.38

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Plant Ash Pond Stability Analysis AB-3 Run 1 (Deep)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant inundation and sap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-3de.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/13/2011



PCSTABL5M/si FSmin=1.68
Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Plant Ash Pond Stability Analysis AB-3 Run 1 (Deep) (Seismic)

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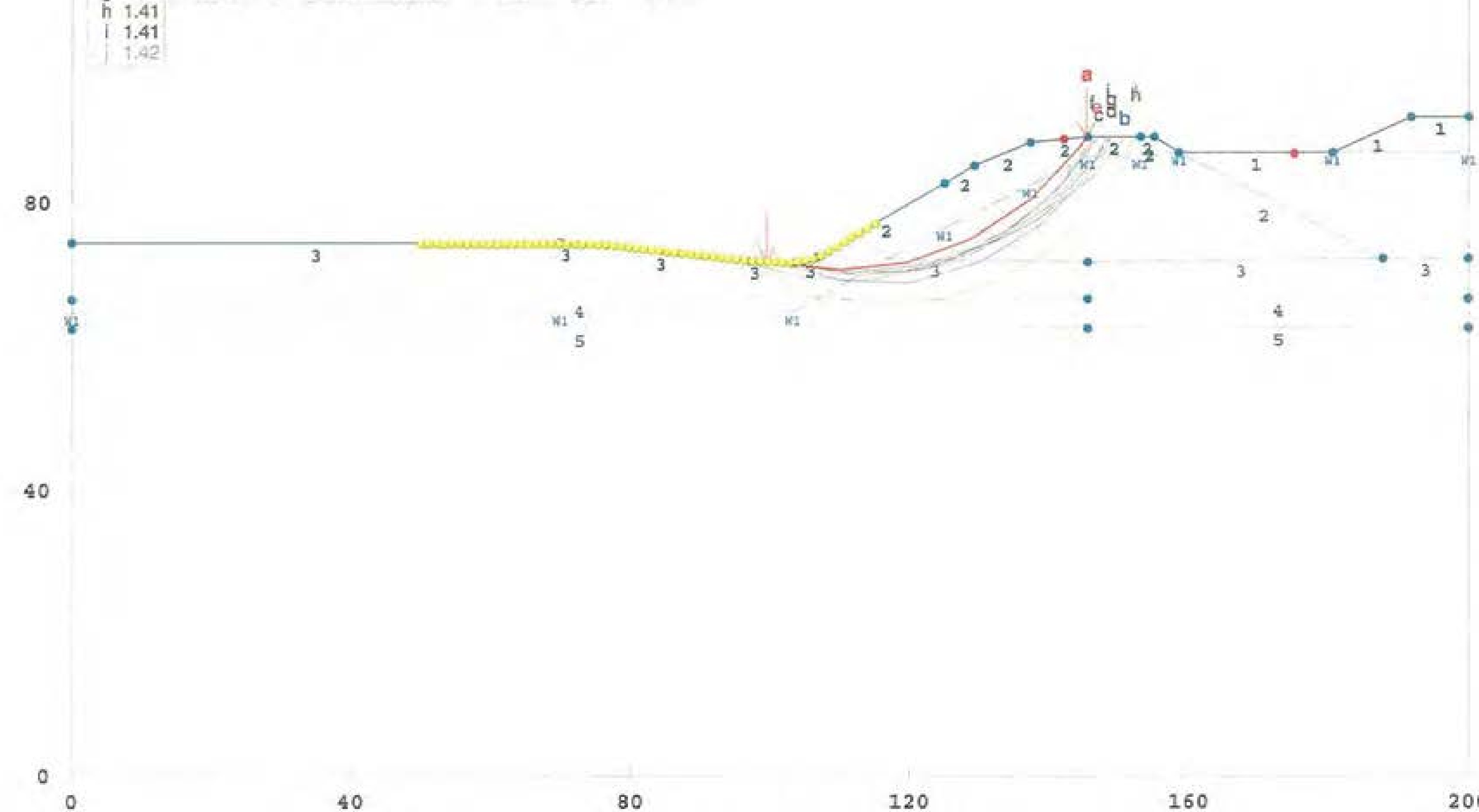
#	FS
a	1.39
b	1.40
c	1.40
d	1.40
e	1.41
f	1.41
g	1.41
h	1.41
i	1.41
j	1.42

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Clay	3	120.0	125.0	0.0	35.0	W1
Clay	4	120.0	125.0	0.0	30.0	W1
Sand	5	120.0	120.0	0.0	33.0	W1

Load	Value
Horiz Eqk	0.080 g<



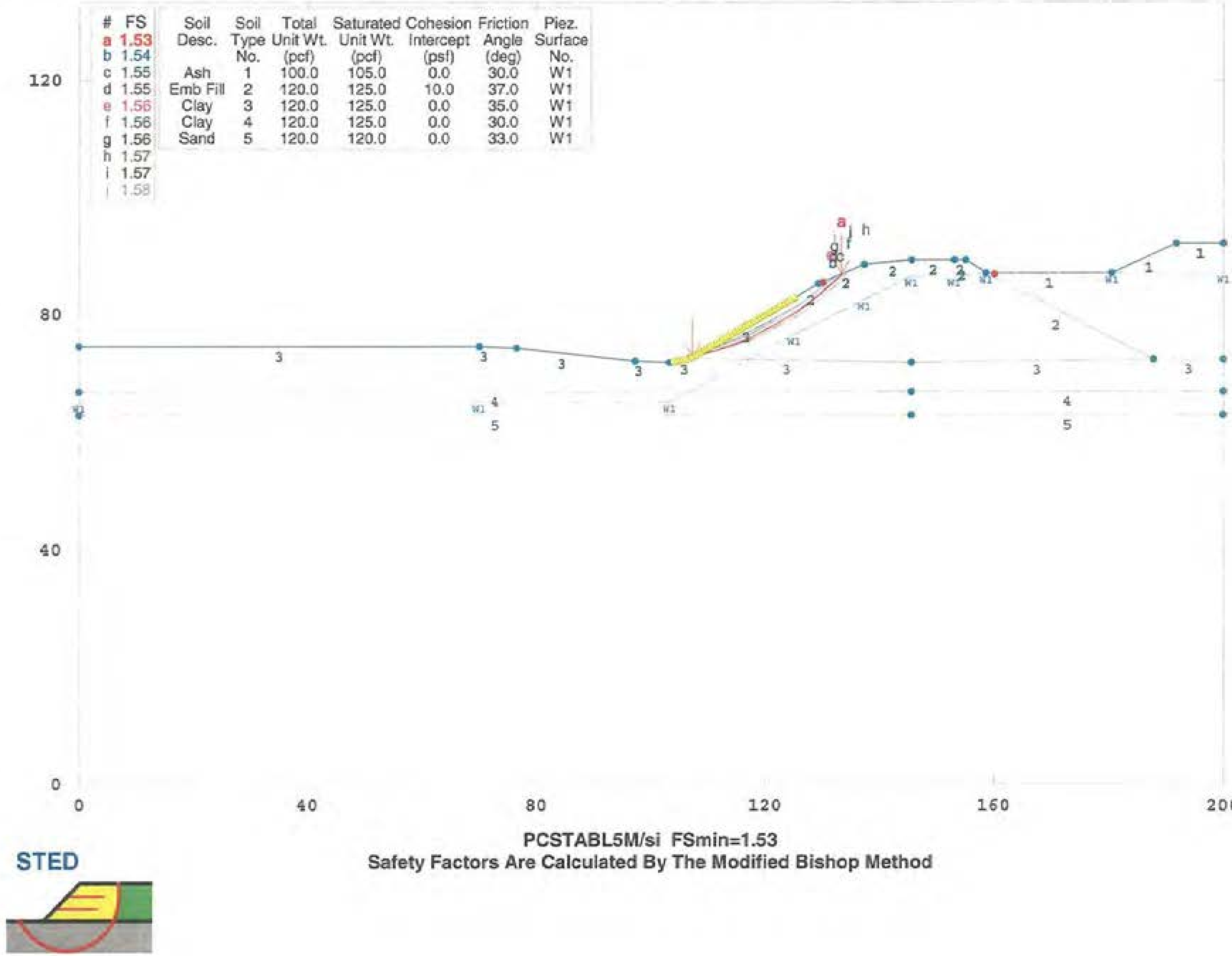
PCSTABL5M/si FSmin=1.39

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Plant Ash Pond Stability Analysis AB-3 Run 1 (Shallow)

p:\6468\progress energy\progress energy projects 2010\lee\6468109191 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\ab-3.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/13/2011



Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Clay	3	120.0	125.0	0.0	35.0	W1
Clay	4	120.0	125.0	0.0	30.0	W1
Sand	5	120.0	120.0	0.0	33.0	W1

PCSTABL5M/si FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

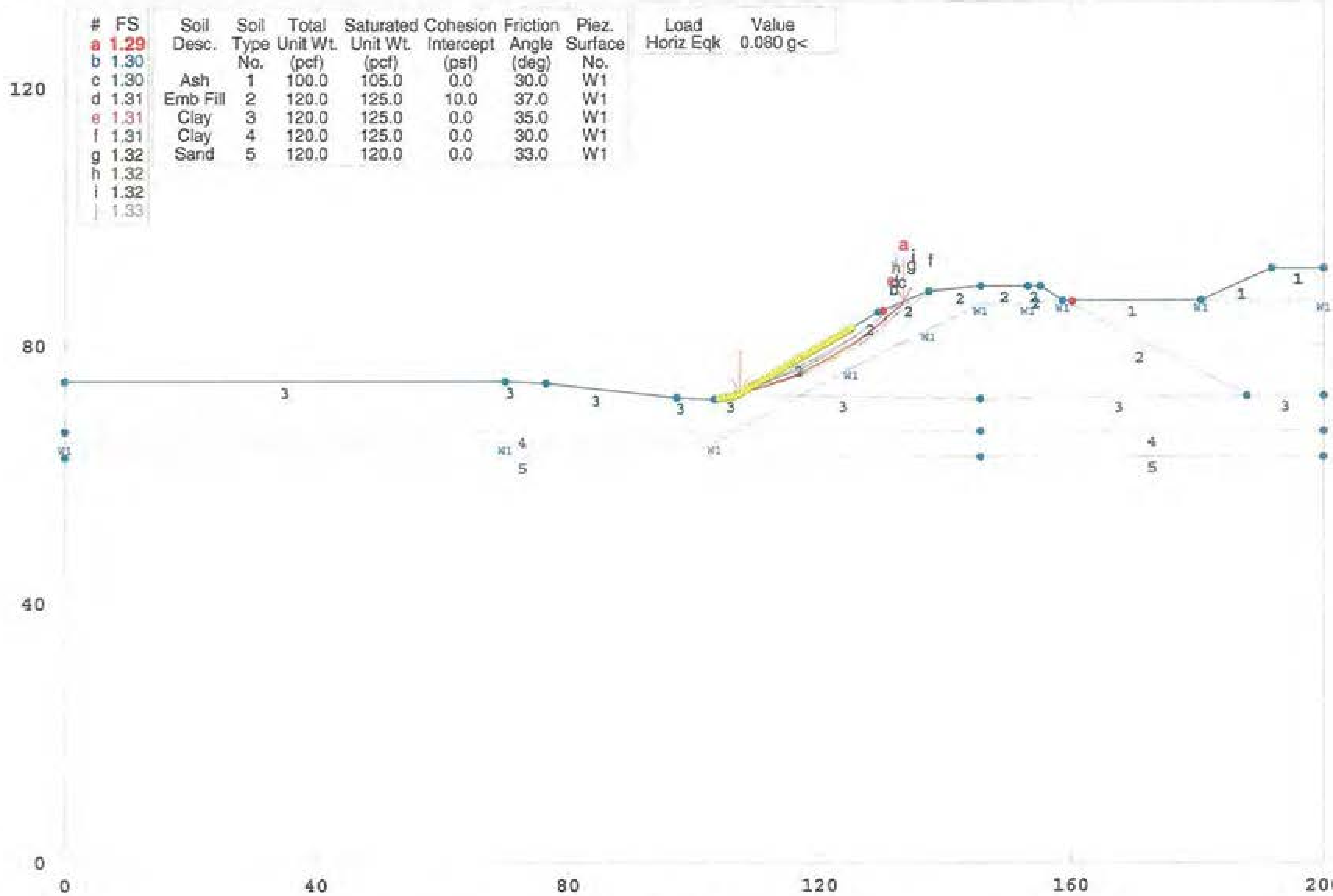
Lee Plant Ash Pond Stability Analysis AB-3 Run 1 (Shallow) (Seismic)

Run By: J. Shane Johnson, MACTEC, Inc

#	FS
a	1.29
b	1.30
c	1.30
d	1.31
e	1.31
f	1.31
g	1.32
h	1.32
i	1.32
j	1.33

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	0.0	30.0	W1
Emb Fill	2	120.0	125.0	10.0	37.0	W1
Clay	3	120.0	125.0	0.0	35.0	W1
Clay	4	120.0	125.0	0.0	30.0	W1
Sand	5	120.0	120.0	0.0	33.0	W1

Load	Value
Horiz Eqk	0.080 g<



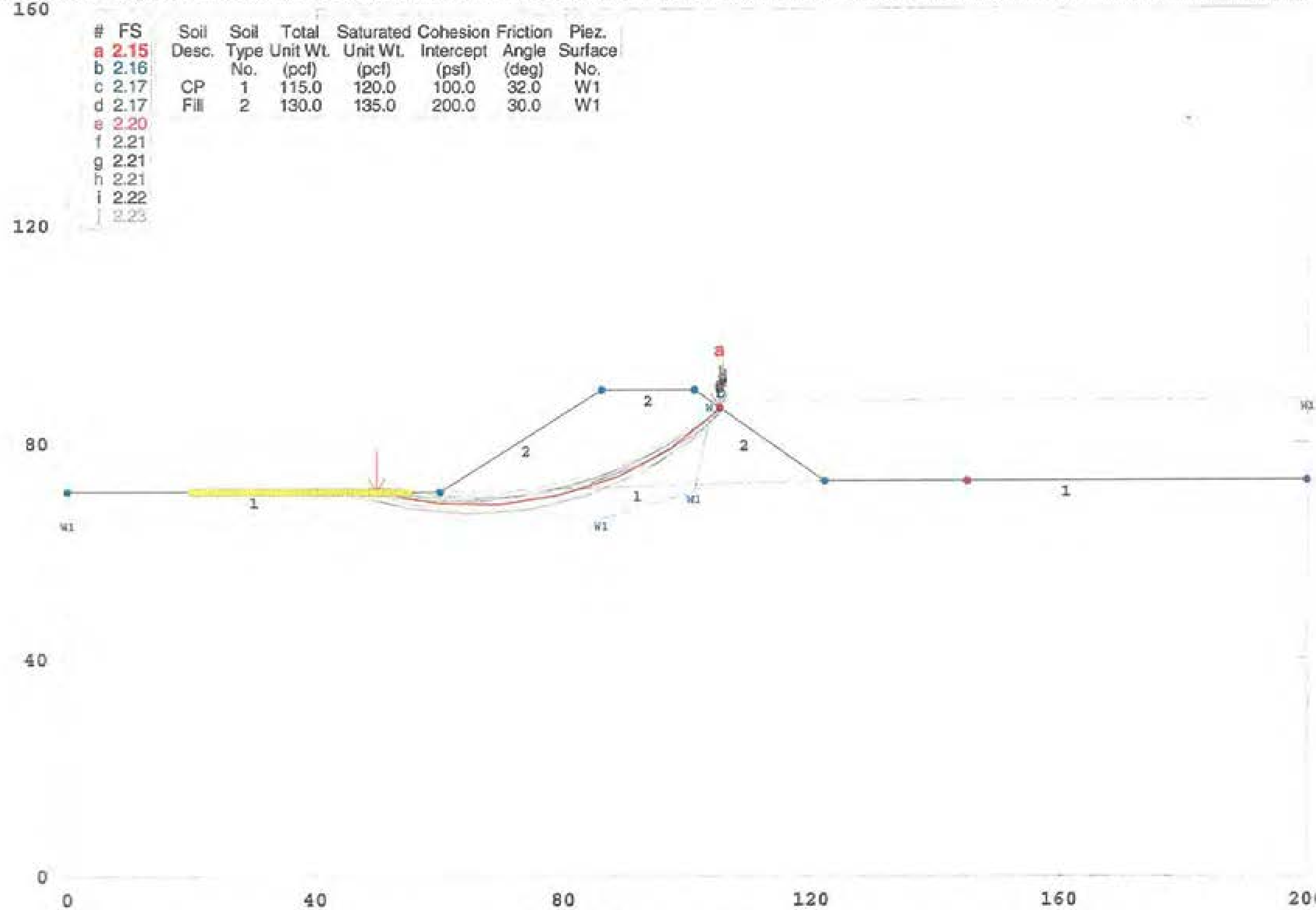
PCSTABL5M/si FSmin=1.29

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Pond Ash Pond Stability Analysis 1999 Analysis (Deep)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant inundation and map\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\1999d.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/13/2011



PCSTABL5M/si FSmin=2.15

Safety Factors Are Calculated By The Modified Bishop Method

STED

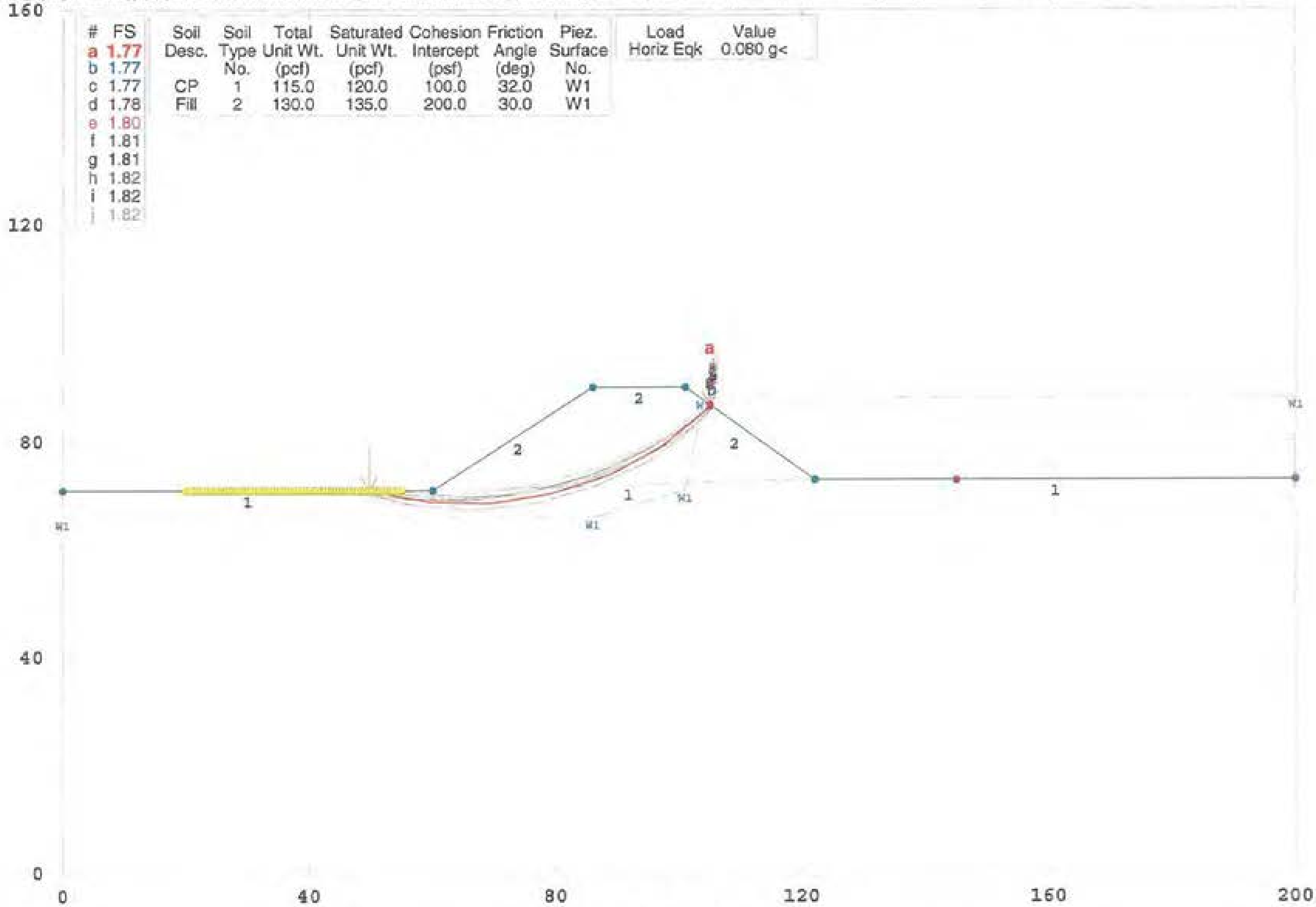
Lee Pond Ash Pond Stability Analysis 1999 Analysis (Deep) (Seismic)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\1999ds.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/14/2011

#	FS
a	1.77
b	1.77
c	1.77
d	1.78
e	1.80
f	1.81
g	1.81
h	1.82
i	1.82
j	1.82

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
CP	1	115.0	120.0	100.0	32.0	W1
Fill	2	130.0	135.0	200.0	30.0	W1

Load	Value
Horiz Eqk	0.080 g<

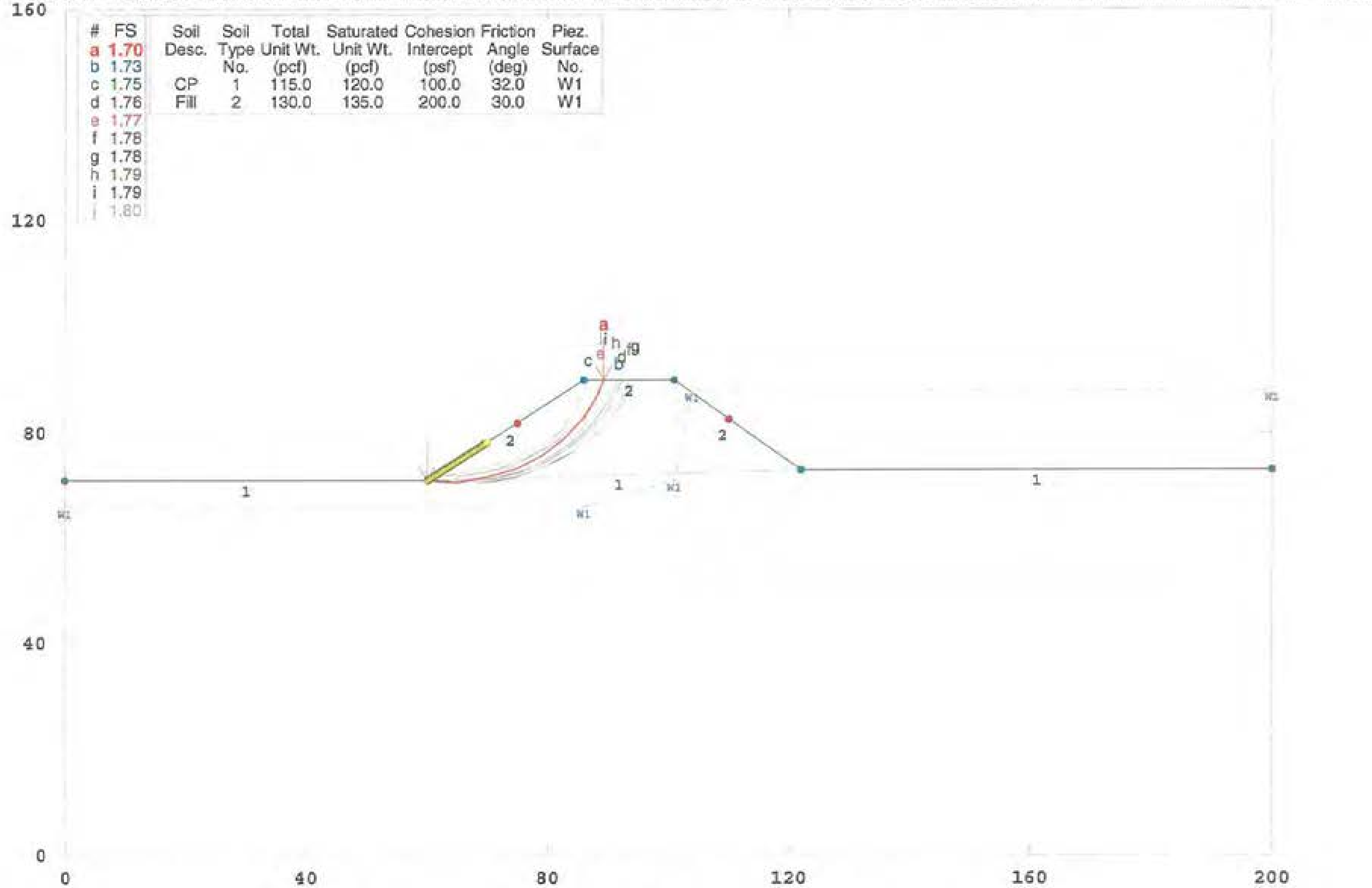


PCSTABL5M/si FSmin=1.77
Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Pond Ash Pond Stability Analysis 1999 Analysis (Shallow)

p:\6468\progress energy\progress energy projects 2010\lee\6468100101 lee plant inundation and eap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\1999s.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/13/2011



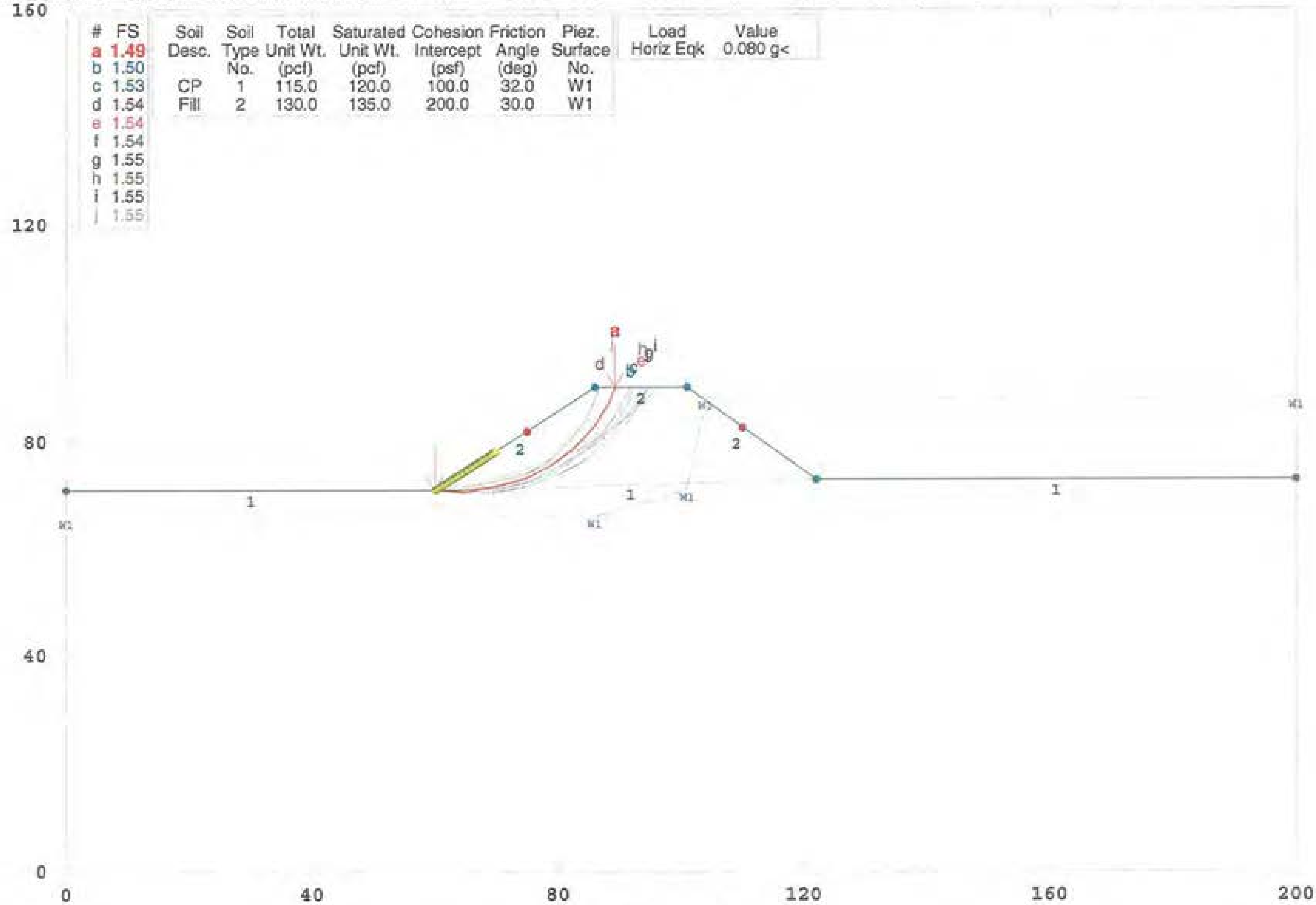
PCSTABL5M/si FSmin=1.70

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Pond Ash Pond Stability Analysis 1999 Analysis (Shallow) (Seismic)

p:\6468\progress energy\progress energy projects 2010\lee\6468100181 lee plant foundation and nap\lee cooling and ash pond stability oct-10\slope stability analysis\ash pond\1999ss.pl1 Run By: J. Shane Johnson, MACTEC, Inc 2/14/2011



PCSTABL5M/si FSmin=1.49
Safety Factors Are Calculated By The Modified Bishop Method

STED

APPENDIX E

Seismic Site Class and Peak Ground Acceleration Calculations

International Building Code Site Class Calculation - Manual Hammer

Project: Lee Ash Pond Stability Analysis
Location: Goldsboro, NC
Project No.: 6468-10-0181
Date: 11/24/2010
Input by: Sharat Gollamudi

Ckd. [illegible] 4/1/11

Boring No.		AB-1	AB-2	AB-3	AB-4
Sample Depth		Field	Field	Field	Field
From	To	SPT	SPT	SPT	SPT
0	2.5	16	9	10	10
2.5	5	18	19	13	15
5	7.5	7	20	19	16
7.5	10	19	18	7	17
10	15	13	16	15	7
15	20	3	15	20	11
20	25	13	19	6	15
25	30	42	28	21	38
30	35	42	28	21	38
35	40	42	28	21	38
40	45	42	28	21	38
45	50	100	100	100	100
50	55	100	100	100	100
55	60	100	100	100	100
60	65	100	100	100	100
65	70	100	100	100	100
70	75	100	100	100	100
75	80	100	100	100	100
80	85	100	100	100	100
85	90	100	100	100	100
90	95	100	100	100	100
95	100	100	100	100	100

Notes:

-The surficial materials are interlayered sandy clays, clayey sands and sands typical of Inner Coastal Plain while deeper materials are residual silty soil derived from chemical and physical weathering of metavolcanic rocks. With increasing depth the residual soils transistion to partially weathered rock (PWR) and rock.

-Borings are typically terminated at a depth of 30-ft.

- PWR is assumed below a depth of 45 feet based on the available historic boring data within the project site.

	AB-1	AB-2	AB-3	AB-4
Navg	24	35	26	30
Site Class	D	D	D	D

Site Class	Vs	N	Su
A	>5000	N/A	N/A
B	2500 to 5000	N/A	N/A
C	1200 to 2500	>50	>2000
D	600 to 1200	15 to 50	1000 to 2000
E	<600	<15	<1000

Site Coefficients and adjusted maximum considered earthquake spectral response acceleration parameters

F_a	=	Site coefficient for CLASS D	= 1.6	(AASHTO/USGS GM-2.1 software)
F_v	=	Site coefficient for CLASS D	= 2.4	(AASHTO/USGS GM-2.1 software)
S_s	=	Mapped Spectral accelerations for short periods	= 0.188	(AASHTO/USGS GM-2.1 software)
S_1	=	Mapped Spectral response for 1-sec period	= 0.107	(AASHTO/USGS GM-2.1 software)
S_{MS}	=	F_aS_s	= 0.3008	(Eq.16-37 International building code 2006)
S_{M1}	=	F_vS_1	= 0.2568	(Eq.16-38 International building code 2006)
S_{DS}	=	$2/3(S_{MS})$	= 0.2005	(Eq.16-40 International building code 2006)

Peak ground acceleration = $S_{DS}/2.5$ = 0.080

AASHTO Earthquake Ground Motion Parameters - Version 2.10
(AASHTO GM-2.1)
Seismic Design Parameters for
2007 AASHTO Seismic Design Guidelines

Poject: Lee Plant - Ash Pond & Cooling Pond Stability Analysis
Date and Time: 11/24/2010 10:23:36 AM

Conterminous 48 States
2007 AASHTO Bridge Design Guidelines
AASHTO Spectrum for 7% PE in 75 years
Latitude = 35.371566
Longitude = -078.068689
Site Class B
Data are based on a 0.05 deg grid spacing.

Period (sec)	Sa (g)	
0.0	0.049	PGA - Site Class B
0.2	0.117	Ss - Site Class B
1.0	0.045	S1 - Site Class B

Conterminous 48 States
2007 AASHTO Bridge Design Guidelines
Spectral Response Accelerations SDs and SD1
Latitude = 35.371566
Longitude = -078.068689
As = FpgaPGA, SDs = FaSs, and SD1 = FvS1
Site Class C - Fpga = 1.20, Fa = 1.20, Fv = 1.70
Data are based on a 0.05 deg grid spacing.

Period (sec)	Sa (g)	
0.0	0.059	As - Site Class C
0.2	0.141	SDs - Site Class C
1.0	0.076	SD1 - Site Class C

Conterminous 48 States
2007 AASHTO Bridge Design Guidelines
Spectral Response Accelerations SDs and SD1
Latitude = 35.371566
Longitude = -078.068689
As = FpgaPGA, SDs = FaSs, and SD1 = FvS1
Site Class D - Fpga = 1.60, Fa = 1.60, Fv = 2.40
Data are based on a 0.05 deg grid spacing.

Period (sec)	Sa (g)	
0.0	0.078	As - Site Class D
0.2	0.188	SDs - Site Class D
1.0	0.107	SD1 - Site Class D

Conterminous 48 States
2007 AASHTO Bridge Design Guidelines
Spectral Response Accelerations SDs and SD1
Latitude = 35.371566
Longitude = -078.068689
As = FpgaPGA, SDs = FaSs, and SD1 = FvS1
Site Class E - Fpga = 2.50, Fa = 2.50, Fv = 3.50
Data are based on a 0.05 deg grid spacing.

Period (sec)	Sa (g)	
0.0	0.122	As - Site Class E
0.2	0.293	SDs - Site Class E
1.0	0.156	SD1 - Site Class E

Purpose - The ground motion parameters obtained in this analysis are for use with the design procedures described in AASHTO Guidelines for the Seismic Design of Highway Bridges (2007) The user may calculate seismic design parameters and response spectra (both for period and displacement), for Site Class A through E.

Description - This program allows the user to obtain seismic design parameters for sites in the 50 states of the United States, Puerto Rico and the U.S. Virgin Islands. In most cases the user may perform an analysis for a site by specifying location by either latitude-longitude (recommended) or zip code. However, locations in Puerto and the Virgin Islands may only be specified by latitude-longitude. Ground motion maps are included in PDF format. These maps may be opened using a map viewer that is part of the software package.

Data - The 2007 AASHTO maps are based on 5% in 50 year probabilistic data from the U.S. Geological Survey data sets for the following regions: 48 conterminous states (2002), Alaska (2006), Hawaii (1998), Puerto Rico and the Virgin Islands (2003). These were the most recent data available at the time of preparation of the AASHTO maps. The AASHTO maps are labeled with a probability of exceedance of7% in 75 years which is approximately equal to the 5% in 50 year data.

MACTEC Engineeering _Consulting, Inc.

Lee Plant

24 November 2010

INPUT	OUTPUT
State Plane, NAD83 3200 - North Carolina, U.S. Feet Vertical - NAVD88, U.S. Feet	Geographic, NAD83 Vertical - NAVD88, U.S. Feet

CB-4

1/2

Northing/Y:	591460.44	**Latitude:**	35 22 17.63990	(35.371566)
Easting/X:	2277623.28	**Longitude:**	78 04 07.27984	(78.068689)
Elevation/Z:	10	**Elevation/Z:**	10.000	
Convergence:	0 32 15.09035			
Scale Factor:	0.999874769			
Combined Factor:	0.999879757			

AB-1

2/2

Northing/Y:	596631.36	**Latitude:**	35 23 08.86733	(35.385743)
Easting/X:	2276734.36	**Longitude:**	78 04 17.43021	(78.071508)
Elevation/Z:	10	**Elevation/Z:**	10.000	
Convergence:	0 32 09.23186			
Scale Factor:	0.999875317			
Combined Factor:	0.999880301			

Remark:

APPENDIX F

Historical Geotechnical Information

F-1 Stability Analysis from 1999 work (Excerpts)

F-2 Stability Analysis at Secondary Settling Pond from 2007 work (Excerpts)

APPENDIX F-1

Stability Analysis from 1999 work (Excerpts)

LAW
LAWGIBB Group Member

LAW Engineering and Environmental Services, Inc
3301 Atlantic Avenue
Raleigh, NC 27604

JOB NO. ______ SHEET ____ OF ____
PHASE ______ TASK ______
JOB NAME ______
BY ______ DATE ______
CHECKED BY ______ DATE ______

Lee Ash Pond Dike

Stability Analyses Summary

	γ_T (pcf)	Drained ϕ	Drained c (psf)	Undrained ϕ	Undrained c (psf)
Fill	130	30	200	0	1000
Coastal Pl	115	32	100	32	100

Downstream Face (Pond at Design Elev 88)

Undrained Min SF = 2.25

Drained Min SF = 1.57

Upstream Face (Pond at Design Elev 88)

Undrained Min SF = 3.39

Drained Min SF = 2.34

3301 ATLANTIC AVE.
P.O. BOX 18289
RALEIGH, NC 27619
919-876-0416

JOB NO. 30720-9 3525-03 SHEET ____ OF ____

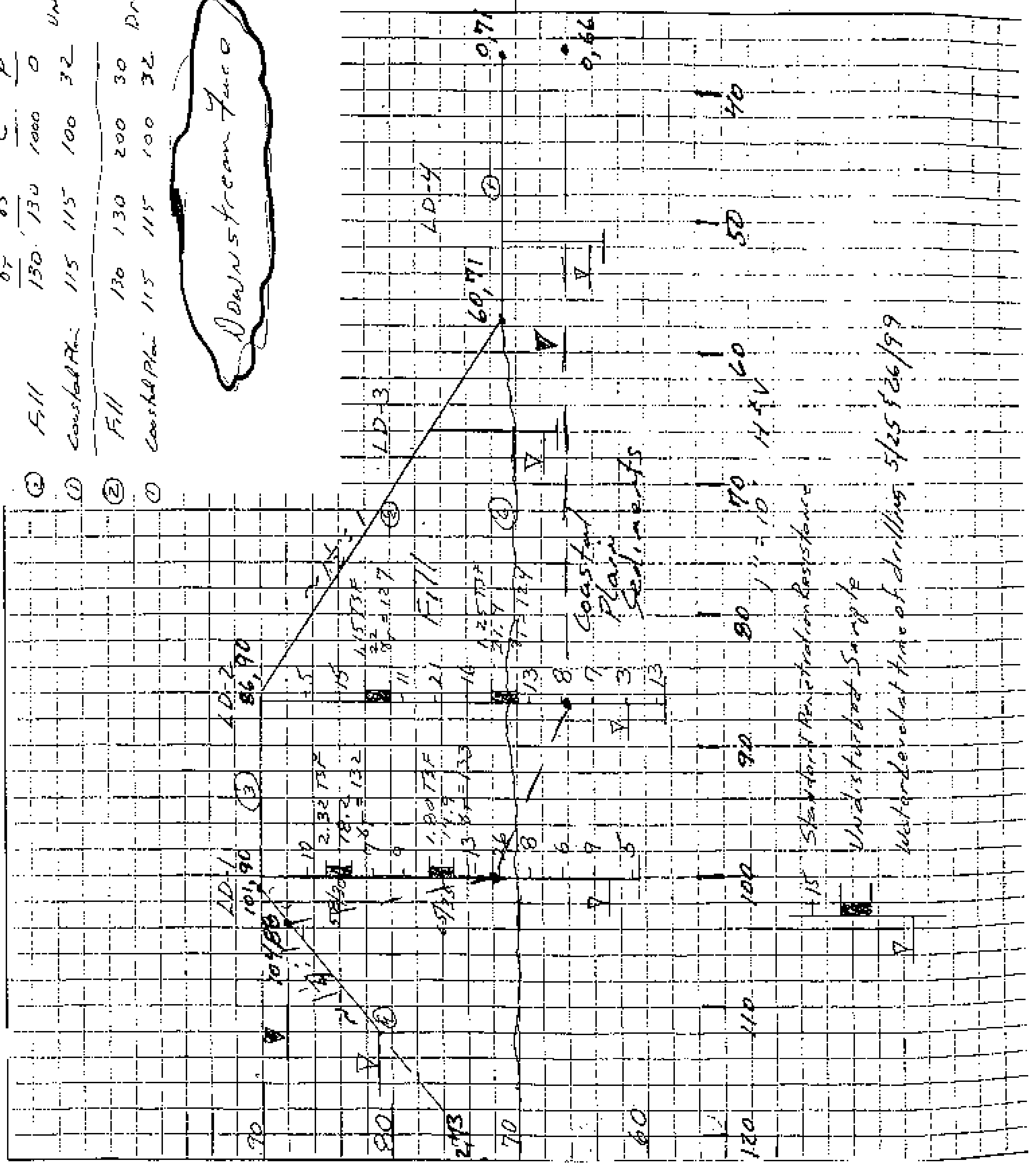
JOB NAME Lee Plant Ash Pond Dike Stability

SUBJECT ____

BY JEV DATE 5/27/99

CHECKED BY ____ DATE ____

		γ_T	γ_S	c	ϕ	
(2)	Fill	130	130	1000	0	Undrained
(1)	Coastal Plain	115	115	100	32	
(2)	Fill	130	130	200	30	Drained
(1)	Coastal Plain	115	115	100	32	



