FINAL

Coal Combustion Residue Impoundment
Round 9 - Dam Assessment Report

L.V. Sutton Steam Electric Plant
Ash Ponds
Progress Energy Carolinas, Inc.
Wilmington, North Carolina

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

Under Contract Number: EP-09W001727
December 2011

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 Progress Energy Carolinas (Progress Energy) L.V. Sutton Steam Electric Plant Ash Ponds is based on a review of available documents and on the site assessment conducted by Dewberry personnel on February 17, 2011. Dewberry assessed two ponds at this facility, the 1971 Pond (referred to in some State documents as the 1983 Pond) and the 1984 Pond. We found the supporting technical documentation adequate (Section 1.1.3). As detailed in Section 1.2.2, there are six recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Sutton 1971 Ash Pond and 1984 Ash Pond are **Satisfactory** 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 FEMA 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 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 Sutton Ash Ponds 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.

FINAL

Table of Contents

Page

1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit on February 17, 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 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. We note that one area along the 1971 ash pond embankment did have a factor of safety at the minimum acceptable value.

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

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

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is 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

Overall, the visual assessment of the ash pond embankment system is satisfactory; however, up to 12-inch diameter trees and numerous shrubs were found on the outer slope of the south embankment of the 1971 Ash Pond (State ID No. NEWHA-004) adjacent to the canal. The 1971 Ash Pond is active. Although this pond does not receive ash sluice continuously, it is a NPDES-permitted pond that receives coal ash sluice water. The management or removal of these trees is being coordinated with the North Carolina Department of Environment Natural Resources (NCDENR). Within the 1984 Ash Pond (State ID No. NEWHA-005) there were also a few areas of minor depressions, non-structural surface erosion, and multiple burrows that require remediation. These areas are reportedly being addressed on a regular maintenance schedule.

In September 2010, an intense local rainfall event of approximately 20 inches caused minor overflow of the 1984 Ash Pond primary dike leading to down cut erosion along the dike exterior. The dike was temporarily repaired under observation and approval of NCDENR at the time of the site visit. (Appendix A: Doc 02 – Ash Pond Summary). Embankments appear structurally sound. After the site visit, Progress Energy provided a completion report and NCDENR's approval of the repair which was dated March 29, 2011. (See Appendix A, Doc 16: Final Approval to Impound and Doc 14: Repair Completion Package.)

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 ash ponds.

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. Piezometers were installed in February of 2009 so there is limited data from the instrumentation.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The 1984 Ash Pond and 1971 Ash Pond are rated Satisfactory for continued safe and reliable operation

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

A liquefaction potential analysis should be performed. Also Section B-2 of the 1971 Ash Pond is marginally acceptable for meeting Minimum Factors of Safety for both static and seismic conditions. We would recommend that Progress Energy monitor the slope's performance and potentially add buttressing or take other actions to improve the stability of the slope.

1.2.2 Recommendations Regarding the Field Observations

The following issues need to be addressed with routine maintenance:

- Continue coordinating with NCDENR about trees on downstream slope to determine a resolution.
- Re-vegetate downstream embankment where necessary.
- Re-vegetate interior embankment where recent work has taken place.
- Address burrows along downstream slope.
- Address rill erosion at locations along downstream embankment.
- Address undercutting and erosion around outfall.

1.2.3 Recommendations Regarding Continued Safe and Reliable Operation

None warranted except those cited above.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Robert Miller, Progress Energy
Bill Forster, Progress Energy
Isaac P. Alderman, Progress Energy
Fred Holt, Progress Energy
Robin Bryson, Progress Energy
Kent Tyndall, Progress Energy
Scott Auger, MACTEC Engineering and Consulting, Inc. (MACTEC)
Andy Schneider, NCDENR
Dan Sams, NCDENR-LQS
Linda Willis, NCDENR-DWQ WIRO
Gary Beecher, NCDENR-LQS
Wes Hare, NCDENR-DWM-Wilmington
Elizabeth Werner, NCDENR-DWM-Raleigh
Shawn McKee, NCDENR-DWM-Raleigh
Eric Smith, NCDENR-DWQ-Raleigh
Debra Watts, NCDENR-DWQ-Raleigh
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 17, 2011.

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

Justin Story

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

NORTH CAROLINA
PROFESSIONAL
SEAL
030624
12-9-2011
ENGINEER
MICHAEL A. HANSON

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

2.1 LOCATION AND GENERAL DESCRIPTION

The L.V. Sutton Steam Electric Plant and ash ponds are located approximately 3 miles from Wilmington, NC off of U.S. 421. Figure 2.1a depicts a vicinity map around the plant while Figure 2.1b depicts an aerial view of the facility.

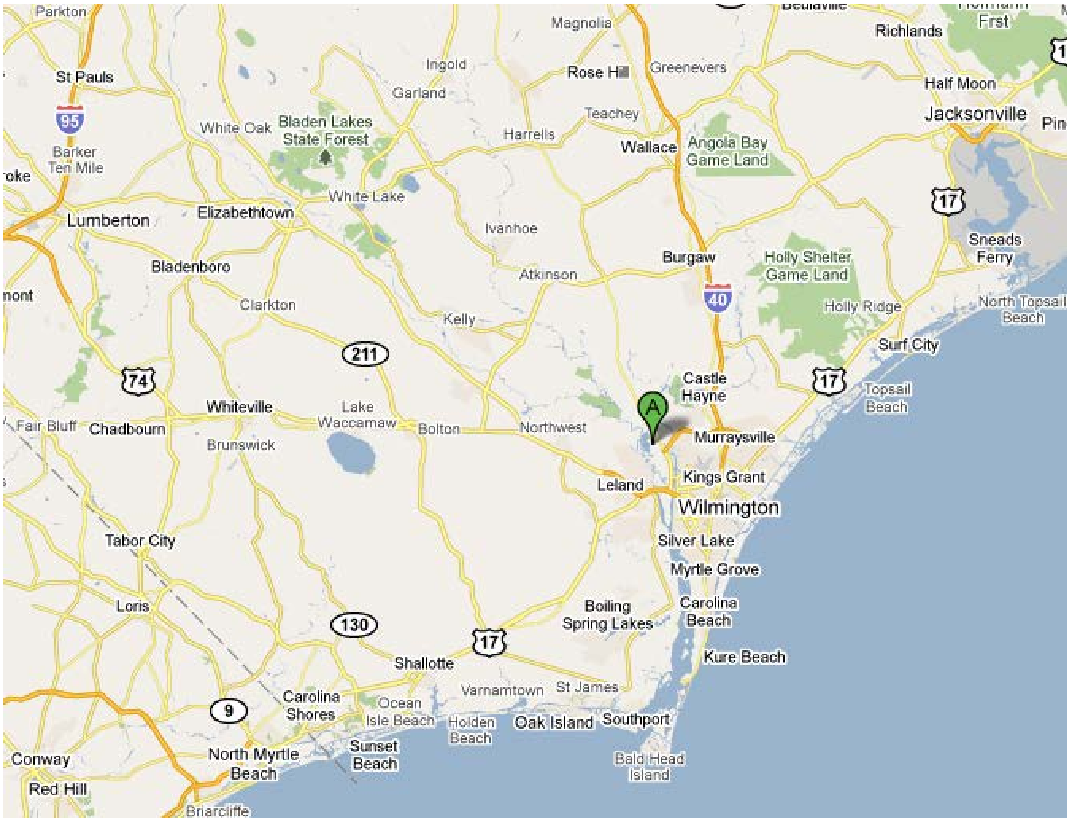


Figure 2.1a: L.V. Sutton Steam Electric Plant Vicinity Map

Figure 2.1b: L.V. Sutton Steam Electric Plant Aerial View

Table 2.1: Summary of Dam Dimensions and Size

	1984 Ash Pond	1971 Ash Pond
Dam Height (ft)	32	24
Crest Width (ft)	12	12
Length (ft)	10,000	7,000
Side Slopes (upstream) H:V	3:1	3:1
Side Slopes (downstream) H:V	3:1	3:1

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is collected 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.

Location from where boiler slag is piped

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 produced or handled.

2.3 SIZE AND HAZARD CLASSIFICATION

The ash pond is impounded by an earthen embankment system consisting of a dike configuration. There are two main ponds handling coal combustion residue (1971 Ash Pond and 1984 Ash Pond) with an internal dike separating the two. Reference Table 2.1 for dam height, crest width, length and side slopes. The storage capacity corresponding to the top of the embankment for the 1971 Pond is 248 acre-feet and the 1984 Pond is 1,364 acre-feet based on the Dam Information Summary dated January 25, 2011 provided by Progress Energy (See Appendix A: Doc 02 – Ash Pond Summary).

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

	1984 Ash pond	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

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

	1971 Ash Pond	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

Per the Federal Guidelines for Dam Safety dated April 2004, a Significant Hazard Potential classification applies to those dams where failure or misoperation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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. A dam breach analysis and inundation map development was performed for the site and the result was that there could potentially be commercial properties affected if a breach occurred on the east side of the ash ponds.

Table 2.3c: 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)

Considering the low probability of loss of life and potential for economic/environmental losses should the ash dam system fail, a Federal Hazard Classification of **Significant** appears to be appropriate for this facility.

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

Per a response to questions asked by the EPA, the following materials are temporarily or permanently contained in the units: 1971 Pond contains fly ash, bottom ash, boiler slag, storm water, ash sluice water, coal pile runoff, and categorical low volume wastewater; the 1984 Pond contains fly ash, bottom ash, boiler slag, and ash sluice water. The drainage area is assumed to be the surface area of the ponds.

Table 2.4: Maximum Capacity of Unit		
	1984 Pond	1971 Pond
Surface Area (acre)	82	54
Current Storage Capacity (cubic yards)	2,200,587	400,107
Current Storage Capacity (acre-feet)	1,364	248
Total Storage Capacity (cubic yards)	2,463,560	1,092,227
Total Storage Capacity (acre-feet)	1,527	677
Crest Elevation (feet)	34	28
Normal Pond Level (feet)	26	24

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

1971 Pond - Per a geotechnical report from Law Engineering, the ash pond was added by constructing a sand fill dike along the north side of the discharging canal. In 1983, the north ash pond dike was modified by placing fill on the sides of the existing dike or constructing a new dike.

Due to the 1983 modification of the 1971 Ash Pond, the 1971 Ash Pond is often referred to as the 1983 Ash Pond.

Possible ash materials were encountered in borings from a subsurface investigation of the 1971 Ash Pond embankment (See Appendix A: Doc 11: Slope Stability Analysis). There is potential that at least a portion of the impoundment was built over ash material.

1984 Pond - The ash pond was constructed of sand fill with one-foot thick clay lining the interior face. The clay lining was covered with a two-foot thick protective sand fill. (See Appendix A: Doc 03: Appendix A – Five-Year Independent Consultant Inspection, October 29, 1987.)

No ash materials were documented in the subsurface investigation of the 1984 Ash Pond embankment. (See Appendix A: Doc 11: Slope Stability Analysis).

2.5.2 Outlet Structures

1971 Pond – The outlet consists of a 4' diameter concrete vertical riser connected to a 3' diameter concrete pipe that would discharge into the cooling lake.

1984 Pond – The outlet consists of a 4' diameter concrete vertical riser connected to a 3' diameter concrete pipe that discharges into the cooling lake. A gated diversion structure also allows flow to be piped to the Cape Fear River.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

All critical infrastructures were located using aerial photography and might not accurately represent what currently exists down-gradient of the site. Progress Energy provided a 5-mile downstream map showing L.V. Sutton Electric Steam Plant and associated critical infrastructure that can be found in Appendix A (Doc 04: Sutton 5-mile Map). There are numerous roads, businesses, schools, places of worship, and other critical areas within the 5-mile radius of the plant. Not all critical infrastructures are labeled for clarity purposes.

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNIT

Progress Energy has provided their dam inspection procedures which can be found in Appendix A (Doc 05: Sutton Dam Inspection Procedure). Additional annual inspections can be found in Appendix A as well.

The recommendations from the Five-Year Independent Consultant Inspection Report, dated December 20, 2007 (Appendix A, Doc 03: Five-Year Independent Consultant Inspection):

1971 Ash Pond

- Large bushes and brushy vegetation needed to be trimmed before summer 2008;
- Progress Energy should continue their tree cutting program;

1984 Ash Pond

- Briars and small brush on interior slope need to be removed;
- Progress Energy should continue their tree cutting program;
- The east dike repair area should be monitored to verify vegetative growth has properly occurred.

Recommendations from the 2010 Limited (Annual) Field Inspection Report, dated December 16, 2010 (Appendix A: Doc 07 – 2010 Annual Inspection):

- 1971 Ash Pond – Plant personnel shall follow up and confirm that water level was lowered to meet the recommendation of NCDENR Dam Safety;
- 1971 Ash Pond – A survey was recommended to check the crest elevation and then provide any necessary fill to bring the crest back to its original elevation of 28.0';
- 1984 Ash Pond – Locate and fill the animal burrows identified;
- 1984 Ash Pond – A survey was recommended to check the crest elevation and then provide any necessary fill to bring the crest back to its original elevation of 34.0'. It was also recommended to survey the crest of the interior storage dike and restore that elevation to 42.0'.

3.2 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The dam is inspected by NCDENR Dam Safety and Division of Water Quality. An example of their inspection can be found in Appendix A (Doc 09 – NCDENR Inspection).

Discharge from the impoundment is regulated by the Federal National Pollutant Discharge Elimination Program and the impoundment has been issued a National Pollutant Discharge Elimination System (NPDES) Permit, No. NC0001422, dated December 14, 2006 (See Appendix A: Doc 10 – NPDES).

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS

In September of 2010, an intense local rainfall event of approximately 20 inches caused minor overflow of the 1984 Ash Pond primary dike leading to down cut erosion along the dike exterior. All ash was contained on site. At the time of the site visit, the dike was temporarily repaired under observation and approval of NCDENR and a permanent repair was scheduled to be implemented in 2011 (Appendix A: Doc 02 – Ash Pond Summary). After the site visit, Progress Energy provided a completion report and NCDENR's approval of the repair which was dated March 29, 2011. (See Appendix A, Doc 16: Final Approval to Impound and Doc 14: Repair Completion Package.)

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The 1971 Ash Pond was constructed in 1971 under the direction of Brown & Root. The original crest elevation was 18.0'.

The 1984 Pond was constructed during 1984 through 1985 by Lindsay and Associates under the direction of Carolina Power & Light.

4.1.2 Significant Changes/Modifications in Design since Original Construction

In 1983, the 1971 Ash Pond dikes were raised 8' to a new crest elevation of 26.0' to provide additional storage capacity.

In 2006, additional storage capacity was generated within the 1984 Ash Pond by the addition of an interior dike with a crest at 42 feet.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No significant repairs/rehabilitation documentation was provided for the 1971 Pond.

The 1984 Pond had some outlet pipe modifications in 2000 when a pipe joint opened up under the upstream slope and seepage through the slope caused a sinkhole. In 2001, interior slope repairs were made on the east dike to fill areas of wave-action erosion. Repairs were made in 2007 to the interior slope and clay liner on the east side of the pond. The most current repair was the breach due to the 20" rainfall event in September 2010. (See Doc 14 – Repair Completion Package and Doc 15 – NCDENR Repair Approval in Appendix A.)

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The ash pond was designed and operated for sedimentation and sediment storage of ash. Plant process waste water, coal combustion waste, coal pile stormwater runoff, and stormwater runoff around the facility are discharged into the ash pond. Inflow water is treated through gravity settling and deposition. The treated process water is discharged through a passive type of overflow outlet structure.

4.2.2 Significant Changes in Operational Procedures and Original Startup

No documentation was provided describing any significant changes in Operating Procedures.

4.2.3 Current Operational Procedures

To the best of our knowledge, original operational procedures are in effect.

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., and Justin Story, EIT, performed a site visit on Thursday, February 17, 2011, with the participants listed in Section 1.3.

The site visit began at 10:00 AM. The weather was windy, cool and partly cloudy. Photographs were taken of conditions observed. Please refer to the Dam Inspection Checklist in Appendix B for additional information from the site visit. 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 minor findings were noted.

5.2 1971 ASH POND

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; however, there were signs of minor rutting, most likely from vehicular traffic.

5.2.2 Upstream/Inside Slope

The upstream/inside slopes were not vegetated in many areas. Progress Energy had performed some work within the pond and stated they would be seeding when the weather was appropriate.

5.2.3 Downstream/Outside Slope and Toe

There were no signs of surficial sloughing along the downstream slope. Rill erosion and animal burrows were found in multiple places along the embankment. There were also areas that were bare from recent repairs and needed to be seeded. Up to 12-inch diameter trees and numerous shrubs were found on the downstream slope of the south embankment of the 1971 Ash Pond adjacent to the canal (see photo below). The management or removal of these trees is being coordinated with the North Carolina Department of Environment Natural Resources (NCDENR).

Trees along downstream south slope of 1971 ash pond.

5.2.4 Abutments and Groin Areas

The ash pond embankment consists of a dike system completely surrounding the 1971 Ash Pond; therefore, the earthen embankment does not abut existing hillsides, rock outcrops or other raised topographic features.

5.3 1984 ASH POND

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; however, there were signs of minor rutting, most likely from vehicular traffic. As reported by J. Mark Frederick, Plant Manager of Progress Energy's Sutton Steam Electric Plant, the increased vehicular traffic, especially in the area of the overflow repair, contributed to the rutting. He also stated once construction of the minor overflow repair was complete, the roadway was restored.

Vehicular rutting along crest of 1984 ash pond

5.3.2 Upstream/Inside Slope

Upstream slopes along 1984 ash pond to be vegetated, Spring 2011. Work conducted in this area was to repair the small overflow from the 1984 ash pond

Repair along downstream east slope of 1984 ash pond. Work conducted in this area was to repair the minor overflow from the 1984 ash pond

The upstream slopes were mostly vegetated with tall grasses. 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

There were no signs of surficial sloughing along the downstream slope. Rill erosion and animals burrows were found in multiple places along the embankment. There were also areas that were bare and need to be seeded.

Rill erosion along downstream slope of internal dike of the 1984 Ash Pond

Animal burrows along downstream slope, 1984 Ash Pond

5.3.4 Abutments and Groin Areas

The 1984 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 OUTLET STRUCTURES

5.4.1 Overflow Structure

The risers for both ponds are described in Section 2.5.2.

5.4.2 Outlet Conduit

The visual portion of the outlet conduit was functioning properly with no apparent deterioration. There was minor undercutting around the concrete outfall caused by splashing from the raised outfall weir.

Concrete outfall of 1984 Ash Pond where undercutting is present

5.4.3 Emergency Spillway

No emergency spillway is present.

5.4.4 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 system is a diked embankment facility having a contributing drainage area equal to the surface area of the impoundments; therefore the impounded pool would not be anticipated to experience significant flood stages. It was noted that a 20” rain in September of 2010 did cause a breach in the 1984 Ash Pond dike. It was also reported that impounded water levels are being maintained at lower elevations since the incident.

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

The 24-hour, 10-sq mi PMP depth is 43 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. The reported maximum discharge from the riser into the cooling pond during a 100-year event is 86.69 cfs. No other flow values or predicted maximum elevations were 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 commercial properties affected if a breach occurred on the east 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 on the water level of the lake (Appendix A: Doc 11 – 71 Ash Pond Inundation Report and Doc 13 – 84 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 both the 1971 Ash Pond and the 1984 Ash Pond, dated March 8, 2011, by MACTEC provides information on the structural stability of the dikes. Steady state (normal) and seismic loading conditions were analyzed. (See Appendix A – Doc 11: Slope Stability Analysis for the complete report.) The analysis results are presented in Section 7.1.4, Factors of Safety and Base Stresses.

7.1.2 Design Parameters and Dam Materials

The 2011 MACTEC report includes documentation of the shear strength design properties for the ash pond embankments, which is included in this report and is presented in the following section. (See Appendix A – Doc 11: Slope Stability Analysis 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.

Table 7.1.2a
Soil Properties for Stability Analysis (1971 Ash Pond)

Soil Description (USCS Classification)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Cohesion (psf)	Effective Fiction Angle (degrees)
Section at B-1				
Dike Fill: (SM, SP-SM)	120	125	10*	33
Dike Fill: (SP)	125	130	10*	38
Dike Fill: (SP)	120	125	0	33
Foundation: (SP)	120	125	0	32
Section at B-2				
Dike Fill: (SM)	120	120	0	33
Dike Fill: (SP)	125	130	0	38
Dike Fill: (SM, SP-SM)	115	120	0	30
Possible Ash (Silt): (MH)	100	105	0	25
Possible Ash (Silt): (MH)	100	105	0	30
Foundation: (SM)	120	125	0	31

Table 7.1.2a Soil Properties for Stability Analysis (1971 Ash Pond)				
Soil Description (USCS Classification)	**Moist Unit Weight (pcf)**	**Saturated Unit Weight (pcf)**	**Effective Cohesion (psf)**	**Effective Fiction Angle (degrees)**
Section at B-3				
Sedimented Ash	100	105	0	30
Dike Fill	125	130	0	38
Dike Fill: (SM)	120	125	0	31
Dike Fill: (SM)	115	120	0	29
Possible Ash (Silt): (ML)	100	105	0	29
Foundation: (SM)	120	125	0	33

*A nominal value of effective cohesion (10 psf) is assigned for analysis to avoid low factors of safety associated with shallow slip surface along the face of the slope.

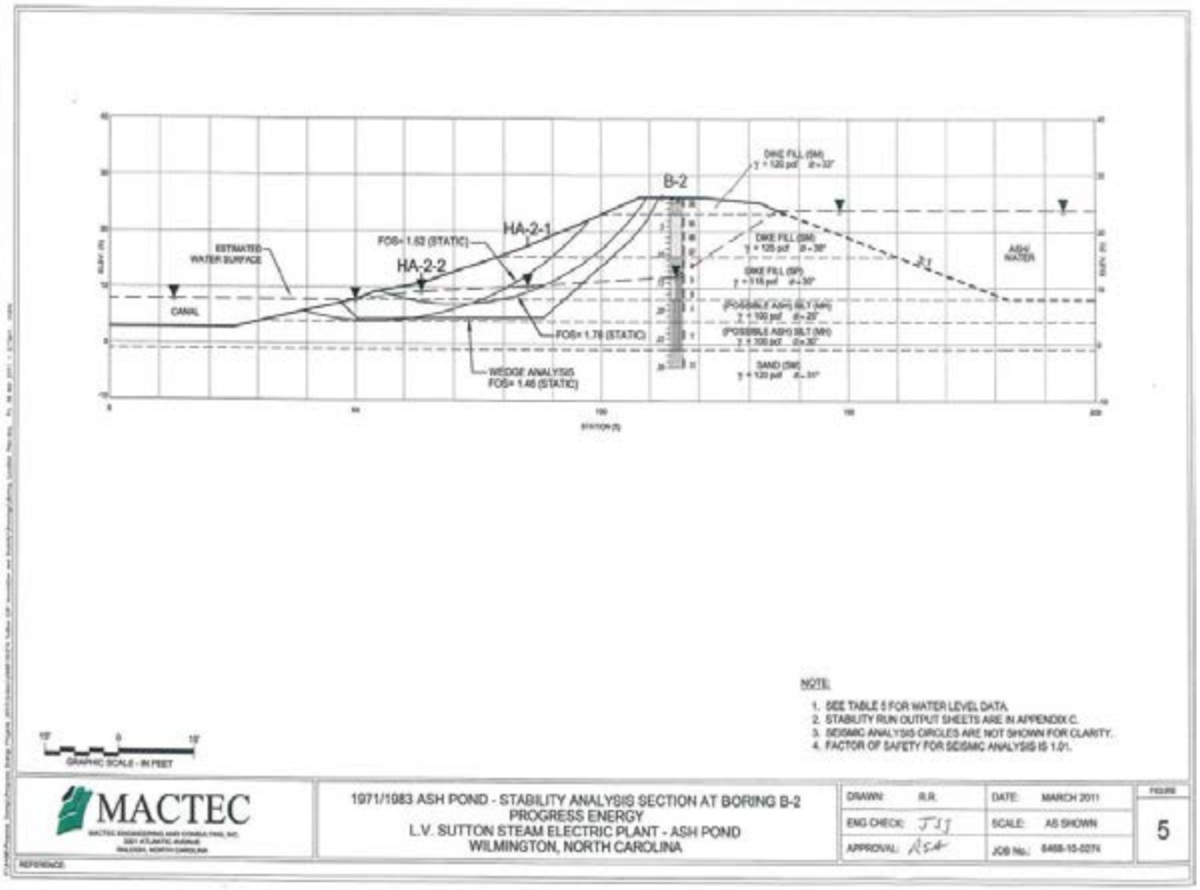
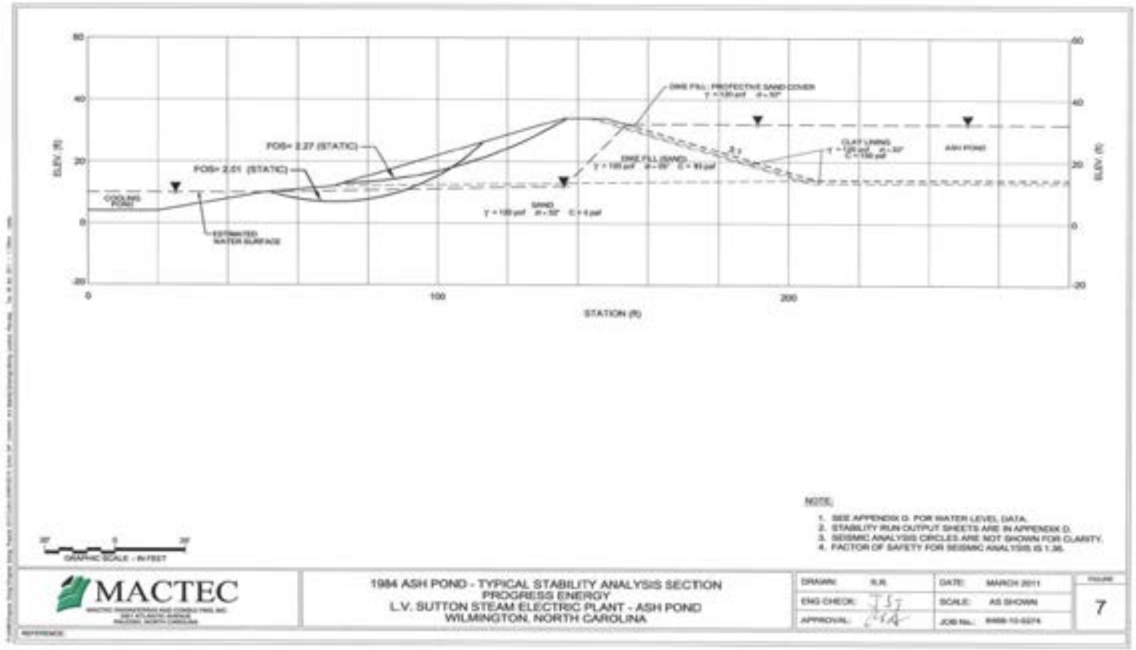


Figure 7.1.2a: 1971 Ash Pond – Typical Stability Analysis Section (B-2)

Table 7.1.2b
Soil Properties for Stability Analysis (1984 Ash Pond)

Soil Description (USCS Classification)	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Cohesion (psf)	Effective Fiction Angle (degrees)
Section at B-1				
Dike Fill: (Sand)	120	125	10*	35
Protective Sand Cover	120	125	0	32
Clay Lining	120	125	150	22
Foundation: Sand	120	125	0	32

*A nominal value of effective cohesion (10 psf) is assigned for analysis to avoid low factors of safety associated with shallow slip surface along the face of the slope.



NOTE:
1. SEE APPENDIX D FOR WATER LEVEL DATA.
2. STABILITY RUN OUTPUT SHEETS ARE IN APPENDIX D.
3. SEISMIC ANALYSIS CIRCLES ARE NOT SHOWN FOR CLARITY.
4. FACTOR OF SAFETY FOR SEISMIC ANALYSIS IS 1.36.

1984 ASH POND - TYPICAL STABILITY ANALYSIS SECTION
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

Figure 7.1.2b: 1984 Ash Pond – Typical Stability Analysis Section

7.1.3 Uplift and/or Phreatic Surface Assumptions

Piezometers were installed in 2009 on the 1984 Ash Pond so data is limited. A location map of the piezometer locations can be found in Figure 7.1.3a. Piezometer readings are shown in the Figure 7.1.3b and more can be found in Appendix A (Doc 11: Slope Stability Analysis)

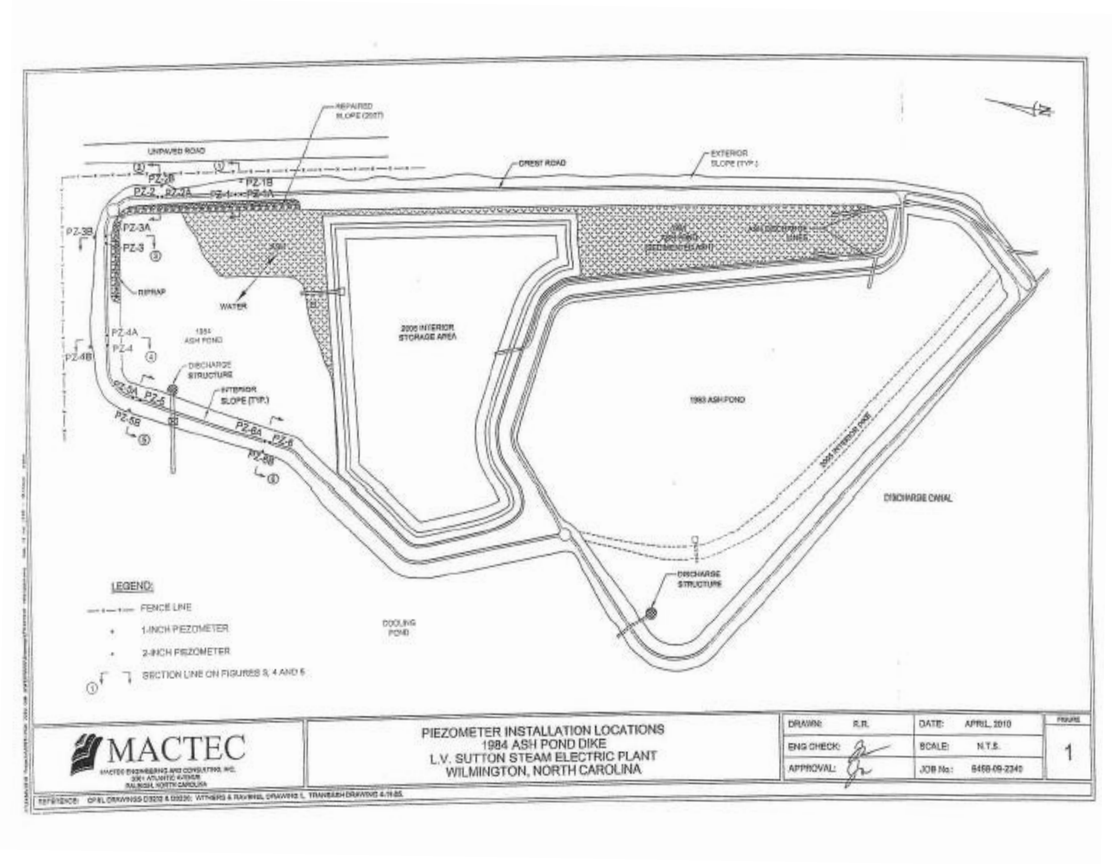


Figure 7.1.3a: 1984 Ash Pond Piezometer Locations

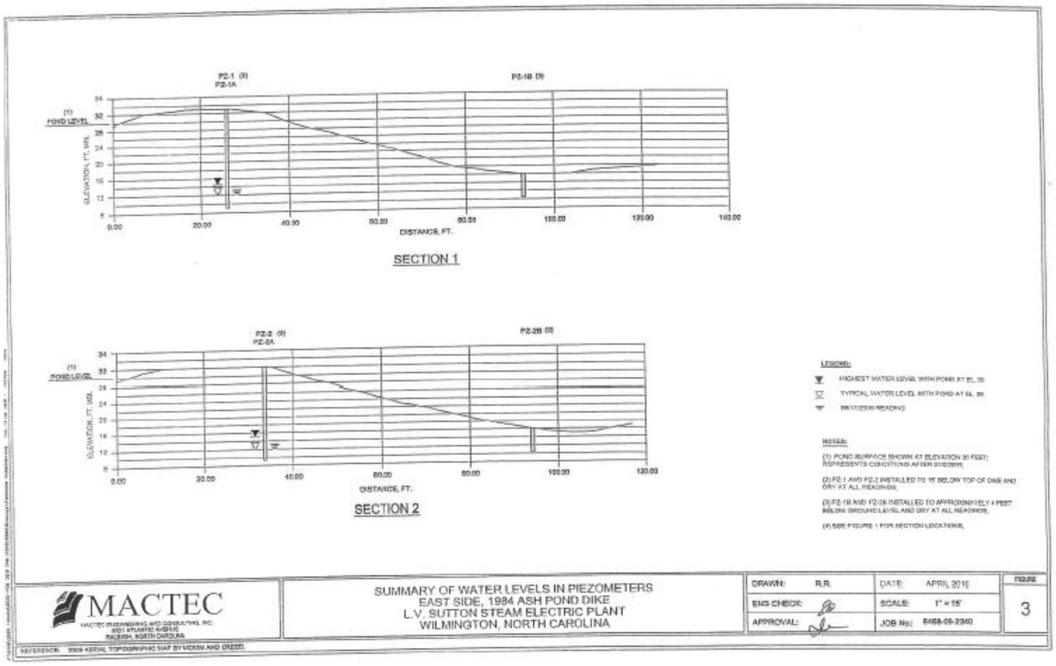


Figure 7.1.3b: 1984 Ash Pond – Summary of Water Levels in Piezometers

7.1.4 Factors of Safety and Base Stresses

Table 7.1.4 – FACTORS OF SAFETY AGAINST SLOPE FAILURE

	Factor of Safety	
	Static	**Seismic**
1971 Pond – Section B-1	1.64	1.18
1971 Pond – Section B-1	1.85	1.40
1971 Pond – Section B-2	1.52	1.03
1971 Pond – Section B-2	1.78	1.25
1971 Pond – Section B-2	1.46*	1.01
1971 Pond – Section B-3	2.51	1.56
1971 Pond – Section B-3	2.51	1.68
1984 Pond	2.51	1.56
1984 Pond	2.51	1.68
1984 Pond – Original Slope Stability Analysis	1.583	NA
1984 Pond – MACTEC Slope Stability Analysis with Original phreatic surface	1.57	NA

*A factor of safety of 1.46 meets the minimum requirement of 1.5. MACTEC in the Slope Stability Analysis (Doc 11, Appendix A), stated they consider this factor of safety acceptable based on the performance of the dike and the expectation of closure in the near future. We concur.

7.1.5 Liquefaction Potential

No liquefaction potential documentation was provided.

7.1.6 Critical Geological Conditions

The site is located in the Coastal Plain Province and is underlain by Castle Hayne Limestone which is eroded through in places to expose the PeeDee Formation. The site falls in the Zone 1 seismic zone according to Corps of Engineers with a design earthquake: ah=0.05g. (Appendix A: Doc 02 – Ash Pond Summary).

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate; however, we would recommend PEC perform a liquefaction analysis to ensure the ponds will not liquefy during seismic events

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the 1971 Pond dam and the 1984 Pond dam are rated Satisfactory. However, Section B-2 of the 1971 Ash Pond is marginally acceptable for meeting Minimum Factors of Safety for both static and seismic conditions. We would recommend that Progress Energy monitor the slope's performance and potentially add buttressing or take other actions to improve the stability of the slope.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

Operational procedures are described in Section 4.2.1.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance of the dam and project facilities is adequate, although a few maintenance items should be addressed.

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

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 include monthly, annual, and five-year inspections.

Annual Inspections:

Annual inspections were provided by Progress Energy and can be found in Appendix A: Doc 06-08. In addition to the annual inspection by Progress Energy, NCDENR conducts an annual inspection.

Five-Year Inspections:

Five-Year inspections reports were provided by Progress Energy and can be found in Appendix A: Doc 03 - Five-Year Independent Consultant Inspection.

9.2 INSTRUMENTATION MONITORING

The 1984 Ash Pond's piezometer program is described in Section 7.1.3. The piezometers were installed in 2009 and the number and location of the instruments is adequate for monitoring the phreatic surface.

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 instrumentation 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.

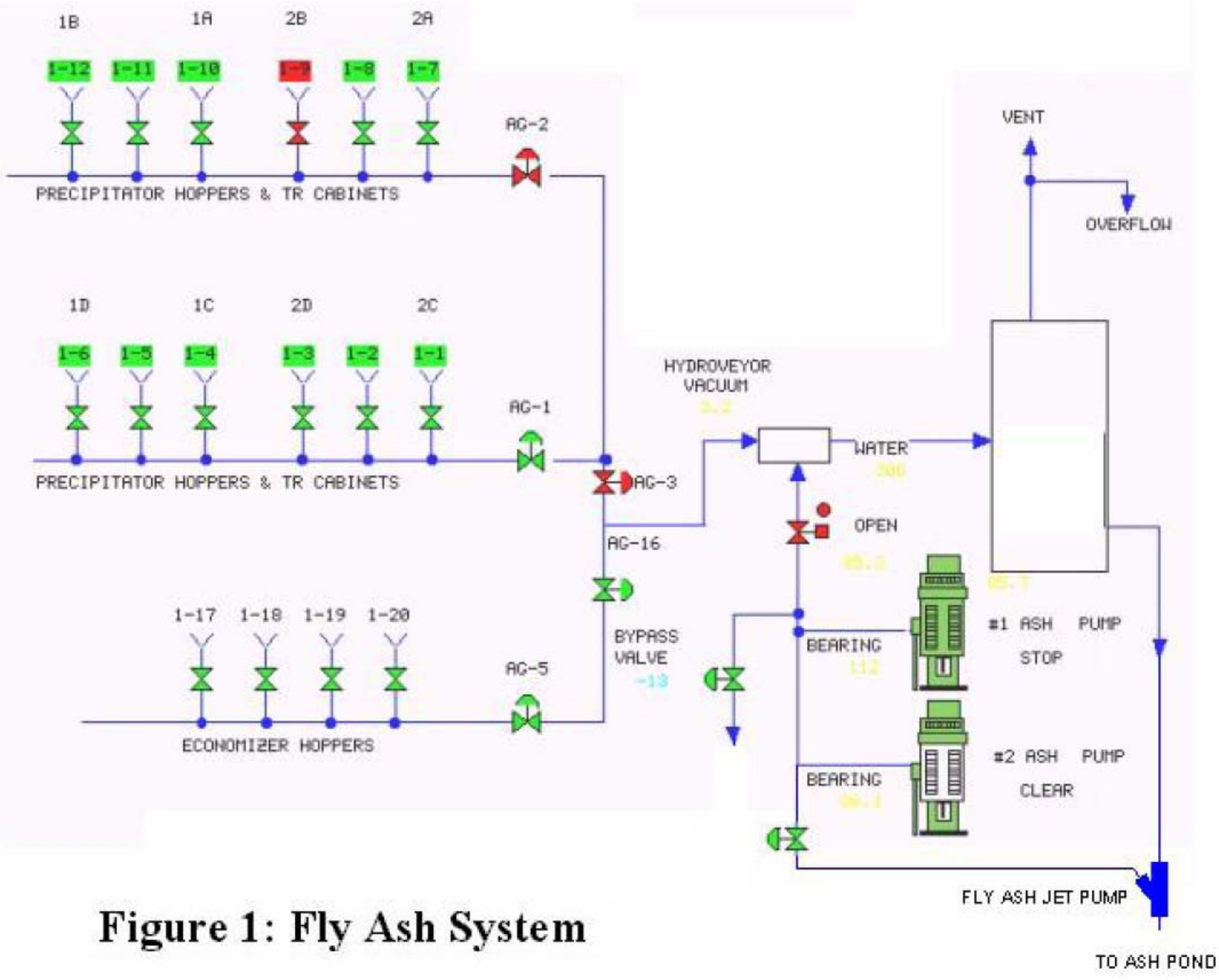


Figure 1: Fly Ash System

APPENDIX A

Document 2

Ash Pond Summary

DAM INFORMATION SUMMARY
L.V. Sutton Steam Electric Plant
Ash Ponds
New Hanover County, North Carolina

1. Location

Located 3 miles northwest of Wilmington, NC

Latitude:	N34.2931° (1983 Pond)	N34.2991° (1984 Pond)
Longitude:	W77.9928° (1983 Pond)	W77.9924° (1984 Pond)

Latitudes and longitudes taken from NC Dam Safety Inventory listing

NC Dam Identification Numbers: NEWHA-004 (1983 Pond); NEWHA-005 (1984 Pond)

2. Size and Dimensions

	1984 Pond	**1983 Pond***
Length:	10,000 feet	7,000 feet
Maximum Structural Height:	32 feet	24 feet
Surface Area (acres):	82	
Storage capacity (acre-feet):	1,364	248
Size Classification:	Medium	Small
Hazard Classification:	Low	Low
(Classifications based on NC Dam Safety Regulations and Dam Safety Inventory)		
Regulatory Design Storm	100 yr **	50 yr**
US Slope:	3 (H):1(V)	3 (H):1(V)
DS Slope:	3 (H):1(V)	3 (H):1(V)
Crest Width:	12 feet	12 feet
Crest Elevation:	34 feet	28 feet
Design maximum operating level:	32 feet	26 feet
Current Operating Level	26 feet	24 feet
Instrumentation	18 piezometers***	None

* The 1983 pond is listed as the 1971 ash pond in the NC Dam Inventory.

** 100-year storm is 10 inches over 12 hours. 50-year storm is 9 inches.

*** Installed in 2009.

3. Geology and Seismicity

Located in Coastal Plain Province. Underlain by Castle Hayne Limestone which is eroded through in places to expose the PeeDee Formation

Zone 1 seismic zone according to Corps of Engineers with
Design Earthquake: $a_h = 0.05$ g

4. Design Information

1983 Pond: Originally designed by Brown & Root in 1971, raised to present elevation under CP&L design with assistance from William Wells. Limited subsurface exploration. No information on stability or seepage analyses. No internal drainage.

Outlet works consist of a 4’ diameter concrete vertical riser connected to a 3’ diameter concrete pipe through the dike that would discharge to the Cooling Lake. There are no seepage collars.

The capacity of the pond and outlet works is sufficient for a 100-yr storm without overtopping the dike.

1984 Pond: Designed by CP&L with assistance from William Wells. Subsurface exploration was performed. Stability was re-evaluated by CP&L in 1987, FS = 1.58. Seepage analysis performed as part of design assuming k = $1x10^{-7}$ cm/sec for 1-foot thick clay liner with calculated seepage rate of 108 gpm. No internal drainage provided.

Outlet works consist of a 4’ diameter concrete vertical riser connected to a 3’ diameter concrete pipe through the dike that is connected to piping leading to the Cape Fear River. There are two seepage collars.

The capacity of the pond and outlet works is sufficient for a 100-yr storm without overtopping the dike.

5. Construction History

1983 Pond

Original construction of north Ash Pond dike done in 1971 under direction of Brown & Root to crest elevation of 18.0 feet. In 1983, Dickerson raised north Ash Pond to operating level to elevation 26.0 feet. Testing was conducted.

1984 Pond

- Constructed by Lindsay and Associates under direction of CP&L. Testing was performed.
- Outlet pipe modifications were provided in 1999 to connect discharge to a pipe leading to the Cape Fear River. A pipe joint opened under the upstream slope and seepage through the slope created start of sinkhole. Grouting of slope conducted in 2000 along with slip-lining of the pipe for long-term protection.
- Interior slope repairs on east dike provided in summer, 2001 to fill areas of beaching erosion and reseed.
- Additional storage capacity was constructed within the pond area and placed in service during 2006. Engineering and design was provided by Withers & Ravenel, and construction by Trans-Ash. This area is not included in the NC Dam Safety Inventory.
- Repairs were made in 2007 to the interior slope and clay liner on the east side of the pond, north end.

6. Inspection History

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

LAW: *1987*, *1997*, *2002*, 2003, 2004, 2005, *2007*, 2008, 2009, 2010
S&ME: *1992*

7. Current Issues

No significant issues based on the 2010 limited field inspection by MACTEC. Vegetation was cut in 2010. Subsequent to the 2010 inspection, a breach due to localized runoff from very heavy rains overtopped a very small portion of the 1984 pond dike occurred in an area containing only sedimented ash. No ash release occurred. Temporary repairs were made and permanent repairs are to be implemented in 2011.

8. Overall Condition

The 2010 inspection indicated the dikes are in good condition. No items requiring emergency actions by the plant were noted.

APPENDIX A

Document 3

Five-Year Independent Consultant Inspection

MACTEC
engineering and constructing a better tomorrow

December 20, 2007

Progress Energy
1420 Walpat Road
Smithfield, North Carolina 27577

Attention: Mr. Bill Forster

SUBJECT: REPORT OF INDEPENDENT CONSULTANT INSPECTION
ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA
MACTEC PROJECT NO. 6468-07-1686 (02)

Dear Mr. Forster:

MACTEC Engineering and Consulting, Inc. (MACTEC), is pleased to submit the attached report of our five-year independent consultant inspection for the ash pond dikes at the Sutton Plant. This report has been prepared in accordance with Work Authorization No. 2720-33 under our contract 2720.

During the 1997 inspection, a Historical Volume was prepared which contained historical information regarding the site geology, design and construction, inspection history and exhibits related to these items. That volume is not updated for subsequent inspections. The attached report contains the field inspection observations and recommendations, photographs, and pertinent exhibits specifically related to current dike conditions.

In general, our inspection noted no external, presently visible signs of serious conditions requiring emergency repairs for public safety. Other than routine maintenance, scheduled Progress Energy inspections, and some minor repairs, no major repairs appear warranted at this time. Overall, the ash pond dikes appear to be in good condition.

We appreciate the opportunity to provide our professional services to you on this project. Please contact us if you have any questions.

Respectfully yours,

MACTEC ENGINEERING AND CONSULTING, INC.

James A. Schiff
Project Professional

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

JS/JAT/js

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

FIVE-YEAR INDEPENDENT CONSULTANT INSPECTION
ASH POND DIKES
L. V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA

Prepared For:

Progress Energy
Smithfield, North Carolina

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
Raleigh, North Carolina

December 20, 2007

MACTEC Project No. 6468-07-1686 (02)

MACTEC

PROGRESS ENERGY

L.V. SUTTON STEAM ELECTRIC PLANT

ASH POND DIKES

WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA

MACTEC JOB NO. 6468-07-1686 (02)

FIVE-YEAR INDEPENDENT CONSULTANT INSPECTION

AS REQUIRED BY

NORTH CAROLINA UTILITIES COMMISSION

December 20, 2007

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

REPORT PREPARED BY

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

SEAL
6428
J. ALLAN TICE

L.V. SUTTON STEAM ELECTRIC PLANT
2007 INDEPENDENT CONSULTANT INSPECTION
ASH POND DIKES

TABLE OF CONTENTS

1.0 SUMMARY

1.1 General

This report presents the results of an independent consultant inspection of the 1983 and 1984 Ash Pond dikes at Progress Energy's L.V. Sutton Steam Electric Plant in Wilmington, North Carolina. The independent inspection is performed at five-year intervals as required by the North Carolina Utilities Commission (NCUC) for facilities owned by Progress Energy in North Carolina and not licensed by the Federal Energy Regulatory Commission (FERC). The inspection was performed in accordance with U.S. Army Corps of Engineers (USACOE) guidelines(1)*.

The last five-year independent inspection was made in 2002 by Law Engineering and Environmental Services, Inc. (LAW) now MACTEC Engineering and Consulting, Inc. (MACTEC). MACTEC acquired LAW in February 2002. The results of that inspection were presented in a report dated October 18, 2002(2). A review of the historical information about the site geology, engineering data, design and construction of the dikes and operations was prepared for the 1997 inspection (3) and is only summarized briefly in this document.

A field inspection was performed on December 4, 2007 to observe the condition of the earth dike and appurtenant structures of the ash ponds. Photographs were obtained to document existing conditions and significant features. Inspection reports prepared by Progress Energy plant personnel were also reviewed.

Overall, the ash pond dikes inspected and their appurtenant structures are judged to be adequately designed, constructed and maintained, and in satisfactory condition.

1.2 Purpose and Scope

The purpose of this dam safety inspection and report is to identify, within the limitations of surface 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 dams, 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 analysis where required, and acceptance of the present condition of the dikes if justified by the engineering data and inspections.

This report, prepared for Progress Energy, is concerned with a safety evaluation of the 1983 and 1984 Ash Pond dikes for the L.V. Sutton Steam Electric Plant. These water retaining structures were constructed to their present configurations in 1983 and 1984-1985. Interior work in both ponds was done since the last five-year independent inspection; however these interior works are not considered new dikes subject to

---

* Number in parentheses refers to reference listed in Reference List Section 5.0.

inspection, because the original pond exterior dikes remain as the primary ash impoundments. The interior works were briefly inspected for the purpose of confirming absence of conditions that would affect the original exterior dikes.

This inspection has been conducted in general conformity with the guidelines outlined in the USACOE publication, "Recommended Guidelines for Safety Inspection of Dams", Phase I[1]. It encompassed a review of the 2002 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. Activities since the 2002 inspection, maintenance history and plans for future maintenance activities were reviewed in consultation with maintenance and operations personnel at the L.V. Sutton Plant.

A site visit was made on December 4, 2007 by MACTEC personal for the purpose of inspecting features relating to the safety and integrity of the ash pond 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.

1.3 Conclusions

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

1. There was no evidence of excessive seepage, erosion, instability or settlement of the dikes. In general, the ash pond dikes appear to be in good condition and are adequately maintained. The discharge structures are generally in good condition; however, the 1983 Ash Pond outlet pipe was not visible for inspection.

2. A good procedure is in place for plant personnel conducting regular safety inspections.

3. The recommended remedial activities/repairs fall under the category of normal maintenance and are not considered emergency actions.

1.4 Recommendations

Based on the field inspection and review of available data, the following recommendations are made. Most of these were reviewed with plant personnel at the completion of the field inspection.

1983 Ash Pond Dike

1. The large bushes and brushy vegetation on the west dike should be trimmed before summer, 2008 to allow better slope visibility.
2. Progress Energy's program of cutting trees on the exterior slopes should continue.
3. If operation of the 1983 pond is resumed, the exterior slope adjacent to the Cooling Pond and discharge canal should be checked during the monthly inspections for signs of seepage.

1984 Ash Pond Dike

1. Patches of briers and small brush on the interior slope should be controlled by spraying or cutting so the slope can be observed during routine inspections.
2. Progress Energy's program of cutting trees on the exterior slopes should continue.
3. The east dike interior repair area should be monitored for progress of vegetative growth the rip rap sprayed as needed to control vegetation.

2.0 ASH POND DESCRIPTIONS

A brief description of the dikes at the ash ponds is given in this section and on the information sheets attached in Appendix A. Further details about the design and construction of the ash ponds are contained in the Historical Volume prepared for the 1997 inspection[5].

2.1 Location

The subject ash ponds are located about 3,000 feet north of the generating area of the L.V. Sutton Plant and on the east side of the plant cooling pond. The L.V. Sutton Plant is located along the east side of the Cape Fear River in New Hanover County, North Carolina, about four miles north of the confluence of the Cape Fear and Northeast Cape Fear Rivers. The site coordinates are 34°17'50" north latitude and 77°59'30" west longitude. Exhibit 1 shows the site location on the Castle Hayne USGS 7.5-minute quadrangle map. Exhibit 2 shows the locations of the ash ponds relative to the plant.

2.2 1983 Ash Pond

2.2.1 General Description

The 1983 Ash Pond dikes were constructed by raising original dikes constructed in 1971. The 1971 design and construction was by Brown and Root. The 1983 modifications were designed by CP& L (now Progress Energy) and constructed by Dickerson Inc. under the administration of CP&L. Law Engineering provided field density testing. Exhibit 3 shows general design information for the 1971 dikes. Exhibits 4 through 8 show plan and sections for the 1983 modifications. The present dikes have a crest elevation varying from elevation 28 feet MSL to 34 feet MSL. The higher elevation is at the common dike with the 1984 Ash Pond. The crest width is 12 feet and side slopes are 3(H):1(V). Including the common dike, the dike length is about 3,800 feet. This ash pond was taken out of service in 1985, but opened in 2001 to allow temporary use during various repair work and ash removal activities in the 1983 and 1984 ponds. Currently, no ash is being discharged into the 1983 Ash Pond. Some free water was present in parts of the pond at the time of our inspection. However most of this pond, including the interior storage area, was dry.

The 1983 pond main discharge structure consists of a 48-inch diameter vertical concrete riser connected to a 12-inch diameter concrete outlet pipe, and is located in the northwest corner of the pond. At the time of our field inspection there was minimal free water around the structure. No water was flowing into the vertical riser. The outlet of the discharge pipe is submerged in the cooling pond and not visible. The design top of the discharge riser was elevation 26 feet MSL. MACTEC recommended in 2005 that the maximum water level, based on a survey of the dike crest be established at elevation 23.5 feet. At the time of our inspection, the water level was at approximately elevation 22 feet.

There are no piezometers or movement monuments in the dikes.

In 2005, an interior storage area was constructed as described in Section 3.1.1. Exhibits 10 and 11 show plan and sections. The dike for this storage area is not considered as a dike requiring NCUC inspections; however it is described in this report for reference and documentation purposes.

2.2.2 Size and Hazard Classification

The 1983 Ash Pond dikes are classified as small size dams under both guidelines of the US Army Corps of Engineers[1] and the North Carolina Dam Safety Regulations[4]. A low hazard classification is appropriate for the dikes due to the lack of potential for loss of life or significant property damage if failure were to occur. The historical volume[3] provides additional discussion.

2.3 1984 Ash Pond

2.3.1 General Description

The 1984 Ash Pond was constructed during 1984/1985. The design was done by CP&L (now Progress Energy). Construction was by Lindsay and Associates under administration of CP&L. Soil and Materials Engineers, Inc. provided field density testing. Exhibits 4 through 9 show plan, section and design details.

The crest of the dikes is at elevation 34 feet MSL, the crest width is 12 feet and the interior and exterior slopes are 3H:1V. The maximum dike height is about 32 feet. The length, including the common dike with the 1983 pond is about 10,000 feet. In 2006, an interior storage area was constructed in the south portion of the pond as discussed in Section 3.YY. The planned maximum operating level for the 1984 pond is elevation 32 feet MSL.

The discharge structure for the 1984 pond is located at the west side, near the northern end. It consists of a 48 inch concrete vertical riser connected to a 36 inch diameter concrete outlet pipe. The vertical riser is constructed of approximate 2-foot tall segments that can be added or removed as needed to allow adjustment of the pond level. At the time of the field visit, the pond level was at about elevation 24, and water was flowing into the riser.

There are no piezometers or movement monuments in the dikes.

In 2001, CP&L contracted with Triangle Grading and Paving for removal of sedimented ash from the south portion of the pond. To accommodate the work, entry and exit ramps were constructed up the exterior side slopes on the east dike. These ramps remain in place and are maintained to facilitate access as needed for ash removal activities.

In 2006, an interior storage area was constructed as described in Section 3.1.2. Exhibits 12 and 13 show plan and sections. The dikes for this storage area are not considered as dikes requiring NCUC inspections; however they are described in this report for reference and documentation purposes.

2.3.2 Size and Hazard Classification

The 1984 Ash Pond dikes are classified as intermediate size dams under both the guidelines of the U.S. Army Corps of Engineers(1) and the North Carolina Dam Safety Regulations(4). A low hazard classification is appropriate for the dikes due to the lack of potential for loss of life or significant property damage if failure were to occur. The historical volume(1) provides additional discussion.

3.0 ACTIVITIES SINCE 2002 INSPECTION

The following actions related to the performance of the dikes, some in response to the 2002 inspection, were taken since the 2002 field inspection by an independent consultant.

3.1 Interior Dike Construction

Two projects have been conducted to increase ash storage capacity since the 2002 inspection. Neither project modified the original perimeter dikes of either pond, and these interior projects are not considered modifications to the dikes subject to the NCUC inspection requirements. Both projects are described briefly for information and reference by future inspectors.

3.1.1 1983 Ash Pond Interior Construction

In 2005, TransAsh constructed low-height (approximately 6 feet high) dikes that tied in to the 1983-1984 common dike and formed an approximate 34-acre area. The initial outfall construction experienced a washout around the pipe that was repaired. Exhibit 10 shows the general plan, and Exhibit 11 shows a section at the repaired outfall structure. The dikes were constructed by excavating ash from within the pond and using it to form dikes. A vertical HDPE riser with stoplog capability was connected to an HDPE outlet pipe that released water into the 1983 pond near its discharge facility. This interior area was taken out of service in 2006, after the 1984 interior area was placed in service. Progress Energy plans to alternate use of this area with the 1984 area to extend the overall ash storage capacity.

3.1.2 1984 Ash Pond Interior Construction

In 2006, Withers & Ravenel designed an interior ash storage area for the southern end of the 1984 Ash Pond. Exhibit No. 12 shows the general plan and section. The design crest elevation is 42.0 ft MSL, and the planned operating level is elevation 40.0 feet. The maximum dike height above the original ash level is about 14 feet. The crest width is 25 feet wide with a gravel road in the center. The interior slope is at a ratio of 2H:1V and the exterior slope on the east, west and south sides is 4H:1V. Where the new dikes are adjacent to the 1984 pond perimeter dikes, the toe of the slope is set back eight feet and the space is graded to promote flow of water toward the north. On the north side, where the dike is adjacent to the impounded water of the 1984 pond, a stability berm with a 25-foot wide crest is added to the main slope.

Withers and Ravenel conducted geotechnical analyses to check the impact of the new dike and retained ash on the existing 1984 pond dikes. Their analyses for static slope stability showed a factor of safety greater than 2 for the existing dikes, which is acceptable. Because the 1984 pond dikes have a clay liner, seepage through the 1984 dikes is not expected.

The discharge facility for this interior pond (Exhibit 13) consists of a concrete riser structure six feet square connected to a 36-inch diameter HDPE pipe with an outlet invert elevation of 24.0 feet. The plans show that the 36-inch diameter HDPE pipe has a flowable fill bedding coupled with a filter diaphragm and seepage drain.

The interior pond dikes were constructed by TransAsh in 2006 under observation by Progress Energy personnel.

3.1 1984 Ash Pond Interior Slope Repairs

The interior slopes on the north and east dikes have a history of erosion and local loss of cover over the clay liner. Repairs were made in 2001, but subsequent storms and pond level fluctuations created additional erosion. In 2006 Progress Energy made additional repairs to these slopes. The repairs were constructed by TransAsh using details selected by Progress Energy from recommended options prepared by Law Engineering in 2000 (Exhibit 14) with addition of rip rap.

3.2 Maintenance Activities

Routine maintenance consists of occasional mowing the crest of the 1983 and 1984 Ash Pond dikes and the exterior slopes of the 1984 Ash Pond dikes by Progress Energy personnel. Additional vegetation control by application of herbicides is conducted by Progress Energy. A program of marking trees for cutting has been initiated, and marked trees are removed as personnel schedules and weather conditions allow.

3.3 Inspection Activities

Progress Energy plant personnel conduct monthly visual inspections of the ash ponds and prepare reports using a checklist. Over the past 5 years, MACTEC has performed limited field inspections of the cooling pond dike in 2003, 2004 and 2005. These limited field inspections consisted of a walking reconnaissance of the dams with representatives of Progress Energy and a review of inspection reports and maintenance activities for the past year. No significant concerns were noted during the field reconnaissance and records review during these limited inspections.

4.0 FIELD INSPECTION OBSERVATIONS

4.1 Method of Inspection

The field inspection for the Five-Year Independent Consultant Inspection of the Ash Pond Dikes was conducted on December 4, 2007 by Mr. Al Tice and Mr. James Schiff of MACTEC. At the plant, we interviewed Mr. Bruce Moorefield, and Mr. Issac Alderman, both chemistry technicians. Mr. Alderman conducts monthly visual inspections of the ash pond dikes.

A visual inspection was made of the dikes and appurtenant structures by observations from a slowly moving vehicle and on foot. Observations were made of the condition of the crest, interior and exterior slopes and structures where foot-accessible. Photographs were taken to document existing conditions and are contained in Appendix D. The location and orientation of each photograph is shown on the Photograph Location Map also contained in Appendix D. In general, comparison of 2007 photographs with comparable 2002 photographs showed no significant change in conditions (except for the repairs made to the northern and eastern interior slopes of the 1984Ash Pond dike and the addition of the interior storage areas).

4.2 1983 Ash Pond

4.2.1 Dikes

Although no ash is presently being placed into the 1983 pond, there was a small area of water impounded around the discharge structure (Photograph 1). Most of the pond surface is dry ash, and there is tree and brush growth on most of the pond. Progress Energy has cut most of the larger tree growth observed in the 2002 inspection.

The water level at the discharge structure was estimated at about six inches below the base of the skimmer structure (Photograph 1). No apparent overflow was occurring. The discharge structure could not be accessed from the dike. We estimate the water elevation is about 22 feet.

The crest is generally level and shows no signs of unusual settlement or tension cracks. A thin layer of gravel is present on most of the crest.

The exterior slope of the west dike, from the intersection with the 1984 Ash Pond dike to about 300 feet south of the discharge structure, is moderately to thickly covered with tall grass. Some trees and brush are present at the toe area, and occasional larger trees are growing on the slope. The larger trees have markers identifying them to be cut during the next maintenance cutting. The slope in this area shows no seepage indications. Where the ash discharge pipe to the Cape Fear River was installed, there are minor local slumps upslope from the pipe, probably remnants of the pipe excavation work. In spots, the HDPE pipe was partly exposed.

The ash line along the exterior slope crosses the Cooling Pond discharge canal about 1000 feet south of the discharge structure. From this point south, the slope of the dike and the toe area are heavily vegetated with tall grass, small brush and small trees. Due to the season, the vegetation had little foliage, and the slope and toe area could be seen with minimal difficulty. However, in the growing season, it is unlikely the lower slope and toe will be visible from the crest. Progress Energy has been conducting maintenance cutting of trees and brush during the past five years as personnel schedules and weather permit. These maintenance operations are planned to continue. The present program is adequate and should continue.

The exterior slope in the area where water is impounded around the discharge structure did not show evidence of seepage from the slope or the toe.

Most of the old tree growth on the interior slope along the junction with the old ash surface was removed as part of the 2005 interior ash storage area construction.

Along the common dike with the 1984 pond, the interior slopes were in good visual condition, with acceptable levels of vegetation. These conditions may change in the spring when vegetation is more visible. We recommend if vegetation is observed in the interior slopes that it be maintained and kept at a minimum.

4.2.2 Discharge Structure

The discharge structure could not be accessed from the dike. The skimmer structure appears in good condition (Photograph 1). Water did not appear to be entering the riser as no sound of flowing water could be heard. The outlet of the discharge pipe is normally submerged below the cooling pond water surface. In 2003, at a time of low water level in the cooling pond, Progress Energy inspected the outlet pipe and found it to be intact, but only 12 inches in diameter, not the 36 inches expected from the original plans. The hydrologic discharge capacity was estimated in 2003 by MACTEC to require up to 83 hours to remove the water from the design storm of 8 inches. Because the 1983 Ash Pond is not regularly used, and even when used is not filled to its maximum capacity, the outlet system is considered adequate.

4.3 1984 Ash Pond

4.3.1 Dikes

The dikes for the 1994 pond were constructed of sand with an interior clay liner. The clay liner extends across the pond bottom as well. The design crest of the dikes is at elevation 34 feet msl, the crest width is 12 feet and the interior and exterior slopes are 3H:1V. The maximum dike height is about 32 feet. The length including the common dike with the 1983 pond is about 10,000 feet. At the time of our inspection, the pond level was about two to three inches above the riser. The riser top was at about elevation 24 feet MSL.

The field reconnaissance found the dike crest to be good visual condition with no signs of unusual settlement or cracking (Photographs 2, 3 and 4). A few small pine trees are present on the west dike. These have been marked for cutting by Progress Energy.

The exterior slopes of the dikes are moderately to well vegetated with grass and some briers and small bushes and weeds (Photographs 2, 3 and 4). Patches of briers are beginning to establish themselves on the slopes; we recommend these be controlled by spraying or cutting so the slope can be observed during routine inspections. No signs of instability or unusual erosion were seen. Even in sparsely vegetated areas, the sand appears to have formed a thin crust which resists surface erosion. A fence has been constructed along the toe that appears to be preventing access by 4-wheelers and horses which previously disrupted the thin crust and caused local erosion. The ash removal contractor has constructed ramps beyond the exterior dike slope. These do not appear to represent any hazard to the dike.

The exterior toe was dry on the west, north and east sides of the pond with no indication of seepage.

The interior slopes are well grassed, and there is a good growth of vegetation along the water line that reduces wave energy in most areas (Photographs 4 and 5). Patches of briers are beginning to establish themselves on the slopes; we recommend these be controlled by spraying or cutting so the slope can be observed during routine inspections.

The areas recently repaired on the north and east interior slopes were in good visual condition (Photograph 6). Vegetation is taking hold in the new rip rap. We recommend that spraying be done to control growth of vegetation in the rip rap. Vegetation that grows in the ash at the water line is acceptable as this vegetation reduces wave energy.

The interior slope around the outlet pipe showed no signs of settlement or loss of ground.

4.3.2 Discharge Structure

The vertical riser was submerged. The skimmer structure and interior surfaces that could be seen were in good visual condition. There is a concrete junction structure on the exterior slope where the ash line diversion to the Cape Fear River intersects the discharge line to the Cooling Pond. Several hairline cracks were seen on the west side of this structure, near the base, with minor efflorescence (Photograph 7). These have been observed previously, are not unusual and pose no concern.

4.3.3 Ash Inlet Lines

The ash inlet lines are supported on the ground surface as they come up the exterior slope at the south end of the 1984 Ash Pond. Valves have been installed to allow directing ash either west to the 1983 Ash Pond or north or east to the 1984 Ash Pond or its interior storage area. The ash is presently being discharged into the south end of the interior storage area in the 1984 Ash Pond. The ash is allowed to flow out directly onto the sedimented ash. No significant concerns for erosion threats to the dikes were observed.

4.4 2006 Interior Ash Pond Dike Project

4.4.1 Interior Dike in 1984 Ash Pond

At the time of our inspections, the water level in the interior storage area was slightly above elevation 40.0 feet MSL, and was flowing over the top of the riser (Photograph 8) and out into the 1984 ash pond (Photograph 9). A slight discharge of seepage water from the seepage drain pipe alongside the discharge pipe was observed on the west side of the pipe.

The interior slopes have rip rap above the water level, and there is a good growth of vegetation along the water line that reduces wave energy in most areas.

The exterior slope has exposed fly ash with sparse to good grass cover (Photographs 3 and 10). Erosion control netting is present on the slope. MACTEC observed several areas along the top of the stability berm on the north dike where circular depressions about one to four inches deep and about one to three feet in diameter were present (Photograph 11). Discussions with Mr. Alderman indicate these areas are the result of filling in erosion rills that developed in the fly ash slope. These areas are filled by Progress Energy as they are noted. We recommend such areas be checked during each monthly inspection and their positions marked with flags so they can continue to be filled. We interpret these depressions as due to infiltration of surface water and not due to subsurface piping. Also, along the toe of the stability berm slope in the general vicinity of the discharge structure, several local slumps with minor seepage or wet areas were observed (Photograph 12). Due to the width of the stability berm and the gentle slope, these local slumps do not represent an immediate concern. They should be marked and observed during monthly inspections for signs of increasing size or seepage flow.

4.5 Plant Inspection/Operation Procedures

Progress Energy has established a procedure for plant personnel to follow for safety-related inspections of the dikes(5). The procedure provides a list of items that the plant staff is to inspect. The procedure indicates the inspection frequency should be monthly at a minimum with less frequent inspection for underwater structures and inspections after major storm events. The procedure also contains a description of recommended inspection practices and a checklist for inspection. Plant inspection records of inspections under the procedure were reviewed and found to be documented in accordance with the procedure. As written, the procedure appears to be satisfactory. We recommend that notes be taken of changes observed in the dams including noting any physical changes (depressions or erosion). Places where there is erosion or depressions should be noted on a copy of the Photograph Location Plan (Figure 2 in Appendix B).

5.0 REFERENCES

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

2. Law Engineering and Environmental Services, Inc., "Five-Year Independent Consultant Inspection Ash Pond Dikes, L.V. Sutton Steam Electric Plant, Wilmington, N.C.," October 18, 2002.

3. Law Engineering and Environmental Services, Inc., "Five-Year Independent Consultant Inspection Ash Pond Dikes, L.V. Sutton Steam Electric Plant, Historical Volume, Wilmington, N.C.," December 15, 1997.

4. North Carolina Department of Environment, Health, and Natural Resources, "North Carolina Administrative Code, Title 15A, Subchapter 2K, Dam Safety, "as amended April 1, 1995".

5. Carolina Power & Light, Sutton Plant Procedures Manual, "Guidelines for Inspection of Dams, Dikes, and Appurtenant Hydraulic Structure", SUT 1.142(Rev.1), February 11, 1997.

EXHIBITS

LIST OF EXHIBITS

1. Site Location Plan

2. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Site Plan, Carolina Power & Light Company Drawing No. D-3235, As-Built, Dated 10/14/85.

3. Civil, Ash Disposal Ponds, North Pond-Discharge Structure, Sheet 1 of 2, Brown and Root Drawing No. G-3177B, Dated 9/7/71.

4. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Plan-Sheet 1, Carolina Power & Light Company Drawing No. D-3236, As-Built, Dated 10/14/85.

5. Sutton Steam Electric Plant, Ash Pond Expansion (1985-1984), Plan-Sheet 2, Carolina Power & Light Company Drawing No. 3252, As-Built, Dated 10/14/85.

6. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Dike Sections (Sheet 1), Carolina Power & Light Company Drawing No. D-3237, As-Built, Dated 10/14/85.

7. Sutton Steam Electric Plant, Ash Pond Expansion, Dike Sections (Sheet 2), Carolina Power & Light Company, Drawing No. D-3239, As-Built, Dated 10/14/85.

8. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Sections and Details (Sheet 1), Carolina Power & Light Company Drawing No. D-3238, As-Built, Dated 10/14/85.

9. Sutton Steam Electric Plant, Ash Pond Expansion, (1983-1984), Sections and Details (Sheet 2), Carolina Power & Light Company Drawing No. D-3253, As-Built, Dated 10/14/85.

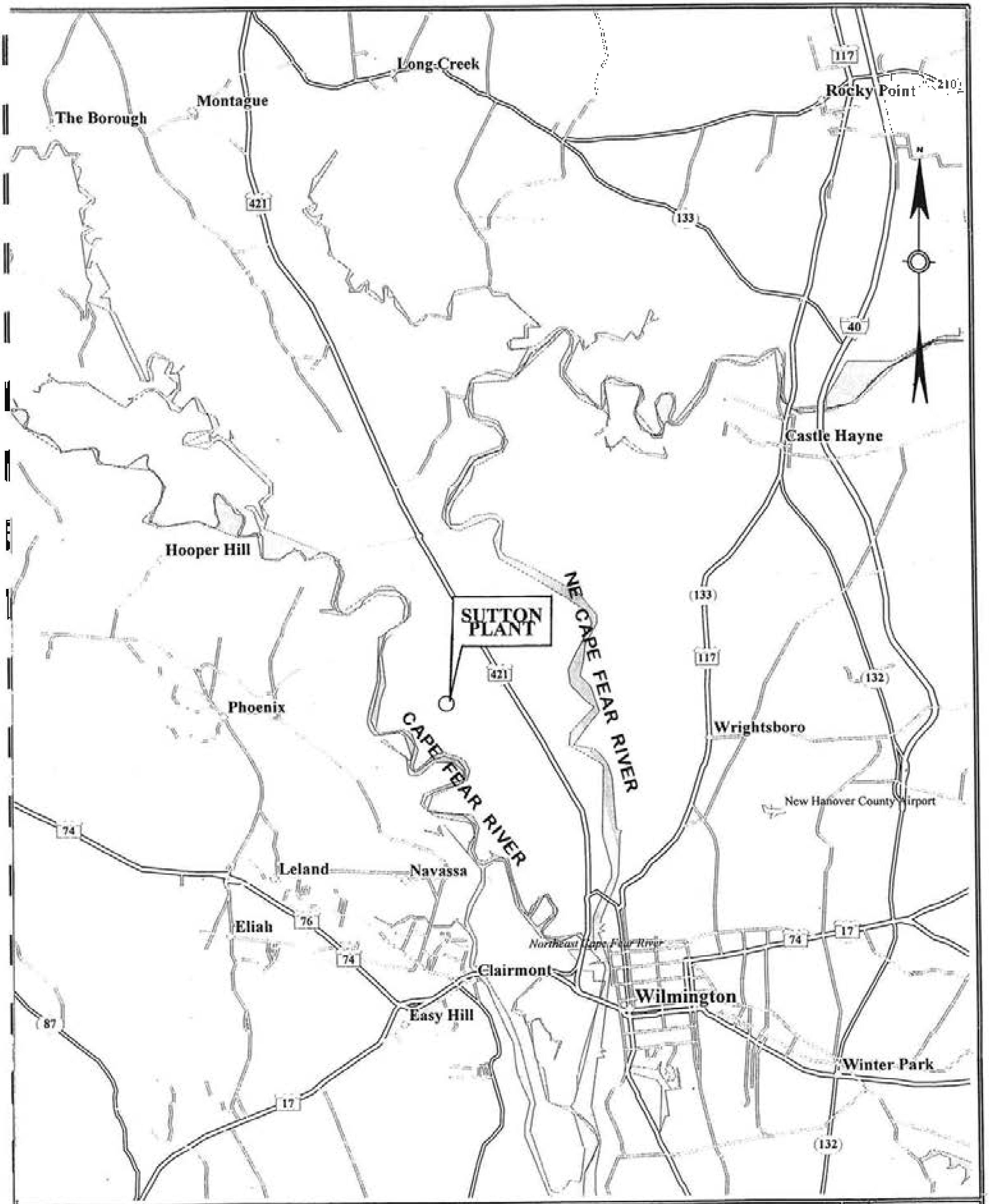
10. Sutton Plant 4-19-05 Survey. Drawing prepared by TransAsh dated 4-27-05.

11. Sutton Plant Outfall, Drawing prepared by TransAsh dated 9-30-05.

12. Site Plan, Interior Ash Pond Dike Project, Progress Energy-Sutton Plant, Withers & Ravenel; Sheet No. 1, Dated May 2006.

13. New Outfall Structure, Interior Ash Pond Dike Project, Progress Energy-Sutton Plant, Withers & Ravenel, Sheet No. 2, Dated May 2006.

14. Clay Liner Repair Plan, Ash Dike Interior Slope, Sutton Plant-CP&L, Law Engineering and Environmental Services, Inc., Drawing No. 1, Dated September 2000.

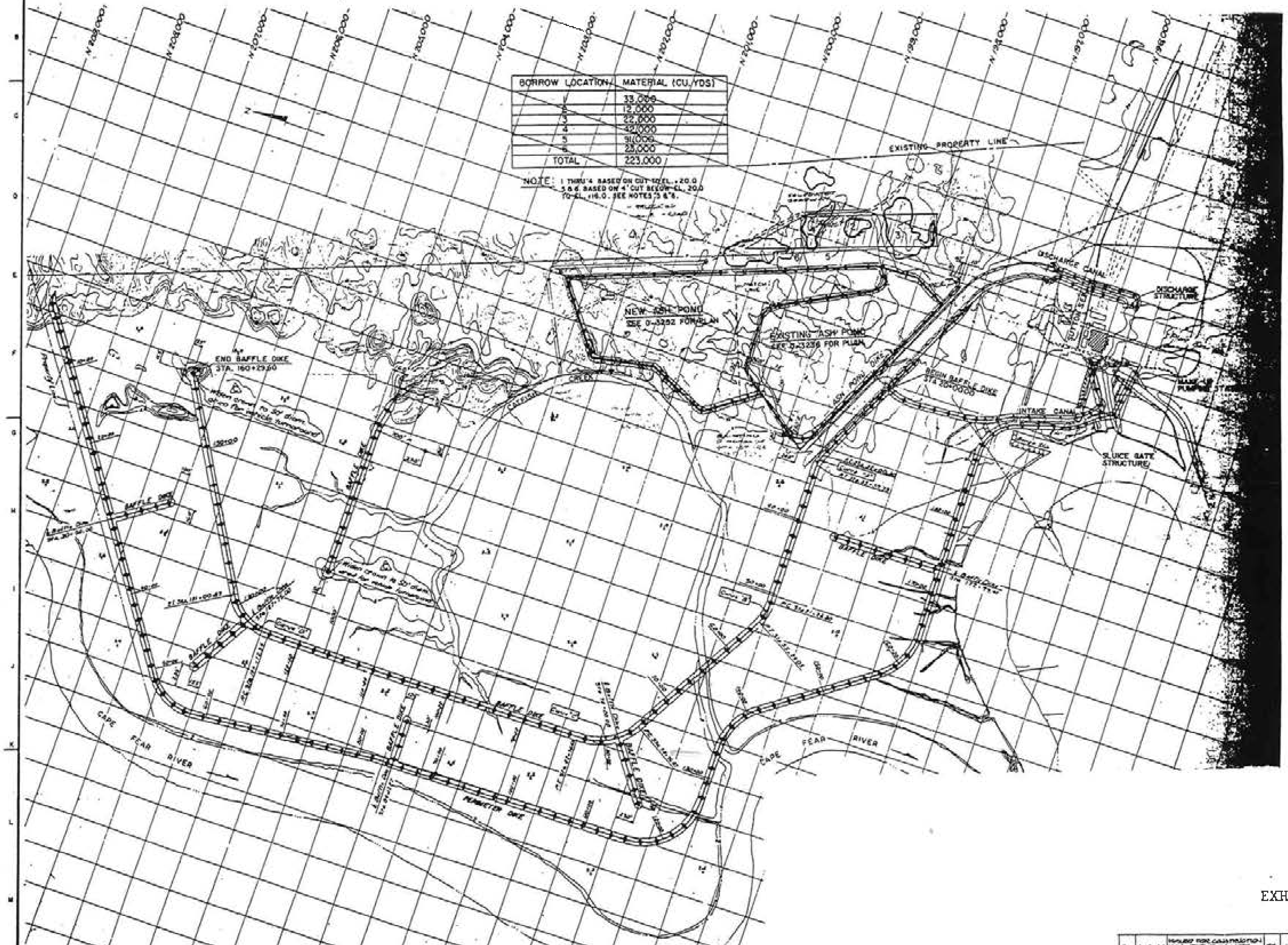


SITE LOCATION PLAN

L.V. SUTTON STEAM ELECTRIC PLANT

NEW HANOVER COUNTY, NORTH CAROLINA

EXHIBIT 1



BORROW LOCATION	MATERIAL (CU. YDS)
1	33,000
2	12,000
3	22,000
4	42,000
5	91,000
6	23,000
TOTAL	223,000

NOTE: 1 THRU 4 BASED ON CUT TO EL. +20.0
5 & 6 BASED ON 4' CUT BELOW EL. 20.0
TO EL. +16.0. SEE NOTES 5 & 6.

ESTIMATED QUANTITIES

(NOT FOR BID)

ITEM	1984 SCOPE (NOTE 2)	[illegible]	NOTES
1 CLEARING	2 ACRES	45 ACRES	
2 EXCAVATION	395,413 CY (SEE NOTE 4)	[illegible] CY	[illegible]
3 FILL	506,740 CY	[illegible]	[illegible]
4 CRUSHED STONE	2656 CY	—	[illegible]
5 SEEDING	22.75 ACRES	[illegible]	
6a RIP RAP	1,400 TON		
6b FILTER FABRIC	2,400 SY		
7a [illegible]	[illegible]	[illegible]	
7b [illegible]	[illegible]	[illegible]	
7c [illegible]	[illegible]	[illegible]	
8 [illegible]	[illegible]	[illegible]	[illegible]
9 [illegible]	[illegible]	[illegible]	
10 CLAY LINER	87 ACRES	—	[illegible]
11 [illegible] FILL	40,077 CY	—	[illegible]

[illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

LIST OF DRAWINGS

D-3250 [illegible]
D-3257 [illegible]
D-3258 [illegible]
D-3255 [illegible]
D-3252 [illegible]
[illegible] [illegible]

REFERENCE DRAWINGS

[illegible]
[illegible]
[illegible]

SPECIFICATIONS

[illegible]

EXHIBIT 2

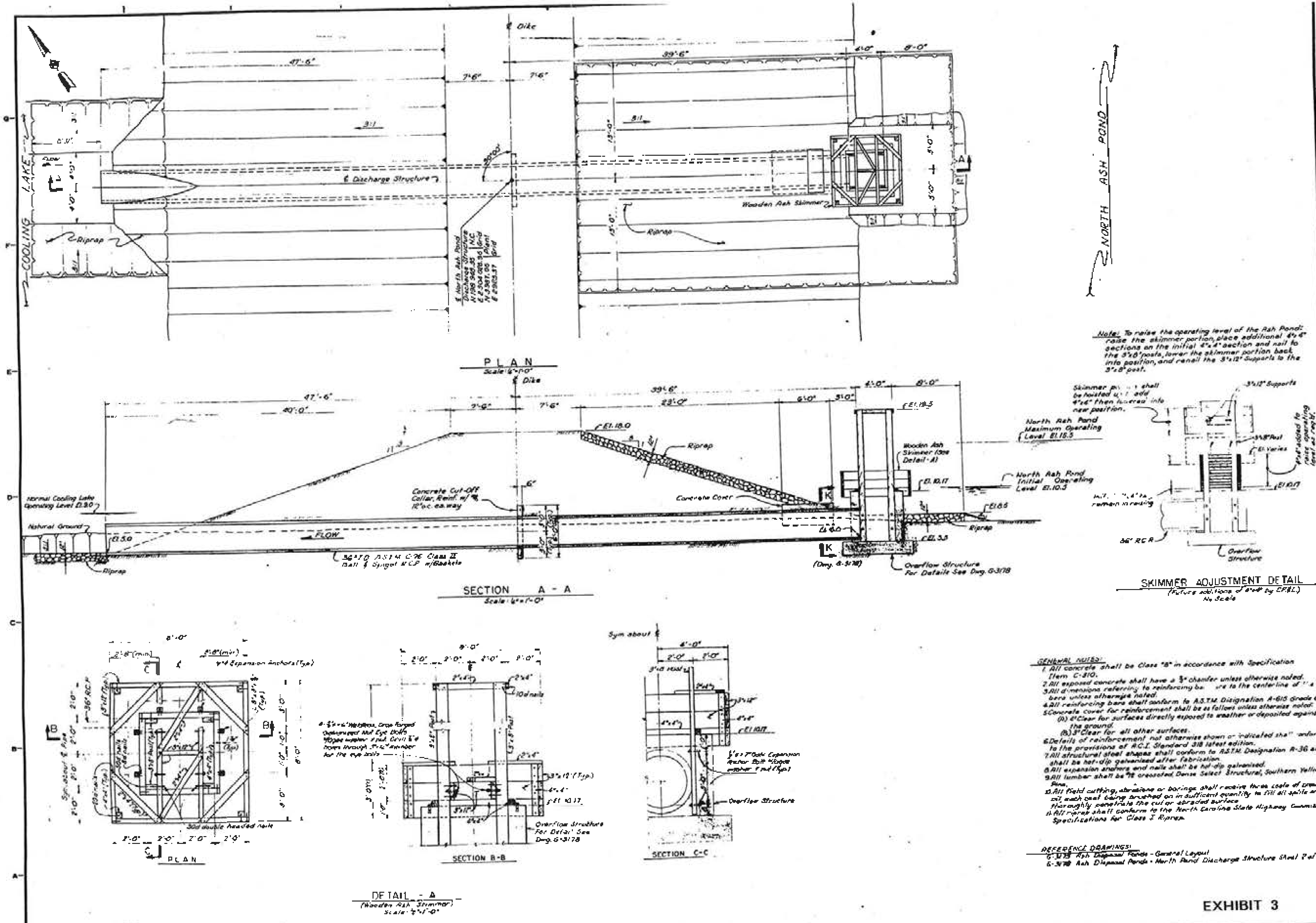
6	10-14-85	AS-BUILT			
5	[illegible]	[illegible]			
4	[illegible]	[illegible]			
NO.	DATE	CHANGES	BY	CK	APPROVED

3	[illegible]	[illegible]			
2	2-15-84	[illegible]			
1	[illegible]	[illegible]			
0	1/1/83	ISSUED FOR CONSTRUCTION			
A	[illegible]	[illegible]			
NO.	DATE	REVISION	BY	CK	APPROVED

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION (1983-1984)
SITE PLAN

DATE 1/1/83
DWG. NO. D-3235



Note: To raise the operating level of the Ash Pond: raise the skimmer portion, place additional 4"x6" sections on the initial 4"x4" section and nail to the 3"x8" posts, lower the skimmer portion back into position, and renail the 3"x12" Supports to the 3"x8" post.

GENERAL NOTES:

1. All concrete shall be Class "B" in accordance with Specification Item C-810.
2. All exposed concrete shall have a 3/4" chamfer unless otherwise noted.
3. All dimensions referring to reinforcing bars are to the centerline of the bars unless otherwise noted.
4. All reinforcing bars shall conform to A.S.T.M. Designation A-615 Grade 60.
5. Concrete cover for reinforcement shall be as follows unless otherwise noted:
   (a) 4" Clear for surfaces directly exposed to weather or deposited against the ground.
   (b) 3" Clear for all other surfaces.
6. Details of reinforcement not otherwise shown or indicated shall conform to the provisions of A.C.I. Standard 318 latest edition.
7. All structural steel shapes shall conform to A.S.T.M. Designation A-36 and shall be hot-dip galvanized after fabrication.
8. All expansion anchors and nails shall be hot-dip galvanized.
9. All lumber shall be 12# creosoted, Dense Select Structural, Southern Yellow Pine.
10. All field cutting, abrasions or borings shall receive three coats of creosote oil, each coat being brushed on in sufficient quantity to fill all splits and thoroughly penetrate the cut or abraded surface.
11. All riprap shall conform to the North Carolina State Highway Commission Specifications for Class I Riprap.

REFERENCE DRAWINGS:

G-3175 Ash Disposal Ponds - General Layout
G-3178 Ash Disposal Ponds - North Pond Discharge Structure Sheet 2 of 2.

EXHIBIT 3

B 10-22-71 Construction Issue - Revised per Comments 2nd Review AKL JFB JCB
A 9-27-71 For Customer Review Revised per Customer Revision
For Customer Review

DRAWN K. Gregory
CHECKED J. Bates
APPROVED J C Vidlack 10-22-71

BROWN & ROOT, INC.
ENGINEERS AND CONSULTANTS
HOUSTON, TEXAS

CAROLINA POWER & LIGHT COMPANY
L. V. SUTTON STEAM ELECTRIC PLANT
1972—420 MW EXTENSION-UNIT NO. 3

DRAWING TITLE
CIVIL
ASH DISPOSAL PONDS
NORTH POND-DISCHARGE STRUCTURE
SHEET 1 OF 2

CONTRACT NO. CR-44
DATE 03-7-71
SCALE: As Shown
B & R DRAWING NO. G-3008-3
G-3177B

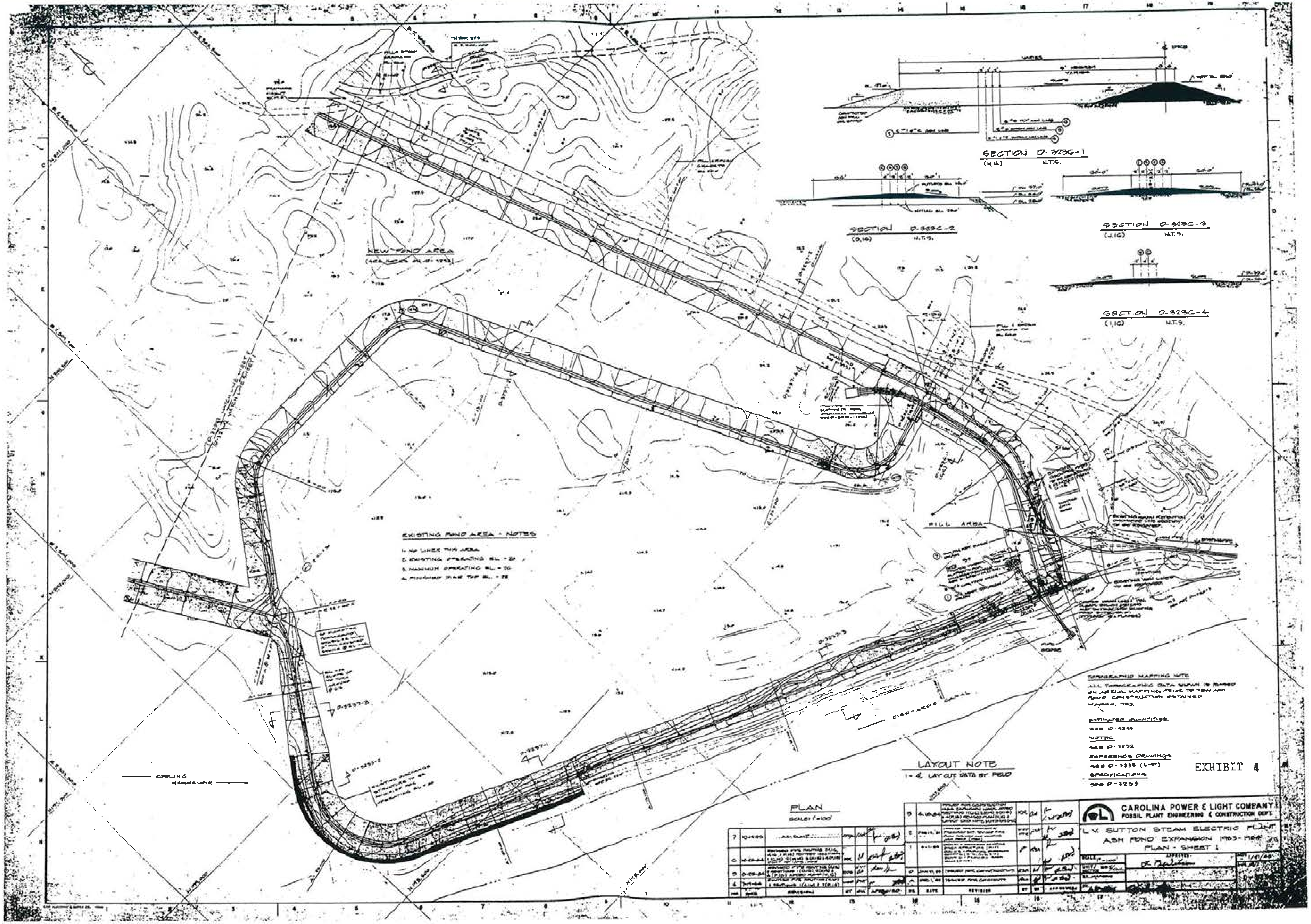
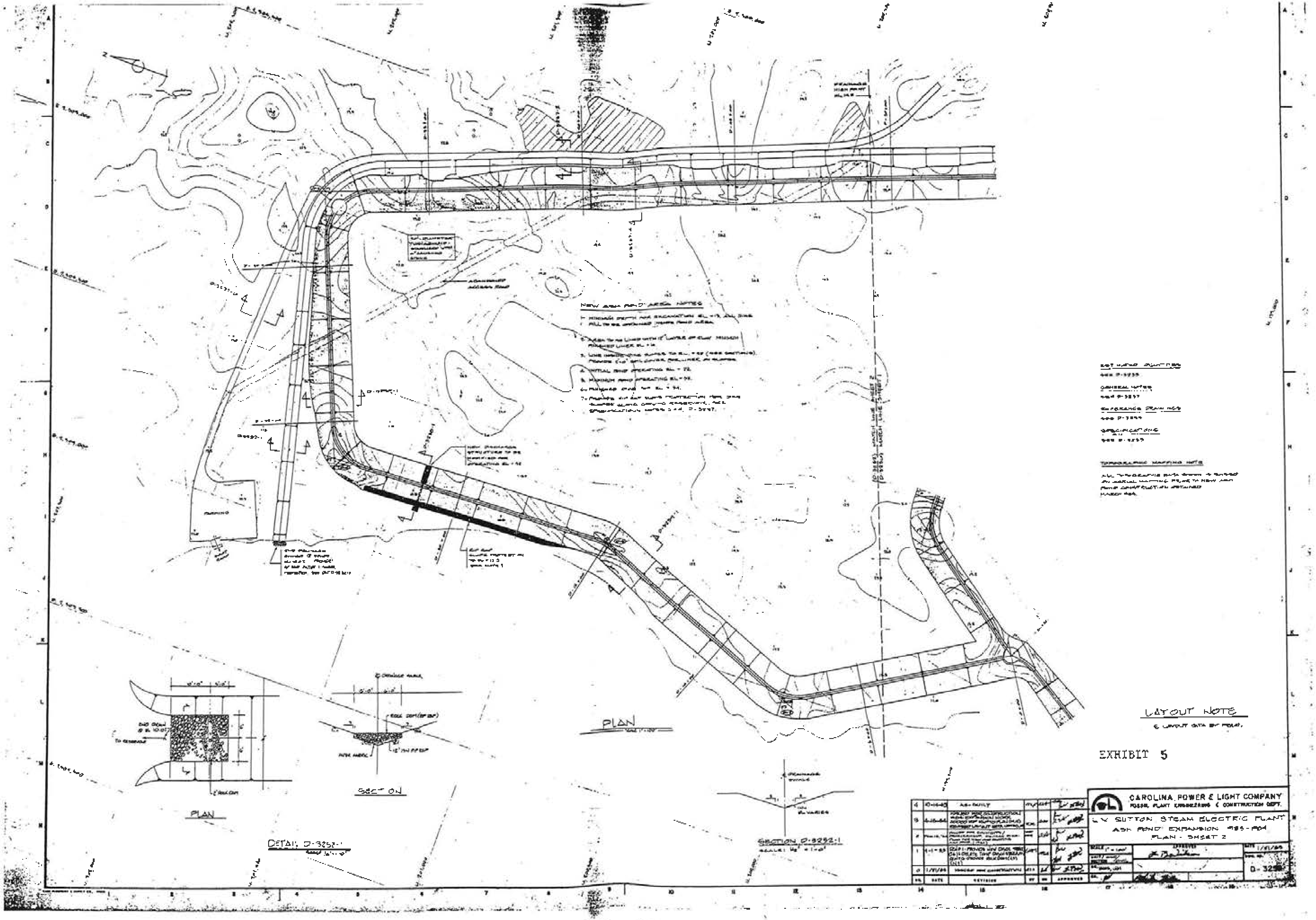
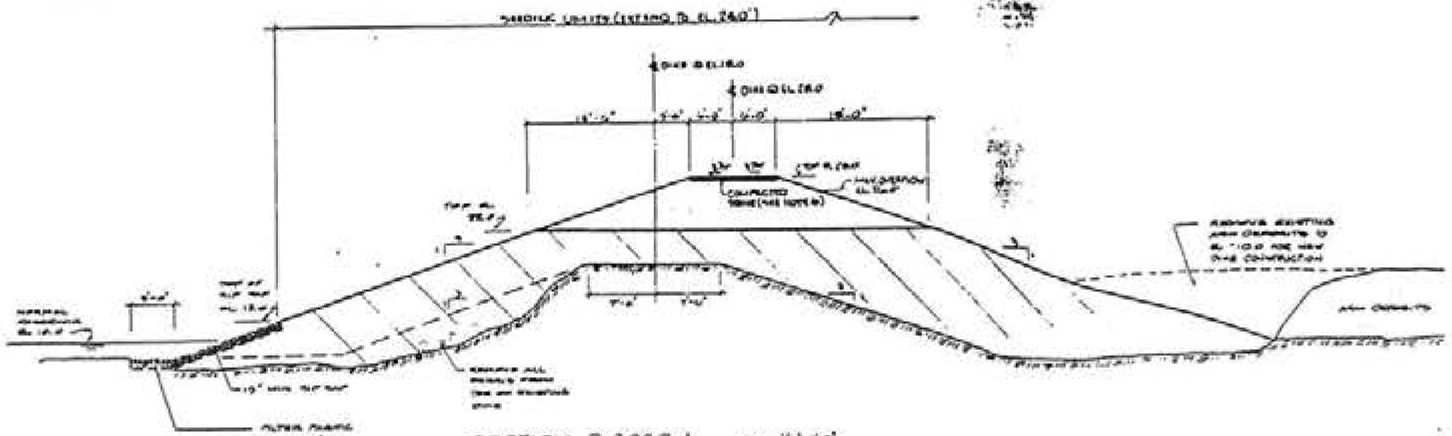

NEW POND AREA
EXISTING POND AREA - NOTES
1. NO LINER THIS AREA
2. EXISTING OPERATING EL = 20
3. MAXIMUM OPERATING EL = 20
4. FINISHED DIKE TOP EL = 28
FILL AREA
DISCHARGE CANAL
SECTION D-3236-1
SECTION D-3236-2
SECTION D-3236-3
SECTION D-3236-4
N.T.S.
TOPOGRAPHIC MAPPING NOTE
ALL TOPOGRAPHIC DATA SHOWN IS BASED ON AERIAL MAPPING PRIOR TO NEW ASH POND CONSTRUCTION OBTAINED MARCH, 1983.
ESTIMATED QUANTITIES
NOTES
REFERENCE DRAWINGS
SPECIFICATIONS
LAYOUT NOTE
1-4 LAYOUT DATA BY FIELD
PLAN
SCALE: 1"=100'
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.
L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
PLAN - SHEET 1
REVISION
DATE

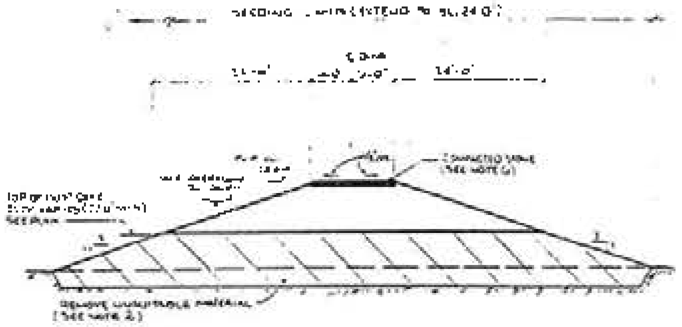
EXHIBIT 4

EXHIBIT 5

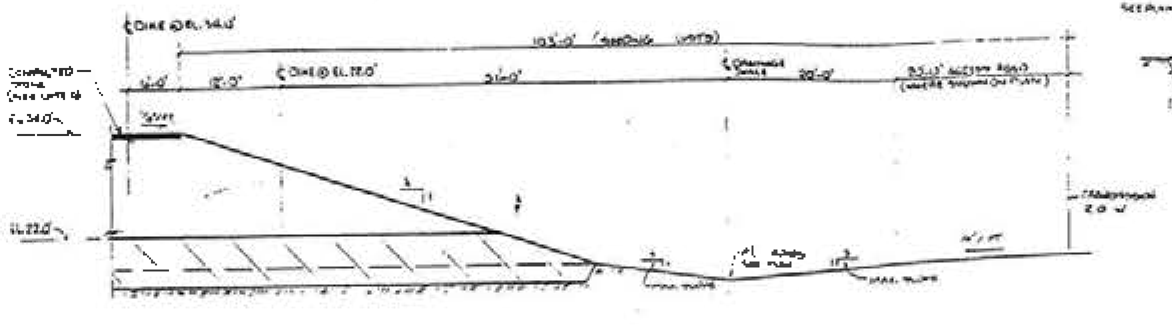

NEW ASH POND AREA NOTES
4. INITIAL POND OPERATING EL. = 22.
5. MAXIMUM POND OPERATING EL. = 32.
TOPOGRAPHIC MAPPING NOTE
PLAN
DETAIL D-3252-1
SECTION
SECTION D-3252-1
LAYOUT NOTE
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.
L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
PLAN - SHEET 2
AS-BUILT
ISSUED FOR CONSTRUCTION
NO.
DATE
REVISION
BY
CK
APPROVED
D-325



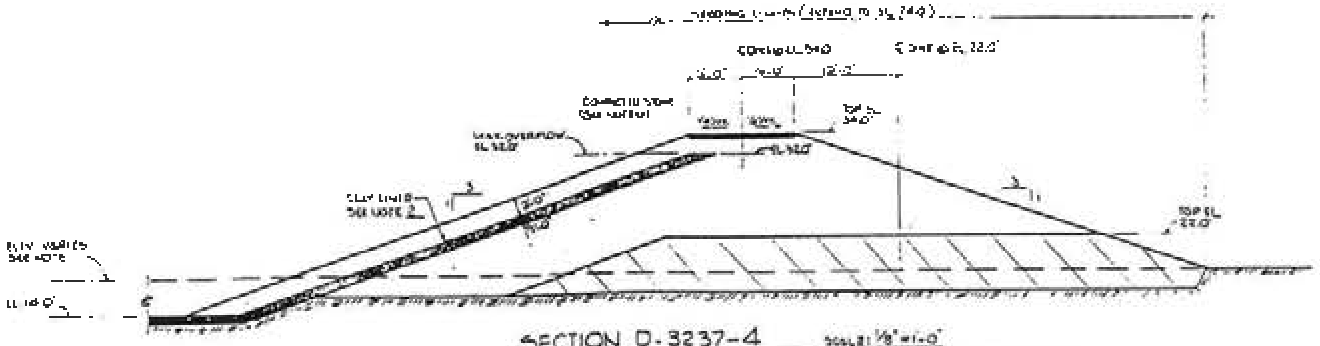
SECTION D-3237-1 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKE FROM EL. 18.0' TO EL. 22.0' (1983)
TYPICAL FOR RAISING DIKE FROM EL. 22.0' TO EL. 28.0'



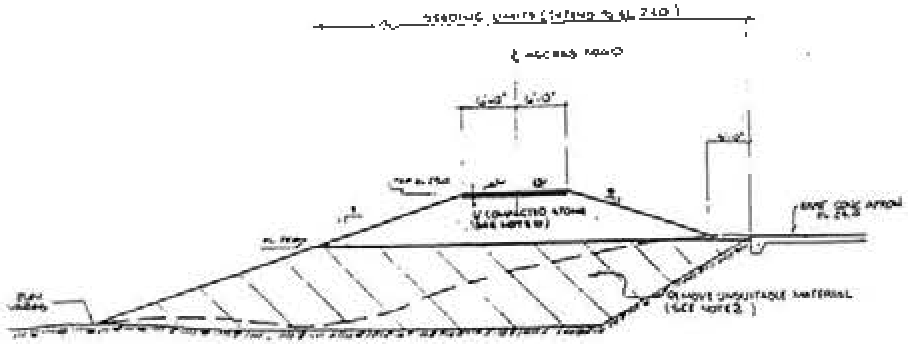
SECTION D-3237-3 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKE TO ELEV. 28.0'



SECTION D-3237-2 SCALE: 1/8"=1'-0"
TYPICAL SECTION @ DRAINAGE SWALE



SECTION D-3237-4 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKES TO EL 34.0 (TO THE INSIDE)
TYPICAL FOR CLAY LINER



SECTION D-3237-5 SCALE: 1/4"=1'-0"
TYPICAL @ CONCRETE BASIN

SECTION D-3237-6 SCALE: 1/2"=1'-0"
TYPICAL FOR RELOCATION OF ACCESS ROAD TO COOLING RESERVOIR BOAT RAMP

LEGEND

▭ NEW SAND FILL OR NEW CONSTRUCTION

▨ SAND FILL (EXISTING)

EXISTING GRADE

CUT

NOTES

1. SEE SPEC. SECTION 02102 FOR CLEARING REQUIREMENTS.
2. SEE SPEC. SECTION [illegible] FOR EARTHWORK REQUIREMENTS.
3. RIP RAP SHALL BE NCDOT SPEC. CLASS I
4. FILTER FABRIC SHALL BE TREVIRA TYPE 1127 OR EQUAL, [illegible]
5. SEE SPEC. SECTION 02485 FOR SEEDING REQUIREMENTS. SEEDING SPEC. SHALL BE REVIEWED BY LOCAL S.C.S. OFFICE AND SHALL BE MODIFIED AS REQUIRED TO MEET LOCAL RECOMMENDATIONS.
6. CRUSHED STONE SHALL BE NCDOT SPECIFICATION GRADATION ABC IN ACCORDANCE WITH SECTION 610. CRUSHED STONE SHALL BE COMPACTED AFTER PLACEMENT TO DEGREE OF MAXIMUM DENSITY.

REFERENCE DRAWINGS & SPECIFICATIONS

[illegible] 1155

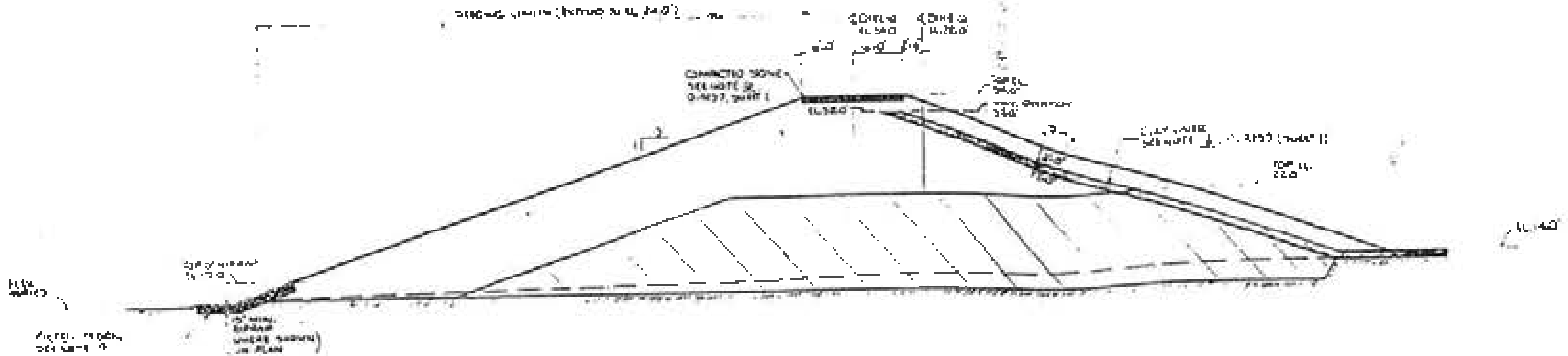
EXHIBIT 6

NO.	DATE	REVISION	BY	CH	APPROVED
4	CHANGES	AS-BUILT			
3	4-10-84	[illegible]			
2	2-15-84	[illegible]			
1	6-1-83	[illegible]			
0	[illegible]	ISSUED FOR CONSTRUCTION			
A	[illegible]	ISSUED FOR COMMENTS			

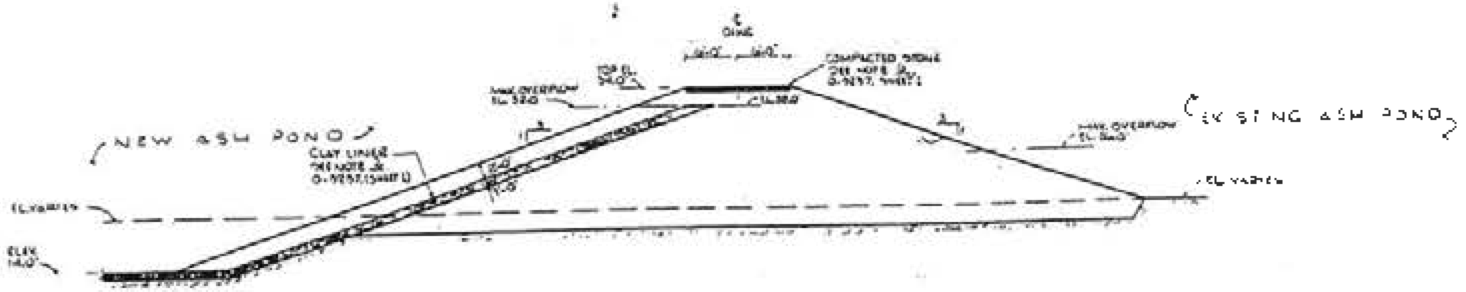
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION (1983-1984)
DIKE SECTIONS (SHEET 1)

DWG. NO. D-3237



SECTION D-3239-1 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKES TO ELEV 34.0' (TO THE OUTSIDE)



SECTION D-3239-2 SCALE: 1/8"=1'-0"
TYPICAL FOR SEPARATION DIKE TO ELEV 34.0'
TYPICAL FOR CLAY LINER

NOTES

1. FOR GENERAL NOTES & LEGEND, SEE DWG D-3237 (SHEET 1).

REFERENCE DRAWINGS & SPECIFICATIONS
SEE D-3237

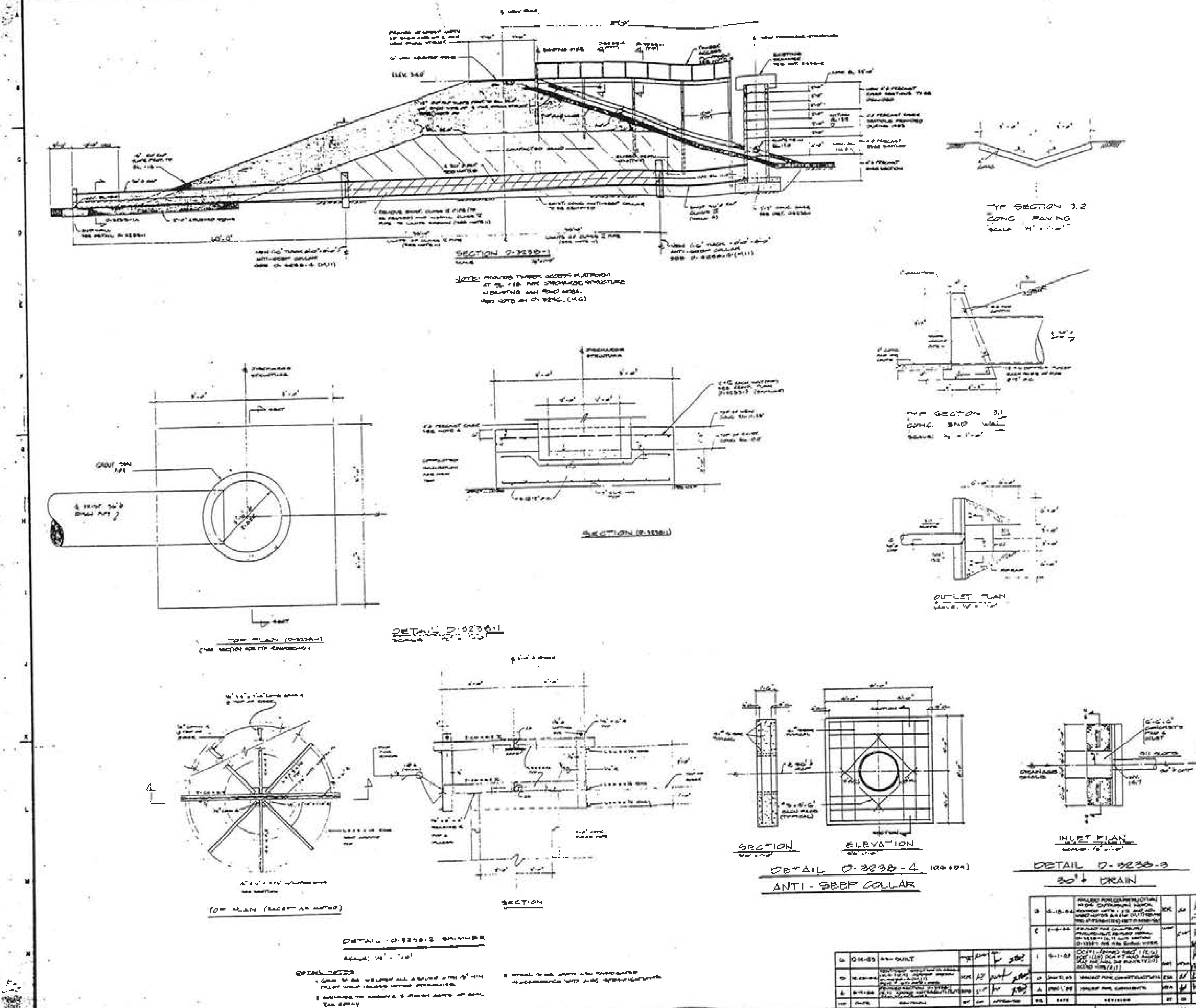
EXHIBIT 7

NO.	DATE	REVISION	BY	CK	APPROVED
1	10-11-85	AS-BUILT	[illegible]	[illegible]	[illegible]
0	4-16-84	ISSUED FOR CONSTRUCTION [illegible]	[illegible]	[illegible]	[illegible]
A	2-15-84	ISSUED FOR [illegible]	[illegible]	[illegible]	[illegible]

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION
DIKE SECTIONS (SHEET 2)

SCALE AS NOTED
APPROVED
DWG. NO. D-3239



NOTES

1. THE DISCHARGE STRUCTURES IN THE [illegible] ASH POND SHALL BE MODIFIED AS SHOWN TO OPERATE WITH A MAXIMUM OVERFLOW ELEV. [illegible]

2. THE DISCHARGE STRUCTURE FOR THE EXISTING ASH POND AREA SHALL BE MODIFIED TO OPERATE WITH A MAXIMUM [illegible] AS SHOWN ON SECTION D-3238-1.

3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI AND REBAR SHALL BE GRADE 60, IN ACCORDANCE WITH NCDOT SPECIFICATIONS.

4. PRECAST MANUFACTURERS SHALL SUBMIT SHOP DRAWINGS FOR REVIEW AND APPROVAL BY OWNER. NEW RISER SECTIONS SHALL GENERALLY BE IN ACCORDANCE WITH ASTM C 478. PROVIDE SUITABLE PERMANENT LIFTING DEVICES FOR ALL PRECAST COMPONENTS.

5. [illegible]

6. PROVIDE RIPRAP WITH FILTER FABRIC ON GRADE WHERE NOTED. SEE NOTES ON D-3237 FOR MATERIAL REQUIREMENTS.

7. [illegible]

8. REPLACE EXISTING CLASS III RCP WITH CLASS IV RCP [illegible]

9. ALL REINFORCED CONCRETE PIPE (RCP) SHALL BE IN ACCORDANCE WITH ASTM C76, CLASS IV [illegible]

10. REMOVE ALL SOFT AND UNSUITABLE MATERIAL FOR PIPE FOUNDATION AND REPLACE WITH COMPACTED FILL. [illegible] AND COMPACT TO 95 % STANDARD PROCTOR. [illegible] MINIMUM COVER FOR PIPE INSTALLATION.

11. [illegible]

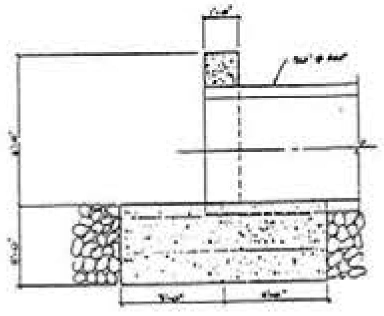
EXHIBIT 8

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
SECTIONS & DETAILS (SHEET 1)

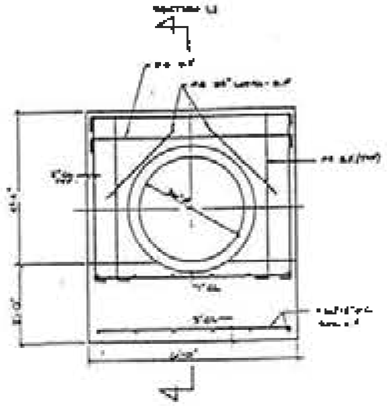
D-3238

NO.	DATE	REVISION	BY	CK	APPROVED
3	4-18-84	[illegible]			
2	2-8-84	[illegible]			
1	9-1-83	[illegible]			
0	[illegible]	[illegible]			
A	[illegible]	[illegible]			
4	011-85	AS-BUILT			



SECTION 1.1

(SEE PLAN ON D-3147)

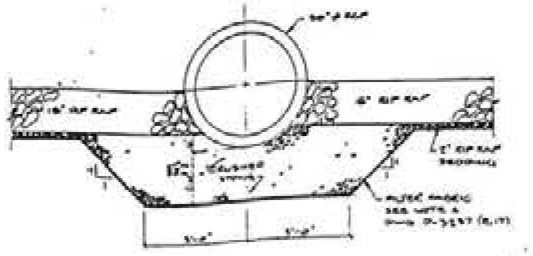


ELEVATION 1.1

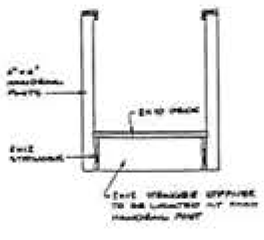
(WITH SEEP DETAILS)

DETAIL D-3253-1

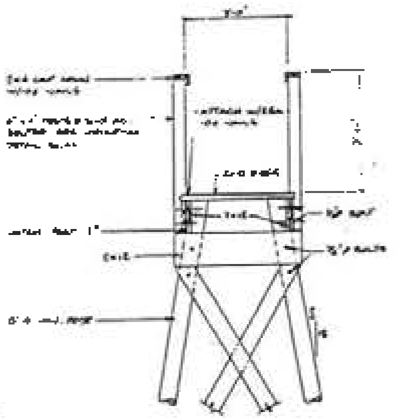
SCALE 1/4"=1'-0"

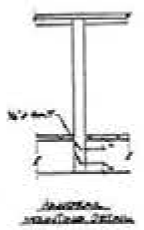


SECTION D-3253-1A

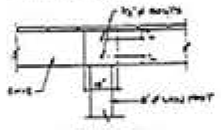


SECTION D-3253-2





HANDRAIL MOUNTING DETAIL

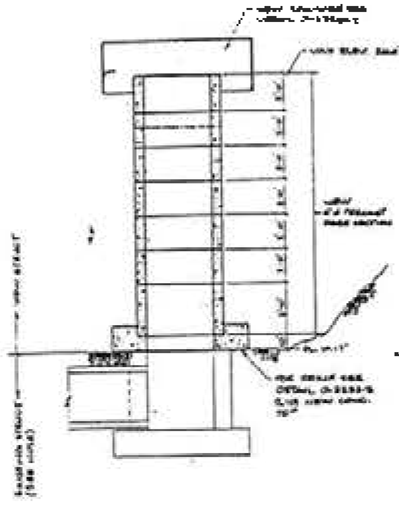


SPLICE DETAIL

SECTION D-3253-1

TYPICAL ACCESS PLATFORM

SCALE 3/4"=1'-0"



SECTION D-3253-3

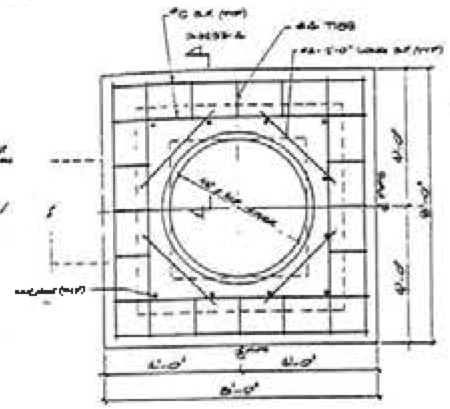
EXISTING DISCHARGE STRUCTURE MODIFICATION

SCALE 1/2"=1'-0"

NOTES

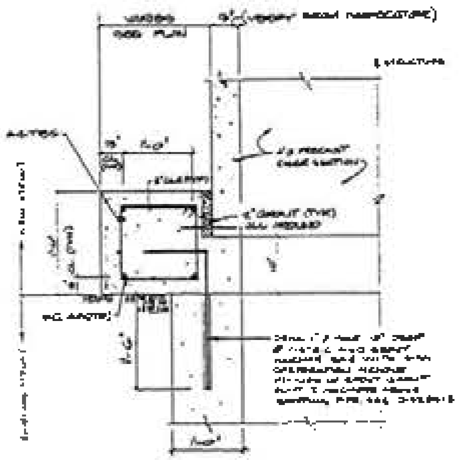
[illegible]

1. [illegible]



DETAIL D-3253-5

PLAN WITH REINFORCING DETAILS



SECTION D-3253-4

NOTES

SEE D-3252

REFERENCE DRAWINGS / SPEC SECTIONS

SEE D-3252

EXHIBIT 9

NO.	DATE	REVISION	BY	CK	APPROVED
2	10-14-85	AS-BUILT	[illegible]	[illegible]	[illegible]
1	5-7-84	[illegible]	[illegible]	[illegible]	[illegible]
0	4-18-84	ISSUED FOR CONSTRUCTION [illegible]	[illegible]	[illegible]	[illegible]
A	[illegible]	ISSUED FOR [illegible]	[illegible]	[illegible]	[illegible]

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

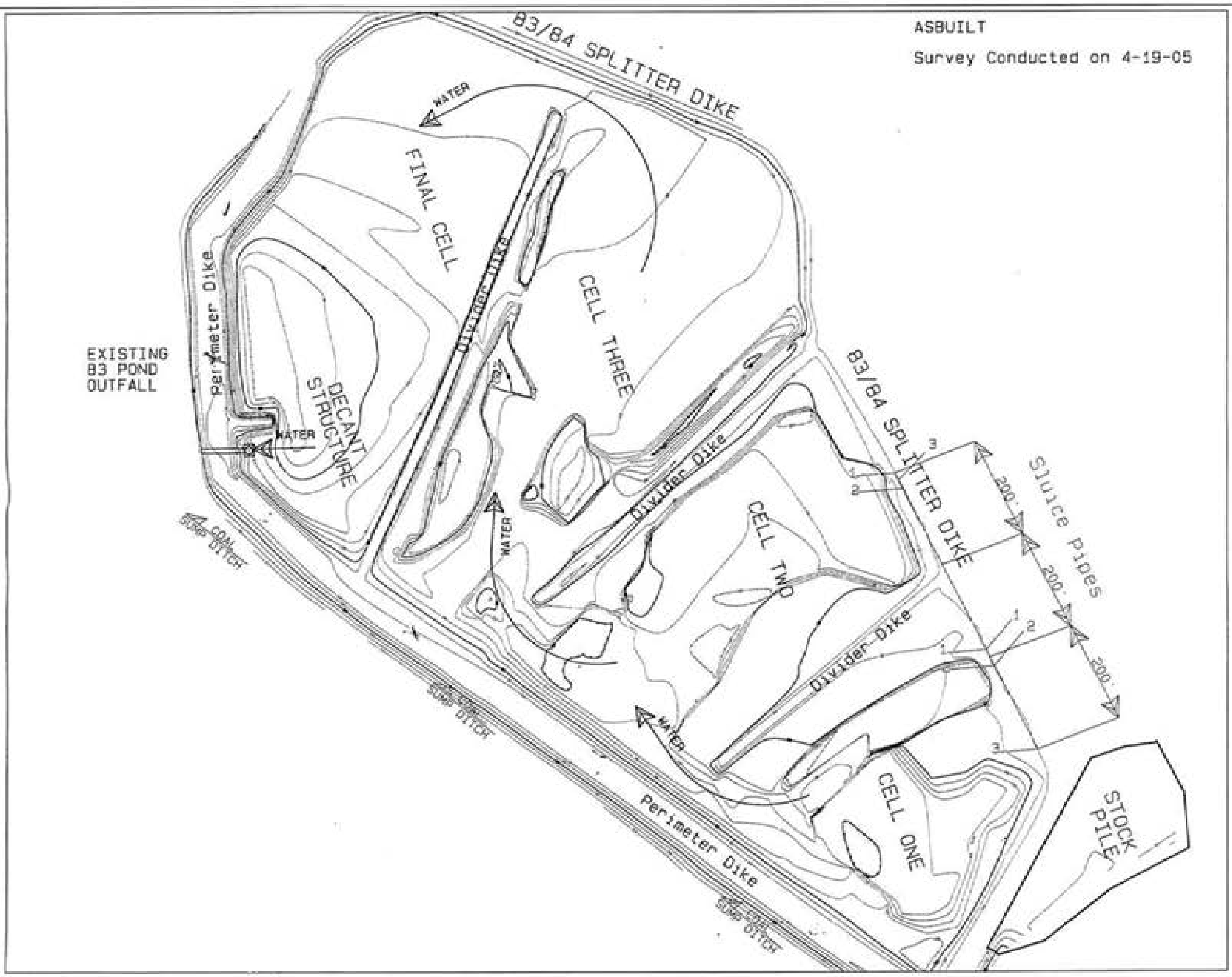
L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
SECTIONS AND DETAILS (SHEET 2)

SCALE AS NOTED

APPROVED

DWG. NO.

D-3253



Drawn By: David Stenger
Designed By:
Checked By: REJ
Approved By:

Save Location

Date
4 27 05

TRANS ASH
617 SHEPHERD DR.
CINCINNATI, OHIO 45215
Phone 513-733-4770 Fax 513-554-6147

SUTTON PLANT
4-19-05 SURVEY

Contents
Plan View

Scale
1" = 200'

Sheet
1 of 1

Plan View

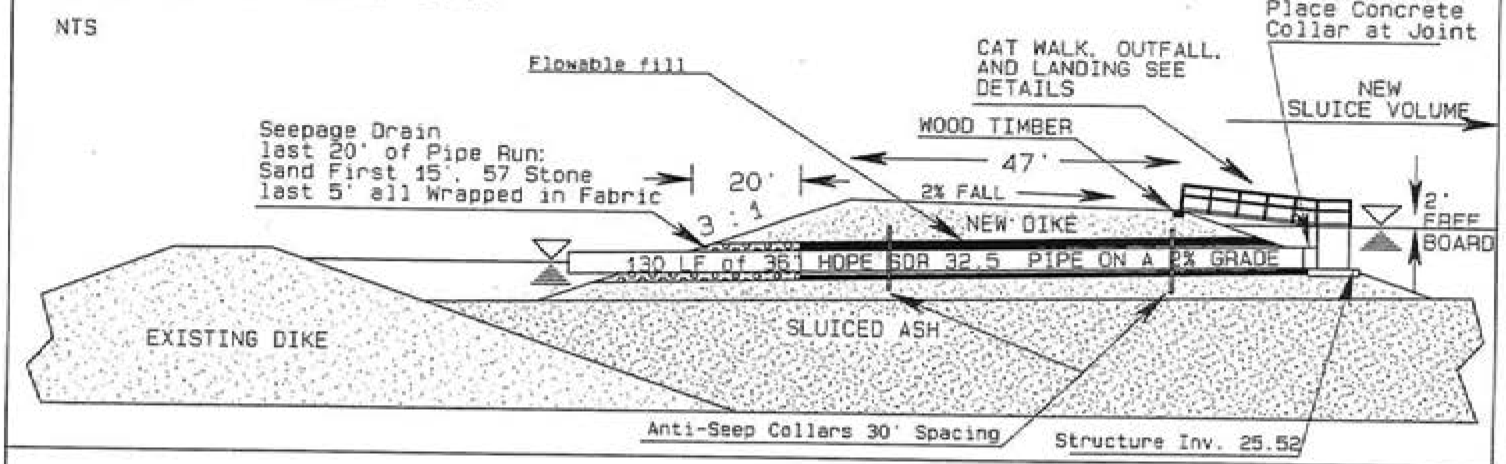
EXHIBIT 10

Sutton Pond Outfall   Drawn By DMS   Date 9-30-05

TYPICAL CROSS-SECTION

DECANT STRUCTURE

NTS



TYPICAL CROSS-SECTION

DECANT STRUCTURE

NTS

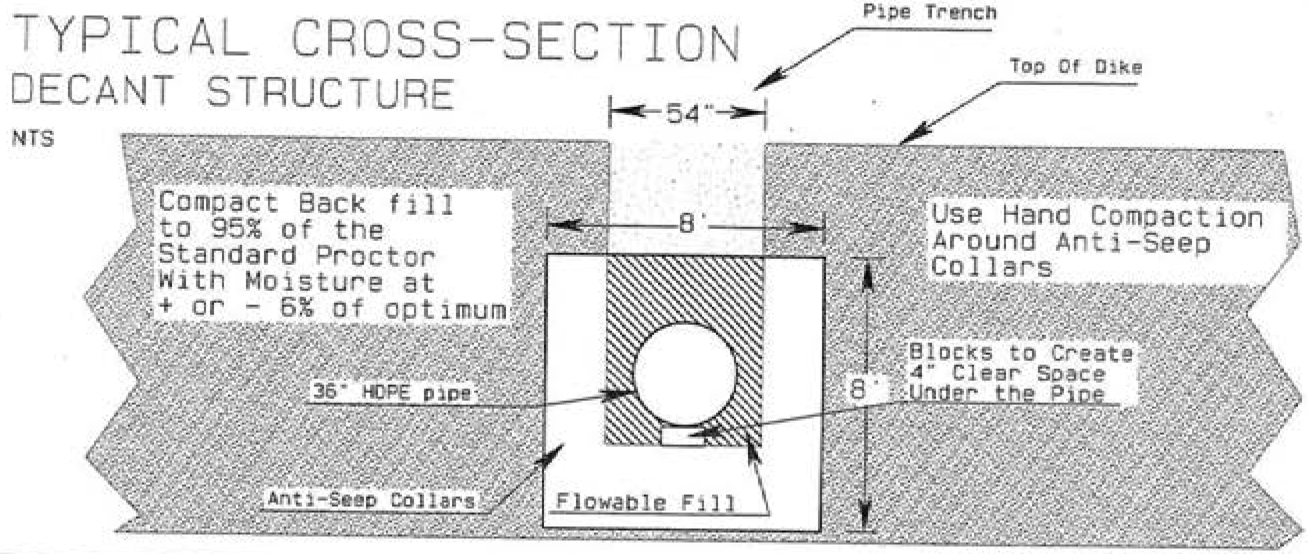


EXHIBIT 11

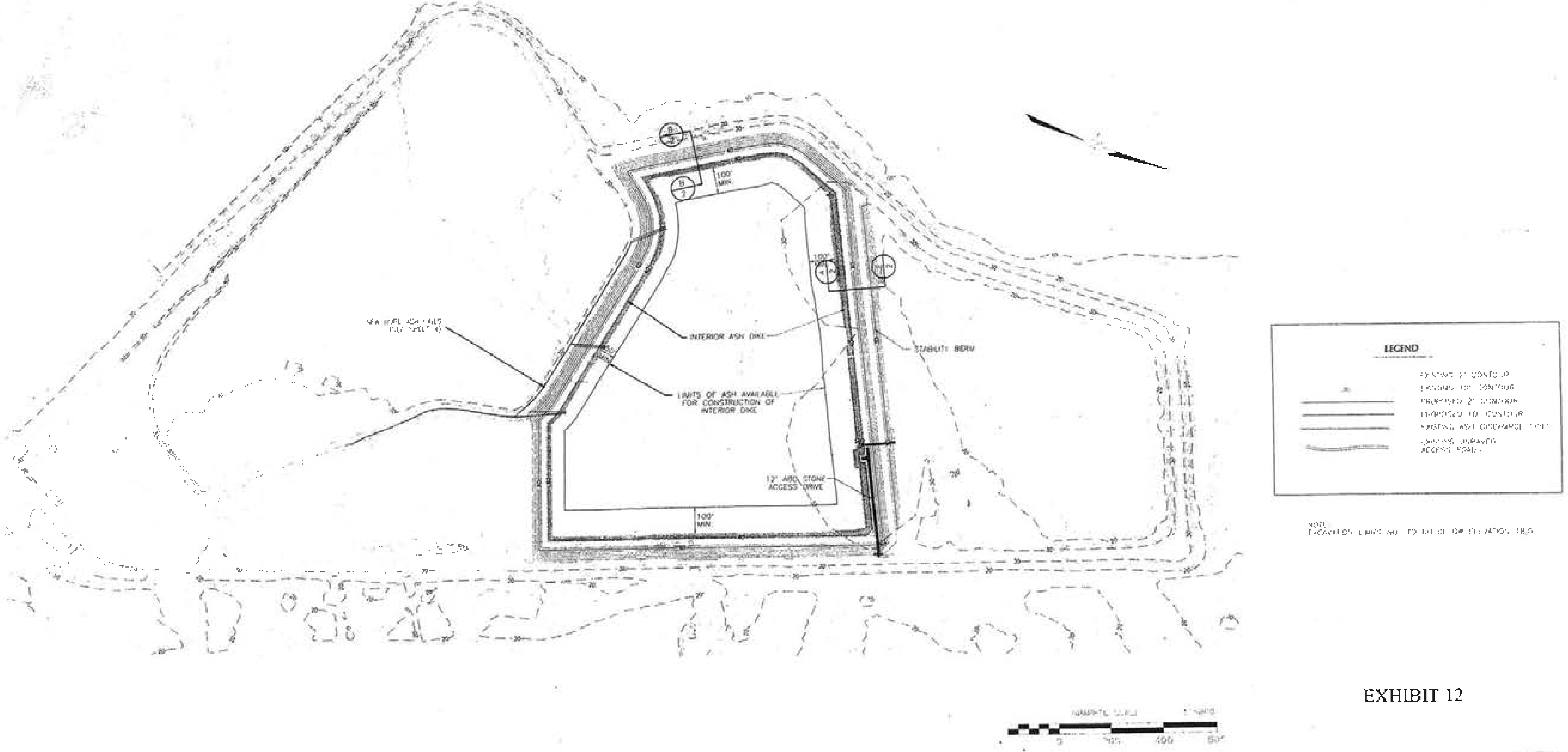


EXHIBIT 12

No.	Revision	Date	By
1			

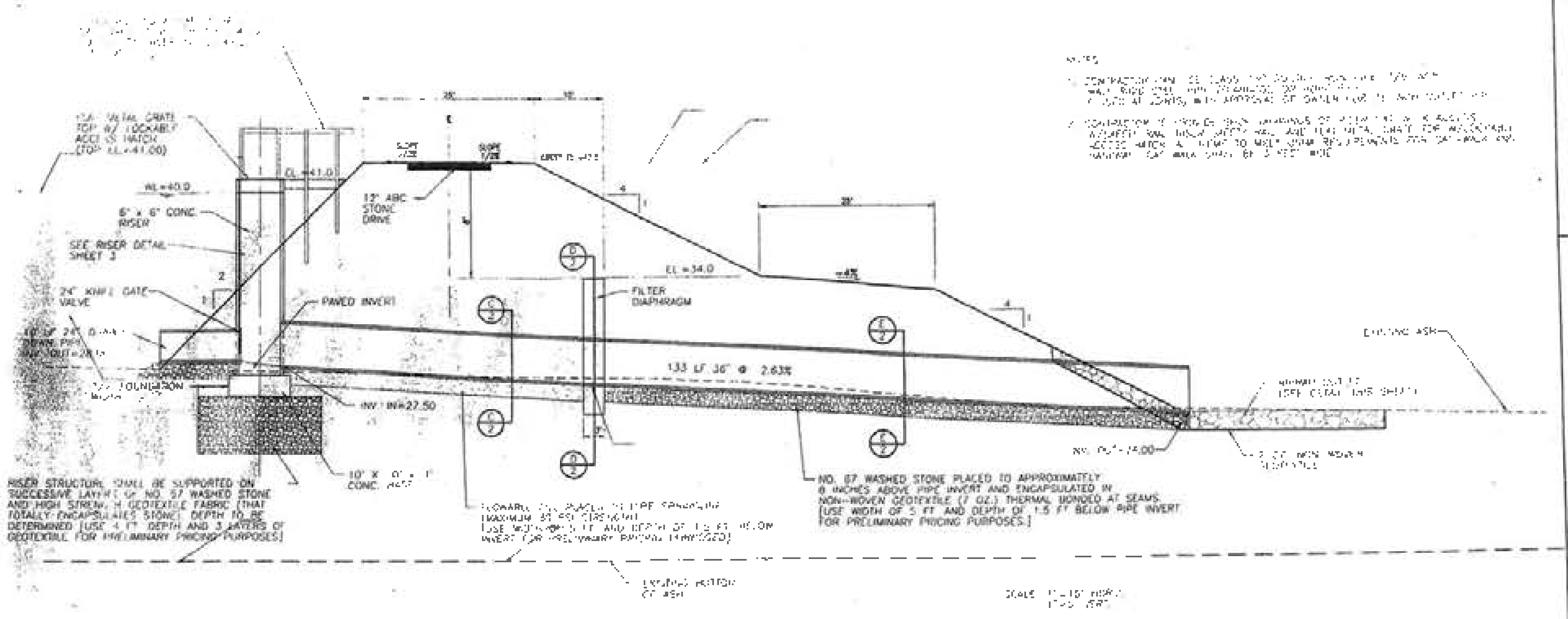
Designer
Drawn By
Checked By
Scale AS NOTED
Date 5/28/06
Job No. 050412.01

INTERIOR ASH POND DIKE PROJECT
PROGRESS ENERGY
SUTTON PLANT

SITE PLAN

WITHERS & RAVENEL
ENGINEERS | PLANNERS | SURVEYORS

Sheet No.
1



RISER STRUCTURE SHALL BE SUPPORTED ON SUCCESSIVE LAYERS OF NO. 57 WASHED STONE AND HIGH STRENGTH GEOTEXTILE FABRIC (THAT TOTALLY ENCAPSULATES STONE). DEPTH TO BE DETERMINED [USE 4 FT. DEPTH AND 3 LAYERS OF GEOTEXTILE FOR PRELIMINARY PRICING PURPOSES]

NO. 57 WASHED STONE PLACED TO APPROXIMATELY 8 INCHES ABOVE PIPE INVERT AND ENCAPSULATED IN NON-WOVEN GEOTEXTILE (7 OZ.) THERMAL BONDED AT SEAMS [USE WIDTH OF 5 FT AND DEPTH OF 1.5 FT BELOW PIPE INVERT FOR PRELIMINARY PRICING PURPOSES.]

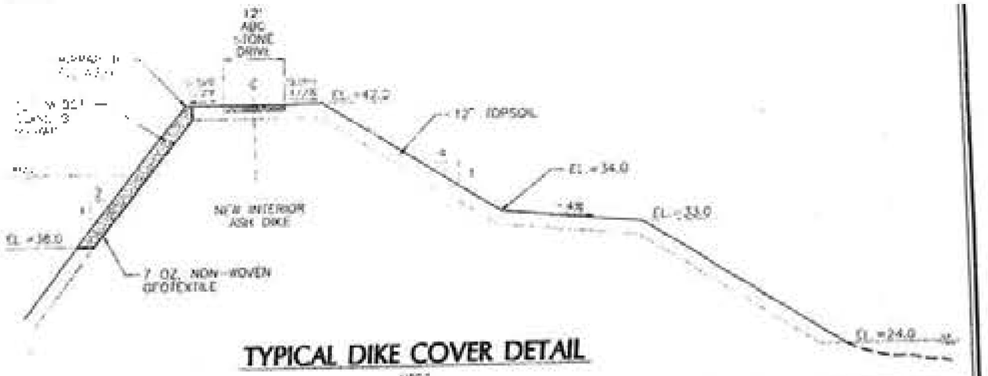
NOTES

1. [illegible]

2. [illegible]

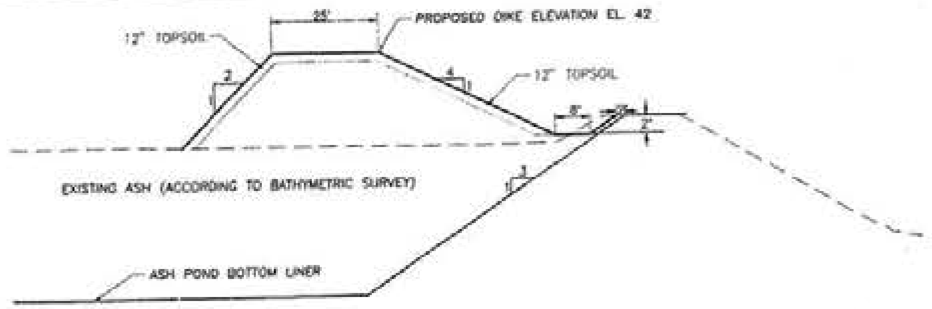
RISER/BARREL PROFILE (A/2)

SCALE: 1"=10' HORZ. 1"=5' VERT.



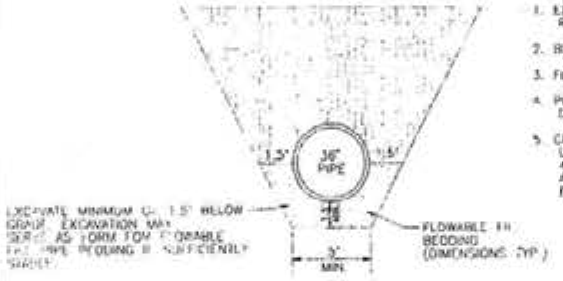
TYPICAL DIKE COVER DETAIL

NTS



INTERIOR DIKE/DITCH SECTION (B/2)

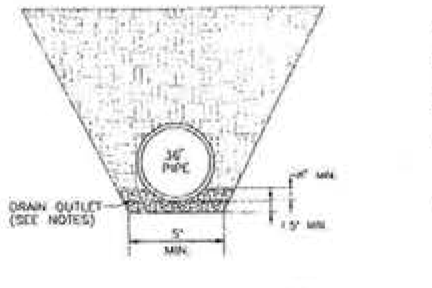
NTS



NOTES:

1. EXCAVATION TO CONFORM TO APPLICABLE OSHA REGULATIONS.
2. BOTTOM WIDTH OF EXCAVATION SHALL BE MIN. 5 FEET.
3. FLOWABLE FILL SHALL BE PLACED UP TO PIPE SPRINGLINE.
4. PIPE TO BE SUPPORTED WITH CONCRETE BLOCKS DURING PLACEMENT OF FLOWABLE FILL BEDDING.
5. COMPACT BACKFILL TO 95% OF ASTM D-698 USING HAND OPERATED MECHANICAL TAMPS WITHIN 4 FEET OF THE PIPE(SIDE & TOP). LARGER COMPACTORS AS APPROVED BY THE ENGINEER MAY BE USED ELSEWHERE.

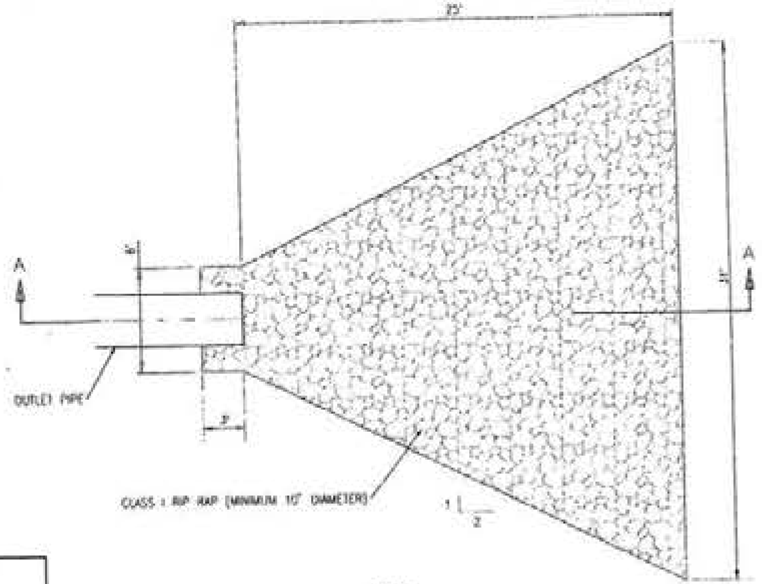
PIPE UPSTREAM OF FILTER DIAPHRAGM (C/2)



NOTES:

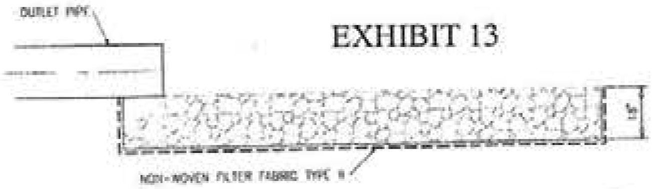
1. EXCAVATE TO CONFORM TO APPLICABLE OSHA REGULATIONS.
2. EXCAVATE TRENCH TO MINIMUM LIMITS SHOWN.
3. DRAIN OUTLET TO BE NCDOT NO. 67 WASHED STONE ENCAPSULATED IN NON-WOVEN FABRIC (7 OZ.) THERMAL BONDED AT SEAMS AND PLACED TO APPROXIMATELY 8 INCHES ABOVE PIPE INVERT.
4. CONTRACTOR MAY USE FLOWABLE FILL AS AN ALTERNATE TO FABRIC-WRAPPED STONE BEDDING. IF FABRIC WRAPPED STONE BEDDING IS USED, PROVIDE 2" ID MACHINE SLOTTED PVC PIPE AS SHOWN BELOW. CONNECT SLOTTED PVC TO SOLID PVC AND RUN ALONG PIPE BEDDING TO DISCHARGE AT OUTLET.

