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SCE&G®
A SCANA COMPANY

June 1, 2011

Mr. Stephen Hoffman
US Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Drive
5th Floor, N-5237
Arlington, VA 22202-2733

Subject: South Carolina Electric & Gas Company
Canadys Steam Power Station
Coal Combustion Residue Impoundment
Round 9 – Dam Assessment Report (May 2011)

Dear Mr. Hoffman:

South Carolina Electric & Gas Company (SCE&G) hereby files electronically our comments regarding the referenced Canadys Steam Power Station Coal Combustion Residual Impoundment Round 9 – Dam Assessment Report (May 2011), including a revised water balance diagram (marked up and clean copy). This report was originally posted on your secured website link on May 5, 2011; then it was revised and reposted on May 20, 2011.

To address the recommendations regarding the structural stability, SCE&G has contracted with a local geotechnical firm to conduct surveys, subsurface borings and a more detailed seismic analysis of the existing embankment. If the results of this investigation confirm issues with seismic factors of safety, an action plan will be developed to address the safety issues.

To address the recommendations regarding the maintenance and methods of operation, SCE&G has already implemented an action plan to re-vegetate the downstream slope of the embankment as necessary.

To address the recommendations regarding continued safe and reliable operation, SCE&G will develop an action plan to increase the factors of safety for the ash pond embankments for seismic loading conditions as based on the results of the geotechnical investigation mentioned above. SCE&G will address surficial sloughing along downstream slope by repairing the area of concern. This work is expected to be completed within the next several weeks.

If you have any questions about this filing, please contact Mr. William Argentieri at (803) 217-9162 or by email at bargentieri@scana.com.

Very truly yours,

James M. Landreth

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c: M. C. Summer/W. R. Argentieri
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Corporate Records

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Coal Combustion Residue Impoundment
Round 9 - Dam Assessment Report

Canadys Steam Power Station

Ash Pond Embankments
South Carolina Electric & Gas
Canadys, South Carolina

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry & Davis, LLC
Fairfax, Virginia

Under Contract Number: EP-09W001727

May 2011

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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion waste from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008 flooded more than 300 acres of land, damaging homes and property. In response the U.S. EPA is assessing the stability and functionality of coal combustion ash impoundments and other management units across the country and, as necessary, identifying any needed corrective measures.

This assessment of the stability and functionality of the Canadys Station management units is based on a review of available documents and on the site assessment conducted by Dewberry personnel on February 15, 2011. We found the supporting technical documentation adequate (Section 1.1.3). As detailed in Section 1.2.5, there were two recommendation based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Canadys Station Ash Pond units are POOR for continued safe and reliable operation, due to the factor of safety for seismic loading conditions not meeting required standards. Note that under static conditions the Canadys Station Ash Pond units are Satisfactory for continued safe and reliable operation.

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PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is embarking on an initiative to investigate the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant or High Hazard Potential ranking. (For Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety.)

In early 2009, the EPA sent its first wave of letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and

functionality of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments. EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age and the amount of material placed in the units. The EPA used the information received from the utilities to determine preliminarily which management units had or potentially could have High Hazard Potential ranking.

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

Factors considered in determining the hazard potential classification of the management unit (s) included the age and size of the impoundment, the quantity of coal combustion residuals or by-products that were stored or disposed of in these impoundments, its past operating history, and its geographic location relative to down gradient population centers and/or sensitive environmental systems.

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

LIMITATIONS

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

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Doc 06:	Additional Stability Analysis
Doc 07:	Quarterly Inspection 2009.10.09
Doc 08:	Quarterly Inspection 2010.03.15
Doc 09:	Quarterly Inspection 2010.06.28
Doc 10:	Quarterly Inspection 2010.09.29
Doc 11:	Seismic Slope Stability Analysis
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Doc 12:	Dam Inspection Check List Form – Active Pond
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Doc 14:	Dam Inspection Check List Form – Polishing Pond

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit on February 15, 2011, and review of technical documentation provided by South Carolina Electric & Gas (SCE&G).