3301 ATLANTIC AVE.
P.O. BOX 18288
RALEIGH, NC 27619
919-876-0416

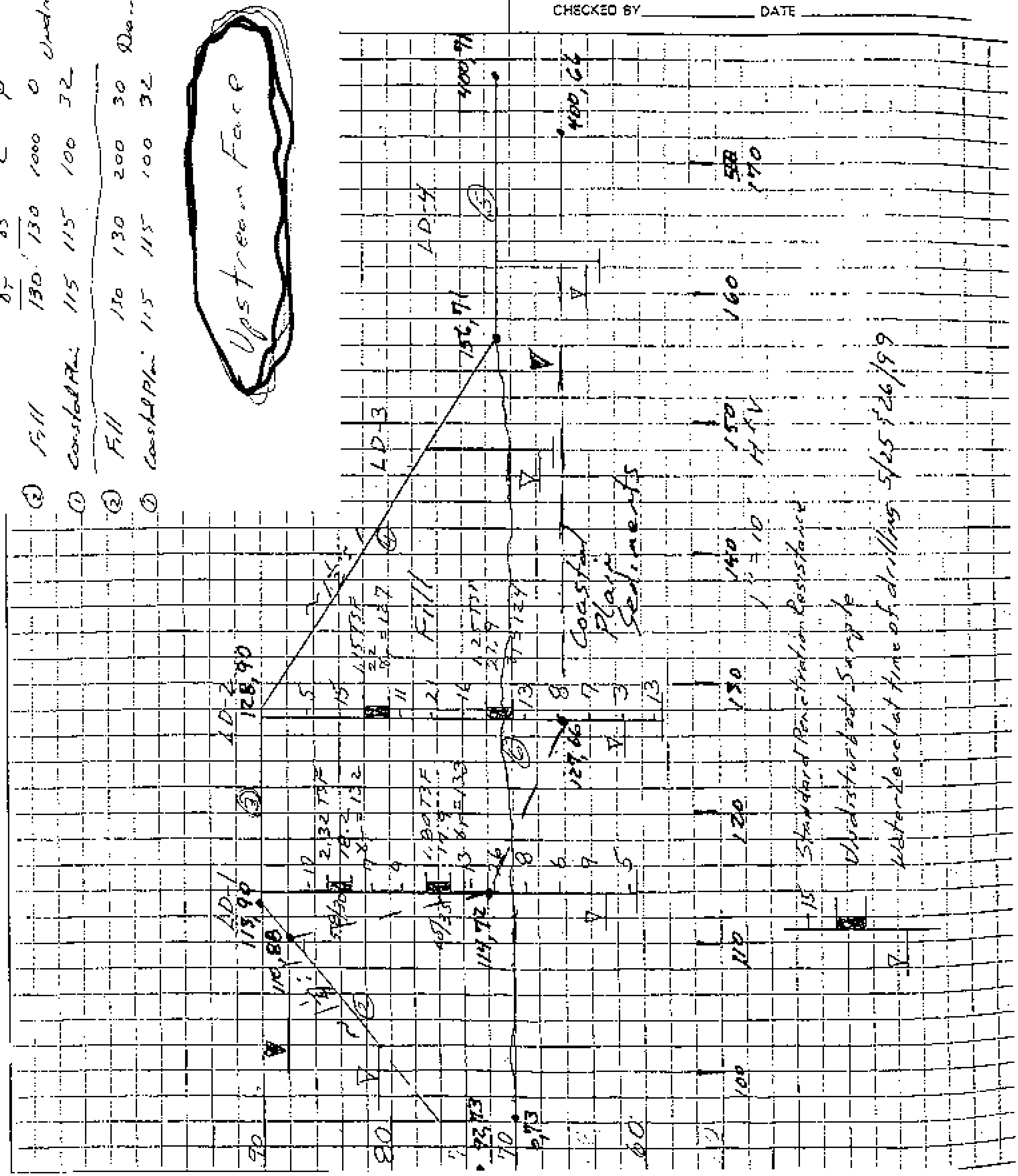
JOB NO. 30720-9 3525-03 SHEET ____ OF ____

JOB NAME Lee Plant Ash Pond Dike Stability

SUBJECT ____

BY JEY DATE 5/27/99

CHECKED BY ____ DATE ____



		γ_T	γ_S	c	ϕ	
②	Fill	130	130	1000	0	Undrained
①	Coastal Plain	115	115	100	32	
②	Fill	130	130	200	30	Drained
①	Coastal Plain	115	115	100	32	

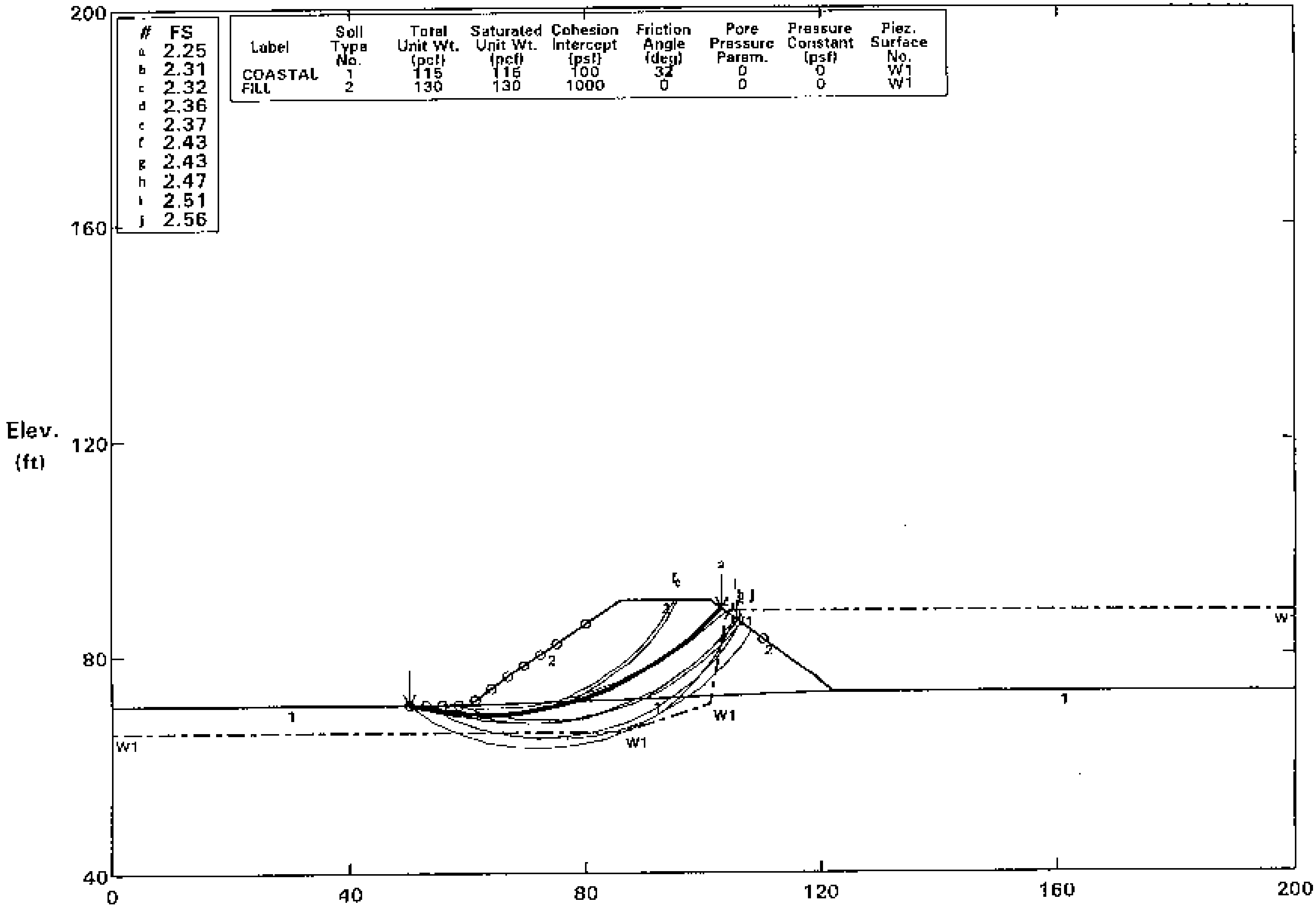
Stability Analysis

- Downstream Face
- Pond at Design Elev 88
- Undrained Condition

Min. SF = 2.25

LEE PLANT DIKE

Ten Most Critical. G:3525.PLT By: Veith 07-06-99 9:23am



#	FS
a	2.25
b	2.31
c	2.32
d	2.36
e	2.37
f	2.43
g	2.43
h	2.47
i	2.51
j	2.56

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
COASTAL	1	115	116	100	32	0	0	W1
FILL	2	130	130	1000	0	0	0	W1

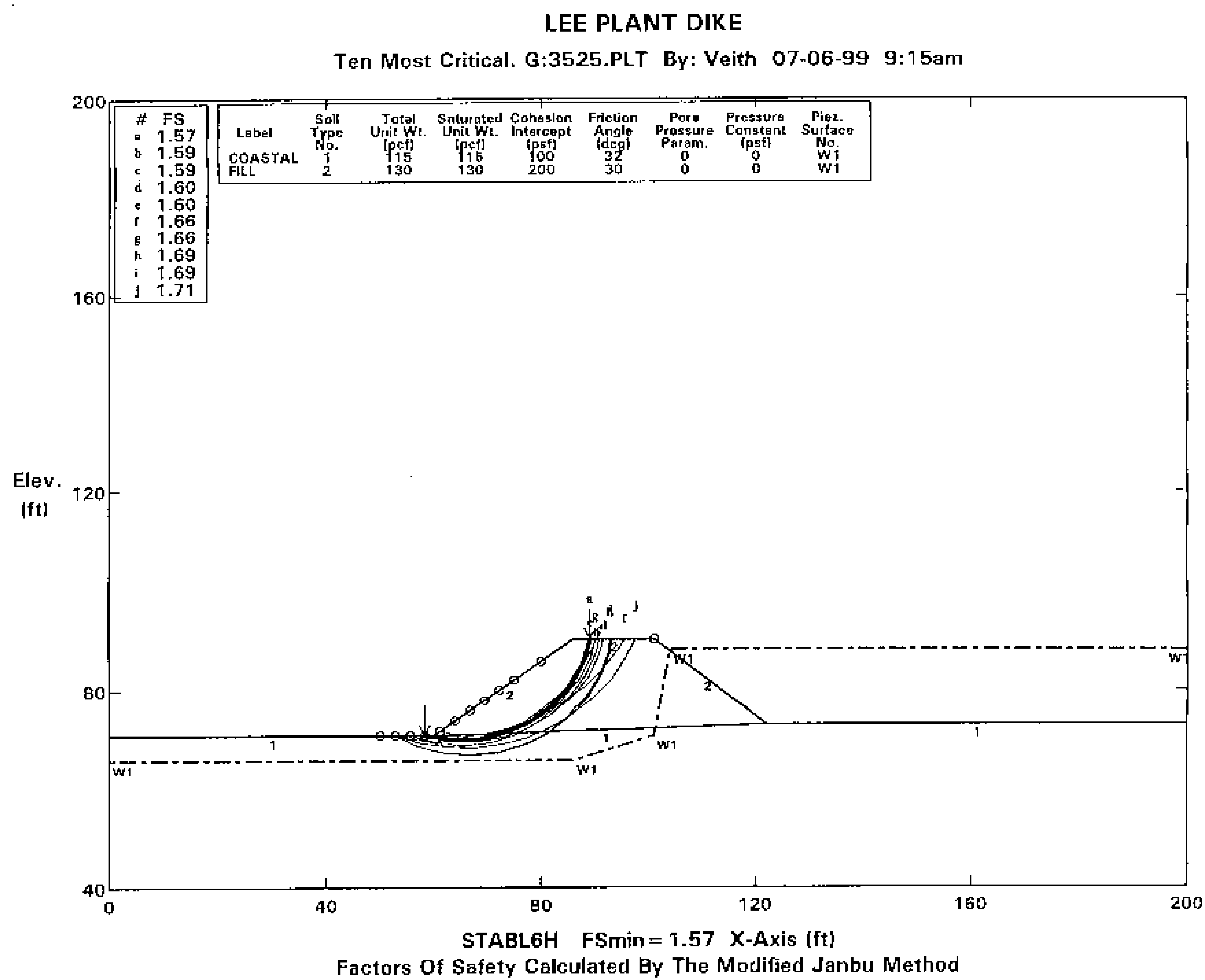
STABL6H FSmin = 2.25 X-Axis (ft)

Factors Of Safety Calculated By The Modified Janbu Method

Stability Analysis

- Downstream Face
- Pond at Design Elev 88
- Drained Condition

Min SF = 1.57


LEE PLANT DIKE
Ten Most Critical. G:3525.PLT By: Veith 07-06-99 9:15am
FS
a 1.57
b 1.59
c 1.59
d 1.60
e 1.60
f 1.66
g 1.66
h 1.69
i 1.69
j 1.71
Label | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
COASTAL | 1 | 115 | 115 | 100 | 32 | 0 | 0 | W1
FILL | 2 | 130 | 130 | 200 | 30 | 0 | 0 | W1
Elev. (ft)
200
160
120
80
40
0
40
80
120
160
200
W1
1
2
STABL6H FSmin = 1.57 X-Axis (ft)
Factors Of Safety Calculated By The Modified Janbu Method

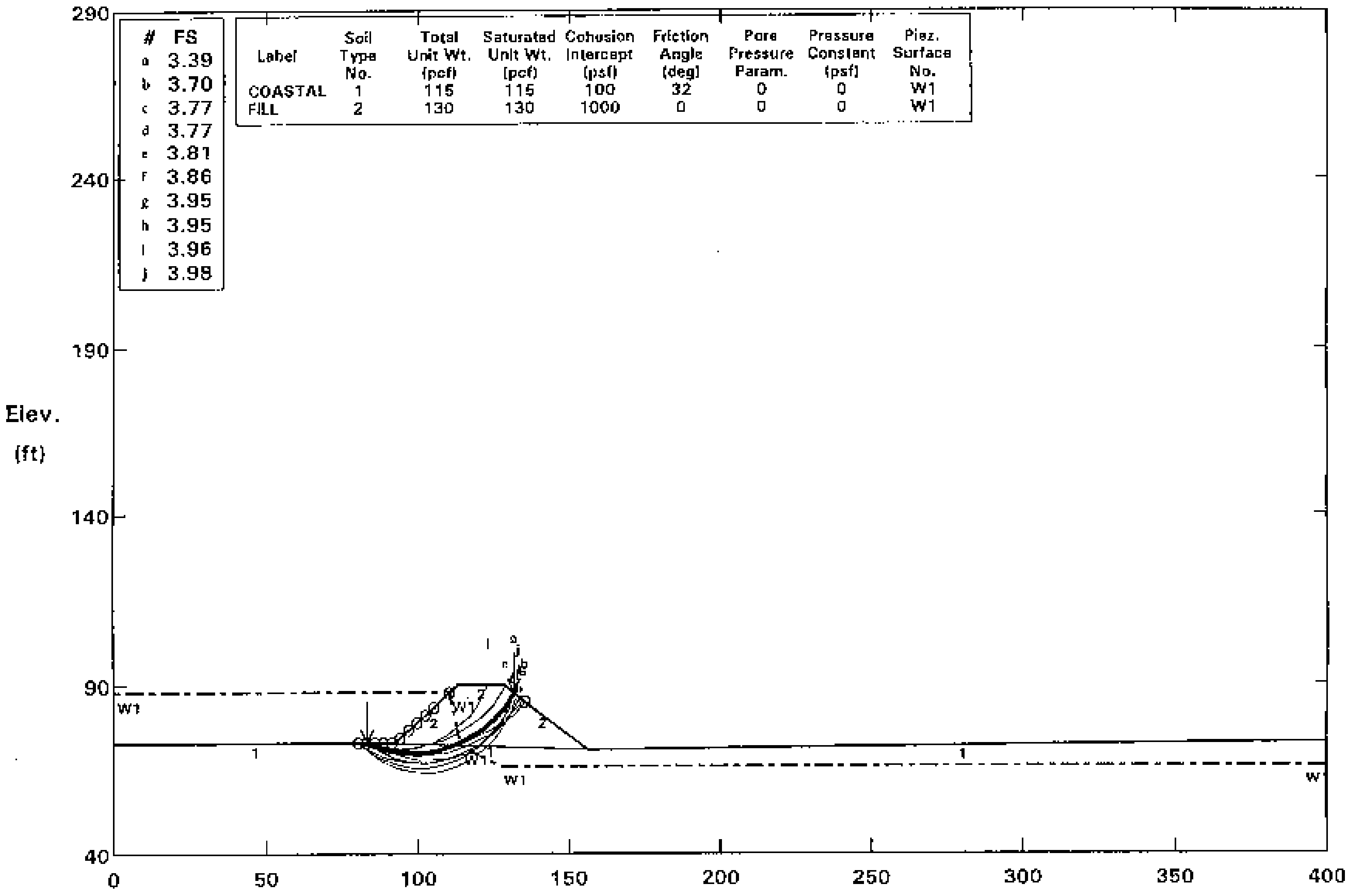
Stability Analysis

- Upstream Face
- Pond at Design Elev 88
- Undrained Condition

Min SF = 3.39

LEE PLANT DIKE

Ten Most Critical. G:3525.PLT By: Veith 07-06-99 9:56am



#	FS
a	3.39
b	3.70
c	3.77
d	3.77
e	3.81
f	3.86
g	3.95
h	3.95
i	3.96
j	3.98

Label	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
COASTAL	1	115	115	100	32	0	0	W1
FILL	2	130	130	1000	0	0	0	W1

Factors Of Safety Calculated By The Modified Janbu Method

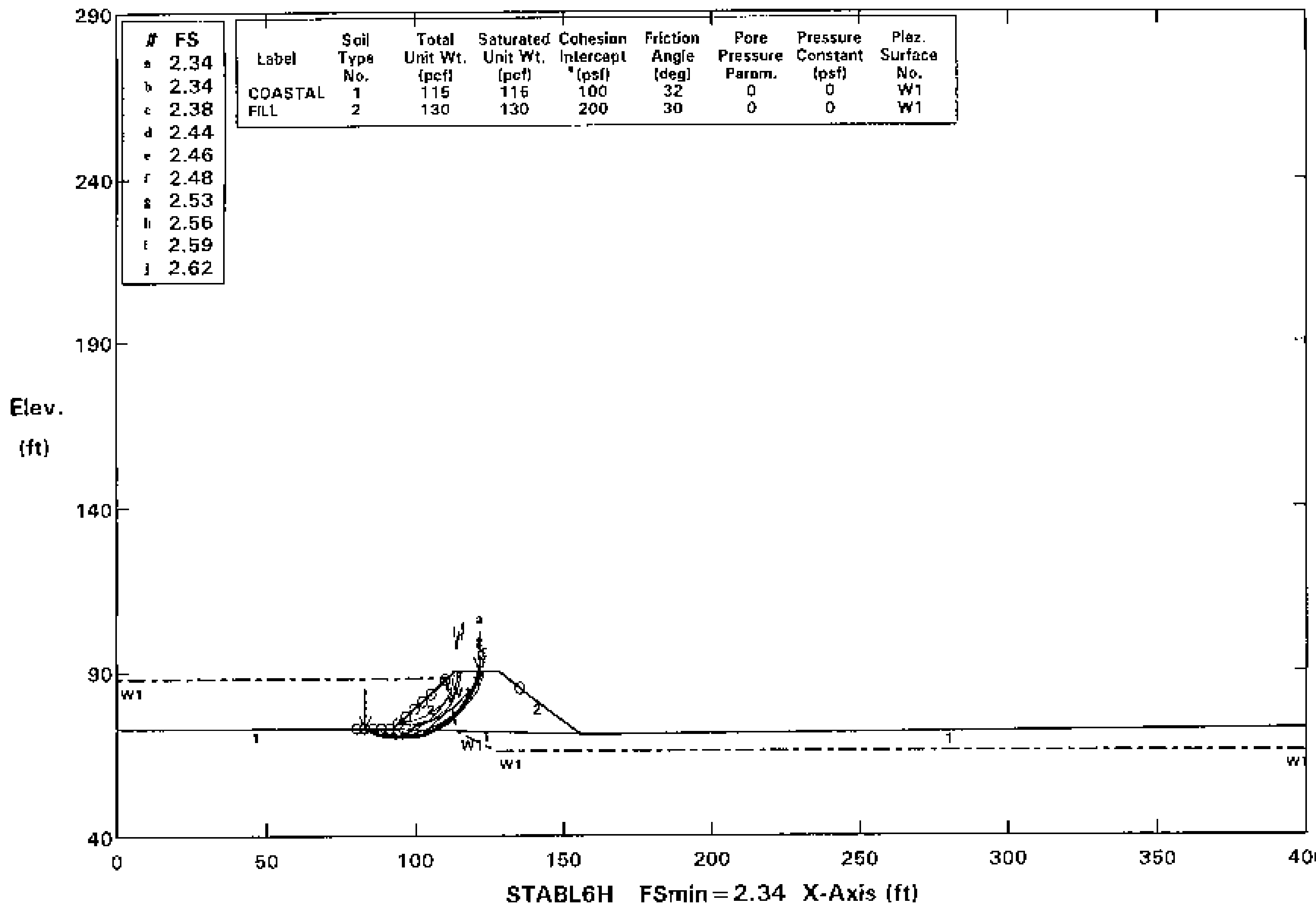
Stability Analysis

- Upstream Face
- Pond at Design Elev. 88
- Drained Condition

Min SF = 2.34

LEE PLANT DIKE

Ten Most Critical. G:3525.PLT By: Veith 07-06-99 10:03am



Factors Of Safety Calculated By The Modified Janbu Method

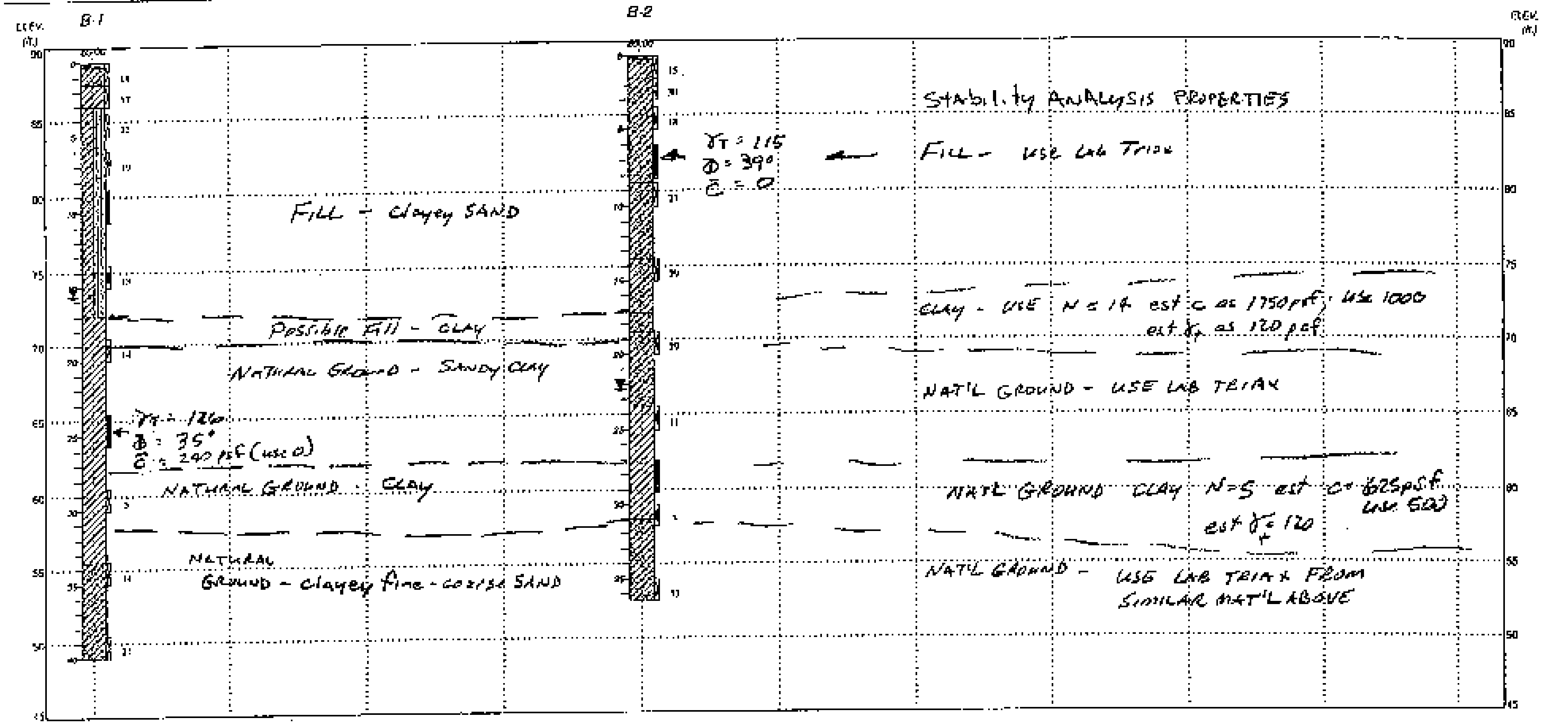
APPENDIX F-2

Stability Analysis at Secondary Settling Pond from 2007 work (Excerpts)

LEE PLANT ASH POND

SECONDARY SETTLING DIKE STABILITY INFORMATION

Slope Stability Analysis Results



MATERIAL LAYERING CODES

Fill	Concrete	Poorly Graded Sand with Clay (SP-SC)
Low Plasticity Inorganic Clays (CL)	Poorly Graded Sand (SP)	Poorly Graded Sand with Silt (SP-SM)
High Plasticity Inorganic Clays (CH)	Well Graded Sand (SW)	Silty Clayey Sand (SC-SM)
Low Plasticity Inorganic Silts (ML)	Silty Sand (SM)	Low Plasticity Organic Soils (OL)
High Plasticity Inorganic Silts (MH)	Clayey Sand (SC)	Limestone
Poorly Graded Sand and Gravel	Siltstone	Weathered Rock

B-1 BORING NO.
26.0 BORING ELEVATION
GROUND WATER 24 HOUR READING
TIME OF BORING
SPLIT SPOON SAMPLE BLOW COUNTS
ROCK CORE SAMPLE
UNDISTURBED SAMPLE
BORING DEPTH
REFUSAL CONDITION

THE SOIL PROFILE SHOWN IS BASED ON INTERPOLATION OF CONDITIONS AT WIDELY SPACED BORINGS OR SOUNDINGS AND REASONABLE ENGINEERING JUDGEMENT AND IS NOT WARRANTED.

SUBSURFACE PROFILE

FIGURE 2

PROJECT: FGN - Lee Plant, Secondary Containment Dike
PROJECT NO. 6468-07-1684

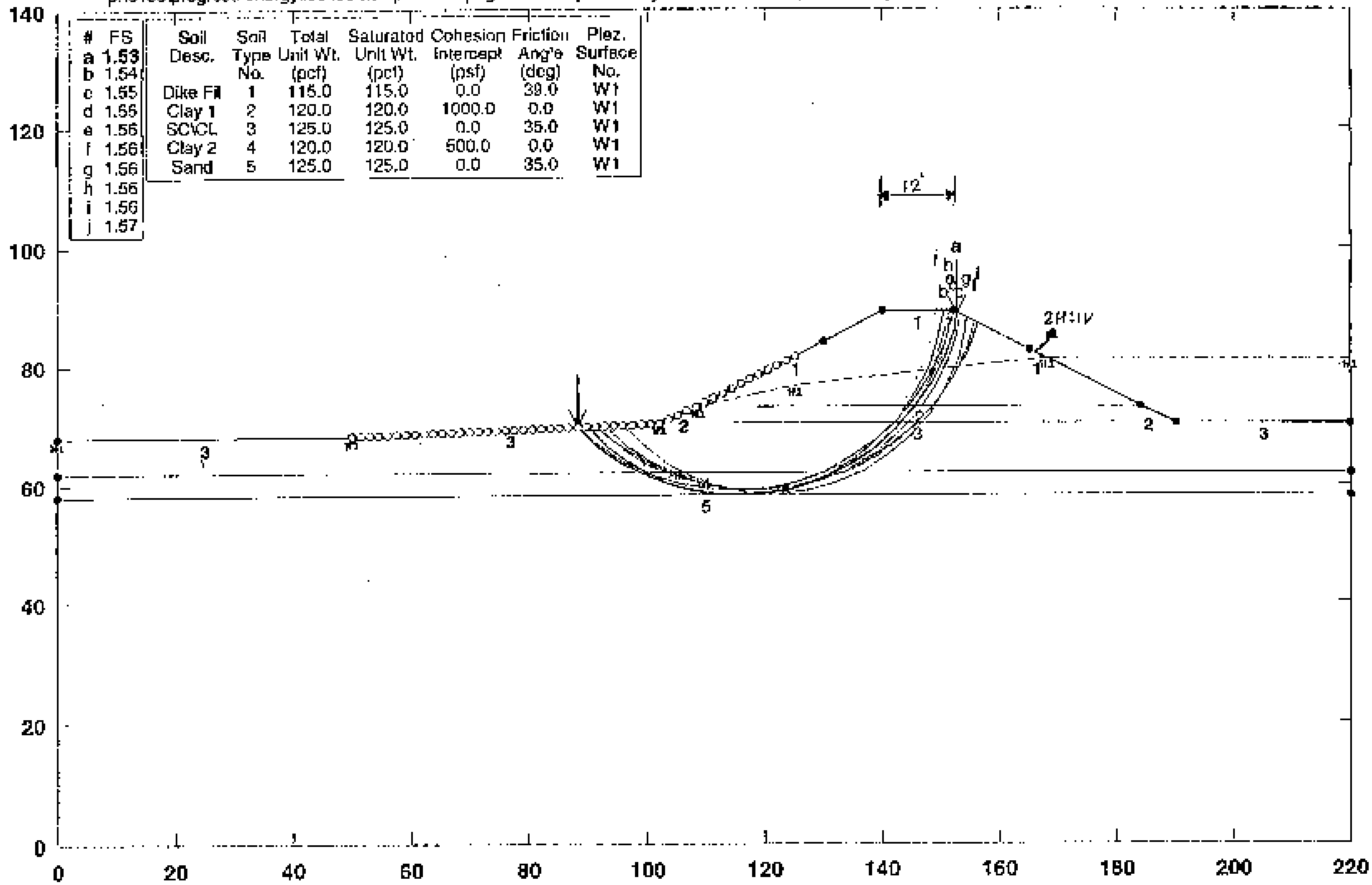
MACTEC

Lee Steam Electric Plant, Goldsboro Pond Elevation +81

p:\6468\progress energy\lee\lee ash pond seepage 2007\slope stability\stedwin\lee-7-10.pl2 Run By: Sharat Gollamudi, MACTEC 7/30/2010 02:20PM

#	FS
a	1.53
b	1.54
c	1.55
d	1.56
e	1.56
f	1.56
g	1.56
h	1.56
i	1.56
j	1.57

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Dike Fill	1	115.0	115.0	0.0	30.0	W1
Clay 1	2	120.0	120.0	1000.0	0.0	W1
SC\CL	3	125.0	125.0	0.0	35.0	W1
Clay 2	4	120.0	120.0	500.0	0.0	W1
Sand	5	125.0	125.0	0.0	35.0	W1



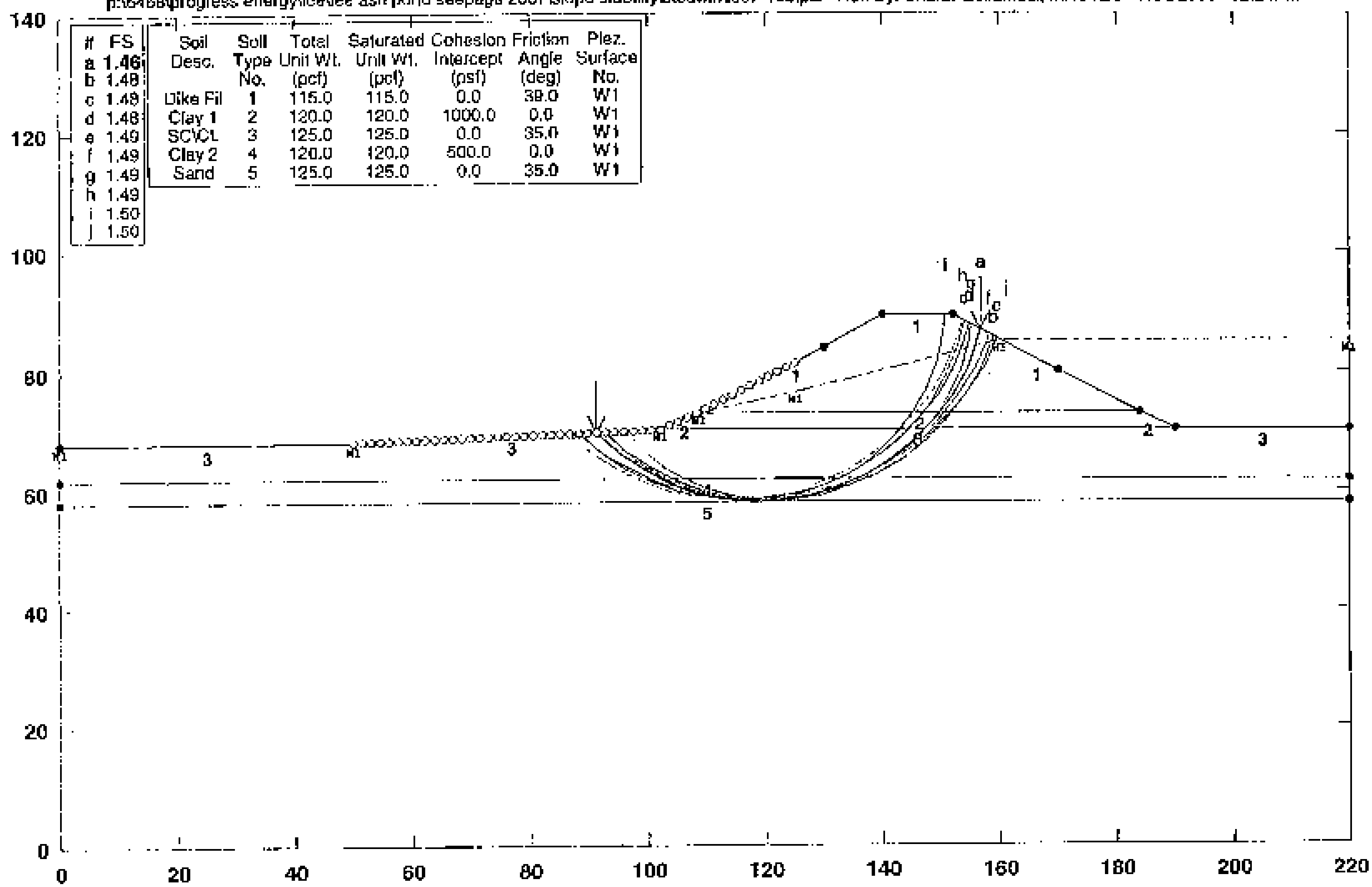
PCSTABL5M/si FSmin=1.53

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Steam Electric Plant, Goldsboro Pond Elevation +85

p:\6468\progress energy\lee\lee ash pond seepage 2007\slope stability\stedwin\lee7-10b.pl2 Run By: Sharat Gollamudi, MACTEC 7/30/2010 02:24PM



PCSTABL5M/si FSmin=1.46

Safety Factors Are Calculated By The Modified Bishop Method

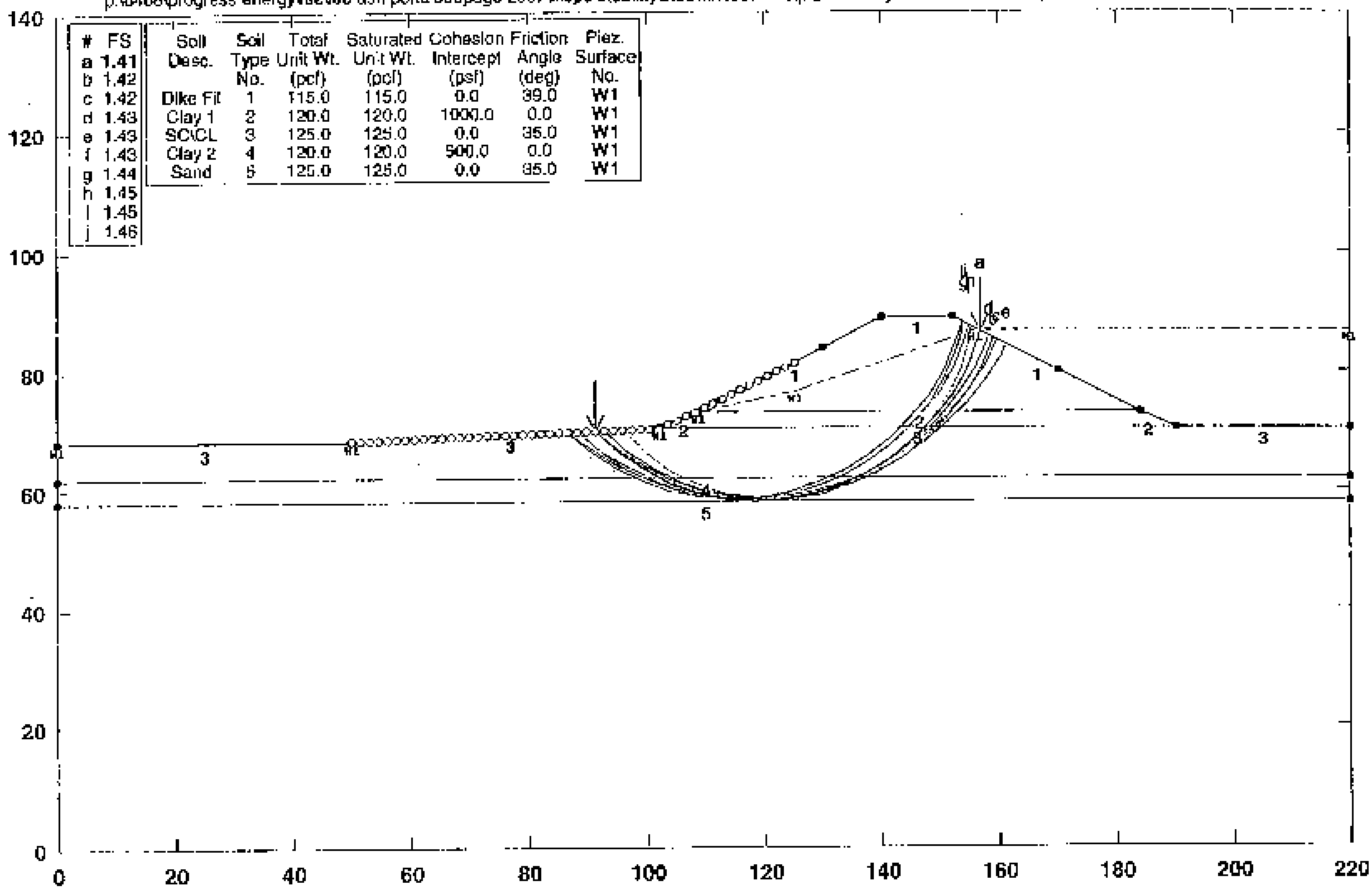
STED

Lee Steam Electric Plant, Goldsboro Pond Elevation +87

p:\6468\progress energy\lee\lee ash pond seepage 2007\slope stability\stedwin\lee7-10c.pl2 Run By: Sharat Gollamudi, MACTEC 7/30/2010 02:25PM

#	FS
a	1.41
b	1.42
c	1.42
d	1.43
e	1.43
f	1.43
g	1.44
h	1.45
i	1.45
j	1.46

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Dike Fill	1	115.0	115.0	0.0	39.0	W1
Clay 1	2	120.0	120.0	1000.0	0.0	W1
SC\CL	3	125.0	125.0	0.0	35.0	W1
Clay 2	4	120.0	120.0	500.0	0.0	W1
Sand	5	125.0	125.0	0.0	35.0	W1



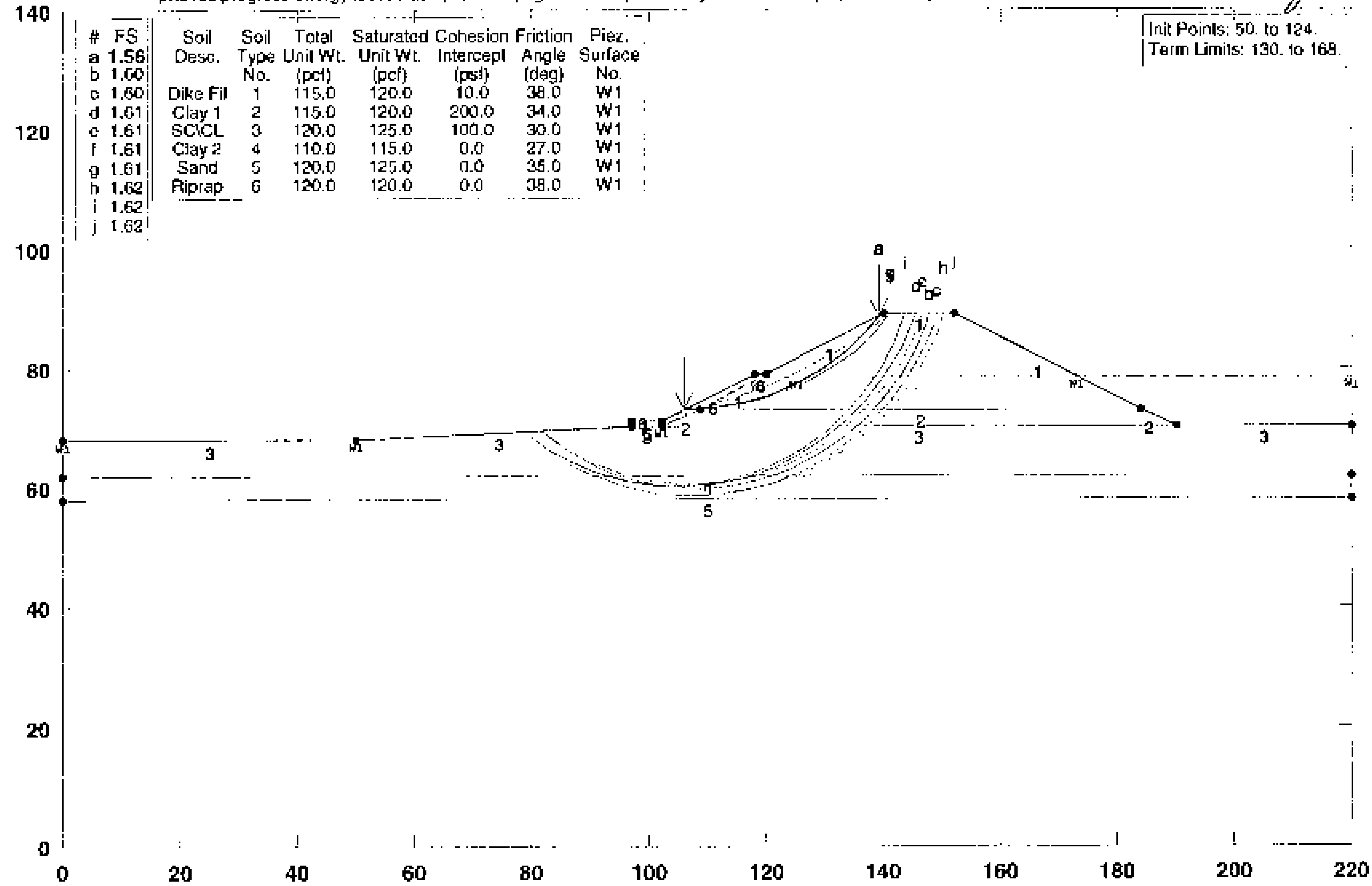
PCSTABL5M/si FSmin=1.41

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Steam Electric Plant, Goldsboro Pond El +78.5 - Riprap El +79

p:\6468\progress energy\lee\lee ash pond seepage 2007\slope stability\stedwin\lee-rip4.pl2 Run By: Sharat Gollamudi 1/21/2011 04:46PM



#	FS
a	1.56
b	1.60
c	1.60
d	1.61
e	1.61
f	1.61
g	1.61
h	1.62
i	1.62
j	1.62

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Dike Fil	1	115.0	120.0	10.0	38.0	W1
Clay 1	2	115.0	120.0	200.0	34.0	W1
SC\CL	3	120.0	125.0	100.0	30.0	W1
Clay 2	4	110.0	115.0	0.0	27.0	W1
Sand	5	120.0	125.0	0.0	35.0	W1
Riprap	6	120.0	120.0	0.0	38.0	W1

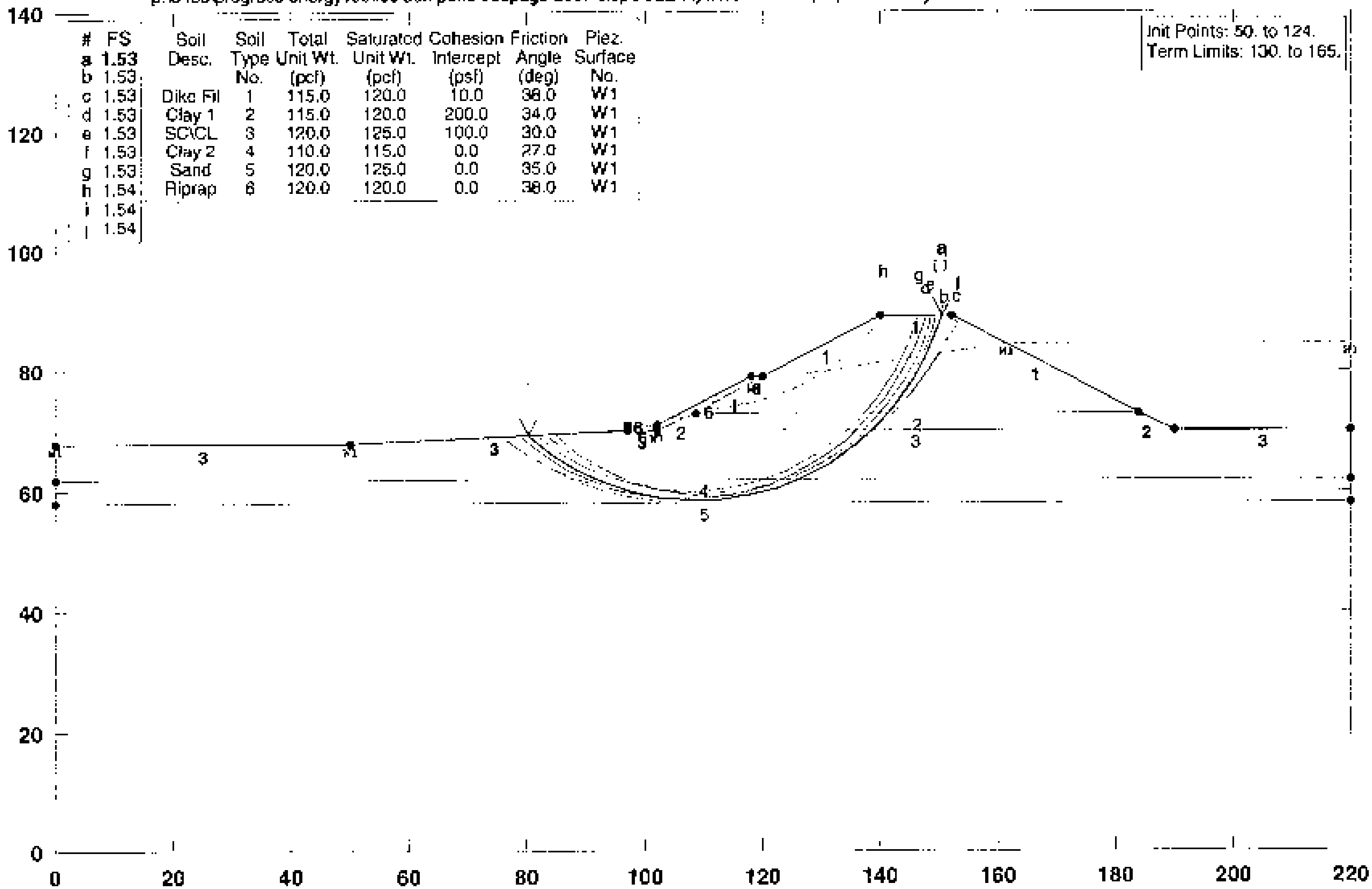
PCSTABL5M/si FSmin=1.56

Safety Factors Are Calculated By The Modified Bishop Method

STED

Lee Steam Electric Plant, Goldsboro Pond El +84.3 - Riprap El +79

p:\6468\progress energy\lee\lee ash pond seepage 2007\slope stability\stedwin\lee-rip2.pl2   Run By: Sharat Gollamudi   1/21/2011   04:32PM



PCSTABL5M/si FSmin=1.53
Safety Factors Are Calculated By The Modified Bishop Method

STED

APPENDIX A

Document 7

Monthly Inspections 1 of 2

File No. 13580-C

Date inspected (Month/Day/Year): August 10. 2009 Inspected by: Dennis Cole/ Ricky Miller

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry / Sunny

Was previous monthly report reviewed? This is the first official documented Inspection.