FILTER DIAPHRAGM DRAIN (E/2)



PLAN

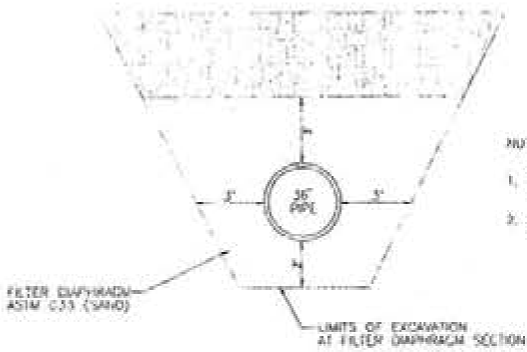
EXHIBIT 13



SECTION A-A

RIPRAP OUTLET DETAIL

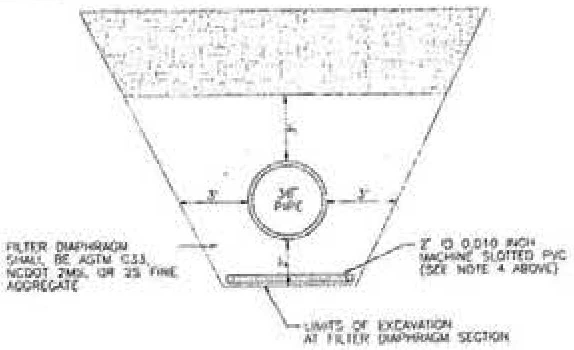
NTS



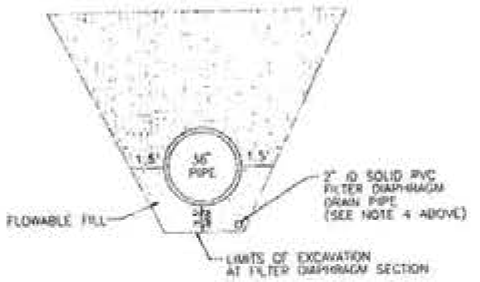
NOTES:

1. FILTER DIAPHRAGM SAND SHALL BE ASTM C33, NCDOT 2MS, OR 2S FINE AGGREGATE
2. FILTER DIAPHRAGM SAND TO BE COMPACTED TO 95% OF ASTM D-698

FILTER DIAPHRAGM (D/2)



ALTERNATE FILTER DIAPHRAGM DRAIN (D/2) ALT



ALTERNATE FILTER DIAPHRAGM DRAIN (E/2) ALT

No	Revision	Date	By

Designer ML	Scale AS NOTED
Drawn By SYW	Date 5/25/06
Checked By ML	Job No 05041/53

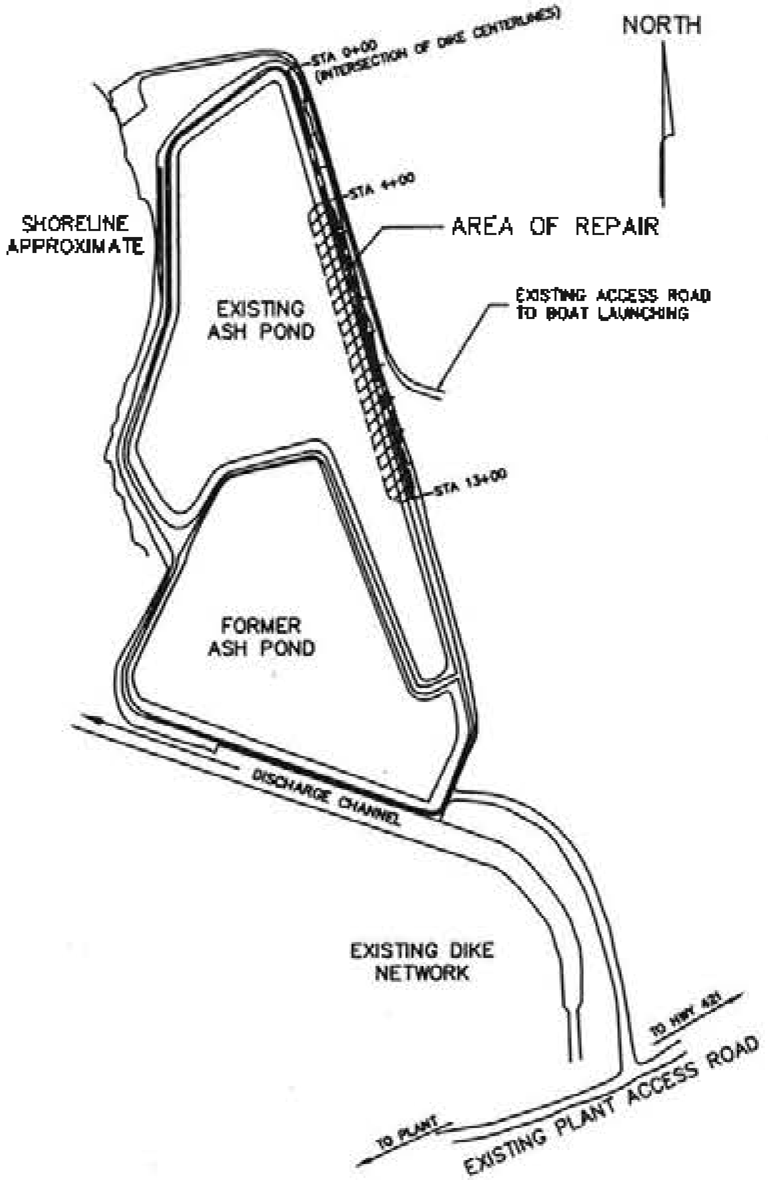
INTERIOR ASH POND DIKE PROJECT
PROGRESS ENERGY
SUTTON PLANT

NEW OUTFALL STRUCTURE

WITHERS & RAVENEL
ENGINEERS | PLANNERS | SURVEYORS

Sheet No
2

NORTH CAROLINA PROFESSIONAL ENGINEER DOUGLAS W. [illegible]



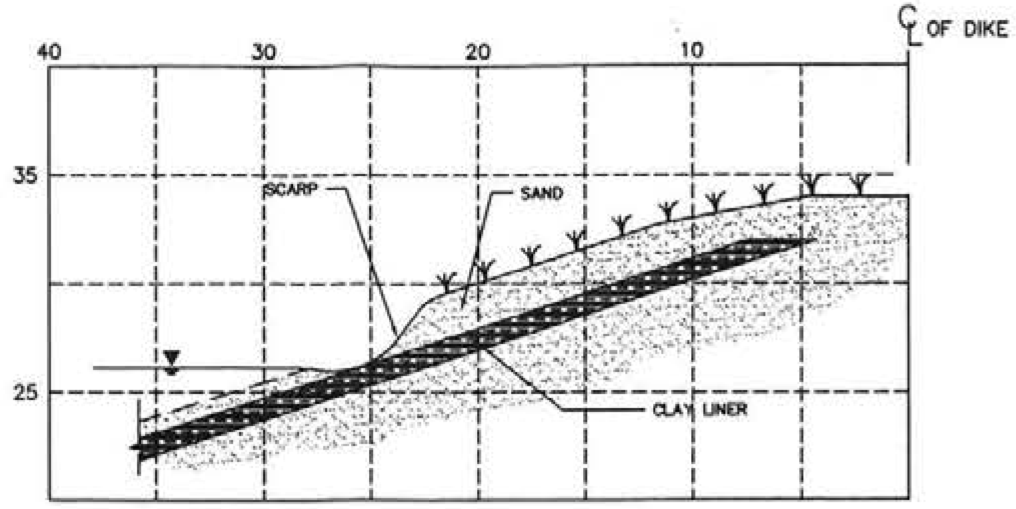
REPAIR LOCATION PLAN

NOT TO SCALE

REPAIR LOCATIONS TABLE

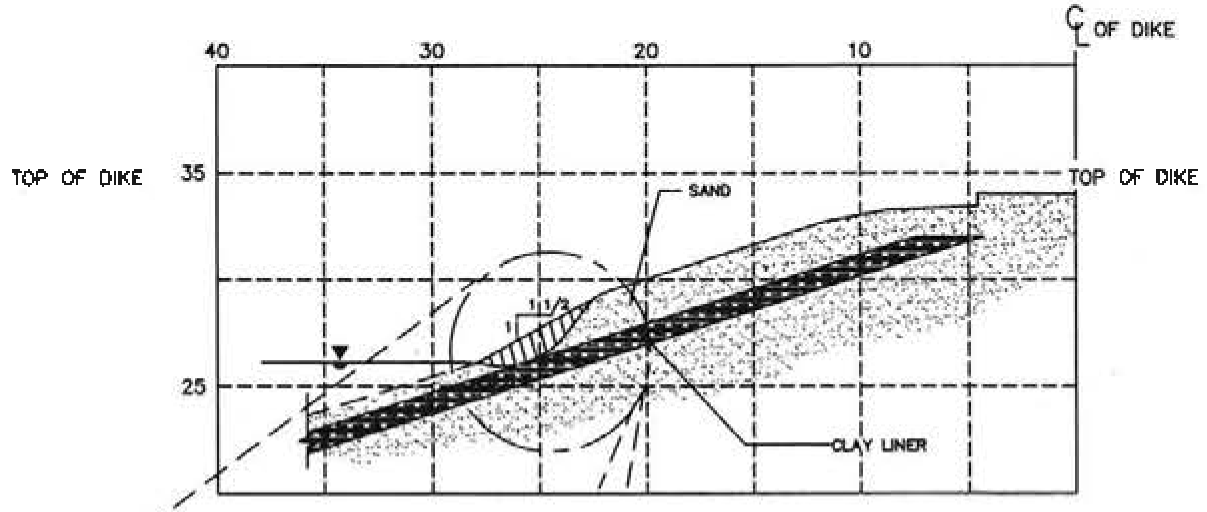
STATION	
5+45 TO 5+90	
6+30* TO 11+10*	
11+35 TO 11+70	

*WITHIN THIS SECTION THERE ARE SEVERAL SMALL AREAS TO BE REPAIRED. ACTUAL LOCATIONS MARKED IN FIELD BY LAW REPRESENTATIVE 7/19/01



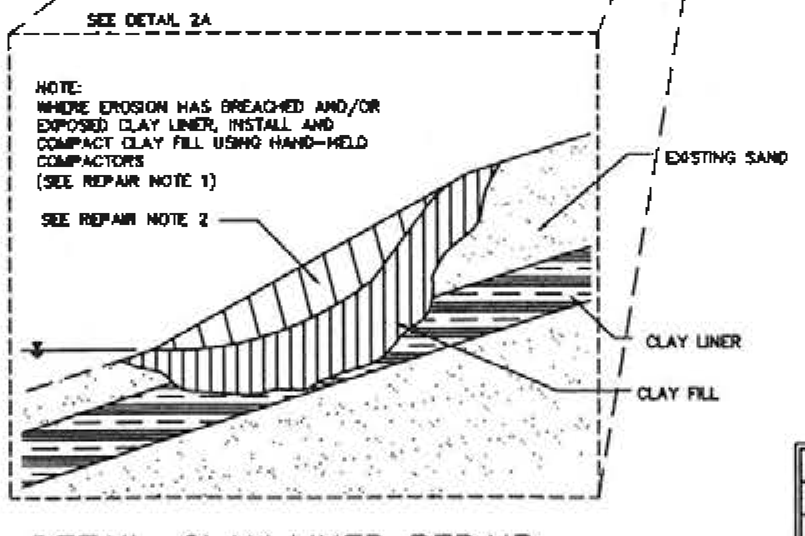
TYPICAL EXISTING SECTION

SCALE: 1"=5'



PROPOSED REPAIR SECTION

SCALE: 1"=5'



DETAIL-CLAY LINER REPAIR

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

GUIDE SPECIFICATIONS

SCOPE

Scope of work consists of preparation for and spot repairs to clay liner erosion of the west face of the east dike in the area shown.

GENERAL

1) The project site is the CP&L Sutton Plant located near Wilmington, North Carolina.

2) The work shall be performed in accordance with and shall comply with all applicable sections of governing building codes and Federal, State of North Carolina and local regulatory requirements.

3) OSHA requirements regarding general construction, excavation and other applicable sections shall apply.

4) Deviation from drawings and guide specifications shall be pre-approved by the owner or owner's representative.

5) Contractor shall submit to owner, prior to construction, for approval, a complete construction schedule, proposed material staging locations and anticipated work hours.

6) All necessary precautions for maintaining a safe work environment shall be the responsibility of the contractor.

7) Contractor shall clear utilities with CP&L prior to any and all excavation or subsurface work.

8) Contractor shall notify owner and engineer (LAW) one week prior to initiating construction activities for purposes of coordinating quality control testing and construction observations.

REPAIR PROCEDURES

1) Repair clay liner at locations where erosion has exposed clay. Scarify existing clay material and compact additional clay soil (USCS classification CL or CH) using hand-held compactors to at least 93 percent of standard Proctor maximum dry density, to achieve a minimum thickness of 12 inches (measured perpendicular to slope).

2) Use additional compacted clay to restore approximate original slope in repair areas.

3) Seeding of upper part of slope and repaired areas will be done by others after repairs are completed.

PROJECT CLOSURE

1) Contractor shall remove from the site all construction debris and other materials associated with construction activities upon completion of the proposed scope of work.

2) Contractor shall maintain the access and crest roads and return roads to CP&L use in equal or improved condition as before construction

FRED SHARPE, JR.
8298
9/29/00

EXHIBIT 14

CLAY LINER REPAIR PLAN
ASH POND DIKE INTERIOR SLOPE
SUTTON PLANT – CP&L
WILMINGTON, NORTH CAROLINA

30-0-3953_X

REV.	DATE	BY	APPR	DESCRIPTION
D				
C				
B				
A	8/3/01	CM	JAT	MODIFY REPAIR SCOPE

DRAWN: KRT
DFT CHECK: EJS
ENG CHECK: EJS
APPROVAL:
DATE: SEPTEMBER 2000
SCALE: AS SHOWN
REFERENCE DWGS:

LAW
LAWGIBB Group Member

LAW ENGINEERING AND
ENVIRONMENTAL SERVICES, INC.
RALEIGH, NORTH CAROLINA

JOB NO.	DWG NO.
30720-0-3953	1

APPENDIX A

DAM INFORMATION SUMMARY
L.V. Sutton Steam Electric Plant
Ash Pond
New Hanover County, North Carolina

1. Location

Located 3 miles northwest of Wilmington, NC

Latitude:	N34° 17' 50"
Longitude:	W77° 59' 30"

2. Size and Dimensions

	1984 Pond	**1983 Pond***
Length:	10,000 feet	7,000 feet
Maximum Structural Height:	32 feet	
Surface Area (acres):	82	
Storage capacity (acre-feet):	1,364	248
Size Classification:	Intermediate	Small
Hazard Classification:	Low	Low
Regulatory Design Storm	100 yr to ½ PMP **	
US Slope:	3.0(H):1(V)	
DS Slope:	3.0(H):1(V)	
Crest Width:	12 feet	
Crest Elevation:	34.0 feet	
Design maximum operating level:	32.0 feet	
Current Operating Level	26.0 feet	
Instrumentation	None	None

* The 1983 pond is not currently in service, but it is able to receive ash on a temporary basis as needed for ash management..

** 100-year storm is 9.5 inches over 24 hours. Probable Maximum Precipitation (PMP) is 38.1 inches over 48 hours. ½ PMP is 19". The long duration is due to potential for tropical storms.

3. Geology and Seismicity

Located in Coastal Plain Province. Underlain by Castle Hayne Limestone which is eroded through in places to expose the PeeDee Formation

Zone 1 seismic zone according to Corps of Engineers with
Design Earthquake: a_n = 0.05 g

4. Design Information

1983 Pond: Originally designed by Brown & Root in 1971, raised to present elevation under CP&L design with assistance from William Wells. Limited subsurface exploration. No information on stability or seepage analyses. No internal drainage.

Outlet works consist of a 4' diameter concrete vertical riser connected to a 12" diameter concrete pipe through the dike that would discharge to the Cooling Pond. There are no seepage collars.

The capacity of the pond and outlet works is sufficient for a 100-yr storm without overtopping the dike.

An interior storage area constructed in 2005 using compacted ash dikes provides additional storage capability.

1984 Pond: Designed by CP&L with assistance from William Wells. Subsurface exploration was performed. Stability was re-evaluated by CP&L in 1987, FS = 1.58. Seepage analysis performed as part of design assuming $k = 1x10^{-7}$ cm/sec for 1-foot thick clay liner with calculated seepage rate of 108 gpm. No internal drainage provided.

Outlet works consist of a 4' diameter concrete vertical riser connected to a 3' diameter concrete pipe through the dike that is connected to piping leading to the Cape Fear River. There are two seepage collars.

The capacity of the pond and outlet works is sufficient for a 100-yr storm without overtopping the dike.

An interior storage area constructed in 2006 using compacted ash dikes provides additional storage capability.

5. Construction History

1983 Pond

Original construction of north Ash Pond dike done in 1971 under direction of Brown & Root to crest elevation of 18.0 feet. In 1983, Dickerson raised north Ash Pond to operating level to elevation 26.0 feet. Testing was conducted. The 2005 interior storage area was constructed by TransAsh. The interior storage is not currently in use and the area is dry.

1984 Pond

- Constructed by Lindsay and Associates under direction of CP&L. Testing was performed.
- Outlet pipe modifications were provided in 1999 to connect discharge to a pipe leading to the Cape Fear River. A pipe joint opened under the upstream slope and seepage through the slope created start of sinkhole. Grouting of slope was conducted in 2000 along with slip-lining of the pipe for long-term protection.
- Interior slope repairs on east dike were done 2001 to fill areas of beaching erosion and reseed.
- Additional interior slope repairs, including the 2001 areas, were made to the north and east dike in 2006 to address continued problems with beaching erosion.
- Additional storage capacity was constructed and placed in service during 2006. Engineering and design was provided by Withers & Ravenel, and construction was by TransAsh.

6. Inspection History

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

LAW/MACTEC:	1987, 1997, 2002, 2003, 2004, 2005
S&ME:	1992

7. Current Issues

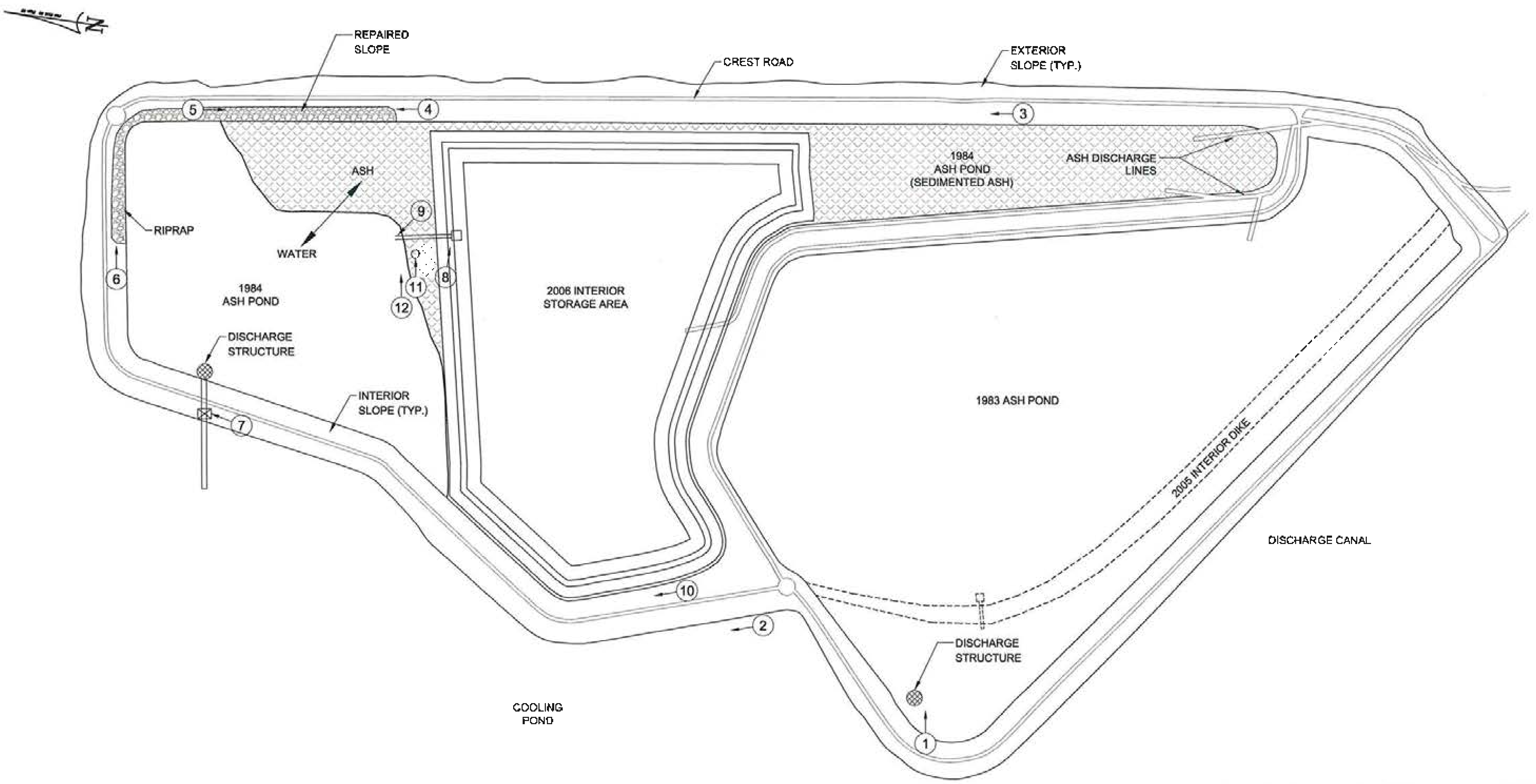
MACTEC did not perform the limited annual inspection during 2006 because of construction in progress for new ash storage capacity. The current issues reported by the 2007 5-year inspection are as follows:

- Continue vegetation maintenance.

8. Overall Condition

The overall condition reported for 2007 was that the dikes are in good condition.

APPENDIX B



LEGEND:

←① PHOTOGRAPH NUMBER AND DIRECTION
(PHOTOGRAPHS TAKEN DECEMBER 4, 2007)

REFERENCE: CP&L DRAWINGS D3232 & D3230; WITHERS & RAVENEL DRAWING 1, TRANSASH DRAWING 4-19-05.

MACTEC
ENGINEERING & CONSULTING, INC.
RALEIGH, NORTH CAROLINA

PHOTOGRAPH LOCATION PLAN
ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

PREPARED BY R.R.	SCALE N.T.S.	CHECKED	DATE DEC. 2007
JOB NO. 6468-07-1686(02)		FIGURE 1	

P:\6468\ CP&L Projects\Sutton 1686 - SUTTON 2007 dam (Y-02)\Drawings\Ash Pond Dikes 12-2007.dwg Mon, 17 Dec 2007 - 1:43pm [illegible]

Photo 1. 1983 Ash Pond – Outlet riser and pond water.

Photo 2. 1984 Ash Pond – Exterior Slope looking northwest.

Photo 3. 1984 Ash Pond – Crest of 1984 dike and exterior slope of 2006 dike.

Photo 4. 1984 Ash Pond – Crest and interior slope looking north.

Photo 5. 1984 Ash Pond – Typical interior slope looking south. Note minor grass growth.

Photo 6. 1984 Ash Pond – Interior slope newly repaired with rip rap. Typical of section with good rip rap.

Photo 7. Ash Pond – Outlet drainage Structure looking northwest.

Photo 8. 2006 Interior Ash Pond Inlet looking east.

Photo 9. 2006 Outlet Pipe draining into 1984 pond.

Photo 10. Ash Pond –Typical exterior slopes of 2006 dike.

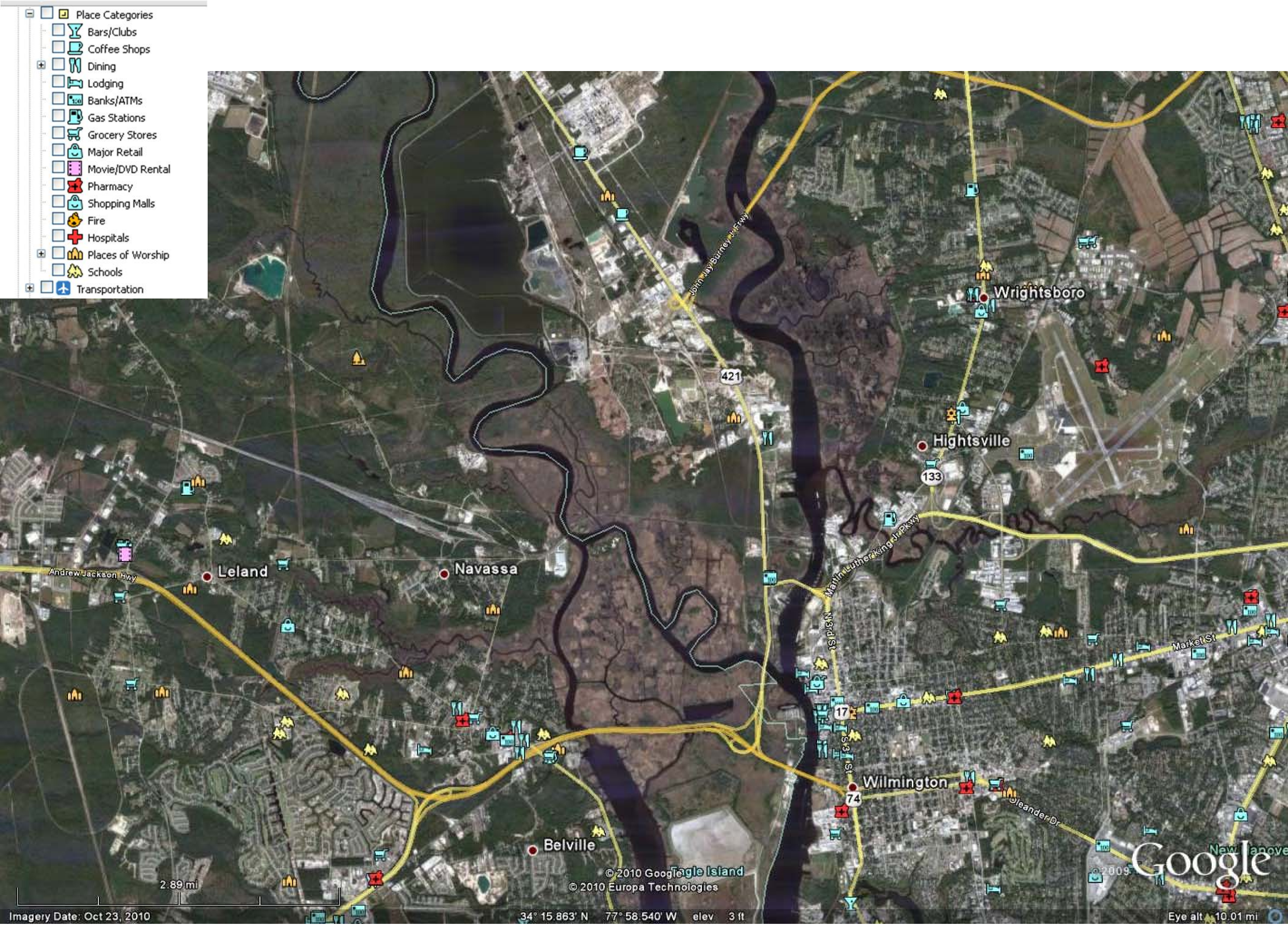
Photo 11. 2006 interior Ash Dike –Exterior Slope looking a sink hole.

Photo 12. 2006 interior Ash Dike – Area of erosion of ash along exterior slope of dike.

APPENDIX A

Document 4

Sutton 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
Wrightsboro
John Jay Burney Jr Frwy
421
Hightsville
133
Martin Luther King Jr Pkwy
Leland
Andrew Jackson Hwy
Navassa
N 3rd St
17
S 3rd St
Market St
Wilmington
74
Oleander Dr
Belville
Eagle Island
New Hanover
2.89 mi
© 2010 Google
© 2010 Europa Technologies
©2009
Google
Imagery Date: Oct 23, 2010
34° 15.863' N
77° 58.540' W
elev 3 ft
Eye alt 10.01 mi

APPENDIX A

Document 5

Sutton Dam Inspection Procedure

Document title

AUTHORIZED COPY

Sutton Plant Dam and Dike Inspection Procedure

Document number

EVC-SUTC-00038

Applies to: Sutton Fossil Plant - Carolinas

Keywords: environmental; inspection, dam, dike

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.

1.2 This procedure is also intended to comply with the requirements specified in corporate document - Non-Hydroelectric Facility Dam and Dike Inspection Program Manual.

1.3 Dam safety issues at Sutton Plant fall under the regulatory jurisdiction of the North Carolina Utilities Commission (NCUC). This procedure specifies how Sutton Plant completes and documents dam and dike inspections.

1.4 IF there is a dam or dike release, THEN **IMPLEMENT** EMG-SUTC-00003, Sutton Plant Dam Emergency Notification Procedure.

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 or ash 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. The purpose of riprap is to aid in the prevention of degradation of the structural fill portion of the 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

3.1 Plant Manager

3.1.1 **IMPLEMENT** this ash pond dam inspection procedure.

1. **ENSURE** inspections are completed on the specified frequency.
2. **IDENTIFY** funding to correct problems or deficiencies.

3.1.2 **REVIEW** and **SIGN** inspection reports.

3.1.3 **RETURN** signed inspection report to plant environmental coordinator.

3.2 Plant Environmental Coordinator

3.2.1 **REVISE** the dam and dike inspection procedure.

1. **UPDATE** every two years, OR
2. **UPDATE** when inspection procedures and/or practices need to be modified.

3.2.2 **ASSIST** in ensuring the dam and dike inspections are completed by the specified frequency.

3.2.3 **REVIEW** inspection reports.

3.2.4 **OBTAIN** plant manager's signature on inspection report.

3.2.5 **FILE** inspection report in Sutton file point location of 13580-C.

3.2.6 **ENSURE** recommendation and deficiencies are addressed in a timely manner.

3.2.7 **NOTIFY** 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).

3.2.8 **ASSIST** in scheduling annual inspection training.

3.3 Plant Chemistry Technicians

3.3.1 **CONDUCT** the dam and dike inspection.

1. Should **RECEIVE** annual inspection training.
2. Sutton Dam Inspection Training Materials

3.3.2 **COMPLETE** FRM-SUTC-00011, Ash Pond Dam and Dike Inspection Form or FRM-SUTC-00012, Sutton Lake Dam and Dike Inspection Form while conducting these inspections.

3.3.3 **GIVE** the dam and dike inspection form(s) to the plant environmental coordinator.

3.3.4 **DISCUSS** appropriate findings with the plant environmental coordinator.

3.3.5 **INITIATE** work request to address any observed issues or problems.

3.4 Field Engineering POG

3.4.1 **VISIT** the site at least once per year.

3.4.2 **REVIEW** Sutton Plant's dam safety inspection status.

3.4.3 **IDENTIFY** any concerns or potential follow-up items.

3.4.4 **ASSIST** with identifying funding to correct problems or deficiencies.

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Detailed inspections have the potential for injury to plant personnel due to the traffic volume on the constricted dike roads, crossing the train track rails, and uneven terrain that can cause foot travel hazards.

5.0 PREREQUISITES

5.1 **ATTEND** annual dam and dike inspection training by a third party contractor or qualified individual.

5.2 **MAINTAIN** inspection consistency by using the same person(s) for observations and condition assessment.

5.3 **REVIEW** this procedure and most recent previous inspection report PRIOR to performing routine inspection.

5.4 **RECEIVE** any special training required to address safety concerns (such as: boating safety).

6.0 MATERIAL AND SPECIAL EQUIPMENT

6.1 There is currently no monitoring instrumentation installed for the dikes at Sutton Plant.

6.2 Suggested items to facilitate the inspection include:

6.2.1 Copy of previous inspection report for reference,

6.2.2 Copy of last 5-year NCUC inspection report for reference,

6.2.3 Camera to photograph areas of concern,

6.2.4 Cell phone or radio to maintain communication with plant for safety,

6.2.5 25 foot tape measure,

6.2.6 Steel rod or stiff wooden pole to probe areas of concern,

6.2.7 Bush axe,

6.2.8 Surveyors marking tape,

6.2.9 Surveyors wooden stakes and marking pen, and

6.2.10 Plant vehicle or other motorized mode of transportation.

7.0 PROCEDURE

7.1 Scope

7.1.1 **REVIEW** the latest 5-Year NCUC Dam Safety Inspection Report to best describe the dams, dikes, and appurtenant structures covered by this inspection procedure.

1. The cooling pond is exempted from North Carolina dam safety regulations because the dikes are less than fifteen (15) feet in height.

7.1.2 **INCLUDE** the following key site features in the inspection scope:

1. Active (New) Ash Pond
   a. Overall integrity of approximately 10,000 linear feet of enclosure dike that surrounds the active ash pond area.
   b. Condition of interior and exterior slopes for the dikes including vegetation provided for stabilization.
   c. Stability of crest of dikes and service road conditions.
   d. Condition of discharge skimmer and overflow standpipe.
   e. Condition of outlet for pond discharge into cooling reservoir.
   f. Condition of warning signs and other site features provided for public safety.
2. Cooling Pond
   a. Overall integrity of approximately 19,000 linear feet of perimeter dike placed adjacent to the Cape Fear River.
   b. Condition of interior and exterior slopes for the dikes including vegetation provided for stabilization, soil-cement interior liner and riprap erosion protection material.
   c. Stability of crest of dikes and service road conditions.
   d. Condition of river discharge structure.
   e. Condition of makeup water pumping station.
   f. Condition of warning signs and other site features provided for public safety and recreation.

g. Condition of baffle dikes. (Detailed inspection needed only once/year)

h. Condition of intake and discharge canals including soil-cement lining for slopes.

i. Condition of bridges and skimmer structure.

7.2 Inspection Frequency

7.2.1 **PERFORM**, at a minimum, monthly routine inspections of ash pond dams, dikes, and appurtenant hydraulic structures.

1. **INSPECT** during periods of dry weather, if possible.

7.2.2 **PERFORM**, at a minimum, quarterly routine inspections of lake dams, dikes, and appurtenant hydraulic structures.

1. **INSPECT** during periods of dry weather, if possible.

7.2.3 **SCHEDULE** supplemental inspection as follows:

1. **INSPECT** underwater inspection for bridges, river discharge structure and canals every five (5) years preferably to coincide with the NCUC inspection schedule.
2. **INSPECT** of entire perimeter of the baffle dikes at least once per year.
3. **INSPECT** immediately following any major storm event to identify obvious damage or public safety hazards.

7.3 Recommended Inspection Practices

7.3.1 **IDENTIFY** any changes in the condition of dams, dikes and appurtenant hydraulic structures that might indicate a problem that could potentially threaten the integrity or safety of those features.

1. **MAINTAIN** accurate record of condition changes to allow consideration of developing trend.
2. **USE** factually quantified words with objective parameters when describing changes such as size (length, width and depth), flow rate (gpm, cfs) and location (upstream/downstream slope, location on dike by stationing, toe of slope, etc.).

APPENDIX A

Document 6

2009 Annual Inspection

MACTEC
engineering and constructing a better tomorrow

June 30, 2009

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

Subject: **REPORT OF 2009 LIMITED (ANNUAL) FIELD INSPECTION**
ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA
MACTEC PROJECT NO. 6468-09-2351 (02)

Dear Mr. Forster:

On March 25, 2009, Mr. Scott Auger and Mr. James Schiff of MACTEC Engineering and Consulting, Inc. (MACTEC) visited the L.V. Sutton Steam Electric Plant to perform a limited field inspection of the Ash Pond Dikes. Prior to the inspection, we reviewed the 2008 Annual Inspection Report to confirm observations from previous inspections. The primary plant contacts for Progress Energy during this inspection were Mr. Bruce Moorefield and Mr. Isaac Alderman.

The field inspection included a discussion of activities since the last inspection visit, review of available records and a driving/walking reconnaissance of the Ash Pond dikes. The weather conditions during the inspection were generally partly cloudy, cool and dry. There was no significant rainfall within 24 hours prior to the inspection. This letter report summarizes the observations during the current inspection and provides recommendations for any follow-up actions. Photographs of selected conditions and updated Progress Energy condition assessment forms are also included with this report by attachment.

MACTEC conducted a dam safety training exercise for Mr. Moorefield and Mr. Alderman in conjunction with the current inspection.

The last 5-year independent consultant inspection was performed by MACTEC in December, 2007 and the next is scheduled in 2012.

SUMMARY

Based on the field observations noted in this report, the ash pond dikes generally appear to be stable and in satisfactory condition. For this inspection, we generally observed improvement in maintenance of vegetation on the slopes. We continue to emphasize the importance of controlling vegetation, brush and tree growth for slopes. The primary objective is to maintain the vegetation in a condition that will facilitate safe and effective routine inspection activities by plant personnel. In addition, trees should be cut on the slopes before reaching a size that would allow roots to deeply penetrate the dikes.

For the current inspection, the new recommendations for follow-up action include:

- (AP-2009-1) 2006 Interior Storage Area - Riprap material on the inside slope was observed to have slipped down the slope on the north side of the dike near the discharge structure. This appears to be a localized conditions affecting about 15-20 linear feet along slope. There was no significant slope damage observed at the time of inspection. We recommend routinely checking this area for slope damage and providing riprap repairs as soon as possible.
- (AP-2009-2) 1983 Ash Pond Area – There appears to be more standing water for the pond area near the discharge structure compared with previous inspections. This area has generally been reported to be inactive for previous inspections. The condition of the dikes and adequacy of the discharge structure should be further evaluated in consideration of the current utilization for this area.
- (AP-2009-3) 1984 Ash Pond – Prior to the current inspection, MACTEC provided support for investigation of possible increased seepage for the 1984 Ash Pond area associated with raising the pond operating level. This condition was identified as a concern by the plant based on comparison of inflow and outflow estimates. MACTEC performed field inspections and installed piezometers for the dike to support the seepage investigation. The investigation results to date and the current inspection activities do not appear to indicate that seepage represents an immediate concern for dike stability. The plant has lowered the water level to the elevation before observation of the possible increased seepage. Further review of this condition may be warranted if the plant considers raising the water level in the future.

RECORDS

As authorized by Progress Energy under Work Authorization No. 2720-161, dated January 26, 2009, MACTEC installed new piezometers for the 1984 Ash Pond area to support seepage investigations. The new piezometers were installed at 6 locations, with 3 piezometers at each location, for a total of 18 new piezometers. Water level readings were obtained for the piezometers during the current inspection and compared to initial readings. The piezometer data does not appear to indicate that the water level in the dikes is increasing or represents a concern for dike stability.

There are currently no other active piezometers or monitoring instrumentation for the Ash Pond Dikes.

Mr. Alderman confirmed that the routine monthly inspections were being performed by the plant staff.

ASH POND INSPECTION

1983 Ash Pond

The 1983 Ash Pond dikes were constructed by raising the original dikes constructed in 1971. The present dikes have a crest elevation varying from Elevation 28 feet (MSL) to Elevation 34 feet (MSL). The higher elevation is at the common dike with the 1984 Ash Pond. The crest width is 12 feet and side slopes are 3(H):1(V). Including the common dike, the dike length is about 3,800 feet. This ash pond area was taken out of service following completion of the 1984 Ash Pond. It has been reported that the 1983 Ash Pond area was temporarily returned to service in 2001. We have generally represented this ash pond area as inactive for recent inspection reports.

For the current inspection, we observed more standing water for the pond area near the discharge structure compared with previous inspections (Photographs 1). We also observed standing water adjacent to the dike along the discharge canal on the south side of the pond area (Photograph 3). We understand that this area currently receives storm water inflow from plant sources including retention ponds, coal pile runoff, and tank farm drainage. In addition, we understand that an interior containment area is actively used for Unit 1 & 2 bottom ash disposal operations.

The 1983 Ash Pond discharge structure consists of a 48-inch diameter vertical concrete riser connected to a 12-inch diameter concrete outlet pipe, and is located in the northwest corner of the pond. The outlet of the discharge pipe is submerged in the cooling pond and not visible. The discharge riser crest was checked by field survey in 2003, and was reported to be around Elevation 23.81 feet (MSL). The 2003 survey indicated that the minimum crest elevation for the dikes was around Elevation 27.6 feet (MSL). In follow-up to the field inspection, Mr. Moorefield reported that a 2 foot extension piece was added to the riser since the 2003 survey, which would place the current riser crest at Elevation 25.81 (MSL). Mr. Moorefield further reported that the water level near the discharge structure generally seems to stay below the crest of the riser except during periods of heavy rainfall. It should be noted that previous inspection reports have recommended maintaining the operating water level around Elevation 23.5 (MSL).

In follow-up to the current inspection, the condition of the dikes and adequacy of the discharge structure should be further evaluated in consideration of the current utilization for this area.

There are no piezometers or movement monuments in the dikes.

In 2006, a temporary interior storage area was constructed within the pond area. The containment dikes for this temporary storage area are not included in this inspection scope. The temporary containment area did not appear to be retaining any significant amount of standing water at the time of inspection.

The dike crest is generally level and shows no signs of unusual settlement or displacement.

The exterior slope of the west dike, from the intersection with the 1984 Ash Pond dike to about 300 feet south of the discharge structure appears to have a fair grass cover for surface stabilization (Photograph 2).

The exterior slope along the discharge canal continues to be heavily overgrown with trees and brush. Inspection of the exterior slopes in this area was limited because of the heavy growth (Photograph 4).

The upper portion of the dike slopes near the crest appeared to have been mowed prior to the inspection. Progress Energy should continue with maintenance cutting of trees and brush to facilitate inspection.

The available reference drawings showing dike sections are included in Appendix C – Exhibits. This reference information was obtained from the 2007 5-Year Independent Consultant Inspection Report.

1984 Ash Pond Area

The dikes for the 1984 pond were constructed of sand with an interior clay liner. The clay liner extends across the pond bottom as well. The crest width is 12 feet and slopes (interior and exterior) are 3(H):1(V). The maximum dike height is about 32 feet above original grade, and the design crest of the dikes is at Elevation 34 feet (MSL). The length including the common dike with the 1983 pond is about 10,000 feet. At the time of our inspection, the pond level was about two to three inches above the riser.

Prior to the current inspection, MACTEC provided support for investigation of possible increased seepage associated with the 1984 Ash Pond area associated with raising the pond operating level. This condition was identified as a concern by the plant based on comparison of inflow and outflow estimates. MACTEC performed field inspections and installed piezometers for the dikes to support the seepage investigation. The investigation results to date and the current inspection activities do not appear to indicate that seepage represents an immediate concern for dike stability. The plant has lowered the water level to the elevation before observation of the possible increased seepage. Further review of this condition may be warranted if the plant considers raising the water level in the future.

Mr. Moorefield reported that the pond level was raised to Elevation 30.0 (MSL) in November, 2008, which was the level where the plant observed possible increased seepage. The plant lowered the pond level to Elevation 28.0 (MSL) in January, 2009, which is the current normal water level.

The dike crest appeared to generally be good condition with no signs of unusual settlement or displacement. (Photographs 5 and 6)

The interior slopes were heavily overgrown with tall grass along with patches of briers which limited inspection. Grass and briers are also becoming established in the riprap slope protection on the interior slope along the east side of the pond area (Photograph 7).

The exterior slopes of the dikes are moderately to well vegetated with grass along with some briers and small bushes (Photograph 8). For this inspection, most of the toe area was checked for seepage. All locations inspected along the toe appeared to be dry with no indication of seepage or slope stability problems. The upper portion of the dike slope near the crest appeared to have been mowed prior to the inspection.

The vertical riser for the discharge structure was observed from the access platform. The skimmer structure and interior surfaces appeared to be in good visual condition (Photograph 11). The downstream outlet structure appeared to be structurally sound with no obvious signs of leakage or displacement (Photograph 12). The discharge from the structure appeared to be free flowing at the time of inspection. Representative photographs of the dike slopes looking toward the discharge structure are included with Appendix B (Photographs 9 and 10).

The available reference drawings showing dike sections are included in Appendix C – Exhibits. This reference information was obtained from the 2007 5-Year Independent Consultant Inspection Report.

<u>1984 Ash Pond Interior Storage Capacity Addition</u>

In 2006, Progress Energy constructed an interior ash storage area for the southern end of the 1984 Ash Pond. The storage capacity addition was designed by Withers & Ravenel and constructed by Trans Ash. The design crest elevation is 42.0 ft (MSL), and the planned operating level is Elevation 40.0 feet (MSL). The maximum dike height above the original ash level is about 14 feet. The crest width is 25 feet wide with a gravel road in the center. The interior slope is 2(H):1(V) and the exterior slope on the east, west and south sides is 4(H):1(V). Where the new dikes are adjacent to the 1984 pond perimeter dikes, the toe of the slope is set back eight feet and the space is graded to promote flow of water toward the north. On the north side, where the dike is adjacent to the impounded water of the 1984 pond, a stability berm with a 25-foot wide crest is added to the main slope. (Photograph 16)

The crest generally appeared to be stable with no signs of unusual settlement or displacement.

The interior slope has rip rap placed for erosion protection above the water level which generally appeared to be intact. However, riprap material on the inside slope was observed to have slipped down the slope on the north side of the dike near the discharge structure. This appears to be a localized conditions affecting about 15-20 linear feet along slope. There was no significant slope damage observed at the time of inspection. We recommend routinely checking this area for slope damage and providing riprap repairs as soon as possible. (Photograph 17)

There is a fairly heavy growth of tall grass in the rip rap above the water line that limited inspection. Progress Energy should consider maintenance cutting or spraying of vegetation that is growing in the riprap to facilitate inspection. (Photographs 15)

The exterior slopes generally appeared to be stable. However, the vegetation on the exterior slopes continued to appear sparse and should be routinely checked for erosion. The toe of slope along the east and west sides appeared to be dry at the time of inspection. Previous inspections have noted depressions and erosion for the stability berm on the north side of the ash storage area. Repairs to the toe berm appear to have been effective. Progress Energy should continue to monitor the toe area for erosion and provide repairs. (Photograph 18)

The discharge structure for this interior storage area consists of a concrete riser structure six feet square connected to a 36-inch diameter HDPE pipe with an outlet invert set at Elevation 24.0 feet (MSL). The plans show that the 36-inch diameter HDPE discharge pipe. The discharge structure appeared to be structurally sound with no indications of displacement. (Photographs 13 and 14))

At the time of our inspections, the water level in the interior storage area was slightly above Elevation 40.0 feet (MSL), and was flowing over the crest of the riser.

The outlet for the discharge appeared to be free flowing at the time of inspection. The area around the discharge pipe is becoming very heavily overgrown, which may limit access for inspection. The plant should routinely check the seepage drain piping for indications of change in flow.

The available reference drawings showing dike sections are included in Appendix C – Exhibits. This reference information was obtained from the 2007 5-Year Independent Consultant Inspection Report.

SUMMARY OF RECOMMENDATIONS

Based on the current inspection results, the status for addressing recommendations for previous annual reports and the 2007 5-year Inspection Report are summarized as follows:

Ref No.	Recommendations	Recomm Time for Impl	Current Status
AP-2007-1 (1983Ash Pond)	The large brushy vegetation on the west dike should be trimmed to allow better slope visibility.	Routine Maintenance	Improvement noted during 2009 inspection. Plant should continue maintenance cutting.
AP-2007-2 (1983Ash Pond)	Progress Energy's program of cutting trees on the exterior slopes should continue.	Routine maintenance	Large trees still present on downstream slope along discharge canal.
AP-2007-3 (1983Ash Pond)	If operation of the 1983 pond is resumed, the exterior slope adjacent to the Cooling Pond and discharge canal should be checked during the monthly inspections for signs of seepage.	Routine inspection	See comments on observed pond utilization for 2009 inspection report.
AP-2007-4 (1984Ash Pond)	Patches of briers and small brush on the interior slope should be controlled by spraying or cutting so the slope can be observed during routine inspections.	Routine maintenance.	Improvement noted for 2009 inspection. Plant should continue with maintenance cutting.
AP-2007-5 (1984Ash Pond)	Progress Energy's program of cutting trees on the exterior slopes should continue.	Routine maintenance	Recommend cutting brush to facilitate inspection.
AP-2007-6 (1984Ash Pond)	The east dike interior repair area should be monitored for progress of vegetative growth. The rip rap should be sprayed as needed to control vegetation.	Routine maintenance	Plant should continue to monitor and provide appropriate maintenance.

CLOSING

MACTEC is pleased to continue assisting Progress Energy with inspections of the dams at the L.V. Sutton Steam Electric Plant. Please contact us if you have any questions about this report.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

6/30/09

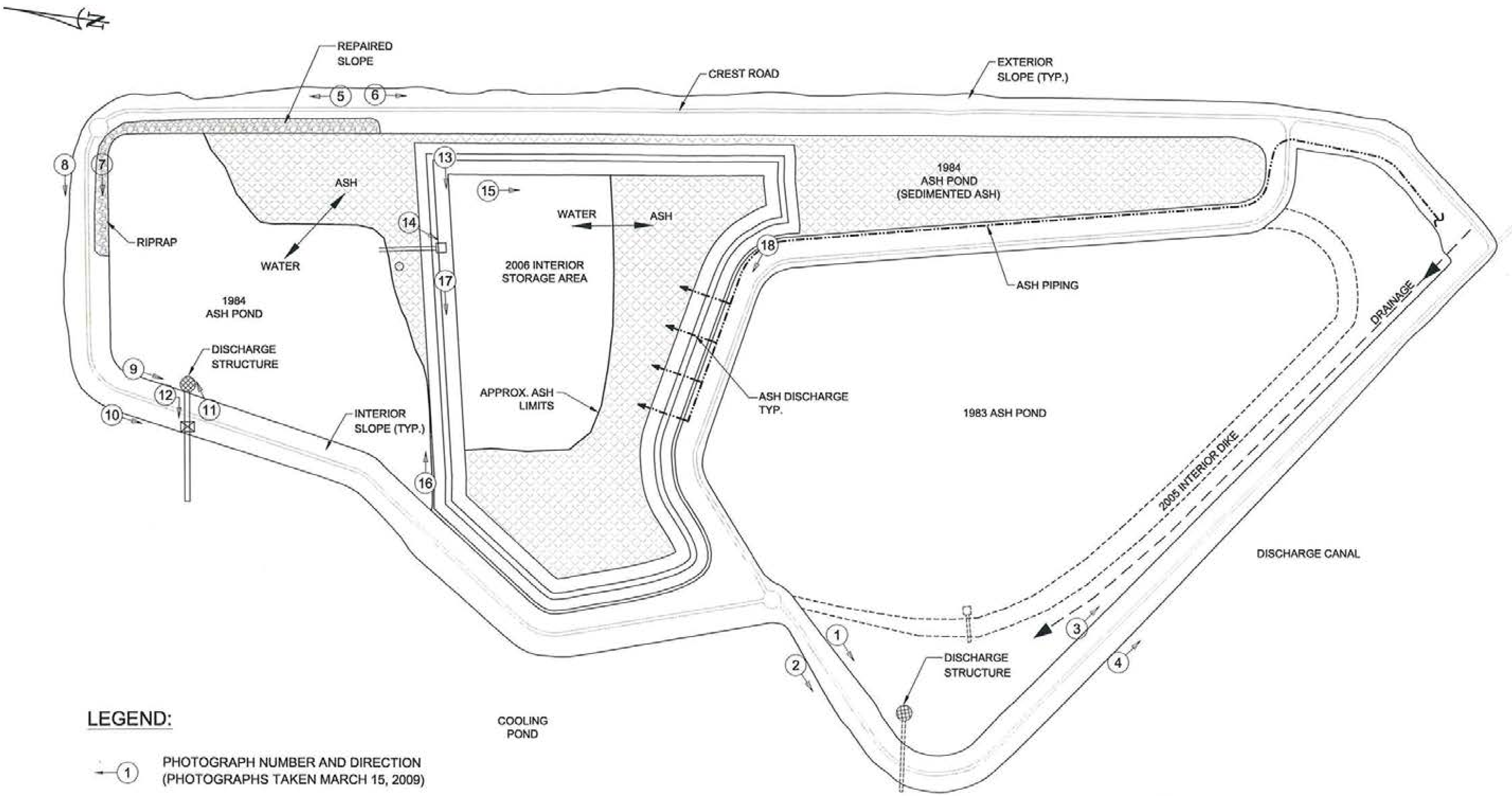
James A. Schiff
Project Professional

Richard S. Auger
Principal Engineer
Registered, North Carolina 8169

RSA/jas

Appendices:
- Appendix A - Photograph Location Drawings (1 drawing)
- Appendix B – Photographs
- Appendix C – Exhibits
- Appendix D – Dam Information Summary Sheets
- Appendix E – Dam Assessment Forms

Appendix A – Photograph Location Drawing



MACTEC

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

PHOTOGRAPH LOCATION PLAN
ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK:
APPROVAL:
DATE: JUNE 2009
SCALE: N.T.S.
JOB No.: 6468-09-2351 (02)
DRAWING 1

REFERENCE: CP&L DRAWINGS D3232 & D3230; WITHERS & RAVENEL DRAWING 1, TRANSASH DRAWING 4-19-05.

P:\6468_Progress Energy_Sutton_2009 Inspection_Drawings\Ash Pond Dikes 3-2009.dwg Tue, 23 Jun 2009 - 9:11am rmbie

Appendix B – Photographs


03/25/2009

1. 1983 Ash Pond – View of interior slope, outlet riser and standing water near riser.

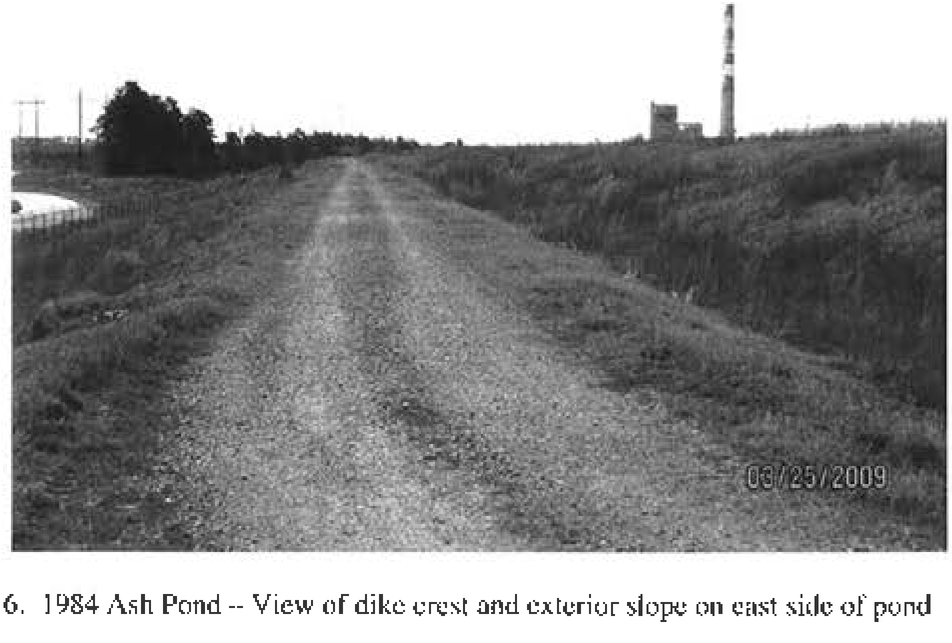

03/25/2009

2. 1983 Ash Pond - View of dike exterior slope near outlet riser

3. 1983 Ash Pond – View of crest, interior slope and standing water adjacent to discharge canal.

4. 1983 Ash Pond – View of crest and exterior slope adjacent to discharge canal.

5. 1984 Ash Pond – View of dike crest and exterior slope east side of pond



6. 1984 Ash Pond -- View of dike crest and exterior slope on east side of pond

7. 1984 Ash Pond - View of riprap placed for interior slope on north side of pond.

8. 1984 Ash Pond – View of exterior slope on north side of pond.

9. 1984 Ash Pond – View of interior slope of dike on west side of pond looking toward discharge riser.

10. 1984 Ash Pond – View of exterior slope of dike on west side of pond looking toward outlet structure.

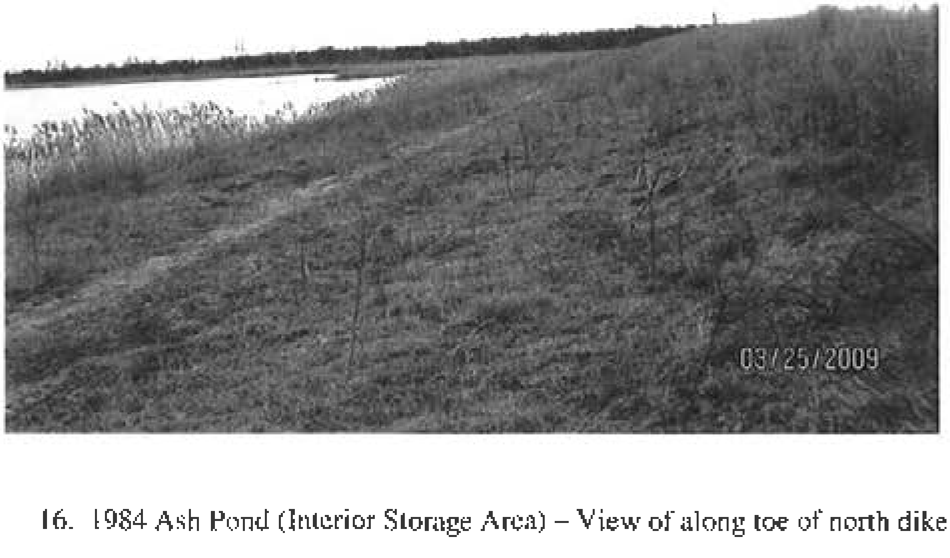
11. 1984 Ash Pond – View of top for discharge riser.

12. 1984 Ash Pond – View of top for discharge structure looking toward cooling pond.

13. 1984 Ash Pond (Interior Storage Area) – View of dike crest looking toward discharge structure on north side of pond.

14. 1984 Ash Pond (Interior Storage Area) – View of discharge structure.

15. 1984 Ash Pond (Interior Storage Area) – View of crest of dike and interior slope along east side of pond.



16. 1984 Ash Pond (Interior Storage Area) – View of along toe of north dike.

17. 1984 Ash Pond (Interior Storage Area) – View of riprap along interior slope on north side of pond.

18. 1984 Ash Pond (Interior Storage Area) – View of exterior slope on south side of pond.

Appendix C - Exhibits

Report of 2009 Limited (Annual) Field Inspection
Ash Pond Dikes
L.V. Sutton Steam Electric Plant
Report Appendices

LIST OF EXHIBITS

The exhibit drawings included with this report were obtained from the 2007 5-Year Independent Consultant Report as follows:

1. Not included

2. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Site Plan, Carolina Power & Light Company Drawing No. D-3235, As-Built, Dated 10/14/85.

3. Civil, Ash Disposal Ponds. North Pond-Discharge Structure. Sheet 1 of 2. Brown and Root Drawing No. G-3177B, Dated 9/7/71.

4. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984). Plan-Sheet 1, Carolina Power & Light Company Drawing No. D-3236, As-Built, Dated 10/14/85.

5. Sutton Steam Electric Plant, Ash Pond Expansion (1985-1984). Plan-Sheet 2, Carolina Power & Light Company Drawing No. 3252, As-Built, Dated 10/14/85.

6. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Dike Sections (Sheet 1), Carolina Power & Light Company Drawing No. D-3237. As-Built. Dated 10/14/85.

7. Sutton Steam Electric Plant, Ash Pond Expansion. Dike Sections (Sheet 2), Carolina Power & Light Company, Drawing No. D-3239, As-Built, Dated 10/14/85.

8. Sutton Steam Electric Plant, Ash Pond Expansion (1983-1984), Sections and Details (Sheet 1). Carolina Power & Light Company Drawing No. D-3238. As-Built. Dated 10/14/85.

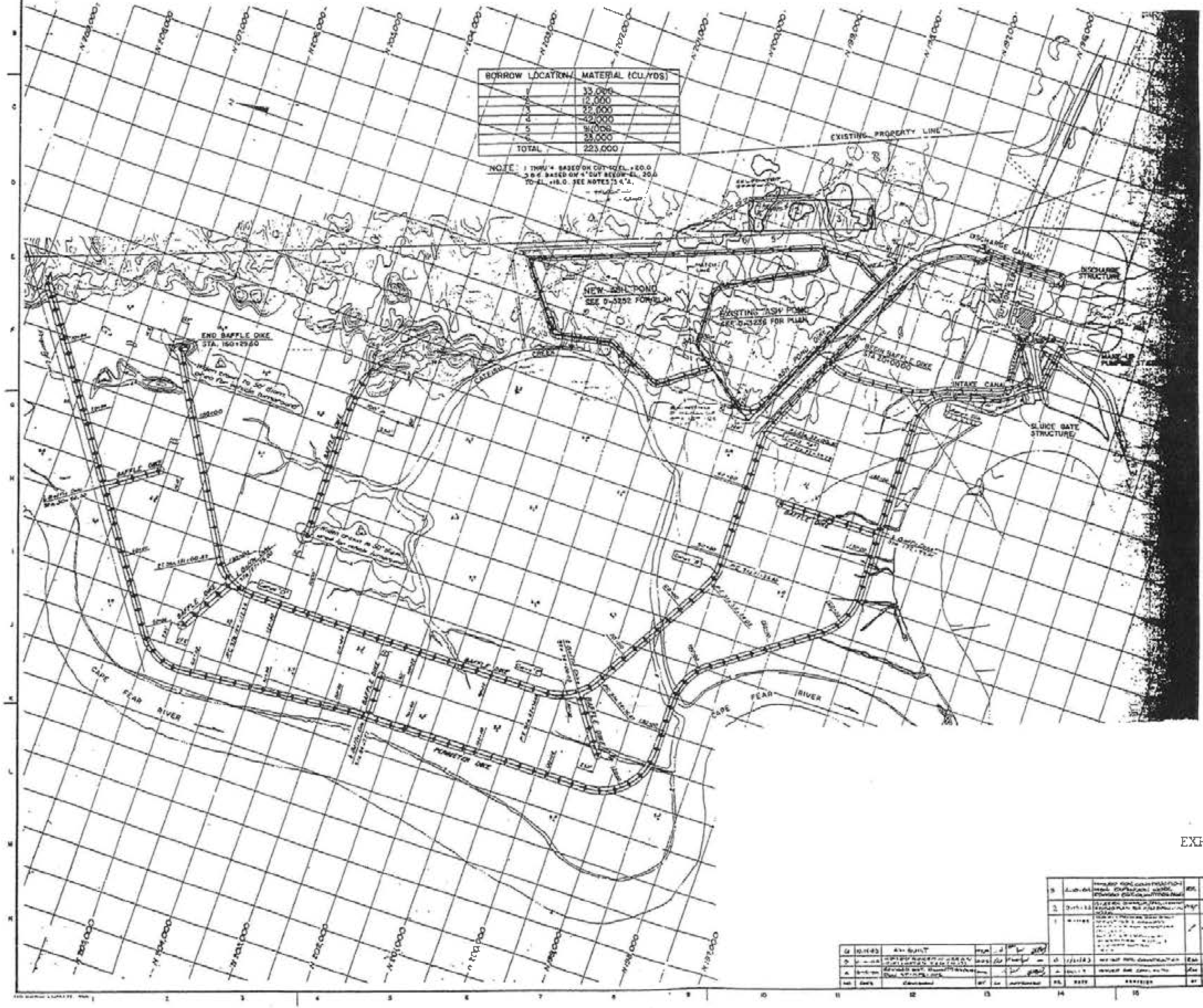
9. Sutton Steam Electric Plant, Ash Pond Expansion, (1983-1984). Sections and Details (Sheet 2). Carolina Power & Light Company Drawing No. D-3253, As-Built, Dated

10. Not included.

11. Not included

12. Site Plan, Interior Ash Pond Dike Project. Progress Energy-Sutton Plant. Withers & Ravenel; Sheet No. 1, Dated May 2006.

13. New Outfall Structure, Interior Ash Pond Dike Project. Progress Energy-Sutton Plant. Withers & Ravenel, Sheet No. 2. Dated May 2006.



BORROW LOCATION	MATERIAL (CU. YDS)
1	33,000
2	12,000
3	22,000
4	42,000
5	91,000
6	23,000
TOTAL	223,000

NOTE: 1 THRU 4 BASED ON CUT TO EL. +20.0
5 & 6 BASED ON 4' CUT BELOW EL. 20.0
TO EL. +16.0. SEE NOTES 3 & 4.

ESTIMATED QUANTITIES

(NOT FOR BID)

ITEM	[illegible]	[illegible]	NOTES
1 CLEARING	[illegible]	[illegible]	
2 EXCAVATION	[illegible]	[illegible]	[illegible]
3 FILL	[illegible]	[illegible]	[illegible]
4 [illegible]	[illegible]		[illegible]
5 SEEDING	[illegible]	[illegible]	
6a [illegible]	[illegible]		
6b [illegible]	[illegible]		
7a [illegible]	[illegible]	[illegible]	
7b [illegible]	[illegible]	[illegible]	
8 [illegible]	[illegible]	[illegible]	
9 [illegible]	[illegible]	[illegible]	[illegible]
10 [illegible]	[illegible] ACRES	—	[illegible]
11 [illegible] FILL	[illegible]	—	[illegible]

GENERAL NOTES:

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. [illegible]

LIST OF DRAWINGS

[illegible]

REFERENCE DRAWINGS

[illegible]

SPECIFICATIONS

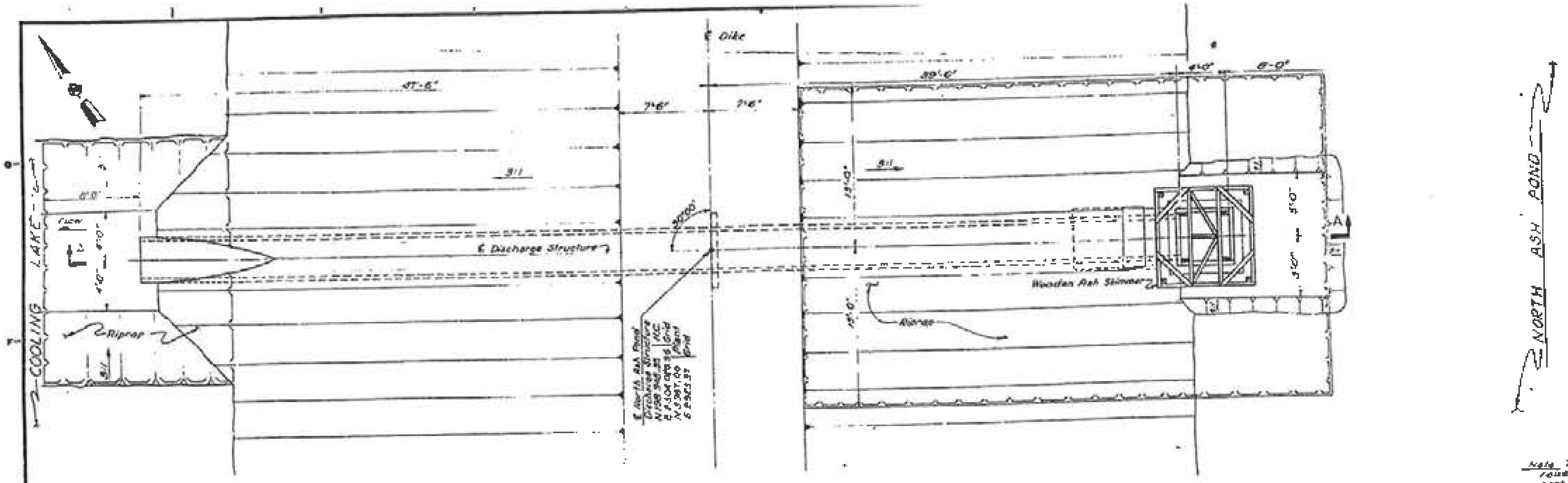
[illegible]

EXHIBIT 2

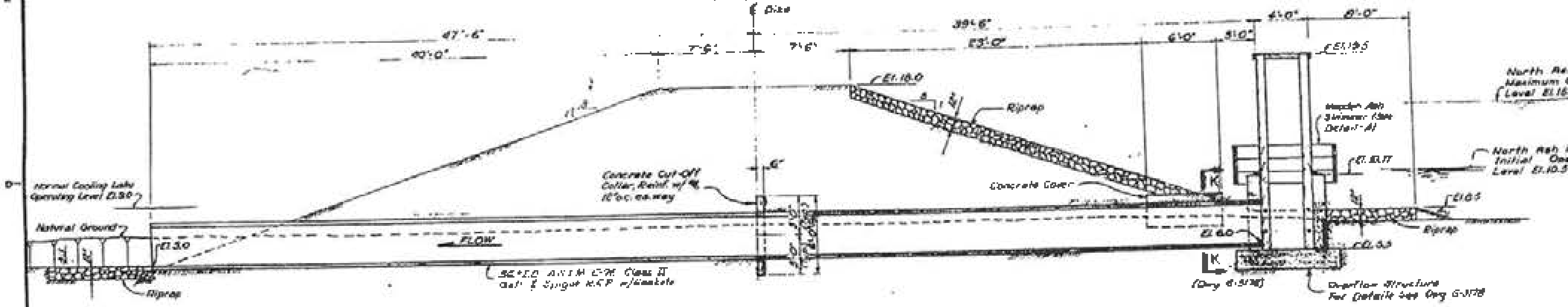
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT

L. V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION (1983-1984)
SITE PLAN

D-3235

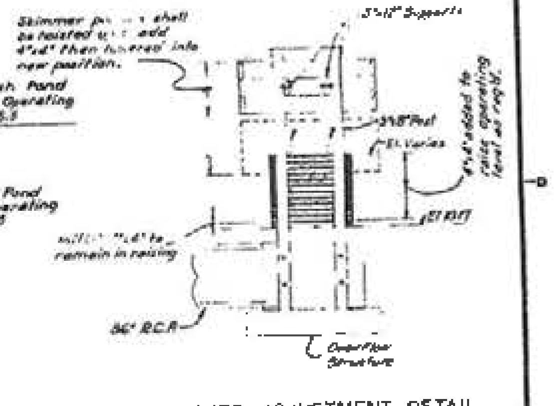


PLAN
Scale 1"=5'-0"

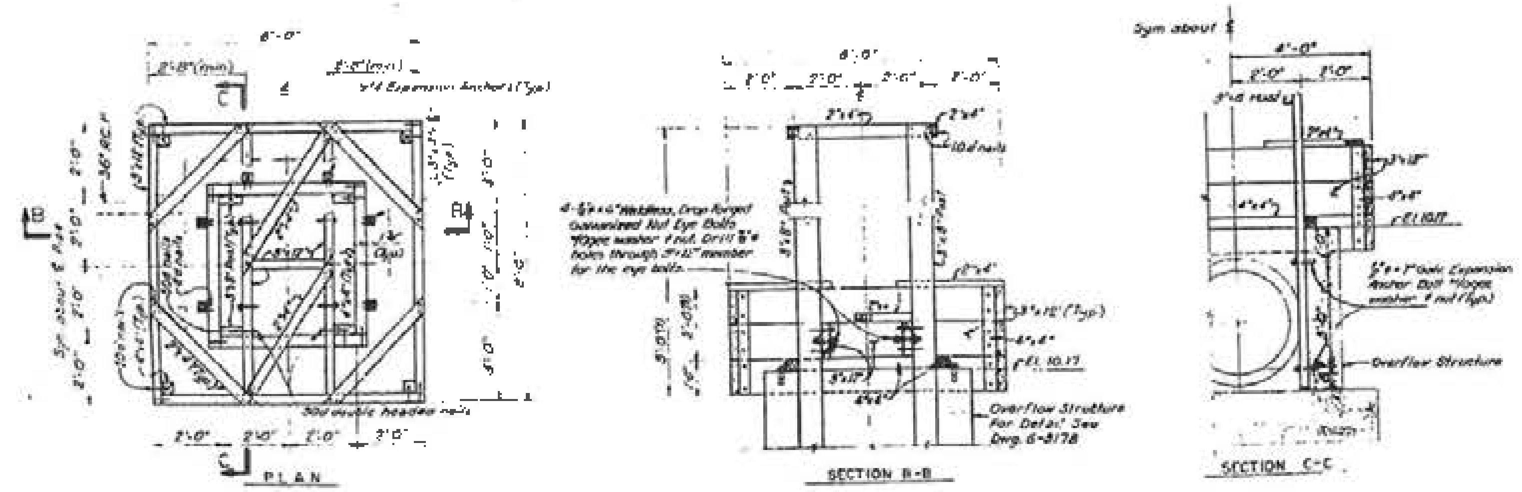


SECTION A - A
Scale 1/8"=1'-0"

Note: To raise the operating level of the Ash Pond: raise the skimmer portion, place additional 4"x4" sections on the initial 4"x4" section and nail to the 8"x8" posts, lower the skimmer portion back into position, and renail the 3"x12" supports to the 3"x8" post.



SKIMMER ADJUSTMENT DETAIL
(Future addition of 4"x4" by CP&L)
No Scale



DETAIL - A
(Wooden Ash Skimmer)
Scale 3/4"=1'-0"

GENERAL NOTES:
1. All concrete shall be Class "B" in accordance with Specification Item C-810.
2. All exposed concrete shall have a 3/4" chamfer unless otherwise noted.
3. All dimensions referring to reinforcing bars are to the centerline of the bars unless otherwise noted.
4. All reinforcing bars shall conform to A.S.T.M. Designation A-615 Grade 60.
5. Concrete cover for reinforcement shall be as follows unless otherwise noted:
   (a) 3" Clear for surfaces directly exposed to weather or deposited against the ground.
   (b) 3" Clear for all other surfaces.
6. Details of reinforcement not otherwise shown or indicated shall conform to the provisions of A.C.I. Standard 318 latest edition.
7. All structural steel shapes shall conform to A.S.T.M. Designation A-36 and shall be hot-dip galvanized after fabrication.
8. All expansion anchors and nails shall be hot-dip galvanized.
9. All lumber shall be 12# creosoted Dense Select Structural, Southern Yellow Pine.
10. All field cutting, abrasions or borings shall receive three coats of creosote oil, each coat being brushed on in sufficient quantity to fill all splits and thoroughly penetrate the cut or abraded surface.
11. All riprap shall conform to the North Carolina State Highway Commission Specifications for Class I Riprap.

REFERENCE DRAWINGS:
G-3175 Ash Disposal Ponds - General Layout
G-3178 Ash Disposal Ponds - North Pond Discharge Structure Sheet 2 of 2.

EXHIBIT 3

B	Construction Issue		DRAWN F. Gregory	BROWN & ROOT, INC. ENGINEERS AND CONSULTANTS HOUSTON, TEXAS	CAROLINA POWER & LIGHT COMPANY L. V. SUTTON STEAM ELECTRIC PLANT 1972—420 MW EXTENSION-UNIT NO. 3	DRAWING TITLE CIVIL ASH DISPOSAL PONDS NORTH POND-DISCHARGE STRUCTURE SHEET 1 OF 2
A	For Customer Review		CHECKED J. Bates			CONTRACT NO. CR-44 DATE 05-7-71 SCALE: As Shown G-3006-3 G-3177B
			APPROVED J C Victorelli			

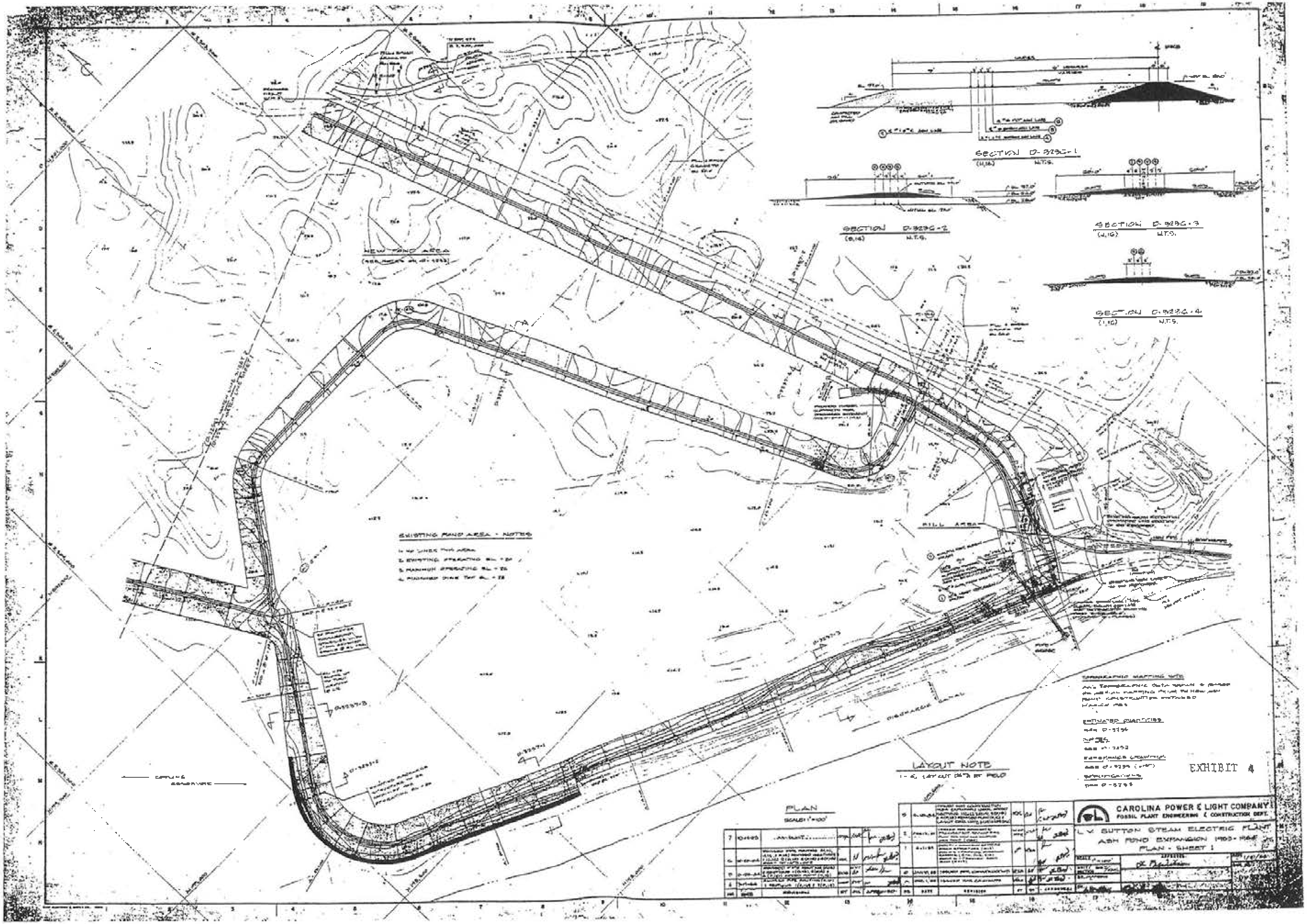
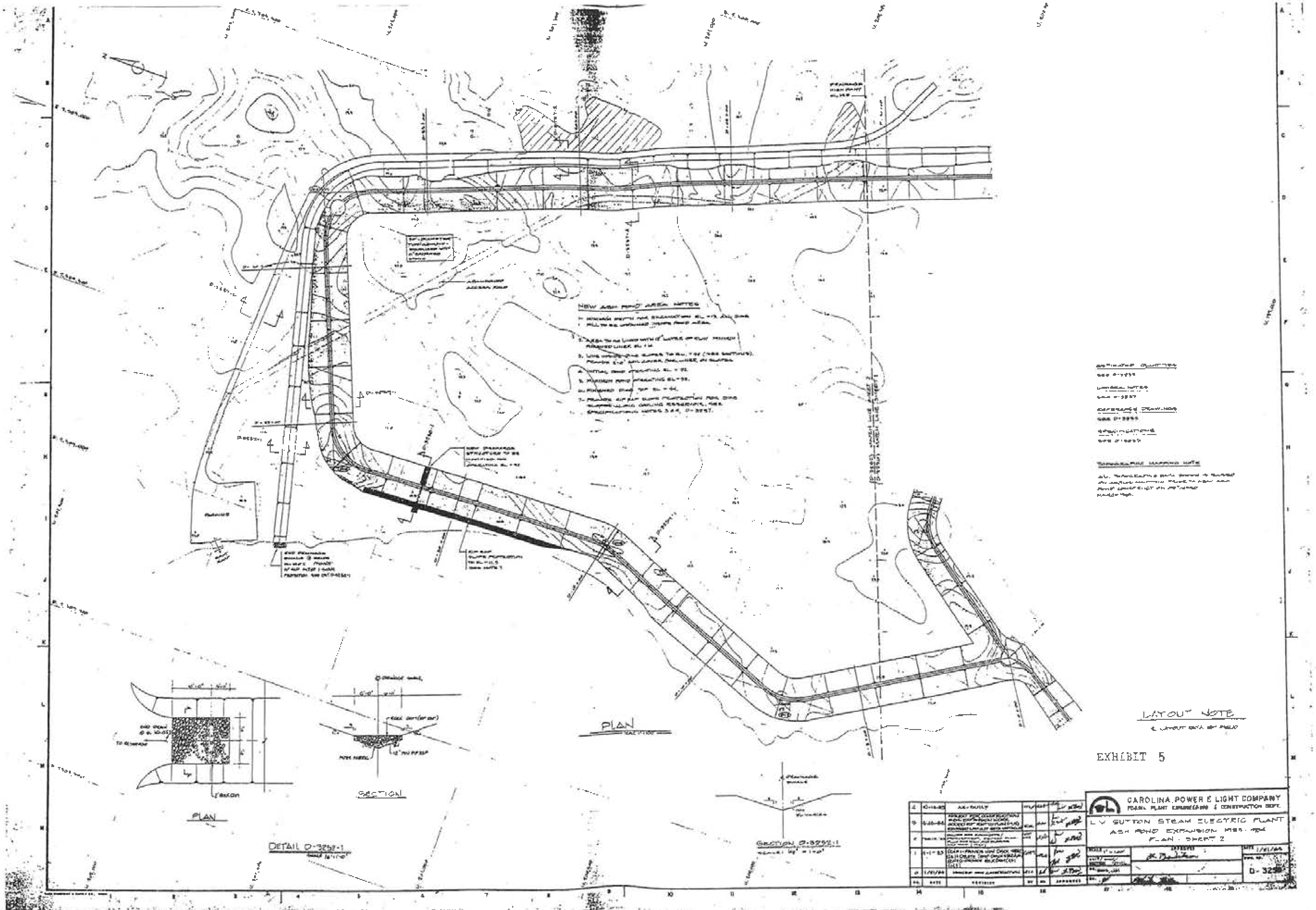
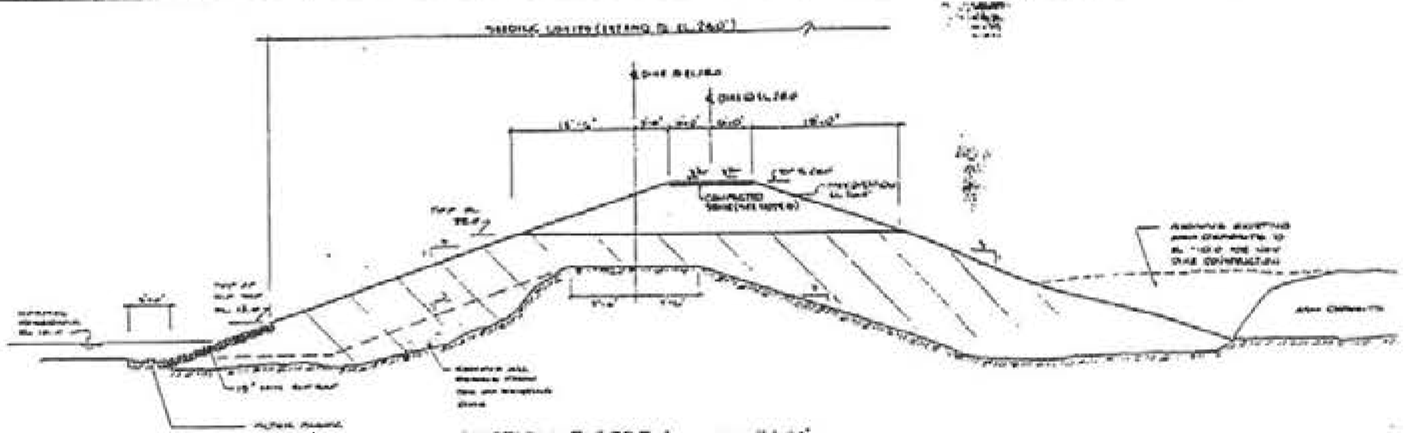

NEW POND AREA
EXISTING POND AREA - NOTES
FILL AREA
DISCHARGE CANAL
SECTION D-3296-1
SECTION D-3296-2
SECTION D-3296-3
SECTION D-3296-4
N.T.S.
LAYOUT NOTE
PLAN
TOPOGRAPHIC MAPPING NOTE
ESTIMATED QUANTITIES
REFERENCE DRAWINGS
SPECIFICATIONS
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.
L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
PLAN - SHEET 1
REVISIONS

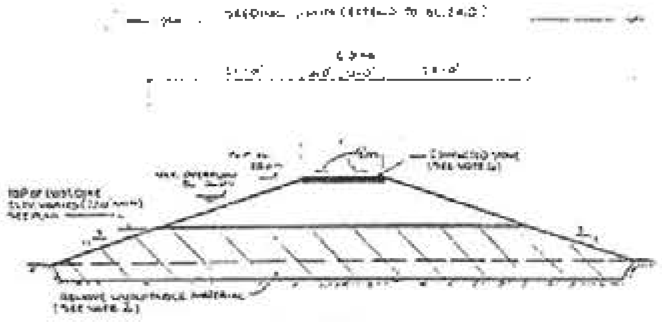
EXHIBIT 4

EXHIBIT 5

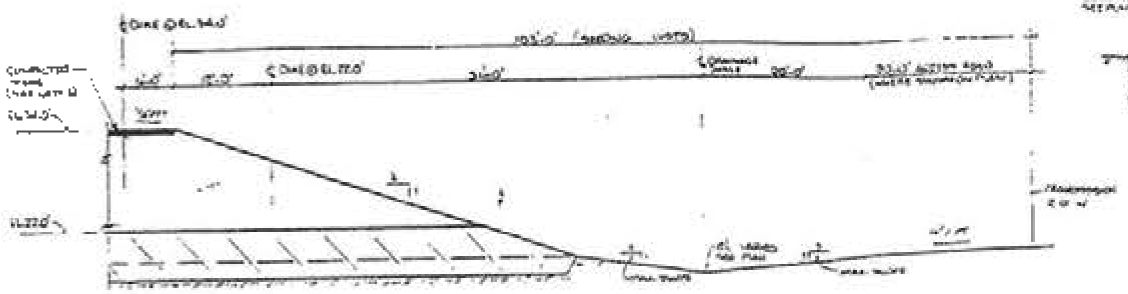

NEW ASH POND AREA NOTES
ESTIMATED QUANTITIES
GENERAL NOTES
REFERENCE DRAWINGS
SPECIFICATIONS
TOPOGRAPHIC MAPPING NOTE
PLAN
LAYOUT NOTE
PLAN
SECTION
DETAIL D-3252-1
SECTION D-3252-1
AS-BUILT
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.
L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION
PLAN - SHEET 2
D-325



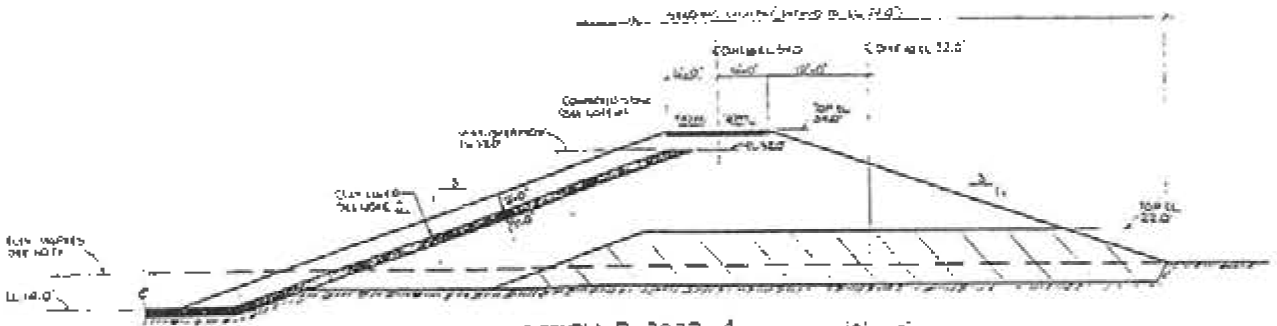
SECTION D-3237-1 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKE FROM EL. 18.0' TO EL. 22.0' (1983)
TYPICAL FOR RAISING DIKE FROM EL. 22.0' TO EL. 28.0'



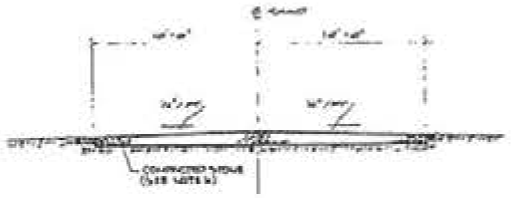
SECTION D-3237-3 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKE TO ELEV. 28.0'



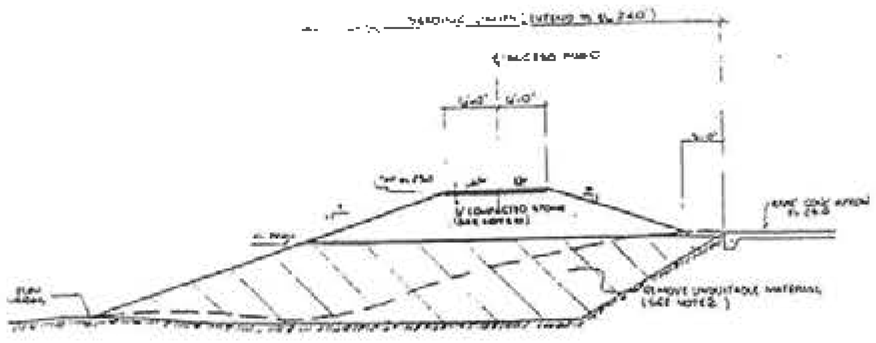
SECTION D-3237-2 SCALE: 1/8"=1'-0"
TYPICAL SECTION @ DRAINAGE SWALE



SECTION D-3237-4 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKES TO EL. 36.0 (TO THE INSIDE)
TYPICAL FOR CLAY LINER



SECTION D-3237-6 SCALE: 1/8"=1'-0"
TYPICAL FOR RELOCATION OF ACCESS ROAD TO EXISTING RESERVOIR BOAT RAMP



SECTION D-3237-5 SCALE: 1/8"=1'-0"
TYPICAL @ CONCRETE BASIN

LEGEND

▭ NEW SAND FILL OR NEW CONSTRUCTION

▨ SAND FILL (EXISTING)

EXISTING GRADE

CUT

NOTES

1. SEE SPEC. SECTION 02100 FOR CLEARING REQUIREMENTS.
2. [illegible]
3. [illegible]
4. [illegible]
5. SEE SPEC. SECTION 02485 FOR SEEDING REQUIREMENTS. SEEDING SPEC. SHALL BE REVIEWED BY LOCAL SCS OFFICE AND SHALL BE MODIFIED AS REQUIRED TO MEET LOCAL RECOMMENDATIONS.
6. CRUSHED STONE SHALL BE NCDOT SPECIFICATION GRADATION ABC IN ACCORDANCE WITH SECTION 1010. CRUSHED STONE SHALL BE COMPACTED AFTER PLACEMENT TO PROVIDE 6" MINIMUM THICKNESS.

REFERENCE DRAWINGS / SPECIFICATIONS

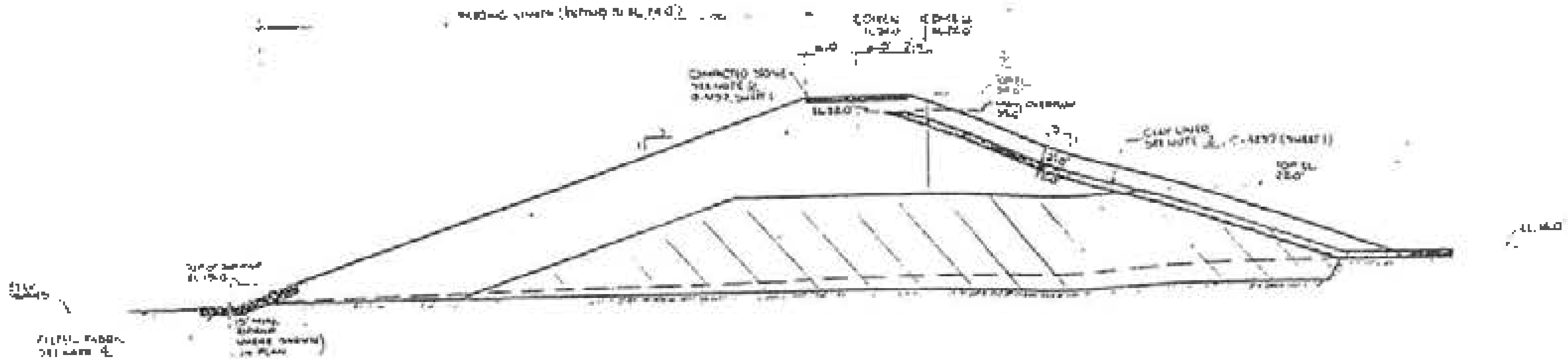
EXHIBIT 6

NO.	DATE	REVISION	BY	CK	APPROVED
3	6-10-84	[illegible]	[illegible]		[illegible]
2	2-15-84	[illegible]	[illegible]		[illegible]
1	6-1-83	[illegible]	[illegible]	[illegible]	[illegible]
0	JAN 11/83	ISSUED FOR CONSTRUCTION	[illegible]	[illegible]	[illegible]
A	[illegible]	ISSUED FOR [illegible]	[illegible]	[illegible]	[illegible]

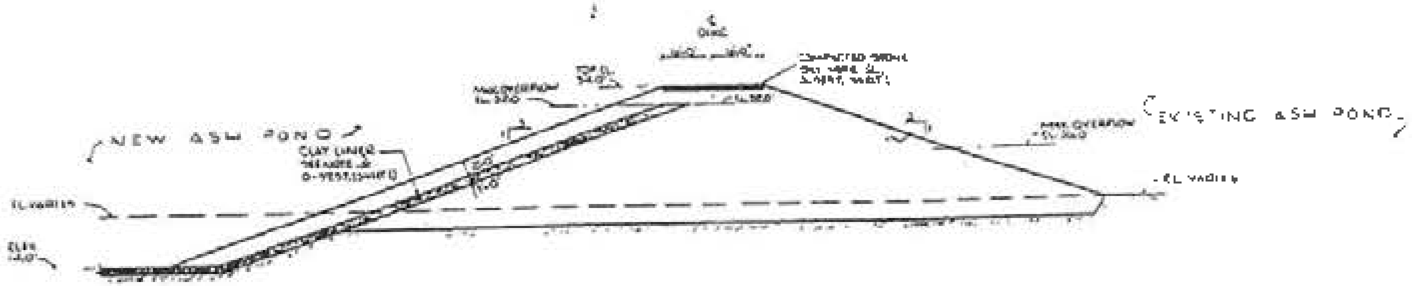
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION (1983-1984)
DIKE SECTIONS (SHEET 1)

D-3237



SECTION D-3239-1 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKES TO ELEV. 34.0' (TO THE OUTSIDE)



SECTION D-3239-2 SCALE: 1/8"=1'-0"
TYPICAL FOR SEPARATION DIKE TO ELEV. 34.0'
TYPICAL FOR CLAY LINER

NOTES

1. FOR GENERAL NOTES & LEGEND SEE DWG. [illegible] (SHEET 1)

REFERENCE DRAWINGS & SPECIFICATIONS
SEE [illegible]

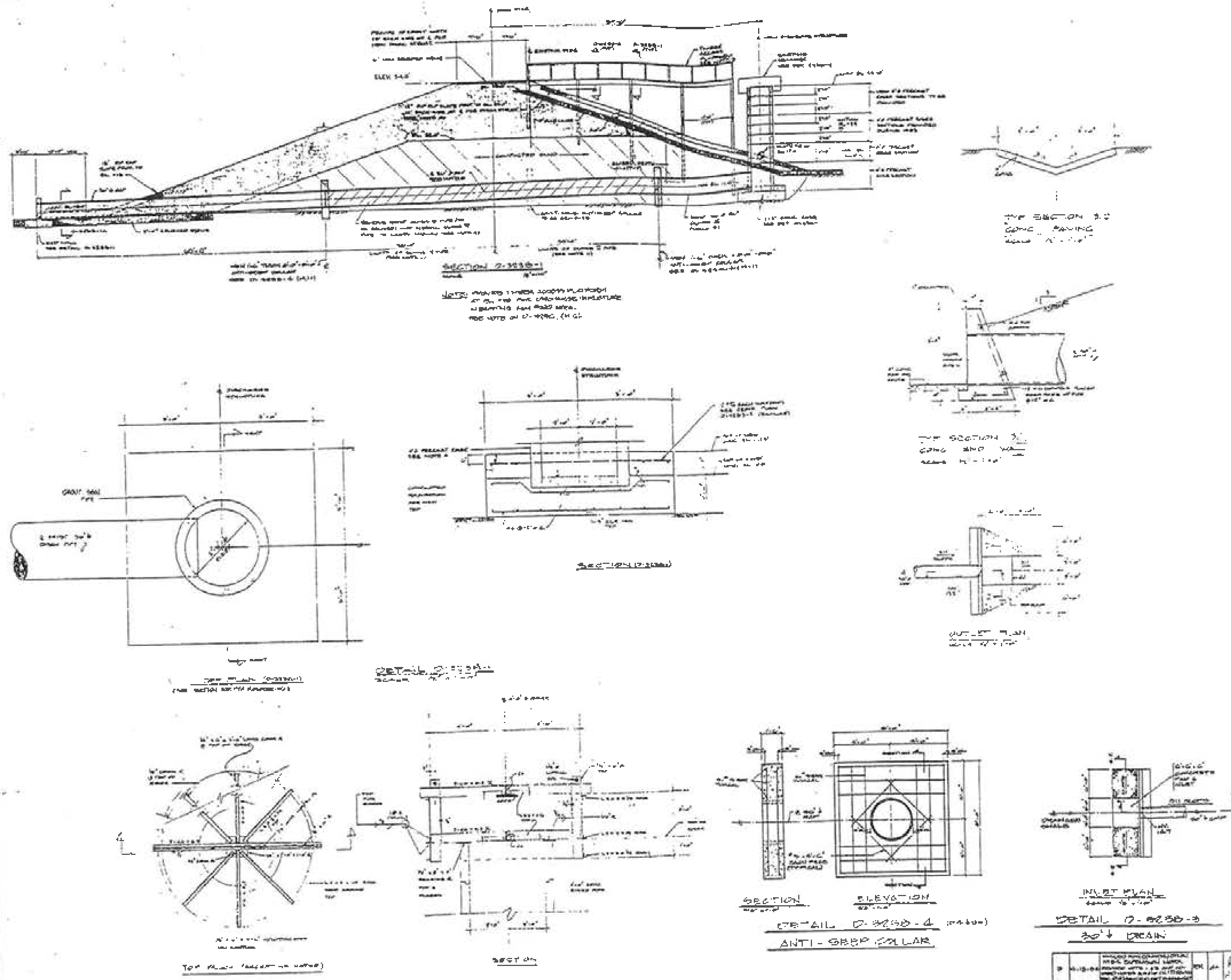
EXHIBIT 7

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION
DIKE SECTIONS (SHEET 2)

NO.	DATE	REVISION	BY	CH.	APPROVED
1	10-14-85	AS-BUILT	[illegible]	[illegible]	[illegible]
0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SCALE AS NOTED
DWG. NO. D-3239



NOTES

[illegible]

2. [illegible]

3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI. [illegible]

4. PRECAST MANUFACTURERS SHALL SUBMIT SHOP DRAWINGS FOR REVIEW AND APPROVAL [illegible]

5. [illegible]

6. [illegible]

7. [illegible]

8. [illegible]

9. [illegible]

10. [illegible]

11. [illegible]

EXHIBIT 8

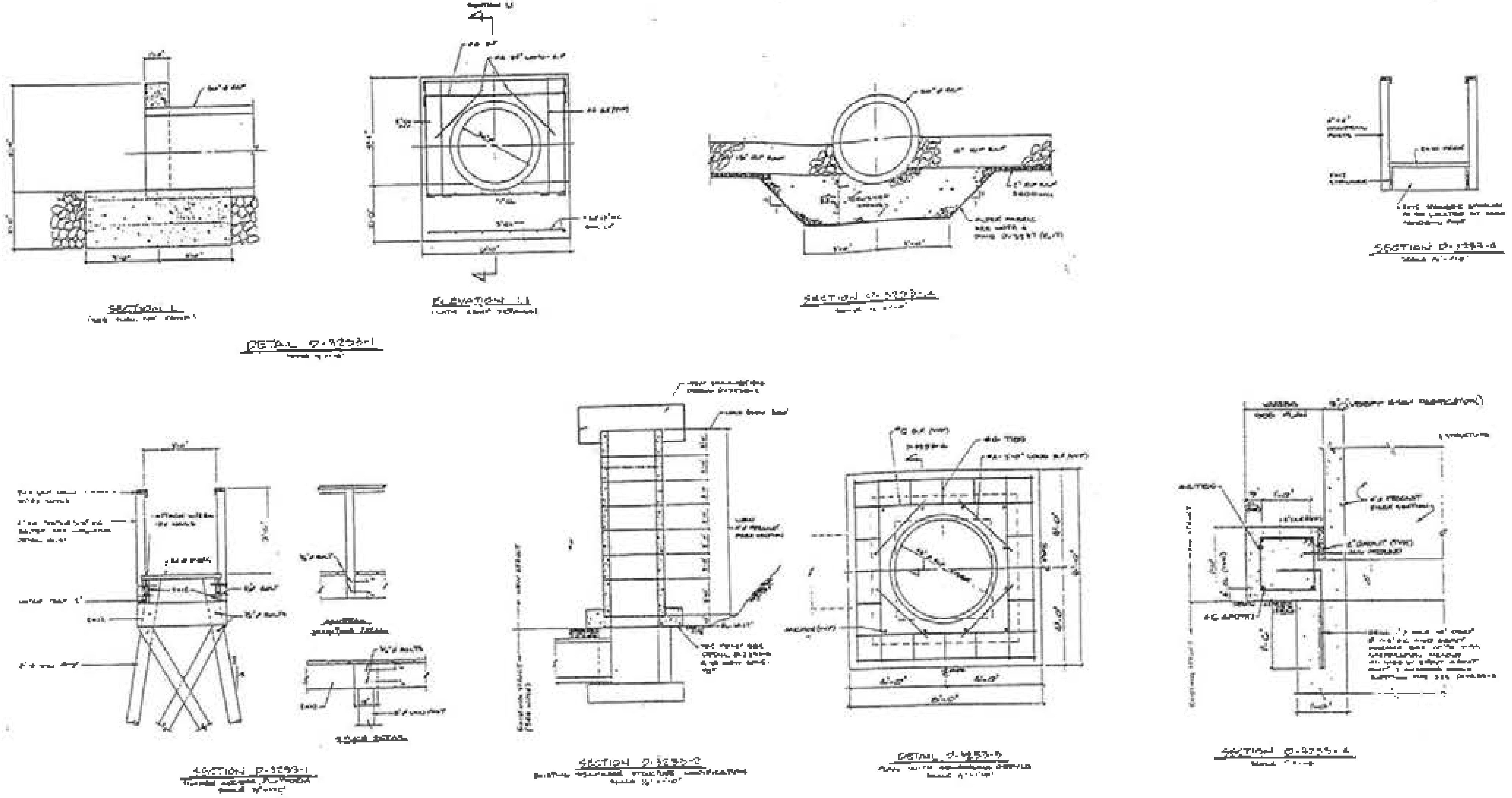
6	12-14-83	AS-BUILT			
5	[illegible]	[illegible]			
4	[illegible]	[illegible]			
NO.	DATE	REVISION	BY	CK	APPROVED

9	[illegible]	[illegible]			
8	[illegible]	[illegible]			
7	[illegible]	[illegible]			
3	[illegible]	[illegible]			
2	[illegible]	[illegible]			
NO.	DATE	REVISION	BY	CK	APPROVED

CAROLINA POWER & LIGHT COMPANY
[illegible]

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
SECTIONS & DETAILS (SHEET 1)

D-3238



NOTES

REFERENCE DRAWINGS & SPECIFICATIONS

EXHIBIT 9

NO.	DATE	REVISION	BY	CK	APPROVED
2	[illegible]	AS-BUILT			
1	[illegible]	[illegible]			
0	[illegible]	[illegible]			
A	[illegible]	[illegible]			

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983–1984
SECTIONS AND DETAILS (SHEET 2)

D-3253

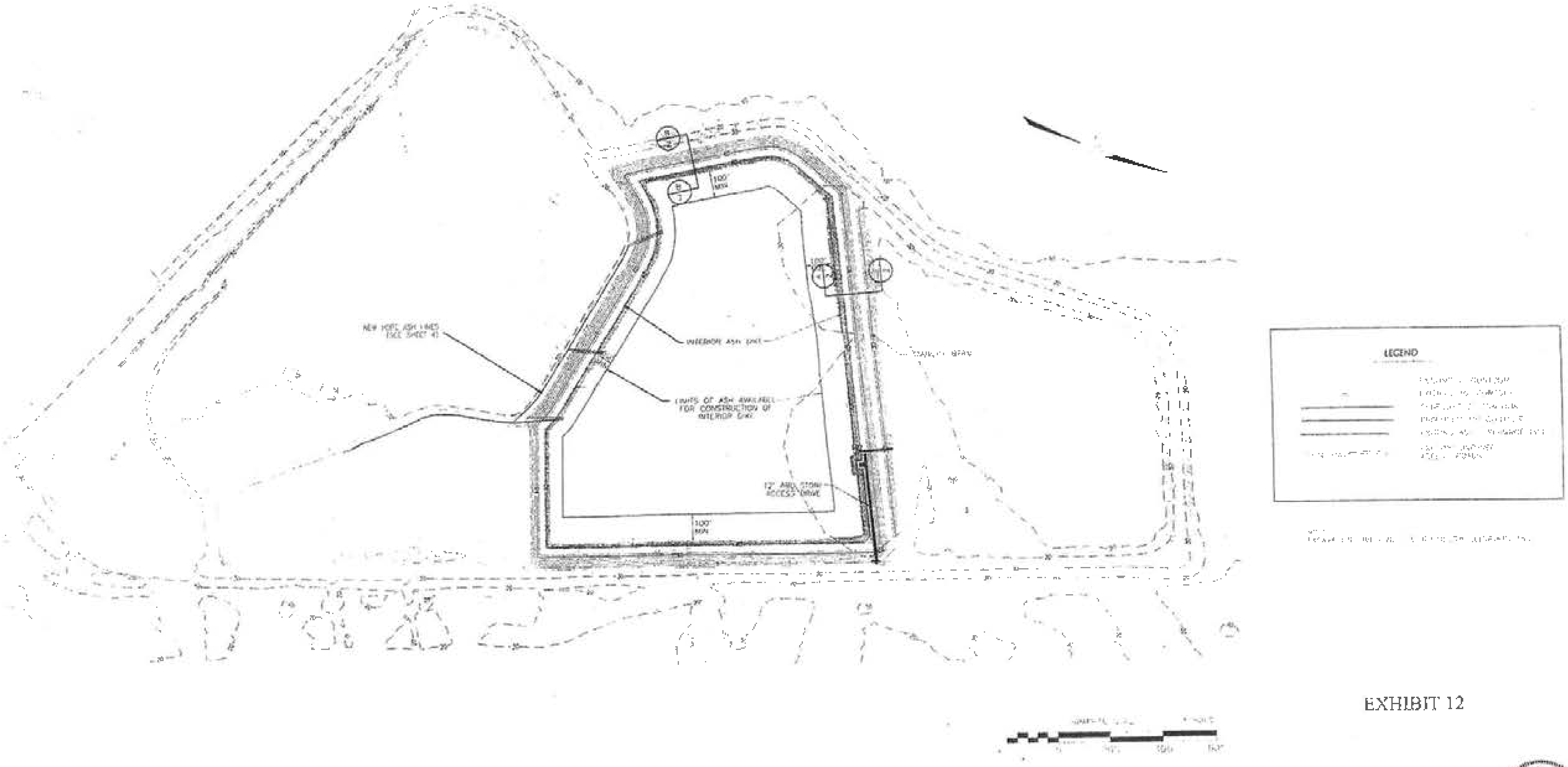


EXHIBIT 12

No.	Revision	Date	By

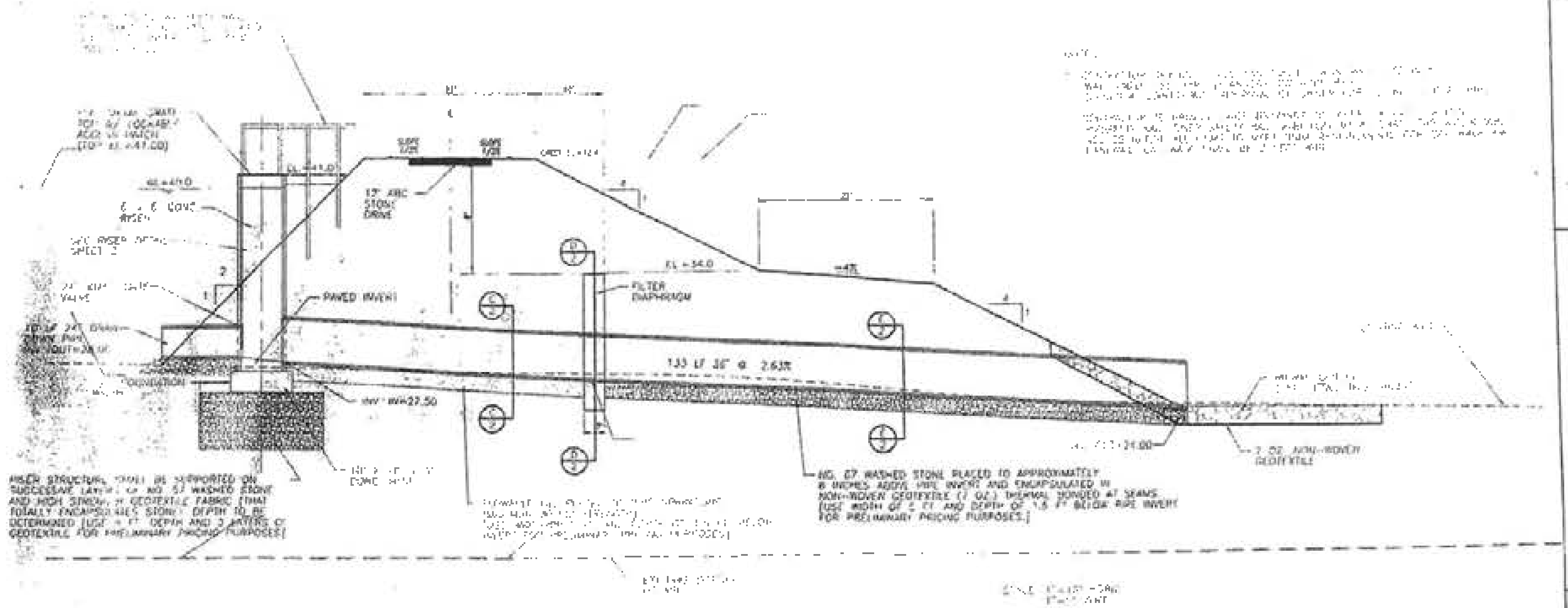
Designer
Scale
Drawn by
Date
Checked by
Job No.

INTERIOR ASH POND DIKE PROJECT
PROGRESS ENERGY
SUTTON PLANT

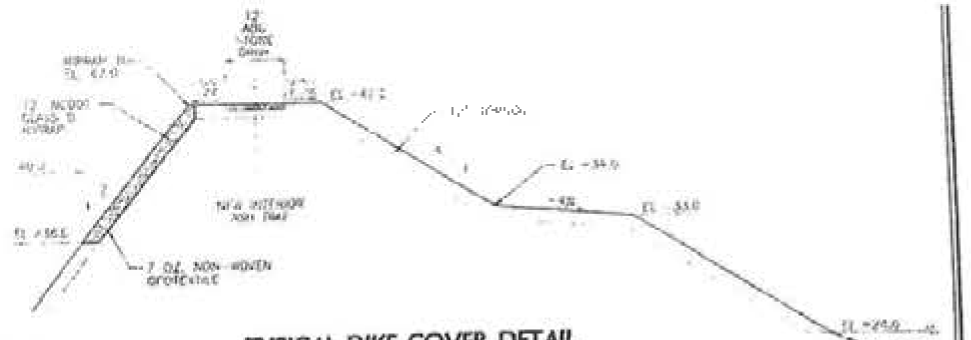
SITE PLAN

WITHERS & RAVENEL
ENGINEERS | PLANNERS | SURVEYORS

Sheet No.
1

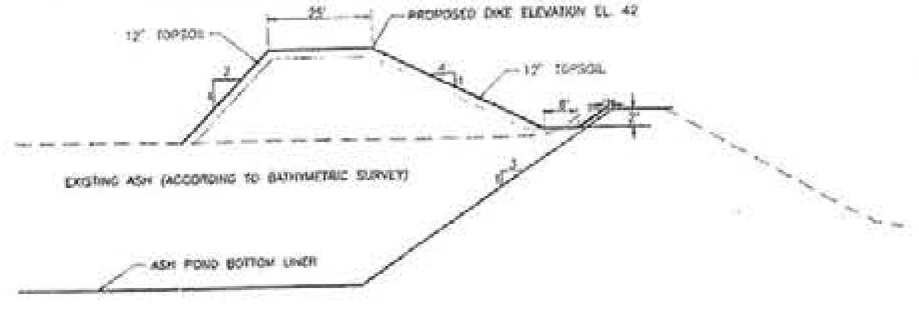


RISER/BARREL PROFILE (A/2)



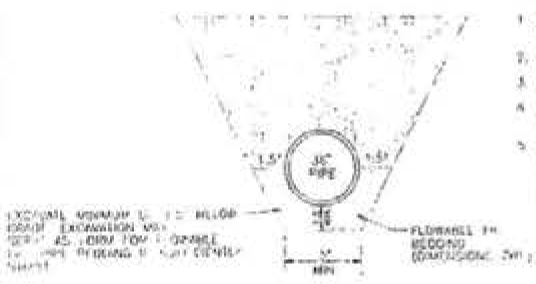
TYPICAL DIKE COVER DETAIL

NTS



INTERIOR DIKE/DITCH SECTION (B/2)

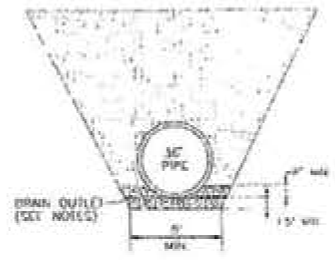
NTS



NOTES:

1. EXCAVATION TO CONFORM TO APPLICABLE OSHA REGULATIONS
2. BOTTOM WIDTH OF EXCAVATION SHALL BE MIN. 5 FEET
3. FLOWABLE FILL SHALL BE PLACED UP TO PIPE SPRINGLINE
4. PIPE TO BE SUPPORTED WITH CONCRETE BLOCKS DURING PLACEMENT OF FLOWABLE FILL BEDDING
5. COMPACT BACKFILL TO 95% OF ASTM D-698 USING HAND OPERATED MECHANICAL TAMPS WITHIN 4 FEET OF THE PIPE(SIDE & TOP). LARGER COMPACTORS AS APPROVED BY THE ENGINEER MAY BE USED ELSEWHERE.

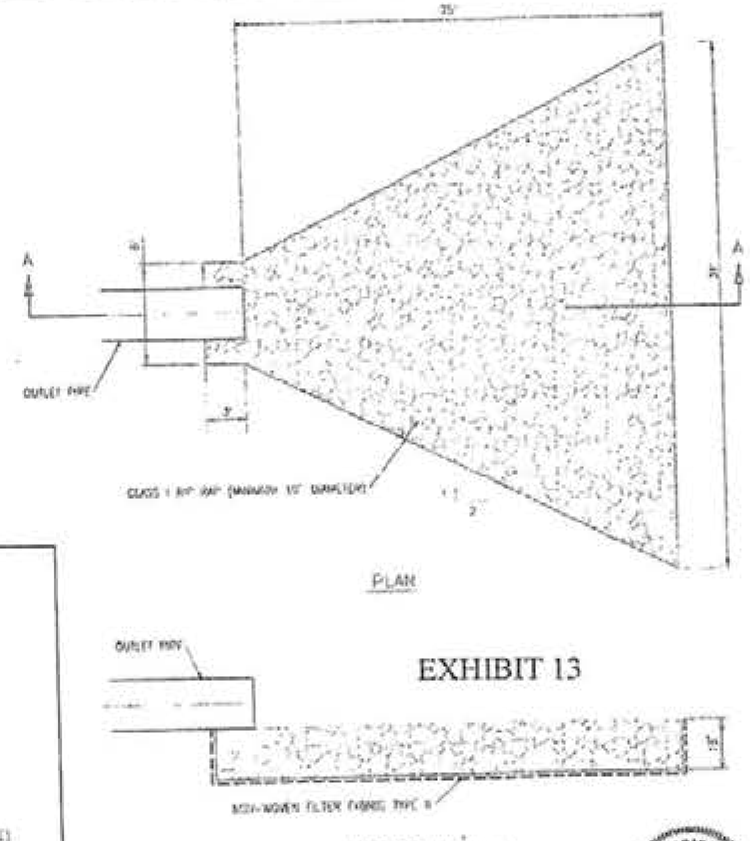
PIPE UPSTREAM OF FILTER DIAPHRAGM (C/2)



NOTES:

1. EXCAVATE TO CONFORM TO APPLICABLE OSHA REGULATIONS
2. EXCAVATE TRENCH TO MINIMUM LIMITS SHOWN
3. DRAIN OUTLET TO BE NCDOT NO. 57 WASHED STONE ENCAPSULATED IN NON-WOVEN FABRIC (7 OZ.) THERMAL BONDED AT SEAMS AND PLACED TO APPROXIMATELY 8 INCHES ABOVE PIPE INVERT.
4. CONTRACTOR MAY USE FLOWABLE FILL AS AN ALTERNATE TO FABRIC-WRAPPED STONE BEDDING. IF FABRIC WRAPPED STONE BEDDING IS USED, PROVIDE 2" ID MACHINE SLOTTED PVC PIPE AS SHOWN BELOW. CONNECT SLOTTED PVC TO SOLID PVC AND RUN ALONG PIPE BEDDING TO DISCHARGE AT OUTLET.

FILTER DIAPHRAGM DRAIN (E/2)



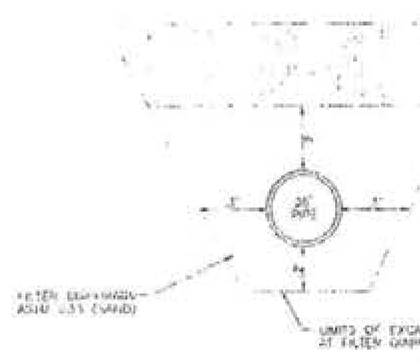
PLAN

SECTION A-A

EXHIBIT 13

RIPRAP OUTLET DETAIL

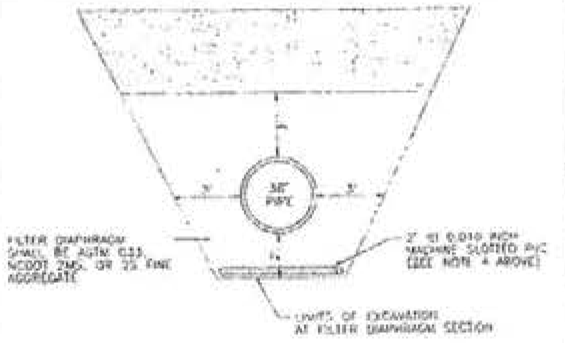
NTS



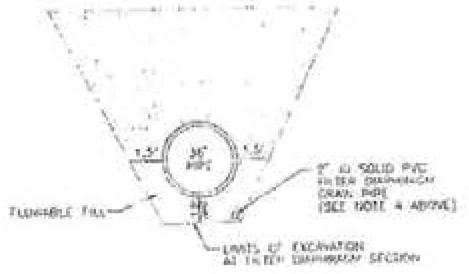
NOTES:

1. FILTER DIAPHRAGM SAND SHALL BE ASTM C33, NCDOT 2MS, OR 2S FINE AGGREGATE
2. FILTER DIAPHRAGM SAND IS TO BE COMPACTED TO 95% OF ASTM D-698

FILTER DIAPHRAGM (D/2)



ALTERNATE FILTER DIAPHRAGM DRAIN (D/2) ALT



ALTERNATE FILTER DIAPHRAGM DRAIN (E/2) ALT

DOUGLAS W.

No.	Revision	Date	By

Designer	Scale AS NOTED
Drawn by	Date 1/25/06
Checked by	Job No.

INTERIOR ASH POND DIKE PROJECT
PROGRESS ENERGY
SUTTON PLANT

NEW OUTFALL STRUCTURE

WITHERS & RAVENEL
ENGINEERS | PLANNERS | SURVEYORS

Sheet No. 2

Appendix D – Dam Information Summary Sheets

DAM INFORMATION SUMMARY
L.V. Sutton Steam Electric Plant
Ash Pond
New Hanover County, North Carolina

1. Location

Located 3 miles northwest of Wilmington, NC

Latitude:	N34° 17' 50"
Longitude:	W77° 59' 30"

2. Size and Dimensions

	1984 Pond	**1983 Pond***
Length:	10,000 feet	7,000 feet
Maximum Structural Height:	32 feet	
Surface Area (acres):	82	
Storage capacity (acre-feet):	1,364	248
Size Classification:	Intermediate	Small
Hazard Classification:	Low	Low
Regulatory Design Storm	100 yr to ½ PMP **	
US Slope:	3.0(H):1(V)	
DS Slope:	3.0(H):1(V)	
Crest Width:	12 feet	
Crest Elevation:	34.0 feet	
Design maximum operating level:	32.0 feet	
Current Operating Level	26.0 feet	
Instrumentation	None	None

* The 1983 pond has been put back into use for short term ash storage.
** 100-year storm is 9.5 inches over 24 hours. Probable Maximum Precipitation (PMP) is 38.1 inches over 48 hours. ½ PMP is 19". The long duration is due to potential for tropical storms.

3. Geology and Seismicity

Located in Coastal Plain Province. Underlain by Castle Hayne Limestone which is eroded through in places to expose the PeeDee Formation

Zone 1 seismic zone according to Corps of Engineers with
Design Earthquake: $a_E = 0.05$ g

4. Design Information

1983 Pond: Originally designed by Brown & Root in 1971, raised to present elevation under CP&L design with assistance from William Wells. Limited subsurface exploration. No information on stability or seepage analyses. No internal drainage.

Outlet works consist of a 4' diameter concrete vertical riser connected to a 3' diameter concrete pipe through the dike that would discharge to the Cooling Lake. There are no seepage collars.

The capacity of the pond and outlet works is sufficient for a 100-yr storm without overtopping the dike.

1984 Pond: Designed by CP&L with assistance from William Wells. Subsurface exploration was performed. Stability was re-evaluated by CP&L in 1987, FS = 1.58. Seepage analysis performed as part of design assuming k = 1x10^{-7} cm/sec for 1-foot thick clay liner with calculated seepage rate of 108 gpm. No internal drainage provided.

Outlet works consist of a 4' diameter concrete vertical riser connected to a 3' diameter concrete pipe through the dike that is connected to piping leading to the Cape Fear River. There are two seepage collars.

The capacity of the pond and outlet works is sufficient for a 100-yr storm without overtopping the dike.

5. Construction History

1983 Pond

Original construction of north Ash Pond dike done in 1971 under direction of Brown & Root to crest elevation of 18.0 feet. In 1983, Dickerson raised north Ash Pond to operating level to elevation 26.0 feet. Testing was conducted.

1984 Pond

- Constructed by Lindsay and Associates under direction of CP&L. Testing was performed.
- Outlet pipe modifications were provided in 1999 to connect discharge to a pipe leading to the Cape Fear River. A pipe joint opened under the upstream slope and seepage through the slope created start of sinkhole. Grouting of slope conducted in 2000 along with slip-lining of the pipe for long-term protection.
- Interior slope repairs on east dike provided in summer, 2001 to fill areas of beaching erosion and reseed.
- Additional storage capacity was constructed and placed in service during 2006. Engineering and design was provided by Withers & Ravenel, and construction by Trans-Ash.
- Repairs were made in 2007 to the interior slope and clay liner on the east side of the pond, north end.

6. Inspection History

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

LAW/MACTEC:	1987, 1997, 2002, 2003, 2004, 2005, 2007, 2008
S&ME:	1992

7. Current Issues

MACTEC performed a limited field visit inspection in 2008. The current issues reported from the 2008 inspection are as follows:

- Continue vegetation maintenance.

8. Overall Condition

The 2008 inspection indicated the dikes are in good condition. No items requiring emergency actions by the plant were noted.

Appendix E- Dam Assessment Forms

FOSSIL GENERATION ASH POND DAM ASSESSMENT FORM

Last Revised 06/22/09

PLANT & UNIT L.V. Sutton Steam Electric Plant

ASH POND 1984 Ash Pond (Active Disposal Area)

VENDOR MACTEC Engineering and Consulting, Inc.

OTHER INFORMATION

Comments Based on site visit March 15, 2009 and previous inspection reports

CONCRETE STRUCTURES	RED	YEL	GRN	Date Revised: 06-22-09 Initials: RSA
CONCRETE SURFACES	☐	☐	☐	NA
STRUCTURAL CRACKING	☐	☐	☐	NA
MOVEMENT	☐	☐	☐	NA
JUNCTIONS	☐	☐	☐	NA
DRAINS	☐	☐	☐	NA
WATER PASSAGES	☐	☐	☐	NA
SEEPAGE	☐	☐	☐	NA
JOINTS	☐	☐	☐	NA
FOUNDATION	☐	☐	☐	NA
ABUTMENTS	☐	☐	☐	NA

EMBANKMENT STRUCTURES	RED	YEL	GRN	Date Revised: 06-22-09 Initials: RSA
SETTLEMENT	☐	☐	🟩	
SLOPE STABILITY	☐	🟨	☐	Riprap slipped down slope for 2006 Area
SEEPAGE	☐	🟨	☐	Plant concern for increased seepage
DRAINAGE SYSTEM	☐	☐	🟩	
SLOPE PROTECTION	☐	🟨	☐	Previous repairs required

SPILLWAY STRUCTURES	RED	YEL	GRN	Date Revised: 06-22-09 Initials: RSA
CONTROL GATES	☐	☐	☐	NA
UNLINED SPILLWAYS	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	☐	NA
STILLING BASIN	☐	☐	☐	NA

OUTLET WORKS	RED	YEL	GRN	Date Revised: 06-22-09 Initials: RSA
INTAKE STRUCTURE	☐	🟨	☐	Possible increased seepage when WL raised
GATES	☐	☐	☐	NA
SLUICES WATER PASSAGES	☐	☐	🟩	
STILLING BASIN	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	🟩	
DRAWDOWN FACILITIES	☐	☐	☐	NA

SAFETY PERFORMANCE INSTRUMENTATION	RED	YEL	GRN	Date Revised: 06/22/09 Initials: RSA
HEADWATER/TAILWATER GAGES	☐	☐	☐	NA
ALIGNMENT INSTRUMENTATION	☐	☐	☐	NA
MOVEMENT INSTRUMENTATION	☐	☐	☐	NA
UPLIFT INSTRUMENTATION	☐	☐	☐	NA
DRAINAGE INSTRUMENTATION	☐	☐	🟩	
SEISMIC INSTRUMENTATION	☐	☐	☐	NA

RESERVOIR	RED	YEL	GRN	Date Revised: 06/22/09 Initials: RSA
SHORE LINE	☐	☐	☐	NA
SEDIMENTATION	☐	☐	☐	NA
HAZARD AREAS	☐	☐	☐	NA
WATERSHED RUNOFF	☐	☐	☐	NA

OPS & MAINT FEATURES	RED	YEL	GRN	Date Revised: 06/22/09 Initials: RSA
RESERVOIR REG. PLAN	☐	☐	☐	NA
MAINTENANCE	☐	☐	☐	NA

DOWNSTREAM CHANNEL	RED	YEL	GRN	Date Revised: 06/22/09 Initials: RSA
DOWNSTREAM CHANNEL	☐	☐	☐	NA

CONCRETE STRUCTURES All concrete structures related to the dam, slopes, or spillway OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 06/22/09 Initials: RSA
CONCRETE SURFACES Evaluate the deterioration and continuing serviceability of the concrete. Conditions should conform to "Guide for Making a Condition Survey of Concrete in Service." ACI Journal, proceedings Vol. 65, No.11, 11/68 pp. 905-918.				Comments: NA
STRUCTURAL CRACKING Examine for cracking resulting from overstress due to applied loads, shrinkage and temperature effects or differential movements.				Comments: NA
HORIZONTAL & VERTICAL MOVEMENT Look for evidence of settlement, heaving, deflections or lateral movements.				Comments: NA
JUNCTIONS Examine junctions of the structure with abutments or embankments. Note any abnormalities.				Comments: NA
DRAINS Ensure any drains are free flowing and capable of performing their function.				Comments: NA
WATER PASSAGES All surfaces in which water passes should be examined for erosion, cavitation, obstructions, leakage, and significant structural cracks.				Comments: NA
SEEPAGE Faces, abutments, and toes should be examined for evidence of abnormal leakage. Records of flow of downstream springs should be reviewed for variation with reservoir pool level				Comments: NA
JOINTS (Monolith and Construction) Determine condition of joint and filler material, any movement of joints, or any indication of distress.				Comments: NA
FOUNDATION Examine for damage of possible undermining of the downstream toe.				Comments: NA
ABUTMENTS Examine for signs of instability or excessive weathering.				Comments: NA

EMBANKMENT STRUCTURES OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☑	GRN Problems likely in > 5yrs ☐	Date Revised: 06/22/09 Initials: RSA
SETTLEMENT Embankment and downstream toe area need to be checked for localized settlement, depressions, or sink holes.			X	Comments: No concern for settlement noted
SLOPE STABILITY Examine for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond toe, and surface cracks which indicate movement.		X		Comments: No concern for slope stability noted for 1984 Ash Pond Area. Rip rap protection for inside slope of 2006 Interior Area has slipped down slope in one location.
SEEPAGE The downstream face of abutments, embankment slopes and toes, embankment - structure contacts, and the downstream valley areas should be examined for evidence of existing or past seepage. The sources of seepage should be investigated to determine cause and potential severity to dam safety under all operating conditions. The presence of animal burrows and tree growth on slopes which might cause detrimental seepage should be examined		X		Comments Plant identified concern for possible increased seepage for 1984 Pond Area when water level raised. Piezometers installed to monitor water level in dike to support seepage investigation. No concerns for seepage or related slope stability identified from inspection.
DRAINAGE SYSTEMS All drainage systems should be examined to determine whether the systems can freely pass discharge and that the discharge water is not carrying embankment or foundation material. Systems used to monitor drainage should be examined to assure they are operational and functioning properly.			X	Comments: No concern for drainage identified.
SLOPE PROTECTION The slope protection should be examined for erosion-formed gullies and wave-formed notches and benches that have reduced the embankment cross-section or expose less wave resistant materials. The adequacy of slope protection against waves, currents, and surface runoff that may occur at the site should be evaluated. The condition of vegetative cover should be evaluated where pertinent.		X		Comments: Grass appeared to be sparse in some areas. Slope repair has been required in past to address erosion on interior slope. No significant concern observed for current inspection.

Date Revised: 06/22/09 Initials: RSA

SPILLWAY STRUCTURES Examination should be made of the structures and features including bulkheads, flashboard, and fuse plugs of all service and auxiliary spillways which serve as principal or emergency spillways for any condition which may impose operational constraints on the functioning of the spillway. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	
CONTROL GATES & OPERATIONAL MACHINERY Structural members, connections, hoists, cables and operating machinery and the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the equipment. Where cranes are intended to be used for handling gates and bulkheads, the availability, capacity and condition of the cranes and lifting beams should be investigated. Operation of control systems and protective and alarm devices such as limit switches, sump high water alarms and drainage pump should be investigated.	☐	☐	☐	Comments: NA
UNLINED SADDLE SPILLWAYS Examine for evidence of erosion and any conditions which may impose constraints on the function of the spillway. The ability of the spillway to resist erosion due to operation and the potential hazard to the safety of the dam.	☐	☐	☐	Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.	☐	☐	☐	Comments: NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.	☐	☐	☐	Comments: NA
STILLING BASIN Basin and energy dissipators should be examined for any conditions which may pose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined.	☐	☐	☐	Comments: NA

OUTLET WORKS All structures and features designed to release reservoir water below the spillway crest through or around the dam. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☑	GRN Problems likely in > 5yrs ☐	Date Revised: 06/22/09 Initials: RSA
INTAKE STRUCTURE Examine for any conditions which may impose operational constraints on the outlet works. Entrances to intake structure should be examined for conditions such as silt or debris accumulation which may reduce the discharge capabilities of the outlet works.		X		Comments: Possible increased seepage observed by plant with water level at Elevation 30.0. Water level reported as lowered to Elevation 28 in January, 2009.
OPERATING AND EMERGENCY CONTROL GATES Structural members, connections, guides, hoists, cables and operating machinery including the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the operating and emergency gates, valves, bulkheads, and other equipment.				Comments: NA
CONDUITS, SLUICES, WATER PASSAGES, ETC. Interior surfaces of conduits should be examined for erosion, corrosion, cavitation, cracks, joint separation and leakage at cracks or joints.			X	Comments: No concerns noted with current inspection.
STILLING BASIN Basin and energy dissipaters should be examined for any conditions which may impose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined by surroundings.				Comments: NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.			X	Comments: No concern noted for current inspection.
DRAWDOWN FACILITIES Facilities provided for drawdown of the reservoir to avert impending failure to the dam or to facilitate repairs in the event of stability or foundation problems should be examined for any conditions which may impose constraints on their functioning as planned.				Comments: NA

SAFETY & PERFORMANCE INSTRUMENTATION Available records and readings of installed instruments should be reviewed to detect any unusual performance of the instruments or evidence of unusual performance of the structure. The adequacy of the installed instrumentation to measure the performance and safety of the dam should be determined. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☑	GRN Problems likely in > 5yrs ☐	Date Revised: 06/22/09 Initials: RSA
HEADWATER AND TAILWATER GAGES Existing records of the headwater and tailwater gages should be examined to determine the relationship between other instrumentation measurements such as stream flow, uplift pressures, alignment, and drainage system discharge with the upper and lower water surface elevations.				Comments: NA
HORIZONTAL & VERTICAL ALIGNMENT INSTRUMENTATION (CONCRETE STRUCTURES) The existing records of alignment and elevation surveys and measurements from inclinometers, inverted plumb bobs, gage points across cracks and joints, or other devices should be examined to determine any change from the original position of the structures.				Comments: NA
HORIZONTAL & VERTICAL MOVEMENT, CONSOLIDATION, AND PORE-WATER PRESSURE INSTRUMENTATION (EMBANKMENT STRUCTURES) The existing records of measurements from settlement plates or gages, surface reference marks, slope indicators and other devices should be examined to determine the movement history of the embankment. Existing piezometer measurements should be examined to determine if the pore-water pressures in the emankment and foundation would impair the safety of the dam, under given conditions.				Comments: NA
UPLIFT INSTRUMENTATION Records of uplift measurements should be examined to determine if the uplift pressures for the maximum pool would impair the safety of the dam.				Comments: NA
DRAINAGE SYSTEM INSTRUMENTATION Records of measurements of the drainage system flow should be examined to establish the normal relationship between elevations and discharge quantities and any changes that have occurred in this relationship during the history of the dam.			X	Comments Continue to monitor toe drain outlet pipes for increase in seepage flow.
SEISMIC INSTRUMENTATTION The existing records of seismic instrumentation should be examined to determine the seismic activity in the area and the response of the structures to past earthquakes.				Comments: NA

RESERVOIR The following features of the reservoir should be examined to determine to what extent the water impounded by the dam would constitute a danger to the safety of the dam or a hazard to human life or property.	**RED** Problems Likely in < 2yrs	**YEL** Problems likely in 2 - 5yrs	**GRN** Problems likely in > 5yrs	Date Revised: 06/22/09	RSA
OVERALL RATING >>>	☐	☐	☐		
SHORE LINE The land forms around the reservoir should be examined for indications of major active or inactive landslide areas and to determine susceptibility of bedrock stratigraphy to massive landslides of sufficient magnitude to significantly reduce reservoir capacity or create waves that might overtop the dam.	☐	☐	☐	Comments: NA	
SEDIMENTATION The reservoir and drainage area should be examined for excessive sedimentation or recent developments in the drainage basin which could cause a sudden increase in sediment load thereby reducing the reservoir capacity with attendant increase in maximum outflow and maximum pool elevation.	☐	☐	☐	Comments: NA	
POTENTIAL UPSTREAM HAZARD AREAS The reservoir area should be examined for features subject to potential backwater flooding resulting in loss of human life or property at reservoir levels up to the maximum water storage capacity including any surcharge storage.	☐	☐	☐	Comments: NA	
WATERSHED RUNOFF POTENTIAL The drainage basin should be examined for any extensive alterations to the surface of the drainage basin such as changed agriculture practices, timber clearing, railroad or highway construction or real estate developments that might extensively affect the runoff characteristics. Upstream projects that could have impact on the safety of the dam should be identified	☐	☐	☐	Comments: NA	

OPERATION AND MAINTENANCE FEATURES OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 06/22/09	Initials: RSA
RESERVOIR REGULATION PLAN The actual practices in regulating the reservoir and discharges under normal and emergency conditions should be examined to determine if they comply with the designed reservoir regulation plan and to assure that they do not constitute a danger to the safety of the dam or to human life or property.	☐	☐	☐	Comments: NA	
MAINTENANCE The maintenance of the operating facilities and features that pertain to the safety of the dam should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.	☐	☐	☐	Comments: NA	

DOWNSTREAM CHANNEL The channel immediately downstream of the dam should be examined for conditions which might impose any constraints on the operation of the dam or present any hazards to the safety of the dam Development of the potential flooded area downstream of the dam should be assessed for the compatibility with the hazard classification.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	Date Revised: 06/22/09 Initials: RSA
OVERALL RATING >>>	☐	☐	☐	
DOWNSTREAM CHANNEL				Comments: NA

APPENDIX A

Document 7

2010 Annual Inspection

MACTEC
engineering and constructing a better tomorrow

December 16, 2010

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

Subject: **REPORT OF 2010 LIMITED (ANNUAL) FIELD INSPECTION**
COOLING POND AND ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA
MACTEC PROJECT NO. 6468-10-0025 (04)
SUTTON 1972 COOLING POND – STATE ID NO. NEWHA-003
SUTTON 1971 ASH POND – STATE ID NO. NEWHA-004
SUTTON 1984 ASH POND – STATE ID NO. NEWHA-005

Dear Mr. Forster:

On May 19, 2010, Mr. Scott Auger of MACTEC Engineering and Consulting, Inc. (MACTEC) visited the L.V. Sutton Steam Electric Plant to perform a limited field inspection of the Cooling Pond and the Ash Pond Dikes. Prior to the inspection, we reviewed the 2009 Limited (Annual) Ash Pond and Cooling Pond Dikes to confirm observations from previous inspections. The plant contacts for Progress Energy during this inspection included Mr. Bruce Moorefield, Mr. Kent Tyndall, and Mr. Isaac Alderman.

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
NEWHA-003	Sutton 1972 Cooling Pond	Low
NEWHA-004	Sutton 1971 Ash Pond	Low
NEWHA-005	Sutton 1984 Ash Pond	Low

The field inspection included a discussion of maintenance activities since the last inspection visit, review of available records and a driving/walking reconnaissance of the Ash Pond and Cooling Pond dikes. The weather conditions during the inspection were clear, warm and dry. Mr. Alderman reported that about 0.7 inches of rainfall had been recorded on site within the past 48 hours prior to the inspection. This letter report summarizes the observations during the current inspection and provides recommendations for any follow-up actions. Photographs of selected conditions and updated Progress Energy condition assessment forms are also included with this report by attachment.

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue, Raleigh, NC 27604 • Phone: 919.876.0416 • Fax
License Number: NC Engineering F-0653 · NC Geology C-247
www.mactec.com

The last 5-year independent consultant inspection was performed by MACTEC in December, 2007 and the next will be in 2012.

To finalize of this report, MACTEC has checked on current status for plant response to the conditions noted for follow-up action. In addition, Mr. Scott Auger of MACTEC performed a site visit for field review of conditions noted for follow-up action on December 15, 2010. The results for our review of follow-up actions are appropriately noted in this report.

SUMMARY

Ash Pond Inspection Summary

Based on the field observations noted in this report, the ash pond dikes generally appear to be stable and in satisfactory condition.
The new recommendations for follow-up noted in the current inspection are as follows:

- (AP-2010-1) 1983/1971 Ash Pond - Follow-up should be provided to confirm that the water level has been lowered consistent with recommendations by NCDENR Dam Safety. *(Follow-up Note: Plant personnel reported that the water level was lowered 1 foot during 2010. This was confirmed during the MACTEC site visit on 12/15/10.)*
- (AP-2010-2) 1983/1971 Ash Pond - We recommend providing a field survey to check the elevation of the crest and then provide fill as needed to restore the crest to the design Elevation 28.0.
- (AP-2010-3) 1984 Ash Pond – Locate and fill animal burrows identified during the current inspection. *(Follow-up Note: Plant personnel reported that no maintenance work was provided for animal burrows during 2010. However, the animal burrows could not be located during the MACTEC site visit on 12/15/10 and may have been covered over by wheel tracks from mowing equipment. No new animal burrows were located.)* .
- (AP-2010-4) 1984 Ash Pond - We recommend providing a field survey to check the elevation of the crest and then provide fill as needed to restore the crest to the design Elevation 34.0. We also recommend providing a field survey to check the elevation of the crest for the interior storage area dike and then providing fill as needed to restore the crest to the design Elevation 42.0.

Cooling Pond Inspection Summary

Based on the field observations noted in this report, the cooling pond dikes generally appear to be stable and in satisfactory condition.

There are no new follow-up recommendations for this inspection.

RECORDS

During 2009, MACTEC installed 18 new piezometers for the 1984 Ash Pond area to support seepage investigations. The results for the seepage investigations are summarized in the MACTEC report dated April 20, 2010 (included as Appendix B). The piezometer data does not appear to indicate that the water level in the dikes is increasing or represents a concern for dike stability.

There are currently no other active piezometers or monitoring instrumentation for the Ash Pond dikes or Cooling Pond dikes.

We confirmed with plant personnel that routine inspections are being performed consistent with the Sutton Plant Dam and Dike Inspection Procedure, EVC-SUTC-00038, Revision 1, dated September, 2009. We confirmed that the routine inspections are continuing to be performed by the plant staff. We understand that Mr. Alderman is performing a documented routine inspection for the Ash Pond area on a monthly basis, and Mr. Moorefield is performing weekly documented inspections for the Cooling Pond.

ACTIVITIES SINCE 2009 INSPECTION

Routine maintenance activities are covered under the following discussion of Field Observations.

