

**INDEPENDENT CONSULTANT INSPECTION
MAIN COOLING LAKE DAM,
WEST ASH POND DAM AND AFTERBAY DAM
ROXBORO ELECTRIC PLANT
PERSON COUNTY, NORTH CAROLINA**

Prepared For:

PROGRESS ENERGY CAROLINAS
Raleigh, North Carolina

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
Raleigh, North Carolina

December 29, 2008

MACTEC Project No. 6468-08-2004



**FIVE-YEAR INDEPENDENT CONSULTANT INSPECTION
MAIN COOLING LAKE DAM,
WEST ASH POND DAM AND AFTERBAY DAM
ROXBORO STEAM ELECTRIC PLANT
PERSON COUNTY, NORTH CAROLINA**

Prepared For:

PROGRESS ENERGY CAROLINAS, INC.
Raleigh, North Carolina

BY MACTEC ENGINEERING AND CONSULTING, INC.
Raleigh, North Carolina

December 29, 2008

MACTEC Project No. 6468-08-2004.03

REPORT PREPARED BY



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



INSPECTION VOLUME

TABLE OF CONTENTS

	PAGE
1.0 SUMMARY	1
1.1 GENERAL.....	1
1.2 PURPOSE AND SCOPE.....	1
1.3 CONCLUSIONS	2
1.4 RECOMMENDATIONS	3
1.4.1 MAIN COOLING LAKE DAM	3
1.4.2 WEST ASH POND DAM	3
1.4.3 DIKE No. 1	4
1.4.4 DIKE NOS. 2 AND 4	4
1.4.5 <i>Afterbay Dam</i>	4
1.4.6 <i>Instrumentation</i>	4
2.0 DAM DESCRIPTIONS.....	5
2.1 LOCATION	5
2.2 MAIN COOLING LAKE DAM	5
2.3 WEST ASH POND DAM	7
2.4 AFTERBAY DAM	9
3.0 ACTIVITIES SINCE 2003 INSPECTION	12
3.1 MAINTENANCE AND INSPECTION ACTIVITIES.....	12
3.2 ENGINEERING STUDIES	12
3.3 SPILLWAY REPAIRS.....	12
3.4 ENGINEERING INSPECTIONS	13
4.0 FIELD INSPECTION OBSERVATIONS.....	14
4.1 METHOD OF INSPECTION	14
4.2 MAIN DAM	14
4.3 MAIN DAM SPILLWAY	16
4.4 WEST ASH POND.....	17
4.4.1 WEST ASH POND DAM	17
4.4.2 DIKE No.1	19
4.4.3 DIKE No. 2/3	20
4.4.4 DIKE No. 4	21
4.5 AFTERBAY DAM	21
4.5.1 CONCRETE SECTIONS	21
4.5.2 EARTH SECTION	23
4.6 INSTRUMENTATION REVIEW	24
4.6.1 MAIN COOLING LAKE DAM	24
4.6.2 WEST ASH POND.....	25
4.6.2.1 WEST ASH POND DAM	25
4.6.2.2 DIKE No. 2	26
4.6.2.3 DIKE No. 4	27
5.0 REFERENCES	28

EXHIBITS

PHOTOGRAPHS

1.0 SUMMARY

1.1 General

This report presents the results of an independent consultant inspection of the Main Cooling Lake Dam, West Ash Pond Dam and associated dikes and Afterbay Dam at Progress Energy Carolinas' Roxboro Steam Electric Plant in Person County, North Carolina. The plant and structure locations are shown on Exhibit 1. The independent inspection is performed at five-year intervals as required by the North Carolina Utilities Commission (NCUC) for facilities owned by Progress Energy Carolinas, Inc. 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 independent inspection was made in 2003 by MACTEC Engineering and Consulting, Inc. (MACTEC). The results of that inspection were presented in a report dated December 4, 2003⁽²⁾. In 1998, a Historical Volume containing information that will not change over time was prepared. For the present inspection, the historical volume is not reproduced; only an inspection report has been prepared. The review of the historical information about the site geology, engineering data, design and construction of the dams and operations is contained in the 1998 Historical Volume⁽³⁾.

Overall, the dams and 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

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

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 Carolinas, Inc. (Progress Energy) is concerned with a safety evaluation of the Main Cooling Lake Dam, the West Ash Pond Dam and associated dikes, and the Afterbay Dam for the Roxboro Steam Electric Plant. These water retaining structures were constructed in 1963, 1973 (modified in 1986) and 1974, respectively. The last 5-year inspection by an independent consultant was in 2003⁽²⁾

This inspection has been conducted in general conformity with the guidelines for Phase I inspections outlined in the USACOE publication, "Recommended Guidelines for Safety Inspection of Dams"⁽¹⁾. It encompassed a review of the 2003 safety inspection report including a description of the geologic and engineering data relative to site conditions as well as the design, construction, and operational features of the dikes and appurtenant structures. Maintenance history and plans for future maintenance activities were reviewed in consultation with maintenance and operations personnel at the Roxboro Plant.

A site visit was made on March 13, 2008 for the purpose of inspecting features relating to the safety and integrity of the dams, 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. At the time of the March field visit, water flow over the Main Dam spillway prevented an adequate inspection. A second field visit was made August 5, 2008 to inspect the spillway under no-flow conditions.

1.3 Conclusions

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

1. At the time of the inspection, no deficiencies were noted which constitute a concern for the near-future safety of the structures. Conditions which, in our professional opinion, do not imminently endanger the safety of the structures, but require continued observation to evaluate their

importance, were noted. These are presented in Section 1.4. No additional engineering analyses needs were noted.

2. Recommendations for maintenance and repair activities contained in the 2003 inspection report had been implemented as of the date of the initial field visit; continuing maintenance of vegetation and drain outlets is needed.
3. The current gate opening procedure for the Afterbay Dam provides for passage of the design storm without overtopping of the dam occurring.

1.4 Recommendations

Based on the field inspection and review of available data, the recommendations listed below are made. The recommended repairs fall under the category of normal maintenance and are not considered emergency actions. A recommended time frame for implementing the recommendations is given where appropriate.

1.4.1 Main Cooling Lake Dam

1. Continue a regular schedule for trimming trees and brush on the downstream slope and on the clay cap area of the east abutment. Vegetation on the dam slopes will need trimming about every three years. The clay cap area may need trimming more frequently depending on the rate of regrowth.
2. Erosion along the junction of the downstream slopes of the Main Cooling Lake Dam and the natural ground should be observed by Progress Energy during the semi-annual inspections by Progress Energy personnel to see if progressive activity is occurring.
3. Plan for a repair and refurbishment of caulked joints in concrete spillway to occur within the next five years.

1.4.2 West Ash Pond Dam

1. Drain outlet channels at the toe of the dam will require regular maintenance to clear vegetation and sediment. The cleaning should be done at least every two years.

2. Continue maintenance work (cutting and spraying) to control vegetation growth on the downstream slope with particular attention to the lower third of the downstream slope.
3. The wet area at the east end of the dam where seepage has occasionally been seen should be observed during each regular inspection for signs of flow or movement of soil in the flow.

1.4.3 Dike No. 1

1. Complete placement of additional rip rap in small slide areas on the interior slope within the next year.
2. Continue to observe the erosion ditch on the east end of the dike to check that the riprap placed is retarding erosion.
3. Vegetation and silt accumulations at the flap gates and in the outlet channels leading from them to the channel should continue to be removed during normal maintenance.

1.4.4 Dike Nos. 2 and 4

1. Continue maintenance of trees and vegetation on the interior and exterior slopes of Dike No. 4 and on the exterior slope of Dike No. 2 (the interior slope is now covered by the new wastewater treatment and flush pond dikes).

1.4.5 Afterbay Dam

1. Continue to maintain vegetation growing on the downstream side of the east gravity section.
2. Observe the area downstream of the earth section where seepage has been noted previously for signs of recurrence or change as part of regular inspections.

1.4.6 Instrumentation

1. Increase frequency of reading West Ash Pond Dam piezometers to monthly until the planned revisions to the 2006 wastewater treatment pond dike within the ash pond area have been completed.

2.0 DAM DESCRIPTIONS

A brief description of the dams and dikes is given in this section. Further details about the design and construction of the structures are contained in the Historical Volume⁽³⁾. Exhibit 1 shows locations of the dams. A summary of the engineering data for each dam is contained in Exhibit 2.

2.1 Location

The subject dams are located at or near the Roxboro Steam Electric Plant. The Roxboro Steam Electric Plant is located adjacent to the Hyco River (now Hyco Lake) in the northwest quadrant of Person County, about 9 miles northwest of Roxboro, North Carolina. The latitudes and longitudes of the dams are as follows:

Main Cooling Lake Dam	N 36° 30' 44", W 79° 3' 24"
West Ash Pond Dam	N 36° 31' 16", W 78° 59' 55"
Afterbay Dam	N 36° 28' 16", W 79° 4' 23"

2.2 Main Cooling Lake Dam

Hyco Lake was created in 1963 by the construction of an earth dam across the Hyco River. The general plan of the Main Dam and emergency spillway is shown on Exhibit 3. Cross-sections and details of the dam are shown on Exhibit 4. Maximum structural height of the embankment is about 68 feet and its length, including a low height dike on the east abutment is 2,560 feet. Crest elevation is 426 feet (MSL), and normal reservoir level is elevation 410 feet (MSL). At that level, the water surface area is 3,750 acres, and the quantity of water stored is 78,000 acre-feet. The drainage area is 190 square miles. Design high water level is elevation 420 feet (MSL). Minimum freeboard during flood periods is thus 6 feet. Design low water level is elevation 405 feet (MSL). Hydraulic head at normal water level is 25 feet. The lower 25 feet of the dam's downstream slope is normally submerged by the Afterbay Dam impoundment.

The crest width of the dam is 20 feet and side slopes are 3(H):1(V) upstream and 2.5(H):1(V) downstream. Between the low water elevation of 405 feet (MSL) and the crest of the dam, the

upstream slope is protected against wave wash by a 2-foot thickness of riprap placed on a 12-inch bed of crushed rock. Below elevation 405 feet (MSL) to elevation 392 feet (MSL), the top of the upstream cofferdam, the upstream slope has a 12-inch layer of quarry run rock placed on a 6-inch bed of crushed rock which protected the slope during reservoir filling. The downstream slope is protected against rain wash for its entire height with a 12-inch layer of quarry run rock.

The dam has a central earth core with a width of 10 feet at its crest elevation of 421 feet (MSL). A cutoff trench extends to sound rock beneath the core and is backfilled with impervious material. Exhibit 5 contains longitudinal profiles of the cutoff trench excavation for the dam and east abutment dike.

On the east abutment, the cutoff trench is at the upstream toe of the dike and a 3-foot thick blanket of impervious material capped with riprap on crushed stone bedding is on the upstream slope as shown on Exhibit 4.

At the west end of the Main Dam, a low height dike extends northwesterly along the top of a ridge for a distance of about 60 feet as shown on Exhibit 3.

A concrete-lined spillway channel is located about 1,500 feet northwest of the west abutment of the dam and has a crest elevation of 410 feet (MSL). Wooden flash boards across the spillway crest extend the top elevation to approximately 410.5 feet (MSL). The spillway width decreases from 620 feet at the crest to 140 feet at the toe over the original 1,000 foot length. Exhibit 6 shows the original plan.

Due to damages to the lower part of the spillway during flooding in 1975, the spillway was modified by adding a drop structure across the spillway to shorten the length to the present 365 feet. Exhibit 7 shows the drop structure plan and section.

Spillway slab repairs were done by Fluor-Daniel in 1997 and consisted of sealing construction joints and cracks in the upper spillway slab, exploring for and grouting of voids beneath the slab and installing six pressure relief valves in slab sections on the north side of the spillway. Exhibit 8 shows the plan of the cracks and repairs prepared after the repair work. The pressure relief valves are

routinely cleaned and maintained annually (spillway conditions permitting) under a work order incorporating a procedure prepared by Progress Energy⁽⁴⁾.

An emergency spillway channel is located about 1,000 feet upstream of the east abutment of the dam as shown on Exhibit 3. The crest elevation of the emergency spillway is 413.5 feet (MSL). The spillway is 240 feet wide, is unpaved, and is grassed.

Based on the height of the dam and its storage capacity, the dam is classified as a “large” dam under the U.S. Army Corps of Engineers guidelines⁽¹⁾ and as a “very large” dam by criteria set out in North Carolina dam safety regulations (15 A NCAC 2K.0205)⁽⁵⁾.

The area along Hyco River below the dam contains one bridge across Hyco River for a State secondary road (S.R. 1322). Below the Afterbay Dam, to the entry to Kerr Reservoir, another State secondary Road (S.R. 1326), two U.S. highways (U.S. 58 and U.S. 501) and the Norfolk Southern Railway cross the Hyco River on bridges. There do not appear to be inhabitable dwellings below elevations that would likely be flooded in the event of a dam failure. The potential for loss of life appears very low to non-existent. Damage to the bridges could occur. Based on the Corps of Engineers’ guidelines⁽¹⁾, a hazard classification of “significant” has been used in all prior inspections. A review of recent aerial photographs of the area below the dam during the present inspection did not indicate any new development in areas that would likely be flooded; the hazard classification of “significant” is still appropriate.

2.3 West Ash Pond Dam

The West Ash Pond Dam was constructed across the mouth of Sargents Creek, which was part of Hyco Lake, in 1973. The dam is an earth fill embankment with a central earth core. The original structural height of the dam was 70 feet with a crest elevation 457 feet (MSL). The original pool elevation was 445 feet (MSL). A cutoff trench was excavated to sound rock for a depth of about 10 feet under the central earth core.

In 1986, the dam was raised 13 feet to elevation 470 feet (MSL) to provide greater storage capacity. The normal water level elevation is 463 feet (MSL), and the maximum water level is elevation 465 feet (MSL). Exhibits 9 and 10 show plans and sections of the present dam.

The present West Ash Pond Dam is a random earth fill dam with an impervious core and a vertical chimney drain with a horizontal filter blanket connected to the original drain systems. The upstream slope is 2.5(H) to 1(V) and is blanketed with riprap. The downstream slope is 2(H) to 1(V).

The circulation pattern of the ash pond was also modified in 1986 by constructing a rock filter dike (Dike No. 1) at the southern end of the existing pond to create a secondary settling basin and also to isolate the major portion of the ash pond from the remaining watershed. A channel/dike system is used to provide a flow path from the secondary settling basin to the main pond discharge point as well as to carry storm runoff from the area south of the pond. This channel/dike system, which runs along the west side of the existing pond, ultimately connects with the original spillway constructed in 1973 and discharges into Hyco Lake. Exhibits 11 and 12 show the plan of the circulation system modifications.

Dike No. 1 is constructed of rock excavated from Channel No. 2 (Exhibit 13). The crest elevation is 473 feet (MSL). The design slopes are 1.3(H) to 1(V) on both upstream and downstream slopes, with a 20-foot wide berm on the downstream slope below elevation 448 feet (MSL). The design normal ash pond water elevation is 463 feet (MSL) and the design maximum water elevation is 465 feet (MSL) providing 8 feet of freeboard. A sand blanket is located on the northern side of the dike to prevent pond ash from discharging to the south side of the pond and into the channel/dike system.

Dike Nos. 2, 3, and 4 are random earth dikes constructed by end-dumping fill material excavated from Channel Nos. 1 and 2. Both upstream and downstream slopes are 2(H) to 1(V) and are protected by riprap underlain by filter fabric. A 20-foot wide berm is present on the downstream side of Dike No. 4. The crest elevation of the dikes is 470 feet (MSL) and the design normal water elevation is 463 feet (MSL). The design maximum water level is 465 feet (MSL) providing 5 feet of freeboard. The plans for these dikes are shown on Exhibit Nos. 10 and 11. Dike No. 3 is a low

height dike across a topographic saddle that is mainly above the normal pond level. As it does not normally impound water, it is not included in the dam inspections.

The bottom ash separation dike, located on the east side of the ash pond, supports the bottom ash lines which lead to the bottom ash reclaim facility located southwest of the main ash pond dam. The existing dike was constructed of random fill material. In 1986, the dike was raised to its present crest elevation of 463 feet (MSL) using bottom ash material.

The ash line discharge structure (Exhibit 14) is a hollow concrete box structure filled with compacted fill material. A 3-foot wide, 5-foot deep concrete cutoff wall beneath the floor slab protects the structure from underseepage. The ash pipes are installed through the structure at elevation 463.5 feet (MSL).

Based on the height and storage capacity, the West Ash Pond Dam and Dikes No. 1, 2, 3, and 4 are classified as “intermediate” in size under the Corps of Engineers’ Guidelines⁽¹⁾. Under North Carolina regulations⁽⁵⁾, the West Ash Pond Dam and Dike No. 1 are classified as “large” and the remaining dikes are classified as “medium”.

Water released from a failure of the West Ash Pond Dam or its dikes would be contained within the cooling lake reservoir. A hazard classification of “significant” has been used in previous inspections and that classification appears appropriate.

2.4 Afterbay Dam

The Afterbay Dam consists of an east concrete gravity dam, a gated ogee spillway with four bays, a west concrete gravity dam, an earth wing dam, and a low earth dike. Maximum structural height of the concrete structures and the earth dam is 80 feet. Normal hydraulic head is 35 feet. Exhibits 15 and 16 show the overall plan and profile. Exhibit 17 contains a plan and sections of the east and west concrete gravity dams. The east gravity dam is a conventional non-overflow gravity dam having a structural height of 52 feet and base width of 40 feet. The east gravity dam is 30 feet in length. It is founded on a rock bench at elevation 350 feet (MSL) excavated into the east abutment as shown on Exhibit 16.

The west gravity dam is a conventional gravity concrete structure having a height of 80 feet and base width of 54 feet as shown on Exhibit 17. The west gravity dam is about 100 feet in length.

Exhibit 18 contains a plan and sections of the spillway structure. It consists of a 4-bay ogee section equipped with tainter gates, each gate being 25 feet wide and 26 feet high. Each of the tainter gates may be rotated open. In the open position, the bottoms of the tainter gates are at elevation 397.5 feet (MSL). The access road across the dam has a structural depth of 2.0 feet and the bottom of the structure is at elevation 398.0 feet (MSL). Maximum structural height of the piers is 88 feet. The crest of the ogee sections is at elevation 360 feet (MSL); normal water level is elevation 385 feet (MSL), and the design maximum water level during floods was elevation 395 feet (MSL). Normal tailwater level is elevation 350 feet (MSL). Following the 1988 five-year inspection, hydrologic analysis by Progress Energy⁽⁶⁾ determined the lake level under a 0.65 PMP storm would be at elevation 398.74. The dam stability was found acceptable for this lake level⁽³⁾. Piping and Howell Bunger valves are provided at two of the piers to pass normal flow. Downstream of the ogee section, a concrete stilling basing is provided.

The foundation of the Afterbay Dam was grouted and a series of drain holes was drilled just downstream of the grout curtain as shown on Exhibits 19 and 20. The foundation drainage system discharges from the two end piers at elevation 350.75 feet (MSL), slightly above normal tailwater.

Exhibits 15 and 21 show plans and sections of the earth dam portion of the Afterbay Dam. The earth dam consists of two segments – one extending west from the concrete dam about 650 feet that is designed as a conventional earth dam, and an additional 950-foot long low height dike that continues northerly. The total length is about 1,600 feet. The earth dam has a crest width of 20 feet, upstream and downstream slopes of 3.5(H):1(V) and crest elevation of 400 feet (MSL). The section of the dam abutting the concrete dam includes a central earth core. Riprap on a crushed stone base protects the entire upstream face from wavewash. Similar riprap is on the downstream face adjacent to the concrete section with a thinner rock layer west of station 3+75.

A chimney drain is provided on the downstream face of the core as shown on Exhibit 21. It consists of a 2-foot thickness of well-graded sand feeding into a 3-foot layer of the same sand

placed horizontally through the downstream shell. Also provided was a foundation drainage system (toe drain) at the toe of the dam, shown in Detail “A” on Exhibit 21. It consists of 12-inch diameter wells spaced 25 feet apart and augered to rock, then filled with concrete sand. Seepage from the top of these wells is collected by a trench filled with concrete sand and having a 6-inch diameter asbestos-cement pipe surrounded by gravel and leading to the river bank.

The low dike section extending northward from the west end of the earth dam section consists essentially of a shallow trench 20 feet wide backfilled with impervious material as shown on Exhibit 21. Side slopes of the superimposed low dike where it is above ground are protected by riprap. An interceptor drain was located a considerable distance downslope of the low dike as shown on Exhibit 15. Exhibit 21 shows details of the interceptor drain. The purpose of this interceptor drain is not documented in the references, but it appears to have been intended to collect surface seepage (natural or from the Afterbay reservoir) and convey it to the river without allowing it to emerge on the ground surface.

Based on the height and storage capacity, the Afterbay Dam is classified as an “intermediate” size dam under the Corps of Engineers’ Guidelines⁽¹⁾ and as a “large” dam under the North Carolina regulations⁽⁵⁾.

The conditions downstream of the Afterbay Dam were described in Section 2.2. There is very low to non-existent risk of loss of life in the event of a dam failure; however, there would be damage to existing bridges. A hazard classification of “significant” has been applied in previous inspections and such a classification still appears appropriate.

3.0 ACTIVITIES SINCE 2003 INSPECTION

Other than routine maintenance actions (e.g. vegetation control), specific engineering studies or repair activities have occurred since the 2003 inspection as described.

3.1 Maintenance and Inspection Activities

Maintenance activities typically consist of grass mowing and some spraying of riprap for vegetation control. Since 2007, the maintenance responsibility has been assigned to the Chemistry Lab, currently under the overview of Mr. Billy Milam. An interview with Mr. Milam was conducted during the field visit. A major vegetation cutting activity was undertaken in Winter, 2007. Also, riprap repairs at the West Ash Pond Dike No. 1 were done in 2007.

Personnel from the chemistry lab, working under Mr. Milam's supervision and following inspection guidelines in Progress Energy procedures⁽⁷⁾, conduct a walkover inspection approximately every three months for all the dams and document the observations on inspection forms. The reports from 2004 through 2007 were reviewed and are adequate for routine inspections. The most common observation in the reports was the need for tree cutting or brush clearing.

3.2 Engineering Studies

No significant engineering studies were conducted specifically for the dams since the 2003 inspection. As part of the design for an interior Wastewater Treatment Pond (WWTP) that was constructed within and adjacent to the West Ash Pond Dam in 2006-2007, a review of the potential impact of the new dike and WWTP on the stability of the West Ash Pond Dam was made by WorleyParsons, the designers. The stability analysis was reviewed by MACTEC as part of the annual site visit in 2006. MACTEC's report of that inspection⁽⁸⁾ concluded the analyses were appropriate and that the new dike and WWTP posed minimal concerns for stability impact to the West Ash Pond Dam.

3.3 Spillway Repairs

Other than localized caulk repair at a few joints in 2000, no major repairs to the spillway have been conducted since 1997.

3.4 Engineering Inspections

Limited field inspections were conducted by MACTEC in 2004, 2005, 2006 and 2007. The visits were made by Mr. Al Tice or Mr. Scott Auger with Progress Energy personnel to conduct a brief inspection of all the dams.

The report of the last (May 21, 2007) site visit⁽⁹⁾ concluded the dams visually appeared in good condition with no items seen that would constitute an imminent stability concern or require immediate remedial action. Continued maintenance to clean seepage outlets at the West Ash Pond Dam and to general vegetation removal was emphasized.

4.0 FIELD INSPECTION OBSERVATIONS

4.1 Method of Inspection

The field inspection was conducted by Mr. Al Tice of MACTEC during two site visits – March 13, 2008 and August 5, 2008. Mr. Richard Horton of Progress Energy accompanied Mr. Tice on both visits, and Mr. Billy Milam also was present during a portion of the March, 13, 2008 visit. Prior to and following the visual review of the dams, discussions were held with plant personnel responsible for the maintenance and operation of the Ash Pond. The following plant personnel were interviewed:

Billy Milam	-	Chemistry Lab Supervisor
Helen McMillen	-	Chemistry Lab Technician

Prior to the field visit, the 2003 inspection report was reviewed as well as reports prepared by MACTEC since 2003 and Progress Energy inspection reports. The inspection of the various dams at the Roxboro Plant was accomplished by a combination of on-foot reconnaissance and observations from a slowly-moving vehicle. A visual inspection was made of the dams, dikes and appurtenant structures. Observations of the condition of the crest, interior and exterior slopes and structures were made where foot-accessible. Photographs were taken to document existing conditions and are contained in the Photographs section. Where feasible, photographs were taken from similar vantage points as the 2003 photographs. The locations and orientations of the photographs are shown on the Photograph Location Maps also contained in the Photographs section.