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Near 1Dike Crest	WO# 1609447	N/A
Overall condition of embankment/slopes		✓	Crest	WO#1609531	Holes/Ruts
Erosion control of exterior slopes		✓	South East Side	WO# 1609598	N/A
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Discharge Areas of Pond	WO# 1609603	N/A
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Gate at Pond Entry needs repair-WO# 1609540		

AUTHORIZED COPY

COMMENTS to August 10. 2009 Inactive Ash Pond Inspections

Although this is the first documented Inspection of the Inactive Ash Ponds, there have been ongoing inspections that were not documented.

All Dikes were in good condition with the exception of the minor issues noted and are to be addressed by the Pass Port Work Orders.

There was no seepage areas identified.

Overall the ponds are in good condition, but will need ongoing maintenance to keep dikes and throughways open to allow good inspections. The vegetation will need to be controlled to allow thorough inspections, but not destroyed as they prevent wind and water erosion.

Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): 9/4/2009 Inspected by: Dennis Cole
Dennis Cole 9/9/09

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Sunny and Dry

Was previous monthly report reviewed? yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Around Dike Crest	Work Order 1609447	N/A
Overall condition of embankment/slopes		✓	Crest near south east corner	work order 1609598	Gradual erosion
Erosion control of exterior slopes		✓	same as above	ref. work order above	same as above
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	South East side	work order 1609603	N/A
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			work will begin on crest growth next month		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

AUTHORIZED COPY

Lee Plant Active Ash Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 9/4/09 Inspected by: Dennis Cole Dennis Cole 9/9/09

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Sunny and Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	All Exterior Dikes	Awaiting Recommendations	Mactec to provide recommendations
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains		✓	North Side of Pond	removed on 9/8/09	Seasonal Issue
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments Pond is operating very well at this time.					

Keywords: emergency;dam inspection; EMG-LEEC-00007
Applies to: Lee Fossil Plant - Carolinas

AUTHORIZED COPY

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 9/4/09 Inspected by: Dennis Cole Dennis L Cole 9/9/09

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Sunny and Dry

Was previous monthly report reviewed? YES

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Around back side of lake	Awaiting MACTEC Recommendations	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike-East End	Work Order-1617653	These areas pose no environmental risk. The impact of leakage would be efficiency loss.
Seepage control of embankment/slopes		✓	north east side of lake	This area has been repaired and is doing very well.	
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)	✓				
Comments:					

Keywords: emergency; dam inspection; EMG-LEE-00007
Applies to: Lee Fossil Plant - Carolinas

AUTHORIZED COPY

Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): October 1, 2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear @ time of Inspection

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Edge of Crest	WO# 1609447 WIP	NA
Overall condition of embankment/slopes		✓	minor repairs needed on south east side	WO# 1609531	Gradual Erosion
Erosion control of exterior slopes		✓	Same as Above	WO# 1609598	Gradual Erosion
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				NA
Erosion control below outlet pipe in to discharge canal	✓				NA
Outlet discharge pipe to canal (corroded)		✓	Old Piping remains in Pond	WO# 1609603	NA
Seepage control of embankment/slopes (in particular along base of north dike)	✓				NA
Ensure the old pond spillways are blocked and not discharging	✓		No Issues-WO# 1609603 will remove any risk	WO# 1609603 has been written to address	NA
Dike Cap (cracks)	✓				NA
Comments:			Work will begin on Gate repair WO# 1609540		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

AUTHORIZED COPY

File Point: 13580-C

Date inspected (Month/Day/Year): October 1, 2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear Weather

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	trees on dike toe	Awaiting Quotes from Rowe Tree Company	NA
Overall condition of pond (overflow likely)	✓		Slight rise of water on south side	Daily Inspections-Maintain with Backhoe	NA
Erosion control of exterior slopes	✓		All slopes look good		NA
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓		All slopes look good		NA
Seepage control of embankment/slopes	✓		Repair Area looks good		NA
Any beaver dams blocking flows at toes drains		✓	Some Dams Exist	Backhoe will need to be used to remove	NA
Pipe from primary basin to secondary basin operating correctly	✓		Looked Good		NA
Pond Spillway (blocked or plugged)	✓		Good Condition		NA
Comments			Overall conditions look good. Need to continue to monitor level on south side		

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): October, 1 2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Exterior Dike of Cooling Pond	Contract set up with Byrd's Landscaping to remove growth	N/A
Overall condition of pond (overflow likely)	✓				N/A
Erosion control of exterior slopes		✓	Center Dike Erosion	work order # 0167653	Gradual erosion
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				N/A
Seepage control of embankment/slopes	✓				N/A
Any beaver dams blocking flows at toes drains or other areas	✓				N/A
Discharge structures to ensure no leakage	✓		Looks good at this time		N/A
Pond Spillway (blocked or plugged)		✓	Need to remove growth &Vegetation	Work Order to be written	N/A
Comments:			CP area looks good. No concerns at this time		

Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): November 4, 2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Growth on Edge	WO# 1609447 WIP	NA
Overall condition of embankment/slopes		✓	minor repairs needed on south east side	WO# 1609598	NA
Erosion control of exterior slopes		✓	Minor Erosion	WO# 1609598	NA
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				NA
Erosion control below outlet pipe in to discharge canal	✓				NA
Outlet discharge pipe to canal (corroded)		✓	Non Functional Piping remains in Pond	WO# 1609603	NA
Seepage control of embankment/slopes (in particular along base of north dike)	✓				NA
Ensure the old pond spillways are blocked and not discharging	✓		No Issues-WO# 1609603 will remove any risk	WO# 1609603 has been written to address	NA
Dike Cap (cracks)		✓	Minor Erosion	WO# 1609531	NA
Comments:			Gate repair WO# 1609540 is complete		

Lee Plant Active Ash Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): November 4, 2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	trees on dike toe	Rowe Tree Company to remove per contract	NA
Overall condition of pond (overflow likely)	✓		Close Monitoring of ditch on North side	Daily Inspections-Maintain with Backhoe	NA
Erosion control of exterior slopes	✓				NA
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				NA
Seepage control of embankment/slopes	✓		Repair Area looks good	Dry considering recent rainfall	NA
Any beaver dams blocking flows at toes drains		✓	Some Dams Exist	WIP by Fuel Handling	NA
Pipe from primary basin to secondary basin operating correctly	✓		Cleaned out the sample pipe	Fuel Handling	NA
Pond Spillway (blocked or plugged)	✓				NA
Comments			Overall conditions look good. Need to continue to monitor level on North side		

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): November 4, 2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Exterior Dike	Contractor to clear in November.	General Growth
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike has areas identified for repairs.	WO# 0167653 written to address.	No Environmental Risk
Seepage control of embankment/slopes	✓				Repair Area looked dry and well maintained
Any beaver dams blocking flows at toes drains or other areas	✓			WIP by Fuel Handling	NA
Discharge structures to ensure no leakage	✓				NA
Pond Spillway (blocked or plugged)		✓	Spillway needs cleaning	WO# 1650772 written to address	
Comments:			Cooling Pond is in good condition.		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File No. 13580-C

Date inspected (Month/Day/Year): 12/2/2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cloudy/Overcast

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Interior Dikes	Trimming- WO# 1609447	N/A
Overall condition of embankment/slopes		✓	Minor repairs needed. No change	WO# 1609598	N/A
Erosion control of exterior slopes		✓	Minor Erosion	WO# 1609598	N/A
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				N/A
Erosion control below outlet pipe in to discharge canal	✓				N/A
Outlet discharge pipe to canal (corroded)		✓	Non-Functional Piping remains	WO# 1609603	N/A
Seepage control of embankment/slopes (in particular along base of north dike)	✓				N/A
Ensure the old pond spillways are blocked and not discharging	✓				N/A
Dike Cap (cracks)		✓	Minor Erosion	WO# 1609531	N/A
Comments:			Conditions are improving as work continues		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File Point: 13580-C

Date inspected (Month/Day/Year): 12/3/2009 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cloudy/ Overcast (Heavy Rains Last Evening)

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Dike Exterior	Rowe Tree Co. is removing trees	N/A
Overall condition of pond (overflow likely)	✓				N/A
Erosion control of exterior slopes	✓				N/A
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				N/A
Seepage control of embankment/slopes	✓		Repair area looks good.		N/A
Any beaver dams blocking flows at toes drains	✓		Worked this week. Trapping will begin next week.		N/A
Pipe from primary basin to secondary basin operating correctly	✓				N/A
Pond Spillway (blocked or plugged)	✓				Flow was good and water clear.
Comments			Overall condition of pond is good. Flow appears to be going to center of	pond.	

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 12/4/2009 Inspected by: Dennis Cole Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Sunny and Breezy

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Dike Exterior	Byrd Landscaping to begin clearing on 12/7/09	General Growth
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike areas identified for repair	WO# 0167653 to address	No Environmental Risk
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				Areas look dry on 1st section and 2nd section wet from rain
Pond Spillway (blocked or plugged)		✓	Vegation needs to be removed when possible	WO# 1650772	
Comments:		Repair Area on Dike looks good	Cooling Pond is in very good condition.	Center Dike repairs coming soon.	

Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): 1/4/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cold/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Around Perimeter	WO# 1609447	N/A
Overall condition of embankment/slopes		✓	South east Corner	WO# 1609598-Materials on site.	N/A
Erosion control of exterior slopes		✓	Same as above	Same as above	N/A
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Discharge areas	WO#1609603	N/A
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓			Areas have repaired	N/A
Comments:			Dike Crest much improved-No Issues		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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Lee Plant Active Ash Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 1/4/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cold/Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓			All trees and growth removed	N/A
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓		South East Corner	Repair Area looks good-No excess water	N/A
Any beaver dams blocking flows at toes drains	✓		Some Activity on the north and east sides	Dams are being removed as required	N/A
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				Water is restricted due to river levels.
Comments		There is some small flow on east end of berm	Pond looks good & is flowing in the right direction	Trans Ash came in during December and cleaned out ditch. 12/19/2009	

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 01/4/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cold and Dry

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓			Byrd Landscaping & Rowe Tree completed clearing on 12/30/09	General Growth
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓			WO# 0167653 completed by FH Crew Center Dike concerns have been repaired for now.	
Seepage control of embankment/slopes	✓				Repair Area looked good
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				Areas looked good
Pond Spillway (blocked or plugged)		✓	Vegation needs to be removed when possible	WO# 1650772	
Comments:		No issues on repair area	Cooling Pond is cleared of trees and vegetation	Center Dike repairs complete as well.	

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File No. 13580-C

Date inspected (Month/Day/Year): 2/12/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cloudy/Cold

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Lake Perimeter	W/O# 1609447	
Overall condition of embankment/slopes		✓	South East Corner	WO# 1609598-Material is on site	
Erosion control of exterior slopes		✓	Same as Above	Same as Above	
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Discharge Areas	WO# 1609603	
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			minimal water standing considering recent	heavy rains.	

File Point: 13580-C

Date inspected (Month/Day/Year): 2/4/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cloudy/Cold

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				Repair Area under water due to river level
Any beaver dams blocking flows at toes drains	✓				Underwater due to river level
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				Flow coming out in spite of high river level
Comments					

File Point: 13580-C

Date inspected (Month/Day/Year): 2/12/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Clear/Cold

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓			Bryd completed trimming	
Overall condition of pond (overflow likely)	✓				Pond Level Low-79' 1"
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	center dike has small areas that will need work in coming months		No Environmental Impact
Seepage control of embankment/slopes		✓	Repair Area seems to have more seepage	WO#-1710623 See Comments Below	
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				No Issues-currently under water-river level
Pond Spillway (blocked or plugged)		✓	Vegetation and Sand Build-up	WO# 1650772 written to address issues	
Comments:			Repair area has new seepage-no significant silt	movement.	

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File No. 13580-C

Date inspected (Month/Day/Year): 3/15/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry/Sunny

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Perimeter of pond	WO-1609447	
Overall condition of embankment/slopes		✓	South East Corner	WO-1609598-Material on site	
Erosion control of exterior slopes		✓	Same as above	Same as above	
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Discharge Area	WO-1609603	
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:					

Lee Plant Active Ash Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 3/15/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry/Sunny

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				Vegetation beginning to grow
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains	✓				No Observed activity
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				River Level high
Comments					

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 3/15/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry/Sunny

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				Pond Level Okay
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓		Minor Areas on Center Dike need to be repaired		No Environmental Issues
Seepage control of embankment/slopes		✓	Repair Area	Inspection reveals no change in flow from last month	
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Sand and debris @ concrete structure	WO# 1650772	
Comments:					

Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): 4/08/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Perimeter of pond	WO-1609447	Slotted
Overall condition of embankment/slopes		✓	South East Corner	WO-1609598-Material on site	Slotted
Erosion control of exterior slopes		✓	Same as above	Same as above	Slotted
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Old Discharge Area	WO-1609603	Slotted
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver Dam removed.		

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File Point: 13580-C

Date inspected (Month/Day/Year): 4/08/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Area around lake and repair area	mow next month	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains	✓				Under control at this time
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments			Stacking plan in progress		

File Point: 13580-C

Date inspected (Month/Day/Year): 4/08/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike	Repair as needed	No Environmental Issues
Seepage control of embankment/slopes		✓	Repair Area	Still minor flow less than last month	Continue to monitor
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Sand and debris @ concrete structure	WO# 1650772	River Level remains high
Comments:					

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APPENDIX A

Document 8

Monthly Inspections 2 of 2

Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): 5/4/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Perimeter of Pond	WO# 1609447	Slotted
Overall condition of embankment/slopes		✓	South East Corner of Pond	WO# 1609598-Material on site	Slotted
Erosion control of exterior slopes		✓	Same as above	Same as above	Slotted
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Old Discharge Area	WO# 1609603	
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver Dams will soon need attention		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File Point: 13580-C

Date inspected (Month/Day/Year): 5/4/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains	✓				
Pipe from primary basin to secondary basin operating correctly	✓				Weir Tube needs to be replaced.
Pond Spillway (blocked or plugged)	✓				
Comments			Stacking Plan in Progress		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File Point: 13580-C

Date inspected (Month/Day/Year): 5/5/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike	Repair as needed	No Environmental Issues
Seepage control of embankment/slopes		✓	Repair Area	Minor Flow	Monitor
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Sand and Debris on concrete structure	WO# 1650772	Slotted
Comments:					

File No. 13580-C

Date inspected (Month/Day/Year): 6/14/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Perimeter of Pond	WO# 1609447	Slotted
Overall condition of embankment/slopes		✓	South East Corner of Pond	WO# 1609598	Slotted
Erosion control of exterior slopes		✓	Same as above	Same as Above	Slotted
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Old Discharge Area	WO# 1609603	
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver Dams-Dry Conditions/Low Risk		

File Point: 13580-C

Date inspected (Month/Day/Year): 6/7/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Internal/External Dikes	Mowing is underway	N/A
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains		✓	Ditches	Beaver Dams currently being removed	
Pipe from primary basin to secondary basin operating correctly		✓	Decaunter	Small Hole repaired WO# 1767808	
Pond Spillway (blocked or plugged)	✓				
Comments			Ash Pond in very good Condition		

File Point: 13580-C

Date inspected (Month/Day/Year): 6/7/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike	Repair as needed-There are no significant erosion areas at this time	No Environmental Issues
Seepage control of embankment/slopes		✓	Repair Area	Minor Flow	Monitor
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Clean up needed on Spillway	WO# 1650772	Slotted
Comments:			Spraying for weeds currently underway		

File No. 13580-C

Date inspected (Month/Day/Year): 7/9/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Warm/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	perimeter of pond	WO # 1609447 Mowing Underway	
Overall condition of embankment/slopes		✓	SE corner of pond	WO # 1609598	
Erosion control of exterior slopes		✓	same as above	same as above	
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Old Discharge Area	WO # 1609603	
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver dams-low risk in summer		

File Point: 13580-C

Date inspected (Month/Day/Year): 7/9/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Seasonal Growth on Dikes	Mowing every two weeks	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				
Any beaver dams blocking flows at toes drains		✓	North Side	Dams were removed two days after inspection	
Pipe from primary basin to secondary basin operating correctly	✓				hole in decaunter was repaired.
Pond Spillway (blocked or plugged)	✓				
Comments					

File Point: 13580-C

Date inspected (Month/Day/Year): 7/9/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike	Small washed-Handle on as needed basis	No Environmental Threat
Seepage control of embankment/slopes		✓	Small area of repair area flowing	Monitor flow	Monitor
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Concrete Area	To be cleaned-WO#-1650772	Slotted
Comments:					

File No. 13580-C

Date inspected (Month/Day/Year): 8/11/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Warm/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	perimeter of pond	WO # 1609447 Mowing Underway	
Overall condition of embankment/slopes		✓	SE corner of pond	WO # 1609598	
Erosion control of exterior slopes		✓	same as above	same as above	
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)		✓	Old Discharge Area	WO # 1609603	
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver dams still present-low risk in summer		

File Point: 13580-C

Date inspected (Month/Day/Year): 8/16/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry/Warm

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Seasonal Growth on Dikes	Mowing every two weeks	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				Seepage area is dry
Any beaver dams blocking flows at toes drains	✓	✓			Dams were removed a week ago
Pipe from primary basin to secondary basin operating correctly	✓				hole in decaunter was repaired.
Pond Spillway (blocked or plugged)	✓				
Comments					

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File Point: 13580-C

Date inspected (Month/Day/Year): 8/16/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry/Warm

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓			
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Center Dike	Small washed-Handle on as needed basis	No Environmental Impact
Seepage control of embankment/slopes		✓	Small area of repair area flowing	May need to make repairs	Monitor and address as required
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Concrete Area	To be cleaned-WO#-1650772	Slotted
Comments:					

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Lee Plant Inactive Ash Pond Monthly Inspection Form

File No. 13580-C

Date inspected (Month/Day/Year): 9/15/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot/Dry

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	perimeter of pond	WO # 1609447 Mowing Underway	
Overall condition of embankment/slopes		✓	SE corner of pond	WO # 1609598	No Change
Erosion control of exterior slopes		✓	same as above	same as above	
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)	✓		Old Discharge Area	WO # 1609603	Out of Service
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver dams-low risk in summer-no water in the area.		

File Point: 13580-C

Date inspected (Month/Day/Year): 9/13/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry/very hot

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Seasonal Growth on Dikes	Mowing every two weeks	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes	✓				Seepage area is dry
Any beaver dams blocking flows at toes drains	✓				Several dams were removed this month
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments			Ash Pond performing very well		

File Point: 13580-C

Date inspected (Month/Day/Year): 9/13/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Hot and Very Dry

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Weeds on Dike	Have been sprayed	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Small areas on the Center Dike	To be repaired as needed.	
Seepage control of embankment/slopes		✓	Small area of repair area flowing	Repairs scheduled for this week.	Monitor daily
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)		✓	Concrete Area-Spillway Area	To be cleaned-WO#-1650772	Slotted
Comments:					

File No. 13580-C

Date inspected (Month/Day/Year): 10/12/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry

Was previous monthly report reviewed? yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	perimeter of pond	partially mowed Mowing will resume	
Overall condition of embankment/slopes		✓	SE Corner of Pond	WO# ~~1609447~~ 1609598	Condition Unchanged
Erosion control of exterior slopes		✓	Same as Above	Same as Above	Condition Unchanged
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)	✓		Abandoned Discharge Area	WO# 1609603	No Issues No Change
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver Dams are present-Low risk/impact	Beaver Dams will be removed by years end	

File Point: 13580-C

Date inspected (Month/Day/Year): 10/12/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Outside Perimeter	Rowe Tree Co. on site working	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes		✓	140' of dike beside repair area	Mactech to inspect & make recommedations	
Any beaver dams blocking flows at toes drains		✓	North side	Maintenance on weekly basis. Trapping will soon resume.	
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓		Seepage area may have been -	wet due to the recent heavy rains.	
Comments					

File Point: 13580-C

Date inspected (Month/Day/Year): 10/12/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry Conditions

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓		perimeter of pond	spraying has been effective. Hand work required to complete.	
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	small areas on center dike	repair as needed	No Change No Environmental Risk
Seepage control of embankment/slopes		✓	minor seepage No Silt movement	Repair has been completed.	No silt movement
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)	✓				Spillway has been cleaned. Work order complete.
Comments:					

File No. 13580-C

Date inspected (Month/Day/Year): 11/30/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cool

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Perimeter of pond	mowing in spring	
Overall condition of embankment/slopes		✓	SE Corner of pond	WO# 1609598	Condition unchanged
Erosion control of exterior slopes		✓	Same as above	Same as above	Condition unchanged
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)	✓		Abandoned Discharge pipe	WO# 1609603	No issues No Change
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver Dams will be removed before next inspection		

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Lee Plant Active Ash Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 11/30/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry Cool Breezy

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes		✓	Plan to repair east side	awaiting state approval	
Any beaver dams blocking flows at toes drains	✓				
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments					

Lee Plant Cooling Pond Monthly Inspection Form

File Point: 13580-C

Date inspected (Month/Day/Year): 11/30/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Dry Cool Brezzy

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Small Areas on the center dike	material is being ordered to make repairs	No Environmental Risk
Seepage control of embankment/slopes		✓	Repair Area	Observations Weekly	No Silt Movement
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)	✓				
Comments:					

File No. 13580-C

Date inspected (Month/Day/Year): 12/16/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cool

Was previous monthly report reviewed? Yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees		✓	Perimeter of pond	mowing in spring	
Overall condition of embankment/slopes		✓	SE Corner of pond	WO# 1609598	Condition unchanged
Erosion control of exterior slopes		✓	Same as above	Same as above	Condition unchanged
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)	✓		Abandoned Discharge pipe	WO# 1609603	No issues No Change
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Beaver Dams will be removed as needed		

File Point: 13580-C

Date inspected (Month/Day/Year): 12/16/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cool

Was previous monthly report reviewed? Yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes		✓	East Side SE Corner on Pond	awaiting Repair Plan approval	Materials being Staged
Any beaver dams blocking flows at toes drains	✓				
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments					

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File Point: 13580-C

Date inspected (Month/Day/Year): 12/16/2010 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cool

Was previous monthly report reviewed? Yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)		✓	Small Areas on the center dike	material is being Stockpiled to make repairs	No Environmental Risk
Seepage control of embankment/slopes		✓	Repair Area	Observations Weekly	No Silt Movement
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)	✓				
Comments:			57 Stone Class B Rip/Rap Fabric now on site		

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File No. 13580-C

Date inspected (Month/Day/Year): January 2011 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cols/Dry Ground wet from recent ice storms

Was previous monthly report reviewed? yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓		perimeter of ponds	mowing to be performed in the spring	
Overall condition of embankment/slopes		✓	SE Corner of pond	WO# 1609598	No Change
Erosion control of exterior slopes		✓	SE Corner of pond	WO# 1609598	No Change
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)	✓		Abandoned Discharge Pipe	WO# 1609603	No Issue No Change
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Surveyor work in progress. New plant work	Beaver Dams have not been removed yet.	

Keywords: environmental; dam inspection; EVC-LEEC-00033
Applies to: Lee Fossil Plant - Carolinas

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File Point: 13580-C

Date inspected (Month/Day/Year): January 2011 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cold/Dry Ground wet from recent ice storms

Was previous monthly report reviewed? yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				Looks good
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes		✓	East side south east corner	Repair plan has been submitted	Materials are staged
Any beaver dams blocking flows at toes drains	✓				
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments			All flows look good		

File Point: 13580-C

Date inspected (Month/Day/Year): January 2011 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Cold/Dry Ground wet from recent ice storms

Was previous monthly report reviewed? yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓		Repairs have been made		
Seepage control of embankment/slopes		✓	Repair Area-North Side	Weekly Observations	No Silt movement
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)	✓				
Comments:					

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File No. 13580-C

Date inspected (Month/Day/Year): February15, 2011 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Warm/Dry

Was previous monthly report reviewed? yes

Inactive Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓		perimeter of ponds	Work is underway	
Overall condition of embankment/slopes		✓	SE Corner of pond	WO# 1609598	No Change
Erosion control of exterior slopes		✓	SE Corner of pond	WO# 1609598	No Change
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Erosion control below outlet pipe in to discharge canal	✓				
Outlet discharge pipe to canal (corroded)	✓		Abandoned Discharge Pipe	WO# 1609603	No Issue No Change
Seepage control of embankment/slopes (in particular along base of north dike)	✓				
Ensure the old pond spillways are blocked and not discharging	✓				
Dike Cap (cracks)	✓				
Comments:			Surveyors are still working	Beaver Dams have been removed.	

File Point: 13580-C

Date inspected (Month/Day/Year): February 15, 2011 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Warm/Dry

Was previous monthly report reviewed? yes

Active Ash Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes		✓	East side south east corner	Repair plan has been re-submitted to the State	Materials are staged
Any beaver dams blocking flows at toes drains	✓				
Pipe from primary basin to secondary basin operating correctly	✓				
Pond Spillway (blocked or plugged)	✓				
Comments			Pond is doing very well.		

AUTHORIZED COPY

File Point: 13580-C

Date inspected (Month/Day/Year): February 15, 2011 Inspected by: Dennis Cole

Conditions/Weather around time of Inspection (If possible, perform inspection during dry weather):

Warm/Dry

Was previous monthly report reviewed? yes

Cooling Pond:

Parameter to be Inspected	Condition		Location of Problem	Corrective Action Taken (i.e., work order submitted)	Comments - Any early warning signs?
	No Issues	Issues Exist			
Vegetation Growth, including trees	✓				
Overall condition of pond (overflow likely)	✓				
Erosion control of exterior slopes	✓				
Erosion control of interior banks/slopes (wave-induced beaching erosion or from animal burrows)	✓				
Seepage control of embankment/slopes		✓	Repair Area-North Side	Weekly Observations	No Silt movement Observed
Any beaver dams blocking flows at toes drains or other areas	✓				
Discharge structures to ensure no leakage	✓				
Pond Spillway (blocked or plugged)	✓				
Comments:					

APPENDIX A

Document 9

Lee Plant Historical Document

LAW

LAWGIBB Group Member

**INDEPENDENT CONSULTANT INSPECTION
COOLING POND DIKE, ASH POND DIKE
H. F. LEE ELECTRIC GENERATING PLANT
WAYNE COUNTY, NORTH CAROLINA**

HISTORICAL VOLUME

Prepared For:

CAROLINA POWER & LIGHT COMPANY
Raleigh, North Carolina

Prepared By:

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
Raleigh, North Carolina

December 22, 1999

Law Project No. 30720-9-3525

CAROLINA POWER & LIGHT COMPANY

H. F. LEE ELECTRIC GENERATING PLANT

COOLING POND DIKE
ASH POND DIKE

WAYNE COUNTY, NORTH CAROLINA

LAW PROJECT NO. 30720-9-3525

December 22, 1999

HISTORICAL VOLUME

BY LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

REPORT PREPARED BY

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NOTE: THIS VOLUME INCLUDES INFORMATION RELATED TO THE DESIGN, CONSTRUCTION AND CLASSIFICATION OF THE COOLING POND DIKE AND ASH POND DIKE, AND SERVES AS A SUPPLEMENT TO THE FIVE-YEAR INDEPENDENT CONSULTANT INSPECTION REPORT.

HISTORICAL VOLUME

TABLE OF CONTENTS

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1.0 PROJECT INFORMATION

This "Historical Volume" of the 1999 Independent Consultant Inspection of the H. F. Lee Electric Generating Plant Cooling Pond Dike and Ash Pond Dike contains general information about the design, construction and operations of the dikes. The information contained herein is substantially compiled from the 1994 Independent Consultant Inspection Report(1)*. Improvements to the dikes, operations modifications, and supplemental engineering studies completed since 1994 are discussed in the "Inspection Volume" of the 1999 Independent Consultant Inspection.

1.1 Location

The H. F. Lee Electric Generating Plant and the cooling pond are located on a peninsula formed by a large U-shaped bend (Quaker Neck) of the Neuse River in Wayne County, about 4.5 miles west of Goldsboro, North Carolina. The ash pond is located on the north side of the bend, across the river from the cooling pond. Access to the plant is by means of SR 1007 and Carolina Power & Light's road connecting thereto. Exhibit 1 shows the location of the plant, cooling pond and ash pond on the Northwest Goldsboro and Southwest Goldsboro USGS 7-1/2 minute quadrangle maps. The latitudes and longitudes of the cooling pond and ash pond are as follows:

Cooling Pond	N 35° 22' 28",	W 78° 4' 30"
Ash Pond	N 35° 22' 28",	W 78° 4' 15"

1.2 General Description

1.2.1 Cooling Pond Dike

Exhibit 2 is a plan of the cooling pond and appurtenant structures. The total length of the outer dike is 4.6 miles and the volume of water stored at the design normal water level, elevation 80.0

*Numbers in parentheses refer to references listed in Section 3.0.

feet mean sea level (msl), is 3,808 acre-feet with a corresponding surface area of 545 acres. The maximum and minimum depths of the pond are 15 feet and 4 feet, respectively. The dike crest has a 10-foot width at elevation 83.0 feet msl.

The pond contains internal diversion and skimmer dikes to increase circulation of cooling water and aid in temperature control. The length of the diversion dike is 1.6 miles and that of the skimmer dike is 0.17 miles. These dikes have 3(H):1(V) side slopes and asphaltic concrete protection on both sides. An earthen dike that impounds the coal storage runoff for release into the cooling pond is located on the western side of the cooling pond north of the discharge structure. These dikes are not of concern with respect to the safety of the Cooling Pond Dike.

Exhibit 3 shows typical section views. The perimeter dike is constructed of compacted sand with an interior slope facing of compacted clay topped by an asphaltic concrete wave protection blanket. Design slopes are 3(H):1(V) on both interior and exterior slopes.

In 1986, broken or damaged sections of the asphaltic concrete wave protection blanket were repaired by placing a blanket of rip-rap underlain by a filter fabric on the interior slope from the toe to approximately elevation 80 feet msl. Repairs continued between 1990 and 1992, ultimately creating a wave protection zone of fabric and rip-rap along the entire length of the perimeter, diversion and skimmer dikes.

Water is pumped from the Neuse River into the cooling pond by two pumps located at the reservoir make-up structure. A re-circulation system constructed in 1973 takes water directly from the pond to the river intake distribution structure, so that the pond operates as a closed-cycle circulating water system with a normal pond level maintained between elevation 78.5 feet msl and 79.2 feet msl. Exhibits 4 and 5 show the plan and details of the re-circulation modifications.

The original construction included a gated, concrete spillway and two discharge structures discharging to the Neuse River. The two discharge structures are now sealed to prevent leakage from the pond into the river, which would violate CP&L's NPDES permit. The gated spillway is operational, but has seen only very limited use since construction of the recirculation system in 1973. The gates are closed under normal operating conditions.

Two circulating water discharge structures are located at the west end of the cooling pond. Cooling water pumped from the plant discharges into the cooling pond from these structures. The two structures are concrete boxes, side by side, with each structure approximately 17 feet across the face, 14 feet high and extending 21 feet into the bank of the cooling pond. The structures were constructed of cast-in-place reinforced concrete. A 66-inch diameter reinforced concrete pipe penetrates the rear wall of each structure.

1.2.2 Ash Pond Dike

Exhibit 6 is a plan of the Ash Pond Dike. The total length of the dike is 2.0 miles and the volume of water or ash stored at the present water level, elevation 81.0 feet msl, is 1,000 acre-feet with a surface area of 143 acres. The water level of the pond is constantly maintained by a metal skimmer-type spillway that discharges into a small secondary settling basin. A second skimmer spillway discharges from the settling pond into the Neuse River. The dike is designed for an ultimate operating level of elevation 88.0 feet msl which provides a storage of 1,980 acre-feet. The dike crest is 12 feet wide at elevation 90.0 feet msl. Design side slopes are 2(H):1(V). Typical sections are shown on Exhibit 7.

1.3 Size Classifications

The size classifications used in this summary as a basis for inspection considerations are those defined by the U.S. Army Corps of Engineers' Guidelines for Dam Safety Inspection[2]. The State of North Carolina has established a different size classification system under regulations in North Carolina Administrative Code Tile 15, Subchapter 2K, Section .0205(15 NCAC2K.0205)[3]. For informational purposes, the North Carolina size classifications are also given. Size classifications consider both storage volume and dam height, with the larger size governing. The table below summarizes the classification ranges for reference:

	CORPS OF ENGINEERS CLASSIFICATION			NORTH CAROLINA DAM SAFETY REGULATIONS CLASSIFICATION			
	SMALL	INTERMEDIATE	LARGE	SMALL	MEDIUM	LARGE	VERY LARGE
Storage Acre-Feet	50-1,000	1,000-5000	>50,000	<750	750-7,500	7,500-50,000	>50,000
Height, Feet	25-40	40-100	>100	<35	35-50	50-100	>100

The size classification for the Cooling Pond Dike and Ash Pond Dike at the Lee Plant are summarized below:

STRUCTURE	APPROXIMATE STORAGE (acre-feet)	HEIGHT (feet)	SIZE CLASSIFICATION: CORPS OF ENGINEERS	SIZE CLASSIFICATION: NORTH CAROLINA DAM SAFETY REGULATIONS
Cooling Pond Dike	5,446	17	Intermediate	Medium
Ash Pond Dike	2,020	20	Intermediate	Medium

1.4 Hazard Classifications

1.4.1 Cooling Pond Dike

The Corps of Engineers[2] considers potential for loss of life and damage to downstream features in evaluating hazard potential of a dam. In the event of a dike failure, water would flow directly into the Neuse River and its flood plain or the discharge channel leading to the river.

There are a few residential structures across the river, south of the pond, along SR 1008. These structures appear to be above elevation 75 feet msl. In the event of a dike failure during a time of normal river flow, there is adequate storage in the river flood plain below elevation 75 feet msl to accommodate all the cooling pond water. The flood wave could cause temporary flooding over State Road 1008 at the bridge across the Neuse River about 3/4 miles below the junction of the discharge canal and the dike. The potential for loss of life appears minimal.

If a dike failure were to occur at a time when the Neuse River was flooding, the additional water would not be noticeable. As discussed in Section 1.7, even a 10-year frequency flood would be at elevation ranging from 73.8 feet msl to 78.2 feet msl around the dike. The effects of a dike failure are not likely to have any greater impact than potential natural events.

Because of the negligible potential for loss of life, but because some damage to downstream features could occur, we believe the appropriate hazard classification for the Cooling Pond Dike is "significant" under the Corps of Engineers Guidelines, and "intermediate" under the North Carolina Dam Safety Regulations.

1.4.2 Ash Pond Dike

A failure of the Ash Pond Dike would also release water directly into the Neuse River and the adjacent flood plain. The entire contents of the ash pond can be stored in the flood plain below elevation 75.0 feet msl. There are no residences in the area of likely inundation. Based on the limited potential for damage, we believe a hazard classification of "low" is appropriate under both the Corps of Engineers' guidelines and the North Carolina Dam Safety Regulations.

1.5 Historical and Subsurface Information

1.5.1 Cooling Pond Dike

The Cooling Pond Dike and appurtenant structures were designed by Ebasco Services, Inc. in 1960. Subsurface explorations were conducted by Eustis Engineering Company of Metairie, Louisiana under the supervision of Ebasco.

Construction of the pond was done under the direction and supervision of Ebasco Services, Inc. The construction was completed in 1961 and the pond was first filled in December 1961.

On September 4, 1962, the river banks in the cooling pond area were inspected by engineers of

Ebasco Services, Inc. The river was at a low stage, approximately elevation 60.0 feet msl and a considerable quantity of seepage was noted on the north side of the cooling pond between Stations 173 and 193. The seepage emerged from the river bank at points a few feet above the low water level. High water combined with seepage from the pond evidently saturated the entire height of the bank and, when the river receded, there was widespread bank caving in this stretch of the river. As much as a 35-foot width of bank was lost and, in places, there remained only 120 feet of bank between the river and the toe of the dike. It was recommended that bank protection be provided along this stretch at the river. At that time, there was no bank caving of significance along the east and south sides of the cooling pond. The report is contained in Exhibit 8.

Exhibit 9 shows the repair methods used to protect the banks. Slide areas were cleaned of loose slide material and displaced trees along the toe of the bank, a gravel filter bed was placed against the slope and on the bottom of the cleaned out river bed, and heavy rip-rap fill was placed to provide stability against further bank movement. The repairs were completed in November 1962 and extended between dike Stations 173+50 to 196+50.

On March 13, 1963, and April 18, 1963, additional inspections of the river bank were made and extensive bank caving was seen in the three river bends on the south side of the cooling pond opposite dike stations 120 and 133, 80 to 90, and 45 to 58[4, 5]. Bank protection of the same type as that shown in Exhibit 8 was provided opposite dike stations 120 to 134, 83 to 94, and 43 to 56 as shown on Exhibit 9.

In 1966, a strip of the asphaltic concrete wave protection blanket between elevations 79.0 feet msl and 81.0 feet msl was repaired by placing an overlay of asphaltic concrete 1-1/2 inches thick over the existing asphalt. The repaving was necessary because of deterioration of the original asphaltic concrete near the normal water surface. The deterioration was apparently caused by alternate wetting and drying, and by wave erosion.

In 1973, a recirculation pipe inlet structure was constructed at a point south of the spillway to provide intake of cooling water directly from the pond (see Exhibits 4 and 5). Since completion of the new inlet, the gated spillway has been kept shut and used only infrequently, when severe rainfall caused very high lake levels.

In 1981, repairs were made to the north embankment of the discharge basin adjacent to the coal storage area. Damage to the asphaltic concrete liner and severe erosion resulted from turbulence of the water at the discharge structure. The repairs, performed by H. F. Lee Plant Maintenance personnel, were made by placing rip-rap in the damaged area.

Also, in 1981, repairs were made to the upper part of the asphalt lining at the cooling pond. Repairs were completed in August of 1981 by Brady Roofing Company under the supervision of H. F. Lee Plant personnel. The repairs included filling the cracks in the asphaltic concrete lining with new asphalt.

In 1982, additional repairs were made to the dike in the vicinity of the discharge structure at Station 111 to Station 122. These repairs, along with additional repairs to the asphaltic liner, were accomplished as shown on Exhibit 9. Repairs were made to approximately 1,100 feet of the asphaltic lining. Additional repairs were required at Station 82 to 84 due to damage caused by wave action. Repairs included restoration of the slope to original grade and placement of a blanket of rip-rap underlain by filter fabric on the slope from the toe to elevation 80.0 feet msl.

Prior to making these repairs, an underwater inspection of the shore line at the cooling pond was conducted by Atlantic Diving & Demolition Company, Inc., under the supervision of CP&L. The divers reported damage to the asphaltic lining on the southeastern side of the pond due to the pond-side collapse of a 36-inch diameter corrugated metal drainage pipe (Station 119+50) and the subsequent settling of the soil around it. Other than damage to the lining, the pipe collapse did not result in any damage to the stability of the dike.

Local repairs to the asphaltic concrete lining have continued since 1984 on an as-needed basis. Exhibit 9 shows the extent of repairs through 1986. The repairs used filter fabric and rip-rap placed by plant personnel to fill damaged areas. Between 1990 and 1992, the placement of fabric and riprap intensified until the interior slopes along the entire lengths of the perimeter dike, diversion dike and skimmer dike were covered.

In May, 1993, CP&L personnel noticed tension cracks and subsidence of soil behind the two circulating water discharge structures. Subsequent inspection by divers revealed a large void beneath the structures. The void was up to 9-feet deep in front of the structures and extended 8 to 12 feet underneath the bottom of the structures. Further inspection of the structures showed evidence of rotational, downward movement pivoting around the heel of the structures. Law Engineering and Environmental Services, Inc. (Law) assisted CP&L in evaluating the damage and design repairs.

Repairs to the structures consisted of installing inclined columns with screw jacks for temporary support to the front of the structures, placing a rip-rap berm in the pond to cross in front of the structures and pumping concrete into voids beneath and along the sides of the structures. Repairs were performed between May 20 and May 25, 1993. A more complete description of the observed damage and repairs is presented in Law's Report of Repair Activity, Circulating Water Discharge Structures dated June 25, 1993[(6)].