On September 27, 2010, a small breach occurred through a section of the 1984 Ash Pond dike on the east side associated with heavy rainfall. As requested by Progress Energy, Mr. J. Allan Tice of MACTEC visited the site to provide engineering support for the initial damage assessment and emergency response plan development. MACTEC is providing support to Progress Energy for development and implementation of a repair plan. *(Follow-up Note: This condition was checked during the MACTEC site visit on 12/15/10. Permanent repairs have not yet been implemented for the breach location because Progress Energy has not received approval of the repair plan from NCDENR Dam Safety. The temporary repair provided for the breach location appears to be stable and a suitable vehicle travel path has been provided. We observed that Progress Energy has implemented drainage improvements in the area of the breach.)*

Prior to issuing this report, Progress Energy authorized MACTEC to perform field investigations and engineering analysis to review the stability of the 1983/1971 Ash Pond dikes.

ASH POND FIELD OBSERVATIONS

1983/1971 Ash Pond

The 1983 Ash Pond dikes were formed by raising the original dikes constructed in 1971. The present dikes have a design crest elevation varying from Elevation 28.0 to Elevation 34 (assumed as feet MSL where Elevation is noted). The higher elevation is at the common dike with the 1984 Ash Pond. The area of standing water near the discharge structure on west side of the pond appeared to be similar in extent to previous inspections. We also observed standing water adjacent to the dike along the discharge canal on the south side of the pond area. We understand that this area currently receives storm water inflow from plant sources including retention ponds, coal pile runoff, and tank farm drainage.

In 2006, a temporary interior storage area was constructed by placement of a containment berm within the pond area. The containment berm has an outlet structure which directs flow to the area of standing water on the west side of the pond. We understand the interior storage area was taken out of service in 1985, but then returned to service in 2001 for temporary use during maintenance work and ash removal activities in the 1983 and 1984 ponds. We also understand that the interior storage area is now actively used for bottom ash disposal operations along with temporary use for fly ash disposal operations. The containment berm for this temporary interior storage area is not included in the independent consultant dam inspection scope.

MACTEC has previously recommended engineering review of the dike stability if the 1983/1971 Ash Pond area is returned to active service for ash disposal operations (see previous recommendation AP-2009-2 updated for this report). In consideration of the current active service for the 1983/1971 Ash Pond described with this report, MACTEC has been authorized by Progress Energy to perform field investigations and engineering analysis to review the stability of the dikes.

The discharge structure is located in the northwest corner of the pond at the area of standing water. The discharge structure consists of a 48-inch diameter vertical concrete riser connected to a 12-inch diameter concrete outlet pipe. The end of the discharge pipe is submerged in the cooling pond and in not visible for inspection. At the time of our inspection, the discharge riser crest was set at about Elevation 25.8. Based on follow-up discussions with the plant, we understand that the discharge riser crest has been lowered by 1 foot to Elevation 24.8. This action was reported to have occurred on September 8, 2010 in response to comments from NCDENR Dam Safety. *(Follow-up Note: MACTEC confirmed that the water level was lowered during the site visit on 12/15/10. We also observed that the skimmer mounted on the discharge riser had a noticeable tilt toward the access walkway from the dike. Plant personnel reported that the tilt was noticed after removal of a section of the riser to lower the water level.)*

The dike crest generally appeared to be stable with no indications of unusual settlement or displacement. The crest does appear to have ruts developing along the vehicle wheel path. Previous reports have indicated that the minimum crest level for the dike is around Elevation 27.6 (compared to the design crest Elevation 28.0). We recommend providing a field survey to check the elevation of the crest and then providing fill as needed to restore the crest to the design Elevation 28.0.

The dike slopes generally appeared to be stable. The exterior slope of the west dike, from the intersection with the 1984 Ash Pond dike to about 300 feet south of the discharge structure has sparse grass cover for surface stabilization. The exterior slope along the discharge canal has a relatively thick growth of trees and brush. Progress Energy should consider maintenance cutting of trees and brush to facilitate inspection. *(Follow-up Note: This condition was checked during the MACTEC site visit on 12/15/10. Maintenance cutting of brush and trees has been provided for upper portion of exterior slope along canal. The lower portion of the exterior slope still has a thick growth of trees and brush.)*

Photographs 1-4 are included in Appendix A to represent conditions observed for the 1983/1971 Ash Pond dike.

1984 Ash Pond Area

The dikes for the 1984 pond are constructed of sand with an interior clay liner. The clay liner extends across the pond bottom as well. The crest width is 12 feet and slopes (interior and exterior) are 3(H):1(V). The maximum developed dike height is about 32 feet above original grade, and the design crest level for the dikes is at Elevation 34.0 (assumed as feet MSL where Elevation is noted). The length including the common dike with the 1983 pond is about 10,000 feet.

At the time of this inspection, the riser crest was reported to be at Elevation 30.0. It was also reported Progress Energy that the water level was raised to the current elevation on June 25, 2009 (from Elevation 28.0). The MACTEC report dated April 20, 2010 included in Appendix B, along with current inspection activities, indicates that seepage is not emerging on the exterior slope and seepage does not represent an immediate concern for dike stability.

The dike crest generally appeared to be stable with no indications of unusual settlement or significant displacement. We recommend providing a field survey to check the elevation of the crest and then providing fill as needed to restore the crest to the design Elevation 34.0.

The interior slopes generally appeared to be stable. The interior slopes have a thick growth of Phragmites along with patches of briers. Grass and briers are also present in the riprap slope protection on the interior slope along the east side of the pond area. From our review, the thick growth of Phragmites is beneficial for slope stabilization and protection from wave action along the water line. However, we recommend continuing to cut the vegetation on upper portion of the interior slope to facilitate inspection.

Photographs 5-16 are included in Appendix A to represent conditions observed for the 1984 Ash Pond dike.

A walking inspection was performed with Mr. Alderman along the outside slope of the dike on the east, north and west sides of the Ash Pond. Mr. Alderman was checking for areas that required maintenance work. During this walking inspection, we observed areas where the sand has shifted or washed down slope. We understand that the plant is planning to mulch and seed these areas to provide surface stabilization. Mr. Alderman also pointed out two locations that appeared to be animal burrows. There is a fairly large burrow located near the top of the exterior slope on the east side of the Ash Pond (Photograph 17). The burrow has an opening of about 1 foot in diameter and was over 4 feet in depth when probed. We also observed a small burrow located on the north exterior slope of the dike (Photograph 18). We understand the plant intends to locate and fill these holes as a routine maintenance activity. *(Follow-up Note: Plant personnel reported that no maintenance work was provided for animal burrows during 2010. However, the animal burrows could not be located during the MACTEC site visit on 12/15/10 and may have been covered over by wheel tracks from mowing equipment. No additional animal burrows were located.)*

The exterior slopes generally appeared to be stable but are sparsely vegetated with grass along with some briers and small bushes. Because of the sparse vegetation, we are noticing some surface erosion and shifting of loose sand on the exterior slopes. This condition is especially noticeable for exterior slopes along the north dike. This condition should be monitored during routine inspections for development of erosion gullies that could potentially undermine the crest.

The vertical riser for the discharge structure was observed from the access platform (Photograph 19). The skimmer structure and interior surfaces appeared to be in good visual condition. The downstream outlet/diversion structure appeared to be structurally sound with no obvious signs of leakage or significant cracking (Photograph 20). The discharge from the outlet structure appeared to be free flowing at the time of inspection.

There were no surface depressions or seepage observed on the dike above the diversion pipe. *(Follow-up Note: This condition was checked during the MACTEC site visit on 12/15/10. A walking inspection was performed to check for surface depressions and seepage along the toe of the dike for the buried pipe. No concerns were identified from this follow-up inspection.)*

1984 Ash Pond Interior Storage Area

In 2006, Progress Energy constructed an interior ash storage area (also referred to as the interior containment area) for the south end of the 1984 Ash Pond. The storage capacity addition was designed by Withers & Ravenel and constructed by Trans Ash. The design crest is at Elevation 42.0, and the planned normal water level is Elevation 40.0. The maximum dike height above the original ash level is about 14 feet, and the crest width is 25 feet. The interior slope is 2(H):1(V) and the exterior slope slope is 4(H):1(V). Where the new dikes are adjacent to the 1984 pond perimeter dikes, the toe of the slope is set back eight feet and graded to drain toward the north. A stability berm is provided on the north side where the dike is adjacent to the impounded water of the 1984 pond.

The water level for the interior containment area appeared to be the same as the last inspection at about Elevation 40.0.

The crest generally appeared to be stable with no indications of unusual settlement or displacement. The crest is becoming somewhat uneven and rutted from vehicle traffic. Gravel stabilization for vehicle access is provided only from the access ramp at the northeast corner to the discharge structure. We recommend providing a field survey to check the elevation of the crest and then providing fill as needed to restore the crest to the design Elevation 42.0.

The exterior slopes generally appeared to be in good condition with no indications of stability concerns. The vegetation on the exterior slopes appears to be sparse, and the slope should be routinely checked for erosion. We did not observe any significant surface erosion during the current inspection. Photographs 21 and 22 provide representative views of the condition of the containment dike from the northeast corner.

Previous inspections have noted depressions and erosion in the stability berm on the north side of the interior containment area. The plant reports that all depressions have been filled. No new depressions were noted during this inspection. Photograph 23 provides a representative view of the stability berm. *(Follow-up Note: This condition was checked during the MACTEC site visit on 12/15/10. With vegetation cut and seasonally dormant, we were able to more carefully check for surface depressions. One small surface depression and an area of localized settlement were observed along the toe. This localized condition appeared to be stable and does not require immediate repair.)*

Some localized riprap loss was noted on the interior slope on the north side of interior storage area for follow-up in the 2009 inspection report. This riprap loss was confirmed as satisfactorily repaired during the current inspection. We did not observe new locations with displacement or loss of riprap slope protection.

The discharge structure for this interior storage area consists of a concrete riser structure six feet square connected to a 36-inch diameter HDPE pipe with an outlet invert set at Elevation 24.0 feet. The discharge structure appeared to be structurally sound with no indications of displacement. The outlet pipe for the discharge structure could not be inspected because the water level at the toe of the stability berm covered the end of the pipe. (Photographs 24 & 25) *(Follow-up Note: The condition of the area where the outlet pipe discharges into the 1984 Ash Pond was checked during the MACTEC site visit on 12/15/10. Flow could be observed emerging into the standing water in the vicinity of the outlet pipe.)*

Ash Pond Summary of Recommendation

Based on the current inspection results, the status for addressing recommendations from the 2007 5-year Inspection Report and recent annual inspections are summarized as follows:

Ref No.	**Recommendations**	**Recommended Time for Implementation**	**Current Status** ***(See note below table)***
AP-2009-1 (2006 Interior Containment Area)	Riprap material on the inside slope was observed to have slipped down the slope on the north side of the dike near the discharge structure (localized condition).	Repair Complete (2010)	Repairs have been provided by the plant.
AP-2009-2 (1983/1971 Ash Pond Area)	We recommend providing an updated engineering review of dike stability and adequacy of the discharge structure in consideration for the current active utilization of the 1983/1971 Ash Pond area. (Recommendation updated for 2010 Report)	Provide updated review during 2011.	Inspection of this area provided by MACTEC for 2010. Follow-up review authorized by Progress Energy in December, 2010.
AP-2009-3 (1984 Ash Pond)	MACTEC provided support for investigation of possible increased seepage for the 1984 Ash Pond area associated with raising the pond operating level. Further review of this condition may be warranted if the plant considers raising the water level in the future.	Complete (2010)	MACTEC report issued on 4/20/10.
AP-2007-1 (1983/1971Ash Pond)	The large brushy vegetation on the west dike should be trimmed to allow better slope visibility	Routine Maintenance	Maintenance cutting provided for slope in vicinity of discharge structure during 2010.
AP-2007-2 (1983/1971Ash Pond)	Progress Energy's program of cutting trees on the exterior slopes should continue.	Routine maintenance	Large trees still present on downstream slope along discharge canal (no change for 2010)

AP-2007-3 (1983/1971Ash Pond)	If operation of the 1983 pond is resumed, the exterior slope adjacent to the Cooling Pond and discharge canal should be checked during the monthly inspections for signs of seepage.	Routine inspection	Inspection provided by plant in 2010 consistent with current procedure.
AP-2007-4 (1984Ash Pond)	Patches of briers and small brush on the interior slope should be controlled by spraying or cutting so the slope can be observed during routine inspections.	Routine maintenance.	Plant is cutting upper portion of dike slope that can be reached by mowing equipment from crest. Thick growth along the toe is beneficial for slope stabilization and protection from wave action.
AP-2007-5 (1984Ash Pond)	Progress Energy's program of cutting trees on the exterior slopes should continue.	Routine maintenance	Slopes have been cleared of brush and trees to the toe of slope.
AP-2007-6 (1984Ash Pond)	The east dike interior repair area should be monitored for progress of vegetative growth. The rip rap should be sprayed as needed to control vegetation.	Routine maintenance	No spraying or clearing provided during 2010.

Note: The status for action items was reviewed with plant personnel prior to issuing this report.

COOLING POND FIELD OBSERVATIONS

The observations for the current inspection are generally consistent with the conditions noted for the 2009 Annual Inspection Report.

The Cooling Pond has an estimated surface area of 1,100 acres and storage capacity at normal pool level estimated at 6,900 acre-feet. Water from the plant enters the pond from a discharge canal at the southeast end of the pond. Circulation of the water through the pond is controlled by a central main baffle dike and a series of "wing"dikes. After cooling, water is taken back into the plant through an intake canal at the south end of the pond.

The water level in the pond is normally maintained around Elevation 9.5. Water can be introduced from the Cape Fear River to the pond area using makeup pumps located as indicated on the attached Photograph Location Plan. The water level can also be lowered to Elevation 2.5 by two sluice gates located near the end of the of the intake canal. The water level at the time of inspection was reported to be between Elevation 9.5 and 9.7. The plant also reported that water was being repeatedly released and subsequently replaced (refilled by make-up pumping) in an effort to control algae growth in the pond. Water was being released at the time of the inspection.

Other than makeup water, inflow into the pond is limited to direct rainfall, surface water runoff from land adjacent to the northeast portion of the pond, and discharge water from the ash pond east of the cooling pond. As a result of a 1998 modification, Ash Pond discharge can be routed either to the Cape Fear River or to the Cooling Pond.

The crest of the dike has a soil cement layer that is badly cracked and, in some places, missing. Gravel has been placed in areas where the soil cement has deteriorated to the point of not being intact. Local low areas were present along the crest. Previous inspections have recommended that a survey should be conducted to confirm the crest elevation; the survey has not been performed as of the date of the current inspection. There was no significant change in this condition noted for the current inspection.

At several locations, cracks parallel to the dike and about three to four feet back of the interior edge have been observed. Previous inspections have recommended monitoring for appearance of open cracks and providing appropriate maintenance by filling with fine gravel (No. 78M Stone for example). There was no significant change in the condition of the crest noted for the current inspection.

The entire interior slope has a liner formed with near horizontal layers of soil-cement. The individual layers are designed to be about six inches thick and six feet wide perpendicular to the dike. Collectively, the soil-cement forms a series of steps along the interior face. Previous inspections have generally indicated a progressive deterioration of the soil-cement liner. A shoreline inspection should be performed to evaluate the progress of erosion and undermining for the soil-cement liner. The results for this inspection should be considered in developing repair plans for the soil-cement liner.

In areas with the most deterioration of the soil-cement liner, riprap material has been placed on top of a geotextile along the toe of slope to reduce erosive effects of lake level fluctuations and wave action. As noted for the current inspection, we observed displacement of the riprap from wave action in many locations. In conjunction with the shoreline inspection, we recommend a more detailed review of the extent of riprap repair required along the toe of the interior slope.

Consistent with the last 5-year inspection report, maintenance spraying to remove vegetation in the rip rap should be continued. We also recommend that cutting of trees that take root along the interior slope should continue.

For the current inspection, observations for the condition of the interior slope are summarized for each bay as follows:

- Bay 1 – Trees are present on the inside slope of the soil-cement liner that should be removed. Pavement on the crest is mostly intact with some broken areas. The toe of slope and riprap material is generally in satisfactory condition (Photographs 26 & 27).
- Bay 2 - Trees are present on the inside slope of the soil-cement liner that should be removed. Pavement on the crest is broken up, uneven, and has experienced some rutting. Deterioration along the toe of slope and loss of riprap material is fairly extensive (Photographs 28 & 29).
- Bay 3 - Pavement on the crest is missing, broken up and uneven. The toe of slope is generally in satisfactory condition with limited loss of riprap material (Photographs 30 & 31).

- Bay 4 – No concerns for slope damage or settlement along the crest were noted in the vicinity of the makeup pumping station. Pavement on the crest is broken and uneven, but mostly intact. Erosion along the toe was noted and should be further evaluated by shoreline inspection. There does not appear to be riprap provided along the toe in this bay (Photographs 32, 33, & 34).
- Bay 5 – The crest is mostly intact, cracked, and uneven with some missing sections of pavement. There is a longitudinal crack with 2-3 inches of vertical displacement toward the north end of the bay. Erosion along the toe was noted and should be further evaluated by shoreline inspection. There does not appear to be riprap provided along the toe in this bay (Photographs 35 & 36).
- Bay 6 – The crest is mostly intact, cracked, and uneven with some missing sections of pavement. Erosion along the toe was noted and should be further evaluated by shoreline inspection. There does not appear to be riprap provided along the toe in this bay. The barricade at the end of the bay was intact. (Photographs 37 & 38)

The plant should continue to monitor cracking and damage to the soil-cement slope protection at the pipe crossing for the canal near the skimmer structure (Photograph 39)

The exterior slope generally appeared to be in stable and in good condition. Consistent with previous recommendations, maintenance cutting of trees and brush should be provided to clear the slope down to the toe. On December 8, 2010, the plant reported that there has been no cutting or maintenance performed for the vegetation on the exterior slopes during 2010.

The concrete walls of the sluice gate structure continue to appear structurally sound and serviceable. There did not appear to be any significant change in the open joints previously observed where the interior slope wing walls and the headwall come together on both sides of the structure. Concrete cracking at the north gate hoist support also appeared to be consistent with previous inspections (Photograph 40).

As noted in the last 5-year inspection report, the ability to operate the sluice gates is an important design safety feature. Emergency operation procedures require lowering the pond level in anticipation of a hurricane. We understand from discussions with the plant personnel that both gates are currently operable. We observed satisfactory operation of one gate during this site visit.

During the 2009 inspection, we noticed what appears to be a submerged concrete floor slab on the downstream side of the sluice gate structure that appeared to be broken up. From follow-up discussions with plant personnel, we understand that this condition has been present for many years. We also understand that the broken slab is probably more visible because discharge flow from the ash pond bypass could be removing silt buildup in the area. We recommend further review and evaluation of this condition to determine if there is potential for undermining of the structure.

The status for addressing previous recommendations from the 2007 Independent Consultant Inspection Report and recent annual inspections are summarized as follows:

Ref No.	Recommendations	Recommended Time for Implementation	Current Status *(See note below table)*
CP-2009-1	The extent of riprap displacement and loss for the toe of dike should be reviewed by a shoreline inspection from a boat. The shoreline inspection should also evaluate the progress of erosion and undermining for the soil-cement liner. The results for this inspection should be considered in developing repair plans for the liner.	Recommend inspection by boat annually to monitor progress.	Plant is performing inspection by boat annually. No areas of concern identified for 2010.
CP-2009-2	We recommend further review of what appears to be a broken concrete slab observed on the downstream side of the sluice gate structure to determine if there is any potential for undermining of the structure.	Recommend follow-up before the next 5-year Independent Consultant Inspection in 2012.	No activity for 2010.
CP-2007-1	A crest elevation survey should be conducted to identify locations that are below design elevation. Provide fill to raise the crest elevation to design requirements as indicated by survey (updated recommendation for 2010)	Recommend survey before the next 5-year Independent Consultant Inspection in 2012.	No activity for 2010
CP-2007-2	Implement a maintenance repair program for the soil-cement slope protection based on progress of erosion observed during inspection by boat. (Updated recommendation for 2010)	Provide engineering review of need for repair before next 5-year Independent Consultant Inspection in 2012.	No activity for 2010
CP-2007-3	Monitor the crest for new open areas and fill with concrete or gravel.	Routine maintenance activity	No significant change observed for 2010
CP-2007-4	Continue with maintenance activity for removal of vegetation growing in the soil-cement.	Routine maintenance activity	Trees should be removed from soil-cement along interior slope.
CP-2007-5	Erosion and damage for the soil-cement surrounding the piles supporting the gas line should be repaired.	Develop plan and implement repair before next 5-year Independent Consultant Inspection in 2012.	No activity for 2010

CP-2007-6	Continue monitoring the open joints and cracking for the sluice gate structure for indications of further movement.	Routine plant inspection activity	No significant change observed for 2010
CP-2007-7	Provide a means to prevent damage to the gate hoisting support structure from "over closing" operations. Implement maintenance repairs for existing cracking and damage to the hoist support structure.	Complete	This appears to have been addressed by plant based on observation during current inspection.

Note: The status for action items was reviewed with plant personnel prior to issuing this report.

CLOSING

MACTEC is pleased to continue assisting Progress Energy with inspections of the dams at the L.V. Sutton Steam Electric Plant. Please contact us if you have any questions about this report.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

J Allan Tice

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

Richard S. Auger

SEAL 8169
Richard S. Auger
12-16-10

Richard S. Auger
Principal Engineer
Registered, North Carolina 8169

RSA/rsa

APPENDICES

APPENDIX A

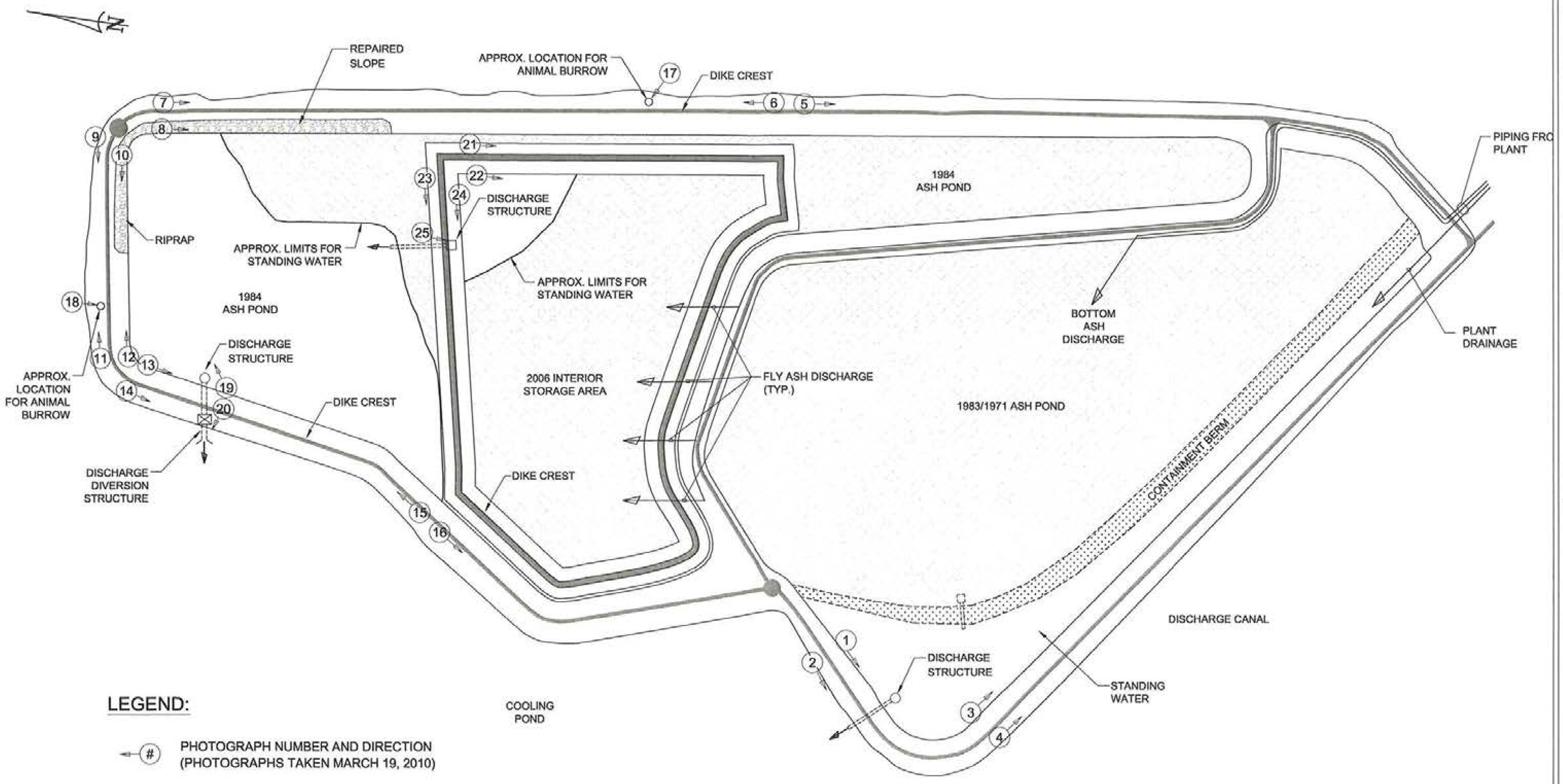
- **Photograph Location (2 drawings)**
- **Photographs**

APPENDIX B

- **MACTEC Report of Piezometer Installation and Observations, 1984 Ash Pond, April 20, 2010.**

APPENDIX A

- **Photograph Location (2 drawings)**
- **Photographs**



LEGEND:

(#) PHOTOGRAPH NUMBER AND DIRECTION
(PHOTOGRAPHS TAKEN MARCH 19, 2010)

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

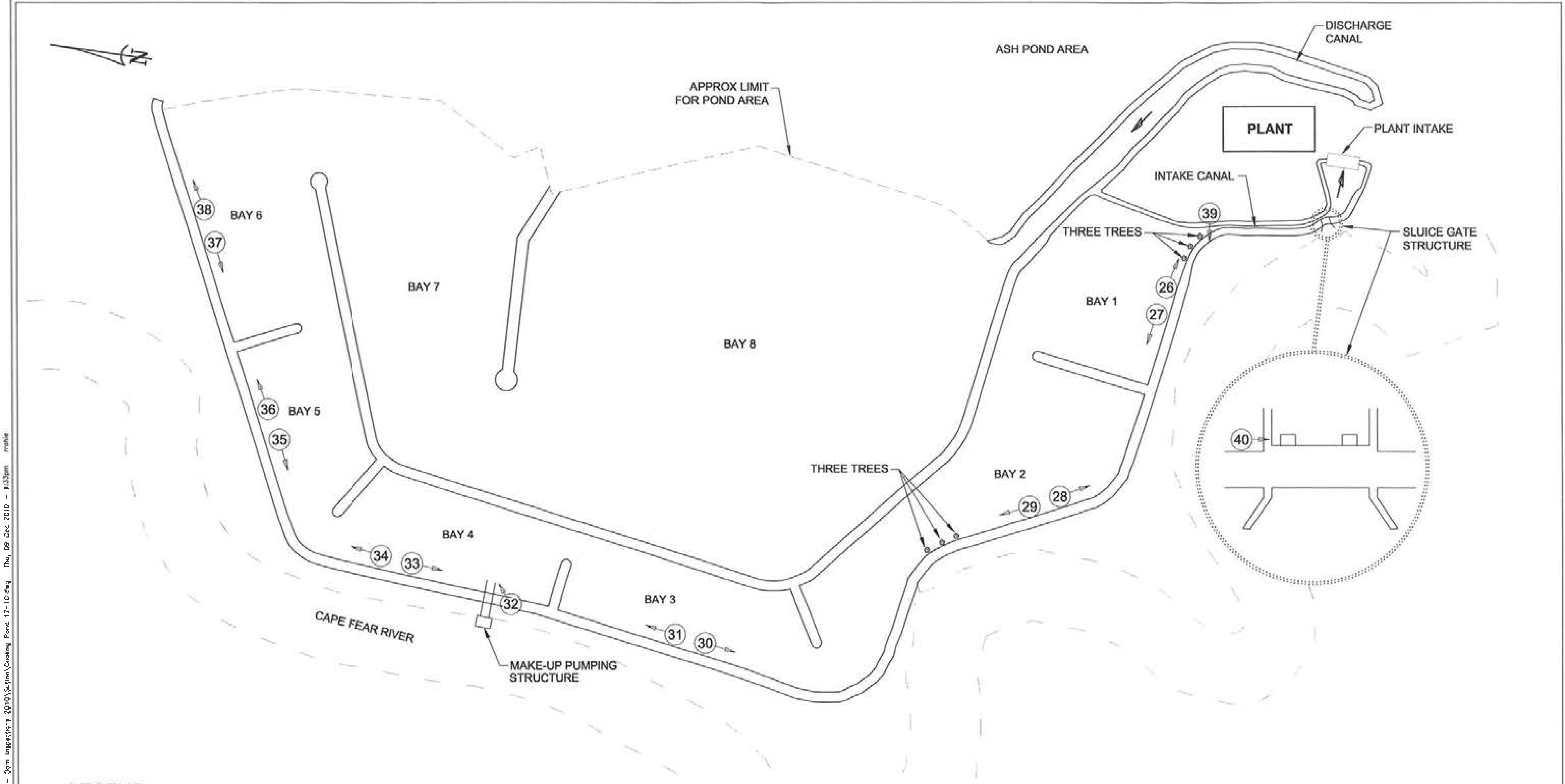
PHOTOGRAPH LOCATION PLAN
ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	DECEMBER 2010
ENG CHECK:	JH2	SCALE:	N.T.S.
APPROVAL:	ESA	JOB No.:	6468-10-0025(04)

DRAWING
1

REFERENCE: CP&L DRAWINGS D3232 & D3230; WITHERS & RAVENEL DRAWING 1, TRANSASH DRAWING 4-19-05.

P:\6468\Progress Energy\Progress Energy Projects 2010\0025 - Dam Inspections 2010\Sutton\Ash Pond Dikes 12-10.dwg Thu, 09 Dec 2010 - 3:37pm mohle



LEGEND:

- (#) PHOTOGRAPH NUMBER AND DIRECTION (PHOTOGRAPHS TAKEN MARCH 19, 2010)

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

PHOTOGRAPH LOCATION PLAN
COOLING POND
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.	DATE: DECEMBER 2010	DRAWING
ENG CHECK: JAZ	SCALE: N.T.S.	2
APPROVAL: CSA	JOB No.: 6468-10-0025(04)	

REFERENCE: CP&L DRAWING NO. G-3102-F.

P:\6468\Progress Energy\Progress Energy Projects 2010\0025 - Dam Inspections 2010\Sutton\Cooling Pond 12-10.dwg Thu, 09 Dec 2010 - 1:33pm rnahle

1. 1983/1971 Ash Pond – View of interior slope for west dike looking toward discharge structure.

2. 1983/1971 Ash Pond – View of exterior slope for west dike looking toward discharge structure.

3. 1983/1971 Ash Pond – View of interior slope for south dike.

4. 1983/1971 Ash Pond – View of exterior slope for south dike.

5. 1984 Ash Pond – View of exterior slope for east dike looking south.

6. 1984 Ash Pond – View of exterior slope for east dike looking north.

7. 1984 Ash Pond – View of exterior slope for east dike looking south (at northeast corner).

8. 1984 Ash Pond – View of interior slope for east dike looking south (at northeast corner).

9. 1984 Ash Pond – View of exterior slope for south dike looking west (at northeast corner).

10. 1984 Ash Pond – View of interior slope for south dike looking west (at northeast corner).

11. 1984 Ash Pond – View of exterior slope for south dike looking toward east (at northwest corner).

12. 1984 Ash Pond – View of exterior slope for south dike looking east (at northwest corner).

13. 1984 Ash Pond – View of interior slope for west dike looking toward discharge structure.

14. 1984 Ash Pond – View of exterior slope for west dike looking toward discharge structure.

15. 1984 Ash Pond – View of exterior slope for west dike looking north.

16. 1984 Ash Pond – View of exterior slope for west dike looking south.

17. 1984 Ash Pond – View of animal burrow on the exterior slope for east dike (12 inch tape extension shown for scale).

18. 1984 Ash Pond – View of animal burrow on the exterior slope for north dike (4" x 7" field book shown for scale).

19. 1984 Ash Pond – View at top of platform mounted on skimmer for discharge structure.

20. 1984 Ash Pond – View of discharge diversion structure at toe of west dike.

21. 1984 Ash Pond/Interior Storage – View of exterior slope for containment dike looking south.

22. 1984 Ash Pond/Interior Storage – View of interior slope for containment dike looking south.

23. 1984 Ash Pond/Interior Storage – View of stability berm for containment dike looking west.

24. 1984 Ash Pond/Interior Storage – View of interior slope for containment dike and discharge structure looking west.

25. 1984 Ash Pond/Interior Storage – View of discharge structure from access platform.

26. Cooling Pond – (Bay #1) View of crest and interior slope showing small trees growing at toe.

27. Cooling Pond – (Bay #1) View of crest and interior slope looking west.

28. Cooling Pond – (Bay #2) View of crest and interior slope looking south.

29. Cooling Pond – (Bay #2) View of crest and interior slope looking north.


05/19/2010

30. Cooling Pond – (Bay #3) View of crest and interior slope looking south.


05/19/2010

31. Cooling Pond – (Bay #3) View of crest and interior slope looking north.

32. Cooling Pond – (Bay #4) View of makeup discharge pipes on upstream side of dike.

33. Cooling Pond – (Bay #4) View of crest and interior slope looking south.

34. Cooling Pond – (Bay #4) View of crest and interior slope looking north.

35. Cooling Pond – (Bay #5) View of crest and interior slope looking east.

36. Cooling Pond – (Bay #5) View of crest and interior slope looking west.

37. Cooling Pond – (Bay #6) View of crest and interior slope looking east.

38. Cooling Pond – (Bay #6) View of crest and interior slope looking west.

05/19/2010

39. Cooling Pond – View of slope protection damage at pipe support on interior slope near the sluice gate structure.

05/19/2010

40. Cooling Pond – View of concrete cracking at sluice gate support on north side of discharge structure.

APPENDIX B

- **MACTEC Report of Piezometer Installation and Observations, 1984 Ash Pond, April 20, 2010.**

MACTEC
engineering and constructing a better tomorrow

April 20, 2010

Mr. Bill Forster
Progress Energy
7001 Pinecrest Road
Raleigh, North Carolina 27614

**SUBJECT: REPORT-OF PIEZOMETER INSTALLATION AND OBSERVATIONS
1984 ASH POND - SUTTON PLANT
WILLMINGTON, NORTH CAROLINA
MACTEC PROJECT NUMBER: 6468-09-2340**

Dear Mr. Forster:

MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to submit our report of installation of piezometers, observation of water levels and interpretation of the results for the 1984 Ash Pond at the Sutton Plant. In February, 2009, MACTEC installed 18 water level observation casings (piezometers) in the dike crest and exterior slopes. Additionally, MACTEC advanced six continuous sampling probes at the dike crest piezometer locations to check the material types used to construct the dikes. This report describes the piezometer installation methods, presents logs of the installations, summarizes the water level readings taken through September, 2009 and provides our assessment of the results relative to the stability of the dikes. The Appendices contain tables, figures, soil description logs, and the well installation logs.

REPORT SUMMARY

Progress Energy raised the water level in the 1984 Ash Pond from elevation 26 feet to elevation 30 feet in November, 2008. After initial observations and comparisons of inflow and outflow records showed the 1985 Ash Pond water level was decreasing, Progress Energy reduced the water level to elevation 28 feet where conditions appeared to stabilize. In February, 2009, MACTEC installed 18 piezometers at six section locations around the 1984 Ash Pond dike to assist in evaluating conditions and if potential pond leakage impacted the stability of the dikes. Water was found only in the six piezometers installed into the natural ground from the crest of the dikes and in one toe piezometer on the north dike. Piezometer readings found water levels in the dikes below those used for original design analyses. The water levels found do not reduce the dike stability.

MACTEC evaluated the dike slopes and toe areas for signs of seepage. No seepage was seen.

MACTEC reviewed piezometer readings and pond water level changes. An increase in the pond water level made in late June, 2009 (raising from elevation 28 to elevation 30 feet) was reflected in an increase in water level elevations in those piezometers that had measureable water present. The increase was similar to the height of pond water level increase. Over the span of about three months the piezometer water level elevations dropped back down to near levels prior to the pond water level increase, while the pond water level remained steady and inflows to the pond were similar to outflows.

MACTEC concludes that the original observations by Progress Energy of possible pond leakage were caused by re-hydration of the original clay liner that was above the pond water level for several years prior to the increase in pond water elevation in November, 2008. Currently, there are no indications of unexplained water level changes in the 1984 Ash Pond, and the pond inflows are similar to the pond outflows.

PROJECT INFORMATION

The dikes for the 1984 Ash Pond were constructed of compacted sandy soils according to Progress Energy construction records. The interior slopes of the dikes and the bottom of the pond were lined with a clay layer designed for 12 inch thickness. An approximate 12-inch thick sand layer was to be placed on top of the clay on the sides to reduce potential drying shrinkage effects and to protect the clay from erosion. Past dike inspections have generally found the dike slopes in good condition. Wave erosion, particularly on the east dike, had caused removal of the sand over the liner in several areas. Repairs to these areas were made in 2001 and again in 2008. The last dam safety inspection by MACTEC in 2009 found no areas of significant concern.

The clay liner is intended to reduce water flow from the pond into the sand dikes and natural ground, thus creating a low water flow line (phreatic surface) within the dike. The low phreatic surface is important to the stability of the dike.

In November, 2008, Progress Energy raised the operating level of the 1984 Ash Pond to approximately elevation 30 feet from its previous elevation of approximately 26 feet by adding sections to the discharge riser pipe. Monitoring of estimated inflows into the pond and outflows from the discharge riser indicated less water being discharged than was entering, and a decrease in the water surface elevation of the pond, even when there was no outflow into the discharge pipe riser. This behavior suggested possible leakage out of the pond, either from the bottom or through the sides. MACTEC was asked to evaluate the possible leakage with respect to potential for impact on stability of the dikes, possible cause of the leakage and possible remedial actions.

FIELD RECONNAISSANCE

A field reconnaissance of the dike was performed on January 8, 2009 by Mr. Al Tice, P. E. of MACTEC and coordinated with Mr. Bruce Moorefield from the Sutton Plant. The pond water surface was observed to be at about elevation 27.7 feet. The exterior slope areas and natural ground adjacent to the base of the dike slopes were visually checked for signs of emerging water or unusual wetness. No indications of seepage from the dike slopes were seen. The drainage swale along the east dike was dry. Some standing water was observed in a low area between the north end of the west dike and the Cooling Lake. This is a natural condition observed in the past. There were no signs of boils or similar disturbances in the standing water that would suggest water is emerging under pressure. Dike toe areas were inspected and appeared to be dry with no indication of seepage.

Several hand auger borings were made near the base of the slope and at points on the slope to check for presence of water. The soils from the hand auger borings at slope midpoints were dry to moist (near the bottom) to depths of about 9 feet. Soils from the hand auger borings made near the dike toe generally became wet to saturated at depths of about 4 feet. At this depth, the boring was below the level of the adjacent natural ground. On the west side, water was encountered about 2 feet below the dike toe, a level consistent with the adjacent Cooling Lake. One hand auger boring was made on the interior slope of the east dike, in an area where the clay liner repairs had been made in 2008. Clay soils were encountered at a depth of about 5 feet and appeared to be in a moist condition. The soils below the clay were damp, indicating water was not leaking through the clay liner at this point.

The interior slopes of the dike had some sparse vegetation on the east side where dike slope repairs to local erosion areas had been made in 2008. No obvious scarps or erosion cuts deep enough to penetrate the clay liner were observed above the pond water level. No visual signs of animal tunnels or borrowing were observed along the interior slopes.

FIELD EXPLORATION

The field reconnaissance work did not find evidence of seepage emerging from the dike slopes and areas adjacent to the dike toe. MACTEC recommended that piezometers be installed to provide a means of checking for conditions at greater depths than could be reached with hand augers and a means of checking water level changes over time as related to pond level changes. The field exploration consisted of six penetrometer soundings along the crest of the dike with soil samples obtained using a lined tube sampler, six hand auger borings near the base of the dike, installation of six pairs of piezometers on the crest and six piezometers along the base at the boring locations. Two exploration points were located on each of the north, east and western portions of the dike. The boring locations were located in the field by MACTEC. Figure 1 in the Appendix shows the approximate boring and piezometer locations.

Soil Exploration Methods

Six probes were pushed from the crest of the dike at the approximate locations shown on Figure 1 in Appendix A using a GeoProbe drill. The GeoProbe has a hollow interior lined with a clear plastic sleeve. Samples of soil were collected in five-foot long increments. The probes were pushed to approximately 30 feet. Based on the dike design drawings, these depths would result in the probes entering the original ground. The soil samples were visually classified in the field using the Unified Soil Classification System (USCS) and representative portions of soil were collected at two-foot intervals from the liners and placed in a sealed plastic bag for possible testing. No further testing was performed on the collected soil samples.

A hand auger was used to advance shallow borings near the toe of the dike slope at the locations shown on Figure 1 in Appendix A. The soils were visually described, and typical materials were placed in sealed plastic bags for later examination.

MACTEC will store the collected soil samples for a period of 90 days. The samples will be discarded after this period unless requested otherwise. Records for the probes and hand auger borings are included in Appendices B and C, respectively. A sheet defining the terms and symbols used on the boring records is also included in Appendix B.

Piezometer Installation Methods

Twelve piezometers for water level observations were installed along the dike crest near the probe locations. At each location, two piezometers were installed. One (PA-series) consisted of a 5-foot length of mechanically slotted well screen set from 10 to 15 feet below the dike crest surface and 10 feet of solid riser. The second piezometer (PZA-series) at each location was set with its screen at 20 to 25 feet below the dike crest. All piezometers included a sand pack around the well screen, a bentonite seal and then cement/bentonite grout up to the ground surface. Each piezometer was completed using a locking PVC cap and a steel roadbox cemented at the ground surface. The locking roadboxes were placed flush with the dike crest. As requested by Mr. Moorefield, 4-inch pipe protective posts were installed near the piezometers.

At the toe of the dike slope, piezometers were installed in the hand auger boreholes at locations shown on Figure 1 in Appendix A. The termination depth was approximately 4 feet below the existing ground surface at the toe of the dike. The piezometers consisted of 2.5 feet of one-inch diameter PVC hand slotted well screen and 2.5 feet of solid riser pipe. Sand was placed to approximately one-foot above the top of the well screen and the hole was backfilled with bentonite chips to the ground surface. Figure 2 in Appendix A shows a typical dike cross section and the piezometer installations in a typical section. Appendix D contains individual records for the piezometers installed on the dike crest, and Appendix C contains installation notes for the piezometers installed in the hand auger borings near the dike toe.

SUBSURFACE CONDITIONS

Dikes

As noted previously, historical records indicate the dike was constructed of sandy soil placed over a natural sandy foundation. The soil samples collected from the probes and hand auger borings were brown, gray and white sand with estimated Unified Soil Classification of SW (well graded sand). Based on color changes and traces of small roots, an approximate boundary between the dike fill and the natural ground was estimated at between 18 to 20 feet below the dike crest. All six probes were terminated in the natural soils at a depth of 30 feet below the crest of the dike.

The hand auger borings drilled for the piezometers at the toe of the slope soils similar to those seen in the probes. Soils near the bottom of the hand auger borings were often very moist or wet.

Water Level Readings

The depth to water was checked in all piezometers at the time of installation and on multiple dates following the installation. Readings were referenced to the top of the piezometer casing. Elevations for the tops of the casings were estimated as 34 feet for all piezometers in the dike crest. For the piezometers at the dike toe, elevations of the top of casing and adjacent ground surface were surveyed by MACTEC personnel using an assumed top of dike elevation of 34 feet. Table 1 in Appendix A summarizes the water elevations from the installation in February, 2009 through September 17, 2009. Figures 3, 4 and 5 illustrate the range of water level elevations for dike cross sections.

DISCUSSION

Figures 6, 7 and 8 show changes in the water level elevations over time. The piezometers were installed and initial readings taken about 25 days after the pond water level had been lowered from elevation 30 feet to elevation 28 feet, too late to observe changes related to the water lowering. Water levels observed in piezometers between February 18, 2009 through June 24, 2009, with the pond level at elevation 28 feet, showed a slight declining trend. During this time frame, the outflows from the upper pond and the outflows from the 1985 pond (clear pond) were similar. No water was found in the shallower piezometers installed on the dike crest. All but one of the piezometers installed at the dike toe had no measureable water. The single piezometer at the dike toe where water was found (on the north dike) was installed at a lower elevation than all other toe piezometers. The water level in that piezometer was below the ground surface elevation.

After the pond level was raised to elevation 30 feet on June 24, 2009, all piezometers that had measureable water showed a rapid water level increase comparable to the pond level increase over a span of 10 days, then a declining trend to values close to those recorded before the pond was raised. Flow records show outflows from both the upper and clear ponds being similar. By September, 2009, water levels were close to levels prior to the pond water level raise, except on the east dike where the levels were still about a foot higher than those before the raise.

MACTEC interprets the changes in piezometer water levels as indicating a pressure connection between the water in the pond and the groundwater below the clay liner in the pond bottom. A pressure connection indicates that the clay liner is saturated, as would be expected due to its long period of submergence. The increase in pond water level causes a pressure increase at the top of the clay liner that is transmitted to the water below the liner. The natural soils below the clay liner are sands and these are continuous under the dikes. The sands have a relatively high permeability and can transmit the pressure increase out to the piezometer locations in the dike, causing their water levels to rise. The pressure increase does not indicate leakage in the clay liner, and the decrease in piezometer water levels over time indicates an adjustment of natural groundwater levels as the local pressure increase under the pond is dissipated out into the surrounding groundwater system.

The clay liner will experience an increase in water flow through it because the pressure gradient changes when the pond water level rises. However, the low permeability of the clay in the liner results in an estimated flow volume through the clay on the order of 10,000 gallons per day, well below a volume that would account for the water level drops observed in December, 2008. Thus, the source of the water level drops is not clearly understood. The flow data show the water level outflows stabilized quickly after the water level in the pond was raised from elevation 28 feet to elevation 30 feet in June, 2009, and the flows have remained comparable since that time. Figure 9 shows the flow data as recorded by Progress Energy covering the period from October, 2008 through October, 2009.

The initial observations of differences between the outflow from the upper pond and clear pond when the pond level was raised in late 2008 from elevation 26 feet to elevation 30 feet were interpreted as possible indications of water loss through the clay liner. The clay liner extends up to approximately elevation 32 feet on the slopes and covers the bottom of the 1985 pond. It is possible the portion of the clay liner above the previous pond level had dried and developed shrinkage cracks that initially allowed water to permeate through the liner. As the clay re-hydrated, the cracks closed due to clay expansion. This, combined with a lowering of the pond water level to elevation 28 feet likely explains why the outflow differences were minimal after the pond was lowered. When the pond level was raised again to elevation 30 feet, the clay liner portion between elevations 28 feet and 30 feet did not have time to dry and reform shrinkage cracks before it was again inundated by the pond raise; thus no further loss of water occurred.

Figure 10 shows a slope stability analysis cross section from the original dike design report. The water surface through the dike is shown. The maximum water level elevations from the piezometers were used to draw a current water surface through the dike (red line on Figure 10). The piezometer data show that the water level within the dike is lower than the water level used when the dike stability analyses were performed during the dike design. No seepage out of the dike at the toe or from the natural ground adjacent to the toe was indicated by the piezometers or by visual reconnaissance on several site visits. The recorded water levels, therefore, do not indicate that possible leakage through the clay liner on the dike slopes or through the clay liner on the pond bottom, if any, is causing a reduction in the dike stability.

CONCLUSIONS AND RECOMMENDATIONS

Based on the information discussed above, MACTEC concludes the following:

- The original apparent leakage was most likely due to re-hydration of the clay liner on the upper dike slopes after a long period of drying. No indications of continuing loss of water from the 1984 Ash Pond are evident.
- Water levels within the dikes of the 1984 Ash Pond are well below those used in the design, and no concerns exist relative to the safety of the dikes against a structural failure.
- No indications of seepage through the dikes are present from visual reconnaissances or from the piezometer readings.
- The dikes were constructed of sandy soils; borings found no fly ash and construction records report no fly ash use.

MACTEC recommends that the piezometers be checked for water levels during regular dam safety inspections by independent inspectors. Additional readings should be made by plant personnel if unusual inflow/outflow patterns are seen or if the pond water level drops for no apparent reasons. If the level of the pond is to be changed by adding or removing a section of the discharge riser pipe, we recommend that piezometer readings be made at least twice in the week prior to the height change, daily for a week after the height change and monthly for three months. A similar pattern of water level changes in the piezometers as observed during the past water level increase would be expected.

Respectfully submitted,

MACTEC ENGINEERING AND CONSULTING, INC.

James A. Schiff
Project Professional

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

Attachments: Appendix A –Table 1 and Figures 1-10
Appendix A-Boring Logs (PZ-1A to PZ-6A)
Appendix B-Auger Boring Well Logs (PZ-1B to PZ-6B)
Appendix C-Type II Monitoring Well Installation Records-All twelve piezometers
Appendix D-Carolina Well Construction Record Logs sent to the State of NC

APPENDIX A

TABLE 1
FIGURES 1-10

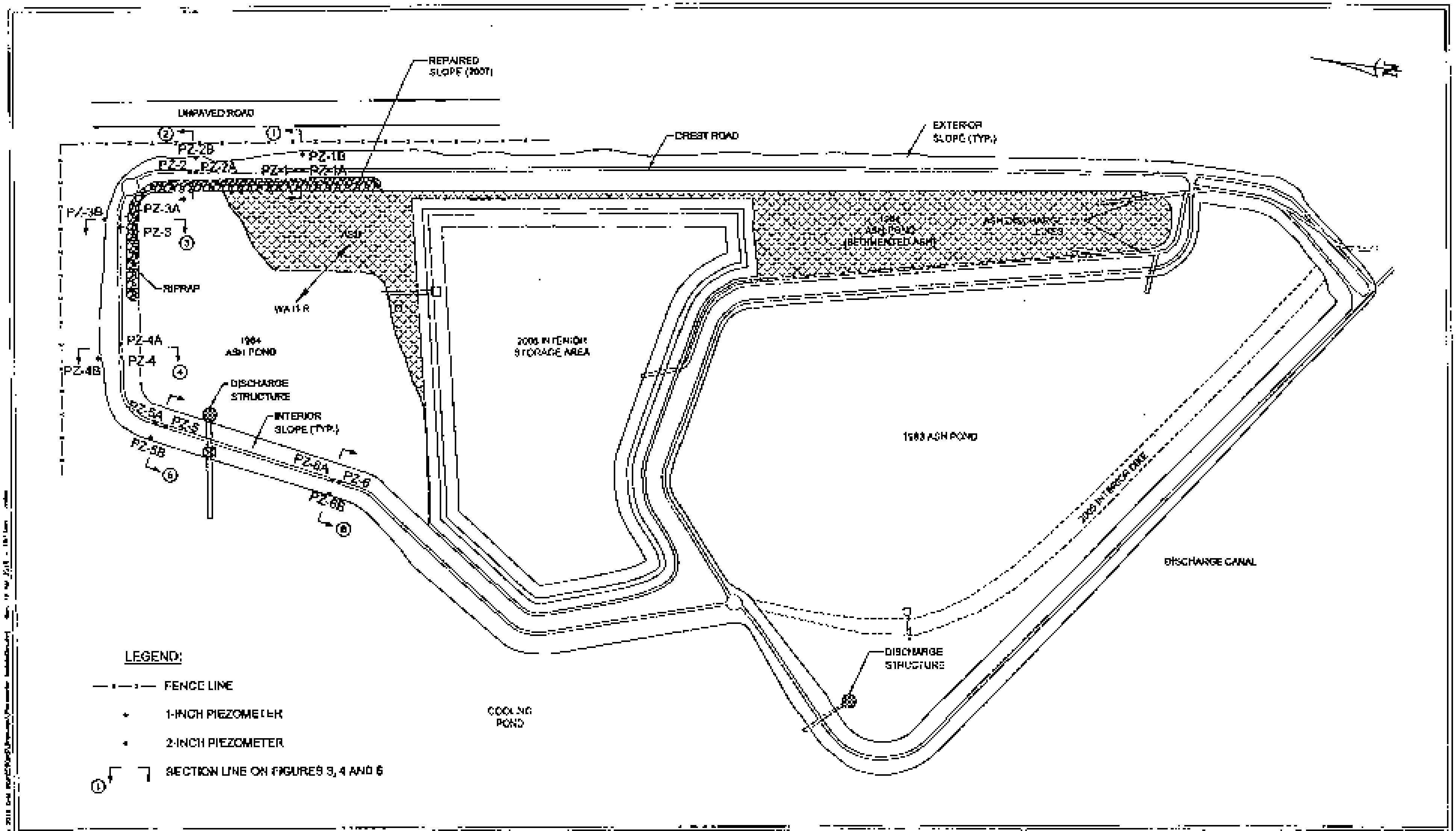
TABLE 1
SUMMARY OF GROUNDWATER INFORMATION IN SHALLOW PIZOMETERS
UPDATED 9-17-09
PROGRESS ENERGY-SUTTON 84 ASH POND-SUTTON PLANT
MACTEC PROJECT No. 6468-09-2340

Location	Approx. Ground Elevation, ft (1)	Top of casing elevation for B Piezometers, ft	Depth to Bottom of Screen, below top of casing, ft	Groundwater Elevations - Date (2, 3)											
				2/18/2009	3/11/2009	3/25/2009	6/24/2009	6/29/2009	7/1/2009	7/6/2009	7/8/2009	7/15/2009	7/30/2009	8/17/2009	9/17/2009
PZ-1	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-1A	34		25	12.10	12.09	11.75	11.6	12.59	13.58	14.1	14.6	14.38	13.6	13.7	13.1
PZ-1B	18.0	19.38	5	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7
PZ-2	34		15	<19	<19	<19	<19	<19	<18	<19	<19	<19	<19	<19	<19
PZ-2A	34		25	12.32	12.10	12.0	11.76	12.81	15.21	14.77	15.2	14.85	13.5	14.1	13.5
PZ-2B	18.7	19.57	5	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2
PZ-3	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<18	<19	<19	<10
PZ-3A	34		25	11.95	11.62	11.75	11.52	12.17	13.05	13.88	14.18	14.01	13.35	13.5	12.9
PZ-3B	19.97	20.79	5	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4
PZ-4	34		15	<19	<19	<19	<18	<19	<10	<19	<18	<19	<19	<19	<19
PZ-4A	34		25	11.13	10.98	10.98	10.71	11.13	11.64	12.11	12.48	12.28	11.89	12.1	11.6
PZ-4B	13.8	14.54	5	10.94	10.89	10.83	10.62	10.99	11.38	11.84	11.40	11.30	10.90	11.09	10.8
PZ-5	34		15	<19	<19	<19	<19	<19	<19	<18	<19	<19	<19	<19	<19
PZ-5A	34		25	11.29	11.16	11.12	10.95	11.50	12.1	12.4	12.6	12.35	11.96	12	11.7
PZ-5B	16.08	17.29	5	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25
PZ-6	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-6A	34		25	10.69	10.51	10.48	10.45	10.74	11.11	11.5	11.78	11.48	11.10	11.2	10.9
PZ-6B	16.27	17.25	5	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4

Notes
1. Approximate ground elevations estimated from the design top of dike elevation of 34 feet or by MACTEC approximate survey for B piezometers
2. Riser top elevation approximately 28 ft through 6/24/2009 with pond water level at top of riser
3. Riser elevation raised to approximately 30 feet on 6/24/2009. Pond level approximately elevation 29 feet on 6/29/2009 and approximately 30 feet on 7/1/2009 and subsequent readings unless noted below.

Piezometer Installation notes
Piezometers Installed on February 12 and 13, 2009 by MACTEC
Piezometers consist of 5 feet of slotted 1" and 2" diameter PVC pipe with solid riser. Backfill with sand around slotted section and bentonite chips/cement-bentonite grout above sand to ground surface.

Prepared By: JAS
Checked By:



LEGEND:

- FENCE LINE
- 1-INCH PIEZOMETER
- 2-INCH PIEZOMETER
- ① SECTION LINE ON FIGURES 3, 4 AND 5

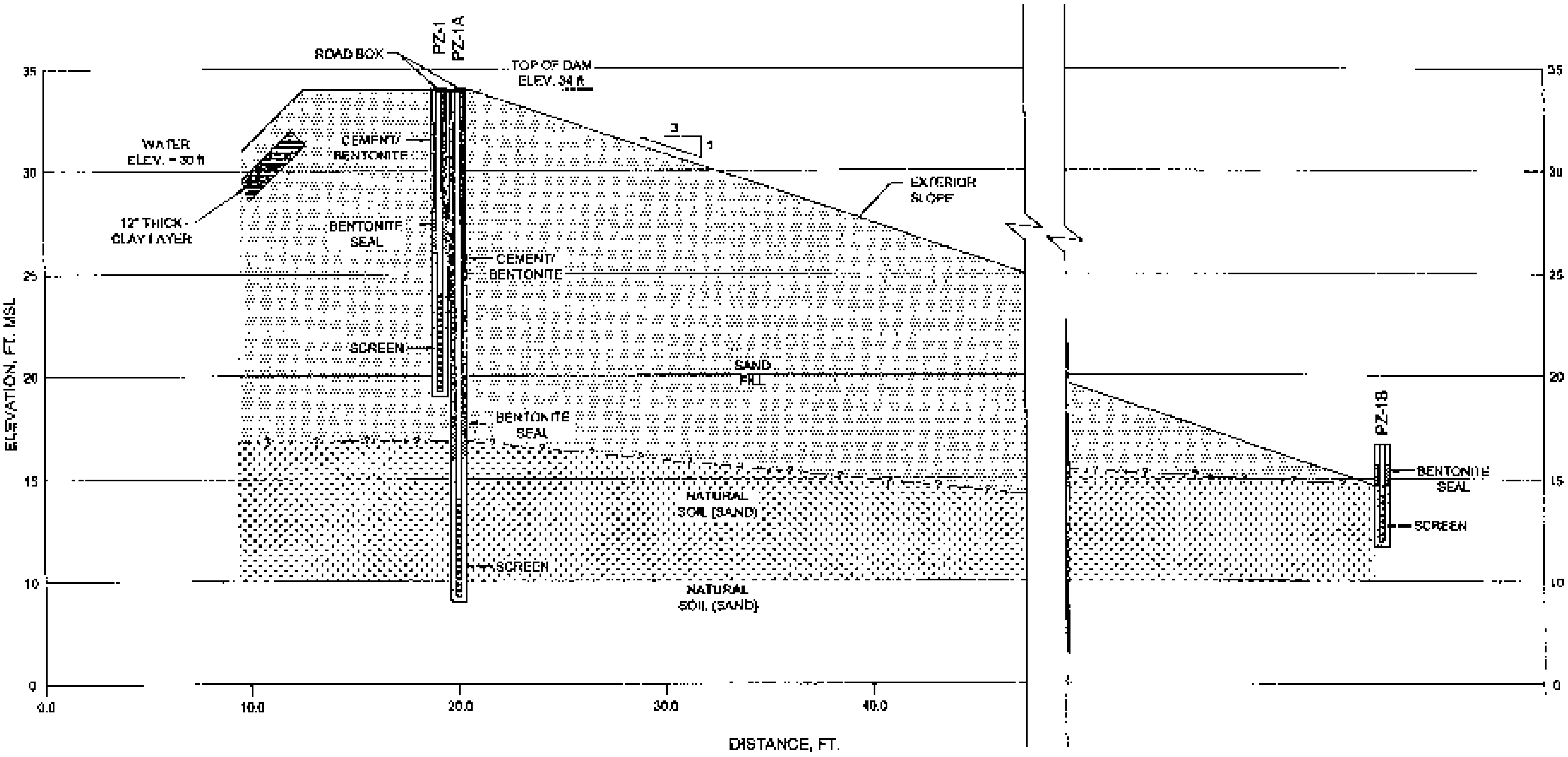
MACTEC

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

PIEZOMETER INSTALLATION LOCATIONS
1994 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL, 2010	FIGURE
ENG CHECK:		SCALE:	N.T.S.	1
APPROVAL:		JOB No.:	6468-09-2340	

REFERENCE: CIVIL DRAWINGS D3232 & D3230; WITHERS & RAVENEL DRAWING 1; TITAN ASH DRAWING 4-19-05.



MACTEC

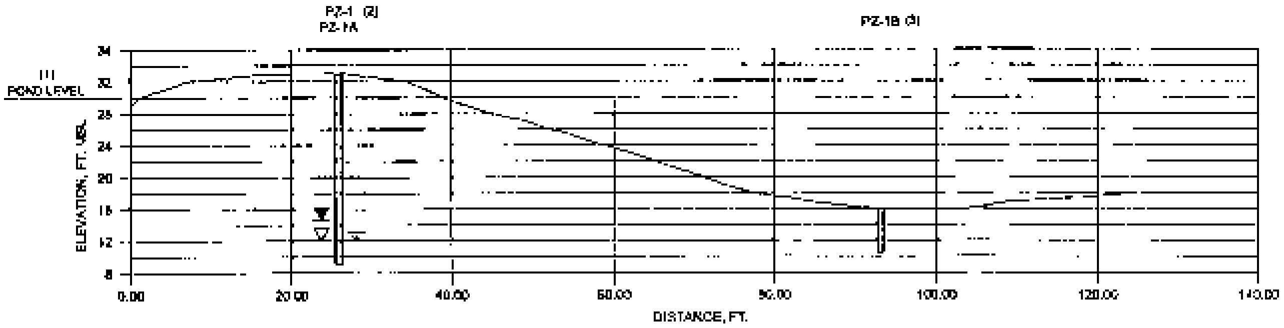
MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

TYPICAL CROSS SECTION OF DIKE SHOWING PIEZOMETER INSTALLATION
SUTTON 1984 ASH POND
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

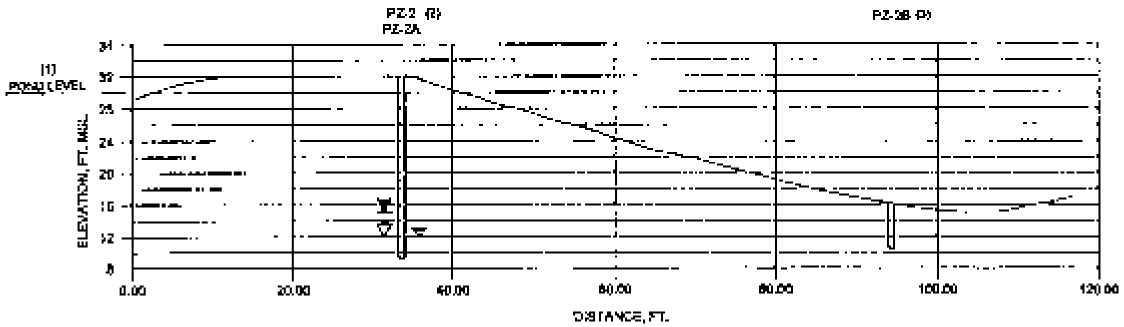
DRAWN:	R.R.	DATE:	APRIL, 2010
ENG CHECK:		SCALE:	1" = 5'
APPROVAL:		JOB No.:	6468-09-2340

FIGURE
2

REFERENCE



SECTION 1



SECTION 2

LEGEND:

▼ HIGHEST WATER LEVEL WITH POND AT EL 30

▽ TYPICAL WATER LEVEL WITH POND AT EL 28

≡ 09/17/2009 READING

NOTES:

(1) POND SURFACE SHOWN AT ELEVATION 30 FEET; REPRESENTS CONDITIONS AFTER [illegible].

(2) PZ-1 AND PZ-2 INSTALLED TO 15' BELOW TOP OF DIKE AND DRY AT ALL READINGS.

(3) PZ-1B AND PZ-2B INSTALLED TO APPROXIMATELY 4 FEET BELOW GROUND LEVEL AND DRY AT ALL READINGS.

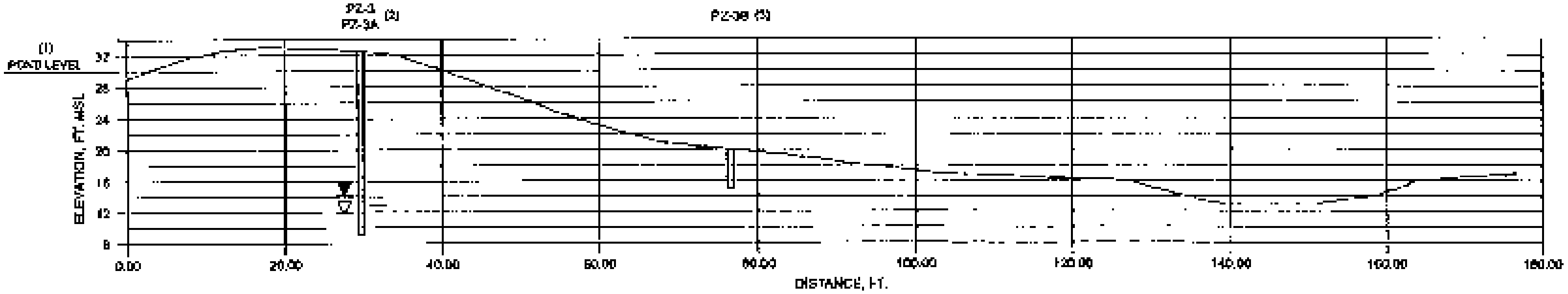
(4) SEE FIGURE 1 FOR SECTION LOCATIONS.

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

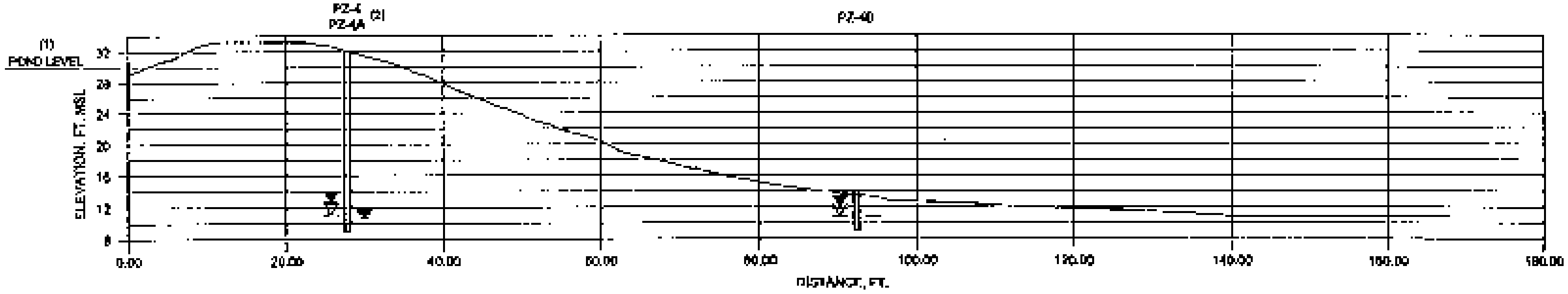
SUMMARY OF WATER LEVELS IN PIEZOMETERS
EAST SIDE, 1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL 2010	FIGURE
ENG CHECK:		SCALE:	1" = 15'	3
APPROVAL:		JOB No.:	6468-09-2340	

REFERENCE: 2005 AERIAL TOPOGRAPHIC MAP BY MCKIM AND CREED



SECTION 3



SECTION 4

LEGEND:

▼ HIGHEST WATER LEVEL WITH POND AT EL. 30

▽ TYPICAL WATER LEVEL WITH POND AT EL 28

⊤ 09/17/2009 READING

NOTES:

(1) POND SURFACE SHOWN AT ELEVATION 30 FEET; REPRESENTS CONDITIONS AFTER [illegible].

(2) PZ-3 AND PZ-4 INSTALLED TO 15' BELOW TOP OF DIKE AND DRY AT ALL READINGS.

(3) PZ-3B INSTALLED TO APPROXIMATELY 4 FEET BELOW GROUND LEVEL AND DRY AT ALL READINGS.

(4) SEE FIGURE 1 FOR SECTION LOCATIONS.

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

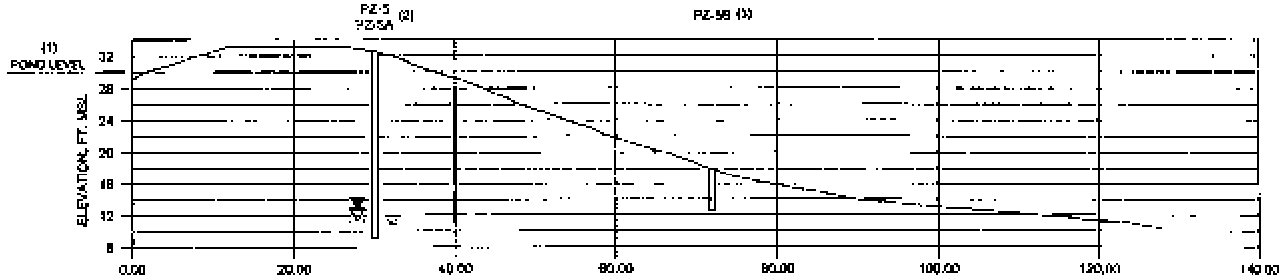
SUMMARY OF WATER LEVELS IN PIEZOMETERS
NORTH SIDE, 1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK:
APPROVAL:

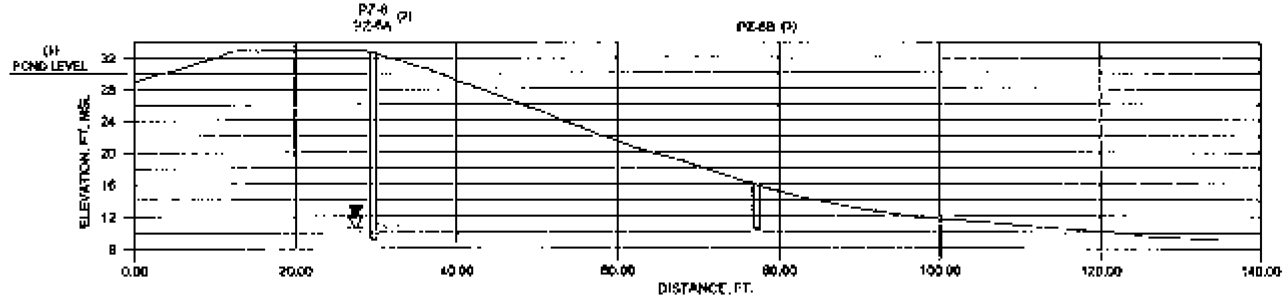
DATE: APRIL 2010
SCALE: 1" = 10'
JOB No.: 6468-09-2340

FIGURE
4

REFERENCE: 2009 AERIAL TOPOGRAPHIC MAP BY McKIM AND CREED.



SECTION 5



SECTION 6

LEGEND:

▼	HIGHEST WATER LEVEL WITH POND AT EL. 30
▽	TYPICAL WATER LEVEL WITH POND AT EL. 28
▼	09/17/2009 READING

NOTES:

(1) POND SURFACE SHOWN AT ELEVATION 30 FEET; REPRESENTS CONDITIONS AFTER 07/09/2009

(2) PZ-5 AND PZ-6 INSTALLED TO 18' BELOW TOP OF DIKE AND DRY AT ALL READINGS.

(3) PZ-5B AND PZ-6B INSTALLED TO APPROXIMATELY 4 FEET BELOW GROUND LEVEL AND DRY AT ALL READINGS.

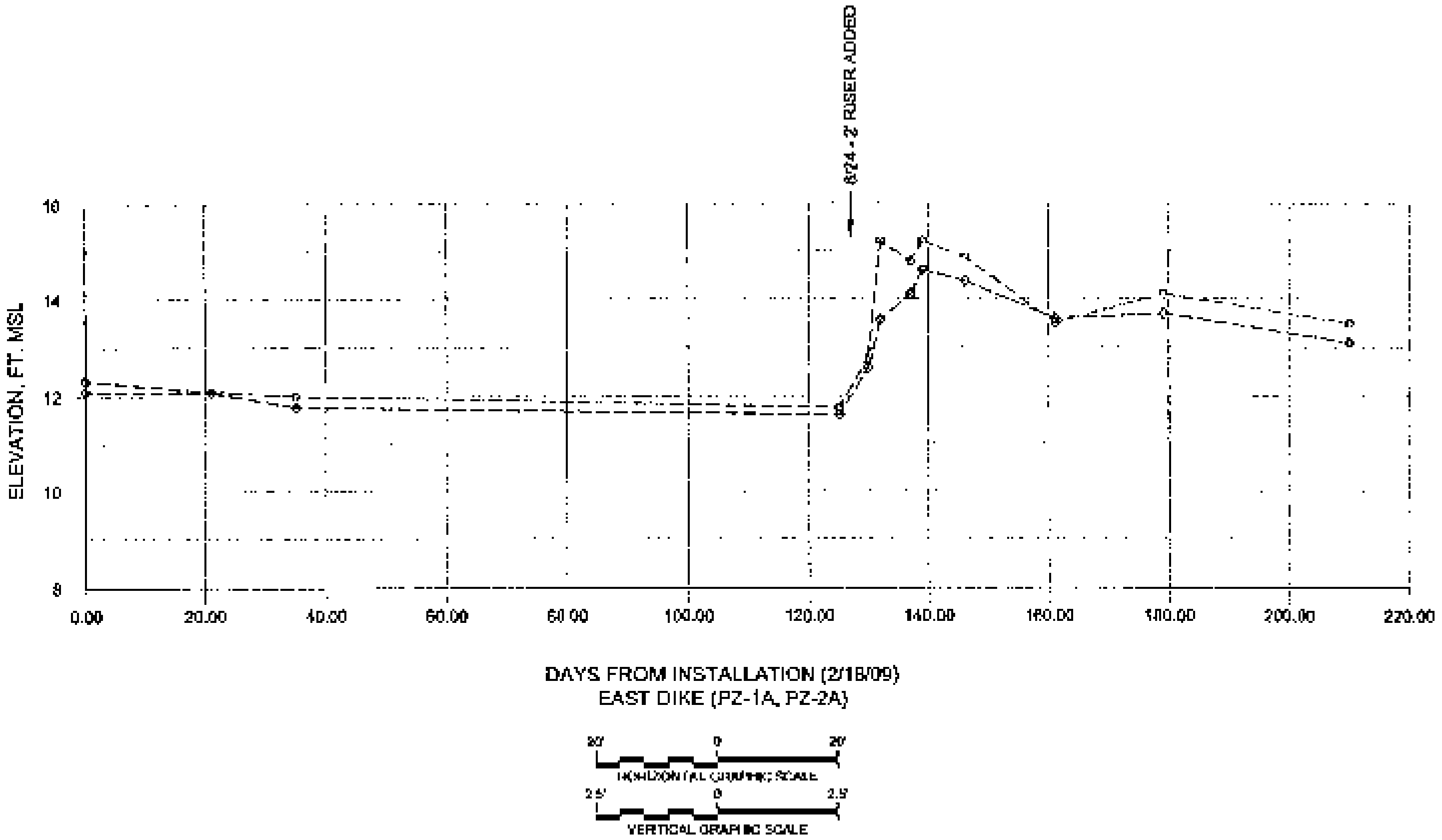
(4) SEE FIGURE 1 FOR SECTION LOCATIONS.

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

SUMMARY OF WATER LEVELS IN PIEZOMETERS
WEST SIDE, 1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL 2010	FIGURE
ENG CHECK:		SCALE:	1" = 15'	5
APPROVAL:		JOB No.:	6468-09-2340	

REFERENCE: 2009 AERIAL TOPOGRAPHIC MAP BY MCKIM AND CREED



NOTES:

1. POND ELEVATION ~28 ft TO JUNE 24, 2009.
2. POND ELEVATION ~29 ft ON JUNE 25, 2009.
3. POND ELEVATION ~30 ft AFTER JUNE 26, 2009.
4. DAY 0 = FEBRUARY 18, 2009.
5. LAST READINGS SEPTEMBER 17, 2009.
6. PIEZOMETERS PZ-1, PZ-1B, PZ-2 AND PZ-2B DRY AT ALL READINGS.

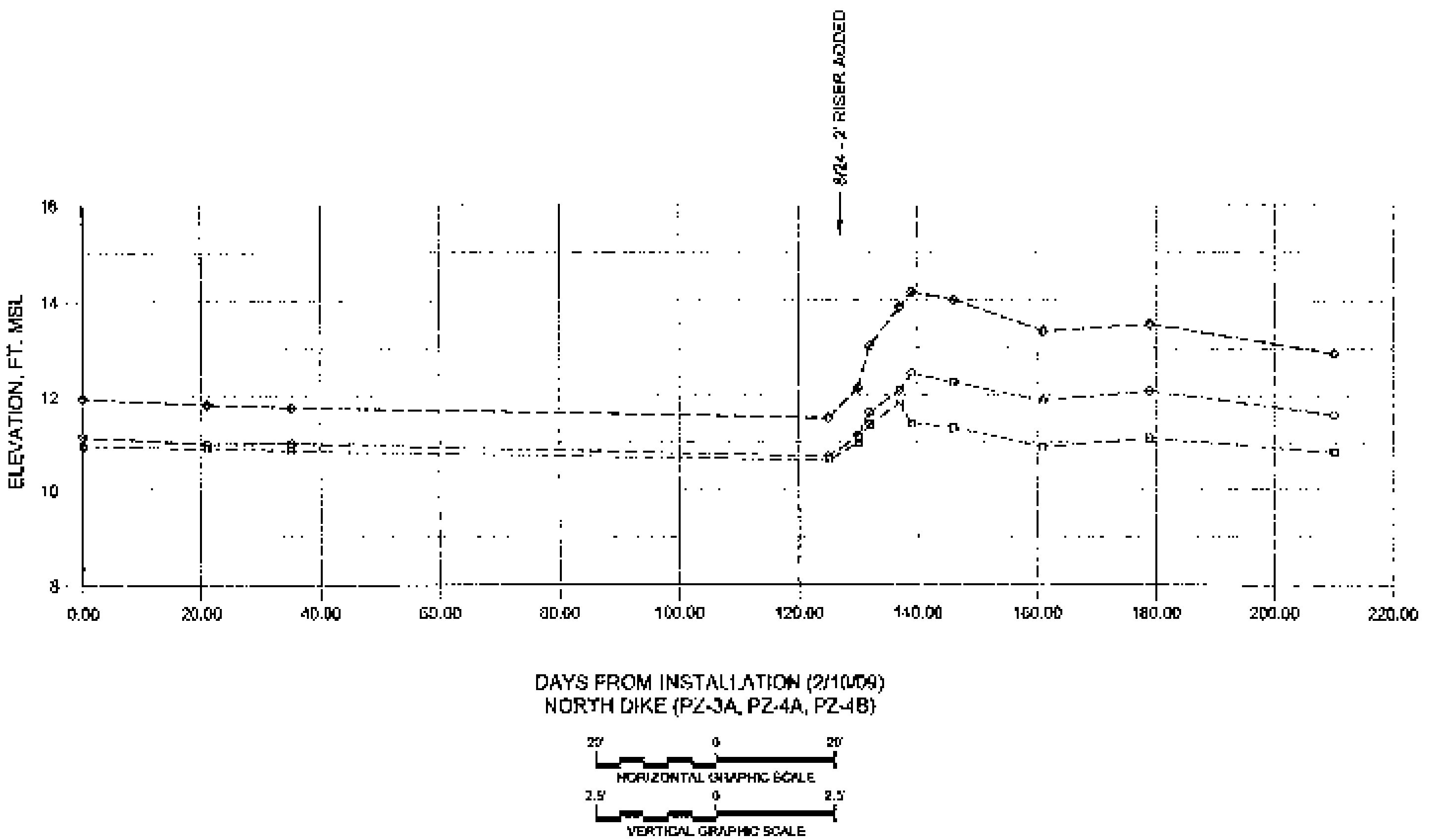
MACTEC
MACTEC ENGINEERING AND CONSULTING, INC
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

PIEZOMETER READINGS - EAST DIKE
1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL 2010
ENG CHECK:		SCALE:	AS SHOWN
APPROVAL:		JOB No.:	6468 09-2340

FIGURE
6

REFERENCE



NOTES:

1. POND ELEVATION ~20 ft TO JUNE 24, 2009.
2. POND ELEVATION ~29 ft ON JUNE 25, 2009.
3. POND ELEVATION ~50 ft AFTER JUNE 26, 2009.
4. DAY 0 = FEBRUARY 18, 2009.
5. LAST READINGS SEPTEMBER 17, 2009.
6. PIEZOMETERS PZ-3, PZ-3B, AND PZ-4 DRY AT ALL READINGS.

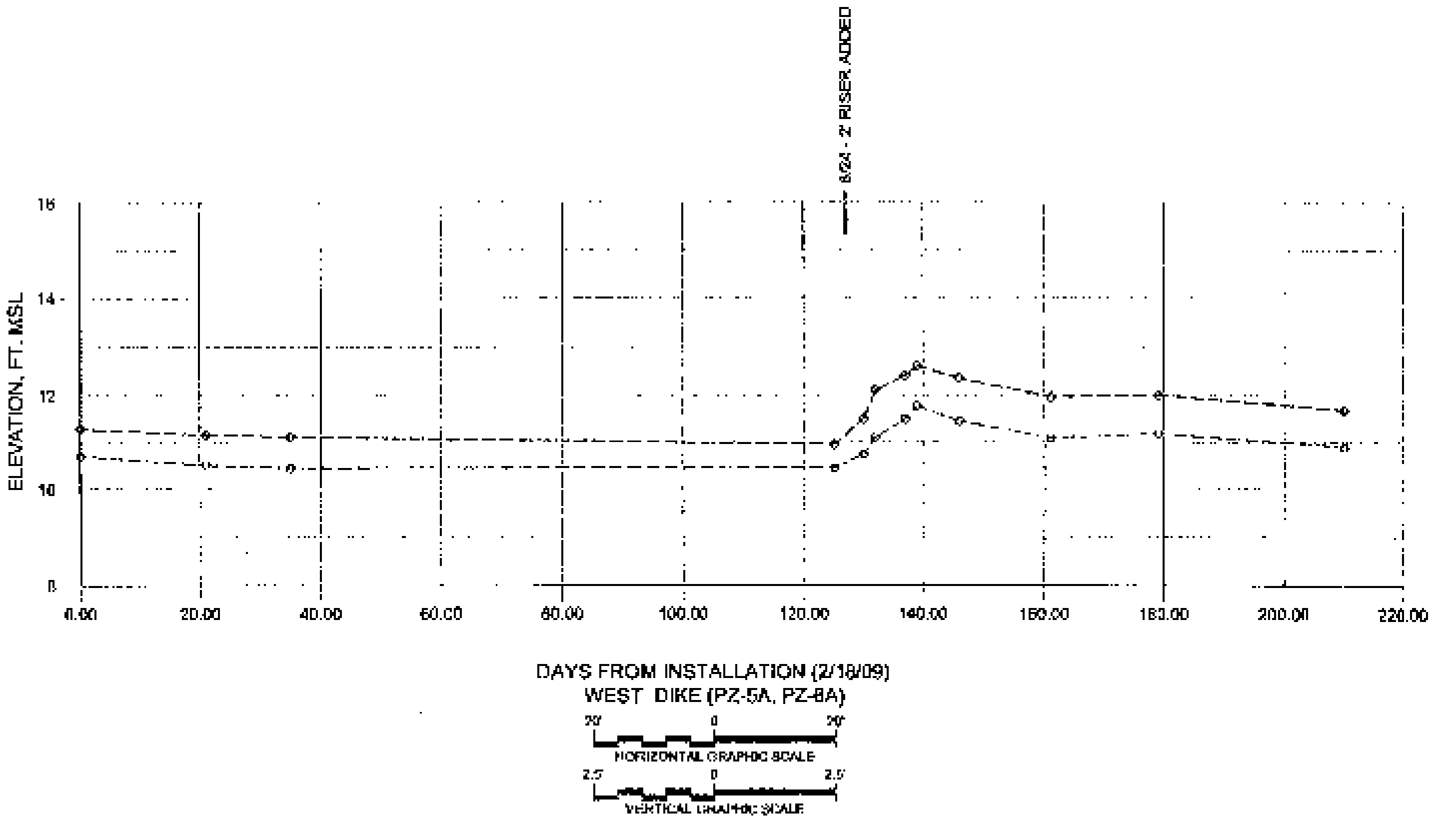
MACTEC
MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

PIEZOMETER READINGS - NORTH DIKE
1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: A.R.
ENG CHECK:
APPROVAL:

DATE: APRIL 2010
SCALE: AS SHOWN
JOB No. 6468-09-2340

FIGURE 7



NOTES:

1. POND ELEVATION ~28 ft TO JUNE 24, 2009.
2. POND ELEVATION ~29 ft ON JUNE 25, 2009.
3. POND ELEVATION ~50 ft AFTER JUNE 26, 2009.
4. DAY 0 ~ FEBRUARY 18, 2009.
5. LAST READINGS SEPTEMBER 17, 2009.
6. PIEZOMETERS PZ-5, PZ-5B, PZ-6 AND PZ-6B DRY AT ALL READINGS.

LEGEND:

---◆--- PZ-5A

---●--- PZ-6A

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

PIEZOMETER READINGS - WEST DIKE
1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL 2010	FIGURE
ENG CHECK:		SCALE:	AS SHOWN	8
APPROVAL:		JOB No.:	6468-08-2340	

REFERENCE

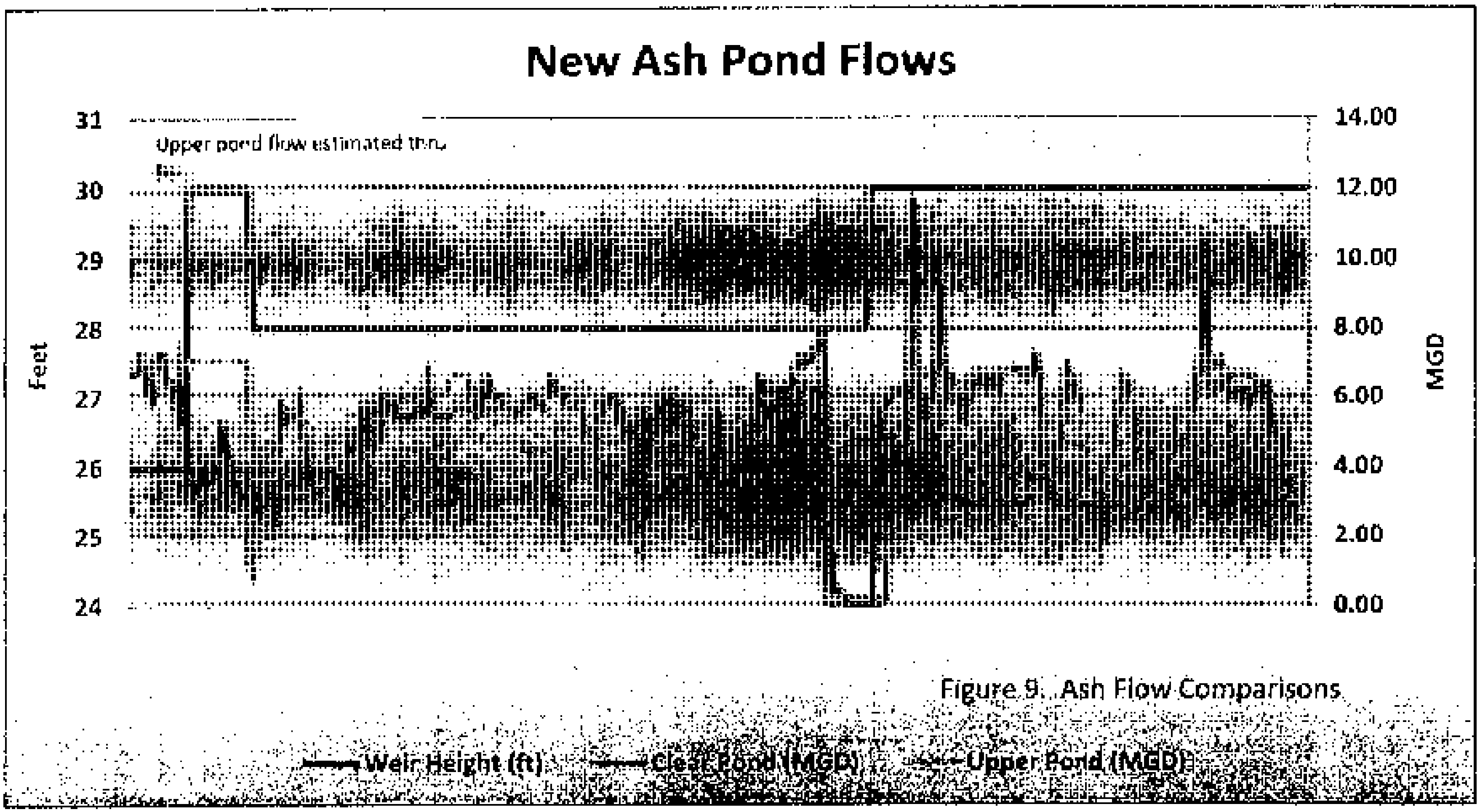


Figure 9. Ash Flow Comparisons

Carolina Power & Light Co.
Raleigh, NC (s/n 5093)

SUTTON ASH POND GEOSLOPE ANALYSIS

100SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.583

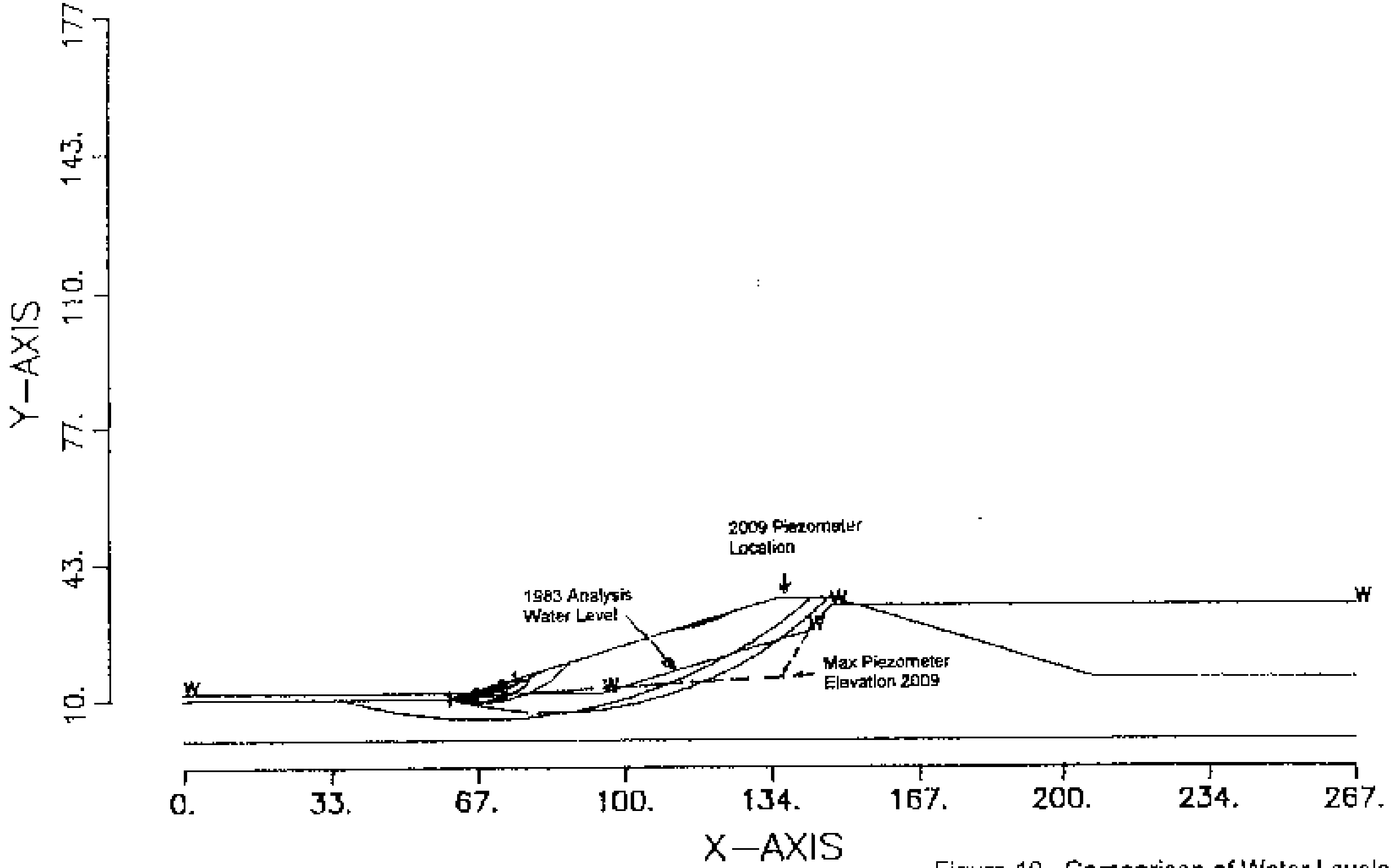


Figure 10. Comparison of Water Levels with Stability Analysis

ATTACHMENT B

BORING RECORDS
(PZ-1A TO PZ-6A)

SOIL CLASSIFICATION

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	⁘	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			⁘	GP	Pooly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	⁘	GM	Silty gravels, gravel - sand - silt mixtures.
			▨	GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)	░	SW	Well graded sands, gravelly sands, little or no fines.
			░	SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	░	SM	Silty sands, sand - silt mixtures
			▨	SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		▥	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
			▨	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			▤	OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		▥	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			▨	CH	Inorganic clays of high plasticity, fat clays
			▤	OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			⁂	PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

NON-SOIL CLASSIFICATION

■	Undisturbed Sample	▌	Auger Cuttings
☒	Split Spoon Sample	≋	Bulk Sample
▯	Rock Core	▩	Crandall Sampler
▩	Dilatometer	⁘	Pressure Meter
▯	Packer	○	No Recovery
∇	Water Table at time of drilling	▼	Water Table after 24 hours
◈	Grab Bag Sample	▣	Caved-in Depth

Correlation of Penetration Resistance with Relative Density and Consistency

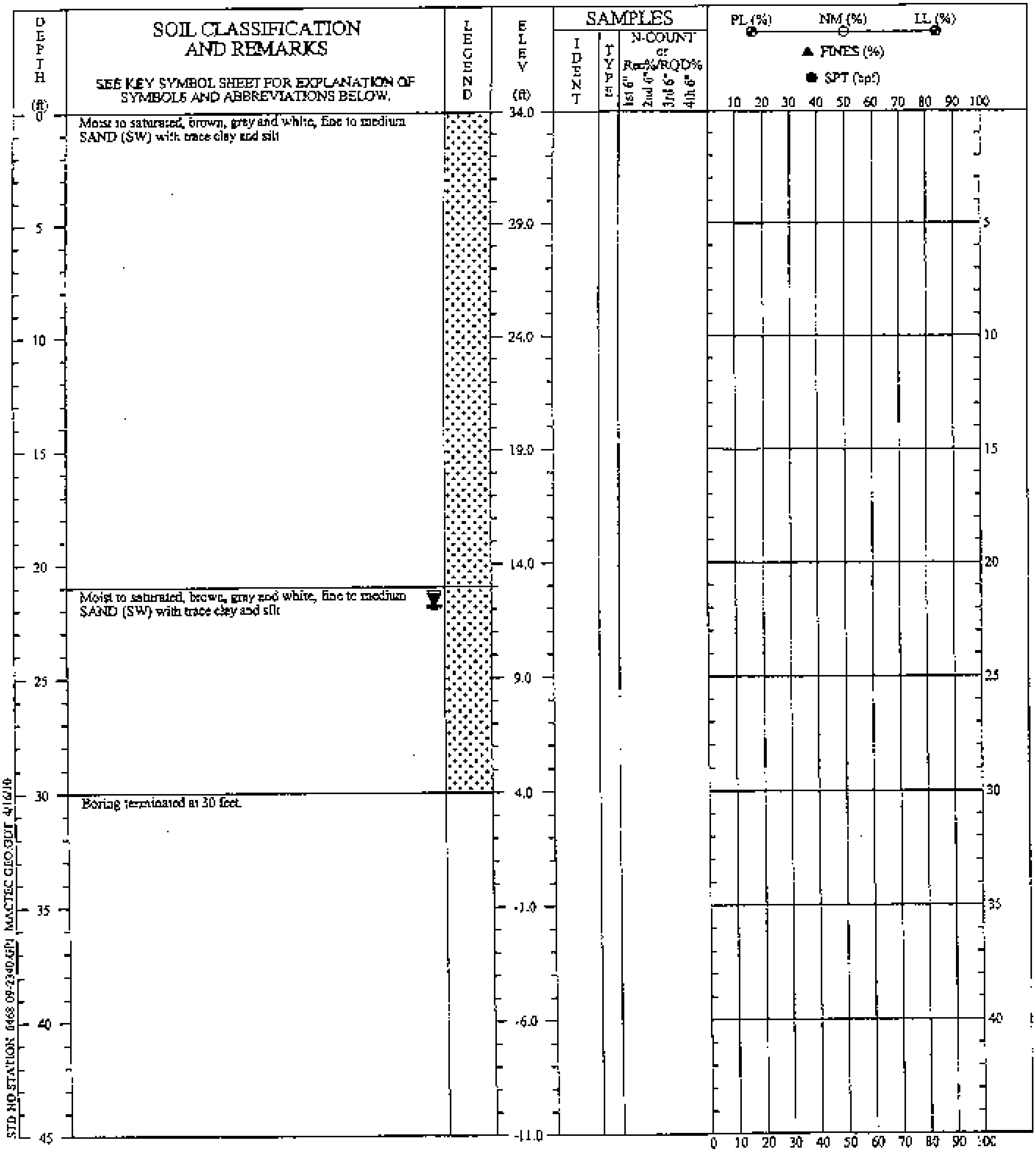
SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
< 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very Stiff
		> 30	Hard

Sample Moisture Description

Saturated:	Usually liquid; very wet, usually from below the groundwater table
Wet:	Semisolid; required drying to attain optimum moisture
Moist:	Solid; at or near optimum moisture
Dry:	Requires additional water to attain optimum moisture

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

DRILLER: Carolina Drilling Co.
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike

Boring No.: PZ-1A

Location: Wilmington, NC
Drilled: February 1[illegible], 2009
Project #: 6468-09-2340

Page 1 **of** [illegible]

MACTEC

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 or Rec%/RQD%: 1st 6"	2nd 6"	3rd 6"	4th 6"
0	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt		34.0						
5			29.0						
10			24.0						
15			19.0						
20			14.0						
	Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt	▼							
25			9.0						
30	Boring terminated at 30 feet.		4.0						
35			-1.0						
40			-6.0						
45			-11.0						

PL (%) NM (%) LL (%)

▲ FINES (%)

● SPT (bpf)

10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

STD-ND STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT-Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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: Progress Energy-Sutton Dike

Boring No.: PZ-2A

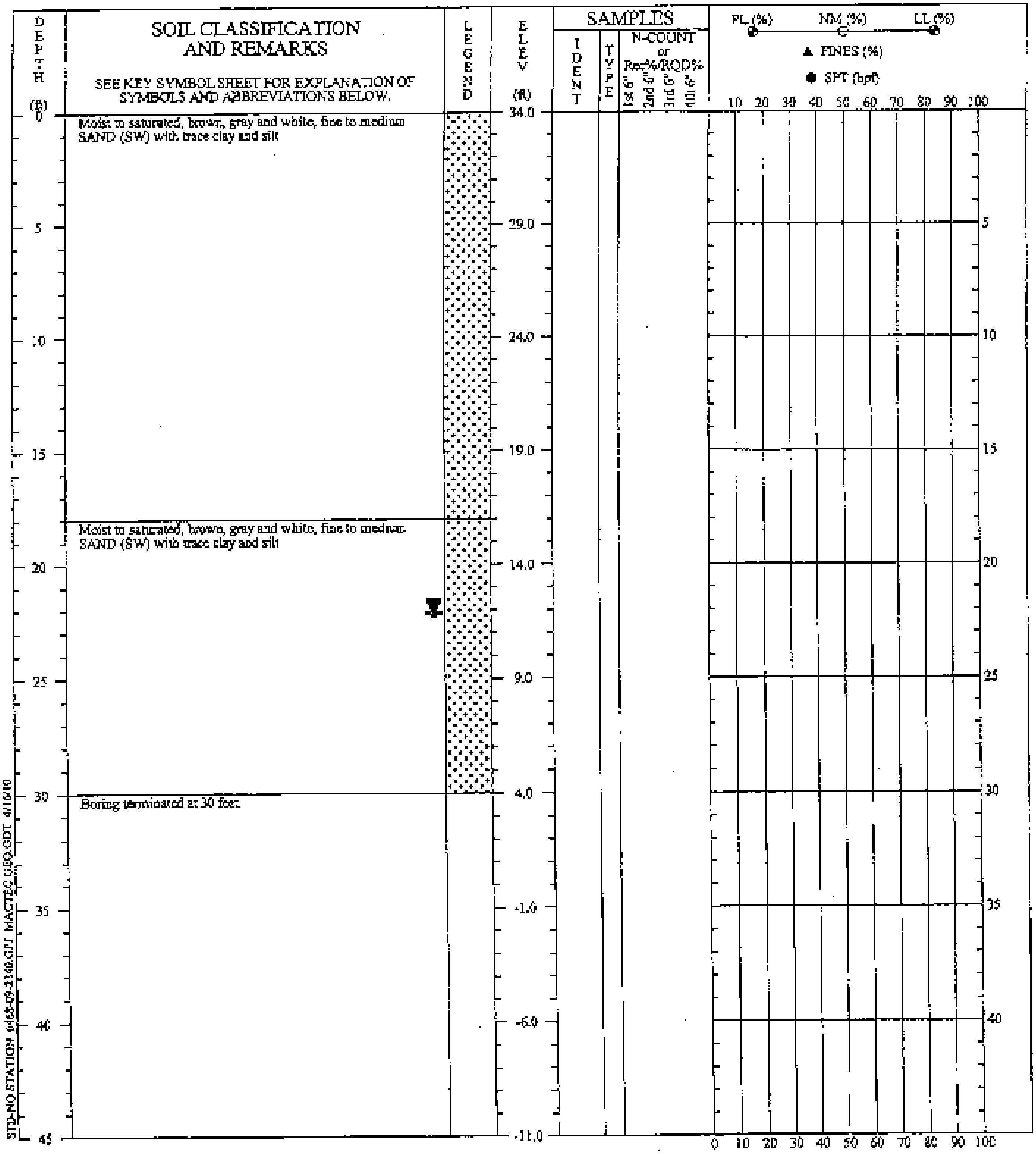
Location: Wilmington, NC

Drilled: February 11, 2009

Project #: 6468-09-2340

Page 1 of 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/09

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT-Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike

Boring No.: PZ-3A

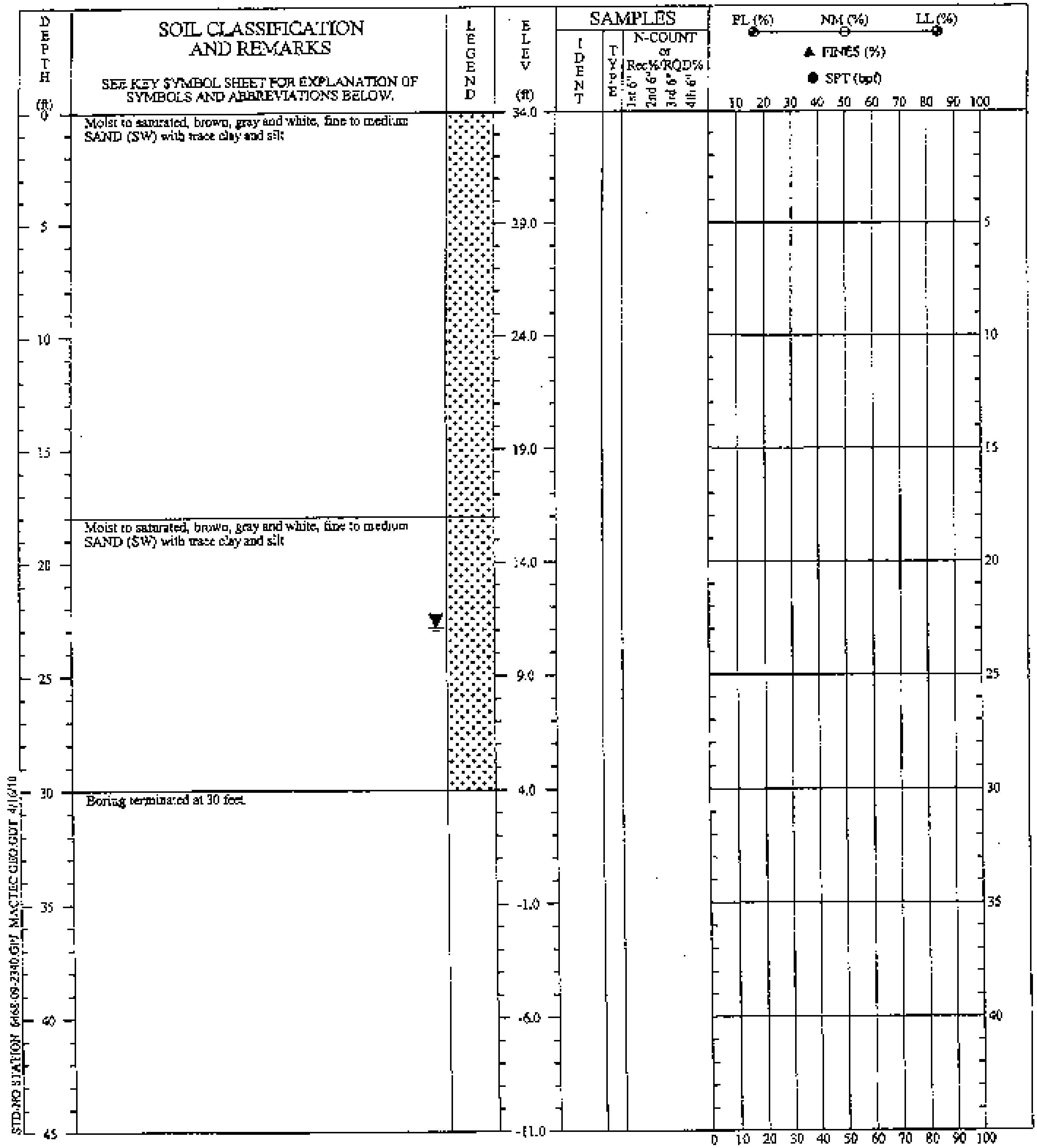
Location: Wilmington, NC

Drilled: February 11, 2009

Project #: 6468-09-2340

Page 1 of 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

DRILLER: Carolina Drilling Co.
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY: GAO

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

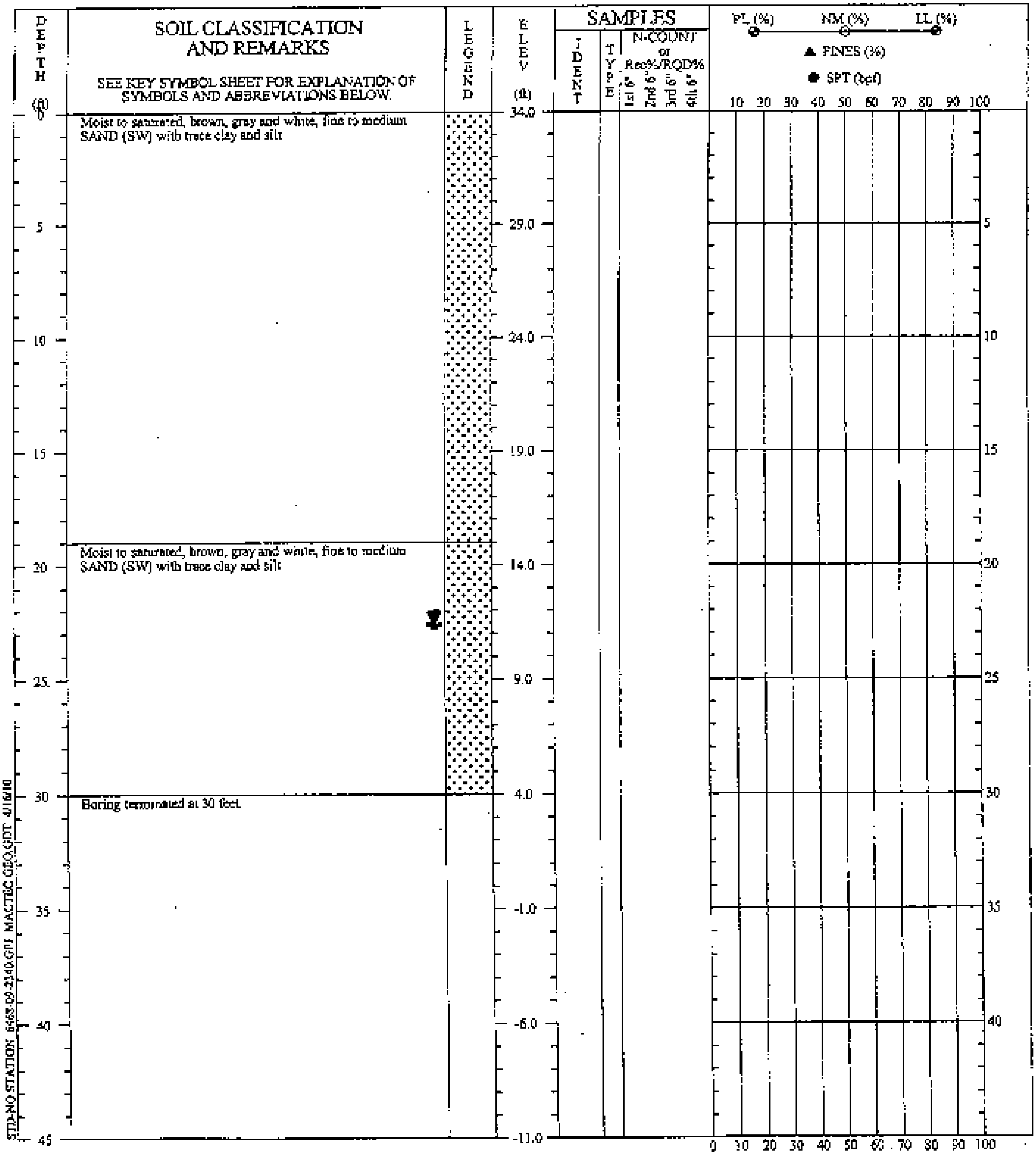
Project: Progress Energy-Sutton Dike

Boring No.: PZ-4A

Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340

Page 1 **of** 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT - Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

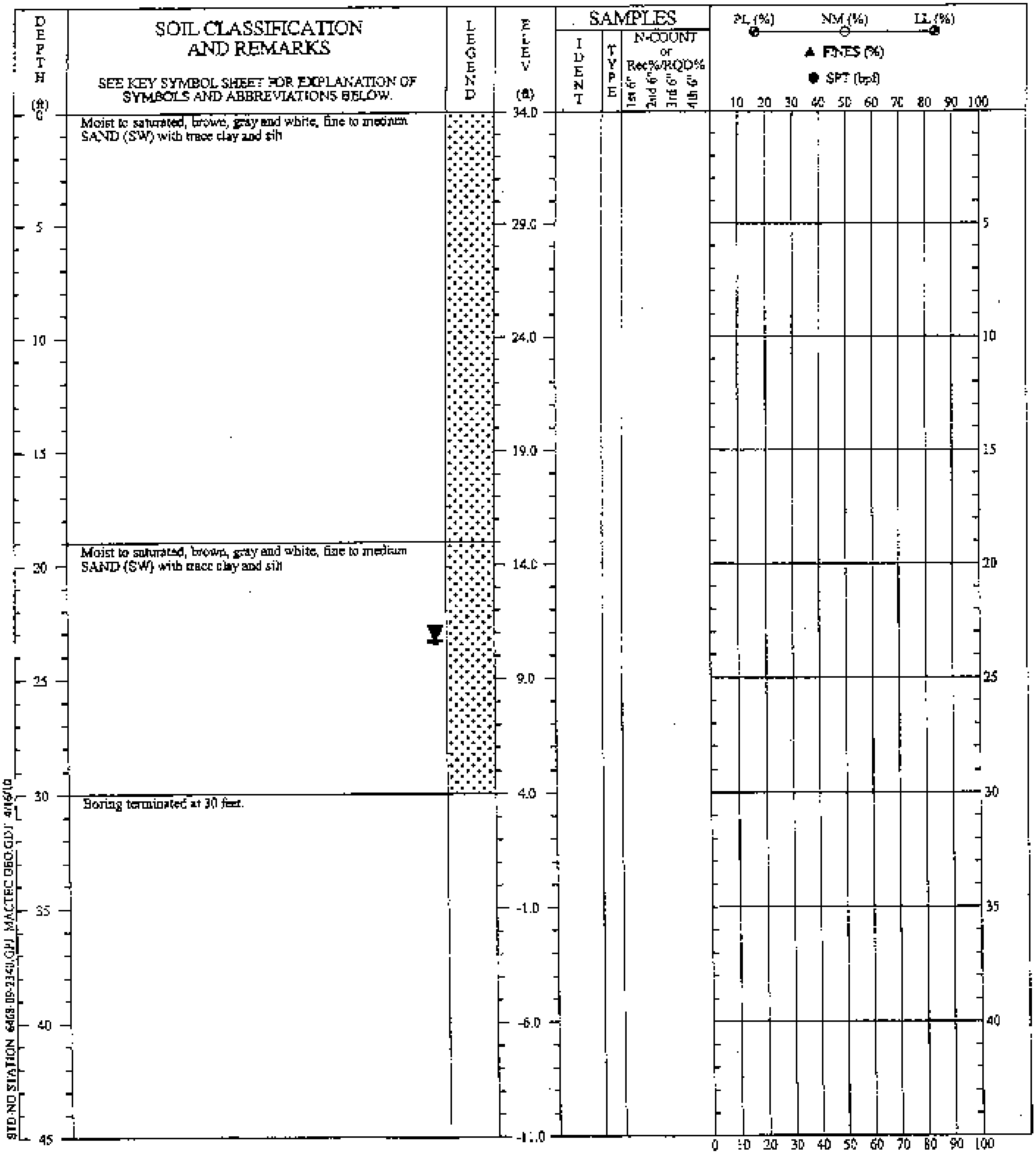
REVIEWED BY: JLD

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: Progress Energy-Sutton Dike
Boring No.: PZ-5A
Location: Wilmington, NC
Drilled: February 12, 2009
Project #: 6468-09-2340
Page 1 **of** 1

MACTEC



0 — Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

19 — Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

30 — Boring terminated at 30 feet.

STD NO STATION 6468-09-2340.GPJ MACTEC DBO.GDT 4/6/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT -Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

REVIEWED BY: JB

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: Progress Energy-Sutton Dike

Boring No.: PZ-6A

Location: Wilmington, NC

Drilled: February 12, 2009

Project #: 6468-09-2340

Page 1 **of** 1

MACTEC

ATTACHMENT C

HAND AUGER BORING/ PIEZOMETER LOGS
(PZ-1B TO PZ-6B)

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant | **Date:** February 11, 2009

Client: Progress Energy | **MACTEC Job No.** 6468-09-2340

Piezometer No. PZ- 1B | **Boring Location:** See boring location plan-toe of the dike slope

Depth (feet)	Blow Counts (None Taken)	Visual Soil Description
0 to 0.2		Dry Light brown/gray silty fine SAND with root fibers
0.2 to 4.5		Moist to wet, light brown and gray fine to medium sand, trace (-) silt (SW)
		Bottom of auger boring at 4.5 feet
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant | **Date:** February 11, 2009

Client: Progress Energy | **MACTEC Job No.** 6468-09-2340

Piezometer No. PZ- 2B | **Boring Location:** See boring location plan-toe of the dike slope

Depth (feet)	Blow Counts (None Taken)	Visual Soil Description
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan slightly silty fine SAND (SW), trace (-) clay
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Prepared by: Reviewed by:

MACTEC

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant
Date: February 11, 2009
Client: Progress Energy
MACTEC Job No. 6468-09-2340
Piezometer No. PZ- 3B
Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW), trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant
Date: February 11, 2009
Client: Progress Energy
MACTEC Job No. 6468-09-2340
Piezometer No. PZ- 4B
Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan slightly fine to medium SAND (SW), trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Groundwater noted at 3.6 feet below top of casing on February 18, 2009.

Hand Auger Boring /Well Log

Prepared by: James A Schaff Reviewed by: ______

MACTEC

Job Name: Progress Energy-Sutton Plant	**Date:** February 11, 2009
Client: Progress Energy	**MACTEC Job No.** 6468-09-2340
Piezometer No. PZ- 5B	**Boring Location:** See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW) with trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant	**Date:** February 11, 2009
Client: Progress Energy	**MACTEC Job No.** 6468-09-2340
Piezometer No. PZ-6B	**Boring Location:** See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW), with trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009

Prepared by: James A. Schiff Reviewed by: ____________________

MACTEC

ATTACHMENT D

PIEZOMETER INSTALLATION RECORDS
PZ-1 TO PZ-6 and PZ-1A TO PZ-6A

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-1**

INSTALLATION DATE **February 11, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

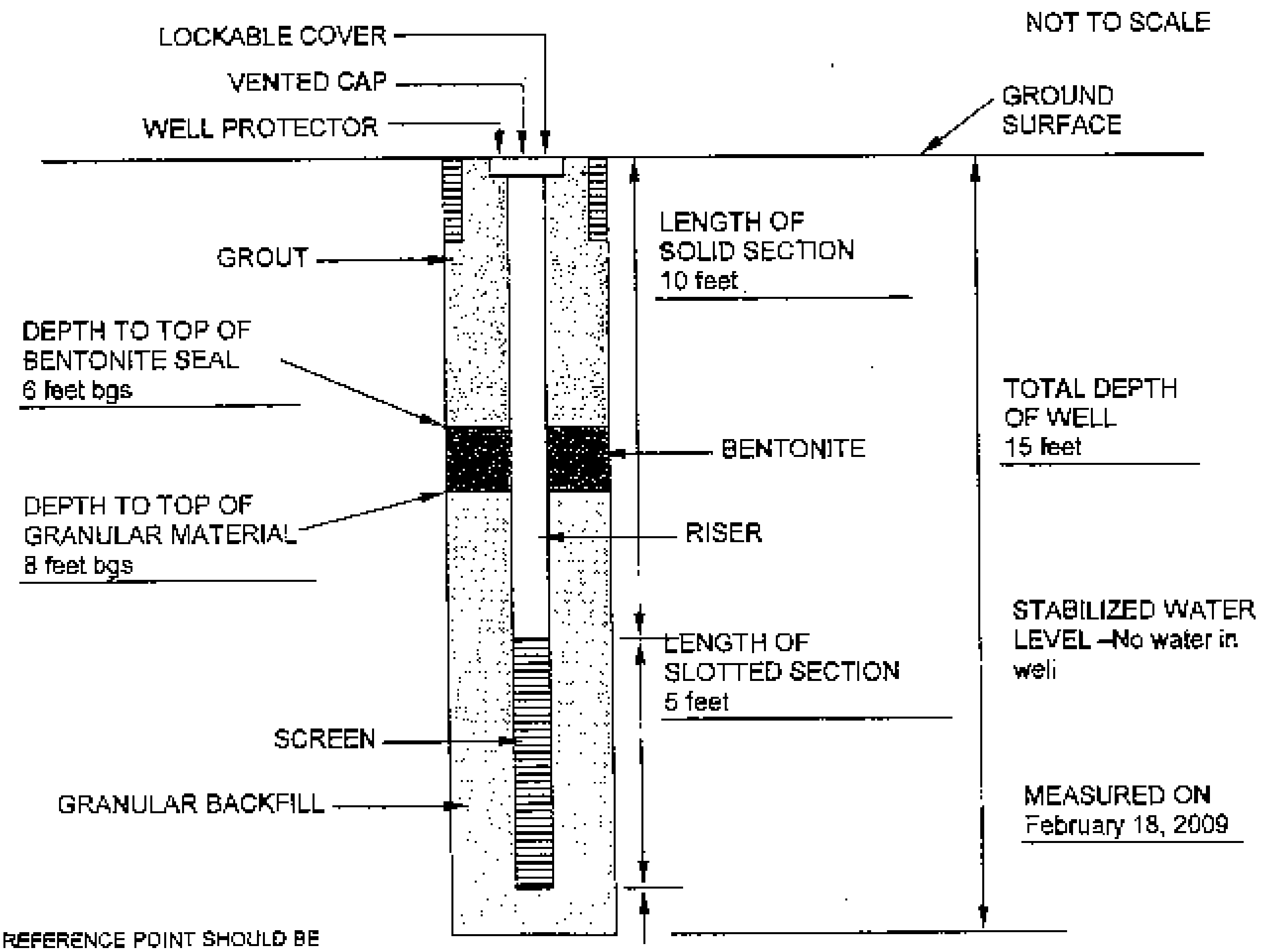
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL –No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No.6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant

JOB NUMBER 6468-09-2340

WELL NUMBER PZ-1A

INSTALLATION DATE February 11, 2009

LOCATION Wilmington, North Carolina

GROUND SURFACE ELEVATION Approx. 34 feet

REFERENCE POINT ELEVATION * Top of PVC

GRANULAR BACKFILL MATERIAL Sand

SLOT SIZE 0.01

SCREEN MATERIAL Schedule 40 PVC

SCREEN DIAMETER 2 inch

RISER MATERIAL Schedule 40 PVC

RISER DIAMETER 2 inch

DRILLING TECHNIQUE Hollow Stem Auger

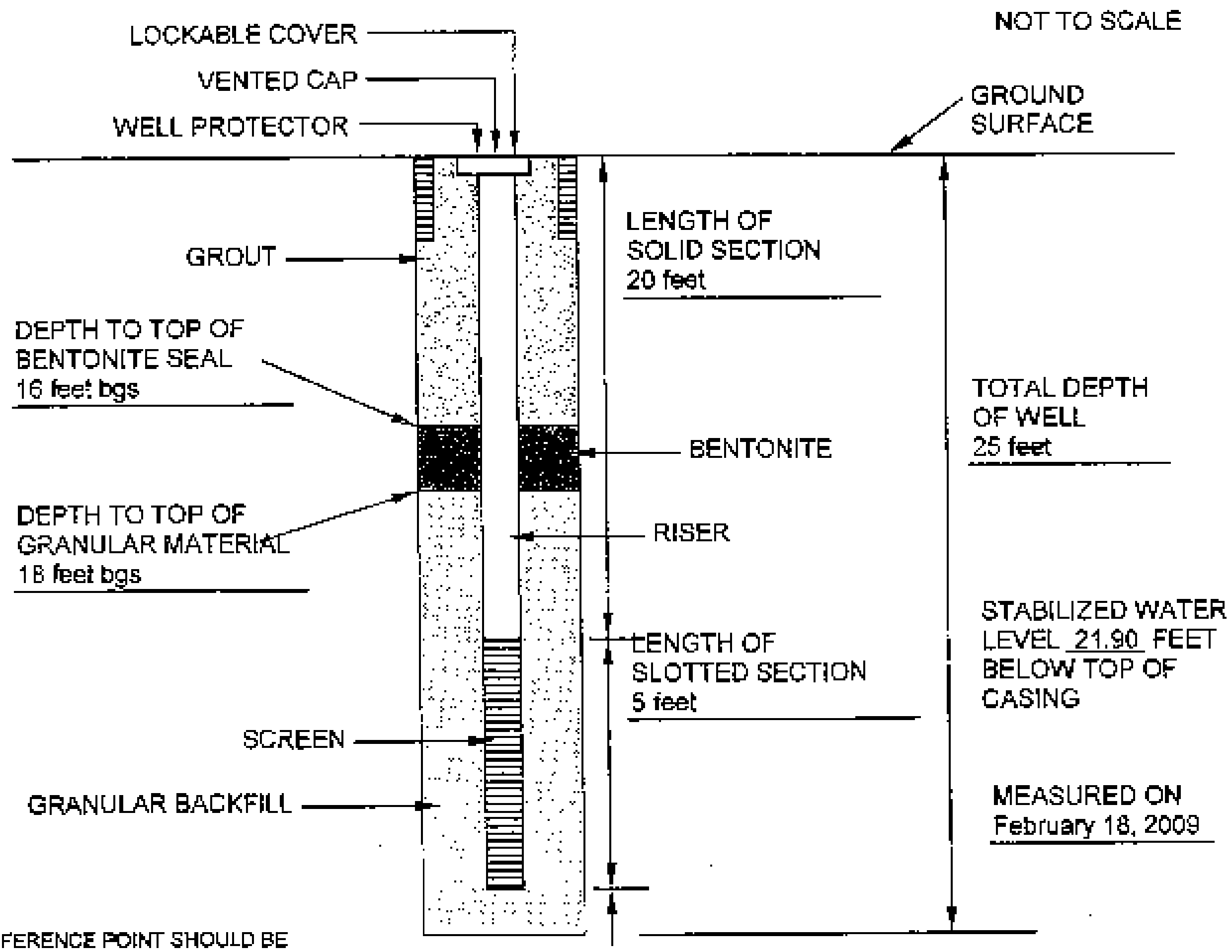
DRILLING CONTRACTOR Carolina Drilling

BOREHOLE DIAMETER 7 inch

MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth

LOCK BRAND Master Lock

KEY CODE/COMBINATION No. 0536



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

STABILIZED WATER LEVEL 21.90 FEET BELOW TOP OF CASING

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant

JOB NUMBER 6468-09-2340

WELL NUMBER PZ-2

INSTALLATION DATE February 12, 2009

LOCATION Wilmington, North Carolina

GROUND SURFACE ELEVATION Approx. 34 feet

REFERENCE POINT ELEVATION * Top of PVC

GRANULAR BACKFILL MATERIAL Sand

SLOT SIZE 0.01

SCREEN MATERIAL Schedule 40 PVC

SCREEN DIAMETER 2 inch

RISER MATERIAL Schedule 40 PVC

RISER DIAMETER 2 inch

DRILLING TECHNIQUE Hollow Stem Auger

DRILLING CONTRACTOR Carolina Drilling

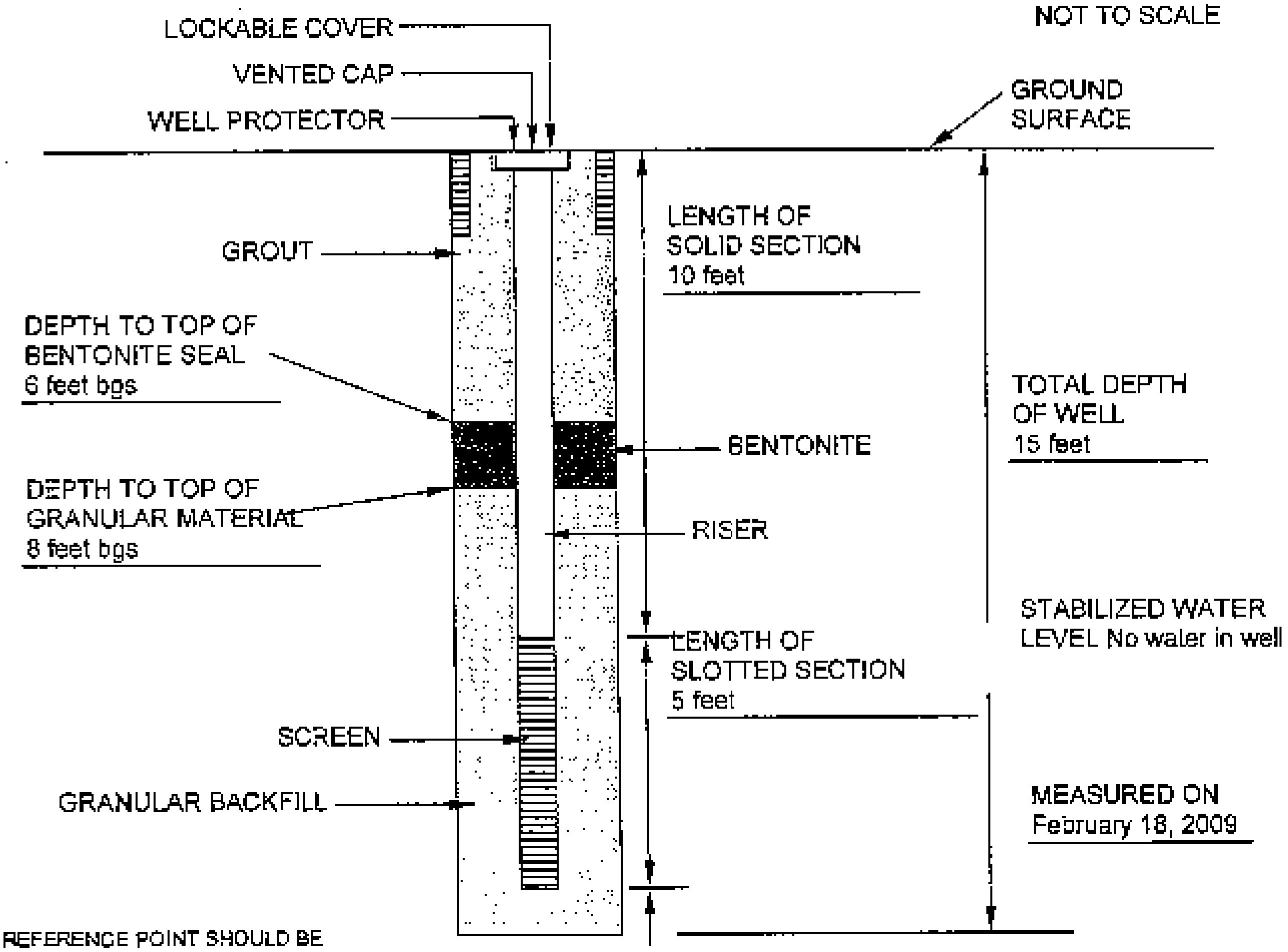
BOREHOLE DIAMETER 7 inch

MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth

LOCK BRAND Master Lock

KEY CODE/COMBINATION No. 0536

NOT TO SCALE



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

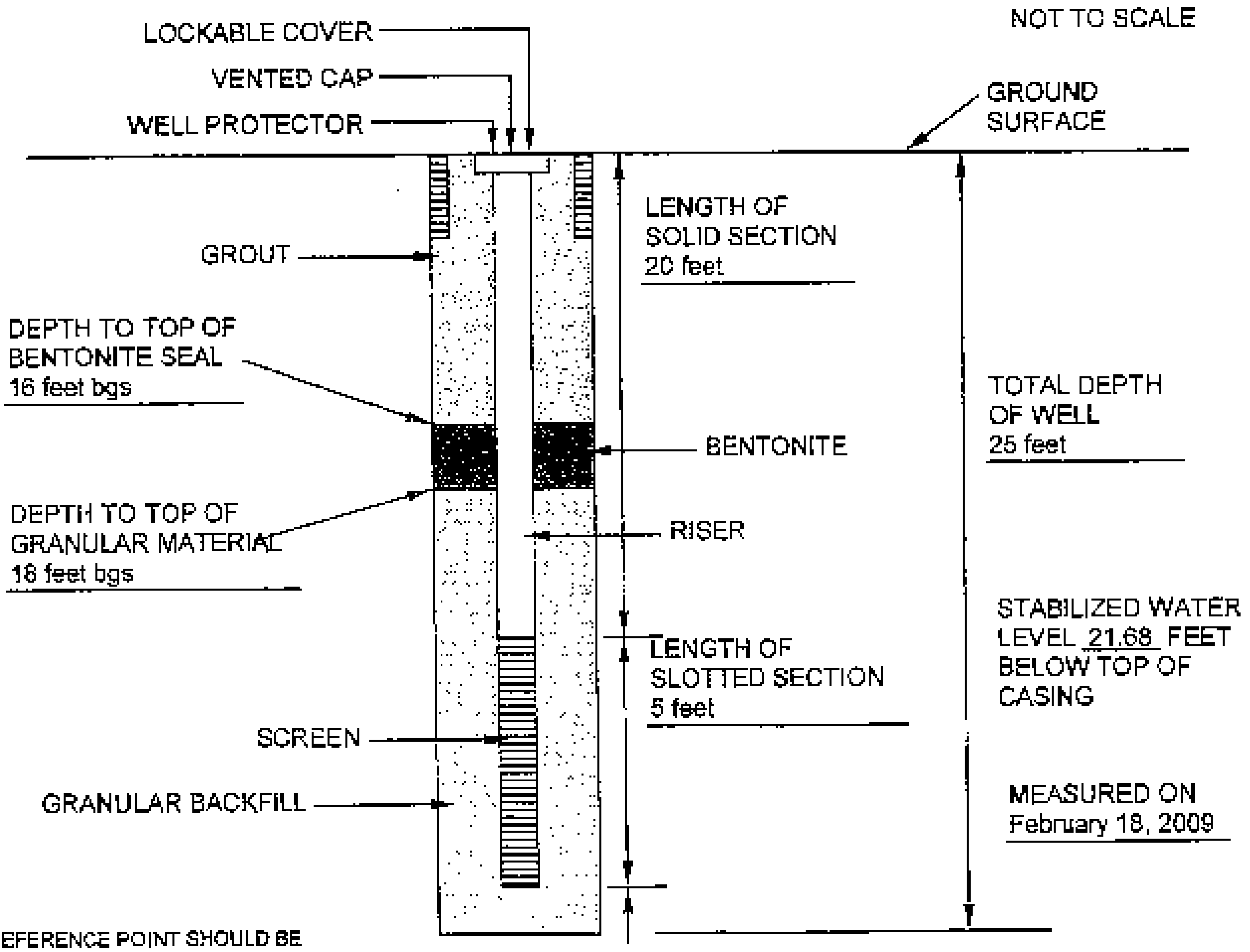
Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL
INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant
JOB NUMBER 6468-09-2340
WELL NUMBER PZ- 2A
INSTALLATION DATE February 12, 2009
LOCATION Wilmington, North Carolina
GROUND SURFACE ELEVATION Approx. 34 feet
REFERENCE POINT ELEVATION * Top of PVC
GRANULAR BACKFILL MATERIAL Sand
SLOT SIZE 0.01
SCREEN MATERIAL Schedule 40 PVC
SCREEN DIAMETER 2 inch
RISER MATERIAL Schedule 40 PVC
RISER DIAMETER 2 inch
DRILLING TECHNIQUE Hollow Stem Auger
DRILLING CONTRACTOR Carolina Drilling
BOREHOLE DIAMETER 7 inch
MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth
LOCK BRAND Master Lock
KEY CODE/COMBINATION 0536



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

STABILIZED WATER LEVEL 21.68 FEET BELOW TOP OF CASING

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL
INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ- 3**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

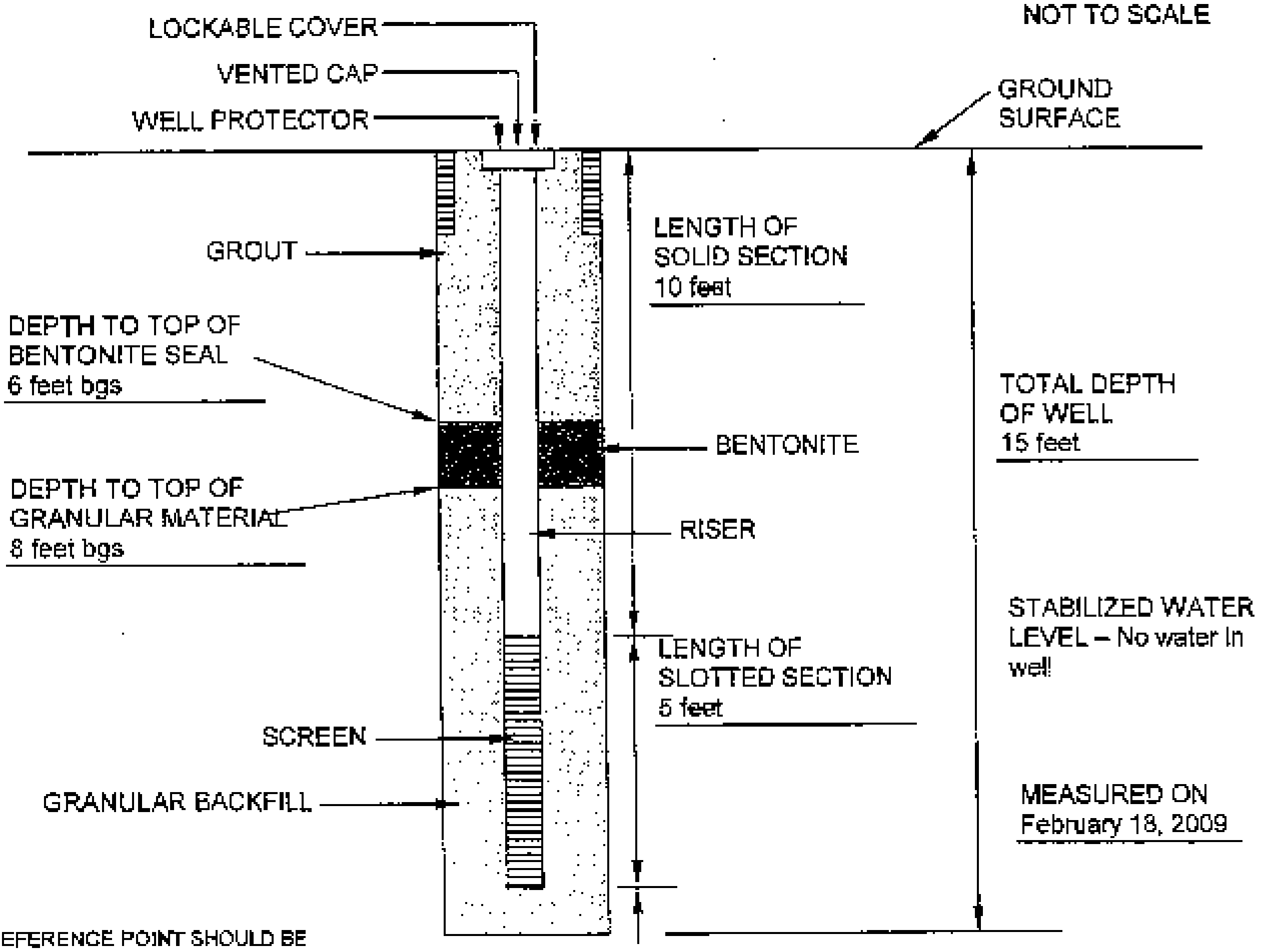
MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

SIZE/MODEL

KEY CODE/COMBINATION **0536**

NOT TO SCALE



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL – No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant Wilmington, North Carolina Project No. 6468-09-2340	MACTEC	TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-3A**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

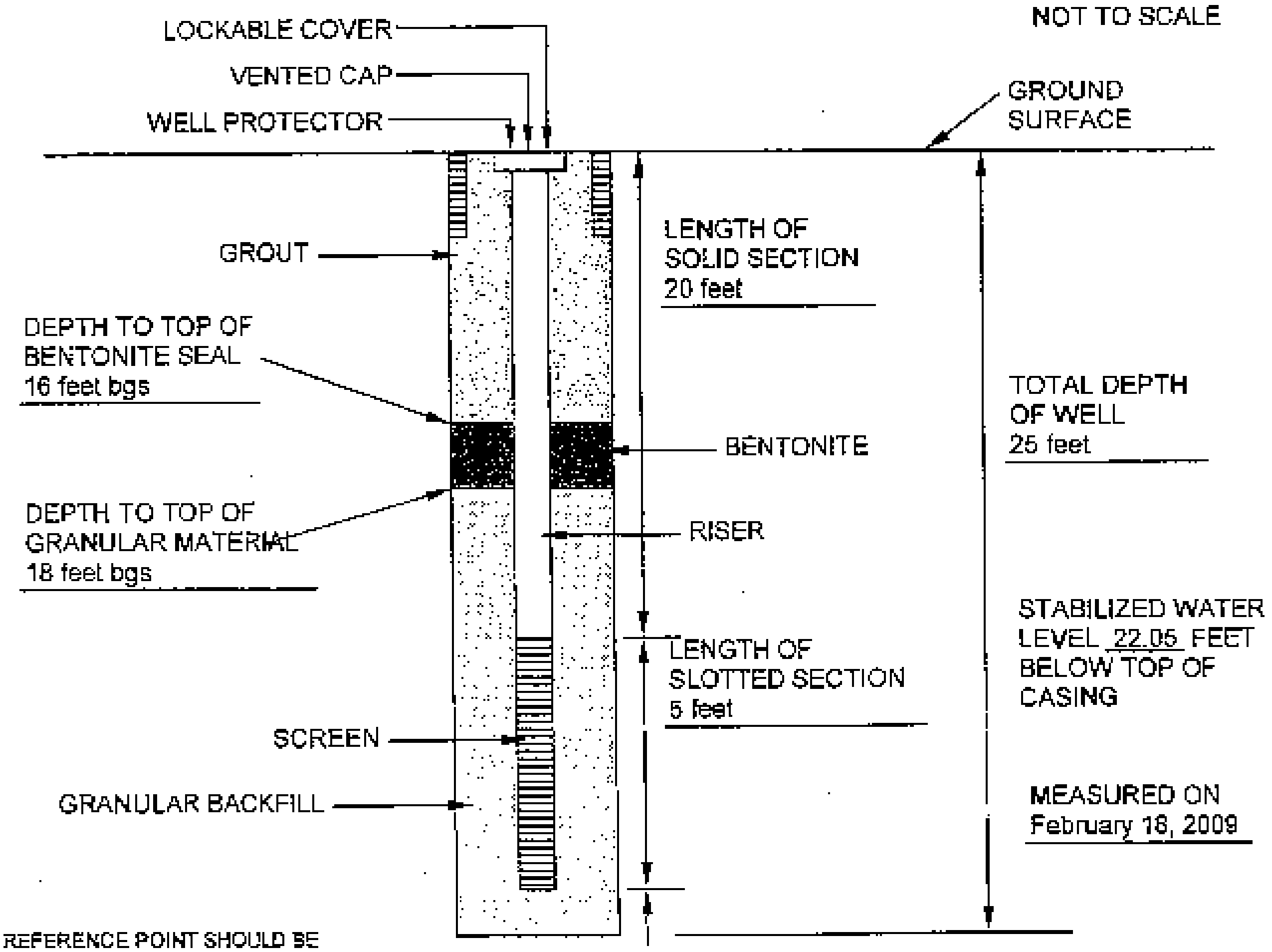
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **0536**