4.2 Main Dam

Overall, the main dam and the associated spillways are in good condition. Except for maintenance items, no repairs are needed at this time; however, a plan to implement general caulk refurbishment and sealing for the joints at the primary spillway is recommended for implementation within the next 5 years.

The crest is level and shows no indications of settlement (Photo 1). The rip-rapped upstream slope has a regular shape with no indications of slope instability (Photo 1). There is minimal vegetative growth in the rip rap.

The downstream slope is also fully covered with rip rap and shows no indications of instability (Photo 2). Vegetation was cut in 2007, and is in control. There is some minor vegetation in the riprap near the afterbay lake level on the downstream slope. This vegetation is not a concern at this time; if routine vegetation maintenance is continued, the vegetation should not become a concern. Based on observations over the last several dam inspections and visits, a thorough cutting of vegetation on the downstream slope every five years appears adequate.

On the west end of the dam, some erosion was noted at the junction between the dam and the natural ground of the abutment during the 1993 and 1998 inspections. The erosion is still present, but has shown little change since the 2003 inspection (Photo 3). The erosion is along the natural flow line of surface runoff. The erosion has cut up to two feet below the original ground level, exposing mainly hard residual soil or soft weathered rock. The ditch is thickly overgrown with vegetation. In one or two spots, the erosion has created a near-vertical slope directly adjacent to the rip rap layer on the downstream slope. No indications of slumping or loss of ground in the downstream slope were seen. There does not appear to be any immediate risk of damage to the dam.

The lack of significant change in the erosion since first noted in 1993 indicates that the erosion is not progressing. This erosion area should continue to be observed during the normal inspections conducted by the plant. In this case, the vegetative growth is beneficial to retarding the erosion. Trimming bushes back to allow visibility should be done, but the vegetation should not be removed or killed. If progressive deepening of the ditch is seen or if any loss of ground from the toe of the dam adjacent to the ditch is seen, repairs to the ditch will be needed.

On the right downstream abutment, minor erosion is present along the natural ground but not immediately adjacent to the dam. As shown in Photo 4, vegetation clearing done in 2007 did not remove or significantly trim the vegetation over the erosion area. The larger bushes should be trimmed to allow better observation of the erosion during normal plant inspections.

In 2002, minor seepage from the lower part of the downstream slope near the west end was seen due to the afterbay lake level being very low. This area was covered by the afterbay lake in 2003. The afterbay lake level was again relatively low at the time of the 2008 visit, but no signs of seepage or unusually wet areas were seen. The seepage area was judged inconsequential in 2002, and remains so.

The main dam has a clay blanket on the upstream east abutment area for seepage control. Tree growth on the clay blanket has been noted in the past, and trees have been cut or sprayed as maintenance control; the last work was in 2007. As shown in Photograph 5, most of the trees appeared dead. Examination of branches revealed some with green underbark, indicating some trees remain viable. The conditions of the trees should be checked during the spring and summer months and trees remaining alive should be sprayed.

The emergency spillway for the dam has a good grass cover and the cut slopes show no indications of instability (Photo 6). Minor tree growth at the entrance was cut in 2007 and appears under control.

4.3 Main Dam Spillway

The primary spillway was observed during the August 5, 2008 site visit when no water was flowing. At the time of the March 13, 2008 visit, with the lake level at approximately elevation 410.7 feet (MSL), the flow pattern down the spillway was smooth (Photos 7 and 8). Overviews of the spillway are shown in Photos 9 and 10. The broken slab sections in Photo 9 are the result of cavitation during early flooding as described in Section 2.2 and more completely in the Historical Volume⁽³⁾. The drop wall constructed as a result of the 1975 failures is shown in Photos 11 and 12. No concerns were seen. The weep holes and underslab drain outlets were generally dry, but signs of past water flow were visible, and one underslab drain outlet showed a slight trickle of seepage flow.

The right spillway concrete walls are in good condition. The left spillway walls have some scaling concrete at two vertical joints where past repairs were made (Photos 13 and 14), but these areas are old and show no change from past observations. Photos 15 through 17 show the left spillway

retaining wall downstream from the drop wall. No significant cracks or concerns were noted. Some minor efflorescence was observed at some locations. Downstream from the end of the left retaining wall there is a lower height retaining wall with a concrete-paved slope above (Photo 18). Movement of the low-height retaining wall has created a crack about 1-inch wide in the concrete paving. This crack has been observed in past inspections, and shows no noticeable change.

The spillway slab was walked during the August 5, 2008 visit to document conditions at the joints. Exhibit 8 shows the slab numbering pattern used in the following discussion. No new cracks of significance were seen; only an occasional extension of an existing crack by a few inches or a hairline new crack near an existing one were found. The main observations were missing or abraded joint tape and some loose crack patches on the left side. Some surface loss of cement mortar around the aggregate was seen on the surface of a few slabs, suggesting concentrated flow is more common across these sections, and an occasional small hole due to an aggregate popout was seen. Photos 19 through 26 document typical conditions. A summary of the field notes is attached in Exhibit 22. While the overall condition of the spillway slab is excellent for its age, the deterioration in caulk and joint tape is progressing. A general refurbishment of the joint caulking should be planned for implementation over the next five years.

4.4 West Ash Pond

The West Ash Pond has a main dam (West Ash Pond Dam) and four smaller dikes that separate the pond from the discharge channel. The water level in the pond is now at the design pond level, elevation 463 feet. In 2006-2007, a new Wastewater Treatment Pond and a Flush Pond were constructed over sedimented ash in the portion of the West Ash Pond from the West Ash Pond Dam north for about 2000 feet. The active section of the West Ash Pond is now from the north end of the new ponds to the filter dike (Dike No. 1). No ash discharges presently reach the area of the West Ash Pond Dam or Dike No. 2.

4.4.1 West Ash Pond Dam

The dam is in good condition with no significant concerns seen. The crest of the dam is relatively level and shows no unusual cracks or settlement (Photo 27). The upstream slope is now covered by the new WWTP dam. (Photo 27).

The downstream slope vegetation was cut on the upper two-thirds in late 2007, and the vegetation is under control. The cutting in 2007 did not reach the lower third of the slope and vegetation there needs cutting back or spraying to improve slope visibility for during routine inspections. There were no obvious signs of slope settlement, slumping or distortion (Photo 28).

The ditch along the junction of the dam and the natural ground about midway down the west side, where some water is often seen, was dry. No significant soil erosion or loss of ground along the ditch was seen.

The exit points for the internal drainage of the dam are mounds of drainage stone with no pipe outlet. Water from these points flows down concrete swales to discharge into Hyco Lake. Minor flow amounts were emerging from six of the seven exit points; flow volumes were estimated at less than ½ gallon per minute, with slightly greater flow from the fifth drain from the west end of the toe. These flow amounts are consistent with past observations. The seepage appeared clear, but orange-stained sediment in the outlet channels has accumulated. No indications of soil loss were seen. The sediment and orange staining is likely due to the vegetative growth that has accumulated around the outlets.

Even though the concrete channels that carry the seepage out to Hyco Lake were cleared of excessive soil and vegetation in 2006, they have accumulated material that blocks seepage flow and needs cleaning (Photo 29).

The ends of the concrete outlet channels at the edge of Hyco Lake were noted in 1998 as being undermined and a potential safety hazard to fishermen who might illegally enter the area. Since 2001, Progress Energy has increased site security measures, and fishermen are not expected to be in the area. The undermining is not a dam safety concern due to the distance from the exit points back to the dam.

A slight amount of seepage was seen in 2003 just east of the easternmost drain channel, emerging from the natural ground about 10 to 15 feet out from the toe. Subsequent site visits and the present site visit have not observed this seepage, although signs of long term wetness (moss and reed

growth), have been observed. The seepage flow as observed in 2003 was extremely slow and no evidence of boils was seen. This area should be observed for change during the routine inspections by plant personnel.

4.4.2 Dike No.1

The crest of the dike is relatively level with no indications of settlement or cracks (Photo 30).

The interior slope appears in generally good visual condition; the steep slopes were formed by end-dumping rock and the slope is irregular (Photos 31 and 32). Three areas previously noted on the interior (north) slope of the eastern part of the dike which appear to indicate recent shallow-seated rock slides have had additional rip rap placed to reduce risk of further movement above the slide areas. At two of the areas, some additional rip rap still needs to be placed. Changes in ash pond water level related to the WWTP construction caused completion of the rip rap placement to be deferred for lack of access by a work barge. The additional rip rap was left on the crest and is to be placed in 2008.

At the exterior slope-natural ground junction on the east end of the dike, minor erosion has created a shallow gully that has been observed during past inspections. The channel appears to be inactive, and some rip rap was placed in it in 2007 to reduce risk of additional erosion. Similar erosion of lesser magnitude is present on the west end of the dike, and does not require repair at this time.

Overall, the exterior slope is in good visual condition (Photos 30 and 33). Due to the method of construction, there are several locally steeper areas where minor rock surface slides have occurred.

A large volume of seepage is emerging from the dike onto the bench. This is normal; no signs of dike distress due to the seepage were seen. The seepage flow through the dike in some spots appears to be at a greater volume than observed in the 2003 inspection, but similar to the volume observed in 2007. The pattern of flow that emerges on the bench at the top of the berm on the downstream slope indicates there are zones of more concentrated flow through the dike. The sand blanket is shown on design drawings to be 4 feet thick. No large accumulations of sand were

observed on the bench, although the flow may be of high enough velocity to prevent sedimentation. It is possible some flow channels through the sand blanket have developed.

Stability analyses for Dike 1 conducted during the design and construction indicate a factor of safety of 1.43 with a water flow line assumed to be slightly below the shot rock. The conditions seen in the field indicate a slightly higher flow path has developed than assumed in the stability analysis. As part of the 2002 field visit work, we used the parameters from the original stability analysis and re-ran an analysis assuming a higher water line within the dike. The impact on the factor of safety is minimal (factor of safety = 1.41) for a water line emerging up to three feet above the berm level, as suggested by the field observations.

With the water line assumed as much as eight feet above level of the berm, the analyses indicated a factor of safety of 1.28, which is relatively low, but considered acceptable for the conservative assumptions. Based on the design and the stability analyses in 2002, the stability of the dike with the presently-observed water flow is not of concern.

The discharge structures for the ash pond are incorporated into Dike No. 1. These structures are two vertical risers with metal skimmer tops (Photos 34 and 35). Due to the pond level being at the top of the riser, the riser pipes could not be observed. The skimmer structures appeared in satisfactory condition.

The discharge pipes exit at concrete headwalls equipped with flap gates (Photos 36 and 37) that were observed to be operating properly at the time of our visit. The flow from the outlet pipes follows excavated channels that have some vegetation, but the flow does not appear to be obstructed (Photos 38 and 39). Maintenance of the vegetation needs to be done as necessary to prevent vegetation blocking the flow path.

4.4.3 Dike No. 2/3

Dike No. 2 is in good visual condition. Dike No. 3, basically an extension of Dike No. 2, is also in good visual condition. Rip rap is present on both interior and exterior slopes. Dike No. 2 no longer has water impounded against it due to the construction of the WWTP and Flush Pond. Dike No. 3

is a saddle dike that is above the design ash pond water level. No indications of excessive settlement, slumping or cracks were seen. No seepage was observed. Vegetation in the form of briars, grass and small trees is moderate to thick in the rip rap. The trees were cut in 2007. Spraying should be done to control future vegetation growth.

4.4.4 Dike No. 4

Dike No. 4 is in good visual condition. Rip rap is present on both interior and exterior slopes. Photograph 40 shows an overview of the interior slope and crest. Photograph 41 shows a view of the exterior slope. No indications of excessive settlement, slumping or cracks were seen. No seepage was observed. Vegetation in the form of briars, grass and small trees is moderate in the rip rap. The vegetation was cut in 2007. Maintenance of the vegetation through spraying and selective hand-cutting of trees should be done to control future vegetation growth.

The surface concrete pad at piezometer D4P-3 was noted in 2003 as cracked; it has not been repaired. This is not a concern assuming the piezometer was constructed according to the plans, since the grout seal will prevent surface water infiltration. Piezometer covers were locked.

4.5 Afterbay Dam

4.5.1 Concrete Sections

The Afterbay lake level was at elevation 378.49 feet (MSL) on March 13, 2008, lower than the normal level of 385 feet. The concrete conditions of the gravity dam portion appeared similar to those seen in 1998 and 2003. Hairline cracking on the tops and sides of the upstream sections of the piers was similar to that previously seen, and it does not present a structural concern. Efflorescence and surface scaling of concrete on the east and west sections of the downstream sides was similar to that seen previously. The depth of concrete scaling appears to be less than 1/2 inch and is not of structural concern.

The piers are in good visual condition. Occasional hairline cracks and efflorescence at construction joints is visible. Photographs 42 through 51 show the downstream sides of the piers to document their condition.

Photographs 52 through 61 document the conditions of the upstream pier sides. Photographs 62 and 63 show typical hairline cracks that are seen on the tops of the piers. The hairline cracking is not excessive. It appears that some water may be leaching downward through the hairline cracks and emerging as efflorescence on the sides.

The downstream side of the concrete dam section is in good condition overall. The downstream side of the east gravity section has moderate efflorescence at construction joints (Photo 64). Portions of the concrete surface adjacent to the joints show sheet spalling with the loosened sheets about ¼ inch thick. No visible seepage was emerging from the joints, and the concrete under the spalled sections appeared sound. Slight seepage was observed at the joint between pier 1 and the gravity section.

The west gravity section also has efflorescence and concrete spalling on the downstream side (Photos 65 and 66). The efflorescence is more pronounced than on the east side, and there is a trace of seepage through joints. A slight amount of seepage was seen in 1998 at the junction of the dam and the rock abutment on the west side. No seepage was visible at the time of the 2003 visit, and the area was only damp at the time of the present site visit. The seepage does not indicate a concern. Vegetative growth on the concrete section appears under control; maintenance to keep the vegetation under control should continue.

The efflorescence observed is not considered abnormal for a dam of this age. It is our professional opinion that the efflorescence is not a present concern with respect to loss of concrete strength, nor is it a likely future concern given the size of the structure.

The Tainter gates and their operating chains are in good condition. The operating chains do show some rust, but there appears to be no loss of section. An assessment of the condition of the chain links was made by Progress Energy personnel in 2007 with the conclusion that the rust presents no structural concerns. The seals on the bottoms of the gates leak slightly, but this does not affect their function. Progress Energy personnel test the operations of the Tainter gates monthly, opening and closing each one approximately six inches. Progress Energy Guideline No. 3-2-760C⁽¹⁰⁾ sets out the test sequence.

Photograph 67 shows an overview of the downstream side of the dam. Water was exiting from the Howell-Bunger valves at the time of our inspection. The flow appeared to be uniform. The downstream channel has minimal obstructions to flow (Photo 68).

The operating guidelines for adjusting the Howell-Bunger valves and Tainter gates to comply with low-flow release requirements and to handle flood events have been updated since the 1998 inspection to provide for better control on flood flows. The present procedure is described in Progress Energy Guideline No. 3-2-752C⁽¹¹⁾. These guidelines modify the gate openings to allow continuing to open gates beyond the apparent limit in the previous revision. The present revision appears appropriate to meet the dual objectives of downstream flood level control and the need to prevent overtopping of the dam.

4.5.2 Earth Section

The crest of the earth section is level and does not indicate unusual subsidence or cracking (Photo 69).

The upstream slope riprap is in good condition with very little vegetation. There were no visual indications of slope distress (Photo 69).

The downstream slope riprap is in good condition with little vegetation. Minor seepage has been seen occasionally along the toe of the slope near the concrete section; however, this area was dry during this visit.

During the 2003 inspection visit, seepage was observed emerging from two concentrated points with a combined flow estimated at 1 gallon per minute from the natural ground about 20 and 30 feet beyond the earth dam toe. No soil was noted in the seepage stream, and no boils were seen. The seepage has been potentially related to the interceptor trench drain shown on the plans which could collect infiltrating surface water. The seepage has been observed during annual inspection visits as having no change. No seepage was seen from these areas during the March 13, 2008 site visit, which was made after the extended dry conditions in 2007. We recommend this seepage area be checked during routine site visits.

4.6 Instrumentation Review

4.6.1 Main Cooling Lake Dam

The only instrumentation in the Main Cooling Lake Dam consists of the piezometers installed in 1995 at locations shown on Exhibit 23. The readings from these piezometers have been added to the quarterly reading cycle done for the piezometers in the other dams since September, 1998. Exhibit 24 shows all the readings from these piezometers.

The review of the data on Progress Energy data sheets in 2003 showed apparent large fluctuations for piezometers L-2-1 and L-2-2. After review, it was determined that, because these two piezometers are installed in the same borehole, the unusual readings were inadvertently mis-labeled when recorded. Review of readings from May, 2003 through June, 2008 found two additional instances of mis-labeling. A clear label needs to be placed on these piezometers to prevent mis-labeling of readings. On Exhibit 24, these mis-labeled readings have been corrected.

The trends of readings and locations of monitoring intervals water levels in the piezometers are below the phreatic line used in the 1995 stability analysis conducted by Law Engineering. A drop in piezometer level in the deeper piezometer in the downstream slope (L-2-1) is shown for June through December, 2007. This corresponds to a period of extended drought when the downstream lake retained by the Afterbay Dam was abnormally low. The level of the downstream lake could affect the piezometer level in L-2-1; however, it is noted that a similar drought period in 2002 affected the shallower piezometer (L-2-2) and not L-2-1. Piezometer L-2-2 did not show unusual drops during the June to December, 2007 period.

Lake levels for Hyco Lake and the Afterbay Lake are currently recorded on the piezometer data sheets at the time of the readings and are included in the data base summaries as was recommended in the 2003 inspection report.

4.6.2 West Ash Pond

4.6.2.1 West Ash Pond Dam

The quarterly piezometer readings through May 2003 do not show any unusual changes over the last five years. Exhibit 25 contains information on the piezometer installations and plots of the data prepared by Progress Energy. Lake levels are currently being recorded and transferred into the data base.

Two sets of paired piezometers were installed on the crest of the dam, with one of each pair monitoring below the sand drainage blanket and the other monitoring above the sand drainage blanket. Progress Energy field forms now record “dry” if there is no water in the piezometers above the drainage blanket (MDP-2 and MDP-4), and they also indicate that the piezometers are normally dry. If water is present, it is recorded with a notation confirming there is water. This process has aided interpretation of the data. Since 1997, the readings in these piezometers have generally indicated water present slightly above the bottom of the piezometers. The elevation of the water surface has slowly risen since 1998, with current elevations about 4 feet higher than in 1998. No abrupt changes are indicated. Both of these piezometers show a slightly greater rate of increase since the Wastewater Treatment Pond was placed in service in mid-2007.

Based on the current data, the two piezometers above the drainage blanket are indicating water present above the blanket consistently. If water is above the drainage blanket, then the present phreatic surface is above the surface used in the original stability analysis by approximately 7 to 11 feet at the piezometer locations.

The cross section of the dam shown on Exhibit 10 indicates that the two piezometers in question are very close to the intersection of the steeply sloping chimney drain and the horizontal drainage blanket. Seepage could be accumulating in the intersection area and then re-entering the horizontal drainage blanket. The horizontal drainage blanket is covered by riprap at its junction with the downstream slope. There is some seepage at the level of the drainage blanket as noted in Section 4.4.1, but the quantity is slight. Seepage higher up the downstream slope, if any, would be

difficult to detect due to the rip rap cover on the slope. Our field observations did not indicate concerns for seepage.

When this condition was first identified during the 1998 inspection, the original stability analysis was reviewed using the March, 1998 piezometer readings as a guide to the phreatic line. The results indicated the critical failure surface is still above the apparent present phreatic line, and the minimum factor of safety was essentially unchanged. The present readings do not indicate a need for further review.

The piezometers installed below the drain blanket, into the bedrock below the dam (MDP-1 and MDP-3), had shown little change since 1999, but from December, 2006 to June 2008, as the wastewater treatment pond was completed and filled, these piezometers have indicated a general rise of about 1 to 1.5 feet. This is interpreted as due to the effects of stress increases on the strata above, and would be expected to dissipate over time.

Piezometers MDP-5 and MDP-6 are installed along the downstream toe of the dam. These piezometers have shown little change since the start of monitoring, except for a drop and then recovery of about 3 to 5 feet during the drought in 2007.

There were settlement monuments installed on the crest of the dam. Readings of these monuments were discontinued prior to 1998 based on the satisfactory performance of the dam.

4.6.2.2 *Dike No. 2*

The two piezometers in this dike continued to show the slight trend of increasing water level noted in the 1998 and 2003 inspection reports until March, 2007. From that point on, the water elevations have risen about 7 feet and they are at the design level of the ash pond. This rise corresponds to activities for construction and initial filling of the wastewater treatment pond, and are interpreted as related to that work. At this time no water is ponded against this dike. In 1998, it was noted that the phreatic line indicated by the readings at that time was above the line used by the designers in the original stability analysis as reported in design documentation assembled by Progress Energy⁽¹²⁾.

A check of the original analysis made in 1998, using the data from the original stability analysis and the lake and piezometer readings at that time, concluded that the dike had an acceptable safety factor with the 1998 phreatic surface and with the estimated phreatic surface for a pond at the design water surface elevation of 463 feet. A review of the 1998 analysis for the pond level at elevation 463 feet shows that the present piezometric levels are below the phreatic line used in the 1998 analysis, so no further analyses are needed at this time.

4.6.2.3 Dike No. 4

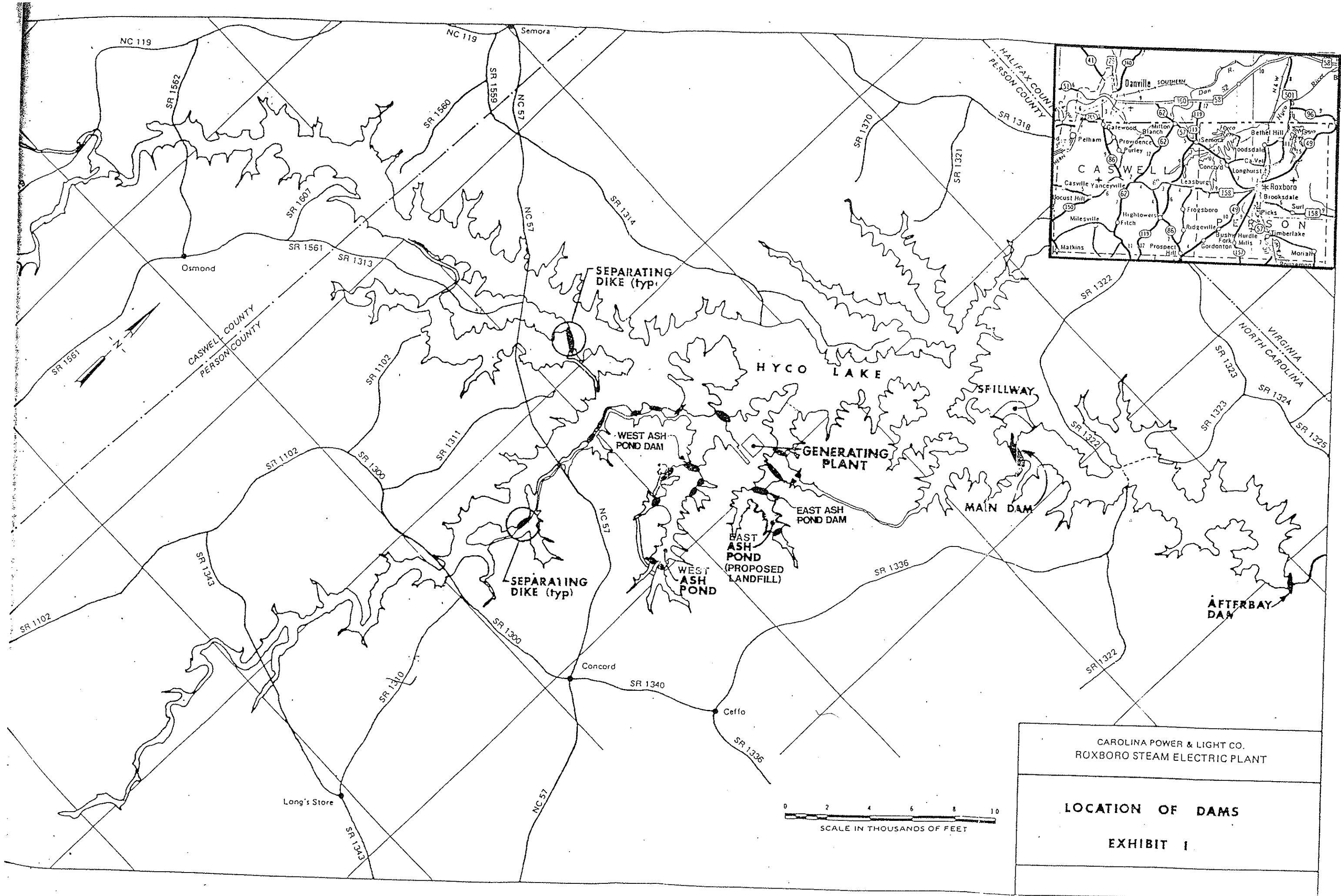
The four piezometers in this dike have shown somewhat erratic fluctuations, but they generally track the pond level. There has been a gradual increase in the levels over the last five years, consistent with the rise in the pond. All four piezometers are reported to be installed to the same elevation, as shown on Exhibit 26, but there is about a 6-foot range of elevation difference in the recorded water levels. The phreatic line indicated by the readings is generally consistent with the original stability analysis. At this time there is no cause for concern indicated by the readings.