1.5.2 Ash Pond Dike

The project was designed by CP&L, which also provided supervision of construction. Earthwork construction was provided by Garrison Grading Company. Subsurface investigation and soil testing during construction was provided by Law Engineering Testing Company. Construction began on September 1, 1978 and was completed in April 1980.

Subsequent to the 1984 dam safety inspection, repairs were made to local sloughs on the interior slopes by CP&L personnel. The repairs consisted of end-dumping soil to restore the original grade and reseeding[(7)]. Similar localized repairs to eroded areas continued on an as-needed basis between 1989 and 1994. In 1991, cattails were seeded along the shoreline of the ash pond to provide a vegetation wave barrier. The seeding was concentrated in areas which had experienced ongoing scour and sloughing of the interior dike slope. At the time of the 1994 inspection, the cattail areas seemed well established[1].

A section of the dike on the south side of the pond from about the separator dike to about 500 feet west of the separator dike has an exterior slope steeper than the design slope. Slopes measured during the 1989 inspection using a Brunton compass ranged from about 1(H):1(V) to 1.5(H):1(V)[8]. Suggestions of an approximate 6-inch near vertical scarp at the edge of the downstream crest were seen in a few spots, but no other indications of recent slope movement were seen. No seepage on the exterior slope in this area and no indication of foundation movement was observed at that time. This area of steeper slope corresponds to an area where slumps were observed on the interior slope.

No other significant repairs to the dike are reported since construction through 1994.

1.6 Geology and Seismicity

1.6.1 Geology

Both the cooling pond and ash pond are located in the transition from the Piedmont to the Coastal Plain physiographic provinces. Alluvial or terrace deposits form the surficial soils and were found in subsurface explorations to extend from the surface to elevation 50.0 feet msl to 60.0 feet msl and to as low as elevation 35 feet msl . The top few feet of the alluvium generally consisted of sandy clays and clayey sands, these being underlain by fine and coarse sands. Beneath the alluvium or terrace deposits, a very stiff shaley clay, grading to hard shale with increasing depth, was found. These materials appear to represent weathered Piedmont materials. The top of the hard shale varies between elevation 37.0 and -4.0 feet msl. In some areas, the top clayey formation does not exist. Exhibits 10 and 11 contain subsurface sampling locations and profiles in the plant area that are illustrative of these conditions.

1.6.2 Seismicity

Under the Corps of Engineers' Guidelines which are the reference guidelines for the NCUC inspections, the site is in Seismic Zone 1 with a recommended seismic coefficient of 0.025g[2]. The guidelines indicate that, "in general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist."

1.7 Neuse River Floods

1.7.1 Floods of Record

The drainage area of the Neuse River at the H. F. Lee Electric Generating Plant is approximately 2,033 square miles. At the nearest gauging station (USGS Gauging Station 02089000) located near Goldsboro, about 10 miles downstream, the drainage area is 2,399 square miles. Little River enters the Neuse River at a point 4.3 miles upstream of the gauging station. It has a drainage area of 315 square miles.

Major floods of record since 1929 at the Goldsboro gauging station prior to construction of the Falls of the Neuse Dam near Raleigh are as follows[9]:

MAGNITUDE	DATE	PEAK DISCHARGE – cfs
1	October 5, 1929	38,600
2	September 23, 1945	30,700
3	October 9, 1964	28,800
4	April 11, 1936	26,300
5	September 8, 1955	23,200

The maximum flood level of record since the plant was constructed is elevation 80.35 feet msl on October 9, 1964. This corresponds to the discharge of 28,800 cubic feet per second at the Goldsboro gauging station.

Flooding of the Neuse River as a result of Hurricane Fran which passed through North Carolina on September 5 and 6, 1996 was some of the most severe in the state. The heaviest amounts of rainfall were reported inland, near and north of Raleigh, in the upper Tar, Neuse, and Cape Fear river basins. At the Goldsboro gauging station, the peak flow was 26,000 cfs recorded September 12, 1996. This flow corresponds to a recurrence interval between 50 and 100 years[10]. CP&L personnel reported that the river level rose above the cooling pond water level during Hurricane Fran flooding. The actual river level was not formally documented at the plant by CP&L personnel. An estimate of elevation 82+/- 0.5 feet was provided by Mr. Randy Brown during a site discussion in 1997. Due to the high river level, it was necessary to open the spillway gates to allow water levels in the pond and river to equalize.

Hurricanes Dennis and Floyd passed through eastern North Carolina September 5-6, 1999 and September 15-16, 1999, respectively, causing even more severe flooding than caused by Hurricane Fran in 1996. On the Neuse River near Goldsboro, the peak stage during Hurricane Floyd was 2.6 feet higher than during Hurricane Fran[11]. At the USGS gauging station near Goldsboro, the Neuse River reached elevation 83.3 feet msl before the gauge was destroyed.

During Hurricane Floyd flooding, the cooling pond dike was completely submerged. The spillway gates were opened to allow water levels in the pond and river to equalize. Flooding of the Neuse River did not overtop the ash pond dike. The high river levels caused minor slumping of the exterior slopes of the ash pond dike on the south side. The water level within the ash pond rose as a result of hurricane precipitation, and wave action caused minor slumping of the interior slopes along the south side of the pond. The high water in the ash pond, and the wave action also caused minor damage to the skimmer in the primary pond. Plans for repairing the ash pond south dike are currently being prepared.

1.7.2 Future Flood Potential

The Federal Emergency Management Agency (FEMA) published a Flood Insurance study for Wayne County in 1983[12]. The study utilized data from gauging stations rather than rainfall data. Contained in that study are Flood Profiles showing predicted river elevations for floods of various recurrence intervals. The FEMA studies took account of the Falls Lake Dam. Based on the Neuse River Flood Profile (Exhibit 12), the river elevations at selected points for various recurrence intervals are as follows:

RIVER ELEVATION AND FLOOD ELEVATION, FEET MSL			
RECURRENCE INTERVAL	AT THE DISCHARGE CANAL ENTRANCE (P-1)	AT THE MID POINT OF THE SOUTH DIKE OF THE ASH POND (P-2)	AT SPILLWAY OF COOLING POND DIKE (P-3)
10 yr.	73.8	78.3	78.7
50 yr.	76.0	80.0	80.8
100 yr.	76.9	80.0	81.4
500 yr.	79.0	83.0	83.8

The relationship of these data to the dikes will be discussed in the hydrology subsections of Section 2.0.

2.0 DESIGN AND CONSTRUCTION INFORMATION

2.1 Cooling Pond Dike

2.1.1 Subsurface Information

Subsurface conditions at the cooling pond site were investigated by Eustis Engineering Company of Metairie, Louisiana, under the supervision of Ebasco Services, Inc. Twenty-five borings were made along the alignment of the dike. Locations are shown on Exhibit 10. The logs of these borings are on file[13]. These logs indicate the general subsurface conditions outlined in Section 1.6.1, however, the sandy clay or clayey sand typically present above the underlying sand stratum was absent in 8 of the 23 borings, generally along the north side of the cooling pond.

Eleven shallow test pits, TP1 to TP11, were also excavated within the pond area as shown on Exhibit 10. Fine to medium sand underlain by coarse sand was found at most of these test pits. Permeability tests performed on a sample of the sand from Test Pit 2, classified as a medium to coarse sand, yielded a coefficient of permeability of 3.6×10^{-2} to 4.9×10^{-1} centimeters per second.

A field permeability test conducted in the vicinity of Boring L-21, in the sand stratum, indicated a coefficient of permeability ranging from 1.3 to 2.3×10^{-3} centimeters per second.

In light of the variable presence of the clayey material, approximately 750 shallow auger borings and several test pits were advanced in the cooling pond area. The results found little to no clayey soil over the underlying sand stratum in some areas, particularly near the northeast corner of the pond. Where clayey cover was present, it was thin with a maximum thickness of six feet.

The additional explorations located two sources of clayey soil within the pond area estimated to contain about 400,000 cubic yards of suitable soil for dike blanketing. Exhibit 2 shows the locations of the borrow area.

No records of strength tests on remolded samples of soils planned for use in the dikes were found.

2.1.2 Design Details

The design of the perimeter dike called for a 10-foot crest width at elevation 83.0 feet msl and side slopes of 3(H):1(V) on both sides. A berm, having a minimum width of 10 feet, was provided at elevation 76.0 feet msl on the interior side slope of the dike to facilitate construction of the asphaltic concrete wave protection blanket. Due to the scarcity of clayey soil, the main portion of the dike was constructed of compacted sand with an interior side slope layer of compacted clay fill, 3 feet in thickness. Exhibit 3 shows cross sections of the dike.

Where natural clay was present in the subsurface, the interior clay layer was constructed to tie into the natural clay. Where natural clay did not exist, the pond bottom adjacent to the dike was blanketed with a 1-foot thickness of clayey material. Generally, the clay blanket was carried inward from the dike for a distance of about 200 to 250 feet depending upon the availability of clay. It was extended farther inward where deemed necessary or advisable by blanketing with fly ash. The extent of the blanketing is shown on Exhibit 2.

The interior side slopes were paved with a 4-inch thickness of asphaltic concrete between elevation 76.0 feet msl and the crown, elevation 83.0 feet msl, for wave protection. The exterior side slope of the dike was also paved along the south and east sides of the pond to protect against erosion by river currents during periods when the river is at a high stage.

The diversion dike and skimmer dike were constructed entirely of sand and paved with asphaltic concrete on both sides to protect against wave action.

2.1.3 Stability Analysis

The designers of the project investigated the stability of the dike section under various assumed conditions and arrived at the following values[14]:

STABILITY OF EARTH DIKE	
CONDITION	FACTOR OF SAFETY
Upstream Slope-End of Construction	9.70
Downstream Slope-End of Construction	2.12
Upstream Slope-Sudden Draw-Down	4.85
Downstream Slope-Steady Seepage	1.10

As may be noted above, the critical condition is the case of steady seepage through the downstream or exterior slope.

No records were found describing the methods of stability analysis or documenting soil strength parameters used. Subsequent to the 1984 safety inspection, Dr. Ralph Fadum and Mr. William Wells reviewed the stability of the design slopes under steady seepage conditions[(15)]. Dr. Fadum noted the analysis used, an infinite slope method with seepage parallel to the slope, was conservative and not representative of the actual dike construction. The clay lining would impede development of a seepage flow parallel to the exterior slope. Dr. Fadum concluded that a calculated factor of safety of 1.1 was acceptable for the analytical methods used.

Law has had experience in designing dikes incorporating a similar sand outer shell/clay blanket combination and using steeper exterior slopes and greater heights. Our experience indicates that the design of the Cooling Pond Dikes is adequate and that circular arc slope stability analyses would likely lead to factors of safety greater than 1.4[(8)].

2.1.4 Seepage

Ebasco Services estimated the quantity of seepage that would pass beneath the dike system to the river. As mentioned in Section 2.1.1, tests of the sand stratum by Eustis Engineering Company yielded coefficient of permeability between 3.6×10^{-2} and 4.9×10^{-1} centimeters per second. Estimates based on the grain size characteristics of the lower and coarser sands indicate a value of 9.0

x 10^{-2} to 1.1 x 10^{-1} centimeters per second. Based on the latter, the rate of seepage was calculated to be 21.0 cubic feet per second. The seepage returns to the river since the entire area is underlain by low permeability shaley clay or shale. The rate of seepage loss was not considered to be of concern with respect to the operation of the cooling pond.

Filling of the pond was initiated at 2:30 p.m. on December 6, 1961. It was completed at 8:00 p.m. on December 27, 1961, an elapsed time of 509.5 hours. The volume of water pumped was 192,070,000 cubic feet. The volume of the pond at elevation 80.0 feet msl is 165,911,000 cubic feet. Ignoring rainfall, if any, and evaporation, the indicated rate of loss is 26,159,000/(509.5 x 3,600) = 14.3 cubic feet per second (cfs). Additional observations of water loss during times when no water was being pumped or discharged gave seepage losses of 8.4 to 10.5 cfs.

2.1.5 Discharge Structures

A concrete chute spillway was constructed at the northwest corner of the cooling pond as shown on Exhibit 2. Originally, the spillway allowed cooling water to flow to the Neuse River. In 1973, a recirculation pipe inlet structure was constructed south of the spillway to provide intake of water directly from the pond, and the pond has been operated since then as a component of a closed circulating water system. Since completion of the inlet structure, the gates and spillway have not been used to control pond water levels except during flooding of the Neuse River as occurred during Hurricane Fran.

Exhibit 13 is a plan of the spillway area. Incorporated in the spillway were two concrete gates, a series of concrete buckets for aeration of the discharge, a stilling basin, and a discharge channel. Originally, an 8-foot wide, steel beam, concrete deck, two-span bridge was provided across the spillway. Subsequently, the bridge was redesigned for greater loading and widened to 18 feet. Timber piles for support of the bridge piers were driven to a minimum tip elevation of 60.0 feet msl.

Exhibit 14 contains a detailed plan and longitudinal section of the spillway. This exhibit and Exhibit 15 show an upstream sheet pile cutoff wall to elevation 60 feet beneath the ogee section and upstream wing walls. The log of Boring L-28, shown on Exhibit 14 indicates that the top of the underlying stiff clay stratum at the spillway is at elevation 63.0 feet msl. At the downstream end of the stilling basin, sheet piles were driven under the end of the slab and parallel to the sidewalls to elevation 45.0 feet msl or 9 feet below the top of the stilling basin slab.

Section A-A and the spillway plan shown on Exhibit 14 indicate that the spillway chute slab and the ogee section were placed on a 1-foot layer of coarse sand that serves as an underdrain. Any water reaching the underdrain is collected by three transverse 6-inch diameter perforated pipes that feed into headers located along the side walls of the chute. These discharge into the tail-water at elevation 59.0 feet msl through the sidewalls of the stilling basin.

Exhibit 15 contains sections of the spillway construction and some details of the bridge widening. All concrete for the spillway was specified to have a 28-day compressive strength of 3,000 pounds per square inch and all concrete structures are reinforced.

A spillway discharge channel was dredged from the end of the stilling basin to the Neuse River. The channel was dredged to elevation 54.0 feet msl, and the banks of the channel were graded and protected by rip-rap between elevations 54.0 and 76.0 feet msl.

Two drainage structures with pipes extending beneath the dike section were provided. Locations are shown on Exhibit 2 and details on Exhibit 16. Each structure consists of a 36-inch diameter corrugated metal pipe with a gate well and slide gate located near the center of the dike. The invert of the pipe is at about elevation 66.0 feet msl.

The log of Boring L-6, which is located near the drainage structure on the south side of the pond (Station 51+60), indicates that the pipe was placed in or on a medium stiff clay stratum underlain at elevation 58.5 feet msl by a sand stratum 8 feet thick. The log of Boring L-13, which is located near the other drainage structure on the east side of the pond (Station 119+50), indicates a similar situation.

Both drainage structures were sealed shut in 1973 when the pond was converted to a recirculating closed system.

2.1.6 Hydrologic Evaluation

The plant operations procedures require the pond level to be maintained between elevation 78.5 feet msl and elevation 79.2 feet msl. When rainfall accumulation causes the pond level to exceed elevation 79.2 feet msl, operation of the make-up water pumps is discontinued until the pond level decreases to normal water level[16].

The top of the spillway gates is at elevation 81.5 feet msl and the crest of the dike is at elevation 83.0 feet msl. Therefore, if the pond level rises above elevation 81.5 feet msl, overflow into the river can occur. At maximum possible pond level, elevation 83.0 feet msl (the crest of the dike), the spillway discharge is 2,016 cubic feet per second calculated using a broad-crested weir formula. The available storage in the pond above elevation 80.0 feet msl is approximately 1,635 acre-feet.

Law Engineering and Environmental Services, Inc. (Law)[8] conducted a hydrologic evaluation of the cooling pond as part of the 1989 dam safety inspection. Their analysis concluded a design flood of 1/2 the Probable Maximum Flood (PMF) was appropriate based on the size and hazard classification. Since the cooling pond does not receive any inflow from streams or land areas, the 1/2 PMP was taken as equal to 1/2 the Probable Maximum Precipitation (PMP). A value of 20.5 inches, obtained from Hydrometeorological Report No. 51[17] for a 24-hour duration storm, was used. Under the 1/2 PMP condition, Law's analysis concluded the pond has sufficient freeboard to retain this design storm without overtopping of the dikes although only minimal freeboard would be available. Water flow through the partly obstructed spillway would allow the excess water to drop to the top of the sealing gates in about 12 hours after the end of the storm.

As reviewed in Section 1.7, floods on the Neuse River could produce a high water elevation at the spillway entrance of 83.8 feet msl during a 500-year flood. The flood level decreases downstream and is only elevation 79.0 feet msl at the discharge canal. Thus, it appears that a small length of the

Cooling Pond Dike could be overtopped during extreme floods. Since the pond water level would also be very high for the extreme flood, it is likely that the dike would be in a near-submerged condition which would not create slope stability concerns. A receding river level could create a partial sudden draw-down condition on the exterior slope. The greatest potential for such a condition would be where no exterior paving is present, a situation that exists along the portion of the dikes most likely to experience the highest floodwater.

The stability analyses results referenced in Section 2.1.3 report a factor of safety of 4.85 for sudden draw-down in the upstream slope. The analysis for a partial sudden draw-down on the exterior slope would be expected to result in a greater factor of safety than for the interior slope. Thus, it appears the dike has acceptable stability under severe flood conditions.

2.1.7 Dike Construction

The construction of the perimeter dike began on June 1, 1960, and proceeded continuously except for short periods of inclement weather until September 1, 1961. The early portion of the work consisted of raising the compacted sand fill to elevation 76.0 feet msl in order to protect the cooling pond area against potential flood conditions on the Neuse River. By December 1, 1960, the compacted sand fill had reached elevation 76.0 feet msl around the pond, and the work then concentrated on placing the clay facing and blankets, completing sand fill and, finally placing the asphaltic concrete slope protection and blanketing the larger interior borrow pits with flay ash.

A soil quality control program for the Cooling Pond Dike was initiated in June, 1969, and continued through the duration of the project. A field soils laboratory was constructed, and two laboratory technicians were trained by a geotechnical engineer to perform the necessary laboratory tests. These included modified Proctor compaction tests, mechanical analyses, water content, permeability, and hydrometer analyses.

A soils inspector was present during all phases of the construction work involving the dikes, cutoff trenches, and impervious blankets. It was reported that density tests performed on the fill during construction indicated a degree of compaction exceeding the requirement of 95 percent of modified Proctor[14].

Technical provisions for construction of the earthwork are contained in Specifications CAR-GB1202. A copy of this specification is not available. However, the provisions are expected to be much the same as those in other Ebasco specifications for similar projects constructed in the early 1960's such as the Roxboro Steam Electric Plant[18]. These other specifications have been generally consistent with good engineering practice.

2.1.8 Monitoring Program

No permanent piezometers or seepage monitors are installed in the dike. CP&L plant personnel conduct inspections to check for evidence of slope instability, embankment settlement, and erosion caused by seepage, surface water or wave action. The inspection reports are kept at the plant. The reports are done on an approximate quarterly frequency.

2.2 Ash Pond Dike

2.2.1 Subsurface Information

A subsurface exploration of the ash pond was conducted by Law Engineering Testing Company in 1978[19] under the direction of CP&L.

Nine soil test borings and thirty-eight auger borings were made at the ash pond site at locations shown on Exhibits 17 and 18. The records of these borings are on file[19]. The borings found surface conditions generally as described in Section 1.6.1. Potential borrow areas were also explored north of the ash pond using backhoe test pits.

Adequate quantities of material suitable to construct the Ash Pond Dike were available within the ash pond area. These materials consisted primarily of relatively impervious, sandy clay deposits within

Borrow Area B of the ash pond as shown on Exhibit 16. Sandy material from Borrow Area B and from an area north of the ash pond were used to construct access roadway sections of the embankment.

Laboratory testing of the borrow area soils was conducted by Law Engineering Testing Company. Tests included grain size distribution through a No. 200 sieve, Atterberg limits, standard Proctor compaction, permeability, and triaxial shear. The test results are available in CP&L files.

2.2.2 Stability Analysis

Only incomplete records of stability analyses were found during the file review for the 1989 independent consultant review for the Ash Pond Dike. The 1989 report recommended that slope stability analyses be performed for dike sections where slopes were steeper than the design slope and where local sloughs had occurred. Subsequent to issuance of the 1989 report, CP&L conducted the recommended analyses[20]. Soil properties for use in the analyses were determined by CP&L using laboratory test results reported from original explorations in the ash pond area. A steady state seepage condition and assumed phreatic surface were used in the analyses.

The following soil properties were used in the analyses:

SOIL	TOTAL UNIT WEIGHT (pcf)	ANGLE OF INTERNAL FRICTION	COHESION (psf)
Compacted fill	115	32	100
Natural Soil	120	30	200

The results of the analyses were provided to Law Engineering for their review and comment. The results of the stability analyses indicated that the interior sloughed areas had safety factors in excess of 1.5 for the pond water level at maximum height, elevation 88.0 feet msl. The analyses indicated a factor of safety of 1.77 for the design exterior slope and 1.34 for the maximum slope with the pond at its maximum planned level. Based on the results of the stability analyses, the review concluded that no repairs of the interior slopes appeared necessary. Although the computed safety factor of 1.34 for the steeper sloped portions of the dike was below the generally accepted guideline, Law concluded that the safety factor was acceptable since the steep-sloped portions were of limited lateral extent and well vegetated[21].

2.2.3 Seepage

A permeability test performed on a sample from Borrow Area B at north 48+00 and east 44+00, had a coefficient of permeability of 1.7×10^{-8} centimeters per second[19]. The borrow material was molded to 95 percent of standard Proctor density at a moisture content 3.5 percent above optimum. An estimate of the amount of seepage that would be lost from the entire periphery of the dike with a pool elevation of 88.0 feet msl and a downstream toe elevation 70.0 feet msl gave a volume of 1.6×10^{-5} cubic feet per second[22]. Such a small value is insignificant.

2.2.4 Discharge Structures

Water from the ash pond is discharged through a vertical pipe riser/culvert into a secondary settling pond. A second vertical riser/culvert combination releases water from the secondary settling pond to the Neuse River. The discharge structures are located at the southeast corner of the pond as shown on Exhibit 6. Design details of the structures are shown on Exhibit 7.

Each discharge structure consists of a 15-inch diameter reinforced concrete pipe culvert under the dike connected to a 15-inch diameter vertical riser. A five-foot diameter metal skimmer structure is attached to the top of the riser. The plans show no provisions for anti-seepage collars on the culverts through the dike nor any filter drainage blankets at the downstream side.

The outlet from the secondary settling pond extends approximately 150 feet from the dike toe, underground, to a discharge point at elevation 67.47 feet msl on the bank of the Neuse River. Exhibit 7 shows sloping rip-rap around the discharge point. Exhibit 7 also shows the 15-inch diameter reinforced concrete pipe is jointed to an 18-inch diameter reinforced concrete pipe 50 feet from the toe of the dike. The 18-inch diameter pipe extends to the outlet point.

Ash from the plant is pumped to the pond through two 12-inch diameter lines. The lines are supported on timber sleepers laid on grade, and are parallel to the dike access road. The pond discharge is into a stilling pool.

2.2.5 Hydrology

As part of the 1989 dam safety inspection, Law conducted a hydrologic evaluation of the ash pond[14]. Their analysis concluded a design flood of 1/2 the Probable Maximum Flood (PMF) as appropriate. Since the ash pond has no contributory watershed, the 1/2 PMF was taken as equal to the 1/2 Probable Maximum Precipitation (PMP). At design operating level, 88.0 feet msl, the 1/2 PMP storm would come within about three inches of overtopping the dike and would overtop the slightly lower dike between the pond and the secondary settling basin. Overtopping the separator dike is not of concern for the stability of the exterior dikes.

2.2.6 Construction

Construction of the Ash Pond Dike was done by Garrison Grading Company under the supervision of CP&L. Technical provisions for construction of the dike are contained in Specifications No. PPCD-78-S-116. A copy of this specification is included in the Appendix.

Soil testing during construction was provided by Law Engineering Testing Company under the supervision of CP&L. Soil testing included standard Proctor compaction tests, field density tests, moisture contents, and soil classifications. "Record of Daily Inspection" reports transmitted during construction of the pond indicate compaction meeting or exceeding the specified requirements[23].

2.2.7 Monitoring Program

No permanent piezometers or seepage monitors were installed at the Ash Pond Dike. CP&L plant personnel conduct visual inspections approximately quarterly to check for signs of instability, seepage, or unusual conditions. Reports are kept at the plant.

3.0 REFERENCES

1. "Five-Year Independent Consultant Inspection, H. F. Lee Electric Generating Plant, Cooling Lake Dike, Ash Pond Dike", Law Engineering and Environmental Services, Inc., September 1994.

2. "Recommended Guidelines for Safety Inspection of Dams", Department of Army, Office of the Chief of Engineers, Washington, D.C., November, 1976.

3. North Carolina Department of Environment, Health and Natural Resources, "North Carolina Administrative Code, Title 15A, Subchapter 2K, Dam Safety", as amended January 1, 1991.

4. Letter to P. S. Colby, Carolina Power & Light from H. W. Stuber, Ebasco Services, March 19, 1963.

5. Letter to P. S. Colby, Carolina Power & Light from H. W. Stuber, Ebasco Services, April 22, 1963.

6. "Report of Repair Activity, Circulating Water Discharge Structures, H. F. Lee Steam Electric Plant, Goldsboro, North Carolina", Law Engineering and Environmental Services, Inc., June 25, 1993.

7. Trip Report – 1985 Follow-Up Inspection for H. F. Lee Steam Electric Plant, Cooling Pond Dike and Ash Pond Dike, 1984 Safety Inspection Report, Carolina Power & Light Company, September 19, 1985.

8. "Five-Year Independent Consultant Inspection, H. F. Lee Electric Generating Plant, Cooling Lake Dike, Ash Pond Dike", Law Engineering and Environmental Services, Inc., September 1989.

9. River Elevation and Rainfall Data – Goldsboro Gauging Station. National Weather Service, information obtained from the Army Corp of Engineers, Wilmington, North Carolina.

10. "Aftermath of Hurricane Fran in North Carolina", United States Geological Survey, Open-File Report 96-499, September 1996.

11. "Hurricane Floyd Beats Out Fran With Record Flood Levels on North Carolina Rivers", USGS News Release September 21, 1999.

12. "Flood Insurance Study, Wayne County, North Carolina, Unincorporated Areas", Federal Emergency Management Agency, Washington, D.C., March 30, 1983.

13. Letter to Carolina Power & Light Company c/o Ebasco Services from T. Bres Eustis, Eustis Engineering Company, February 10, 1960.

14. "Safety Inspection of Cooling Pond Dike – H. F. Lee Steam Electric Plant", for Carolina Power & Light Company, November, 1979, by William L. Wells.

15. Letter to Timothy J. Carrere, North Carolina Utilities Commission, from B. Mitchell Williams, Carolina Power & Light Company, April 26, 1985.

16. H. F. Lee Steam Electric Plant – Plant Operations Manual. Operation of the Cooling Lake, Procedure No. H. F. Lee S.E.P., March 4, 1981.

17. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian", Hydrometeorological Report No. 51, U. S. Department of Commerce, Washington, D.C. 1978.

18. "Specification for Construction of Cooling Pond Dam", Appendix A, Safety Inspection of Main Dam, Afterbay Dam and Ash Pond Dams, Roxboro Steam Electric Plant, November, 1978.

19. "Report of Subsurface Investigation, H. F. Lee Steam Electric Plant, Wayne County, North Carolina", Law Engineering Testing Company, July 27, 1978.

20. "H. F. Lee Ash Pond Stability Analysis", Carolina Power & Light, file EXDE-001-022-864, Transmittal to Law Engineering September 1989.

21. "Review of Stability Analysis Ash Pond Dike, H. F. Lee Electric Generating Plant", Law Engineering and Environmental Services, Inc., July 3, 1990.

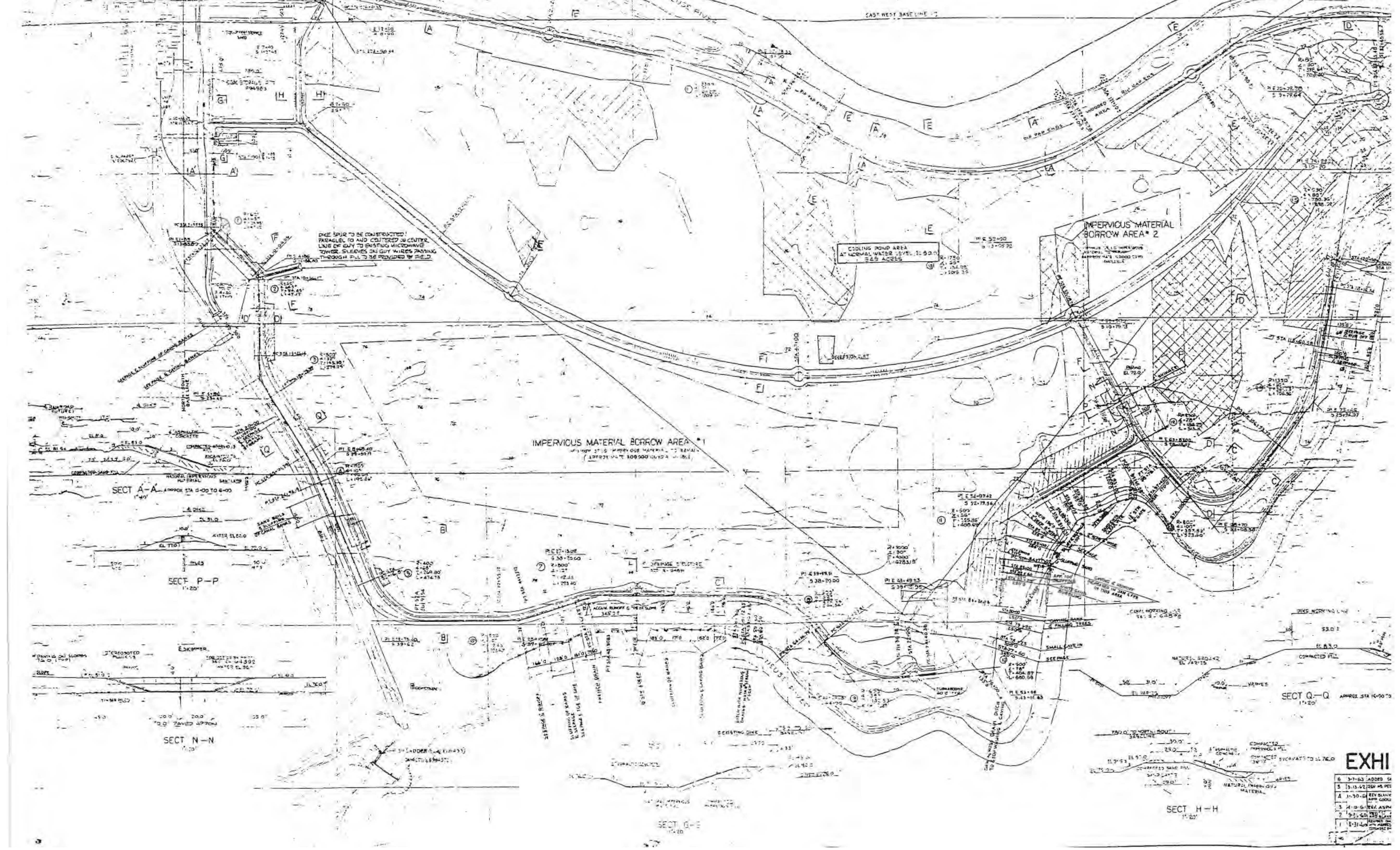
22. "Safety Inspection of Cooling Pond Dike and Ash Pond Dike", H. F. Lee Steam Electric Plant, Ralph E. Fadum Consulting Engineer, November, 1984.

23. Letter to L. B. Wilson from W. L. Wells, May 14, 1979.

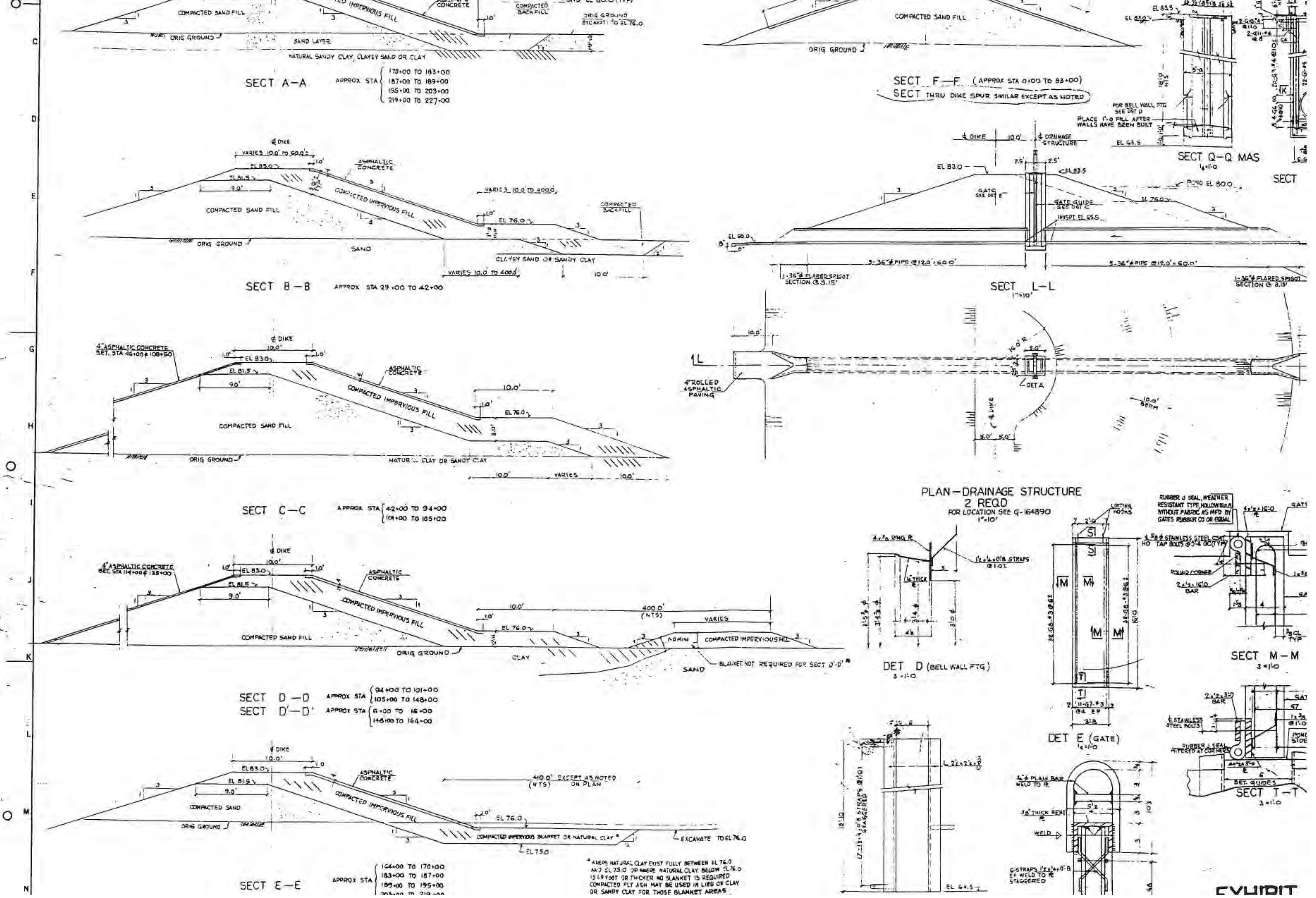
EXHIBITS

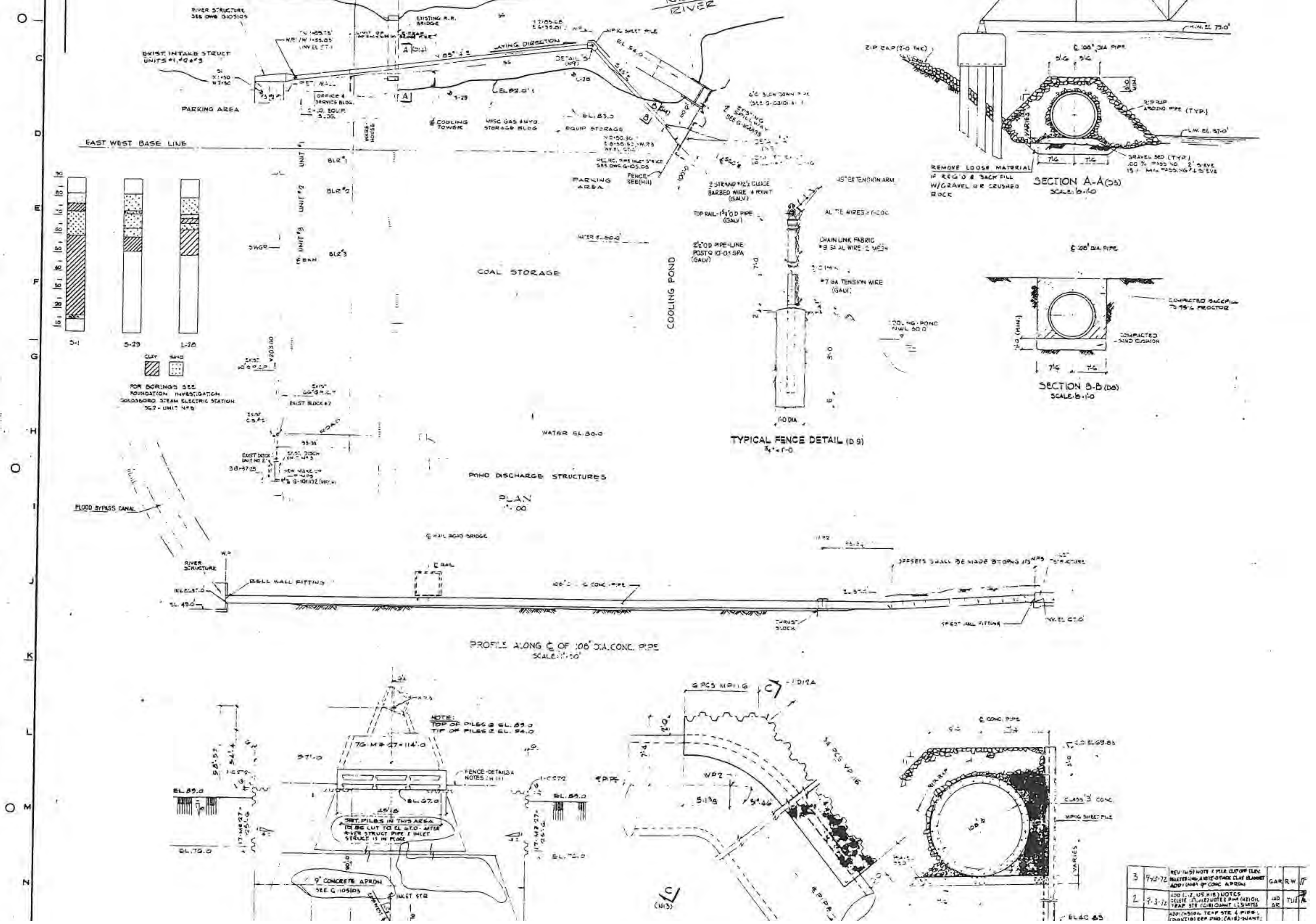
1. Site location map (taken from USGS 7-1/2 minute quadrangle maps).
2. Cooling Pond, General Plan – Ebasco Drawing G-164890.
3. Cooling Pond Dam, Sections and Details – Ebasco Drawing G-164891.
4. Circulating Water System Modification – General Plan and Profile – Ebasco Drawing G-105102.
5. Circulating Water System Modification Recirculating Pipe Inlet Structure – Ebasco Drawing G-105103.
6. Ash Pond Area Plan – CP&L Drawing RCD-372.
7. Ash Disposal Area – Sections & Details – CP&L Drawing RCD-373.
8. Goldsboro SEP Unit 3, River Bank Protection, Dike Station 173 to 193.
9. Cooling Pond Dike Repairs – 1982 – CP&L Drawing D-1647.
10. Foundation Investigation – Sheet No. 1 – Ebasco Drawing G-164885.
11. Foundation Investigation – Sheet No. 2 – Ebasco Drawing G-164886.
12. Neuse River flood profile in vicinity of H. F. Lee Plant (from Reference 8).
13. Spillway Area – Ebasco Drawing G-164892.
14. Spillway Masonry – Sheet No. 1 – Ebasco Drawing G-164893.
15. Spillway Masonry – Sheet No. 2 – Ebasco Drawing G-164894.
16. Circulating Water System Pond Discharge – Masonry – Ebasco Drawing G-164966.
17. Ash Pond Boring Location Overlay – CP&L Drawing RCD-372 (Overlay) – Law Engineering Testing Company.
18. Ash Pond Boring Location Sketch – Unlabelled Drawing from CP&L files.