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

STABILIZED WATER LEVEL 22.05 FEET BELOW TOP OF CASING

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**

JOB NUMBER **6468-09-2340**

WELL NUMBER **PZ-4**

INSTALLATION DATE **February 12, 2009**

LOCATION **Wilmington, North Carolina**

GROUND SURFACE ELEVATION **Approx. 34 feet**

REFERENCE POINT ELEVATION * **Top of PVC**

GRANULAR BACKFILL MATERIAL **Sand**

SLOT SIZE **0.01**

SCREEN MATERIAL **Schedule 40 PVC**

SCREEN DIAMETER **2 inch**

RISER MATERIAL **Schedule 40 PVC**

RISER DIAMETER **2 inch**

DRILLING TECHNIQUE **Hollow Stem Auger**

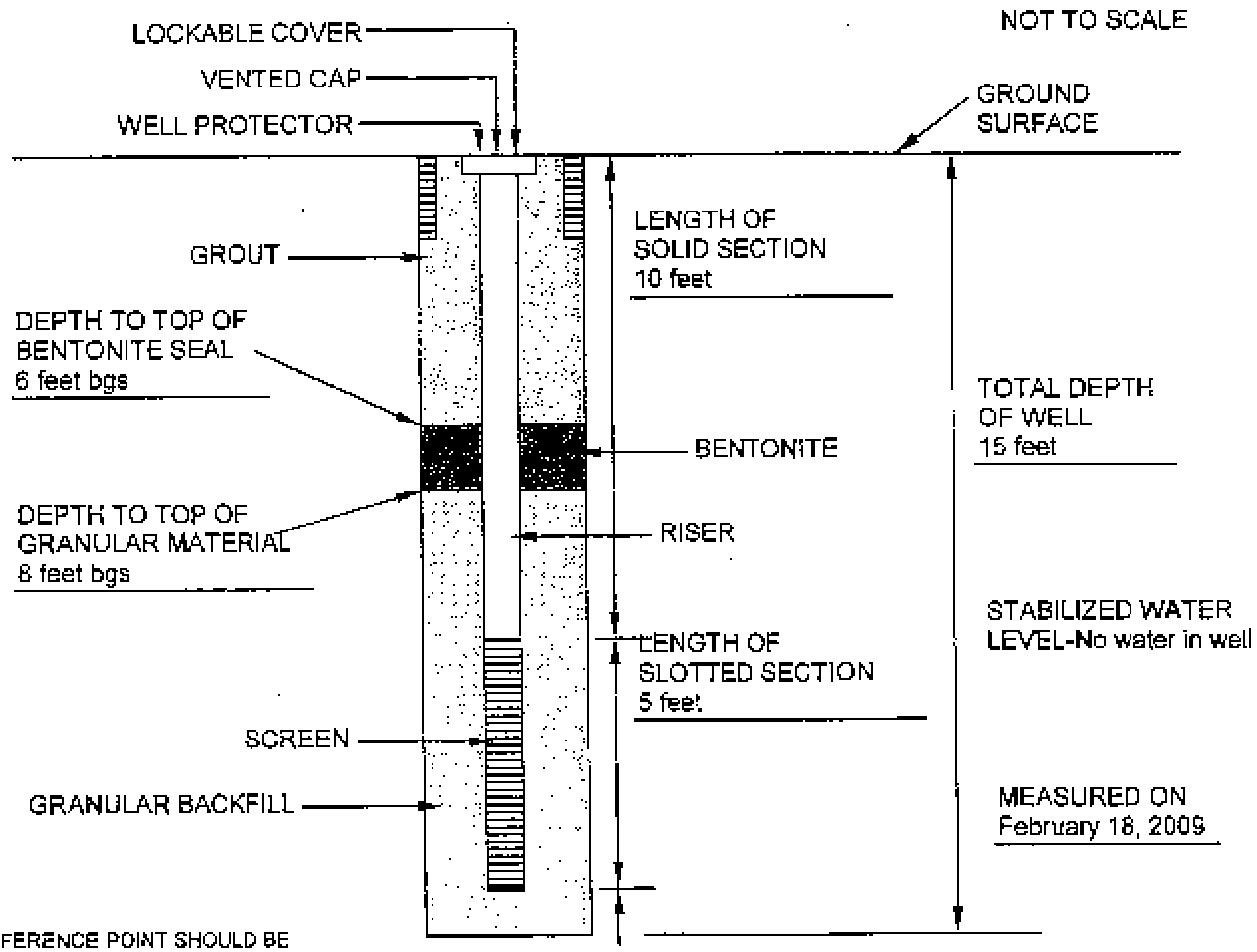
DRILLING CONTRACTOR **Carolina Drilling**

BOREHOLE DIAMETER **7 inch**

MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**

LOCK BRAND **Master Lock**

KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL-No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant

JOB NUMBER 6468-09-2340

WELL NUMBER PZ-4A

INSTALLATION DATE February 12, 2009

LOCATION Wilmington, North Carolina

GROUND SURFACE ELEVATION Approx. 34 feet

REFERENCE POINT ELEVATION * Top of PVC

GRANULAR BACKFILL MATERIAL Sand

SLOT SIZE 0.01

SCREEN MATERIAL Schedule 40 PVC

SCREEN DIAMETER 2 inch

RISER MATERIAL Schedule 40 PVC

RISER DIAMETER 2 inch

DRILLING TECHNIQUE Hollow Stem Auger

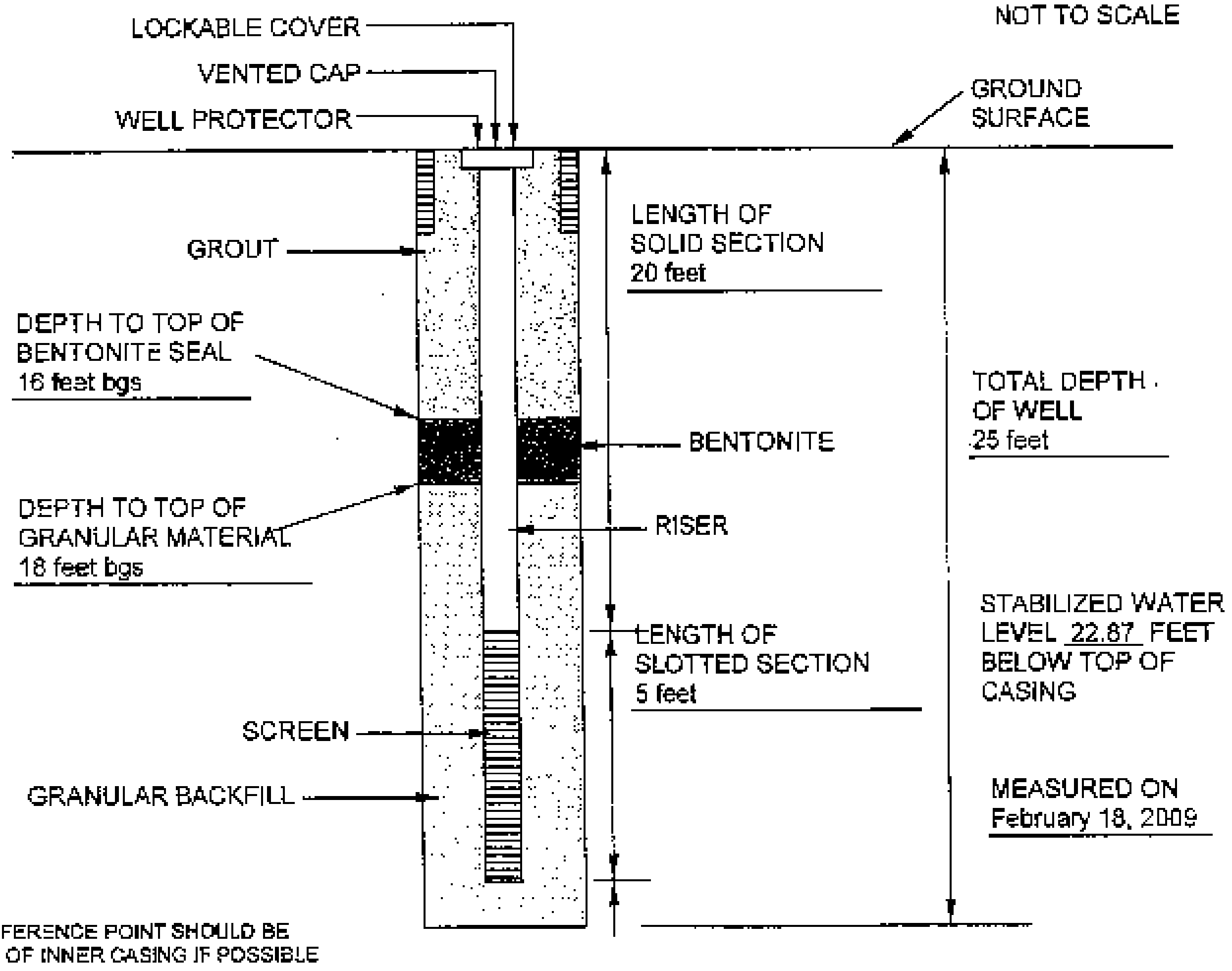
DRILLING CONTRACTOR Carolina Drilling

BOREHOLE DIAMETER 7 inch

MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth

LOCK BRAND Master Lock

KEY CODE/COMBINATION No. 0536



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL 22.87 FEET BELOW TOP OF CASING

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant

JOB NUMBER 6468-09-2340

WELL NUMBER PZ-5

INSTALLATION DATE February 12, 2009

LOCATION Wilmington, North Carolina

GROUND SURFACE ELEVATION Approx. 34 feet

REFERENCE POINT ELEVATION * Top of PVC

GRANULAR BACKFILL MATERIAL Sand

SLOT SIZE 0.01

SCREEN MATERIAL Schedule 40 PVC

SCREEN DIAMETER 2 inch

RISER MATERIAL Schedule 40 PVC

RISER DIAMETER 2 inch

DRILLING TECHNIQUE Hollow Stem Auger

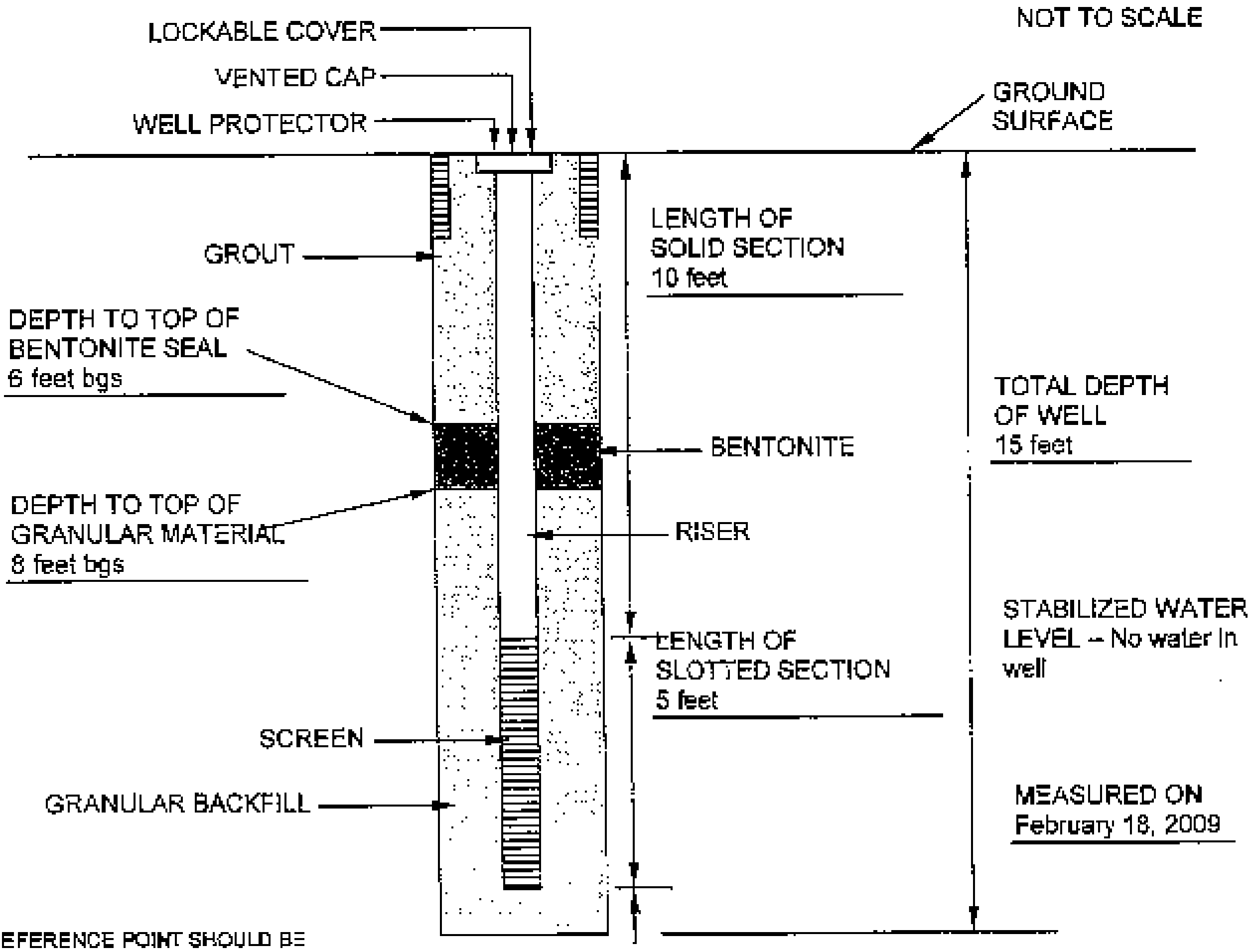
DRILLING CONTRACTOR Carolina Drilling

BOREHOLE DIAMETER 7 inch

MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth

LOCK BRAND Master Lock

KEY CODE/COMBINATION No. 0536



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15 feet

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

STABILIZED WATER LEVEL -- No water in well

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant

JOB NUMBER 6468-09-2340

WELL NUMBER PZ-5A

INSTALLATION DATE February 12, 2009

LOCATION Wilmington, North Carolina

GROUND SURFACE ELEVATION Approx. 34 feet

REFERENCE POINT ELEVATION * Top of PVC

GRANULAR BACKFILL MATERIAL Sand

SLOT SIZE 0.01

SCREEN MATERIAL Schedule 40 PVC

SCREEN DIAMETER 2 inch

RISER MATERIAL Schedule 40 PVC

RISER DIAMETER 2 inch

DRILLING TECHNIQUE Hollow Stem Auger

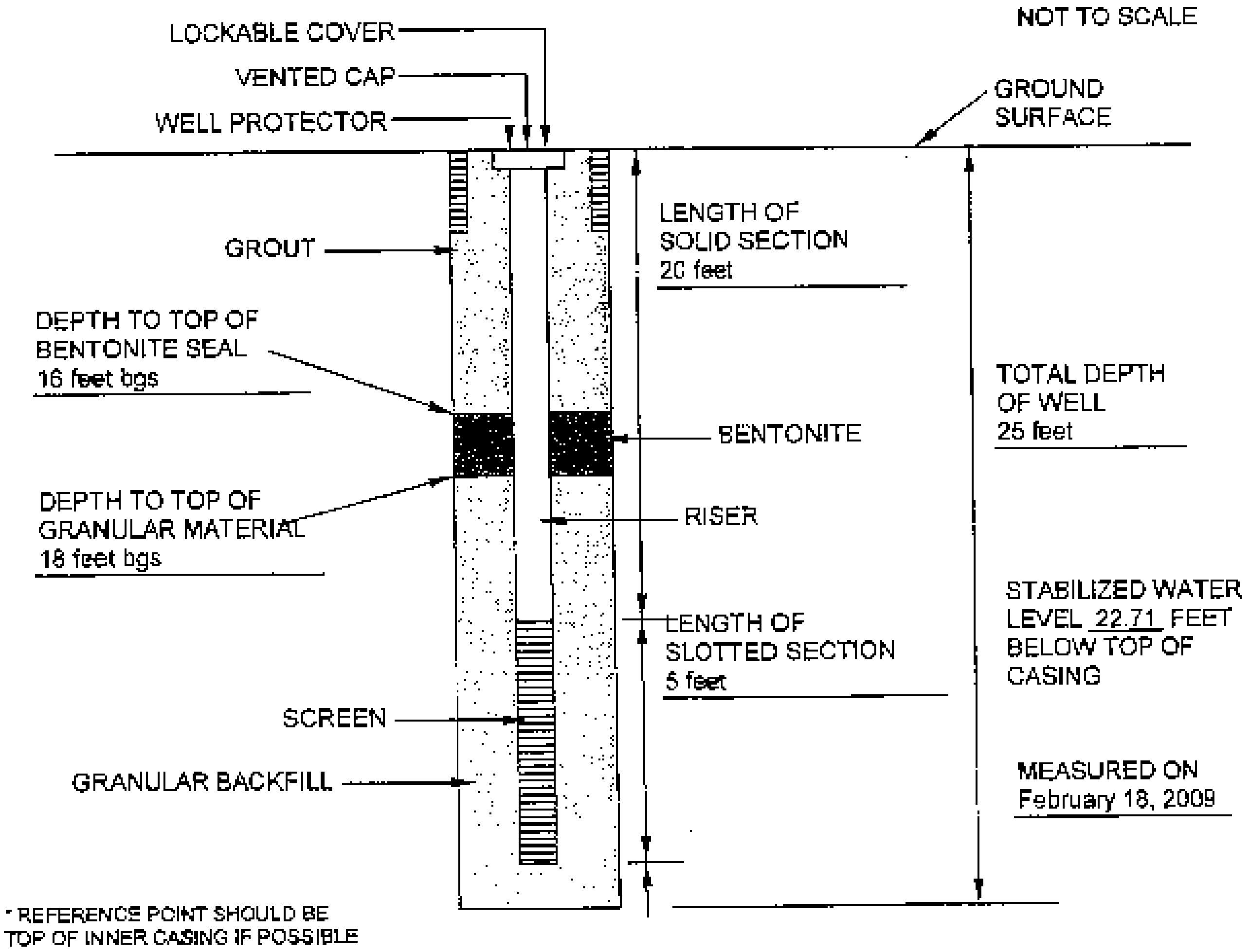
DRILLING CONTRACTOR Carolina Drilling

BOREHOLE DIAMETER 7 inch

MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth

LOCK BRAND Master Lock

KEY CODE/COMBINATION No. 0536



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

LENGTH OF SLOTTED SECTION 5 feet

STABILIZED WATER LEVEL 22.71 FEET BELOW TOP OF CASING

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

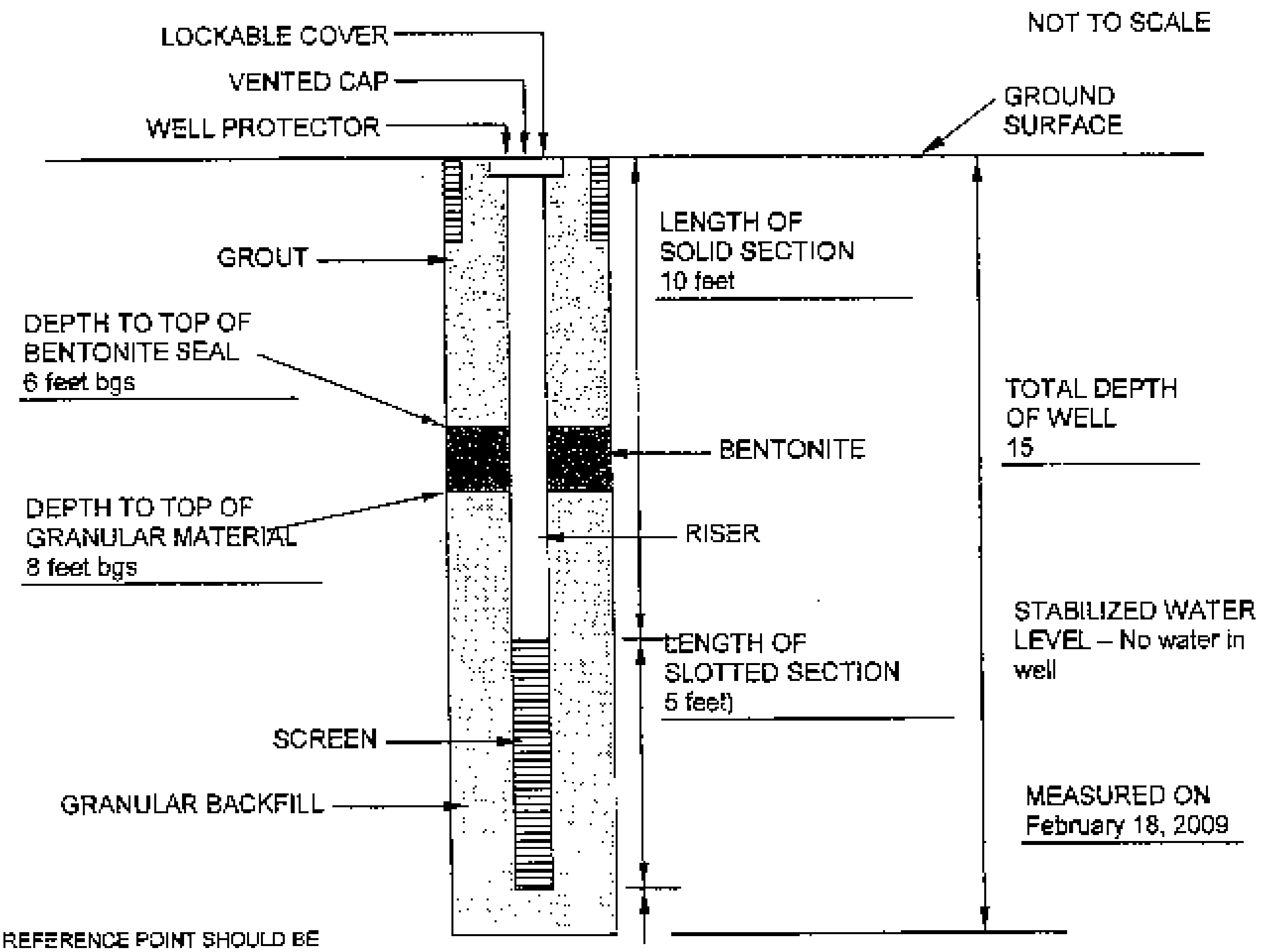
Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME **Progress Energy- Sutton Plant**
JOB NUMBER **6468-09-2340**
WELL NUMBER **PZ-6**
INSTALLATION DATE **February 12, 2009**
LOCATION **Wilmington, North Carolina**
GROUND SURFACE ELEVATION **Approx. 34 feet**
REFERENCE POINT ELEVATION * **Top of PVC**
GRANULAR BACKFILL MATERIAL **Sand**
SLOT SIZE **0.01**
SCREEN MATERIAL **Schedule 40 PVC**
SCREEN DIAMETER **2 inch**
RISER MATERIAL **Schedule 40 PVC**
RISER DIAMETER **2 inch**
DRILLING TECHNIQUE **Hollow Stem Auger**
DRILLING CONTRACTOR **Carolina Drilling**
BOREHOLE DIAMETER **7 inch**
MACTEC ENGINEERING FIELD REPRESENTATIVE **Peter Worth**
LOCK BRAND **Master Lock**
KEY CODE/COMBINATION **No. 0536**



LENGTH OF SOLID SECTION 10 feet

DEPTH TO TOP OF BENTONITE SEAL 6 feet bgs

TOTAL DEPTH OF WELL 15

DEPTH TO TOP OF GRANULAR MATERIAL 8 feet bgs

LENGTH OF SLOTTED SECTION 5 feet)

STABILIZED WATER LEVEL – No water in well

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

PIEZOMETER INSTALLATION RECORD

JOB NAME Progress Energy- Sutton Plant

JOB NUMBER 6468-09-2340

WELL NUMBER PZ-6A

INSTALLATION DATE February 12, 2009

LOCATION Wilmington, North Carolina

GROUND SURFACE ELEVATION Approx. 34 feet

REFERENCE POINT ELEVATION * Top of PVC

GRANULAR BACKFILL MATERIAL Sand

SLOT SIZE 0.01

SCREEN MATERIAL Schedule 40 PVC

SCREEN DIAMETER 2 inch

RISER MATERIAL Schedule 40 PVC

RISER DIAMETER 2 inch

DRILLING TECHNIQUE Hollow Stem Auger

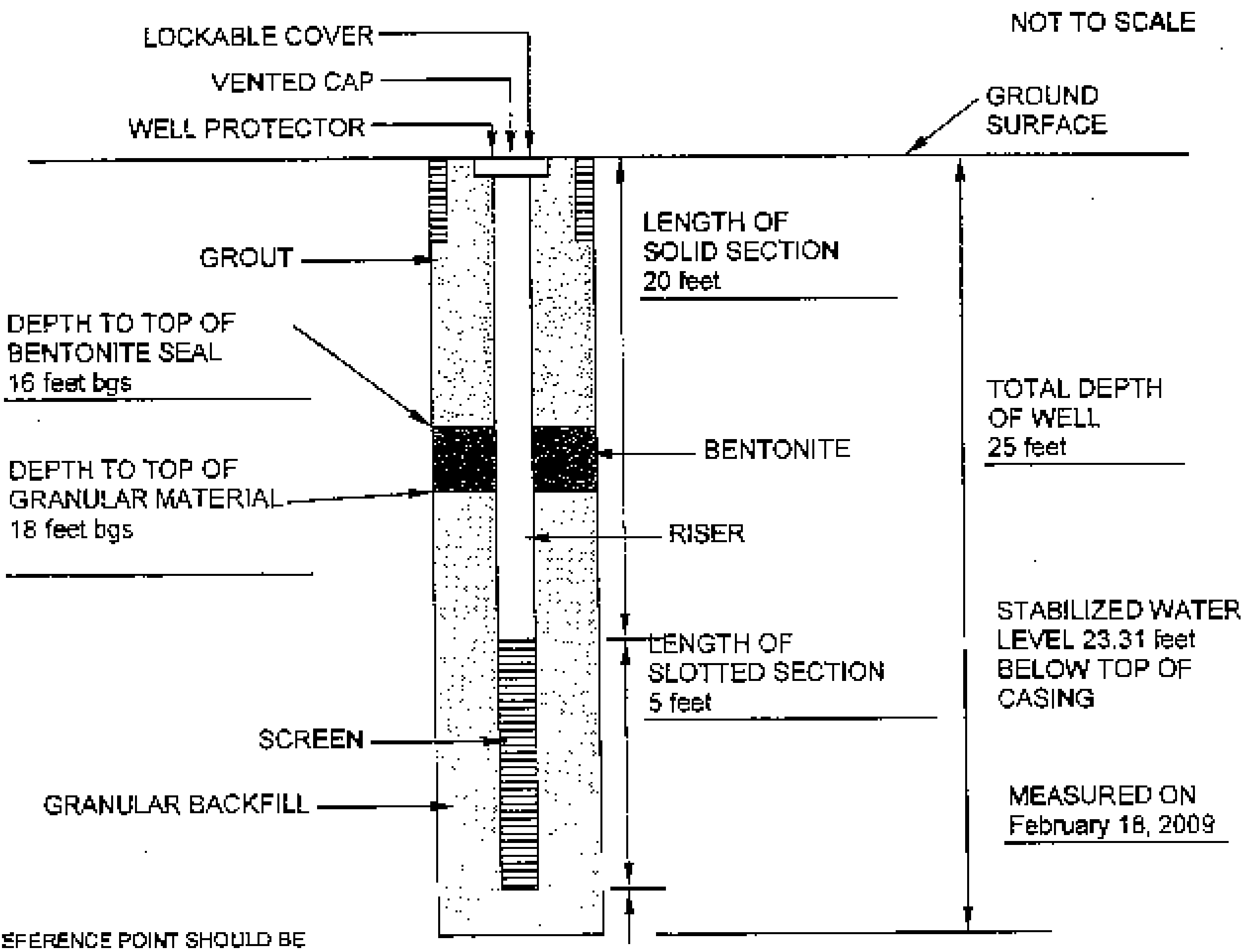
DRILLING CONTRACTOR Carolina Drilling

BOREHOLE DIAMETER 7 inch

MACTEC ENGINEERING FIELD REPRESENTATIVE Peter Worth

LOCK BRAND Master Lock

KEY CODE/COMBINATION No. 0536



LENGTH OF SOLID SECTION 20 feet

DEPTH TO TOP OF BENTONITE SEAL 16 feet bgs

TOTAL DEPTH OF WELL 25 feet

DEPTH TO TOP OF GRANULAR MATERIAL 18 feet bgs

STABILIZED WATER LEVEL 23.31 feet BELOW TOP OF CASING

LENGTH OF SLOTTED SECTION 5 feet

MEASURED ON February 18, 2009

* REFERENCE POINT SHOULD BE TOP OF INNER CASING IF POSSIBLE

Progress Energy – Sutton Plant
Wilmington, North Carolina
Project No. 6468-09-2340

MACTEC

TYPE II MONITORING WELL INSTALLATION RECORD

APPENDIX E

CAROLINA DRILLING CONSTRUCTION RECORDS
(SENT TO THE STATE OF NC)

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eisler
Well Contractor (Individual) Name

Bridger Drilling Enterprises, inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-1
WELL CONSTRUCTION PERMIT#(if applicable) ____
OTHER ASSOCIATED PERMIT #(if applicable) ____

3. WELL USE (Check Applicable Box) Monitoring ☑ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐ Irrigation ☐ Other ☐ (list use) ____

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM ☐ PM ☑

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover
Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☑ Ridge ☐ Other ____
(check appropriate box)

LATITUDE 34 17 931
LONGITUDE 77 59 323

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable) ____
NAME OF FACILITY Progress Energy Sutton Plant
STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield
MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15'
b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☑
c. WATER LEVEL Below Top of Casing: 0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ____ METHOD OF TEST ____

f. DISINFECTION: Type ____ Amount ____

g. WATER ZONES (depth):

From ____	To ____	From ____	To ____
From ____	To ____	From ____	To ____
From ____	To ____	From ____	To ____

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 10 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 6 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 10	To 15 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 8	To 15 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	15	tan, gray and dark sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 2/10/09 DATE

Gerald Eisler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eister
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

City or Town	State	Zip Code
Wilmington	NC	28457

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-1A

WELL CONSTRUCTION PERMIT#(if applicable) ____

OTHER ASSOCIATED PERMIT #(if applicable) ____

3. WELL USE (Check Applicable Box) Monitoring☑ Municipal/Public☐ Industrial/Commercial☐ Agricultural☐ Recovery☐ Injection☐ Irrigation☐ Other☐ (list use) ____

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM☐ PM☑

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☑ Ridge ☐ Other ____
(check appropriate box)

LATITUDE 34 17 831

LONGITUDE 77 59 322

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY is the name of the business where the well is located.

FACILITY ID #(if applicable) ____

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

City or Town	State	Zip Code
Wilmington	NC	28401

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

City or Town	State	Zip Code
Wilmington	NC	28401

(910) 343-3208
Area code + Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 25'

b. DOES WELL REPLACE EXISTING WELL? YES☐ NO☑

c. WATER LEVEL Below Top of Casing: 21.8 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ____ METHOD OF TEST ____

f. DISINFECTION: Type ____ Amount ____

g. WATER ZONES (depth):

From	To	From	To

7. CASING:

Depth From	To	Ft. Diameter	Thickness/Weight	Material
0	20	2"	sch40	pvc

8. GROUT:

Depth From	To	Material	Method
0	16	neat	tremie

9. SCREEN:

Depth From	To	Diameter (in.)	Slot Size (in.)	Material
20	25	2	0.10	pvc

10. SAND/GRAVEL PACK:

Depth From	To	Size	Material
18	25	med	sand

11. DRILLING LOG

From	To	Formation Description
0	25	tan, gray and dark gray sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Gerald R. Eister 7/4/67
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eister
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eisler
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-2

WELL CONSTRUCTION PERMIT#(if applicable)

OTHER ASSOCIATED PERMIT #(if applicable)

3. WELL USE (Check Applicable Box) Monitoring☒ Municipal/Public☐ Industrial/Commercial☐ Agricultural☐ Recovery☐ Injection☐ Irrigation☐ Other☐ (list use)

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM☐ PM☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other
(check appropriate box)

LATITUDE 34 17 998

LONGITUDE 77 59 353

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- Is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15'

b. DOES WELL REPLACE EXISTING WELL? YES☐ NO☒

c. WATER LEVEL Below Top of Casing: 0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): METHOD OF TEST

f. DISINFECTION: Type Amount

g. WATER ZONES (depth):
From To From To
From To From To
From To From To

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 10 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 6 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 10	To 15 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 8	To 15 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	15	tan, gray and dark sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Gerald Eisler 2/19/09
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eisler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eisler
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-2A

WELL CONSTRUCTION PERMIT#(if applicable) ______

OTHER ASSOCIATED PERMIT #(if applicable) ______

3. WELL USE (Check Applicable Box) Monitoring ☒ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐ Irrigation ☐ Other ☐ (list use) ______

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM ☐ PM ☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other ______
(check appropriate box)

LATITUDE 34 17 997

LONGITUDE 77 59 352

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable) ______

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 25'

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 21.7 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ______ METHOD OF TEST ______

f. DISINFECTION: Type ______ Amount ______

g. WATER ZONES (depth):

From	To	From	To
From	To	From	To
From	To	From	To

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 20	Ft. 2"	sch40	pvc
From	To	Ft.		
From	To	Ft.		

8. GROUT:

Depth		Material	Method
From 0	To 16	Ft. neat	tremie
From	To	Ft.	
From	To	Ft.	

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 20	To 25	Ft. 2 in.	0.10 in.	pvc
From	To	Ft. in.	in.	
From	To	Ft. in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 16	To 25	Ft. med	sand
From	To	Ft.	
From	To	Ft.	

11. DRILLING LOG

From	To	Formation Description
0	25	tan, gray and dark gray sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Gerald R. Eisler 2/19/09
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eisler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt.,
1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eisler
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-3

WELL CONSTRUCTION PERMIT#(if applicable) ____

OTHER ASSOCIATED PERMIT #(if applicable) ____

3. WELL USE (Check Applicable Box) Monitoring☒ Municipal/Public☐ Industrial/Commercial☐ Agricultural☐ Recovery☐ Injection☐ Irrigation☐ Other☐ (list use) ____

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM☐ PM☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other ____
(check appropriate box)

LATITUDE 34 18 053

LONGITUDE 77 59 420

May be in degrees, minutes, seconds or in a decimal format.

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable) ____

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15'

b. DOES WELL REPLACE EXISTING WELL? YES☐ NO☒

c. WATER LEVEL Below Top of Casing: 0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ____ METHOD OF TEST ____

f. DISINFECTION: Type ____ Amount ____

g. WATER ZONES (depth):

From	To	From	To

7. CASING:

Depth From	To	Ft. Diameter	Thickness/Weight	Material
0	10	2"	sch40	pvc

8. GROUT:

Depth From	To	Ft. Material	Method
0	6	neat	tremie

9. SCREEN:

Depth From	To	Ft. Diameter	in. Slot Size	in. Material
10	15	2	0.10	pvc

10. SAND/GRAVEL PACK:

Depth From	To	Ft. Size	Material
8	15	med	sand

11. DRILLING LOG

From	To	Formation Description
0	15	tan, gray and dark sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 2/19/09 DATE

Gerald Eisler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eister
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-3A

WELL CONSTRUCTION PERMIT#(if applicable) ______

OTHER ASSOCIATED PERMIT #(if applicable) ______

3. WELL USE (Check Applicable Box) Monitoring ☑ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐ Irrigation ☐ Other ☐ (list use) ______

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM ☐ PM ☑

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☑ Ridge ☐ Other ______
(check appropriate box)

LATITUDE 34 18 053

LONGITUDE 77 59 422

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☑ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY - is the name of the business where the well is located.

FACILITY ID #(if applicable) ______

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 25'

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☐

c. WATER LEVEL Below Top of Casing: 22.2 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ______ METHOD OF TEST ______

f. DISINFECTION: Type ______ Amount ______

g. WATER ZONES (depth):

From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___
From ___ To ___ From ___ To ___

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 20 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 16 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 20	To 25 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 18	To 25 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	25	tan, gray and dark gray sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 2/19/09 DATE

Gerald Eister
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eister
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-4

WELL CONSTRUCTION PERMIT#(if applicable)

OTHER ASSOCIATED PERMIT #(if applicable)

3. WELL USE (Check Applicable Box) Monitoring☒ Municipal/Public☐ Industrial/Commercial☐ Agricultural☐ Recovery☐ Injection☐ Irrigation☐ Other☐ (list use)

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM☐ PM☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other
(check appropriate box)

LATITUDE 34 18 029

LONGITUDE 77 59 502

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15'

b. DOES WELL REPLACE EXISTING WELL? YES☐ NO☐

c. WATER LEVEL Below Top of Casing: 0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): METHOD OF TEST

f. DISINFECTION: Type Amount

g. WATER ZONES (depth):

From To From To
From To From To
From To From To

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 10 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 6 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 10	To 15 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 8	To 15 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	15	tan, gray and dark sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Gerald R Eister 2/19/09
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eister
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eister
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-4A

WELL CONSTRUCTION PERMIT#(if applicable) ____

OTHER ASSOCIATED PERMIT #(if applicable) ____

3. WELL USE (Check Applicable Box) Monitoring ☑ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐ Irrigation ☐ Other ☐ (list use) ____

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM ☐ PM ☑

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☑ Ridge ☐ Other ____
(check appropriate box)

LATITUDE 34 18 027

LONGITUDE 77 59 503

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable) ____

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3206
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 25'

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 22.9 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ____ METHOD OF TEST ____

f. DISINFECTION: Type ____ Amount ____

g. WATER ZONES (depth):

From	To	From	To
From	To	From	To
From	To	From	To

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 20 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 16 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 20	To 25 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 18	To 25 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	25	tan, gray and dark gray sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR

2/13/09
DATE

Gerald Eister
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev. 12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eisler
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910)-799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-5

WELL CONSTRUCTION PERMIT#(if applicable) ____

OTHER ASSOCIATED PERMIT #(if applicable) ____

3. WELL USE (Check Applicable Box) Monitoring ☐ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐ Irrigation ☐ Other ☐ (list use) ____

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM ☐ PM ☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N

(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:

☒ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other ____
(check appropriate box)

LATITUDE 34 17 980

LONGITUDE 77 59 544

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable) ____

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910)-343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15'

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ____ METHOD OF TEST ____

f. DISINFECTION: Type ____ Amount ____

g. WATER ZONES (depth):

From ____ To ____ From ____ To ____
From ____ To ____ From ____ To ____
From ____ To ____ From ____ To ____

7. CASING: Depth Diameter Thickness/Weight Material

From 0 To 10 Ft. 2" sch40 pvc
From ____ To ____ Ft. ____
From ____ To ____ Ft. ____

8. GROUT: Depth Material Method

From 0 To 6 Ft. neat tremie
From ____ To ____ Ft. ____
From ____ To ____ Ft. ____

9. SCREEN: Depth Diameter Slot Size Material

From 10 To 15 Ft. 2 in. 0.10 in. pvc
From ____ To ____ Ft. ____ in. ____ in. ____
From ____ To ____ Ft. ____ in. ____ in. ____

10. SAND/GRAVEL PACK:

Depth Size Material

From 8 To 15 Ft. med sand
From ____ To ____ Ft. ____
From ____ To ____ Ft. ____

11. DRILLING LOG

From	To	Formation Description
0	15	tan, gray and dark sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Gerald K. Eisler 2/15/09
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eisler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eisler
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-5A

WELL CONSTRUCTION PERMIT#(if applicable) ______

OTHER ASSOCIATED PERMIT #(if applicable) ______

3. WELL USE (Check Applicable Box) Monitoring☑ Municipal/Public☐ Industrial/Commercial☐ Agricultural☐ Recovery☐ Injection☐ Irrigation☐ Other☐ (list use) ______

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM☐ PM☑

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☑ Ridge ☐ Other______
(check appropriate box)

LATITUDE 34 17 980
LONGITUDE 77 59 545

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☐ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY-is the name of the business where the well is located.

FACILITY ID #(if applicable) ______

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3206
Area code – Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 25'

b. DOES WELL REPLACE EXISTING WELL? YES☐ NO☒

c. WATER LEVEL Below Top of Casing: 22.6 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): ______ METHOD OF TEST ______

f. DISINFECTION: Type ______ Amount ______

g. WATER ZONES (depth):

From ____	To ____	From ____	To ____
From ____	To ____	From ____	To ____
From ____	To ____	From ____	To ____

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 20 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 16 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 20	To 25 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 18	To 25 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	25	tan, gray and dark gray sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CERTIFIED WELL CONTRACTOR 2/19/09 DATE

Gerald Eisler
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eister
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-6

WELL CONSTRUCTION PERMIT#(if applicable)

OTHER ASSOCIATED PERMIT #(if applicable)

3. WELL USE (Check Applicable Box) Monitoring ☑ Municipal/Public ☐ Industrial/Commercial ☐ Agricultural ☐ Recovery ☐ Injection ☐ Irrigation ☐ Other ☐ (list use)

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM ☐ PM ☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other
(check appropriate box)

LATITUDE 34 17 883
LONGITUDE 77 59 541

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 15'

b. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒

c. WATER LEVEL Below Top of Casing: 0 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): METHOD OF TEST

f. DISINFECTION: Type Amount

g. WATER ZONES (depth):
From To From To
From To From To
From To From To

7. CASING: Depth Diameter Thickness/Weight Material
From 0 To 10 Ft. 2" sch40 pvc
From To Ft.
From To Ft.

8. GROUT: Depth Material Method
From 0 To 6 Ft. neat tremie
From To Ft.
From To Ft.

9. SCREEN: Depth Diameter Slot Size Material
From 10 To 15 Ft. 2 in. 0.10 in. pvc
From To Ft. in. in.
From To Ft. in. in.

10. SAND/GRAVEL PACK:
Depth Size Material
From 8 To 15 Ft. med sand
From To Ft.
From To Ft.

11. DRILLING LOG

From	To	Formation Description
0	15	tan, gray and dark sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Gerald R. Eister 2/19/09
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eister
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

NON RESIDENTIAL WELL CONSTRUCTION RECORD

North Carolina Department of Environment and Natural Resources- Division of Water Quality

WELL CONTRACTOR CERTIFICATION # 2394

1. WELL CONTRACTOR:

Gerald Eister
Well Contractor (Individual) Name

Bridger Drilling Enterprises, Inc. dba Carolina Drilling
Well Contractor Company Name

STREET ADDRESS 114 Chimney Lane

Wilmington NC 28457
City or Town State Zip Code

(910) 799-0394
Area code- Phone number

2. WELL INFORMATION:

SITE WELL ID #(if applicable) PZ-6A

WELL CONSTRUCTION PERMIT#(if applicable)

OTHER ASSOCIATED PERMIT #(if applicable)

3. WELL USE (Check Applicable Box) Monitoring☒ Municipal/Public☐ Industrial/Commercial☐ Agricultural☐ Recovery☐ Injection☐ Irrigation☐ Other☐ (list use)

DATE DRILLED 2/12/09

TIME COMPLETED 3:00 AM☐ PM☒

4. WELL LOCATION:

CITY: Wilmington COUNTY New Hanover

Hwy 421 N
(Street Name, Numbers, Community, Subdivision, Lot No., Parcel, Zip Code)

TOPOGRAPHIC / LAND SETTING:
☐ Slope ☐ Valley ☐ Flat ☒ Ridge ☐ Other
(check appropriate box)

LATITUDE 34 17 881

LONGITUDE 77 59 540

May be in degrees, minutes, seconds or in a decimal format

Latitude/longitude source: ☒ GPS ☐ Topographic map
(location of well must be shown on a USGS topo map and attached to this form if not using GPS)

5. FACILITY- is the name of the business where the well is located.

FACILITY ID #(if applicable)

NAME OF FACILITY Progress Energy Sutton Plant

STREET ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

CONTACT PERSON Bruce Moorefield

MAILING ADDRESS 801 Sutton Stream Plant Rd

Wilmington NC 28401
City or Town State Zip Code

(910) 343-3208
Area code - Phone number

6. WELL DETAILS:

a. TOTAL DEPTH: 25'

b. DOES WELL REPLACE EXISTING WELL? YES☐ NO☒

c. WATER LEVEL Below Top of Casing: 23.4 FT.
(Use "+" if Above Top of Casing)

d. TOP OF CASING IS -0.2 FT. Above Land Surface*
*Top of casing terminated at/or below land surface may require a variance in accordance with 15A NCAC 2C .0118.

e. YIELD (gpm): METHOD OF TEST

f. DISINFECTION: Type Amount

g. WATER ZONES (depth):
From To From To
From To From To
From To From To

7. CASING:

Depth		Diameter	Thickness/Weight	Material
From 0	To 20 Ft.	2"	sch40	pvc
From	To Ft.			
From	To Ft.			

8. GROUT:

Depth		Material	Method
From 0	To 16 Ft.	neat	tremie
From	To Ft.		
From	To Ft.		

9. SCREEN:

Depth		Diameter	Slot Size	Material
From 20	To 25 Ft.	2 in.	0.10 in.	pvc
From	To Ft.	in.	in.	
From	To Ft.	in.	in.	

10. SAND/GRAVEL PACK:

Depth		Size	Material
From 18	To 25 Ft.	med	sand
From	To Ft.		
From	To Ft.		

11. DRILLING LOG

From	To	Formation Description
0	25	tan, gray and dark gray sand

12. REMARKS:

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15A NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

2/19/09
SIGNATURE OF CERTIFIED WELL CONTRACTOR DATE

Gerald Eister
PRINTED NAME OF PERSON CONSTRUCTING THE WELL

Submit the original to the Division of Water Quality within 30 days. Attn: Information Mgt., 1617 Mail Service Center – Raleigh, NC 27699-1617 Phone No. (919) 733-7015 ext 568.

Form GW-1b
Rev.12/07

APPENDIX A

Document 8

2010 Annual Inspection (Supplemental)

MACTEC
engineering and constructing a better tomorrow

December 16, 2010

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

Subject: **SUPPLEMENTAL REPORT OF LIMITED FIELD NSPECTION (2010)**
COOLING POND AND ASH POND DIKES
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA
MACTEC PROJECT NO. 6468-10-0025 (04)

Dear Mr. Forster:

On May 19, 2010, Mr. Scott Auger of MACTEC Engineering and Consulting, Inc. (MACTEC) visited the L.V. Sutton Steam Electric Plant to perform a limited field inspection of the Cooling Pond and the Ash Pond Dikes. MACTEC has completed and submitted a report to cover all dams and dikes currently considered to be under the jurisdiction of the North Carolina DENR, Land Quality Section, Dam Safety (NCDENR Dam Safety). This supplemental report is provided to cover observations for features of dams and dikes that are not under the jurisdiction of NCDENR Dam Safety. For this inspection, the supplement is intended to cover observations concerning the interior storage area within the 1983/1971 Ash Pond.

We have also included with this report the Progress Energy Dam Assessment Forms to cover all inspection activities for 2010 in Appendix A.

1983/1971 ASH POND – INTERIOR STORAGE AREA

In 2006, a temporary interior storage area was constructed by placement of a containment berm within the pond area. The containment berm has an outlet structure which directs flow to the area of standing water on the west side of the pond. We understand the interior storage area was taken out of service in 1985, but then returned to service in 2001 for temporary use during maintenance work and ash removal activities in the 1983 and 1984 ponds. We also understand that the interior storage area is now actively used for bottom ash disposal operations along with temporary use for fly ash disposal operations. The containment berm for this temporary interior storage area is not currently included in the independent consultant dam inspection scope.

In consideration of the current active service for the interior storage area, MACTEC recommends providing field investigations and engineering analysis to review the stability of the containment berm. We also recommend providing an engineering analysis to determine if the existing discharge structure for the interior storage area along with the discharge structure for the 1983/1971 Ash Pond can safely pass the required design storm without overtopping the dikes. As requested by Progress Energy, this engineering review will be performed in conjunction with the 2011 Annual Dam Inspection.

The current field inspection of the interior storage area indicated that the containment berm and discharge structure were generally in satisfactory condition. During a follow-up site visit by MACTEC on 12/15/10, we observed that the interior storage area was actively impounding water. We also observed that the containment berm slopes have been cut and cleared of brush to facilitate inspection. The following photograph showing the containment berm and impounded water (to left of photo) was taken during the site visit on 12/15/10. The area of standing water to right of photograph is near the discharge structure on the west side of the 1983/1971 Ash Pond area.

1983/1971 Ash Pond – View of containment berm for interior storage area (12/15/10)

CLOSING

MACTEC is pleased to continue assisting Progress Energy with inspections of the dams at the L.V. Sutton Steam Electric Plant. Please contact us if you have any questions about this report.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

J Allan Tice

Richard S. Auger

SEAL
8169
RICHARD S. AUGER
12-16-10

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

Richard S. Auger
Principal Engineer
Registered, North Carolina 8169

RSA/rsa

APPENDIX A – Progress Energy Dam Assessment Forms

- **Sutton Cooling Pond**
- **Sutton 1983/1971 Ash Pond**
- **Sutton 1984 Ash Pond**

APPENDIX A – Progress Energy Dam Assessment Forms

- **Sutton Cooling Pond**
- **Sutton 1983/1971 Ash Pond**
- **Sutton 1984 Ash Pond**

APPENDIX A – Progress Energy Dam Assessment Forms

- Sutton Cooling Pond

FOSSIL GENERATION COOLING AND ASH POND DAM ASSESSMENT FORM

Last Revised: 12/10/10

PLANT & UNIT: L. V. SUTTON

COOLING POND: Sutton Cooling Pond

VENDOR: MACTEC Engineering and Consulting

OTHER INFORMATION:

Comments: Based on current status inspection in 2010

CONCRETE STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
CONCRETE SURFACES	☐	☐	🟩	No concerns noted during current inspection
STRUCTURAL CRACKING	☐	🟨	☐	Cracking observed for sluice gate concrete support
MOVEMENT	☐	🟨	☐	Open joints observed for sluice gate structure
JUNCTIONS	☐	☐	🟩	No concerns noted during current inspection
DRAINS	☐	☐	☐	NA
WATER PASSAGES	☐	🟨	☐	Broken concrete slab downstream from sluice gate structure
SEEPAGE	☐	☐	🟩	
JOINTS	☐	🟨	☐	Open joints are being monitored for gate hoist structure
FOUNDATION	☐	☐	🟩	No concerns noted during current inspection
ABUTMENTS	☐	☐	☐	NA

EMBANKMENT STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
SETTLEMENT	☐	🟨	☐	Cracking and settlement reported for crest
SLOPE STABILITY	☐	☐	🟩	No concerns noted during current inspection
SEEPAGE	☐	☐	🟩	No concerns noted during current inspection
DRAINAGE SYSTEM	☐	☐	☐	NA
SLOPE PROTECTION	☐	🟨	☐	Soil-cement slope protection is deteriorated and undermined

SPILLWAY STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
CONTROL GATES	☐	🟨	☐	Recommend gate mod to prevent over operation damage
UNCONTROLLED SPILLWAYS	☐	☐	☐	NA
OUTLET CHANNEL	☐	🟨	☐	Check for erosion and undermining
APPROACH CHANNEL	☐	☐	☐	NA
STILLING BASIN	☐	☐	☐	NA

OUTLET WORKS	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
INTAKE STRUCTURE	☐	☐	🟩	No concerns noted during current inspection
GATES	☐	☐	🟩	No concerns noted during current inspection
SLUICES/WATER PASSAGES	☐	☐	☐	NA
STILLING BASIN	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	☐	NA
DRAWDOWN FACILITIES	☐	☐	☐	NA

SAFETY/PERFORMANCE INSTRUMENTATION	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
HEADWATER/TAILWATER GAGES	☐	☐	☐	NA
ALIGNMENT INSTRUMENTATION	☐	☐	☐	NA
MOVEMENT INSTRUMENTATION	☐	☐	☐	NA
UPLIFT INSTRUMENTATION	☐	☐	☐	NA
DRAINAGE INSTRUMENTATION	☐	☐	☐	NA
SEISMIC INSTRUMENTATION	☐	☐	☐	NA

RESERVOIR	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
SHORE LINE	☐	☐	☐	NA
SEDIMENTATION	☐	☐	☐	NA
HAZARD AREAS	☐	☐	☐	NA
WATERSHED RUNOFF	☐	☐	☐	NA

OPS & MAINT FEATURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
RESERVOIR REG. PLAN	☐	☐	🟩	No concerns noted during current inspection
MAINTENANCE	☐	☐	☐	NA

DOWNSTREAM CHANNEL	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
DOWNSTREAM CHANNEL	☐	☐	☐	NA

CONCRETE STRUCTURES All concrete structures related to the dam, slopes, or spillway OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☑	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
CONCRETE SURFACES Evaluate the deterioration and continuing serviceability of the concrete. Conditions should conform to "Guide for Making a Condition Survey of Concrete in Service," ACI Journal, proceedings Vol. 65, No.11, 11/68 pp. 905-918			X	Comments:
STRUCTURAL CRACKING Examine for cracking resulting from overstress due to applied loads, shrinkage and temperature effects or differential movements.		X		Comments: Concrete cracking observed for concrete gate hoist support structure. Damage observed concrete slope protection at gas pipeline crossing.
HORIZONTAL & VERTICAL MOVEMENT Look for evidence of settlement, heaving, deflections, or lateral movements		X		Comments: Open joints are being monitored between upstream retaining walls and main deck of sluice gate structure.
JUNCTIONS Examine junctions of the structure with abutments or embankments. Note any abnormalities.			X	Comments:
DRAINS Ensure any drains are free flowing and capable of performing their function.				Comments: NA
WATER PASSAGES All surfaces in which water passes should be examined for erosion, cavitation, obstructions, leakage, and significant structural cracks.		X		Comments: Concrete apron on downstream side of discharge structure appears to be broken up. Plant reports this condition has been present for many years and does not affect sluice gate operations. Follow-up has been recommended to check for erosion and undermining of the structure.
SEEPAGE Faces, abutments, and toes should be examined for evidence of abnormal leakage. Records of flow of downstream springs should be reviewed for variation with reservoir pool level.			X	Comments: No concerns noted for current inspection.
JOINTS (Monolith and Construction) Determine condition of joint and filler material, any movement of joints, or any indication of distress.		X		Comments: Open joints are being monitored between upstream retaining walls and main deck of sluice gate structure.
FOUNDATION Examine for damage of possible undermining of the downstream toe.			X	Comments: As noted, follow-up recommended to check for erosion and undermining downstream from sluice gate structure.
ABUTMENTS Examine for signs of instability or excessive weathering.				Comments: NA

EMBANKMENT STRUCTURES OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☑	Date Revised: 12/10/2010 Initials: RSA
SETTLEMENT Embankment and downstream toe area need to be checked for localized settlement, depressions, or sink holes.		X		Comments: Deterioration and cracking reported for soil cement on crest of dam. Recommendation provided for survey to confirm crest elevation and maintenance repair.
SLOPE STABILITY Examine for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond toe, and surface cracks which indicate movement.			X	Comments: No concerns for slope stability noted for current
SEEPAGE The downstream face of abutments, embankment slopes and toes, embankment - structure contacts, and the downstream valley areas should be examined for evidence of existing or past seepage. The sources of seepage should be investigated to determine cause and potential severity to dam safety under all operating conditions. The presence of animal burrows and tree growth on slopes which might cause detrimental seepage should be examined.			X	Comments: Standing water and slowly flowing water present adjacent to toe in many places, but does not appear to be seepage. Area receives flooding from river
DRAINAGE SYSTEMS All drainage systems should be examined to determine whether the systems can freely pass discharge and that the discharge water is not carrying embankment or foundation material. Systems used to monitor drainage should be examined to assure they are operational and functioning properly.				Comments: NA
SLOPE PROTECTION The slope protection should be examined for erosion-formed gullies and wave-formed notches and benches that have reduced the embankment cross section or expose less wave resistant materials. The adequacy of slope protection against waves, currents, and surface runoff that may occur at the site should be evaluated. The condition of vegetative cover should be evaluated where pertinent		X		Comments: Extensive deterioration and erosion of the soil-cement slope protection has been observed. Riprap material placed along toe has been displaced. Implementation of repair plan recommended.

SPILLWAY STRUCTURES Examination should be made of the structures and features including bulkheads, flashboard, and fuse plugs of all service and auxiliary spillways which serve as principal or emergency spillways for any condition which may impose operational constraints on the functioning of the spillway. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☑	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
CONTROL GATES & OPERATIONAL MACHINERY Structural members, connections, hoists, cables and operating machinery and the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the equipment. Where cranes are intended to be used for handling gates and bulkheads, the availability, capacity and condition of the cranes and lifting beams should be investigated. Operation of control systems and protective and alarm devices such as limit switches, sump high water alarms and drainage pump should be investigated.		X		Comments: Over operation during closing of the north sluice gate has caused damage to the concrete structure (block) supporting the gate. Repair of the damaged concrete has been recommended. Plant reports that both gates are operable in current condition.
UNLINED SADDLE SPILLWAYS Examine for evidence of erosion and any conditions which may impose constraints on the function of the spillway. The ability of the spillway to resist erosion due to operation and the potential hazard to the safety of the dam.				Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.		X		Comments: Concrete apron on downstream side of discharge structure appears to be extensively broken up. Plant reports this condition has been present for many years and does not affect sluice gate operations. Follow-up has been recommended to check for erosion and undermining of the structure. Also noted under concrete structures.
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
STILLING BASIN Basin and energy disipators should be examined for any conditions which may pose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined.				Comments: NA

OUTLET WORKS All structures and features designed to release reservoir water below the spillway crest through or around the dam. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☑	Date Revised: 12/10/2010 Initials: RSA
INTAKE STRUCTURE Examine for any conditions which may impose operational constraints on the outlet works. Entrances to intake structure should be examined for conditions such as silt or debris accumulation which may reduce the discharge capabilities of the outlet works.			X	Comments: Makeup structure was not observed during this inspection.
OPERATING AND EMERGENCY CONTROL GATES Structural members, connections, guides, hoists, cables and operating machinery including the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the operating and emergency gates, valves, bulkheads, and other equipment.			X	Comments: Operation of sluice one sluice gate was was observed for current inspection. Plant reports that both gates are currently operable. No change in previously reported structural damage to the north sluice gate support noted.
CONDUITS, SLUICES, WATER PASSAGES, ETC. Interior surfaces of conduits should be examined for erosion, corrosion, cavitation, cracks, joint separation and leakage at cracks or joints				Comments: NA
STILLING BASIN Basin and energy dissipaters should be examined for any conditions which may impose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined by surroundings.				Comments: NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
DRAWDOWN FACILITIES Facilities provided for drawdown of the reservoir to avert impending failure to the dam or to facilitate repairs in the event of stability or foundation problems should be examined for any conditions which may impose constraints on their functioning as planned.				Comments: NA

OPERATION AND MAINTENANCE FEATURES OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
RESERVOIR REGULATION PLAN The actual practices in regulating the reservoir and discharges under normal and emergency conditions should be examined to determine if they comply with the designed reservoir regulation plan and to assure that they do not constitute a danger to the safety of the dam or to human life or property			X	Comments: Plant procedures call for lowering pond level to elevation 8.7 feet if a hurricane warning is issued.. This was not reviewed during curent inspection.
MAINTENANCE The maintenance of the operating facilities and features that pertain to the safety of the dam should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.				Comments: NA

DOWNSTREAM CHANNEL The channel immediately downstream of the dam should be examined for conditions which might impose any constraints on the operation of the dam or present any hazards to the safety of the dam. Development of the potential flooded area downstream of the dam should be assessed for the compatibility with the hazard classification. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
DOWNSTREAM CHANNEL				Comments: NA

Date Revised: 12/10/2010 Initials: RSA

SAFETY & PERFORMANCE INSTRUMENTATION Available records and readings of installed instruments should be reviewed to detect any unusual performance of the instruments or evidence of unusual performance of the structure. The adequacy of the installed instrumentation to measure the performance and safety of the dam should be determined. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	
HEADWATER AND TAILWATER GAGES Existing records of the headwater and tailwater gages should be examined to determine the relationship between other instrumentation measurements such as stream flow, uplift pressures, alignment, and drainage system discharge with the upper and lower water surface elevations.				Comments: NA
HORIZONTAL & VERTICAL ALIGNMENT INSTRUMENTATION (CONCRETE STRUCTURES) The existing records of alignment and elevation surveys and measurements from inclinometers, inverted plumb bobs, gage points across cracks and joints, or other devices should be examined to determine any change from the original position of the structures.				Comments: NA
HORIZONTAL & VERTICAL MOVEMENT, CONSOLIDATION, AND PORE-WATER PRESSURE INSTRUMENTATION (EMBANKMENT STRUCTURES) The existing records of measurements from settlement plates or gages, surface reference marks, slope indicators and other devices should be examined to determine the movement history of the embankment. Existing piezometer measurements should be examined to determine if the pore-water pressures in the embankment and foundation would impair the safety of the dam, under given conditions.				Comments: NA
UPLIFT INSTRUMENTATION Records of uplift measurements should be examined to determine if the uplift pressures for the maximum pool would impair the safety of the dam.				Comments: NA
DRAINAGE SYSTEM INSTRUMENTATION Records of measurements of the drainage system flow should be examined to establish the normal relationship between elevations and discharge quantities and any changes that have occurred in this relationship during the history of the dam.				Comments NA
SEISMIC INSTRUMENTATTION The existing records of seismic instrumentation should be examined to determine the seismic activity in the area and the response of the structures to past earthquakes.				Comments: NA

Date Revised: 12/10/2010 Initials: RSA

RESERVOIR The following features of the reservoir should be examined to determine to what extent the water impounded by the dam would constitute a danger to the safety of the dam or a hazard to human life or property.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	
OVERALL RATING >>>	☐	☐	☐	
SHORE LINE The land forms around the reservoir should be examined for indications of major active or inactive landslide areas and to determine susceptibility of bedrock stratigraphy to massive landslides of sufficient magnitude to significantly reduce reservoir capacity or create waves that might overtop the dam.				Comments: NA
SEDIMENTATION The reservoir and drainage area should be examined for excessive sedimentation or recent developments in the drainage basin which could cause a sudden increase in sediment load thereby reducing the reservoir capacity with attendant increase in maximum outflow and maximum pool elevation.				Comments: NA
POTENTIAL UPSTREAM HAZARD AREAS The reservoir area should be examined for features subject to potential backwater flooding resulting in loss of human life or property at reservoir levels up to the maximum water storage capacity including any surcharge storage.				Comments. NA
WATERSHED RUNOFF POTENTIAL The drainage basin should be examined for any extensive alterations to the surface of the drainage basin such as changed agriculture practices, timber clearing, railroad or highway construction or real estate developments that might expensively affect the runoff characteristics. Upstream projects that could have impact on the safety of the dam should be identified				Comments: NA

APPENDIX A – Progress Energy Dam Assessment Forms

- **Sutton 1983/1971 Ash Pond**

FOSSIL GENERATION COOLING AND ASH POND DAM ASSESSMENT FORM

Last Revised: 12/13/10

PLANT & UNIT: Sutton Plant
ASH POND: 1983/1971 Ash Pond
VENDOR: MACTEC Engineering and Consulting
OTHER INFORMATION:
Comments: Based on 2010 Dam Inspection

CONCRETE STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
CONCRETE SURFACES	☐	☐	☐	NA
STRUCTURAL CRACKING	☐	☐	☐	NA
MOVEMENT	☐	☐	☐	NA
JUNCTIONS	☐	☐	☐	NA
DRAINS	☐	☐	☐	NA
WATER PASSAGES	☐	☐	☐	NA
SEEPAGE	☐	☐	☐	NA
JOINTS	☐	☐	☐	NA
FOUNDATION	☐	☐	☐	NA
ABUTMENTS	☐	☐	☐	NA

EMBANKMENT STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
SETTLEMENT	☐	☐	🟩	No concerns for current inspection
SLOPE STABILITY	☐	🟨	☐	Engineering review of dike stability recommended
SEEPAGE	☐	☐	🟩	No concerns for current inspection.
DRAINAGE SYSTEM	☐	☐	🟩	No concerns for current inspection
SLOPE PROTECTION	☐	🟨	☐	Concern for heavy growth along discharge canal

SPILLWAY STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
CONTROL GATES	☐	☐	☐	NA
UNLINED SPILLWAYS	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	☐	NA
STILLING BASIN	☐	☐	☐	NA

OUTLET WORKS	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
INTAKE STRUCTURE	☐	☐	🟩	No concerns for current inspection.
GATES	☐	☐	☐	NA
SLUICES/WATER PASSAGES	☐	☐	🟩	No concerns for current inspection.
STILLING BASIN	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	☐	NA
DRAWDOWN FACILITIES	☐	☐	☐	NA

SAFETY/PERFORMANCE INSTRUMENTATION	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
HEADWATER/TAILWATER GAGES	☐	☐	☐	NA
ALIGNMENT INSTRUMENTATION	☐	☐	☐	NA
MOVEMENT INSTRUMENTATION	☐	☐	☐	NA
UPLIFT INSTRUMENTATION	☐	☐	☐	NA
DRAINAGE INSTRUMENTATION	☐	☐	☐	NA
SEISMIC INSTRUMENTATION	☐	☐	☐	NA

RESERVOIR	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
SHORE LINE	☐	☐	☐	NA
SEDIMENTATION	☐	🟨	☐	Engineering inspection recommended for conveyance
HAZARD AREAS	☐	☐	☐	NA
WATERSHED RUNOFF	☐	☐	☐	NA

OPS & MAINT FEATURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
RESERVOIR REG. PLAN	☐	☐	☐	NA
MAINTENANCE	☐	☐	☐	NA

DOWNSTREAM CHANNEL	RED	YEL	GRN	Date Revised: 12/13/10 Initials: RSA
DOWNSTREAM CHANNEL	☐	☐	☐	NA

CONCRETE STRUCTURES All concrete structures related to the dam, slopes, or spillway. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
CONCRETE SURFACES Evaluate the deterioration and continuing serviceability of the concrete. Conditions should conform to "Guide for Making a Condition Survey of Concrete in Service," ACI Journal, proceedings Vol. 65, No.11, 11/68 pp. 905-918.				Comments: NA
STRUCTURAL CRACKING Examine for cracking resulting from overstress due to applied loads, shrinkage and temperature effects or differential movements.				Comments: NA
HORIZONTAL & VERTICAL MOVEMENT Look for evidence of settlement, heaving, deflections, or lateral movements.				Comments: NA
JUNCTIONS Examine junctions of the structure with abutments or embankments. Note any abnormalities.				Comments NA
DRAINS Ensure any drains are free flowing and capable of performing their function.				Comments NA
WATER PASSAGES All surfaces in which water passes should be examined for erosion, cavitation, obstructions, leakage, and significant structural cracks.				Comments: NA
SEEPAGE Faces, abutments, and toes should be examined for evidence of abnormal leakage. Records of flow of downstream springs should be reviewed for variation with reservoir pool level.				Comments: NA
JOINTS (Monolith and Construction) Determine condition of joint and filler material, any movement of joints, or any indication of distress.				Comments: NA
FOUNDATION Examine for damage of possible undermining of the downstream toe.				Comments: NA
ABUTMENTS Examine for signs of instability or excessive weathering.				Comments: NA

EMBANKMENT STRUCTURES OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☑	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
SETTLEMENT Embankment and downstream toe area need to be checked for localized settlement depressions, or sink holes.			X	Comments: No concerns for settlement noted for current inspection.
SLOPE STABILITY Examine for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond toe, and surface cracks which indicate movement.		X		Comments: No concerns for slope stability noted for current inspection. However, engineering review of dike stability should be provided in consideration of active utilization for the 1983/1971 Ash Pond area.
SEEPAGE The downstream face of abutments, embankment slopes and toes, embankment - structure contacts, and the downstream valley areas should be examined for evidence of existing or past seepage. The sources of seepage should be investigated to determine cause and potential severity to dam safety under all operating conditions. The presence of animal burrows and tree growth on slopes which might cause detrimental seepage should be examined.			X	Comments: No concerns for seepage noted for current inspection.
DRAINAGE SYSTEMS All drainage systems should be examined to determine whether the systems can freely pass discharge and that the discharge water is not carrying embankment or foundation material. Systems used to monitor drainage should be examined to assure they are operational and functioning properly.			X	Comments: No concerns for internal drainage noted.
SLOPE PROTECTION The slope protection should be examined for erosion-formed gullies and wave-formed notches and benches that have reduced the embankment cross-section or expose less wave resistant materials. The adequacy of slope protection against waves, currents, and surface runoff that may occur at the site should be evaluated. The condition of vegetative cover should be evaluated where pertinent.		X		Comments: Dike appear to have sparse vegetation for slope protection near discharge structure. Clearing of slopes adjacent to discharge canal recommended to facilitate inspection as active pond area.

SPILLWAY STRUCTURES Examination should be made of the structures and features including bulkheads, flashboard, and fuse plugs of all service and auxiliary spillways which serve as principal or emergency spillways for any condition which may impose operational constraints on the functioning of the spillway.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	Date Revised: 12/10/2010 Initials: RSA
OVERALL RATING >>>	☐	☐	☐	
CONTROL GATES & OPERATIONAL MACHINERY Structural members, connections, hoists, cables and operating machinery and the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the equipment. Where cranes are intended to be used for handling gates and bulkheads, the availability, capacity and condition of the cranes and lifting beams should be investigated. Operation of control systems and protective and alarm devices such as limit switches, sump high water alarms and drainage pump should be investigated	☐	☐	☐	Comments: NA
UNLINED SADDLE SPILLWAYS Examine for evidence of erosion and any conditions which may impose constraints on the function of the spillway. The ability of the spillway to resist erosion due to operation and the potential hazard to the safety of the dam.	☐	☐	☐	Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.	☐	☐	☐	Comments NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.	☐	☐	☐	Comments: NA
STILLING BASIN Basin and energy disipators should be examined for any conditions which may pose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined.	☐	☐	☐	Comments: NA

	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 5yrs ☐	GRN Problems likely in > 5yrs ☑	Date Revised: 12/10/2010 Initials: RSA
OUTLET WORKS All structures and features designed to release reservoir water below the spillway crest through or around the dam. OVERALL RATING >>>				
INTAKE STRUCTURE Examine for any conditions which may impose operational constraints on the outlet works. Entrances to intake structure should be examined for conditions such as silt or debris accumulation which may reduce the discharge capabilities of the outlet works.			X	Comments: Water level lowered by 1 foot during 2010 as recommended by NCDENR Dam Safety.
OPERATING AND EMERGENCY CONTROL GATES Structural members, connections, guides, hoists, cables and operating machinery including the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the operating and emergency gates, valves, bulkheads, and other equipment.				Comments NA
CONDUITS, SLUICES, WATER PASSAGES, ETC. Interior surfaces of conduits should be examined for erosion, corrosion, cavitation, cracks, joint separation and leakage at cracks or joints.			X	Comments: Discharge pipe may become block by sand and should be periodically checked.
STILLING BASIN Basin and energy dissipaters should be examined for any conditions which may impose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined by surroundings.				Comments: NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
DRAWDOWN FACILITIES Facilities provided for drawdown of the reservoir to avert impending failure to the dam or to facilitate repairs in the event of stability or foundation problems should be examined for any conditions which may impose constraints on their functioning as planned.				Comments: NA

SAFETY & PERFORMANCE INSTRUMENTATION	RED	YEL	GRN	Date Revised: 12/10/2010 Initials: RSA
Available records and readings of installed instruments should be reviewed to detect any unusual performance of the instruments or evidence of unusual performance of the structure. The adequacy of the installed instrumentation to measure the performance and safety of the dam should be determined. OVERALL RATING >>>	Problems likely in < 2yrs ☐	Problems likely in 2 - 5yrs ☐	Problems likely in > 5yrs ☑	
HEADWATER AND TAILWATER GAGES Existing records of the headwater and tailwater gages should be examined to determine the relationship between other instrumentation measurements such as stream flow, uplift pressures, alignment, and drainage system discharge with the upper and lower water surface elevations.				Comments: NA
HORIZONTAL & VERTICAL ALIGNMENT INSTRUMENTATION (CONCRETE STRUCTURES) The existing records of alignment and elevation surveys and measurements from inclinometers, inverted plumb bobs, gage points across cracks and joints, or other devices should be examined to determine any change from the original position of the structures.				Comments: NA
HORIZONTAL & VERTICAL MOVEMENT, CONSOLIDATION, AND PORE-WATER PRESSURE INSTRUMENTATION (EMBANKMENT STRUCTURES) The existing records of measurements from settlement plates or gages, surface reference marks, slope indicators and other devices should be examined to determine the movement history of the embankment. Existing piezometer measurements should be examined to determine if the pore-water pressures in the embankment and foundation would impair the safety of the dam, under given conditions.				Comments: NA
UPLIFT INSTRUMENTATION Records of uplift measurements should be examined to determine if the uplift pressures for the maximum pool would impair the safety of the dam.				Comments: NA
DRAINAGE SYSTEM INSTRUMENTATION Records of measurements of the drainage system flow should be examined to establish the normal relationship between elevations and discharge quantities and any changes that have occurred in this relationship during the history of the dam.				Comments: NA
SEISMIC INSTRUMENTATTION The existing records of seismic instrumentation should be examined to determine the seismic activity in the area and the response of the structures to past earthquakes.				Comments: NA

RESERVOIR The following features of the reservoir should be examined to determine to what extent the water impounded by the dam would constitute a danger to the safety of the dam or a hazard to human life or property.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	Date Revised: 12/10/2010 Initials: RSA
OVERALL RATING >>>	☐	☑	☐	
SHORE LINE The land forms around the reservoir should be examined for indications of major active or inactive landslide areas and to determine susceptibility of bedrock stratigraphy to massive landslides of sufficient magnitude to significantly reduce reservoir capacity or create waves that might overtop the dam				Comments: NA
SEDIMENTATION The reservoir and drainage area should be examined for excessive sedimentation or recent developments in the drainage basin which could cause a sudden increase in sediment load thereby reducing the reservoir capacity with attendant increase in maximum outflow and maximum pool elevation.		X		Comments: A containment berm has been placed within the 1983/1971 Ash Pond and is actively used for bottom ash and occasionally for fly ash storage. The containment dike and internal discharge structure have not previously been included in the independent consultant dam inspection scope. Engineering inspection is recommended for these features in consideration of the active use of the 1983/1971 Ash Pond. for ash storage.
POTENTIAL UPSTREAM HAZARD AREAS The reservoir area should be examined for features subject to potential backwater flooding resulting in loss of human life or property at reservoir levels up to the maximum water storage capacity including any surcharge storage				Comments: NA
WATERSHED RUNOFF POTENTIAL The drainage basin should be examined for any extensive alterations to the surface of the drainage basin such as changed agriculture practices, timber clearing, railroad or highway construction or real estate developments that might extensively affect the runoff characteristics. Upstream projects that could have impact on the safety of the dam should be identified.				Comments: NA

OPERATION AND MAINTENANCE FEATURES OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
RESERVOIR REGULATION PLAN The actual practices in regulating the reservoir and discharges under normal and emergency conditions should be examined to determine if they comply with the designed reservoir regulation plan and to assure that they do not constitute a danger to the safety of the dam or to human life or property.				Comments: NA
MAINTENANCE The maintenance of the operating facilities and features that pertain to the safety of the dam should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.				Comments: NA

DOWNSTREAM CHANNEL The channel immediately downstream of the dam should be examined for conditions which might impose any constraints on the operation of the dam or present any hazards to the safety of the dam. Development of the potential flooded area downstream of the dam should be assessed for the compatibility with the hazard classification. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☐	Date Revised: 11/30/2010 Initials: RSA
DOWNSTREAM CHANNEL				Comments: NA

APPENDIX A – Progress Energy Dam Assessment Forms

- Sutton 1984 Ash Pond

FOSSIL GENERATION COOLING AND ASH POND DAM ASSESSMENT FORM

Last Revised: 12/10/10

PLANT & UNIT: Sutton Plant

ASH POND: 1984 Ash Pond & Interior Containment

VENDOR: MACTEC Engineering and Consulting

OTHER INFORMATION:

Comments: Based on 2010 Dam Inspection

CONCRETE STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
CONCRETE SURFACES	☐	☐	☐	NA
STRUCTURAL CRACKING	☐	☐	☐	NA
MOVEMENT	☐	☐	☐	NA
JUNCTIONS	☐	☐	☐	NA
DRAINS	☐	☐	☐	NA
WATER PASSAGES	☐	☐	☐	NA
SEEPAGE	☐	☐	☐	NA
JOINTS	☐	☐	☐	NA
FOUNDATION	☐	☐	☐	NA
ABUTMENTS	☐	☐	☐	NA

EMBANKMENT STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
SETTLEMENT	☐	☐	🟩	No concerns for current inspection.
SLOPE STABILITY	☐	☐	🟩	No concerns for current inspection
SEEPAGE	☐	☐	🟩	No concerns for current inspection
DRAINAGE SYSTEM	🟥	☐	☐	Internal drainage for south end of 1984 Ash Pond
SLOPE PROTECTION	☐	🟨	☐	Sparse vegetation for slope protection

SPILLWAY STRUCTURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
CONTROL GATES	☐	☐	☐	NA
UNLINED SPILLWAYS	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	☐	NA
STILLING BASIN	☐	☐	☐	NA

OUTLET WORKS	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
INTAKE STRUCTURE	☐	☐	🟩	No concerns for current inspection.
GATES	☐	☐	☐	NA
SLUICES/WATER PASSAGES	☐	☐	🟩	No concerns for current inspection
STILLING BASIN	☐	☐	☐	NA
APPROACH CHANNEL	☐	☐	☐	NA
OUTLET CHANNEL	☐	☐	☐	NA
DRAWDOWN FACILITIES	☐	☐	☐	NA

SAFETY/PERFORMANCE INSTRUMENTATION	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
HEADWATER/TAILWATER GAGES	☐	☐	☐	NA
ALIGNMENT INSTRUMENTATION	☐	☐	☐	NA
MOVEMENT INSTRUMENTATION	☐	☐	🟩	No concerns for current inspection.
UPLIFT INSTRUMENTATION	☐	☐	☐	NA
DRAINAGE INSTRUMENTATION	☐	☐	🟩	No concerns for current inspection.
SEISMIC INSTRUMENTATION	☐	☐	☐	NA

RESERVOIR	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
SHORE LINE	☐	☐	☐	NA
SEDIMENTATION	🟥	☐	☐	Ash fill for interior Containment & north end Ash Pon
HAZARD AREAS	☐	☐	☐	NA
WATERSHED RUNOFF	☐	☐	☐	NA

OPS & MAINT FEATURES	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
RESERVOIR REG. PLAN	☐	☐	☐	NA
MAINTENANCE	☐	☐	☐	NA

DOWNSTREAM CHANNEL	RED	YEL	GRN	Date Revised: 12/10/10 Initials: RSA
DOWNSTREAM CHANNEL	☐	☐	☐	NA

CONCRETE STRUCTURES

All concrete structures related to the dam, slopes, or spillway.

Date Revised: 12/10/2010 Initials: RSA

	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	
OVERALL RATING >>>	☐	☐	☐	
CONCRETE SURFACES Evaluate the deterioration and continuing serviceability of the concrete. Conditions should conform to "Guide for Making a Condition Survey of Concrete in Service," ACI Journal, proceedings Vol. 65, No.11, 11/68 pp. 905-918.	☐	☐	☐	Comments: NA
STRUCTURAL CRACKING Examine for cracking resulting from overstress due to applied loads, shrinkage and temperature effects or differential movements.	☐	☐	☐	Comments: NA
HORIZONTAL & VERTICAL MOVEMENT Look for evidence of settlement, heaving, deflections, or lateral movements	☐	☐	☐	Comments: NA
JUNCTIONS Examine junctions of the structure with abutments or embankments. Note any abnormalities.	☐	☐	☐	Comments NA
DRAINS Ensure any drains are free flowing and capable of performing their function.	☐	☐	☐	Comments: NA
WATER PASSAGES All surfaces in which water passes should be examined for erosion, cavitation, obstructions, leakage, and significant structural cracks.	☐	☐	☐	Comments: NA
SEEPAGE Faces, abutments, and toes should be examined for evidence of abnormal leakage. Records of flow of downstream springs should be reviewed for variation with reservoir pool level.	☐	☐	☐	Comments: NA
JOINTS (Monolith and Construction) Determine condition of joint and filler material, any movement of joints, or any indication of distress.	☐	☐	☐	Comments: NA
FOUNDATION Examine for damage of possible undermining of the downstream toe	☐	☐	☐	Comments: NA
ABUTMENTS Examine for signs of instability or excessive weathering.	☐	☐	☐	Comments: NA

EMBANKMENT STRUCTURES OVERALL RATING >>>	🟥 RED Problems likely in < 2yrs ☑	🟨 YEL Problems likely in 2 - 5yrs ☐	🟩 GRN Problems likely in > 5yrs ☐	Date Revised: 12/10/2010 Initials: RSA
SETTLEMENT Embankment and downstream toe area need to be checked for localized settlement, depressions, or sink holes			X	Comments: No concerns for settlement noted for current inspection.
SLOPE STABILITY Examine for irregularities in alignment and variances from smooth uniform slopes, unusual changes from original crest alignment and elevation, evidence of movement at or beyond toe, and surface cracks which indicate movement.			X	Comments: No concerns for slope stability noted for current inspection.
SEEPAGE The downstream face of abutments, embankment slopes and toes, embankment - structure contacts, and the downstream valley areas should be examined for evidence of existing or past seepage. The sources of seepage should be investigated to determine cause and potential severity to dam safety under all operating conditions. The presence of animal burrows and tree growth on slopes which might cause detrimental seepage should be examined.			X	Comments: During 2009, the plant identified concern for possible increased seepage when the water level was raised in the 1984 Ash Pond. Piezometers were installed to monitor water level in the dike during 2009. MACTEC issued a report on 4/20/10 summarizing results of seepage review. The report concludes that seepage does not appear to represent a concern for dike stability. No concerns for seepage were noted from current inspection. The plant should continue to monitor seepage with routine inspections.
DRAINAGE SYSTEMS All drainage systems should be examined to determine whether the systems can freely pass discharge and that the discharge water is not carrying embankment or foundation material. Systems used to monitor drainage should be examined to assure they are operational and functioning properly.	X			Comments: Internal drainage for north end of 1984 Ash Pond. On 9/27/20, a small breach occurred through a section of the 1984 Ash Pond dike on the east side associated with heavy rainfall. Follow-up investigation of the root cause is in progress. Also, MACTEC is supporting Progress Energy in development and implementation of a repair plan.
SLOPE PROTECTION The slope protection should be examined for erosion-formed gullies and wave-formed notches ad benches that have reduced the embankment cross-section or expose less wave resistant materials. The adequacy of slope protection against waves, currents, and surface runoff that may occur at the site should be evaluated. The condition of vegetative cover should be evaluated where pertinent.		X		Comments: Improvement in maintenance of vegetation observed during current inspection. Dikes appear to have sparse vergetation for slope protection.

SPILLWAY STRUCTURES Examination should be made of the structures and features including bulkheads, flashboard, and fuse plugs of all service and auxillary spillways which serve as principal or emergency spillways for any condition which may impose operational constraints on the functioning of the spillway.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	Date Revised: 12/10/2010 Initials: RSA
OVERALL RATING >>>	☐	☐	☐	
CONTROL GATES & OPERATIONAL MACHINERY Structural members, connections, hoists, cables and operating machinery and the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the equipment. Where cranes are intended to be used for handling gates and bulkheads, the availability, capacity and condition of the cranes and lifting beams should be investigated. Operation of control systems and protective and alarm devices such as limit switches, sump high water alarms and drainage pump should be investigated.				Comments: NA
UNLINED SADDLE SPILLWAYS Examine for evidence of erosion and any conditions which may impose constraints on the function of the spillway. The ability of the spillway to resist erosion due to operation and the potential hazard to the safety of the dam.				Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
STILLING BASIN Basin and energy disipators should be examined for any conditions which may pose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined.				Comments: NA

OUTLET WORKS All structures and features designed to release reservoir water below the spillway crest through or around the dam. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	🟩 GRN Problems likely in > 5yrs ☑	Date Revised: 12/10/2010 Initials: RSA
INTAKE STRUCTURE Examine for any conditions which may impose operational constraints on the outlet works. Entrances to intake structure should be examined for conditions such as silt or debris accumulation which may reduce the discharge capabilities of the outlet works.			X	Comments: Water level is currently at Elevation 30. No concerns for seepage were identified from the current inspection.
OPERATING AND EMERGENCY CONTROL GATES Structural members, connections, guides, hoists, cables and operating machinery including the adequacy of normal and emergency power supplies should be examined and tested to determine the structural integrity and verify the operational adequacy of the operating and emergency gates, valves, bulkheads, and other equipment.				Comments: NA
CONDUITS, SLUICES, WATER PASSAGES, ETC. Interior surfaces of conduits should be examined for erosion, corrosion, cavitation, cracks, joint separation and leakage at cracks or joints.			X	Comments: No concerns noted for current inspection.
STILLING BASIN Basin and energy dissipaters should be examined for any conditions which may impose constraints on the ability of the stilling basin to prevent downstream scour or erosion which may create or present a potential hazard to the safety of the dam. The existing condition of the channel downstream of the stilling basin should be determined by surroundings				Comments: NA
APPROACH CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
OUTLET CHANNELS Examine for any condition that may impose constraints on the functioning of the spillway and present a potential hazard to the safety of the dam.				Comments: NA
DRAWDOWN FACILITIES Facilities provided for drawdown of the reservoir to avert impending failure to the dam or to facilitate repairs in the event of stability or foundation problems should be examined for any conditions which may impose constraints on their functioning as planned.				Comments: NA

SAFETY & PERFORMANCE INSTRUMENTATION Available records and readings of installed instruments should be reviewed to detect any unusual performance of the instruments or evidence of unusual performance of the structure. The adequacy of the installed instrumentation to measure the performance and safety of the dam should be determined. OVERALL RATING >>>	RED Problems likely in < 2yrs ☐	YEL Problems likely in 2 - 5yrs ☐	GRN Problems likely in > 5yrs ☑	Date Revised: 12/10/2010 Initials: RSA
HEADWATER AND TAILWATER GAGES Existing records of the headwater and tailwater gages should be examined to determine the relationship between other instrumentation measurements such as stream flow, uplift pressures, alignment, and drainage system discharge with the upper and lower water surface elevations.				Comments: NA
HORIZONTAL & VERTICAL ALIGNMENT INSTRUMENTATION (CONCRETE STRUCTURES) The existing records of alignment and elevation surveys and measurements from inclinometers, inverted plumb bobs, gage points across cracks and joints, or other devices should be examined to determine any change from the original position of the structures.				Comments NA
HORIZONTAL & VERTICAL MOVEMENT, CONSOLIDATION, AND PORE-WATER PRESSURE INSTRUMENTATION (EMBANKMENT STRUCTURES) The existing records of measurements from settlement plates or gages, surface reference marks, slope indicators and other devices should be examined to determine the movement history of the embankment. Existing piezometer measurements should be examined to determine if the pore-water pressures in the embankment and foundation would impair the safety of the dam, under given conditions.			X	Comments: Piezometers installed in secondary settling pond dike are being monitored - no concerns noted.
UPLIFT INSTRUMENTATION Records of uplift measurements should be examined to determine if the uplift pressures for the maximum pool would impair the safety of the dam.				Comments: NA
DRAINAGE SYSTEM INSTRUMENTATION Records of measurements of the drainage system flow should be examined to establish the normal relationship between elevations and discharge quantities and any changes that have occurred in this relationship during the history of the dam.			X	Comments: Internal drain provided for discharge pipe for Interior Containment area. This feature could not be checked during the current inspection.
SEISMIC INSTRUMENTATTION The existing records of seismic instrumentation should be examined to determine the seismic activity in the area and the response of the structures to past earthquakes.				Comments NA

Date Revised: 12/10/2010 Initials: RSA

RESERVOIR The following features of the reservoir should be examined to determine to what extent the water impounded by the dam would constitute a danger to the safety of the dam or a hazard to human life or property.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	
OVERALL RATING >>>	☑	☐	☐	
SHORE LINE The land forms around the reservoir should be examined for indications of major active or inactive landslide areas and to determine susceptibility of bedrock stratigraphy to massive landslides of sufficient magnitude to significantly reduce reservoir capacity or create waves that might overtop the dam.				Comments: NA
SEDIMENTATION The reservoir and drainage area should be examined for excessive sedimentation or recent developments in the drainage basin which could cause a sudden increase in sediment load thereby reducing the reservoir capacity with attendant increase in maximum outflow and maximum pool elevation.	X			Comments: The Interior Containment area appears to be close to limit of useful storage capacity. Also, ash fill in the "neck" area at the north end of the 1984 Ash Pond may have contributed to the dike breaching event.
POTENTIAL UPSTREAM HAZARD AREAS The reservoir area should be examined for features subject to potential backwater flooding resulting in loss of human life or property at reservoir levels up to the maximum water storage capacity including any surcharge storage.				Comments: NA
WATERSHED RUNOFF POTENTIAL The drainage basin should be examined for any extensive alterations to the surface of the drainage basin such as changed agriculture practices, timber clearing, railroad or highway construction or real estate developments that might expensively affect the runoff characteristics. Upstream projects that could have impact on the safety of the dam should be identified				Comments: NA

OPERATION AND MAINTENANCE FEATURES	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	Date Revised: 12/10/2010	Initials: RSA
OVERALL RATING >>>	☐	☐	☐		
RESERVOIR REGULATION PLAN The actual practices in regulating the reservoir and discharges under normal and emergency conditions should be examined to determine if they comply with the designed reservoir regulation plan and to assure that they do not constitute a danger to the safety of the dam or to human life or property.	☐	☐	☐	Comments: NA	
MAINTENANCE The maintenance of the operating facilities and features that pertain to the safety of the dam should be examined to determine the adequacy and quality of the maintenance procedures followed in maintaining the dam and facilities in safe operating condition.	☐	☐	☐	Comments: NA	

DOWNSTREAM CHANNEL The channel immediately downstream of the dam should be examined for conditions which might impose any constraints on the operation of the dam or present any hazards to the safety of the dam. Development of the potential flooded area downstream of the dam should be assessed for the compatibility with the hazard classification.	RED Problems likely in < 2yrs	YEL Problems likely in 2 - 5yrs	GRN Problems likely in > 5yrs	Date Revised: 11/30/2010 Initials: RSA
OVERALL RATING >>>	☐	☐	☐	
DOWNSTREAM CHANNEL				Comments: NA

APPENDIX A

Document 9

NCDENR Inspection

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

RECEIVED
JAN 25 2010
Progress Energy
L. V. Sutton Plant

January 22, 2010

NOTICE OF INSPECTION

Progress Energy Carolinas, Inc. – L.V. Sutton Electric Plant
Mr. R. Kent Tyndall, Environmental Specialist
801 Sutton Steam Plant Road
Wilmington, NC 28401-8357

RE: Sutton Plant 1972 Cooling Pond Dam – NEWHA-003
Sutton Plant 1971 Ash Pond Dam – NEWHA-004
Sutton Plant 1984 Ash Pond Dam – NEWHA-005
New Hanover County, North Carolina
Cape Fear River Basin

Dear Mr. Tyndall:

The Dam Safety Law of 1967, as amended, provides for the certification and inspection of dams in the interest of public health, safety and welfare, in order to reduce the risk of failure of such dams; to prevent injuries to persons, damage to property, and to insure that maintenance of stream flows.

On January 14 and 15, 2010, staff of our office met with you, Mr. Mark Frederick, Plant Manager, and staff of the L.V. Sutton Electric Plant in New Hanover County to conduct an inspection of three dams on the Progress Energy facility. These inspections revealed no apparent problems with the three dams. The following items are recommended items pertinent to continuous maintenance and operations of the dams:

Sutton Plant 1972 Cooling Pond Dam

1. Both woody and brush vegetation is heavy on the downstream slope and needs to be culled to the extent feasible. Bush hogging and mowing from the top of the slope is needed, as is tree removal of all evergreens and deciduous trees smaller than 6 inches in diameter. This will serve to prevent the formation of a root system which might significantly increase seepage through the dam which could ultimately result in failure of the structure. It would also reduce the possibility of damage to the dam due to the uprooting of trees by wind or other natural causes, and facilitate ease of inspection and increase the likelihood of early detection more serious problems connected with the dam.

2. There are steep slopes of note along the curve of the north and west facing slopes. Please monitor this area for any potential erosion or seepage problems that might occur due to that slope.

1612 Mail Service Center, Raleigh, North Carolina 27699-1612 • Telephone 919-733-4574 / FAX: 919-733-2876
127 Cardinal Drive Ext., Wilmington, NC 28405 • Internet:http://www.dlr.enr.state.nc.us/pages/landqualitysection.html
An Equal Opportunity / Affirmative Action Employer – 50% Recycled / 10% Post Consumer Paper

3. The toe of the north face of the downstream slope has flowing watercourses apparent fed by groundwater. Beaver dams have been constructed along at least five locations of the north toe. The elimination of those dams and removal of the northern slope trees might facilitate the relocation of the beavers.

Sutton Plant 1971 Ash Pond Dam

1. The southwestern downstream slope has heavy vegetation. Please consider the removal of all evergreens and deciduous trees smaller than 6 inches in diameter.

2. Freeboard at the pond area was very small. Please lower the water surface if possible, in order to avoid overtopping in an emergency situation.

Sutton Plant 1984 Ash Pond Dam

1. The back of the pond's dike, the eastern face had a number of animal burrows that need to be eliminated. Some pines saplings are beginning to grow and should be mowed before getting larger.

2. Areas on the north and west slopes where vegetation is sparse have signs of either erosion or slides. Most were already marked and being monitored. Please continue to monitor these areas and provide vegetation where possible.

During these inspections, we also investigated the potential for property damage and loss of life in the event that any of these dams fail. This investigation determined that failure of any of the three would result in minor property damage downstream. Therefore, we are listing all dams at this facility in the "Low Hazard" category. A copy of the Hazard Classification Data Form for each dam is enclosed.

Please be advised that though we make every reasonable effort to determine the safety of these dams, our resources limit us the surficial inspections. There is no certainty regarding the internal stability of the dam. Dams, and especially their spillways and conduits, deteriorate with age. Therefore, you are advised to keep a close watch on your dam and to notify us if you detect any changes, especially cracks, ground movements, or changes in seepage rate or color.

Your cooperation and consideration in maintaining a safe dam is appreciated. If ownership of the dams change, or if your company is not responsible for these dams, please notify us so that we can update our records . Should you have questions concerning our inspection, please contact me at (910) 796-7215.

Sincerely,

Daniel Sams, PE
Wilmington Office Regional Engineer
Land Quality Section

cc: State Dam Safety Engineer
Wilmington Regional Office File

DA... SAFETY INSPECTION REPC..T

NAME SUTTON STEAM PLANT 1972 COOLING POND DAM	COUNTY NEW HANOVER	NO. 003	INSPECTED BY SAMS, JAMES, WORTHINGTON, MILLS	DATE 1/15/2010
OWNER PROGRESS ENERGY	ADDRESS 801 SUTTON STEAM PLANT ROAD, WILMINGTON 28401			PHONE 910-343-3244

TYPE DAM ☐ Concrete gravity ☐ Concrete arch ☐ Other ☒ Embankment ☐ Concrete buttress ☐ Stone masonary

TYPE INSPECTION ☐ Periodic ☒ Initial ☐ Followup ☐ Other

SITE CONDITIONS ☐ Wet ☒ Dry ☐ Snowcover ☐ Other

HAZARD DESCRIPTION
A BREACH WOULD BE ABSORBED IN THE FLOW OF THE CAPE FEAR RIVER

HAZARD CLASS ☒ Low (A) ☐ Intermediate (B) ☐ High (C)

REMARKS
OVERALL THE DAM IS IN GOOD CONDITION, BUT WOODY AND WEEDY VEGETATION IS VERY THICK AND NEEDS TO BE CULLED TO MAKE INSPECTION EASIER AND MORE COMPREHENSIVE.

ACTION
☐ None
☒ Maintenance
☐ Monitoring
☐ Minor repair
☐ Engineering

RECOMMENDATIONS
☒ Inspection letter
☐ Deficiency letter
☐ RE notice
☐ Engineering study
☐ Inspection by RE
☐ Inspection by DSE
☐ Dam safety order
☐ Enforcement
☐ Periodic reinspection
☐ Other reinspection

AREA	PROBLEMS	COMMENTS
UPSTREAM SLOPE / FACE	☒ 1.None ☐ 2.Trees ☐ 3.High bushes ☐ 4.Burrows ☐ 5.Wave erosion ☐ 6.Livestock damage ☐ 7.Slides ☐ 8.Depressions ☐ 9.Bulges ☐ 10.Sparse rip rap ☐ 11.Displaced rip rap ☐ 12.Cracks ☐ 13.Undermining ☐ 14.Holes ☐ 15.Spalling ☐ 16.Displaced joints ☐ 17.Deteriorated joints ☐ 18.Exposed reinforcement ☐ 19.Other	COVER: ☐ Vegetation ☐ Rip rap ☒ Concrete ☐ Asphalt ☐ Other The stepped concrete slope was in good shape.
TOP OF DAM	☒ 1.None ☐ 2.Trees ☐ 3.High bushes ☐ 4.Burrows ☐ 5.Ruts ☐ 6.Livestock damage ☐ 7.Depressions ☐ 8.Unlevel ☐ 9.Misalignment ☐ 10.Has overtopped ☐ 11.Cracks ☐ 12.Spalling ☐ 13.Deteriorated joints ☐ 14.Displaced joints ☐ 15.Exposed reinforcement ☐ 16.Other	COVER: ☒ Vegetation ☐ Gravel ☐ Concrete ☒ Asphalt ☐ Other The paved access road has ~~[illegible]~~ weathered but is overall in good shape. Its shoulders on the downstream side needs to be bushhogged.
DOWNSTREAM SLOPE / FACE	☐ 1.None ☒ 2.Trees ☒ 3.High bushes ☐ 4.Burrows ☐ 5.Erosion ☐ 6.Livestock damage ☐ 7.Slides ☐ 8.Depressions ☐ 9.Bulges ☐ 10.Wetness ☐ 11.Seepage ☐ 12.Boils ☐ 13.Cracks ☐ 14.Holes ☐ 15.Spalling ☐ 16.Displaced joints ☐ 17.Deteriorated joints ☐ 18.Exposed reinforcement ☐ 19.Other	COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☐ Other THE SLOPE IS IN GOOD SHAPE. THE CLAY LINER OPERATED WELL. WOODY AND WEEDY VEGETATION ~~[illegible]~~ THICK AND NEEDS CULLING AND CLEANING. GIVEN THE LOW HAZARD CLASSIFICATION MOWING AND CLEANING ~~[illegible]~~ CAN BE CONDUCTED FROM THE TOP AND ALLOW THE ~~TOP~~ TOE VEGETATION TO REMAIN.
TOE CONTACT	☐ 1.None ☐ 2.Trees ☐ 3.High bushes ☐ 4.Burrows ☐ 5.Erosion ☐ 6.Livestock damage ☐ 7.Slides ☐ 8.Depressions ☐ 9.Bulges ☐ 10.Wetness ☐ 11.Seepage ☐ 12.Boils ☐ 13.Cracks ☐ 14.Holes ☐ 15.Spalling ☐ 16.Displaced joints ☐ 17.Deteriorated joints ☐ 18.Exposed reinforcement ☐ 19.Undermining ☒ 20.Other Beaver dams	COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☒ Other Standing and flowing water MOST OF THE SLOPE TOE HAS A DEPRESSION (PROBABLY THE ORIGINAL CONSTRUCTION DIP) THAT BREACHES THE HIGH WATER TABLE. AT LOCATIONS WHERE NATURAL RELIEF CREATES FLOW BEAVER DAMS HAVE BEEN CONSTRUCTED ALONG THE NORTH SLOPE AT FIVE LOCATIONS.

AREA	PROBLEMS		COMMENTS
ABUTMENT CONTACTS	☒ 1.None ☐ 2.Trees ☐ 3.High bushes ☐ 4.Burrows ☐ 5.Erosion ☐ 6.Livestock damage ☐ 7.Slides ☐ 8.Depressions ☐ 9.Bulges ☐ 10.Wetness	☐ 11.Seepage ☐ 12.Boils ☐ 13.Cracks ☐ 14.Holes ☐ 15.Spalling ☐ 16.Displaced joints ☐ 17.Deteriorated joints ☐ 18.Exposed reinforcement ☐ 19.Undermining ☐ 20.Other	COVER: ☒ Vegetation ☐ Rip rap ☒ Concrete ☐ Other THE ABUTMENT IS IN GOOD SHAPE.
PRINCIPAL SPILLWAY	☒ 1.None ☐ 2.No trashguard ☐ 3.Obstructed ☐ 4.Plugged ☐ 5.Rusted ☐ 6.Damaged ☐ 7.Gates leaking ☐ 8.Joints leaking ☐ 9.Cracks ☐ 10.Joint deterioration	☐ 11.Joint displacement ☐ 12.Undermined ☐ 13.Voids ☐ 14.Erosion ☐ 15.Holes ☐ 16.Conduit collapsed ☐ 17.Spalling ☐ 18.Outlet undercutting ☐ 19.Misalignment ☐ 20.Other	TYPE/SIZE: SPILLWAY AND WEIR THE SPILLWAY IS IN GOOD SHAPE.
EMERGENCY SPILLWAY	☒ 1.None ☐ 2.No ES ☐ 3.Same as PS ☐ 4.Obstructed ☐ 5.Erosion ☐ 6.Displaced rip rap ☐ 7.Sparse rip rap ☐ 8.Joints leaking ☐ 9.Cracks ☐ 10.Joint deterioration	☐ 11.Joint displacement ☐ 12.Undermining ☐ 13.Voids ☐ 14.Holes ☐ 15.Exposed reinforcement ☐ 16.Spalling ☐ 17.Outlet erosion ☐ 18.Misalignment ☐ 19.Inadequate capacity ☐ 20.Other	TYPE/SIZE: NONE
DRAINS / OTHER OUTLETS	☒ 1.None ☐ 2.No bottom drain ☐ 3.Bottom drain inoperable ☐ 4.Subsurface drain dry ☐ 5.Subsurface drain muddy flow ☐ 6.Subsurface drain obstructed ☐ 7.No animal guard ☐ 8.Other		TYPE: NONE

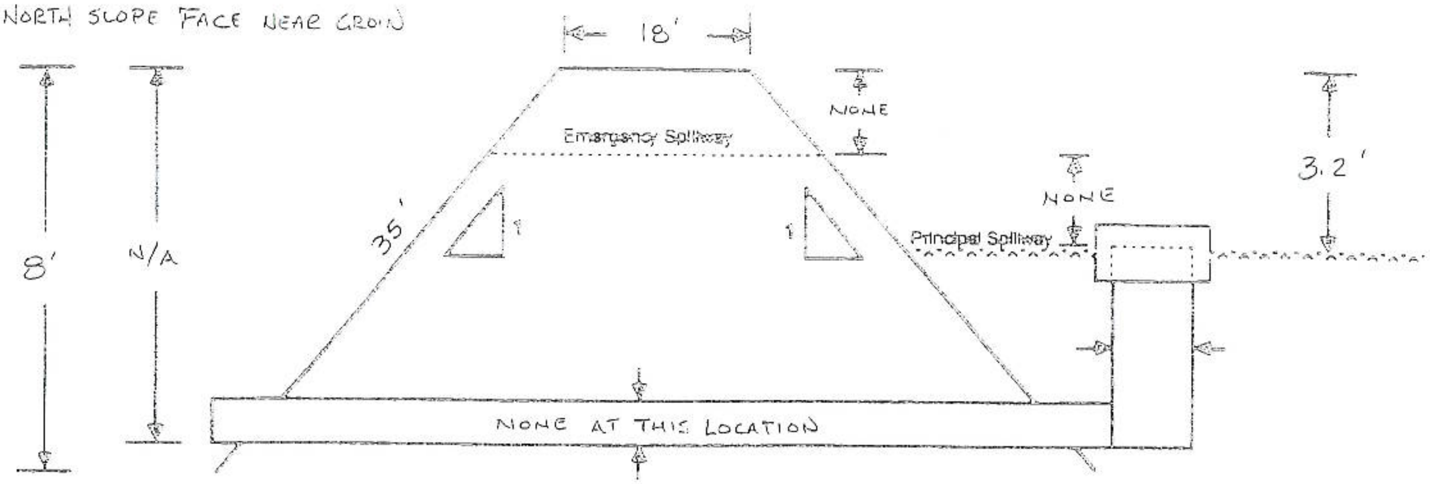
SKETCHES/COMMENTS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1972 COOLING POND DAM	NEW HANOVER	003	SAMS, JAMES, MILLS, PW	1/15/2010

EMBANKMENT CROSS SECTION

NORTH SLOPE FACE NEAR GROIN

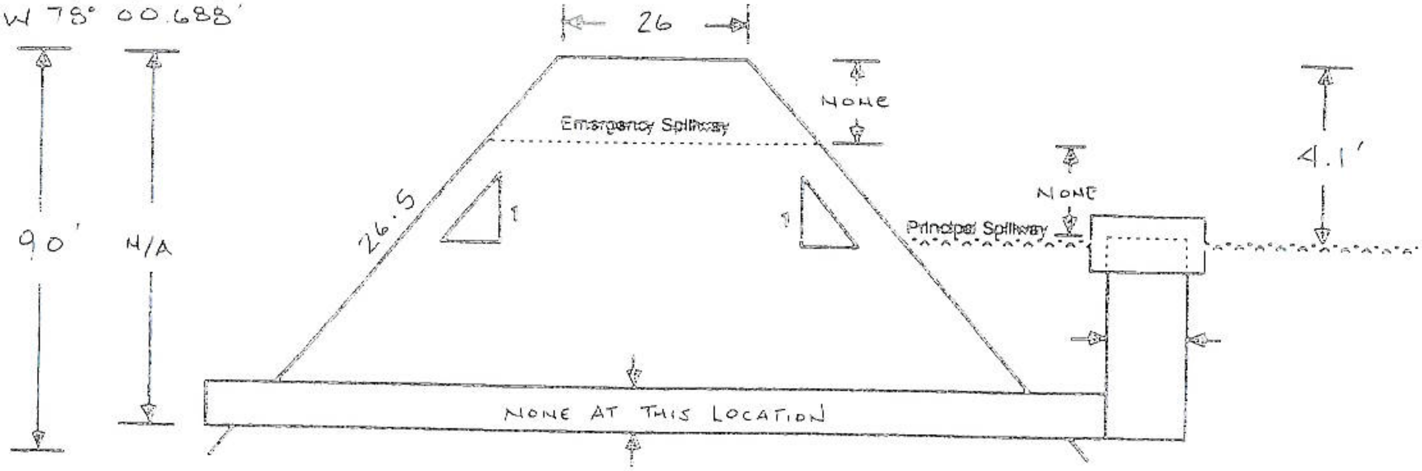


EMBANKMENT DAM SKETCHES AND MEASUREMENTS

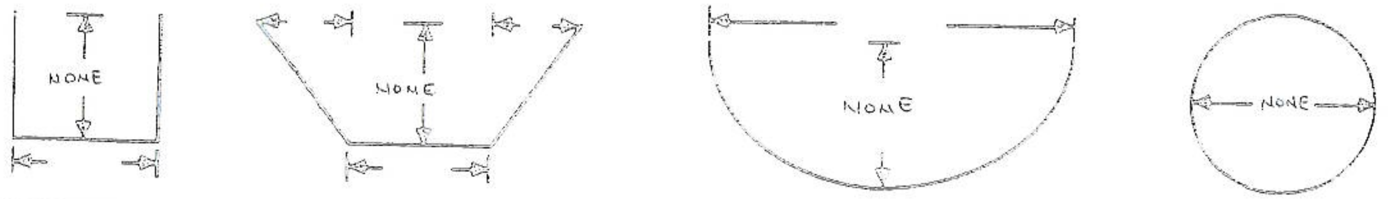
NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1972 COOLING POND WEST SLOPE	NEW HANOVER	003	JAMS, JAMES, NORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

N 34° 18.164'
W 78° 00.688'



EMERGENCY SPILLWAY CROSS SECTION



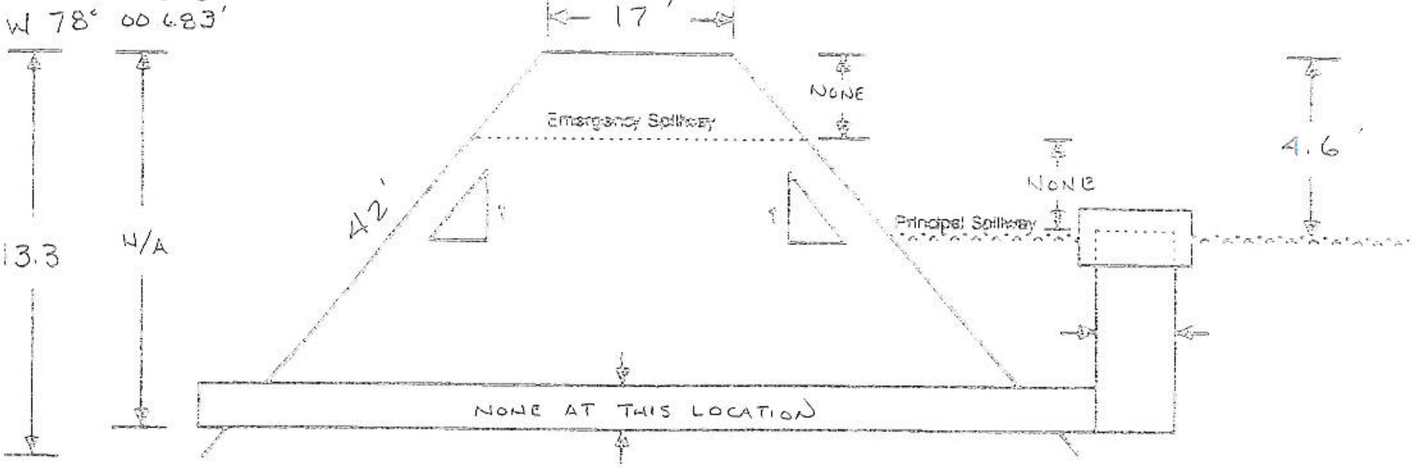
PLAN VIEW OF DAM AND SPILLWAYS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1972 COOLING POND DAM	NEW HANOVER	003	SAMS, JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

N 34° 17.565'
W 78° 00.683'

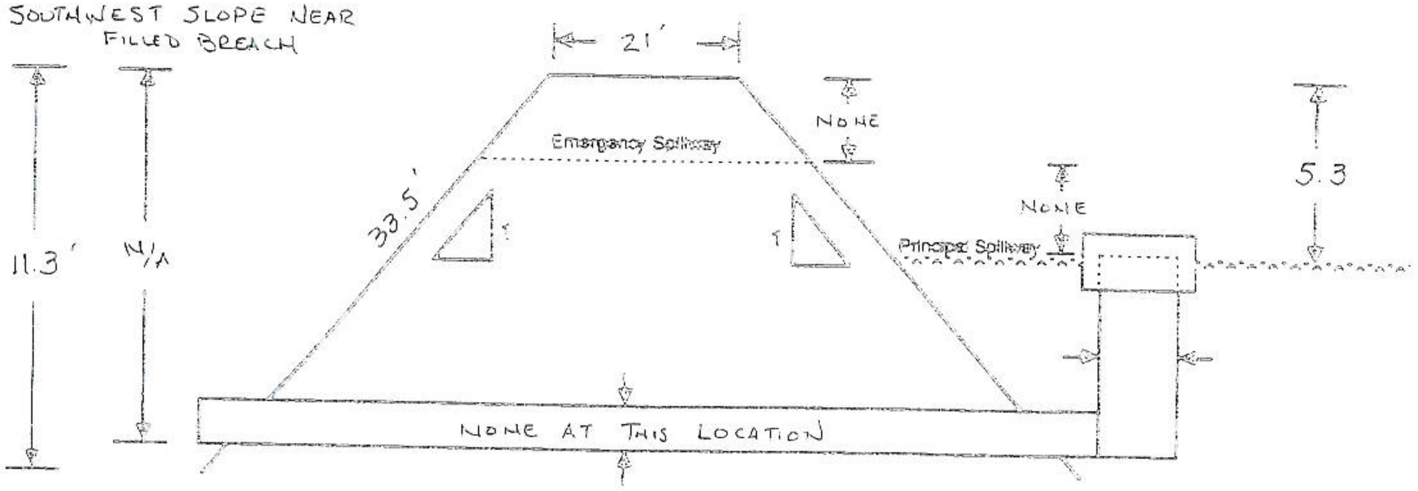


EMBANKMENT DAM SKETCHES AND MEASUREMENTS

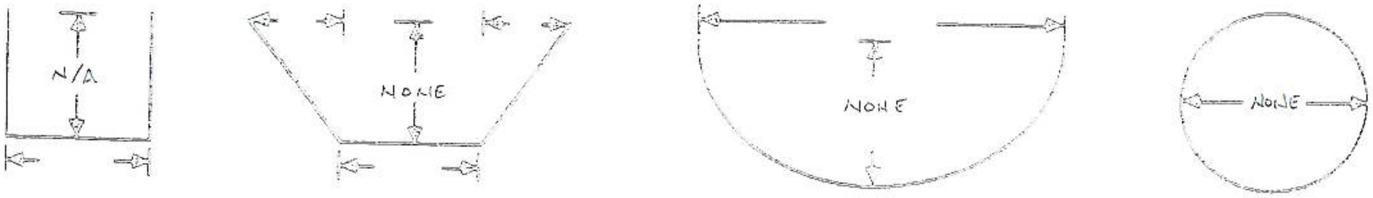
NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1972 COOLING POND DAM	NEW HANOVER	003	SAMS JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

SOUTHWEST SLOPE NEAR
FILLED BREACH



EMERGENCY SPILLWAY CROSS SECTION



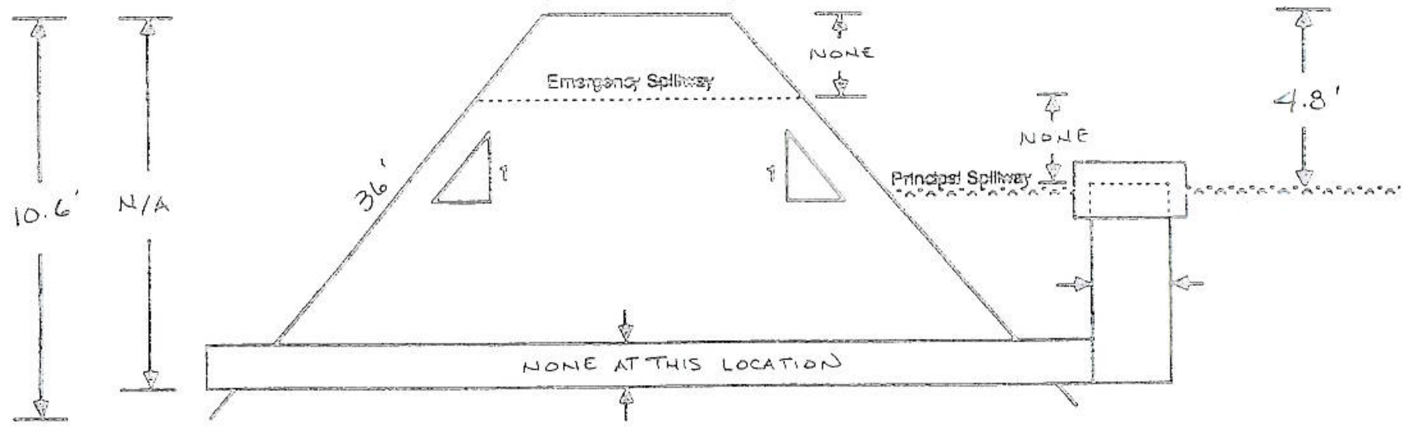
PLAN VIEW OF DAM AND SPILLWAYS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

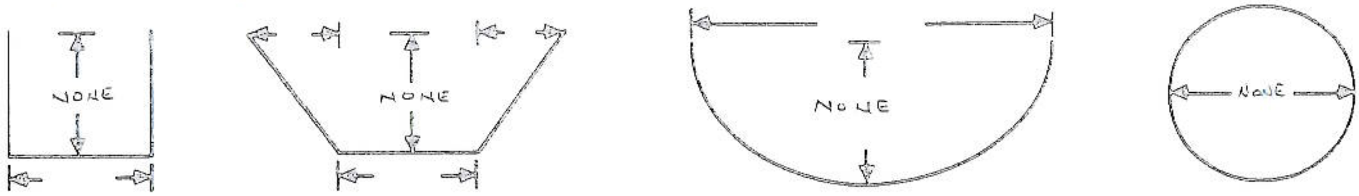
NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1972 COOLING POND DAM	NEW HANOVER	003	SAMS, JAMES, WORTHINGTON, MILLS	1/15/2010

EMBANKMENT CROSS SECTION

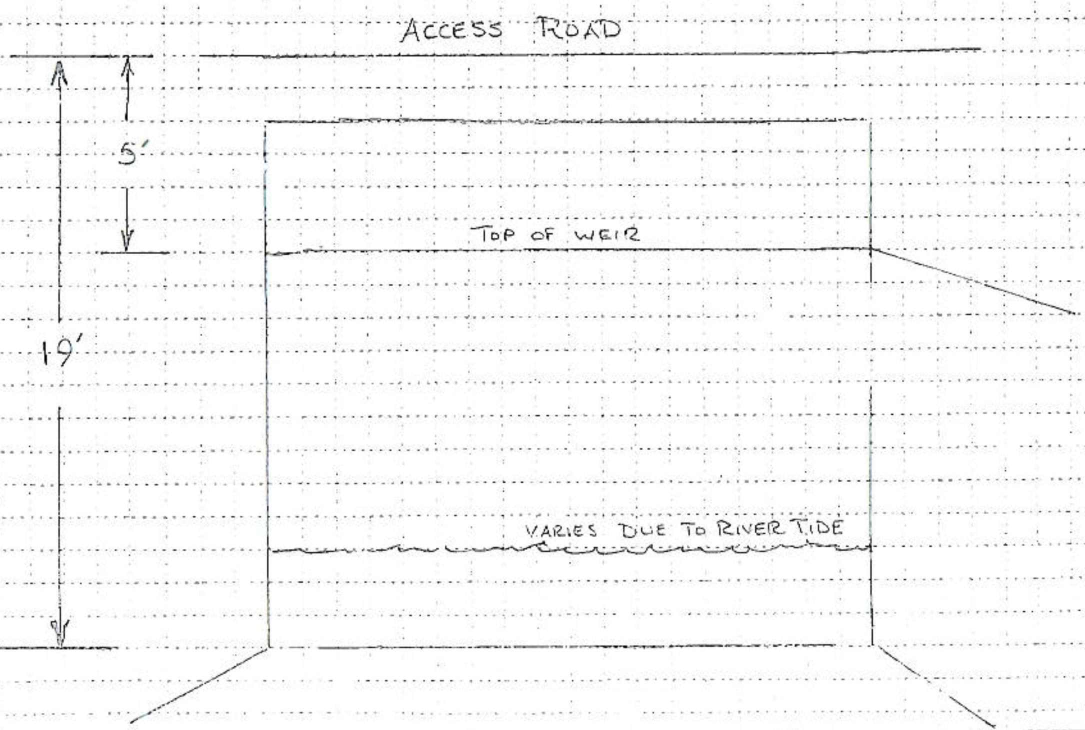
SOUTH SLOPE FACE NEAR GROIN



EMERGENCY SPILLWAY CROSS SECTION

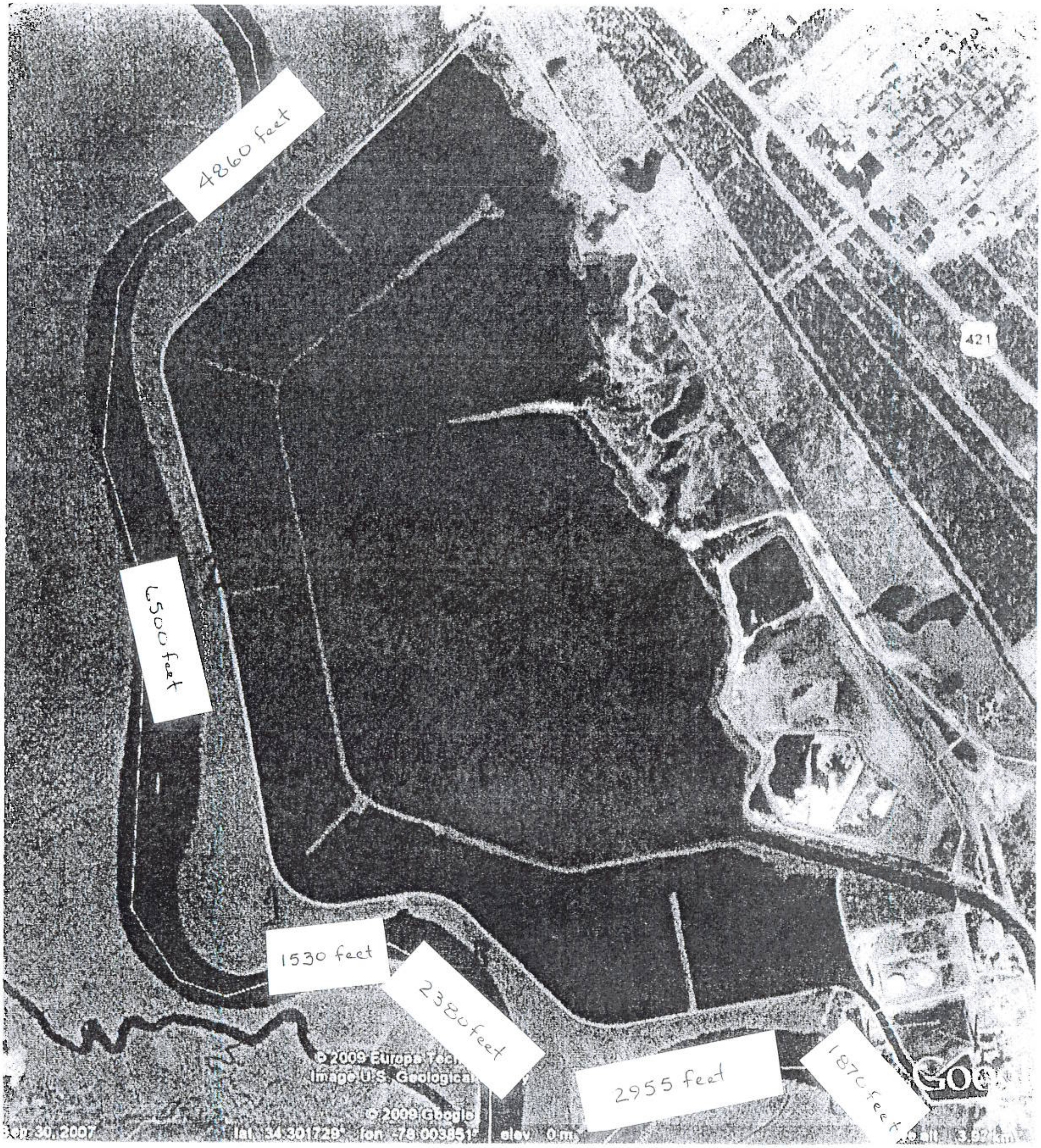


PLAN VIEW OF DAM AND SPILLWAYS



EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON PLANT 1972 COOLING POND DAM	NEW HANOVER	003	SAMS, JAMES, MILLS, et al	1/15/2010



HAZARD CLASSIFICATION DATA FORM FOR DAMS

DAM NAME SUTTON PLANT 1972 COOLING POND DAM COUNTY NEW HANOVER NUMBER NEW HA-003

RIVER STREAM CAPE FEAR RIVER QUADRANGLE LELAND

DAM HEIGHT 19 feet SURFACE AREA ACRES 1100 acres STORAGE CAPACITY ACRE FT. 6,900

PRIMARY DOWNSTREAM LAND USE:

☐ WOODLAND ☐ AGRICULTURAL ☐ RESIDENTIAL ☒ INDUSTRIAL COMMERCIAL

DOWNSTREAM IMPROVEMENTS:

☐ DWELLINGS ☐ BUILDINGS ☐ ROADS ☐ UTILITIES

DOWNSTREAM IMPROVEMENT DATA:

Type Improvement	Distance Downstream	Floodplain Width	Channel Slope	Elevation Above Floodplain	Breach Wave Elevation	Culvert/Bridge Dimensions	Traffic Count	Sight Distance
NONE, RECEIVING WATER COURSE CAPE FEAR RIVER	PRIMARY DISCHARGE IN RIVER	VARIES	VARIES	9 to 12 feet dependent upon tide	NOT KNOWN	NOT APPLICABLE	NONE	N/A

DESCRIBE POTENTIAL FOR LOSS OF LIFE AND STRUCTURAL OR ENVIRONMENTAL DAMAGE TO EXISTING OR POTENTIAL FUTURE DOWNSTREAM IMPROVEMENTS: THE COOLING POND WATER SURFACE HEIGHT IS BETWEEN 9 TO 12 FEET HIGHER THAN THE WATER SURFACE OF THE CAPE FEAR RIVER, DEPENDING UPON THE TIDE OF THE RIVER. THE WATER OF THE COOLING POND MUST CONTINUALLY MEET NPDES' REQUIREMENTS AS AUTHORIZED BY NCDENR DIVISION OF WATER QUALITY. GIVEN THAT THE POND INTAKE FROM THE CAPE FEAR RIVER BALANCES BOTH WATER TEMPERATURE AND NUTRIENT LEVELS OF THE COOLING POND TO THAT OF THE SURROUNDING SYSTEM A BREACH WOULD NOT APPEAR TO POSE AN ENVIRONMENTAL RISK. THE RIVER CAN ABSORB THE DIFFERENTIAL VOLUME OF THE POND.

RECOMMENDED HAZARD CLASSIFICATION: ☒ LOW ☐ INTERMEDIATE ☐ HIGH

BY TITLE WILMINGTON REG. ENGR. DATE 1/15/2010

CONCURRED BY TITLE STATE DAM SAFTY ENGR. DATE 1/15/2010

DAM SAFETY INSPECTION REPORT

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1971 ~~1983~~ ASH POND	NEW HANOVER	004	SAMS, MCEVOY, JAMES, etc	1/14 & 15/2010

OWNER	ADDRESS	PHONE
PROGRESS ENERGY	801 SUTTON STEAM PLANT ROAD, WILMINGTON NC	910-343-3244

TYPE DAM: ☒ Embankment ☐ Concrete gravity ☐ Concrete buttress ☐ Concrete arch ☐ Stone masonary ☐ Other

TYPE INSPECTION: ☒ Initial ☐ Followup ☐ Periodic ☐ Other

SITE CONDITIONS: ☒ Dry ☐ Snowcover ☐ Wet ☐ Other

HAZARD DESCRIPTION: ALL FLOW IN THE EVENT OF A BREACH GOES TO THE COOLING POND

HAZARD CLASS: ☒ Low (A) ☐ Intermediate (B) ☐ High (C)

REMARKS: THE DIKE IS IN GOOD SHAPE. WE WERE UNABLE TO INSPECT THE OUTFALL CULVERT BECAUSE IT IS SUBMERGED IN THE COOLING POND. ALL WOODY VEGETATION LESS THAN 6 INCHES ALONG THE SOUTHWEST FACE OF THE DIKE SHOULD BE REMOVED.

ACTION:
- ☐ None
- ☒ Maintenance
- ☐ Monitoring
- ☐ Minor repair
- ☐ Engineering

RECOMMENDATIONS:
- ☒ Inspection letter
- ☐ Deficiency letter
- ☐ RE notice
- ☐ Engineering study
- ☐ Inspection by RE
- ☐ Inspection by DSE
- ☐ Dam safety order
- ☐ Enforcement
- ☐ Periodic reinspection
- ☐ Other reinspection

AREA	PROBLEMS	COMMENTS

UPSTREAM SLOPE / FACE

- ☒ 1.None
- ☐ 2.Trees
- ☐ 3.High bushes
- ☐ 4.Burrows
- ☐ 5.Wave erosion
- ☐ 6.Livestock damage
- ☐ 7.Slides
- ☐ 8.Depressions
- ☐ 9.Bulges
- ☐ 10.Sparse rip rap
- ☐ 11.Displaced rip rap
- ☐ 12.Cracks
- ☐ 13.Undermining
- ☐ 14.Holes
- ☐ 15.Spalling
- ☐ 16.Displaced joints
- ☐ 17.Deteriorated joints
- ☐ 18.Exposed reinforcement
- ☐ 19.Other

COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☐ Asphalt ☐ Other

ASH STORAGE HAS DISPLACED MOST OF THE PONDING AREA BUT A SMALL AREA FOR TANK FARM STORM WATER RETENTION) REMAINED. FREE BOARD HEIGHT IS LOW. IF STORMWATER RUNOFF TO THE POND CAN BE REDUCED, IT WOULD BE DESIRABLE TO INCREASE FREEBOARD (NOT REQUIRED).

TOP OF DAM

- ☒ 1.None
- ☐ 2.Trees
- ☐ 3.High bushes
- ☐ 4.Burrows
- ☐ 5.Ruts
- ☐ 6.Livestock damage
- ☐ 7.Depressions
- ☐ 8.Unlevel
- ☐ 9.Misalignment
- ☐ 10.Has overtopped
- ☐ 11.Cracks
- ☐ 12.Spalling
- ☐ 13.Deteriorated joints
- ☐ 14.Displaced joints
- ☐ 15.Exposed reinforcement
- ☐ 16.Other

COVER: ☒ Vegetation ☒ Gravel ☐ Concrete ☐ Asphalt ☐ Other

THE ACCESS ROAD ALONG THE TOP IS IN GOOD SHAPE.

DOWNSTREAM SLOPE / FACE

- ☐ 1.None
- ☒ 2.Trees
- ☒ 3.High bushes
- ☐ 4.Burrows
- ☐ 5.Erosion
- ☐ 6.Livestock damage
- ☐ 7.Slides
- ☐ 8.Depressions
- ☐ 9.Bulges
- ☐ 10.Wetness
- ☐ 11.Seepage
- ☐ 12.Boils
- ☐ 13.Cracks
- ☐ 14.Holes
- ☐ 15.Spalling
- ☐ 16.Displaced joints
- ☐ 17.Deteriorated joints
- ☐ 18.Exposed reinforcement
- ☐ 19.Other

COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☐ Other

THE OPEN SLOPES DOWNSTREAM ARE IN GOOD SHAPE. ANY EFFORTS TO INCREASE THE DENSITY OF GRASS ENVIRONMENT, TOPDRESSING, ADDITIONAL SOIL AMENDMENTS, VARIATION OF GRASS TYPES, WOULD BE APPRECIATED. THE SOUTHWEST SLOPE SECTION HAS EXCESSIVE WOODY AND BRUSH VEGETATION THAT SHOULD BE REMOVED FOR BOTH STRUCTURAL SECURITY OF THE DAM AND FOR BETTER INSPECTIONS. PLEASE REMOVE ALL WOODY VEGETATION UNDER 6" IN DIAMETER, AND LARGER EVERGREENS.

TOE CONTACT

- ☐ 1.None
- ☒ 2.Trees
- ☐ 3.High bushes
- ☐ 4.Burrows
- ☐ 5.Erosion
- ☐ 6.Livestock damage
- ☐ 7.Slides
- ☐ 8.Depressions
- ☐ 9.Bulges
- ☐ 10.Wetness
- ☐ 11.Seepage
- ☐ 12.Boils
- ☐ 13.Cracks
- ☐ 14.Holes
- ☐ 15.Spalling
- ☐ 16.Displaced joints
- ☐ 17.Deteriorated joints
- ☐ 18.Exposed reinforcement
- ☐ 19.Undermining
- ☐ 20.Other

COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☐ Other

WHERE THE TOE CAN BE INSPECTED IT IS IN GOOD SHAPE. THE EAST SLOPE (SHARED WITH THE 1984 ASH POND) HAS SOME BURROW ACTIVITY (MOST IS ON THE 1984 SECTION). THE VEGETATION NOTED ON THE SOUTHWEST SLOPE ABOVE EXTENDS ONTO THE SLOPE. BRUSH VEGETATION SHOULD BE REMOVED TO PROVIDE BETTER INSPECTIONS.

AREA	PROBLEMS	COMMENTS

ABUTMENT CONTACTS

☒ 1.None
☐ 2.Trees
☐ 3.High brushes
☐ 4.Burrows
☐ 5.Erosion
☐ 6.Livestock damage
☐ 7.Slides
☐ 8.Depressions
☐ 9.Bulges
☐ 10.Wetness
☐ 11.Seepage
☐ 12.Boils
☐ 13.Cracks
☐ 14.Holes
☐ 15.Spalling
☐ 16.Displaced joints
☐ 17.Deteriorated joints
☐ 18.Exposed reinforcement
☐ 19.Undermining
☐ 20.Other

COVER: ☐ Vegetation ☐ Rip rap ☐ Concrete ☐ Other

THE IMPOUNDMENT IS A COMPREHENSNE PERIMETER, THERE IS NO ABUTMENT.

PRINCIPAL SPILLWAY

☒ 1.None
☐ 2.No trashguard
☐ 3.Obstructed
☐ 4.Plugged
☐ 5.Rusted
☐ 6.Damaged
☐ 7.Gates leaking
☐ 8.Joints leaking
☐ 9.Cracks
☐ 10.Joint deterioration
☐ 11.Joint displacement
☐ 12.Undermined
☐ 13.Voids
☐ 14.Erosion
☐ 15.Holes
☐ 16.Conduit collapsed
☐ 17.Spalling
☐ 18.Outlet undercutting
☐ 19.Misalignment
☐ 20.Other

TYPE/SIZE: RISER / BARREL STRUCTURE

NO PROBLEMS WITH THE RISER, INTAKE. THE OUTFALL COULD NOT BE INSPECTED BECAUSE IT IS LOCATED UNDERWATER OF THE RECEIVING COOLING POND.

EMERGENCY SPILLWAY

☒ 1.None
☐ 2.No ES
☐ 3.Same as PS
☐ 4.Obstructed
☐ 5.Erosion
☐ 6.Displaced rip rap
☐ 7.Sparse rip rap
☐ 8.Joints leaking
☐ 9.Cracks
☐ 10.Joint deterioration
☐ 11.Joint displacement
☐ 12.Undermining
☐ 13.Voids
☐ 14.Holes
☐ 15.Exposed reinforcement
☐ 16.Spalling
☐ 17.Outlet erosion
☐ 18.Misalignment
☐ 19.Inadequate capacity
☐ 20.Other

TYPE/SIZE: NONE

DRAINS / OTHER OUTLETS

☒ 1.None
☐ 2.No bottom drain
☐ 3.Bottom drain inoperable
☐ 4.Subsurface drain dry
☐ 5.Subsurface drain muddy flow
☐ 6.Subsurface drain obstructed
☐ 7.No animal guard
☐ 8.Other

TYPE: NONE

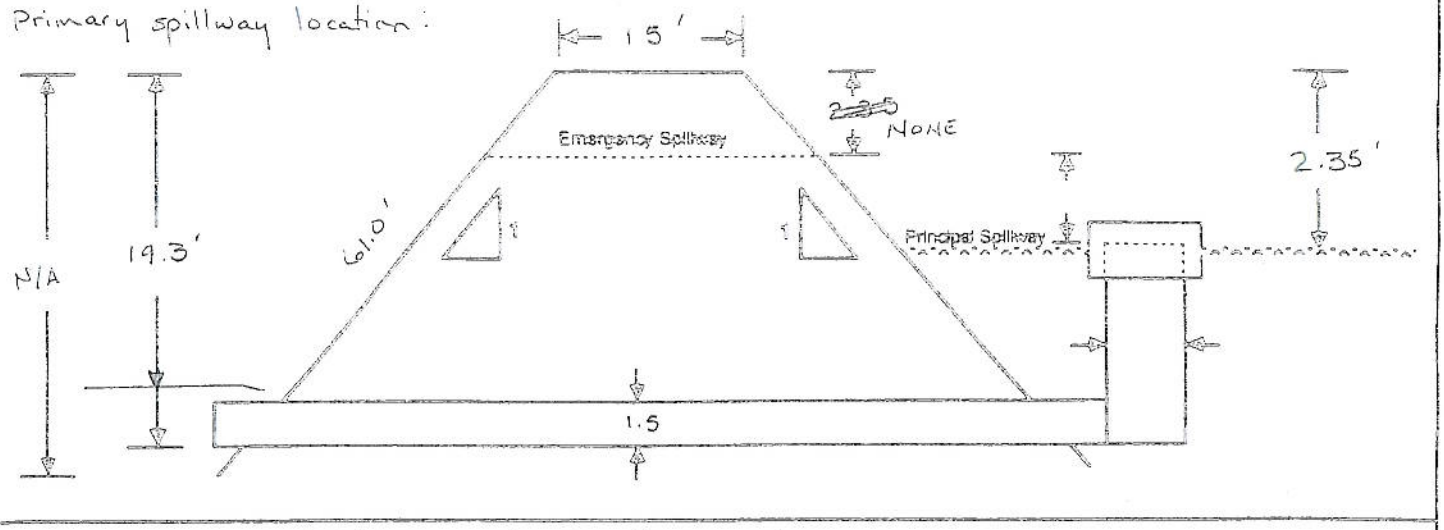
SKETCHES/COMMENTS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON PLANT 1971 ASH POND DAM	NEW HANOVER	004	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

Primary spillway location:



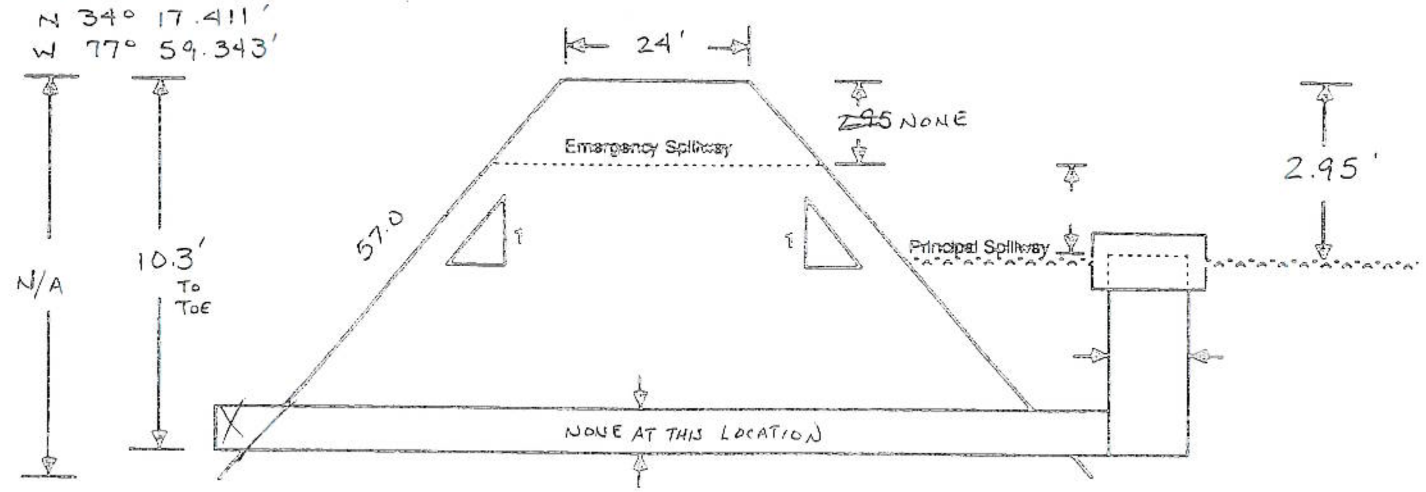
N 34° 17.588' W 77° 59.569'

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

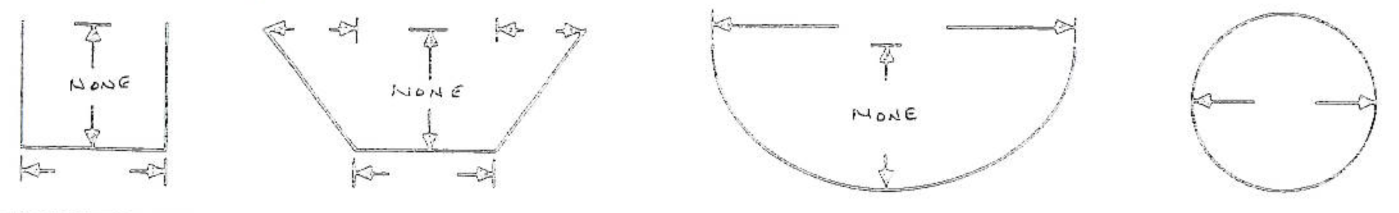
NAME	COUNTY	NO.	INSPECTED BY	DATE
SOUTHWEST SLOPE LOCATION (1971 AshPond)	NEW HANOVER	004	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

N 34° 17.411'
W 77° 59.343'



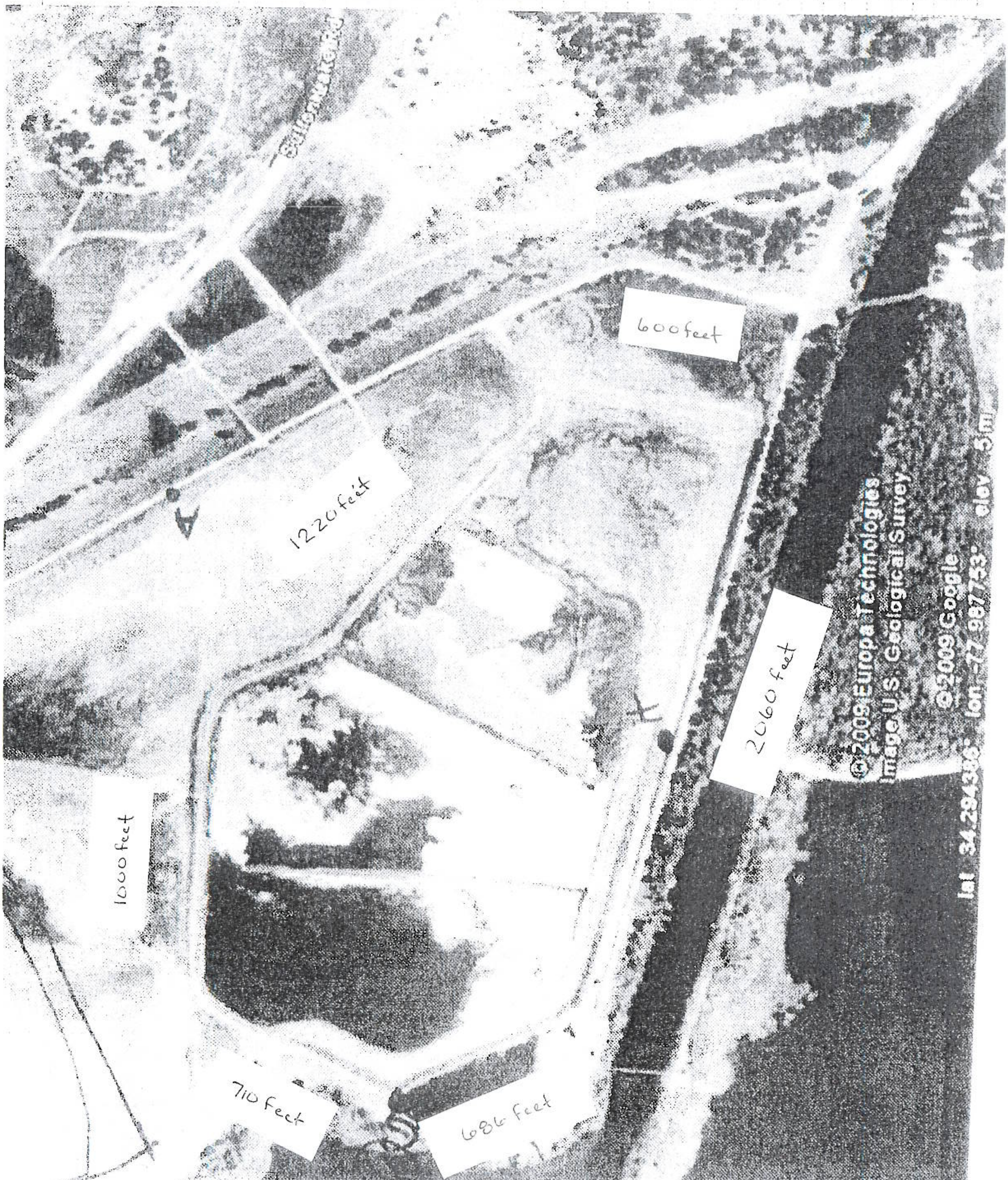
EMERGENCY SPILLWAY CROSS SECTION



PLAN VIEW OF DAM AND SPILLWAYS

SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1971 ASH POND	NEW HANOVER	004	SAMS, JAMES, WORTHINGTON	1/14&15/2010



HAZARD CLASSIFICATION DATA FORM FOR DAMS

DAM NAME SUTTON PLANT 1971 ASH POND DAM COUNTY NEW HANOVER NUMBER NEWHA-004
RIVER/STREAM SUTTON PLANT 1972 COOLING POND QUADRANGLE CASTLE HAYNE
DAM HEIGHT 19 feet SURFACE AREA(ACRES) 28 acres STORAGE CAPACITY (ACRE FT.) 248

PRIMARY DOWNSTREAM LAND USE:

☐ WOODLAND ☐ AGRICULTURAL ☐ RESIDENTIAL ☒ INDUSTRIAL/COMMERCIAL

DOWNSTREAM IMPROVEMENTS:

☐ DWELLINGS ☐ BUILDINGS ☐ ROADS ☐ UTILITIES

DOWNSTREAM IMPROVEMENT DATA:

Type Improvement	Distance Downstream	Floodplain Width	Channel Slope	Elevation Above Floodplain	Breach Wave Elevation	Culvert/Bridge Dimensions	Traffic Count	Sight Distance
ON-SITE COOLING POND	PRIMARY DISCHARGE IN POND	INDETERMINATE POND SURFACE AREA 6,900 ACRES	NOT APPLICABLE	N/A	N/A	NONE	NONE	N/A

DESCRIBE POTENTIAL FOR LOSS OF LIFE AND STRUCTURAL OR ENVIRONMENTAL DAMAGE TO EXISTING OR POTENTIAL FUTURE DOWNSTREAM IMPROVEMENTS: THE ASH POND DISCHARGE MUST MEET NCDENR DIVISION OF WATER QUALITY NPDES REQUIREMENTS AND IS CONTINUALLY MONITORED. A CATASTROPHIC BREACH WOULD APPEAR TO BE CONFINED TO THE RECEIVING SUTTON PLANT 1972 COOLING POND. A BREACH AND RESULTING NECESSARY CLEAN UP ~~WOULD~~ MAY SUSPEND OPERATIONS OF THE SUTTON PLANT, BUT WOULD NOT AFFECT ELECTRICAL SERVICE BECAUSE THE EXISTING POWER GRID SHOULD COMPENSATE. IF THE COMPOSITION OF THE POND'S COAL ASH IS NOT DESIGNATED HAZARDOUS, A DAM FAILURE HERE DOES NOT PRESENT AN ENVIRONMENTAL OR LIFE THREATENING CIRCUMSTANCE.