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. MACTEC Engineering and Consulting, Inc., "Five-Year Independent Consultant Inspection, Roxboro Steam Electric Plant, Main Cooling Lake Dam, West Ash Pond Dam and Afterbay Dam, Person County," December 4, 2003.
3. Law Engineering and Environmental Services, Inc., "Independent Consultant Inspection, Main Cooling Lake Dam, West Ash Pond Dam, and Afterbay Dam Historical Volume", Roxboro Steam Electric Plant, Person County, North Carolina, December 18, 1998.
4. Carolina Power & Light Company, "Work Order :Package 0009046 01", dated April 9, 2002.
5. North Carolina Department of Environment, Health, and Natural Resources, "North Carolina Administrative Code, Title 15A, Subchapter 2K, Dam Safety," as amended January 1, 1991.
6. Carolina Power & Light Company, "Roxboro Steam Electric Plant-Main Dam and Afterbay Dam Hydrological Study-Summary", dated September 1, 1989.
7. Carolina Power & Light Company, "Roxboro SEP West Ash Pond Dam Monitoring Program Procedures Manual", Revision 1, November 11, 1988.
8. MACTEC Engineering and Consulting, Inc. "Report of Limited Field Inspection, West Ash Pond Dam and Dikes, Cooling Lake Dam and Afterbay Dam, Roxboro Plant, May 30, 2006
9. MACTEC Engineering and Consulting, Inc. "Report of Limited Field Inspection, West Ash Pond Dam and Dikes, Cooling Lake Dam and Afterbay Dam, Roxboro Plant, May 21, 2007.
10. CP&L, Roxboro Plant, "Guideline No. 3-2-760C, Afterbay Monthly Test, Revision No. 5", September 15, 1998.
11. CP&L, Roxboro Plant, "Guideline No. 3-2-752C, Afterbay Howell Bunger Valves & Tainter Gate Operating Instructions, Revision No. 10", August 1, 1999.
12. Carolina Power & Light, "Roxboro Steam Electric Plant-Ash Pond Expansion Project Final Design Report" Volumes I and II, dated August 31, 1987.

EXHIBITS

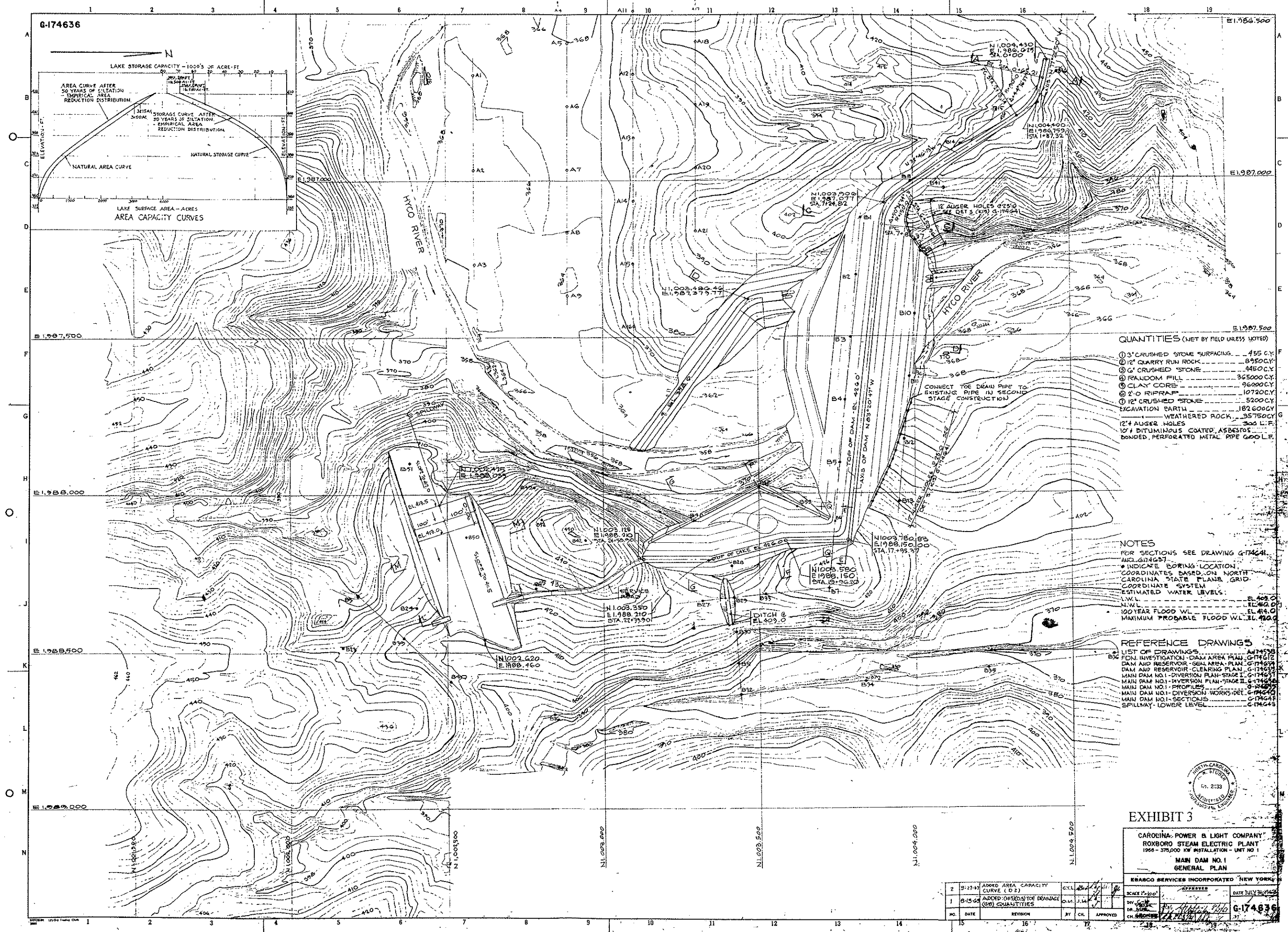
1. Locations of Dams
2. Summary of Engineering Data
3. Main Dam No. 1, General Plan (Ebasco Drawing G-174636)
4. Main Dam No. 1, Sections (Ebasco Drawing G-174641)
5. Main Dam No. 1, Profiles (Ebasco Drawing G-174639)
6. Spillway-Low Level-Excavation Plan (Ebasco Drawing G-174655)
7. Recommended Drop Structure (Figure 31 in report by Gunwaldsen⁽¹²⁾)
8. Plan View of Completed Upper Spillway – Hyco Lake Dam. Drawing prepared by Law Engineering and Environmental Services, Inc. September, 1997
9. Roxboro Steam Electric Plant – Ash Pond Expansion – Plan Sheet I (CP&L Drawing No. D-4150).
10. Roxboro Steam Electric Plant-Ash Pond Expansion-Dam Sections and Details (CP&L Drawing No. D-4155)
11. Roxboro Steam Electric Plant-Ash Pond Expansion-Plan Sheet II (CP&L Drawing No. D-4151)
12. Roxboro Steam Electric Plant-Ash Pond Expansion-Plan Sheet III (CP&L Drawing No. D-4152)
13. Roxboro Steam Electric Plant-Ash Pond Expansion-Dike #1 –Filter (CP&L Drawing No. SK-FCR-016)
14. Roxboro Steam Electric Plant-Ash Pond Expansion-Ash Line Discharge Structure (CP&L Drawing No. D-4157).
15. Circulating Water System Modification, Afterbay Reservoir Area - Plan (Ebasco Drawing CAR1623-G-205108)
16. Circulating Water System Modification, Afterbay Reservoir Dam - Profile (Ebasco Drawing CAR1623 – G-205110)
17. Circulating Water System Modification, Concrete Gravity Dam Plan - Masonry (Ebasco Drawing CAR1623-G-205122)
18. Circulating Water System Modification, Spillway - Plan and Sections (Ebasco Drawing CAR1623-G205112)
19. Circulating Water System Modification, Spillway Ogee Block M (Ebasco Drawing CAR1623-G-205113)
20. Circulating Water System Modification, Grouting Plan, Sections and Details (Ebasco Drawing CAR1623-G-205123).
21. Circulating Water System Modification, Earth Dam, Sections (Ebasco Drawing CAR1623-G-205111).
22. Summary of Field Observations of Main Dam Primary Spillway Joints, August 5, 2008.
23. Boring Plan and Piezometer Installation, Main Cooling Lake Dam.
24. Piezometer Readings in Main Dam Summarized from Progress Energy Data.
25. West Ash Pond Monitoring Piezometer Plots, (CP&L Drawing D-8186 plus 4 plots).

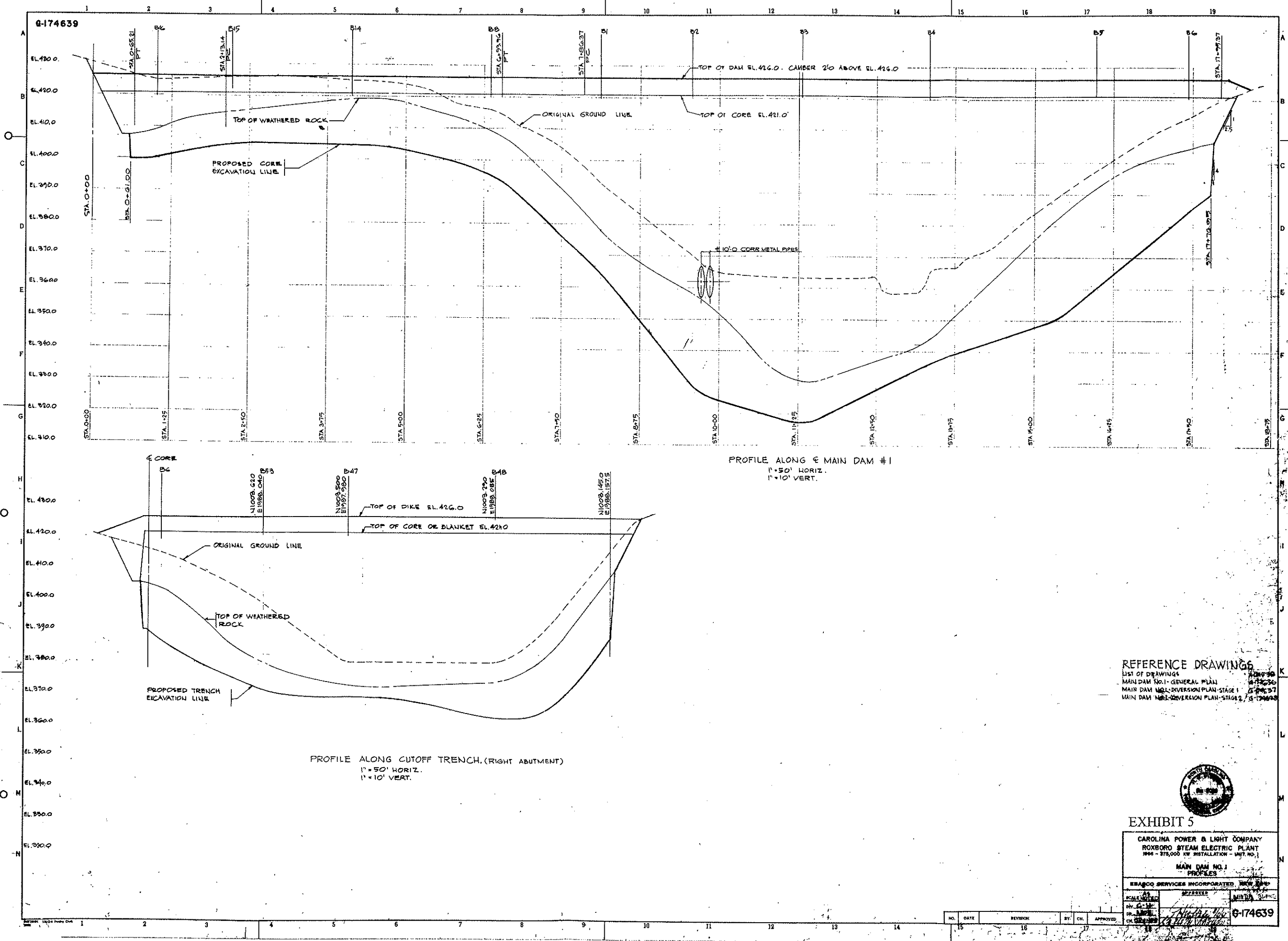


SUMMARY OF ENGINEERING DATA

DESIGN DATA	MAIN DAM	AFTERBAY DAM	WEST ASH POND DAM ⁽¹⁾
Date of Construction	1963	1974	1986
Drainage Area (Sq. Mi.)	190	190	0.54
Surface Area (Acre)	3750	650	240
Storage Capacity (Ac-Ft)	78000	12000	4800
Maximum Structure Height (Ft)	68	80	70
Crest Width (Ft)	20	15/20	20
Crest Length (Ft)	1800	860	1360±
Crest Elevation	426	400	470
Design Water Level	410	385	463 ⁽³⁾
Maximum Water Level	425.65 ⁽²⁾	398.74 ⁽²⁾	465
Design Flood or Freeboard (Ft)	1/3 ⁽²⁾	1-1/4 ⁽²⁾	5
Normal Tailwater Elevation	385	350	410
Hydraulic Head (Ft)	25	35	53

- (1) Dam constructed originally in 1973 to elevation 457 (MSL)
- (2) Proportion of Probable Maximum Precipitation based on CP&L Hydrologic Study, September 1, 1989 (Ref. 6).
- (3) Present (2008) operating level is approximately elevation 463.





REFERENCE DRAWINGS
 LIST OF DRAWINGS
 MAIN DAM NO. 1 - GENERAL PLAN
 MAIN DAM NO. 1 - DIVERSION PLAN - STAGE 1
 MAIN DAM NO. 1 - DIVERSION PLAN - STAGE 2

EXHIBIT 5

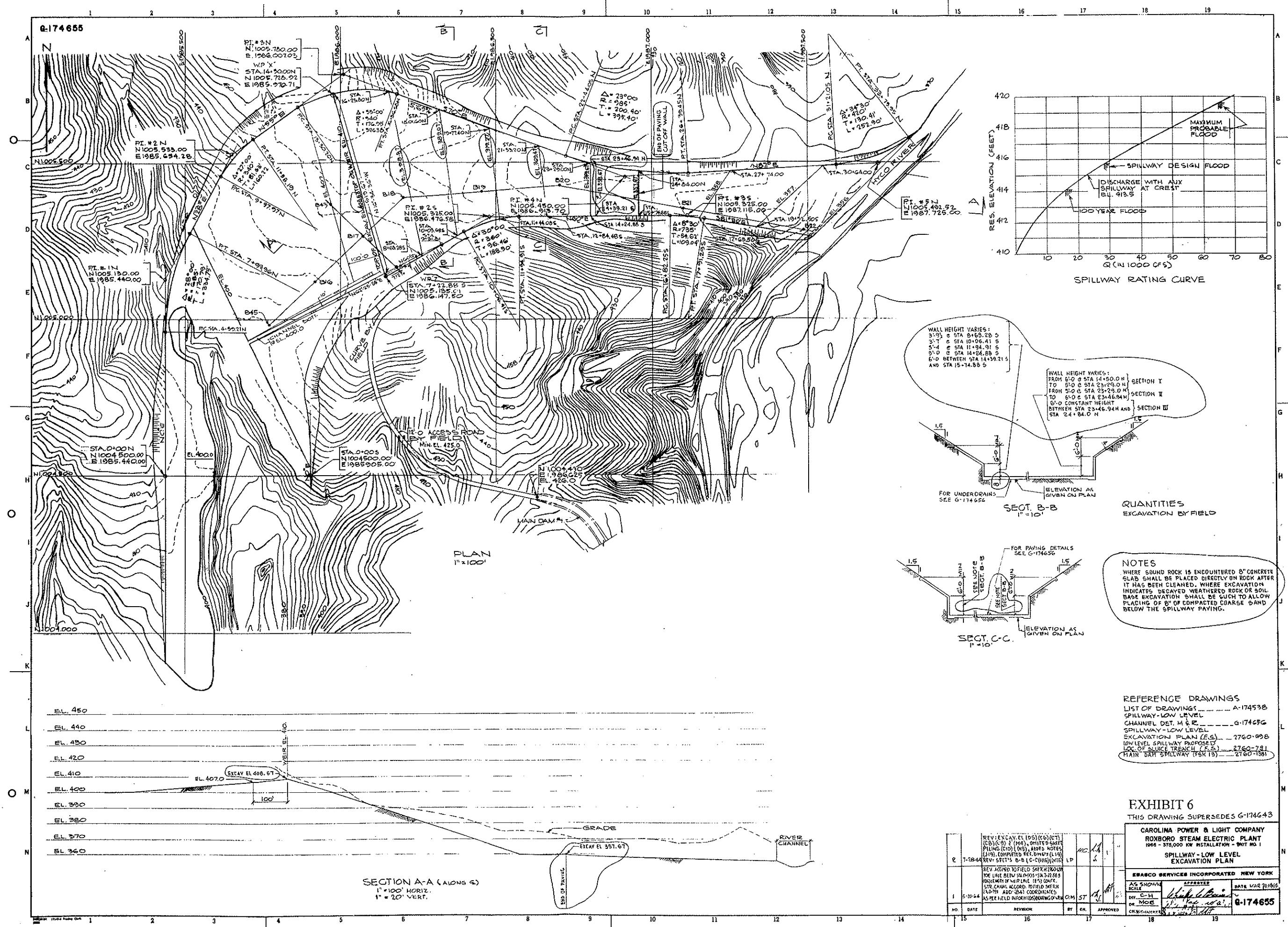
CAROLINA POWER & LIGHT COMPANY
 ROXBORO STEAM ELECTRIC PLANT
 1944 - 375,000 KW INSTALLATION - UNIT NO. 1

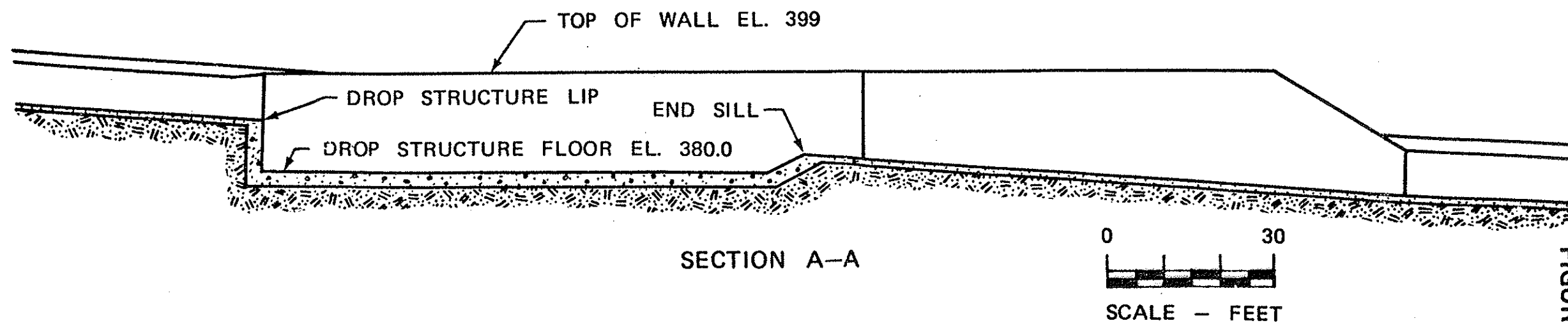
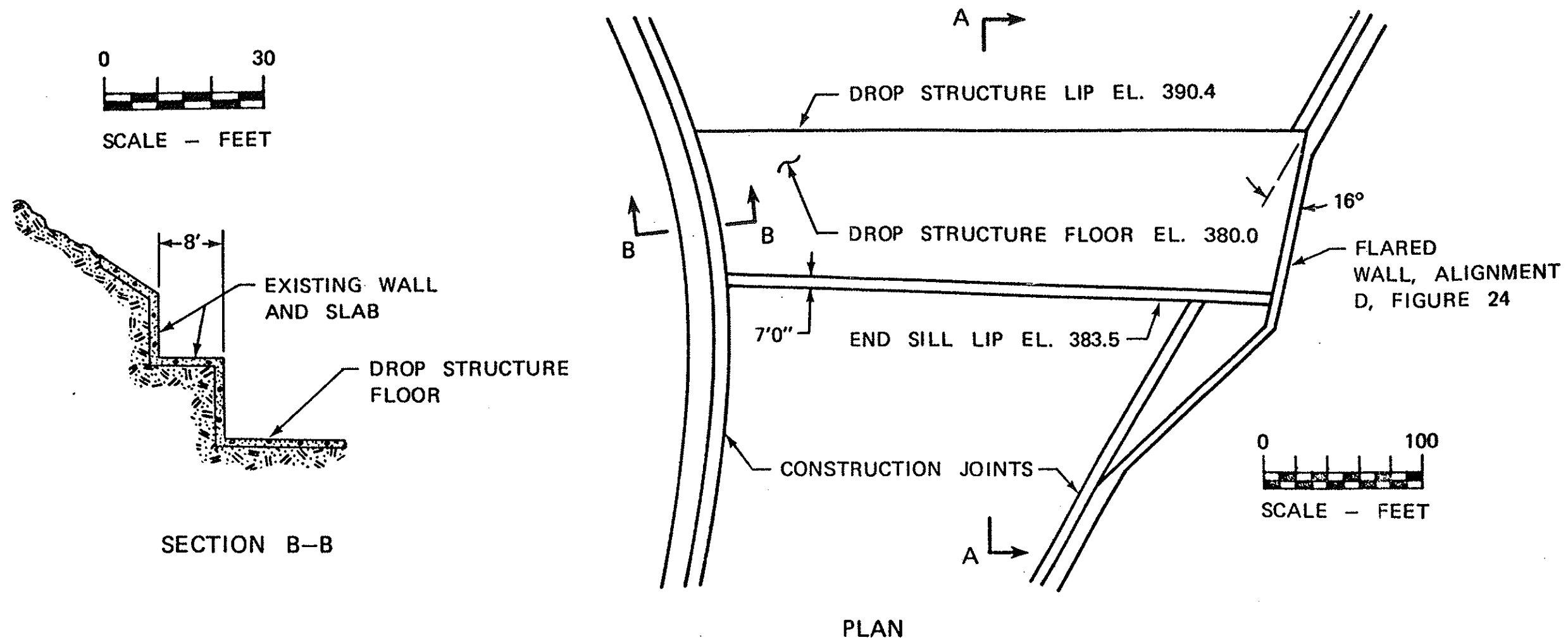
MAIN DAM NO. 1
 PROFILES

ERACOG SERVICES INCORPORATED, INC. 2000

NO. DATE REVISION BY CH. APPROVED

0-174639





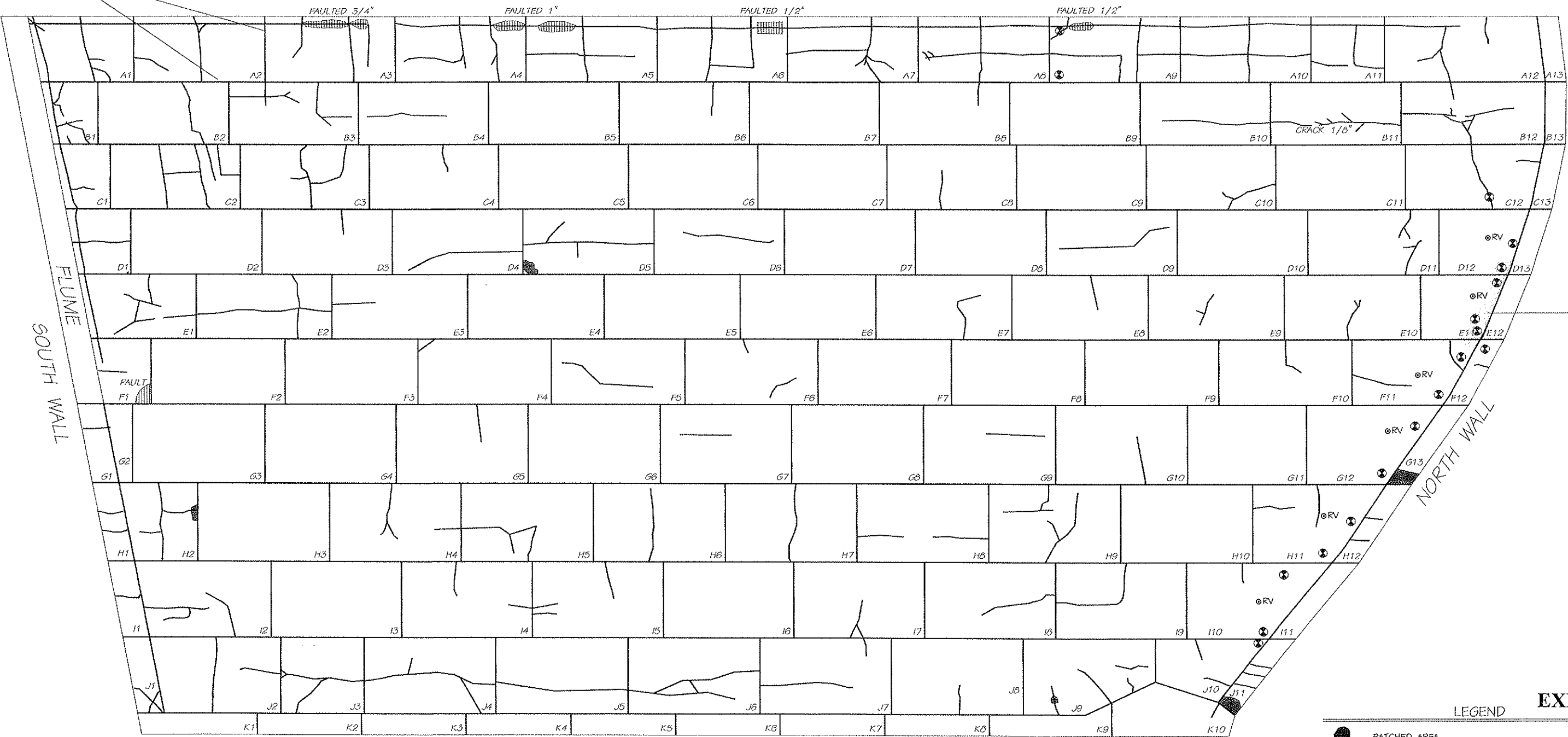
RECOMMENDED DROP STRUCTURE



FIGURE 31

LONGITUDINAL (SHORT)
AND TRANSVERSE (LONG)
CONSTRUCTION JOINT.