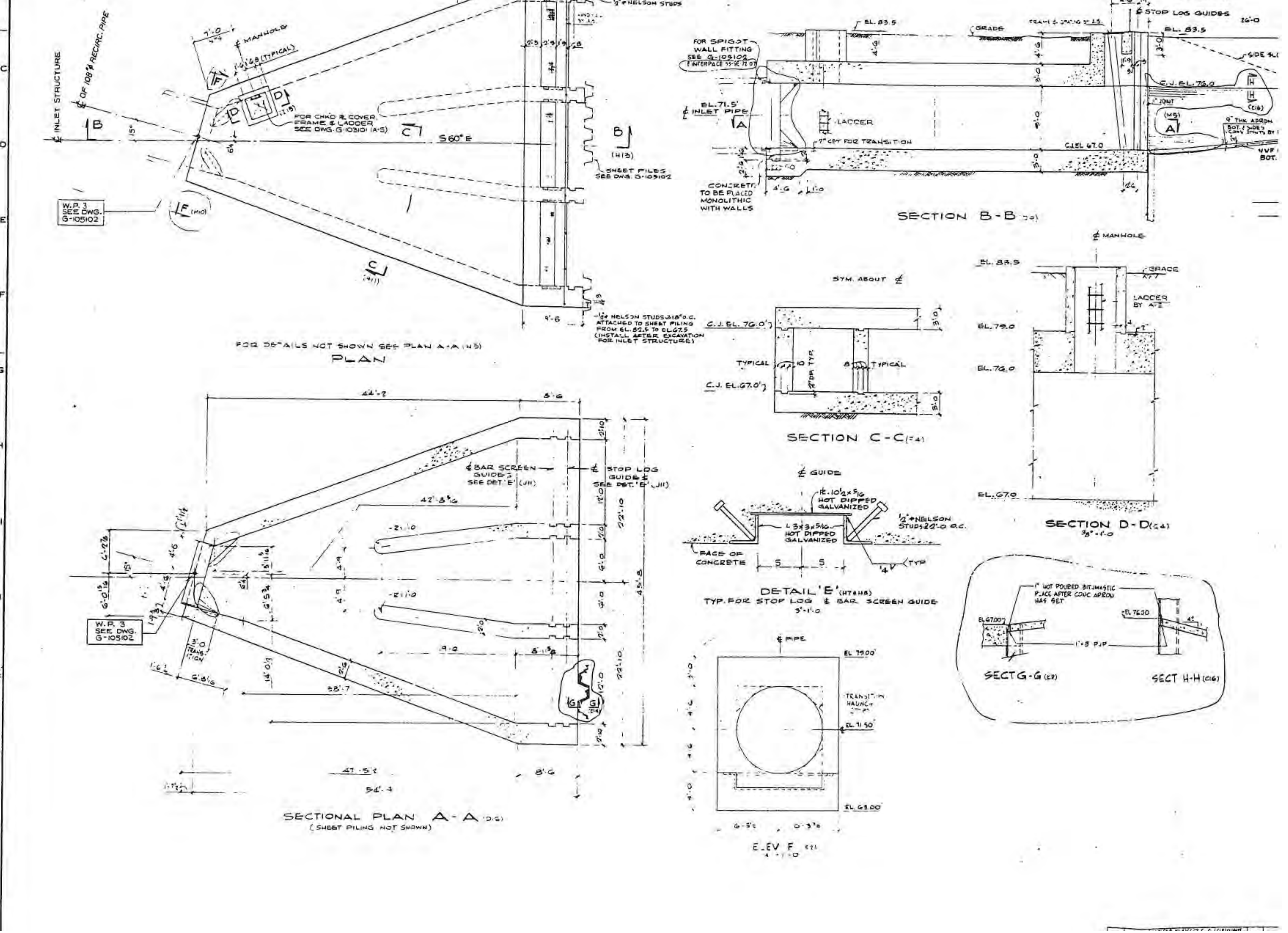

NEUSE RIVER
Quaker Neck Lake
WALL
Powerplant
Substa
Branch
Creek
PIPELINE
Antioch Ch
CHERRY HOSPITAL
Filtration Plant
Youth Center
SOUTHERN
Cem
GRAVEL PIT
Neuse River Cut-Off
1224
1227
1223
1008
1222
1007
BM 132
BM 89
BM 73
BM 75
BM 77



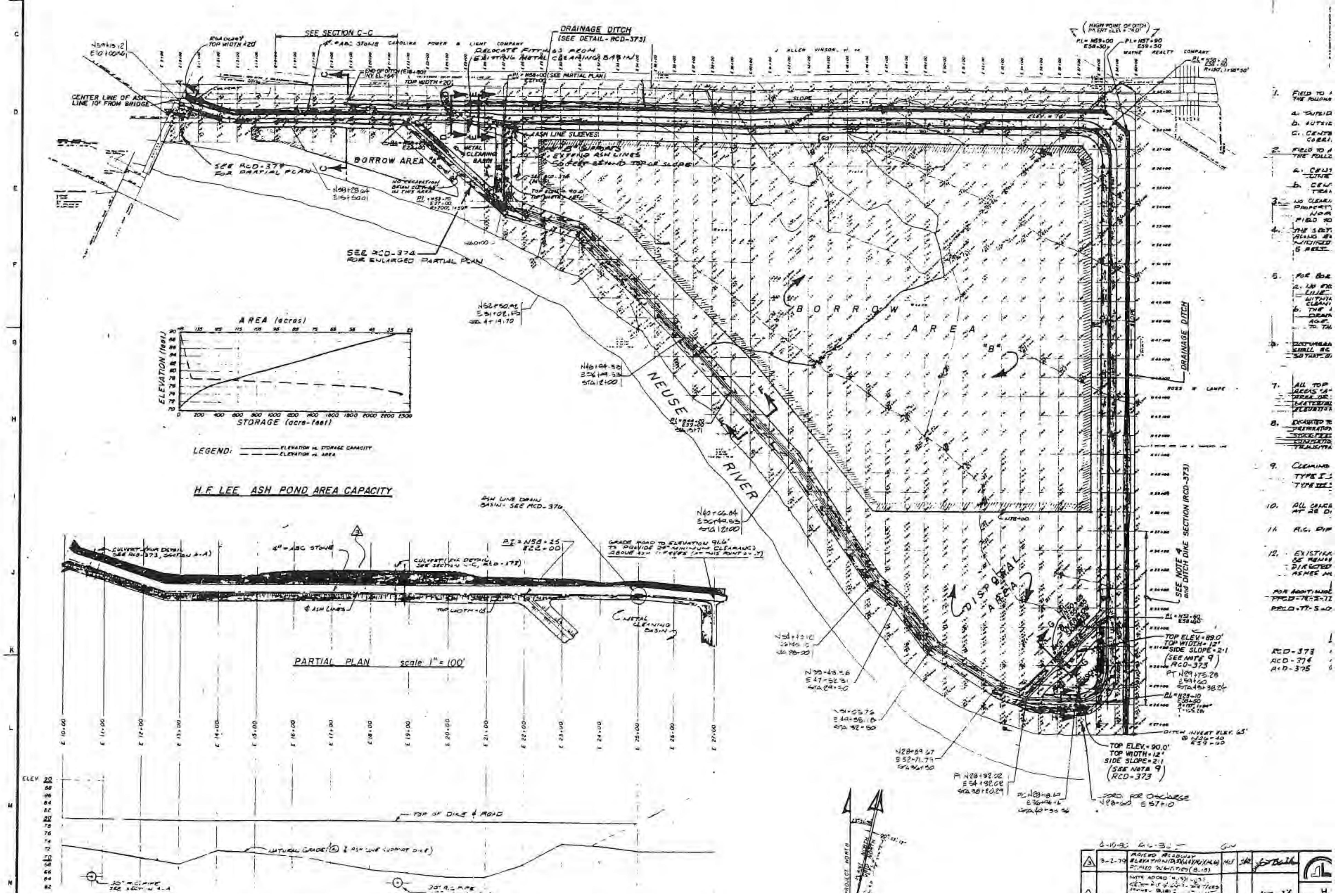
EAST WEST BASE LINE
DIKE SPUR TO BE CONSTRUCTED PARALLEL TO AND CENTERED ON CENTER LINE OF GUY TO EXISTING MICROWAVE TOWER. SLEEVES ON GUY WIRES PASSING THROUGH FILL TO BE PROVIDED BY FIELD
COOLING POND AREA
AT NORMAL WATER LEVEL EL 50.0
549 ACRES
IMPERVIOUS MATERIAL BORROW AREA # 2
IMPERVIOUS MATERIAL BORROW AREA #1
NORTH-SOUTH BASE LINE
SECT A-A
SECT P-P
SECT N-N
SECT G-G
SECT Q-Q
SECT H-H
SEEPAGE & RIDGES
SLUFFING OF BANKS & SEEPAGE
FRENCH DRAIN
SLUFFING OF BANKS
SLUFFING & CAVING BANKS
DITCH WITH NUMEROUS DRAINS
EXISTING DIKE
SMALL CAVE IN
SEEPAGE
DIKE WORKING LINE
EXHI


SECT A-A APPROX STA 170+00 TO 183+00, 187+00 TO 189+00, 195+00 TO 203+00, 219+00 TO 227+00
NATURAL SANDY CLAY, CLAYEY SAND OR CLAY
SECT B-B APPROX STA 29+00 TO 42+00
CLAYEY SAND OR SANDY CLAY
SECT C-C APPROX STA 42+00 TO 94+00, 101+00 TO 105+00
4" ASPHALTIC CONCRETE SET. STA 46+00 & 108+50
COMPACTED IMPERVIOUS FILL
COMPACTED SAND FILL
NATURAL CLAY OR SANDY CLAY
SECT D-D APPROX STA 94+00 TO 101+00, 105+00 TO 148+00
SECT D'-D' APPROX STA 6+00 TO 16+00, 146+00 TO 164+00
BLANKET NOT REQUIRED FOR SECT D'-D' *
SECT E-E APPROX STA 164+00 TO 170+00, 183+00 TO 187+00, 189+00 TO 195+00
COMPACTED IMPERVIOUS BLANKET OR NATURAL CLAY *
EXCAVATE TO EL 76.0
* WHERE NATURAL CLAY EXIST FULLY BETWEEN EL 76.0 AND EL 75.0 OR WHERE NATURAL CLAY BELOW EL 76.0 IS 1.0 FOOT OR THICKER NO BLANKET IS REQUIRED. COMPACTED FLY ASH MAY BE USED IN LIEU OF CLAY OR SANDY CLAY FOR THOSE BLANKET AREAS.
SECT F-F (APPROX STA 0+00 TO 83+00)
SECT THRU DIKE SPUR SIMILAR EXCEPT AS NOTED
SECT L-L 1"=10'
5-36"⌀ PIPE @ 12.0' = 60.0'
1-36"⌀ FLARED SPIGOT SECTION @ 8.15'
SECT Q-Q MAS
PLACE 1'-0 FILL AFTER WALLS HAVE BEEN BUILT
PLAN-DRAINAGE STRUCTURE 2 REQ.D FOR LOCATION SEE G-164890 1"=10'
4" ROLLED ASPHALTIC PAVING
DET D (BELL WALL FTG)
DET E (GATE)
SECT M-M
SECT T-T
RUBBER J SEAL, WEATHER RESISTANT TYPE HOLLOW BULB WITHOUT FABRIC AS MFD BY GATES RUBBER CO OR EQUAL
EXHIBIT


RIVER
RIVER STRUCTURE SEE DWG G-105105
EXIST. INTAKE STRUCT UNITS #1, #2 & #3
PARKING AREA
EXISTING R.R. BRIDGE
LAYING DIRECTION
OFFICE & SERVICE BLDG.
EAST WEST BASE LINE
UNIT #1
UNIT #2
UNIT #3
BLR #1
BLR #2
BLR #3
WARE-HOUSE
℄ COOLING TOWER
MISC GAS & HYD STORAGE BLDG
EQUIP STORAGE
EL.82.0'±
EL.83.0
PARKING AREA
FENCE SEE (H11)
S-1
S-29
L-28
CLAY
SAND
FOR BORINGS SEE FOUNDATION INVESTIGATION GOLDSBORO STEAM ELECTRIC STATION
COAL STORAGE
COOLING POND
WATER EL.80.0
ROAD
POND DISCHARGE STRUCTURES
PLAN
FLOOD BYPASS CANAL
2 STRAND #12½ GUAGE BARBED WIRE 4 POINT (GALV)
TOP RAIL-1⅝"O.D PIPE (GALV)
2½"O.D PIPE-LINE POSTS 10'-0 SPA (GALV)
45° EXTENSION ARM
ALL TIE WIRES 3'-0 O.C.
CHAIN LINK FABRIC #9 GA AL WIRE 2" MESH
#7 GA TENSION WIRE (GALV)
1'-0 DIA.
TYPICAL FENCE DETAIL (D9)
¾"=1'-0
REMOVE LOOSE MATERIAL IF REQ'D & BACK FILL W/GRAVEL OR CRUSHED ROCK
SECTION A-A (D3)
SCALE: ½"=1'-0
℄ 108" DIA PIPE
RIP RAP AROUND PIPE (TYP)
GRAVEL BED (TYP)
COMPACTED BACKFILL
COMPACTED SAND CUSHION
SECTION B-B (D8)
SCALE: ½"=1'-0
℄ RAIL ROAD BRIDGE
RIVER STRUCTURE
BELL WALL FITTING
℄ RAIL
SPIGOT WALL FITTING
THRUST BLOCK
EL.49.0'
INV.EL 67.0'
PROFILE ALONG ℄ OF 108" DIA. CONC. PIPE
NOTE:
TOP OF PILES @ EL. 89.0
TIP OF PILES @ EL. 94.0
EL.89.0
EL.76.0
EL.67.0
FENCE DETAILS & NOTES (H 11)
9" CONCRETE APRON SEE G-105103
INLET STR
6 PCS MP116
34 PCS VP16
WP2
℄ PIPE
RIP RAP
℄ CONC. PIPE
CLASS 3 CONC.
VARIES
EL.60.85
3 | 9-13-72 | REV. (M-5) NOTE & PILE CUTOFF ELEV. ... ADD (N14) 9" CONC. APRON | GAR | R.W.
2 | 7-3-72 | ADD (J, 7, US, H18) NOTES ... | | TW



℄ INLET STRUCTURE
℄ OF 108"ϕ RECIRC. PIPE
℄ MANHOLE
FOR CHKD. PL. COVER, FRAME & LADDER SEE DWG. G-105101 (A-5)
S60°E
SHEET PILES SEE DWG. G-105102
W.P. 3 SEE DWG. G-105102
½"ϕ NELSON STUDS @18" O.C. ATTACHED TO SHEET PILING FROM EL. 82.5 TO EL. 67.5 (INSTALL AFTER EXCAVATION FOR INLET STRUCTURE)
FOR DETAILS NOT SHOWN SEE PLAN A-A (H5)
PLAN
℄ BAR SCREEN GUIDES SEE DET. 'E' (J11)
℄ STOP LOG GUIDES SEE DET. 'E' (J11)
SECTIONAL PLAN A-A (D6)
(SHEET PILING NOT SHOWN)
FOR SPIGOT WALL FITTING SEE G-105102
EL. 71.5' ℄ INLET PIPE
CONCRETE TO BE PLACED MONOLITHIC WITH WALLS
LADDER
EL. 83.5
GRADE
℄ STOP LOG GUIDES
C.J. EL. 76.0
C.J. EL. 67.0
9" THK. APRON
SIDE SLOPE
SECTION B-B (D1)
SYM. ABOUT ℄
C.J. EL. 76.0'
C.J. EL. 67.0'
TYPICAL
SECTION C-C (F4)
℄ MANHOLE
EL. 83.5
EL. 79.0
EL. 76.0
EL. 67.0
LADDER BY A-E
SECTION D-D (C4)
℄ GUIDE
PL. 10½ x 5/16 HOT DIPPED GALVANIZED
L 3x3x5/16 HOT DIPPED GALVANIZED
½"ϕ NELSON STUDS @2'-0 O.C.
FACE OF CONCRETE
DETAIL 'E' (H7 & H8)
TYP. FOR STOP LOG & BAR SCREEN GUIDE
3" = 1'-0
℄ PIPE
EL. 79.00'
TRANSITION HAUNCH
EL. 71.50'
EL. 63.00'
ELEV F (E3)
1" HOT POURED BITUMASTIC PLACE AFTER CONC. APRON HAS SET
EL. 67.00'
EL. 76.00
SECT G-G (E8)
SECT H-H (C16)


SEE SECTION C-C
DRAINAGE DITCH (SEE DETAIL-RCD-373)
ROADWAY TOP WIDTH = 20'
CAROLINA POWER & LIGHT COMPANY
RELOCATE FITTINGS FROM EXISTING METAL CLEARING BASIN
J. ALLEN VINSON
WAYNE REALTY COMPANY
CENTER LINE OF ASH LINE 10' FROM BRIDGE
ASH LINE SLEEVES
EXTEND ASH LINES 50 FEET BEYOND TOP OF SLOPE
METAL CLEARING BASIN
SEE RCD-374 FOR PARTIAL PLAN
BORROW AREA "A"
SEE RCD-374 FOR ENLARGED PARTIAL PLAN
BORROW AREA "B"
NEUSE RIVER
DISPOSAL AREA
DRAINAGE DITCH
SEE NOTE 4 and DITCH DIKE SECTION (RCD-373)
TOP ELEV.= 89.0' TOP WIDTH = 12' SIDE SLOPE = 2:1 (SEE NOTE 9) RCD-373
TOP ELEV.= 90.0' TOP WIDTH = 12' SIDE SLOPE = 2:1 (SEE NOTE 9) RCD-373
DITCH INVERT ELEV. 65'
FORD FOR DISCHARGE
AREA (acres)
ELEVATION (feet)
STORAGE (acre-feet)
LEGEND: ELEVATION vs. STORAGE CAPACITY; ELEVATION vs. AREA
H.F. LEE ASH POND AREA CAPACITY
4" ABC STONE
ASH LINE DRAIN BASIN - SEE RCD-376
GRADE ROAD TO ELEVATION 91.6' TO PROVIDE 24" MINIMUM CLEARANCE ABOVE ASH LINES
METAL CLEARING BASIN
PARTIAL PLAN scale 1" = 100'
TOP OF DIKE & ROAD
NATURAL GRADE
30" R.C. PIPE
PROJECT NORTH
RCD-373
RCD-374
RCD-375

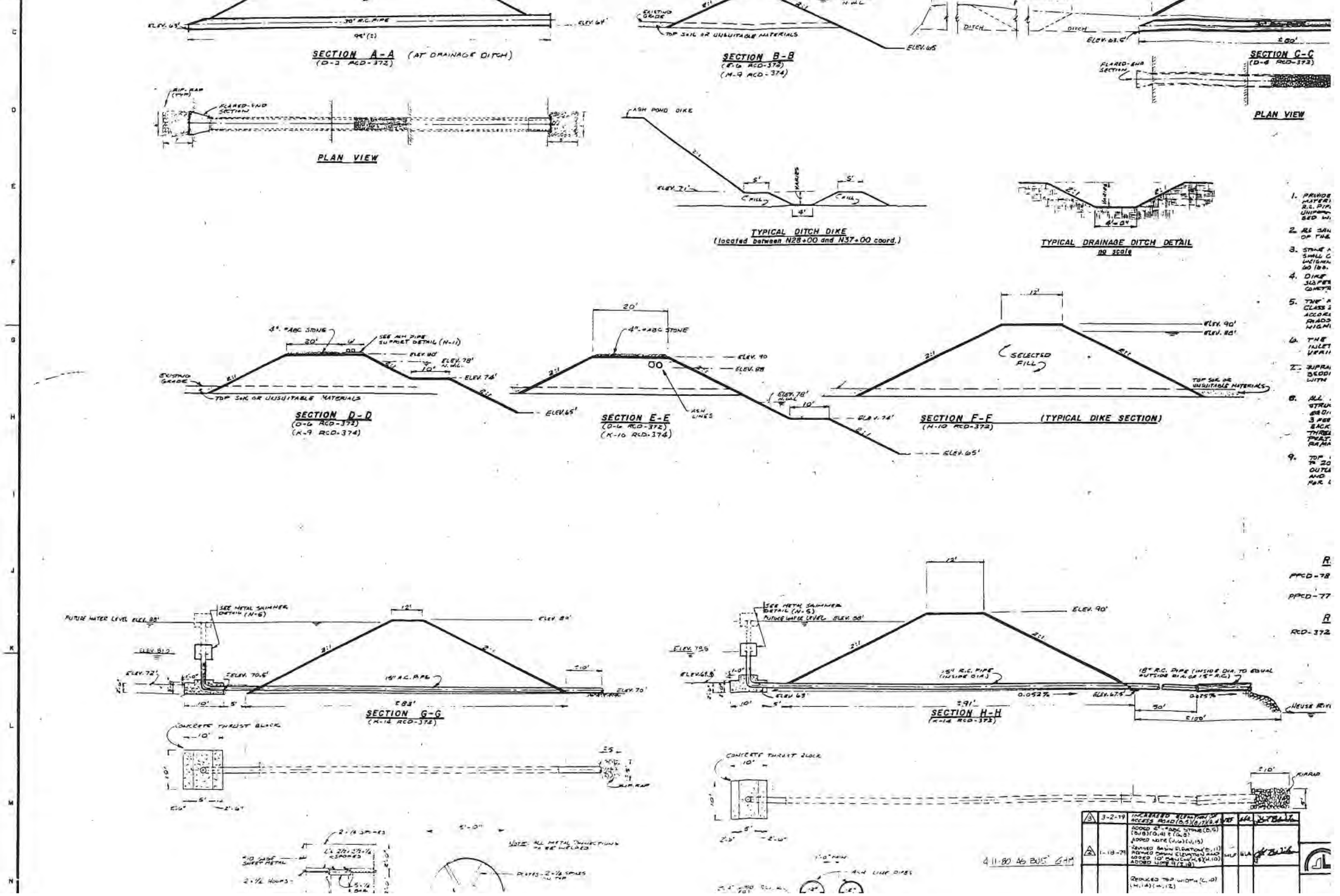

SECTION A-A (AT DRAINAGE DITCH)
(D-2 RCD-372)
30' R.C. PIPE
ELEV. 64'
PLAN VIEW
FLARED-END SECTION
RIP-RAP (TYP)
SECTION B-B
(E-6 RCD-372)
(M-9 RCD-374)
EXISTING GRADE
TOP SOIL OR UNSUITABLE MATERIALS
ELEV. 65
ASH POND DIKE
ELEV. 71'
FILL
VARIES
TYPICAL DITCH DIKE
(located between N28+00 and N37+00 coord.)
SECTION C-C
(D-8 RCD-372)
DITCH
PLAN VIEW
TYPICAL DRAINAGE DITCH DETAIL
no scale
4'-0"
VARIES
4" #ABC STONE
SEE ASH PIPE SUPPORT DETAIL (N-11)
ELEV. 80'
ELEV. 78' N.W.L.
ELEV. 74'
SECTION D-D
(O-6 RCD-372)
(K-9 RCD-374)
ELEV. 65'
SECTION E-E
(O-6 RCD-372)
(K-10 RCD-374)
ASH LINES
ELEV. 90
ELEV. 88
SECTION F-F (TYPICAL DIKE SECTION)
(H-10 RCD-372)
SELECTED FILL
TOP SOIL OR UNSUITABLE MATERIALS
ELEV. 90'
ELEV. 80'
SECTION G-G
(K-14 RCD-372)
FUTURE WATER LEVEL ELEV. 88'
SEE METAL SKIMMER DETAIL (N-6)
15" R.C. PIPE
CONCRETE THRUST BLOCK
RIP-RAP
NOTE: ALL METAL CONNECTIONS TO BE WELDED
SECTION H-H
(K-14 RCD-372)
SEE METAL SKIMMER DETAIL (N-5)
15" R.C. PIPE (INSIDE DIA.)
18" R.C. PIPE (INSIDE DIA. TO EQUAL OUTSIDE DIA. OF 15" R.C.)
NEUSE RIVER
RIPRAP
4-11-80 AS BUILT GHM
REDUCED TOP WIDTH (C,10) (H,14) (K,12)

EXHIBIT 8

September 10, 1962

Mr A J Skeale, Vice President, Oper & Engineering
Carolina Power & Light Company
P O Box 1551
Raleigh, North Carolina

GOLDSBORO STEAM ELECTRIC PLANT - UNIT 3
RIVER BANK PROTECTION

Dear Mr Skeale:

Reference is made to our letter of June 22, 1961 to W W Miller on the above subject, copy of which was forwarded to you. That letter outlined the results of an inspection of the river banks made on June 9, 1961 and recommended that no bank protection works be provided until such time as the need for same became evident.

On September 4, 1962 the river banks were inspected by Messrs Naylor, Miller and Wells of this office. The river was at low stage (approximately el 60) and a considerable quantity of seepage was noted on the north side approximately between stations 173 and 193. This seepage emerges from the river bank a few feet above low water. The recent high water combined with seepage from the pond evidently saturated the entire height of bank and when the river receded there was widespread bank caving in this stretch. As much as a 35 ft width of bank was lost and at places there remains only 120 ft of bank between the river and the toe of the dike. There is every reason to believe that this action will continue in the future and that within a relatively short period of time the dike will be threatened.

This action can be stopped either by shutting off or greatly reducing the underseepage flow or by providing bank retaining works. Both means have been considered. In order to shut off or greatly reduce the quantity of underseepage it would be necessary to blanket the cooling pond area to the south between the dike and the dividing dike or drive a line of sheet piling approximately 2000 ft long and 35 ft deep. Either of the above methods would be very expensive, costing something in the order of $250,000, and as the loss of water is of little value economically, we recommend that the bank caving be stopped by means of a heavy rock-fill revetment as shown on the attached sketch. This construction involves cleaning out loose slide material and displaced trees along the toe of the bank, placing a gravel filter bed against the slope and on the bottom of the cleaned out river bed and then placing a heavy rock-fill to provide stability against bank movement or sliding. The cost of this type of construction will only be a fraction of that required to shut off or greatly reduce the quantity of underseepage.

The river banks on the east and south side of the cooling pond

COPY

as well as the banks of the flood bypass canal show no change from conditions that prevailed prior to filling the pond and there is no need for protective works within those reaches at the present time.

It is recommended that the protective work be constructed on the north side approximately between stations 173 and 193 at your earliest convenience.

Very truly yours,

H W Stuber
Chief Concrete Hydraulic Engineer

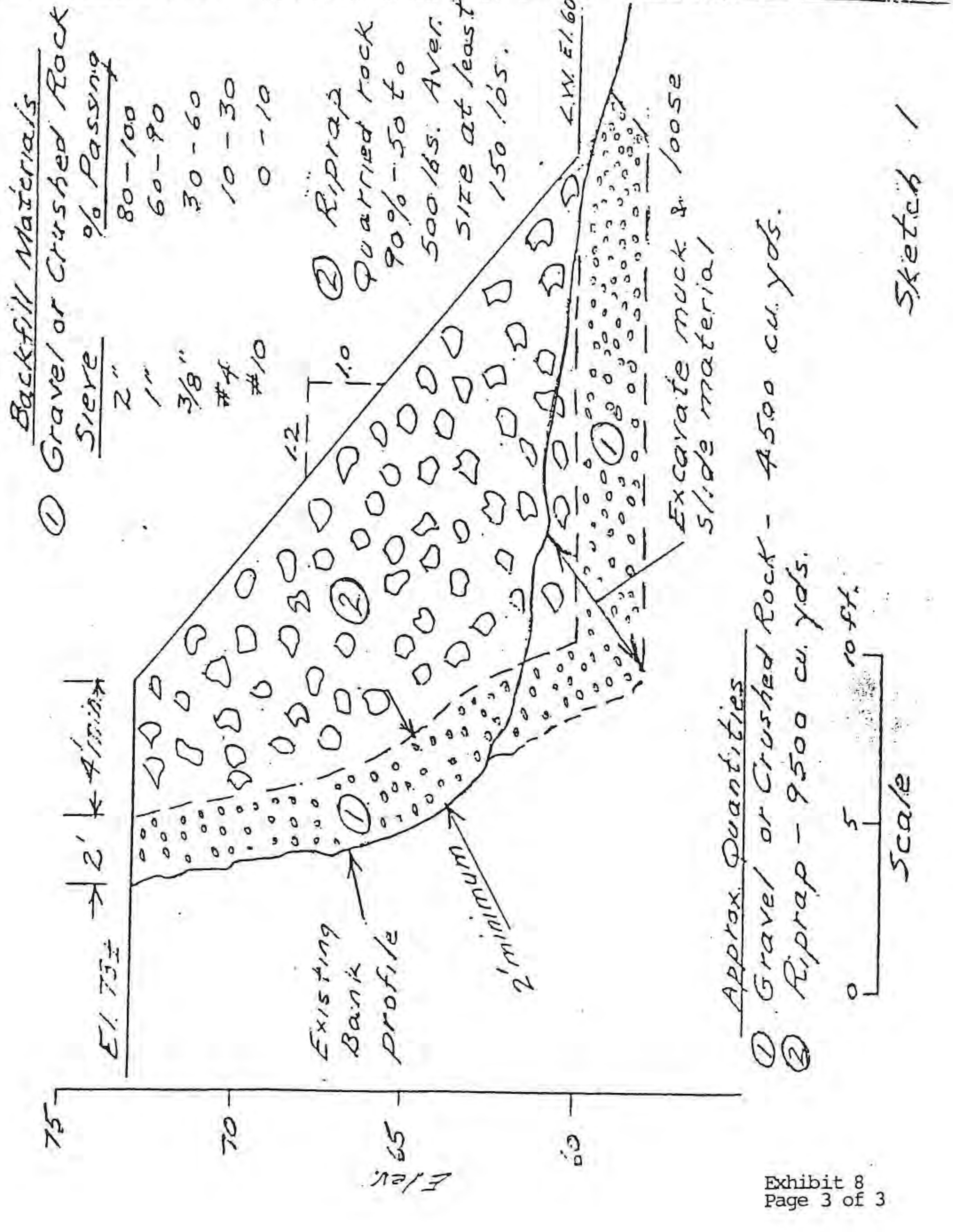
HWS:ww
Encl
cc: A J Skaale
R S Talton(Encl)
E J Pearson (Encl)
W W Miller (Encl)
E C Yaw/E B Worthington/D M Pulito
E C Yaw/C E Dyer/J V Sweeney
H W Stuber/O D Ides/C F Whitehead
J R Smith/H C Bohn
W Wallace
A W Naylor(Encl)
C H Reker

DATE	INCORPORATED	SHEET NO. 1 OF
CHKD. BY DATE	NEW YORK	E.O. NO. 260824 DIV. C

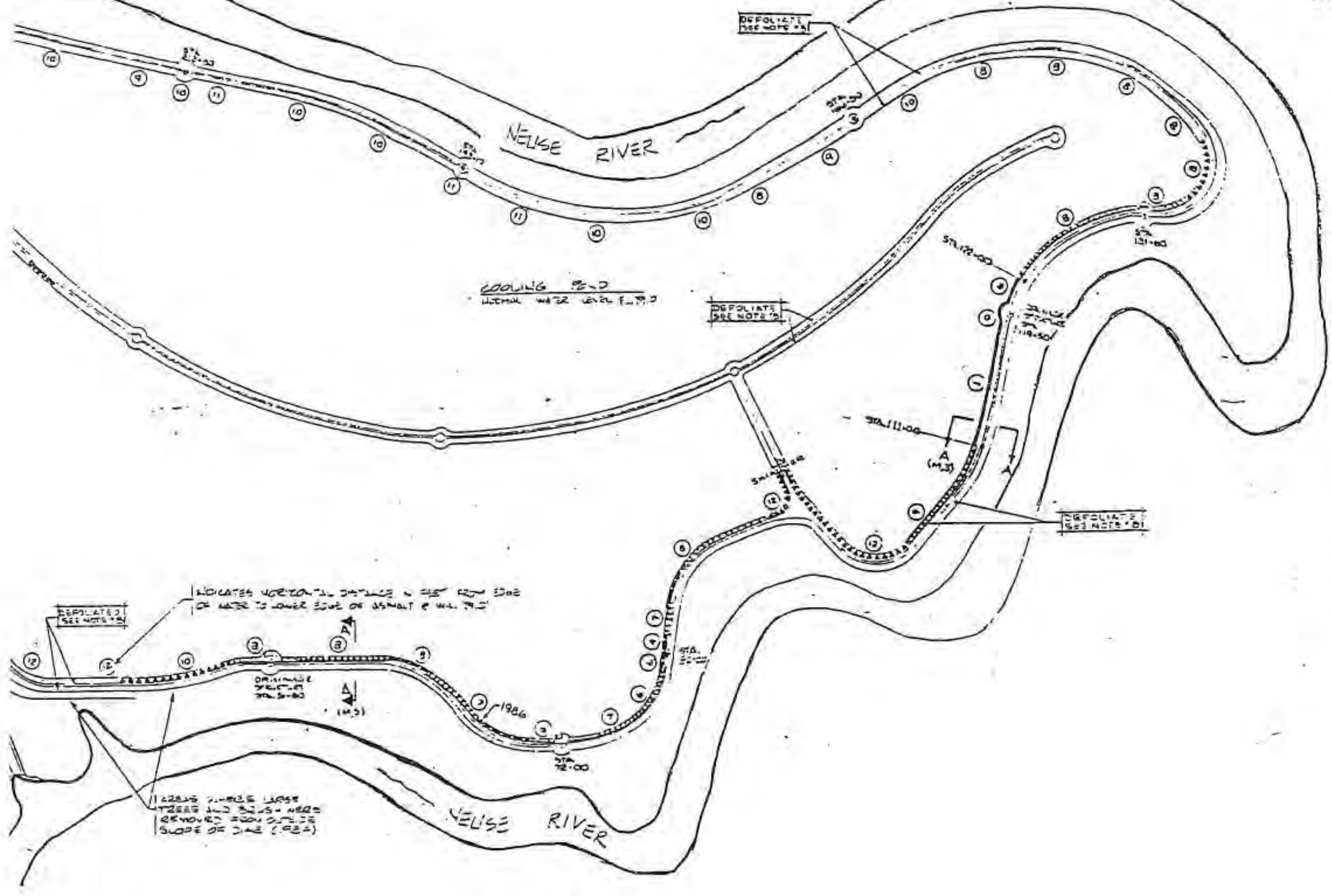
COMPANY Carolina Power & Light Co

PROJECT Goldsboro SES

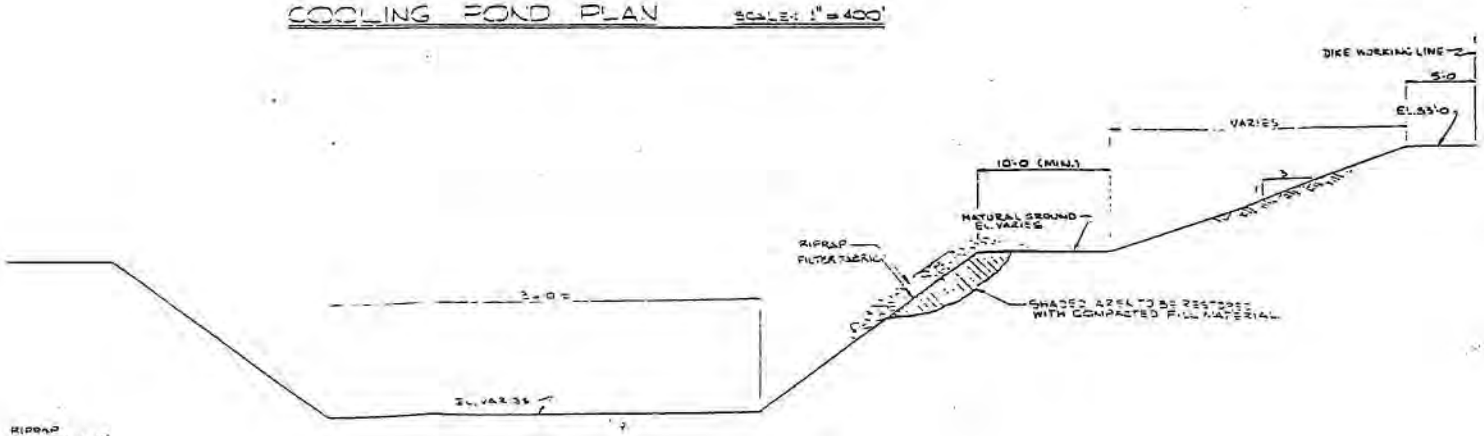
SUBJECT Bank Protection - Dike Sta. 173 thru 19[illegible]



RIP RAP	2400 TONS	390 TONS	4,100 TONS	3,422 TONS
FILTER FABRIC	770 SY	1000 SY	6,633 SY	SY
LINEAL FEET OF REPAIRS	1,000		300	3300



COOLING POND PLAN   SCALE: 1" = 400'



LEGEND

- 1982 REPAIRS
- 1984 REPAIRS
- 1985 REPAIRS
- 1986 REPAIRS

NOTES

COOLING POND DIKE REPAIRS

1. RIPRAP AND BEDDING MATERIALS SHALL CONSIST OF HARD, DENSE, DURABLE. ROCK FRAGMENTS THAT ARE RESISTANT TO ABRASION, FREE OF CRACKS, SEAMS, OR OTHER DEFECTS THAT WOULD TEND TO INCREASE THEIR DESTRUCTION BY WATER OR FROST ACTION.

2. RIPRAP SHALL HAVE AN AVERAGE ROCK SIZE OF 10 INCHES, AND AVERAGE WEIGHT OF 80 POUNDS. THE ROCK SIZE DISTRIBUTION SHALL RANGE FROM 16 INCHES TO NOT LESS THAN 6 INCHES. SEVENTY PERCENT OF THE ROCK SIZES SHALL RANGE FROM 16 INCHES TO 8 INCHES. THE MAXIMUM WEIGHT SHALL BE 320 POUNDS, AND THE MINIMUM WEIGHT SHALL BE 10 POUNDS.

3. IN AREAS WHERE THE ASPHALTIC CONCRETE WAVE PROTECTION APRON HAS BEEN DAMAGED AND EROSION OF THE CLAY BLANKET IS LESS THAN ONE FOOT, THE AREA SHALL BE CLEARED OF DEBRIS, FILTER FABRIC PLACED AGAINST THE CLAY BLANKET, AND THE SLOPE RESTORED TO ORIGINAL GRADE WITH NC DOT # 57 OR 67 STONE. RIP-RAP SHALL BE PLACED AFTER THE STONE TO PREVENT EROSION.

4. ALL REPAIRS AND RIPRAP PLACEMENTS SHALL BE PERFORMED AT A MINIMUM WATER LEVEL OF 79.0'.

5. DATA OBTAINED FROM FIELD INSPECTION, DATED MAY 1, 1984

6. ALL NEW RIPRAP SHALL BE UNDERLAIN WITH TRIVERA 1127 POLYESTER FILTER FABRIC INSTALLED AS PER MANUFACTURERS RECOMMENDATIONS

7. 1985 REPAIRS SHALL INCLUDE REPAIRING ALL AREAS INDICATED WHERE THE ASPHALTIC CONC. WAVE PROTECTION APRON HAS BEEN DAMAGED (IN ACCORDANCE WITH SECTION 'A-A' AND NOTES 3 & 10.). BETWEEN THE DAMAGED AREAS RIP-RAP SHALL BE PLACED ON THE ASPHALTIC WAVE PROTECTION BLANKET WITHOUT USING FILTER FABRIC OR STONE.

8. A DEFOLIATE SPRAY WILL BE APPLIED TO THE INTERIOR AND EXTERIOR SIDE SLOPE OF THE COOLING POND DIKE, DIVERSION DIKE, AND SKIMMER DIKE TO DESTROY VEGETATIVE GROWTH.

DISCHARGE CANAL REPAIRS 1984

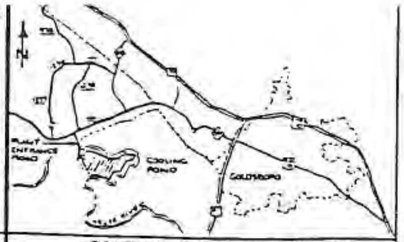
9. THE SLOPE AT THE DISCHARGE CANAL WHERE SLOUGHING AND CAVING ARE PRESENT WILL BE RESTORED TO DESIGN GRADE WITH COMPACTED FILL AND RIP RAP INSTALLED AS SHOWN ON SECTION 'E-E' (M.3)

10. IN AREAS WHERE THE ASPHALTIC CONCRETE WAVE PROTECTION BLANKET HAS BEEN DAMAGED AND EROSION OF THE CLAY BLANKET IS GREATER THAN ONE FOOT, THE AREA SHALL BE CLEARED OF DEBRIS, FILLED WITH SANDBAGS CONTAINING 2 PARTS SAND AND 1 PART CEMENT. COVER WITH FILTER FABRIC AND RIP RAP ENTIRE AREA.