RECOMMENDED HAZARD CLASSIFICATION: ☒ LOW ☐ INTERMEDIATE ☐ HIGH

BY TITLE WILMINGTON REG. ENGR. DATE 1/15/2010

CONCURRED BY TITLE STATE DAM SAFETY ENGR. DATE 1/15/2010

DAM SAFETY INSPECTION REPORT

NAME SUTTON STEAM PLANT 1984 ASH POND

COUNTY NEW HANOVER

NO. 005

INSPECTED BY SAMS McEVOY, JAMES et al

DATE 1/14 & 15/2010

OWNER PROGRESS ENERGY

ADDRESS 801 SUTTON STEAM PLANT ROAD, WILMINGTON, NC

PHONE 910-343-3244

TYPE DAM ☐ Concrete gravity ☐ Concrete arch ☐ Other ☒ Embankment ☐ Concrete buttress ☐ Stone masonry

TYPE INSPECTION ☐ Periodic ☒ Initial ☐ Followup ☐ Other

SITE CONDITIONS ☐ Wet ☒ Dry ☐ Snowcover ☐ Other

HAZARD DESCRIPTION ALL FLOW IN THE EVENT OF A BREACH GOES TO THE COOLING POND

HAZARD CLASS ☐ Intermediate (B) ☒ Low (A) ☐ High (C)

REMARKS THE DIKE IS IN GOOD SHAPE. THE BACK SIDE (THE EAST FACING SLOPE) HAS A NUMBER OF BURROWS THAT NEEDS TO ELIMINATED. THE NORTH AND WEST SLOPES HAS SPARSE VEGETATION AND POSSIBLY A SMALL BULGE THAT NEEDS ADDITIONAL COVER.

ACTION
☐ None
☒ Maintenance
☐ Monitoring
☐ Minor repair
☐ Engineering

RECOMMENDATIONS
☒ Inspection letter
☐ Deficiency letter
☐ RE notice
☐ Engineering study
☐ Inspection by RE
☐ Inspection by DSE
☐ Dam safety order
☐ Enforcement
☐ Periodic reinspection
☐ Other reinspection

AREA | **PROBLEMS** | **COMMENTS**

UPSTREAM SLOPE / FACE

☒ 1.None
☐ 2.Trees
☐ 3.High bushes
☐ 4.Burrows
☐ 5.Wave erosion
☐ 6.Livestock damage
☐ 7.Slides
☐ 8.Depressions
☐ 9.Bulges
☐ 10.Sparse rip rap
☐ 11.Displaced rip rap
☐ 12.Cracks
☐ 13.Undermining
☐ 14.Holes
☐ 15.Spalling
☐ 16.Displaced joints
☐ 17.Deteriorated joints
☐ 18.Exposed reinforcement
☐ 19.Other

COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☐ Asphalt ☐ Other

THE UPSTREAM IS IN GOOD SHAPE. THE FREEBOARD IS A REASONABLE HEIGHT.

TOP OF DAM

☒ 1.None
☐ 2.Trees
☐ 3.High bushes
☐ 4.Burrows
☐ 5.Ruts
☐ 6.Livestock damage
☐ 7.Depressions
☐ 8.Unlevel
☐ 9.Misalignment
☐ 10.Has overtopped
☐ 11.Cracks
☐ 12.Spalling
☐ 13.Deteriorated joints
☐ 14.Displaced joints
☐ 15.Exposed reinforcement
☐ 16.Other

COVER: ☒ Vegetation ☒ Gravel ☐ Concrete ☐ Asphalt ☐ Other

THE ACCESS ROAD ALONG THE TOP IS IN GOOD SHAPE.

DOWNSTREAM SLOPE / FACE

☐ 1.None
☐ 2.Trees
☐ 3.High bushes
☒ 4.Burrows
☐ 5.Erosion
☐ 6.Livestock damage
☒ 7.Slides
☐ 8.Depressions
☒ 9.Bulges
☐ 10.Wetness
☐ 11.Seepage
☐ 12.Boils
☐ 13.Cracks
☐ 14.Holes
☐ 15.Spalling
☐ 16.Displaced joints
☐ 17.Deteriorated joints
☐ 18.Exposed reinforcement
☐ 19.Other

COVER: ☒ Vegetation ☐ Rip rap ☐ Concrete ☐ Other

THE EAST WALL OF DIKE HAS A NUMBER OF BURROW LOCATIONS:

1. N 34° 17' 44.86" W 77° 59' 14.63"
2. N 34° 17' 49.65" W 77° 59' 16.48"
3. N 34° 17' 50.07" W 77° 59' 16.76"
4. N 34° 17' 51.89" W 77° 59' 17.27"
5. N. 34° 17' 52.15" W 77° 59 17.40"

PLEASE ADDRESS THESE BURROWS.
AREAS ALONG THE NORTH AND WEST SLOPES NEED ADDITIONAL VEGETATION. A POSSIBLE SLIDE AND BULGE BETWEEN THE RISER/BARREL AND THE INTERSECT WITH THE 1971 DAM SHOULD BE MONITORED.

TOE CONTACT

☐ 1.None
☒ 2.Trees
☒ 3.High bushes
☐ 4.Burrows
☐ 5.Erosion
☐ 6.Livestock damage
☐ 7.Slides
☐ 8.Depressions
☐ 9.Bulges
☐ 10.Wetness
☐ 11.Seepage
☐ 12.Boils
☐ 13.Cracks
☐ 14.Holes
☐ 15.Spalling
☐ 16.Displaced joints
☐ 17.Deteriorated joints
☐ 18.Exposed reinforcement
☐ 19.Undermining
☐ 20.Other

COVER: ☐ Vegetation ☐ Rip rap ☐ Concrete ☐ Other

THE EAST SLOPE IS EASILY ACCESSIBLE AND IN GOOD SHAPE. THE NORTH SLOPE HAS TREES BUT IS STILL EASILY ACCESSIBLE. THE WEST SLOPE (THE COOLING POND SIDE) HAS HEAVY BRUSH, THICKETS AND SMALL TREES THAT HAMPER THE INSPECTION. PLEASE REMOVE ALL VINE-LIKE VEGETATION AND THICKETS, REMOVE ~~BRUSH~~ BUSHES AND TREES THAT HAMPER ACCESSIBILITY.

AREA	PROBLEMS	COMMENTS
ABUTMENT CONTACTS	☒ 1.None ☐ 2.Trees ☐ 3.High bushes ☐ 4.Burrows ☐ 5.Erosion ☐ 6.Livestock damage ☐ 7.Slides ☐ 8.Depressions ☐ 9.Bulges ☐ 10.Wetness ☐ 11.Seepage ☐ 12.Boils ☐ 13.Cracks ☐ 14.Holes ☐ 15.Spalling ☐ 16.Displaced joints ☐ 17.Deteriorated joints ☐ 18.Exposed reinforcement ☐ 19.Undermining ☐ 20.Other	COVER: ☐ Vegetation ☐ Rip rap ☐ Concrete ☐ Other THE IMPOUNDMENT IS A COMPREHENSIVE PERIMETER; THERE ARE NO ABUTMENTS.
PRINCIPAL SPILLWAY	☒ 1.None ☐ 2.No trashguard ☐ 3.Obstructed ☐ 4.Plugged ☐ 5.Rusted ☐ 6.Damaged ☐ 7.Gates leaking ☐ 8.Joints leaking ☐ 9.Cracks ☐ 10.Joint deterioration ☐ 11.Joint displacement ☐ 12.Undermined ☐ 13.Voids ☐ 14.Erosion ☐ 15.Holes ☐ 16.Conduit collapsed ☐ 17.Spalling ☐ 18.Outlet undercutting ☐ 19.Misalignment ☐ 20.Other	TYPE/SIZE: RISER/BARREL WITH A SUSPENDED WEIR AS AN OUTFALL THE WATERFALL DISCHARGE OVER THE WEIR COULD PRESENT A LONGTERM STABILITY PROBLEM FOR THE OPEN CONCRETE TROUGH THAT DISCHARGES THE WATER INTO THE COOLING POND. PLEASE CONTINUE TO MONITOR.
EMERGENCY SPILLWAY	☐ 1.None ☐ 2.No ES ☐ 3.Same as PS ☐ 4.Obstructed ☐ 5.Erosion ☐ 6.Displaced rip rap ☐ 7.Sparse rip rap ☐ 8.Joints leaking ☐ 9.Cracks ☐ 10.Joint deterioration ☐ 11.Joint displacement ☐ 12.Undermining ☐ 13.Voids ☐ 14.Holes ☐ 15.Exposed reinforcement ☐ 16.Spalling ☐ 17.Outlet erosion ☐ 18.Misalignment ☐ 19.Inadequate capacity ☐ 20.Other	TYPE/SIZE: NONE
DRAINS / OTHER OUTLETS	☒ 1.None ☐ 2.No bottom drain ☐ 3.Bottom drain inoperable ☐ 4.Subsurface drain dry ☐ 5.Subsurface drain muddy flow ☐ 6.Subsurface drain obstructed ☐ 7.No animal guard ☐ 8.Other	TYPE: NONE

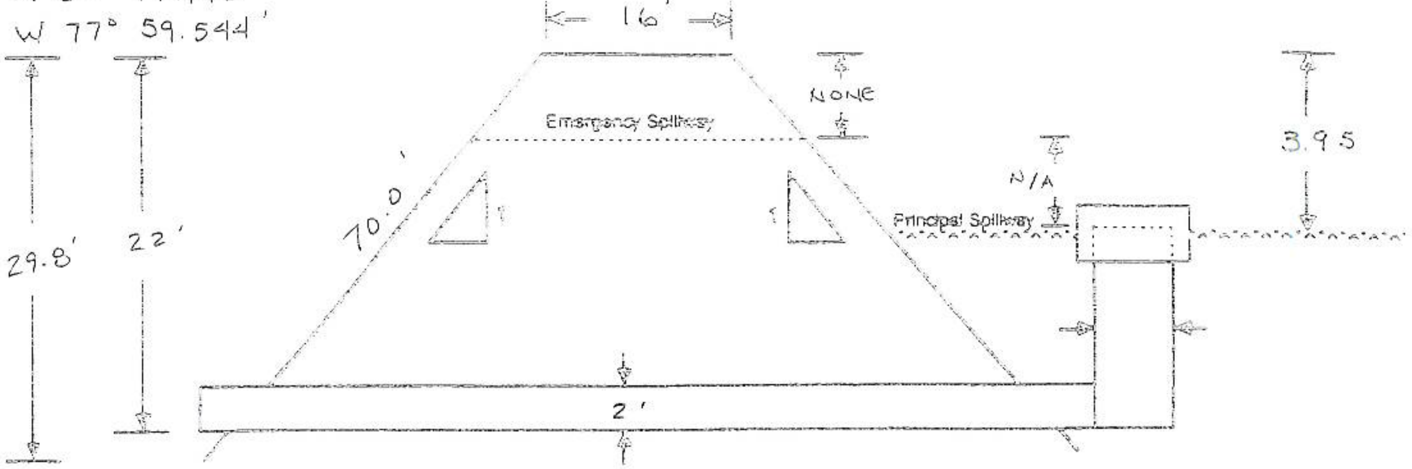
SKETCHES/COMMENTS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON PLANT 1984 ASH POND OUTFALL LOCATION	NEW HANOVER	005	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

N 34° 17.945'
W 77° 59.544'

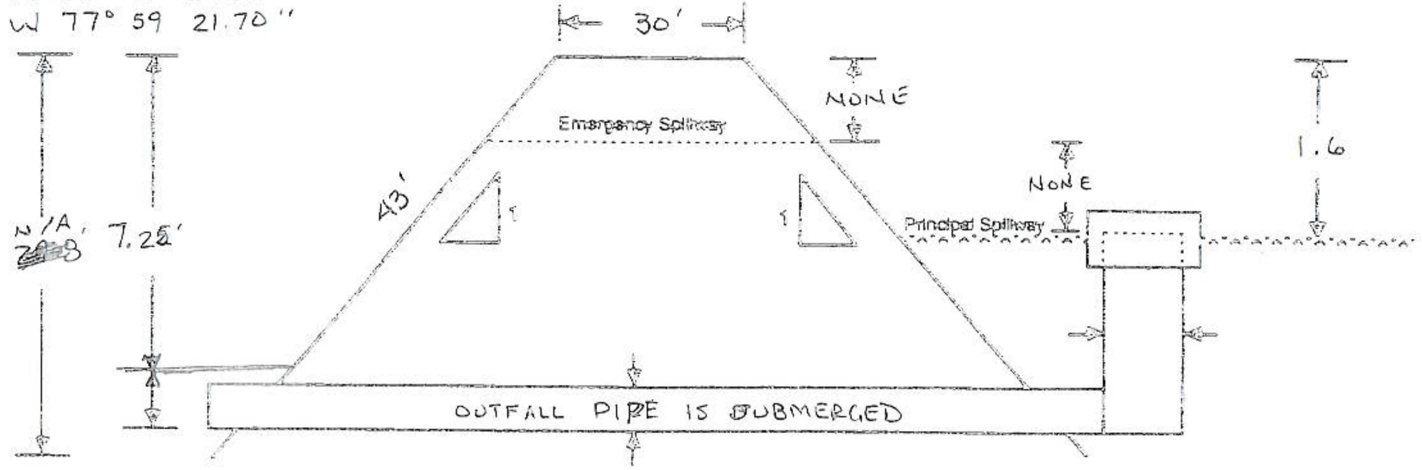


EMBANKMENT DAM SKETCHES AND MEASUREMENTS

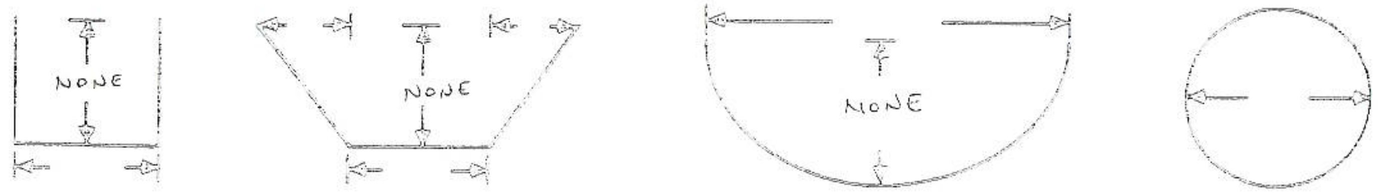
NAME	COUNTY	NO.	INSPECTED BY	DATE
1984 ASH POND UPPER LIFT OUTFALL LOCATION	NEW HANOVER	005	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

N 34° 17' 51.58"
W 77° 59 21.70"



EMERGENCY SPILLWAY CROSS SECTION



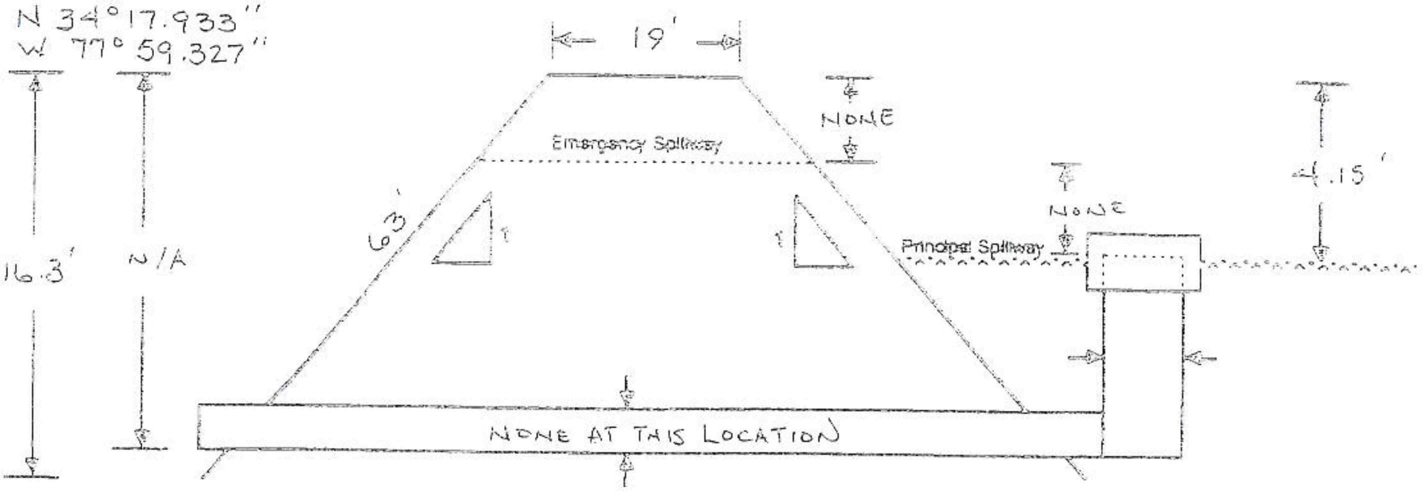
PLAN VIEW OF DAM AND SPILLWAYS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON PLANT 1984 ASH POND DAM	NEW HANOVER	005	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

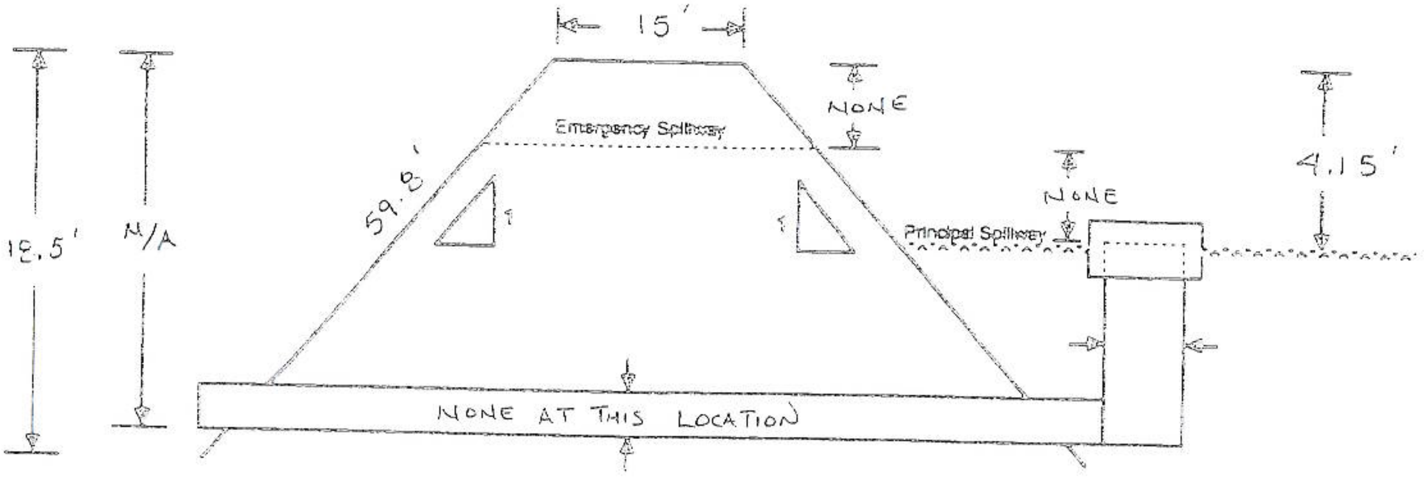
N 34°17.933"
W 77°59.327"



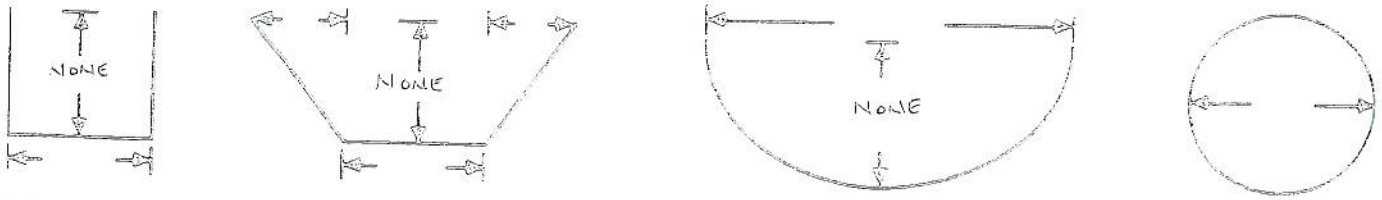
EMBANKMENT DAM SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
NORTH SLOPE CROSS SECTION	NEW HANOVER	005	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION



EMERGENCY SPILLWAY CROSS SECTION



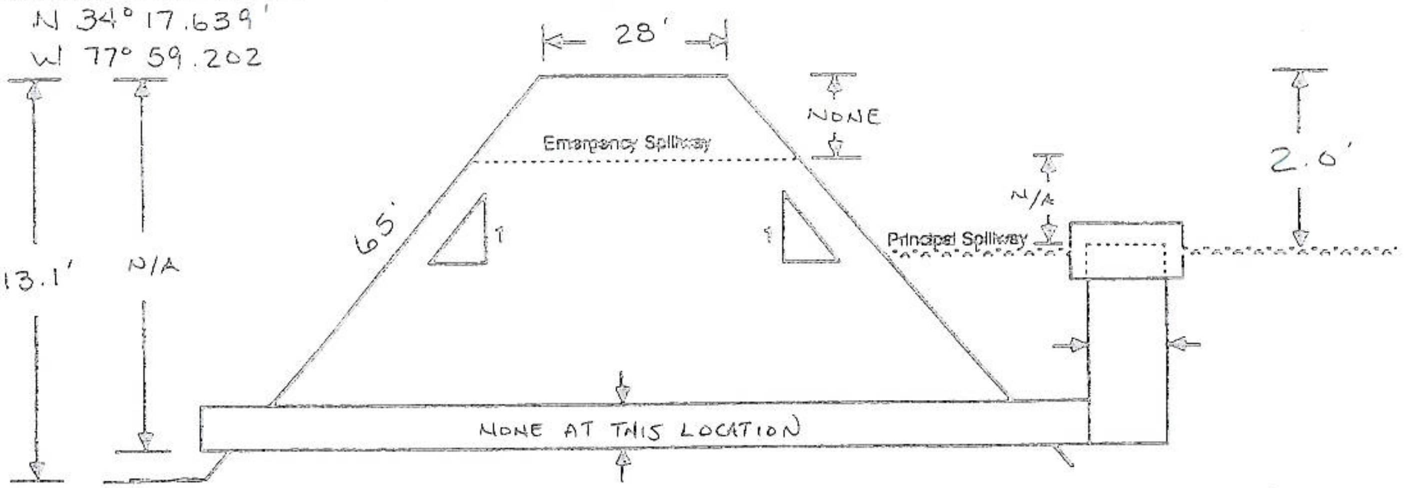
PLAN VIEW OF DAM AND SPILLWAYS

EMBANKMENT DAM SKETCHES AND MEASUREMENTS

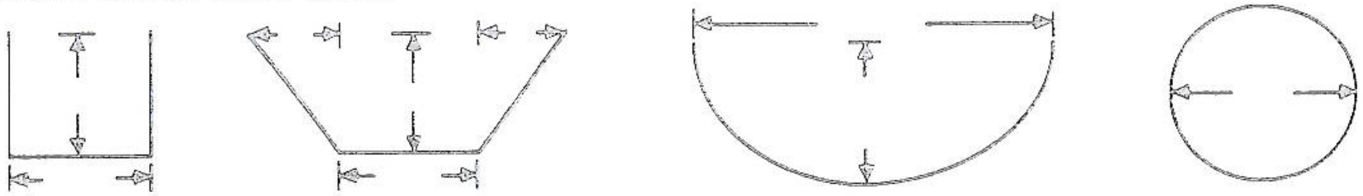
NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON PLANT 1984 ASH POND DAM	NEW HANOVER	005	JAMES, WORTHINGTON	1/15/2010

EMBANKMENT CROSS SECTION

N 34° 17.639'
W 77° 59.202

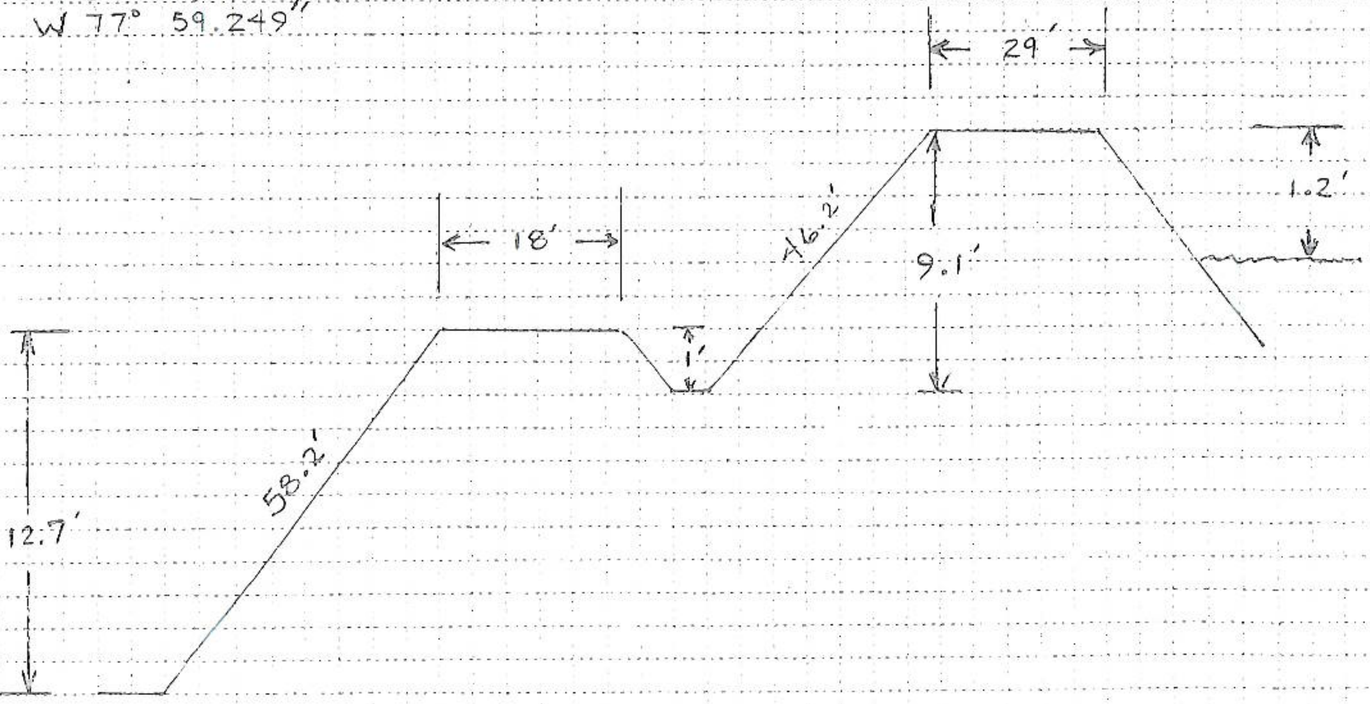


EMERGENCY SPILLWAY CROSS SECTION



PLAN VIEW OF DAM AND SPILLWAYS

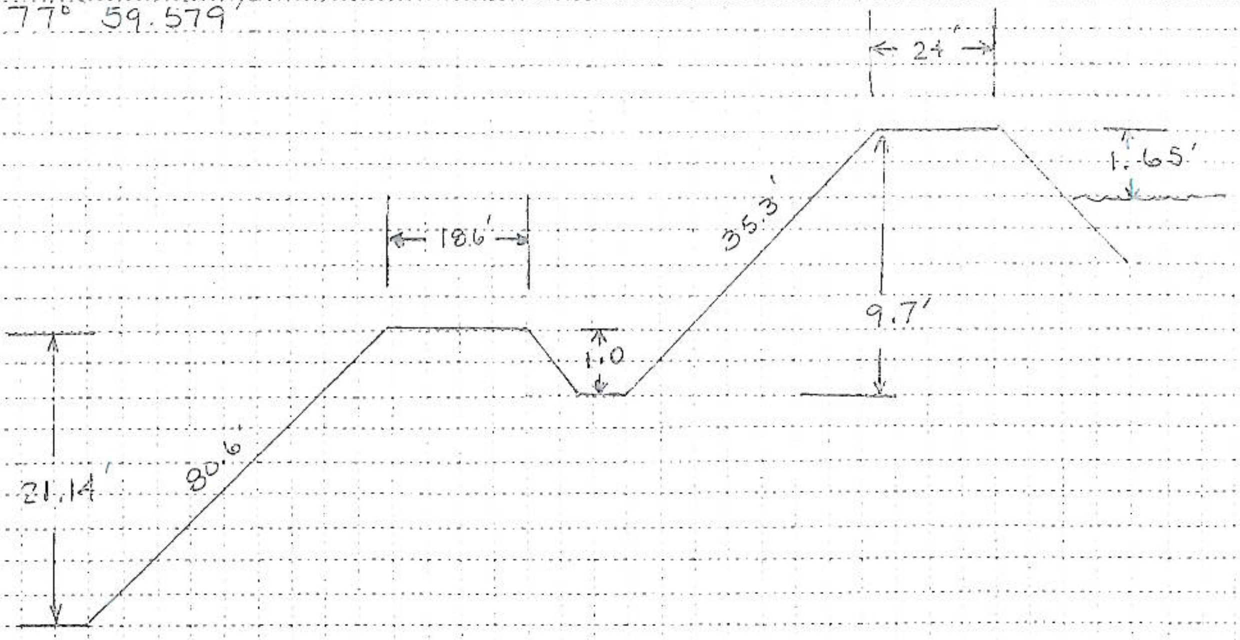
N 34° 17.751"
W 77° 59.249"



SKETCHES AND MEASUREMENTS

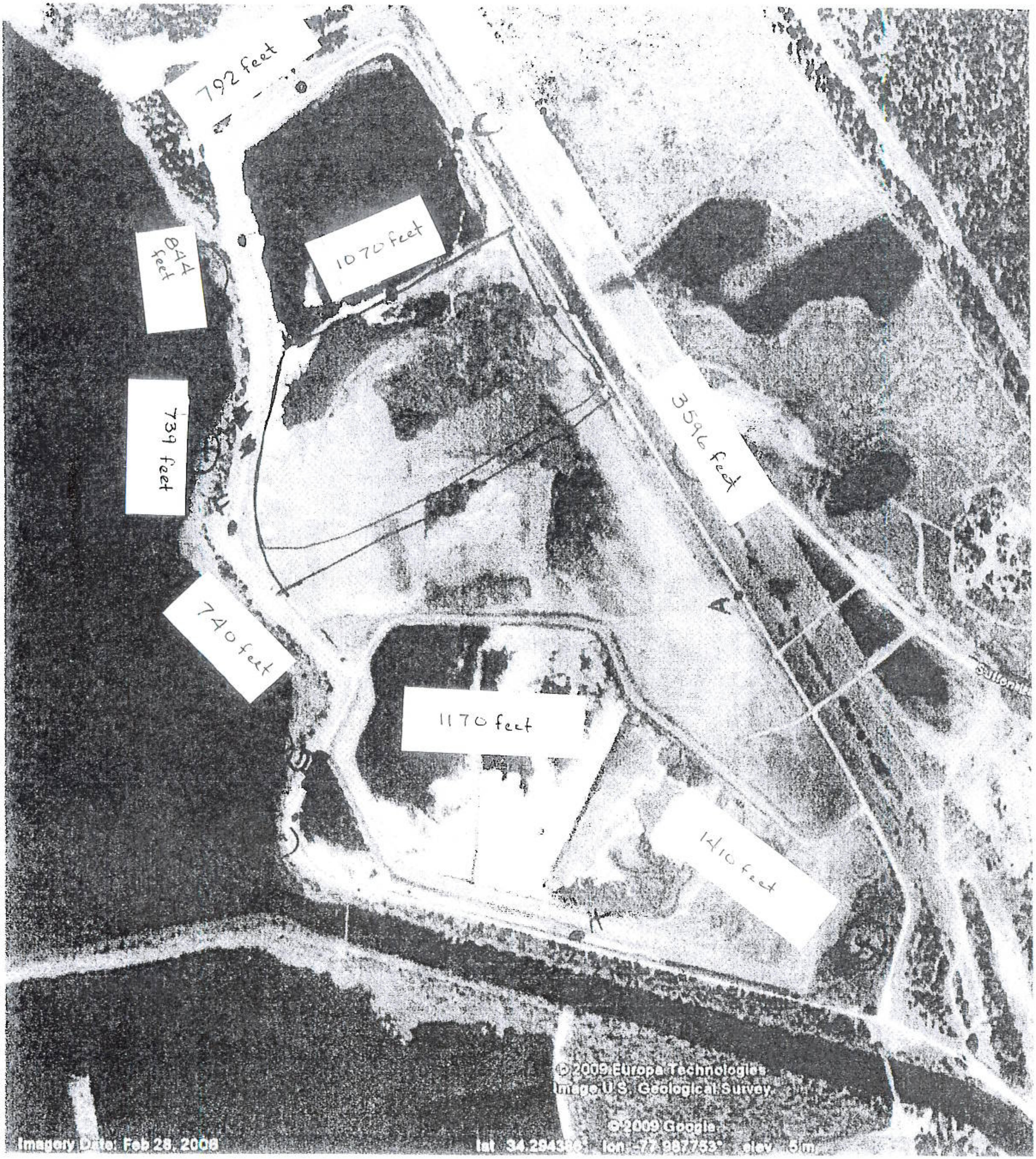
NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON PLANT 1984 ASH POND DAM	NEW HANOVER	005	JAMES, WORTHINGTON	1/15/2010

N 34° 17.712'
W 77° 59.579'



SKETCHES AND MEASUREMENTS

NAME	COUNTY	NO.	INSPECTED BY	DATE
SUTTON STEAM PLANT 1984 ASH POND	NEW HANOVER	005	SAMS, JAMES, WORTHINGTON	1/15/2010



HAZARD CLASSIFICATION DATA FORM FOR DAMS

DAM NAME SUTTON PLANT 1984 ASH POND DAM COUNTY NEW HANOVER NUMBER NEWHA-005

RIVER/STREAM SUTTON PLANT 1972 COOLING POND QUADRANGLE CASTLE HAYNE

DAM HEIGHT 32 feet SURFACE AREA ACRES 82 acres STORAGE CAPACITY ACRE FT. 1364

PRIMARY DOWNSTREAM LAND USE:

☐ WOODLAND ☐ AGRICULTURAL ☐ RESIDENTIAL ☒ INDUSTRIAL COMMERCIAL

DOWNSTREAM IMPROVEMENTS:

☐ DWELLINGS ☐ BUILDINGS ☐ ROADS ☐ UTILITIES

DOWNSTREAM IMPROVEMENT DATA:

Type Improvement	Distance Downstream	Floodplain Width	Channel Slope	Elevation Above Floodplain	Breach Wave Elevation	Culvert/Bridge Dimensions	Traffic Count	Sight Distance
ON-SITE COOLING POND	PRIMARY DISCHARGE IN POND	INDETERMINATE POND SURFACE AREA 6900 ACRES ~~FEET~~	NOT APPLICABLE	N/A	N/A	NONE	NONE	N/A

DESCRIBE POTENTIAL FOR LOSS OF LIFE AND STRUCTURAL OR ENVIRONMENTAL DAMAGE TO EXISTING OR POTENTIAL FUTURE DOWNSTREAM IMPROVEMENTS: THE ASH POND DISCHARGE MUST MEET DENR DIVISION OF WATER QUALITY NPDES REQUIREMENTS AND IS CONTINUALLY MONITORED. A CATASTROPHIC BREACH WOULD BE CONFINED TO THE RECEIVING SUTTON PLANT 1972 COOLING POND. A RESULTING BREACH AND NECESSARY CLEANUP ~~WOULD~~ MAY SUSPEND OPERATIONS OF THE SUTTON PLANT, BUT WOULD NOT EFFECT POWER SERVICE BECAUSE THE EXISTING ELECTRICAL GRID CAN COMPENSATE. IF THE COMPOSITION OF COAL ASH IS NOT DESIGNATED A HAZARD, A DAM FAILURE HERE DOES NOT PRESENT AN ENVIRONMENTAL OR LIFE THREATENING CIRCUMSTANCE.

RECOMMENDED HAZARD CLASSIFICATION: ☒ LOW ☐ INTERMEDIATE ☐ HIGH

BY TITLE WILMINGTON REG. ENGR. DATE 1/15/2010

CONCURRED BY TITLE STATE DAM SAFETY ENGR. DATE 1/15/2010

Requested Item

Number: RITM0031706
Stage: Delivery
Request: REQ0028919
Approval: Approved
Item: Audio Conferencing (Meeting Exchange)
Due date: 09/12/2010 06:43:08
Short description: Audio Conferencing (Meeting Exchange)

Variables

Requested For
TYNDALL,R. KENT

Corp ID
I15384

Location
SUTTON FOS PLT

Preferred contact method
More information
Work

Other contact number

Which service are you requesting
● Request Meeting Exchange audio conference account
○ Request AT&T TeleConference account
○ Terminate an audio conference account

What is the client's desk phone number for the account disconnect
More information

Provide details for services requested in Additional Comments

Additional Comments
this request is for audio conference line for Kent Tyndall, Sutton Plant, Wilmington NC

APPENDIX A

Document 10

NPDES

DIVISION OF WATER QUALITY
DWQ
NCDENR

Michael F. Easley
Governor

William G. Ross, Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E., Director
Division of Water Quality

RECEIVED
DEC 18 2006

December 14, 2006

Mr. Harry Sideris, Plant Manager
Carolina Power and Light d/b/a/ Progress Energy Carolinas, Inc.
Sutton Steam Plant
801 Sutton Steam Plant Road
Wilmington, North Carolina 28401

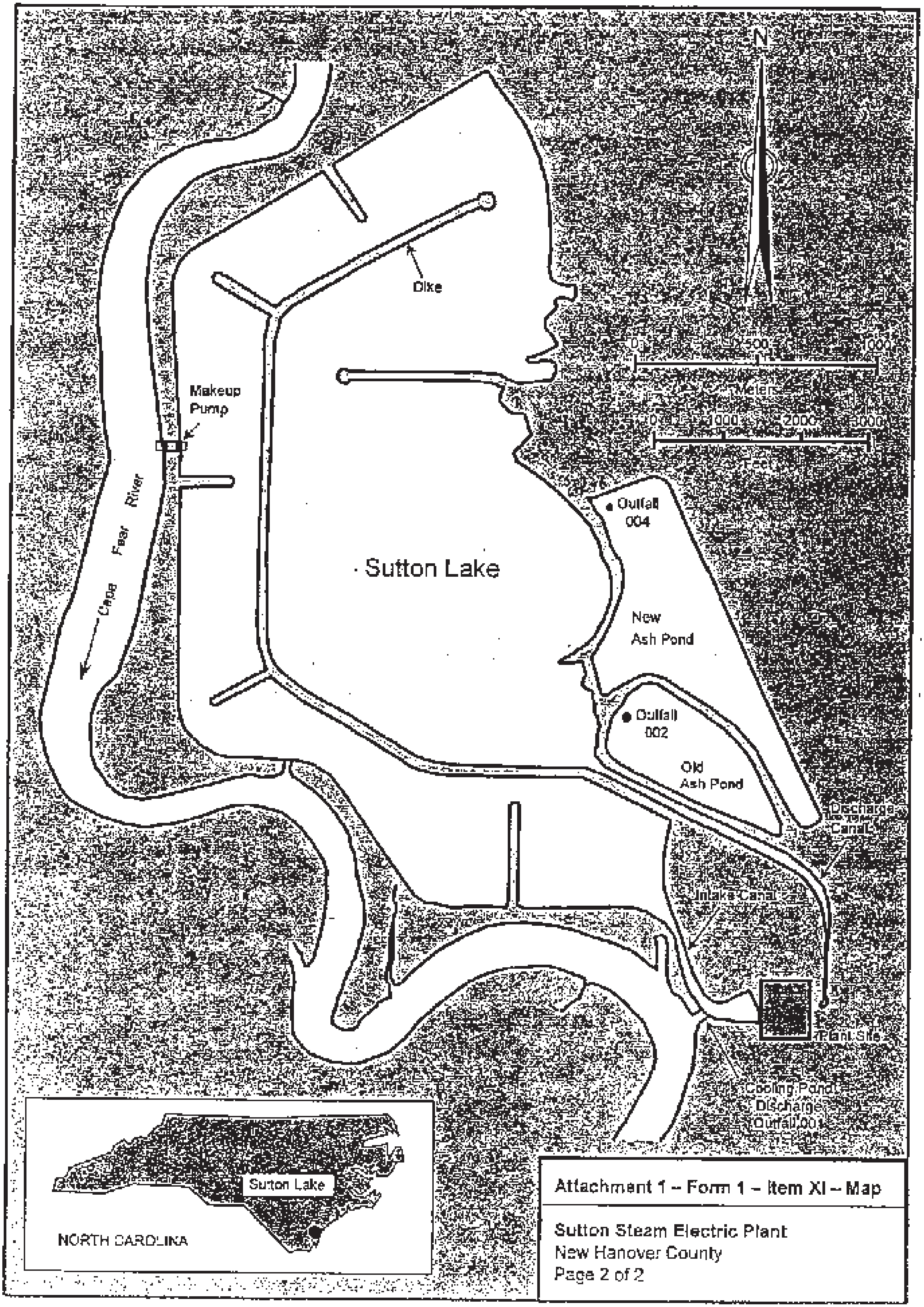
Subject: Issuance of NPDES Permit
Permit NC0001422
L.V. Sutton Electric Plant
New Hanover County

Dear Mr. Sideris:

Division personnel have reviewed and approved your application for renewal of the subject permit. Accordingly, we are forwarding the attached NPDES discharge permit. This permit is issued pursuant to the requirements of North Carolina General Statute 143-215.1 and the Memorandum of Agreement between North Carolina and the U.S. Environmental Protection Agency dated May 9, 1994 (or as subsequently amended).

This final permit includes the following major changes from the draft permit sent to you on October 11, 2006.

- Monitoring for TN and TP has been increased to Monthly for Outfall 001 in response to EPA comment and to be consistent with the new Cape Fear Permitting Strategy. The Division cannot grant your request to reduce monitoring to Quarterly. This segment of the Cape Fear River is impaired and additional monitoring is necessary to support water quality modeling efforts within the Cape Fear River Basin.
- Monthly monitoring for DO has been added in response to EPA's comment and to evaluate the impact of the facility's discharge on the receiving stream. The Division cannot grant your request to remove this monitoring from the permit. This segment of Cape Fear River is impaired due to low DO concentrations and the Division has to evaluate the impact of individual dischargers. In addition, the DO analysis is very simple, quick, and inexpensive.
- Selenium Monitoring for Outfall 004 has been reduced to Quarterly in response to your request and to be consistent with the requirements for Outfall 002.
- The following text was added to Section A. (12) to reflect new requirements of the Environmental Sciences Section: "Fish tissue monitoring will only be completed if the ash pond discharges to the river for 120 days in a calendar year". The Division will also allow you to submit fish monitoring data 4 month after the calendar year in which the samples are taken.
- Groundwater monitoring wells 17, 18, and 19 were added to the list of monitoring wells in response to your request.



Attachment 1 – Form 1 – Item XI – Map

Sutton Steam Electric Plant
New Hanover County
Page 2 of 2

A. (1) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (001)

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge from **Outfall 001 (Cooling pond blowdown, recirculation cooling water, non-contact cooling water, and treated wastewater from internal outfalls 002, 003, and 004)**. Such discharges shall be limited and monitored by the Permittee as specified below:

EFFLUENT CHARACTERISTICS	LIMITS		MONITORING REQUIREMENTS		
	Weekly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow			Daily	Estimate	Effluent
Temperature [1,2]			Daily	Grab	Effluent, U, D
Total Residual Chlorine [3]		200 µg/L	Weekly	Grab	Effluent
Time of Chlorine Addition (min/day/unit)		120	Daily	Logs	Effluent
Total Copper		NL (µg/L)	Quarterly	Grab	Effluent
Total Selenium		56 µg/L	Weekly	Grab	Effluent
Total Nitrogen (NO_2 + NO_3 + TKN)		NL (mg/L)	Monthly	Grab	Effluent
Total Phosphorus		NL (mg/L)	Monthly	Grab	Effluent
Dissolved Oxygen			Monthly	Grab	Effluent
Acute Toxicity [4]			Quarterly	Grab	Effluent
Total Arsenic[5]	50 µg/L		Weekly	Grab	Effluent
pH		$6 \le pH \le 9$	Daily	Grab	Effluent

NL = No limit

Notes:

1. U: Upstream, 2700 feet above outfall. D: Downstream, 1.25 miles below outfall. **Instream monitoring is provisionally waived in light of the permittee's participation in the Lower Cape Fear River Basin Association. Instream monitoring shall be conducted as stated in this permit should the permittee end its participation in the Association.**

2. The receiving water's temperature shall not be increased by more than 2.8°C above ambient water temperature and in no case exceed 32°C, except in the mixing zone described as follows: Extending from the eastern shore to the centerline of the river and extending not more than 1.25 miles downstream nor more than 2700 feet from the point of discharge. The cross-sectional area of the mixing zone shall not exceed 9% of the total cross sectional area of the river at the point of discharge nor 2.5% at the mouth of Toomer's Creek.

3. Total residual chlorine may not be discharged from any single generating unit for more than two hours per day, unless the Permittee can demonstrate to the Division of Water Quality that discharge for more than two hours is required for macroinvetebrate control. Simultaneous multi-unit chlorination is permitted.

4. Acute Toxicity Monitoring (Fathead Minnow, 24 hour); Part I, Condition A. (5).

5. The limit becomes effective January 1, 2008.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

A. (2) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (002)

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge *to the Cooling Pond from **Outfall 002*** **(Old Ash Pond – coal pile runoff, low volume wastes, ash sluice water, chemical metal cleaning wastes (Outfall 003), and stormwater runoff)**. Such discharges shall be limited and monitored by the Permittee as specified below:

EFFLUENT CHARACTERISTICS	**LIMITS**		**MONITORING REQUIREMENTS**		
	Monthly Average	**Daily Maximum**	**Measurement Frequency**	**Sample Type**	**Sample Location**
Flow			Weekly	Pump Logs or similar	Effluent
Oil and Grease	15 mg/L	20 mg/L	Monthly	Grab	Effluent
Total Suspended Solids	30 mg/L	100 mg/L	Monthly	Grab	Effluent
Total Arsenic		NL (µg/L)	Quarterly	Grab	Effluent
Total Selenium		NL (µg/L)	Quarterly	Grab	Effluent
Ammonia-Nitrogen[1]			Weekly	Grab	Effluent

1. Monitoring is only required when ash sluicing occurs.

Samples taken in compliance with the monitoring requirements specified above shall be taken prior to mixing with other waste streams.

A. (3) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (003)

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge *to the Old Ash Pond from **Outfall 003*** **(Chemical metal cleaning wastes)**. Such discharges shall be limited and monitored by the Permittee as specified below*:

EFFLUENT CHARACTERISTICS	**LIMITS**		**MONITORING REQUIREMENTS**		
	Monthly Average	**Daily Maximum**	**Measurement Frequency**	**Sample Type**	**Sample Location**
Flow			Weekly	Pump Logs or similar	Effluent
Total Copper	1 mg/L	1 mg/L	2/Month	Grab	Effluent
Total Iron	1 mg/L	1 mg/L	2/Month	Grab	Effluent

* Effluent requirements for Outfall 003 have been suspended due to the changes in disposal method for chemical metal cleaning wastes. If the plant needs to discharge these wastes through Outfall 003, you shall notify the Division 1 week in advance of such discharge. Upon commencement of the discharge, all the requirements for this outfall become active. Following the discharge of metal cleaning waste, effluent requirements

A. (4) EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (004)

During the period beginning on the effective date of the permit and lasting until expiration, the Permittee is authorized to discharge to the Cooling Pond and/or to Outfall 001 *from Outfall 004* **(New Ash Pond – ash sluice water, coal pile runoff, low volume wastes, chemical metal cleaning wastes (Outfall 003), and stormwater runoff)**. Such discharges shall be limited and monitored by the Permittee as specified below:

EFFLUENT CHARACTERISTICS	LIMITS		MONITORING REQUIREMENTS		
	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type	Sample Location
Flow			Weekly	Pump Logs or similar	Effluent
Oil and Grease	15 mg/L	20 mg/L	Monthly	Grab	Effluent
Total Suspended Solids	30 mg/L	100 mg/L	Monthly	Grab	Effluent
Total Arsenic		NL (µg/L)	Quarterly	Grab	Effluent
Total Selenium		NL (µg/L)	Quarterly	Grab	Effluent
Ammonia-Nitrogen			Weekly	Grab	Effluent

Samples taken in compliance with the monitoring requirements specified above shall be taken prior to mixing with other waste streams.

A. (5) ACUTE TOXICITY MONITORING (QRTRLY)

The permittee shall conduct acute toxicity tests on a *quarterly* basis using protocols defined in the North Carolina Procedure Document entitled "Pass/Fail Methodology For Determining Acute Toxicity In A Single Effluent Concentration" (Revised-July, 1992 or subsequent versions). The monitoring shall be performed as a Fathead Minnow (*Pimephales promelas*) 24 hour static test. The effluent concentration at which there may be at no time significant acute mortality is 90% (defined as treatment two in the procedure document). Effluent samples for self-monitoring purposes must be obtained during representative effluent discharge below all waste treatment. The tests will be performed **during the months of February, May, August and November.**

All toxicity testing results required as part of this permit condition will be entered on the Effluent Discharge Monitoring Form (MR-1) for the month in which it was performed, using the parameter code TGE6C. Additionally, DWQ Form AT-2 (original) is to be sent to the following address:

Attention: North Carolina Division of Water Quality
Environmental Sciences Section
1621 Mail Service Center
Raleigh, North Carolina 27699-1621

Completed Aquatic Toxicity Test Forms shall be filed with the Environmental Sciences Section no later than 30 days after the end of the reporting period for which the report is made.

Test data shall be complete and accurate and include all supporting chemical/physical measurements performed in association with the toxicity tests, as well as all dose/response data. Total residual chlorine of the effluent toxicity sample must be measured and reported if chlorine is employed for disinfection of the waste stream.

Should there be no discharge of flow from the facility during a month in which toxicity monitoring is required, the permittee will complete the information located at the top of the aquatic toxicity (AT) test form indicating the facility name, permit number, pipe number, county, and the month/year of the report with the notation of "No Flow" in the comment area of the form. The report shall be submitted to the Environmental Sciences Section at the address cited above.

APPENDIX A

Document 11

Sutton – Slope Stability Analysis

ASH POND DIKE STABILITY ANALYSIS
PROGRESS ENERGY – SUTTON PLANT
NEW HANOVER COUNTY, NORTH CAROLINA

Sutton 1971/1983 Ash Pond (State ID No. NEWHA-004)
Sutton 1984 Ash Pond (State ID No. NEWHA-005)

Prepared for:

Progress Energy

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

March 8, 2011

MACTEC Project No. 6468-10-0274

MACTEC
engineering and constructing a better tomorrow

March 8, 2011

Mr. Rob Miller
Progress Energy
7001 Pinecrest Road
Raleigh, North Carolina 27613

**SUBJECT: REPORT OF ASH POND DIKE STABILITY ANALYSIS
PROGRESS ENERGY - SUTTON PLANT
SUTTON 1971/1983 ASH POND (STATE ID NO. NEWHA-004)
SUTTON 1984 ASH POND (STATE ID NO. NEWHA-005)
MACTEC PROJECT NO. 6468-10-0181**

Dear Mr. Miller:

MACTEC Engineering and Consulting, Inc. (MACTEC) is pleased to submit the attached report of our Ash Pond dike stability analysis for Progress Energy's Sutton Plant located near Wilmington, North Carolina. The work was authorized by Progress Energy under Work Authorization No. 2720-220, effective December 8, 2010.

The results of stability analysis indicate that the dikes meet the appropriate standards for factor of safety. Based on the results, we have not identified the need for remedial work for the dikes. However, routine inspections should continue on the frequency outlined in the plant procedure.

MACTEC is pleased to have performed this work for Progress Energy. Please contact Scott Auger (919-831-8033) or Shane Johnson (919-831-8017) if you have questions.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, Inc.

SEAL
8169
Richard S. Auger
3-8-11

J. Shane Johnson, P.G., P.E. (Preparer)
Project Geotechnical Engineer
Registered, North Carolina 037422

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

RSA/rsa

Enclosures

MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue, Raleigh, NC 27604 • Phone: 919.876.0416 • Fax
License Number: NC Engineering F0653 NC Geology C-247

www.mactec.com
Please Recycle!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

MACTEC Engineering and Consulting, Inc. (MACTEC) was retained by Progress Energy to provide an assessment of structural stability for the Ash Pond dikes located at the L. V. Sutton Steam Electric Plant (Sutton Plant) in New Hanover County, North Carolina. The location of the plant and associated pond areas is shown on Figure 1. The scope of services covered by this report is consistent with Progress Energy Work Authorization No. 2720-220, effective December 8, 2010.

There are two ash ponds at the Sutton Plant - the 1971/1983 Ash Pond and the 1984 Ash Pond. Previous results of stability analyses for the 1984 Ash Pond dike were located in plant file records. For this evaluation, these previous reports were reviewed and supplemented with additional analyses incorporating updated water level information. No records of stability analyses for the 1971/1983 Ash Pond dikes were available. Therefore, field and laboratory investigations were performed on the 1971/1983 Ash Pond dikes and stability analyses were conducted.

This report presents the results of MACTEC's field investigations, laboratory testing, stability analyses, and engineering review for the Ash Pond dikes.

2.0 SUMMARY OF RESULTS

This report presents results of a geotechnical study of the stability of existing dikes at the Sutton Plant Ash Ponds. The study included review of past dam inspection reports and existing geotechnical information. Additional geotechnical borings and laboratory testing were also performed for the 1971/1983 Ash Pond. Topographic information was obtained from available aerial topographic mapping prepared as part of other recent plant studies.

Slope stability analyses were performed for cross sections considered representative of the existing dike conditions. Results of the stability analyses indicate that the factors of safety for slope stability of the Ash Pond dikes are acceptable.

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. Water level readings in piezometers and temporary water level observation casings do not indicate presence of water exiting the slope or toe of the dikes.

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

3.0 DESCRIPTION

3.1 SUTTON PLANT

The Sutton Plant includes three operating coal fired steam electric generating units identified as Sutton Units 1, 2, & 3. Coal combustion by-products from operation of the plant are disposed of in two active ash pond areas located north of the plant as shown in Figure 2. The ash pond areas are identified as the 1971/1983 Ash Pond (State Dam ID No. NEWHA-004) and the 1984 Ash Pond (STATE ID No. NEWHA-005). The coal combustion by-products primarily consist of fly ash and bottom ash material. The ash material is conveyed to the ash pond areas by sluicing methods.

3.2 REGULATORY JURISDICTION

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 dikes covered by this report are included in the NCDENR Dam Safety inventory listing with descriptions as follows:

State ID No.	State Dam Name	State Hazard Potential Description
NEWHA-004	Sutton 1971 Ash Pond*	Low
NEWHA-005	Sutton 1984 Ash Pond	Low

*It should be noted that the 1971 Ash Pond is also referred to in this report as the 1971/1983 Ash Pond.

3.3 SUTTON 1971/1983 ASH POND (STATE ID NO. NEWHA-004)

The current configuration of the 1971/1983 Ash Pond dikes was constructed by raising the original 1971 Ash Pond dike. Design and construction of the 1971 Ash Pond dike was provided by Brown and Root. The 1983 modifications were designed by CP& L (now Progress Energy) and constructed by Dickerson Inc. under the administration of CP&L. Law Engineering provided field density testing during construction of the 1983 dike. The general design information for the 1971 dike is included in the attached Appendix F, Exhibit 3. Appendix F, Exhibits 4 through 8 provide design details for the 1983 dike modifications. The present dikes have a crest elevation varying from Elevation 28 feet MSL to 34 feet MSL. The higher elevation is at the common dike with the 1984 Ash Pond. The crest width is 12 feet and side slopes are 3(H):1(V). Including the common dike, the dike length is about 3,800 feet. This ash pond area was taken out of service in 1985, but then returned to service in 2001.

In 2005, an interior ash storage area was constructed by placement of a containment berm within the pond area. Design and construction was performed by Trans Ash. The containment berm has an outlet structure which directs flow to the area near the discharge structure on the west side of the ash pond area. The interior storage area is not considered to be jurisdictional under NCDENR Dam Safety regulations.

The 1971/1983 Ash Pond discharge structure, located in the northwest corner of the pond, consists of a 48-inch diameter vertical concrete riser connected to a 12-inch diameter concrete outlet pipe. The exit point of the outlet pipe is submerged by the adjacent Cooling Lake.

The design features for the current configuration of the 1971/1983 Ash Pond dike are summarized as follows:

- Length: 7,000 feet
- Maximum Structural Height: 24 feet
- Surface Area (acres): 49.5
- Storage capacity (acre-feet): 1200 (estimated based on average depth of 24 feet)
- Size Classification: Small*
- Hazard Classification: Low*
- Regulatory Design Storm 50 year**
- US Slope: 3 (H):1(V)
- DS Slope: 3 (H):1(V)
- Crest Width: 12 feet
- Crest Elevation: 28 feet
- Design maximum operating level: Elevation 26 feet***
- Current Operating Level: Elevation 24.8 feet (from 2010 Inspection Report)
- Instrumentation: 3 piezometers (installed 2010)

*Classifications based on NCDENR Dam Safety regulations and inventory description.
** Rainfall for 50-year storm event is 9 inches.
***The maximum water level is now set at the current operating level of Elevation 24.8.

3.4 SUTTON 1984 ASH POND (STATE ID NO. NEWHA-005)

The 1984 Ash Pond dike was constructed of sand fill with a one foot thick clay liner for the interior slope and bottom of the ash pond area. The clay liner was covered with a 2-foot protective layer of sand fill on the slopes. The top of the liner on the interior slope is at Elevation 32 feet (where Elevation noted), and the top of the bottom liner is set at Elevation 14.0. The dike crest width is 12 feet and slopes (interior and exterior) are 3(H):1(V). The design crest for the dikes is at Elevation 34.0, and the length including the common dike with the 1983 Ash Pond is about 10,000 feet. The maximum developed dike height is estimated to be about 24 feet above the original minimum grade at Elevation 10.0 (Elevation 34.0 - Elevation 10.0 = 24 feet).

The 1984 Ash Pond discharge structure consists of a 48-inch diameter vertical concrete riser connected to a 3 foot diameter concrete outlet pipe, located in the northwest corner of the pond. The outlet pipe is connected to a concrete outlet structure provided for diversion of discharge flow to the Cape Fear River. The outlet structure is equipped with a gate valve for flow control. Flow can be diverted to the Cape Fear River or allowed to discharge directly into the Cooling Pond at the outlet structure.

At the time of the 2010 inspection, the riser crest was reported to be at Elevation 30.0 feet. It was also reported by Progress Energy that the water level was raised to the current elevation on June 25, 2009 (from Elevation 28.0).

The MACTEC report dated April 20, 2010, indicates that seepage does not represent a concern for dike stability.

In 2006, Progress Energy constructed an interior ash storage area (also referred to as the interior containment area) in the south end of the 1984 Ash Pond. The storage capacity addition was designed by Withers & Ravenel and constructed by Trans Ash. The design crest is at Elevation 42.0, and the design normal water level is at Elevation 40.0. The maximum dike height above the original ash level is about 14 feet, and the crest width is 25 feet. The interior slope is 2(H):1(V) and the exterior slope is 4(H):1(V). Where the interior containment area dikes are adjacent to the 1984 Ash Pond dikes, the toe of the slope is set back eight feet and graded to drain toward the north. A stability berm is provided on the north side where the dike is adjacent to the impounded water within the 1984 Ash Pond. The interior containment area is not considered to be jurisdictional under NCDENR Dam Safety regulations.

The design features for the current configuration of the 1984 Ash Pond dike are summarized as follows:

• Length:	10,000 feet
• Maximum Structural Height:	32 feet
• Surface Area (acres):	82
• Storage capacity (acre-feet):	1,364
• Size Classification:	Medium*
• Hazard Classification:	Low*
• Regulatory Design Storm	100 yr **
• US Slope:	3 (H):1(V)
• DS Slope:	3 (H):1(V)
• Crest Width:	12 feet
• Crest Elevation:	34 feet
• Design maximum operating level:	Elevation 32 feet
• Current Operating Level	Elevation 30 feet (from 2010 Inspection Report)
• Instrumentation :	18 piezometers (installed in 2009)

*Classifications based on NCDENR Dam Safety regulations and inventory description.
** 100-year storm is 10 inches over 12 hours. 50-year storm is 9 inches.

4.0 FIELD INVESTIGATIONS

4.1 1971/1983 ASH POND

The field investigation program was performed from December 15, 2010 through February 11, 2011. The scope of field investigations included:

- Advancing three soil test borings with standard penetration sampling from the crest of the existing dikes. A temporary water level observation casing was installed within the dike portion of the borehole to allow checks of water levels over time. The lower portion of the borehole was sealed with bentonite pellets prior to installing the observation casing.
- Performing six 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 in hand auger boreholes to allow for 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 2006.

The boring locations were identified in the field by MACTEC personnel utilizing a Trimble GPS unit. The soil borings were performed by a CME-55LC drill rig mounted on a track carrier. 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 an automatic 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.

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 approximately three to ten feet below the ground surface and were stopped just beneath the depth groundwater was encountered. To allow checks for water levels over time along the slope and at the toe of the slope, 1-inch diameter PVC pipes with slotted sections were installed in the hand auger boreholes. The PVC pipes were set in the open hole, a sand pack placed to within 1 feet of the ground surface and a bentonite seal was used to fill the remainder of the borehole. After a period of stabilized water levels were measured, the well casings were removed and the boreholes were sealed with bentonite.

A field geologist observed the drilling operations, logged the 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 A. 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 within the dike portion of the borehole. The lower portion of the borehole was sealed with bentonite pellets prior to installing the temporary casing. 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.

4.2 1984 ASH POND

No geotechnical borings have been performed on the 1984 Ash Pond dikes. However, in February 2009, MACTEC installed 18 water level observation casings (piezometers) in the dike crest and exterior slopes. Additionally, MACTEC advanced six continuous sampling probes at the dike crest piezometer locations to check the materials types used to construct the dikes. The probes were advanced from the crest of the dike using a GeoProbe direct push method. The GeoProbe has a hollow interior liner with a clear plastic sleeve. Continuous samples of soil were collected in five foot increments. The probes were pushed to approximately 30 feet below the crest of dike. Based on the original design drawings, these depths would result in the probes entering the dike foundation soils. The soil samples were visually classified in the field using the USCS and representative portions of soil were collected at two-foot intervals from the liners and placed in a sealed bag for possible testing.

A hand auger was used to advance shallow borings near the toe of the dike slope at the soil probe locations. The soils were visually described, and typical materials were placed in sealed bags for later examination.

Twelve piezometers for water level observations were installed along the dike crest near the probe locations. At each location, two piezometers were installed. One (PA-series) consisted of a 5-foot length of mechanically slotted well screen set from 10 to 15 feet below the dike crest surface and 10 feet of solid riser. The second piezometer (PZA-series) at each location was set with its screen at 20 to 25 feet below the dike crest. All piezometers included a sand pack around the well screen, a bentonite seal and then cement/bentonite grout up to the ground surface. Each piezometer was completed using a locking PVC cap and a steel roadbox cemented at the ground surface. The locking roadboxes were placed flush with the dike crest. Pipe protective posts were installed near the piezometers.

At the toe of the dike slope, piezometers were installed in the hand auger boreholes. The termination depth was approximately 4 feet below the existing ground surface at the toe of the dike. The piezometers consisted of 2.5 feet of one-inch diameter PVC hand slotted well screen and 2.5 feet of solid riser pipe. Sand was placed to approximately one-foot above the top of the well screen and the hole was backfilled with bentonite chips to the ground surface.

Appendix G includes piezometer data and boring records for reference information from the MACTEC Report of Piezometer Installation and Observation, dated April 20, 2010.

5.0 LABORATORY TESTING

5.1 1971/1983 ASH POND

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 and Atterberg Limits. All testing was done in general accordance with applicable ASTM specifications. A summary of laboratory test results is included in Appendix B.

5.2 1984 ASH POND

No laboratory tests were performed for this exploration.

6.0 SUBSURFACE CONDITIONS

6.1 1971/1983 ASH POND

Subsurface conditions are illustrated on Figures 4 through 6; a legend for the symbols used is on Figure 3. Based on borings performed for this exploration a 6 to 12-inch layer of gravel was encountered along the crest of the dike. Beneath the gravel layer, the dike fill materials typically consist of layers of very loose to very dense slightly silty fine to medium sand (SP, SP-SM) and silty fine to medium sand (SM). The dike fill materials were encountered to depths ranging from approximately 15.5 to 18.5 feet beneath the crest of the dike. In the location of boring B-3, possible ash materials were encountered in the silty sands from depths of approximately 8 to 15.5 feet beneath the crest of the dike. Possible ash material with sandy silt and silty sand texture was encountered in HA-3-1 at the ground surface and extended to a depth of approximately 5.5 feet below the ground surface. Approximately 1.5 feet of ash material (silt texture) was encountered in hand auger boring HA-3-2 performed at the toe of the slope.

N-values within the dike fill range from 2 blows per foot (bpf) to 50 blows with 4 inches of penetration with results further summarized as follows:

- Boring B-1 - The average N-value for the upper 15 feet of the dike at the location of boring B-1 is 54 bpf. The average N-value in the lower portion of the dike in the location of boring B-1 is 28 bpf.
- Boring B-2 - The average N-value for the upper 11 feet of the dike at the location of boring B-2 is 52 bpf. The average N-value in the lower portion of the dike in the location of boring B-2 is 7 bpf .
- Boring B-3 - The average N-value for the upper 8 feet of the dike at the location of boring B-3 is 65 bpf. The average N-value in the lower portion of the dike in the location of boring B-3 is 8 bpf.

N-values recorded in the upper portion of the dike are indicative of fills that have received a reasonable amount of compaction. N-values recorded in the lower portion of the dike at boring B-1 are indicative of fills that have received a reasonable amount of compaction. N-values recorded in the lower portion of the dike located at borings B-2 and B-3 are indicative of fills that have received marginal compaction. Material properties of the fill are discussed further in Section 7.

Beneath the dike fill, possible ash deposits and Coastal Plain soils were encountered to the termination depth of the borings. Based on the borings, a layer of possible ash was encountered beneath the dike fill from a depth of approximately 18 to 27 feet beneath the crest of the dike in boring B-2 and from a depth of approximately 15.5 to 22 feet beneath the crest of the dike in boring B-3. The possible ash material has a consistency of very soft to medium stiff fine sandy silt (ML, MH). N-values in the possible ash deposits range from 1 to 7 bpf.

The original ground as encountered in the borings consists of Coastal Plain sands, further described as slightly silty fine to medium sand (SP) and silty fine to coarse sand (SM). N-values within the Coastal Plain sands range from 11 to 25 bpf indicating a medium dense relative density. The average N-values in the foundation soils are 5 bpf in the possible ash deposits and 17 bpf in the Coastal Plain sands. Material properties of these soils are discussed further in Section 7.

6.2 1984 ASH POND

The dikes for the 1984 Ash Pond were constructed of compacted sandy soils placed on a sandy foundation according to Progress Energy construction records. Field compaction testing was performed by Law Engineering during construction. The interior slopes of the dikes and the bottom of the pond were lined with a clay layer designed for 12 inch thickness. An approximate 24-inch thick sand layer was to be placed on top of the clay for the slopes to reduce potential drying shrinkage effects and to protect the clay from erosion. Past dike inspections have generally found the dike slopes in good condition. Wave erosion, particularly on the east dike, has caused removal of the sand over the liner in several areas. The eroded areas have been repaired using clay soils.

The clay liner is intended to reduce water flow from the pond into the sand dikes and natural ground, thus creating a low water flow line (phreatic surface) within the dike. The low phreatic surface is important to the stability of the dike.

The soil samples collected from the probes and hand auger borings were brown, gray and white sand with estimated Unified Soil Classification of SW (well graded sand). Based on color changes and traces of small roots, an approximate boundary between the dike fill and the natural ground was estimated at between 18 to 20 feet below the dike crest. All six probes were terminated in the natural soils at a depth of 30 feet below the crest of the dike. Boring records are included in Appendix G (referenced as Attachment B).

The hand auger borings advanced for the piezometers at the toe of the slope indicate soils similar to those observed in the probes. Soils near the bottom of the hand auger borings were often very moist or wet.

7.0 1971/1983 ASH POND MATERIALS PROPERTIES

7.1 DIKE FILL

Based on previous information, borrow material for the ash pond dikes was obtained by excavating natural soils located in the vicinity of the ash pond area. The strength properties for the dike fill consisting of relatively "clean" sands and silty sands are based on N-values obtained from this exploration. Correlations of N-values with friction angle were used to estimate a friction angle for the sand portion of the dike fill. The 1971/1983 Ash Pond dike has been in place for over 39 years; therefore, 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.

In dikes containing cohesionless soil at the slope surface, the lowest factor of safety determined by analysis is generally associated with very shallow slip surfaces coincident with the face of the slope. However, very shallow sloughing of the slope surface is considered to be essentially a maintenance concern and not a condition that will affect the overall stability of the dike. To address this condition, we have assigned a nominal value of effective cohesion (10 psf) for analysis (where noted) to avoid low factors of safety associated with shallow slip surfaces along the face of the slope.

7.2 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 a possible ash deposit in the location of borings B-2 and B-3 and relatively "clean" sand and silty sand. The SPT data indicate very soft to medium stiff consistencies and medium dense relative densities for the foundation soils. As previously noted, the pore water pressures are assumed to be stabilized in the foundation soils. 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 soils are based on the N-values recorded during this exploration. Correlations of N-values with friction angles were used to estimate a friction angle for the possible ash deposits and the Coastal Plain sand foundation soils.

TABLE 1: 1971/1983 ASH POND SUMMARY OF MATERIAL PROPERTIES FOR ANALYSIS

ID	Description	Moist Unit Weight	Saturated Unit Weight	Effective Cohesion	Effective Friction Angle
#		pcf	pcf	psf	Deg
Section at B-1					
1	Dike Fill (SM,SP-SM)	120	125	10*	33
2	Dike Fill: (SP)	125	130	10*	38
3	Dike Fill: (SP)	120	125	0	33
4	Foundation: (SP)	120	125	0	32
Section at B-2					
1	Dike Fill: (SM)	120	125	0	33
2	Dike Fill: (SP)	125	130	0	38
3	Dike Fill: (SM,SP-SM)	115	120	0	30
4	Possible Ash (Silt): (MH)	100	105	0	25
5	Possible Ash (Silt): (MH)	100	105	0	30
6	Foundation: (SM)	120	125	0	31
Section at B-3					
1	Sedimented Ash	100	105	0	30
2	Dike Fill	125	130	0	38
3	Dike Fill: ((SM)	120	125	0	31
4	Dike Fill: (SM)	115	120	0	29
5	Possible Ash (Silt): (ML)	100	105	0	29
6	Foundation: (SM)	120	125	0	33

*A nominal value of effective cohesion (10 psf) is assigned for analysis to avoid low factors of safety associated with shallow slip surfaces along the face of the slope.

8.0 1984 ASH POND MATERIALS PROPERTIES

8.1 DIKE FILL

Based on the GeoProbe borings and information provided Appendix G, the dike consists of a relatively "clean" to silty sand. The strength properties for the dike fill are based on typical values assigned for compacted sandy soils and soil parameters assigned by CP&L in the original dike design. Because the dike has been in place for over 25 years, pore water pressures are assumed to be stabilized. Thus, effective stress (drained) parameters were used in the analysis to assess the static stability. Strength parameters for the clay liner were assigned based on experience. The parameters used in the analysis are summarized in Table 2.

In dikes containing cohesionless soil at the slope surface, the lowest factor of safety determined by analysis is generally associated with very shallow slip surfaces coincident with the face of the slope. However, very shallow sloughing of the slope surface is considered to be essentially a maintenance concern and not a condition that will affect the overall stability of the dike. To address this condition, we have assigned a nominal value of effective cohesion (10 psf) for analysis (where noted) to avoid low factors of safety associated with shallow slip surfaces along the face of the slope.

8.2 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 a sandy material. Because the dike has been in place for more than 25 years, pore water pressures are stabilized in the foundation soils. Thus, effective stress (drained) parameters were used in the analysis to assess the static stability. Strength parameters for the foundation soils are based on typical strength values assigned to sandy soils.

TABLE 2: 1984 ASH POND – SUMMARY OF MATERIAL PROPERTIES FOR ANALYSIS

ID	Description	Moist Unit Weight	Saturated Unit Weight	Effective Cohesion	Effective Friction Angle
#		pcf	pcf	psf	Deg
Section at B-1					
1	Dike Fill (Sand)	120	125	10*	35
2	Protective Sand Cover	120	125	0	32
3	Clay Lining	120	125	150	22
4	Foundation: Sand	120	125	0	32

*A nominal value of effective cohesion (10 psf) is assigned for analysis to avoid low factors of safety associated with shallow slip surfaces along the face of the slope. .

9.0 PHREATIC SURFACES

9.1 1971/1983 ASH POND

The normal water level in the Ash Pond is controlled by the top of the vertical riser which is currently set at Elevation 24.8 feet. We understand that the plant intends to maintain the current level as the maximum operating level for the 1971/1983 Ash Pond. The pond level used for analysis was based on the observed water level at the time of field investigation.

As shown in Table 5, water levels at the dike crest are 13 to 14 feet below the crest. Water levels at the toe of the dike range from approximately 1.4 to 5.4 feet below the ground surface. Only one of the three casings installed on the slope itself encountered water (at location B-2) at a depth of approximately 7.2 feet below ground surface. The measured water levels in the installed casings are summarized in Table 5 (placed at end of text).

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 could affect the phreatic surface within the interior portion of the dike cross-section due to the sandy composition of dike fill material. The assumed phreatic lines for each geotechnical section are shown on Figures 4 through 6.

As indicated under Section 12.1, the exterior slope and toe of the 1971/1983 Ash Pond dike have been observed during regular inspections by plant personnel and by MACTEC during the 5-year and annual inspections since 1987. Seepage has not been noted as a concern in the reports of those inspections.

9.2 1984 ASH POND

The phreatic surface used in the slope stability analysis was determined from the MACTEC Report of Piezometer Installation and Observations, dated April 20, 2010. Data from this report that was used for determination of phreatic water level is included in Appendix G.

It should be noted that much of the pond area is now filled with ash material with no standing water present. For analysis purposes, a phreatic surface passing from the exposed pond water level at its intersection with the dike interior slope, through the measured water level in the observation casings at the crest of the dike to the cooling pond water level elevation was used to represent the static conditions.

No seepage was noted along the slopes or toe during the time of piezometer installation, nor have dam inspections performed since 1987 noted the presence of seepage.

10.0 SEISMIC LOADS

The determination of the seismic Site Class for Ash Pond dikes is based on the North Carolina Building Code, 2006 Edition, which incorporates the 2003 International Building Code. The basis of the Site Class is the average shear wave velocity in the top 100 feet of the profile; however, the code also presents a conservative estimation procedure using N-values. Using the N-value methodology outlined in the building code and only considering the materials within the dike a Site Class D is applicable before considering liquefaction potential. To confirm the site class in the absence of deeper subsoil information at the dike location, MACTEC used past Refraction Microtremor (ReMi) test data obtained within 2 miles of the project site. The test data showed an average shear wave velocity of approximately 1030 ft/s which corresponds to a seismic Site Class D.

For an earthquake analysis, seismic design parameters were obtained adhering to 2006 North Carolina Building Code Amendments and the spectral acceleration maps developed by the United States Geological Survey (USGS) in 2002. Code provisions require that the higher of deterministic seismic hazard analysis (DSHA) and probabilistic seismic hazard analysis (PSHA) be used in the design. Due to the proximity of the site to Charleston, South Carolina, a DSHA was performed using the Charleston source zone and a moment magnitude of 7.3 for the earthquake. A PSHA was performed using background and regional source zones. The PSHA was performed for a maximum considered earthquake ground motion having 2 percent probability of exceedance within a 50-year period. The Peak Ground Acceleration (PGA) is calculated in accordance with section 1802.2.7 of International Building Code 2006 and is included in Appendix E of this report. A PGA of 0.105g is applicable to structures in this zone. Therefore, for a pseudo-static representation of earthquake effects, a seismic coefficient of 0.105g (rounded to 0.11 for analysis) 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.

Liquefaction is a phenomenon that can occur during an earthquake when loose sands are present below the groundwater table. MACTEC limited the liquefaction analysis to 30 feet below the top of the dikes due to limited boring depths. The liquefaction potential was evaluated using a Site Class D with a PGA 0.105g. The N-values indicate that the dike material is very dense to medium dense with some loose silty sand layers. The results of analysis indicate that the liquefaction is not possible within the dike and upper foundation material. The lowest factor of safety of 1.8 against liquefaction is obtained in boring B-2 at a depth of 13.5 feet. The results of liquefaction analysis are included in Appendix E of the report.

The previous discussion of liquefaction potential is primarily associated with dike and upper foundations material for the 1971/1983 Ash Pond dikes. The dike and upper foundation material for the 1984 Ash Pond dikes is believed to be at least comparable to or better than for the 1971/1983 Ash Pond dikes. Therefore, we believe that the factor of safety for liquefaction associated with the 1984 Ash Pond dikes should be at least comparable to the 1971/1983 Ash Pond dikes.

11.0 SLOPE STABILITY ANALYSIS

11.1 REGULATORY REQUIREMENTS

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(9)

- 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

11.2 1971/1983 ASH POND

Slope stability analysis performed for the exterior slopes of the 1971/1983 Ash Pond dikes considered both static and seismic loading conditions. The analyses were conducted for the normal operating level of the pond. 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. Three sections were selected for slope stability analyses – at boring B-1 (Figure 4), at boring B-2 (Figure 5), and at B-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 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 C.

TABLE 3: 1971/1983 ASH POND - FACTORS OF SAFETY AGAINST SLOPE FAILURE

Description of Analysis	Factor of Safety	
	Static	Seismic
1971/1983 Ash Pond – Analysis Section B-1		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	1.64	1.18
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. A nominal value of effective cohesion (10 psf) is assigned for analysis to avoid low factors of safety associated with shallow slip surfaces along the face of the slope.	1.85	1.40
1971/1983 Ash Pond – Analysis Section B-2		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	1.52	1.03
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.	1.78	1.25
Exterior Slope (Wedge Analysis), Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	1.46	1.01
1971/1983 Ash Pond – Analysis Section B-3		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	2.51	1.56
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.	2.51	1.68

Two of the borings along the west dike (B-2 and B-3) of the 1971/1983 Ash Pond encountered apparent fly ash below the sandy fill soils. The consistency of the fly ash varied from very soft to medium stiff. No records indicate placement of fly ash as part of the dike construction, but anecdotal indications are that ash was once sluiced out in some of the area now occupied by the 1971/1983 Ash Pond (near the southern section). Our stability analyses at boring location B-2 included the ash as a separate layer with low strength properties, and both circular arc and sliding wedge failure mechanisms were analyzed. The lowest factor of safety result was for a sliding wedge mode of failure with a value of 1.46. Considering the successful history of performance of the dike and the expectation of closure in the near term, MACTEC considers the factor of safety acceptable. However, no vertical extension of the dike should be performed without further detailed analyses. Development of the closure plans for the Ash Pond should include further evaluation of the stability of the west dike under the load of potential capping approaches. Providing a stability berm along the toe would be one approach to improve the stability if future loads were to be added on the crest of the dike or the interior of the pond near the dike.

11.3 1984 ASH POND

Slope stability analysis performed for the exterior slopes of the 1984 Ash Pond dikes considered both static and seismic loading conditions. The analyses were conducted for the maximum normal operating level of the pond at Elevation 32 feet. Rapid drawdown was not evaluated because in order to have a rapid drawdown condition, a breach of the dam would be needed.

A representative cross section of the western perimeter dike adjacent to the cooling pond was evaluated for this study. The design geometry of the dike was obtained from the design drawings included in Appendix F. A stability analysis performed by Carolina Power & Light for the original dike design indicates a factor of safety against slope stability of 1.583. For the CP&L analysis, a phreatic surface was assumed to be as indicated on Figure 8.

MACTEC installed piezometers in the crest, slope and toe of the dike at six locations along the 1984 ash pond dike to measure water levels within the dike. The recorded water levels resulted in a lower phreatic surface than assumed in the original design. A water level at Elevation 12 feet was assumed at the crest for analysis. Analysis for this study included using the same dike geometry and soil properties from the original dike design, but with the phreatic surface determined from the piezometers installed in the dike. The MACTEC analysis shows a higher factor of safety for slope stability than determined in the original CP&L analysis because of the lower phreatic surface. The stability analysis section as performed by MACTEC based on current piezometer data is shown as Figure 7.

In addition, an analysis using the same slope geometry, soil properties and phreatic surface as the original CP&L analysis was performed for comparison purposes. The factor of safety determined the comparison analysis was consistent with the factor of safety determined by CP&L. The slope stability analysis section originally performed by CP&L is illustrated in Figure 8.

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 4 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 4: 1984 ASH POND - FACTORS OF SAFETY AGAINST SLOPE FAILURE

Description of Analysis	Factor of Safety	
	Static	Seismic
1984 Ash Pond		
Exterior Slope, Phreatic Surface developed from measured water level. Failure surface extending into the foundation.	2.51	1.56
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. A nominal value of effective cohesion (10 psf) is assigned for analysis to avoid low factors of safety associated with shallow slip surfaces along the face of the slope.	2.51	1.68
CP&L Original Slope Stability Analysis (reference Figure 8)	1.583	NA
MACTEC Slope Stability Analysis with same phreatic surface as CP&L analysis for comparison. This analysis is included in Appendix D as "Sutton Plant Ash Pond Stability 1984 Ash Pond Dike (Deep) Run 2"	1.57	NA

12.0 SEEPAGE CONDITIONS

12.1 1971/1983ASH POND

The exterior slope and toe of the 1971/1983 Ash Pond dike have been observed during regular inspections by plant personnel and by MACTEC during the 5-year and annual inspections since 1987. Seepage has not been noted in the reports of those inspections. Seepage was not observed along the toe during the field work conducted for the present evaluation. Water levels in hand augers at the toe generally encountered water at depths corresponding to the water level elevation of the adjacent Cooling Lake and discharge canal.

12.2 1984 ASH POND

The exterior slopes of the 1984 Ash Pond dike have been observed during regular inspections by plant personnel and by MACTEC during the 5-year and annual inspections since 1987. Seepage has not been noted as a concern in the reports of those inspections. Records of water level readings in piezometers is discussed under Section 9.2 and reference data is included in Appendix G. The piezometer readings do not appear to indicate seepage close to the existing dike slope or toe surface.

13.0 CONCLUSIONS

The analysis results for the 1971/1983 and 1984 Ash Pond dikes indicate the factors of safety for slope stability are acceptable. Observations made from recent field inspections have not indicated signs 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.

14.0 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, Ash Pond Dikes, L. V. Sutton Steam Electric Generating Plant, New Hanover County, North Carolina, December 20, 2007.

3. MACTEC Engineering and Consulting, Inc., Report of Piezometer Installation and Observations, 1984 Ash Pond, Sutton Plant. April 20, 2010.

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

15.0 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 037422

SEAL
8169
RICHARD S. AUGER

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

TABLE 5: 1971/1983 ASH POND – WATER LEVEL SUMMARY

Table 5: 1971/1983 Ash Pond - Water Level Summary

1971/1983 Ash Pond Dike Stability Evaluation
L.V. Sutton Steam Plant
Wilmington, North Carolina
MACTEC Job No.: 6468-10-0274

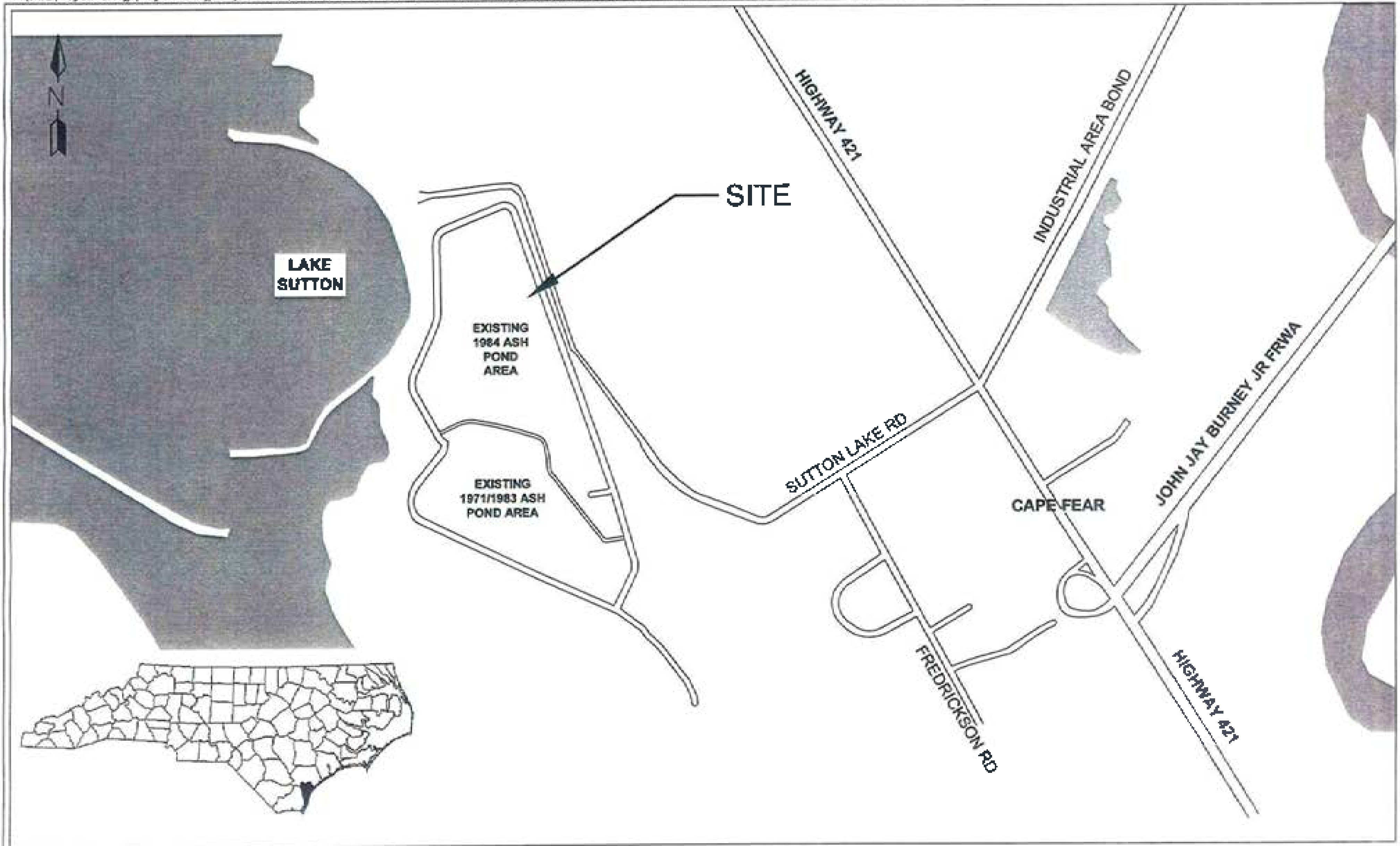
Location	Ground Surface Elevation	Casing Depth	Screen Interval	Depth to Groundwater				Groundwater Elevation			
				12/15/2010	12/16/2010	1/7/2011	2/11/2011	12/15/2010	12/16/2010	1/7/2011	2/11/2011
B-1	26.00	15.0	5-15	-	-	13.4	13.2	-	-	12.60	12.80
HA 1-1	20.36	9.90	-	Dry @ 9.9	Dry @ 9.9	Dry @ 9.9	Dry @ 9.9	Dry	Dry	Dry	Dry
HA-1-2	11.73	4.85	-	3.30	3.40	3.90	3.20	8.43	8.33	7.83	8.53
B-2	26.00	17.00	7-17	-	12.9*	14.50	14.05	-	13.1*	11.50	11.95
HA 2-1	17.39	8.85	-	7.25	7.2	7.70	7.25	10.14	10.19	9.69	10.14
HA-2-2	10.69	3.50	-	1.50	1.40	1.80	1.40	9.19	9.29	8.89	9.29
B-3	26.00	15.00	5-15	-	13.8*	14.70	14.52	-	12.2*	11.30	11.48
HA-3-1	18.02	9.95	-	Dry @ 9.95	Dry @ 9.95	Dry @ 9.95	Dry @ 9.95	Dry	Dry	Dry	Dry
HA-3-2	12.56	6.95	-	4.90	4.80	5.4	4.8	7.66	7.76	7.16	7.76

*Water level measured at end of day.

Prepared By: JLJ Date: 3/4/11
Checked By: TGA Date: 3/4/11

FIGURES

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton EAP Inundation and Stability\Drawings\Boring Location Plan.dwg Fri, 04 Mar 2011 - 2:15pm rrahie



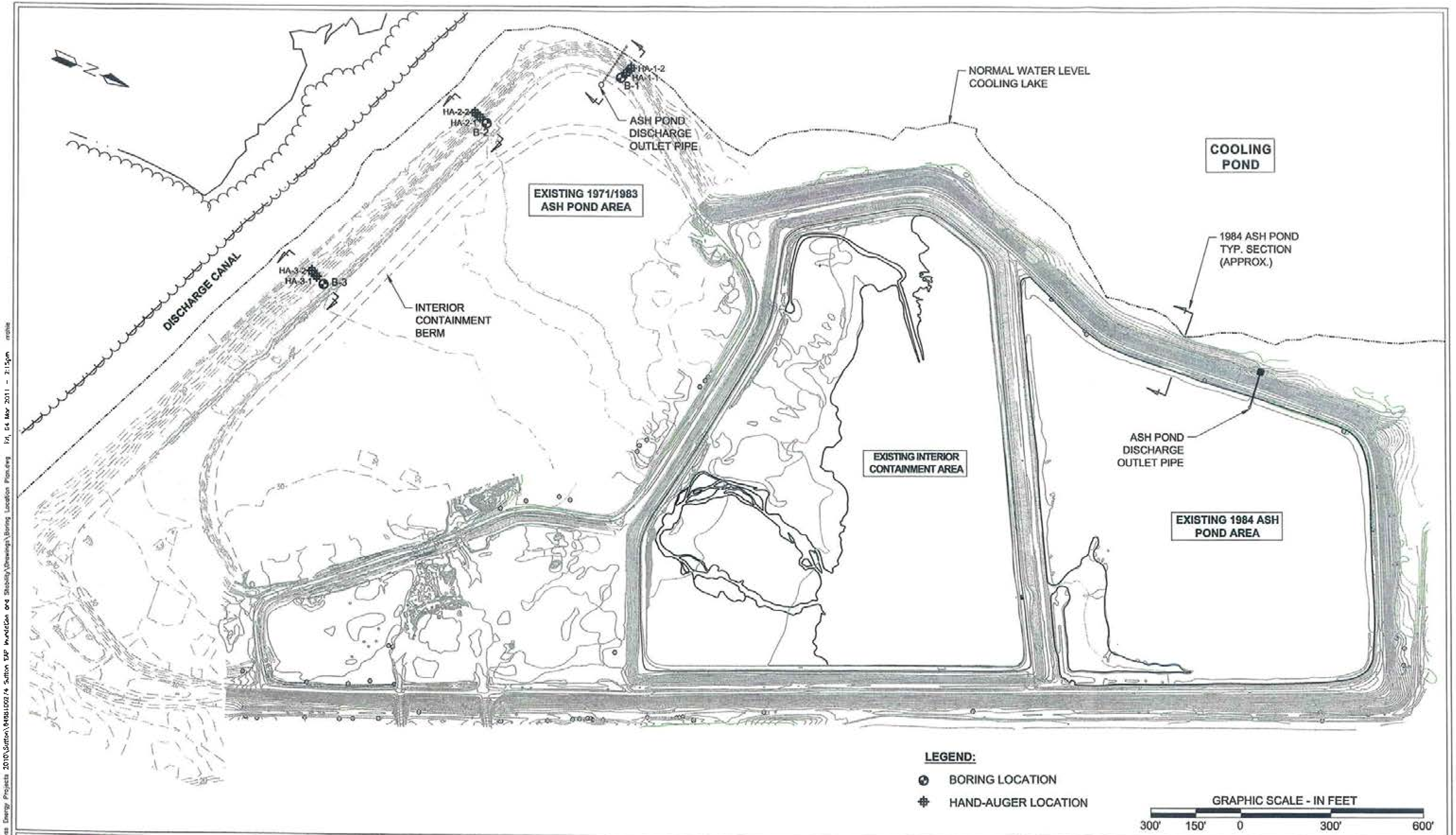
MACTEC

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

SITE LOCATION MAP
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK: JJT
APPROVAL: RSA
DATE: MARCH 2011
SCALE: N.T.S.
JOB No.: 6468-10-0274
FIGURE 1

REFERENCE:



MACTEC

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

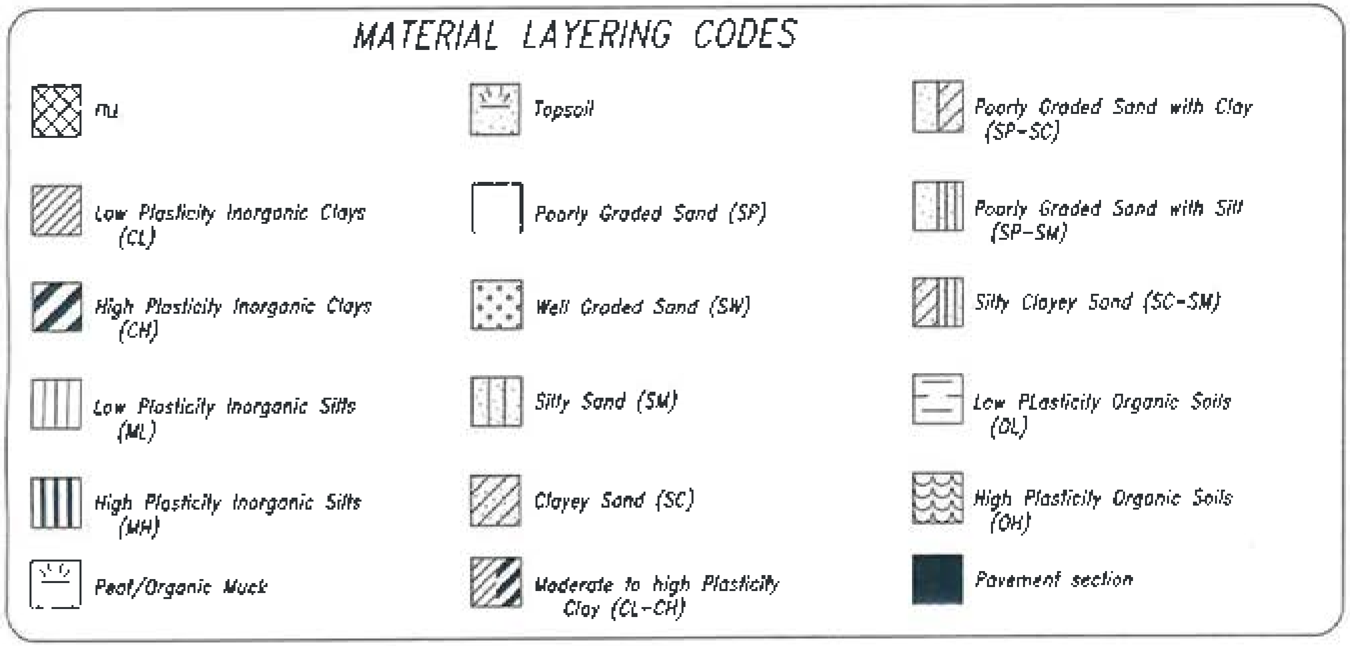
BORING LOCATION PLAN
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

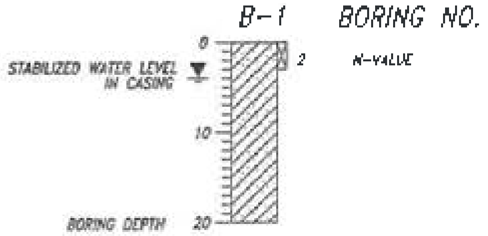
DRAWN:	R.R.	DATE:	MARCH 2011	FIGURE
ENG CHECK:	JSJ	SCALE:	AS SHOWN	2
APPROVAL:	RSA	JOB No.:	6468-10-0274	

REFERENCE: TOPO FOR 1984 ASH POND WAS PREPARED BY MCKIM & CREED BASED ON AERIAL IMAGERY COLLECTED JULY 15, 2009. TOPO FOR 1971/1983 ASH POND OBTAINED FROM WITHERS & RAVENEL, SITE PLAN DATED 5/25/06.

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton EAP Inundation and Stability\Drawings\Boring Location Plan.dwg Fri, 04 Mar 2011 - 2:15pm rrahle

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton EAP Inundation and Stability\Drawings\Boring Location Plan.dwg Thu, 03 Mar 2011 - 4:01pm rrahie





MACTEC

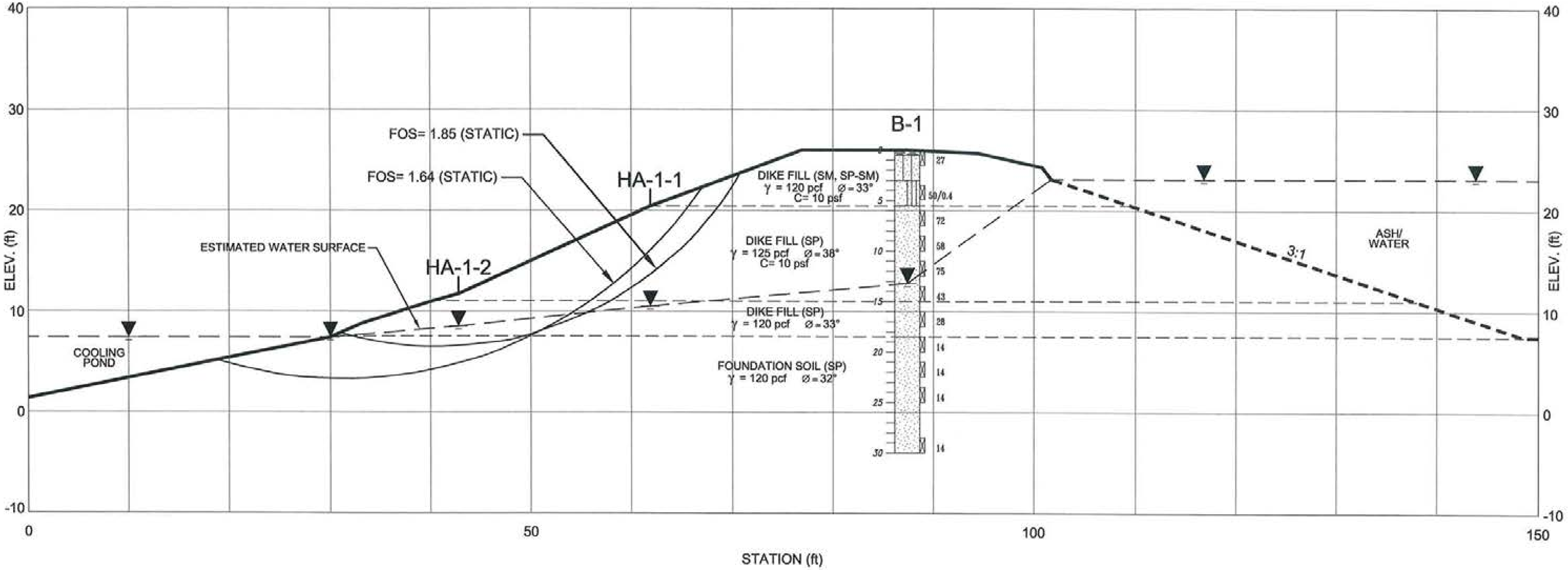
MACTEC ENGINEERING AND CONSULTING, INC
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

LEGEND FOR SECTIONS
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	MARCH 2011
ENG CHECK:	JJT	SCALE:	
APPROVAL:		JOB No:	6468-10-0274

FIGURE
3

REFERENCE:



NOTE:

1. SEE TABLE 5 FOR WATER LEVEL DATA.
2. STABILITY RUN OUTPUT SHEETS ARE IN APPENDIX C.
3. SEISMIC ANALYSIS CIRCLES ARE NOT SHOWN FOR CLARITY.
4. FACTOR OF SAFETY FOR SEISMIC ANALYSIS IS 1.18.

10' 0 10'
GRAPHIC SCALE - IN FEET

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

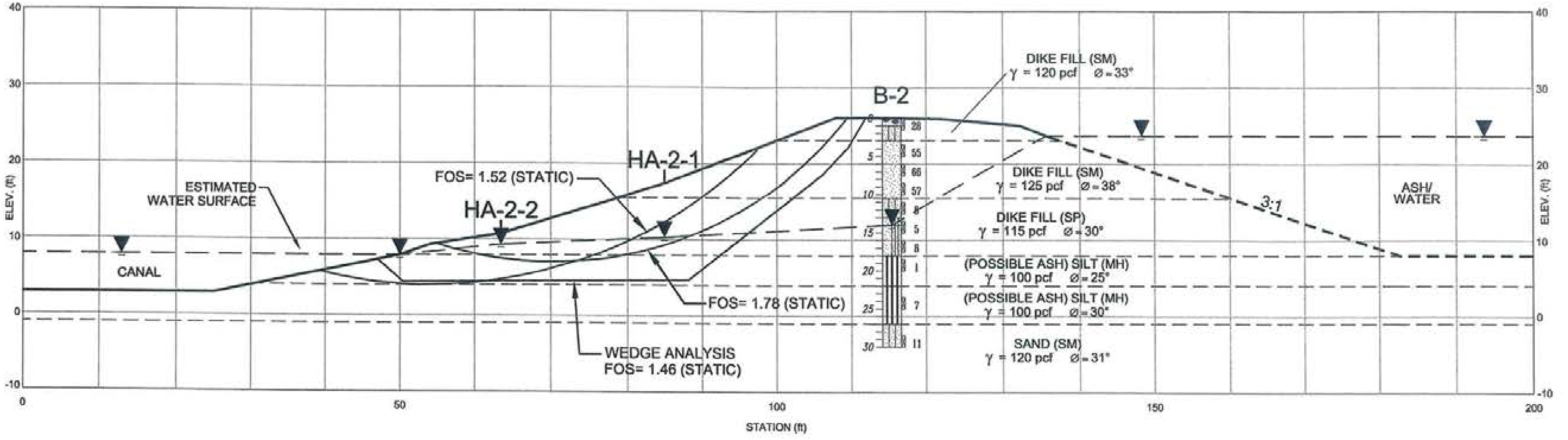
1971/1983 ASH POND - STABILITY ANALYSIS SECTION AT BORING B-1
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	MARCH 2011
ENG CHECK:	JJS	SCALE:	AS SHOWN
APPROVAL:	RSA	JOB No.:	6468-10-0274

FIGURE
4

REFERENCE:

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton EAP Foundation and Stability\Drawings\Boring Location Plan.dwg Tue, 08 Mar 2011 - 11:08am rmohle



NOTE:

1. SEE TABLE 5 FOR WATER LEVEL DATA.
2. STABILITY RUN OUTPUT SHEETS ARE IN APPENDIX C.
3. SEISMIC ANALYSIS CIRCLES ARE NOT SHOWN FOR CLARITY.
4. FACTOR OF SAFETY FOR SEISMIC ANALYSIS IS 1.01.

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

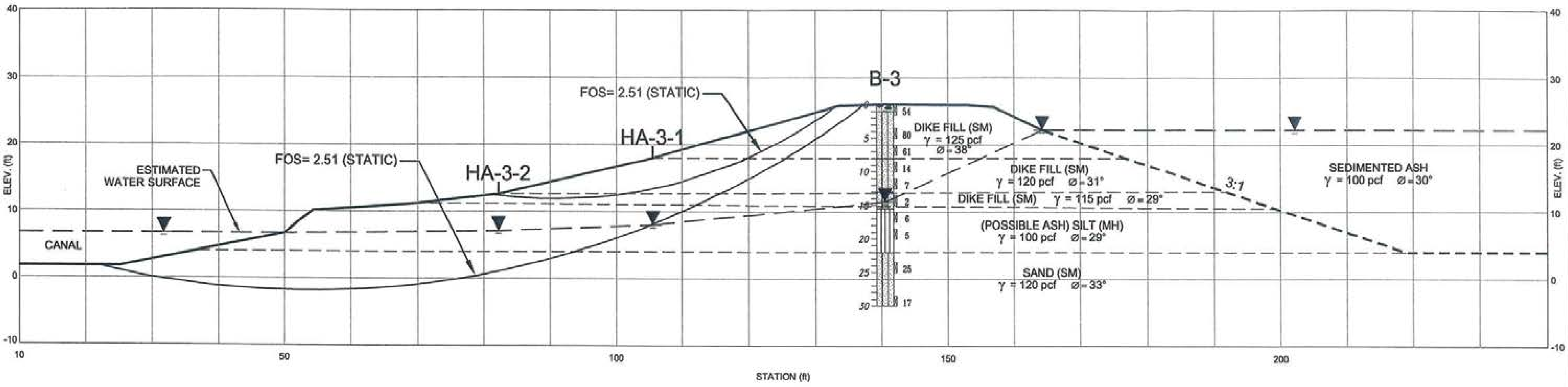
1971/1983 ASH POND - STABILITY ANALYSIS SECTION AT BORING B-2
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

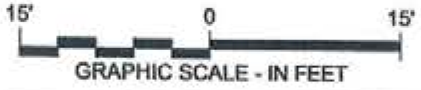
DRAWN:	R.R.	DATE:	MARCH 2011
ENG CHECK:	JSJ	SCALE:	AS SHOWN
APPROVAL:	RSA	JOB No.:	6468-10-0274

FIGURE
5

REFERENCE:

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton EAP Inspection and Stability\Drawings\Boring Location Plan.dwg Fri, 04 Mar 2011 - 2:56pm mchie





NOTE:

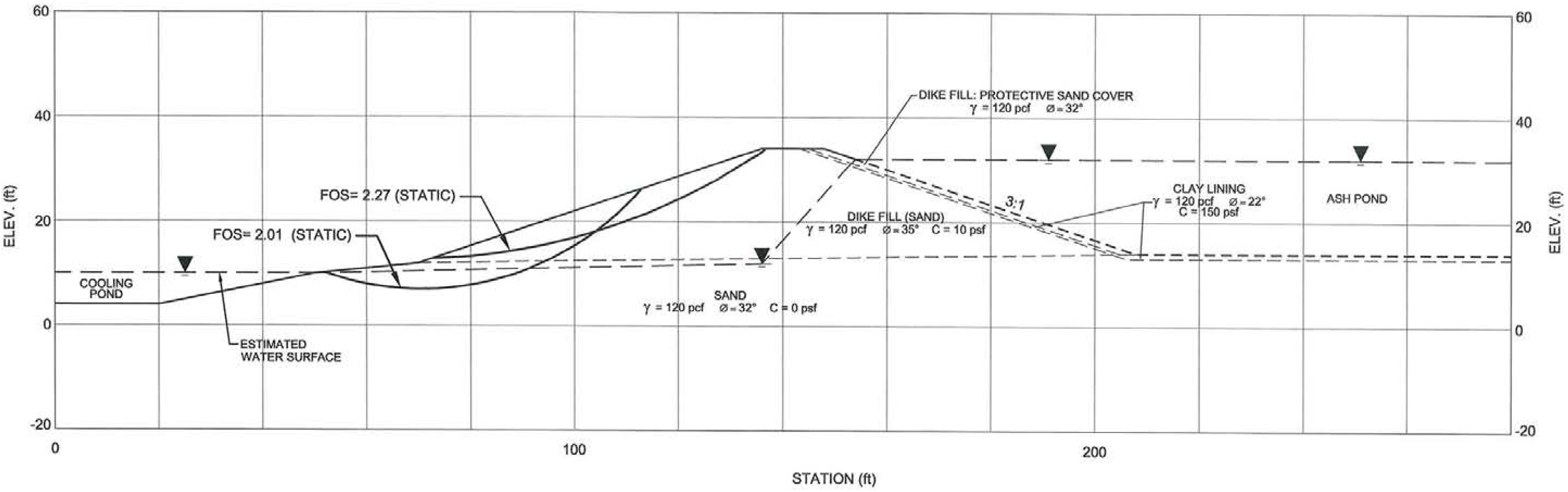
1. SEE TABLE 5 FOR WATER LEVEL DATA.
2. STABILITY RUN OUTPUT SHEETS ARE IN APPENDIX C.
3. SEISMIC ANALYSIS CIRCLES ARE NOT SHOWN FOR CLARITY.
4. FACTOR OF SAFETY FOR SEISMIC ANALYSIS IS 1.56.

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

1971/1983 ASH POND - STABILITY ANALYSIS SECTION AT BORING B-3
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK: JJJ
APPROVAL: RSA
DATE: MARCH 2011
SCALE: AS SHOWN
JOB No.: 6468-10-0274
FIGURE 6

REFERENCE:



20' 0 20'

GRAPHIC SCALE - IN FEET

NOTE:

1. SEE APPENDIX G FOR WATER LEVEL DATA.
2. STABILITY RUN OUTPUT SHEETS ARE IN APPENDIX D.
3. SEISMIC ANALYSIS CIRCLES ARE NOT SHOWN FOR CLARITY.
4. FACTOR OF SAFETY FOR SEISMIC ANALYSIS IS 1.36.

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

1984 ASH POND - TYPICAL STABILITY ANALYSIS SECTION
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK: JSJ
APPROVAL: MA

DATE: MARCH 2011
SCALE: AS SHOWN
JOB No.: 6468-10-0274

FIGURE
7

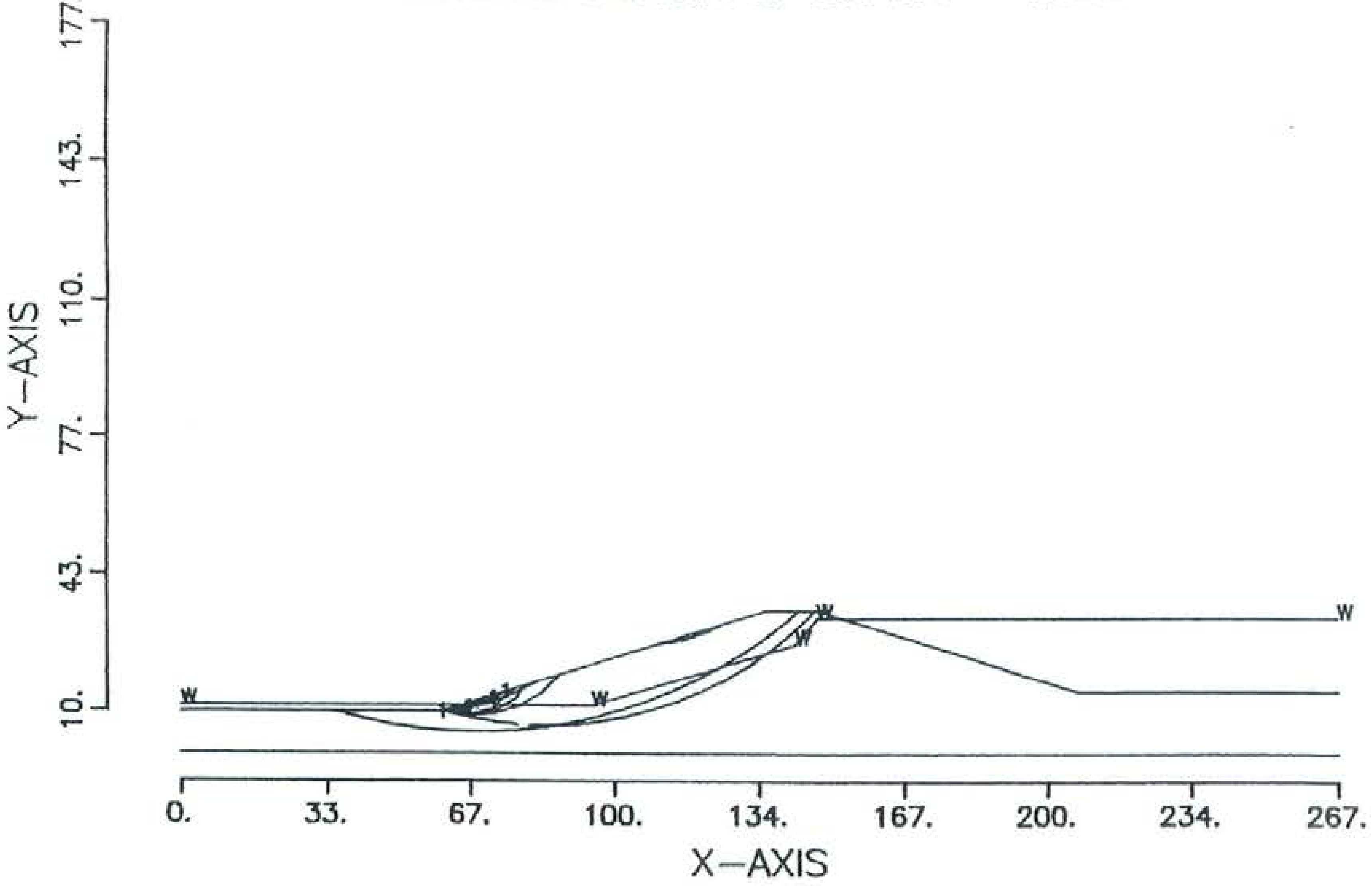
REFERENCE:

P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton EAP ...undation and Stability\Drawings\Boring Location Plan.dwg Tue, 08 Mar 2011 - 11:59am rnable

Carolina Power & Light Co.
Raleigh, NC (s/n 5093)

SUTTON ASH POND GEOSLOPE ANALYSIS

100SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.583



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

1984 ASH POND- CP&L ORIGINAL STABILITY ANALYSIS
PROGRESS ENERGY
L.V. SUTTON STEAM ELECTRIC PLANT - ASH POND
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	MARCH 2011
ENG CHECK:	JST	SCALE:	N.T.S.
APPROVAL:	RBA	JOB No.:	6468-10-0274

FIGURE
8

REFERENCE:

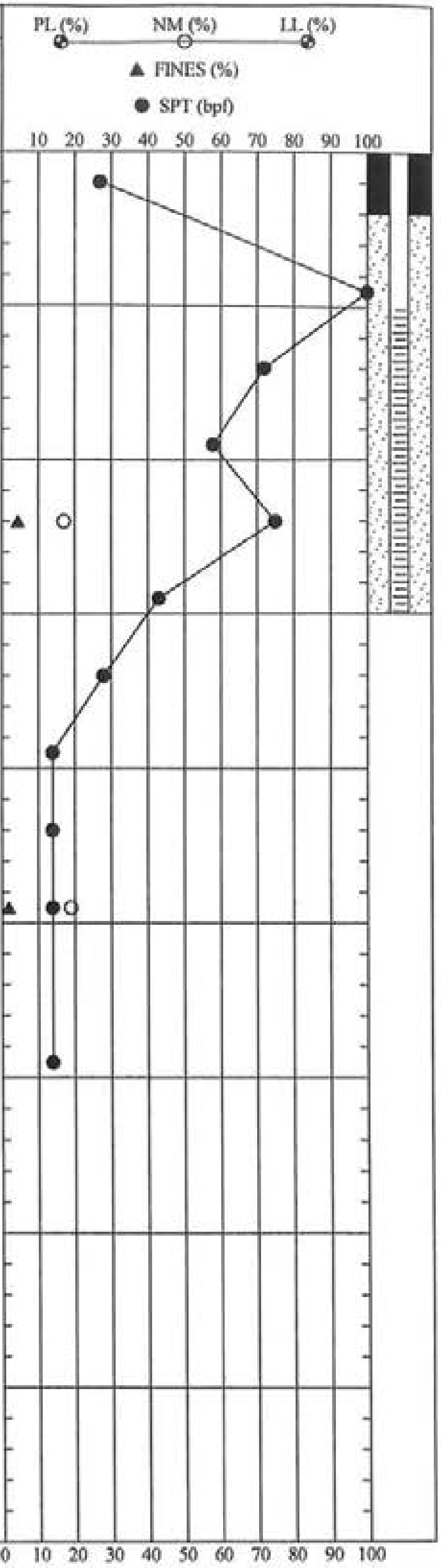
P:\6468\Progress Energy\Progress Energy Projects 2010\Sutton\6468100274 Sutton SAP Inundation and Stability\Drawings\Boring Location Plan.dwg Thu, 03 Mar 2011 - 4:01pm rrahle

APPENDICES

APPENDIX A: 1971/1983 ASH POND - TEST BORING AND HAND AUGER BORING RECORDS

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.	ELEV (ft)
0	Dike Fill: Gray sandy GRAVEL, moist	26.0
	Dike Fill: Medium dense, gray, silty fine to medium SAND (SM), moist	
	Dike Fill: Very dense, brown, tan, slightly silty fine to medium SAND (SP-SM) with trace of rock fragments, moist	
5		21.0
	Dike Fill: Very Dense to medium dense, tan, slighlty silty fine to medium SAND (SP), wet	
10		16.0
15		11.0
	Coastal Plain Deposits: Medium Dense, tan to light gray, fine to medium SAND (SP) with trace of silt, saturated	
20		6.0
25		1.0
30	Boring terminated at 30 feet.	-4.0
35		-9.0
40		-14.0
45		-19.0

SAMPLES IDENT	TYPE	N-COUNT or Rec%/RQD% 1st 6" 2nd 6" 3rd 6" 4th 6"
SS-1	☒	10-13-14
SS-2	☒	7-19-50/0.4
SS-3	☒	22-32-40
SS-4	☒	16-26-32
SS-5	☒	18-27-48
SS-6	☒	18-18-25
SS-7	☒	12-14-14
SS-8	☒	4-6-8
SS-9	☒	3-6-8
SS-10	☒	5-6-8
SS-11	☒	7-7-7



DRILLER:	D. White
EQUIPMENT:	CME-45 LC
METHOD:	Mud Rotary
HOLE DIA.:	3"
REMARKS:	Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed in the borehole. A Groundwater level of 13.2 feet was measured in the casing on 2/11/2011.

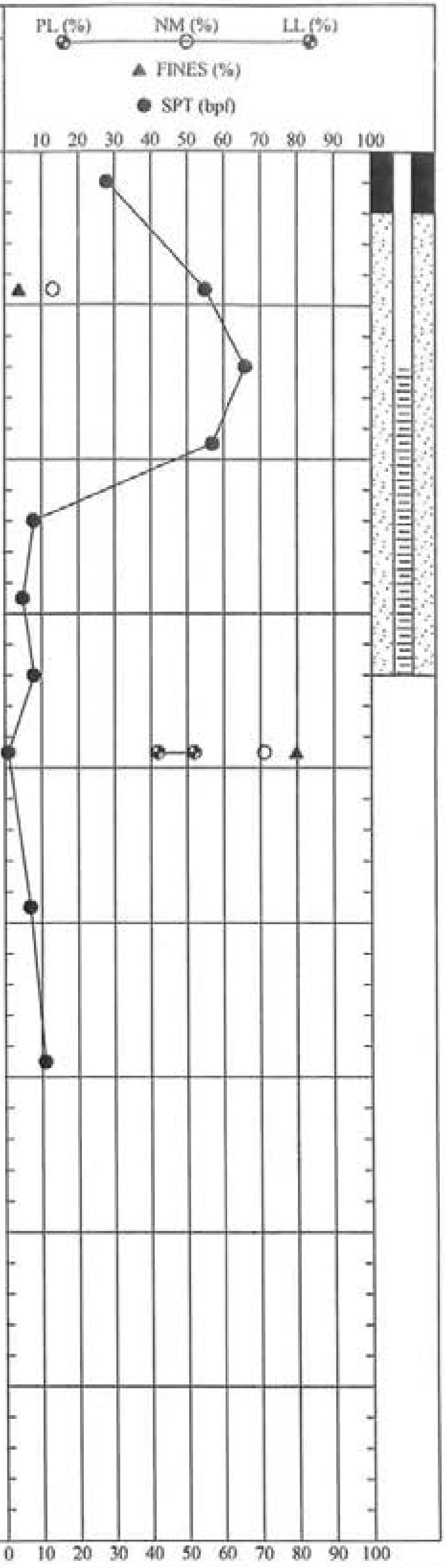
REVIEWED BY: JJJ / RSA

SOIL TEST BORING RECORD

Project: Sutton Plant Ash Pond Dike Stability
Boring No.: B-1
Location: Wilmington, North Carolina
Drilled: December 16, 2010
Project #: 6468-10-0274
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	SAMPLES N-COUNT or Rec%/RQD% 1st 6" 2nd 6" 3rd 6" 4th 6"
0	Dike Fill: Gray, sandy GRAVEL, moist	26.0		
	Dike Fill: Medium Dense, gray, silty fine to medium SAND (SM), wet		SS-1	24-16-12
	Dike Fill: Very dense, Light brown, fine to medium SAND (SP), with trace of silt, wet		SS-2	14-29-26
5		21.0		
			SS-3	21-26-40
			SS-4	15-25-32
10		16.0		
	Dike Fill: Loose, gray, silty fine SAND (SM), saturated		SS-5	4-4-4
	Dike Fill: Loose, brown, slightly silty fine to medium SAND (SP-SM), saturated		SS-6	2-2-3
15		11.0		
			SS-7	3-4-4
	Possible Ash: Very soft to medium stiff, gray, fine sandy SILT (MH), wet		SS-8	1-0-1
20		6.0		
			SS-9	2-4-3
25		1.0		
	Coastal Plain Deposits: Medium dense, brown-gray, silty fine to coarse SAND (SM), saturated		SS-10	9-6-5
30	Boring terminated at 30 feet.	-4.0		
35		-9.0		
40		-14.0		
45		-19.0		



STD-NO STATION SUTTON.GPJ MACTEC GEO.GDT 3/4/11

DRILLER: D. White
EQUIPMENT: CME-45 LC
METHOD: Mud Rotary
HOLE DIA.: 4"
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed in the borehole. A Groundwater level of 14.1 feet was measured in the casing on 2/11/2011.

REVIEWED BY: JJJ / RSA

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: Sutton Plant Ash Pond Dike Stability
Boring No.: B-2
Location: Wilmington, North Carolina
Drilled: December 16, 2010
Project #: 6468-10-0274
Page 1 **of** 1

MACTEC

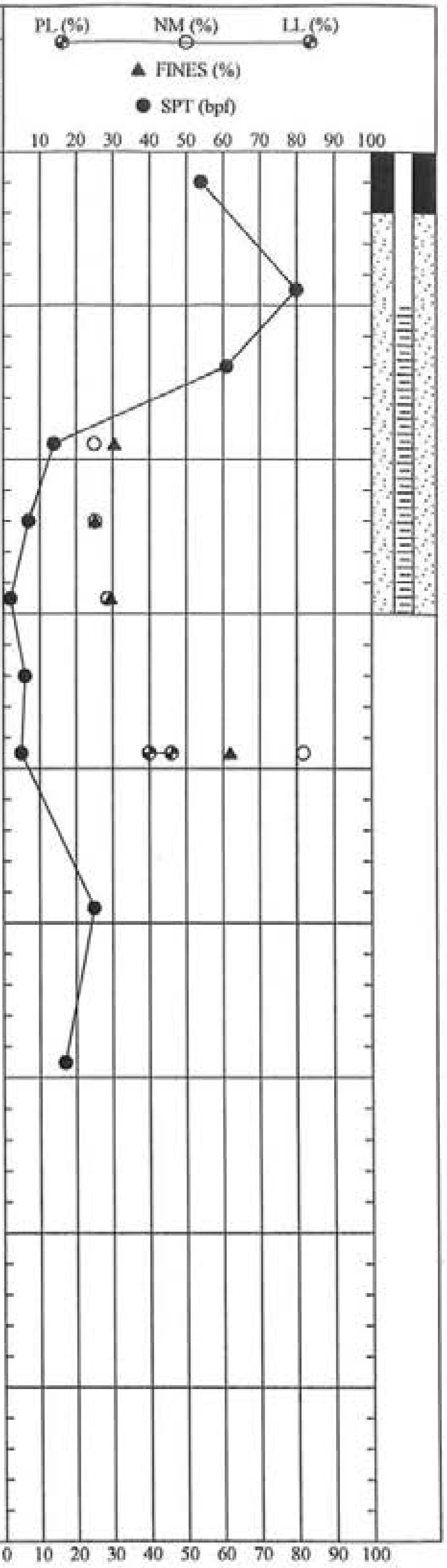
SOIL CLASSIFICATION AND REMARKS

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

DEPTH (ft)	ELEV (ft)
0	26.0
5	21.0
10	16.0
15	11.0
20	6.0
25	1.0
30	-4.0
35	-9.0
40	-14.0
45	-19.0

SOIL CLASSIFICATION AND REMARKS
Dike Fill: Gray fine sandy GRAVEL
Dike Fill: Very dense, gray-brown, silty fine to medium SAND (SM), moist to wet
Dike Fill: Medium dense to loose, gray, slightly clayey, silty fine to medium SAND (SM), with possible ash, saturated
Dike Fill: Very loose, gray, silty fine to medium SAND (SM), with possible ash, saturated
Possible Ash: Medium stiff, dark gray, fine sandy SILT (ML), wet
Coastal Plain Depoists: Medium dense, brown to gray, slighlty silty fine to coarse SAND (SP-SM), saturated
Boring terminated at 30 feet.

SAMPLES IDENT	TYPE	N-COUNT or Rec%/RQD% 1st 6" 2nd 6" 3rd 6" 4th 6"
SS-1	☒	64-19-35
SS-2	☒	25-40-40
SS-3	☒	27-38-23
SS-4	☒	5-6-8
SS-5	☒	4-4-3
SS-6	☒	2-1-1
SS-7	☒	2-3-3
SS-8	☒	4-2-3
SS-9	☒	7-10-15
SS-10	☒	5-7-10



DRILLER: D. White
EQUIPMENT: CME-45 LC
METHOD: Mud Rotary
HOLE DIA.: 3"
REMARKS: Groundwater level upon completion of boring not measured since drilling slurry was used. A casing was installed in the borehole. A Groundwater level of 14.5 feet was measured in the casing on 2/11/2011.