CREST OF SPILLWAY



TOP OF DROP STRUCTURE

EXHIBIT 8

LEGEND

- PATCHED AREA
- FAULTED CRACK - DISPLACEMENT AS NOTED
- SEALED CONSTRUCTION JOINT AND/OR CRACK
- PANEL ID NUMBER
- CORE HOLE FOR SUB-SLAB VOID LOCATION/GROUTING
- NEW RELIEF VALVE

NOTES:

- THIS DRAWING ACCOMPANIES A REPORT ENTITLED "FIELD REPORT OF UPPER SPILLWAY REPAIRS" DATED SEPTEMBER, 1997.
- LOCATIONS OF EXISTING CRACKS, PATCHES, SUSPECTED VOID AREA AND CONSTRUCTION JOINTS BASED ON FIELD WORK CONDUCTED BY LAW IN JULY, 1995, AUGUST, 1996, AND JULY AND AUGUST, 1997.

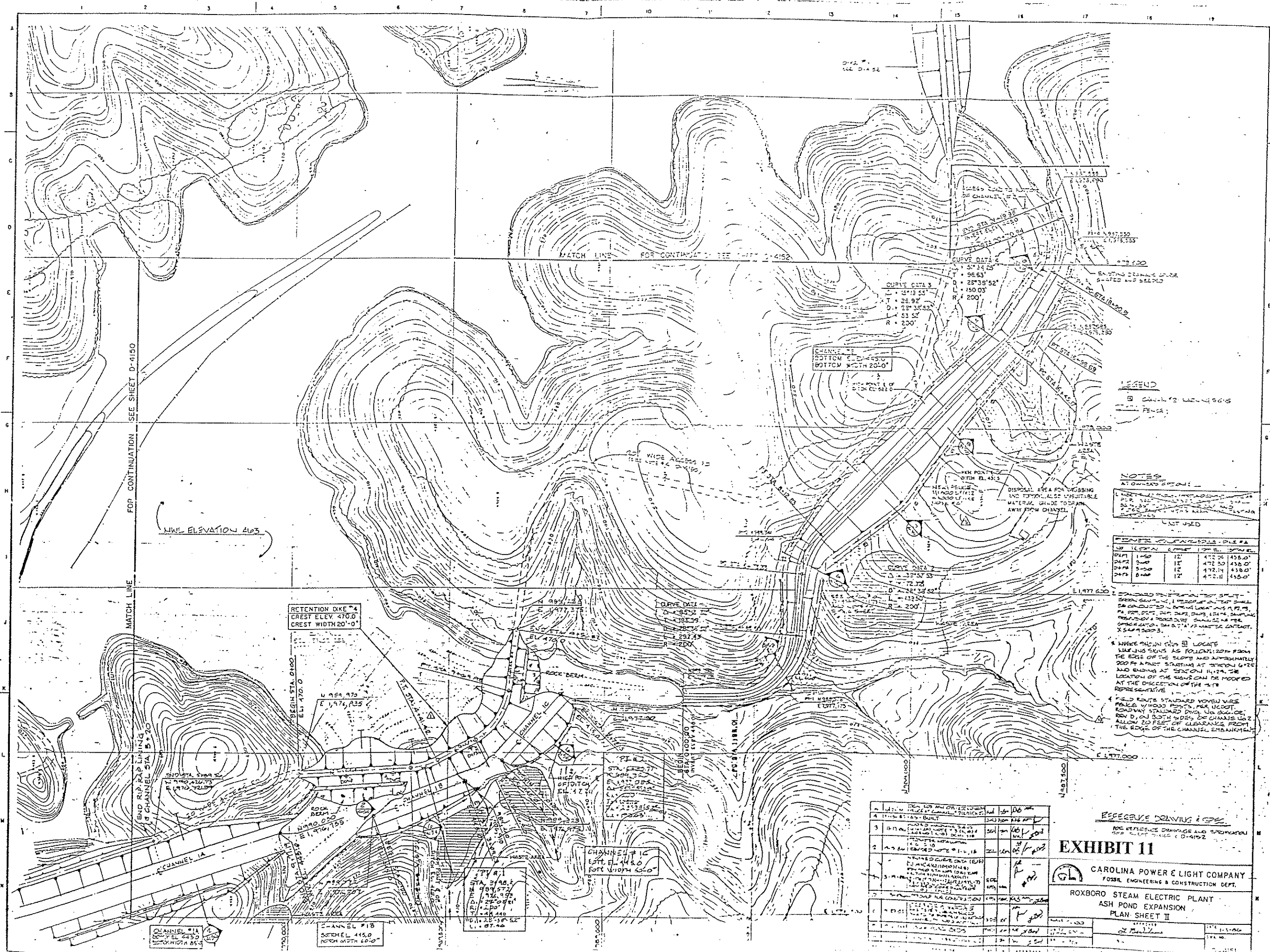
D				
C				
B				
A				

PLAN VIEW OF COMPLETED REPAIRS
UPPER SPILLWAY - HYCO LAKE DAM
ROXBORO, NORTH CAROLINA

DRAWN:	DW
DPT CHECK:	SL
ENG CHECK:	DW
APPROVAL:	SL
DATE:	SEPTEMBER, 1997
SCALE:	1"=20'-0"
REFERENCE DWGS:	G-174656 RCD-201 RCD-202

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

JOB NO.	DWG NO.
---------	---------



LEGEND
Channel #2 Lining
Pond

NOTES
1. Channel #2 Lining shall be constructed in accordance with the specifications for Channel #2 Lining.
2. Channel #2 Lining shall be constructed in accordance with the specifications for Channel #2 Lining.
3. Channel #2 Lining shall be constructed in accordance with the specifications for Channel #2 Lining.

Channel #2 Lining	Channel #2 Lining	Channel #2 Lining	Channel #2 Lining
Channel #2 Lining	Channel #2 Lining	Channel #2 Lining	Channel #2 Lining
Channel #2 Lining	Channel #2 Lining	Channel #2 Lining	Channel #2 Lining
Channel #2 Lining	Channel #2 Lining	Channel #2 Lining	Channel #2 Lining

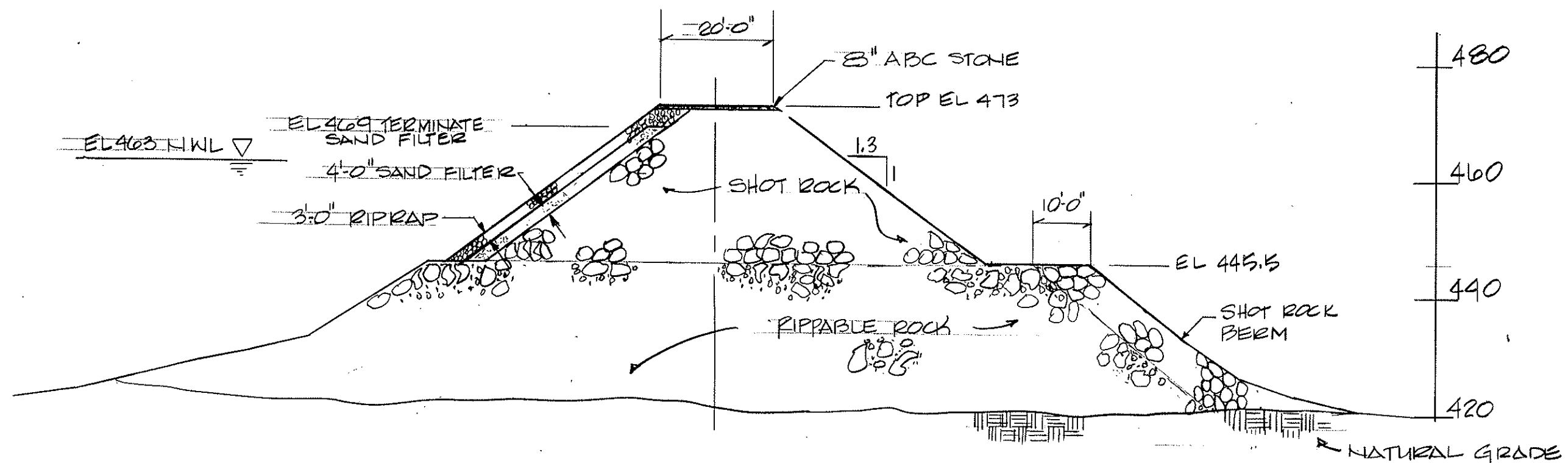
1. Channel #2 Lining shall be constructed in accordance with the specifications for Channel #2 Lining.
2. Channel #2 Lining shall be constructed in accordance with the specifications for Channel #2 Lining.
3. Channel #2 Lining shall be constructed in accordance with the specifications for Channel #2 Lining.

EXHIBIT 11

CAROLINA POWER & LIGHT COMPANY
POWER ENGINEERING & CONSTRUCTION DEPT.

ROXBORO STEAM ELECTRIC PLANT
ASH POND EXPANSION
PLAN SHEET II

Scale: 1" = 100'
Date: 11/1/52
By: J. B. Smith



NOTE: THE SAND FILTER AT THE FACE OF THE DIKE MAY BE ELIMINATED FROM ELEVATION 469 TO THE TOP OF THE DIKE. NO FILTER MATERIAL IS REQUIRED BENEATH THE ROADWAY SECTION OF THE DIKE.

DIKE #1

SCALE 1"=20'

EXHIBIT 13



CAROLINA POWER & LIGHT COMPANY
FOSSIL ENGINEERING & CONSTRUCTION DEPT.

ROXBORO STEAM ELECTRIC PLANT
ASH POND EXPANSION
DIKE #1-FILTER

SCALE 1"=20'

APPROVED

DATE 10/21/86

UNIT/SECTION CIVIL

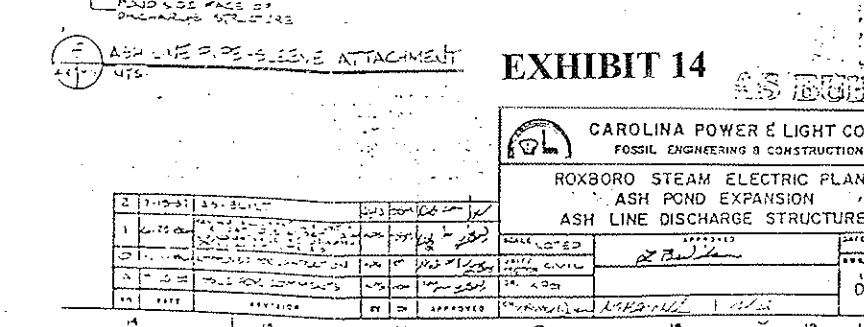
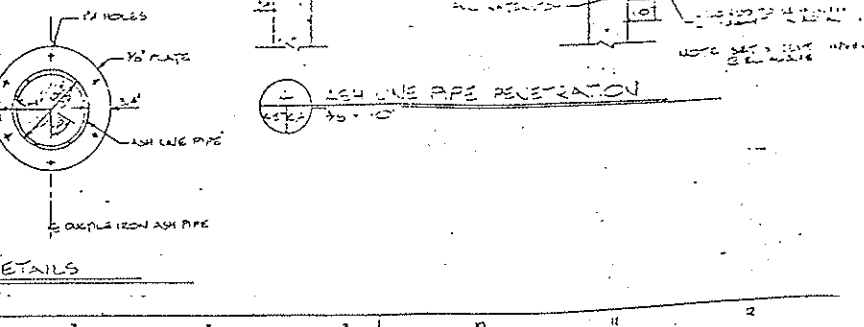
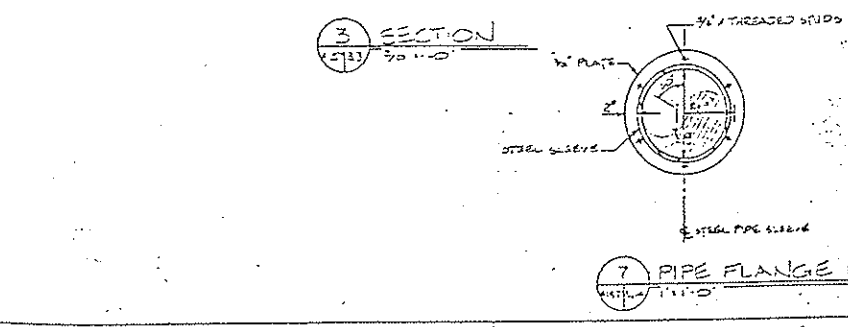
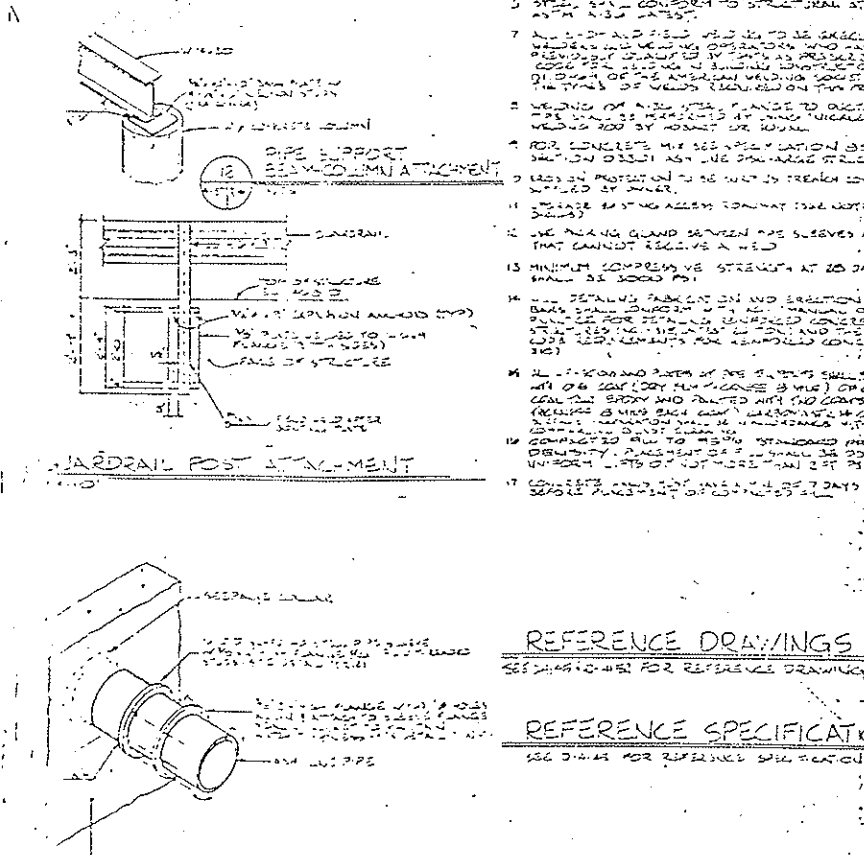
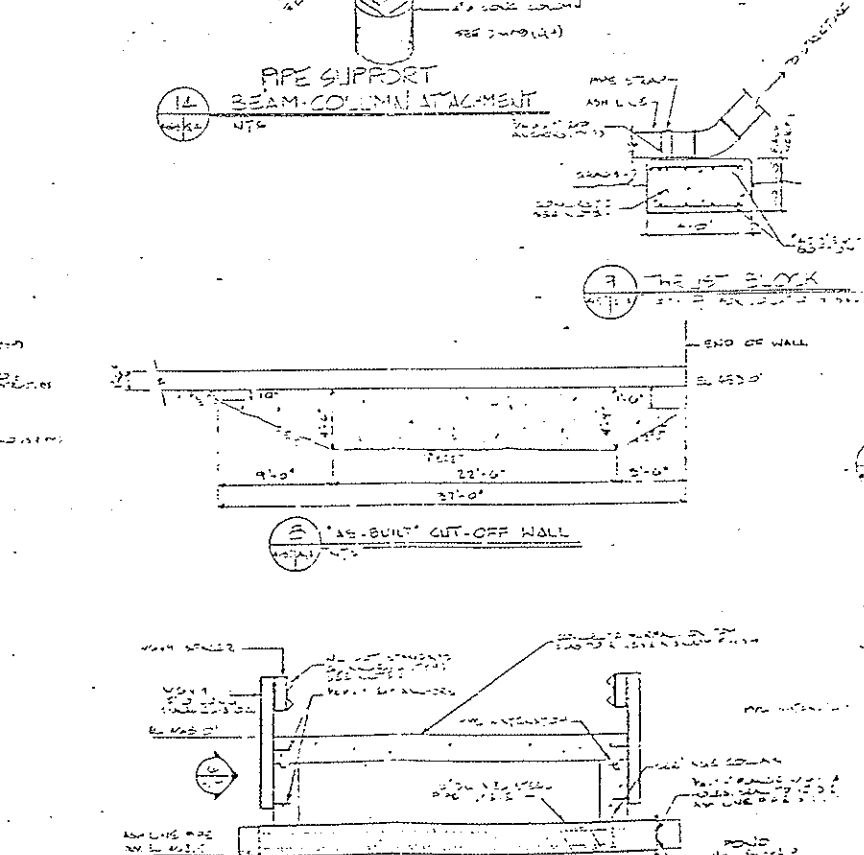
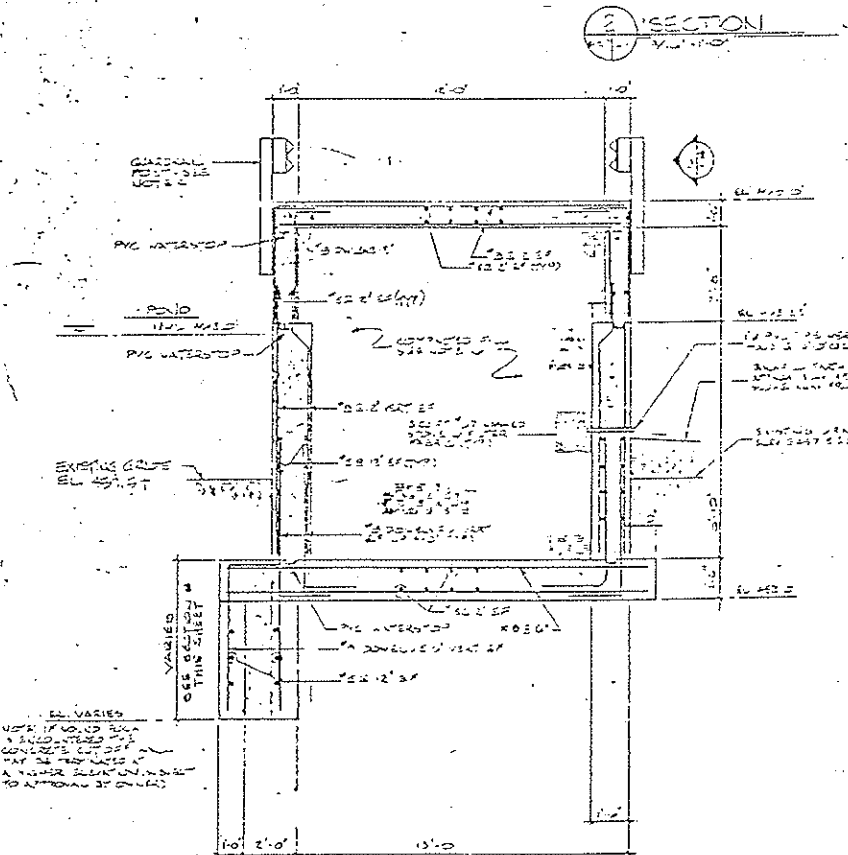
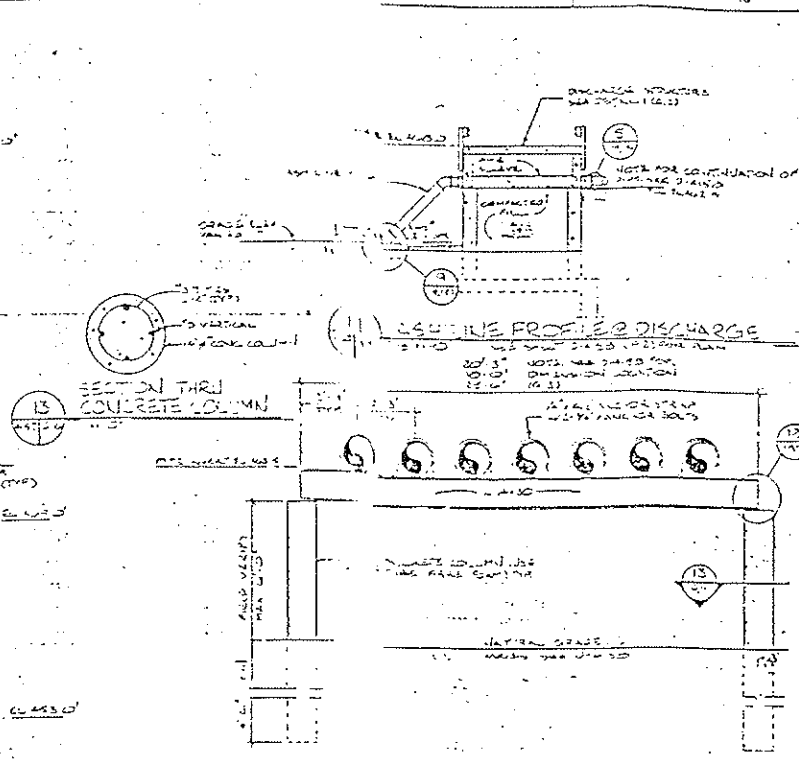
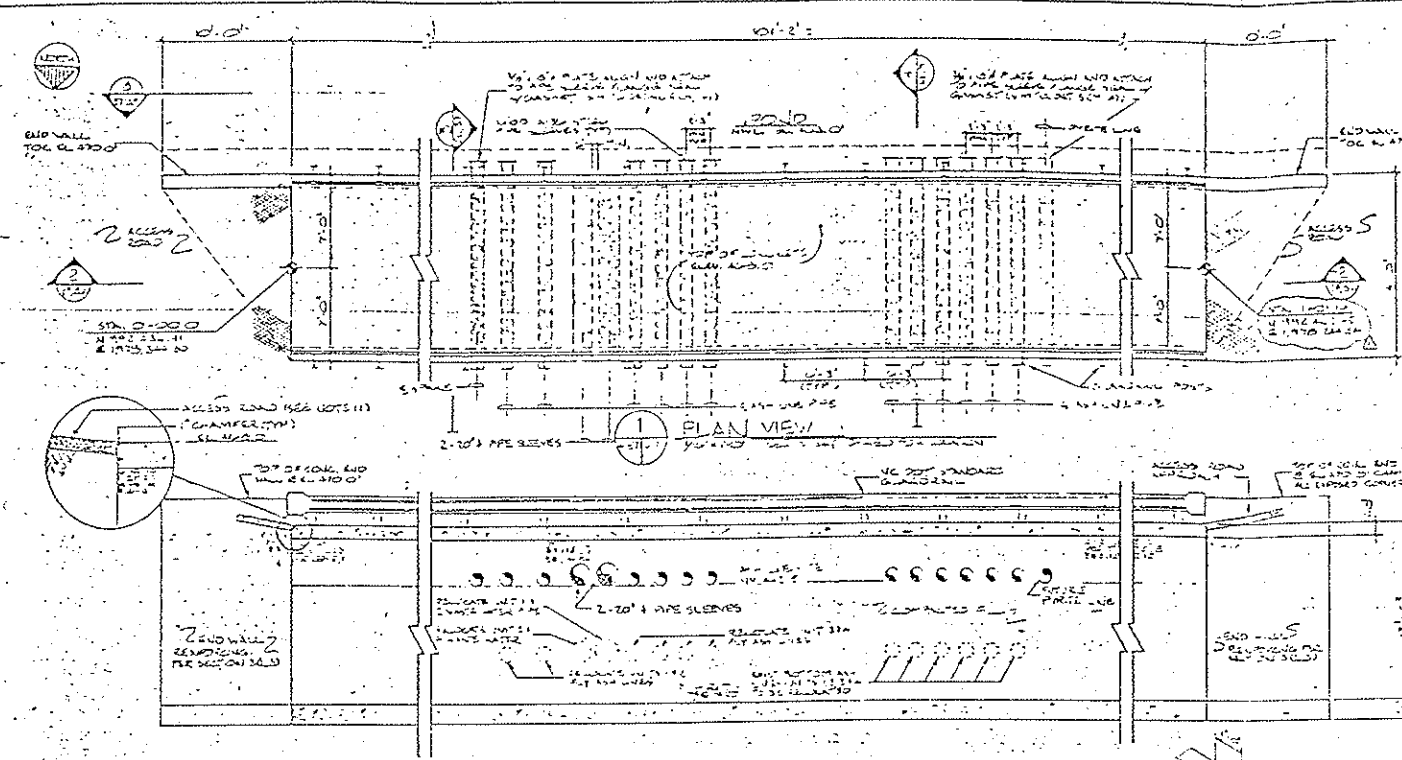
DWG. NO.