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

The dike embankments and spillway appear to be structurally sound based on a review of the engineering data provided by the owner's technical staff and Dewberry engineers' observations during the site visit; however, factors of safety for seismic loading conditions do not meet required standards. It should be noted that a deep-seated failure that would compromise the overall integrity of the dike during the design earthquake is not likely and that the dike will be capable of retaining the coal ash during and immediately following the design earthquake event.

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

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

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

Supporting technical documentation is adequate. Engineering documentation reviewed is referenced in Appendix A.

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

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

1.1.5 Conclusions Regarding the Field Observations

The overall visual assessment of the ash pond embankment system was that it was in satisfactory condition; however, surficial sloughing was observed along the Ash Pond's downstream slope. Embankments visually appear structurally sound.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operation appear to be adequate for the ash management unit.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The facility is rated POOR for continued safe and reliable operation due to the factors of safety for seismic loading conditions that do not meet required standards.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

As recommended by its own engineering studies, additional data are required on the dike and foundation soils to permit a more in-depth analysis of risks from seismic events. An action plan needs to be developed and implemented to take the necessary actions to increase factors of safety, meet all applicable standards and requirements, and to address surficial sloughing.

1.2.2 Recommendations Regarding Maintenance and Methods of Operation

The following issues need to be addressed with routine maintenance:

- Re-vegetate embankment where necessary

1.2.3 Recommendations Regarding Continued Safe and Reliable Operation

- Develop an action plan to increase the factors of safety for the ash pond embankments to meet or exceed the minimum requirement for factors of safety for seismic loading conditions.
- Develop an action plan to address surficial sloughing along downstream slope. Perform remediation along downstream slopes where surficial sloughing is occurring.

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1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Tim Miller, South Carolina Electric & Gas (SCE&G)
Wes Coker, South Carolina Electric & Gas (SCE&G)
Michelle Camburn, South Carolina Electric & Gas (SCE&G)
Tom Effinger, SCANA
Jean-Claude Younan, SCANA
Frederic Shmurak, Dewberry & Davis, Inc.
Justin Story, Dewberry & Davis, Inc.

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on February 15, 2011.

Frederic Shmurak, P.E.	Justin Story, E.I., LEED AP BD+C

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

2.1 LOCATION AND GENERAL DESCRIPTION

The Canadys Steam Power Station and ash ponds are located approximately 1 mile north of Canadys, South Carolina along the Edisto River. The town of Givhans is approximately 16 miles downstream of the ash ponds. Figure 2.1a depicts a vicinity map around the Canadys Steam Power Station while Figure 2.1b depicts an aerial view of the Canadys Facility.