REVIEWED BY: JJT / RSA

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: Sutton Plant Ash Pond Dike Stability
Boring No.: B-3
Location: Wilmington, North Carolina
Drilled: December 16, 2010
Project #: 6468-10-0274
Page 1 **of** 1

MACTEC

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/2010
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-1-1
Boring Location: On slope at B-1

Depth (feet)	**Blow Counts**	**Visual Soil Description**
0 - 4	NA	Tan Slightly Silty Fine to Coarse SAND (SP-SM), Moist
4-10	NA	Gray Slightly Silty Fine to Coarse SAND (SP-SM), Moist
		Boring dry at completion of hand auger.
		Dry on 12/16/10, 1/7/11 and 2/11/11

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/10
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-1-2
Boring Location: Near Toe of slope at B-1

Depth (feet)	**Blow Counts**	**Visual Soil Description**
0-5	NA	Tan Slightly Silty Fine to Medium SAND (SP-SM), Moist to wet
		Groundwater at 4.0 feet at hand auger completion.
		Groundwater at 3.3 feet on 12/15/10 (evening)
		Groundwater at 3.4 feet on 12/16/10
		Groundwater at 3.9 feet on 1/7/11
		Groundwater at 3.2 feet on 2/11/11

Prepared by: JJJ Reviewed by: RSA

MACTEC

Hand Auger Log

Job Name: Sutton Ash Pond Stability

Date: 12/15/2010

Client: Progress Energy

MACTEC Job No. 6468-10-0274

Boring No. HA-2-1

Boring Location: **On slope at B-2**

Depth (feet)	**Blow Counts**	**Visual Soil Description**
0-4	NA	Tan Slightly Silty Fine to Coarse SAND (SP), dry to moist
4-5	NA	Tan to Brown Slightly Silty Fine to Coarse SAND (SP), moist
5-9	NA	Gray Silty Fine to Medium SAND (SM), moist to wet
		Boring dry at completion of hand auger.
		Groundwater at 7.3 feet on 12/15/10 (evening)
		Groundwater at 7.2 feet on 12/16/10
		Groundwater at 7.7 feet on 1/7/11
		Groundwater at 7.3 feet on 2/11/11

Hand Auger Log

Job Name: Sutton Ash Pond Stability

Date: 12/15/2010

Client: Progress Energy

MACTEC Job No. 6468-10-0274

Boring No. HA-2-2

Boring Location: **Near Toe of Slope at B-2**

Depth (feet)	**Blow Counts**	**Visual Soil Description**
0-1.5	NA	Brown-tan to Gray Silty Fine to Coarse SAND (SP-SM), moist to wet
1.5-3	NA	Gray Silty Fine SAND (SM), with trace organic matter, wet
		Groundwater at 1.5 feet at hand auger completion.
		Groundwater at 1.5 feet on 12/15/10 (evening)
		Groundwater at 1.4 feet on 12/16/10
		Groundwater at 1.8 feet on 1/7/11
		Groundwater at 1.4 feet on 2/11/11

Prepared by: JST Reviewed by: RSA

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/2010
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-3-1
Boring Location: On Slope Near B-3

Depth (feet)	Blow Counts	Visual Soil Description
0-2	NA	Possible Ash: Gray Silty Fine SAND, (SM), moist
2-5.5	NA	Possible Ash: Gray fine Sandy SILT (ML), moist
5.5-8	NA	Gray and Tan Slightly Silty Fine to Coarse SAND (SP-SM), moist
8-10	NA	Gray Silty Fine Sand (SM), with Silt Seams, wet
		Boring dry at completion of hand auger.
		Dry on 12/16/10, 1/7/11 and 2/11/11

Hand Auger Log

Job Name: Sutton Ash Pond Stability
Date: 12/15/2010
Client: Progress Energy
MACTEC Job No. 6468-10-0274
Boring No. HA-3-2
Boring Location: Near Toe of slope at AB-3

Depth (feet)	Blow Counts	Visual Soil Description
0-1.5	NA	Possible Ash: Gray Fine Sandy SILT (ML), moist
1.5-5.5	NA	Gray Silty Fine to Medium Sand (SM), moist
5.5-7	NA	Gray Fine Sandy SILT (ML), wet
		Groundwater at 5.5 feet at hand auger completion
		Groundwater at 4.9 feet on 12/15/10 (evening)
		Groundwater at 4.8 feet on 12/16/10
		Groundwater at 5.4 feet on 1/7/11
		Groundwater at 4.8 feet on 2/11/11

Prepared by: JJT Reviewed by: RBA

MACTEC

APPENDIX B: 1971/1983 ASH POND - LABORATORY TEST RESULTS

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

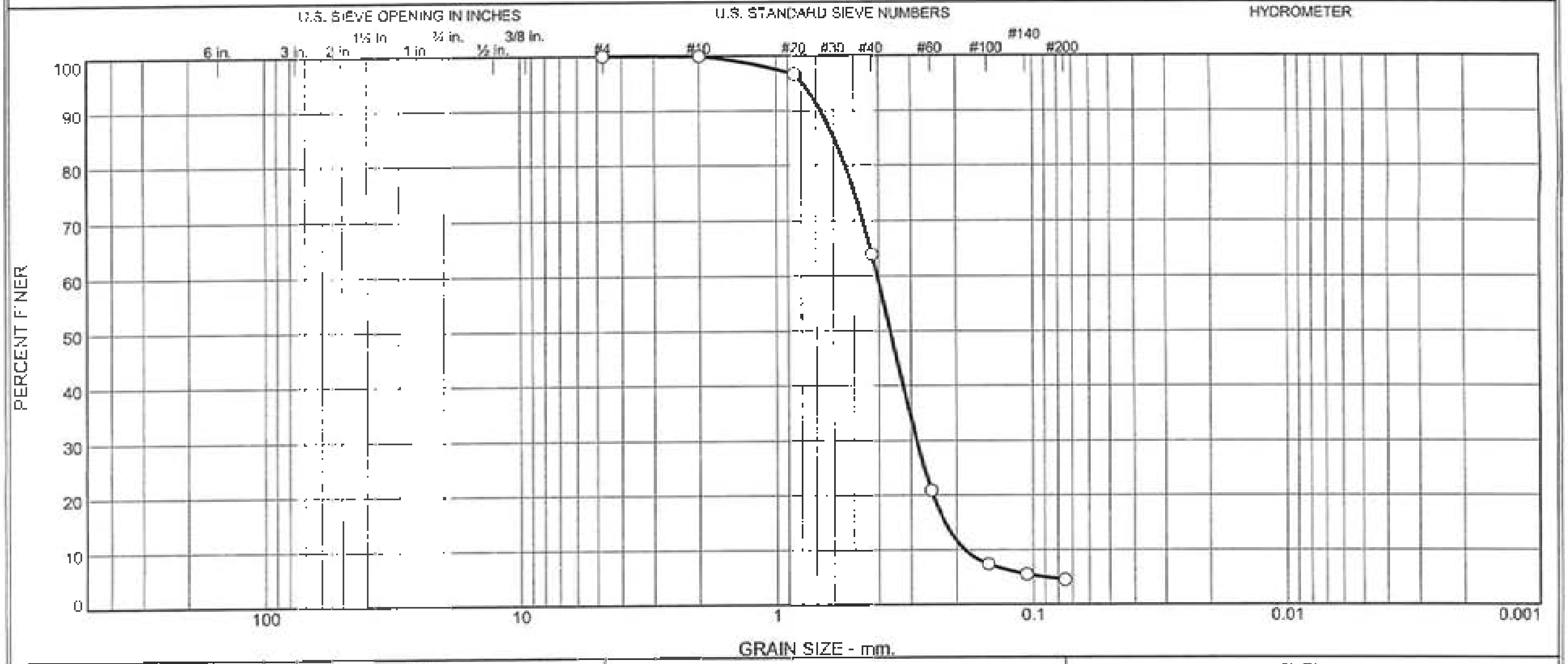
Boring No.	Sample No.	Sample Depth (ft)		Natural Moisture Content (%)	Grain Size	Atterberg Limits			USCS	Visual Description/Comments
		From	To		# 200	PL	LL	PI		
B 1	SS-5	11.0	12.5	17.1	4.5	-	-	-	SP*	Tan slightly silty fine to medium SAND
B-1	SS-10	23.5	25.0	19.0	1.8	-	-	-	SP*	Tan slightly silty fine to medium SAND
B-2	SS-2	3.5	5.0	13.2	4.1	-	-	-	SP*	Light Brown fine to medium SAND with trace of silt
B-2	SS-8	18.5	20.0	71.1	79.8	42	52	10	MH	Gray fine sandy SILT
B-3	SS-4	8.5	10.0	25.0	30.6	NP	NV	NP	SM	Gray slightly clayey silty fine to medium SAND
B-3	SS-5	11.0	12.5	25.3	25.3	NP	NV	NP	SM	Gray slightly clayey silty fine to medium SAND
B-3	SS-6	13.5	15.0	28.7	29.5	NP	NV	NP	SM	Gray silty fine to medium SAND
B 3	SS-8	18.5	20.0	62.1	81.8	40	46	6	MI	Dark gray fine sandy SILT

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: JJT

Checked By: ____________________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	36.0	59.4	4.5	

	Source	Sample #	Depth/Elev	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-1	SS-5	11.0	12/22/10	SP (visual)	Tan slightly Silty fine to medium SAND (visual)	17.1	ND	ND

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

○ ND = Not Determined

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

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-1
Depth: 11.0 **Sample Number:** SS-5
Material Description: Tan slightly Silty fine to medium SAND (visual)
Date: 12/22/10 **Natural Moisture:** 17.1
USCS Class.: SP
Testing Remarks: ND - Not Determined
Tested by: CS **Checked by:** IAM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare** = 575.12
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
575.12	0.00	0.00	#4	0.00	100.0
			#10	0.38	99.9
			#20	19.09	96.7
			#40	207.40	63.9
			#60	454.90	20.9
			#100	533.00	7.3
			#140	544.00	5.4
			#200	549.50	4.5

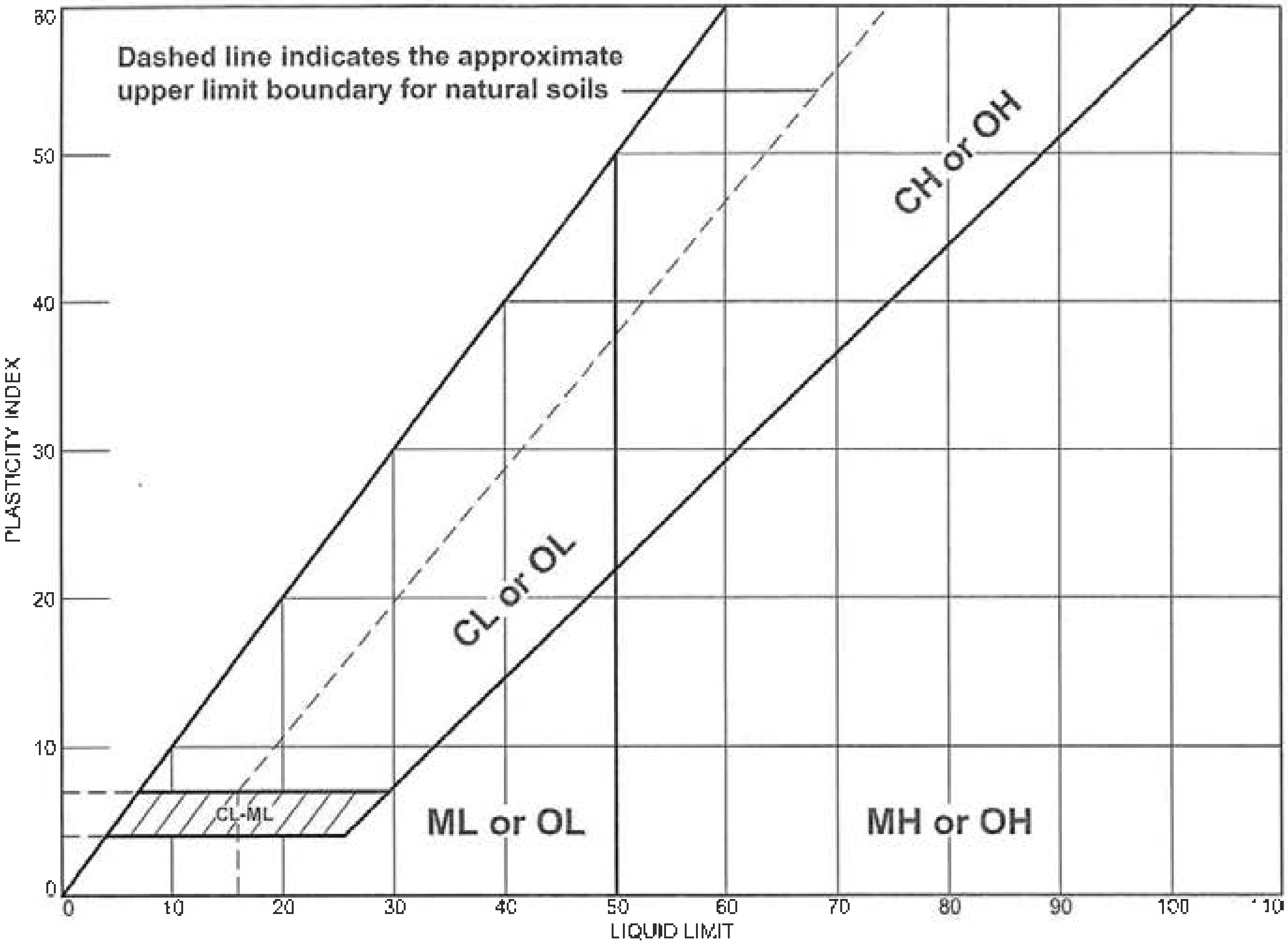
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	36.0	59.4	95.5			4.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.1857	0.2214	0.2461	0.2853	0.3605	0.4048	0.5409	0.5967	0.6726	0.7900

Fineness Modulus	C_u	C_c
1.75	2.18	1.08

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Tan slightly Silty fine to medium SAND (visual)				63.9	4.5	SP

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-1 **Depth:** 11.0 **Sample Number:** SS-5

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

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

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

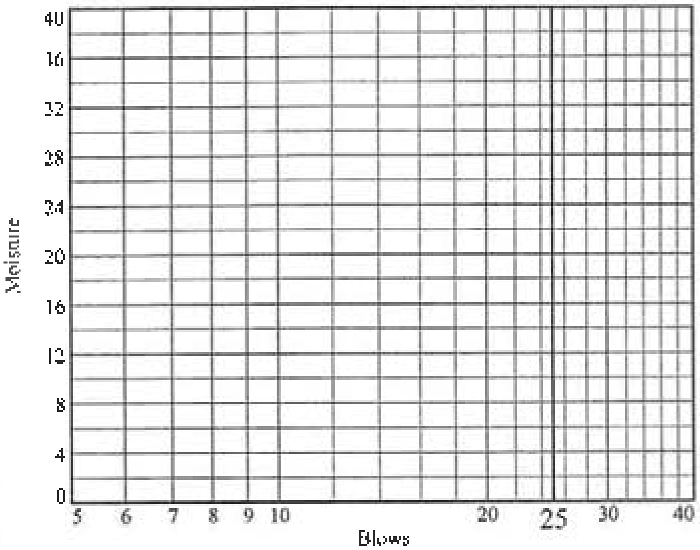
Location: Boring B-1

Depth: 11.0 **Sample Number:** SS-5

Material Description: Tan slightly Silty fine to medium SAND (visual)

%<#40: 63.9 **%<#200:** 4.5 **USCS:** SP **AASHTO:** ND

Tested by: CS **Checked by:** JAM



Liquid Limit= ________

Plastic Limit= ________

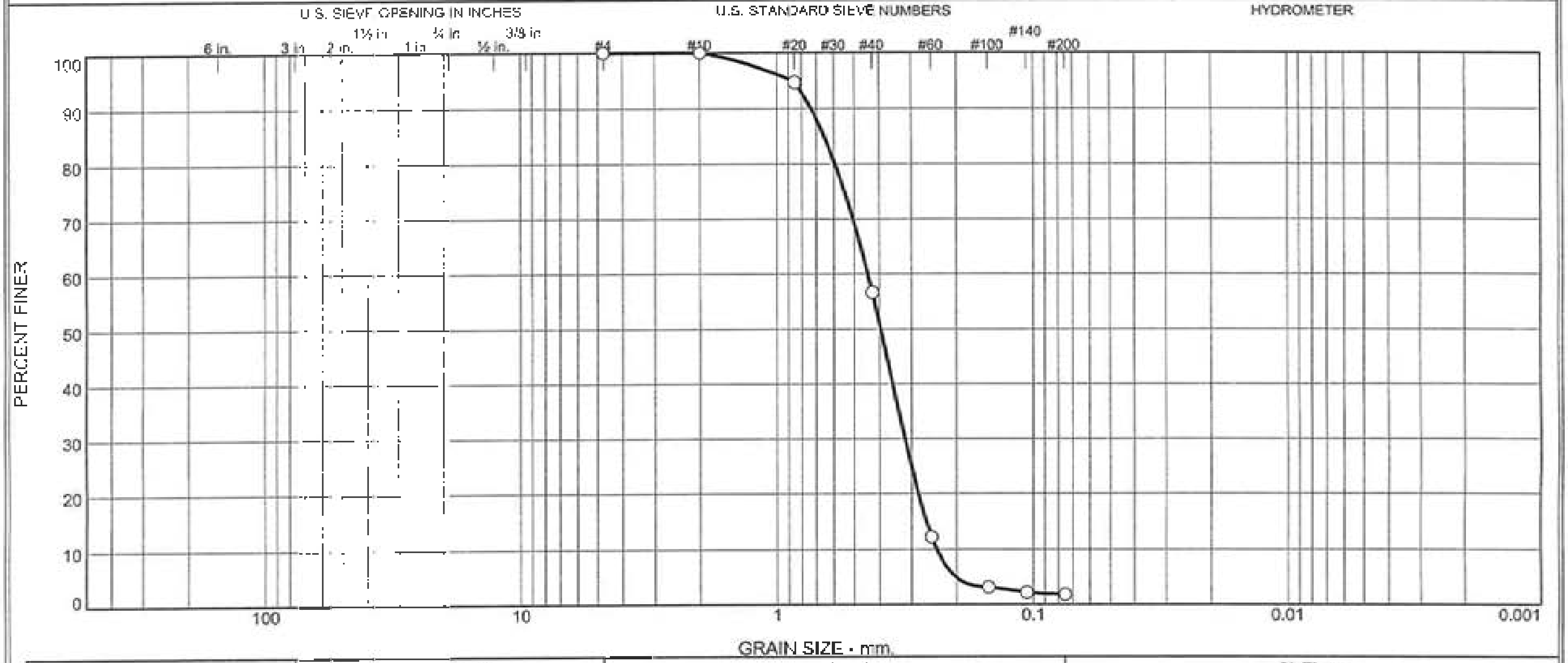
Plasticity Index= ________

Natural Moisture= 17.1

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
818.15	719.79	144.67	17.1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	43.4	54.8	1.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-1	SS-10	23.5	12/22/10	SP (visual)	Tan slightly Silty fine to medium SAND (visual)	19.0	ND	ND

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274 Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

○ ND – Not Determined

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

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-1

Depth: 23.5 **Sample Number:** SS-10

Material Description: Tan slightly Silty fine to medium SAND (visual)

Date: 12/22/10 **Natural Moisture:** 19.0

USCS Class.: SP

Testing Remarks: ND = Not Determined

Tested by: CS **Checked by:** IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
526.50	0.00	0.00	#4	0.00	100.0
			#10	0.06	100.0
			#20	28.11	94.7
			#40	228.70	56.6
			#60	462.10	12.2
			#100	510.00	3.1
			#140	514.80	2.2
			#200	516.80	1.8

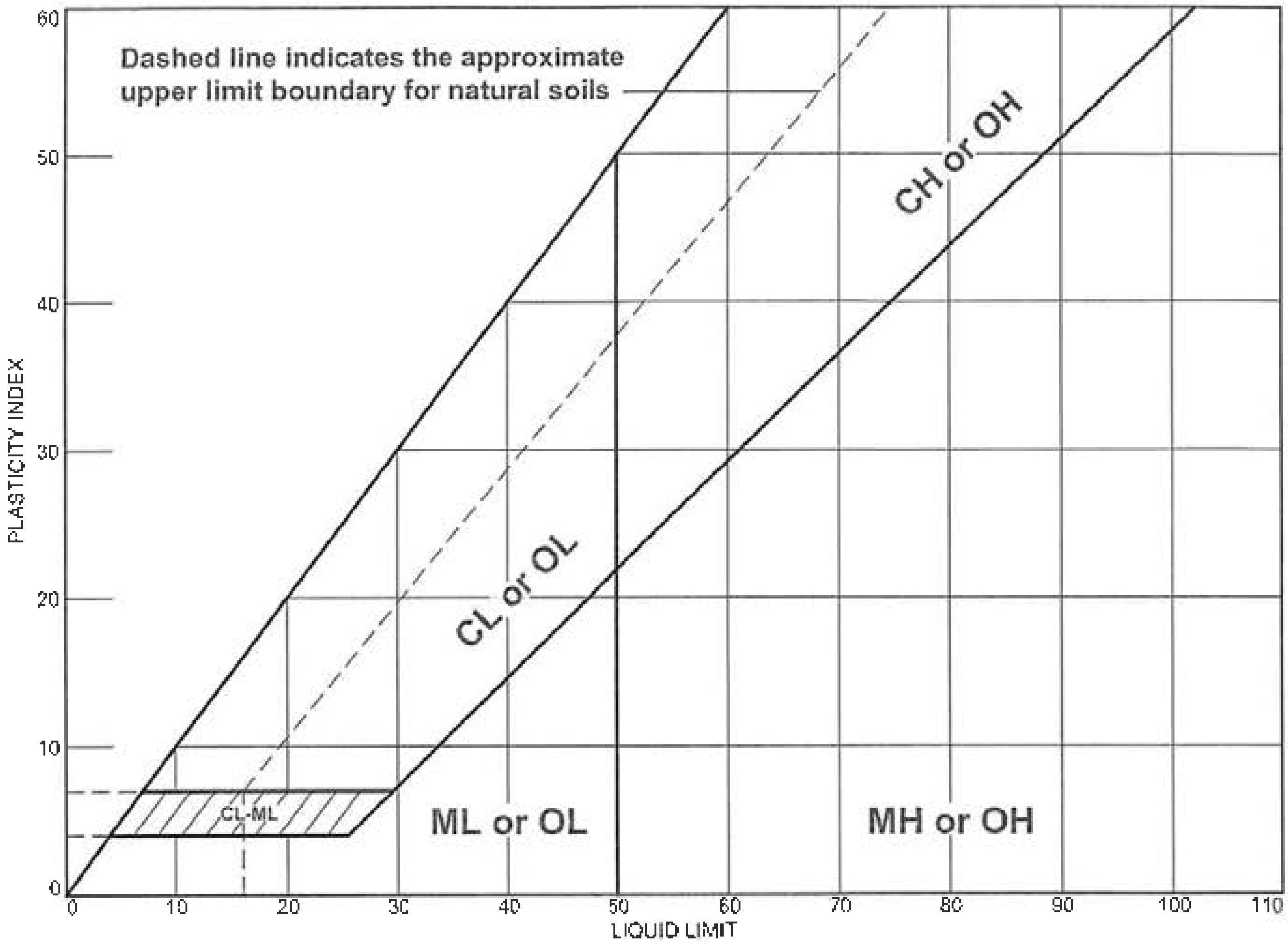
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	43.4	54.8	98.2			1.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.2388	0.2621	0.2817	0.3178	0.3947	0.4428	0.5929	0.6535	0.7351	0.8820

Fineness Modulus	C_u	C_c
1.94	1.85	0.96

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Tan slightly Silty fine to medium SAND (visual)				56.6	1.8	SP

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-1 **Depth:** 23.5 **Sample Number:** SS-10

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

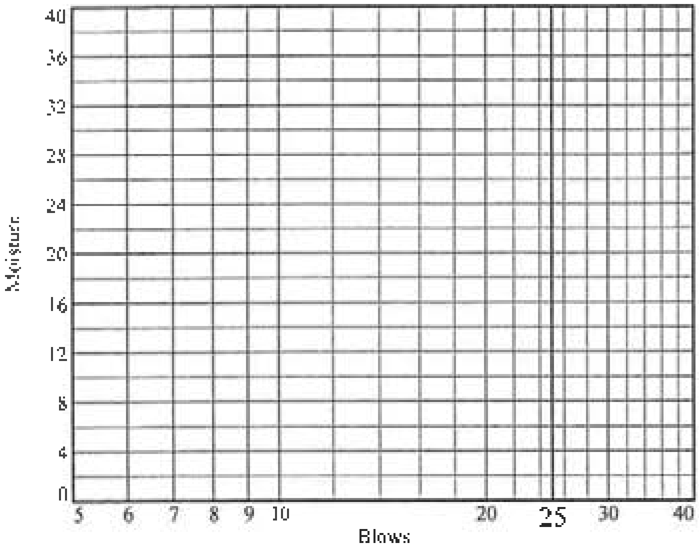
Figure

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

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-1
Depth: 23.5 **Sample Number:** SS-10
Material Description: Tan slightly Silty fine to medium SAND (visual)
%<#40: 56.6 **%<#200:** 1.8 **USCS:** SP **AASHTO:** ND
Tested by: CS **Checked by:** IAM

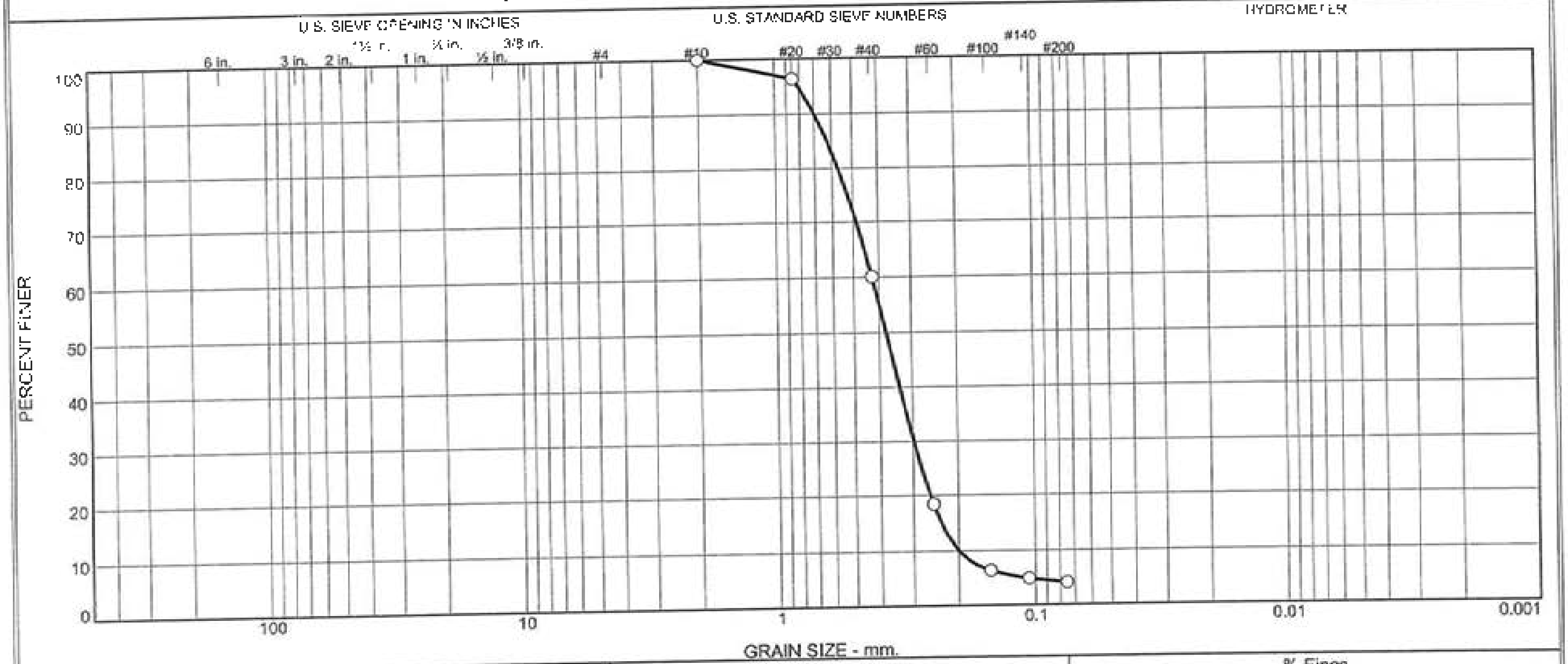


Liquid Limit= ______
Plastic Limit= ______
Plasticity Index= ______
Natural Moisture= 19.0

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
723.37	623.57	97.07	19.0

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	39.9	56.0	4.1	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-2	SS-2	3.5-5.0'	12/22/10	SP (visual)	Light Brown fine to medium SAND with trace of silt (visual)	13.2	ND	ND

Client Progress Energy

Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274

Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

○ ND = Not Determined

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

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 3.5-5.0'
Sample Number: SS-2
Material Description: Light Brown fine to medium SAND with trace of silt (visual)
Date: 12/22/10
Natural Moisture: 13.2
USCS Class.: SP
Testing Remarks: ND Not Determined
Tested by: CS
Checked by: IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
629.03	0.00	0.00	#10	0.00	100.0
			#20	23.20	96.3
			#40	251.20	60.1
			#60	513.20	18.4
			#100	589.00	6.4
			#140	598.40	4.9
			#200	603.30	4.1

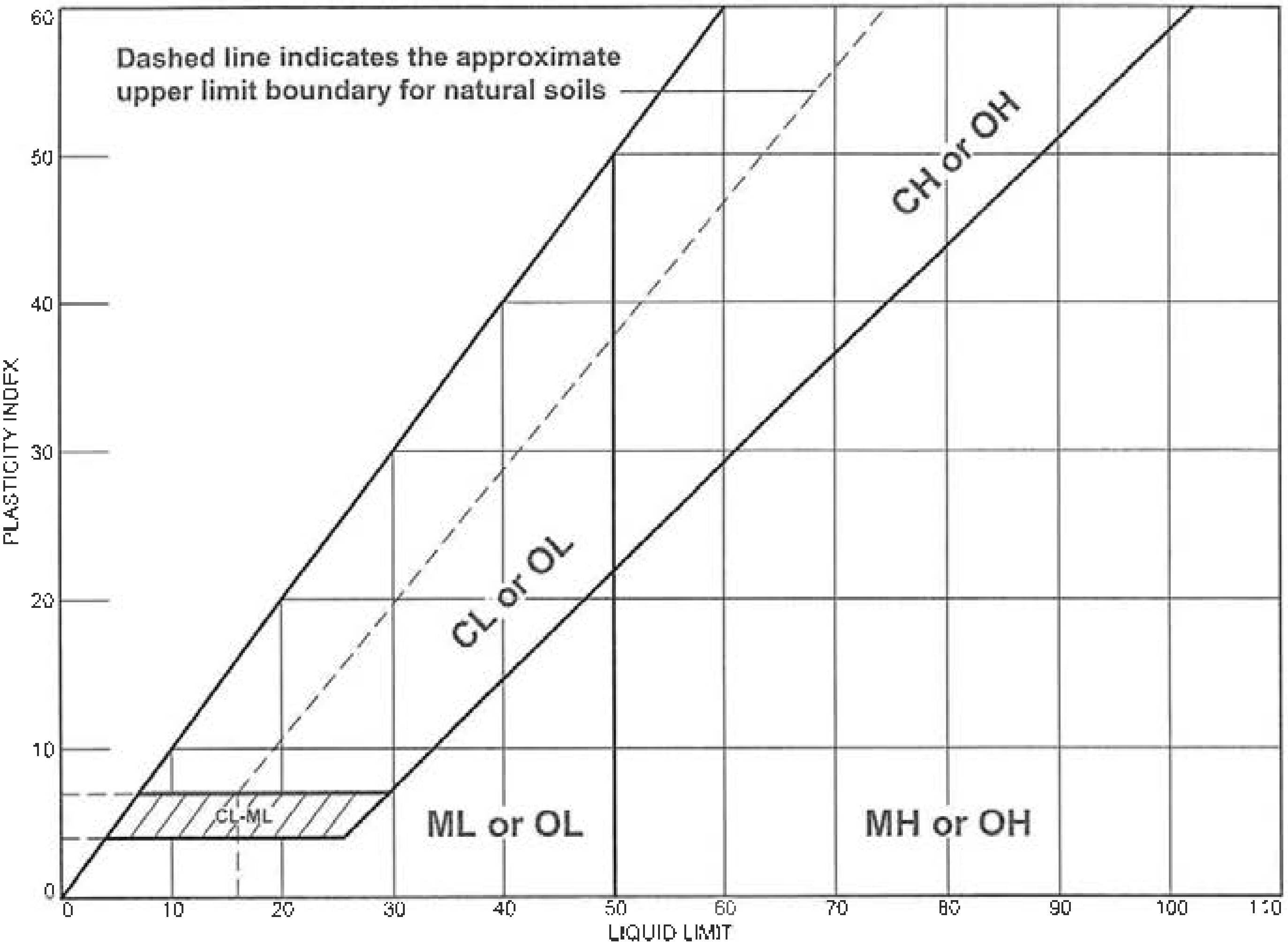
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	39.9	56.0	95.9			4.1

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.2000	0.2331	0.2571	0.2969	0.3767	0.4247	0.5700	0.6270	0.7015	0.8103

Fineness Modulus	C_u	C_c
1.82	2.12	1.04

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Light Brown fine to medium SAND with trace of silt (visual)				60.1	4.1	SP

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-2 **Depth:** 3.5-5.0' **Sample Number:** SS-2

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

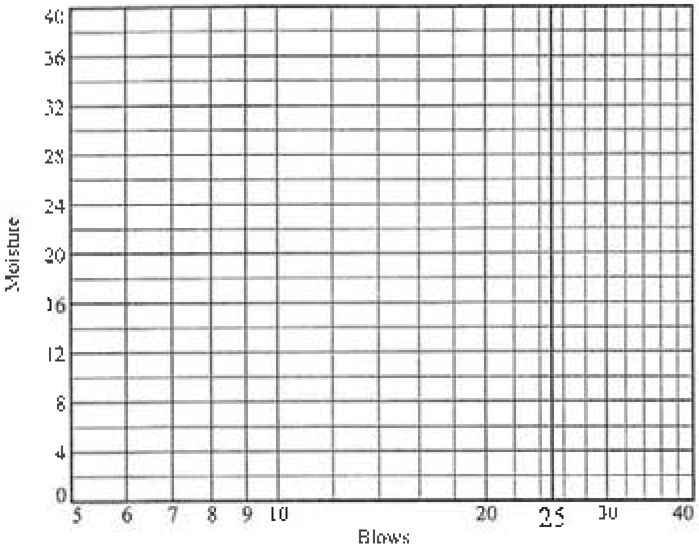
Figure

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

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 3.5-5.0'
Sample Number: SS-2
Material Description: Light Brown fine to medium SAND with trace of silt (visual)
%<#40: 60.1
%<#200: 4.1
USCS: SP
AASHTO: ND
Tested by: CS
Checked by: IAM

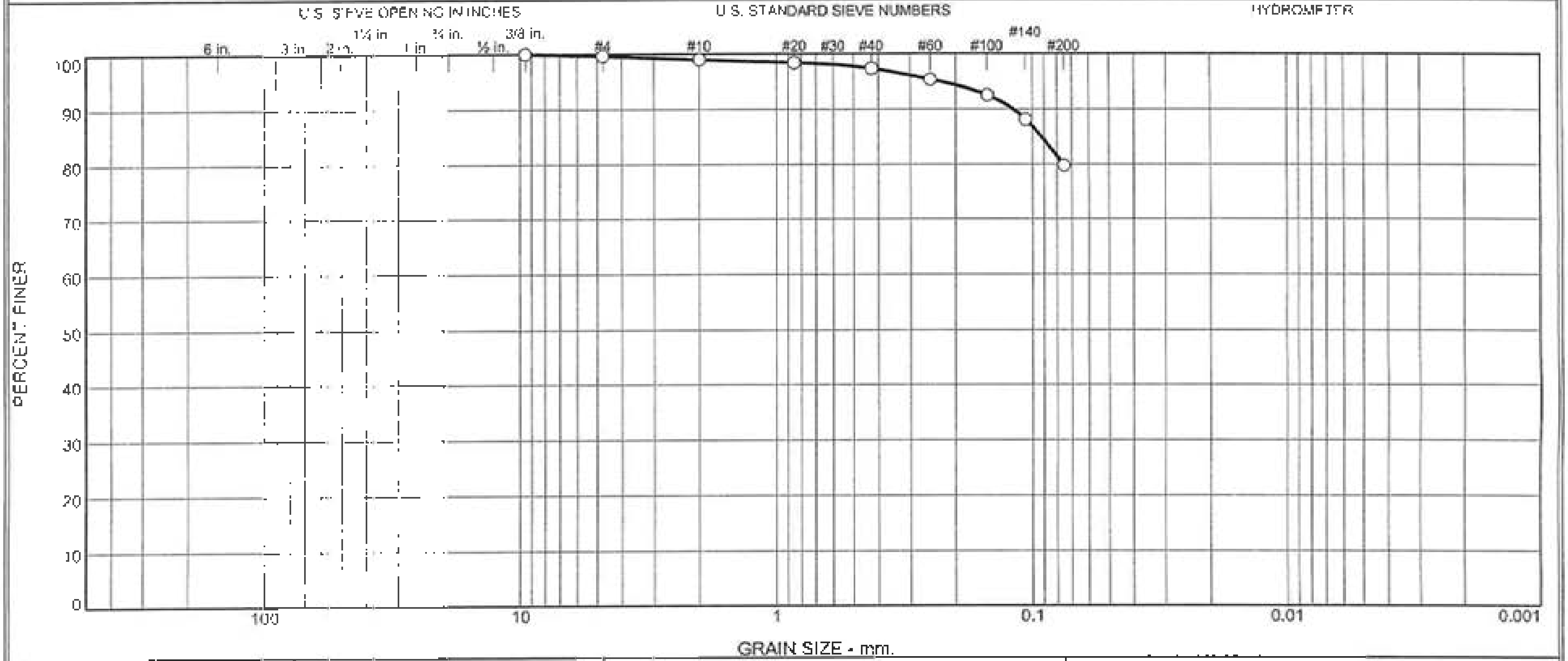


Liquid Limit= ________
Plastic Limit= ________
Plasticity Index= ________
Natural Moisture= 13.2

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
855.04	771.94	142.91	13.2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	0.6	1.7	17.5	79.8	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-2	SS-8	18.5-20.0	12/22/10	MH	Gray fine Sandy SILT (MH)	71.1	52	42

Client Progress Energy

Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274

Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS

Checked By: IAM

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-2
Depth: 18.5-20.0 **Sample Number:** SS-8
Material Description: Gray fine Sandy SILT (MH)
Date: 12/22/10 **Natural Moisture:** 71.1
Liquid Limit: 52 **Plastic Limit:** 42 **USCS Class.:** MH
Tested by: CS **Checked by:** IAM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare** = 62.26
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
62.26	0.00	0.00	3/8"	0.00	100.0
			#4	0.25	99.6
			#10	0.65	99.0
			#20	1.01	98.4
			#40	1.66	97.3
			#60	2.92	95.3
			#100	4.65	92.5
			#140	7.39	88.1
			#200	12.60	79.8

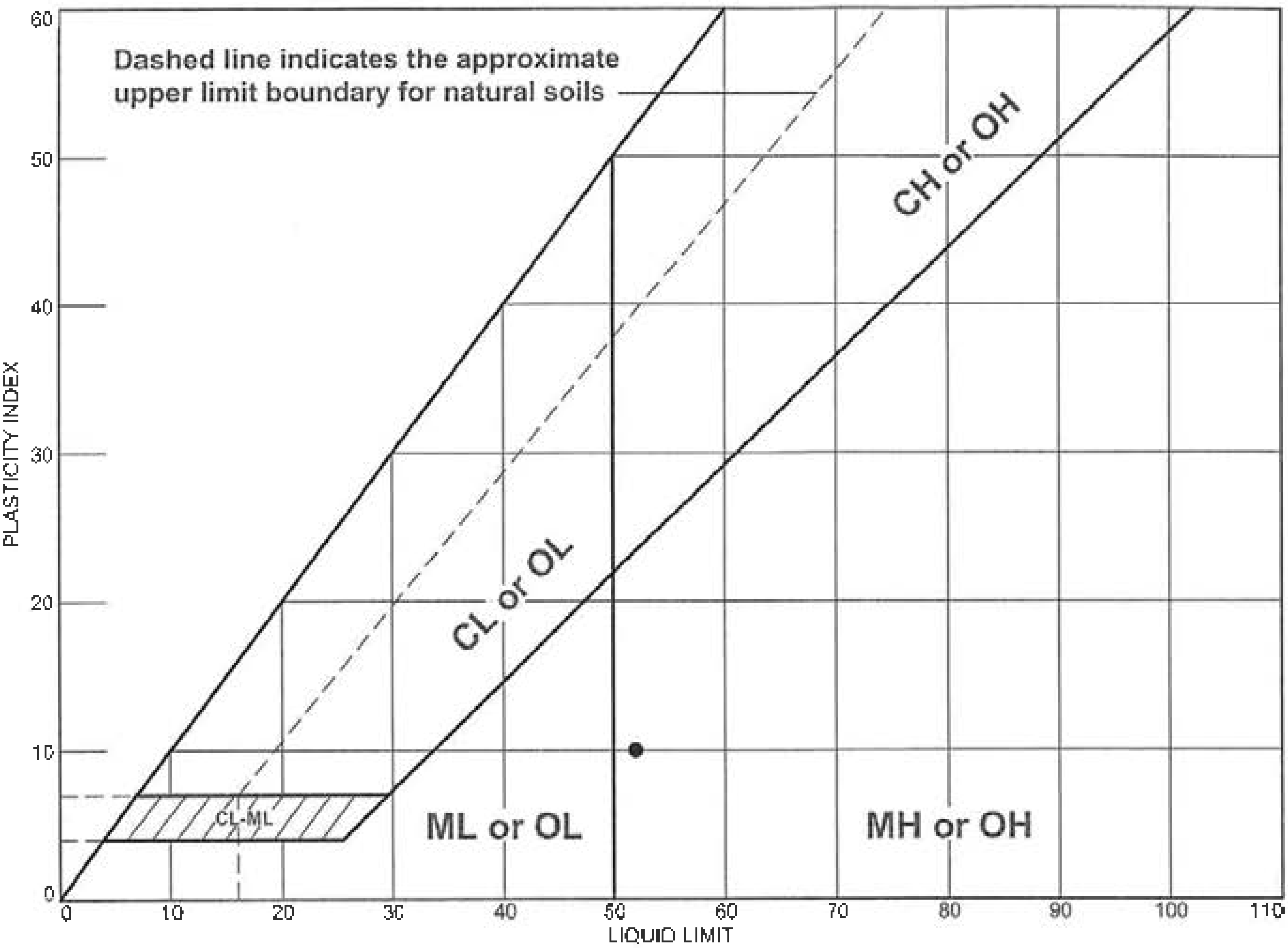
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.4	0.4	0.6	1.7	17.5	19.8			79.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0757	0.0918	0.1187	0.2322

Fineness Modulus
0.16

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray fine Sandy SILT (MH)	52	42	10	97.3	79.8	MH

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-2 **Depth:** 18.5-20.0 **Sample Number:** SS-8

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

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

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-2

Depth: 18.5-20.0 **Sample Number:** SS-8

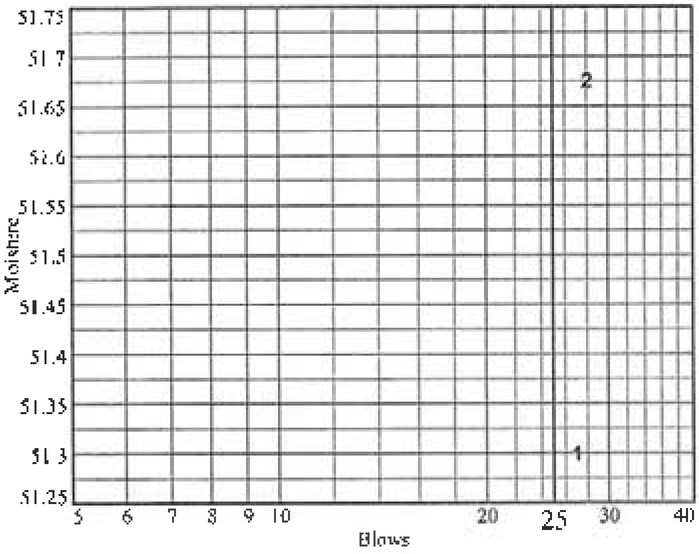
Material Description: Gray fine Sandy SILT (MH)

%<#40: 97.3 **%<#200:** 79.8 **USCS:** MH **AASHTO:** A-5(12)

Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.14	20.98				
Dry+Tare	19.97	19.13				
Tare	15.74	15.55				
# Blows	27	28				
Moisture	51.3	51.7				



Liquid Limit= 52

Plastic Limit= 42

Plasticity Index= 10

Natural Moisture= 71.1

Liquidity Index= 2.9

Plastic Limit Data

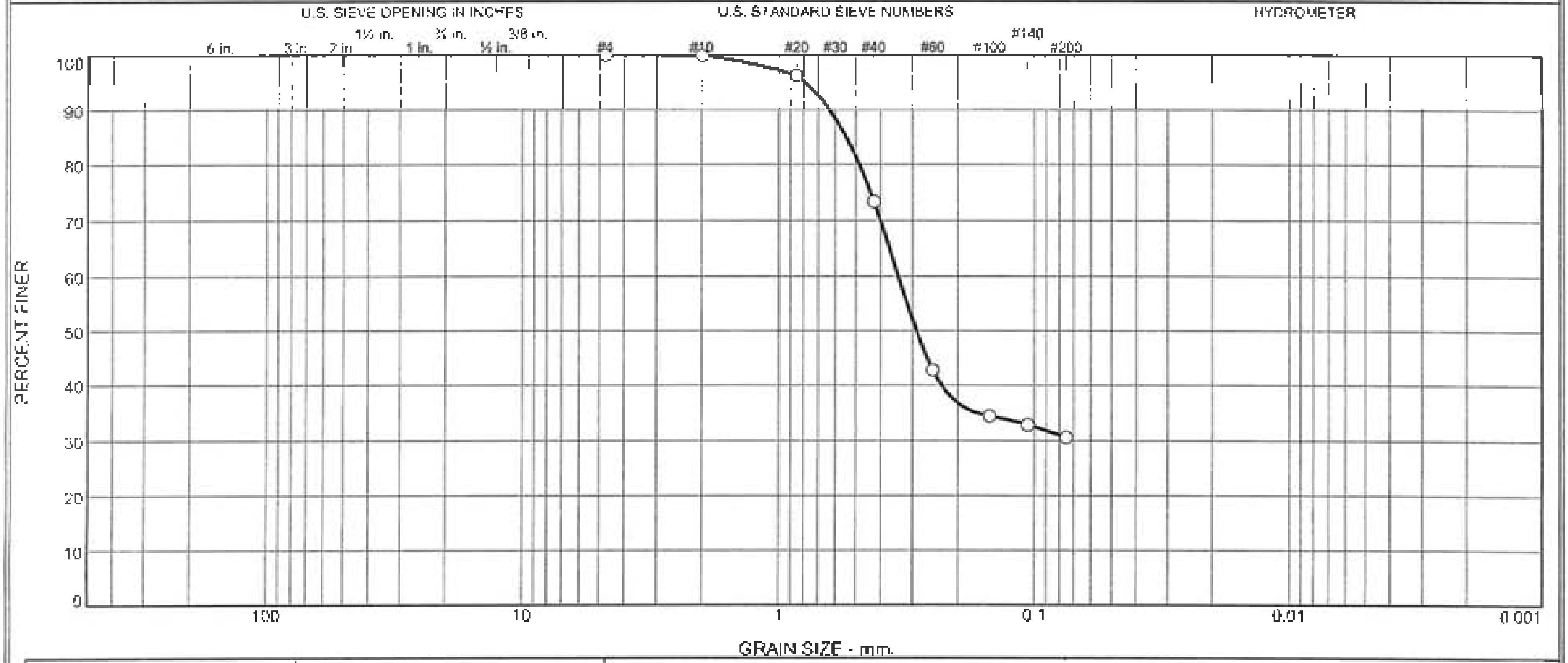
Run No.	1	2	3	4	
Wet+Tare	22.12	21.84			
Dry+Tare	20.23	19.97			
Tare	15.67	15.47			
Moisture	41.4	41.6			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
185.10	140.81	78.55	71.1

MACTEC Engineering and Consulting, Inc.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	26.4	42.8	30.6	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-4	8.5-10.0	12/22/10	SM	Gray slightly Clayey Silty fine to medium SAND	25.0	NV	NP

Client Progress Energy

Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274

Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS

Checked By: IAM

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-3

Depth: 8.5-10.0 **Sample Number:** SS-4

Material Description: Gray slightly Clayey Silty fine to medium SAND

Date: 12/22/10 **Natural Moisture:** 25.0

Liquid Limit: NV **Plastic Limit:** NP **USCS Class.:** SM

Tested by: CS **Checked by:** IAM

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare** = 166.87
Tare Wt. = 0.00
Minus #200 from wash = 0.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
166.87	0.00	0.00	#4	0.00	100.0
			#10	0.26	99.8
			#20	6.31	96.2
			#40	44.38	73.4
			#60	95.53	42.8
			#100	109.47	34.4
			#140	112.12	32.8
			#200	115.80	30.6

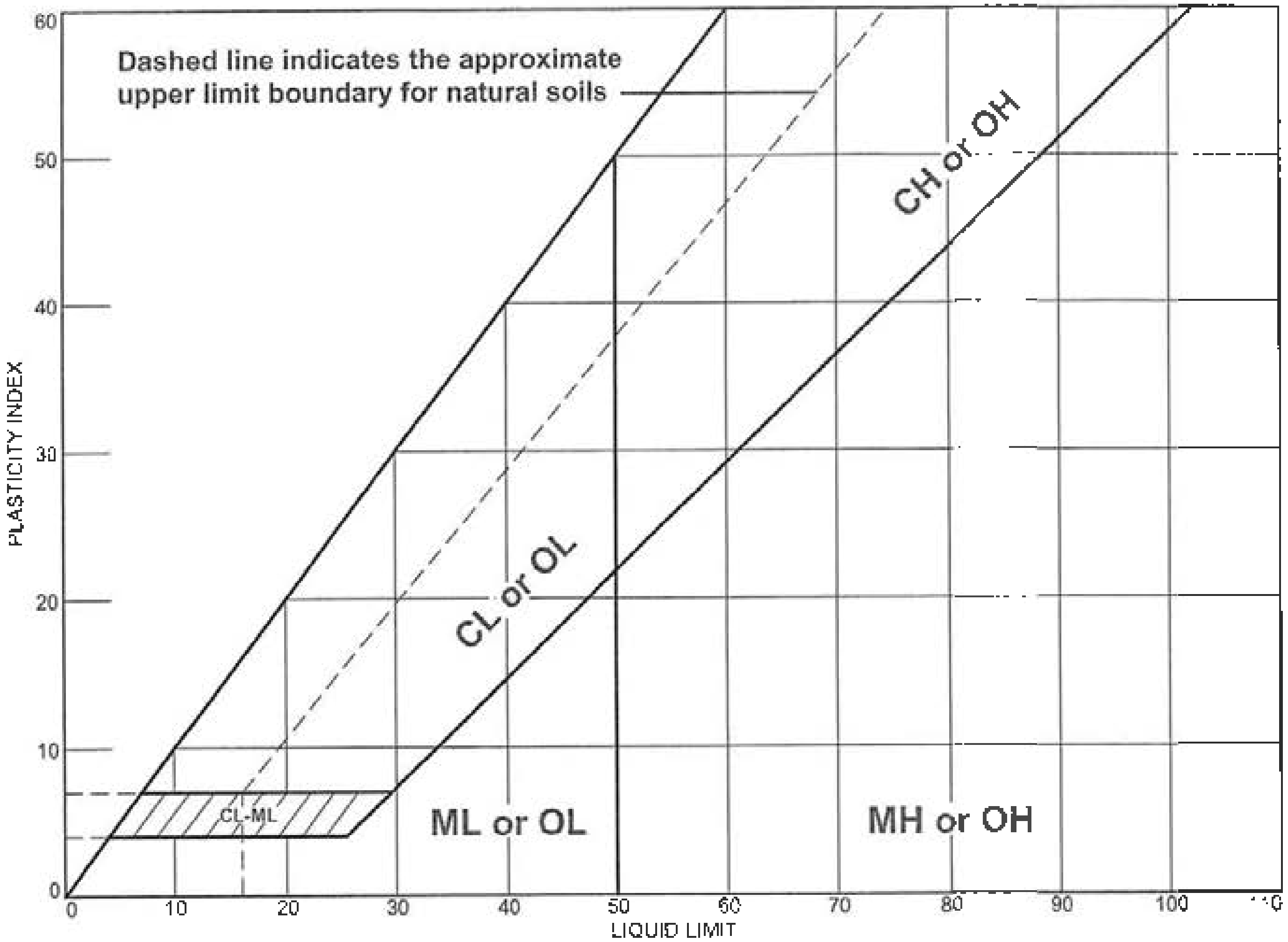
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.2	26.4	42.8	69.4			30.6

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.2898	0.3416	0.4839	0.5453	0.6344	0.7887

Fineness Modulus
1.27

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray slightly Clayey Silty fine to medium SAND	NV	NP	NP	73.4	30.6	SM

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 8.5-10.0 **Sample Number:** SS-4

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

Tested By: CS

Checked By: IAM

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-3

Depth: 8.5-10.0 **Sample Number:** SS-4

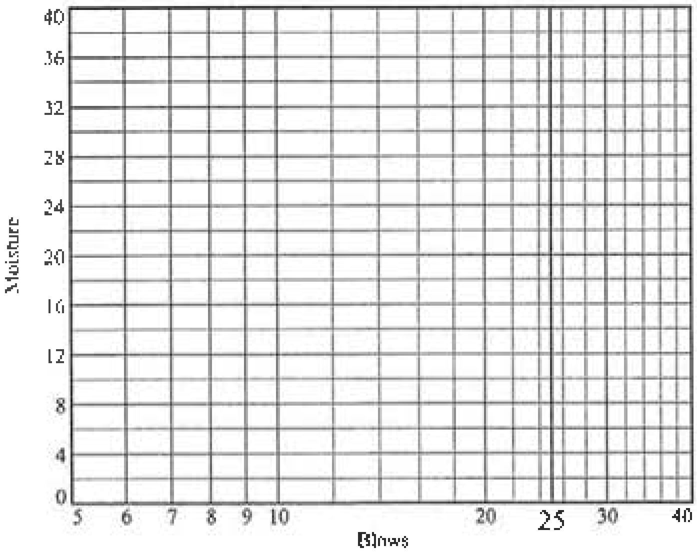
Material Description: Gray slightly Clayey Silty fine to medium SAND

%<#40: 73.4 **%<#200:** 30.6 **USCS:** SM **AASHTO:** A-2-4(0)

Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV

Plastic Limit= NP

Plasticity Index= NP

Natural Moisture= 25.0

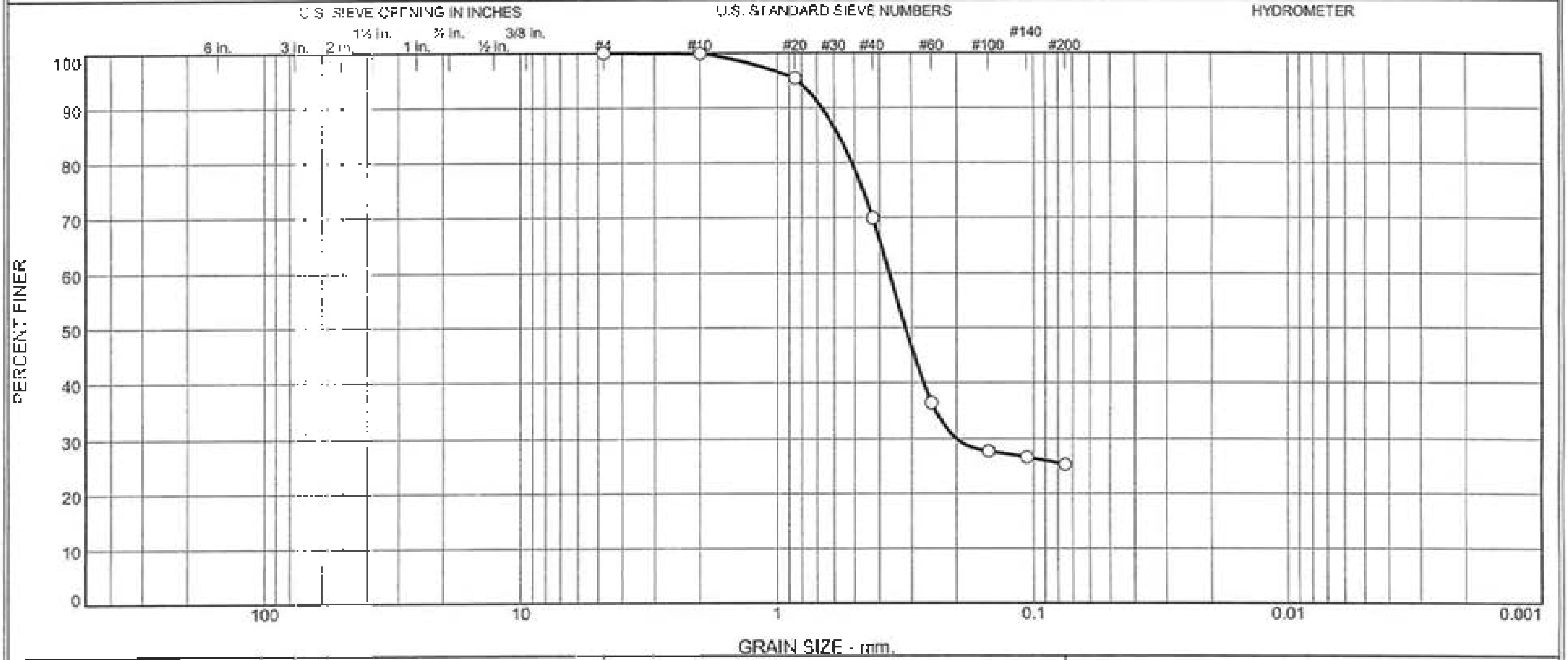
Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
285.17	243.48	76.61	25.0

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	30.0	44.6	25.3	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-5	11.0-12.5	12/22/10	SM	Gray slightly Clayey Silty fine to medium SAND	25.3	NV	NP

Client Progress Energy
Project Sutton Plant Ash Pond Dike Stability
Project No. 6468100274
Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

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

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 11.0-12.5 **Sample Number:** SS-5
Material Description: Gray slightly Clayey Silty fine to medium SAND
Date: 12/22/10 **Natural Moisture:** 25.3
Liquid Limit: NV **Plastic Limit:** NP **USCS Class.:** SM
Tested by: CS **Checked by:** JAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
131.18	0.00	0.00	#4	0.00	100.0
			#10	0.14	99.9
			#20	5.98	95.4
			#40	39.46	69.9
			#60	83.45	36.4
			#100	94.77	27.8
			#140	96.25	26.6
			#200	97.99	25.3

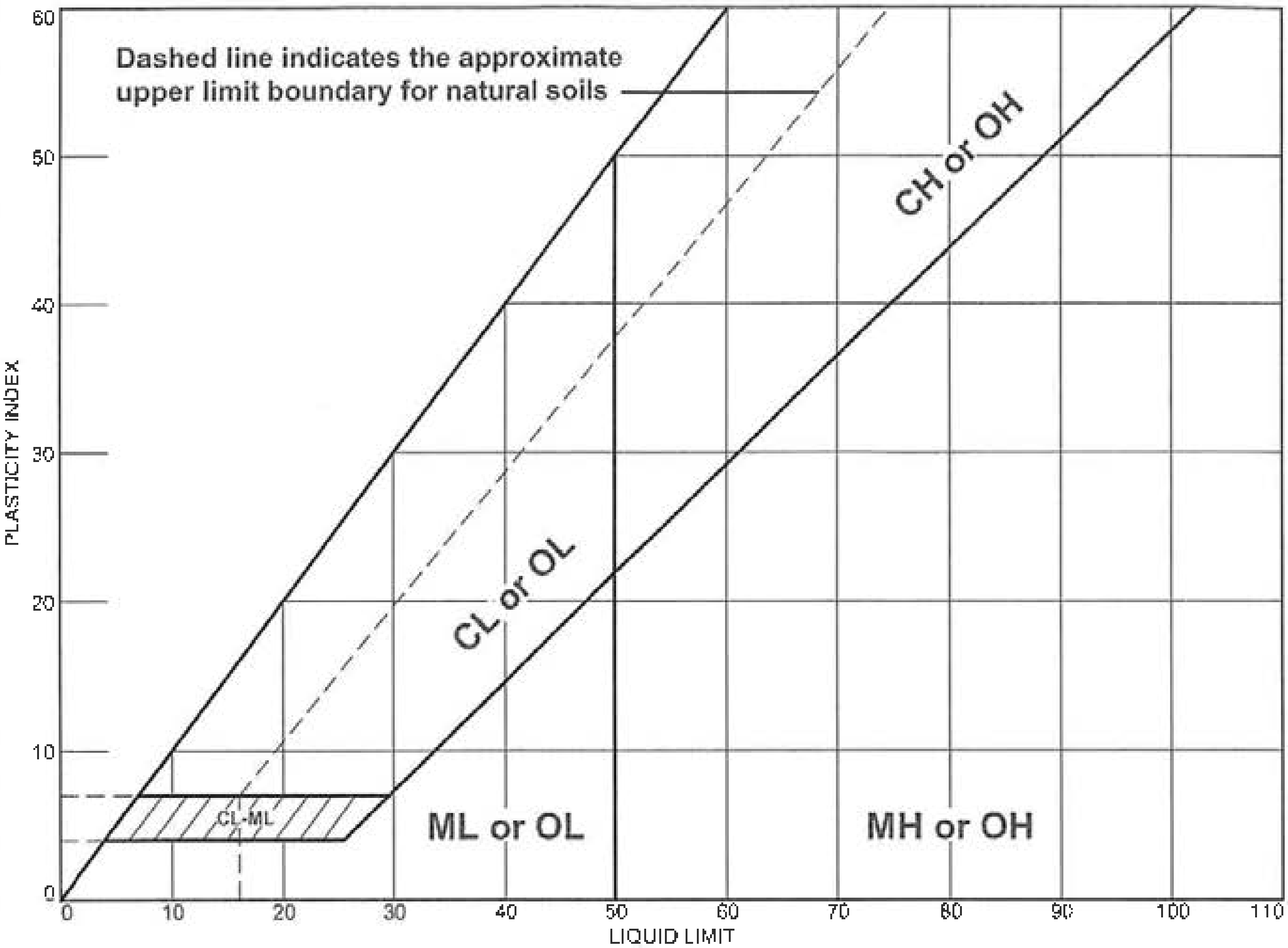
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	30.0	44.6	74.7			25.3

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.2001	0.3168	0.3660	0.5123	0.5764	0.6691	0.8289

Fineness Modulus
1.42

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray slightly Clayey Silty fine to medium SAND	NV	NP	NP	69.9	25.3	SM

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 11.0-12.5 **Sample Number:** SS-5

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

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

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-3

Depth: 11.0-12.5 **Sample Number:** SS-5

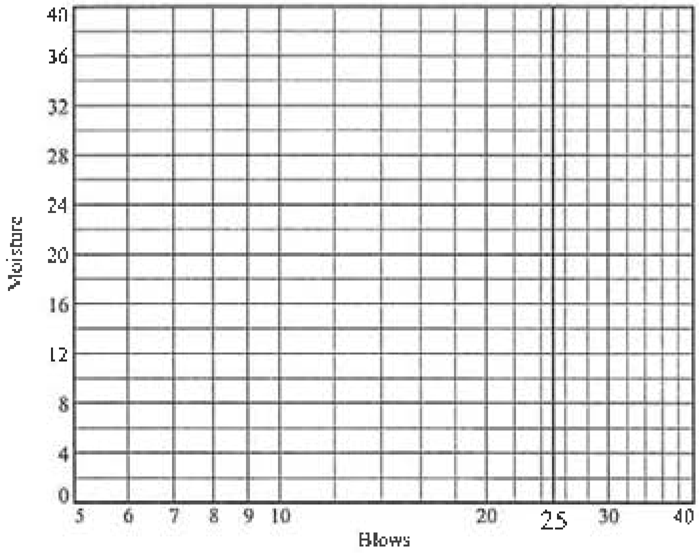
Material Description: Gray slightly Clayey Silty fine to medium SAND

%<#40: 69.9 **%<#200:** 25.3 **USCS:** SM **AASHTO:** A-2-4(0)

Tested by: CS **Checked by:** JAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV

Plastic Limit= NP

Plasticity Index= NP

Natural Moisture= 25.3

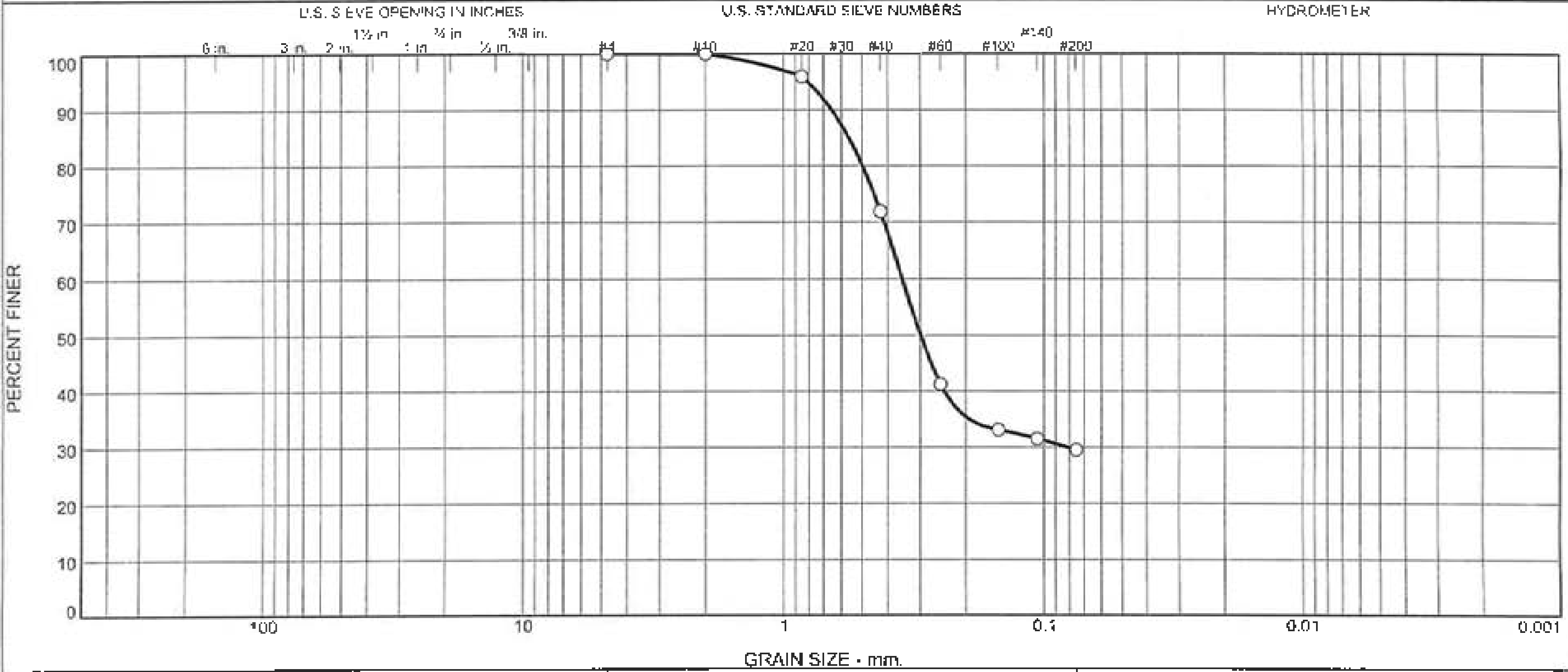
Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
246.89	213.73	82.55	25.3

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	28.1	42.3	29.5	

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-6	13.5-15.0	12/22/10	SM	Gray Silty fine to medium SAND	28.7	NV	NP

Client Progress Energy

Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274

Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Tested By: CS

Checked By: IAM

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 13.5-15.0
Sample Number: SS-6
Material Description: Gray Silty fine to medium SAND
Date: 12/22/10
Natural Moisture: 28.7
Liquid Limit: NV
Plastic Limit: NP
USCS Class.: SM
Tested by: CS
Checked by: IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
121.14	0.00	0.00	#4	0.00	100.0
			#10	0.09	99.9
			#20	4.92	95.9
			#40	34.11	71.8
			#60	71.20	41.2
			#100	81.05	33.1
			#140	82.97	31.5
			#200	85.39	29.5

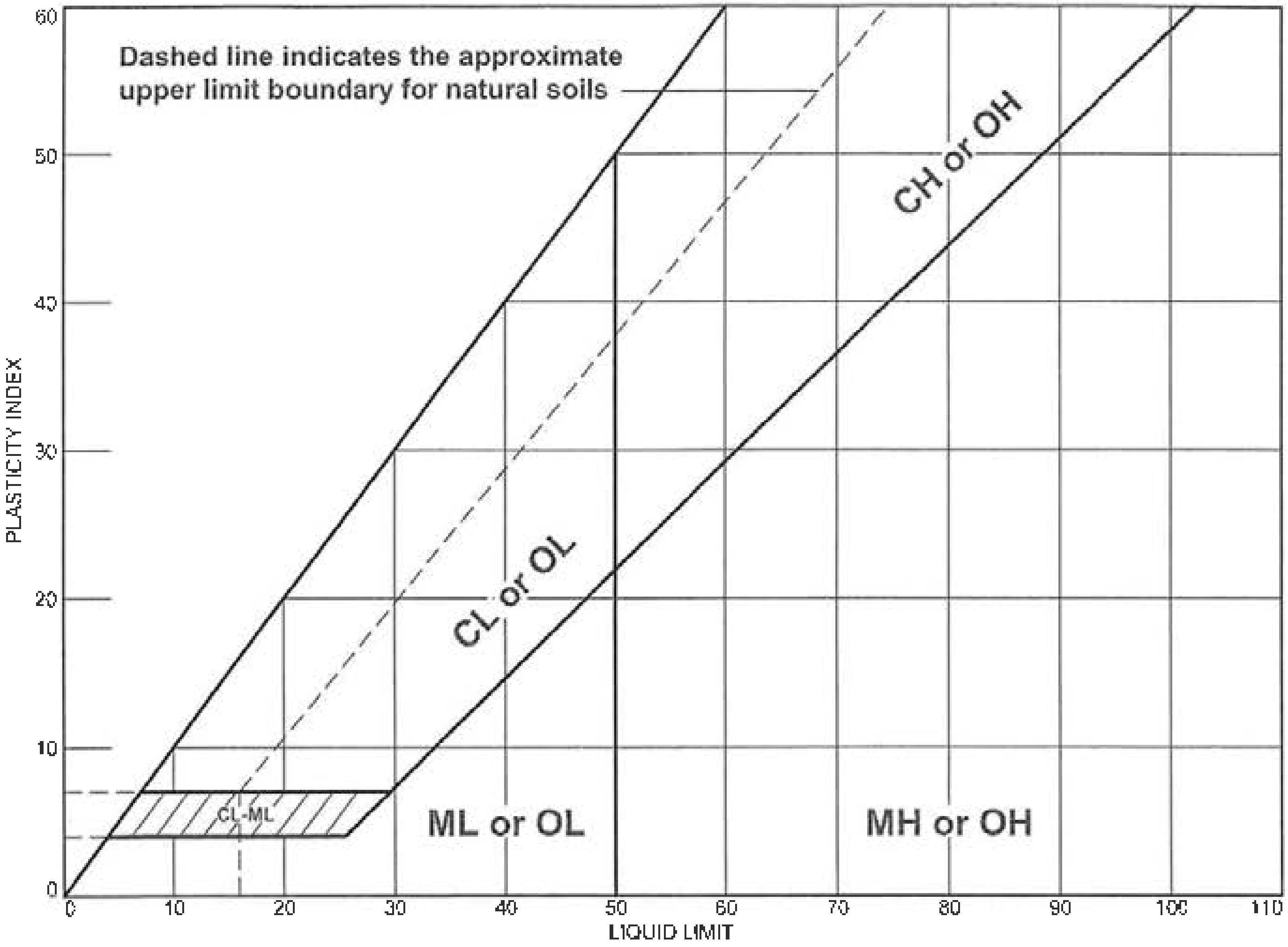
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	28.1	42.3	70.5			29.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0813	0.2982	0.3506	0.4985	0.5621	0.6528	0.8057

Fineness Modulus
1.31

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silty fine to medium SAND	NV	NP	NP	71.8	29.5	SM

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 13.5-15.0 **Sample Number:** SS-6

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

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

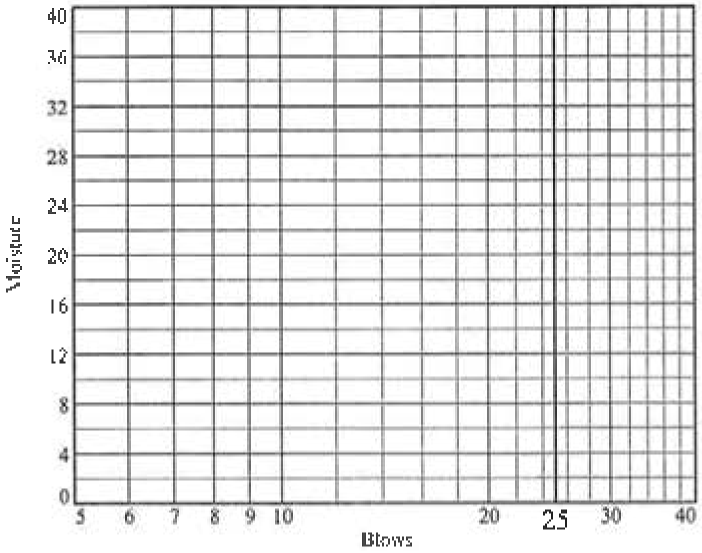
LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 13.5-15.0 **Sample Number:** SS-6
Material Description: Gray Silty fine to medium SAND
%<#40: 71.8 **%<#200:** 29.5 **USCS:** SM **AASHTO:** A-2-4(0)
Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 28.7

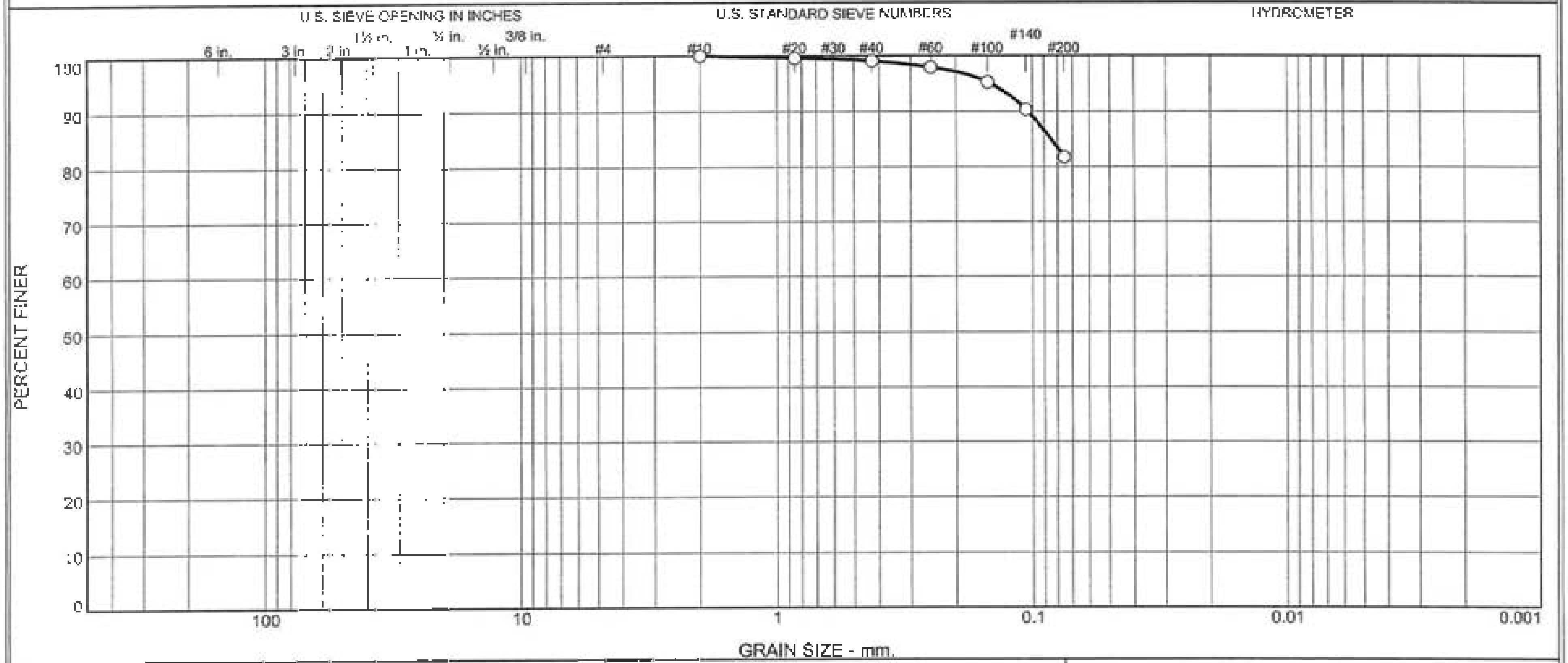
Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
234.01	199.19	78.05	28.7

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.9	17.3	81.8	

	Source	Sample #	Depth/Elev	Date Sampled	USCS	Material Description	NM %	LL	PL
○	Boring B-3	SS-8	18.5-20.0	12/22/10	ML	Dark Gray Fine Sandy SILT	62.1	46	40

Client Progress Energy

Project Sutton Plant Ash Pond Dike Stability

Project No. 6468100274

Figure

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

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

GRAIN SIZE DISTRIBUTION TEST DATA

2/23/2011

Client: Progress Energy
Project: Sutton Plant Ash Pond Dike Stability
Project Number: 6468100274
Location: Boring B-3
Depth: 18.5-20.0 **Sample Number:** SS-8
Material Description: Dark Gray Fine Sandy SILT
Date: 12/22/10 **Natural Moisture:** 62.1
Liquid Limit: 46 **Plastic Limit:** 40 **USCS Class.:** ML
Tested by: CS **Checked by:** IAM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
106.68	0.00	0.00	#10	0.00	100.0
			#20	0.44	99.6
			#40	1.00	99.1
			#60	2.26	97.9
			#100	5.08	95.2
			#140	10.31	90.3
			#200	19.45	81.8

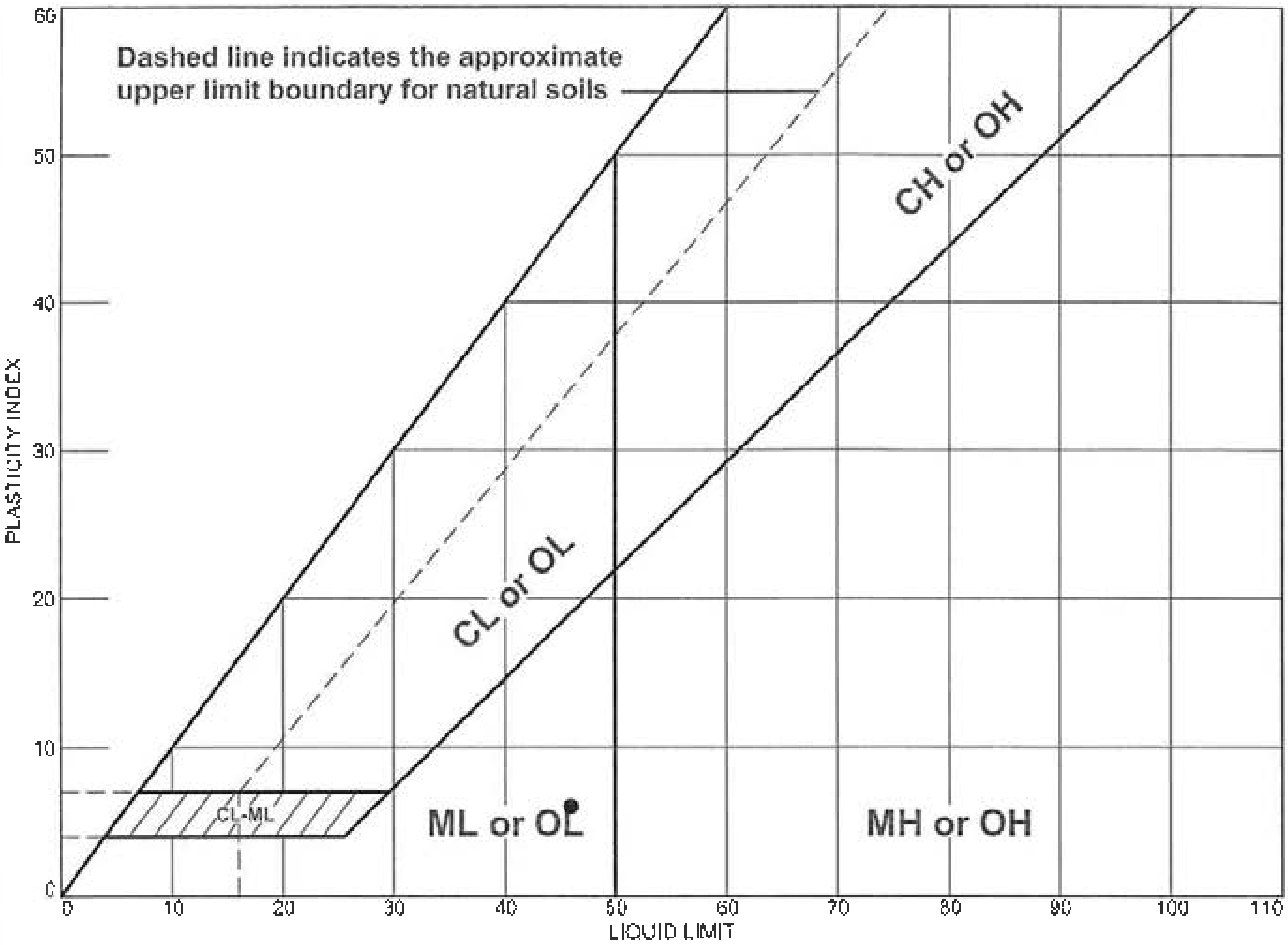
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.9	17.3	18.2			81.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
							0.0846	0.1043	0.1463

Fineness Modulus
0.07

LIQUID AND PLASTIC LIMITS TEST REPORT ASTM D4318 (05)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Gray Fine Sandy SILT	46	40	6	99.1	81.8	ML

Project No. 6468100274 **Client:** Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

● **Source of Sample:** Boring B-3 **Depth:** 18.5-20.0 **Sample Number:** SS-8

Remarks:

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

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

LIQUID AND PLASTIC LIMIT TEST DATA

2/23/2011

Client: Progress Energy

Project: Sutton Plant Ash Pond Dike Stability

Project Number: 6468100274

Location: Boring B-3

Depth: 18.5-20.0 **Sample Number:** SS-8

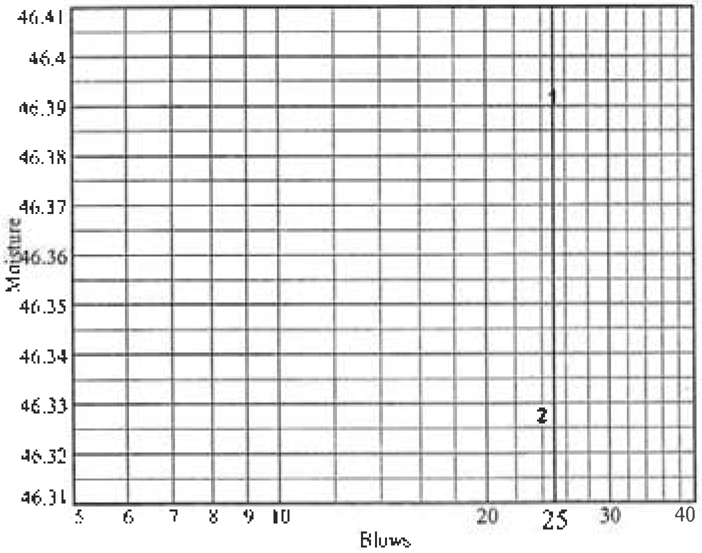
Material Description: Dark Gray Fine Sandy SILT

%<#40: 99.1 **%<#200:** 81.8 **USCS:** ML **AASHTO:** A-5(8)

Tested by: CS **Checked by:** IAM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.91	25.84				
Dry+Tare	21.21	22.56				
Tare	15.39	15.48				
# Blows	25	24				
Moisture	46.4	46.3				



Liquid Limit= 46

Plastic Limit= 40

Plasticity Index= 6

Natural Moisture= 62.1

Liquidity Index= 3.7

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	21.80	22.01			
Dry+Tare	19.99	20.15			
Tare	15.47	15.54			
Moisture	40.0	40.3			

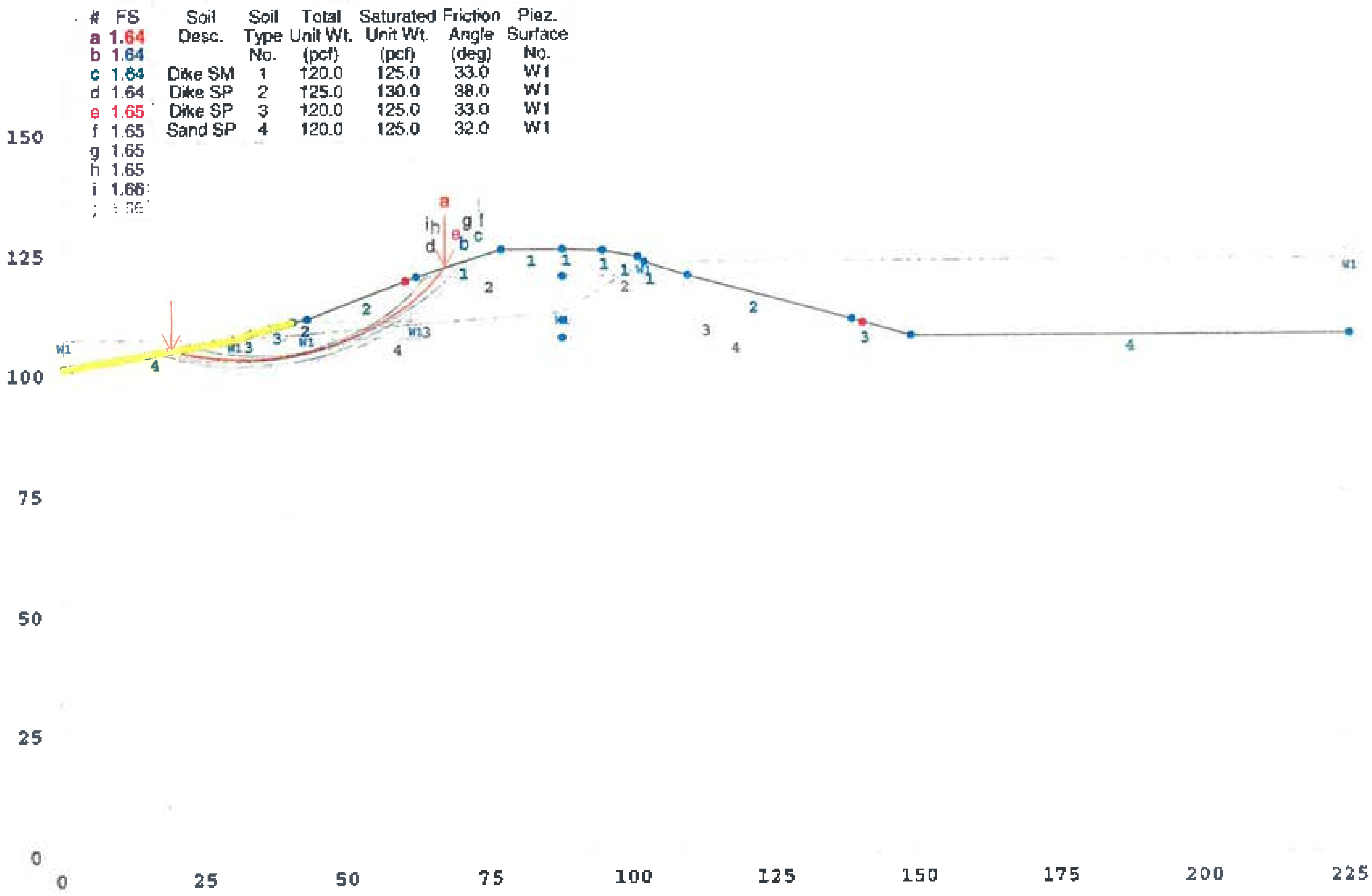
Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
257.45	191.25	84.57	62.1

APPENDIX C: 1971/1983 ASH POND - STABILITY ANALYSIS PLOTS

Sutton Plant Ash Pond Stability Section B-1 (Deep)

p:\6468\progress energy\progress energy projects 2010\sutton\6468103274 sutton eap inundation and stability\slope stability\b-1deep.pl2 Run By: J. Shane Johnson. MACTEC. Inc 3/8/2011



#	FS
a	1.64
b	1.64
c	1.64
d	1.64
e	1.65
f	1.65
g	1.65
h	1.65
i	1.66
j	1.66

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Dike SM	1	120.0	125.0	33.0	W1
Dike SP	2	125.0	130.0	38.0	W1
Dike SP	3	120.0	125.0	33.0	W1
Sand SP	4	120.0	125.0	32.0	W1

PCSTABL5M/si FSmin=1.64
Safety Factors Are Calculated By The Modified Bishop Method

STED

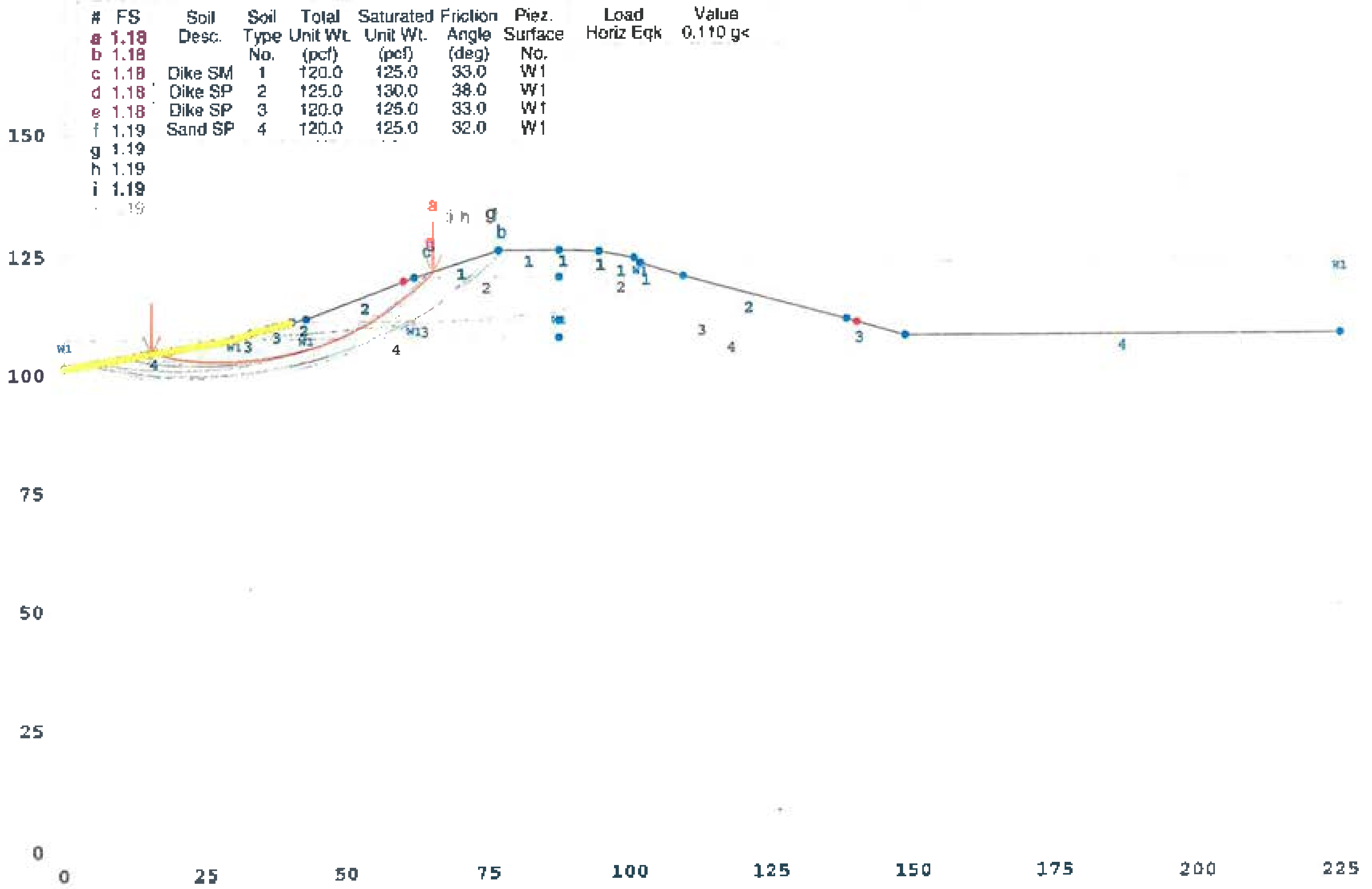
Sutton Plant Ash Pond Stability Section B-1 (Deep) (Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton cap foundation and stability\slope stability\b-1dps.pl2   Run By: J. Shane Johnson, MACTEC, Inc   3/4/2011

#	FS
a	1.18
b	1.18
c	1.18
d	1.18
e	1.18
f	1.19
g	1.19
h	1.19
i	1.19
	1.19

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Dike SM	1	120.0	125.0	33.0	W1
Dike SP	2	125.0	130.0	38.0	W1
Dike SP	3	120.0	125.0	33.0	W1
Sand SP	4	120.0	125.0	32.0	W1

Load	Value
Horiz Eqk	0.110 g<



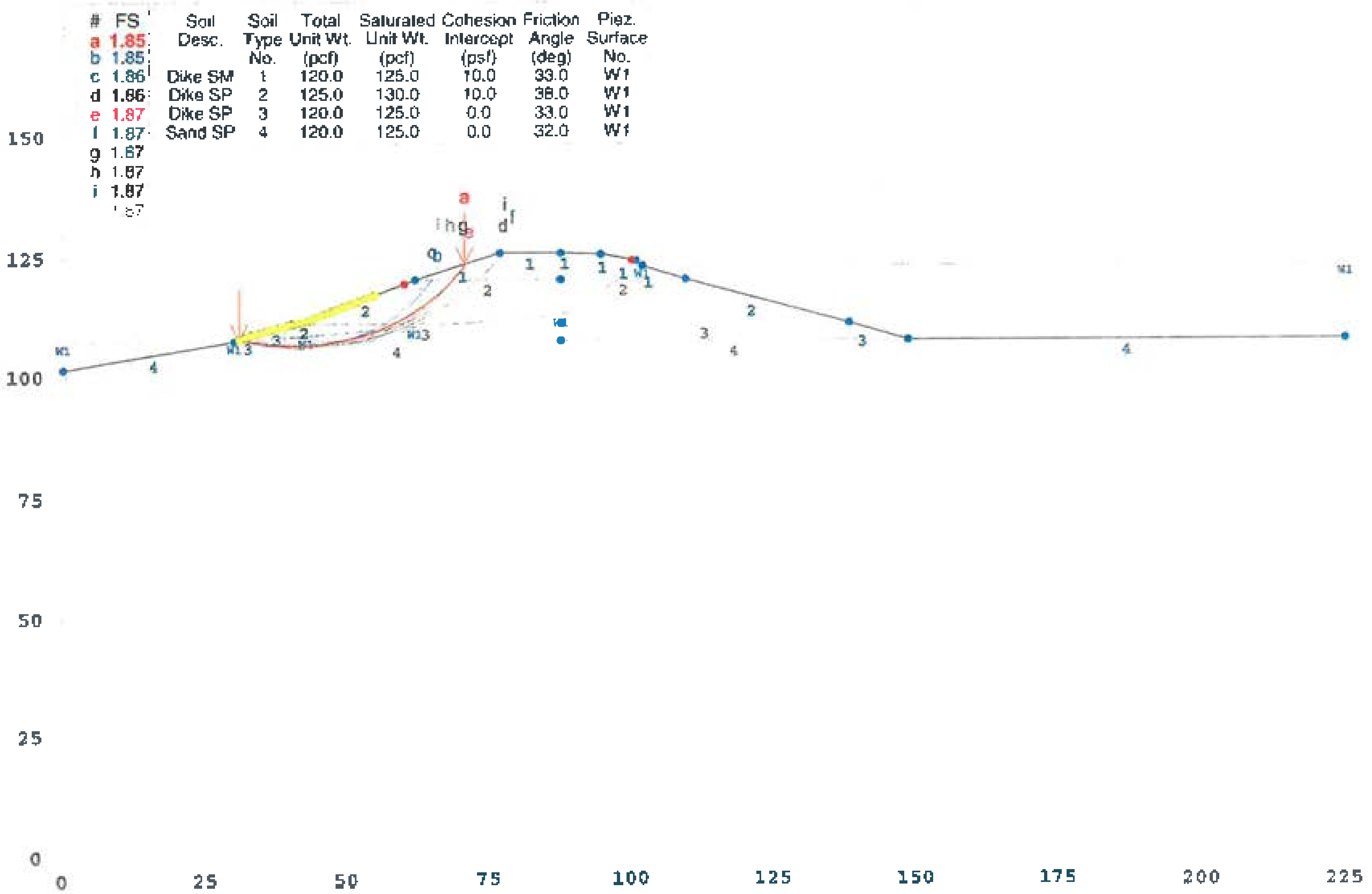
PCSTABL5M/si FSmin=1.18

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-1 (Shallow)

p:\6469\progress energy\progress energy projects 2010\sutton\6469103274 sutton cop inundation and stability\slope stability\b-1shall.pl2 Run By: J. Shane Johnson, MACTEC, Inc 3/9/2011



#	FS
a	1.85
b	1.85
c	1.86
d	1.86
e	1.87
f	1.87
g	1.87
h	1.87
i	1.87
	1.87

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Dike SM	1	120.0	125.0	10.0	33.0	W1
Dike SP	2	125.0	130.0	10.0	38.0	W1
Dike SP	3	120.0	125.0	0.0	33.0	W1
Sand SP	4	120.0	125.0	0.0	32.0	W1

PCSTABL5M/si FSmin=1.85

Safety Factors Are Calculated By The Modified Bishop Method

STED

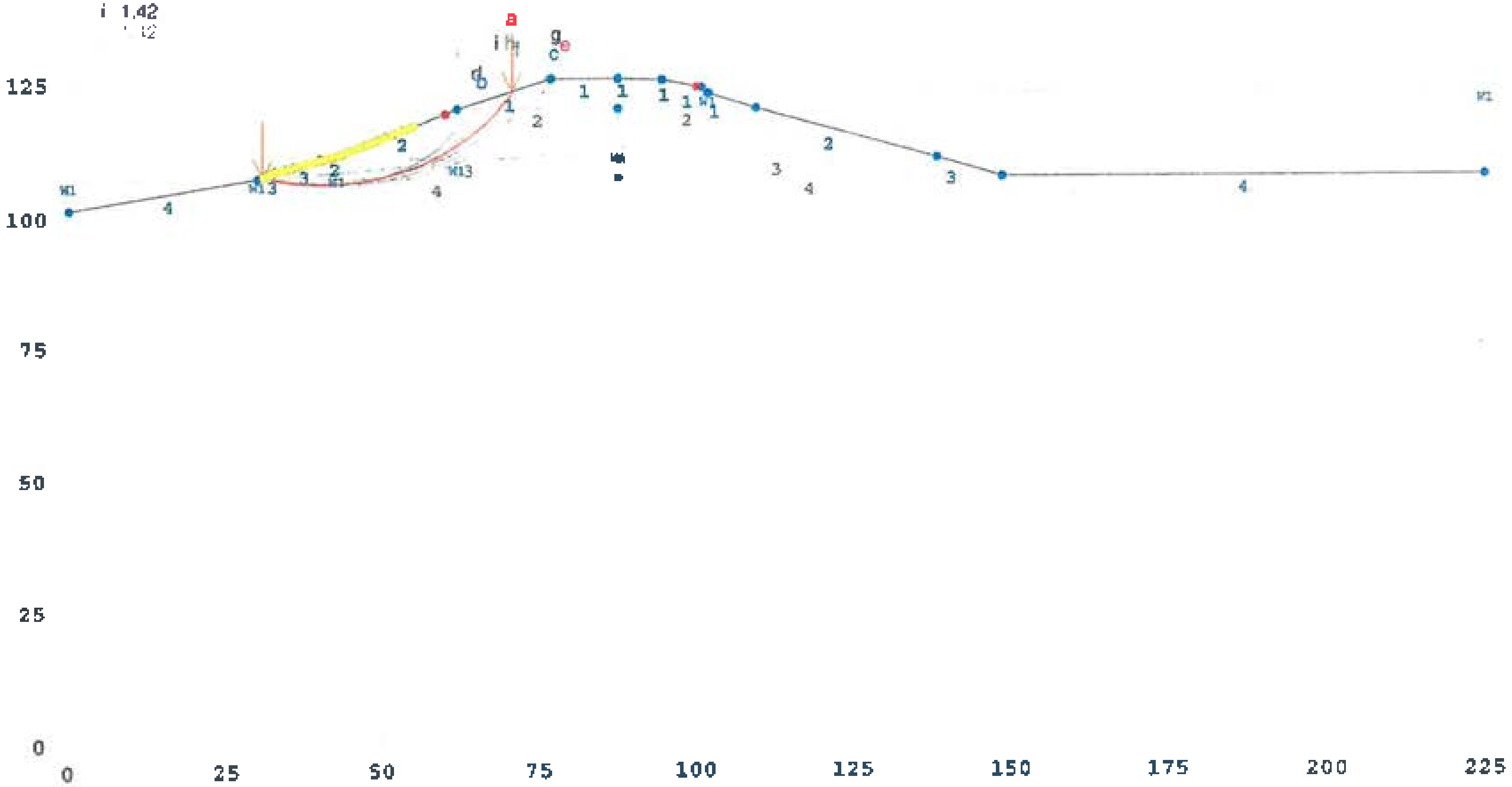
Sutton Plant Ash Pond Stability Section B-1 (Shallow) (Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton eap inundation and stability\slope stabilty\b 1shals.pl2   Run By: J Shane Johnson, MACTEC, Inc   3/3/2011

#	FS
a	1.40
b	1.40
c	1.40
d	1.40
e	1.41
f	1.41
g	1.41
h	1.41
i	1.42
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.
Dike SM	1	120.0	125.0	10.0	33.0	W1
Dike SP	2	125.0	130.0	10.0	38.0	W1
Dike SP	3	120.0	125.0	0.0	33.0	W1
Sand SP	4	120.0	125.0	0.0	32.0	W1

Load	Value
Horiz Eqk	0.110 g<



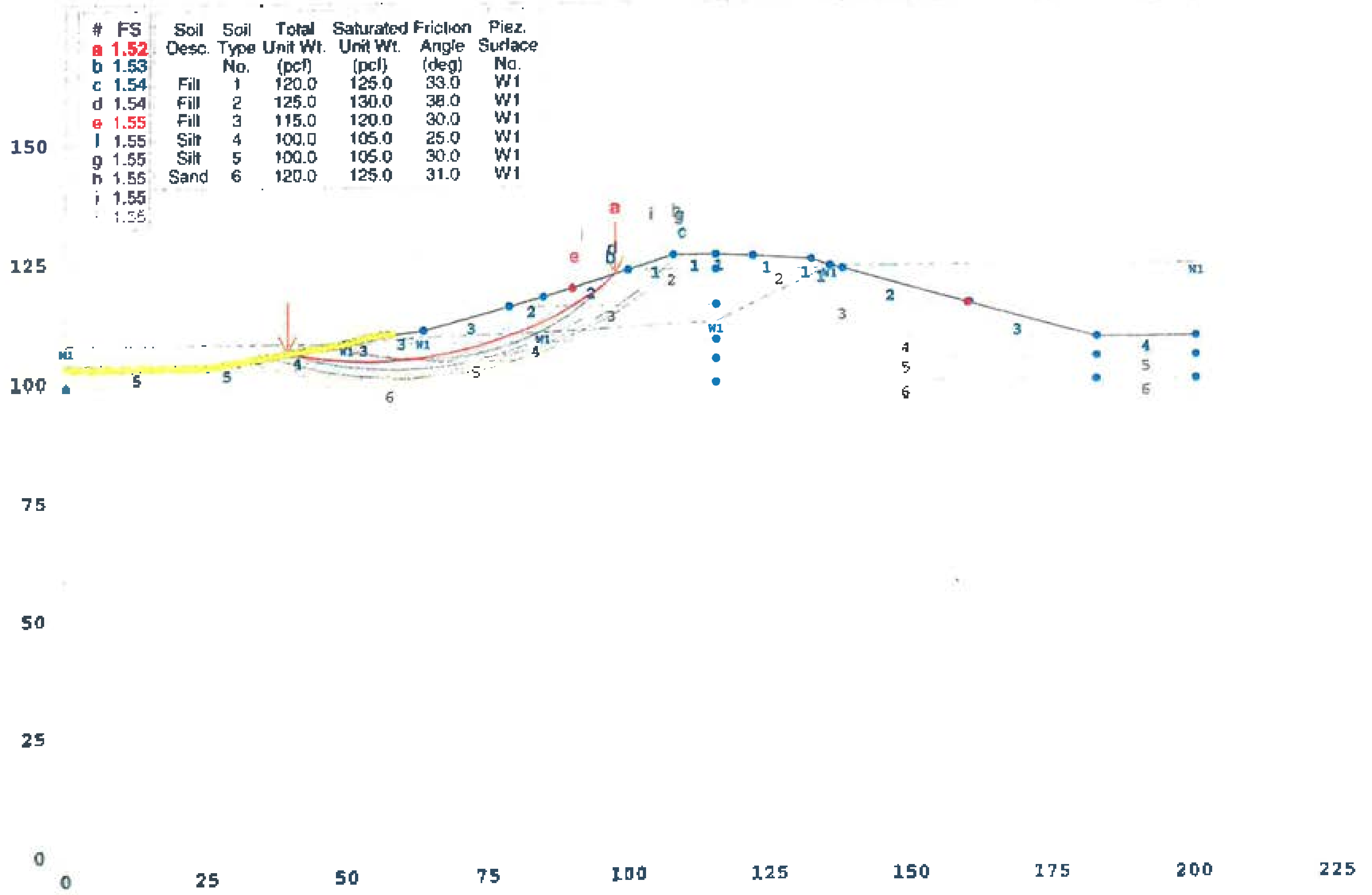
PCSTABL5M/si FSmin=1.40

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-2 (Deep) Run 2

p:\6469\progress energy\progress energy projects 2010\sutton\6468100274 sutton eap inundation and stability\slope stabilty\b-2r2.pl2   Run By: J. Shane Johnson, PACTEC, Inc   3/24/2011



#	FS
a	1.52
b	1.53
c	1.54
d	1.54
e	1.55
f	1.55
g	1.55
h	1.55
i	1.55
j	1.55

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	125.0	33.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	115.0	120.0	30.0	W1
Silt	4	100.0	105.0	25.0	W1
Silt	5	100.0	105.0	30.0	W1
Sand	6	120.0	125.0	31.0	W1

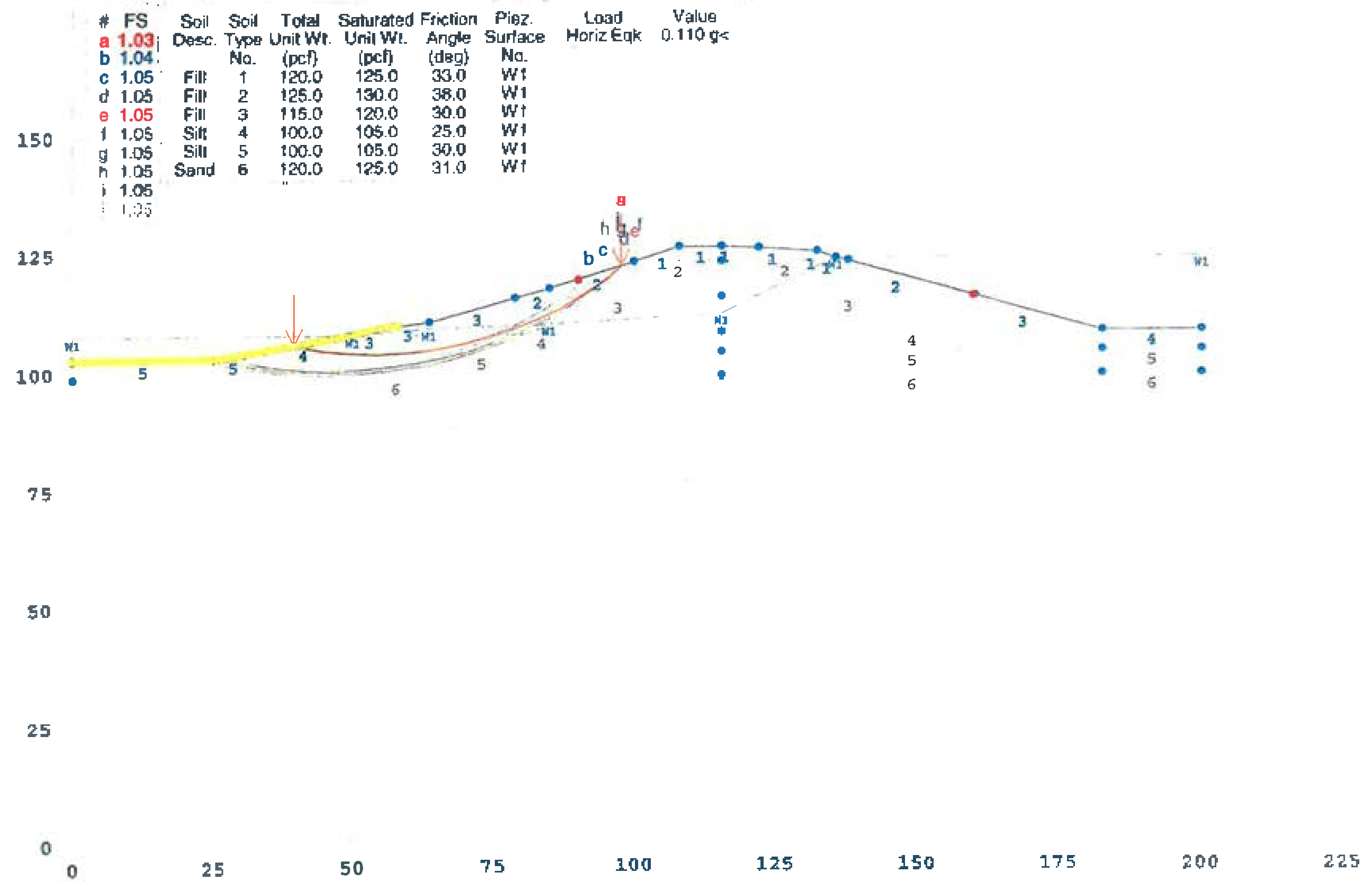
PCSTABL5M/sl FSmin=1.52

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-2 (Deep) (Seismic) Run 2

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton cap inundation and stability\slope stabilty\b-2sa.pl2   Run By: J. Shane Johnson, MACTEC, Inc   2/21/2011



#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
a	1.03	Fill	1	120.0	125.0	33.0	W1
b	1.04	Fill	2	125.0	130.0	38.0	W1
c	1.05	Fill	3	115.0	120.0	30.0	W1
d	1.05	Silt	4	100.0	105.0	25.0	W1
e	1.05	Silt	5	100.0	105.0	30.0	W1
f	1.05	Sand	6	120.0	125.0	31.0	W1
g	1.05						
h	1.05						
i	1.05						
j	1.05						

Load	Value
Horiz Eqk	0.110 g<

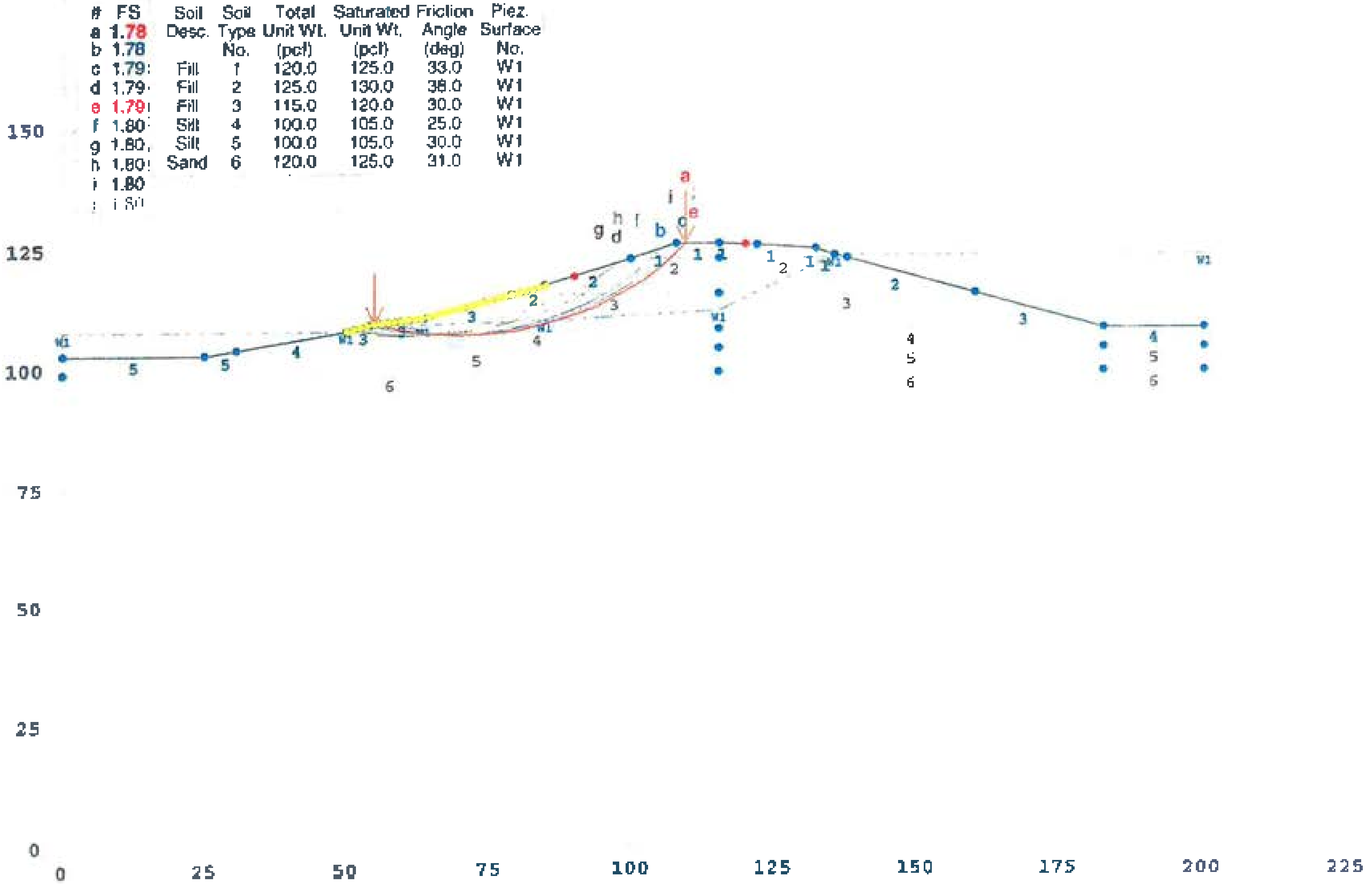
PCSTABL5M/sl FSmin=1.03

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-2 (Shallow)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton eap foundation and stability\slope stability\b 2shal.plz Run By: J. Shane Johnson, MACTEC, Inc [illegible]



#	FS
a	1.78
b	1.78
c	1.79
d	1.79
e	1.79
f	1.80
g	1.80
h	1.80
i	1.80
j	1.80

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	125.0	33.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	115.0	120.0	30.0	W1
Silt	4	100.0	105.0	25.0	W1
Silt	5	100.0	105.0	30.0	W1
Sand	6	120.0	125.0	31.0	W1

PCSTABL5M/si FSmin=1.78

Safety Factors Are Calculated By The Modified Bishop Method

STED

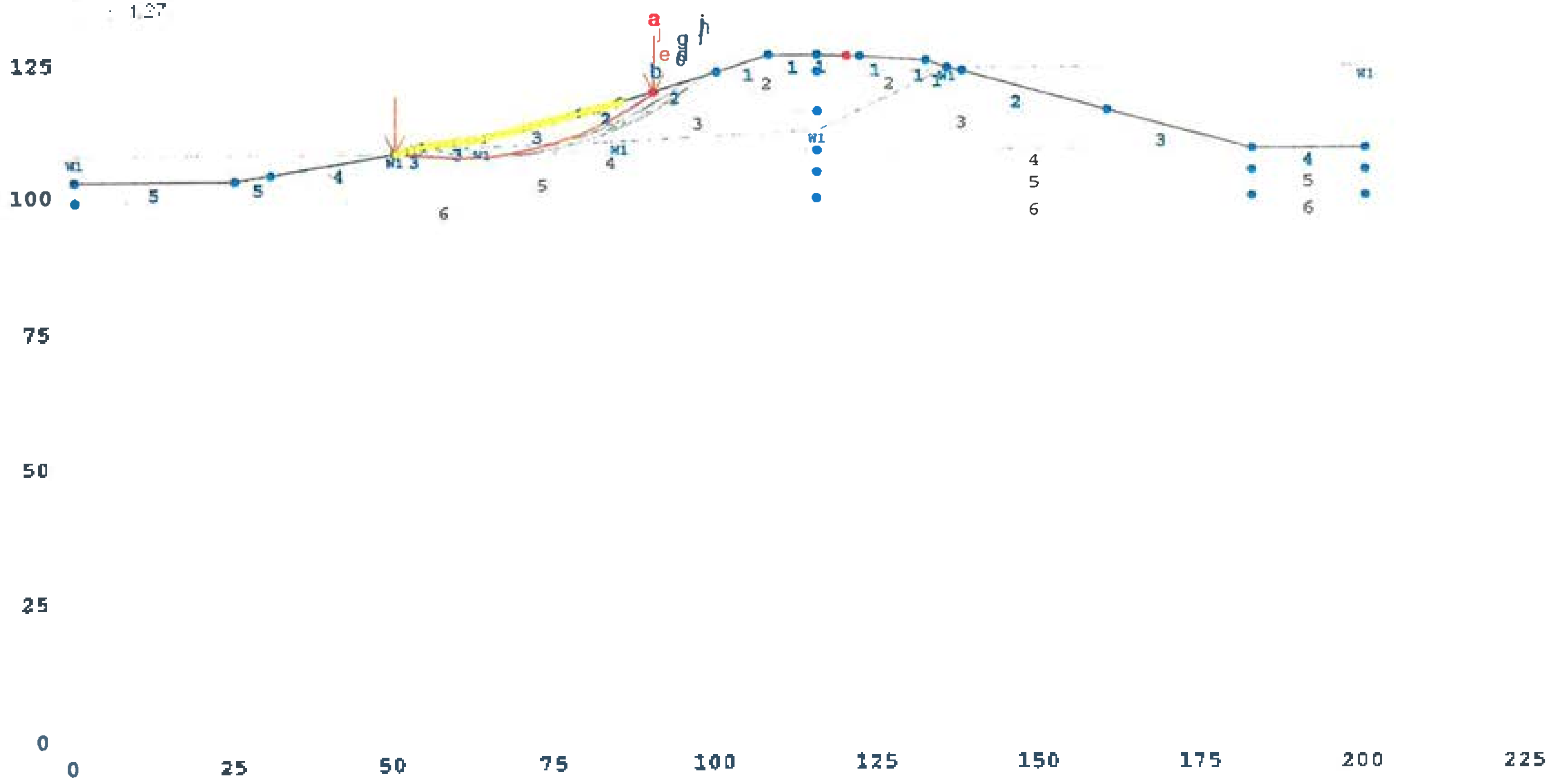
Sutton Plant Ash Pond Stability Section B-2 (Shallow) (Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100774 sutton eap foundation and stability\slope stabilty\b-2shale.pl2   Run By: J. Shane Johnson, MACTEC, Inc   2/23/2011

#	FS
a	1.25
b	1.25
c	1.25
d	1.26
e	1.26
f	1.26
g	1.26
h	1.27
i	1.27
j	1.27

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	125.0	33.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	115.0	120.0	30.0	W1
Silt	4	100.0	105.0	25.0	W1
Silt	5	100.0	105.0	30.0	W1
Sand	6	120.0	125.0	31.0	W1

Load	Value
Horiz Eqk	0.110 g<



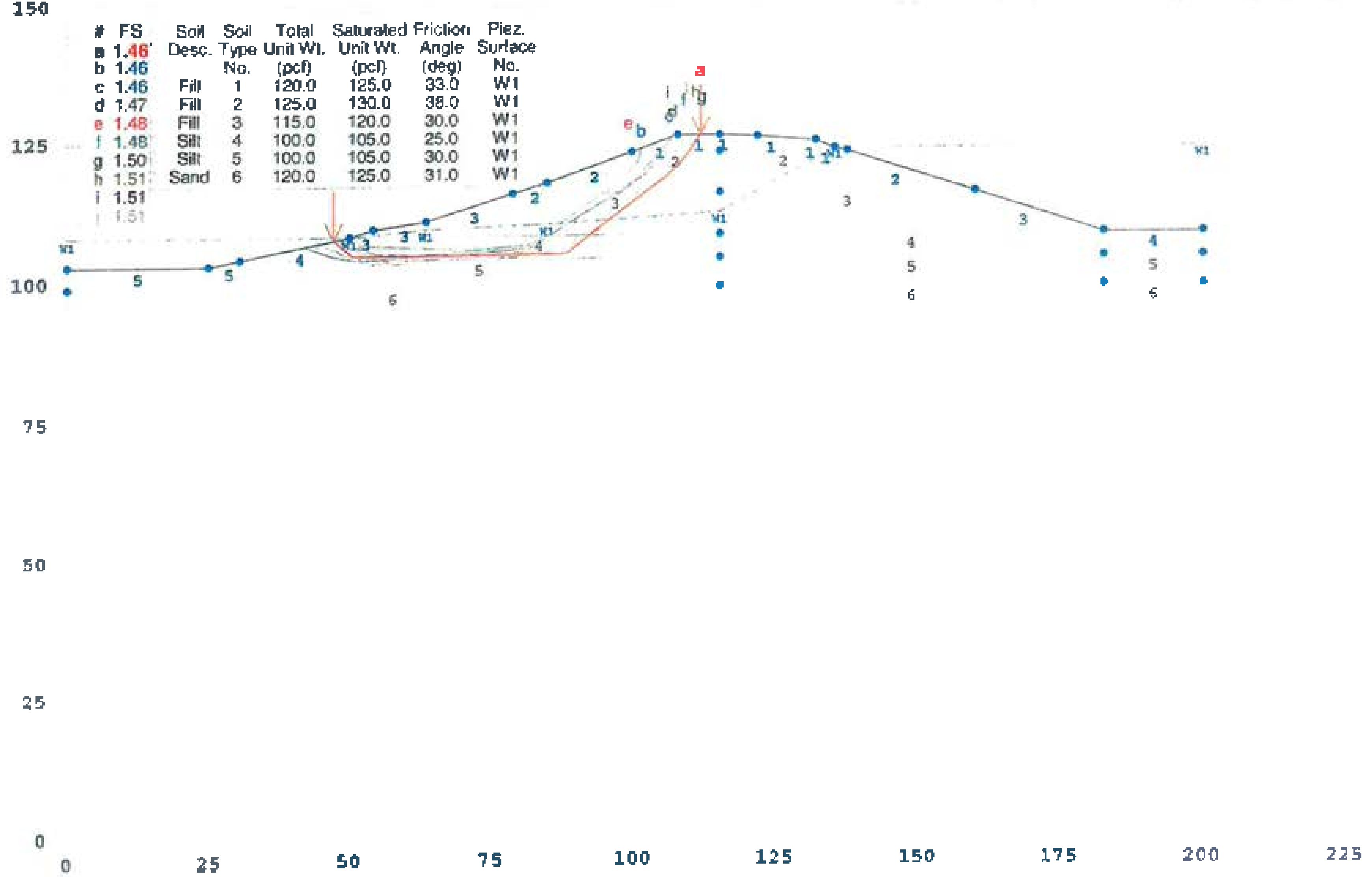
PCSTABL5M/si FSmin=1.25

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-2 (Wedge Analysis)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton cap foundation and stability\slope stability\b-2wedg.pl2   Run By: J. Shane Johnson, MACTEC, Inc   7/1/2011



#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
a	1.46						
b	1.46						
c	1.46	Fill	1	120.0	125.0	33.0	W1
d	1.47	Fill	2	125.0	130.0	38.0	W1
e	1.48	Fill	3	115.0	120.0	30.0	W1
f	1.48	Silt	4	100.0	105.0	25.0	W1
g	1.50	Silt	5	100.0	105.0	30.0	W1
h	1.51	Sand	6	120.0	125.0	31.0	W1
i	1.51						
j	1.51						

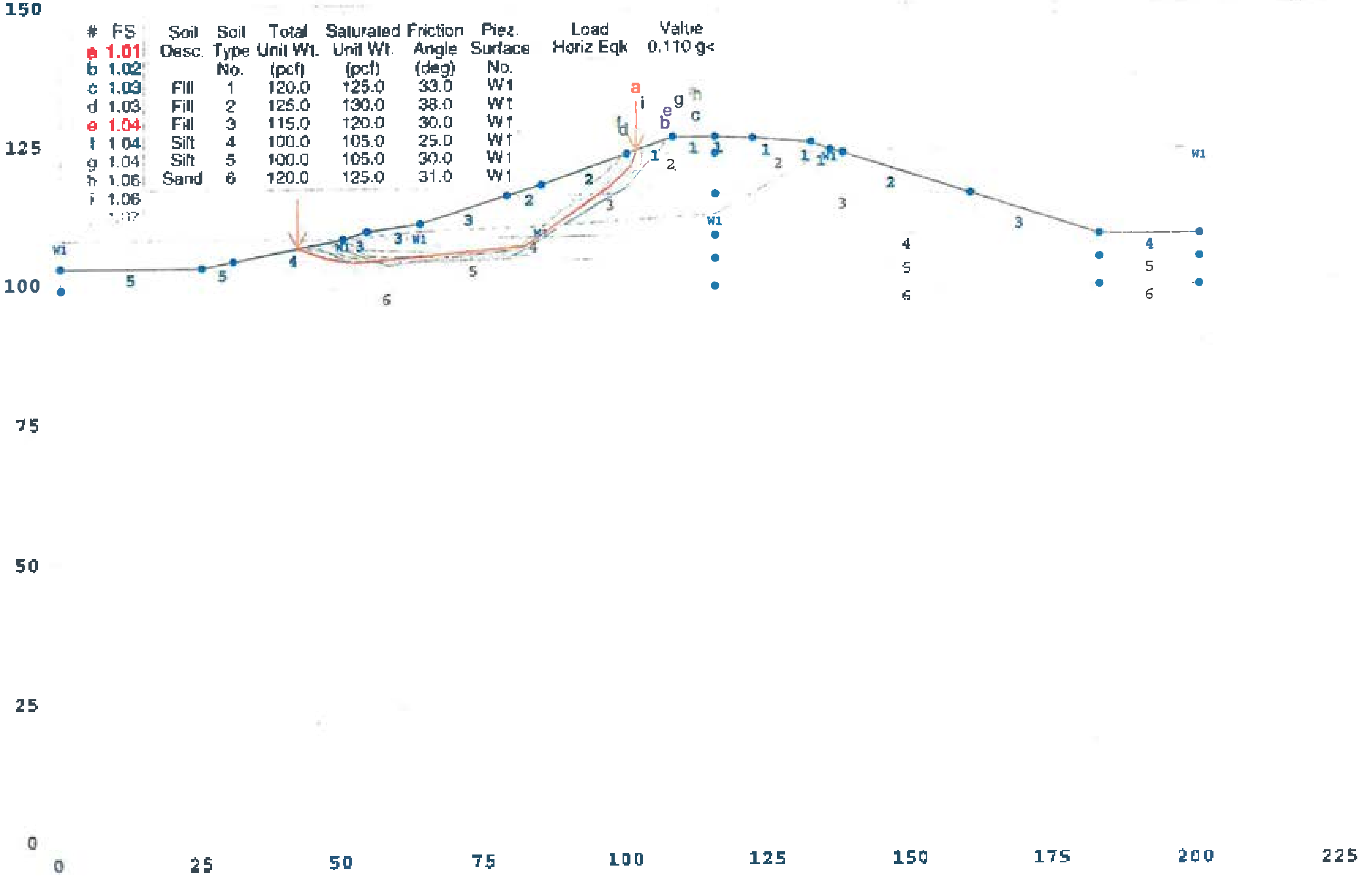
PCSTABL5M/si FSmin=1.46

Safety Factors Are Calculated By The Modified Janbu Method

STED

Sutton Plant Ash Pond Stability Section B-2 (Wedge Analysis-Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton eap inundation and stability\slope stability\b 2wedge.pl2 Run By: J. Shane Johnson, MACTEC, Inc 3/1/2011



#	FS
a	1.01
b	1.02
c	1.03
d	1.03
e	1.04
f	1.04
g	1.04
h	1.06
i	1.06
	1.07

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	125.0	33.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	115.0	120.0	30.0	W1
Silt	4	100.0	105.0	25.0	W1
Silt	5	100.0	105.0	30.0	W1
Sand	6	120.0	125.0	31.0	W1

Load	Value
Horiz Eqk	0.110 g<

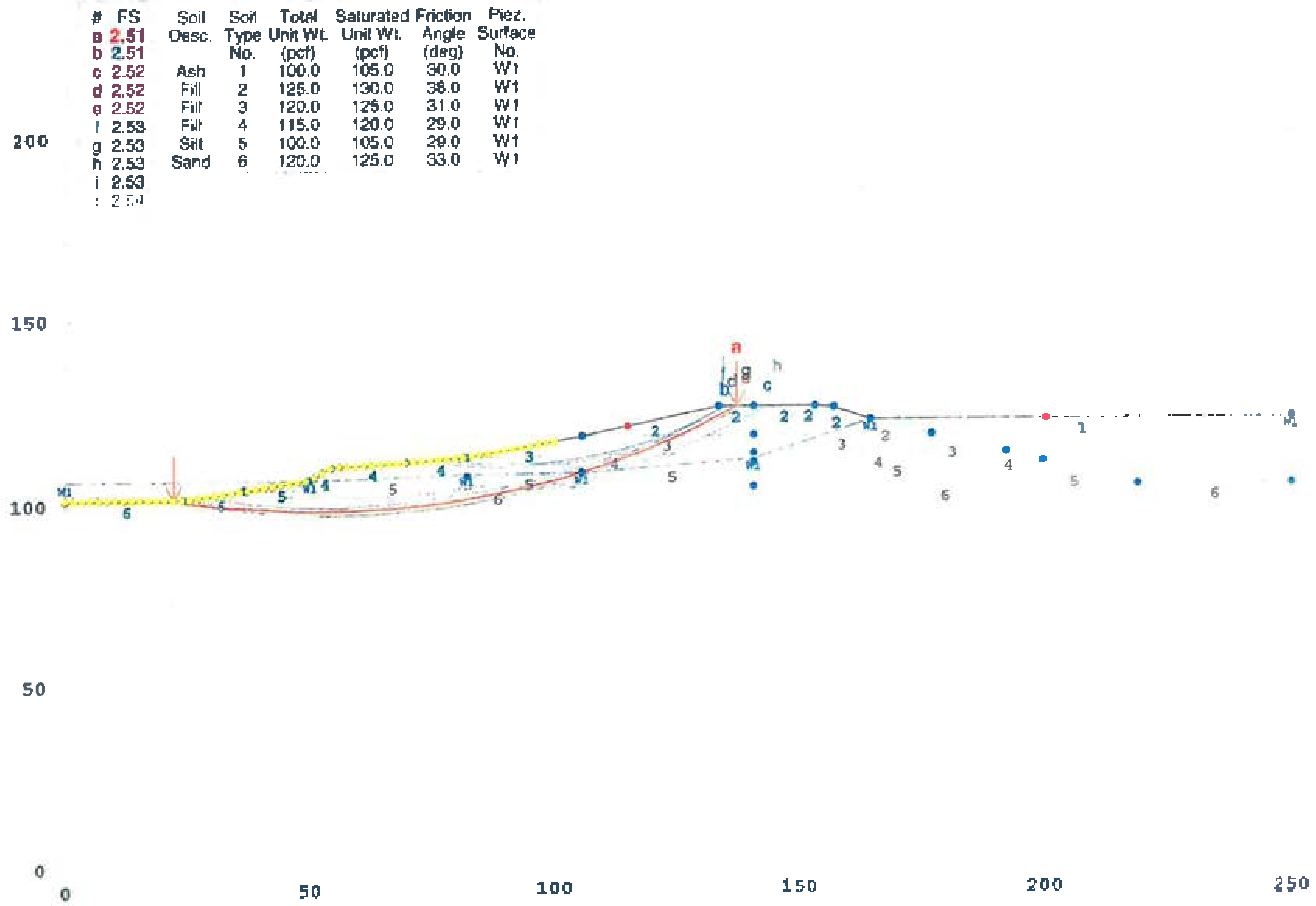
PCSTABL5M/si FSmin=1.01

Safety Factors Are Calculated By The Modified Janbu Method

STED

Sutton Plant Ash Pond Stability Section B-3 (Deep)

p:\6468\progress energy\progress energy projects 2010\sutton\6468130274 sutton cap inundation and stability\slope stability\b 1.pl2 Run By: J. Shane Johnson, MACTEC, Inc 2/2./2011



#	FS
a	2.51
b	2.51
c	2.52
d	2.52
e	2.52
f	2.53
g	2.53
h	2.53
i	2.53
j	2.54

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	30.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	120.0	125.0	31.0	W1
Fill	4	115.0	120.0	29.0	W1
Silt	5	100.0	105.0	29.0	W1
Sand	6	120.0	125.0	33.0	W1

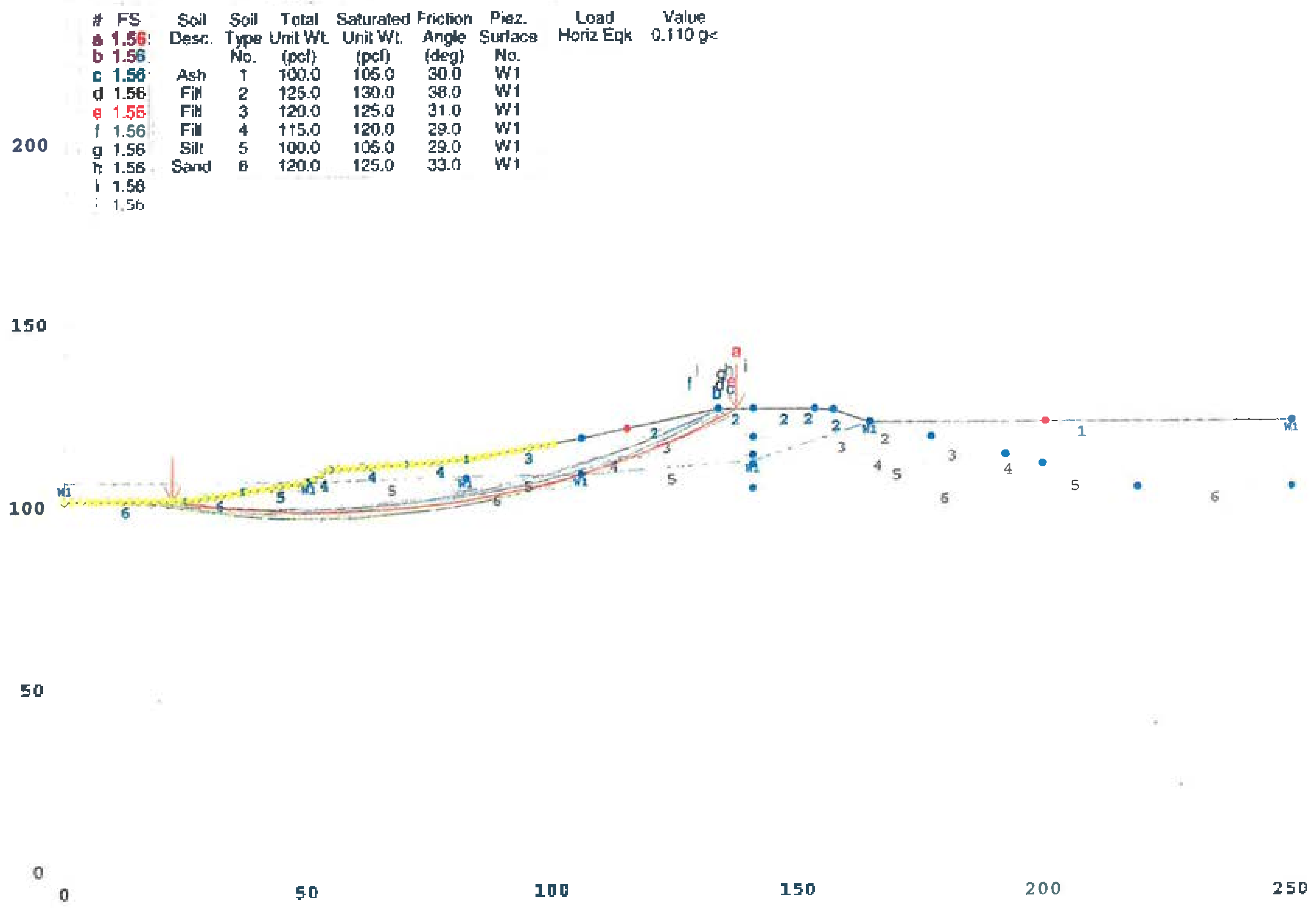
PCSTABL5M/sl FSmin=2.51

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-3 (Deep) (Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468105274 sutton eap inundation and stability\slope stability\b-3sein.pl2 Run By: J Shane Johnson, MACTEC, Inc 2/23/2011



#	FS	Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.	Load	Value
a	1.56							Horiz Eqk	0.110 g<
b	1.56								
c	1.56	Ash	1	100.0	105.0	30.0	W1		
d	1.56	Fill	2	125.0	130.0	38.0	W1		
e	1.56	Fill	3	120.0	125.0	31.0	W1		
f	1.56	Fill	4	115.0	120.0	29.0	W1		
g	1.56	Silt	5	100.0	105.0	29.0	W1		
h	1.56	Sand	6	120.0	125.0	33.0	W1		
i	1.56								
j	1.56								

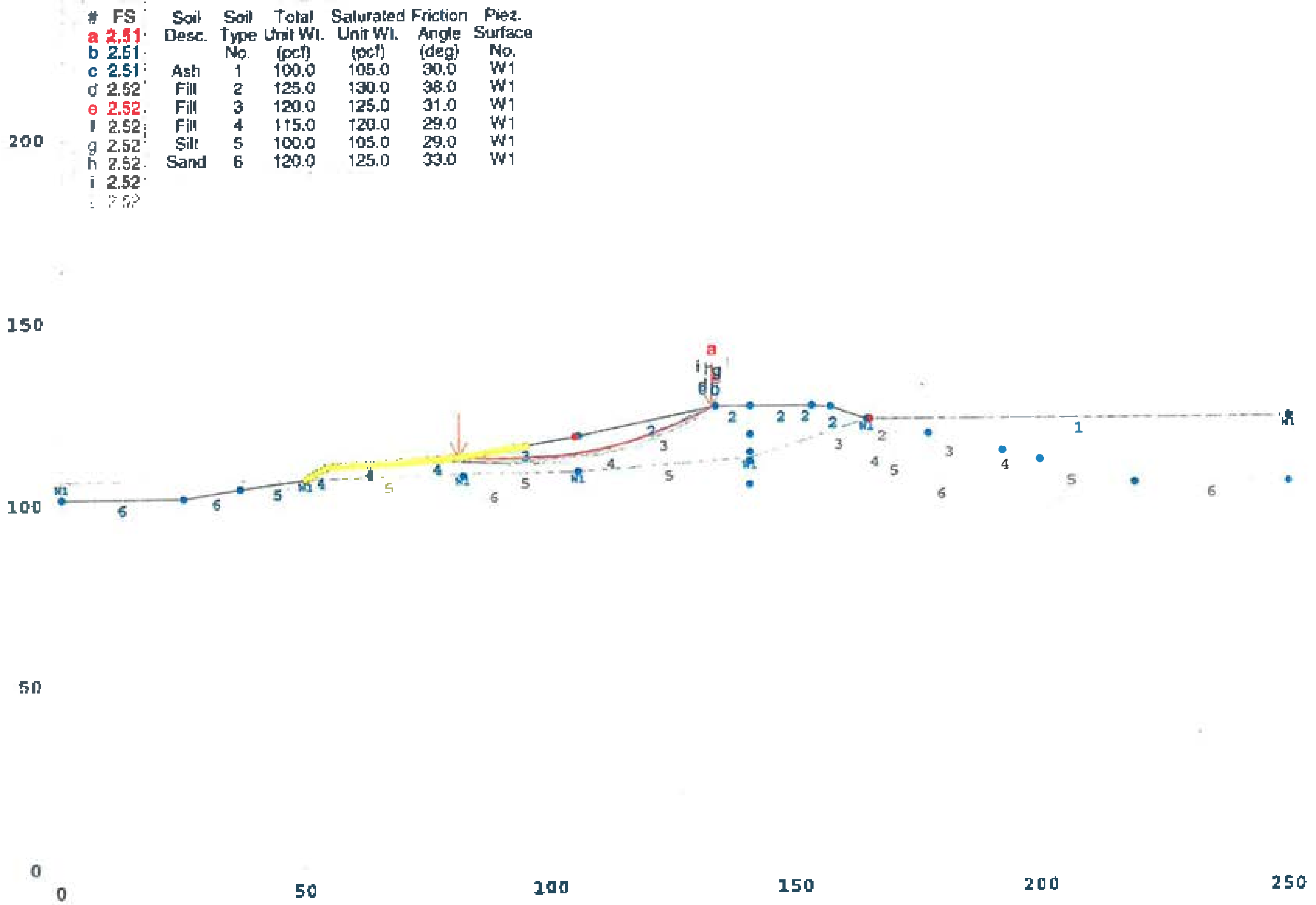
PCSTABL5M/si FSmin=1.56

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability Section B-3 (Shallow)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton cap inundation and stability\slope stability\b-3shal.pl2   Run By: J. Shane Johnson, MACTEC, Inc   2/27/2011



#	FS
a	2.51
b	2.51
c	2.51
d	2.52
e	2.52
f	2.52
g	2.52
h	2.52
i	2.52
[illegible]	2.52

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	30.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	120.0	125.0	31.0	W1
Fill	4	115.0	120.0	29.0	W1
Silt	5	100.0	105.0	29.0	W1
Sand	6	120.0	125.0	33.0	W1

PCSTABL5M/sl FSmin=2.51

Safety Factors Are Calculated By The Modified Bishop Method

STED

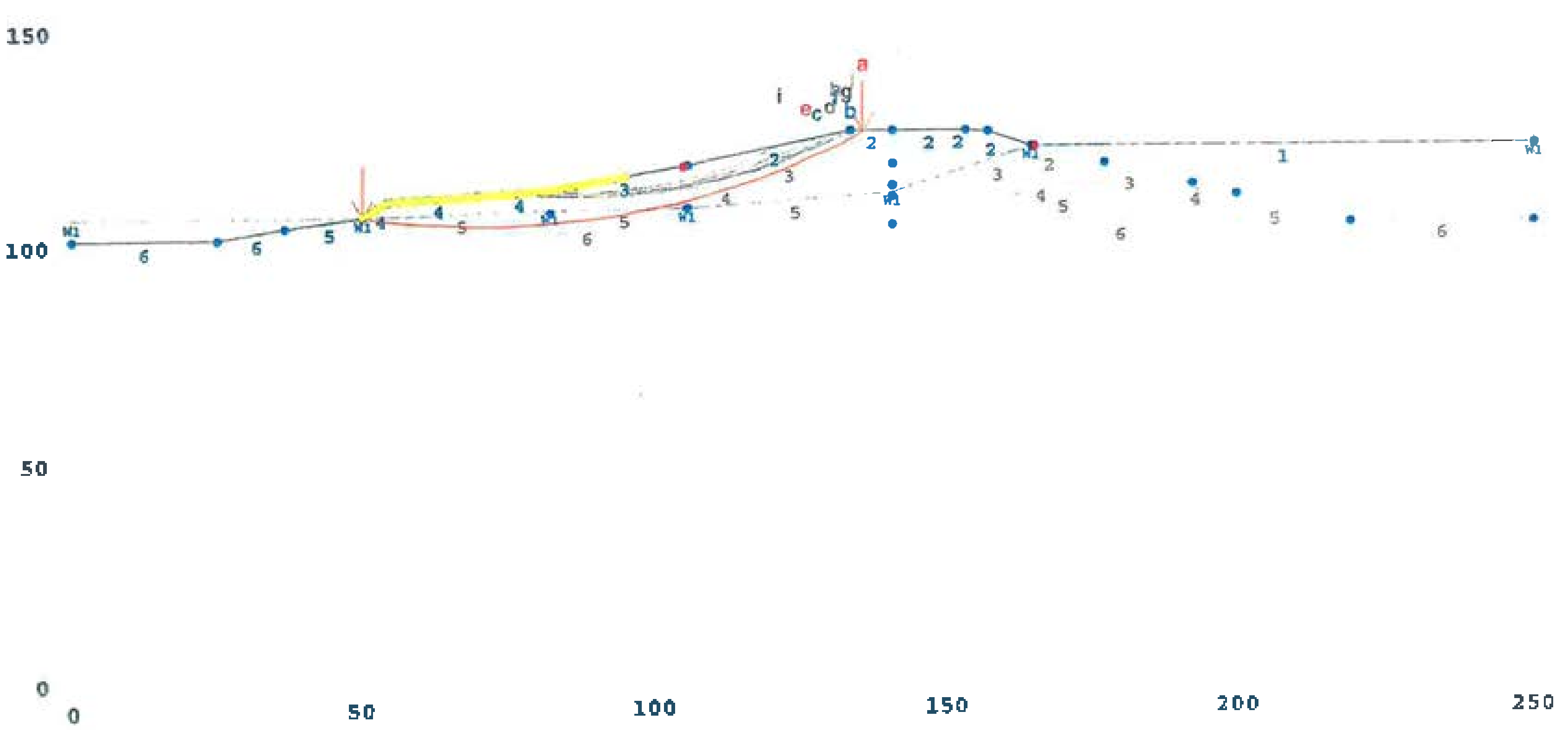
Sutton Plant Ash Pond Stability Section B-3 (Shallow) (Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton eap inundation and stability\slope stability\b-3shsei.pl2   Run By: J Shane Johnson, MACTEC, Inc   2/11/2011

#	FS
a	1.68
b	1.71
c	1.71
d	1.71
e	1.71
f	1.71
g	1.71
h	1.71
i	1.71
[illegible]	[illegible]

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Ash	1	100.0	105.0	30.0	W1
Fill	2	125.0	130.0	38.0	W1
Fill	3	120.0	125.0	31.0	W1
Fill	4	115.0	120.0	29.0	W1
Silt	5	100.0	105.0	29.0	W1
Sand	6	120.0	125.0	33.0	W1

Load	Value
Horiz Eqk	0.110 g<



PCSTABL5M/si FSmin=1.68

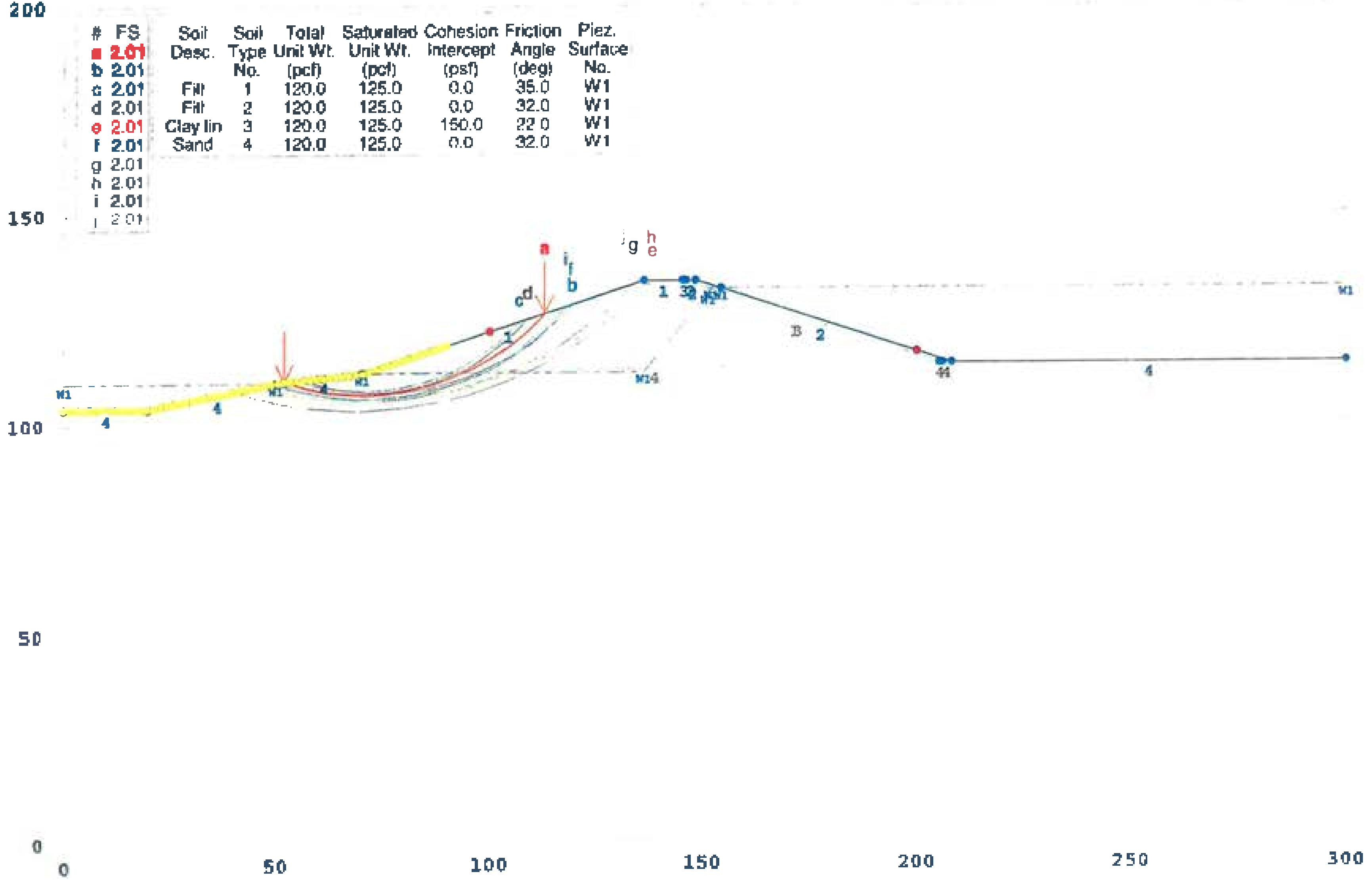
Safety Factors Are Calculated By The Modified Bishop Method

STED

APPENDIX D: 1984 ASH POND – STABILITY ANALYSIS PLOTS

Sutton Plant Ash Pond Stability 1984 Ash Pond Dike (Deep)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton cap inundation and stability\slope stability\1984deep.plz   Run By: J. Shane Johnson, MACTEC, Inc   3/2/2011



#	FS
a	2.01
b	2.01
c	2.01
d	2.01
e	2.01
f	2.01
g	2.01
h	2.01
i	2.01
j	2.01

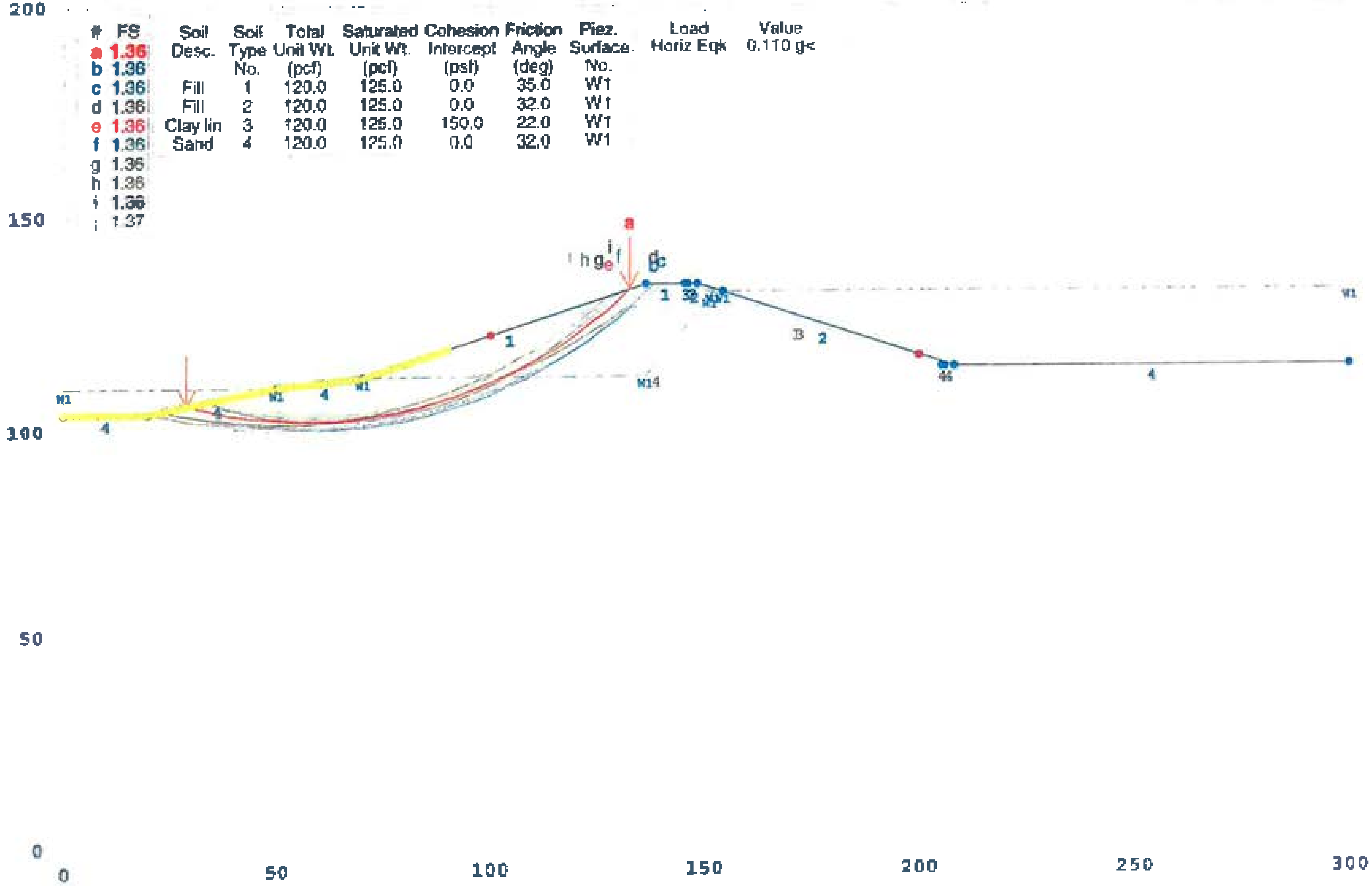
Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	125.0	0.0	35.0	W1
Fill	2	120.0	125.0	0.0	32.0	W1
Clay lin	3	120.0	125.0	150.0	22.0	W1
Sand	4	120.0	125.0	0.0	32.0	W1

PCSTABL5M/si FSmin=2.01
Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability 1984 Ash Pond Dike (Deep) (Seismic)

p:\6468\progress energy\progress energy projects 2010\sutton\6468190274 sutton eap inundation and stability\slope stability\1984deep.pl2 Run By: J. Shane Johnson, MACTEC, Inc 3/2/2011



#	FS
a	1.36
b	1.36
c	1.36
d	1.36
e	1.36
f	1.36
g	1.36
h	1.36
i	1.36
j	1.37

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface. No.
Fill	1	120.0	125.0	0.0	35.0	W1
Fill	2	120.0	125.0	0.0	32.0	W1
Clay lin	3	120.0	125.0	150.0	22.0	W1
Sand	4	120.0	125.0	0.0	32.0	W1

Load	Value
Horiz Eqk	0.110 g<

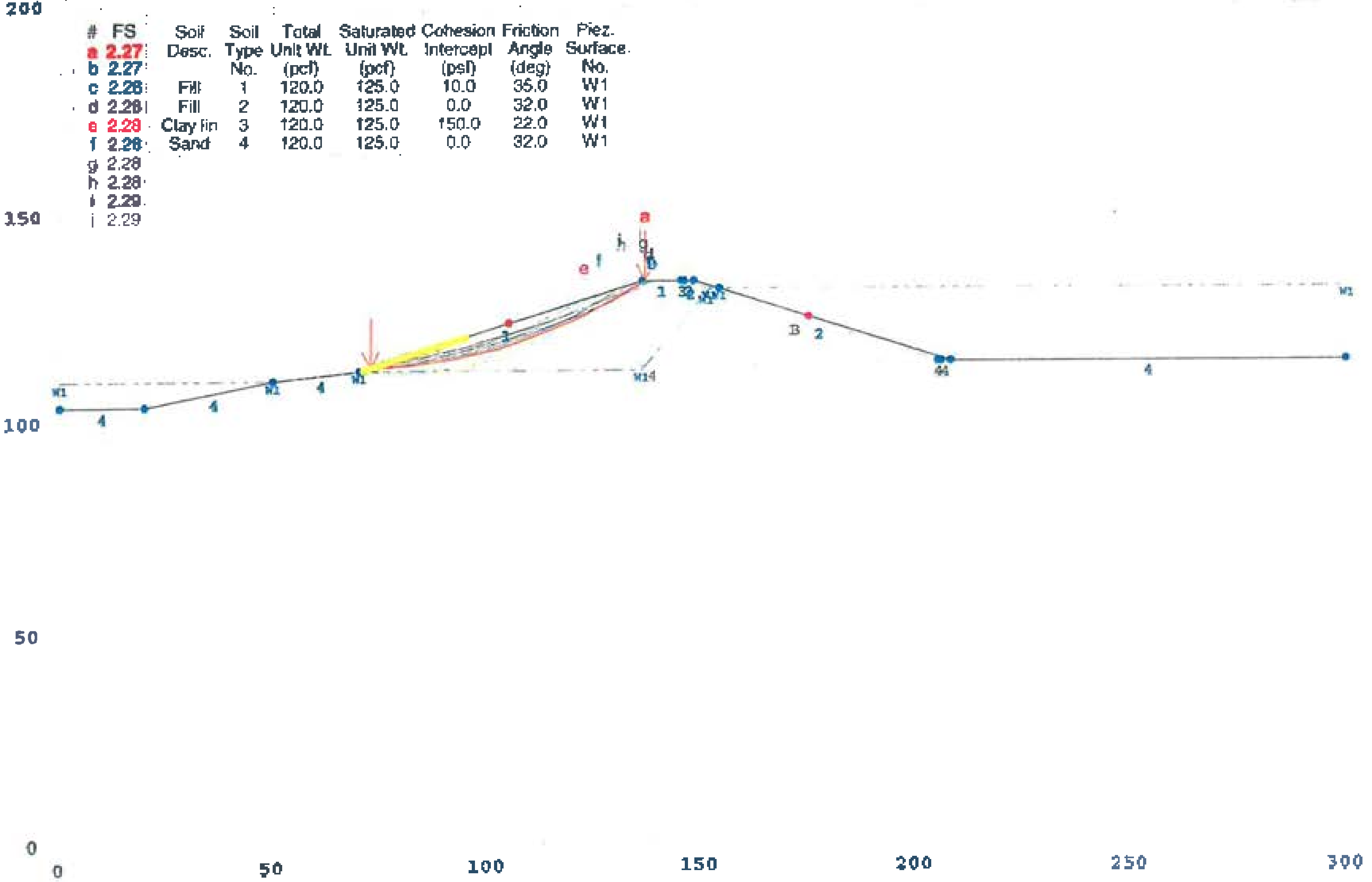
PCSTABL5M/si FSmin=1.36

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability 1984 Ash Pond Dike (Shallow)

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton cap inundation and stability\slope stability\1984shal.plz   Run By: J. Shane Johnson, MACTEC, Inc   3/2/2011



#	FS
a	2.27
b	2.27
c	2.28
d	2.28
e	2.28
f	2.28
g	2.28
h	2.28
i	2.29
j	2.29

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface. No.
Fill	1	120.0	125.0	10.0	35.0	W1
Fill	2	120.0	125.0	0.0	32.0	W1
Clay fin	3	120.0	125.0	150.0	22.0	W1
Sand	4	120.0	125.0	0.0	32.0	W1

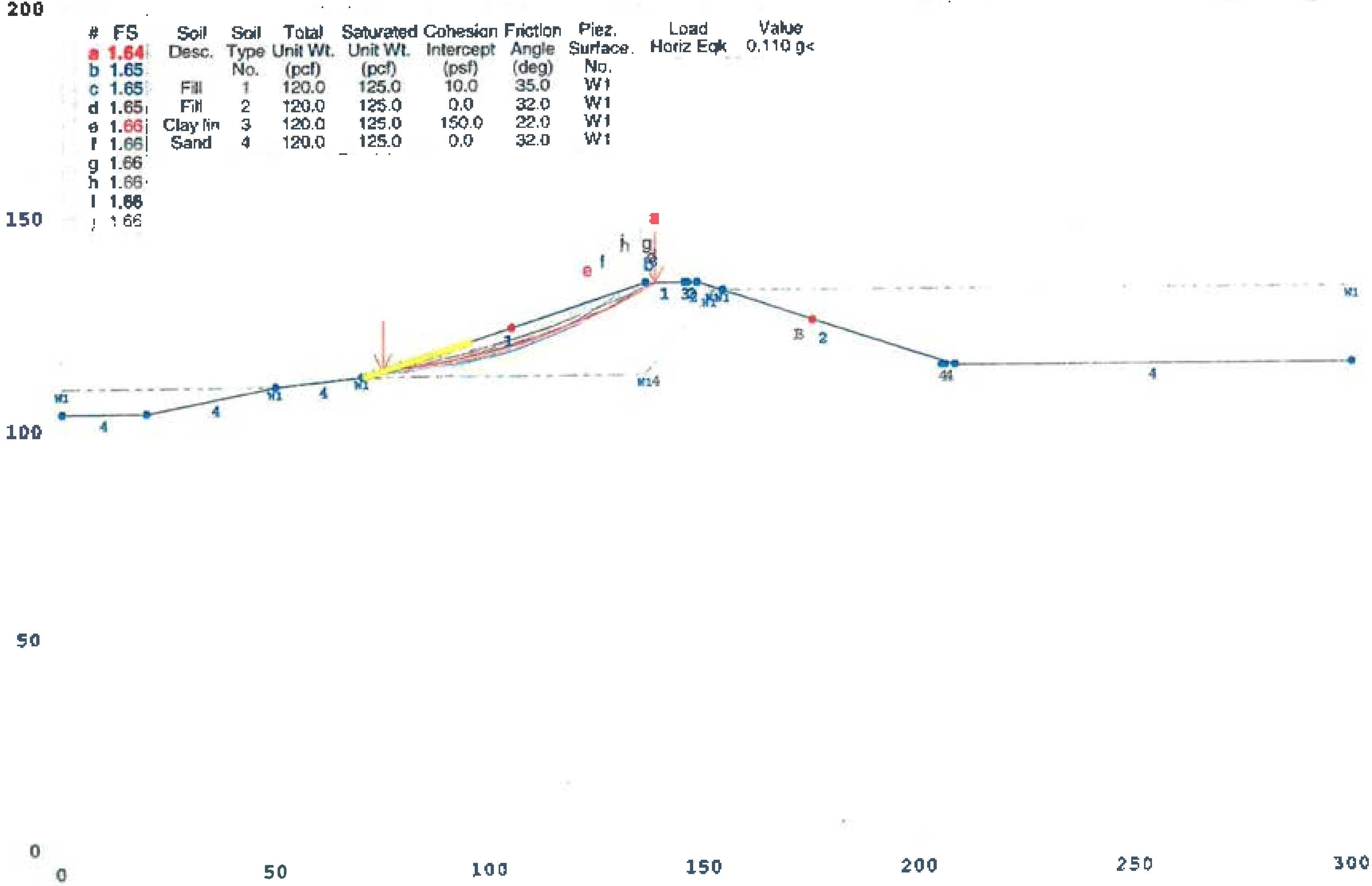
PCSTABL5M/si FSmin=2.27

Safety Factors Are Calculated By The Modified Bishop Method

STED

Sutton Plant Ash Pond Stability 1984 Ash Pond Dike (Shallow) (Seismic)

p:\6469\progress energy\progress energy projects 2010\sutton\6466150274 sutton eap inundation and stability\slope stabilty\1984shas.pl2   Run By: J. Shane Johnson, MACTEC, Inc   1/2/2011



#	FS
a	1.64
b	1.65
c	1.65
d	1.65
e	1.66
f	1.66
g	1.66
h	1.66
i	1.66
j	1.66

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface. No.
Fill	1	120.0	125.0	10.0	35.0	W1
Fill	2	120.0	125.0	0.0	32.0	W1
Clay lin	3	120.0	125.0	150.0	22.0	W1
Sand	4	120.0	125.0	0.0	32.0	W1

Load	Value
Horiz Eqk	0.110 g<

PCSTABL5M/si FSmin=1.64

Safety Factors Are Calculated By The Modified Bishop Method

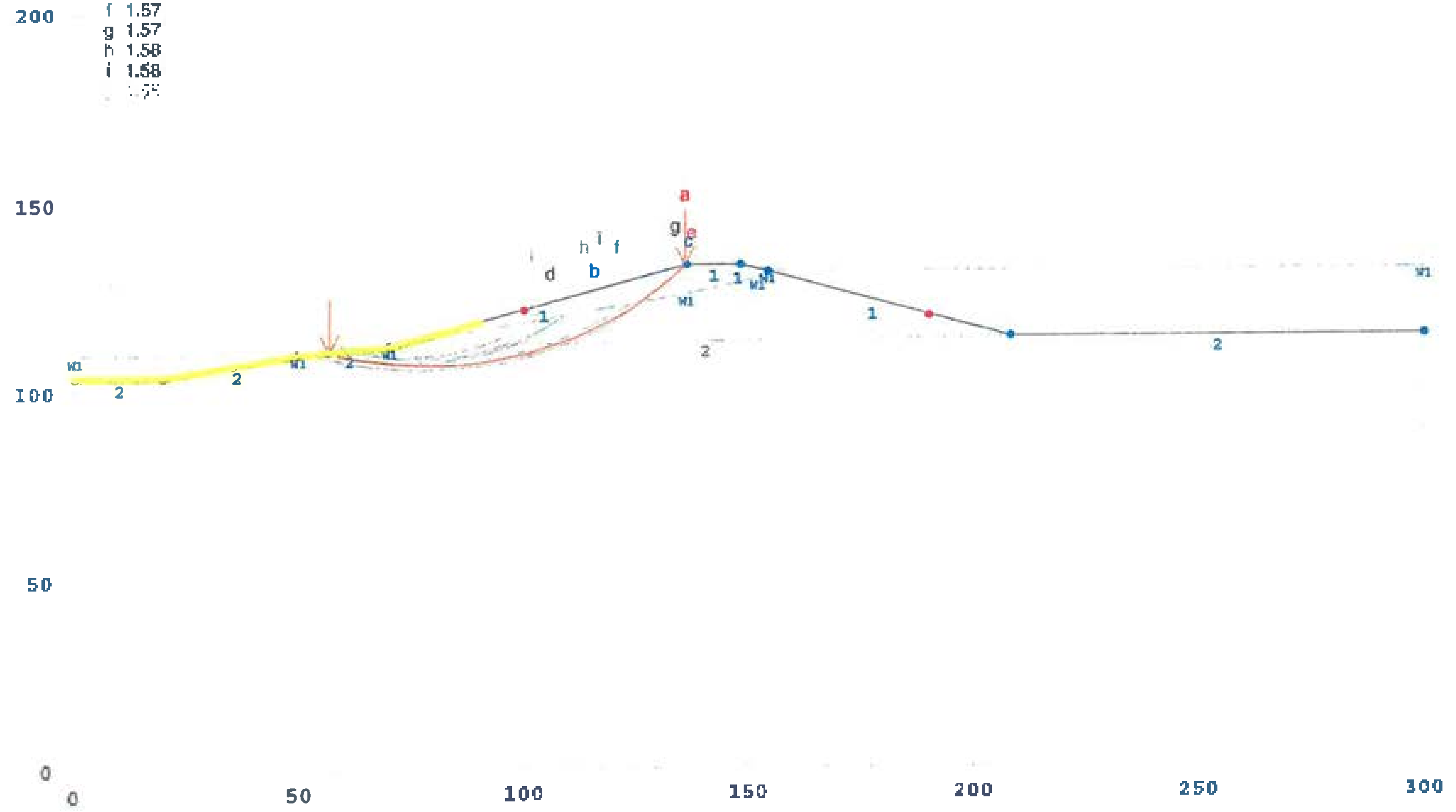
STED

Sutton Plant Ash Pond Stability 1984 Ash Pond Dike (Deep) Run 2

p:\6468\progress energy\progress energy projects 2010\sutton\6468100274 sutton eap inundation and stability\slope stability\1984dee2.pl2 Run By: J. Shane Johnson, MACTEC, Inc 7/21/2011

#	FS
a	1.57
b	1.57
c	1.57
d	1.57
e	1.57
f	1.57
g	1.57
h	1.58
i	1.58
	1.58

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Friction Angle (deg)	Piez. Surface No.
Fill	1	120.0	125.0	35.0	W1
Sand	2	120.0	125.0	32.0	W1



PCSTABL5M/si FSmin=1.57
Safety Factors Are Calculated By The Modified Bishop Method

STED

APPENDIX E: SEISMIC SITE CLASS AND PEAK GROUND ACCELERATION CALCULATIONS – FOR STABILITY AND LIQUEFACTION POTENTIAL EVALUATION

6468-10-0274
J Veith
2/18/11

Sutton Ash Pond Liquefaction
LAT 34.292040
LON -77.993119

		DSHA	PSHA	Recommended	~~M_w~~	~~a_{max}~~
Wilmington 1.98	PGA	0.095	0.118	0.118		
mi to NE	S_s	0.218	0.247	0.247		
	S_1	0.070	0.078	0.078		
	Site Class			D		
	M_w			7.3		
	a_{max}			$\boxed{0.105}$		

0.11 used for Seismic Stability Analysis
JST 3/4/11

GLE 4.06
mi to NE

	DSHA	PHA	Reccommend
PGA	0.106	0.111	0.111
S_s	0.225	0.240	0.240
S_1	0.071	0.093	0.093
Site Class			D
M_w			7.3
a_{max}			0.102

Project Name Sutton Ash Dike
Project No. [illegible]
Location Wilmington, NC
Boring No. B-1
Depth to Groundwater (ft) 15
Analysis Groundwater Depth (ft) 10
Date [illegible]
Hole Diameter 4
Hammer Type (safety = 1, auto = 2) 2 ER = 85 %
Sampler Type C_S = 1 for standard 1.5" samplers
= 1.2 for 1.5" sampler w/o liners C_S = 1

Site Class D
S_s 0.243
S_1 0.078
F_a
F_v
M_w 7.3
a_{max} used in calculation 0.105

T_{req} 2475 yrs
S_{MS} 0.000 = F_a S_s
S_{M1} 0.000 = F_v S_1
S_{DS} 0.000 = 2/3 * S_{MS}
S_{D1} 0.000 = 2/3 * S_{M1}

2006 IBC a_{max} 0.000 =0.4*S_{DS}
VA. Tech a_{max} #DIV/0! = [0.0606*(Fa*S1)^2]/(Fv*S1) + 0.267*Fa*Ss

🟨 Data from Wilmington Project, 1.98 mi to northeast of Sutton
🟧 From GLE project

Input by Veith Date 2/18/2011
Checked by Date:

1	2	3	4	4A	5	6	7	7A	8	9	10	11	12	13	14	15	16	17	18	18A	19	19A	20	21	22	23	24
Sample Depth (ft)	N-Value Depth (ft)	N_m (bpf)	USCS	SAND or CLAY	γ_m (pcf)	FC (%)	P_o (psf)	U_o (psf)	P_o' (psf)	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60}$ (bpf)	Alpha	Beta	$(N_1)_{60cs}$ (bpf)	r_d	f_d	K_{sigma}	U_A (psf)	P'_{oA} (psf)	CSR	$CRR_{7.5}$	MSF	FS
0-1.5	1	27	SM	SAND	120	5	120	-	120	1.70	0.75	1.42	1.00	1.0	48.8	-	1.00	48.8	0.998	0.600	1.00	-	120	0.068	1.357	1.093	N.L.
3.5-5	4.5	100	SM	SAND	150	5	645	-	645	1.70	0.75	1.42	1.00	1.0	180.6	-	1.00	180.6	0.990	0.600	1.00	-	645	0.068	2.333	1.093	N.L.
6-7.5	7	72	SM	SAND	140	5	995	-	995	1.46	0.75	1.42	1.00	1.0	111.7	-	1.00	111.7	0.984	0.600	1.00	-	995	0.067	1.822	1.093	N.L.
8.5-10	9.5	75	SM	SAND	140	5	1,345	-	1,345	1.25	0.80	1.42	1.00	1.0	106.3	-	1.00	106.3	0.978	0.600	1.00	-	1,345	0.067	1.782	1.093	N.L.
11-12.5	12	43	SM	SAND	130	5	1,670	-	1,670	1.13	0.85	1.42	1.00	1.0	58.5	-	1.00	58.5	0.972	0.600	1.00	125	1,545	0.072	1.428	1.093	21.7
13.5-15	14.5	28	SM	SAND	120	5	1,970	-	1,970	1.04	0.85	1.42	1.00	1.0	35.1	-	1.00	35.1	0.966	0.600	1.00	281	1,689	0.077	1.255	1.093	17.8
16-17.5	17	14	SM	SAND	120	2	2,270	125	2,145	0.99	0.85	1.42	1.00	1.0	16.7	-	1.00	16.7	0.960	0.694	1.00	437	1,833	0.081	0.178	1.093	2.4
18.5-20	19.5	14	SM	SAND	120	2	2,570	281	2,289	0.96	0.95	1.42	1.00	1.0	18.1	-	1.00	18.1	0.955	0.683	1.00	593	1,977	0.085	0.193	1.093	2.5
23.5-25	24.5	14	SM	SAND	120	2	3,170	593	2,577	0.91	0.95	1.42	1.00	1.0	17.1	-	1.00	17.1	0.943	0.691	0.98	905	2,265	0.090	0.182	1.093	2.2
28.5-30	29.5	14	SM	SAND	120	2	3,770	905	2,865	0.86	0.95	1.42	1.00	1.0	16.2	-	1.00	16.2	0.931	0.698	0.94	1,217	2,553	0.094	0.172	1.093	1.9

Column 4A - Use SAND for SC, SM, SP, GW, GM or combinations. Use CLAY for ML, CL, MH, CH or combinations, or PWR or Rock.
Column 24 - N.L. = non liquefiable because soil has "CLAY" designation, or sample is above the water table.
☐ Enter data into all colored cells

Column No.