DR. BMT

SK-FCR-016

CH. SBM

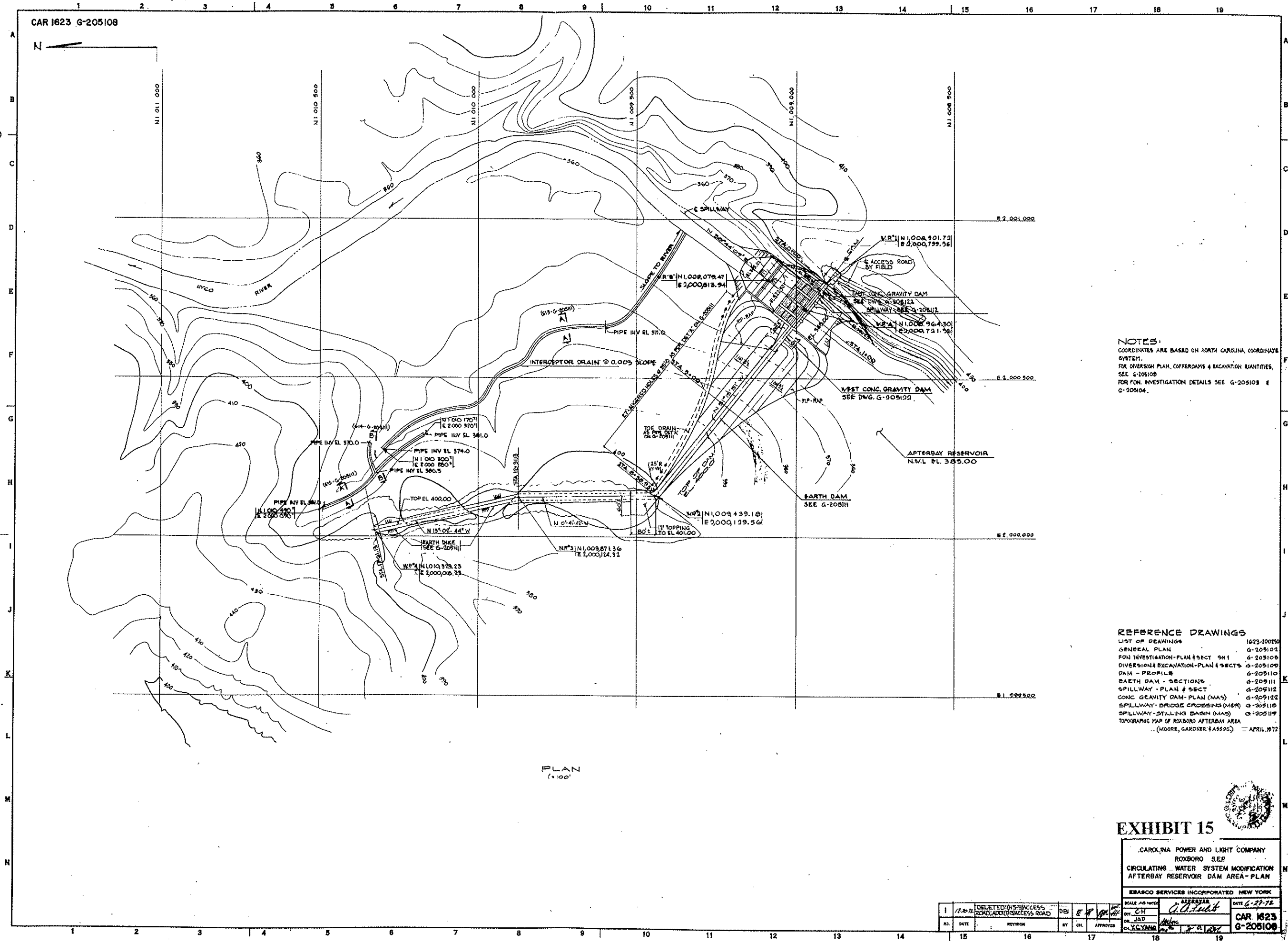
NO.	DATE	REVISION	BY	CH	APPROVED



ACTUAL QUANTITIES				
ITEM NO.	QTY	UNIT	DESCRIPTION	REMARKS
1	100	CY	CONCRETE	
2	100	TONS	REINFORCING STEEL (BARS)	
3	100	LB	PIPE	
4	100	EA	WELDS	
5	100	EA	ANCHORS	
6	100	EA	PLATES	
7	100	EA	CHANNELS	
8	100	EA	BEAMS	
9	100	EA	COLUMNS	
10	100	EA	WALLS	
11	100	EA	FLOORS	
12	100	EA	CEILINGS	
13	100	EA	ROOFS	
14	100	EA	GROUNDS	
15	100	EA	WATERS	
16	100	EA	AIRS	
17	100	EA	SOILS	
18	100	EA	ROCKS	
19	100	EA	VEGETATIONS	
20	100	EA	BUILDINGS	
21	100	EA	FURNITURES	
22	100	EA	EQUIPMENTS	
23	100	EA	VEHICLES	
24	100	EA	PERSONS	
25	100	EA	ANIMALS	
26	100	EA	PLANTS	
27	100	EA	FUNGUSES	
28	100	EA	BACTERIAS	
29	100	EA	VIRUSES	
30	100	EA	PARASITES	
31	100	EA	INSECTS	
32	100	EA	MAMMALS	
33	100	EA	BIRDS	
34	100	EA	REPTILES	
35	100	EA	AMPHIBIANS	
36	100	EA	MOLUSKS	
37	100	EA	ARTHROPODS	
38	100	EA	NEUROPODS	
39	100	EA	POLYPODS	
40	100	EA	CNIDARIANS	
41	100	EA	MOLUSKS	
42	100	EA	ECHINODERMS	
43	100	EA	CHORDATES	
44	100	EA	VERTEBRATES	
45	100	EA	INVERTEBRATES	
46	100	EA	MICROORGANISMS	
47	100	EA	MACROORGANISMS	
48	100	EA	ORGANISMS	
49	100	EA	LIFE FORMS	
50	100	EA	SPECIES	
51	100	EA	GENUS	
52	100	EA	FAMILY	
53	100	EA	ORDER	
54	100	EA	CLASS	
55	100	EA	PHYLUM	
56	100	EA	KINGDOM	
57	100	EA	DOMAIN	
58	100	EA	EUKARYOTE	
59	100	EA	PROKARYOTE	
60	100	EA	EUKARYOTIC	
61	100	EA	PROKARYOTIC	

CAR 1623 G-205108

N



NOTES:
COORDINATES ARE BASED ON NORTH CAROLINA COORDINATE SYSTEM.
FOR DIVERSION PLAN, COUNTERDAMS & EXCAVATION QUANTITIES, SEE G-205108
FOR FOM INVESTIGATION DETAILS SEE G-205103 & G-205104.

REFERENCE DRAWINGS
LIST OF DRAWINGS
GENERAL PLAN G-205102
FOM INVESTIGATION-PLAN & SECT. 3H1 G-205103
DIVERSION & EXCAVATION-PLAN & SECT. G-205104
DAM - PROFILE G-205110
EARTH DAM - SECTIONS G-205111
SPILLWAY - PLAN & SECT. G-205112
CONC. GRAVITY DAM-PLAN (M&S) G-205122
SPILLWAY-BRIDGE CROSSING (M&S) G-205113
SPILLWAY-STILLING BASIN (M&S) G-205117
TOPOGRAPHIC MAP OF ROXBORO AFTERBAY AREA
(MOORE, GARDNER & ASSOC.) APRIL, 1972

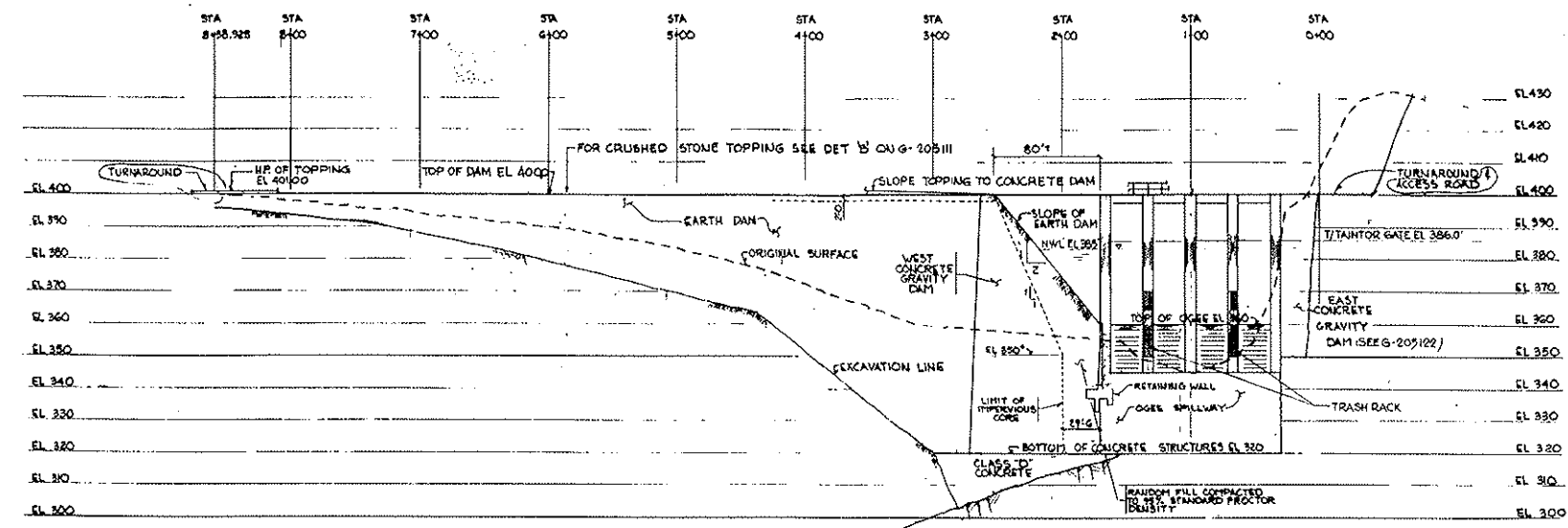
EXHIBIT 15

CAROLINA POWER AND LIGHT COMPANY
ROXBORO S.E.P.
CIRCULATING WATER SYSTEM MODIFICATION
AFTERBAY RESERVOIR DAM AREA - PLAN

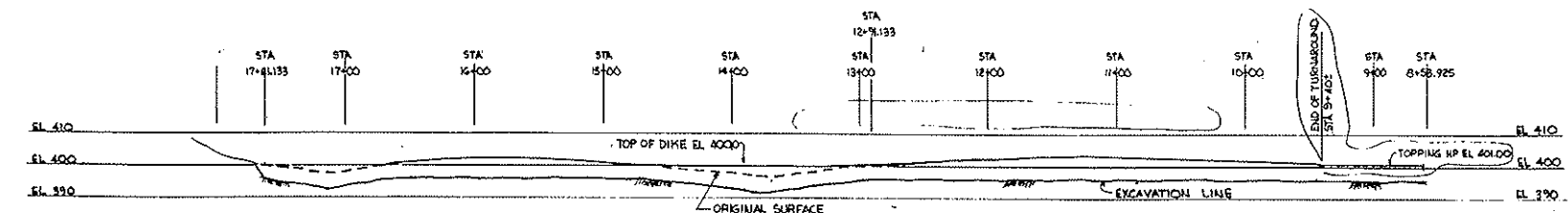
EXASCO SERVICES INCORPORATED NEW YORK

1	1/24-72	DELETED (HIS ACCESS ROAD, ADD (HIS ACCESS ROAD)	DB	E	18	1/24-72	DATE 6-29-72	CAR 1623
2	DATE	REVISION	BY	CHK	APPROVED	BY	DATE	G-205108

CAR 1623 G-205110



DAM PROFILE - STA 0+00 TO STA 8+58.93
SCALE HORIZ 1"=50'
VERT 1"=20'



DIKE PROFILE - STA 8+58.93 TO STA 17+61.13
SCALE HORIZ 1"=50'
VERT 1"=20'

QUANTITIES (NET BY FIELD UNLESS NOTED)

EXCAVATION	27,600 CU YD
RANDOM FILL	56,500 CU YD
IMPERVIOUS CORE	44,000 CU YD
CRUSHED STONE	8,370 CU YD
RIPEAP	3,100 CU YD
QUARRY RUN ROCK	1,190 CU YD
10" PERFORATED ASPHALT	
CEMENT PIPE	1800 LINF
6" PERFORATED ASPHALT	
CEMENT PIPE	700 LINF

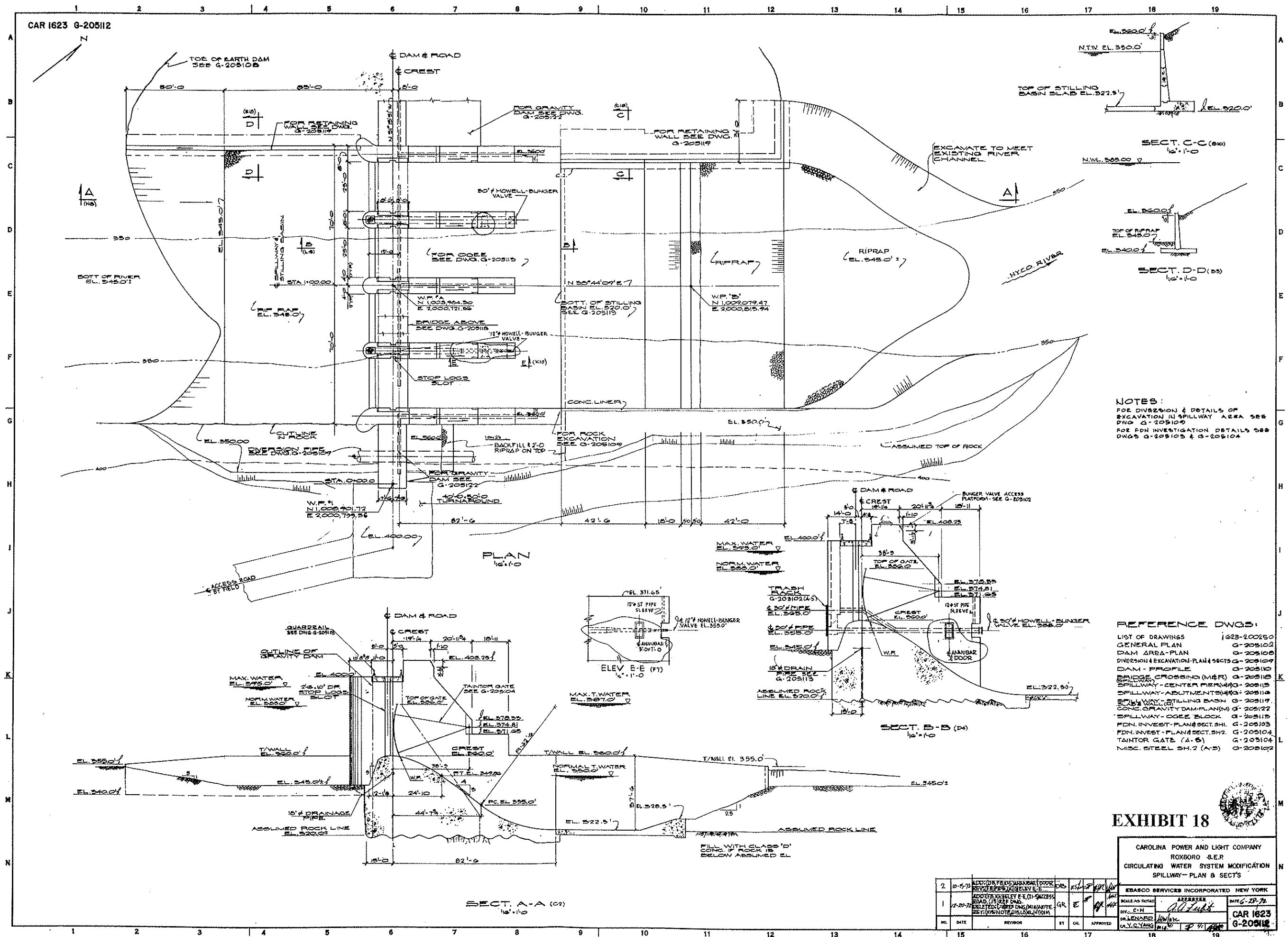
NOTES
FOR LOCATION SEE DRAWING G-205108
FOR DETAILED SPECIFICATIONS ON
CONSTRUCTION, COMPACTION AND GRADATION
OF DAM MATERIALS SEE CAR 1025 CH-18
'EMBANKMENT DAM'
FOR DETAILS OF DAM & DIKE CONSTRUCTION
SEE G-205111

REFERENCE DRAWINGS

LIST OF DRAWINGS	4-205108
AFTERBAY RESERVOIR - DAM AREA PLAN	G-205108
EARTH DAM - SECTIONS	G-205111
SPILLWAY - PLAN & SECT (M)	G-205112
CONC GRAVITY DAM - PLAN (M)	G-205122

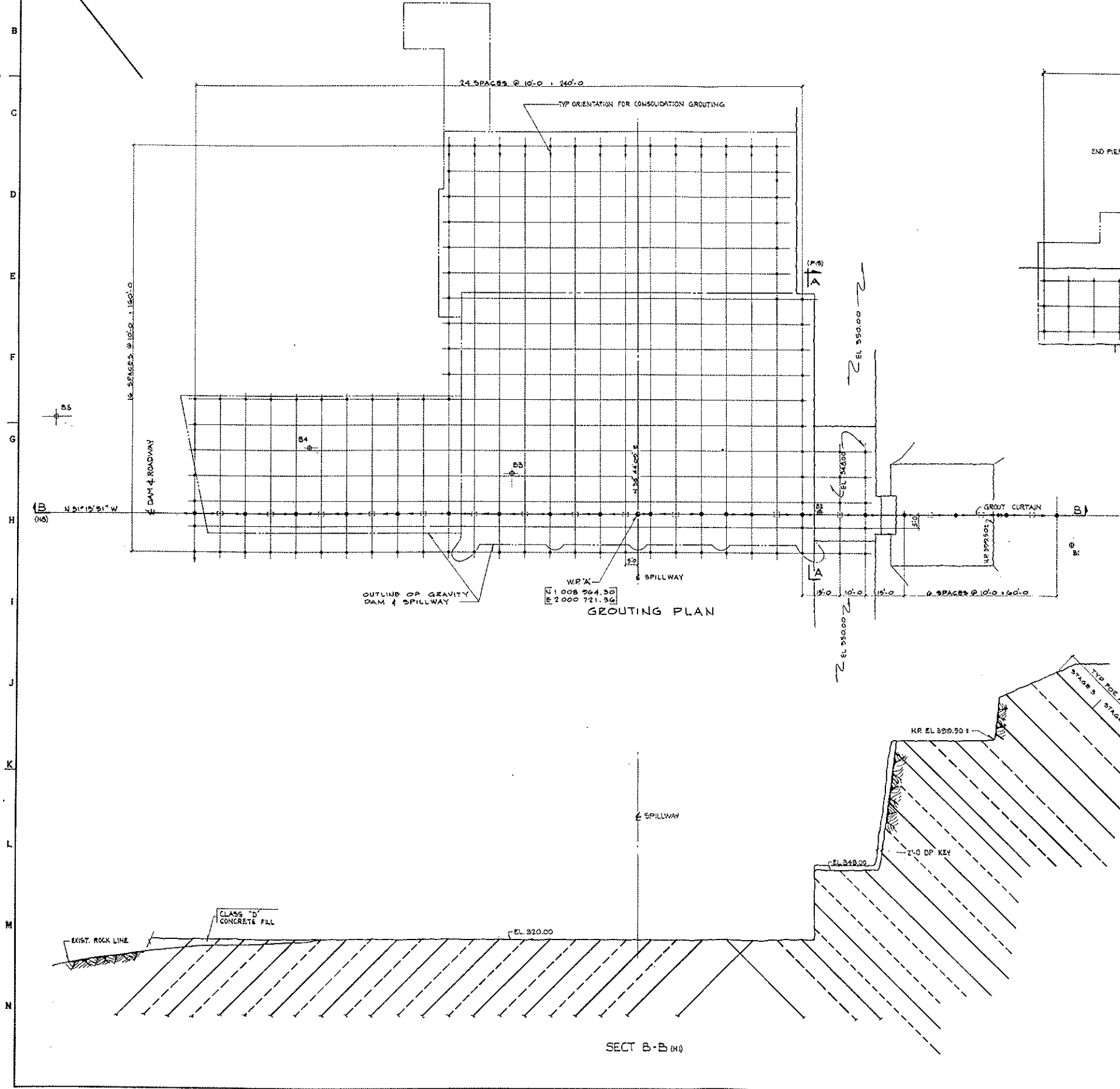
EXHIBIT 16

CAROLINA POWER AND LIGHT COMPANY ROXBORO S.E.P.						
CIRCULATING WATER SYSTEM MODIFICATION AFTERBAY RESERVOIR DAM - PROFILE						
KASCO SERVICES INCORPORATED NEW YORK						
2	12-20-76	DELETED G-205110 NOTE REVISION QUALITY CONTROL REVISED G-205110	DB	EA	APPROVED	DATE 7-10-76
1	11-1-72	REVISED G-205110 NOTE REVISED G-205110 NOTE REVISED G-205110 NOTE	AR	EA	APPROVED	CAR 1623 G-205110
NO. DATE		REVISION	BY	CHK	APPROVED	



CAR 1623 G-205123

N



QUANTITIES: (NET BY FIELD UNLESS NOTED)
CONSOLIDATION GROUT HOLES 308 REQD
PRIMARY CURTAIN GROUT HOLES 24 REQD
SECONDARY CURTAIN GROUT HOLES 12 REQD

NOTES:
THIS DRAWING HAS BEEN PREPARED FOR THE USE OF DESIGN PERSONNEL OF EBARCO SERVICES INCORPORATED ONLY. INFORMATION CONTAINED HEREON IS AN INTERPRETATION OF THE ORIGINAL LOGS OF THE BORINGS FOR DESIGN PURPOSES ONLY AND MAY OR MAY NOT BE COMPLETE. DATA NOT PERTINENT TO DESIGN PURPOSES OR AVAILABLE IN OTHER REPORTS OR DATA SHEETS MAY NOT BE INCORPORATED HEREON.
ANY PERSON USING THIS DRAWING FOR ANY PURPOSE OTHER THAN THE ABOVE SHOULD REQUEST TO EXAMINE AND REFER TO THE ORIGINAL LOGS AND DATA SHEETS.