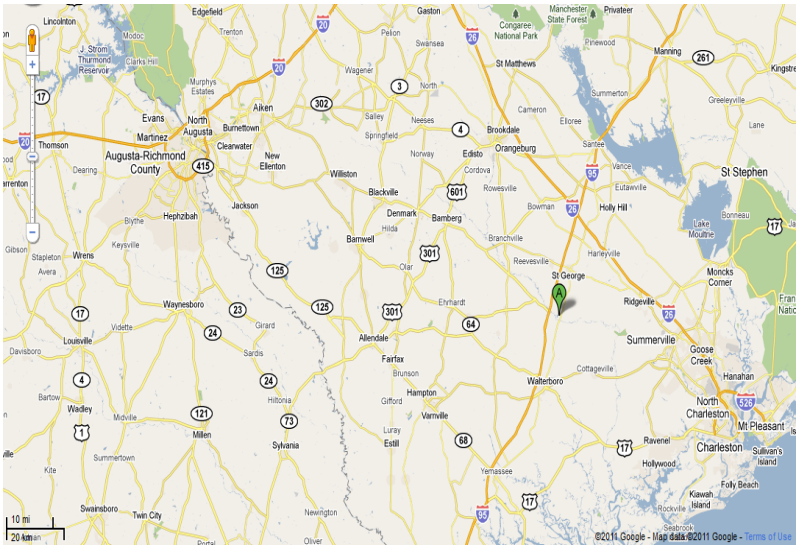

Figure 2.1a: Canadys Steam Power Station Vicinity Map

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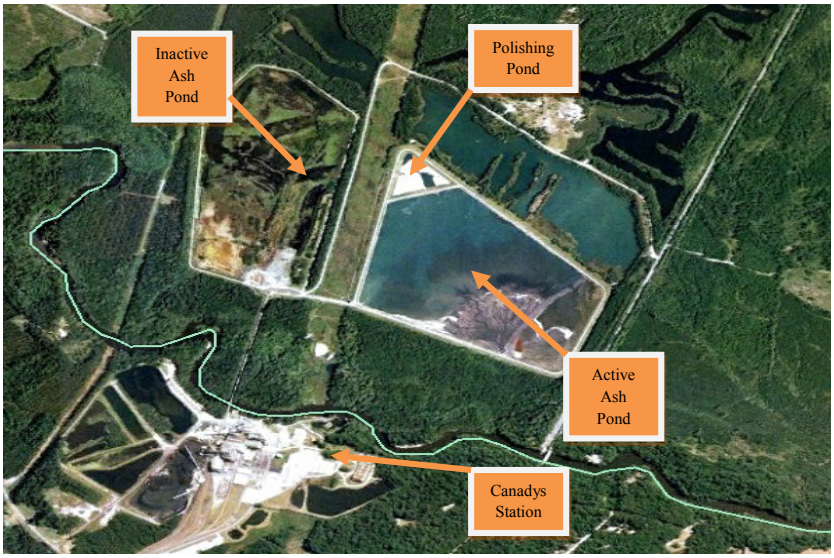

Figure 2.1b: Canadys Steam Power Station Aerial View

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

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

Fly ash is collected from the hoppers of the electrostatic precipitators (ESP) on Units 1 and 2 and from the hoppers of the baghouse on Unit 3 (see photo below). The fly ash from Units 1 and 2 is conveyed hydraulically through a series of pipes, along with the bottom ash and boiler slag from these units, to the active ash pond. Like Units 1 and 2, the fly ash from Unit 3 can also be conveyed hydraulically, along with the bottom ash and boiler slag, to the active ash pond. However, the Unit 3 fly ash may also be pneumatically conveyed to a 1,200 ton ash storage silo. From the silo, the plant has the option of loading the fly ash into

trucks to be transported for beneficial reuse. Silo storage and transport is the preferred method of handling the Unit 3 fly ash if the opportunity for beneficial use is available. The discharge into the ash pond is continuous as long as any of the three units within the plant are in service. If all three of the units are off line, the ash sluice system may be shut down. A flowchart for hydraulically conveying the ash is shown in Appendix A (Doc 01 – Water Flow Diagram).

Hopper feeding ash sluice line

2.2.2 Bottom Ash

~~Bottom ash is collected from the furnace and conveyed through the same pipe as the fly ash into the Active Ash Pond.~~

Bottom ash is collected from the boilers, along with the boiler slag, and is sluiced to the active ash pond in the same pipes as the fly ash and boiler slag.

2.2.3 Boiler Slag

~~Boiler slag is collected from the boiler and is sluiced into the same pipe that conveys fly and bottom ash into the Active Ash Pond.~~

Boiler slag is collected from the boilers, along with the bottom ash, and is sluiced to the active ash pond in the same pipes as the fly and bottom ash.

2.2.4 Flue Gas Desulfurization Sludge

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

2.3 SIZE AND HAZARD CLASSIFICATION

The ash pond is impounded by an earthen embankment system consisting of a dike configuration. There are two main ponds, one that is active with an internal dike separating the ash pond from the polishing pond, and one that is inactive. Table 2.1 provides information on dam height, crest width, length and side slopes.