1 Sample depth
2 depth to N-value
3 Field N-value, blows per foot
4 USCS designation, input for informational purposes only.
4A "SAND" for SC, SM, SP, GW, GM or combinations. "CLAY" for ML, CL, MH, CH or combinations, or PWR or Rock.
5 Total soil unit weight at N-Value depth, pounds per cubic foot
6 FC - fines content, percent passing the number 200 sieve.
7 P_T - total overburden pressure, pounds per square foot
7A Porewater pressure based on depth to water at time of drilling, pounds per square foot
8 P_0' - effective overburden pressure at N-value depth, pounds per square foot
9 C_N - N-value correction factor for for depth. Max $C_N = 1.7$. $C_N = (2116/P_0')^{0.5}$
10 C_R - N-value correction factor for rod weight based on sample depth. Assumes 2 ft rod stickup.
= 0.75 for Rod length < 10 ft.
= 0.80 for Rod Length <13 ft.
= 0.85 for Rod Length <20 ft.
= 0.95 for Rod Length <33 ft
= 1.0 for Rod Length >33 ft.
11 C_E - N-value correction factor for hammer type. $C_E = 1$ for safety hammer, $C_E = 0.75$ for automatic hammer
12 C_B - N-value correction factor for borehole size. $C_B = 1$ for H.S.A. inside diameter or mud-rotary between 2.5 and 4.5
13 C_S - N-value correction factor for sampler type. $C_S = 1$ for standard 1-3/8" IDsampler, $C_S = 1.2$ for 1-1/2" ID sampler without liners
14 $(N_1)_{60}$ - N-value, blows per foot for depth, corrected for rod weight, hammer energy, borehole size, and sampler type
15 Alpha - correction factor constant for fines content
16 Beta - correction factor constant for fines content
17 $(N_1)_{60CS}$ - $(N_1)_{60}$-value corrected for fines content, blows per foot
18 r_d - stress reduction factor based on depth
18A f - function of site conditions used in calculating K_{sigma}

N1(60)	f
0	0.8
7.1	0.8
16	0.7
28.4	0.6
625	0.6

19 K_{sigma} - overburden correction factor
19A Porewater pressure based on analysis depth to water, psf
20 P_{ogw}' - effective overburden pressure at ground-water analysis depth, pounds per cubic foot
21 CSR - cyclic stress ratio
22 $CRR_{7.5}$ - cyclic resistance ratio for magnitude 7.5 earthquake
23 MSF - magnitude scaling factor. for Mw<7.5 MSF =$(Mw/7.5)^{11}$, Mw>=7.5 MSF = $10^{2.24}/Mw^{2.56}$
24 FS = $(CRR_{7.5} * K_{sigma} * MSF) / CSR$

Project Name: Sutton Ash Lake
Project No.: 6468-10-0274
Location: Wilmington, NC
Boring No.: B-2
Depth to Groundwater (ft): 15
Analysis Groundwater Depth (ft): 10
Date: 08/25/09
Hole Diameter: 4
Hammer Type (safety = 1, auto = 2): 2 ER = 85 %
Sampler Type C_S = 1 for standard D-1586 sampler
= 1.2 for D-1586 sampler w/o liners C_S = 1

Site Class: D
S_s: 0.247
S_1: 0.078
F_a:
F_v:
M_w: 7.3
a_{max} used in calculation: 0.105

Freq: 2%/50 yrs
S_{MS}: 0.000 = F_a*S_s
S_{M1}: 0.000 = F_v*S_1
S_{DS}: 0.000 = 2/3 * S_{MS}
S_{D1}: 0.000 = 2/3 * S_{M1}

2006 IBC a_{max} 0.000 =0.4*S_{DS}
VA. Tech a_{max} #DIV/0! =[0.0606*(Fa*S1)^2/(Fv*S1) + 0.267*Fa*Ss

🟨 Data from Williard Project 1.98 mi to northeast of Sutton
🟧 From GEL project

Input by: Venh Date: 2/18/2011
Checked by: Date:

1	2	3	4	4A	5	6	7	7A	8	9	10	11	12	13	14	15	16	17	18	18A	19	19A	20	21	22	23	24
Sample Depth (ft)	N-Value Depth (ft)	N_m (bpf)	USCS	SAND or CLAY	γ_{tot} (pcf)	FC (%)	P_o (psf)	U_o (psf)	P_o' (psf)	C_N	C_E	C_r	C_B	C_S	$(N_1)_{60}$ (bpf)	Alpha	Beta	$(N_1)_{60cs}$ (bpf)	r_d	f_d	K_{sigma}	U_x (psf)	P'_{vdes} (psf)	CSR	$CRR_{7.5}$	MSF	FS
0-1.5	1	28	SM	SAND	120	5	120	-	120	1.70	0.75	1.42	1.00	1.0	50.6	-	1.00	50.6	0.998	0.600	1.00	-	120	0.068	1.370	1.093	N.L.
3.5-5	4.5	55	SM	SAND	140	5	610	-	610	1.70	0.75	1.42	1.00	1.0	99.3	-	1.00	99.3	0.990	0.600	1.00	-	610	0.068	1.731	1.093	N.L.
6-7.5	7	66	SM	SAND	140	5	960	-	960	1.48	0.75	1.42	1.00	1.0	103.8	-	1.00	103.8	0.984	0.600	1.00	-	960	0.067	1.764	1.093	N.L.
8.5-10	9.5	57	SM	SAND	140	5	1,310	-	1,310	1.27	0.80	1.42	1.00	1.0	82.0	-	1.00	82.0	0.978	0.600	1.00	-	1,310	0.067	1.602	1.093	N.L.
11-12.5	12	8	SM	SAND	110	25	1,585	-	1,585	1.16	0.85	1.42	1.00	1.0	11.2	4.29	1.12	16.8	0.972	0.754	1.00	125	1,460	0.072	0.179	1.093	2.7
13.5-15	14.5	5	SM	SAND	110	25	1,860	-	1,860	1.07	0.85	1.42	1.00	1.0	6.4	4.29	1.12	11.4	0.966	0.800	1.00	281	1,579	0.078	0.126	1.093	1.8
16-17.5	17	8	SM	SAND	110	25	2,135	125	2,010	1.03	0.85	1.42	1.00	1.0	9.9	4.29	1.12	15.3	0.960	0.769	1.00	437	1,698	0.082	0.163	1.093	2.2
18.5-20	19.5	1	MH	CLAY	90	80	2,360	281	2,079	1.01	0.95	1.42	1.00	1.0	1.4	5.00	1.20	6.7	0.955	0.800	1.00	593	1,767	0.087	0.085	1.093	N.L.
23.5-25	24.5	7	MH	CLAY	110	80	2,910	593	2,317	0.96	0.95	1.42	1.00	1.0	9.0	5.00	1.20	15.8	0.943	0.779	1.00	905	2,005	0.093	0.168	1.093	N.L.
28.5-30	29.5	15	SM	SAND	120	5	3,510	905	2,605	0.90	0.95	1.42	1.00	1.0	18.2	-	1.00	18.2	0.931	0.682	0.97	1,217	2,293	0.097	0.194	1.093	2.1
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.

Column 4A - Use SAND for SC, SM, SP, GW, GM or combinations. Use CLAY for ML, CL, MH, CH or combinations, or PWR or Rock.
Column 24 - N.L. = non liquefiable because soil has "CLAY" designation or sample is above the water table.
☐ Enter data into all colored cells

Project Name: Sutton Ash Dike
Project No.: 6468-10-8224
Location: Wilmington, NC
Boring No.: B-3
Depth to Groundwater (ft): 15
Analysis Groundwater Depth (ft): 10
Date: 10/25/09
Hole Diameter: 4
Hammer Type (safety = 1, auto = 2): 2 ER = 85 %
Sampler Type: C_s = 1 for standard D-1586 sampler
= 1.2 for LS sampler w/o liners C_s 1

Site Class: D
S_s: 0.247
S_1: 0.078
F_a:
F_v:
M_w: 7.3
a_{max} used in calculation: 0.105

Freq: 2%/50 yrs
S_{MS}: 0.000 = Fa*Ss
S_{M1}: 0.000 = Fv*S1
S_{DS}: 0.000 = 2/3 * S_{MS}
S_{D1}: 0.000 = 2/3 * S_{M1}

2006 IBC a_{max} 0.000 =0.4*S_{DS}
VA. Tech a_{max} #DIV/0! = [0.0606*(Fa*S1)^2/(Fv*S1) + 0.267*Fa*Ss

🟨 Data from WilSam Project, 1.98 mi to northeast of Sutton
🟧 From GLE project

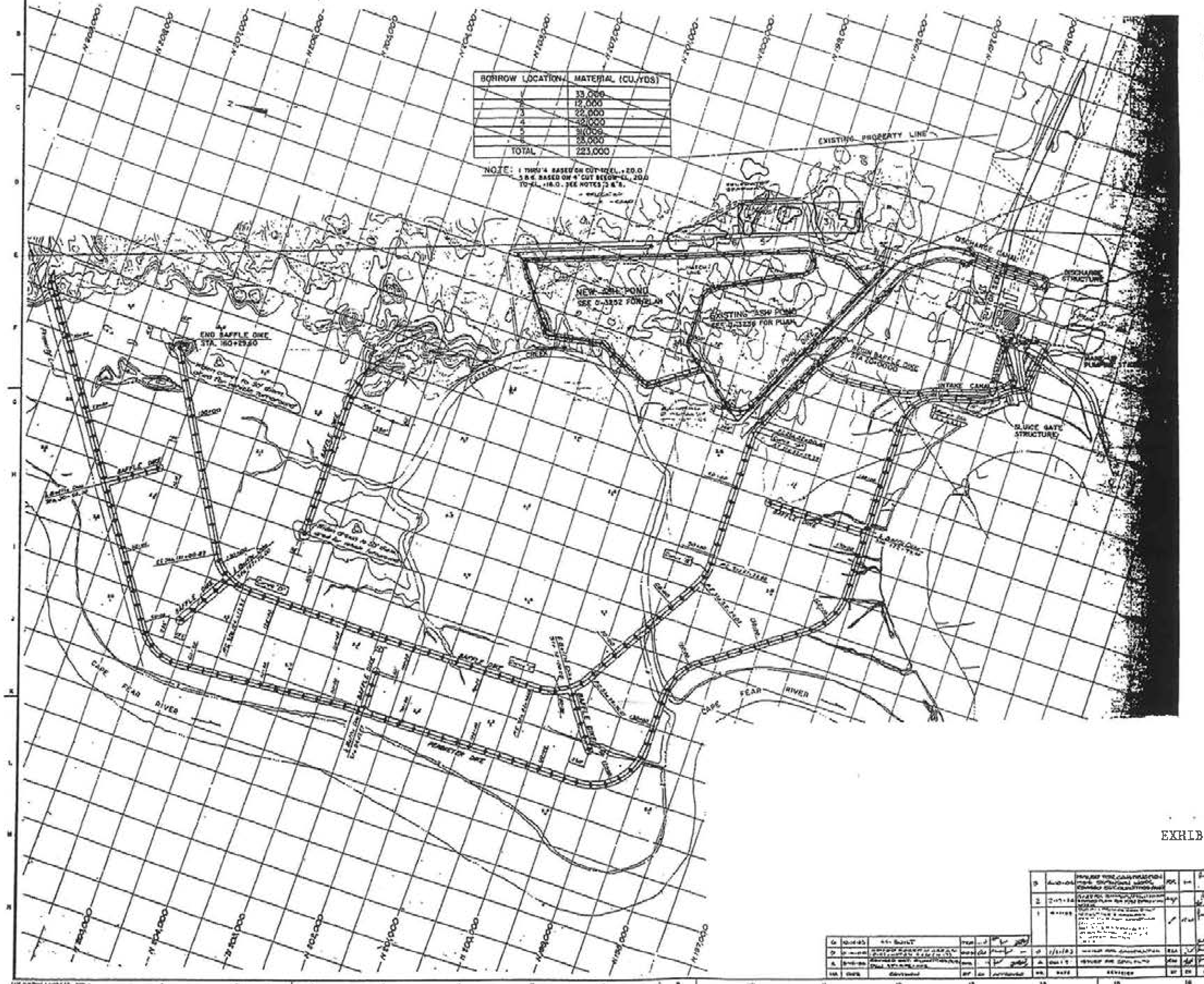
Input by: Veeh Date: 2/16/2011
Checked by: Date:

1	2	3	4	4A	5	6	7	7A	8	9	10	11	12	13	14	15	16	17	18	18A	19	19A	20	21	22	23	24
Sample Depth (ft)	N-Value Depth (ft)	N_m (bpf)	USCS	SAND or CLAY	γ_{tot} (pcf)	FC (%)	P_o (psf)	U_o (psf)	P_o' (psf)	C_N	C_R	C_E	C_B	C_S	$(N_1)_{60}$ (bpf)	Alpha	Beta	$(N_1)_{60CS}$ (bpf)	r_d	f_d	K_{sigma}	U_A (psf)	P'_{oA} (psf)	CSR	$CRR_{7.5}$	MSF	FS
0-1.5	1	54	SM	SAND	140	5	140	-	140	1.70	0.75	1.42	1.00	1.0	97.5	-	1.00	97.5	0.998	0.600	1.00	-	140	0.068	1.717	1.093	N.L.
3.5-5	4.5	80	SM	SAND	140	5	630	-	630	1.70	0.75	1.42	1.00	1.0	144.5	-	1.00	144.5	0.990	0.600	1.00	-	630	0.068	2.065	1.093	N.L.
6-7.5	7	61	SM	SAND	140	5	980	-	980	1.47	0.75	1.42	1.00	1.0	95.3	-	1.00	95.3	0.984	0.600	1.00	-	980	0.067	1.701	1.093	N.L.
8.5-10	9.5	14	SM	SAND	120	5	1,280	-	1,280	1.29	0.80	1.42	1.00	1.0	20.5	-	1.00	20.5	0.978	0.664	1.00	-	1,280	0.067	0.222	1.093	N.L.
11-12.5	12	7	SM	SAND	110	25	1,555	-	1,555	1.17	0.85	1.42	1.00	1.0	9.9	4.29	1.12	15.3	0.972	0.769	1.00	125	1,430	0.072	0.163	1.093	2.5
13.5-15	14.5	2	SM	SAND	100	29	1,805	-	1,805	1.08	0.85	1.42	1.00	1.0	2.6	4.64	1.15	7.6	0.966	0.800	1.00	281	1,524	0.078	0.093	1.093	1.3
16-17.5	17	6	ML	CLAY	110	81	2,080	125	1,955	1.04	0.85	1.42	1.00	1.0	7.5	5.00	1.20	14.0	0.960	0.796	1.00	437	1,643	0.083	0.150	1.093	N.L.
18.5-20	19.5	5	ML	CLAY	110	81	2,355	281	2,074	1.01	0.95	1.42	1.00	1.0	6.8	5.00	1.20	13.2	0.955	0.800	1.00	593	1,762	0.087	0.142	1.093	N.L.
23.5-25	24.5	25	SM	SAND	120	5	2,955	593	2,362	0.95	0.95	1.42	1.00	1.0	32.0	-	1.00	32.0	0.943	0.600	1.00	905	2,050	0.093	0.732	1.093	8.6
28.5-30	29.5	17	SM	SAND	120	5	3,555	905	2,650	0.89	0.95	1.42	1.00	1.0	20.4	-	1.00	20.4	0.931	0.665	0.97	1,217	2,338	0.097	0.220	1.093	2.4
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.
					-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N.L.

Column 4A - Use SAND for SC, SM, SP, GW, GM or combinations. Use CLAY for ML, CL, MH, CH or combinations or PWR or Rock.
Column 24 - N.L. = non liquefiable because soil has CLAY designation or sample is above the water table.
☐ Enter data into all colored cells

APPENDIX F: ASH POND REFERENCE DRAWING INFORMATION (from 2007 5-Year Inspection Report)

- Exhibit 2 – CP&L, Ash Pond Expansion (1983-1984), Site Plan, Drawing D-3235
- Exhibit 3 – B&R, Ash Disposal Ponds, North Pond-Discharge Structure, Drawing G-3177B
- Exhibit 4 - CP&L, Ash Pond Expansion (1983-1984), Plan - Sheet 1, Drawing No. obscured
- Exhibit 5 - CP&L, Ash Pond Expansion (1983-1984), Plan – Sheet 2, Drawing No. obscured
- Exhibit 6 - CP&L, Ash Pond Expansion (1983-1984), Dike Sections (Sheet 1), Drawing D-3237
- Exhibit 7 - CP&L, Ash Pond Expansion (1983-1984), Dike Sections (Sheet 2), Drawing D-3239
- Exhibit 8 - CP&L, Ash Pond Expansion (1983-1984), Sections & Details (Sheet 1), Drawing D-3238



BORROW LOCATION	MATERIAL (CU. YDS)
1	33,000
2	12,000
3	22,000
4	42,000
5	81,000
6	33,000
TOTAL	223,000

NOTE: 1 THRU 4 BASED ON CUT TO EL. +20.0
5 & 6 BASED ON 4' CUT BELOW EL. 20.0
TO EL. +16.0. SEE NOTES 3 & 5.

ESTIMATED QUANTITIES
(NET IN FIELD)

ITEM	1984 SCOPE (UNIT 2)	[illegible]	NOTES
1. CLEARING	[illegible]	[illegible]	
2. EXCAVATION	[illegible] CY (SEE NOTE 4)	[illegible]	[illegible]
3. FILL	[illegible] CY	[illegible]	[illegible]
4. CRUSHED STONE	[illegible] CY	—	[illegible]
5. SEEDING	[illegible] ACRES	[illegible]	
[illegible]	1,400 TON		
[illegible]	[illegible] CY		
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
10. [illegible]	67 ACRES	—	[illegible]
11. [illegible] FILL	[illegible] CY	—	[illegible]

GENERAL NOTES

1. [illegible]

2. [illegible]

3. [illegible]

4. [illegible]

5. [illegible]

6. [illegible]

LIST OF DRAWINGS

D-3235 [illegible]
D-3237 [illegible]
D-3238 [illegible]
[illegible]
D-3252 [illegible]
[illegible]

REFERENCE DRAWINGS

[illegible]

SPECIFICATIONS

[illegible]

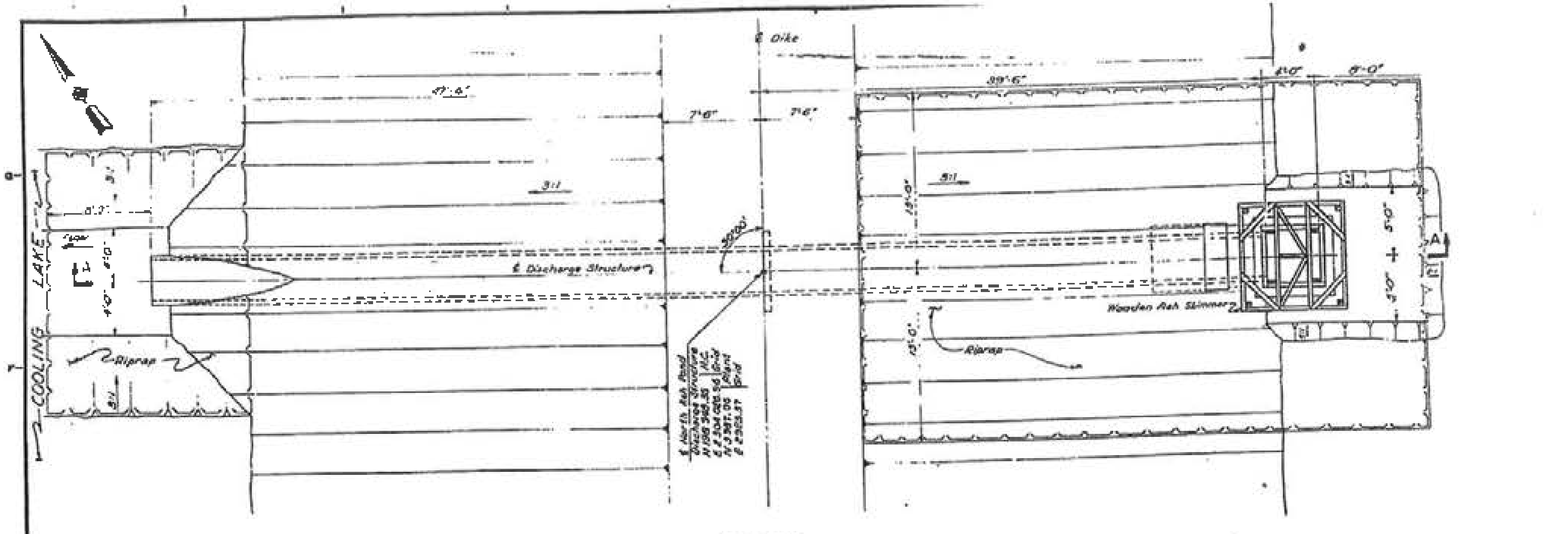
EXHIBIT 2

NO.	DATE	REVISION	BY	CH	APPROVED
6	[illegible]	AS BUILT	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	1/11/83	[illegible]	[illegible]	[illegible]	[illegible]
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

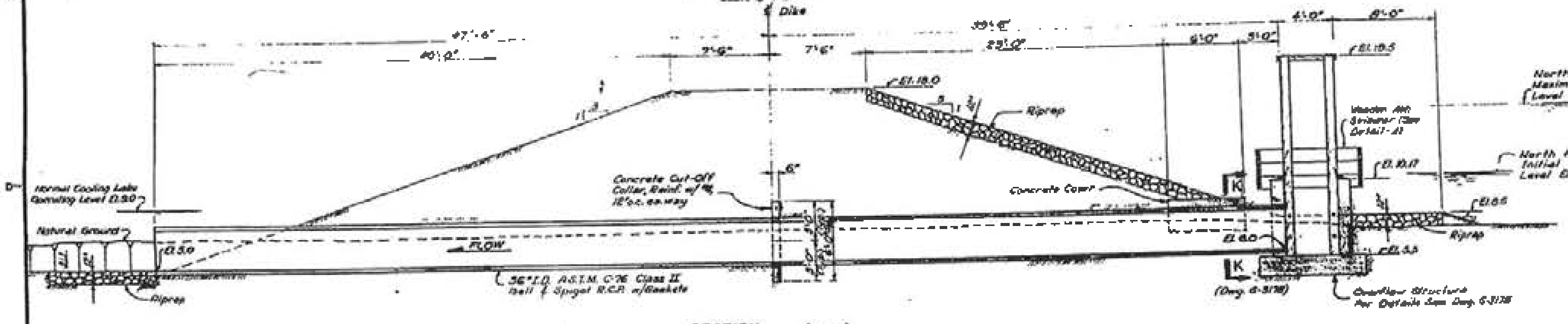
L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION (1983-1984)
SITE PLAN

DATE 1/11/83
D-3235



PLAN

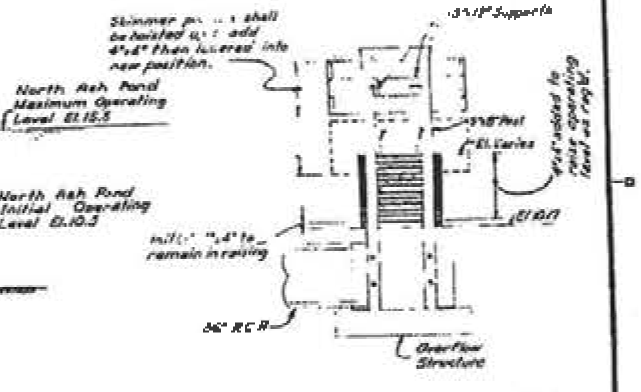
Scale: ⅛"=1'-0"



SECTION A - A

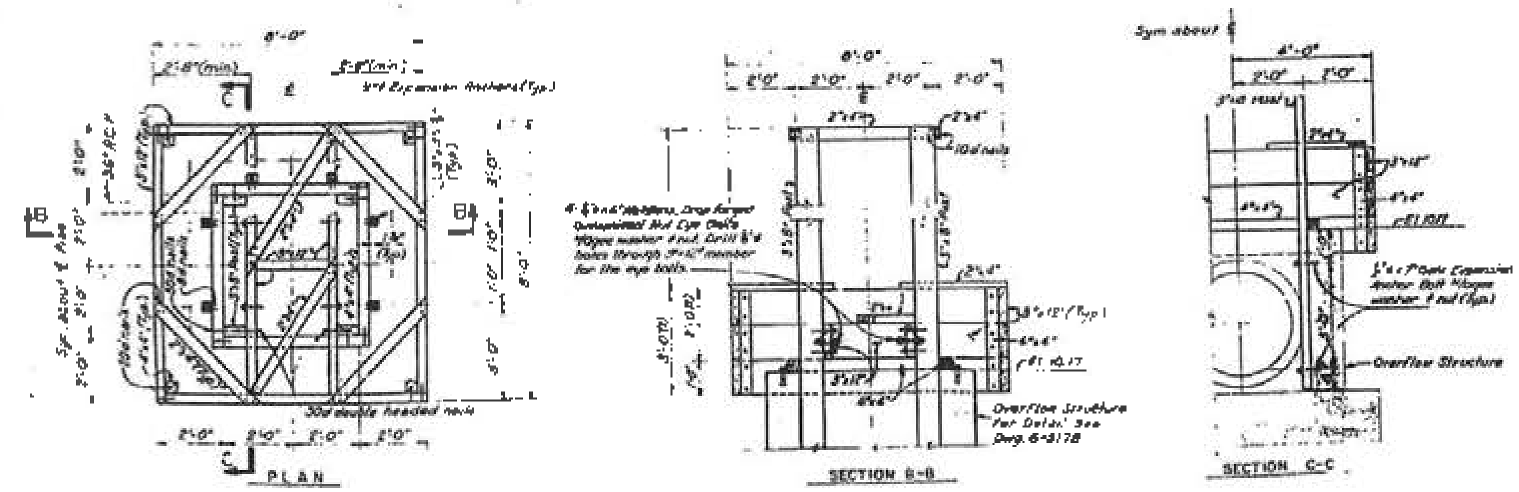
Scale: ⅛"=1'-0"

Note: To raise the operating level of the Ash Pond: raise the skimmer portion, place additional 4"x4" sections on the initial 4"x4" section and nail to the 3"x8" posts, lower the skimmer portion back into position, and reinstall the 3"x12" Supports in the 3"x8" post.



SKIMMER ADJUSTMENT DETAIL

(Future additions of 4"x4" by CP&L)
No Scale



DETAIL - A

(Wooden Ash Skimmer)
Scale: ½"=1'-0"

GENERAL NOTES:
1. All concrete shall be Class "5" in accordance with Specification Item C-310.
2. All exposed concrete shall have a ¾" chamfer unless otherwise noted.
3. All dimensions referring to reinforcing bars are to the centerline of the bars unless otherwise noted.
4. All reinforcing bars shall conform to A.S.T.M. Designation A-615 Grade 60.
5. Concrete cover for reinforcement shall be as follows unless otherwise noted:
   (A) 4" Clear for surfaces directly exposed to weather or deposited against the ground.
   (B) 3" Clear for all other surfaces.
6. Details of reinforcement not otherwise shown or indicated shall conform to the provisions of A.C.I. Standard 318 latest edition.
7. All structural steel shapes shall conform to A.S.T.M. Designation A-36 and shall be hot-dip galvanized after fabrication.
8. All expansion anchors and nails shall be hot-dip galvanized.
9. All lumber shall be creosoted, Dense Select Structural, Southern Yellow Pine.
10. All field cutting, abrasions or borings shall receive three coats of creosote oil, each coat being brushed on in sufficient quantity to fill all splits and thoroughly penetrate the cut or abraded surfaces.
11. All riprap shall conform to the North Carolina State Highway Commission Specifications for Class 1 Riprap.

REFERENCE DRAWINGS:
G-3175 Ash Disposal Ponds - General Layout
G-3178 Ash Disposal Ponds - North Pond Discharge Structure Sheet 2 of 2.

EXHIBIT 3

B		Construction Issue - Revised per Comments				DRAWN K. Gregory
A		For Customer Review				CHECKED J. Baltz
						APPROVED

BROWN & ROOT, INC.
ENGINEERS AND CONSULTANTS
HOUSTON, TEXAS

CAROLINA POWER & LIGHT COMPANY
L. V. SUTTON STEAM ELECTRIC PLANT
1972—420 MW EXTENSION-UNIT NO. 3

DRAWING TITLE
CIVIL
ASH DISPOSAL PONDS
NORTH POND-DISCHARGE STRUCTURE
SHEET 1 OF 2

CONTRACT NO. CR-44
DATE
SCALE: As Shown
B & R DRAWING NO. G-3008-3
G-3177B

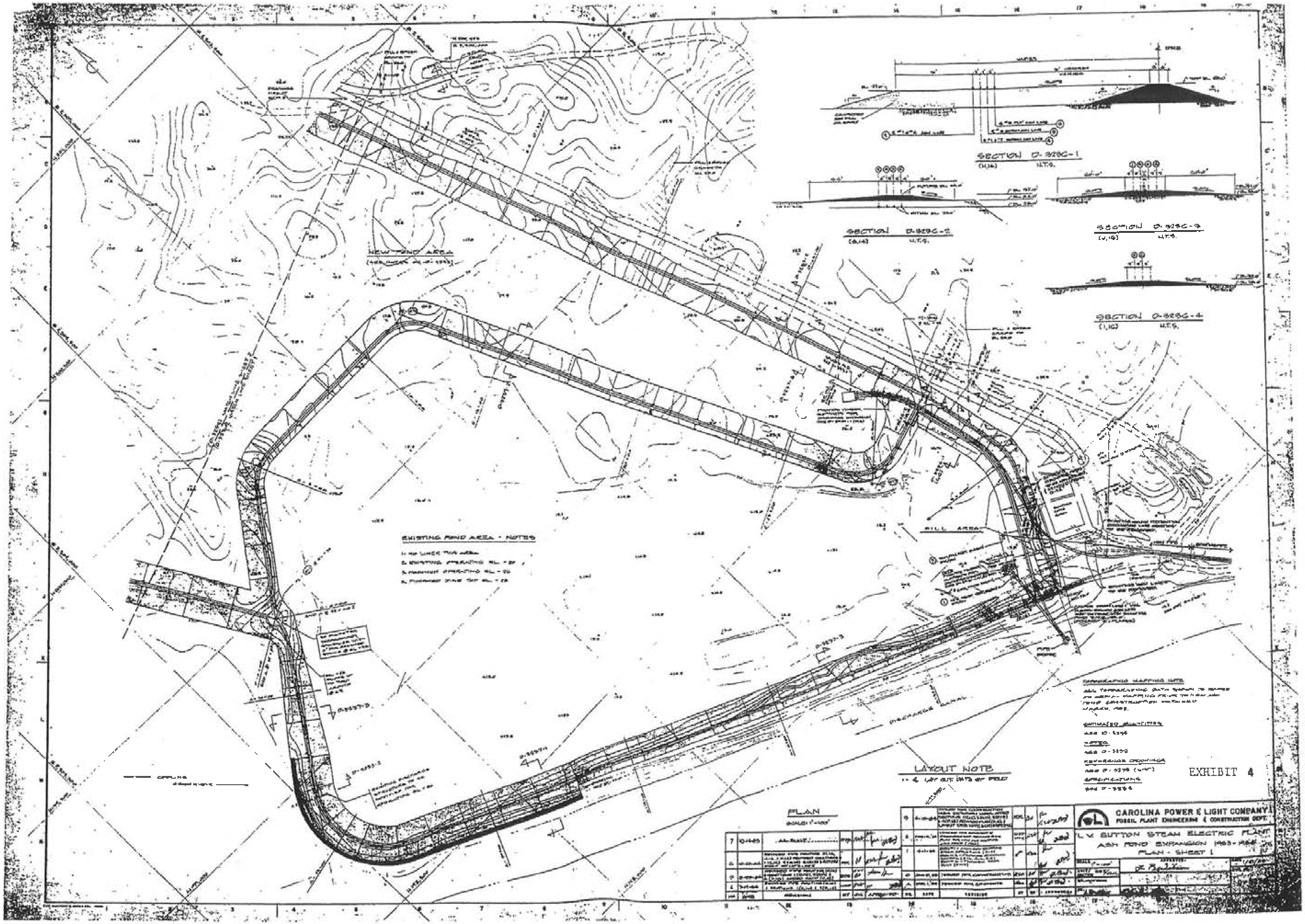
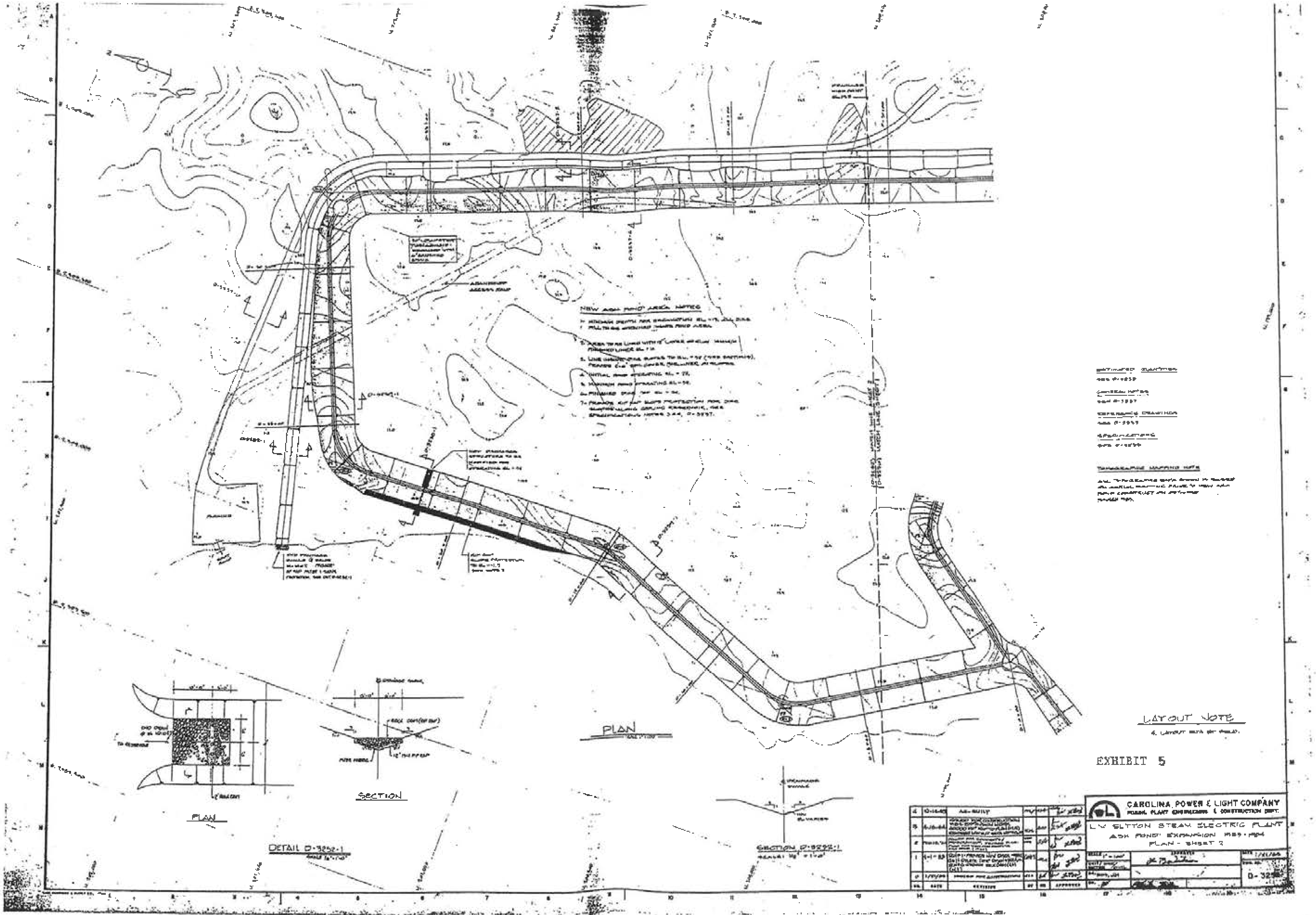

SECTION D-3236-1
(H,16) N.T.S.
SECTION D-3236-2
(G,14) N.T.S.
SECTION D-3236-3
(J,16) N.T.S.
SECTION D-3236-4
(I,16) N.T.S.
NEW POND AREA
EXISTING POND AREA - NOTES
1. NO LINER THIS AREA
FILL AREA
DISCHARGE CANAL
LAYOUT NOTE
PLAN
TOPOGRAPHIC MAPPING NOTE
ESTIMATED QUANTITIES
NOTES
REFERENCE DRAWINGS
SPECIFICATIONS
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.
L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
PLAN - SHEET 1
REVISION

EXHIBIT 4

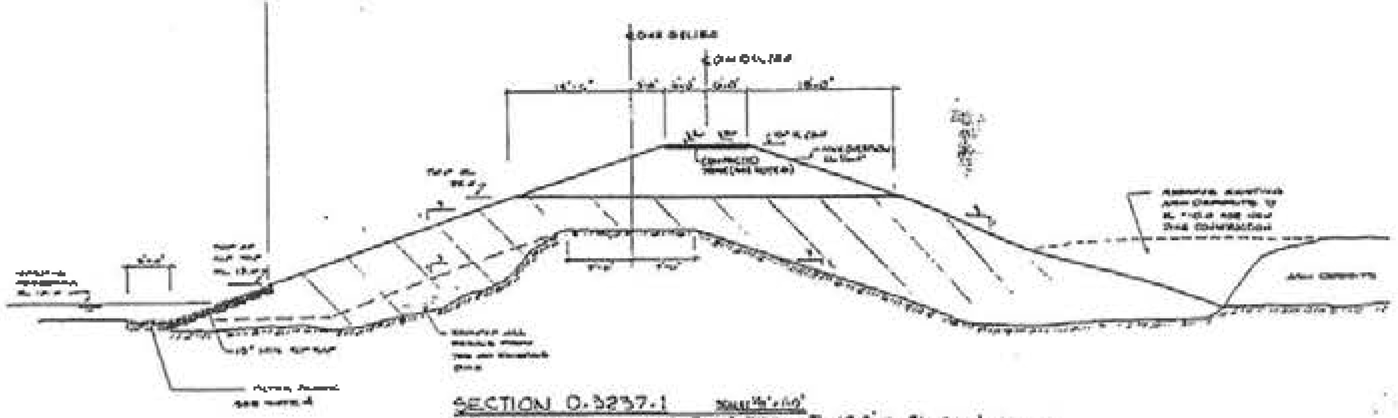


CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
PLAN - SHEET 2

D-325

EXHIBIT 5



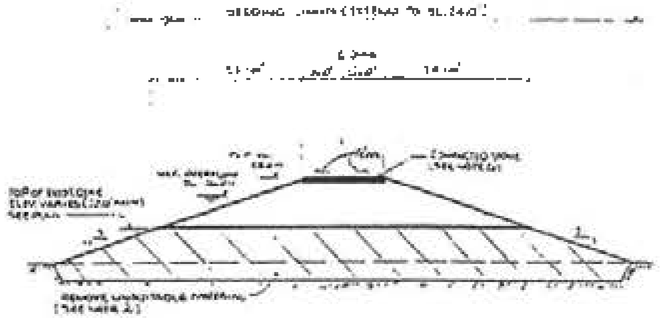
SECTION D-3237-1 SCALE 1/8"=1'-0"
TYPICAL FOR RAISING DIKES FROM EL. 19.0' TO EL. 28.0' (1983)
TYPICAL FOR RAISING DIKE FROM EL. 22.0' TO EL. 28.0'

LEGEND

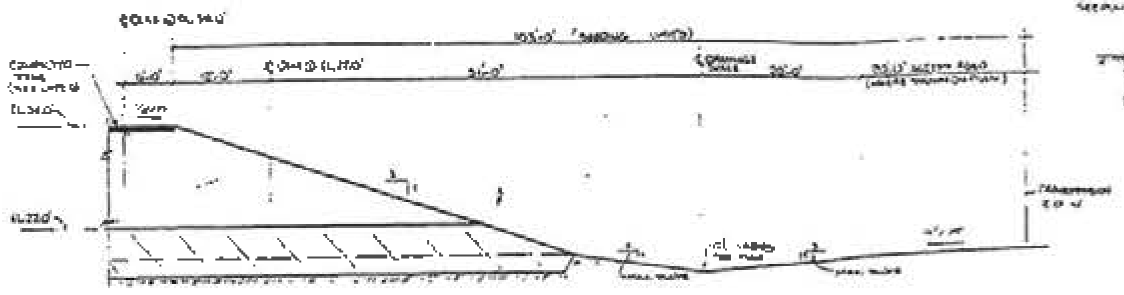
▭	NEW SAND FILL OR NEW CONSTRUCTION
▨	SAND FILL (EXISTING)
- - -	EXISTING GRADE
	CUT

NOTES

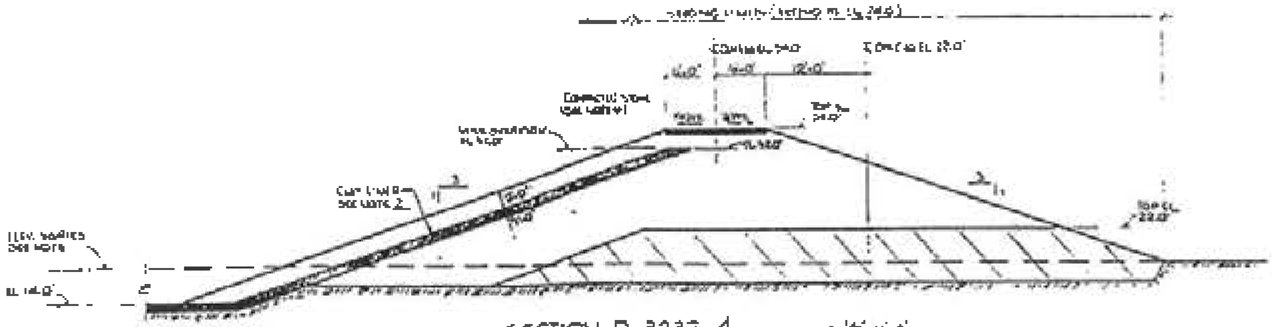
1. SEE SPEC. SECTION [illegible] FOR CLEARING REQUIREMENTS.
2. [illegible]
3. [illegible]
4. [illegible]
5. SEE SPEC. SECTION [illegible] FOR SEEDING REQUIREMENTS. SEEDING SPEC. SHALL BE REVIEWED BY LOCAL S.C.S. OFFICE AND SHALL BE MODIFIED AS REQUIRED TO MEET LOCAL RECOMMENDATIONS.
6. CRUSHED STONE SHALL BE NCDOT SPECIFICATION GRADATION [illegible] IN ACCORDANCE WITH SECTION 710. CRUSHED STONE SHALL BE COMPACTED AFTER PLACEMENT TO PROVIDE AN [illegible] SURFACE.



SECTION D-3237-3 SCALE 1/8"=1'-0"
TYPICAL FOR RAISING DIKE TO ELEV. 34.0'

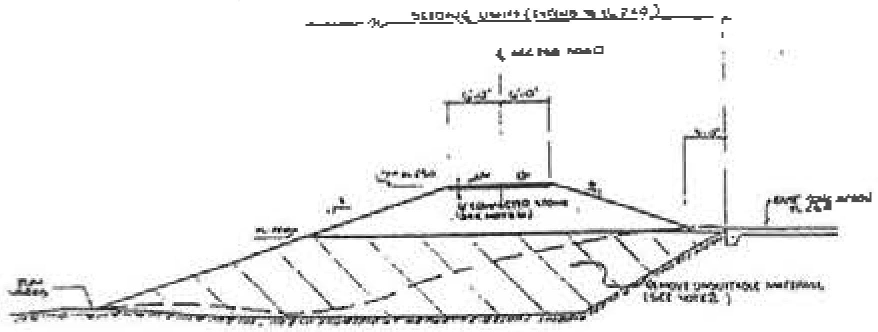


SECTION D-3237-2 SCALE: 1/8"=1'-0"
TYPICAL SECTION @ DRAINAGE SWALE

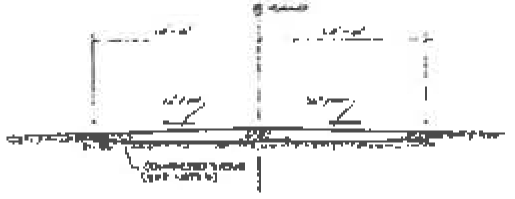


SECTION D-3237-4 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKES TO EL. 34.0 (TO THE INSIDE)
TYPICAL FOR CLAY LINER

REFERENCE DRAWINGS & SPECIFICATIONS



SECTION D-3237-5 SCALE: 1/8"=1'-0"
TYPICAL @ CONCRETE BASIN



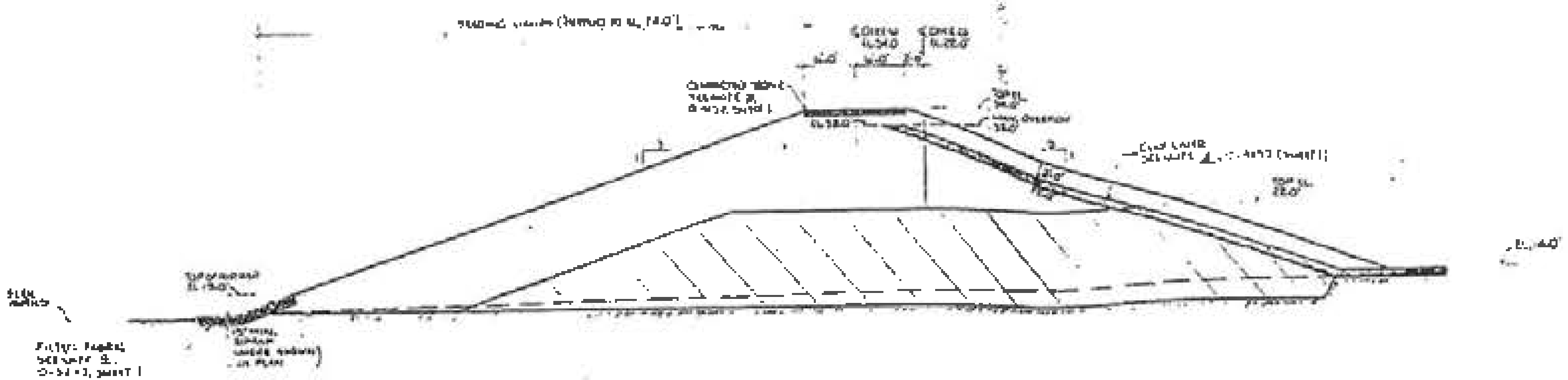
SECTION D-3237-6 SCALE: 1/8"=1'-0"
TYPICAL FOR RELOCATION OF ACCESS ROAD TO COOLING RESERVOIR BOAT RAMP

EXHIBIT 6

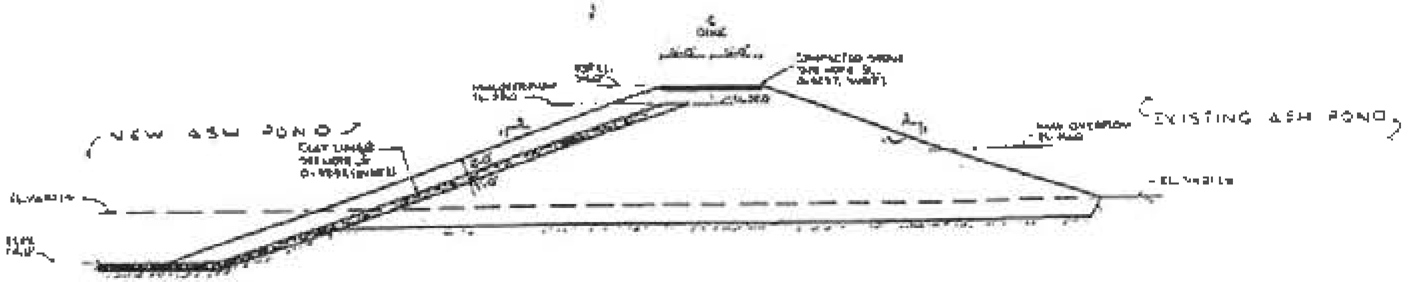
CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

C. V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION (1983-1984)
DIKE SECTIONS (SHEET 1)

DWG. NO. D-3237



SECTION D-3239-1 SCALE: 1/8"=1'-0"
TYPICAL FOR RAISING DIKES TO ELEV. 34.0' (TO THE OUTSIDE)



SECTION D-3239-2 SCALE: 1/8"=1'-0"
TYPICAL FOR SEPARATION DIKE TO ELEV. 34.0'
TYPICAL FOR CLAY LINER

NOTES

1. FOR GENERAL NOTES & LEGEND, SEE DWG. D-3239 (SHEET 1)

REFERENCE DRAWINGS & SPECIFICATIONS
SEE D-[illegible]

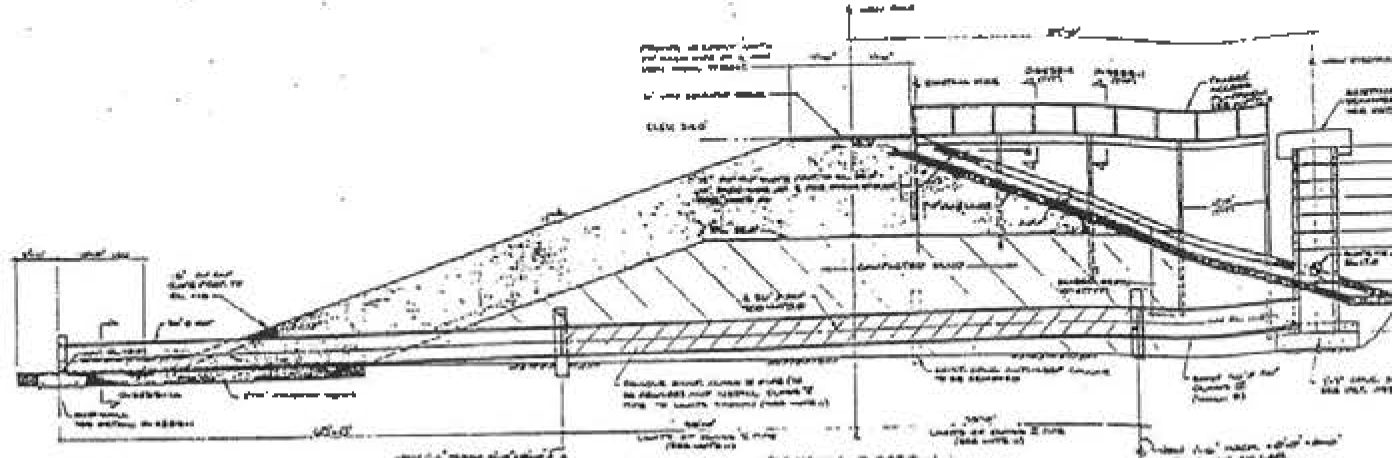
EXHIBIT 7

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L.V. SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION
DIKE SECTIONS (SHEET 2)

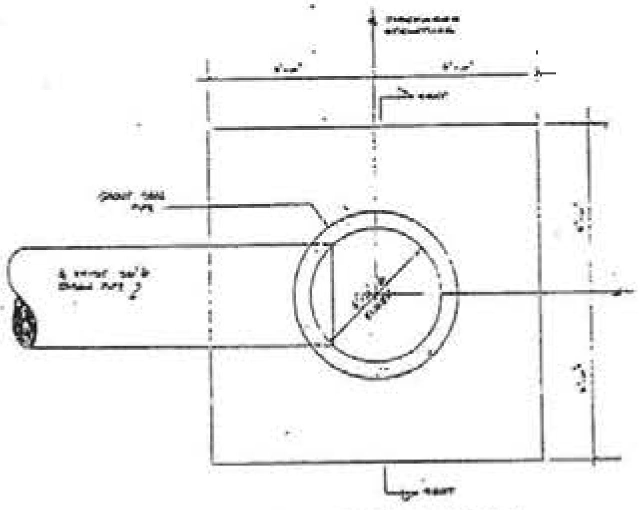
SCALE AS NOTED
D-3239

NO.	DATE	REVISION	BY	CH	APPROVED
1	10-11-85	AS-BUILT	[illegible]	[illegible]	[illegible]
0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A	2-15-84	[illegible]	[illegible]	[illegible]	[illegible]

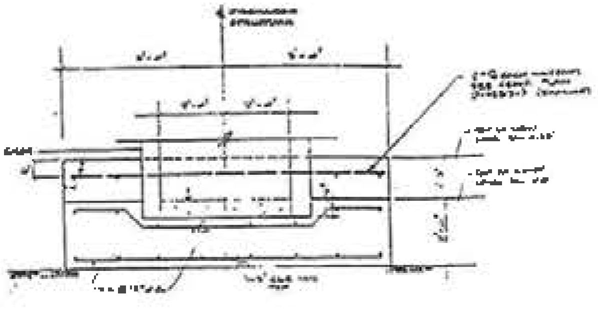


SECTION D-3236-1

NOTE: PROVIDE THREE ACCESS PLATFORMS AT ALL THE NEW DISCHARGE STRUCTURE LOCATIONS [illegible]

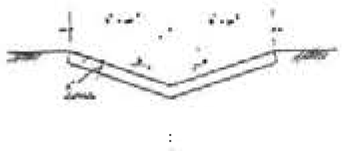


TOP PLAN (D-3236-1)

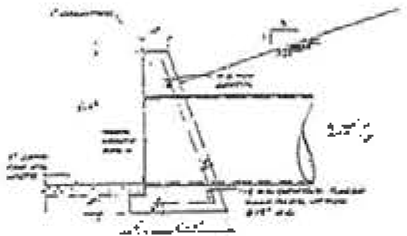


SECTION (D-3236)

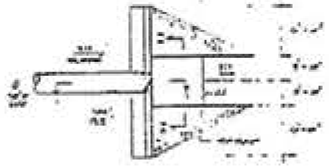
DETAIL D-3236-1



TYP SECTION 3.2
CONC. PAVING



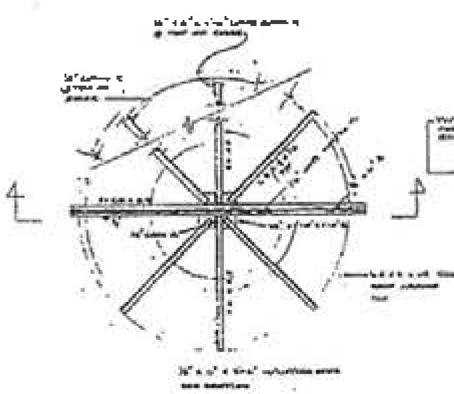
TYP SECTION 3.1
CONC. END WALL



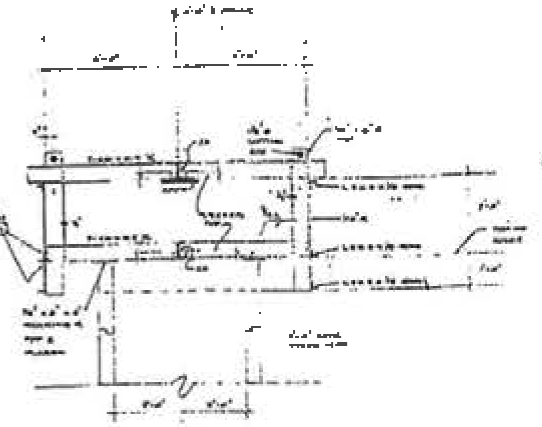
OUTLET PLAN

NOTES

1. THE DISCHARGE STRUCTURE IN THE NEW ASH POND AREA SHALL BE MODIFIED AS SHOWN TO OPERATE WITH A MAXIMUM OVERFLOW ELEV. [illegible]
2. THE DISCHARGE STRUCTURE FOR THE EXISTING ASH POND AREA SHALL BE MODIFIED TO OPERATE WITH A MAXIMUM ELEV. [illegible] AS SHOWN IN SECTION [illegible]
3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 PSI. AND REBAR SHALL BE GRADE 60, IN ACCORDANCE WITH [illegible] SPECIFICATIONS.
4. PRECAST MANUFACTURERS SHALL SUBMIT SHOP DRAWINGS FOR REVIEW AND APPROVAL BY OWNER. [illegible] PERMANENT [illegible] FOR ALL PRECAST COMPONENTS.
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. ALL REINFORCED CONCRETE PIPE (RCP) SHALL BE IN ACCORDANCE WITH ASTM C76, CLASS [illegible] UNLESS OTHERWISE NOTED.
10. REMOVE ALL SOFT AND UNSUITABLE MATERIAL FOR PIPE FOUNDATION AND REPLACE WITH COMPACTED FILL. [illegible]
11. [illegible]



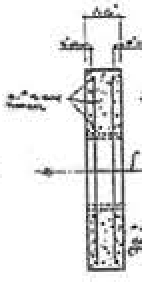
TOP PLAN



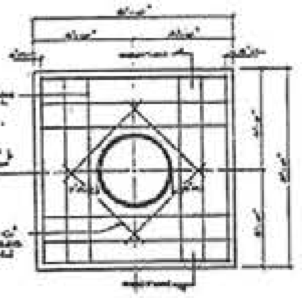
SECTION

DETAIL D-3236-2 SKIMMER

DETAIL NOTES

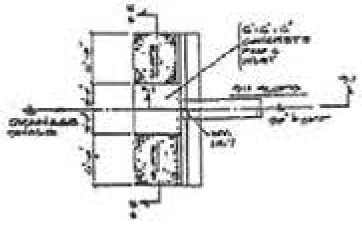


SECTION



ELEVATION

DETAIL D-3236-4
ANTI-SEEP COLLAR



INLET PLAN

DETAIL D-3236-5
30"φ DRAIN

EXHIBIT 8

CAROLINA POWER & LIGHT COMPANY

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
SECTIONS & DETAILS SHEET 1

D-3236

APPENDIX G: REFERENCE INFORMATION FROM MACTEC REPORT OF PIEZOMETER INSTALLATION AND OBSERVATIONS, APRIL 20, 2010

- Table 1 – Summary of Groundwater Information in Shallow Piezometers1 – Piezometer Installation Locations
- Figure 1 – Piezometer Installation Locations
- Figure 2 – Typical Cross Section of Dike Showing Piezometer Installation (PZ-1, PZ-1A, PZ-1B)
- Figure 3 – Summary of Water Levels in Piezometers (Section 1 & 2)
- Figure 4 - Summary of Water Levels in Piezometers (Section 3 & 4)
- Figure 5 - Summary of Water Levels in Piezometers (Section 5 & 6)
- Figure 10 – Comparison of Water Levels with Stability Analysis
- Attachment B – Boring Records

TABLE 1
SUMMARY OF GROUNDWATER INFORMATION IN SHALLOW PIZOMETERS
UPDATED 9-17-09

PROGRESS ENERGY-SUTTON 84 ASH POND SUTTON PLANT

MACTEC PROJECT No. 6468-09 2340

Location	Approx. Ground Elevation, ft (1)	Top of casing elevation for B Piezometers, ft	Depth to Bottom of Screen, below top of casing, ft	Groundwater Elevations - Date (2, 3)											
				2/18/2009	3/11/2009	3/25/2009	6/24/2009	6/29/2009	7/1/2009	7/6/2009	7/8/2009	7/15/2009	7/30/2009	8/17/2009	9/17/2009
PZ-1	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-1A	34		25	12.10	12.08	11.76	11.6	12.59	13.56	14.1	14.6	14.36	13.6	13.7	13.1
PZ-1B	18.0	19.36	5	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7	<11.7
PZ-2	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-2A	34		25	12.32	12.10	12.0	11.76	12.81	15.21	14.77	15.2	14.65	13.5	14.1	13.5
PZ-2B	18.7	19.57	5	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2	<10.2
PZ-3	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-3A	34		25	11.95	11.82	11.75	11.52	12.17	13.05	13.86	14.18	14.01	13.35	13.5	12.9
PZ-3B	19.97	20.79	5	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4	<15.4
PZ-4	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-4A	34		25	11.13	10.98	10.98	10.71	11.13	11.64	12.11	12.46	12.28	11.89	12.1	11.6
PZ-4B	13.8	14.54	5	10.94	10.89	10.83	10.62	10.99	11.38	11.84	11.40	11.30	10.90	11.09	10.6
PZ-5	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-5A	34		25	11.29	11.16	11.12	10.95	11.50	12.1	12.4	12.6	12.35	11.96	12	11.7
PZ-5B	16.08	17.29	5	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25	<12.25
PZ-6	34		15	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19	<19
PZ-6A	34		25	10.69	10.51	10.48	10.45	10.74	11.11	11.5	11.78	11.46	11.10	11.2	10.9
PZ-6B	16.27	17.25	5	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4	<11.4

Notes:

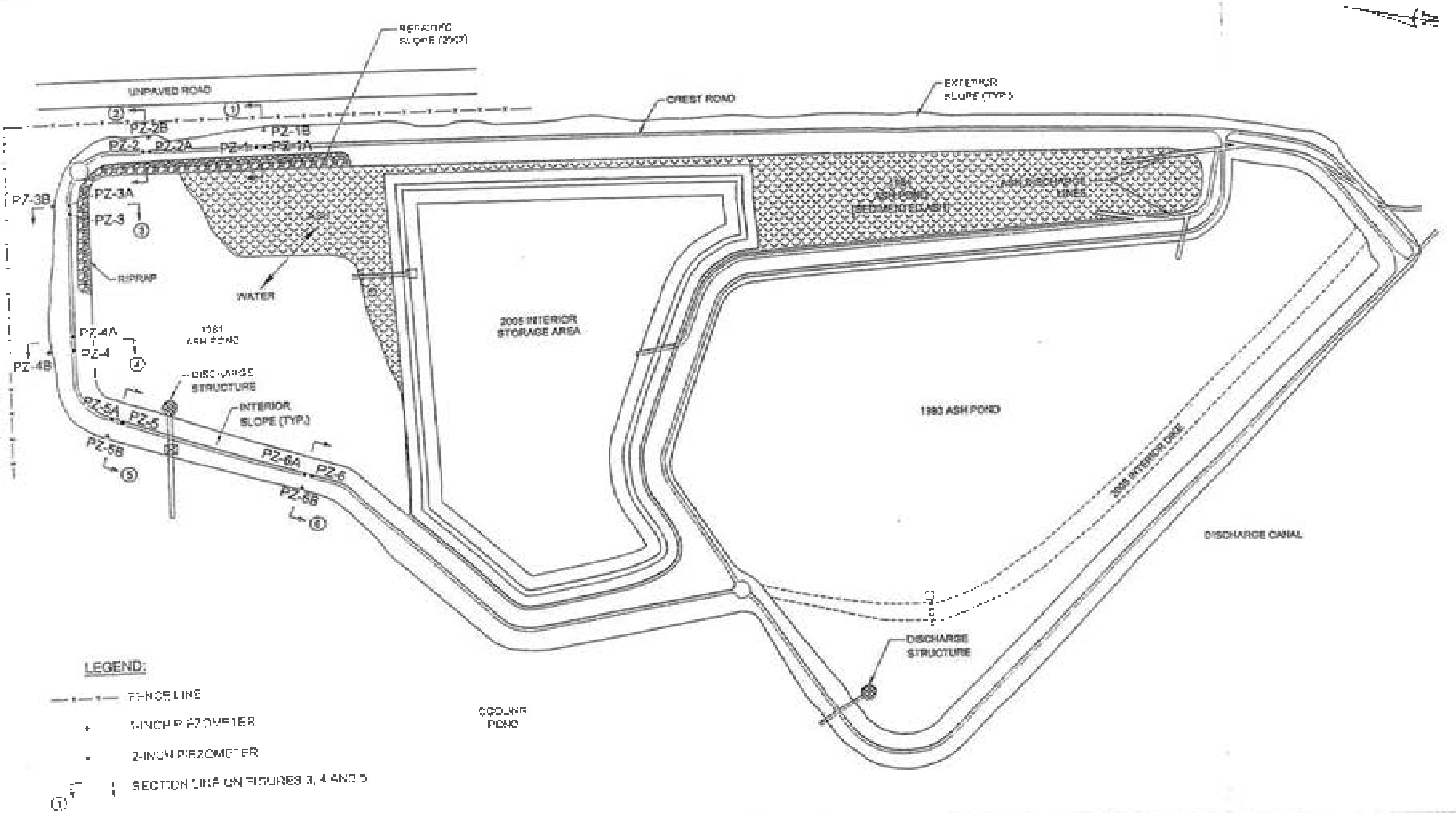
1. Approximate ground elevations estimated from the design top of dike elevation of 34 feet or by MACTEC approximate survey for B piezometers
2. Riser top elevation approximately 29 ft through 6/24/2009 with pond water level at top of riser
3. Riser elevation raised to approximately 30 feet on 6/24/2009 Pond level approximately elevation 29 feet on 6/29/2009 and approximately 30 feet on 7/1/2009 and subsequent readings unless noted below.

Piezometer installation notes

Piezometers installed on February 12 and 13, 2009 by MACTEC

Piezometers consist of 5 feet of slotted 1" and 2" diameter PVC pipe with solid riser. Backfill with sand around slotted section and bentonite chips/cement-bentonite grout above sand to ground surface.

Prepared By: JAS
Checked By: JAJ



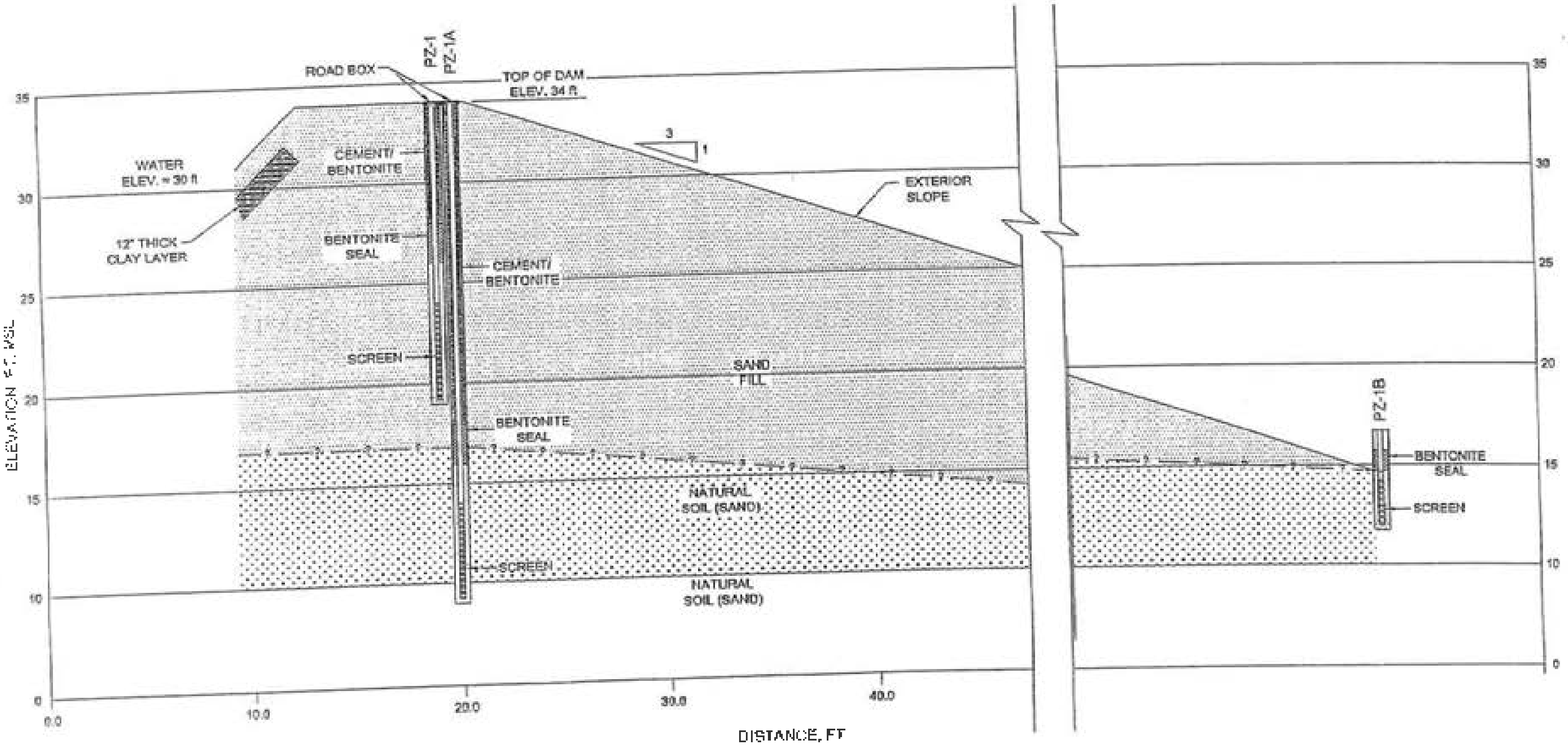
MACTEC

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

PIEZOMETER INSTALLATION LOCATIONS
1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL, 2010	FIGURE
ENG CHECK:		SCALE:	N.T.S.	1
APPROVAL:		JOB No.:	6468-09-2340	

REFERENCE: CP&L DRAWINGS D9232 & D9230; WITHERS & RAVENEL DRAWING 1, TRANSASH DRAWING 4-19-05.

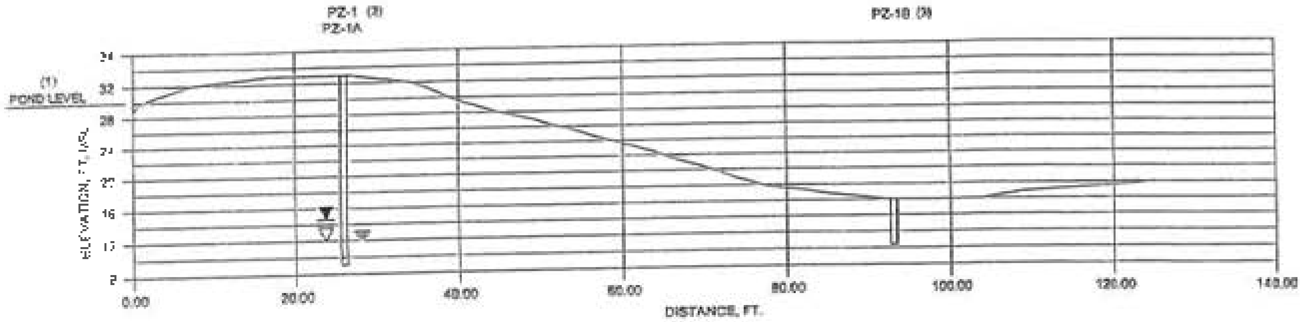


MACTEC
MACTEC ENGINEERING AND CONSULTING, INC
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

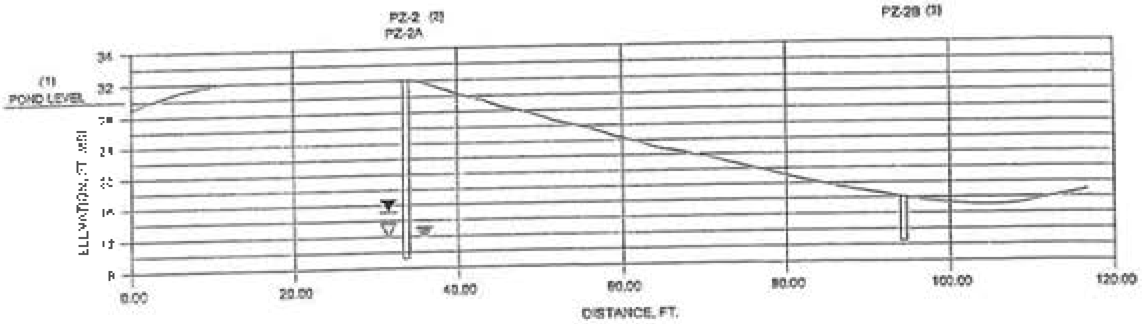
TYPICAL CROSS SECTION OF DIKE SHOWING PIEZOMETER INSTALLATION
SUTTON 1984 ASH POND
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL, 2010	FIGURE
ENG CHECK:	JB	SCALE:	1" = 5'	2
APPROVAL:		JOB No.:	6468-09-2340	

REFERENCE:



SECTION 1



SECTION 2

LEGEND:

▼ HIGHEST WATER LEVEL WITH POND AT EL 30

▽ TYPICAL WATER LEVEL WITH POND AT EL 29

▼ 09/11/2009 READING

NOTES:

(1) POND SURFACE SHOWN AT ELEVATION 30 FEET REPRESENTS CONDITIONS AFTER 07/2009.

(2) PZ-1 AND PZ-2 INSTALLED TO 15' BELOW TOP OF DIKE AND DRY AT ALL READINGS.

(3) PZ-1B AND PZ-2B INSTALLED TO APPROXIMATELY 4 FEET BELOW GROUND LEVEL AND DRY AT ALL READINGS.

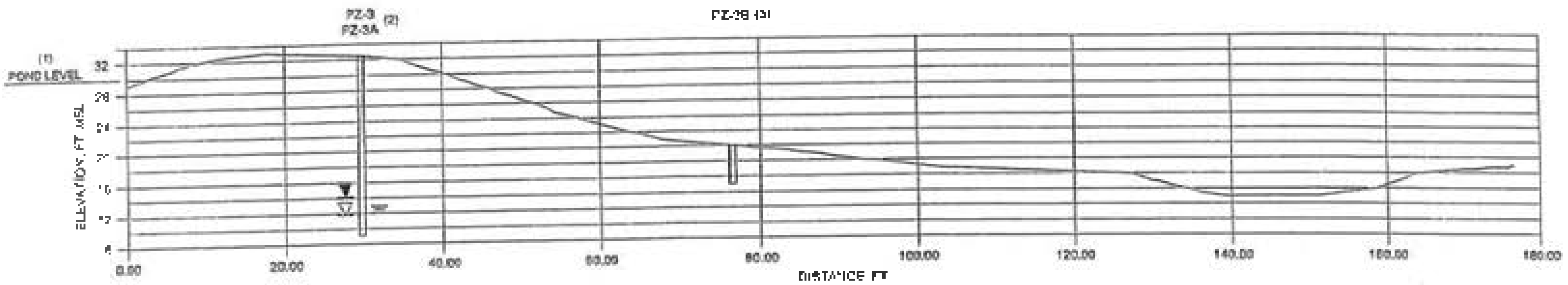
(4) SEE FIGURE 1 FOR SECTION LOCATIONS.

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

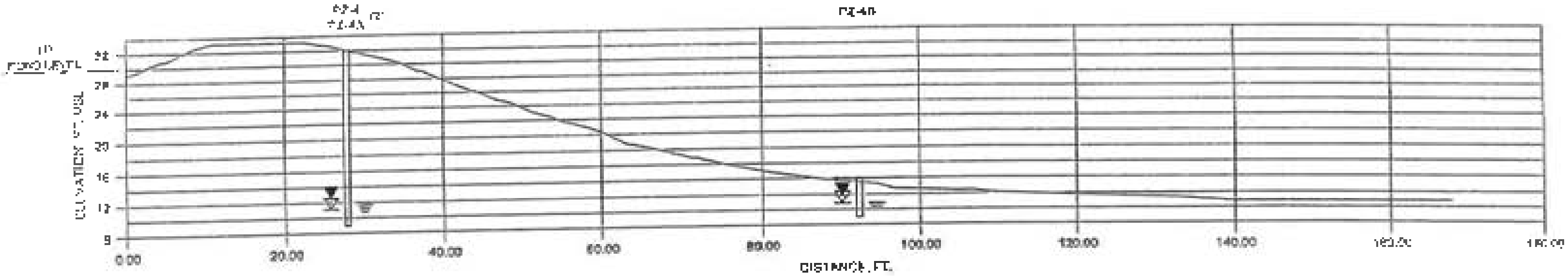
SUMMARY OF WATER LEVELS IN PIEZOMETERS
EAST SIDE, 1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN:	R.R.	DATE:	APRIL 2010	FIGURE
ENG CHECK:		SCALE:	1" = 15'	3
APPROVAL:		JOB No.:	6468-09-2340	

REFERENCE: 2005 AERIAL TOPOGRAPHIC MAP BY MCKIM AND CREED.



SECTION 3



SECTION 4

LEGEND:

▼ HIGHEST WATER LEVEL WITH POND AT EL. 30

▽ TYPICAL WATER LEVEL WITH POND AT EL. 28

═ [illegible] READING

NOTES:

(1) POND SURFACE SHOWN AT ELEVATION [illegible] REPRESENTS CONDITIONS AFTER [illegible].

(2) PZ-3 AND PZ-4 INSTALLED TO 15' BELOW TOP OF DIKE AND DRY AT ALL READINGS.

(3) PZ-3B INSTALLED TO APPROXIMATELY 4 FEET BELOW GROUND LEVEL AND DRY AT ALL READINGS.

(4) SEE FIGURE 1 FOR SECTION LOCATIONS.

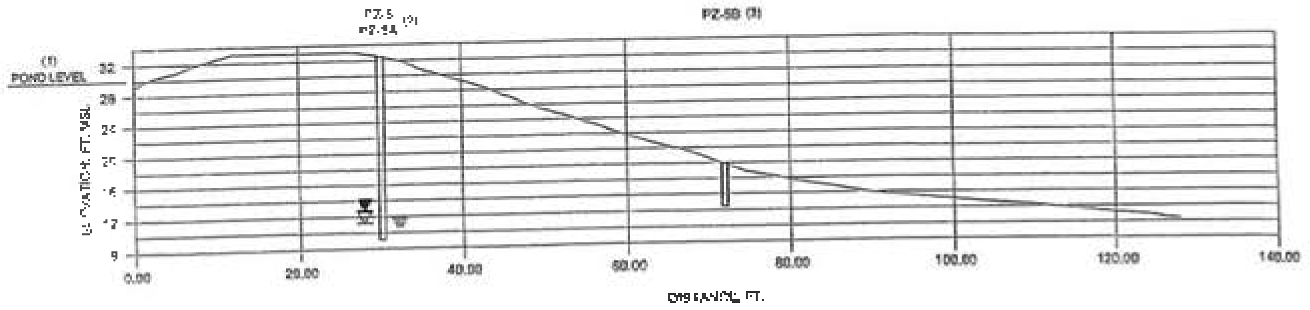
MACTEC
MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

SUMMARY OF WATER LEVELS IN PIEZOMETERS
NORTH SIDE, 1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

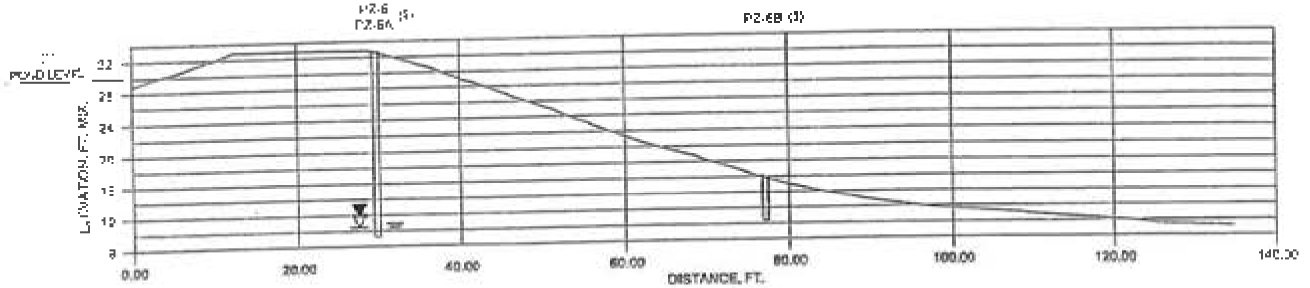
DRAWN:	R.R.	DATE:	APRIL 2010
ENG CHECK:		SCALE:	1" = 15'
APPROVAL:		JOB No.:	6468-09-2340

FIGURE
4

REFERENCE: 2009 AERIAL TOPOGRAPHIC MAP BY MCKIM AND CREED.



SECTION 5



SECTION 6

LEGEND:

▼ HIGHEST WATER LEVEL WITH POND AT EL 30

▽ TYPICAL WATER LEVEL WITH POND AT EL 28

▾ 09/17/2009 READING

NOTES:

(1) POND SURFACE SHOWN AT ELEVATION 30 FEET REPRESENTS CONDITIONS AFTER 07/5/2009

(2) PZ-5 AND PZ-6 INSTALLED TO 15' BELOW TOP OF DIKE AND DRY AT ALL READINGS.

(3) PZ-5B AND PZ-6B INSTALLED TO APPROXIMATELY 4 FEET BELOW GROUND LEVEL AND DRY AT ALL READINGS.

(4) SEE FIGURE 1 FOR SECTION LOCATIONS.

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

SUMMARY OF WATER LEVELS IN PIEZOMETERS
WEST SIDE, 1984 ASH POND DIKE
L.V. SUTTON STEAM ELECTRIC PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK:
APPROVAL:
DATE: APRIL 2010
SCALE: 1" = 15'
JOB No.: 6468-09-2340
FIGURE 5

REFERENCE: 2009 AERIAL TOPOGRAPHIC MAP BY MCKIM AND CREED.

Carolina Power & Light Co.
Raleigh, NC (s/n 5093)

SUTTON ASH POND GEOSLOPE ANALYSIS

100SURFACES HAVE BEEN GENERATED
10 MOST CRITICAL OF SURFACES GENERATED
MINIMUM FACTOR OF SAFETY = 1.583

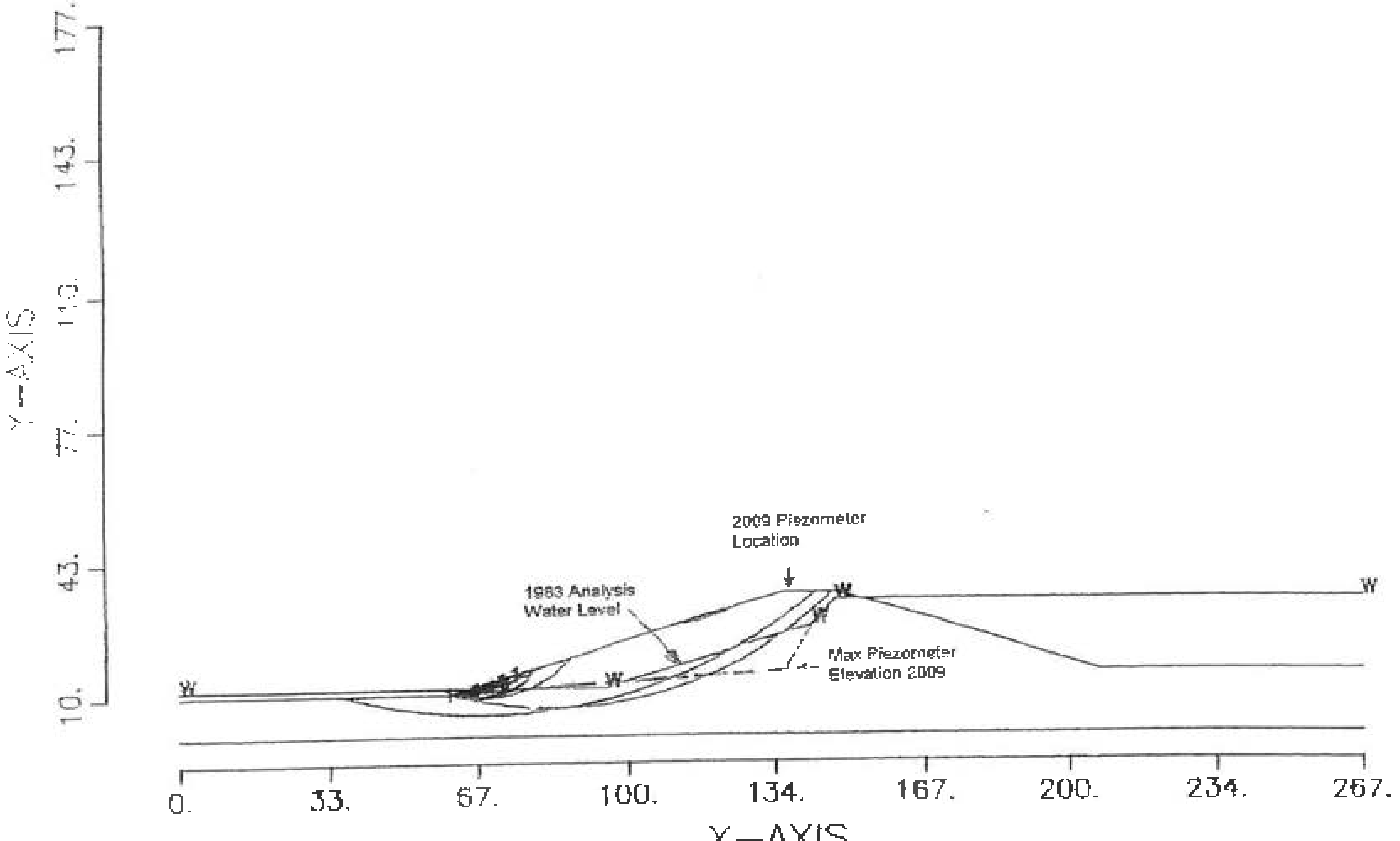


Figure 10. Comparison of Water Levels with Stability Analysis

ATTACHMENT B

BORING RECORDS
(PZ-1A TO PZ-6A)

SOIL CLASSIFICATION

MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	▨	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			▨	GP	Poorly graded gravels or gravel - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	▨	GM	Silty gravels, gravel - sand - silt mixtures.
			▨	GC	Clayey gravels, gravel - sand - clay mixtures
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)	▨	SW	Well graded sands, gravelly sands, little or no fines
			▨	SP	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES (Appreciable amount of fines)	▨	SM	Silty sands, sand silt mixtures
			▨	SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		▥	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
			▨	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			▤	OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		▥	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			▨	CH	Inorganic clays of high plasticity, fat clays
			▨	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			▨	PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. I, March, 1953 (Revised April, 1960)

NON-SOIL CLASSIFICATION

■	Undisturbed Sample	▮	Auger Cuttings
☒	Split Spoon Sample	▨	Bulk Sample
▯	Rock Core	▨	Crandall Sampler
▨	Dilatometer	▨	Pressure Meter
□	Packer	○	No Recovery
▽	Water Table at time of drilling	▼	Water Table after 24 hours
☝	Grab Bag Sample	▨	Caved-in Depth

Correlation of Penetration Resistance with Relative Density and Consistency

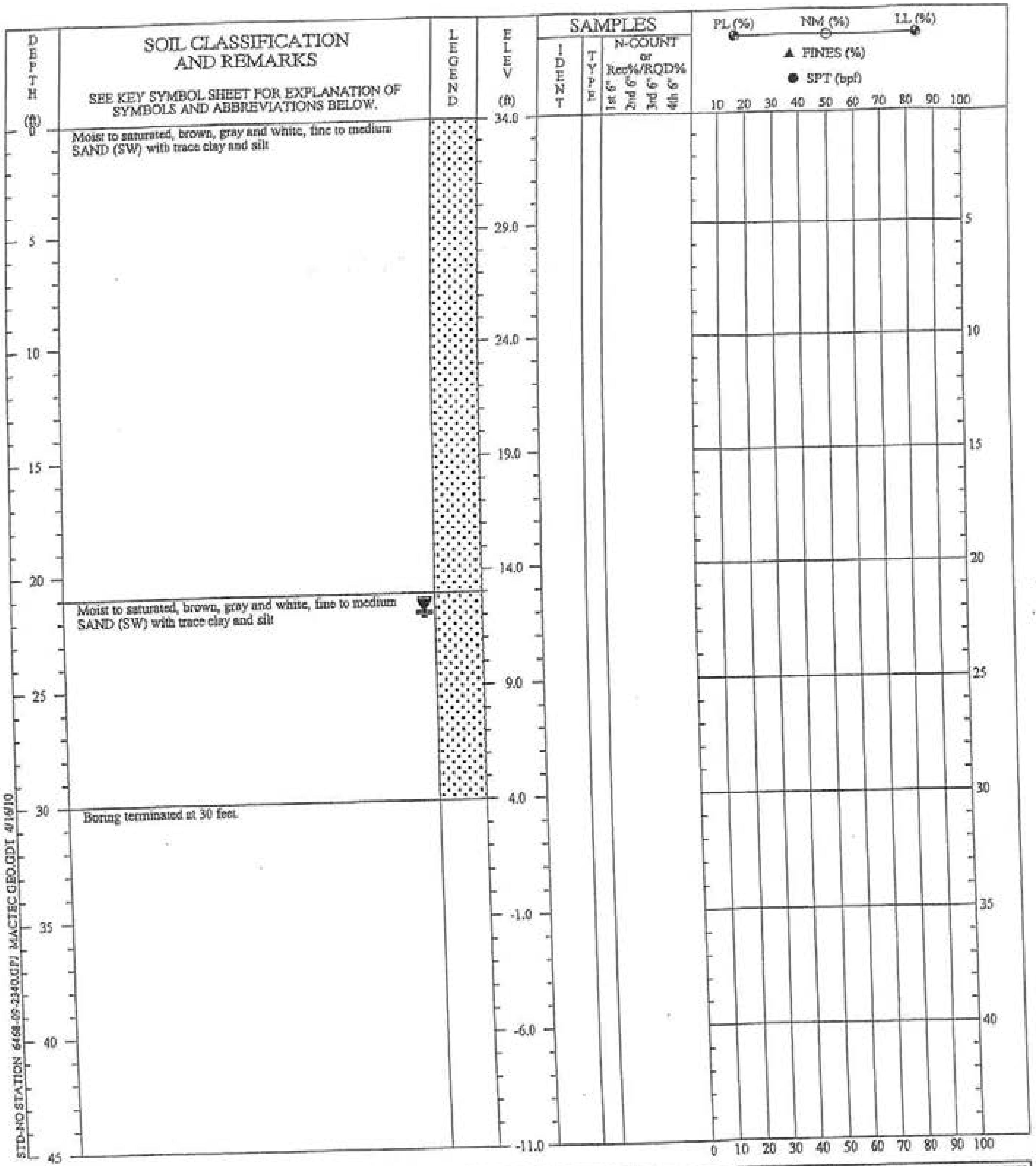
SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
< 4	Very Loose	< 2	Very Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium Dense	4 - 8	Medium Stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very Stiff
		> 30	Hard

Sample Moisture Description

Saturated:	**Usually liquid; very wet, usually from below the groundwater table**
Wet:	**Semisolid; required drying to attain optimum moisture**
Moist:	**Solid; at or near optimum moisture**
Dry:	**Requires additional water to attain optimum moisture**

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT	Geoprobe Rig
METHOD:	CPT-Direct Push
HOLE DIA.:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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: Progress Energy-Sutton Dike

Boring No.: PZ-1A

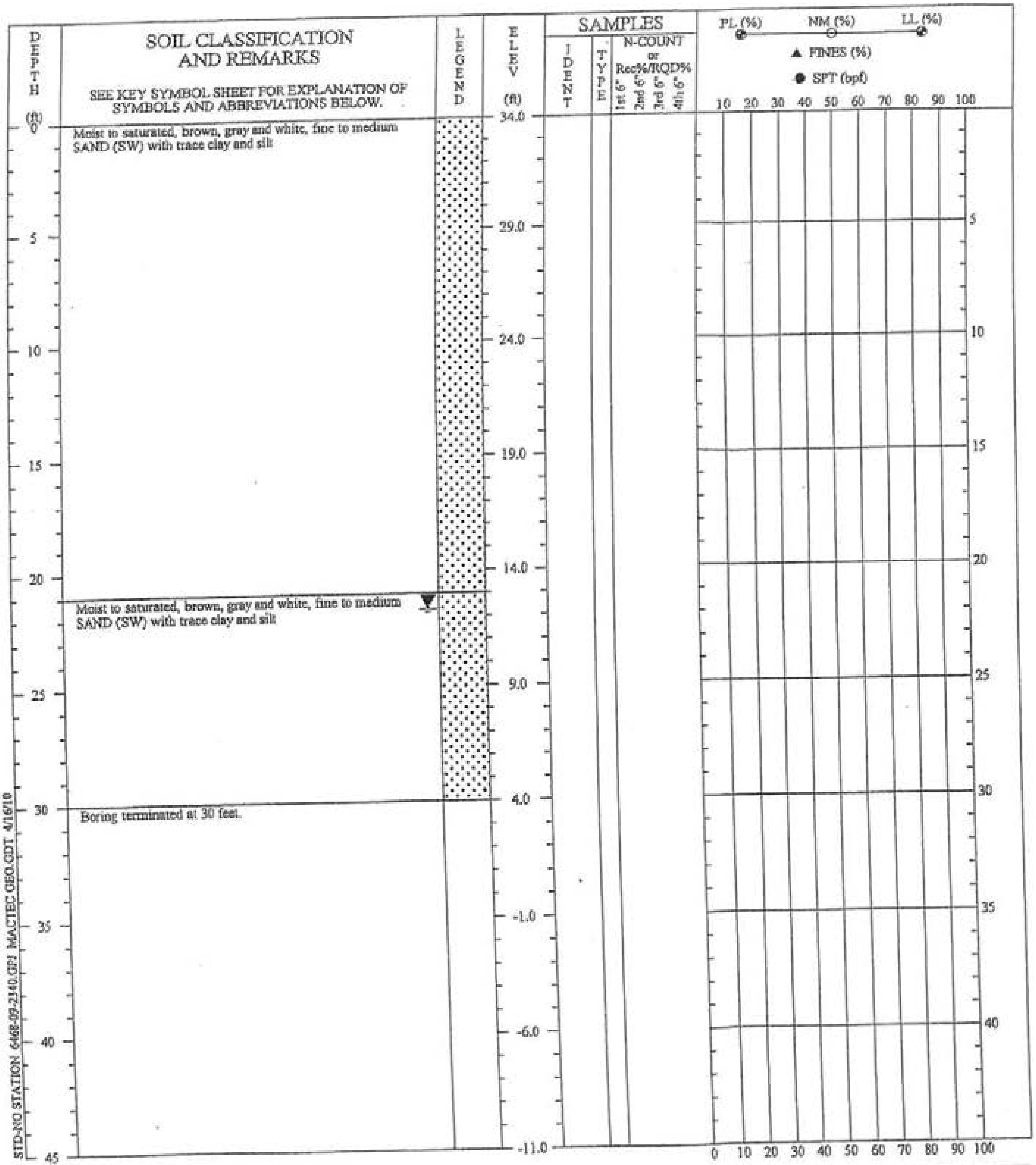
Location: Wilmington, NC

Drilled: February 11, 2009

Project #: 6468-09-2340

Page 1 of 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER: Carolina Drilling Co.
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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.

SOIL TEST BORING RECORD

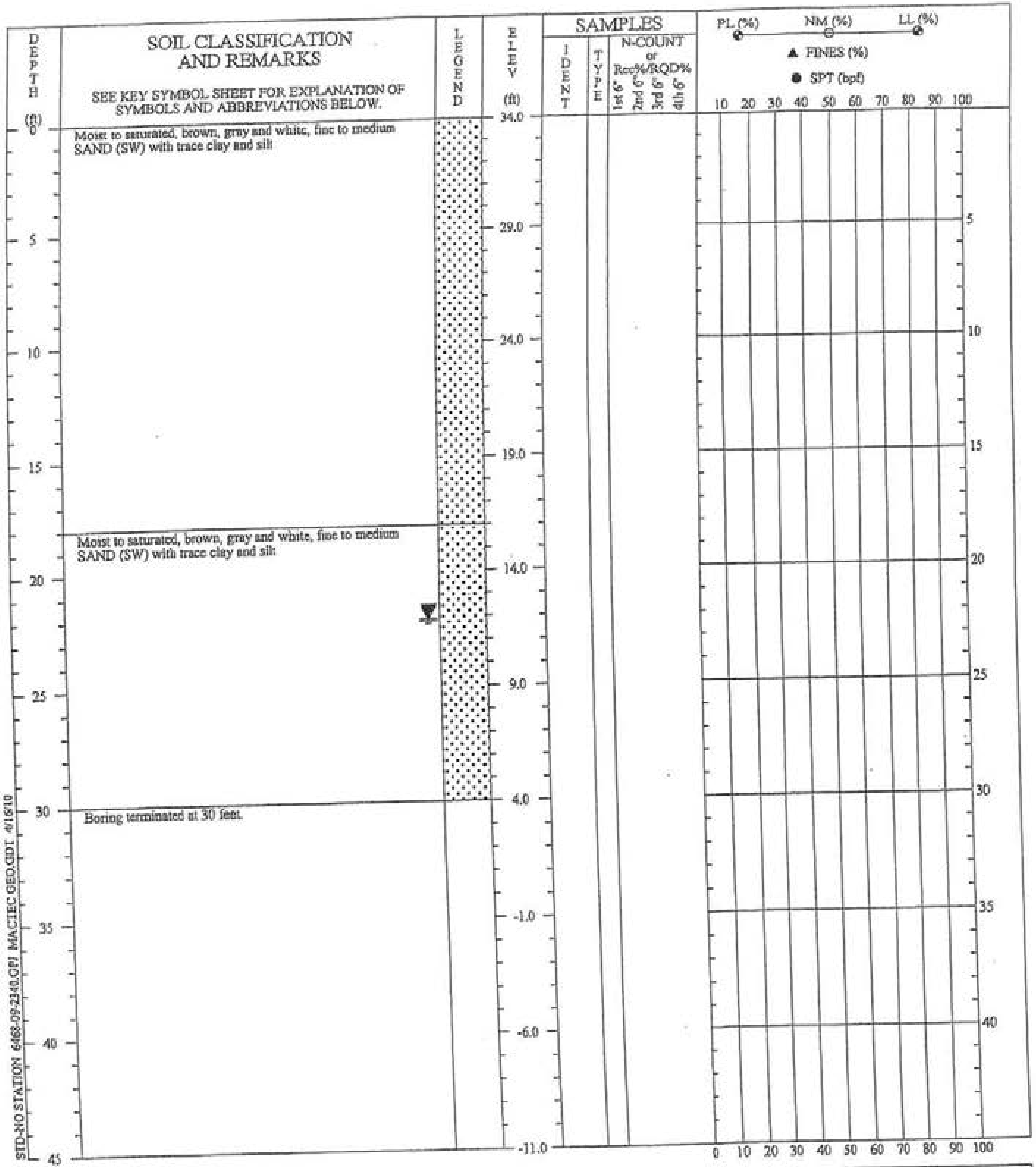
Project: Progress Energy-Sutton Dike

Boring No.: PZ-2A

Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340

Page 1 **of** 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER: Carolina Drilling Co
EQUIPMENT: Geoprobe Rig
METHOD: CPT-Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5, 5-10, 10-15' etc. to 30 feet)

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.

SOIL TEST BORING RECORD

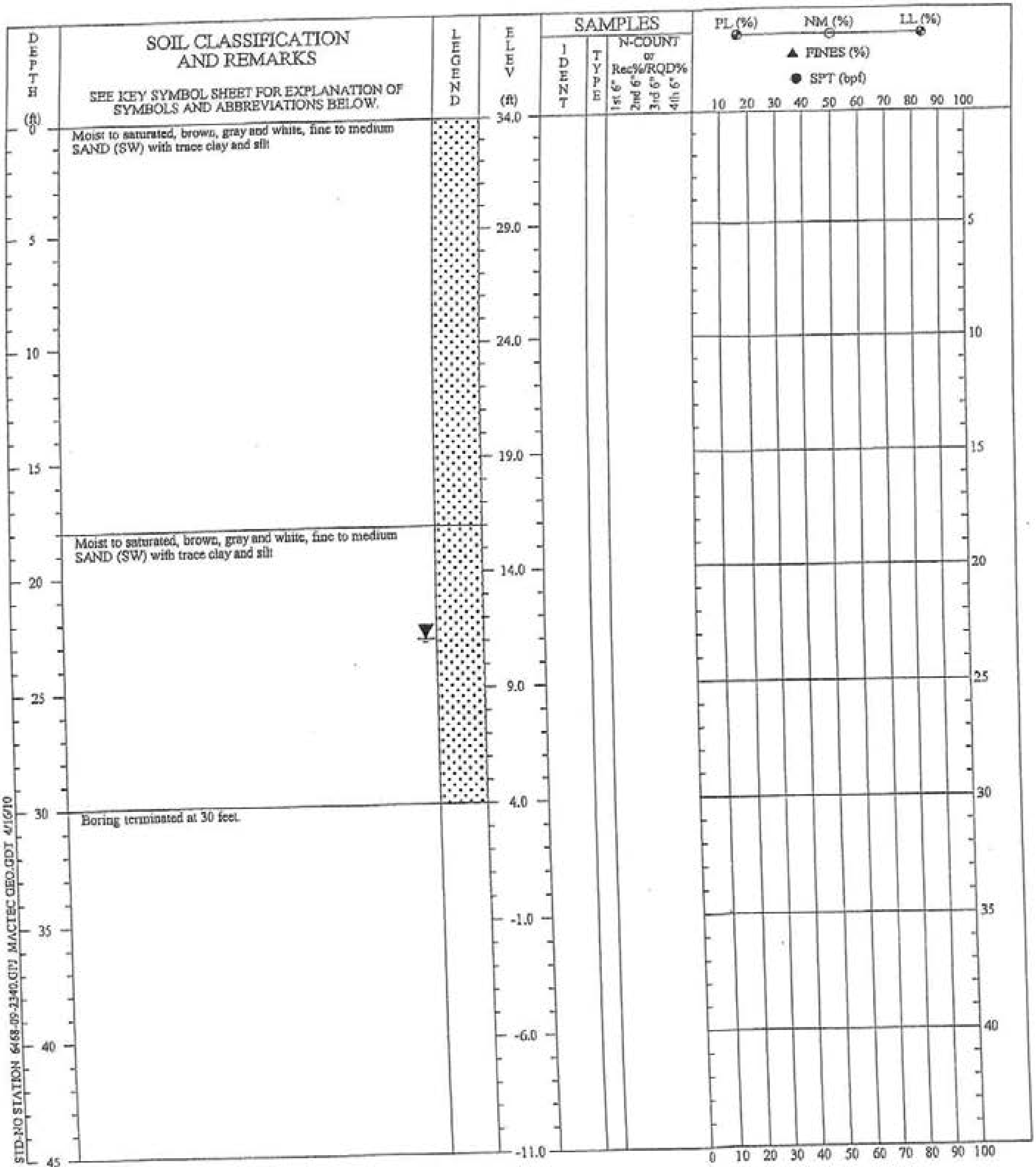
Project: Progress Energy-Sutton Dike

Boring No.: PZ-3A

Location: Wilmington, NC
Drilled: February 11, 2009
Project #: 6468-09-2340

Page 1 of 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/1/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT-Direct Push
HOLE DIA:	2 inch
REMARKS:	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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: Progress Energy-Sutton Dike

Boring No.: PZ-4A

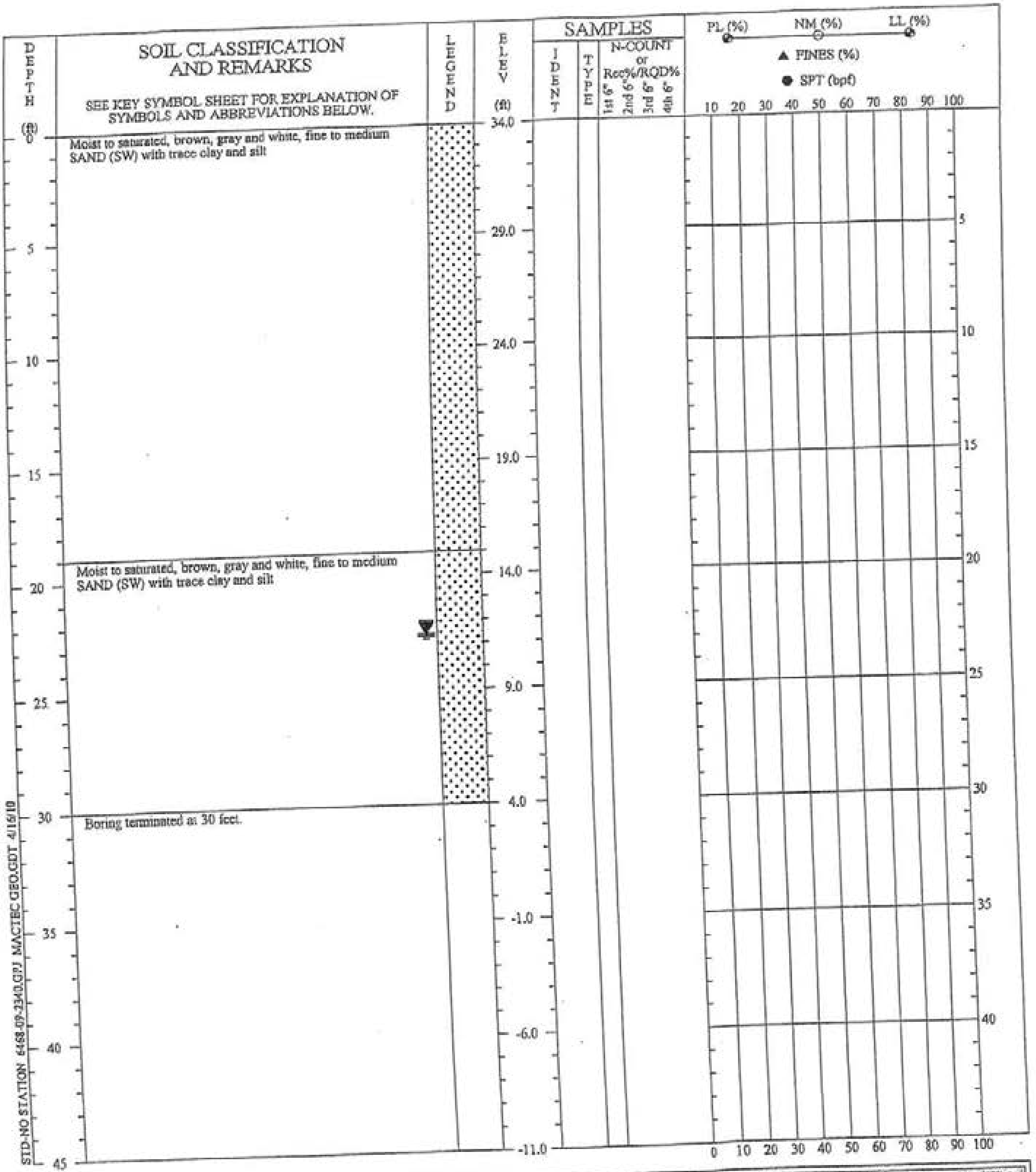
Location: Wilmington, NC

Drilled: February 11, 2009

Project #: 6468-09-2340

Page 1 **of** 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER:	Carolina Drilling Co.
EQUIPMENT:	Geoprobe Rig
METHOD:	CPT - Direct Push
HOLE DIA.:	2 inch
REMARKS	Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5, 5-10, 10-15, etc. to 30 feet)

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.

SOIL TEST BORING RECORD

Project: Progress Energy-Sutton Dike

Boring No.: PZ-5A

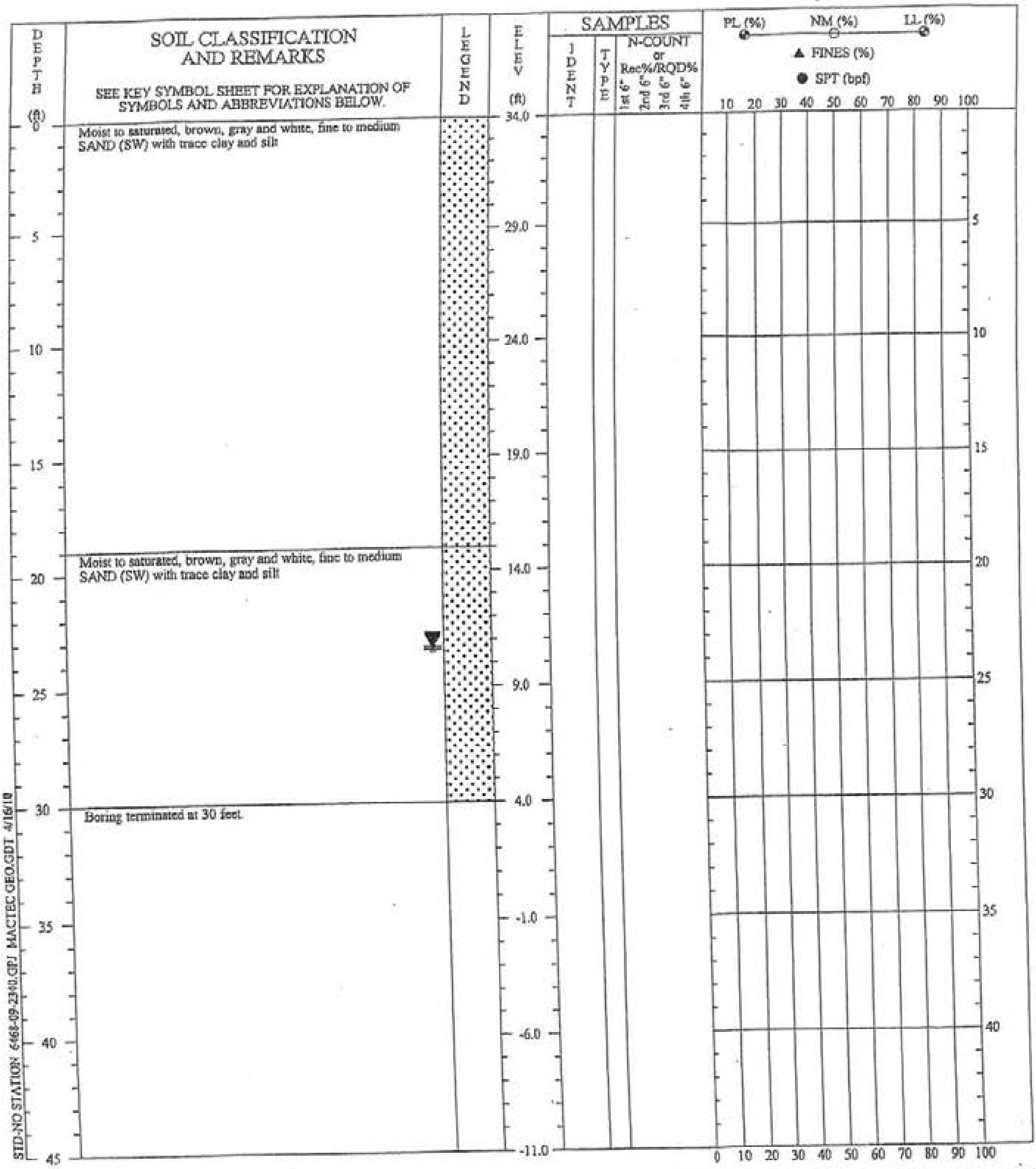
Location: Wilmington, NC

Drilled: February 12, 2009

Project #: 6468-09-2340

Page 1 of 1

MACTEC



Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Moist to saturated, brown, gray and white, fine to medium SAND (SW) with trace clay and silt

Boring terminated at 30 feet.

STD-NO STATION 6468-09-2340.GPJ MACTEC GEO.GDT 4/16/10

DRILLER: Carolina Drilling Co
EQUIPMENT: Geoprobe Rig
METHOD: CPT -Direct Push
HOLE DIA.: 2 inch
REMARKS: Used Direct Push Method-Filling a 5 foot long plastic sleeve with soil (Sample intervals 0-5', 5-10', 10-15' etc. to 30 feet)

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: Progress Energy-Sutton Dike
Boring No.: PZ-6A
Location: Wilmington, NC
Drilled: February 12, 2009
Project #: 6468-09-2340
Page 1 of 1

MACTEC

ATTACHMENT C

HAND AUGER BORING/ PIEZOMETER LOGS
(PZ-1B TO PZ-6B)

Hand Auger Boring/ Well Log		
Job Name: Progress Energy-Sutton Plant		**Date:** February 11, 2009
Client: Progress Energy		**MACTEC Job No.** 6468-09-2340
Piezometer No. PZ- 1B	**Boring Location:** See boring location plan-toe of the dike slope	
Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 0.2		Dry Light brown/gray silty fine SAND with root fibers
0.2 to 4.5		Moist to wet, light brown and gray fine to medium sand, trace (-) silt (SW)
		Bottom of auger boring at 4.5 feet
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Hand Auger Boring/ Well Log		
Job Name: Progress Energy-Sutton Plant		**Date:** February 11, 2009
Client: Progress Energy		**MACTEC Job No.** 6468-09-2340
Piezometer No. PZ- 2B	**Boring Location:** See boring location plan-toe of the dike slope	
Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan slightly silty fine SAND (SW), trace (-) clay
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Prepared by: James A. Schill Reviewed by: ____________

MACTEC

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant

Date: February 11, 2009

Client: Progress Energy

MACTEC Job No. 6468-09-2340

Piezometer No. PZ- 3B

Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW), trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009.

Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant

Date: February 11, 2009

Client: Progress Energy

MACTEC Job No. 6468-09-2340

Piezometer No. PZ- 4B

Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan slightly fine to medium SAND (SW), trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Groundwater noted at 3.6 feet below top of casing on February 18, 2009.

Hand Auger Boring /Well Log

Prepared by: James A. Schiff Reviewed by:

MACTEC

Job Name: Progress Energy-Sutton Plant
Date: February 11, 2009
Client: Progress Energy
MACTEC Job No. 6468-09-2340
Piezometer No. PZ- 5B
Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW) with trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometet. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009

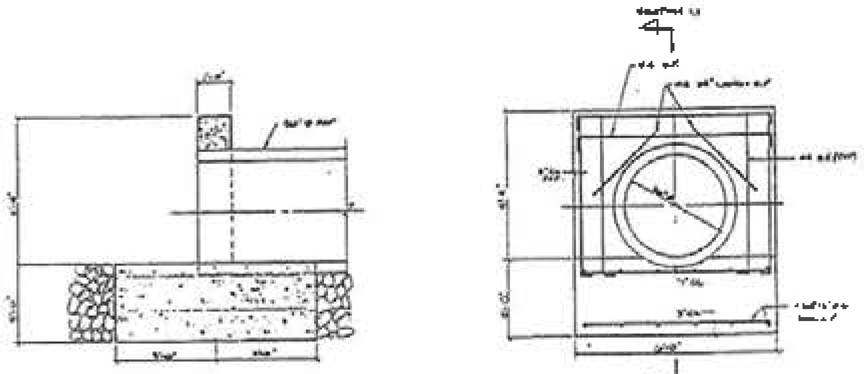
Hand Auger Boring/ Well Log

Job Name: Progress Energy-Sutton Plant
Date: February 11, 2009
Client: Progress Energy
MACTEC Job No. 6468-09-2340
Piezometer No. PZ-6B
Boring Location: See boring location plan-toe of the dike slope

Depth (feet)	**Blow Counts (None Taken)**	**Visual Soil Description**
0 to 4		Dry to slightly moist light brown/tan slightly silty fine SAND (SW)
4 to 4.5		Moist to wet brown/tan fine to medium SAND (SW). with trace clay and silt
		Note: Installed 1 inch PVC piezometer at 4 feet, 2.5 feet of slotted wellscreen and 2.5 feet solid riser. Bentonite chips placed at top of piezometer. No groundwater encountered after installing piezometer.
		Piezometer dry to bottom on February 18, 2009

Prepared by: James A. Schiff Reviewed by: ______

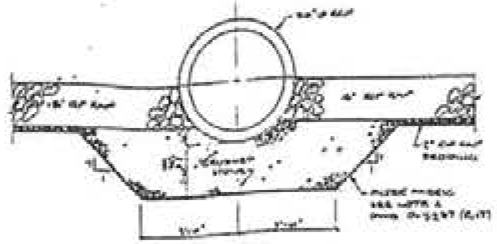
MACTEC



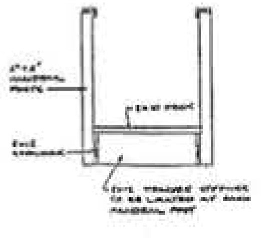
SECTION 1-1

ELEVATION 1-1

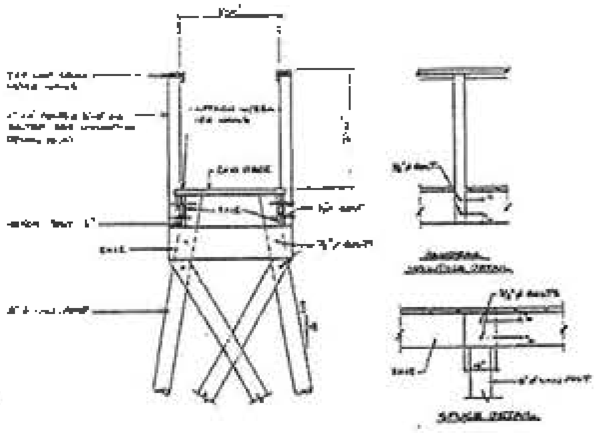
DETAIL D-3253-1



SECTION D-3253-1A



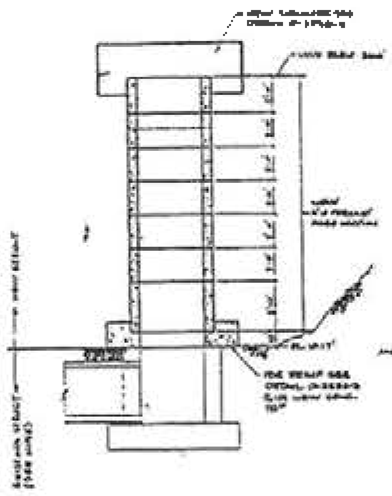
SECTION D-3253-4



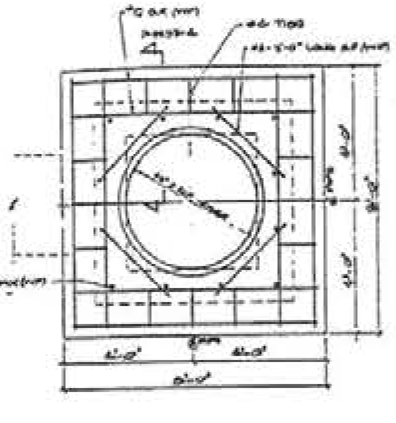
HANDRAIL DETAIL

SPLICE DETAIL

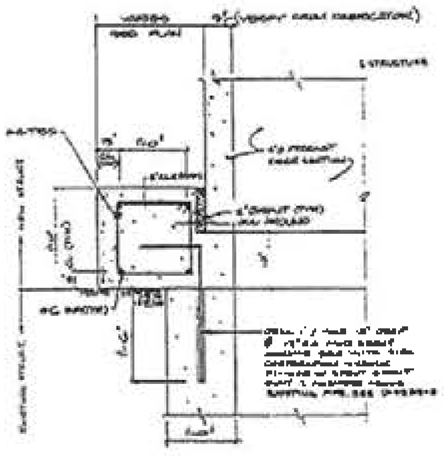
SECTION D-3253-1



SECTION D-3253-2



DETAIL D-3253-3



SECTION D-3253-4

NOTES

1. [illegible]

2. [illegible]

NOTES

REFERENCE DRAWINGS & SPECIFICATIONS

EXHIBIT 9

NO.	DATE	REVISION	BY	CK	APPROVED
2	10-14-85	AS-BUILT	[illegible]	[illegible]	[illegible]
1	5-9-84	[illegible]	[illegible]	[illegible]	[illegible]
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CAROLINA POWER & LIGHT COMPANY
FOSSIL PLANT ENGINEERING & CONSTRUCTION DEPT.

L V SUTTON STEAM ELECTRIC PLANT
ASH POND EXPANSION 1983-1984
SECTIONS AND DETAILS (SHEET 2)

D-3253

APPENDIX A

Document 12

71 Ash Pond Inundation Report

MACTEC
engineering and constructing a better tomorrow

DAM BREACH ANALYSES AND INUNDATION MAP DEVELOPMENT

for

83 Ash Pond Dam

at

Progress Energy L.V. Sutton Plant
New Hanover County, North Carolina

Prepared for
Progress Energy

Prepared by

MACTEC Engineering and Consulting, Inc.

Project 6468-10-0274

February 18, 2011

Stephen J. Hanks	D. Wayne Ingram
Project Engineer	Principal Engineer

TABLE OF CONTENTS

List of Tables

List of Figures

Appendix

1.0 Executive Summary

The Progress Energy L.V. Sutton Plant 83 Ash Pond is a storage area for coal combustion byproducts. The 83 Ash Pond Dam is an approximately 24-foot high earthen dam. The impoundment has a normal surface area of approximately 54 acres and a maximum storage capacity of approximately 677 acre-feet. This report summarizes the dam breach and breach inundation analyses completed for the 83 Ash Pond Dam. The analyses were completed for a wet weather failure and a dry weather failure. The breach flood wave was routed overland to the east of the impoundment towards the Northeast Cape Fear River. Analysis of a breach into the cooling reservoir adjacent to the west was not completed since the available storage within the cooling reservoir above normal pool elevation is approximately 4,700 acre-feet. The breach flood wave was routed along the flowpath using Hydrologic Engineering Center – River Analysis System (HEC-RAS) version 4.1 (US Army Corps of Engineers, 2010).

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. The HEC-RAS model was developed using 3 meter resolution elevation data published by the USGS, and the inundation extent of the breach wave was determined from the USGS elevation data as well.

Available information indicates that the constructed top width of the embankment is 12 feet and the crest elevation is 28 feet North American Vertical Datum of 1988 (NAVD 1988). The design side slopes are 3.0 foot horizontal to 1 foot vertical (3H:1V) on the exterior and interior. The maximum height of the dam is 15 feet from crest low point to the downstream toe at an existing ditch, and 24 feet above the bottom of the cooling reservoir. The hydrologic design criterion for the storage area is a 50-year event.

The routing of the flood wave was accomplished using HEC-RAS. The breach discharge was routed overland towards the Northeast Cape Fear River. The flood wave was retained by US Highway 421.

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 40 percent of the total capacity of the impoundment. The bottom width of a trapezoidal-shaped breach was estimated to be approximately 13 feet. The bottom elevation of the breach was assumed to be at 14 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 0.6 hour.

The breach analyses indicate that the breach of the 83 Ash Pond is not likely to overtop US 421. The majority of flood attenuation occurs in low lying areas adjacent to the embankment, and west of US 421. However, it is apparent that a breach of the 83 Ash Pond could potentially affect commercial properties adjacent to the eastern side of the embankment. The location of the potentially affected properties is depicted on the inundation maps provided in the Appendix.

2.0 Introduction

This report summarizes dam breach analyses completed for the 83 Ash Pond at the Progress Energy L.V. Sutton Plant to determine the extent of the inundation resulting from a dam breach. Analyses were completed using 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. 83 Ash Pond Structure Information

Impoundment Name	83 Ash Pond
State Dam ID No	NEWHA-004
Current Size Classification	Small
Current Hazard Classification	Low
Location	Latitude: 34.2931° Longitude: -77.9928°
County	New Hanover
Receiving Stream(s)	N/A
Impoundment Area	54 acres
Maximum Dam Height	24 feet (4 ft to 28 ft)
Normal Water Elevation	24 feet NAVD
Maximum Operating Elevation	26 feet NAVD
Maximum Depth	12 feet
Maximum Hydraulic Storage Volume	677 acre-feet (as designed) (29,490,000 cubic yards)
Material(s) Stored	Coal combustion product
Storage status	Unknown
Principal Spillway	Riser/Barrel
Emergency Spillway	N/A
Dam Minimum Section	Top width: 12 feet, Interior Slope: 3H:1V, Exterior Slope: 3H:1V
Embankment Materials	Earthen

3.0 Description of Facilities and Potentially Impacted Area

3.1 General

The 83 Ash Pond Dam is used for storage of coal combustion byproducts produced at the L.V. Sutton Plant. The reservoir has a designed storage capacity of 587 acre-feet (AF) below the maximum operating elevation of 26 feet NAVD, and a maximum storage capacity of 677 acre-feet below the the embankment crest elevation of 28 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 overland approximately 7,000 feet to a borrow pit located within the floodplain of the Northeast Cape Fear River. US Highway 421 intersects the breach flowpath approximately 4,500 feet from the embankment. The analyses included an assessment of the sensitivity of the model predictions to various breach parameters and flowable impoundment storage volumes.

Other potential 83 Ash Pond dam breach locations were considered. However, it was determined that potential locations along the western side of the embankment would drain into the cooling reservoir which would accommodate the breach without significant rise in water level, since the available storage within the cooling reservoir above normal pool elevation is approximately 4,700 acre-feet. Consequently, the single breach location along the east side of the embankment was analyzed.

Based on available information there appears to be four commercial properties located along the breach flowpath between the embankment and US 421.

3.2 Impoundment and Embankment Characteristics

The impoundment and embankment characteristics were based on design information presented in the 1983-1984 Ash Pond Expansion Plan, and aerial imagery. The interior crest of the embankment was digitized from aerial imagery, and then off-set the appropriate distance based on the specified slope and bottom elevation. The digitized features of the pond design were utilized in HEC-GeoRAS to develop an elevation-storage volume curve for the pond. HEC-GeoRAS is an extension of ArcGIS capable of analyzing a terrain model for hydraulic analysis. The elevation – volume curve for the 83 Ash Pond is presented in Figure 1.

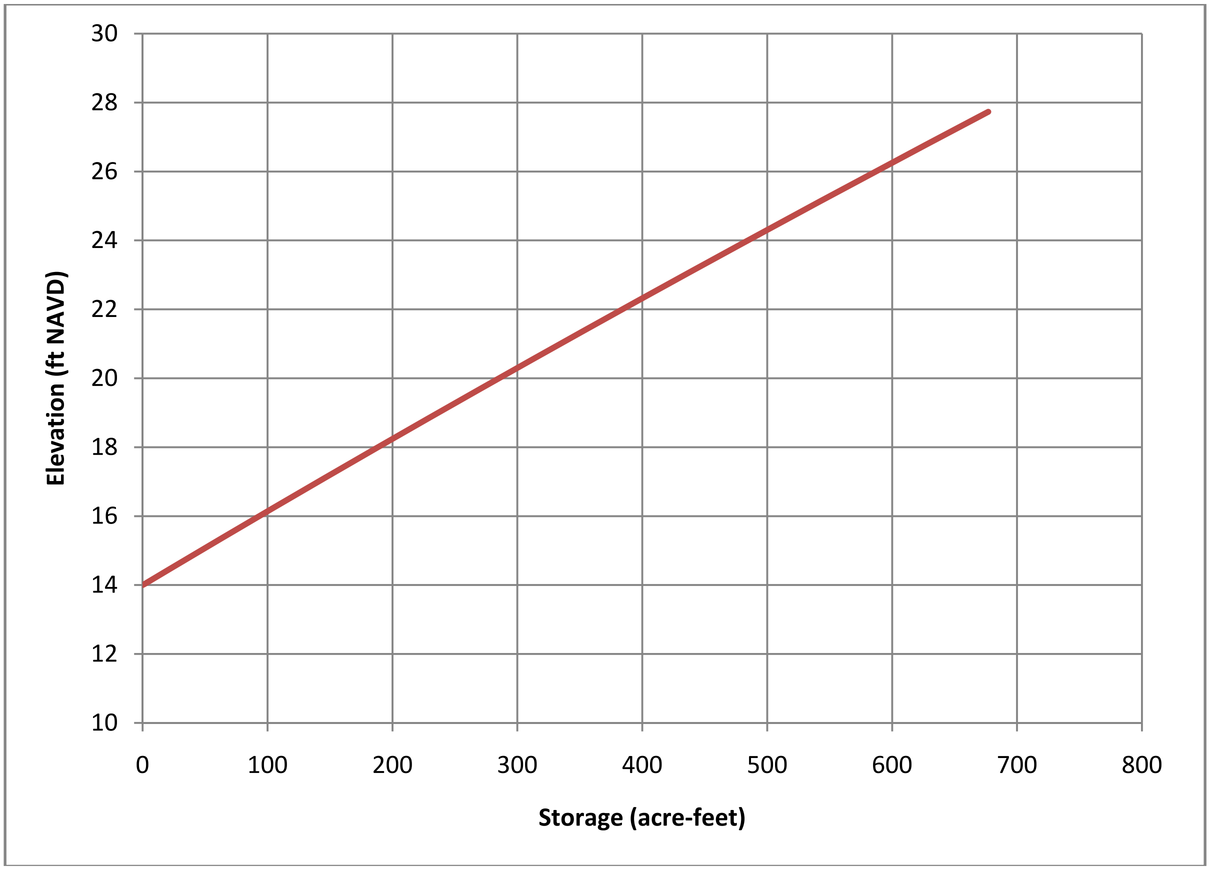


Figure 1. 83 Ash Pond Elevation – Storage Volume Curve

The design top width of the embankment is 12 feet. The design side slopes are 3H:1V on the interior and exterior. The dam crest is approximately 24 feet above surrounding grade. Excess water in the reservoir is discharged into the cooling water reservoir through a riser and barrel spillway with an maximum overflow elevation of 26 ft NAVD. The hydrologic design criterion for the storage area is a 50-year event. There is no drainage area to the 83 Ash Pond except the 83 Ash Pond dike.

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 83 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 the coal combustion products (CCP) stored in this 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 hydraulic model development came from readily available sources including 3 meter elevation data from the USGS National Elevation Dataset.

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 inline structure option to model the embankment to be breached. An inline structure in HEC-RAS is a structure located perpendicular 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.

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 specified initial pool elevation in the impoundment and a constant stage at the tailwater of the model. The initial pool elevation for the dry weather scenario was set to the maximum operating elevation of 26 feet NAVD. The initial pool elevation for the wet weather scenario was set to the crest elevation of 28 feet NAVD. The tailwater stage for both conditions was set to 9 feet NAVD. The tailwater stage was assumed to be 2 feet below the bank of the borrow pit located in the floodplain of the Northeast Cape Fear River.

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 40 percent of the total capacity of the impoundment. It was assumed that 40 percent of the total water and solids volume of the 83 Ash Pond would flow out of the pond. The trapezoidal-shaped breach bottom width was estimated to be 14 feet for the wet weather failure scenario. The breach bottom width was estimated to be 13 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 14 feet NAVD. 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 0.6 hour.