COORDINATES BASED ON NORTH CAROLINA STATE GRID SYSTEM

EXECUTION DRAWING TO BE MADE BY FIELD BASED UPON ACTUAL GEOLOGY WITH SEPARATE IDENTIFICATION SCHEMES USED FOR CURTAIN AND CONSOLIDATION HOLES.

ALL DRILLING TO BE PERFORMED IN ACCORDANCE WITH SPECIFICATION CAR 1623-11 CH-15 "DRILLING"

ALL GROUTING TO BE PERFORMED IN ACCORDANCE WITH SPECIFICATION CAR 1623-11 CH-16 "GROUTING"

ALL CONSOLIDATION GROUT HOLES SHALL BE 20 FT. LONG WITH AN INCLINATION OF 45° ACCORDING TO THE ORIENTATION & GRID PATTERN SHOWN ON PLAN & SECTIONS

ALL PRIMARY CURTAIN GROUT HOLES SHALL BE 70 FT. LONG @ 20 FT. INTERVALS WITH AN INCLINATION OF 45° ACCORDING TO THE ORIENTATION & GRID PATTERN SHOWN ON PLAN & SECTIONS. ADDITIONAL SECONDARY CURTAIN GROUT HOLES AS REQUIRED TO BE LOCATED AS PER PLAN & SECTIONS

ALL CURTAIN GROUTING SHALL BE DONE IN THREE (3) STAGES AS FOLLOWS: (SEE SECT B-B)
1ST: BOTTOM 30 FT. LONG @ 30 PSI PRESSURE
2ND: MIDDLE 20 FT. " @ 15 PSI
3RD: TOP 20 FT. " @ 10 PSI

ALL CONSOLIDATION GROUTING SHALL BE PERFORMED IN A SINGLE STAGE OPERATION AT A PRESSURE OF 5 PSI MEASURED AT TOP OF HOLE

GROUTING TO CONTINUE ON ANY HOLE OR STAGE OF A HOLE UNTIL THE GROUT TAKE IS LESS THAN 0.5 BAGS OF CEMENT PER HOUR MEASURED OVER A PERIOD OF TIME NOT LESS THAN 10 MINUTES

LEGEND
○ - INDICATES CONSOLIDATION GROUT HOLE - 20 FT. LONG
● - PRIMARY CURTAIN GROUT HOLE - 70 FT. LONG
○ - SECONDARY
○ B1 - BORING (SEE G-205105 & G-205104)

REFERENCE DRAWINGS
LIST OF DRAWINGS 1623-200150
FOR INVESTIGATION - PLAN & SECT SH 1 G-205103
FOR INVESTIGATION - PLAN & SECT SH 2 G-205104
DAM AREA - PLAN G-205106
DAM - PROFILE G-205110
SPILLWAY - PLAN & SECT G-205112
CONC GRAVITY DAM - PLAN (N) G-205122

EXHIBIT 20

CAROLINA POWER AND LIGHT COMPANY
ROXBORO, S.E.P.
CIRCULATING WATER SYSTEM MODIFICATION
GROUTING PLAN, SECT'S & DET'S

EBARCO SERVICES INCORPORATED NEW YORK

SCALE 1/4" = 1'-0"	APPROVED	DATE 6-26-72
BY C-H	<i>[Signature]</i>	
DR [Signature]		
CH [Signature]		

CAR 1623
G-205123

NO.	DATE	REVISION	BY	CH.	APPROVED

SUMMARY OF FIELD OBSERVATIONS
PRIMARY SPILLWAY SLAB SECTIONS
ROXBORO MAIN DAM
AUGUST 5, 2008

SLAB ID NUMBER	JOINT ID	OBSERVATIONS
	A2/A3	Caulk surface damage
	A3/A4	Caulk surface damage
	A4/A5	Caulk surface damage
A5		Small patch slightly loose
A7		One small aggregate popout
A8		Upper joint parallel to flashboards has loose caulk
A9		Caulk in cracks has some damage
A10		Caulk damage in some cracks
	A10/A11	Caulk surface damage
B1		Caulk in one crack has tape loose
B5		One small aggregate popout
	B6/B7	Caulk surface damage
	B7/B8	Caulk surface damage
	B8/B9	Caulk tape missing in spots
	B10/B11	Caulk tape missing in spots
B11		Some tape worn/missing
B12		Some tape worn/missing
	C2/C3	Some tape worn/missing
	C3/C4	Some tape worn/missing and caulk missing below
	C4/C5	Some tape worn/missing and caulk missing below
	C6/C7	Some tape worn/missing
C7		One small aggregate popout
C12		Exposed aggregate
	D1/D2	Small patch slightly loose
	D4/D5	Caulk separation upper part of joint
	D5/D6	Lot of caulk missing, tapes loose
	D8/D9	Some caulk tape loose and pulled up
	D9/D10	Some caulk tape loose and pulled up
D10		One small aggregate popout
	D10/D11	Caulk tape missing at upstream end
	D12/C12/ D13/C13	Junction of 4 slabs with patch - patch loose on C12 and D12
E3		One small aggregate popout
	E3/E4	Some tape worn/missing
	E5/E6	Some tape worn/missing
	E7/E8	Some tape worn/missing
	E9/E10	Some tape worn/missing
E10		At joint with D slab, two spalled concrete pieces loose
E12		At joint with D slab, caulk missing. Patch at wall joint partly missing
F1		Fault shown on Exhibit 8 does not exist.
	F3/F4	Some tape worn/missing
	F5/F6	Some tape worn/missing
	F6/F7	Some tape worn/missing
	F7/F8	Some tape worn/missing
	F8/F9	Loose tape in spots
	F9/F10	Some tape worn/missing
F10		Some caulk has splits and tape missing

SUMMARY OF FIELD OBSERVATIONS
PRIMARY SPILLWAY SLAB SECTIONS
ROXBORO MAIN DAM

SLAB ID NUMBER	JOINT ID	AUGUST 5, 2008 OBSERVATIONS
	F10/F11	Some tape worn/missing
F11		Caulk gaps and some tape missing
G1		Caulk at joint with slab F pulled up
	G1/G2	Caulk pulled up some loose tape
	G2/G3	Some tape worn/missing
	G4/G5	Some tape worn/missing
G5		Some tape worn/missing
	G5/G6	Some tape worn/missing
	G6/G7	Some tape worn/missing
	G7/G8	Many spots of missing tape or loose tape
	G8/G9	Many spots of missing tape or loose tape
	G10/G11	Some tape worn/missing
G13		Patch at junction of G12. G13, H11 and H12 has hollow sound
	H1/H2	Caulk stripped up in spots
H2		About half caulk tape eroded/worn
	H2/H3	Some tape worn/missing
H3		Surface shows exposed aggregate
	H3/H4	Many spots of missing tape or loose tape
H4		Caulk eroded over about 50% of cracks
H5		Some tape worn/missing
	H5/H6	Some tape worn/missing
H6		Caulk eroded over about 50% of cracks
	H6/H7	Some tape worn/missing
	H7/H8	Some tape worn/missing
H8		Some tape worn/missing
	H8/H9	Some tape worn/missing
H9		Small patch near slab G partly missing
H11		Surface shows exposed aggregate; some caulk eroded
	I1/I2	One loose caulk piece near downstream end
I2		About 25% caulk tape eroded
	I3/I4	Some tape worn and loose
I4		About 50% caulk tape eroded
	I4/I5	Tapes missing over 50% of length
I5		About 25% caulk tape eroded
	I5/I6	Some tape worn/missing
I6		One small aggregate popout
	I6/I7	About 50% caulk tape eroded, one end stripped up
I7		About 25% caulk tape eroded
	I7/I8	Some tape worn/missing
	I8/I9	Some tape worn/missing
	I9/I10	Some tape worn/missing
I10		About 50% caulk tape eroded
I11		Downstream corner with J11 patch eroded
J3		Minor caulk tape erosion
	J4/J5	Tapes missing over 50% of length
	J5/J6	Tapes missing over 50% of length
	J7/J8	Tapes missing over 50% of length
J8		About 50% caulk tape eroded; patch at K joint has hollow sound
	J9/J10	Some tape worn/missing
J10		About 50% caulk tape eroded

SUMMARY OF FIELD OBSERVATIONS
PRIMARY SPILLWAY SLAB SECTIONS
ROXBORO MAIN DAM

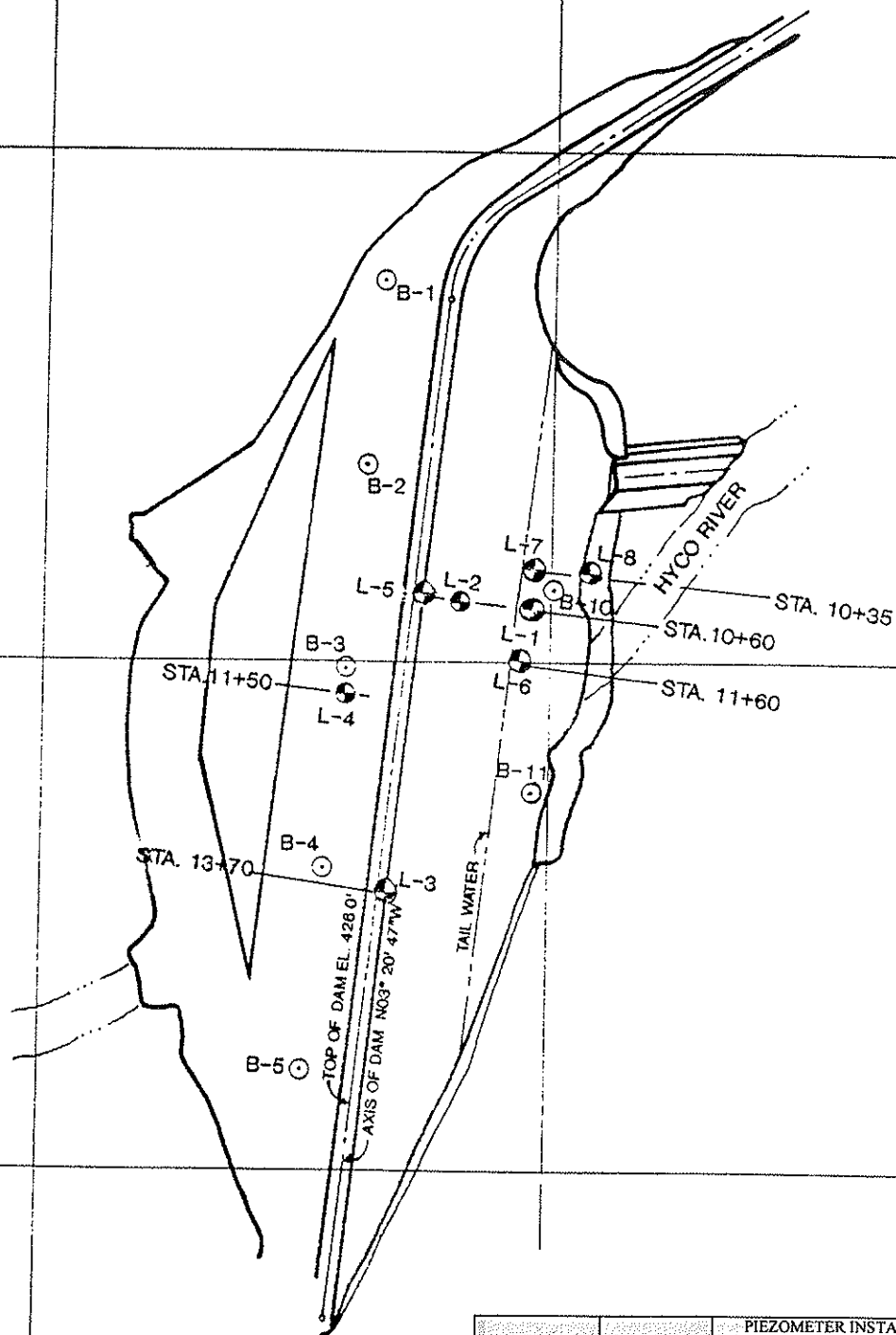
SLAB ID NUMBER	JOINT ID	AUGUST 5, 2008 OBSERVATIONS	
	J10/J11	Patch has hollow sound and shows cracks	
	K3/K4	About 50% caulk tape eroded	
	K5/K6	Some tape worn/missing	
K6		At joint with J slab, small patch with loose edges	
	K6/K7	Some tape worn/missing; tapes loose or pulled up in spots	
	K7/K8	Caulk missing upstream end	

Note - Observations noted only for slabs or joints with noticeable concerns
Refer to Exhibit 8 for slab numbering scheme

E1,987.000

E1,987.500

E1,988.000

**LEGEND**

○ PRECONSTRUCTION BORING (B)

● 1995 BORINGS (L)

PIEZOMETER	DATE INSTALLED	PIEZOMETER INSTALLATION INFORMATION		
		GROUND SURFACE ELEVATION	TOP OF CASING ELEVATION	MONITORING INTERVAL ELEVATION
L-2-1	08-30-95	410.5	413.1	350.5-318.3
L-2-2	08-30-95	410.5	413.1	386.5-374.5
L-3	08-17-95	426.7	426.5	400.2-388.2
L-5	09-15-95	426.6	426.3	400.6-388.1

EXHIBIT 23**LAW**ENGINEERING AND ENVIRONMENTAL SERVICES
CHARLOTTE, NORTH CAROLINABORING PLAN
MAIN COOLING LAKE DAM
ROXBORO PLANTPREPARED
BY

DATE

CHECKED

DATE

JOB NO.

30720-5-0898

FIGURE

1

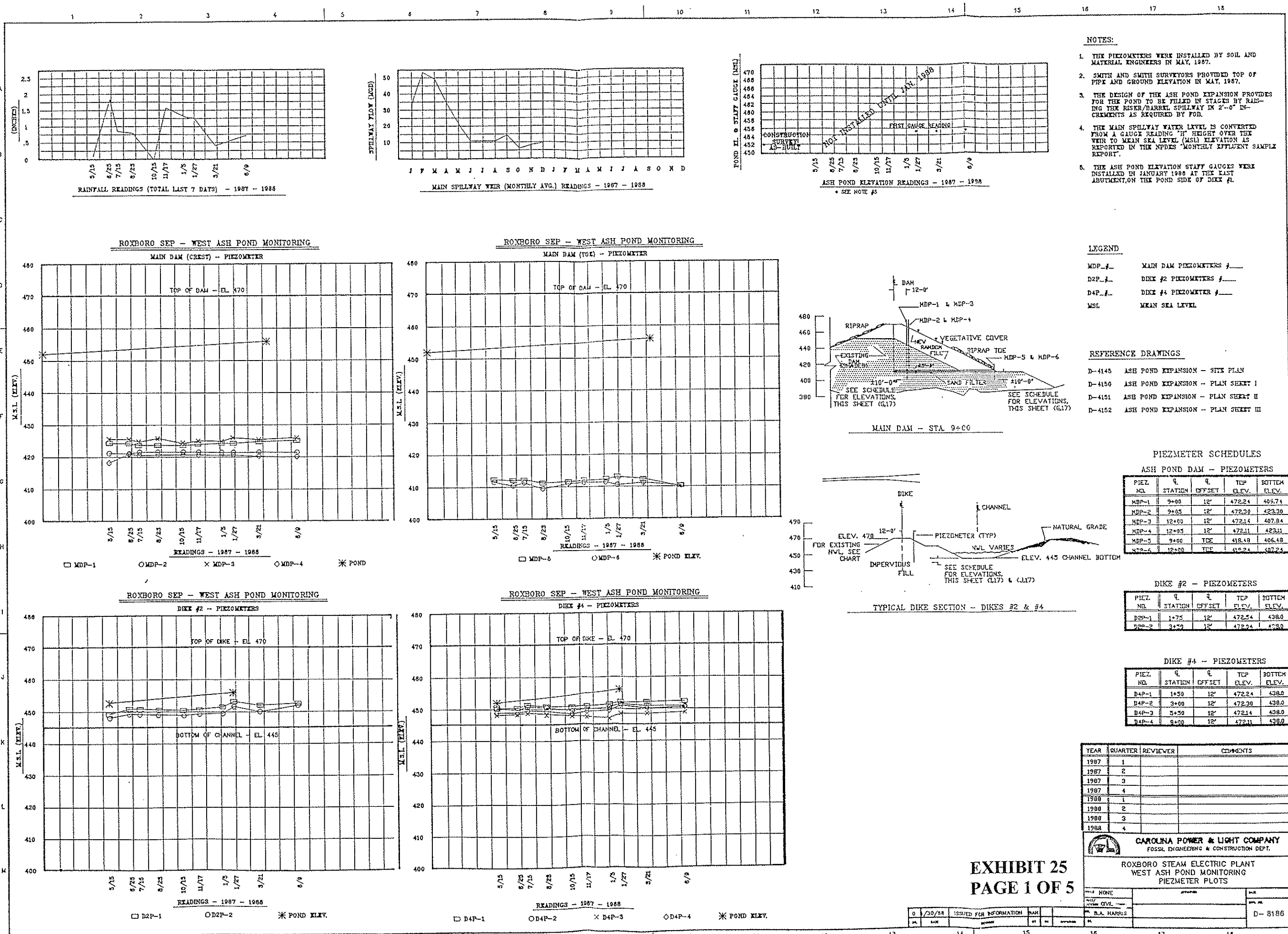
**SUMMARY OF PIEZOMETER READINGS
MAIN COOLING LAKE DAM
ROXBORO STEAM ELECTRIC PLANT**

Date	Piezometer Number/ Water Elevation, Ft, msl			
	L-2-1	L-2-2	L-3	L-4
10-5-95	384.1	393.5	400.2	389.6 ⁽¹⁾
8-8-97	374.8	392.4	399.3	394.0
9-98	374.48 ⁽²⁾	392.0 ⁽²⁾	399.4	393.88
12-98	372.26 ⁽²⁾	391.26 ⁽²⁾	398.5	393.04
3-99	382.92 ⁽²⁾	392.82 ⁽²⁾	399.72	393.5
6-99	379.82 ⁽²⁾	392.4 ⁽²⁾	399.58	394.3
6-01	382.4	393.02	399.94	394.86
9-01	378.5	392.8	399.64	394.4
3-02	375.82	392.28	399.6	393.66
7-02	376.96	392.22	399.7	393.98
12-02	383.4	384.46	399.8	394.7
5-03	382.98	394.1	400.12	395.4
9-03	382.10	393.24	400.12	395.90
12-03	381.70	393.00	399.99	395.84
3-04	381.90	392.58	399.41	394.31
6-04	381.45 ⁽²⁾	393.07 ⁽²⁾	399.90	394.71
9-04	382.70	387.79	399.98	394.85
3-05	382.90	392.22	399.85	394.60
6-05	381.48	391.45	399.42	393.65
9-05	381.6	391.9	399.2	393.8
12-05	383.9	391.57	399.6	393.76
3-06	383.61	391.86	399.03	393.63
6-06	380.9	392.34	399.42	394
9-06	381.39	392.55	399.59	394.19
12-06	383.14	392.5	399.53	392.44
3-07	383.42	392.36	399.11	394.14
6-07	380.18 ⁽²⁾	392.3 ⁽²⁾	399.69	394.16
9-07	375.76 ⁽²⁾	391.04 ⁽²⁾	398.55	392.97
12-07	375.2 ⁽²⁾	391.56 ⁽²⁾	398.04	392.42
3-08	385.05	391.77	399.02	393.17
6-08	382.59	384.49	399.65	388.11

(1) Water level reported as not stabilized due to short time since installation.

(2) Water level readings on data sheets interpreted as being switched for these two piezometers due to trends before and after and based on location of monitoring levels. The readings as shown are believed to be correct.

Above data taken from Progress Energy data sheets..



- NOTES:
- 1. THE PIEZOMETERS WERE INSTALLED BY SOIL AND MATERIAL ENGINEERS IN MAY, 1987.
 - 2. SMITH AND SMITH SURVEYORS PROVIDED TOP OF PIPE AND GROUND ELEVATION IN MAY, 1987.
 - 3. THE DESIGN OF THE ASH POND EXPANSION PROVIDES FOR THE POND TO BE FILLED IN STAGES BY RAISING THE RISER/BARRREL SPILLWAY IN 2'-0" INCREMENTS AS REQUIRED BY FOD.
 - 4. THE MAIN SPILLWAY WATER LEVEL IS CONVERTED FROM A GAUGE READING 'H' HEIGHT OVER THE WEIR TO MEAN SEA LEVEL (MSL) ELEVATION AS REPORTED IN THE MPEDES 'MONTHLY EFFLUENT SAMPLE REPORT'.
 - 5. THE ASH POND ELEVATION STAFF GAUGES WERE INSTALLED IN JANUARY 1988 AT THE EAST ABUTMENT ON THE POND SIDE OF DIKE #1.

- LEGEND
- MDP-# MAIN DAM PIEZOMETERS #
 - D2P-# DIKE #2 PIEZOMETERS #
 - D4P-# DIKE #4 PIEZOMETER #
 - MSL MEAN SEA LEVEL

- REFERENCE DRAWINGS
- D-4145 ASH POND EXPANSION - SITE PLAN
 - D-4150 ASH POND EXPANSION - PLAN SHEET I
 - D-4151 ASH POND EXPANSION - PLAN SHEET II
 - D-4152 ASH POND EXPANSION - PLAN SHEET III

PIEZMETER SCHEDULES

ASH POND DAM - PIEZOMETERS

PIEZ. NO.	STATION	Q. OFFSET	TOP ELEV.	BOTTOM ELEV.
MDP-1	9+00	12'	472.24	427.74
MDP-2	9+05	12'	472.30	423.30
MDP-3	12+00	12'	472.14	427.84
MDP-4	12+05	12'	472.11	423.11
MDP-5	9+00	TDE	418.49	406.49
MDP-6	12+00	TDE	418.24	407.24

DIKE #2 - PIEZOMETERS

PIEZ. NO.	STATION	Q. OFFSET	TOP ELEV.	BOTTOM ELEV.
D2P-1	1+75	12'	472.54	438.0
D2P-2	3+50	12'	472.04	438.0

DIKE #4 - PIEZOMETERS

PIEZ. NO.	STATION	Q. OFFSET	TOP ELEV.	BOTTOM ELEV.
D4P-1	1+50	12'	472.24	438.0
D4P-2	3+00	12'	472.30	438.0
D4P-3	5+50	12'	472.14	438.0
D4P-4	8+00	12'	472.11	438.0

YEAR	QUARTER	REVIEWER	COMMENTS
1987	1		
1987	2		
1987	3		
1987	4		
1988	1		
1988	2		
1988	3		
1988	4		

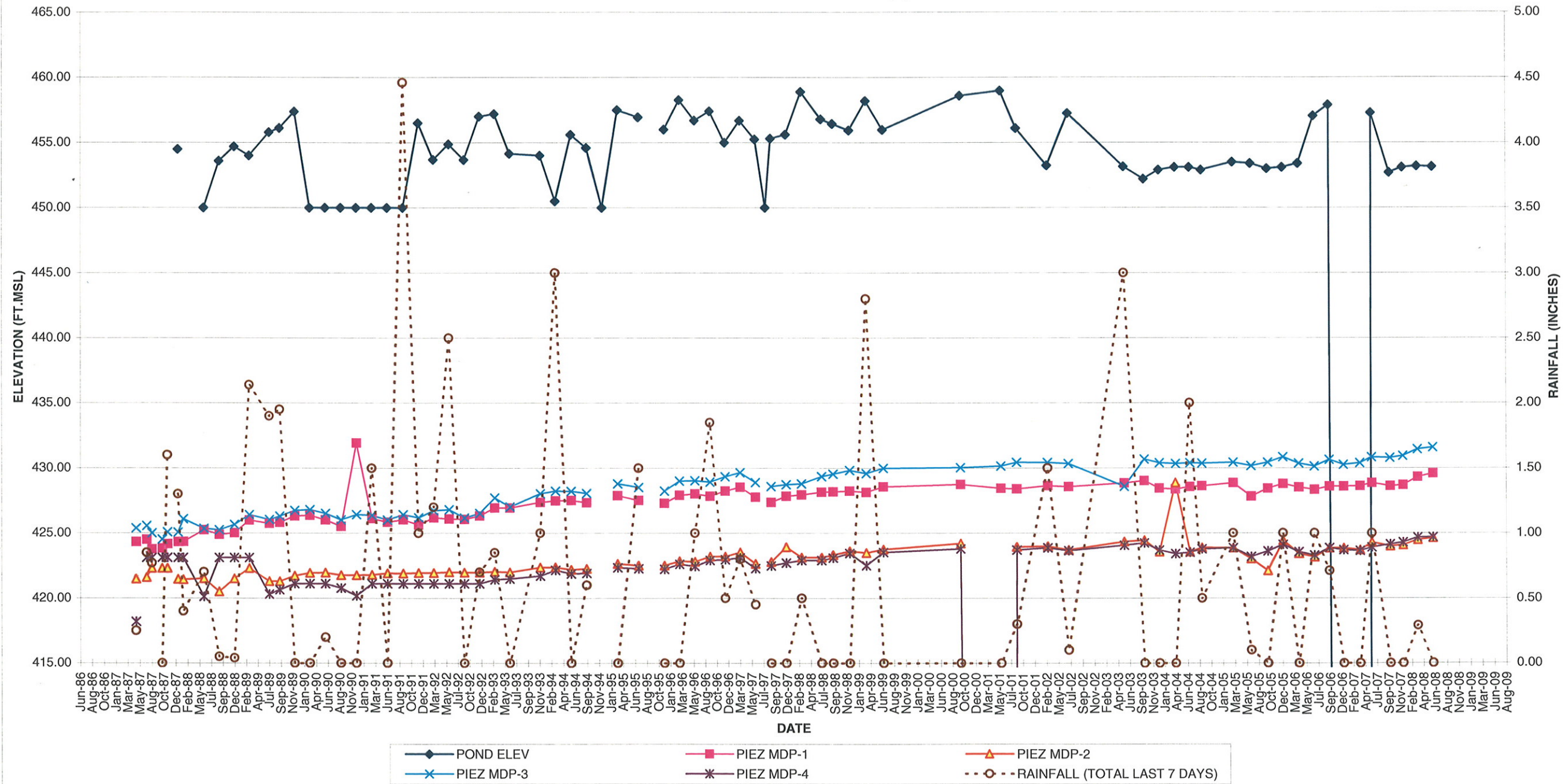
CAROLINA POWER & LIGHT COMPANY
FOSSIL ENGINEERING & CONSTRUCTION DEPT.