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Table 2.1: Summary of Dam Dimensions and Size		
	Active Ash Pond	**Inactive Ash Pond**
Dam Height (ft)	20	12
Crest Width (ft)	12'/20'	15
Length (ft)	9,050	7,700
Side Slopes (upstream) H:V	2.5:1	1:2
Side Slopes (downstream) H:V	2.5:1	1.5:1

Inactive Pond - The maximum remaining storage volume corresponding to the top of the embankment for the Inactive Ash Pond is 938,300 cubic yards based on an SCE&G Response to EPA (Appendix A: Doc 02 - Response to EPA) dated March 20, 2009. However, the Inactive Ash Pond is no longer used for coal combustion residual productions.

Active Pond - The Active Ash Pond has a maximum remaining storage volume corresponding to the top of the embankment of 80,732 cubic yards based on the SCE&G Response to EPA. It should be noted that since this last evaluation (2009) the Active Pond has been in use and the numbers have most likely changed.

Table 2.2 provides information on the storage capacity and size of the ponds. Based on the storage capacity and other data in Tables 2.1 and 2.2, both ponds are considered Intermediate in size.

Table 2.2: Maximum Capacity of Unit		
	Active Ash Pond	**Inactive Ash Pond**
Surface Area (acre)	95	80
Current Storage Capacity (cubic yards)	2,189,468	675,000
Current Storage Capacity (acre-feet)	1,357	418
Total Storage Capacity (cubic yards)	2,270,200	1,613,300
Total Storage Capacity (acre-feet)	1,407	1,000
Crest Elevation (feet)	80	69.5
Normal Pond Level (feet)	72.1	-

Table 2.3a: USACE ER 1110-2-106 Size Classification		
	Active Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

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Table 2.3b: USACE ER 1110-2-106 Size Classification		
	Inactive Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

A Hazard Classification has not been assigned by a regulatory agency, but based on observations and the lack of population in the surrounding area, a classification of **Low** appears to be appropriate. Per the Federal Guidelines for Dam Safety dated April 2004, a Low Hazard Potential classification applies to those dams where failure or mis-operation results in no probable loss of human life and low economic or environmental losses. Losses are principally limited to the owner's property, and the land use surrounding the plant is rural.

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

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

Both the Inactive Pond and the Active Ash Pond ~~permanently~~ contain fly ash, bottom ash, pyrites and boiler slag. The contents of the Active Ash Pond are available for beneficial reuse based on market demands. The drainage area is the surface area of the ponds. Please note the polishing pond data is included with the Active Ash Pond for this section.

Principal Project Structures

2.4.1 Earth Embankment

The original material of the embankment appears to be native soils based on ~~Progress Energy's~~SCE&G's supplied Geotechnical data.

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2.4.2 Outlet Structures

The Inactive Ash Pond had a 30" diameter riser and an outlet pipe that is a free outlet with no tailwater condition.

The Active Ash Pond discharges into the polishing pond through a 4' inside diameter riser with a 3' barrel. The discharge into the polishing pond is below the pond surface.

The polishing pond discharges through a Parshall Flume to the Edisto River.

2.5 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

Critical structures were located by using aerial photography which might not accurately represent what currently exists down-gradient of the site. No critical infrastructure was found to be downstream of the site with the exception of Colleton State Park and Jeffries Hwy/Porter Avenue (S.C. Highway 15~~HWY 15~~).

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3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

Summary of Reports on the Safety of the Management Unit

~~Progress Energy~~SCE&G provided the two most recent annual inspection reports. The most recent is the 2010 Annual Ash Pond Dike Inspection, Canadys Station, dated December 14, 2010 (Appendix A: Doc 03 - 2010 Inspection Report).

- Recommendations from 2009 report had been "aggressively repaired and maintained";
- The trench caused by the slurry wall construction silt fence had been repaired as noted in the 2009 report;
- Minor surface erosion was present along the downstream slope where hydroseeding was not successful;
- Rutting of the downstream slope was observed where mowing equipment was used;
- The berm separating the polishing pond from the active ash pond appears to have "a very small localized slough";
- Woody vegetation observed in 2009 in the rip rap along the downstream slope had been removed.
- Vegetation along the interior embankment had been cut down,
- Tall grass was observed growing in the area of the inactive pond where little or no water was apparent.