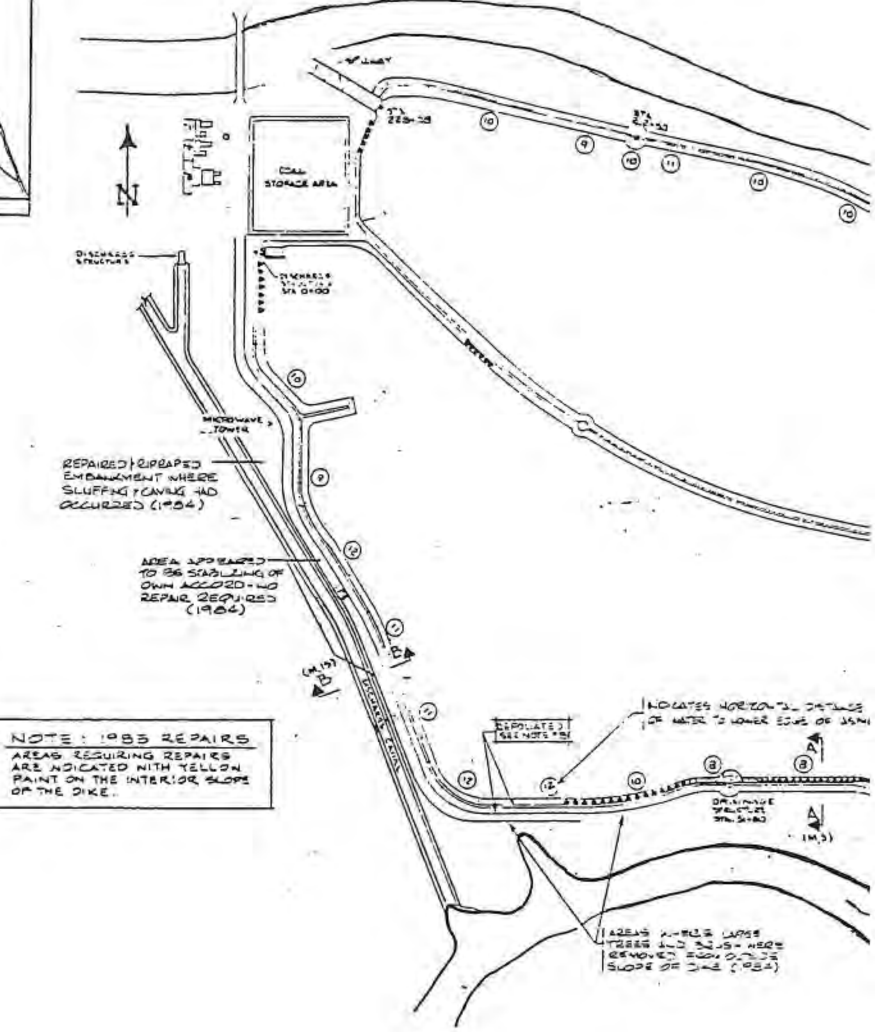
REFERENCE DRAWINGS

(EBASCO)

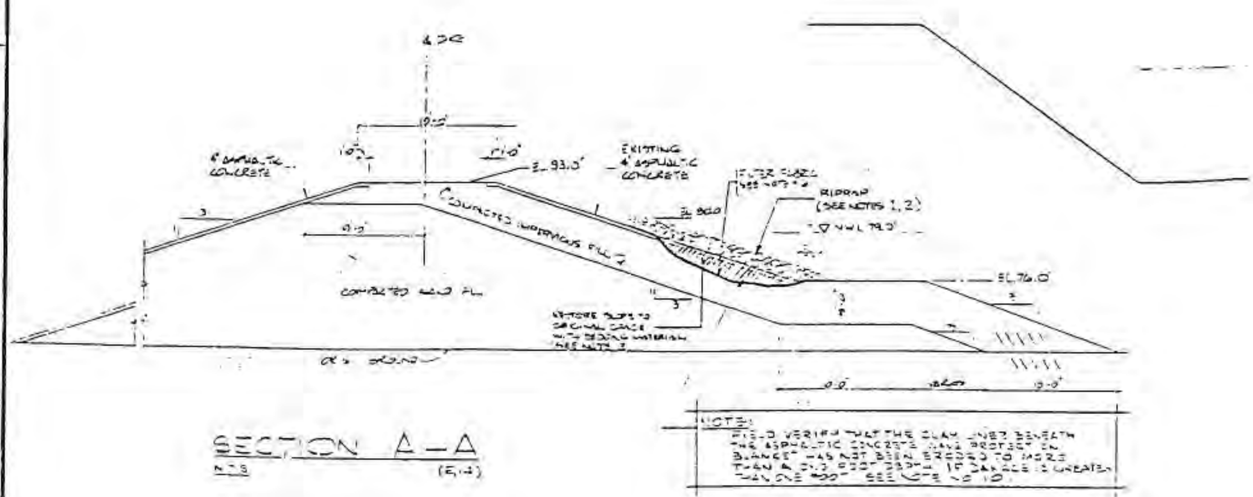
G-164390   COOLING POND - GENERAL PLAN
G-164391   COOLING POND DAM - SECTIONS & DETAILS



LOCATION PLAN (NOT TO SCALE)

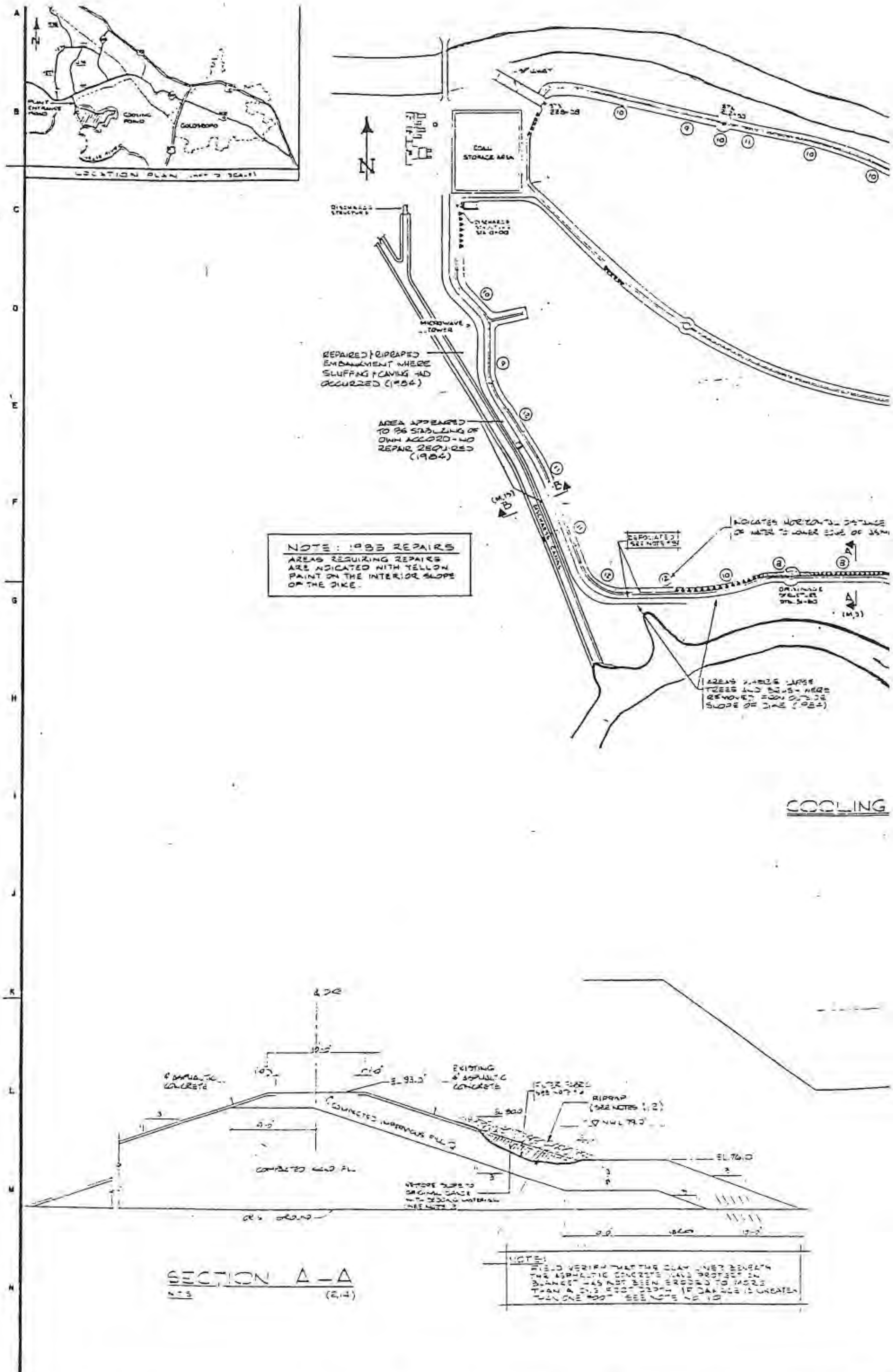


COOLING

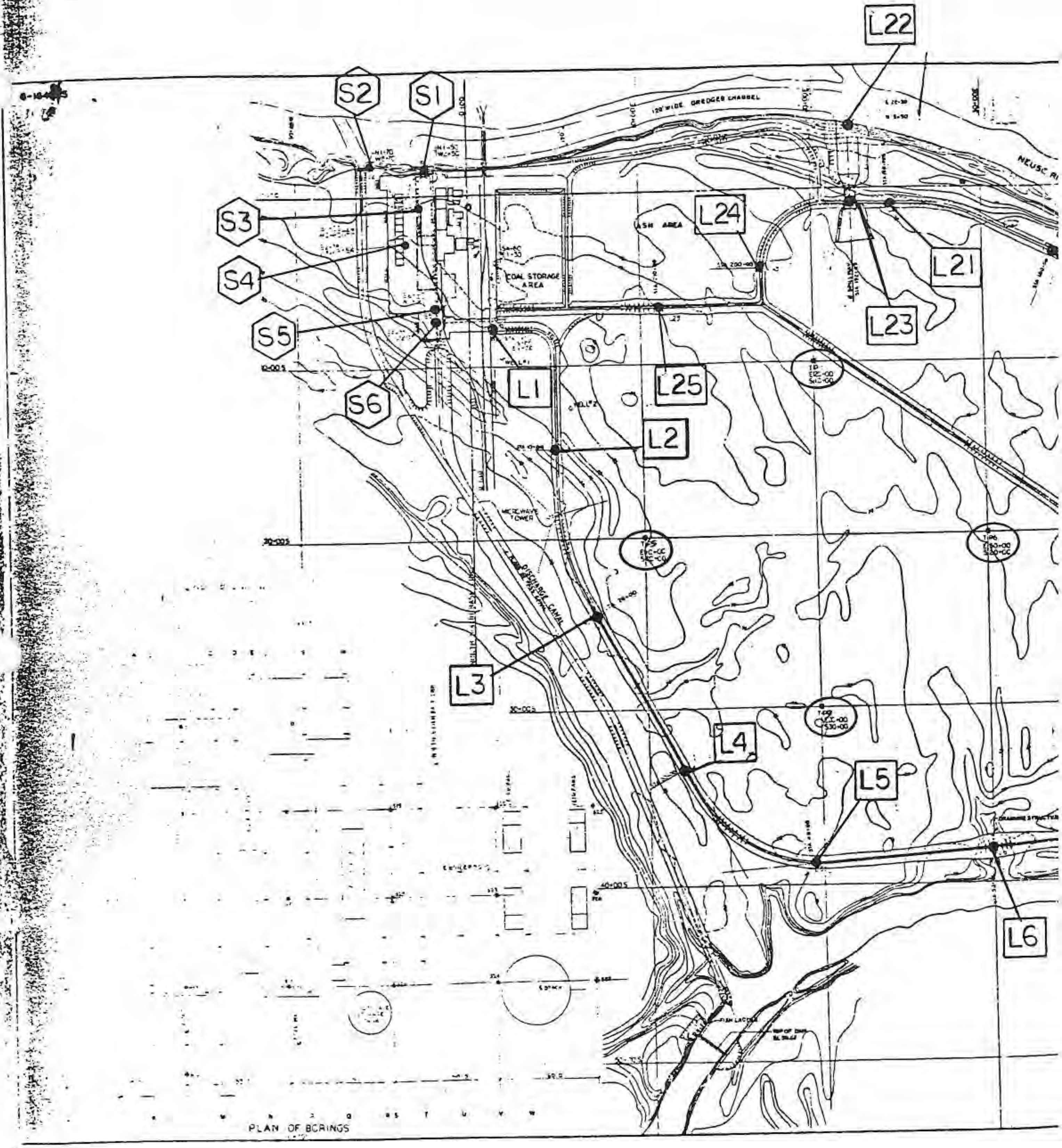


SECTION A–A

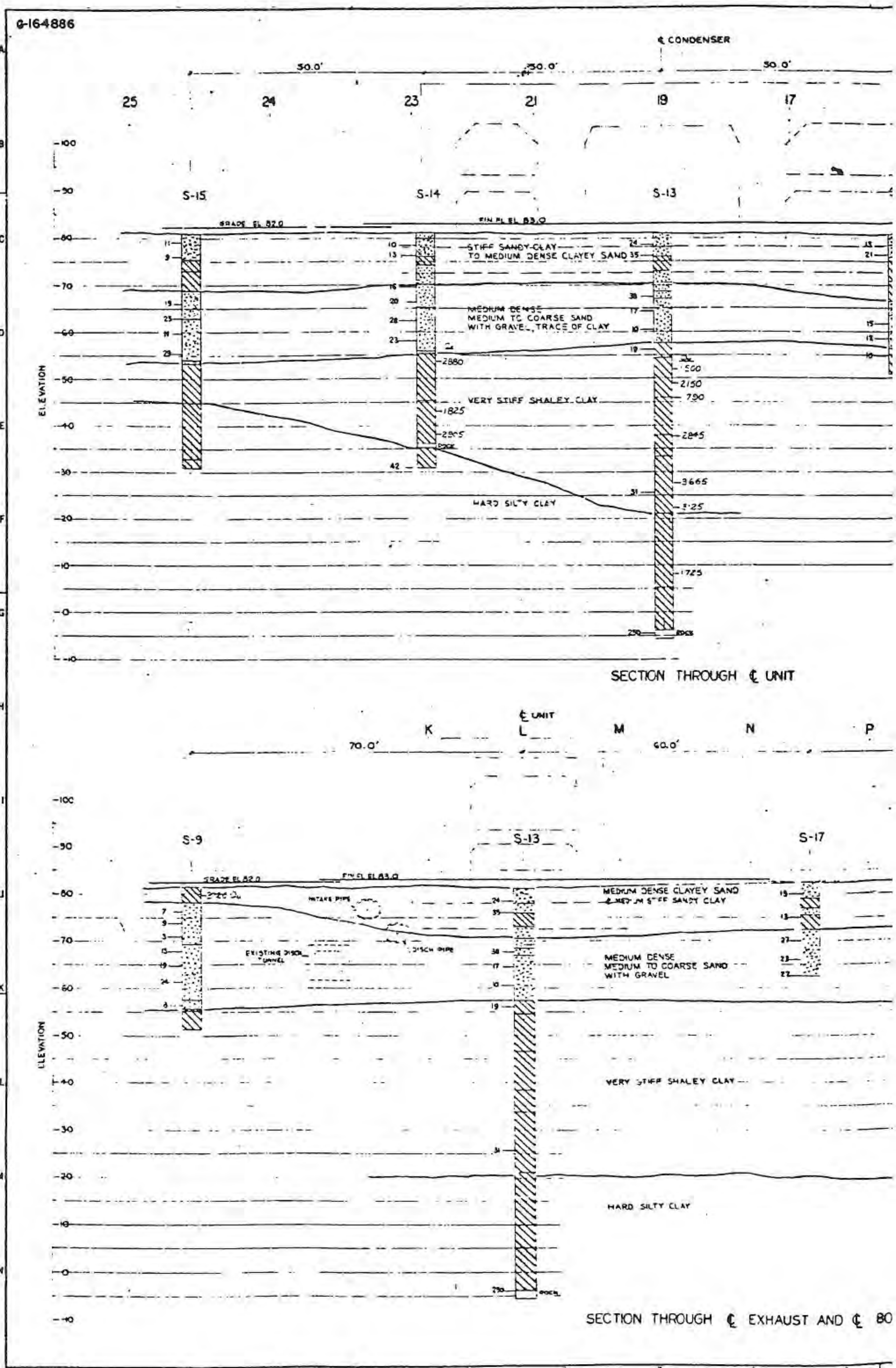
NTS (E,14)

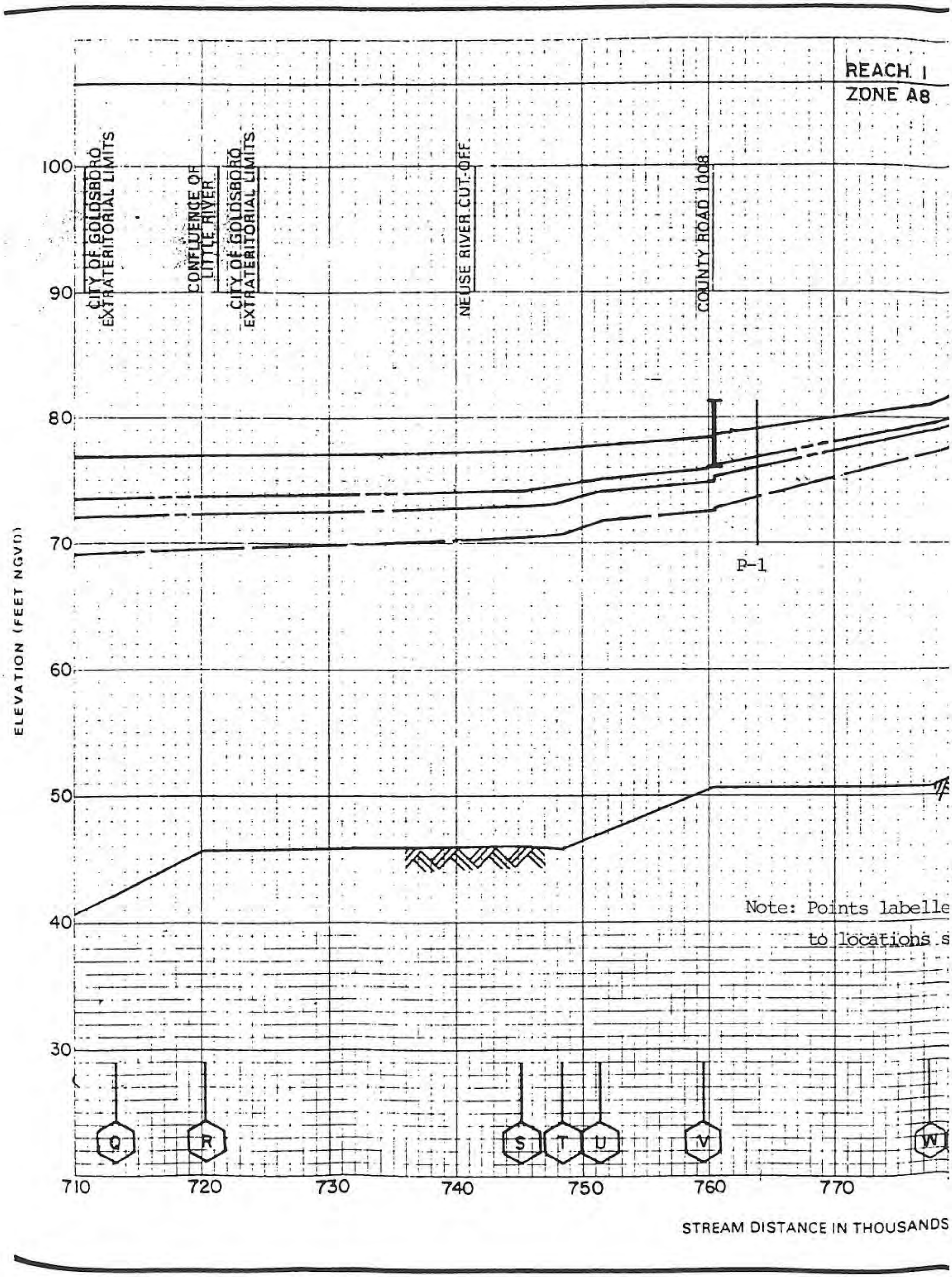


LOCATION PLAN (NOT TO SCALE)
PLANT ENTRANCE ROAD
COOLING POND
GOLDSBORO
COAL STORAGE AREA
DISCHARGE STRUCTURE
MICROWAVE TOWER
REPAIRED & RIPRAPED EMBANKMENT WHERE SLUFFING & CAVING HAD OCCURRED (1984)
AREA APPEARED TO BE STABLIZING OF OWN ACCORD-NO REPAIR REQUIRED (1984)
NOTE: 1983 REPAIRS
AREAS REQUIRING REPAIRS ARE INDICATED WITH YELLOW PAINT ON THE INTERIOR SLOPE OF THE DIKE.
INDICATES HORIZONTAL DISTANCE OF WATER TO LOWER EDGE OF ASPH
AREAS WHERE LARGE TREES AND BRUSH WERE REMOVED FROM OUTSIDE SLOPE OF DIKE (1984)
DRAINAGE STRUCTURE
COOLING
6" ASPHALTIC CONCRETE
COMPACTED IMPERVIOUS FILL
EXISTING 6" ASPHALTIC CONCRETE
EL 93.0'
RIPRAP (SEE NOTES 1, 2)
NWL 79.0'
EL 76.0
COMPACTED RAND. FILL
ORIG. GROUND
SECTION A–A
N.T.S. (2,14)
NOTE:
FIELD VERIFY THAT THE CLAY LINER BENEATH THE ASPHALTIC CONCRETE WAVE PROTECTION BLANKET HAS NOT BEEN ERODED TO MORE THAN A 0.5 FOOT DEPTH. IF DAMAGE IS GREATER THAN ONE FOOT SEE NOTE NO. 10.



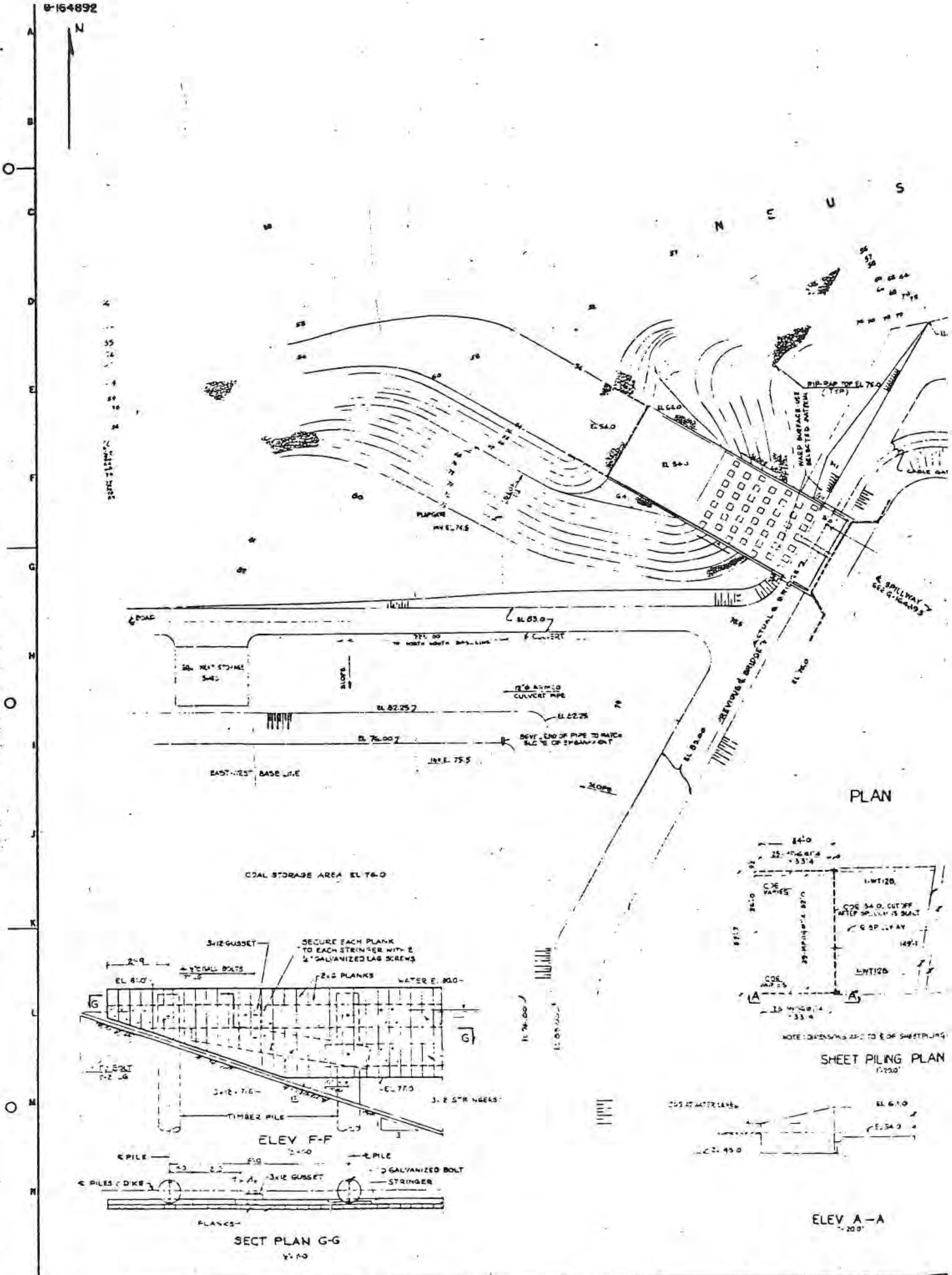
PLAN OF BORINGS


G-164886
℄ CONDENSER
50.0'
50.0'
50.0'
25
24
23
21
19
17
S-15
S-14
S-13
GRADE EL 82.0
FIN FL EL 83.0
STIFF SANDY CLAY
TO MEDIUM DENSE CLAYEY SAND
MEDIUM DENSE
MEDIUM TO COARSE SAND
WITH GRAVEL, TRACE OF CLAY
VERY STIFF SHALEY CLAY
HARD SILTY CLAY
ELEVATION
ROCK
SECTION THROUGH ℄ UNIT
℄ UNIT
K
L
M
N
P
70.0'
60.0'
S-9
S-13
S-17
GRADE EL 82.0
FIN FL EL 83.0
INTAKE PIPE
EXISTING DISCH TUNNEL
DISCH PIPE
MEDIUM DENSE CLAYEY SAND
& MEDIUM STIFF SANDY CLAY
MEDIUM DENSE
MEDIUM TO COARSE SAND
WITH GRAVEL
VERY STIFF SHALEY CLAY
HARD SILTY CLAY
ELEVATION
ROCK
SECTION THROUGH ℄ EXHAUST AND ℄ 80



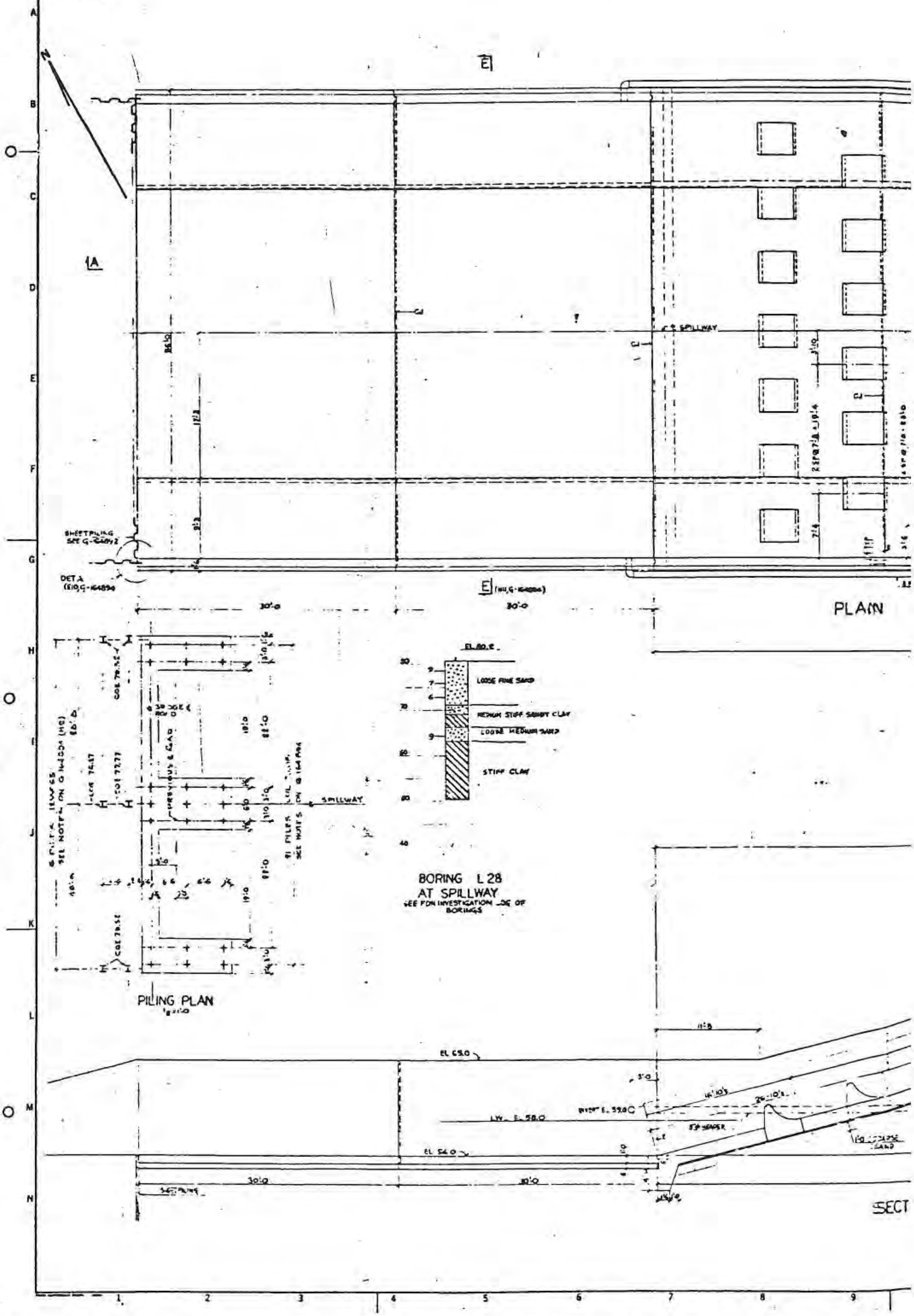
REACH I
ZONE A8
CITY OF GOLDSBORO EXTRATERRITORIAL LIMITS
CONFLUENCE OF LITTLE RIVER
CITY OF GOLDSBORO EXTRATERRITORIAL LIMITS
NEUSE RIVER CUT-OFF
COUNTY ROAD 1008
P-1
Note: Points labelle
to locations s
Q
R
S
T
U
V
W
ELEVATION (FEET NGVD)
100
90
80
70
60
50
40
30
710
720
730
740
750
760
770
STREAM DISTANCE IN THOUSANDS

B-164892

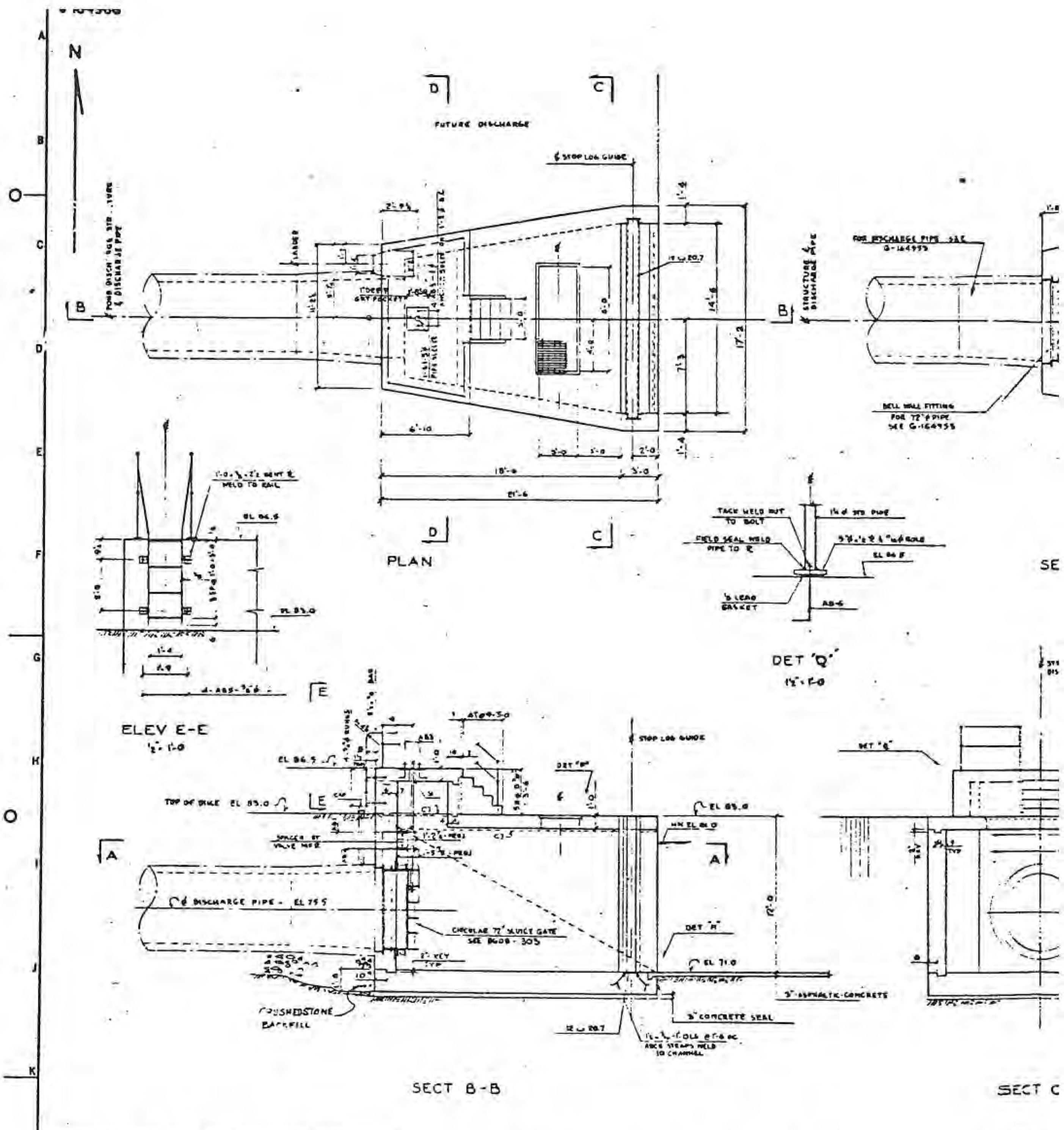


N
PLAN
RIP-RAP TOP EL 76.0 (TYP)
WARP SURFACE-USE SELECTED MATERIAL
EL 54.0
EL 64.0
PREVIOUS & BRIDGE
EL 76.0
EL 83.0
EL 82.25
EL 76.00
12"Ø ARMCO CULVERT PIPE
BEVEL END OF PIPE TO MATCH SLOPE OF EMBANKMENT
EAST-WEST BASE LINE
COAL STORAGE AREA EL 76.0
SLOPE
INV EL 74.5
℄ SPILLWAY SEE G-164493
SHEET PILING PLAN
NOTE: DIMENSIONS ARE TO ℄ OF SHEETPILING
ELEV A-A
EL 61.0
EL 54.0
EL 43.0
3x12 GUSSET
SECURE EACH PLANK TO EACH STRINGER WITH 2 ½" GALVANIZED LAG SCREWS
2x12 PLANKS
WATER EL 80.0
EL 81.0
TIMBER PILE
3-2 STRINGERS
ELEV F-F
℄ PILE
GALVANIZED BOLT
STRINGER
℄ PILES ℄ DIKE
PLANKS
SECT PLAN G-G

G-164893



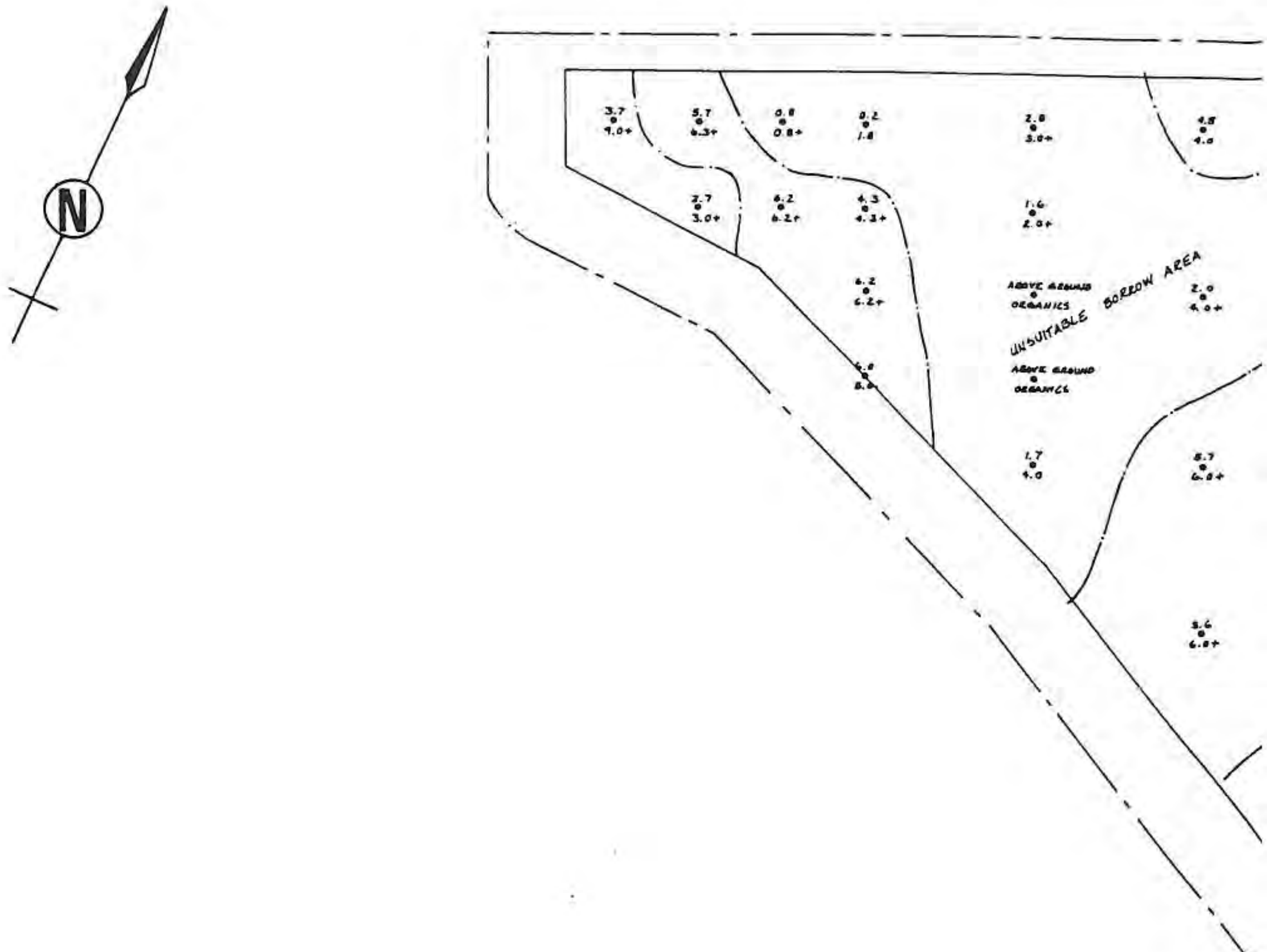
PLAN
30'-0
30'-0
SPILLWAY
PILING PLAN
EL 80.0
LOOSE FINE SAND
MEDIUM STIFF SANDY CLAY
LOOSE MEDIUM SAND
STIFF CLAY
BORING L 28
AT SPILLWAY
SEE FDN INVESTIGATION LOG OF BORINGS
EL 65.0
LW. EL 58.0
EL 54.0
SECT



ANCHOR BOLT SCHEDULE

TYPE I TYPE II TYPE III TYPE IV TYPE V TYPE VI

BOLT						NUT	SLEEVE			ANCHOR ℄		TOP ELEV. BOLT
MARK	NO	DIA	TYPE	LENGTH	LENGTH OF THD	NO.	NO	DIA	LENGTH	NO	SIZE	
AB1	2		II	[illegible]	2½	2	–	–	–	–	–	SEE SECT A-A
AB2	2		II	3'-4	[illegible]	2	–	–	–	–	–	SEE SECT B-B
AB3	4	1	II	2'-2	2½	4	–	–	–	–	–	86.84
AB4	6	⅞	II	1'-1	2½	6	–	–	–	–	–	SEE DET "Q"
AB5	4	⅞	II	0'-8	1½	4	–	–	–	–	–	SEE SECT B-B
AB6	8	⅞	II	1'-0	3	8	–	–	–	–	–	84.75


N
3.7
9.0+
5.7
6.3+
0.8
0.8+
0.2
1.8
2.8
3.0+
4.8
4.0
2.7
3.0+
6.2
6.2+
4.3
4.3+
1.6
2.0+
6.2
6.2+
ABOVE GROUND
ORGANICS
UNSUITABLE BORROW AREA
2.0
4.0+
ABOVE GROUND
ORGANICS
1.7
4.0
8.7
6.8+
5.6
6.8+

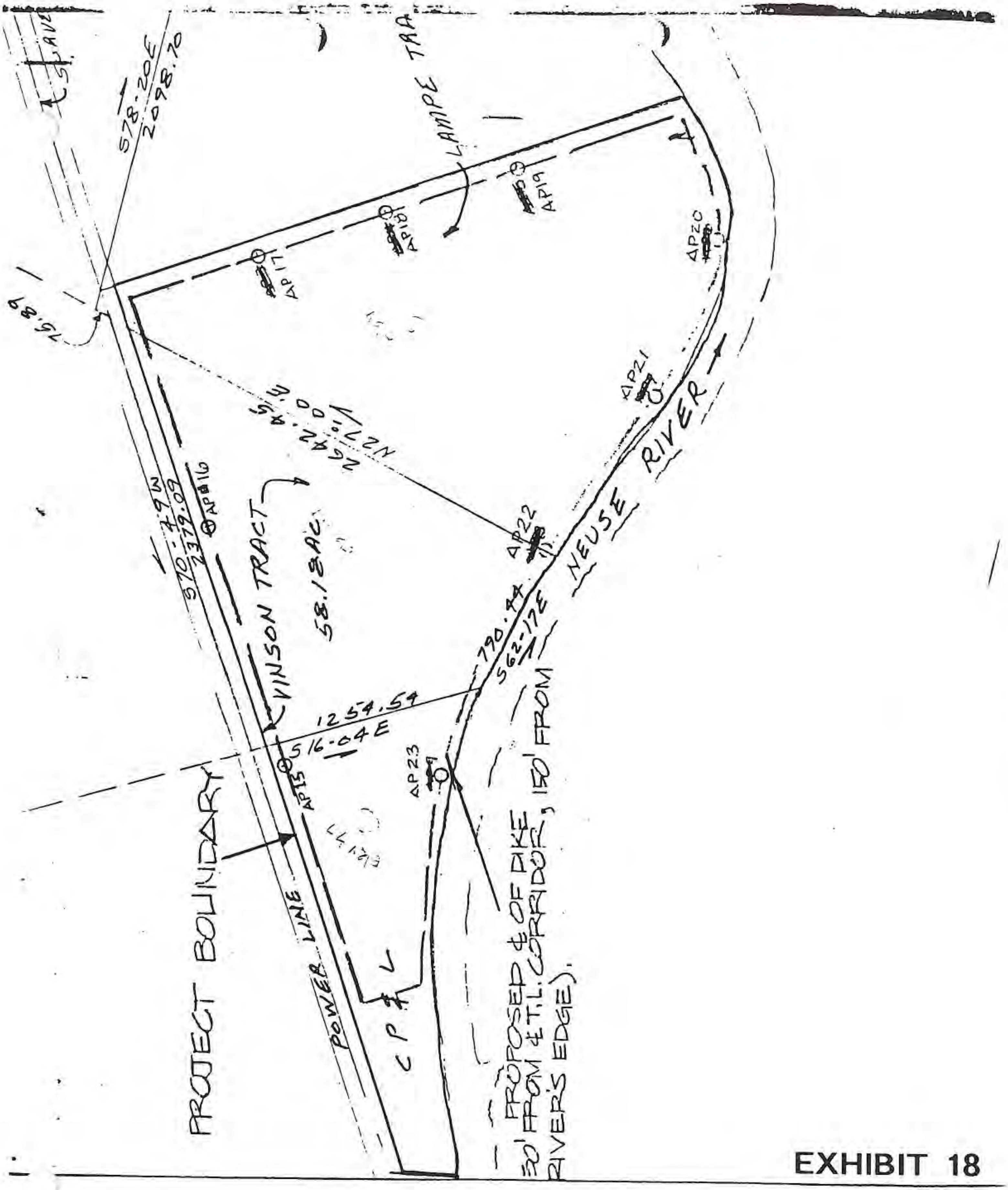

PROJECT BOUNDARY
POWER LINE
VINSON TRACT
58.18 AC.
NEUSE RIVER
S70-29W
2379.09
S78-20E
2098.70
S16-04E
1254.54
S62-17E
790.44
AP15
AP16
AP17
AP18
AP19
AP20
AP21
AP22
AP23
PROPOSED ℄ OF DIKE
50' FROM ℄ T.L. CORRIDOR, 150' FROM
RIVER'S EDGE).

EXHIBIT 18

APPENDICES

CAROLINA POWER & LIGHT COMPANY

H. F. LEE ELECTRIC GENERATING PLANT

ASH POND DIKE

SPECIFICATIONS FOR CONSTRUCTION PPCD-78-8-116

CAROLINA POWER & LIGHT COMPANY

H. F. LEE STEAM ELECTRIC PLANT

TECHNICAL SPECIFICATION

FOR

ASH POND EXPANSION

SPECIFICATION NO. PPCD-78-S-116

ISSUED MAY 30, 1978

POWER PLANT CONSTRUCTION DEPARTMENT

Revision No.	Date	Prepared By	Reviewed By	Approved By
0	8/29/78	BLA	DMK DMK	L B Wilson 8/29/-

H. F. LEE STEAM ELECTRIC PLANT
TECHNICAL SPECIFICATION
FOR
CONSTRUCTION OF ASH POND EXPANSIONS
SPECIFICATION NO. PPCD-78-S-116

TABLE OF CONTENTS

H. F. LEE STEAM ELECTRIC PLANT TECHNICAL SPECIFICATION FOR ASH POND EXPANSION

1.0 REQUIREMENTS

This Specification covers the construction of new dikes for the ash pond expansion at the H. F. Lee Steam Electric Plant. All work covered by this Specification will be performed in compliance with the Owner's erosion and sedimentation control plan.

2.0 FOUNDATION PREPARATION

A. Stripping

The entire areas for the base of the dike shall be stripped. The areas within the base of the dikes shall be grubbed free of all stump debris and other unsuitable materials, etc., including topsoil, organic, and other objectionable materials which might interfere with the proper compacting of the dike materials.

B. Dewatering

The foundation area shall be sufficiently dewatered to allow proper placement of embankment materials.

C. Subsurface Investigation

For ash line support embankment and ash pond dikes, after all necessary stripping has been completed and any soft or unsuitable materials have been excavated to establish a suitable foundation, the foundation for the earth fill shall be prepared by scraping so that the surface materials of the foundation can be well-bonded with the first layer of the fill as is specified for the subsequent layers of the earth fill.

3.0 COMPACTED FILL

A. Source

The fill material for ash line support dike shall be obtained from the area within the borrow area "A" or from areas as designated by the Owner.

All fill material for the ash pond and metal cleaning basin dikes shall be obtained from the borrow area "B" within the proposed ash pond site or from areas as designated by the Owner. The material shall contain not less than 15% fines passing No. 200 sieve.

B. Placement

1. Lifts shall be placed in approximately horizontal layers extending the entire length of the embankment and width of the dike being constructed. The thickness of each layer or lift shall not be greater than that required to achieve the specified compaction.

2. An evaluation will be made by the Owner using equipment to be used for embankment construction to determine the optimum thickness of lift, the optimum number of passes for the construction equipment, and the optimum moisture content to be used in the compaction of the earth fill.

3. If the rolled surface of any layer of fill is too smooth to bond properly with the layer of material to be placed thereon, it shall be harrowed to a sufficient depth to provide a satisfactory bonding surface before the next succeeding layer of fill material is placed.

C. Moisture Control

1. The moisture content of the fill materials may not be at the desired water content, and some drying or wetting may be required prior to completion as described below:

   a. The application of water to the fill materials, when required, shall be accomplished by sprinkling the materials after placement on the fill. Uniform moisture distribution shall be obtained by discing, blading, or other approved methods prior to compaction of a layer. If the surface of the prepared foundation or the rolled surface of any layer of fill is too dry to bond properly with the layer of material to be placed thereon, it shall be scarified and moistened by sprinkling to the acceptable moisture content prior to placement of the next layer of fill.

b. If the rolled surface of any layer of the fill in place is too wet for proper compaction of the layer of fill material to be placed thereon, it shall be allowed to dry or be worked with harrow or scarified, as required, to reduce the water content to an acceptable level and then compacted before the next succeeding layer of fill is placed.