ROXBORO STEAM ELECTRIC PLANT
WEST ASH POND MONITORING
PIEZMETER PLOTS

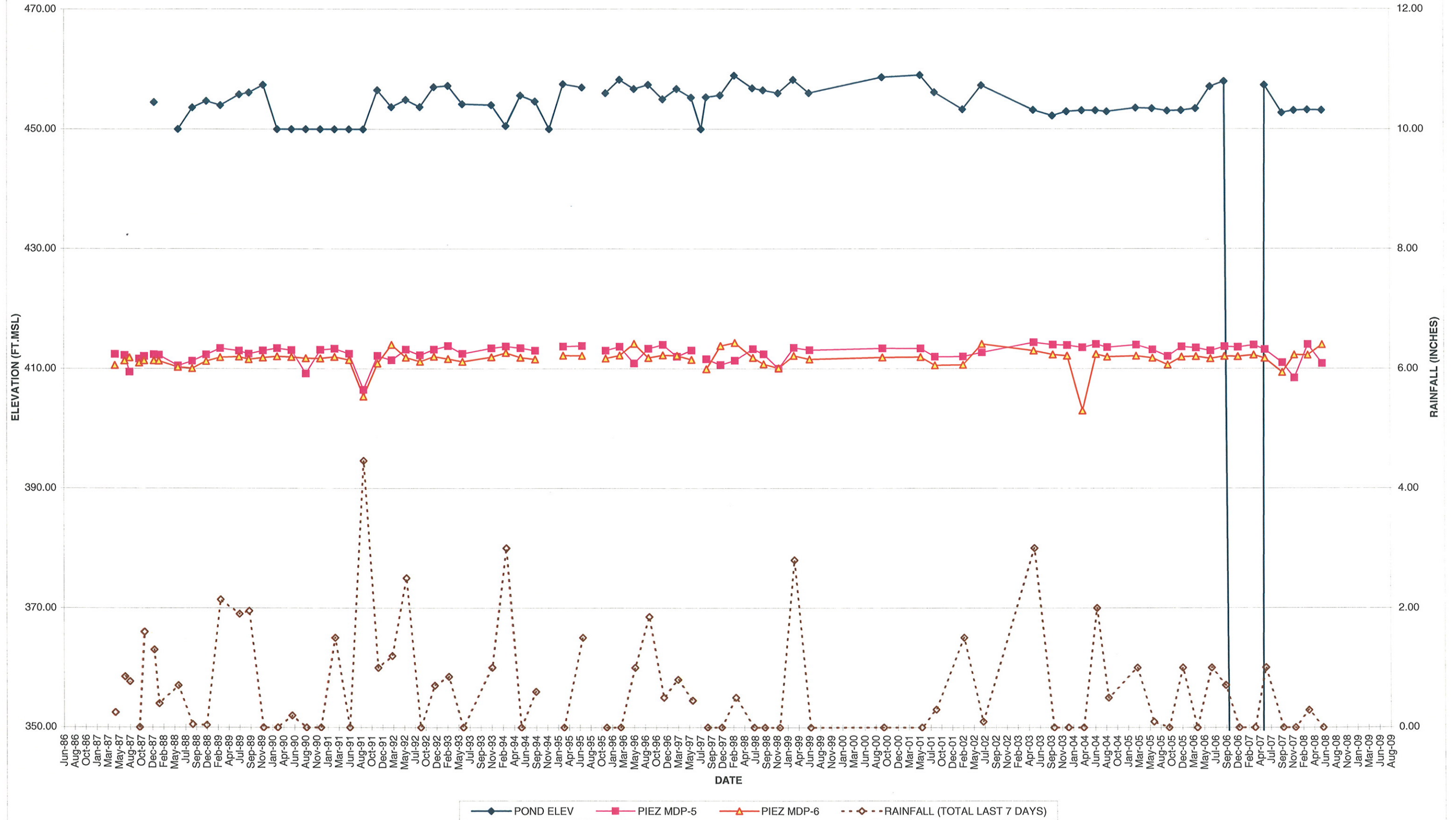
DATE: 10/20/88
ISSUED FOR INFORMATION: []
BY: []
CHECKED BY: []
APPROVED BY: []

D-8186

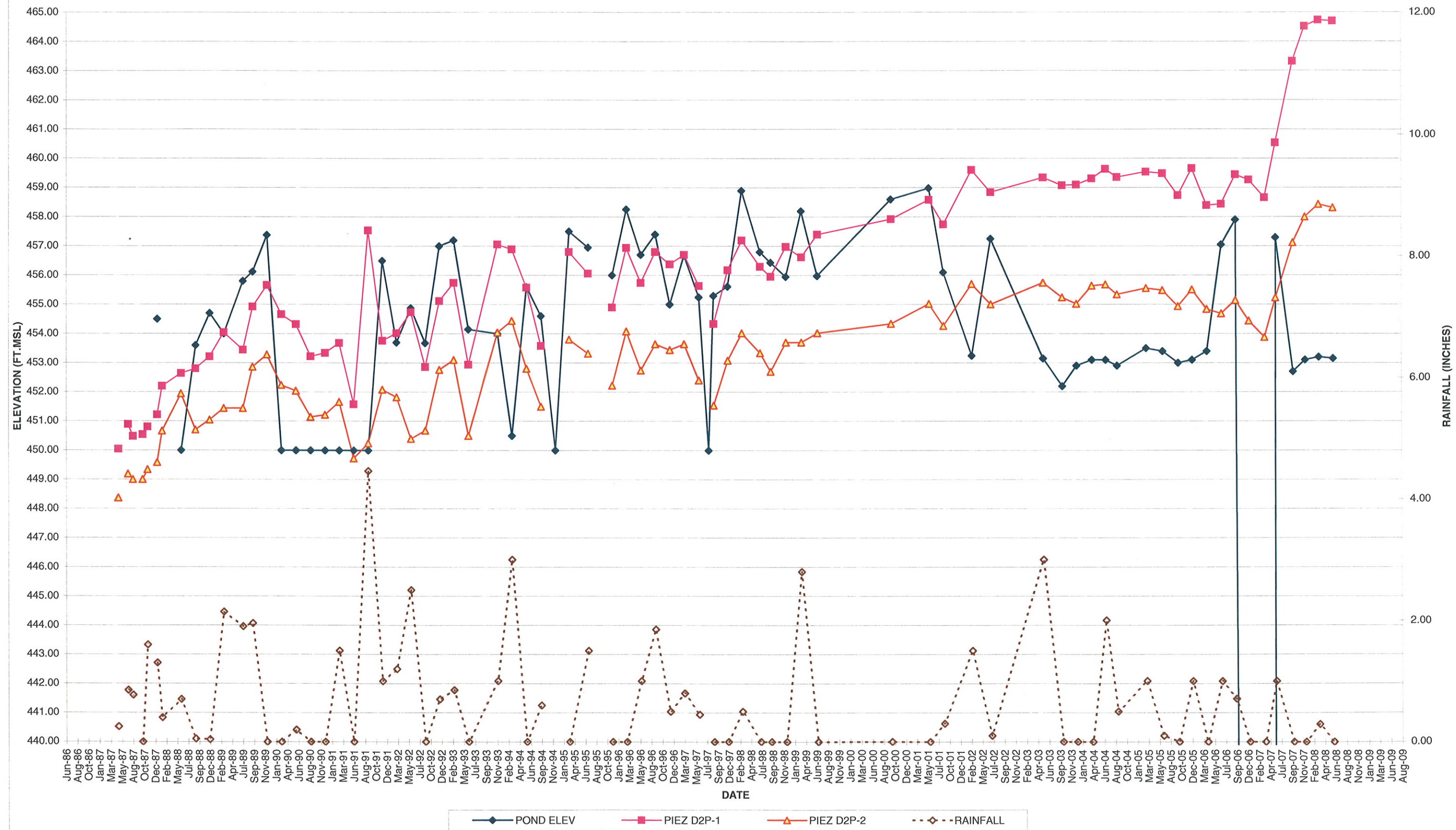
ROXBORO PLANT
WEST ASH POND DAM MONITORING PROGRAM
MAIN DAM - PIEZOMETERS MDP-1,2,3 & 4



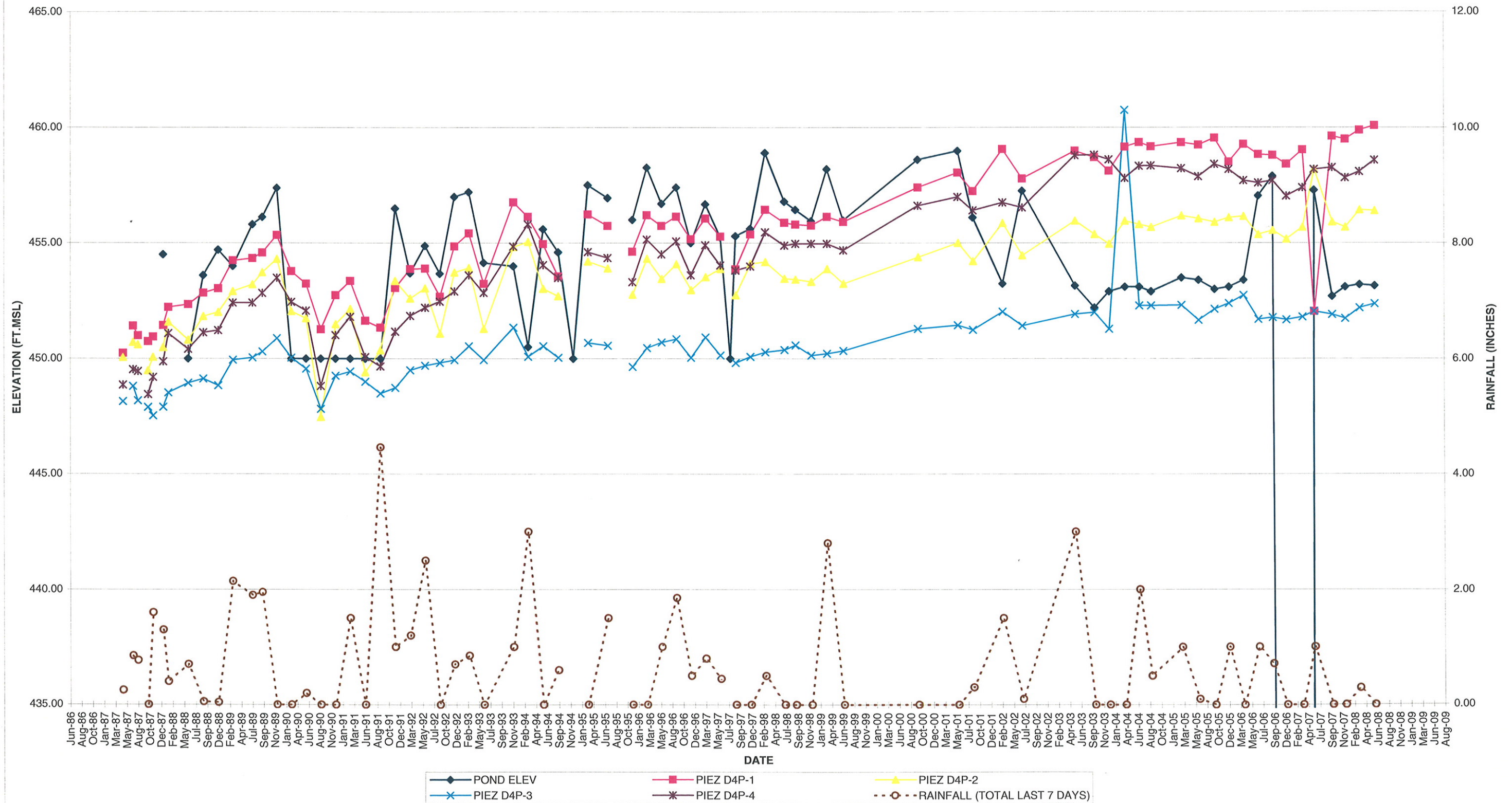
ROXBORO PLANT
WEST ASH POND MONITORING PROGRAM
MAIN DAM - PIEZOMETERS MDP-5 & 6

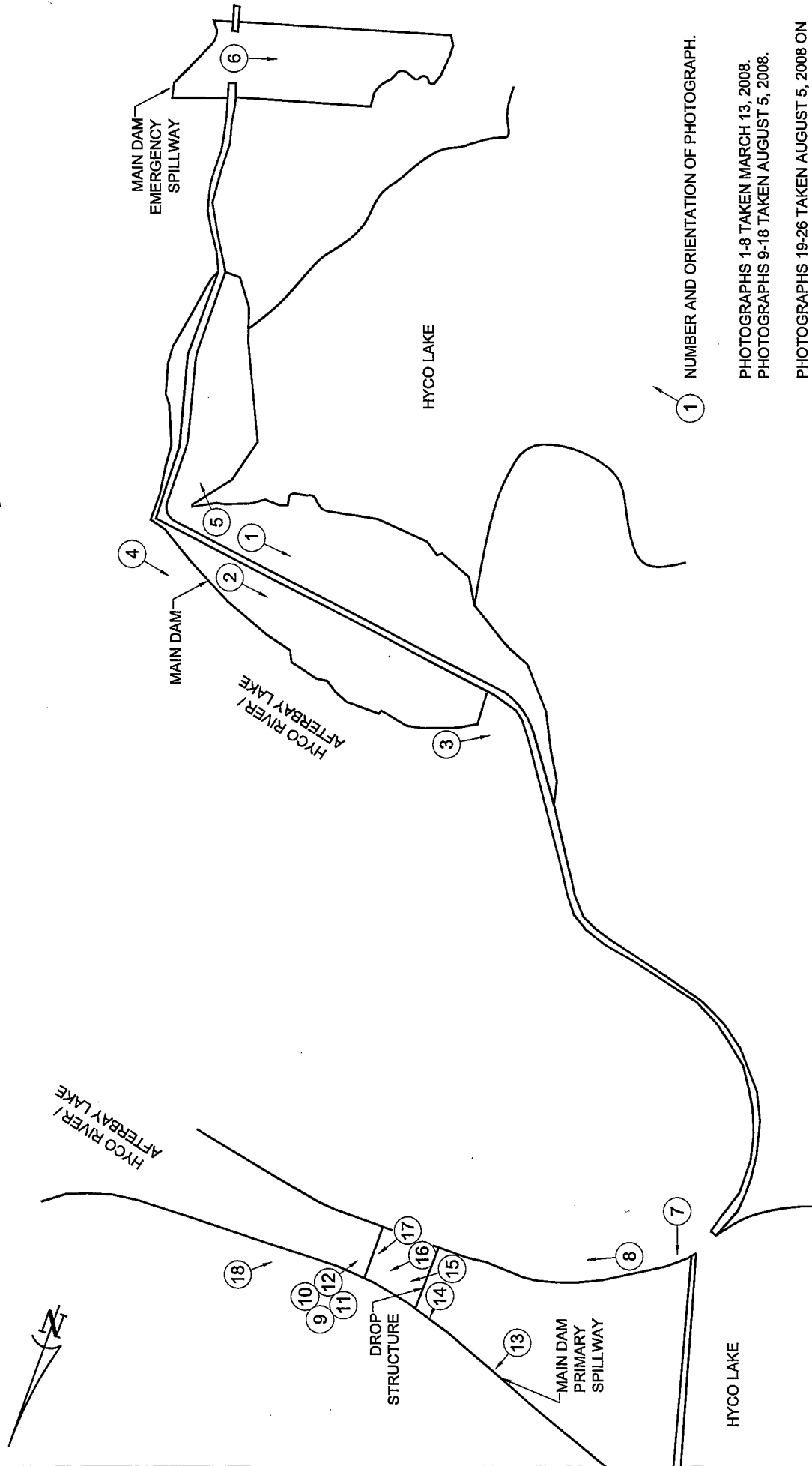


ROXBORO PLANT
WEST ASH POND MONITORING PROGRAM
DIKE #2 PIEZOMETERS D2P-1 & 2



ROXBORO PLANT
WEST ASH POND MONITORING PROGRAM
DIKE #4 PIEZOMETERS D4P 1,2,3 & 4



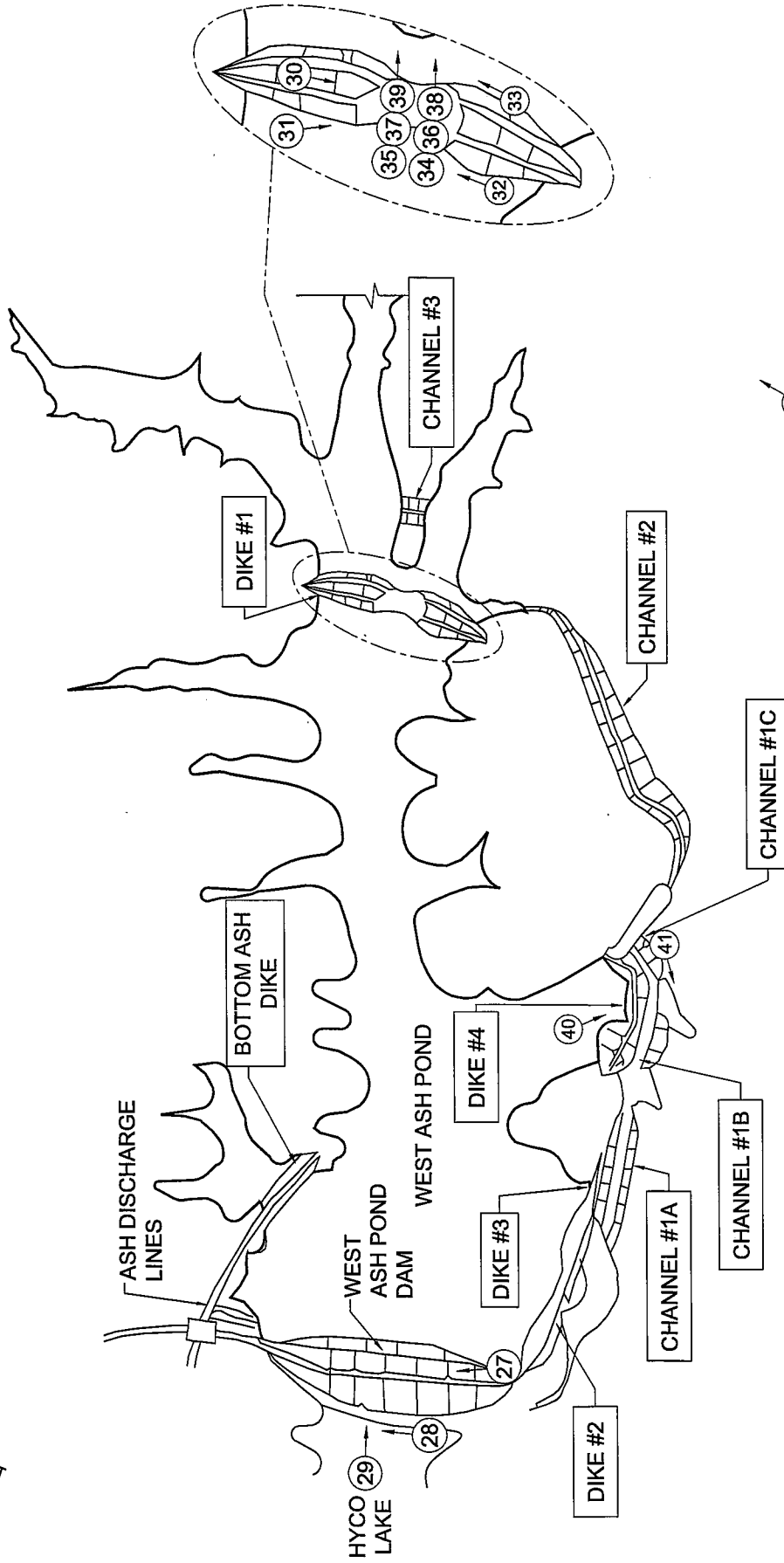


DRAWN:	R.R.	DATE:	DECEMBER 2008	DRAWING
DFT CHECK:	---	SCALE:	N.T.S.	1
APPROVAL:	<i>[Signature]</i>	JOB No.:	6468-07-2004.03	

PHOTOGRAPH LOCATION PLAN
MAIN DAM
ROXBORO STEAM ELECTRICAL PLANT
PERSON COUNTY, NORTH CAROLINA

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

REFERENCE:



(27) NUMBER AND ORIENTATION OF PHOTOGRAPH.

PHOTOGRAPHS 28-41 TAKEN MARCH 13, 2008.

PHOTOGRAPH 27 TAKEN AUGUST 5, 2008.