2009 Annual Ash Pond Dike Inspection, Canadys Station, dated 12/04/2009. (Appendix A: Doc 04 - 2009 Inspection Report)

Active Ash Pond

- Minor surface erosion was present along the downstream slope;
- Sloughing had occurred where the silt fence was trenched into the dike during recent construction;
- The berm separating the polishing pond and the active ash pond appeared to have been damaged during construction and a small localized slough was noticed.

- Woody vegetation that had established in the rip rap of the downstream slope had been removed.
- Small trees were observed growing on the interior embankment of the ash pond and on the downstream slope near the outfall.
- Deep ruts were noticed along the downstream toe of the ash pond which was noted to have been caused by recent vehicular traffic.

Inactive Ash Pond

- Surficial erosion was observed; it was noted that the areas were small and should "be easily repaired";
- Thick vegetation has established along the interior bank;
- Tall grass was noted inside the active ash pond where little or no water was apparent.
- The observer noticed "medium, large, and very large trees" flourishing within the ash of both ponds.
- Waterfowl ~~was~~ were noticed in the impounded water within the inactive pond.

3.1 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

Discharge from the impoundment is regulated by the Federal National Pollutant Discharge Elimination Program (NPDES) and the impoundment has been issued a National Pollutant Discharge Elimination System Permit (No. SC0002020, dated July ~~18, 1995~~ 1, 2004). The South Carolina Department of Health and Environmental Control periodically inspects the ash ponds for compliance.

3.2 SUMMARY OF SPILL/RELEASE INCIDENTS

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

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4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The Inactive Ash Pond was commissioned in 1974. The pond was designed by Gilbert Associates, Inc., but detailed documentation for the original design and construction of the pond was not provided.

The Active Ash Pond was constructed in 1987 from original ground surface at an approximate elevation of 60'.

4.1.2 Significant Changes/Modifications in Design since Original Construction

A new slurry wall was constructed in 2007 within the Active Ash Pond to prevent seepage within the dike. This construction was approved by South Carolina Department of Health and Environmental Control on September 22, 2005.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No documentation of significant repairs/rehabilitation since the original construction was provided.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

The original ash pond (i.e., Inactive Ash Pond) and Active Ash Pond are designed and operated for reservoir sedimentation and sediment storage of ash. Plant process waste water, coal combustion waste, coal pile stormwater runoff, and minimal stormwater runoff around the Ash Pond facility are discharged into the reservoirs. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff are discharged through an unregulated type overflow outlet structure.

4.2.2 Significant Changes in Operational Procedures and Original Startup

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

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4.2.3 Current Operational Procedures

To the best of our knowledge, original operational procedures are in effect. The Inactive Ash Pond received coal combustion by-products until 1989 and it has not been used since.

4.2.4 Other Notable Events since Original Startup

No additional information was provided.

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5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel, Frederic Shmurak, P.E. and Justin Story, E.I., performed a site visit on Tuesday February 15, 2011.

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

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

5.2 ACTIVE ASH POND

5.2.1 Crest

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

5.2.2 Upstream/Inside Slope

The upstream slopes are mostly vegetated with tall grasses and other wetland vegetation. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

5.2.3 Downstream/Outside Slope and Toe

There were signs of surficial sloughing particularly along the downstream slope. Wetlands and a waterway channel are located along the downstream toe of the embankments. (See Photos 1, 2, and 3.)

DRAFT

Photo 1. Standing water in vehicular traffic ruts

Photo 2. Channel along the downstream toe

DRAFT

Photo 3. Surficial sloughing along downstream slope

5.2.4 Abutments and Groin Areas

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

5.3 INACTIVE ASH POND

5.3.1 Crest

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

5.3.2 Upstream/Inside Slope

The interior of the pond is heavily vegetated and it appears the upstream slopes at one point in time had woody vegetation that was recently removed. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

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5.3.3 Downstream/Outside Slope and Toe

No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed.