5.4 Flood Wave Routing

The routing of the flood wave from the breach location to the borrow pit located within the floodplain of the Northeast Cape Fear River was accomplished by extracting topographical information from elevation data available in a 3 meter resolution from the USGS National Elevation Dataset. The GIS dataset was converted into a continuous Triangulated Irregular Network (TIN) for the area along the flow paths of the flood wave. The flow path centerline was inferred from the TIN. The cross section lines were then drawn orthogonal to the inferred direction of flow. The topology of the flow path centerlines and geometry of the cross section lines were extracted from the TIN using HEC-GeoRAS version 4.1.1 (USACE HEC, September 2005). HEC-GeoRAS is an extension of ArcGIS developed by the USACE to perform spatial analysis of TINs, and extract geometric information from the TIN for direct import into a HEC-RAS geometry model.

Following the import of the HEC-GeoRAS output file, a storage area element and in-line structure element were incorporated into the model to simulate the impoundment and embankment, respectively. Additionally, a lateral structure and storage area was added to the model to replicate flow that would exit the flowpath and collect within the low lying area located along the eastern portion of the embankment. Also US 421 was incorporated into the model as an inline structure. It was assumed that no culverts would allow flow of the breach wave across US 421. The Manning roughness values for the cross sections located along the flow paths were set to 0.08.

6.0 Model Stability

Hydraulic models of unsteady flows inherently experience problems with stability of the model calculations. HEC-RAS provides a limited number a means to control instability through input parameter selection and model operation control parameters. The breach model was run for a range of inputs related not only to the breach size and rate of development, but other model inputs as well. Doing so provides for development of a more robust model with regard to stability, as well as providing an assessment of sensitivity of the model to the varied inputs.

To increase the stability of the routing model, a pilot channel was added along the entire breach flow path. Pilot channels are one of the available options to prevent the model from going unstable at low flows (USACE HEC, March 2008). The pilot channels were given a width of 4 feet and a Manning roughness value of 0.2. The high Manning value was chosen to restrict flow through the pilot channel during routing of the flood wave. Additionally, a pilot flow of 1 cfs was incorporated to provide baseflow within the model. The magnitude of the baseflow was determined as 0.1 percent of the peak discharge, since increases in flow conditions greater than a 1,000 times the baseflow conditions cause instability. Also, additional cross sections were interpolated along the flowpath so that the maximum distance between cross sections was reduced to 50 feet. This was required due the numerous steep drops along the flowpath, resulting in an overestimation of the water surface elevations in the upper portion of the model.

7.0 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 12-ft deep, 54-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)	Time to Initial Impact 0.4 Miles from Embankment (minutes)
None	1,638	21.4	50
Increased Breach Bottom Width by 50%	2,047	22.0	50
Reduced Manning's n Coefficient by 50%	1,637	20.9	45
Increased Manning's n Coefficient by 50%	1,636	22.2	55
Reduced Breach Development Time to 0.25 hr	1,814	21.7	35
Increased Breach Development Time to 0.75 hr	1,571	21.6	60

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%	2,235	310.2
80%	1,938	234.9
60%	1,867	185.2
40%	1,638	134.6

8.0 Summary of Selected Final Analyses

8.1 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 601 cfs (24.0 percent). The selected HEC-RAS model inputs for the final breach analyses are presented in Table 4.

Table 4. HEC-RAS Model Inputs for Wet Weather Conditions

Input	Value
Breach Development Time (minutes)	36
Breach Bottom Width (feet)	14 feet *
Breach Side Slopes (H:1V)	1
Breach Bottom Elevation (feet NAVD)	14 feet
Breach Progression Rate	Linear
Computation time increment (seconds)	60

* Breach bottom width was estimated to be 16 feet for the dry weather condition.

8.2 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 necessarily dependent on the time of arrival of the maximum water level, but the critical time is often dependent 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 foot 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 set to the maximum operating elevation of 26 feet NAVD. The second initial condition is representative of wet weather conditions where the pool elevation is at 28 feet NAVD and failure of the embankment occurs as a result of overtopping from high inflow. Flood wave travel time for dry weather and wet weather conditions are presented in Tables 4a and 4b.

Table 4a. 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
Vacant Lot Adjacent to Embankment	0.1	4.4	35	130
Near Entrance to First Commercial Property	0.4	4.2	50	160
Near US 421	0.9	3.0	490	615

Table 4b. Flood Wave Travel Time (Wet Weather Conditions)

Location	Distance Downstream (miles)	Peak Inundation Depth (feet)	Time from Start of Breach (minutes)	
			At Initial Impacts	At Peak Elevation
Vacant Lot Adjacent to Embankment	0.1	4.7	35	160
Near Entrance to First Commercial Property	0.4	4.6	55	180
Near US 421	0.9	3.4	230	335

Due to storage volume of the low lying areas between the breach location and US 421, overtopping of US 421 is not observed for either scenario. Discharge and stage hydrographs at the embankment are presented for the dry weather condition and the wet weather condition in Figures 2 and 3, respectively. In the dry weather condition, the initial breach flood wave of 6 feet attenuates to 3 feet by the time it reaches US 421. In the wet weather condition, the initial breach flood wave of 6 feet attenuates to 3.4 feet by the time it reaches US 421. Neither condition overtops US 421.

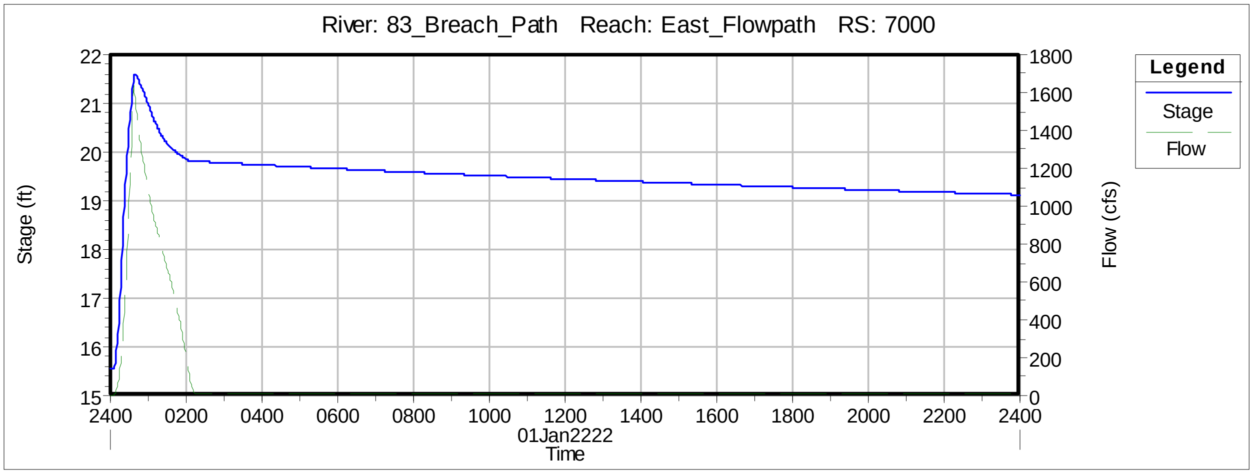


Figure 2. Discharge and Stage Hydrographs at embankment, Dry Weather Breach

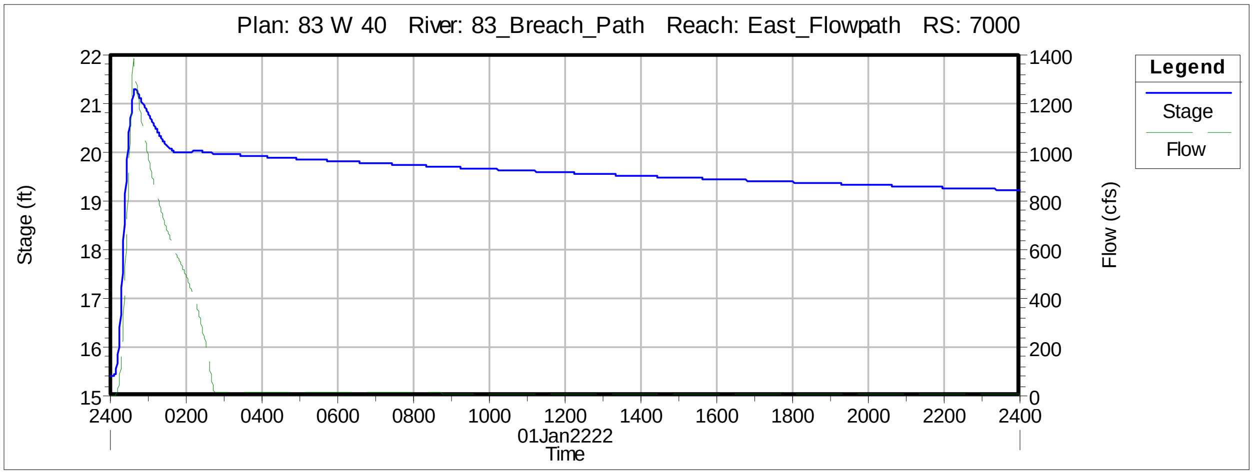


Figure 3. Discharge and Stage Hydrographs at embankment, Wet Weather Breach

Stream profiles depicting the effects along the flowpath from the embankment breach for the dry and wet weather scenarios are provided in Figures 4 and 5. The baseline stream profile is shown as well.

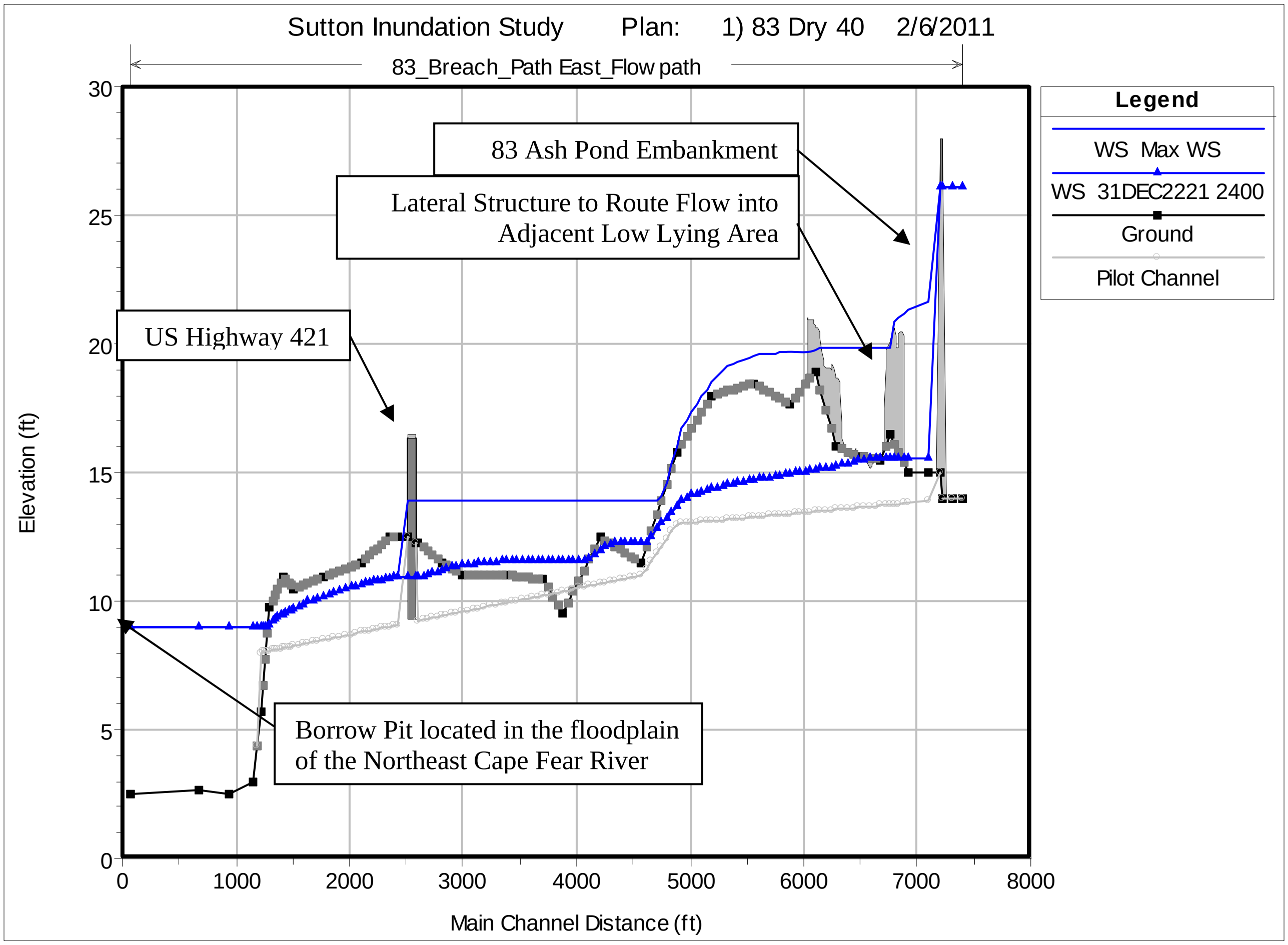


Figure 4. Breach Profile along Flowpath, Dry Weather Breach

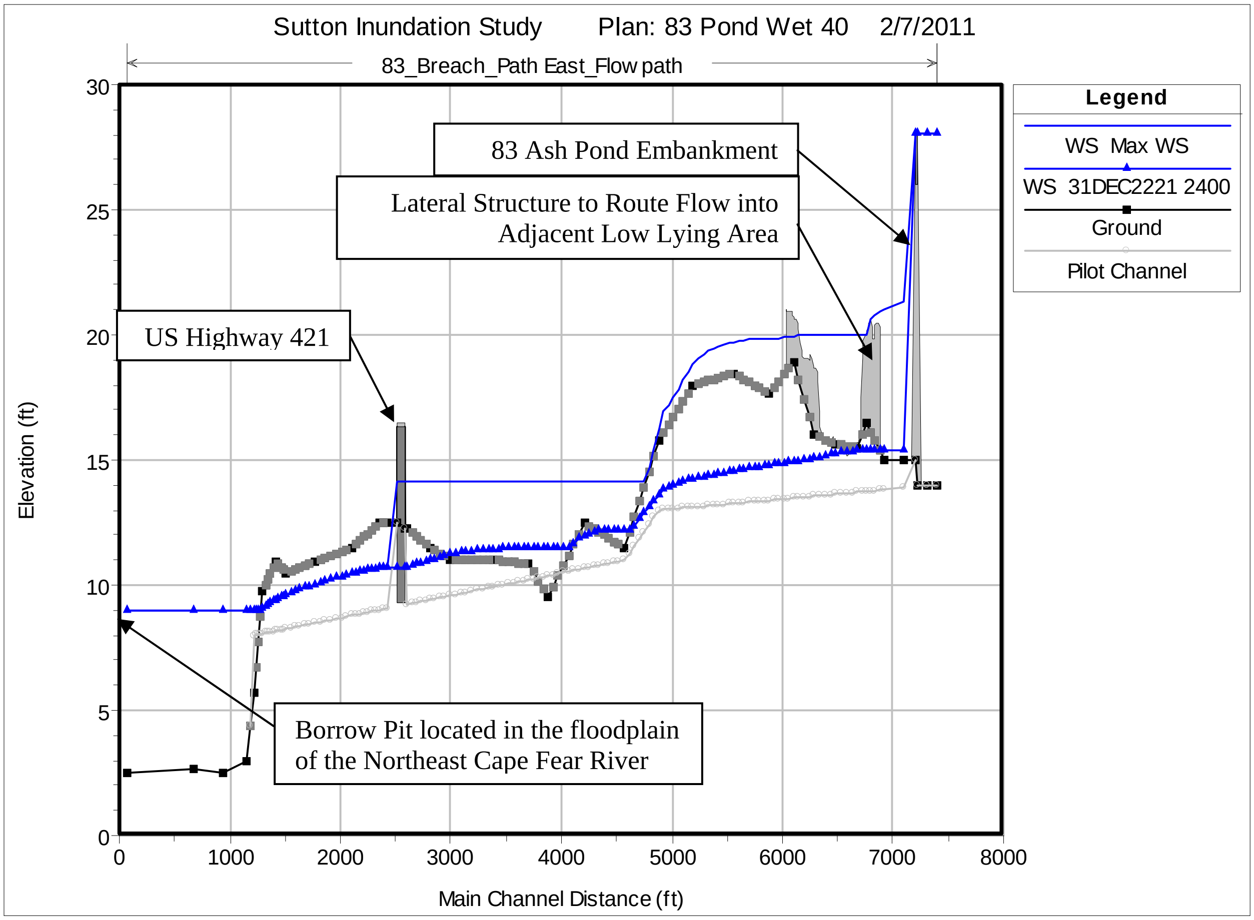


Figure 5. Breach Profile along Flowpath, Wet Weather Breach

8.3 Summary of Breach Analysis

The breach analyses indicate that the breach of the 83 Ash Pond is not likely to overtop US 421. The majority of flood attenuation occurs in low lying areas adjacent to the embankment, and west of US 421. However, it is apparent that a breach of the 83 Ash Pond could potentially affect commercial properties adjacent to the east of the embankment. The location of the potentially affected properties is depicted on the inundation maps provided in the Appendix.

9.0 References

CPL, 1983. Ash Pond Expansion Plan.

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, September 2005. HEC-GeoRAS GIS Tools for Support of HEC-RAS Using ArcGIS User's Manual. Davis, CA.

USACE HEC, March 2008. HEC-RAS River Analysis System User's Manual. Davis, CA.

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.

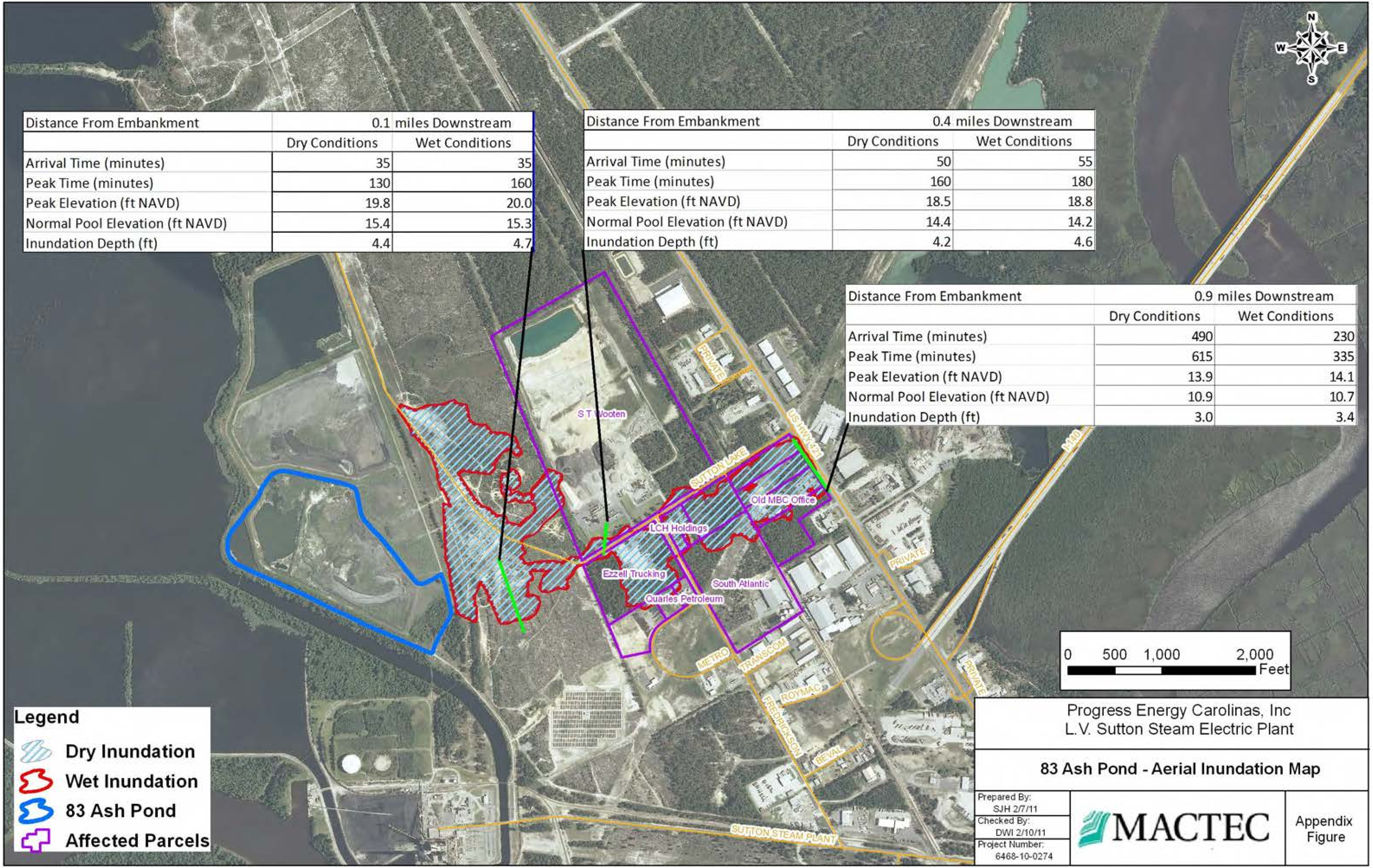
10.0 Abbreviations

AF	acre-feet
cfs	cubic feet per second
FEMA	Federal Emergency Management Agency
ft	feet
GIS	geographic information system
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HW	headwater (HEC-RAS)
NAVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Agency
PMP	Probable Maximum Precipitation
RS	River Station (HEC-RAS)
TW	tailwater (HEC-RAS)
USGS	United States Geological Survey
WS	water surface (HEC-RAS)

APPENDIX

83 Ash Pond – Aerial Inundation Map

83 Ash Pond – Topographical Inundation Map



Distance From Embankment	0.1 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	35	35
Peak Time (minutes)	130	160
Peak Elevation (ft NAVD)	19.8	20.0
Normal Pool Elevation (ft NAVD)	15.4	15.3
Inundation Depth (ft)	4.4	4.7

Distance From Embankment	0.4 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	50	55
Peak Time (minutes)	160	180
Peak Elevation (ft NAVD)	18.5	18.8
Normal Pool Elevation (ft NAVD)	14.4	14.2
Inundation Depth (ft)	4.2	4.6

Distance From Embankment	0.9 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	490	230
Peak Time (minutes)	615	335
Peak Elevation (ft NAVD)	13.9	14.1
Normal Pool Elevation (ft NAVD)	10.9	10.7
Inundation Depth (ft)	3.0	3.4

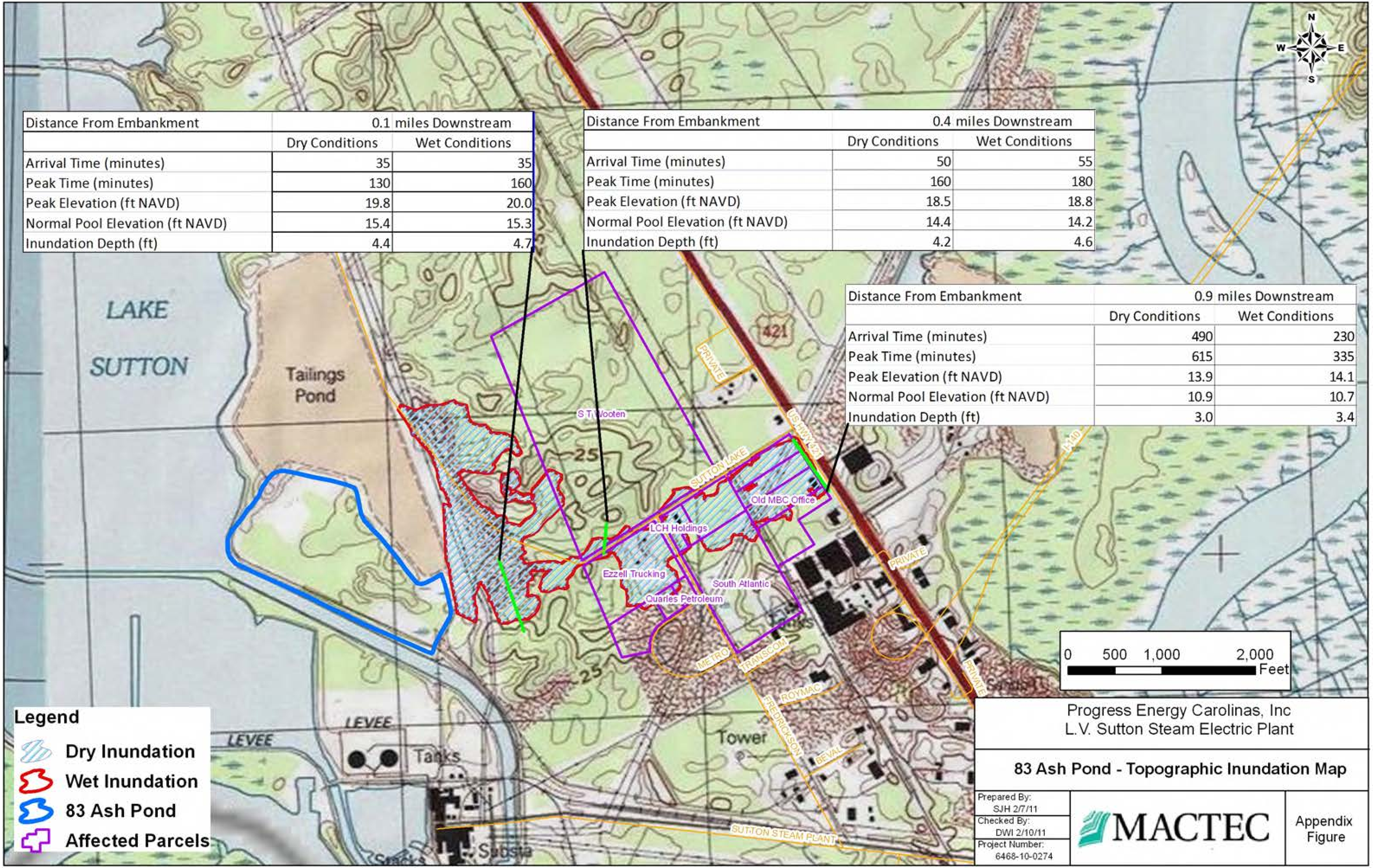
Progress Energy Carolinas, Inc
L.V. Sutton Steam Electric Plant

83 Ash Pond - Aerial Inundation Map

Prepared By:
SJH 2/7/11
Checked By:
DWI 2/10/11
Project Number:
6468-10-0274

MACTEC

Appendix
Figure



Distance From Embankment	0.1 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	35	35
Peak Time (minutes)	130	160
Peak Elevation (ft NAVD)	19.8	20.0
Normal Pool Elevation (ft NAVD)	15.4	15.3
Inundation Depth (ft)	4.4	4.7

Distance From Embankment	0.4 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	50	55
Peak Time (minutes)	160	180
Peak Elevation (ft NAVD)	18.5	18.8
Normal Pool Elevation (ft NAVD)	14.4	14.2
Inundation Depth (ft)	4.2	4.6

Distance From Embankment	0.9 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	490	230
Peak Time (minutes)	615	335
Peak Elevation (ft NAVD)	13.9	14.1
Normal Pool Elevation (ft NAVD)	10.9	10.7
Inundation Depth (ft)	3.0	3.4

Progress Energy Carolinas, Inc
L.V. Sutton Steam Electric Plant

83 Ash Pond - Topographic Inundation Map

Prepared By:
SJH 2/7/11
Checked By:
DWI 2/10/11
Project Number:
6468-10-0274

MACTEC

Appendix
Figure

APPENDIX A

Document 13

84 Ash Pond Inundation Report

MACTEC
engineering and constructing a better tomorrow

DAM BREACH ANALYSES AND INUNDATION MAP DEVELOPMENT

for

84 Ash Pond Dam

at

Progress Energy L.V. Sutton Plant
New Hanover County, North Carolina

Prepared for
Progress Energy

Prepared by

MACTEC Engineering and Consulting, Inc.

Project 6468-10-0274

February 18, 2011

Stephen J. Hanks
Project Engineer

D. Wayne Ingram
Principal Engineer

TABLE OF CONTENTS

List of Tables

List of Figures

Appendix

1.0 Executive Summary

The Progress Energy L.V. Sutton Plant 84 Ash Pond is a storage area for coal combustion byproducts. The 84 Ash Pond Dam is an approximately 32-foot high earthen dam. The impoundment has a normal surface area of approximately 82 acres and a maximum storage capacity of approximately 1,527 acre-feet. This report summarizes the dam breach and breach inundation analyses completed for the 84 Ash Pond Dam. The analyses were completed for a wet weather failure and a dry weather failure. The breach flood wave was routed overland to the east of the impoundment towards the Northeast Cape Fear River. Analysis of a breach into the cooling reservoir adjacent to the west was not completed since the storage within the cooling reservoir above normal pool elevation is approximately 4,700 acre-feet. The breach flood wave was routed along the flowpath using Hydrologic Engineering Center – River Analysis System (HEC-RAS) version 4.1 (US Army Corps of Engineers, 2010).

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. The HEC-RAS model was developed using 3 meter resolution elevation data published by the USGS, and the inundation extent of the breach wave was determined from the USGS elevation data as well.

Available information indicates that the constructed top width of the embankment is 12 feet and the crest elevation is 34 feet North American Vertical Datum of 1988 (NAVD 1988). The design side slopes are 3.0 foot horizontal to 1 foot vertical (3H:1V) on the exterior and interior. The maximum height of the dam is 20 feet from crest low point to the downstream toe at an existing ditch, and 32 feet above the bottom of the cooling reservoir. The hydrologic design criterion for the storage area is a 100-year event.

The routing of the flood wave was accomplished using HEC-RAS. The breach discharge was routed overland towards the Northeast Cape Fear 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 approximately 19 feet. The bottom elevation of the breach was assumed to be at 14 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 0.9 hour.

The breach analyses indicate that the breach of the 84 Ash Pond would likely overtop US 421 by approximately 2 feet. Additionally, it is apparent that a breach of the 84 Ash Pond could potentially affect commercial properties located along the flowpath to the east of the embankment. The locations of the properties that could be affected by a potential breach are depicted in the inundation maps provided in the Appendix.

2.0 Introduction

This report summarizes dam breach analyses completed for the 84 Ash Pond at the Progress Energy L.V. Sutton Plant to determine the extent of the inundation resulting from a dam breach. Analyses were completed using 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. 84 Ash Pond Structure Information

Impoundment Name	84 Ash Pond
State Dam ID No	NEWHA-005
Current Size Classification	Medium
Current Hazard Classification	Low
Location	Latitude: 34.2991° Longitude: -77.9924°
County	New Hanover
Receiving Stream(s)	N/A
Impoundment Area	82 acres
Maximum Dam Height	32 feet (2 ft to 34 ft)
Normal Water Elevation	26 feet NAVD
Maximum Operating Elevation	32 feet NAVD
Maximum Depth	20 feet
Maximum Hydraulic Storage Volume	1,527 acre-feet (as designed) (66,520,000 cubic yards)
Material(s) Stored	Coal combustion product
Storage status	Unknown
Principal Spillway	Riser/Barrel
Emergency Spillway	N/A
Dam Minimum Section	Top width: 12 feet, Interior Slope: 3H:1V, Exterior Slope: 3H:1V
Embankment Materials	Earthen

3.0 Description of Facilities and Potentially Impacted Area

3.1 General

The 84 Ash Pond Dam is used for storage of coal combustion byproducts produced at the L.V. Sutton Plant. The impoundment has a designed storage capacity of 1,364 acre-feet (AF) below maximum operating elevation of 32 feet NAVD, and a maximum storage capacity of 1,527 acre-feet below the embankment crest elevation of 34 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 overland approximately 6,500 feet to a borrow pit located within the floodplain of the Northeast Cape Fear River. US Highway 421 intersects the breach flowpath approximately 4,500 feet from the embankment. The analyses included an assessment of the sensitivity of the model predictions to various breach parameters and flowable impoundment storage volumes.

Other potential 84 Ash Pond dam breach locations were considered. However, it was determined that potential locations along the western side of the embankment would drain into the cooling reservoir which would accommodate the breach without significant rise in water level, since the available storage within the cooling reservoir above normal pool elevation is approximately 4,700 acre-feet. Consequently, the single breach location along the east side of the embankment was analyzed.

Based on available information there appears to be four commercial properties located along the breach flowpath between the embankment and the borrow pit located within the floodplain of the Northeast Cape Fear River.

3.2 Impoundment and Embankment Characteristics

The impoundment and embankment characteristics were based on design information presented in the 1983-1984 Ash Pond Expansion Plan, and aerial imagery. The interior crest of the embankment was digitized from aerial imagery, and then off-set the appropriate distance based on the specified slope and bottom elevation. The digitized features of the pond design were utilized in HEC-GeoRAS to develop an elevation-storage volume curve for the pond. HEC-GeoRAS is an extension of ArcGIS capable of analyzing a terrain model for hydraulic analysis. The elevation – volume curve for the 84 Ash Pond is presented in Figure 1.

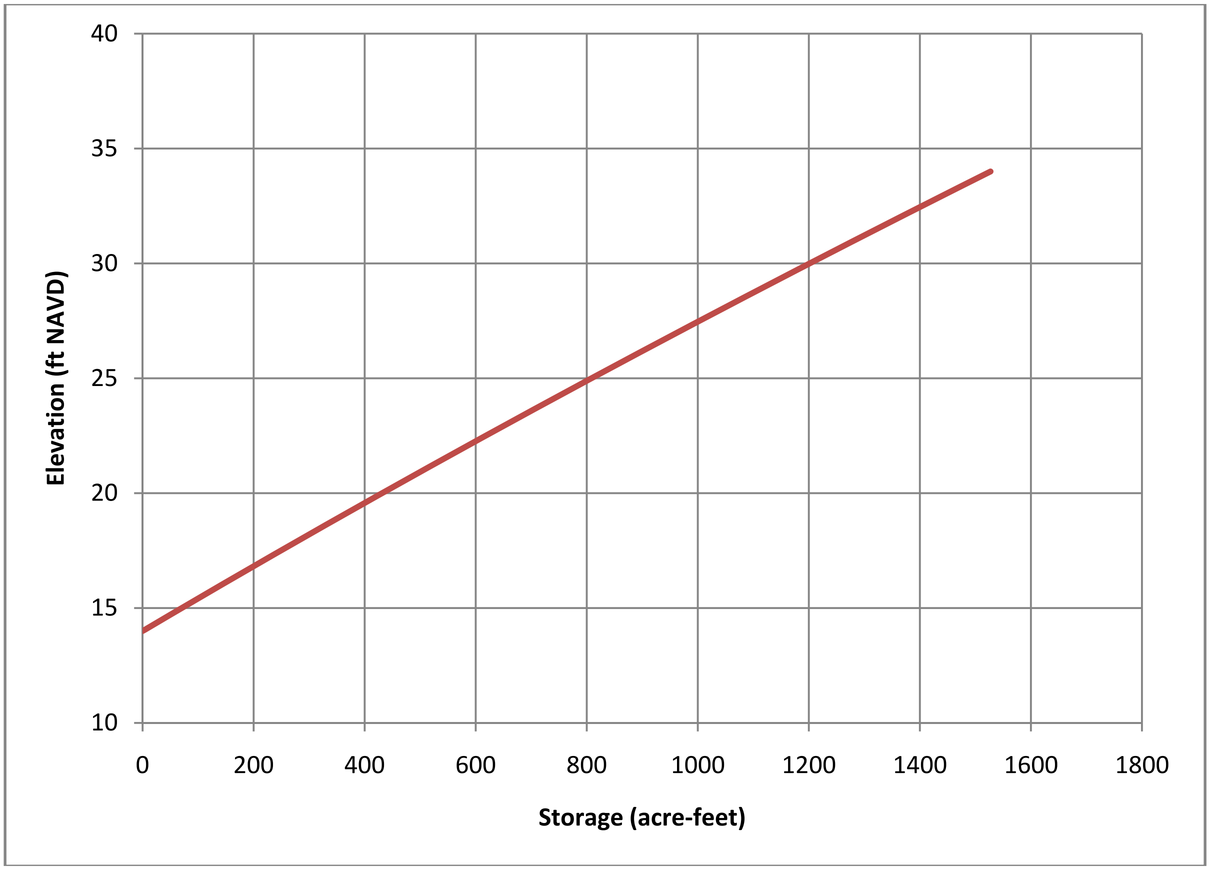


Figure 1. 84 Ash Pond Elevation – Storage Volume Curve

The design top width of the embankment is 12 feet. The design side slopes are 3H:1V on the interior and exterior. The dam height is approximately 32 feet above surrounding grade to the west of the embankment, and approximately 20 feet above surrounding grade to the east of the embankment. Excess water in the reservoir is discharged into the cooling water reservoir through a riser and barrel spillway with a variable overflow elevation. The overflow elevation of the riser is adjusted using 2-foot high sections of interlocking concrete cylinders. The hydrologic design criterion for the storage area is a 100-year event. There is no drainage area to the 84 Ash Pond except the 84 Ash Pond dike.

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 84 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 the coal combustion products (CCP) stored in this 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 hydraulic model development came from readily available sources including 3 meter elevation data from the USGS National Elevation Dataset.

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 inline structure option to model the embankment to be breached. An inline structure in HEC-RAS is a structure located perpendicular 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.

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 specified initial pool elevation in the impoundment and a constant stage at the tailwater of the model. The initial pool elevation for the dry weather scenario was set to the maximum operating elevation of 32 feet NAVD. The initial pool elevation for the wet weather scenario was set to the crest elevation of 34 feet NAVD. The tailwater stage for both conditions was set to 9 feet NAVD. The tailwater stage was assumed to be 2 feet below the bank of the borrow pit located in the floodplain of the Northeast Cape Fear River.

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 84 Ash Pond would flow out of the pond. The trapezoidal-shaped breach bottom width was estimated to be 19 feet for the wet weather failure scenario. The breach bottom width was estimated to be 17 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 14 feet NAVD. 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 0.9 hour.

5.4 Flood Wave Routing

The routing of the flood wave from the breach location to the borrow pit located within the floodplain of the Northeast Cape Fear River was accomplished by extracting topographical information from elevation data available in a 3 meter resolution from the USGS National Elevation Dataset. The GIS dataset was converted into a continuous Triangulated Irregular Network (TIN) for the area along the flow paths of the flood wave. The flow path centerline was inferred from the TIN. The cross section lines were then drawn orthogonal to the inferred direction of flow. The topology of the flow path centerlines and geometry of the cross section lines were extracted from the TIN using HEC-GeoRAS version 4.1.1 (USACE HEC, September 2005). HEC-GeoRAS is an extension of ArcGIS developed by the USACE to perform spatial analysis of TINs, and extract geometric information from the TIN for direct import into a HEC-RAS geometry model.

Following the import of the HEC-GeoRAS output file, a storage area element and in-line structure element were incorporated into the model to simulate the impoundment and embankment, respectively. Additionally, a lateral structure and storage area was added to the model to replicate flow that would exit the flowpath and collect within the low lying area located along the eastern portion of the embankment. Also US 421 was incorporated into the model as an inline structure. It was assumed that no culverts would allow flow of the breach wave across US 421. The Manning roughness values for the cross sections located along the flow paths were set to 0.08.

6.0 Model Stability

Hydraulic models of unsteady flows inherently experience problems with stability of the model calculations. HEC-RAS provides a limited number a means to control instability through input parameter selection and model operation control parameters. The breach model was run for a range of inputs related not only to the breach size and rate of development, but other model inputs as well. Doing so provides for development of a more robust model with regard to stability, as well as providing an assessment of sensitivity of the model to the varied inputs.

To increase the stability of the routing model, a pilot channel was added along the entire breach flow path. Pilot channels are one of the available options to prevent the model from going unstable at low flows (USACE HEC, March 2008). The pilot channels were given a width of 4 feet and a Manning roughness value of 0.2. The high Manning value was chosen to restrict flow through the pilot channel during routing of the flood wave. Additionally, a pilot flow of 5 cfs was incorporated to provide baseflow within the model. The magnitude of the baseflow was determined as 0.1 percent of the peak discharge, since increases in flow conditions greater than a 1,000 times the baseflow conditions cause instability. A cross section located approximately 2,700 feet from the embankment that characterized a ridge along the flowpath was converted into an inline structure so that flow over the ridge would be evaluated utilizing weir flow equations rather than channel flow equations in order to increase model stability. Also, additional cross sections were interpolated along the flowpath so that the maximum distance between cross sections was reduced to 50 feet. This was required due the numerous steep drops along the flowpath, resulting in an overestimation of the water surface elevations in the upper portion of the model.

7.0 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 20-ft deep, 82-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)	Time to Initial Impact 0.4 Miles from Embankment (minutes)
None	4,489	20.4	40
Increased Breach Bottom Width by 50%	5,735	20.9	40
Reduced Manning’s n Coefficient by 50%	4,729	19.9	40
Increased Manning’s n Coefficient by 50%	4,726	21.1	45
Reduced Breach Development Time to 0.25 hr	5,292	20.4	30
Increased Breach Development Time to 0.75 hr	4,221	20.4	55

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%	5,355	1,193.4
80%	4,996	962.8
60%	4,849	731.0
40%	4,164	497.1

8.0 Summary of Selected Final Analyses

8.1 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 inundation resulting from the increase in Manning’s n Coefficient. Increasing the Manning’s n Coefficient by 50 percent results in a peak inundation increase of 0.7 feet (21.1 feet NAVD). Increasing the breach bottom width by 50 percent results in a peak discharge rate increase of 1,246 cfs (27.8 percent). The selected HEC-RAS model inputs for the final breach analyses are presented in Table 4.

Table 4. HEC-RAS Model Inputs for Wet Weather Conditions

Input	Value
Breach Development Time (minutes)	54
Breach Bottom Width (feet)	19 feet *
Breach Side Slopes (H:1V)	1
Breach Bottom Elevation (feet NAVD)	14 feet
Breach Progression Rate	Linear
Computation time increment (seconds)	60

* Breach bottom width was estimated to be 17 feet for the dry weather condition.

8.2 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 necessarily dependent on the time of arrival of the maximum water level, but the critical time is often dependent 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 foot 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 equal to the maximum operating elevation of 32 feet NAVD. The second initial condition is representative of wet weather conditions where the pool elevation is at 34 feet NAVD and failure of the embankment occurs as a result of overtopping from high inflow. A breach occurring during wet weather conditions will likely inundate US 421 by 1.9 feet. Flood wave travel time for dry weather and wet weather conditions are presented in Tables 4a and 4b.

Table 4a. 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
Vacant Lot Adjacent to Embankment	0.1	5.9	25	75
Back Lot of First Commercial Property	0.4	5.6	40	75
US 421	0.9	1.7	65	135
Borrow Pit	1.1	4.6	90	125

Table 4b. Flood Wave Travel Time (Wet Weather Conditions)

Location	Distance Downstream (miles)	Peak Inundation Depth (feet)	Time from Start of Breach (minutes)	
			At Initial Impacts	At Peak Elevation
Vacant Lot Adjacent to Embankment	0.1	6.3	25	70
Back Lot of First Commercial Property	0.4	5.9	40	75
US 421	0.9	1.9	60	135
Borrow Pit	1.1	5.0	85	135

Discharge and stage hydrographs at the embankment are presented for the dry weather condition and the wet weather condition in Figures 2 and 3, respectively. In the dry weather condition, the initial breach flood wave of 6 feet attenuates to 4.6 feet by the time it reaches the borrow pit located in the floodplain of the Northeast Cape Fear River. In the wet weather condition, the initial breach flood wave of 6 feet attenuates to 5.0 feet by the time it reaches the borrow pit located in the floodplain of the Northeast Cape Fear River. Both conditions overtop US 421 by approximately 2 feet.

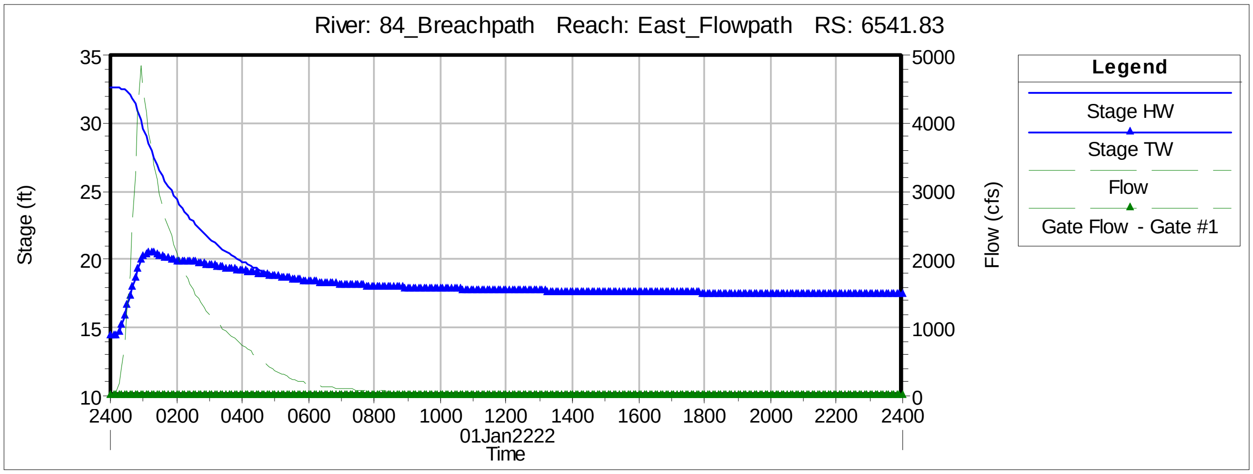


Figure 2. Discharge and Stage Hydrographs at embankment, Dry Weather Breach

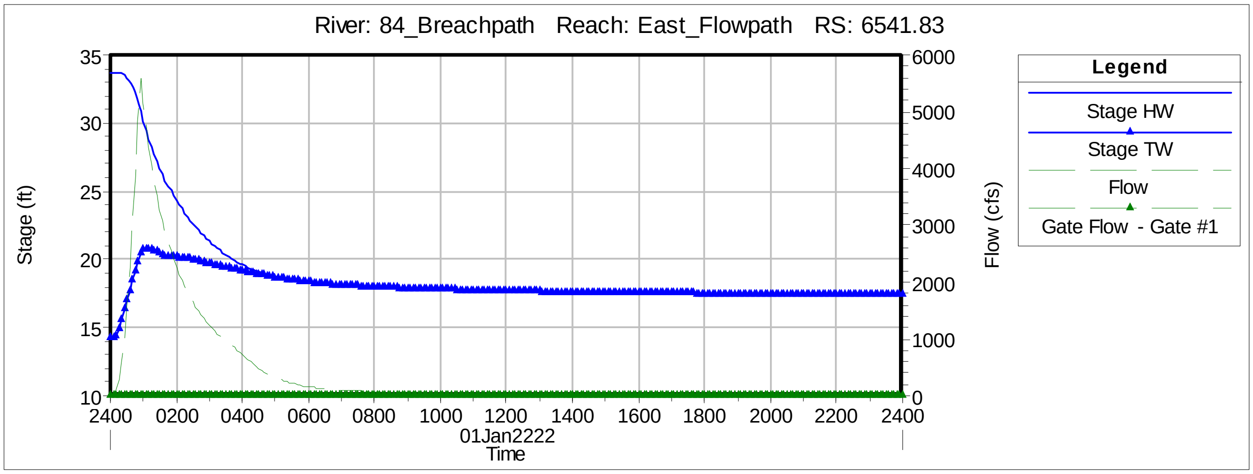


Figure 3. Discharge and Stage Hydrographs at embankment, Wet Weather Breach

Stream profiles depicting the effects along the flowpath from the embankment breach for the dry and wet weather scenarios are provided in Figures 4 and 5. The baseline stream profile is shown as well.

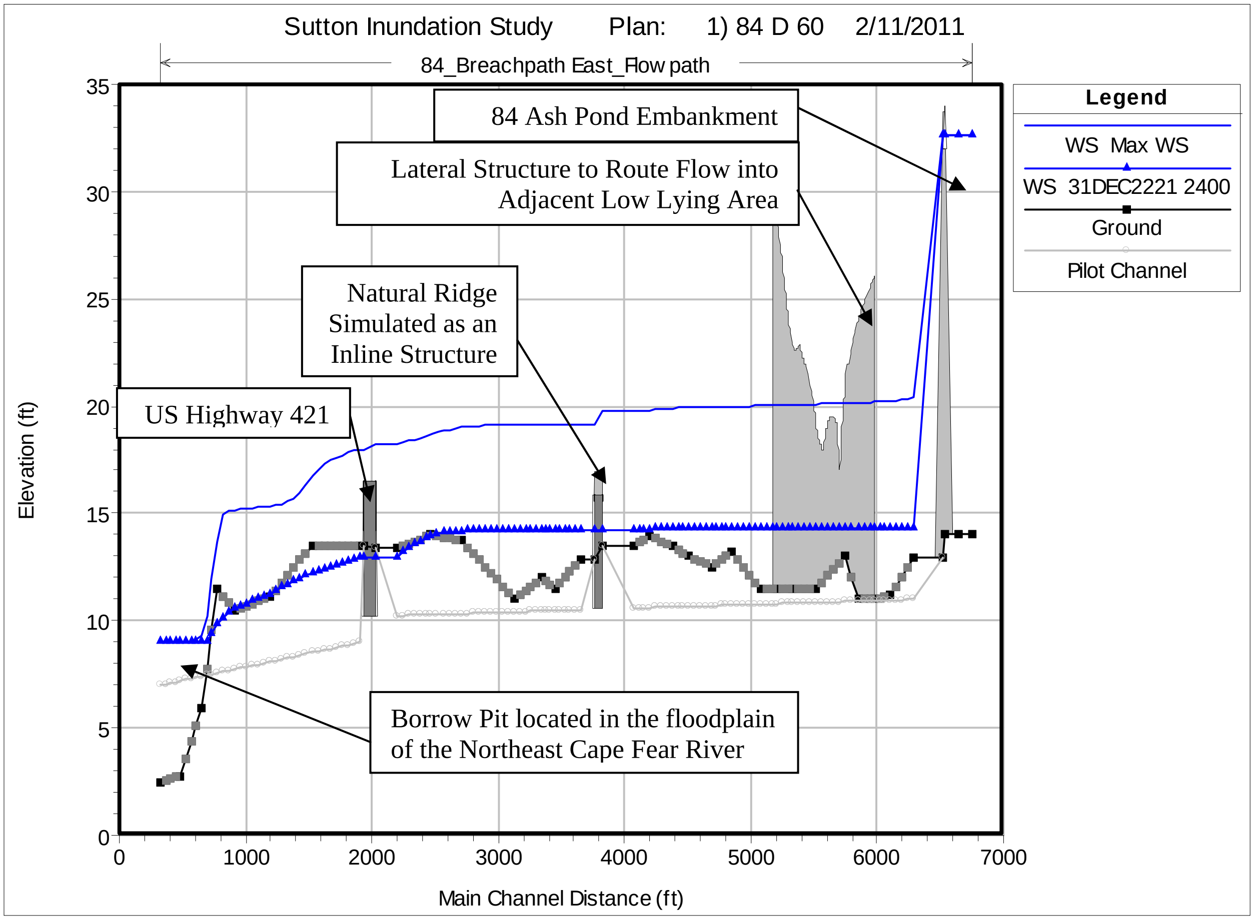


Figure 4. Breach Profile along Flowpath, Dry Weather Breach

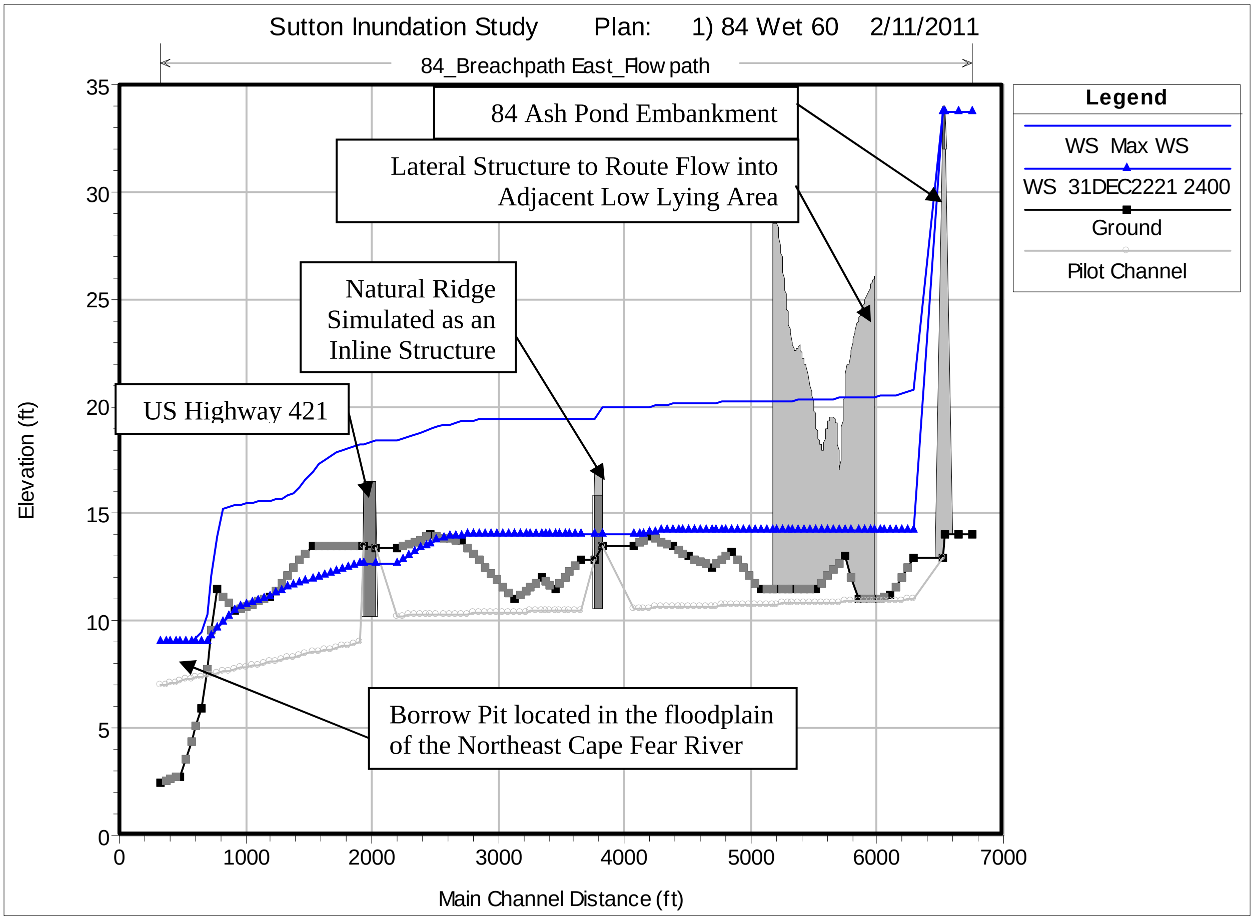


Figure 5. Breach Profile along Flowpath, Wet Weather Breach

8.3 Summary of Breach Analysis

The breach analyses indicate that the breach of the 84 Ash Pond would likely overtop US 421 by approximately 2 feet. Additionally, it is apparent that a breach of the 84 Ash Pond could potentially affect commercial properties located along the flowpath to the east of the embankment. The locations of the properties that could be affected by a potential breach are depicted in the inundation maps provided in the Appendix.

9.0 References

CPL, 1983. Ash Pond Expansion Plan.

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, September 2005. HEC-GeoRAS GIS Tools for Support of HEC-RAS Using ArcGIS User's Manual. Davis, CA.

USACE HEC, March 2008. HEC-RAS River Analysis System User's Manual. Davis, CA.

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.

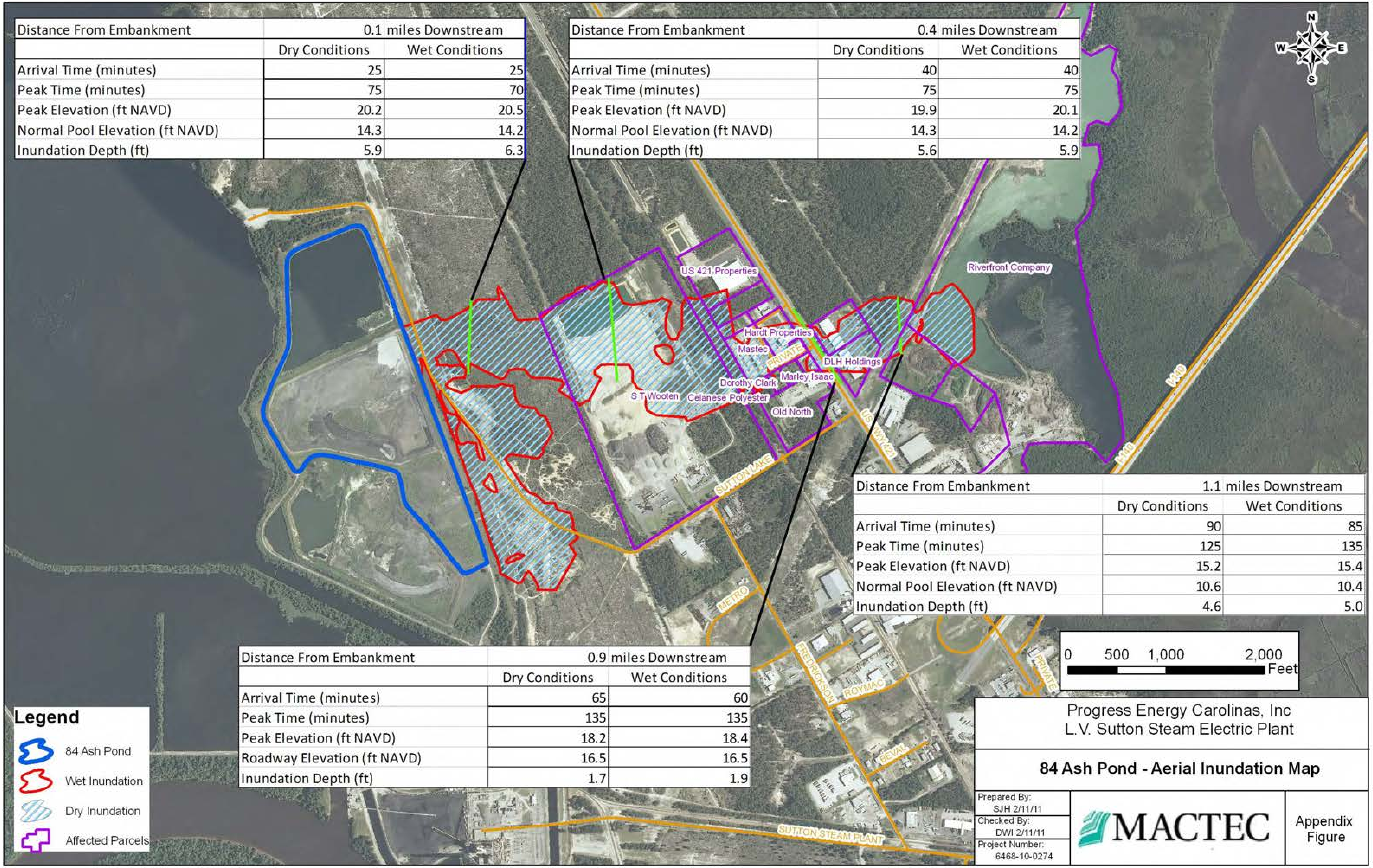
10.0 Abbreviations

AF	acre-feet
cfs	cubic feet per second
FEMA	Federal Emergency Management Agency
ft	feet
GIS	geographic information system
HEC-RAS	Hydrologic Engineering Center – River Analysis System
HW	headwater (HEC-RAS)
NAVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Agency
PMP	Probable Maximum Precipitation
RS	River Station (HEC-RAS)
TW	tailwater (HEC-RAS)
USGS	United States Geological Survey
WS	water surface (HEC-RAS)

APPENDIX

84 Ash Pond – Aerial Inundation Map

84 Ash Pond – Topographical Inundation Map



Distance From Embankment	0.1 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	25	25
Peak Time (minutes)	75	70
Peak Elevation (ft NAVD)	20.2	20.5
Normal Pool Elevation (ft NAVD)	14.3	14.2
Inundation Depth (ft)	5.9	6.3

Distance From Embankment	0.4 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	40	40
Peak Time (minutes)	75	75
Peak Elevation (ft NAVD)	19.9	20.1
Normal Pool Elevation (ft NAVD)	14.3	14.2
Inundation Depth (ft)	5.6	5.9

Distance From Embankment	1.1 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	90	85
Peak Time (minutes)	125	135
Peak Elevation (ft NAVD)	15.2	15.4
Normal Pool Elevation (ft NAVD)	10.6	10.4
Inundation Depth (ft)	4.6	5.0

Distance From Embankment	0.9 miles Downstream	
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	65	60
Peak Time (minutes)	135	135
Peak Elevation (ft NAVD)	18.2	18.4
Roadway Elevation (ft NAVD)	16.5	16.5
Inundation Depth (ft)	1.7	1.9

Legend

- 84 Ash Pond
- Wet Inundation
- Dry Inundation
- Affected Parcels

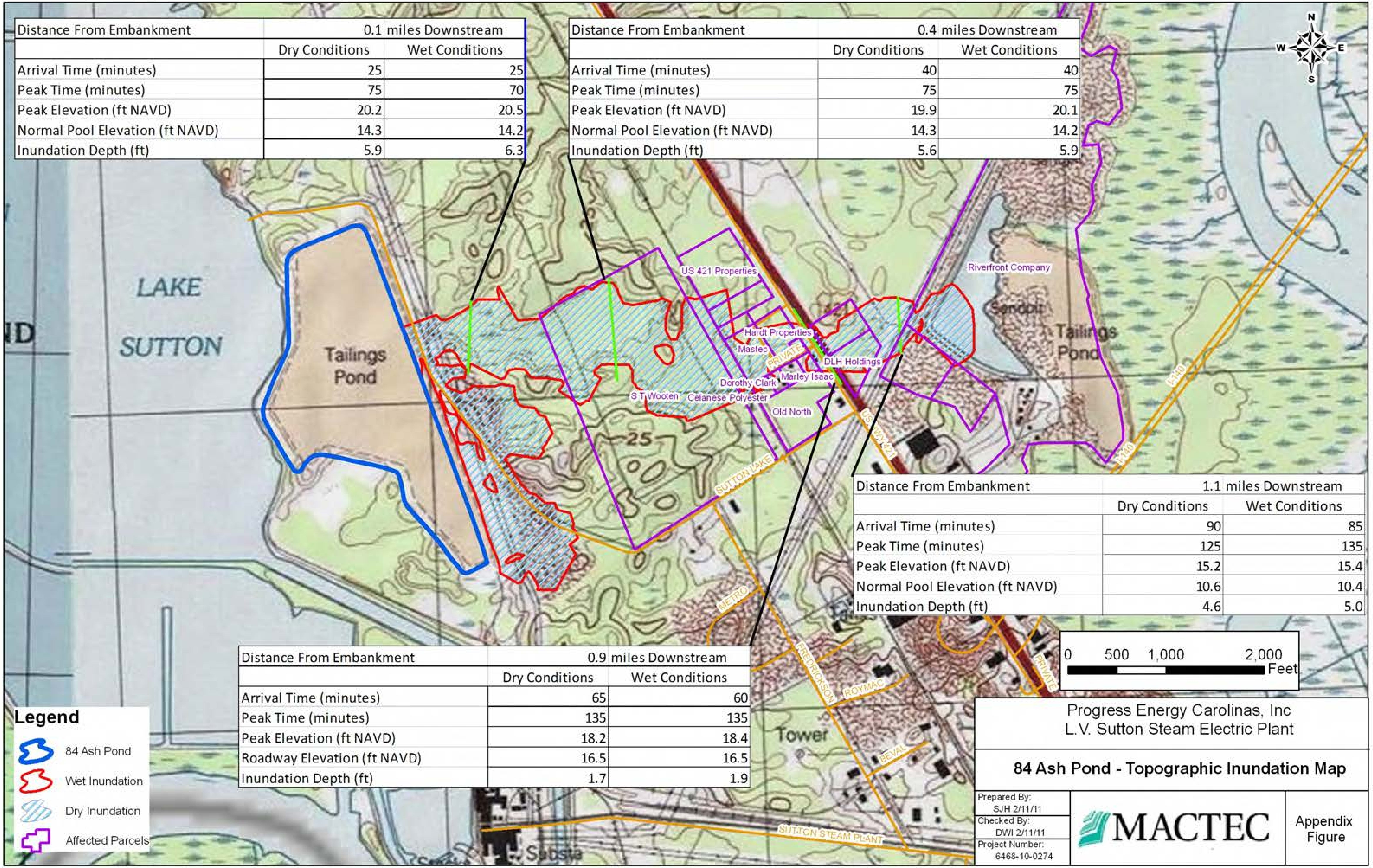
Progress Energy Carolinas, Inc
L.V. Sutton Steam Electric Plant

84 Ash Pond - Aerial Inundation Map

Prepared By:
SJH 2/11/11
Checked By:
DWI 2/11/11
Project Number:
6468-10-0274

MACTEC

Appendix
Figure



Distance From Embankment	0.1	miles Downstream
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	25	25
Peak Time (minutes)	75	70
Peak Elevation (ft NAVD)	20.2	20.5
Normal Pool Elevation (ft NAVD)	14.3	14.2
Inundation Depth (ft)	5.9	6.3

Distance From Embankment	0.4	miles Downstream
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	40	40
Peak Time (minutes)	75	75
Peak Elevation (ft NAVD)	19.9	20.1
Normal Pool Elevation (ft NAVD)	14.3	14.2
Inundation Depth (ft)	5.6	5.9

Distance From Embankment	1.1	miles Downstream
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	90	85
Peak Time (minutes)	125	135
Peak Elevation (ft NAVD)	15.2	15.4
Normal Pool Elevation (ft NAVD)	10.6	10.4
Inundation Depth (ft)	4.6	5.0

Distance From Embankment	0.9	miles Downstream
	Dry Conditions	Wet Conditions
Arrival Time (minutes)	65	60
Peak Time (minutes)	135	135
Peak Elevation (ft NAVD)	18.2	18.4
Roadway Elevation (ft NAVD)	16.5	16.5
Inundation Depth (ft)	1.7	1.9

Progress Energy Carolinas, Inc
L.V. Sutton Steam Electric Plant

84 Ash Pond - Topographic Inundation Map

Prepared By:
SJH 2/11/11
Checked By:
DWI 2/11/11
Project Number:
6468-10-0274

MACTEC

Appendix
Figure

APPENDIX A

Document 14

Repair Completion Package

MACTEC
engineering and constructing a better tomorrow

February 16, 2011

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

**SUBJECT: TRANSMITTAL OF COMPLETION REPORT/CERTIFICATION
DIKE BREACH REPAIRS
SUTTON 1984 ASH POND DIKE – NEWHA-005
SUTTON STEAM ELECTRIC PLANT
NEW HANOVER COUNTY, NORTH CAROLINA
MACTEC PROJECT NO6468-11-0312**

Dear Mr. Forster:

MACTEC Engineering and Consulting, Inc. (MACTEC) has provided engineering observation and construction testing services related to implementation of repairs to the small breach area in the 1985 Ash Pond Dike at the Sutton Plant. Plans for the repair plans were prepared by MACTEC under the engineering supervision of J. Allan Tice, P. E. and approved by the North Carolina Department of Environment and Natural Resources, Division of Land Resources (DLR) by letter dated January 21, 2011. The attached Completion Report summarizes construction activities and our observations and testing results. Sets of Record Drawings and a Certificate of Completion are attached to the Completion Report. The Completion Report, the Certificate of Completion and two sets of the Record Drawings are required to be submitted to DLR.

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 Allan Tice

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

Attachments: Completion Report

MACTEC Engineering and Consulting, Inc. NC License F-0653
3301 Atlantic Avenue • Raleigh, NC 27604 • Phone: 919.876.0416 • Fax: 919.831.8136

www.mactec.com

COMPLETION REPORT
REPAIRS TO DIKE BREACH SECTION
1984 ASH POND DIKE (NEWHA-005)
SUTTON STEAM ELECTRIC PLANT
NEW HANOVER COUNTY, NORTH CAROLINA

PREPARED FOR:

PROGRESS ENERGY CAROLINAS

2-16-11

PREPARED BY:

MACTEC ENGINEERING AND CONSULTING, INC.

J. ALLAN TICE, P. E.

PROJECT INFORMATION

MACTEC Engineering and Consulting, Inc. (MACTEC) has provided engineering observation and construction testing services related to implementation of repairs to the small breach area in the 1985 Ash Pond Dike at the Sutton Plant. Emergency repairs in the breach area were made immediately after the breach, in September, 2010. Plans for a permanent repair were prepared by MACTEC under the engineering supervision of J. Allan Tice, P. E. and approved by the North Carolina Department of Environment and Natural Resources, Division of Land Resources (DLR) by letter dated January 21, 2011. This Completion Report summarizes construction activities and MACTEC's observations and testing results. Appendices contain results of laboratory and field tests. Two sets of Record Drawings and a Certificate of Completion are attached. This Completion Report and its attachments is to be submitted to DLR by Progress Energy.

CONSTRUCTION SUMMARY

Progress Energy notified Mr. Dan Sams of the Wilmington office of DLR that construction was to begin on February 11, 2011. Work commenced on that date. Progress Energy performed the work with internal forces and equipment under the supervision of Mr. Philip Bordeaux. Samples of proposed soil materials were obtained by MACTEC and approved for use. Laboratory test results are included in Attachment B. Mr. Tice met with Mr. Bordeaux on site and reviewed the planned work approach and details with the Progress work force prior to the start of work. Mr. Daniel Atkinson, L.G. and Mr. Chris Beals (MACTEC) were also present. After the plan review and a safety briefing, work began about 9:00 AM. Weather was cold and windy with occasional snow, sleet and rain showers.

Existing silt fencing remaining from the emergency repair in September, 2010 was inspected and found in acceptable condition. Some sections had slipped down the posts; these were re-tied. Loose materials and vegetation in the bottom and on the sides of the breach area were removed off with a bulldozer and a tracked bucket excavator. The bottom was rolled using a drum vibratory roller to create a firm base for further fill placement (Photo 1; photos are in Attachment A). The sides of the breach were roughly stepped and scarified to provide bonding of new and existing fill.

The planned geotextile was placed over the existing riprap plug slope (Photo 2). Sand was shoveled onto the riprap to provide a cushion for the geotextile. Sequential lifts of clay and sand approximately 12-inches thick were placed and compacted (Photo 3). A RamEx roller was used to compact the clay. The vibratory drum roller was used for the sand.

Slight changes were made in the surface completion for the road and crest. The thickness of aggregate base course was increased to 12 inches, the planned geogrid was replaced by the geotextile used elsewhere in the repairs, and available small concrete rubble material was used along with the aggregate base course (Photos 4 and 5). These changes were approved by Mr. Tice and are shown on the Record Drawings.

Work continued February 12 and was completed February 13, 2011. Weather on those days was sunny and cool to mild. Field testing those days was conducted by MACTEC representative Mr. Pete Worth.

MACTEC representatives were on site during all the work documenting the construction activities and performing soil density testing. Copies of the test reports are included in Appendix B. All field density test results showed compaction met the required values either initially or upon retest.

Mr. Tice returned to the site February 13, 2011 to observe the final stages of construction and inspect the completed work. Work was completed in a satisfactory manner and in accordance with the approved plans (Photo 6).

In addition to the breach filling, Progress Energy requested that the access ramp adjacent to the repair area be modified to flatten the side slope as it abutted into the dike repair. This work was not part of the planned dike repair; it is mentioned here as it was done simultaneously. The result was to create a flatter slope for portions of the repair area, which is acceptable from the performance standpoint.

Progress Energy personnel will spread a temporary seed mixture developed based on a soil test to provide cover until the spring when they plan an overall dike reseeding program.

Attachments:

A – Photographs

B – Laboratory Test Reports

C – Field Density Test Reports

D – Completion Certificate

E – Record Drawings (4 sheets)

ATTACHMENT A

PHOTOGRAPHS

Photo 1. Breach bottom area after initial preparation.

Photo 2. Placing geotextile across riprap face of emergency plug.

Photo 3. Sand and clay fill nearing top of repair zone.

Photo 4. Placing geotextile in preparation for crest gravel.

02/13/2011

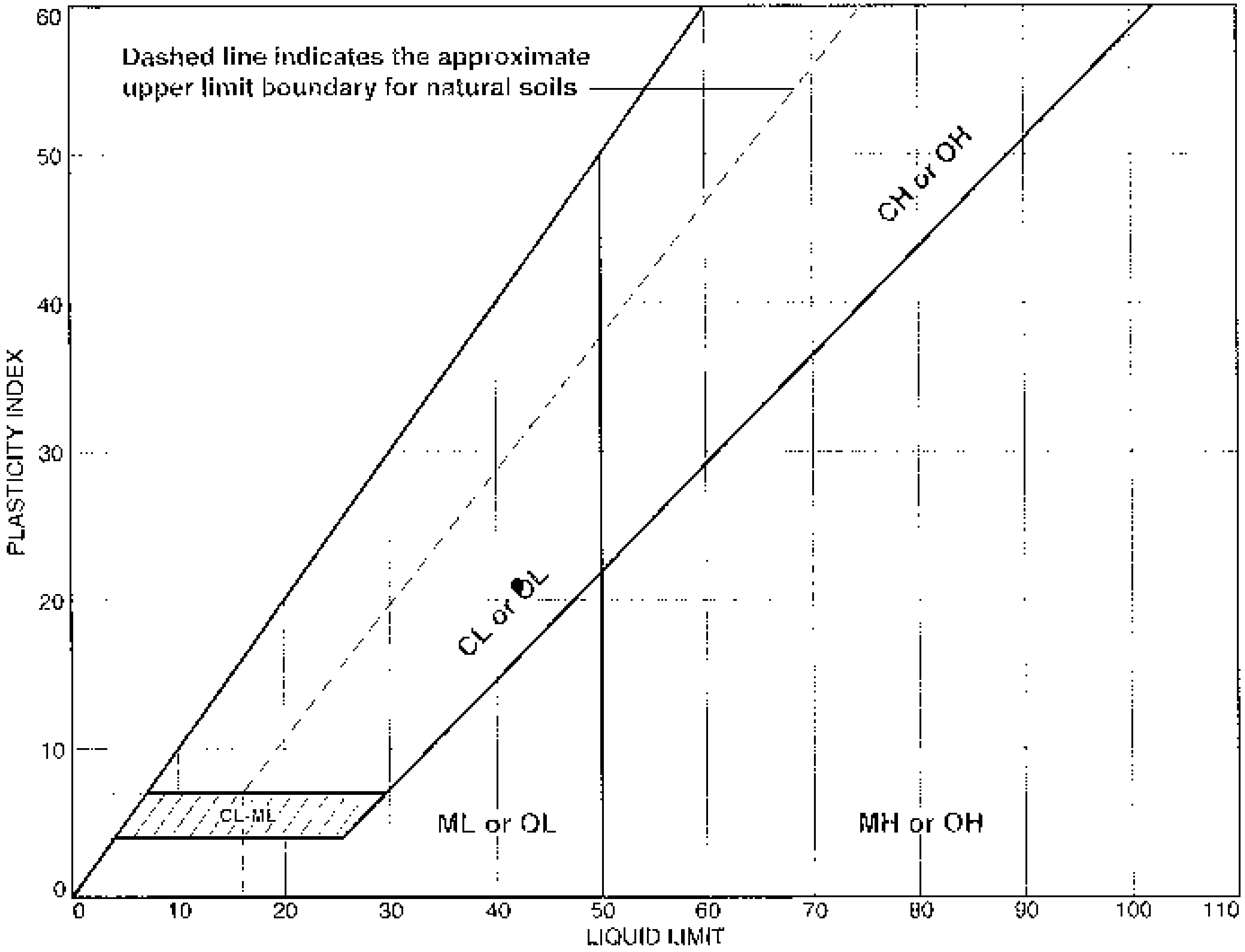
Photo 5. Crest at final grade.

Photo 6. Completed repair slope.

ATTACHMENT B

LABORATORY TEST RESULTS

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



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring B-1	11/035	Bulk	ND	21	42	21	CL

Note: Material Came From MW-1s, P.I. S-2 Previously used. Recheck for [illegible]

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Client: Progress Energy
Project: Sutton Dike Repair

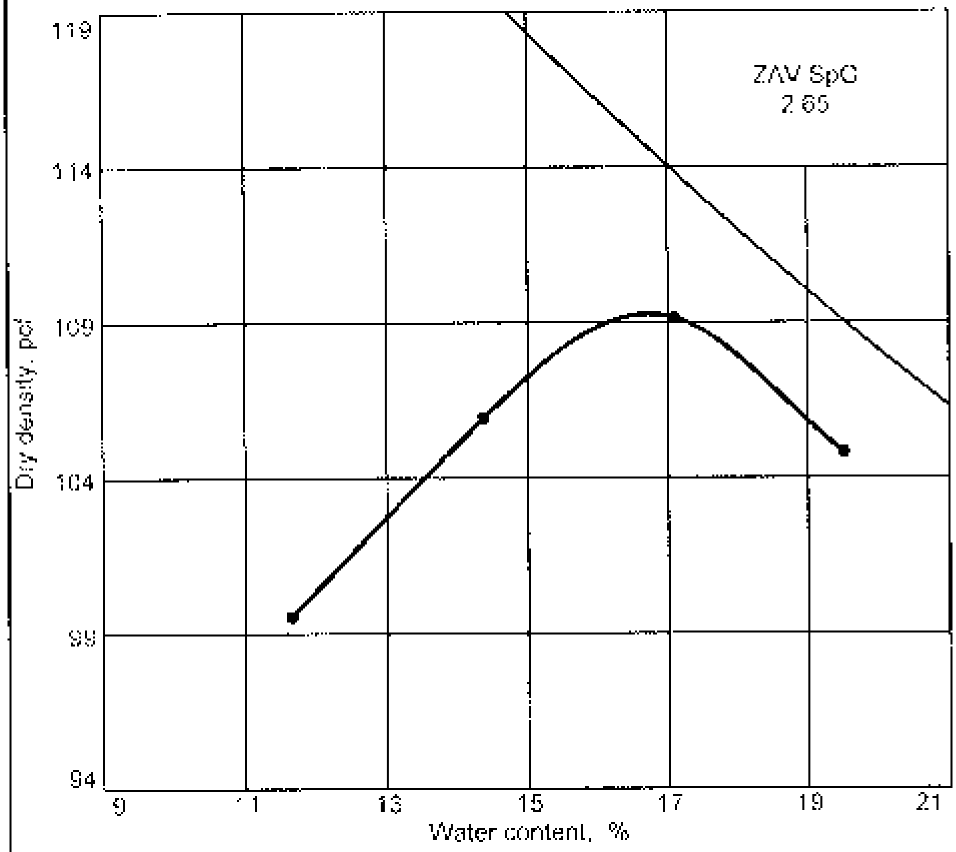
Project No.: 6468110031201

Figure

Tested By: CS

Chk by

COMPACTION TEST REPORT



Curve No.
10-017

Test Specification:
ASTM D 698-91 Procedure A Standard

Preparation Method Moist
Hammer Wt. 5.5 lb.
Hammer Drop 12 in.
Number of Layers three
Blows per Layer 25
Mold Size 0.0333 cu.ft.
Test Performed on Material Passing No.4 **Sieve**
NM ND **LL** 44 **PI** 23
Sp.G. (ASTM D 854) ND
%>No.4 0.0 **%<No.200** 41.1
USCS SC **AASHTO** A-7-6(5)
Date Sampled 9/1/10
Date Tested 9/3/10
Tested By CS

TESTING DATA

	1	2	3	4	5	6
WM + WS	[illegible]	[illegible]	[illegible]	[illegible]		
WM	[illegible]	[illegible]	[illegible]	[illegible]		
WW + T #1	[illegible]	[illegible]	[illegible]	[illegible]		
WD + T #1	[illegible]	[illegible]	[illegible]	[illegible]		
TARE #1	[illegible]	[illegible]	[illegible]	[illegible]		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	[illegible]	[illegible]	17.1	[illegible]		
DRY DENSITY	[illegible]	[illegible]	109.2	[illegible]		

TEST RESULTS

Maximum dry density = 109.3 pcf

Optimum moisture = 16.7 %

Material Description

Brown Clayey SAND

Remarks:

Project No. 6468100144 **Client:**

Project: Hope Mills Dam 2010

● **Source:** Hope Mills **Sample No.:** Pit S-3 **Elev./Depth:** Bulk

Checked by: TAM

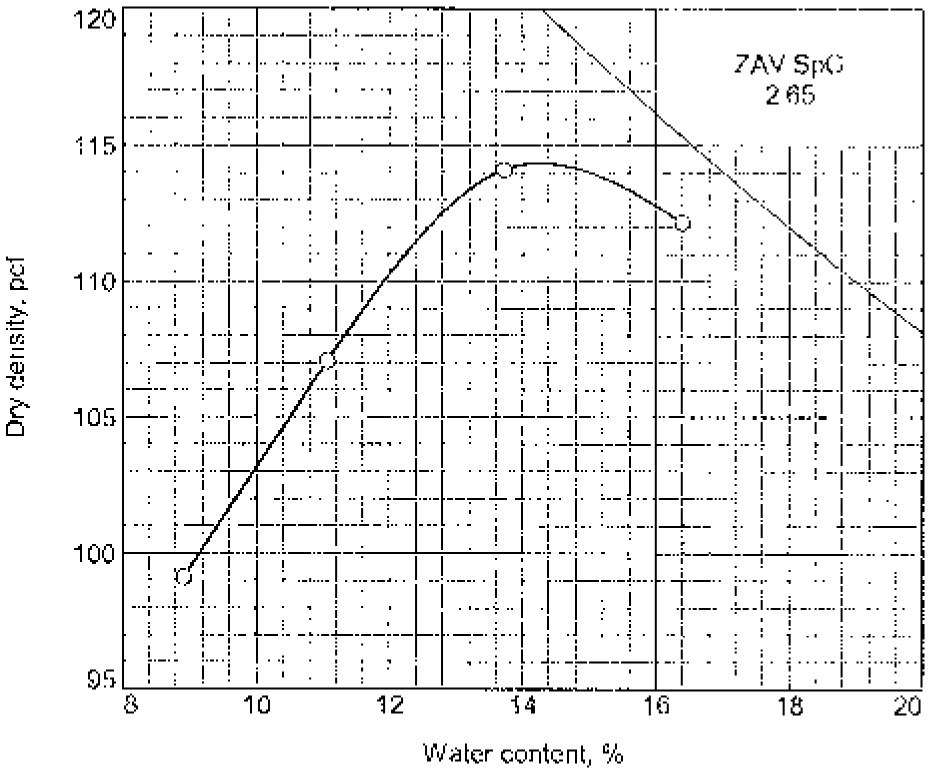
Title: Senior Engineer

MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Figure

COMPACTION TEST REPORT



Curve No.
10/319-02

Test Specification:
ASTM D 698-07e1 Method A Standard

Preparation Method DRY
Hammer Wt. 5.5 lb.
Hammer Drop 12 in.
Number of Layers three
Blows per Layer 25
Mold Size 0.03333 cu. ft.

Test Performed on Material
Passing #4 **Sieve**

NM ND **LL** ND **PI** ND
Sp.G. (ASTM D 854) ND
%>#4 <5% **%<No.200** ND
USCS SC(vis) **AASHTO** ND
Date Sampled 12/5/2010
Date Tested 12/7/10
Tested By GS

TESTING DATA

	1	2	3	4	5	6
WM + WS	12.85	13.22	13.58	13.61		
WM	9.26	9.26	9.25	9.26		
WW + T #1	1896.2	2086.4	2246.1	2217.6		
WD + T #1	1766.1	1907.9	2010.5	1972.7		
TARE #1	307.6	294.9	294.2	295.5		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	8.9	11.1	13.7	16.4		
DRY DENSITY	99.1	107.1	114.1	112.2		

TEST RESULTS

Maximum dry density = 114.4 pcf

Optimum moisture = 14.3 %

Material Description

Reddish brown clayey SAND

Remarks:

Project No. 6468100144 **Client:** Mactec
Project: Hope Mills Dam Emergency Repair

○ **Sample Source:** Import Fill **Depth:** n/a **Sample No.:** 10/319-02

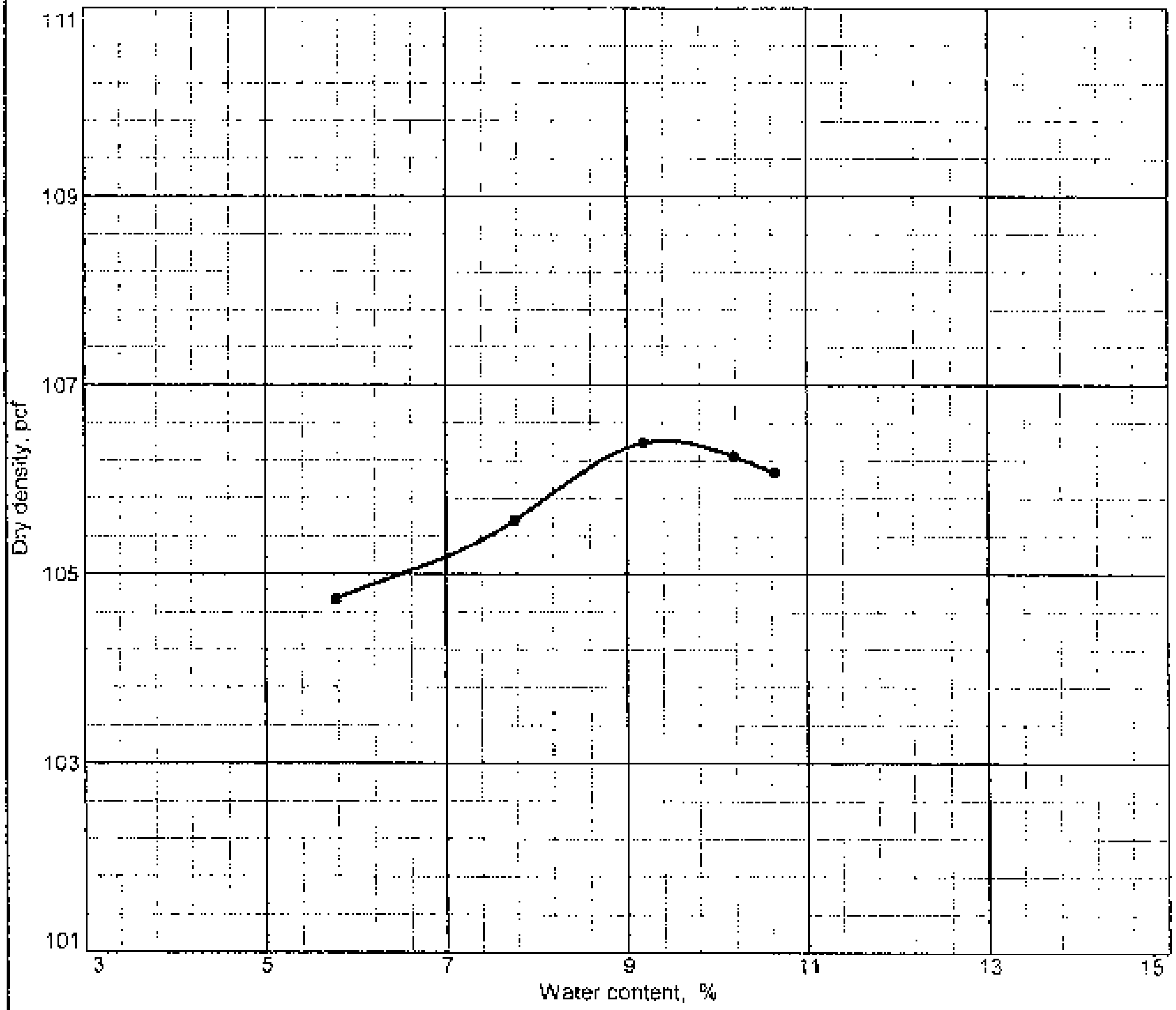
MACTEC Engineering and Consulting, Inc.

Raleigh, North Carolina

Checked by: IAM
Title: Senior Engineer

Figure 10/319-02

COMPACTION TEST REPORT - ASTM D698



Test specification: AASHTO T 99 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	N/A	N/A	N/A	N/A	N/A	N/A	0.0	N/A

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 106.4 pcf Optimum moisture = 9.4 %	Brown Course Sand

Project No. 6468110312 **Client:** Progress Energy

Project: Backfill of Ash Pond [illegible] [illegible] [illegible]

● **Location:** ~~Ditch~~ Site Stockpile [illegible]

Remarks:
N/A

COMPACTION TEST REPORT - ASTM D698

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Plate

ATTACHMENT C

FIELD DENSITY TEST RESULTS

REPORT OF FIELD DENSITY TEST BY NUCLEAR GAUGE (ASTM D2922)

MACTEC ENGINEERING AND CONSULTING SERVICES, INC
WILMINGTON, NORTH CAROLINA

MACTEC

TECHNICIAN: Chris Beals/Daniel Atkinson
PROJECT NAME: Sutton Plant Dike Repair
PROJECT NO.: 6468-11-0312

NUCLEAR DENSITY EQUIPMENT
MAKE: Troxler MODEL: 3430 SERIAL NO.: 23417
STANDARD COUNT: 2485
CHECKED BY:
DATE: 2/4/11

				NUCLEAR DENSITY DATA					FIELD MOISTURE DATA*			PROCTOR		RESULTS			
Test Date	Test Location	Depth Below Finished Grade or Elev. (ft)	Test Mode	Rod Depth, (in.)	Moisture Reading (%)	Moisture Correction (%)	Corrected Moisture Content (%)	Total Density, (pcf)	Wet Weight, (g)	Dry Weight, (g)	Moisture Content, (%)	Proctor No.	Maximum Dry Density, (pcf)	Dry Density, (pcf)	Percent Compaction, (%)	Required Compaction, (%)	Pass or Fail?
2/13/11	2	-6	NORM	2	11.6	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	100.8	94	95	*Fail
2/12/11	2	-6	NORM	2	11.3	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	101.0	95	95	Pass
2/12/11	2	-5	NORM	2	13.7	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	103.3	97	95	Pass
2/16/11	2	-5	NORM	2	14.3	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	101.5	95	95	Pass
2/13/11	3	0	NORM	2	13.5	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	101.3	95	95	Pass

NO	MAXIMUM DRY DENSITY, (pcf)	OPTIMUM MOISTURE, (%)	REMARKS
10-017	109.5	13.6	* Failing test used as bridge fill
10-319-02	116.4	14.3	Test location 2 - sand at top of dike
11-001	106.4	9.4	Test Location 3 - sand at mid point of dike

* Moisture by nuclear method unless field moisture data shown, in which case moisture per ASTM D 2216.

REPORT OF FIELD DENSITY TEST BY NUCLEAR GAUGE (ASTM D2922)

MACTEC ENGINEERING AND CONSULTING SERVICES, INC.
WILMINGTON, NORTH CAROLINA

MACTEC

NUCLEAR DENSITY EQUIPMENT

TECHNICIAN: Pete Worth

PROJECT NAME: Sutton Plant Dike Repair

PROJECT NO.: 6468-11-0312

MAKE: Troxler MODEL: 3430 SERIAL NO.: 23417

STANDARD COUNT: 2485

CHECKED BY:

DATE: 2/14/11

				NUCLEAR DENSITY DATA					FIELD MOISTURE DATA*			PROCTOR		RESULTS			
Test Date	Test Location	Depth Below Finished Grade or Elev. (ft)	Test Mode	Rod Depth, (in.)	Moisture Reading (%)	Moisture Correction (%)	Corrected Moisture Content (%)	Total Density, (pcf)	Wet Weight, (g)	Dry Weight, (g)	Moisture Content, (%)	Proctor No.	Maximum Dry Density, (pcf)	Dry Density, (pcf)	Percent Compaction, (%)	Required Compaction, (%)	Pass or Fail?
2/12/11	1	-6	NORM	2	18.2	N/A	N/A	N/A	N/A	N/A	N/A	10-319-02	114.4	105.9	92	92	Pass
2/12/11	1	-5	NORM	2	16.9	N/A	N/A	N/A	N/A	N/A	N/A	10-319-02	114.4	106.7	93	92	Pass
2/12/11	1	-4	NORM	2	17.4	N/A	N/A	N/A	276	228	17.4	10-319-02	114.4	106.1	92	92	Pass
2/12/11	2	-4	NORM	2	10.1	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	107.9	100	95	Pass
2/12/11	1	-3	NORM	2	17.9	N/A	N/A	N/A	N/A	N/A	N/A	10-319-02	114.4	108.7	95	92	Pass
2/12/11	2	-3	NORM	2	12.5	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	102.4	96	95	Pass
2/12/11	1	-2	NORM	2	18.4	N/A	N/A	N/A	N/A	N/A	N/A	10-319-02	114.4	108.0	94	92	Pass
2/12/11	2	-2	NORM	2	11.1	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	102.1	96	95	Pass
2/12/11	1	-1	NORM	2	19.7	N/A	N/A	N/A	N/A	N/A	N/A	10-319-02	114.4	106.4	93	92	Pass
2/12/11	2	-1	NORM	2	10.5	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	104.7	98	95	Pass
2/12/11	1	0	NORM	2	16.9	N/A	N/A	N/A	N/A	N/A	N/A	10-319-02	114.4	106.2	92	92	Pass
2/12/11	2	0	NORM	2	12.3	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	102.1	95	95	Pass

NO	MAXIMUM DRY DENSITY, (pcf)	OPTIMUM MOISTURE, (%)
10-017	109.3	13.6
10-319-02	114.4	14.3
11-001	106.4	9.4

REMARKS

Test location 1 - clay

Test location 2 - sand at top of dike

* Moisture by nuclear method unless field moisture data shown, in which case moisture per ASTM D 2216

REPORT OF FIELD DENSITY TEST BY NUCLEAR GAUGE (ASTM D2922)
MACTEC ENGINEERING AND CONSULTING SERVICES, INC.
WILMINGTON, NORTH CAROLINA

MACTEC

NUCLEAR DENSITY EQUIPMENT

TECHNICIAN: Pete Worth

PROJECT NAME: Sunset Plant Dike Repair

PROJECT NO.: 6468-11-0312

MAKE: Troxler MODEL: 3430 SERIAL NO. 23417

STANDARD COUNT: 2485

CHECKED BY:

DATE: 2/14/11

				NUCLEAR DENSITY DATA					FIELD MOISTURE DATA*			PROCTOR		RESULTS			
Test Date	Test Location	Depth Below Finished Grade or Elev. (ft)	Test Mode	Rod Depth, (in.)	Moisture Reading (%)	Moisture Correction (%)	Corrected Moisture Content (%)	Total Density, (pcf)	Wet Weight, (g)	Dry Weight, (g)	Moisture Content, (%)	Proctor No.	Maximum Dry Density, (pcf)	Dry Density, (pcf)	Percent Compaction, (%)	Required Compaction, (%)	Pass or Fail?
2/13/11	3	-4	NORM	2	13.3	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	102.0	95	95	Pass
2/13/11	3	-3	NORM	2	12.6	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	104.7	98	95	Pass
2/13/11	3	-2	NORM	2	13.4	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	102.2	96	95	Pass
2/13/11	3	-1	NORM	2	10.8	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	103.6	97	95	Pass
2/13/11	3	0	NORM	2	11.9	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	98.1	95	95	*Fail
2/13/11	3	0	NORM	2	12.9	N/A	N/A	N/A	N/A	N/A	N/A	11-001	106.4	103.0	96	95	*Pass

NO	MAXIMUM DRY DENSITY, (pcf)	OPTIMUM MOISTURE, (%)
10-017	109.3	13.6
10-319-02	114.4	14.3
11-001	106.4	9.4

REMARKS

* Retested Retest

Test location 3 sand in dike slope area

* Moisture by nuclear method unless field moisture data shown, in which case moisture per ASTM D 2216.

ATTACHMENT D

COMPLETION CERTIFICATE

COMPLETION CERTIFICATION

DIKE BREACH REPAIRS

1984 ASH POND (NEWHA-005)

SUTTON PLANT

The work documented in the Completion Report dated February 16, 2011 and on the Record Drawings was performed in accordance with the approved plans and specifications and other requirements. The work was observed by Mr. J. Allan Tice, P. E. and his designated inspection personnel. A final inspection was performed by Mr. Tice on February 13, 2011, and the completed work was found to be satisfactory. Based on the engineering observations, the testing and the final inspection, the repaired dike section is safe with respect to slope stability failure to the best of my knowledge and belief.

Certificate Submitted By:

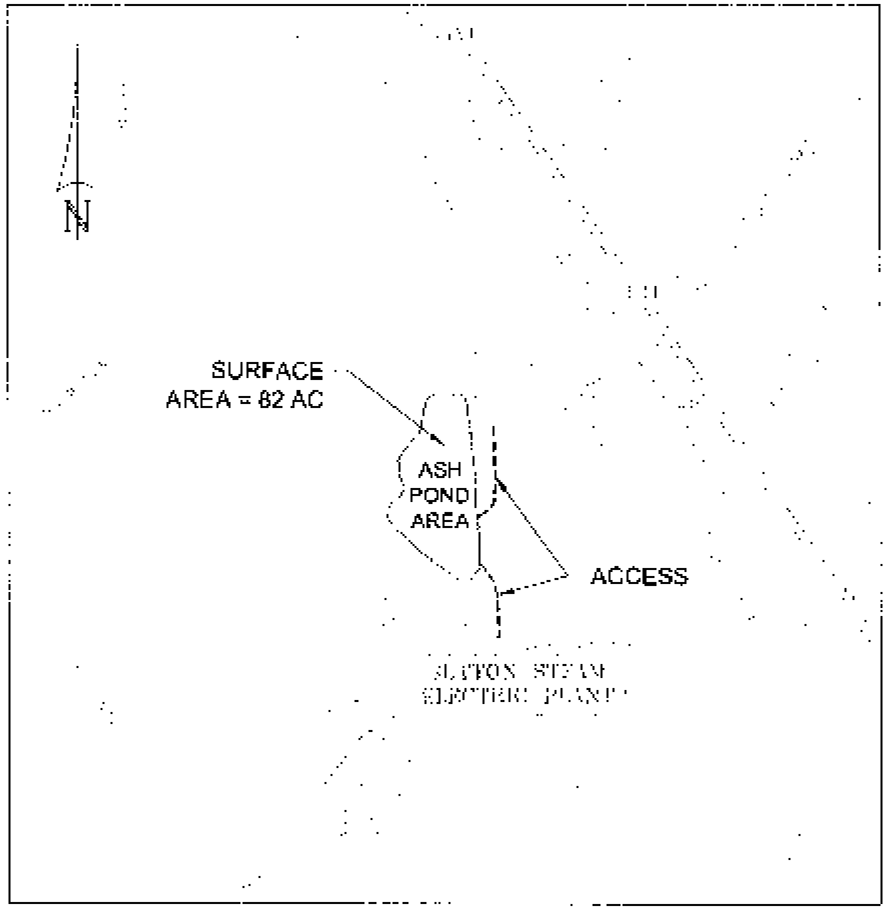
J. Allan Tice, P. E. (NC 6428)
Senior Principal Engineer
MACTEC Engineering and Consulting, Inc.

J Allan Tice
2-16-11

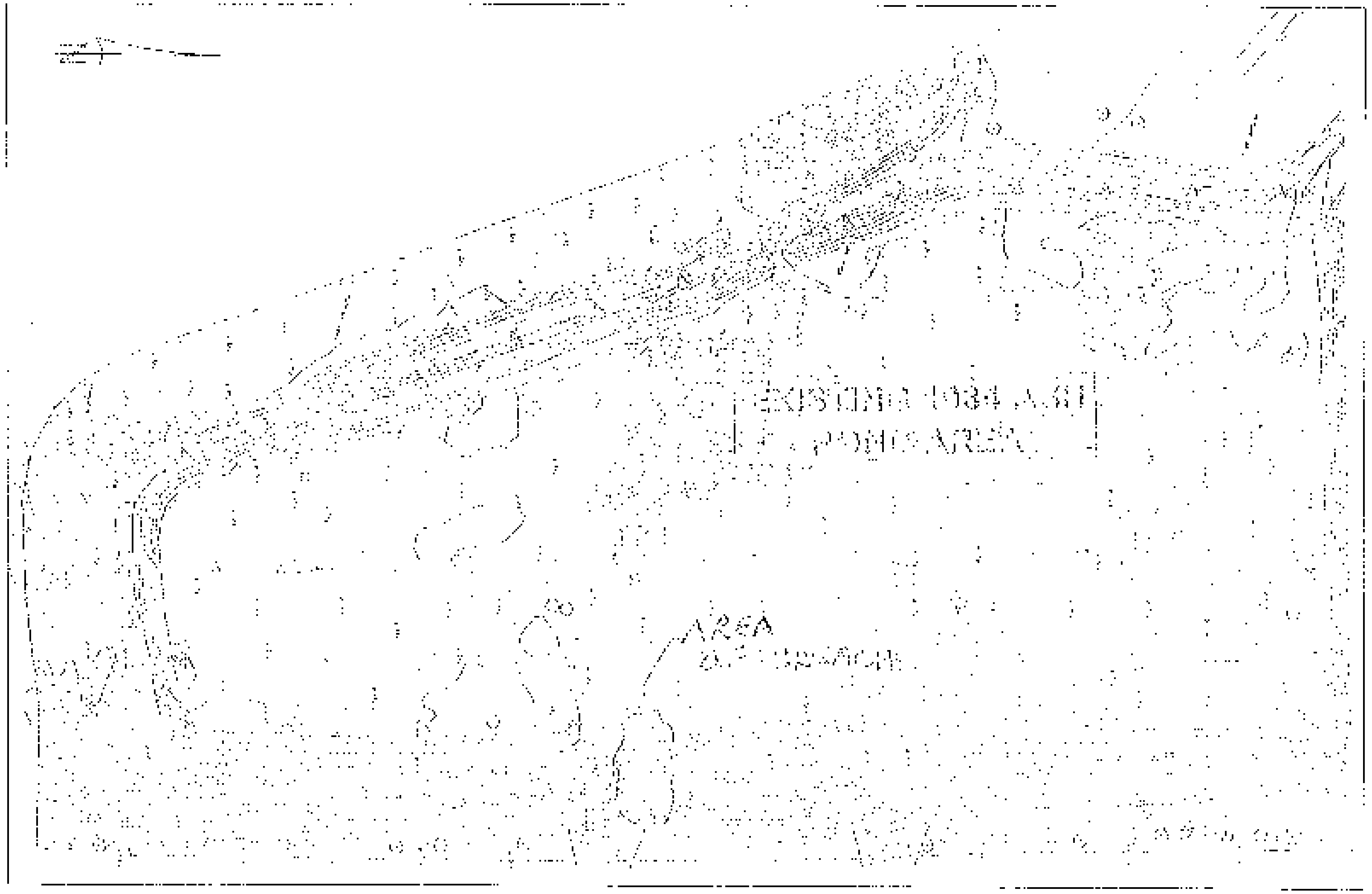
ATTACHMENT E

RECORD DRAWINGS

REPAIR PLAN FOR LOCAL BREACH
1984 ASH POND DIKE (NEWHA-005)
PROGRESS ENERGY
SUTTON STEAM ELECTRIC PLANT
NEW HANOVER COUNTY, NORTH CAROLINA
MACTEC PROJECT NO. 6468-10-0025 (04)



SITE LOCATION



BREACH LOCATION

GENERAL NOTES:

1. OWNER OF DIKE AND SURROUNDING PROPERTY IS PROGRESS ENERGY CAROLINAS, 801 SUTTON STEAM PLANT ROAD, WILMINGTON, NC 28401.
2. OWNER REPRESENTATIVE IS KENT TYNDALL.
3. ENGINEER IS MACTEC ENGINEERING AND CONSULTING, INC. 3301 ATLANTIC AVENUE, RALEIGH, NC 27604.
4. ENGINEER REPRESENTATIVE IS J. ALLAN TICE, P.E.
5. NO STREAM IS IMPOUNDED BY THE 1984 ASH POND DIKE.
6. THE DIKE IS CLASSIFIED AS LOW HAZARD.

PROJECT DESCRIPTION

THE WORK INCLUDES CHECKING AND REFURBISHING AS NECESSARY THE IN-PLACE SILT FENCING AROUND THE WORK AREA, PREPARING THE AREA OF A DIKE BREACH TO RECEIVE NEW FILL, PLACING AND COMPACTING NEW FILL MATERIAL AND SEEDING THE COMPLETED FILL SURFACES, ALL AS DESCRIBED IN THESE PLANS AND SPECIFICATION NOTES ON THE DRAWINGS.

PROJECT STARTED : FEBRUARY 11, 2011.

PROJECT COMPLETED : FEBRUARY 13, 2011 (EXCEPT FINAL SEEDING).

J. ALLAN TICE
2-16-11

RECORD DRAWING

DRAWING INDEX

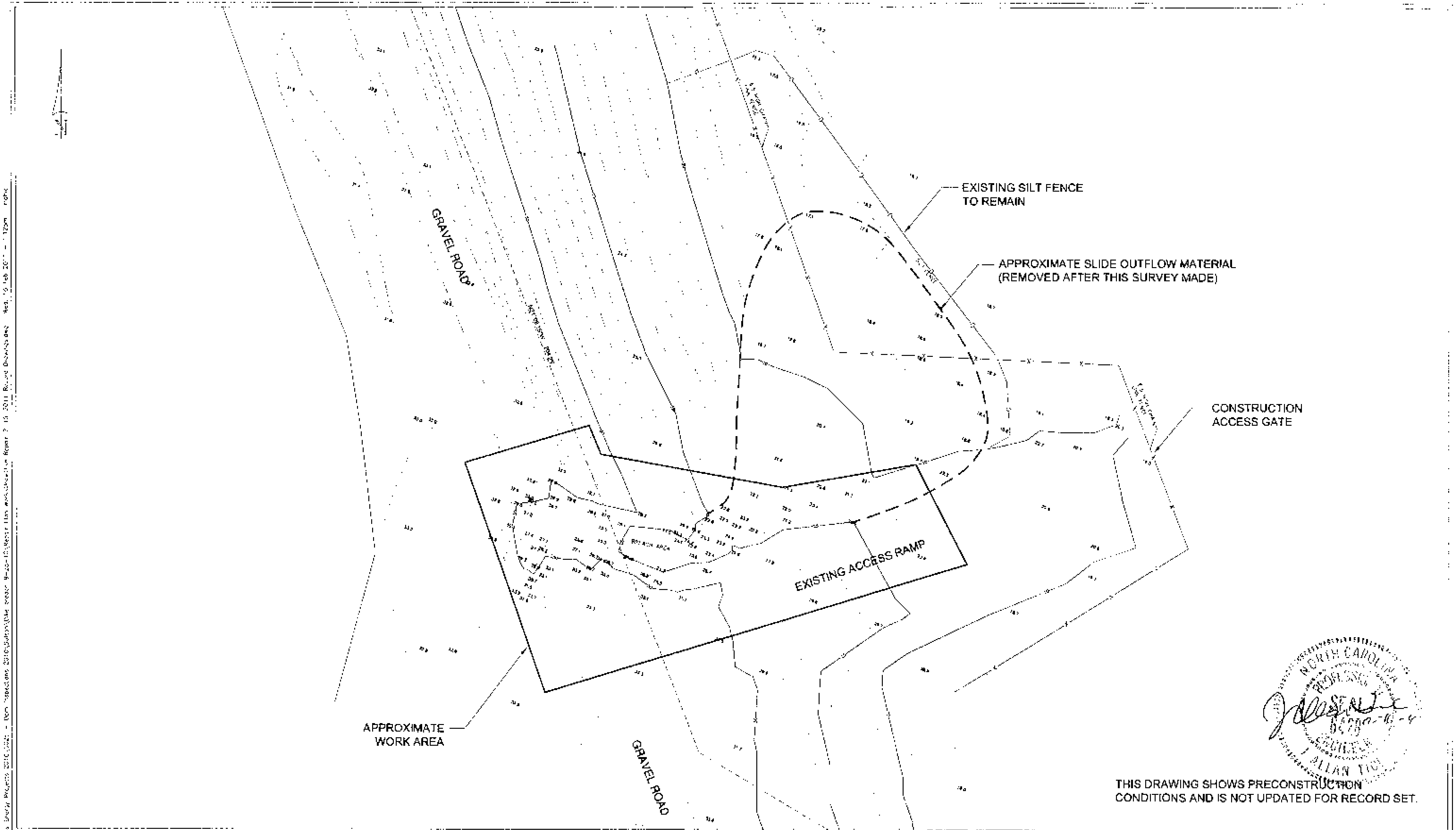
1. COVER SHEET
2. GENERAL PLAN
3. BREACH PLAN AND PROFILE
4. SECTIONS

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

DIKE REPAIR - COVER SHEET
1984 ASH POND DIKE (NEWHA-005)
SUTTON PLANT
WILMINGTON, NORTH CAROLINA

DRAWN: R.R.
ENG CHECK:
APPROVAL:
DATE: FEBRUARY, 2011
SCALE: N.T.S.
JOB No.: 6468-10-0025.04
DRAWING 1

REFERENCE:



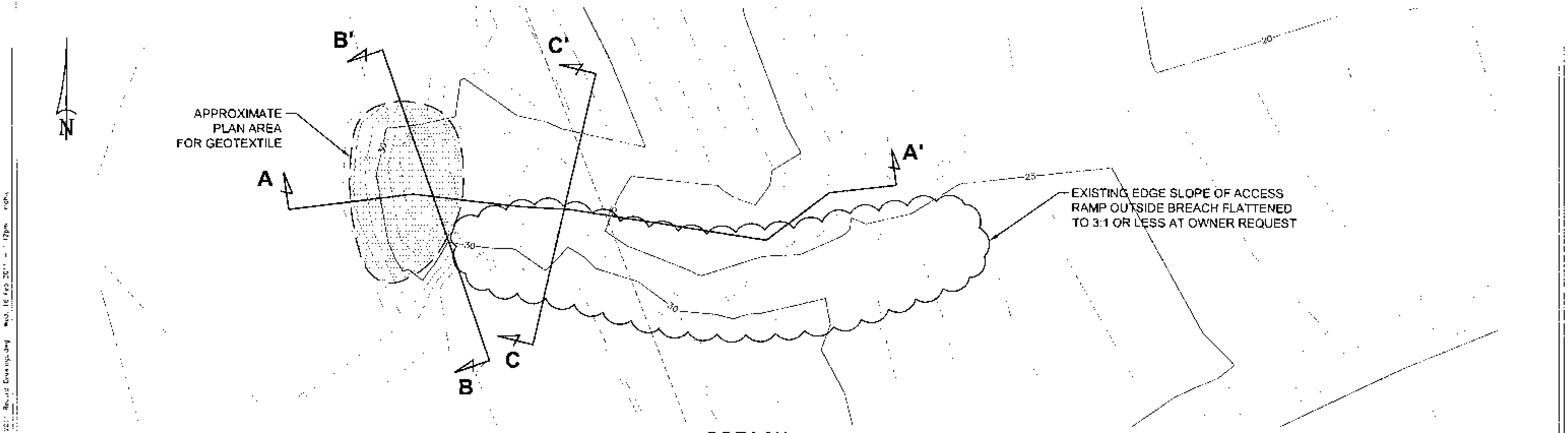
THIS DRAWING SHOWS PRECONSTRUCTION CONDITIONS AND IS NOT UPDATED FOR RECORD SET.

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

GENERAL PLAN
1984 ASH POND DIKE (NEWHA-005)
SUTTON PLANT
WILMINGTON, NORTH CAROLINA

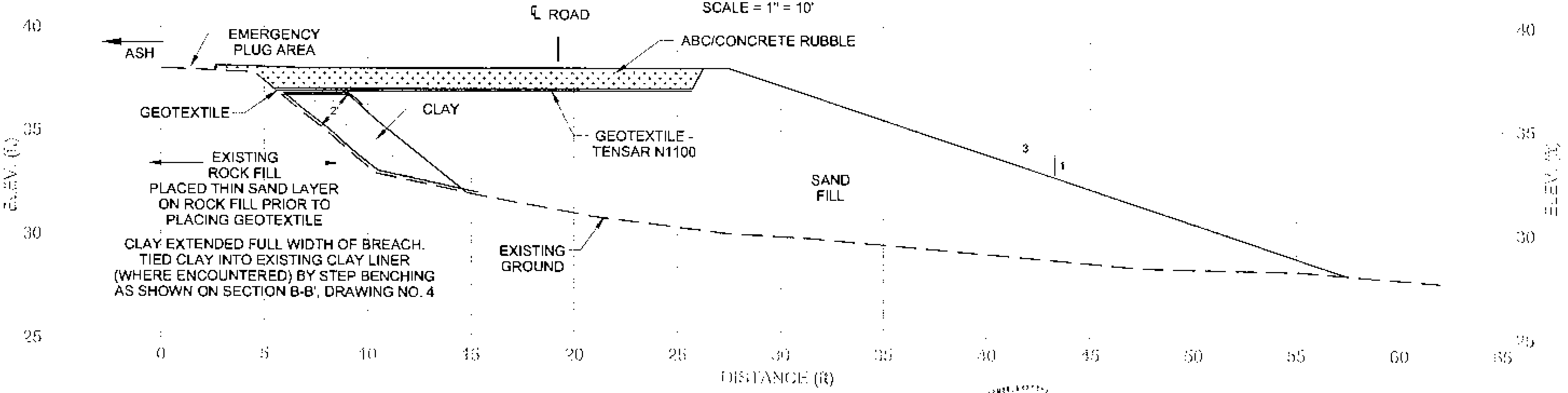
DRAWN:	R.R.	DATE:	FEBRUARY, 2011	DRAWING
ENG CHECK:		SCALE:	1" = 20'	2
APPROVAL:		JOB No.:	6468-10-0025.04	

REFERENCE: MCKIM & CREED SURVEY INFORMATION 10-14-10.



BREACH PLAN

SCALE = 1" = 10'



PROFILE A-A'

SCALE = 1" = 5'

RECORD DRAWING

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

REFERENCE: SURVEY INFORMATION FROM MCKIM & CREED, 10-14-10.

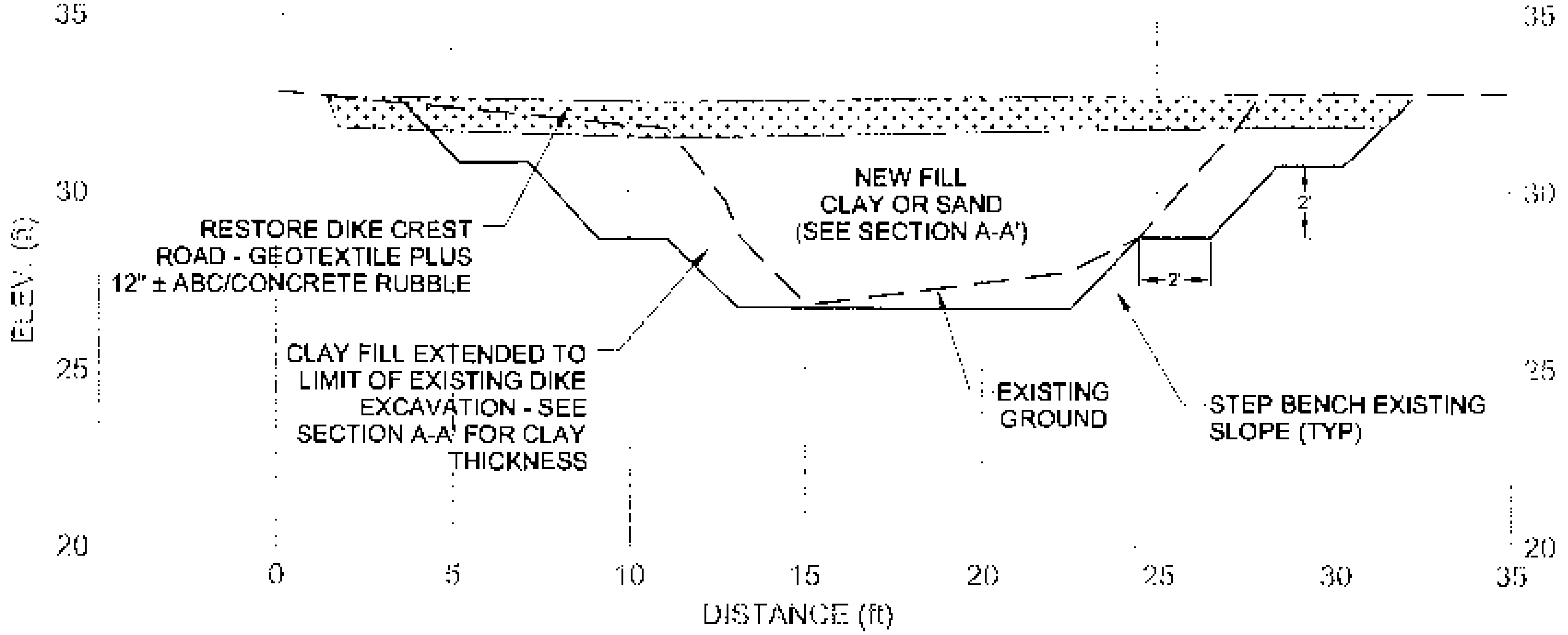
BREACH PLAN AND PROFILE
1984 ASH POND DIKE (NEWHA-005)
SUTTON PLANT
WILMINGTON, NORTH CAROLINA

2-16-11

DRAWN: R.R.
ENG CHECK:
APPROVAL:

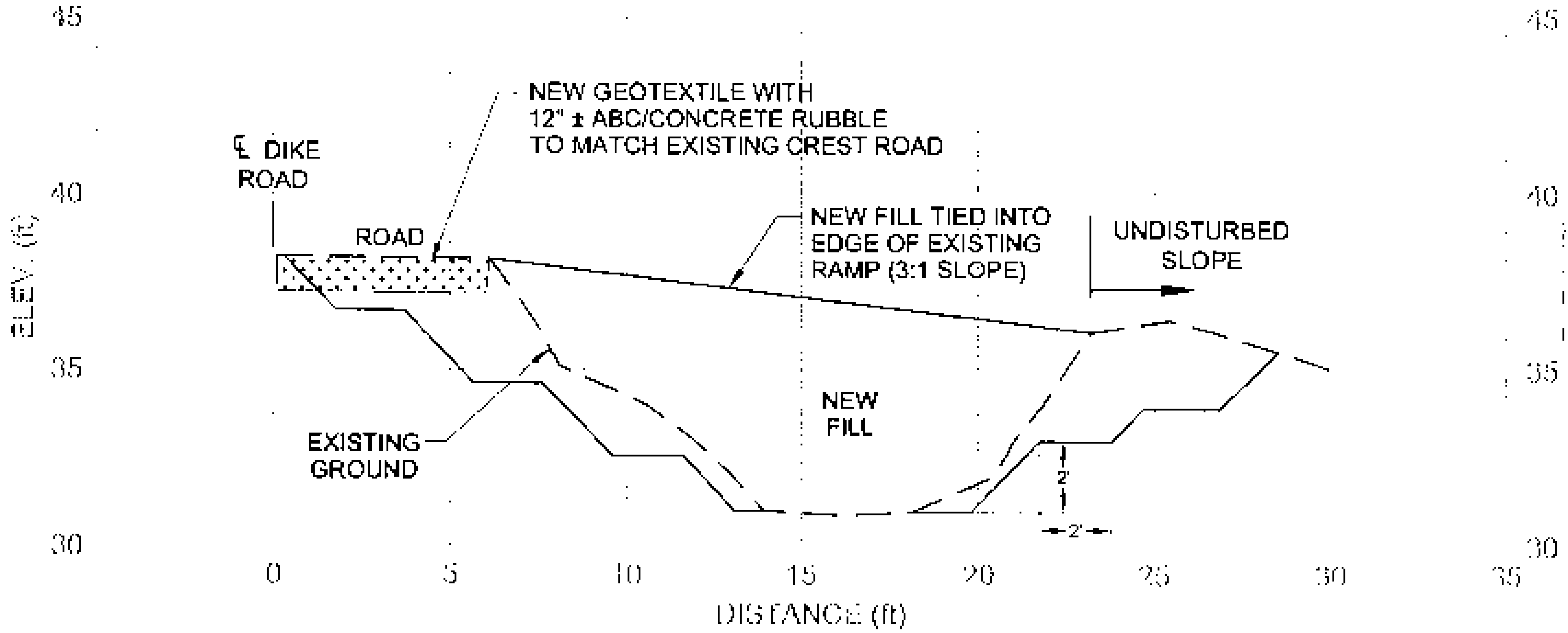
DATE: FEBRUARY, 2011
SCALE: AS SHOWN
JOB No.: 6468-10-0025.04

DRAWING
3



SECTION B-B' (CUT PARALLEL TO DIKE CREST)

SCALE = 1" = 5'



SECTION C-C' (CUT PERPENDICULAR TO BREACH AXIS)

SCALE = 1" = 5'

CONSTRUCTION SEQUENCE:

1. REVIEW EXISTING SILT FENCE AND REPAIR AS NEEDED.
2. STRIP VEGETATIVE COVER AND SOFT/LOOSE SOILS FROM AREAS TO RECEIVE NEW FILL. DISPOSE OF STRIPPED MATERIAL IN AN OWNER-DESIGNATED LOCATION WITHIN THE EXISTING ASH STORAGE AREA.
3. PREPARE NEW FILL AREA BY CREATING STEP BENCHES IN EXISTING DIKE FILL AS SHOWN ON THE DRAWINGS. MATERIAL REMOVED TO CREATE STEP BENCHES MAY BE STOCKPILED AND REUSED IN DIKE FILLING WORK IF IT DOES NOT CONTAIN ORGANIC MATERIAL. OTHERWISE, DISPOSE OF REMOVED MATERIAL IN AN OWNER-DESIGNATED LOCATION WITHIN THE EXISTING ASH STORAGE AREA.
4. SUBMIT SAMPLES OF PROPOSED FILL MATERIAL TO ENGINEER FOR APPROVAL AT LEAST TWO WEEKS IN ADVANCE OF START OF FILLING WORK.
5. PLACE AND COMPACT APPROVED FILL MATERIAL TO CLOSE THE DIKE BREACH AS SHOWN ON THE DRAWINGS.
6. AFTER APPROVAL OF FILL PLACEMENT WORK BY ENGINEER, PREPARE DIKE SLOPE SURFACE FOR SEEDING AND PERFORM SEEDING AS DESCRIBED ON THE DRAWINGS.
7. PLACE NEW GEOTEXTILE AND AGGREGATE BASE COURSE STONE/CONCRETE RUBBLE TO FORM CREST ROAD AS SHOWN ON THE DRAWINGS.
8. ALLOW INSPECTION OF COMPLETED WORK BY REPRESENTATIVES OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES, DIVISION OF LAND RESOURCES, DAM SAFETY.
9. AFTER ACCEPTANCE OF WORK BY ENGINEER AND DAM SAFETY, REMOVE EROSION AND SEDIMENT CONTROL MEASURES FROM THE SITE, IF DIRECTED BY OWNER.

MATERIAL AND PLACEMENT REQUIREMENTS:

1. FILL MATERIAL (CLAY): MATERIAL HAVING USCS DESCRIPTIONS OF CL, ML OR CH WITH LIQUID LIMIT BETWEEN 20 AND 60%, PLASTICITY INDEX BETWEEN 15 AND 30% AND >50% PASSING A NO. 200 SIEVE, OR AS APPROVED BY ENGINEER.
2. FILL MATERIAL (SAND): MATERIAL HAVING USCS DESCRIPTIONS OF SP, SM OR SC WITH NO MORE THAN 25% PASSING NO. 200 SIEVE, OR AS APPROVED BY ENGINEER.
3. PLACEMENT: NATURAL GROUND AT BASE OF EXCAVATION INSPECTED BY ENGINEER OR DESIGNATED REPRESENTATIVE AND COMPACTED AS REQUIRED TO FORM A FIRM BASE FOR NEW FILL. PLACE APPROVED FILL IN APPROXIMATE 12-INCH LOOSE LIFTS AND COMPACT WITH VIBRATORY ROLLER OR TAMPERS. COMPACT CLAY TO 92% OF STANDARD PROCTOR (ASTM D 698) MAXIMUM DRY DENSITY WITHIN MOISTURE RANGE OF OPTIMUM -2% TO OPTIMUM + 4%. COMPACT SAND TO 95% OF THE ABOVE STANDARD WITHIN A MOISTURE CONTENT RANGE OF +/- 2% OF OPTIMUM. ALLOW ENGINEER'S REPRESENTATIVE TO PERFORM FIELD DENSITY TESTS ON BEHALF OF OWNER.
4. FILTER FABRIC: TENSAR N1100 OR APPROVED SUBSTITUTE
5. CRUSHED STONE: NC DOT AGGREGATE BASE COURSE (ABC); CONCRETE RUBBLE ALSO USED.
6. GEOTEXTILE/STONE PLACEMENT: LAY OUT GEOTEXTILE OVER AREA OF DIKE CREST ROAD AND PULL TAUT. PLACE APPROXIMATELY 12" OF ABC OVER GEOTEXTILE AND COMPACT WITH VIBRATORY ROLLER TO A GENERALLY DENSE CONDITION. FIELD DENSITY TESTING IS NOT REQUIRED. ADD ADDITIONAL THICKNESS OF CONCRETE RUBBLE AS DESIRED.
7. SEEDING: SEEDING: SPREAD INITIAL SEED MIX (COASTAL WINTER SLOPEMASTER) CONSISTING OF 20% UNHULLED SAHARA BERMUDA, 25% UNHULLED SERICEA LESPEDEZA, 20% GREYSTONE TALL FESCUE, 10% PENSACOLA BAHIAGRASS' 10% DURANA WHITE CLOVER, 10% RYE GRAIN AND 5% WEEPING LOVEGRASS AT RATE OF 75 TO 100 POUNDS PER ACRE. AREA TO BE RESEEDED IN SPRING WHEN PLANNED DIKE SLOPE SEEDING IS DONE.

RECORD DRAWING

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

SECTIONS
1984 ASH POND DIKE (NEWHA-005)
SUTTON PLANT
WILMINGTON, NORTH CAROLINA

J. ALLAN
2-16-

DRAWN:	R.R.	DATE:	FEBRUARY, 2011
ENG CHECK:		SCALE:	AS SHQWN
APPROVAL:		JOB No.:	6468-10-0025.04

DRAWING
4

REFERENCE:

APPENDIX A

Document 15

NCDENR Repair Approval

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

March 8, 2011

Mr. J. Mark Frederick, Plant Manager
801 Sutton Steam Plant Road
Goldsboro, NC 27530

RE: Sutton 1984 Ash Pond Dam
New Hanover County
State Dam ID: NEWHA-005

Dear Mr. Frederick:

This is to acknowledge receipt of your "as-built" for repair submittal and application for impoundment dated February 24, 2011, for the subject dam. The submittal was received in our office on February 28, 2011.

Applications for Approval to Impound require a comprehensive field inspection by our Regional Office staff. Upon completion of the field inspection and confirmation by our field staff that the dam has been constructed in accordance with the approved plan and as reported in the as-built submittal, our office will issue Approval to Impound. If significant discrepancies are found to exist, revisions may be required before Approval to Impound can be issued. We endeavor to respond to applications within 60 days of receipt of the application.

Please contact Mr. Dan Sams, P.E., Regional Engineer, Land Quality Section, 127 Cardinal Drive, Wilmington, North Carolina 28405, telephone number (910) 796-7215, or me at telephone number (919) 733-4574 should you have any questions concerning this matter.

Sincerely,

Steven M. McEvoy, PE
State Dam Safety Engineer
Land Quality Section

SMM/rdk

cc: Mr. J. Allen Tice, PE, Design Engineer
Mr. Fred Holt, Progress Energy
Mr. Dan Sams, PE, Land Quality Regional Engineer
Surface Water Protection Supervisor

Filename: NEWHA-005_20110308_RECT-As-Built Repair_Sutton 1984 Ash Pond

APPENDIX A

Document 16

Final Approval to Impound - NCDENR

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

March 29, 2011

Mr. Fred Holt
Progress Energy Carolinas, Inc.
Environmental, Health and Safety Services Section
Post Office Box 1551 PEB 4
Raleigh, North Carolina 27601

RE: Sutton 1984 Ash Pond Dam
New Hanover County
State Dam ID: NEWHA-005

Dear Mr. Holt:

This concerns the subject dam recently repaired pursuant to an Approval to Repair dated January 21, 2011, as required by the Dam Safety Law of 1967. Record Drawings and the engineer's certification were received on February 28, 2011. The dam was certified by Mr. J. Allan Tice, PE.

An inspection of this dam was made by Land Quality Section staff of the Wilmington Regional Office on February 17, 2011. The dam was found to be in general conformance with the approved plans and specifications, and you may impound water.

The Land Quality Section staff will make periodic inspections of this dam to assure 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.

Sincerely,

Steven M. McEvoy, PE
State Dam Safety Engineer
Land Quality Section

1612 Mail Service Center, Raleigh, North Carolina 27699-1612 • Telephone 919-733-4574 / FAX: 919-733-2876
512 North Salisbury Street, Raleigh, North Carolina, 27604 • Internet:http://www.dlr.enr.state.nc.us/pages/landqualitysection.html

SMM/whd

cc: Mr. J. Allan Tice, PE, MACTEC
Mr. Dan Sams, PE, Regional Engineer
Surface Water Protection Regional Supervisor

File Name: NEWHA-005_20110328_COPA_Sutton 1984 Ash Pond Dam

APPENDIX B

Document 17

Dam Inspection Checklist Form (1971 Ash Pond)

Coal Combustion Dam Inspection Checklist Form

Protection Agency

Site Name: PEC LV SUTTON

Date:

Unit Name: 1971 Ash Pond

Operator's Name: Kent Tyndall

Unit I.D.:

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: Michael Hanson & Justin Story

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 & 5yr		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	24 MSL		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	23.81 MSL		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)?	28 MSL		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?		✓	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

9. Trees & shrubs present on bank adjacent to canal. Removal being coordinated w/ NCDENR due to env. concerns

23. One side of impoundment abuts a canal leading to the cooling pond. Slope is stable

EPA FORM -XXXX

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW) Impoundment Inspection

Impoundment NPDES Permit # NC0001422 INSPECTOR Dewberry
Date 2/17/2011

Impoundment Name 1971 Ash Pond (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: Receives Coal pile runoff and plant stormwater only - former ash pond.

Nearest Downstream Town : Name Wilmington
Distance from the impoundment 2.4 mi
Impoundment
Location: Longitude W77.992 Degrees ___ Minutes ___ Seconds
Latitude N 34.243 Degrees ___ Minutes ___ Seconds
State NC County New Hanover

Does a state agency regulate this impoundment? YES ✓ NO ___

If So Which State Agency? NC DENR Dam Safety + Division 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.

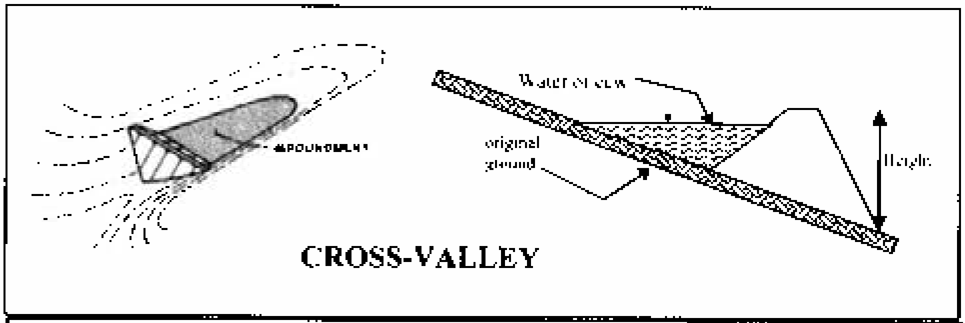
___✓___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

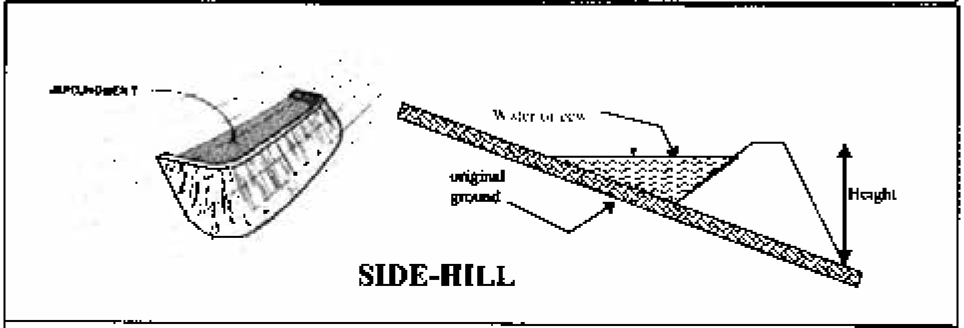
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

A dam breach analysis and inundation map development was performed for the site and the result was that there could potentially be commercial properties affected if a breach occurred on the east side of the ash ponds

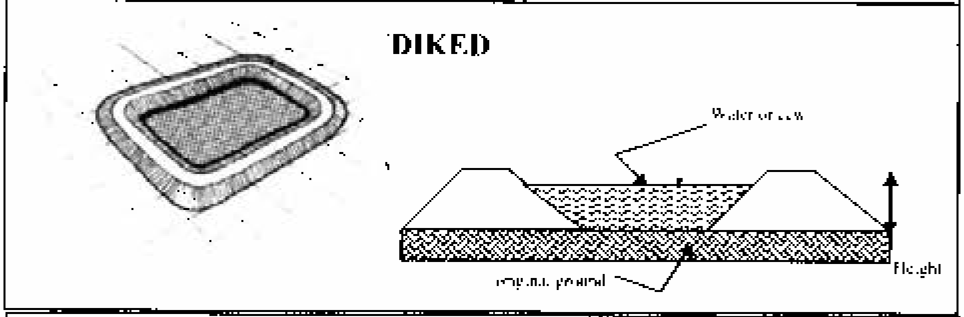
CONFIGURATION:



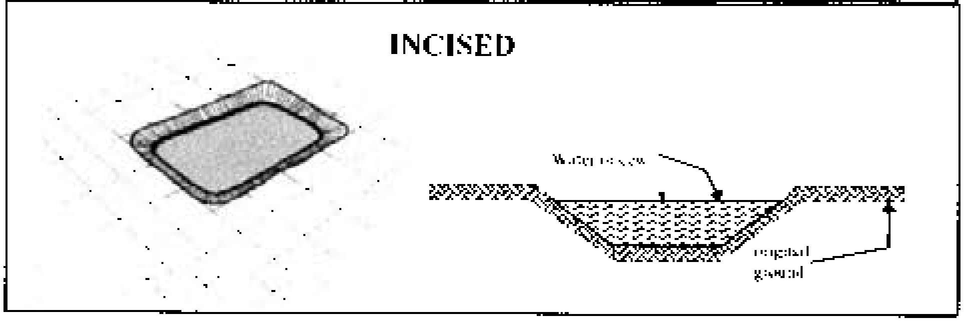
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

_____ Cross-Valley
_____ Side-Hill
✓ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

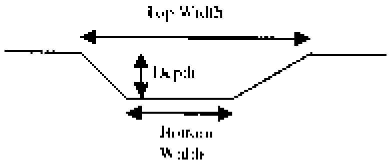
Embankment Height 24 feet
Pool Area N/A acres
Current Freeboard 4 feet
Embankment Material Native Soil
Liner N/A
Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

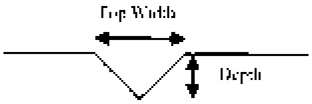
N/A **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

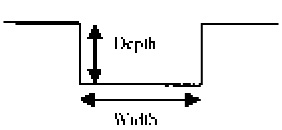
TRAPEZOIDAL



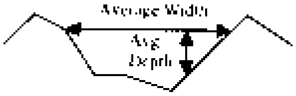
TRIANGULAR



RECTANGULAR

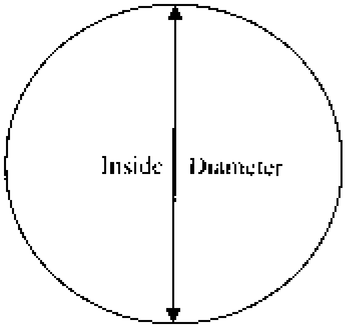


IRREGULAR



/ **Outlet**

48" inside diameter



Material
_____ corrugated metal
_____ welded steel
✓ concrete w/welded steel skimmer
_____ 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 Brown & Root in 1971, Dickerson raised Ash Pond in 1983

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.

Possible ash materials were encountered in borings from a subsurface investigation of the 1971 Ash Pond Embankment. There is potential that at least a portion of the impoundment was built over ash material.

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 18

Dam Inspection Checklist Form (1984 Ash Pond)

Coal Combustion Dam Inspection Checklist Form

Protection Agency

Site Name: PEC LV SUTTON

Date:

Unit Name: 1984 ASH POND

Operator's Name: KENT TYNDALL

Unit I.D.:

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: MICHAEL HANSON & JUSTIN STORY

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)?	26 MSL		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	26 MSL		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)?	34 MSL		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?		✓	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

5. Terraced dike interior to primary dike-crest @ 42 MSL w/ normal pool @ 40 MSL - Riser discharges to primary dike interior.

11. a) Few areas of minor depression - requires normal maintenance
b) Non-Structural surface erosion near access ramp - scheduled for repair
c) 3 varment holes noted - active maintenance program underway

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # NC001422 INSPECTOR Dewberry

Date 2/17/2011

Impoundment Name 1984 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 Fly + Bottom ash from all active units

Nearest Downstream Town : Name Wilmington

Distance from the impoundment 2.4 mi

Impoundment Location:

Longitude W77.992 Degrees ____ Minutes ____ Seconds

Latitude N34.293 Degrees ____ Minutes ____ Seconds

State NC County New Hanover

Does a state agency regulate this impoundment? YES ✓ NO ____

If So Which State Agency? N C DENR Dam Safety + Division 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.

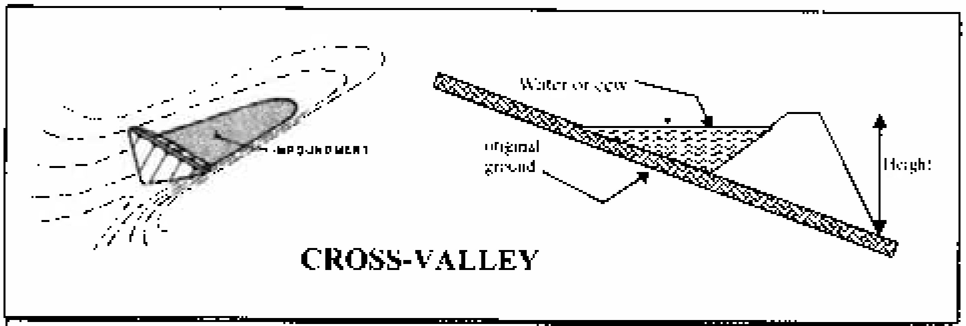
__✓__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

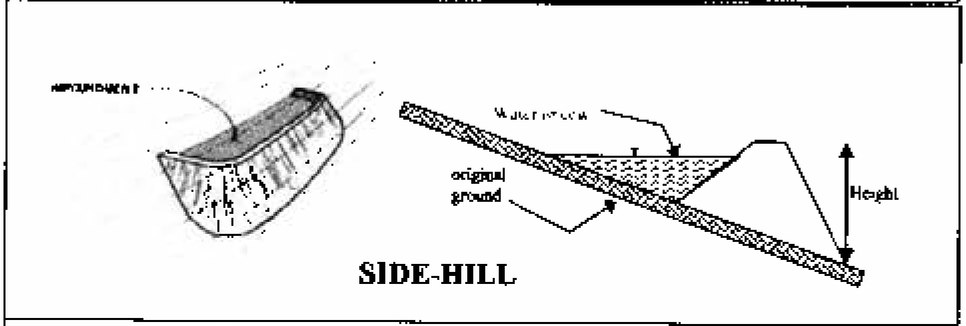
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

A dam breach analysis and inundation map development was performed for the site and the result was that there could potentially be commercial properties affected if a breach ocured on the east side of the ash ponds.

CONFIGURATION:

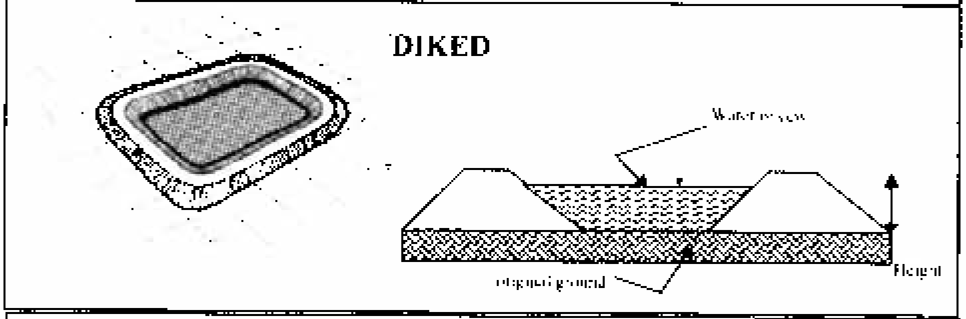


CROSS-VALLEY

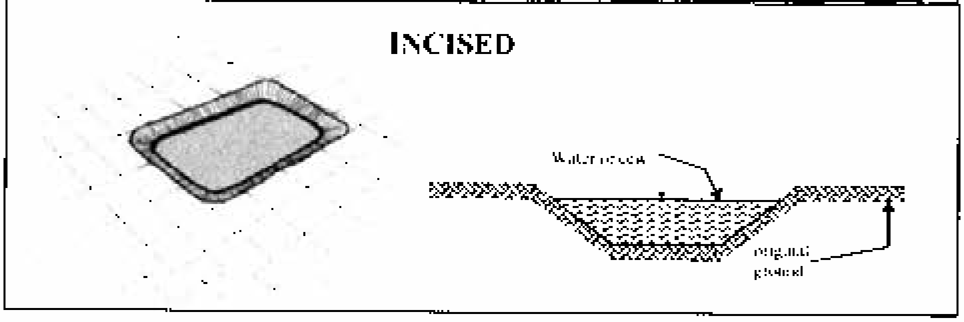


SIDE-HILL

DIKED



INCISED



______ Cross-Valley
______ Side-Hill
__✓__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

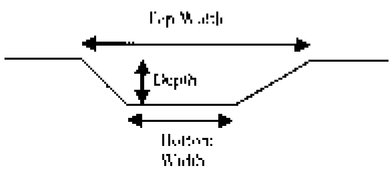
Embankment Height 30 feet Embankment Material Natural Soil
Pool Area 82 ~~acres~~ acres Liner Clay
Current Freeboard 8 feet Liner Permeability 1 x 10^{-7} cm/sec

TYPE OF OUTLET (Mark all that apply)

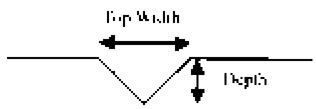
N/A **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width

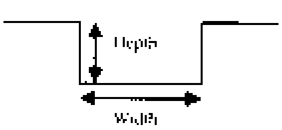
TRAPEZOIDAL



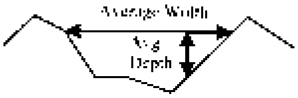
TRIANGULAR



RECTANGULAR

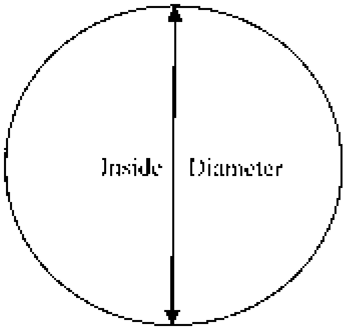


IRREGULAR



1 **Outlet**

48" inside diameter



Material
______ corrugated metal
______ welded steel
✓ concrete w/welded steel skimmer
______ 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 Lindsay and Associates + CP&L staff

Has there ever been a failure at this site? YES ✓ NO ____

If So When? Sept. 2010

If So Please Describe : O-verflow of interior dike during intense local rainfall of approximately 20 inches caused ~~to~~ minor overflow of primary dike leading to down erosion to dike exterior. Ash was contained on site. Dike has been repaired under observation and approval of NCDENR. Repair Report will accompany full Report on this assessment.

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 ash materials were documented in the subsurface investigation.

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?

Yes. In September of 2010, an intense local rainfall event of approximately 20 inches caused minor overflow of the 1984 Ash Pond primary dike leading to down cut erosion along the dike exterior. It was noted that all ash was contained on site. Progress Energy provided documentation that the dike has been repaired and approved by NCDENR.