D. Compaction

Each layer of the earth fill placed in the dike shall be compacted to a density as specified on the drawings.

4.0 SEEDING

A. Scope

All dike slopes and areas disturbed by construction activities are to be seeded.

B. Materials

All materials shall meet the requirements of Division IX of the latest issue of the North Carolina State Highway Commission Standard Specifications for Roads and Structures shown below:

Fertilizer	Article 960-1
Limestone	Article 960-2
Seed	Article 960-3
Mulch for erosion control	Article 960-4

C. Seedbed Preparation

1. The soil shall be scarified or otherwise loosened to a depth of not less than 5 inches except as otherwise provided or directed by Owner. Clods shall be broken, and the top 2 to 3 inches of soil shall be worked into an acceptable seedbed by the use of soil pulverizers, dragss or harrows, or by other methods approved by the Owner. These requirements shall be applied up to and including 2:1 cut slopes.

2. On cut slopes that are steeper than 2:1, the depth of preparation of the seedbed may be reduced as directed by the Ownerr; but in all cases, the slope surface shall be scarified, grooved, trenched, or punctured so as to provide pockets, ridges, or trenches to provide lodging for seeding materials. Seedbed preparation within 2 feet of the edge of any pavement shall be limited to a depth of 2 to 3 inches.

3. Where indicated on the drawings, preparation of seedbed shall include spreading of 6 inches of topsoil on the area to be seeded.

4. The preparation of seedbeds shall not progress when the soil is frozen, extremely wet, or when working conditions are determined unfavorable by the Owner.

C. Application of Materials

1. Limestone, fertilizer, and seed shall be applied within 24 hours after completion of seedbed preparation unless directed otherwise by the Owner.

2. Limestone may be applied as a part of the seedbed preparation provided it is immediately worked into the soil. Otherwise, limestone and fertilizer shall be spread uniformly over the prepared seedbed at the specified rate and then harrowed, raked, or otherwise thoroughly worked or mixed into the seedbed.

3. Seed shall be distributed uniformly over the seedbed at the required rate of application and immediately harrowed, dragged, raked, or worked so as to cover the seed with a sufficient layer of soil. If two kinds of seed are to be used which require different depths of coverage, they shall be sown separately.

4. Immediately after seed has been properly covered, the seedbed shall be compacted in the manner and degree approved by the Owner.

5. The kinds of seed and the rates of application of seed, fertilizer, and limestone shall be as stated below. During periods of overlapping dates, the kinds of seed to be used shall be as determined by the Owner.

All Rates Are In Pounds Per Ton

August 1 - March 1	February 15 - June 1	May 1 - September 1
120# Ky. Tall Fescue or Alta Tall Fescue	70# Ky. Tall Fescue or Alta Tall Fescue	50# Ky. Tall Fescue or Alta Tall Fescue
1,200# Fertilizer	50# Korean or Kobe Lespedeza	70# Korean or Kobe Lespedeza
		25# Sudan Grass
2,000# Limestone	1,200# Fertilizer	1,200# Fertilizer
	2,000# Limestone	2,000# Limestone

On fill slopes 2:1 or steeper, add 25 pounds rye grain August 1 to June 1.

On cut and fill slopes 2:1 or steeper, add 25 pounds Sericca Lespedeza January 1 to December 31.

6. Fertilizer shall be 8-8-8 grade with not more than 400 pounds per ton potential acidity. Upon written approval of the Owner, a different grade of fertilizer may be used provided the 1-1-1 ratio is maintained and the rate of application adjusted to provide the same amount of plant food as 8-8-8 grade.

D. Mulching

1. All seeded area shall be mulched unless otherwise directed by the Owner. Grain straw may be used as mulch at any time of the year. Use of materials other than straw shall require approval of the Owner.

2. Mulch shall be applied within 24 hours after the completion of seeding unless otherwise directed by the Owner. Care shall be exercised to prevent displacement of soil or seed or other damage to the seeded area during the mulching operations. Mulch shall be uniformly spread by hand or by approved mechanical spreaders or blowers. An acceptable application will be that which will allow some sunlight to penetrate and air to circulate but partially shade the ground, reduce erosion, and conserve soil moisture.

3. Mulch shall be held in place by a sufficient amount of asphalt or other approved binding material to assure that the mulch is properly held in place. The rate and method of application of binding material shall be approved by the Owner.

4. Sufficient precautions shall be taken to prevent mulch from entering drainage structures through displacement by wind, water, or other causes; and any blockage to drainage facilities which may occur shall be removed.

E. Maintenance of Seeding and Mulching

1. Areas where seeding and mulching have been performed shall be maintained in a satisfactory condition until final acceptance of the project. Sufficient water shall be applied when needed to seeded areas to provide adequate moisture for germination and growth.

2. Areas of damage or failure due to any cause shall be corrected by being repaired or by reseeding as may be directed by the Owner.

APPENDIX A

Document 10

Lee Ash Pond Inundation Report

MACTEC
engineering and constructing a better tomorrow

DRAFT DAM BREACH ANALYSES AND INUNDATION MAP DEVELOPMENT

for

Ash Pond Dam

at

Progress Energy H. F. Lee Plant
Wayne County, North Carolina

Prepared for
Progress Energy

Prepared by

MACTEC Engineering and Consulting, Inc.

Project 6468-10-0181

November 1, 2010

Stephen J. Hanks
Project Engineer

D. Wayne Ingram
Principal Engineer

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Appendix

1.0 Executive Summary

The Ash Pond is a storage area for coal combustion byproducts for the Progress Energy H. F. Lee Plant. The Ash Pond Dam is an approximately 20-foot high earthen dam. The impoundment has a normal surface area of approximately 143 acres and a design maximum storage capacity of approximately 1,980 acre-feet. This report summarizes the dam breach and breach inundation analyses completed for the Ash Pond Dam. The analyses were completed for a wet weather failure and a dry weather failure. The breach flood wave was routed into the Neuse River. The breach flood wave was routed through the downstream floodplain using HEC-RAS.

Based on available information there appears to be few inhabited structures along the floodplain of the Neuse River within the vicinity of the embankment, with the exception of the Stevens Mill Village mobile home community which is located approximately 2.7 miles from the Ash Pond Dam. There are two bridge crossings that could be affected by a breach flood wave, the most heavily traveled of which is the bridge over the Neuse River on State Road 1008 (also known as Stevens Mill Road).

These analyses are intended to be conservative, using worst case assumptions related to failure events, for use in an Emergency Action Plan for the facility. Data for the hydraulic analyses were obtained from readily available information with limited field data collection. The HEC-RAS model developed by FEMA for the preparation of the Wayne County Flood Insurance Study was used to analyze the resulting inundation of the breach wave. The elevation – storage volume curve for the Ash Pond was developed from topographic information provided by Progress Energy.

Available information indicates that the constructed top width of the embankment is 12 feet and the crest elevation is 90 feet North American Vertical Datum of 1988 (NAVD). The design side slopes were estimated to be 2 foot horizontal to 1 foot vertical (2H:1V) on the interior and exterior. The maximum height of the dam is 20 ft from crest low point to the downstream toe near the Neuse River. The hydrologic design criterion for the storage area is retention of one half of the Probable Maximum Precipitation (PMP).

The routing of the flood wave was accomplished using Hydrologic Engineering Center – River Analysis System (HEC-RAS) version 4.1 (US Army Corps of Engineers, 2010). The breach of the embankment was routed directly into the Neuse River without any attenuation of the flood wave occurring in the overbank portion of the river.

The breach parameters were developed pursuant to the empirical equations presented by Froehlich (1995) following the evaluation of 63 dam breaches. The breach width estimates were based on a storage volume equal to 60 percent of the total capacity of the impoundment. The bottom width of a trapezoidal-shaped breach was estimated to be 24 feet. The bottom elevation of the breach was assumed to be at 70 feet NAVD. Breach section side slopes of 1H:1V were chosen as they represent the upper limit of the typical range of values. The breach development time was estimated to be 0.5 hours.

The breach analyses indicates that the breach of the Ash Pond is not likely to cause a water level increase of greater than 1 foot in any area downstream of the Ash Pond within the extent of analyses for the wet weather condition. The breach analyses indicate that the areas inundated by the dry weather breach will be contained to the confines of the banks of the Neuse River with, the exception of the area adjacent to the southeast corner of the embankment. Therefore, it is apparent that a breach of the Ash Pond Dam will not pose a significant risk to public safety.

2.0 Introduction

This report summarizes dam breach analyses completed for the Ash Pond at the Progress Energy H. F. Lee Plant to determine the extent of the inundation resulting from a dam breach. Analyses were completed using Hydrologic Engineering Center – River Analysis System (HEC-RAS) version 4.1 (US Army Corps of Engineers, 2010). Basic pertinent information regarding the impoundment and dam is summarized in Table 1.

Table 1. Ash Pond Structure Information

Impoundment Name	Ash Pond
State Dam ID No	Not assigned
Current Size Classification	Intermediate
Current Hazard Classification	Significant
Location	Latitude: 35.379° Longitude: -78.069°
County	Wayne
Receiving Stream(s)	Neuse River
Impoundment Area	143 acres
Maximum Dam Height	20 feet (70 ft to 90 ft)
Normal Water Elevation	84 feet NAVD
Maximum Depth	20 feet
Maximum Hydraulic Storage Volume	1,980 acre-feet (as designed) (3,194,400 cubic yards)
Material(s) Stored	Coal combustion product
Storage status	Unknown
Principal Spillway	None
Emergency Spillway	None
Dam Minimum Section	Top width: 12 feet, Interior Slope: 2.0H:1V, Exterior Slope: 2.0H:1V
Embankment Materials	Earthen

3.0 Description of Facilities and Potentially Impacted Area

3.1 General

The Ash Pond Dam is used for storage of coal combustion byproducts for the H. F. Lee Plant. The reservoir has a designed storage capacity of 1,980 acre-feet (AF) below the embankment crest elevation of 90 feet NAVD. Information describing the characteristics of the impoundment, spillway facilities and maximum dam section are provided in Table 1.

The breach flood wave was routed directly the Neuse River with no interlaying overland flow. The analyses included an assessment of the sensitivity of the model predictions to various breach parameters and flowable impoundment storage volumes.

Based on available information there appears to be few, inhabited structures along the floodplain of the Neuse River within the vicinity of the embankment, with the exception of the Stevens Mill Village mobile home community which is located approximately 2.7 miles from the Ash Pond Dam. There are two bridge crossings that could be affected by a breach flood wave, the most heavily traveled of which is the bridge over the Neuse River on State Road 1008 (also known as Stevens Mill Road).

3.2 Impoundment and Embankment Characteristics

The impoundment characteristics were determined from topographic information provided by Progress Energy. The elevation – volume curve for the impoundment were developed in accordance with the methodologies presented in Malcom 1995. The elevation – volume curve for the Ash Pond is presented in Figure 1.

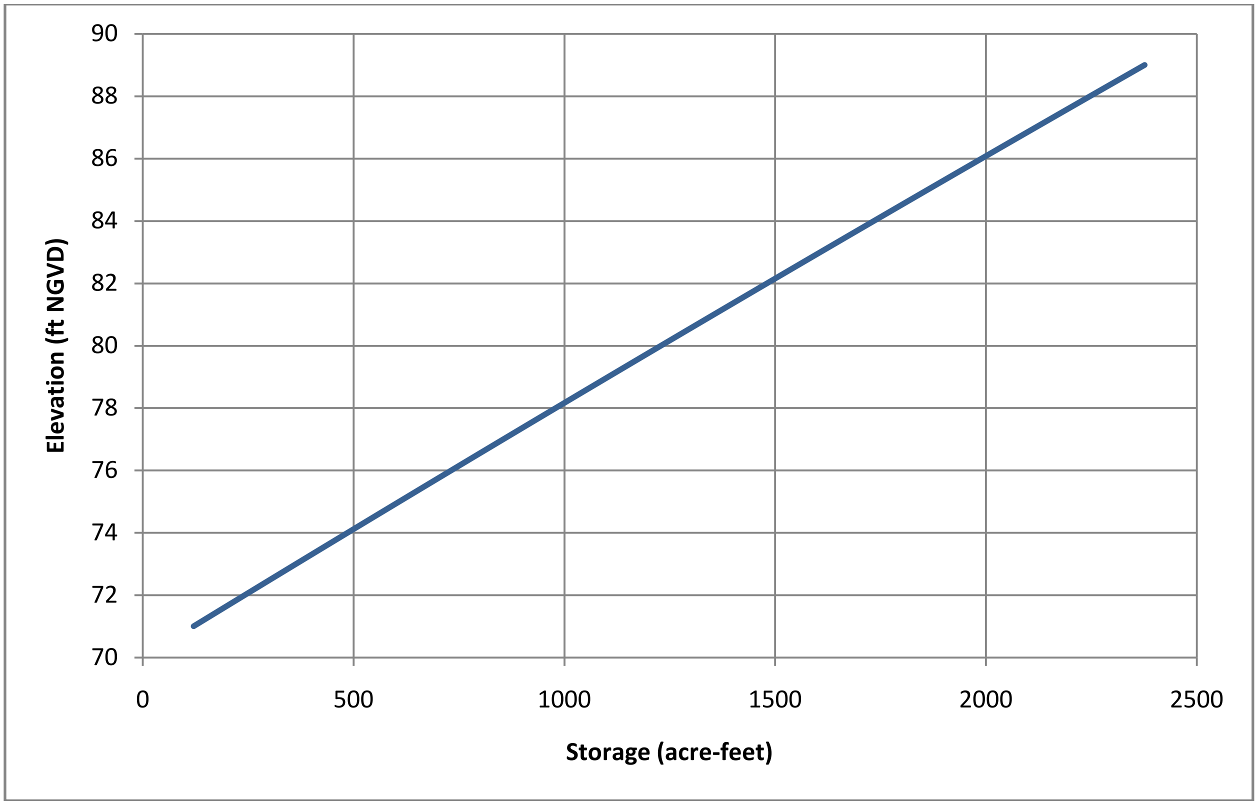


Figure 1. Ash Pond Elevation – Storage Volume Curve

The design top width of the embankment is 12 feet. The design side slopes are 2H:1V on the interior and 2H:1V the exterior. The dam crest is approximately 20 feet above surrounding grade. Excess water in the reservoir is discharged into the Neuse River through a barrel and riser with an overflow elevation of 84 ft NAVD. The hydrologic design criterion for the storage area is retention of one half of the PMP.

4.0 Scope of Investigation

This report summarizes the results of analyses completed to determine the extent of the inundation resulting from a breach of the Ash Pond dam. The analyses extended as far downstream from the impoundment structure in question as significant impacts of a reasonable worst case scenario were determined to propagate. The extent of significant impacts was a site-specific determination, considering factors such as:

- sensitivity of impacted features to high water level (human safety, property damage, emergency services demands, transportation systems, etc.), and
- maximum water level relative to naturally occurring high water levels and fluctuations from precipitation events.

Assessment of the risk of a dam breach occurrence was not part of this work; nor was detailed investigation of the most probable breach location or breach characteristics such as rate of growth, dimensions, and other information that would require more detailed geotechnical information including site-specific materials investigations, testing and analyses. The detailed considerations and analyses required to develop a quantitative descriptive model of the fluidization of coal combustion products (CCP) stored in the impoundment, the transport and settlement at downstream locations was also not included in the scope of this investigation. Rather, it was assumed that the volume of fluid discharged as a result of a breach behaves as water, a Newtonian fluid in hydraulics terminology. This is a conservative assumption because entrainment of solids in the fluids discharged would cause increased energy losses in the fluid, resulting in slower velocities, quicker flood wave dissipation due to loss of volume due to solids settling and other fluid mechanics considerations.

Recognizing that conservative assumptions regarding breach formation characteristics, conditions at time of breach, along with an assumption that the entire impoundment volume is water would create an unrealistically conservative prediction, the analyses did include an assumption regarding the fraction of the total impoundment volume that would become fluidized and discharged. Also recognizing that this is an assumption, a sensitivity assessment was completed to characterize resultant critical predictions of water levels and timing as a function of the assumed storage volume fluidized.

Data for model development were from readily available sources with limited field work to confirm conditions or collect additional information. No engineering survey was completed for floodplain cross sections or bridges that cross the streams.

5.0 Summary of Methods and Approach

5.1 Hydraulic Analysis

The hydraulic analyses completed for this study were based predominantly on application of the hydraulic model Hydraulic Engineering Center – River Analysis System (HEC-RAS), version 4.1 (USACE HEC, January 2010). HEC-RAS is a general application, one-dimensional model that can perform unsteady flow routing through an open channel system that may also include culverts, bridges, levees, tributaries, storage areas and traversing dams. Unsteady flow analyses deals with flow conditions that vary temporally and spatially.

For this study, the general approach was to define the impoundment as a HEC-RAS storage area and analyze a dam breach using the lateral structure option to model the embankment to be breached. A lateral structure in HEC-RAS is a structure located parallel to the flow direction of the river with flow over the structure being analyzed as a weir for which a breach scenario can be prescribed. The hydraulic model of the Neuse River developed by FEMA for the Flood Insurance Study of Wayne County was used to analyze the affects to the Neuse River resulting from the breach of the Ash Pond Dam.

5.2 Boundary Conditions

The inundation resulting from a breach of the embankment was analyzed for two separate weather conditions. For both weather conditions, the boundaries of the hydraulic model were described using a constant flow rate at the headwater of the model, and a specified stage at the tailwater of the model. The flow and tailwater stage of the Neuse River for a dry weather scenario was determined from the maximum monthly mean discharge of 4,700 cfs specified in the 2009 Water Data Report for USGS streamflow gauge 02089000 – Neuse River near Goldsboro (Wayne County). The boundary conditions for the wet weather condition were input as the flow rate and tailwater stage of the Neuse River for a 100-year frequency flood of 39,093 cfs as specified in the Flood Insurance Study for Wayne County.

The initial pool elevation for the dry weather scenario was set to the normal pool elevation of 84 feet NAVD. The initial pool elevation for the wet weather scenario was set to the crest elevation of 90 feet NAVD.

5.3 Embankment Breach

The breach parameters were developed pursuant to the empirical equations presented by Froehlich (1995) following the evaluation of 63 dam breaches. The breach width estimates were based on a storage volume equal to 60 percent of the total capacity of the impoundment. It was assumed that 60 percent of the total water and solids volume of the Ash Pond would flow out of the pond. The trapezoidal-shaped breach bottom width was estimated to be 24 feet for the wet weather failure scenario. The breach bottom width was estimated to be 23 feet for the dry weather failure scenario. The bottom elevation of the breach was assumed to be the elevation of the reservoir bottom, which is approximately 70 feet NAVD 1988. Breach side slopes of 1H:1V were chosen as they represent the upper limit of the typical range of values. The breach development time was estimated at 0.5 hours.

6.0 Sensitivity Assessment

There are several parameters that can be identified as potentially important to determining the prediction of results of a dam breach. Not all, but most, of these are typically inputs to available dam breach models. These parameters have a significant amount of uncertainty in what a representative value might be. In addition to these normal uncertainties, modeling of discharges from impoundments that contain material such as ash or gypsum that may be fluidized by a breach presents additional uncertainties.

It is unlikely that all the contents of the 143-acre impoundment would become fluidized in the event of even an extremely large and rapid embankment breach. To assess the impacts of the assumption regarding the fraction of total volume (solids and pore space water) that would be mobilized, various fractions of the total storage volume were assumed to be discharged. The results of four simulations with various fractions of the total storage volume are presented below. Additionally, model sensitivity to breach bottom width, breach development time, and breach side slopes were evaluated. The results of the sensitivity analysis are presented in Tables 2 and 3.

Table 2. Results of Sensitivity Analysis for a Dry Weather Breach

Modification	Peak Discharge Rate (cubic feet per second)	Peak Tailwater Stage (feet NAVD 1988)
None	5,181	68.9
Increased Breach Bottom Width by 50%	6,696	69.1
Reduced Breach Development Time to 0.25 hr	5,363	68.9
Increased Breach Development Time to 1 hr	4,876	68.9

Table 3. Peak Breach Discharge versus Discharge Volume for a Dry Weather Breach

Percent of Total Volume	Peak Discharge Rate (cubic feet per second)	Discharge Volume (acre-feet)
100%	5,951	1,842
80%	5,616	1,499
60%	5,181	1,145
40%	4,627	778

7.0 Summary of Selected Final Analyses

7.1 Assumptions and Selected Inputs

The sensitivity assessment indicates that minor changes in the maximum inundation will result from the modification of the selected parameters, with the most significant alteration in the breach hydrograph resulting from the increase in breach bottom width. Increasing the breach bottom width by 50 percent results in a peak discharge rate increase of 1,122 cfs (23.7 percent). The selected HEC-RAS model inputs for the final breach analyses are presented in Table 4.

Table 4. HEC-RAS Model Inputs

Input	Value
Breach Development Time (minutes)	30
Breach Bottom Width (feet)	24 feet (Wet Weather)*
Breach Side Slopes (H:1V)	1
Breach Bottom Elevation (feet NAVD 1988)	70 feet
Breach Progression Rate	Linear
Computation time increment (seconds)	60

* Breach bottom width was estimated to be 23 feet for the dry weather condition.

7.2 Flood Wave Travel Time and Route of Travel

It is important for emergency responders to have an estimate of how much time is available in the event of a dam failure to take action at various downstream locations. The available time is not dependent on the time of arrival of the maximum water level, but rather on a condition that is typically less clear – when impacts become critical. Perhaps the most apparent example of this is when access to an area becomes inundated, affecting the safety of movement of the public and emergency service workers. A default initial impact of 1 feet of inundation was chosen since this is a value were egress by automobile becomes difficult.

The flood wave travel time was determined for two initial conditions. The first initial condition is representative of typical dry weather conditions where the pool elevation is at 84 feet NAVD. The second initial condition is representative of wet weather conditions where the pool elevation is at 90 feet and failure of the embankment occurs as a result of overtopping from high inflow. Due to the conveyance capacity of Neuse River relative to the discharge rate occurring from the embankment breach, minimal inundation is observed for either breach scenario. As a result no areas of the Neuse River were inundated more than 1 foot for the wet weather condition. A summary of the inundation depth and flood wave travel time is presented for the dry weather condition in Table 5.

Table 5. Flood Wave Travel Time (Dry Weather Conditions)

Location	Distance Downstream (miles)	Peak Inundation Depth (feet)	Time from Start of Breach (minutes)	
			At Initial Impacts	At Peak Elevation
Near beginning of Quaker Neck	0.4	1.5	45	115
Near Stevens Mill Village Mobile Home Community	2.6	1.1	130	200

A discharge and stage hydrograph at the inflow to the Neuse River is presented for the dry weather condition and the wet weather condition in Figures 2 and 3, respectively.

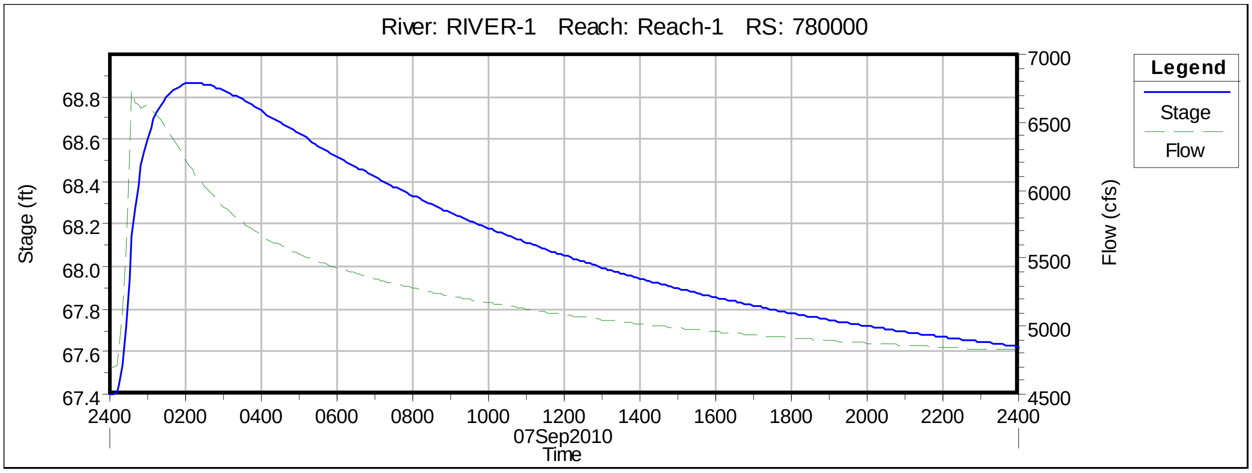


Figure 2. Discharge and Stage Hydrographs at inflow to Neuse River, Dry Weather Breach

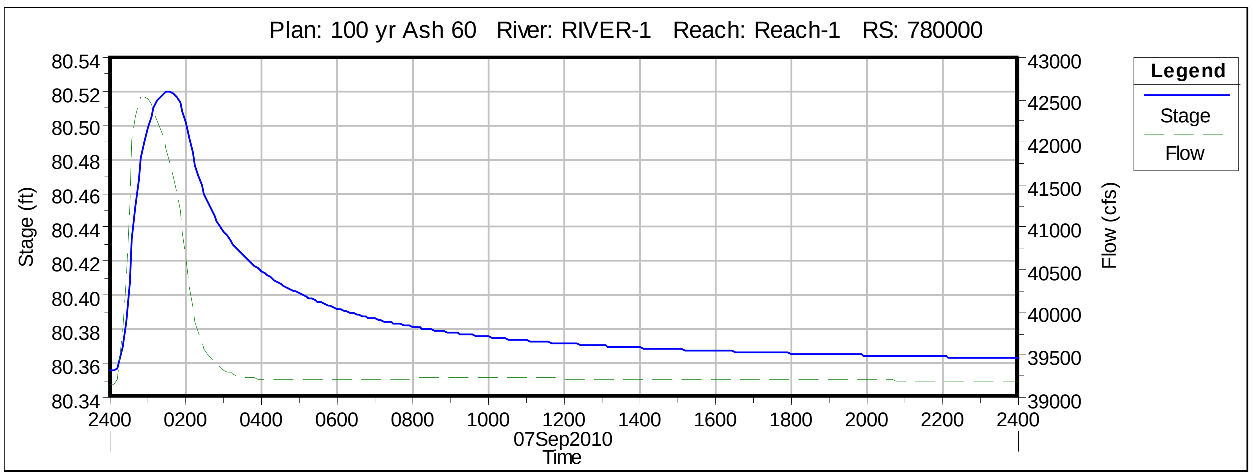


Figure 3. Discharge and Stage Hydrographs at inflow to Neuse River, Wet Weather Breach

Stream profiles depicting the affects to the Neuse River from the embankment breach for the dry and wet weather scenarios are provided in Figures 4 and 5. The baseline stream profile is depicted as well.

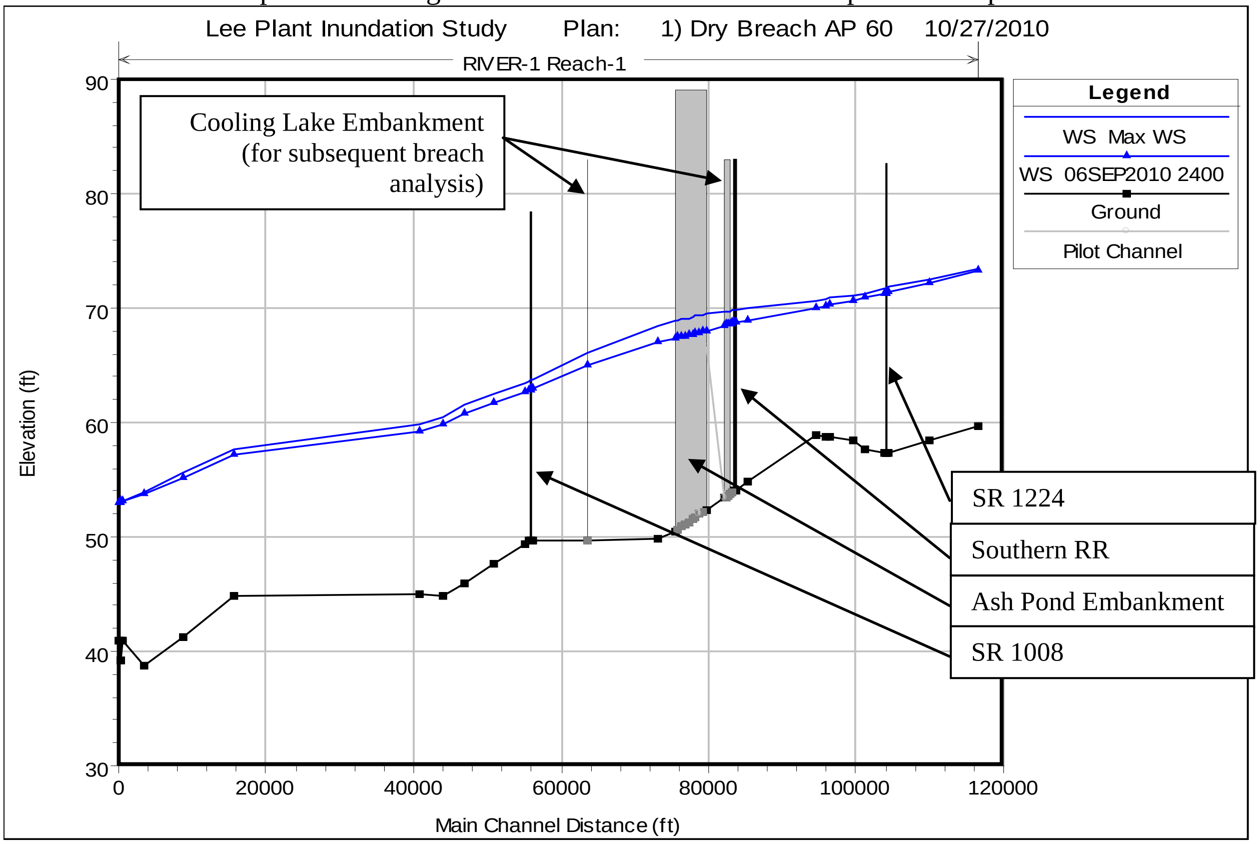


Figure 4. Stream Profile, Dry Weather Breach affect to Neuse River

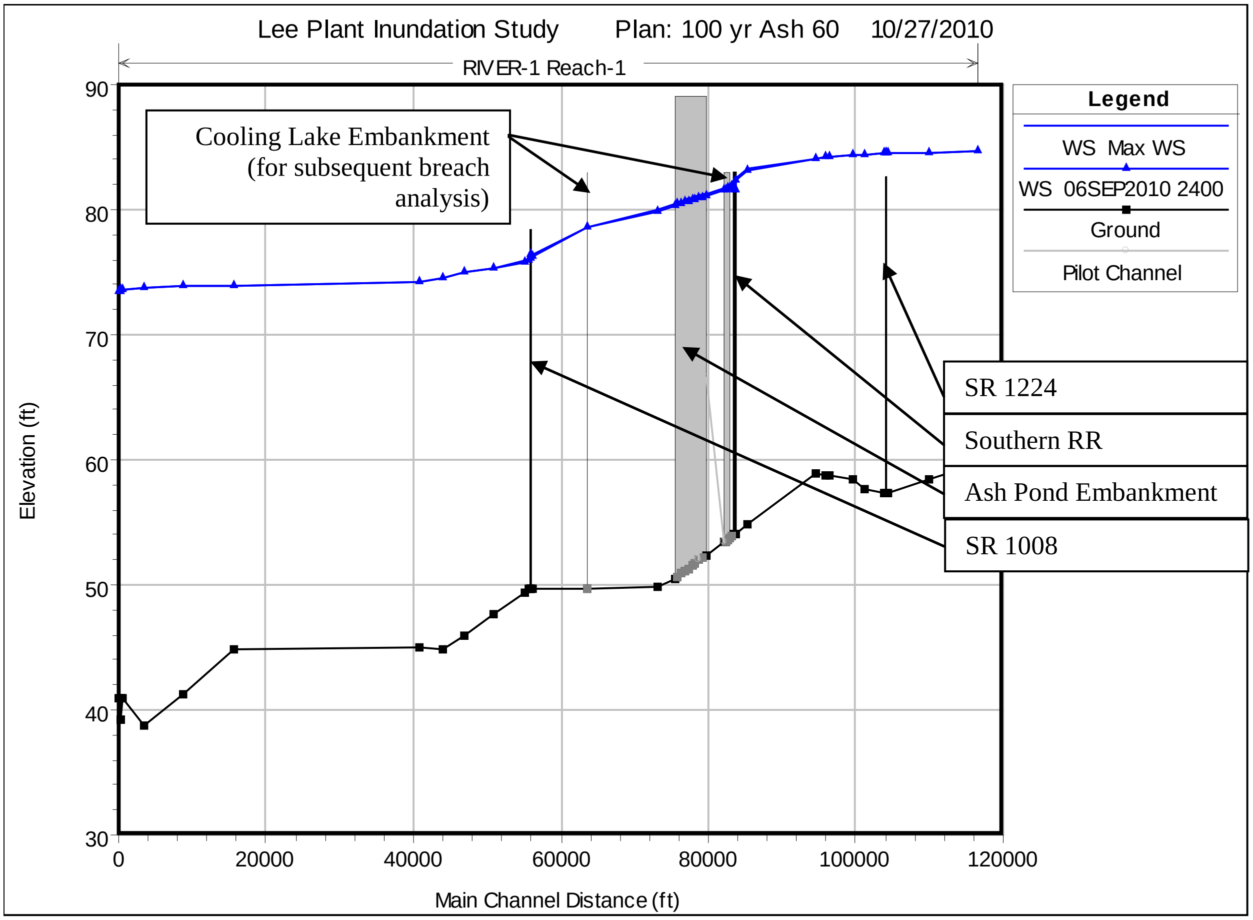


Figure 5. Stream Profile, Wet Weather Breach affect to Neuse River

7.3 Summary of Breach Analysis

The breach analyses indicates that the breach of the Ash Pond is not likely to cause a water level increase of greater than 1 foot in any area downstream of the Ash Pond within the extent of analyses for the wet weather condition. The breach analyses indicate that the areas inundated by the dry weather breach will be contained to the confines of the banks of the Neuse River with, the exception of the area adjacent to the southeast corner of the embankment. Therefore, it is apparent that a breach of the Ash Pond Dam will not pose a significant risk to public safety.

8.0 References

FEMA, Flood Insurance Study 2005. 37191CV0000A – Wayne County and Incorporated Areas.

Fread, D.L, 1988. User's Manual for DAMBRK. National Weather Service.

Froehlich, David C., 1995a,"Peak Outflow from Breached Embankment Dam," Journal of Water Resources Planning and Management, vol.121, no.1.

USACE HEC, March 2008. HEC-RAS River Analysis System User's Manual. Davis, CA.

USGS, Water Data Report 2009. 02089000 – Neuse River near Goldsboro (Wayne County).

Wahl, Tony L., 1998. Predication of Embankment Dam Breach Parameters – A Literature Review and Needs Assessment, U.S. Bureau of Reclamation Dam Safety Report DSO-980004, July 1998.

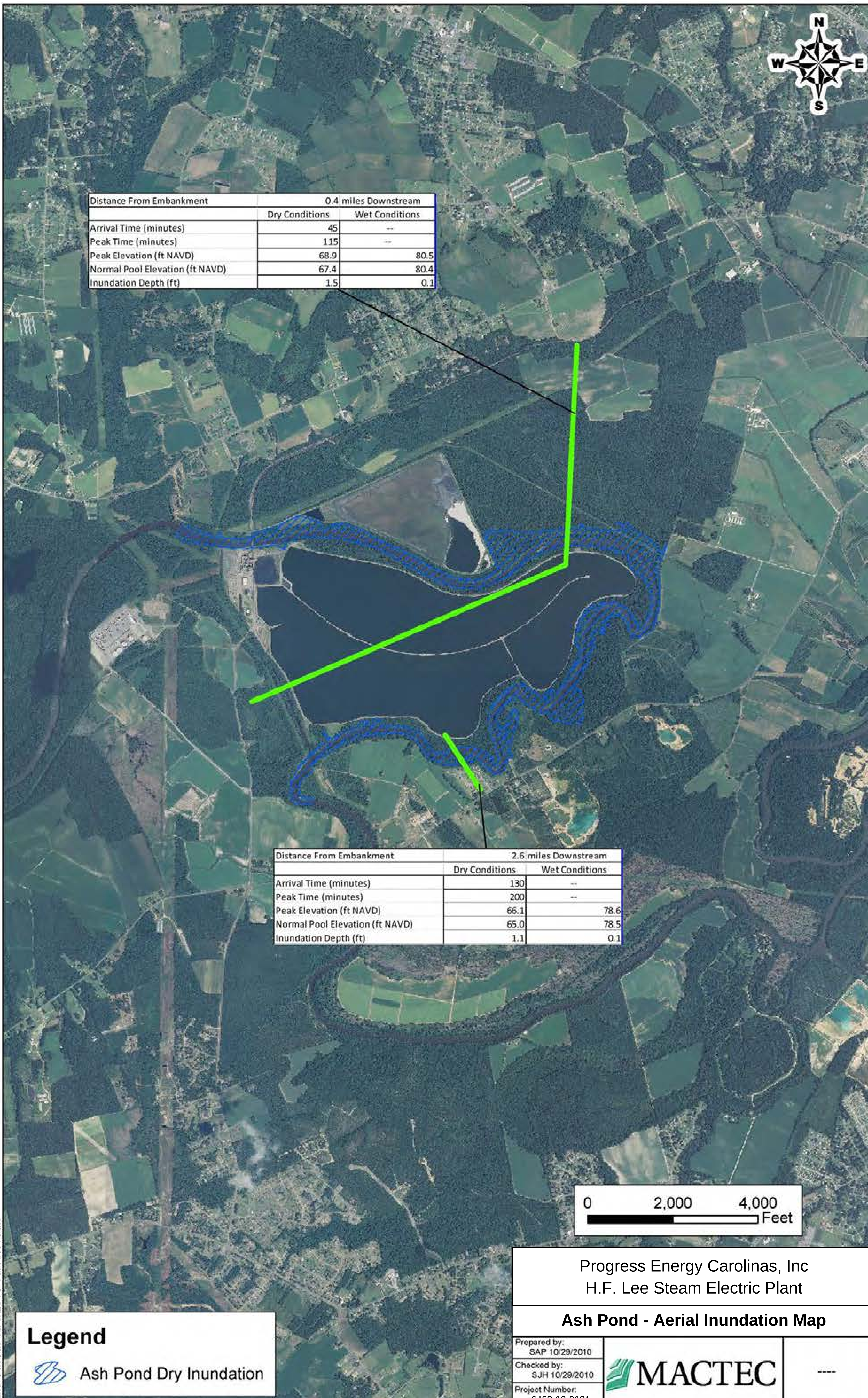
9.0 Abbreviations

AF	acre-feet
cfs	cubic feet per second
GIS	geographic information system
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HW	headwater (HEC-RAS)
NCDENR	North Carolina Department of Environment and Natural Resources
NAVD	North American Vertical Datum of 1988
NOAA	National Oceanic and Atmospheric Agency
NRCS	Natural Resource Conservation Service (formerly SCS)
PMP	Probable Maximum Precipitation
RS	River Station (HEC-RAS)
SCS	Soil Conservation Service
TW	tailwater (HEC-RAS)
USGS	United States Geological Survey
WS	water surface (HEC-RAS)

APPENDIX

Ash Pond Dam – Aerial Inundation Map

Ash Pond Dam – Topographical Inundation Map



Distance From Embankment	0.4 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	45	--
Peak Time (minutes)	115	--
Peak Elevation (ft NAVD)	68.9	80.5
Normal Pool Elevation (ft NAVD)	67.4	80.4
Inundation Depth (ft)	1.5	0.1

Distance From Embankment	2.6 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	130	--
Peak Time (minutes)	200	--
Peak Elevation (ft NAVD)	66.1	78.6
Normal Pool Elevation (ft NAVD)	65.0	78.5
Inundation Depth (ft)	1.1	0.1

Progress Energy Carolinas, Inc
H.F. Lee Steam Electric Plant

Ash Pond - Aerial Inundation Map

Prepared by: SAP 10/29/2010
Checked by: SJH 10/29/2010
Project Number: 6468-10-0181

MACTEC

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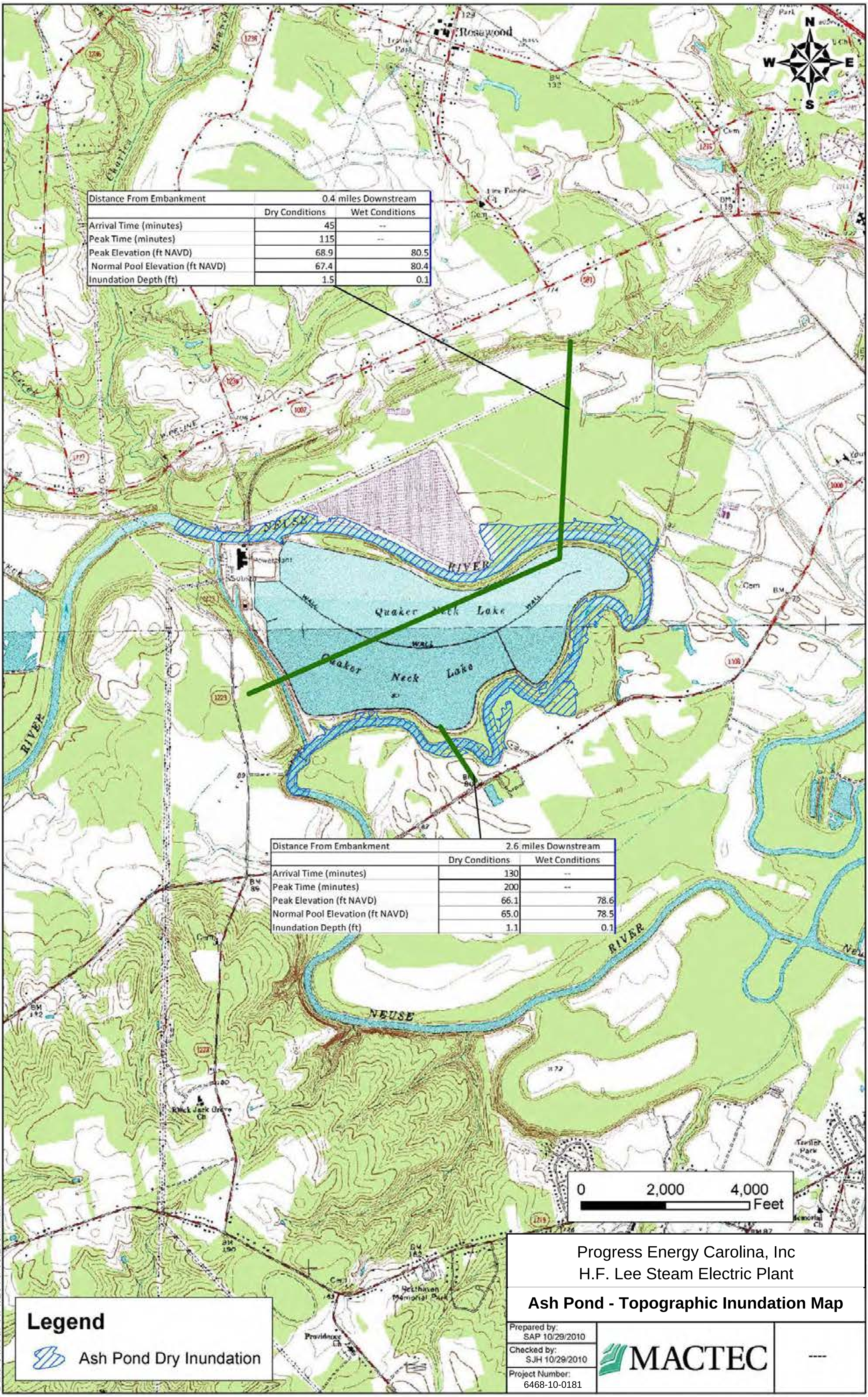

Distance From Embankment	0.4 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	45	--
Peak Time (minutes)	115	--
Peak Elevation (ft NAVD)	68.9	80.5
Normal Pool Elevation (ft NAVD)	67.4	80.4
Inundation Depth (ft)	1.5	0.1

Distance From Embankment	2.6 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	130	--
Peak Time (minutes)	200	--
Peak Elevation (ft NAVD)	66.1	78.6
Normal Pool Elevation (ft NAVD)	65.0	78.5
Inundation Depth (ft)	1.1	0.1

Progress Energy Carolina, Inc
H.F. Lee Steam Electric Plant

Ash Pond - Topographic Inundation Map

Prepared by: SAP 10/29/2010
Checked by: SJH 10/29/2010
Project Number: 6468-10-0181

MACTEC

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APPENDIX A

Document 11

Approval to Impound

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Land Resources
Land Quality Section

James D. Simons, PG, PE
Director and State Geologist

Beverly Eaves Perdue, Governor
Dee Freeman, Secretary

Final Approval to Impound

October 5, 2011

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Fred Holt
Progress Energy Carolinas, Inc.
Environmental, Health and Safety Services Section
PO Box 1551 PEB 4
Raleigh, NC 27602

RE: Approval to Impound
H.F. Lee Active Ash Pond Dam
Wayne County
WAYNE-022-H

Dear Mr. Holt:

This concerns the subject dam recently repaired pursuant to issuance of an Approval to Repair on March 28, 2011 as required by the Dam Safety Law of 1967. Record Drawings and the engineer's certification, were received on June 21, 2011. The dam was certified by Mr. Richard S. Auger, PE.