5.3.4 Abutments and Groin Areas

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

5.4 OUTLET STRUCTURES

5.4.1 Overflow Structure

The outlet structures for the Active Ash Pond and the Polishing Pond were properly discharging flow from the pond and visually appeared to be in good condition.

5.4.2 Outlet Conduit

The visual portion of the outlet conduit was functioning properly with no apparent deterioration for the Active, Inactive and Polishing Ponds.

5.4.3 Emergency Spillway

No emergency spillway is present.

5.4.4 Low Level Outlet

No low level outlet is present.

DRAFT

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation was provided about the flood of record. The Active Ash Pond is a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore, the impounded pool would not be anticipated to experience significant changes in flood stage.

6.1.2 Inflow Design Flood

According to FEMA Federal Guidelines for Dam Safety, the current practice in the design of dams is to use the Inflow Design Flood (IDF) that is deemed appropriate for the hazard potential of the dam and reservoir, and to design spillways and outlet works that are capable of safely accommodating the flood flow without risking the loss of the dam or endangering areas downstream from the dam to flows greater than the inflow. The recommended IDF or spillway design flood for a low-hazard intermediate-sized structure (See section 2.3), in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams, ER 1110-2-106 criteria, is the 100-year to ½ PMF (See Table 6.1.2).

Table 6.1.2: USACE Hydrologic Evaluation Guidelines Recommended Spillway Design floods

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

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

The 24-hour, 10-square mile PMP depth is 44 inches (3.7'). The freeboard of the Active Ash Pond is 7.9' and the Polishing Pond is 16.6'. Since the facility has a contributing drainage area equal to the surface area of the impoundment, adequate freeboard exists so the facility would not experience significant flood states and could safely pass the design storm.

6.1.3 Spillway Rating

No spillway rating was provided. The Ash Ponds are a diked embankment facility having a contributing drainage area equal to the surface area of the impoundment; therefore, the impounded pool would not be anticipated to experience significant changes in elevation. The outlet structure uses a riser/barrel outlet device and the pond's discharge is controlled by the hydraulic performance of the riser/barrel. The outlet structure does not include devices to restrict or control outlet flow. ~~type is unregulated and, given~~ Given little change in the normal pool elevation, the resulting discharge rate is expected to be relatively constant.

Comment [wra1]: The term "unregulated" can be confusing and is easily misinterpreted. Therefore, we are requesting a change to reflect the intended description as we understand it.

6.1.4 Downstream Flood Analysis

No downstream flood analysis was provided.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry is adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

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

DRAFT

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

A stability analysis report for the ash pond dated December 8, 2005, by GEI Consultants, Inc., provides information on the stability analysis results. Updated slope stability analysis reports, prepared by CDM dated March 16, 2011 and May 17, 2011 were provided after the site visit (Appendix A: Doc 11 - Seismic Slope Stability Analysis and Doc 12 – Static Slope Stability Analysis). Steady state (normal) and seismic loading conditions were analyzed and are presented in Section 7.1.4 Factors of Safety and Base Stresses.

7.1.2 Design Parameters and Dam Materials

The GEI Consultants, Inc. 2005 report includes documentation of the shear strength design properties for the ash pond embankments, and is presented in the following section. The CDM 2007 report shows the geotechnical analysis of the new cement-bentonite slurry trench. Soil properties information used in stability analyses from these reports is provided in Table 4a. Additional information on soil properties was provided in the CDM 2011 report, see Table 4b. The soil properties are generally acceptable values for these types of materials.