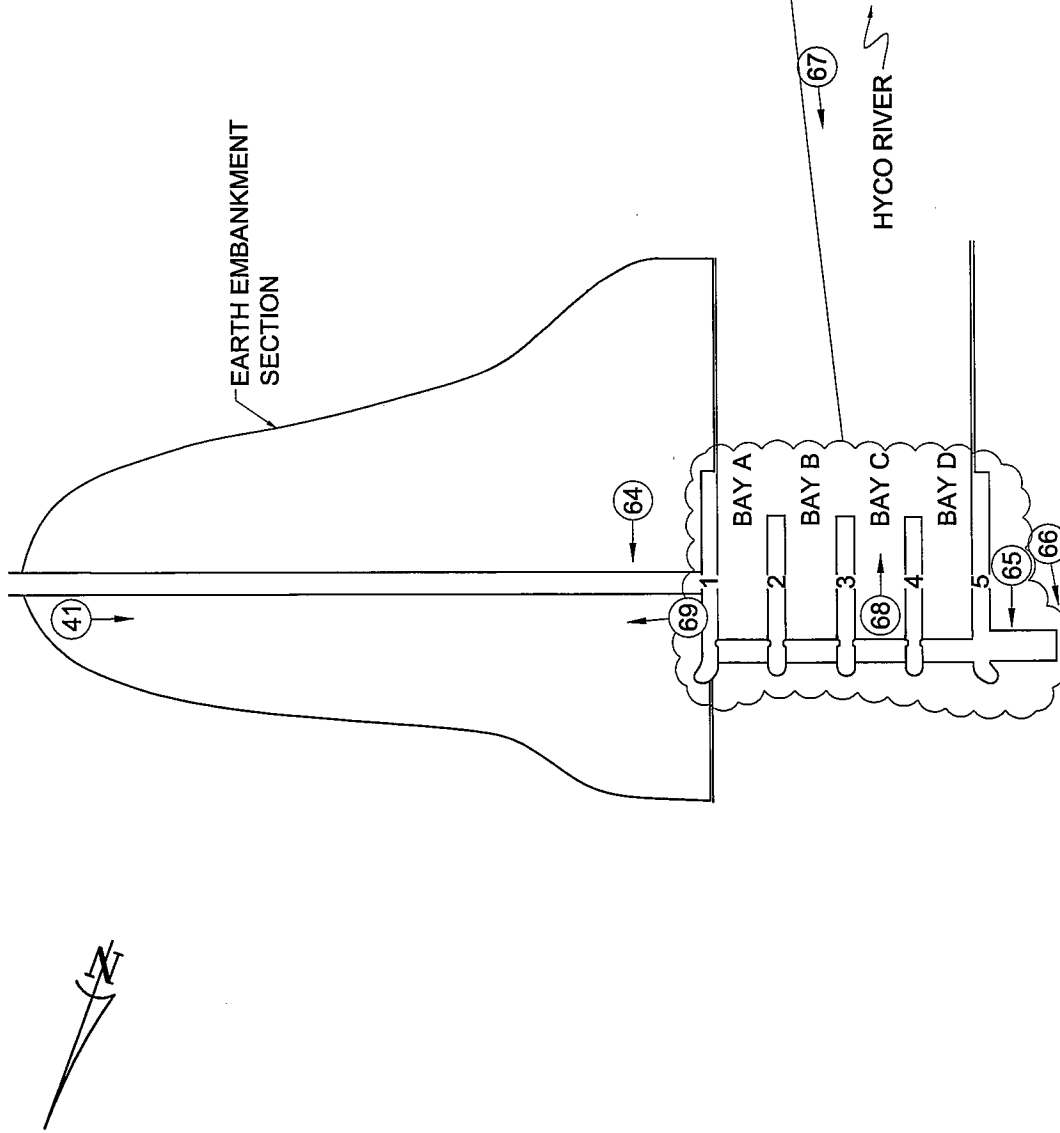
MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE RALEIGH, NORTH CAROLINA

PHOTOGRAPH LOCATION PLAN
WEST ASH POND
ROXBORO STEAM ELECTRICAL PLANT
PERSON COUNTY, NORTH CAROLINA

DRAWN:	R.R.	DATE:	DECEMBER 2008
DFT CHECK:		SCALE:	N.T.S.
APPROVAL:		JOB No.:	6468-07-2004.03

DRAWING	2
---------	---

REFERENCE:



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

PHOTOGRAPH LOCATION PLAN
AFTERBAY DAM
ROXBORO STEAM ELECTRICAL PLANT
PERSON COUNTY, NORTH CAROLINA

DRAWN:	R.R.	DATE:	DECEMBER 2008
DFT CHECK:	—	SCALE:	N.T.S.
APPROVAL:	<i>[Signature]</i>	JOB No.:	6468-07-2004.03

3

REFERENCE:

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



1. Main Dam – Crest and upstream slope looking west.



2. Main Dam – Crest and downstream slope looking west.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



3. Main Dam – Old erosion channel on west end of downstream slope of abutment with vegetation.



4. Main Dam – Old erosion channel on east end of downstream slope of abutment with vegetation.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



5. Main Dam – Tree growth in area of clay blanket on east upstream abutment.



6. Main Dam – Emergency spillway looking toward lake.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



7. Main Dam – Primary spillway looking north. Note smooth water flow pattern, approximately 2 inches of overflow.



8. Main Dam – Primary spillway looking east toward drop structure. Note smooth flow pattern.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



9. Main Dam – Lower spillway (August 5, 2008).



10. Main Dam – Lower spillway from left wall (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise

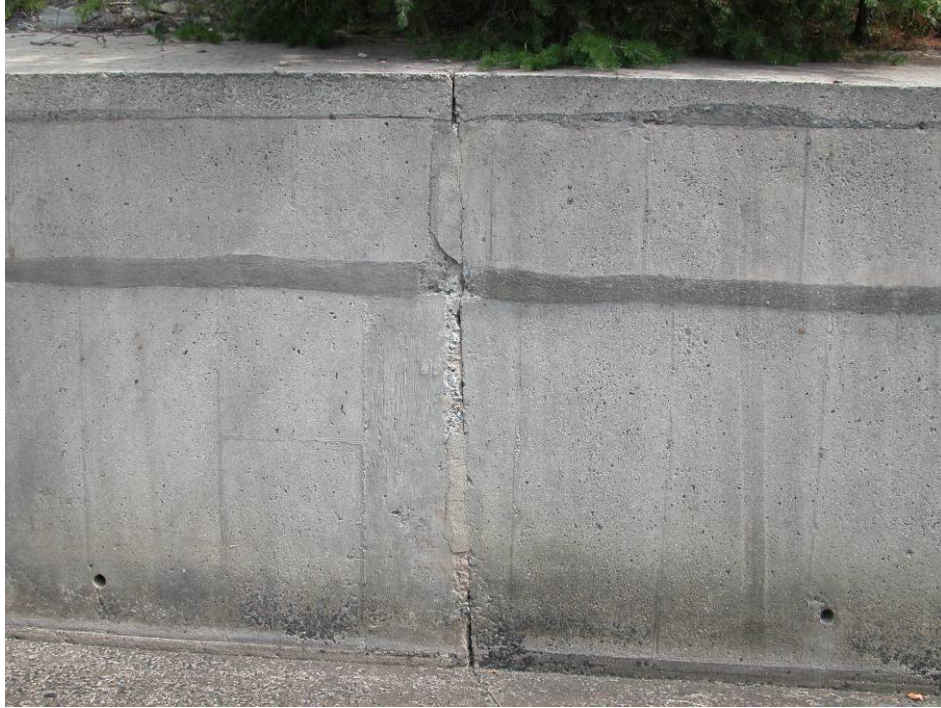


11. Main Dam – Drop wall (August 5, 2008).



12. Main Dam – Drop wall (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



13. Main Dam – Left spillway retaining wall joint at slab E12 missing concrete patch piece (August 5, 2008).



14. Main Dam – Left spillway retaining wall joint at slab J11/K12. Portion of concrete patch missing (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



15. Main Dam – Spillway left wall (August 5, 2008).



16. Main Dam – Spillway left wall (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



17. Main Dam – Spillway left wall (August 5, 2008)..



18. Main Dam – Old crack in concrete slope paving behind downstream end of spillway left retaining wall (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



19. Main Dam – Example of tape over caulked joint pulled off (joint B11/B12 - August 5, 2008).



20. Main Dam – Patch at joint D12/D13 to joint D13 torn out; E11/E12 caulk torn out at D13 joint (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



21. Main Dam – Weir flow channel caulk separated (slab F1 looking upstream - (August 5, 2008).



22. Main Dam – Patch eroded out and caulk pulled up (I11/J11 - August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



23. Main Dam – Patch with loose caulk on C12, D12, tight C13, D13 at junction C12, C13, D12, D13 (August 5, 2008).



24. Main Dam – Patch over intersection G12/G13/H11/H12 has hollow sounds (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



25. Main Dam – Aggregate popout hole 2 inches by 3 inches and 1.5 inches deep in section B5 (August 5, 2008).



26. Exposed aggregate in section C12 (August 5, 2008).

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



27. West Ash Pond Dam – View along crest of dam from west abutment. Toe of slope and drainage swale for new wastewater treatment pond is to the north (August 5, 2008)



28. West Ash Pond Dam – Downstream slope and toe.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



29. West Ash Pond Dam – Typical condition of toe drain outflow channels where flow is present.



30. West Ash Pond Dike No. 1 – Crest and exterior slope looking toward west abutment.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



31. West Ash Pond Dike No. 1 – Interior slope looking toward west abutment.



32. West Ash Pond Dike No. 1 – Rip rap on interior slope

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



33. West Ash Pond Dike No. 1 – Riprap and toe of exterior slope looking toward east.



34. West Ash Pond Dike No. 1 – West skimmer.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



35. West Ash Pond Dike No. 1 – East skimmer.



36. West Ash Pond Dike No. 1 – West flap gate.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



37. West Ash Pond Dike No. 1 – East flap gate.



38. West Ash Pond Dike No. 1 – West outflow channel.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



39. West Ash Pond Dike No. 1 – East outflow channel.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise

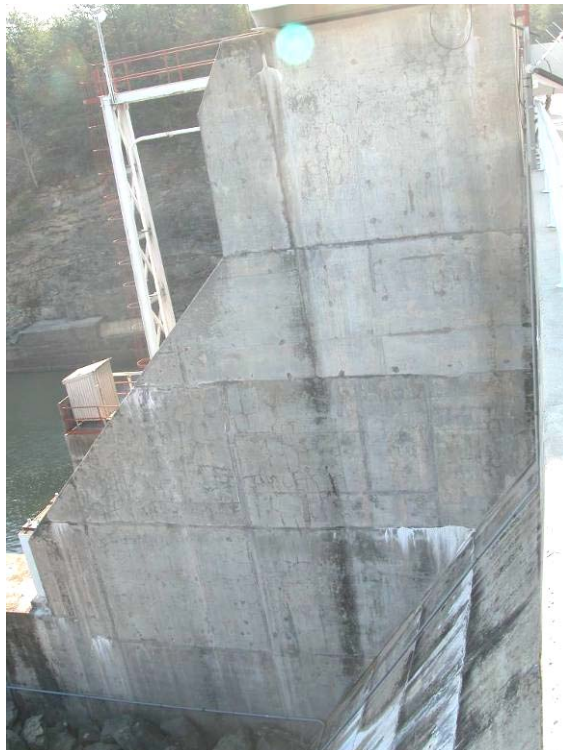


40. West Ash Pond Dike No. 4 –Interior slope.



41. West Ash Pond Dike No. 4 – Exterior slope.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise

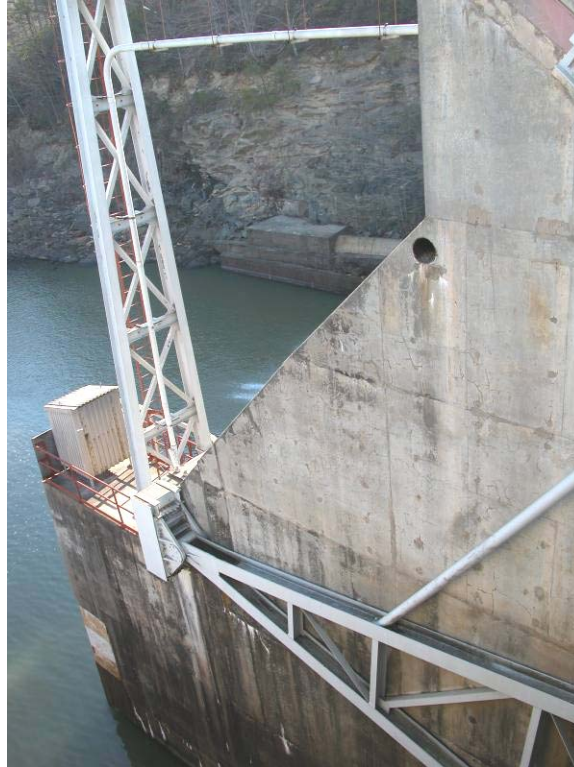


42. Afterbay Dam – East side Pier 1.



43. Afterbay Dam – West side Pier 1.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



44. Afterbay Dam – East side Pier 2.



45. Afterbay Dam – West side Pier 2.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



46. Afterbay Dam – East side Pier 3.

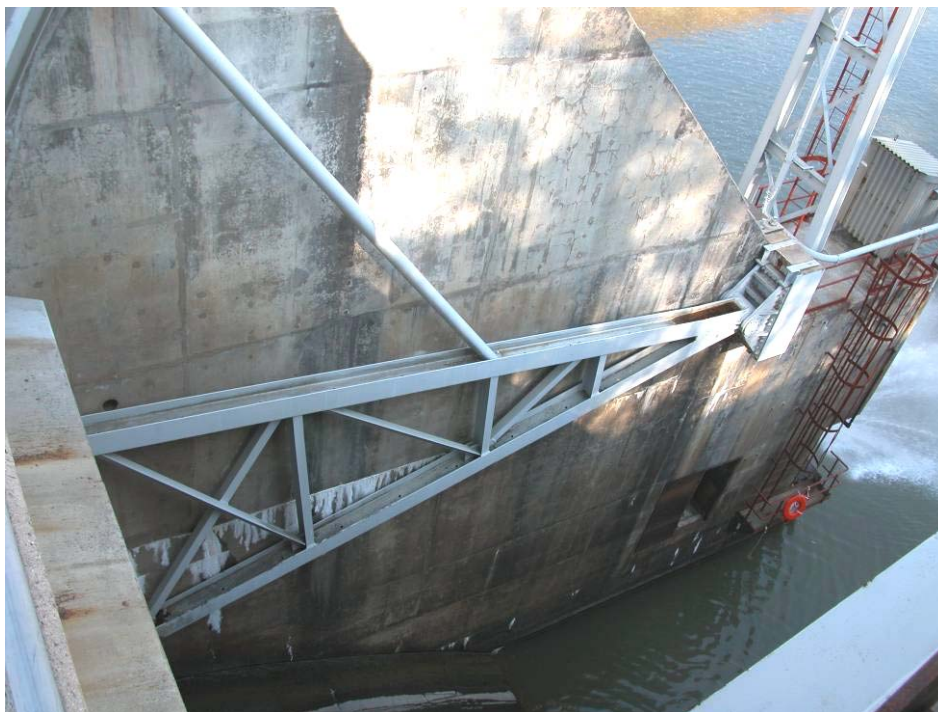


47. Afterbay Dam – West side Pier 3.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



48. Afterbay Dam – East side Pier 4.



49. Afterbay Dam – West side Pier 4.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



50. Afterbay Dam – East side Pier 5.

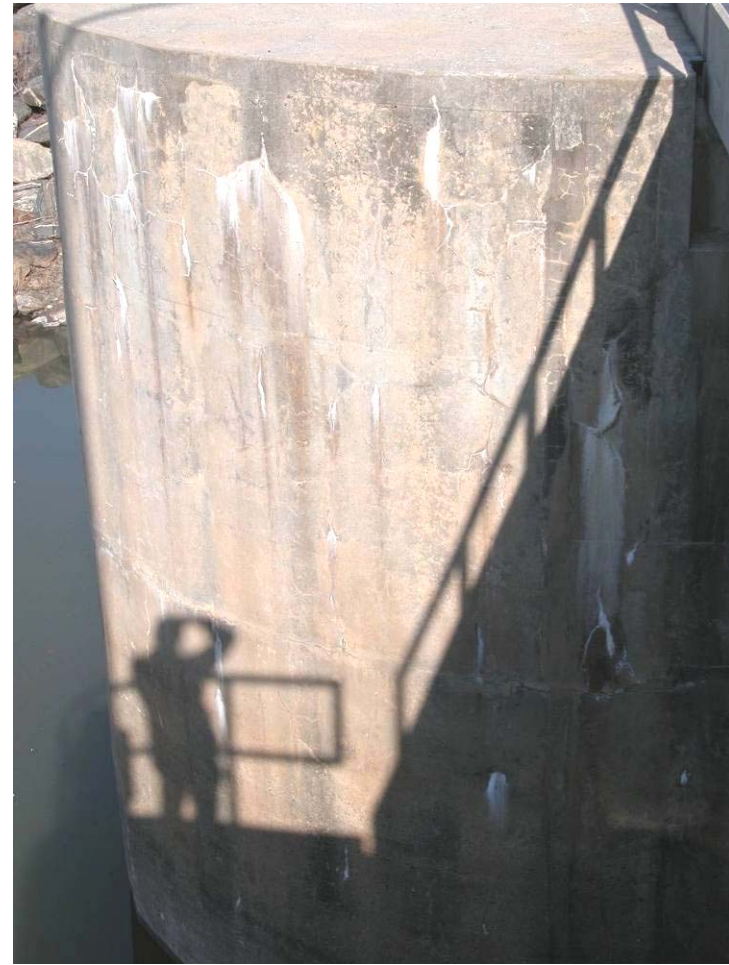


51. Afterbay Dam – West side Pier 5.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



52. Afterbay Dam – East side Pier 1, upstream.

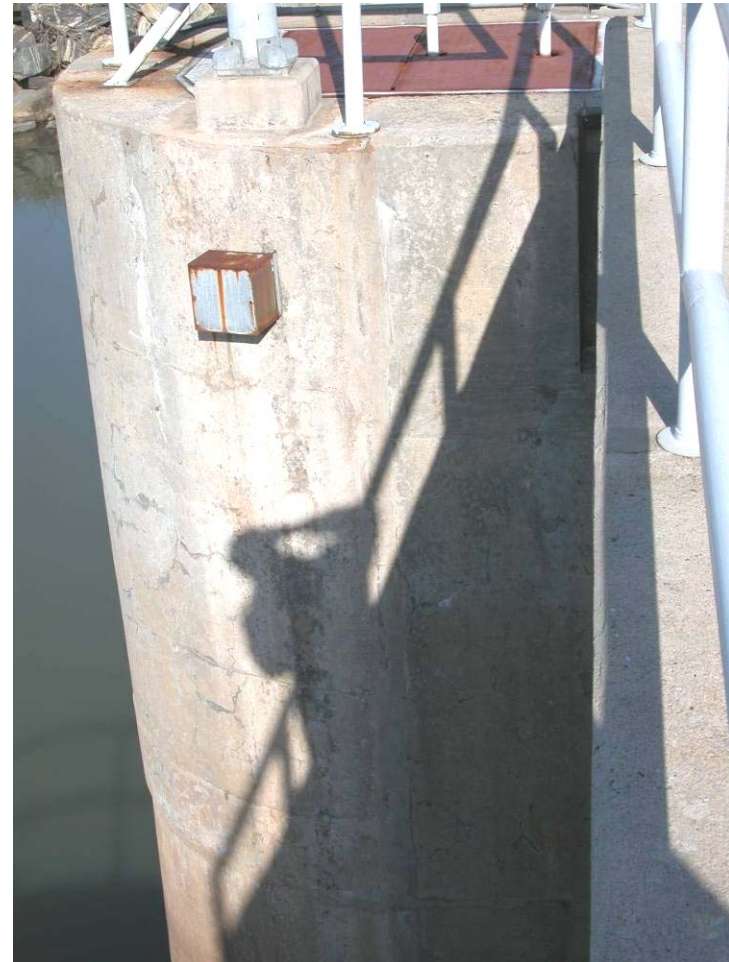


53. Afterbay Dam – West side Pier 1, upstream.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



54. Afterbay Dam – East side Pier 2, upstream.



55. Afterbay Dam – West side Pier 2, upstream.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



56. Afterbay Dam – East side Pier 3, upstream.

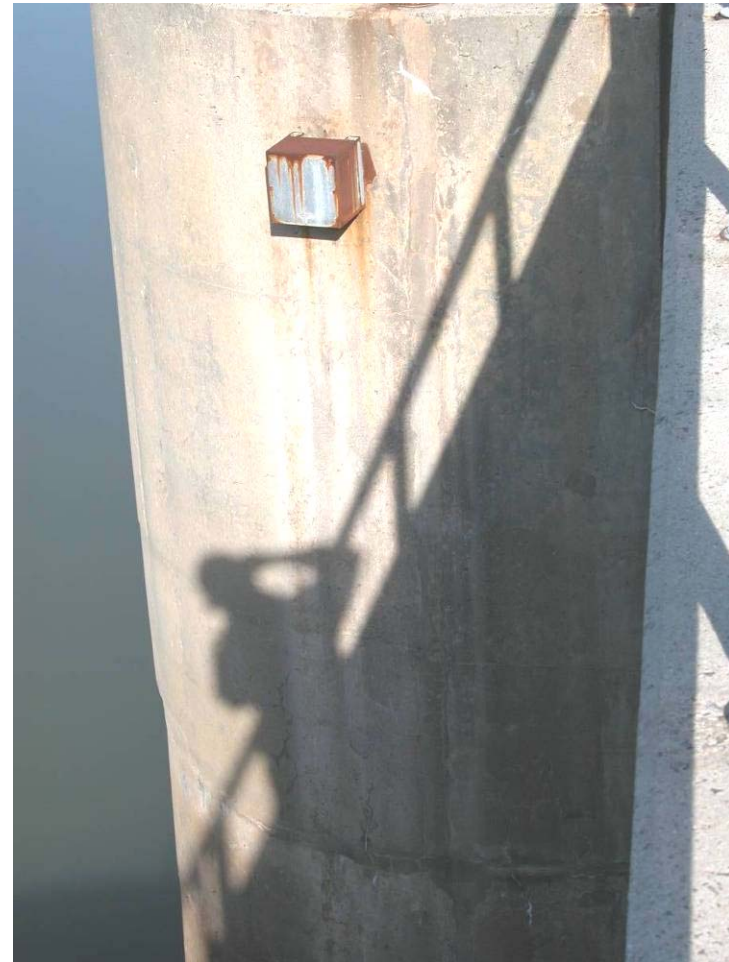


57. Afterbay Dam – West side Pier 3, upstream.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



58. Afterbay Dam – East side Pier 4, upstream.

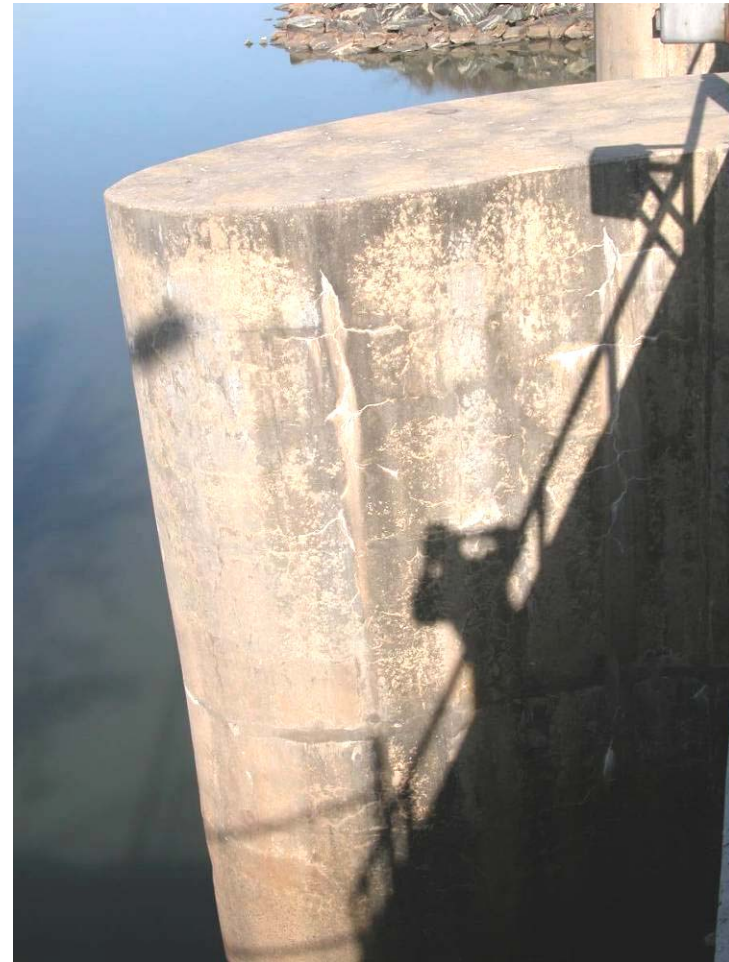


59. Afterbay Dam – West side Pier 4, upstream.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



60. Afterbay Dam – East side Pier 5, upstream.



61. Afterbay Dam – West side Pier 5, upstream.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



62. Afterbay Dam – View of cracking at crest of Pier 2.



63. Afterbay Dam – View of cracking at crest of Pier 3.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



64. Afterbay Dam – View of efflorescence and minor surface scaling on east gravity section.



65. Afterbay Dam – View of efflorescence and minor surface scaling on west gravity section;
slight dampness at junction of gravity section and Pier 5.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



66. Afterbay Dam – View of bulging concrete and maximum efflorescence on west gravity section.



67. Afterbay Dam – General view of downstream concrete section.

Photographs - Roxboro 5-year Inspection, 2008.
All photos taken March 13, 2008 unless noted otherwise



68. Afterbay Dam – View of downstream channel, no major obstructions.



69. Afterbay Dam – View of upstream slope earth embankment section.