An inspection of this dam was made by Land Quality Section staff of the Washington Regional Office on August 1, 2011. The dam was found to be in general conformance with the approved plans and specifications and you may impound water.

It is noted that this office has not received an approved Emergency Action Plan (EAP) for the above referenced dam in accordance with stipulation 6 of the March 28, 2011 Approval to Repair. While there is no statutory requirement to submit an EAP to this office for approval, EAP's function as an essential, and in fact, a primary tool in protecting the public welfare during a dam emergency. Without an approved EAP, this function cannot be fulfilled. It is therefore requested that an EAP be submitted as soon as possible for review. Please advise us of your intentions in this matter.

The Land Quality Section staff will make periodic inspections of this dam to verify that the dam is being maintained in good operating condition. These inspections, however, will be relatively infrequent. It is advised that you closely inspect and monitor your dam, and that you notify your engineer and the Division of Land Resources if you see or suspect any problems concerning its safety. If an EAP is submitted and approved by this office it shall be reviewed by the owner on an annual basis and updated if downstream conditions change.

Sincerely,

Steven M. McEvoy, PE
State Dam Safety Engineer
Land Quality Section

SMM/ahs

cc: Mr. Richard S. Auger, PE, MACTEC, Design Engineer
Pat McClain, PE, Land Quality Regional Engineer
Surface Water Protection Regional Supervisor

File Name: WAYNE-022_20111005_COFA

APPENDIX A

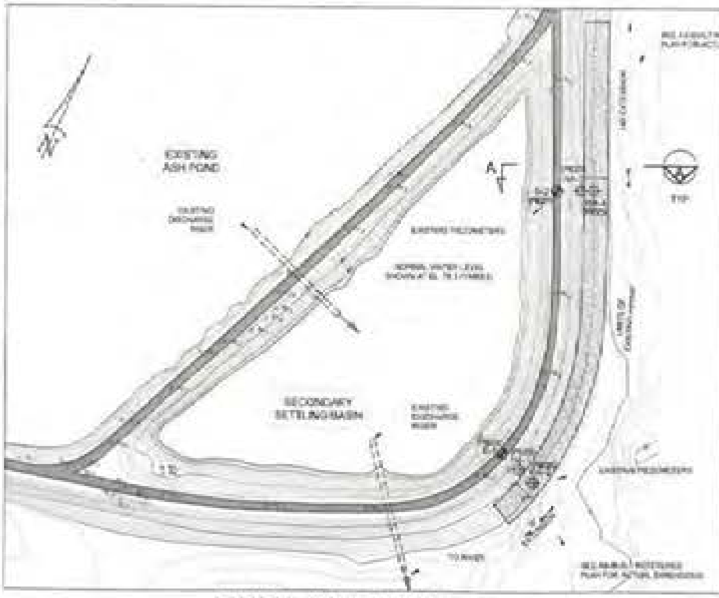
Document 12

Seepage Repair As-Built

LEE PLANT

LOCATION PLAN

SECONDARY SETTLING BASIN - SEE DETAIL PLAN



RIPRAP EXTENSION - DETAIL PLAN

REFERENCE: TOPOGRAPHIC MAPPING PREPARED BY MOXIN & KERLO FROM AERIAL PHOTOGRAPHY TAKEN APRIL 12, 2010.

TABLE OF AS-BUILT REFERENCE INFORMATION (SEE PLAN BELOW)

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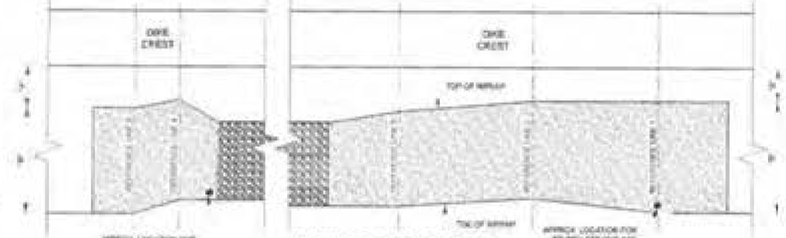
[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

As-Built Reference Information Notes:

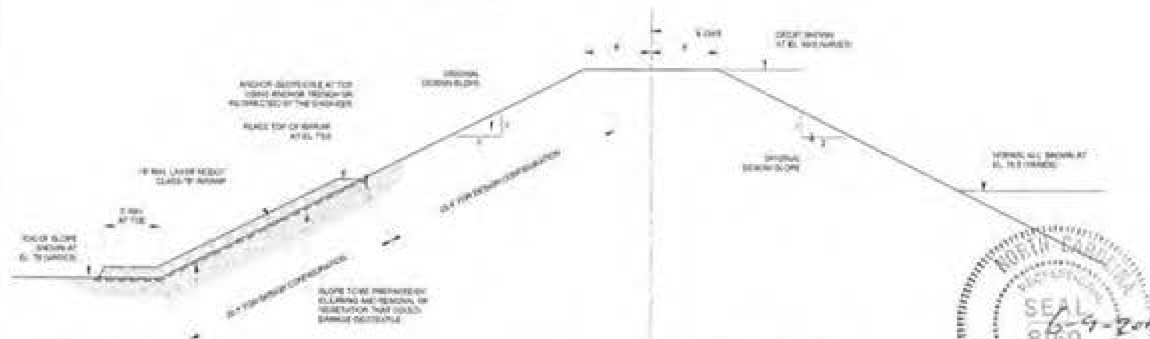
1. [illegible]
2. [illegible]
3. [illegible]

INSTALLATION NOTES

1. THE APPROXIMATE LIMITS FOR RIPRAP EXTENSION WILL BE AS SHOWN ON THE DRAWING.
2. THE TOP OF THE RIPRAP WILL BE PLACED APPROXIMATELY IN LINE WITH THE EXISTING RIPRAP AT EL. [illegible]
3. THE SLOPE SURFACE WILL BE PREPARED FOR RIPRAP PLACEMENT BY CLEARING AND REMOVAL OF BRUSH, ROOTS AND OTHER VEGETATION THAT COULD CAUSE DAMAGE TO THE GEOTEXTILE INSTALLATION. ROOTS SHOULD BE CUT OFF GROUND DOWN BELOW GROUND SURFACE.
4. PLACE NCDOT NO. 57 STONE TO FILL HOLES ON THE SLOPE AND AROUND ANY EXPOSED ROOTS LEFT IN PLACE BELOW GRADE.
5. ENGINEERING INSPECTION WILL BE PROVIDED TO CONFIRM THAT SLOPE PREPARATION IS SATISFACTORY PRIOR TO INSTALLATION OF GEOTEXTILE MATERIAL.
6. REMOVE RIPRAP MATERIAL AT THE EXISTING PLACEMENT LIMITS TO EXPOSE AT LEAST 2 FEET OF EXISTING GEOTEXTILE FOR OVERLAP WITH NEW GEOTEXTILE PLACEMENT.
7. PLACE GEOTEXTILE ON THE PREPARED SLOPE ALLOWING AT LEAST OVERLAP OF AT LEAST 2 FEET. THE GEOTEXTILE WILL BE MIRAFI 1160N OR EQUAL AS APPROVED BY THE ENGINEER. GEOTEXTILE WILL BE ANCHORED ALONG THE TOP USING AND ANCHOR TRENCH OR AS DIRECTED BY THE ENGINEER.
8. PLACE 16 INCHES MINIMUM THICKNESS OF NCDOT CLASS "B" RIP ON THE GEOTEXTILE IN A MANNER THAT WILL NOT CAUSE DAMAGE TO THE GEOTEXTILE.
9. COMPLETED INSTALLATION WILL BE INSPECTED BY THE ENGINEER TO CONFIRM THAT INSTALLATION HAS BEEN COMPLETED IN A SATISFACTORY MANNER.



AS-BUILT REFERENCE PLAN
(SLOPE DISTANCES REPRESENTED)



A TYPICAL SECTION FOR RIPRAP EXTENSION

AS-BUILT
RECORD DRAWING

REV	DATE	BY	APPR	DESCRIPTION
1	[illegible]	[illegible]	R.S.A.	AS-BUILT RECORD DRAWING
0	[illegible]	[illegible]	R.S.A.	ISSUED FOR INFORMATION
A	[illegible]	[illegible]	R.S.A.	ISSUED FOR COMMENTS

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

DRAWN:	[illegible]
DFT CHECK:	[illegible]
ENG CHECK:	R.S.A.
APPROVAL:	
DATE:	
SCALE:	AS SHOWN

RIPRAP EXTENSION PLAN
SECONDARY SETTLING BASIN
ASH POND (STATE ID NO. WAYNE-[illegible])
PROGRESS ENERGY LEE PLANT

JOB NO.	DWG NO.
[illegible]	[illegible]

APPENDIX B

Document 13

Dam Inspection Check List Form – Active Pond

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	PEC Lee Plant	**Date:**	2/18/2011
Unit Name:	Active Ash Pond	**Operator's Name:**	Ricky Miller
Unit I.D.:		**Hazard Potential Classification:**	High (Significant) Low
Inspector's Name:			

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?	annual + 5 yrs		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	84		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	84		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	90		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?		N/A	Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		N/A	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?	✓	
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?		✓
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
20.	Discharge observed during assessment showed slight gray color against silty orange flow in river. PEC indicated they were monitoring and meeting discharge quality criteria. No sign of erosion near riser in pond or along outfall path.
21.	Area of seepage was repaired in 2010 and plan to expand repair to adjacent side slopes is in NCDENR approval process now.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC 0003417 INSPECTOR Dawberry

Date 2/18/2011

Impoundment Name Active Ash Pond

Impoundment Company Progress Energy

EPA Region IV

State Agency (Field Office) Addresss ____

Name of Impoundment ____

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ____ Update ✓

	Yes	No
Is impoundment currently under construction?		✓
Is water or ccw currently being pumped into the impoundment?	✓	

IMPOUNDMENT FUNCTION: Receives CCW from all Units

Nearest Downstream Town : Name Goldsboro

Distance from the impoundment 3.2 miles

Impoundment

Location: Longitude W78.0698 Degrees ____ Minutes ____ Seconds

Latitude N35.3791 Degrees ____ Minutes ____ Seconds

State NC County Wayne

Does a state agency regulate this impoundment? YES ✓ NO ____

If So Which State Agency? NCDENR Dam Safety + Div. of Water Quality

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.

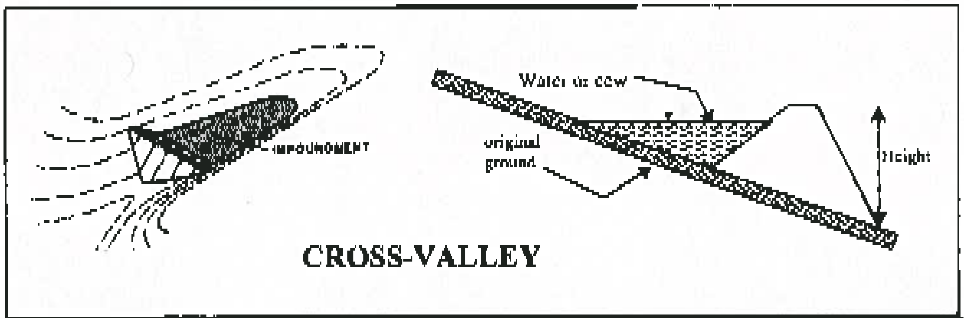
✓ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

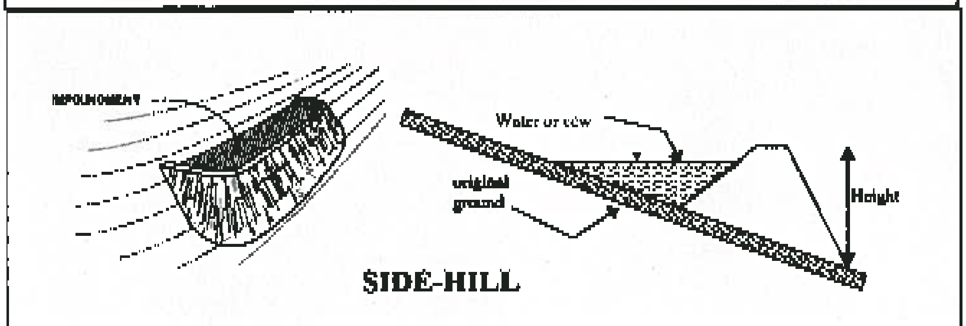
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

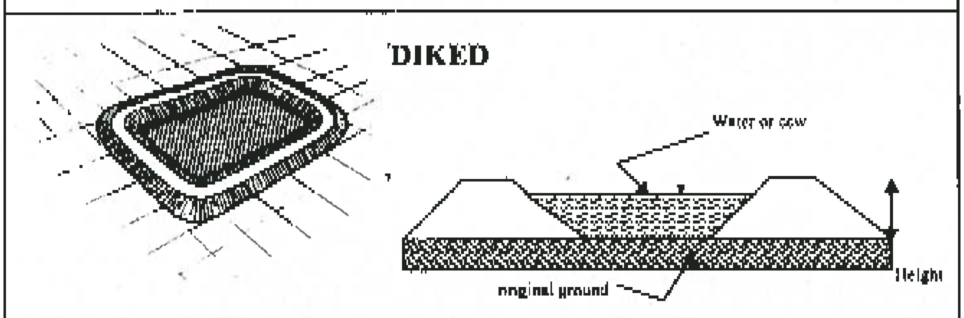
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

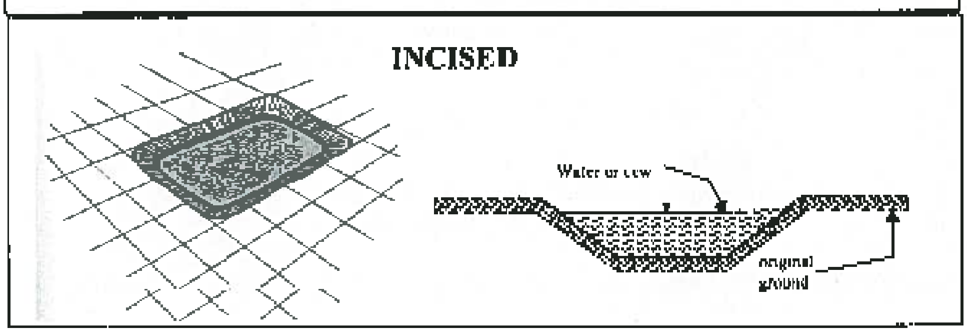
Completely contained on land owned by PEC w/ no nearby residential or commercial property. Failure would result in release to Neuse River after transport through wooded buffer.

CONFIGURATION:









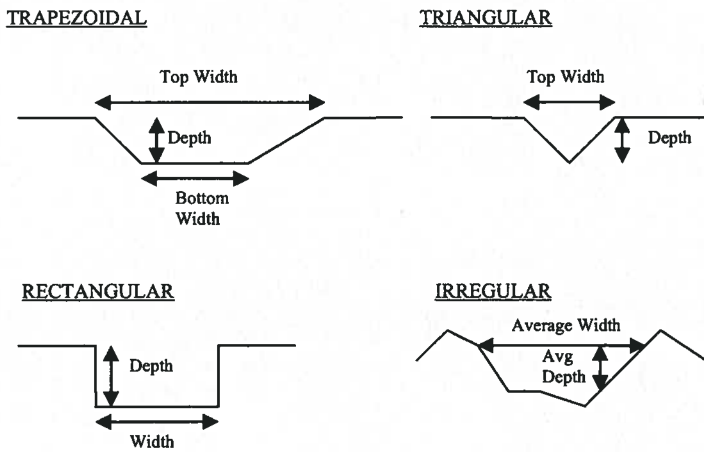
_____ Cross-Valley
_____ Side-Hill
__✓__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height __20__ feet   Embankment Material __Native soil__
Pool Area __143__ acres   Liner __N/A__
Current Freeboard __5.5__ feet   Liner Permeability __N/A__

TYPE OF OUTLET (Mark all that apply)

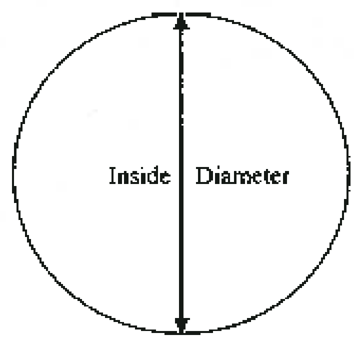
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



1 **Outlet**

15" inside diameter



Material
_____ corrugated metal
_____ welded steel
✓ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ________________

Is water flowing through the outlet? YES ✓ NO _____

N/A **No Outlet**

N/A **Other Type of Outlet** (specify) ________________

The Impoundment was Designed By Progress Energy
L. B. Wilson

Has there ever been a failure at this site? YES ✓ NO ____

If So When? 2000

If So Please Describe : Intense rain during Hurricane Floyd accompanied by record floods on Neuse River caused significant interior slope slumping and distress along part of exterior slope. Repairs were made in 2000, designed by LAW.

Has there ever been significant seepages at this site? YES ✓ NO ______

If So When? 2009 + 2010

IF So Please Describe: local seepage on secondary settling pond exterior dike was repaired w/ geotextile and rip rap. Repair report will be provided in full report.

additional areas ≃ 170 ft long were exhibiting seepage from mid dike to toe during assessment. Repair plan is under review @ NCDENR and repairs will proceed upon approval as above.

Current repairs appear stable, but do not stop seepage.

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ✓ NO ______

If so, which method (e.g., piezometers, gw pumping,...)? piezometer

If so Please Describe : as part of seepage repairs investigation were performed using piezometer monitoring. Report will be provided in full report.

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 evidence of approximately 170 linear feet of local seepage observed from the mid-dike to the toe of the secondary settling pond northern exterior dike. There also was evidence of approximately 400 linear feet of a past seepage repair adjacent to the observed seepage which consisted of geotextile fabric and rip rap. This was further clarified by the owner's representative to be an ongoing repair effort. The latest activities (expansion of the repaired area) were not yet completed at the time of the visit.

APPENDIX B

Document 14

Dam Inspection Check List Form – Inactive Pond 1

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name: PEC Lee Plant	Date: 2/18/2011
Unit Name: Ash Pond 1 (In-Active)	Operator's Name: R. [illegible] Miller
Unit I.D.:	Hazard Potential Classification: High Significant **Low** (circled)
Inspector's Name:	

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?	Annual + [illegible]		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?		N/A	19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?		N/A	20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		N/A	Is water entering inlet, but not exiting outlet?		N/A
5. Lowest dam crest elevation (operator records)?	80		Is water exiting outlet, but not entering inlet?		N/A
6. If instrumentation is present, are readings recorded (operator records)?		N/A	Is water exiting outlet flowing clear?		N/A
7. Is the embankment currently under construction?		N/A	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)	✓		At isolated points on embankment slopes?		N/A
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		N/A
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?	✓		23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # — Comments

9. In-active pond is fully wooded on interior and dike side slopes

12. Decant pipe only discharges stormwater runoff

16. Some leaf litter and tree debris noted in decant overflow pipe

23. Stream flows @ toe of east dike – no erosion apparent

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC0003417 INSPECTOR Dewberry
Date 2/18/2011

Impoundment Name Ash Pond 1 (In-active)
Impoundment Company Progress Energy
EPA Region IV
State Agency (Field Office) Addresss ______

Name of Impoundment ______
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ______ Update ✓

	Yes	No
Is impoundment currently under construction?		✓
Is water or ccw currently being pumped into the impoundment?		✓

IMPOUNDMENT FUNCTION: In-active since 1973

Nearest Downstream Town : Name Goldsboro
Distance from the impoundment 3.2 miles
Impoundment
Location: Longitude W-78 Degrees 6 Minutes 20 Seconds
Latitude N 35 Degrees 22 Minutes 50 Seconds
State NC County Wayne

Does a state agency regulate this impoundment? YES ✓ NO ______

If So Which State Agency? NC DENR Division of Water Quality

<u>**HAZARD POTENTIAL**</u> (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__✓__ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

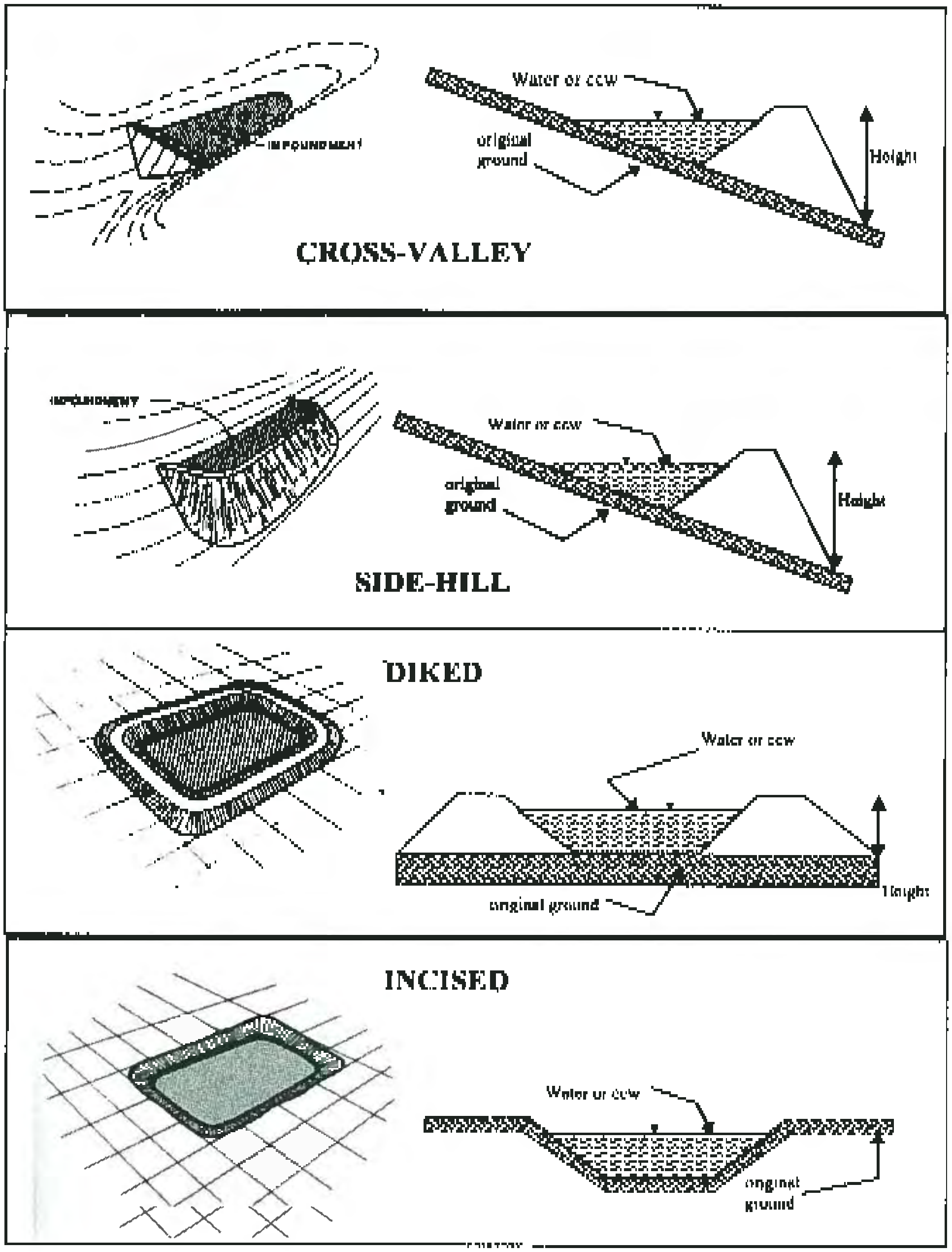
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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:

Inactive and fully treed

CONFIGURATION:



___ Cross-Valley
___ Side-Hill
✓ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

* completely filled

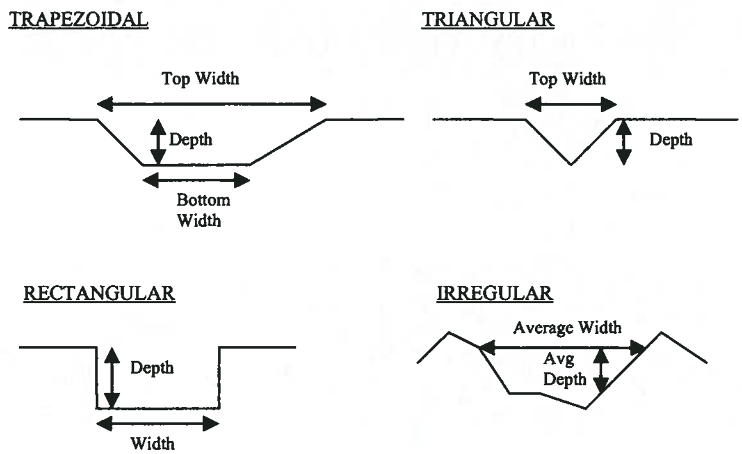
Embankment Height 5-7 feet
Pool Area 33 * acres
Current Freeboard N/A feet

Embankment Material Native Soil
Liner N/A
Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

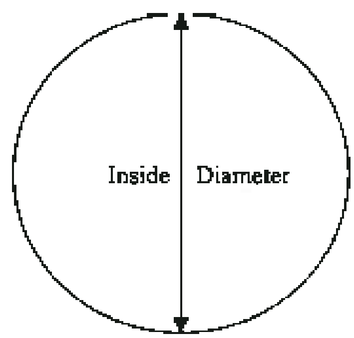
N/A Open Channel Spillway
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



1 Outlet

36" inside diameter (manhole riser)



Material
_____ corrugated metal
_____ welded steel
✓ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO ✓

N/A No Outlet

N/A Other Type of Outlet (specify) ________________________________

The Impoundment was Designed By Wm. Olsen and Associates

Has there ever been a failure at this site? YES __________ NO ___✓___

If So When? ______________________________

If So Please Describe : ______________________________

Has there ever been significant seepages at this site? YES _______ NO ✓

If So When? ____________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO ✓

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No geotechnical data was provided.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No

APPENDIX B

Document 15

Dam Inspection Check List Form – Inactive Pond 2

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Date: 2/18/2011
Unit Name: Ash Pond 2 (In-active)	Operator's Name: Ricky Miller
Unit I.D.:	Hazard Potential Classification: High Significant (Low)
Inspector's Name:	

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?	annual + 5 yr		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	N/A		19. Major erosion or slope deterioration?	✓	
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		N/A
5. Lowest dam crest elevation (operator records)?	80		Is water exiting outlet, but not entering inlet?		N/A
6. If instrumentation is present, are readings recorded (operator records)?		N/A	Is water exiting outlet flowing clear?		N/A
7. Is the embankment currently under construction?		N/A	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)	✓		At isolated points on embankment slopes?		N/A
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		N/A
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?	✓		23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
9.	In-active pond is fully wooded on interior and dike side slopes.
12.	Decant pipe only discharges stormwater runoff
16.	Some leaf litter and tree debris noted in decant overflow pipe
19.	2 areas of significant undercut (scarp) on outer slope of dike east side along active stream - will provide recommendations in full report.
23.	Stream flows @ toe of east dike (see note 19)

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC0003417 INSPECTOR Dewberry
Date 2/18/2011

Impoundment Name Ash Pond 2 (In-active)
Impoundment Company Progress Energy
EPA Region IV
State Agency (Field Office) Addresss ______

Name of Impoundment ______
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ______ Update ✓

	Yes	No
Is impoundment currently under construction?		✓
Is water or ccw currently being pumped into the impoundment?		✓

IMPOUNDMENT FUNCTION: In-active since 1973

Nearest Downstream Town : Name Goldsboro
Distance from the impoundment 3.2 mi
Impoundment
Location: Longitude W77.104 Degrees ______ Minutes ______ Seconds
Latitude N35.3529 Degrees ______ Minutes ______ Seconds
State NC County Wayne

Does a state agency regulate this impoundment? YES ✓ NO ______

If So Which State Agency? NC DENR Division of Water Quality

EPA Form XXXX-XXX, Jan 09

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.

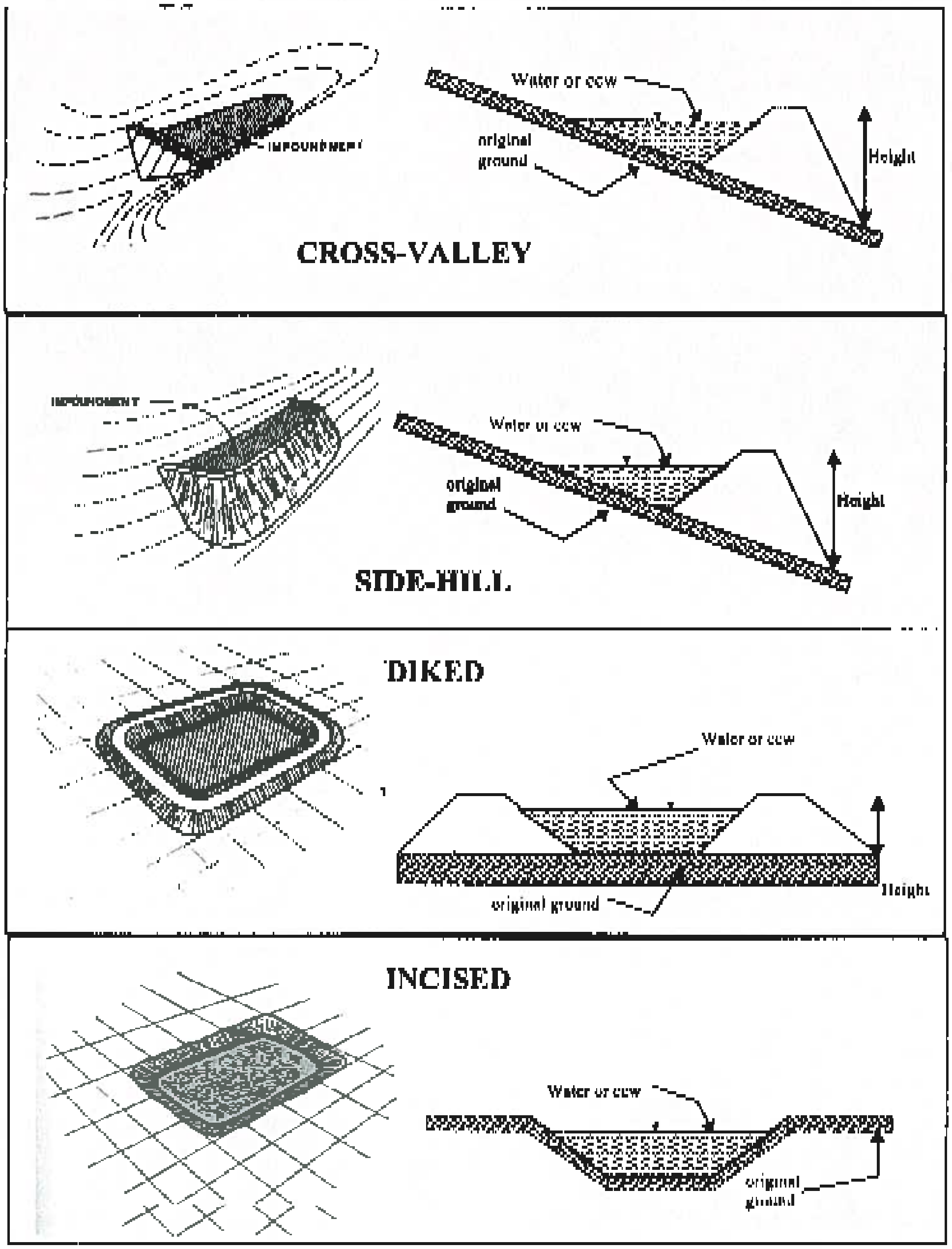
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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:

Inactive and fully treed

CONFIGURATION:



_____ Cross-Valley
_____ Side-Hill
__✓__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

* Completely filled

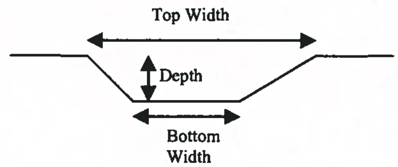
Embankment Height 12-15 feet   Embankment Material Native Soil
Pool Area 53 ± acres   Liner N/A
Current Freeboard N/A feet   Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

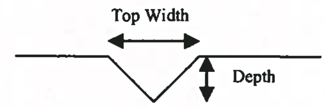
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

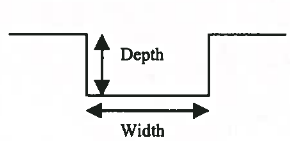
TRAPEZOIDAL



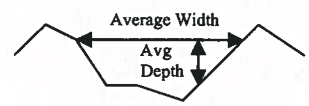
TRIANGULAR



RECTANGULAR

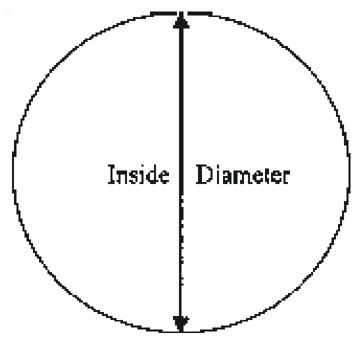


IRREGULAR



1 **Outlet**

36" inside diameter (manhole riser)



Material
_____ corrugated metal
_____ welded steel
✓ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO ✓

N/A **No Outlet**

N/A **Other Type of Outlet** (specify) ____________________

The Impoundment was Designed By WM. Olsen and Associates

Has there ever been a failure at this site? YES __________ NO ____✓____

If So When? ____________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO ✓

If So When? ___________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO ___✓___

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ______________________________

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No geotechnical data was provided.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

No

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

No

APPENDIX B

Document 16

Dam Inspection Check List Form – Inactive Pond 3

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	Date: 2/18/2011
Unit Name: Ash Pond 3 (In-active)	Operator's Name: Ricky Miller
Unit I.D.:	Hazard Potential Classification: High Significant (Low)
Inspector's Name:	

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?	annual + 5 yr		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	N/A		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		N/A
5. Lowest dam crest elevation (operator records)?	80		Is water exiting outlet, but not entering inlet?		N/A
6. If instrumentation is present, are readings recorded (operator records)?		N/A	Is water exiting outlet flowing clear?		N/A
7. Is the embankment currently under construction?		N/A	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?		N/A	From underdrain?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)	✓		At isolated points on embankment slopes?		N/A
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?	✓		Over widespread areas?		✓
12. Are decant trashracks clear and in place?	✓		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		N/A
15. Are spillway or ditch linings deteriorated?		✓	22. Surface movements in valley bottom or on hillside?		✓
16. Are outlets of decant or underdrains blocked?	✓		23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
9.	Inactive pond is fully wooded on interior and dike side slopes
11.	Several areas along crest will hold 12"-18" of runoff - requires monitoring and maintenance
12.	Decant pipe only discharges stormwater runoff.
16.	Some leaf litter and tree debris noted in decant overflow

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC000.3417 INSPECTOR Dewberry
Date 2/18/2011

Impoundment Name Ash Pond 3 (inactive)
Impoundment Company Progress Energy
EPA Region IV
State Agency (Field Office) Addresss ______

Name of Impoundment ______
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ______ Update ✓

	Yes	No
Is impoundment currently under construction?		✓
Is water or ccw currently being pumped into the impoundment?		✓

IMPOUNDMENT FUNCTION: Inactive since 1973

Nearest Downstream Town : Name Goldsboro
Distance from the impoundment 3.2 miles
Impoundment
Location: Longitude W 77.[illegible] Degrees ______ Minutes ______ Seconds
Latitude N 35.3258 Degrees ______ Minutes ______ Seconds
State NC County Wayne

Does a state agency regulate this impoundment? YES ✓ NO ______

If So Which State Agency? NC DENR Div. of Water Quality

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.

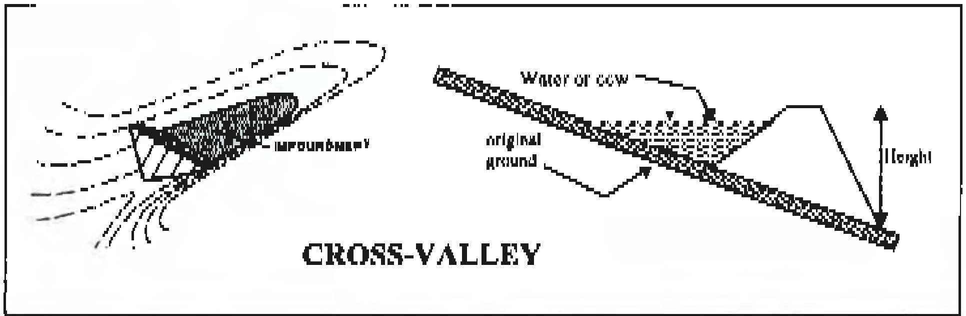
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

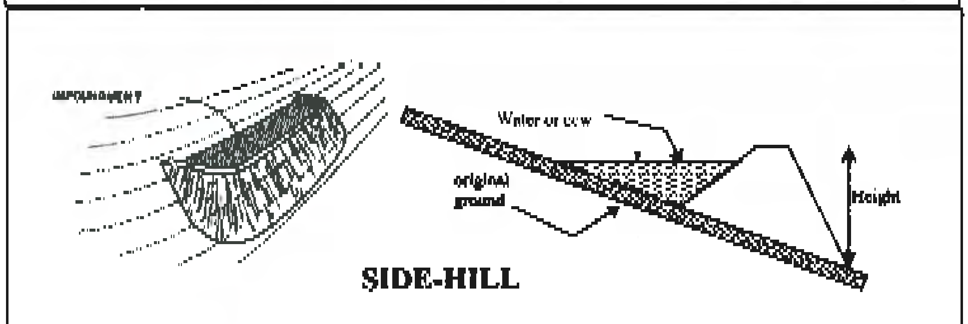
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

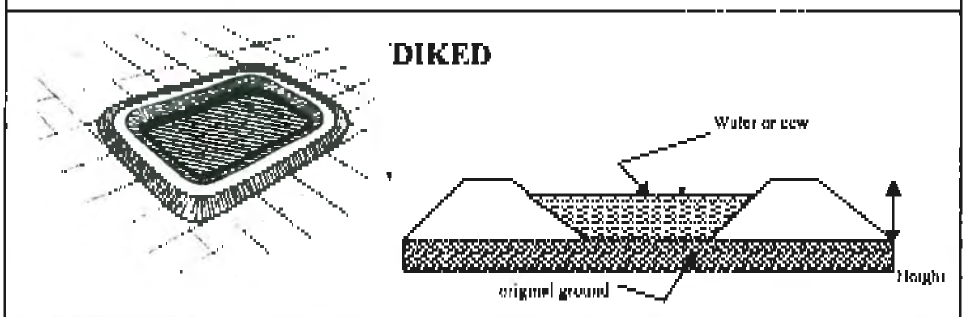
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

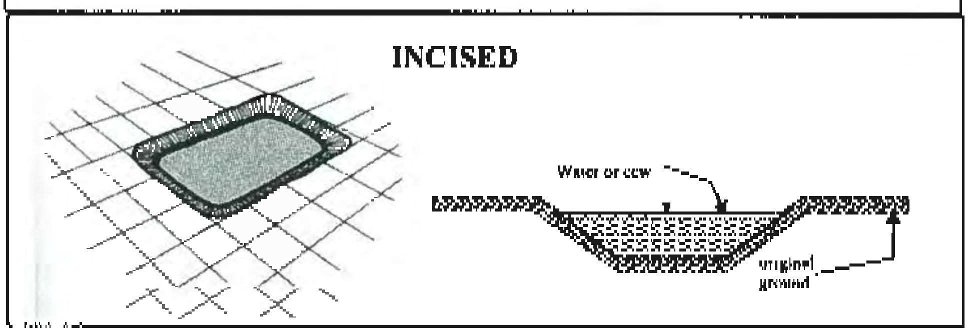
Inactive and fully wooded.

CONFIGURATION:









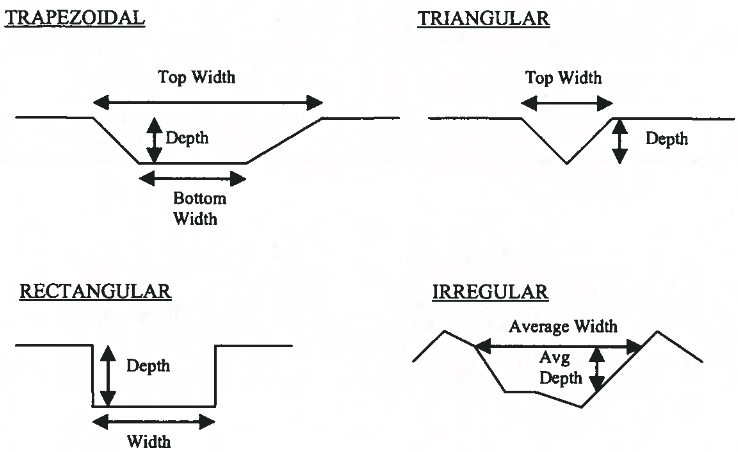
_____ Cross-Valley
_____ Side-Hill
__✓__ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

Embankment Height ___8-10___ feet Embankment Material ___Native Soil___
Pool Area ___85___ acres Liner ___N/A___
Current Freeboard ___N/A___ feet Liner Permeability ___N/A___

TYPE OF OUTLET (Mark all that apply)

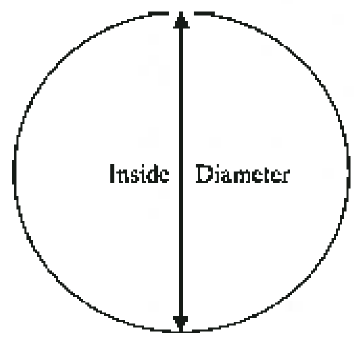
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width



1 **Outlet**

36 inside diameter (manhole riser)



Material
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_____ welded steel
✓ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES ______ NO ✓

N/A **No Outlet**

N/A **Other Type of Outlet** (specify) ____________________________

The Impoundment was Designed By W.M. Olsen and Associates

Has there ever been a failure at this site? YES __________ NO ____✓____

If So When? ____________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO ✓

If So When? ____________________________

IF So Please Describe: ____________________________

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO ✓

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No