Table 4a

Soil Properties for Stability Analysis North Embankment

Soil Description (USCS Classification)	Unit Weight (pcf)	Fiction Angle (degrees)	Cohesion (psf)
Dike (SM)	130	34	0
Dike (SC-SM)	125	34	0
Existing Soil – Bentonite Backfill	130	38	0
Proposed Cement Bentonite	70	-	-

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Table 4b Soil Properties for Stability Analysis (From March 16, 2011 Report)			
Material	**Unit Weight (pcf)**	**Fiction Angle (degrees)**	**Cohesion (psf)**
Ash	80	0	0
Silty Sand	120	32	0
Clayey Sand	110	30	0
Widely Graded Sand	125	0	550
Sandy Silt (Cooper Marl)	110	0	4,000
Soil-Bentonite slurry-wall	130	0	0
Cement-Bentonite slurry wall	80	0	10,000

Appendix A: Doc 11 – Seismic Slope Stability Analysis

7.1.3 Uplift and/or Phreatic Surface Assumptions

Monitoring instrumentation devices have not been installed to verify water levels within the embankment. The assumed phreatic surfaces are shown on the figures below and the depiction seems appropriate for these types of structures. No additional information was provided. The water level of the Active Ash Pond was stated to be 72.1' and the Polishing Pond to be 63.4'. These elevations were not verified.

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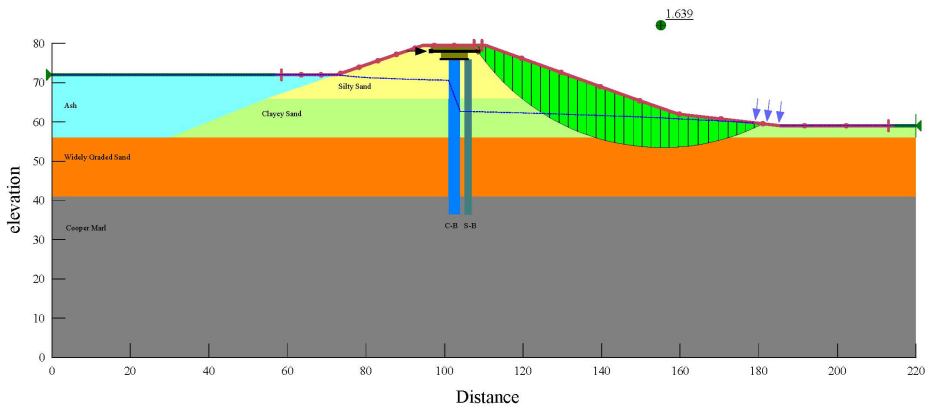
Stability Analysis - 95-Acre Ash Storage Pond, Canadys, SC

Morgenstern-Price Analysis
Distance between S-B wall (downstream) and C-B wall: 1 foot

Low Water Level: El. 72 ft



Name: Silty sand Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 0 Phi: 32
Name: Clayey sand Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 0 Phi: 30
Name: Widely graded sand Model: Mohr-Coulomb Unit Weight: 125 Cohesion: 0 Phi: 28
Name: Cooper Marl Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 4000 Phi: 0
Name: Ash Model: Mohr-Coulomb Unit Weight: 80 Cohesion: 1 Phi: 0
Name: C-B wall Model: Mohr-Coulomb Unit Weight: 80 Cohesion: 10000 Phi: 0
Name: Common fill Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 0 Phi: 32
Name: GABC Model: Mohr-Coulomb Unit Weight: 125 Cohesion: 0 Phi: 38
Name: Soil-Bentonite Model: Mohr-Coulomb Unit Weight: 130 Cohesion: 0 Phi: 25

7.1.4 Factors of Safety and Base Stresses

A slope stability analysis was performed determining the factors of safety for the stability of the dike with the new slurry wall installed. A factor of safety of 1.6 for static conditions was determined which exceeds the required standard of 1.5. (See Appendix A: Doc 12 – Static Slope Stability Analysis).

DRAFT

Table 7.1.4a Factor of Safety against Slope Failure (~~Seismic~~ Static Conditions)		
Slope	**Factor of Safety Low Water**	**Factor of Safety High Water**
Upstream	1.90	1.88
Downstream	1.64	1.60

Factors of safety for seismic loading conditions are listed in table 7.1.4b and do not meet the minimum required standard of 1.1. It was concluded by CDM that a deep-seated failure that would compromise the overall integrity of the dike during the design earthquake is not likely and that the dike will be capable of retaining the coal ash during and immediately following the design earthquake event. However, significant deformation of the dike slopes during the design earthquake is likely to occur, particularly for the upstream slope. These deformations could threaten the longer term integrity of the dike as a containment facility and not allow the impoundment pond to remain functional following the design seismic event until repairs are made. (Appendix A: Doc 11 – Seismic Slope Stability Analysis).

Table 7.1.4b Factor of Safety against Slope Failure (Seismic Conditions)			
Slope	**Failure Mode**	**Factor of Safety Low Water**	**Factor of Safety High Water**
Upstream	Localized and Surficial Failure	0.19	0.18
	Major and Deep Seated Failure	1.12	1.16
Downstream	Localized and Surficial Failure	0.87	0.80
	Major and Deep Seated Failure	1.01	1.00

See Appendix A: Doc 11 – Seismic Slope Stability Analysis

7.1.5 Liquefaction Potential

The CDM 2011 report evaluated the potential for liquefaction and determined the embankment material is not susceptible to widespread liquefaction with the exception of the soil-bentonite wall material. It was noted that this liquefaction screening evaluation was conducted based on limited boring, laboratory and cone penetrometer test data (Appendix A: Doc 11 – Seismic Slope Stability Analysis). Soil liquefaction in conjunction with seismic activity has been documented in the region by the University of South Carolina as well as USGS.

7.1.6 Critical Geological Conditions

The site is located within the Coastal Plain of South Carolina. The sedimentary rocks of the Coastal Plain partly consist of sediment eroded from the Piedmont and Fall Line and partly of limestone generated by marine organisms and processes. A highly calcareous-cemented clay and silt size stratum refer to as the "Cooper Marl" is typically located about 60' below the surface. The site is also located in a relatively high seismic area. The 1886 Charleston earthquake demonstrated that substantial earthquake hazards exist in the region.

Based on USGS Seismic-Hazard Maps for the Conterminous United States, the facility is located in an area anticipated to experience a 0.45 g acceleration with a 2-percent probability of exceedance in 50 years.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting technical documentation is adequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the dam visually appears adequate, however based on the factor of safety for seismic loading conditions, the embankment system does not meet required standards.

The CDM 2011 report recommends that additional analysis be performed to better define the risks, to better estimate the likely deformations, and to estimate repairs required following a seismic event. The report notes that additional data on the dike and formation soils and their strength is needed before more detailed engineering analyses are performed. We agree with these recommendations.

DRAFT

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The ash pond was designed and operated for reservoir sedimentation and sediment storage of ash. Plant process waste water, coal combustion waste, coal pile stormwater runoff, and minimal stormwater runoff around the Ash Pond facility are discharged into the reservoir. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff is discharged through an NPDES-permitted~~, unregulated type~~ overflow outlet structure. The outlet structure uses a riser/barrel outlet device and the pond's discharge is controlled by the hydraulic performance of the riser/barrel. The outlet structure does not include devices to restrict or control outlet flow.

Comment [wra2]: The term "unregulated" can be confusing and is easily misinterpreted. Therefore, we are requesting a change to reflect your intention as we understand it.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance of the dam and project facilities is adequate, although the following maintenance items need to be addressed:

- Remediate surficial sloughing
- Bare areas should be vegetated

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

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

8.3.2 Adequacy of Maintenance

Based on the assessments of this report, maintenance procedures appear to be adequate, although some minor maintenance repairs are recommended.

DRAFT

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Quarterly Inspections:

Quarterly inspections reports were provided by SCE&G/SCANA and can be found in Appendix A: Docs 07 – 10.

Annual Inspections:

Annual inspections were provided by SCE&G/SCANA and can be found in Appendix A: Doc 03 & 04.

9.2 INSTRUMENTATION MONITORING

The Canadys Steam Power Station ash impoundment dikes do not have an instrumentation monitoring system.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

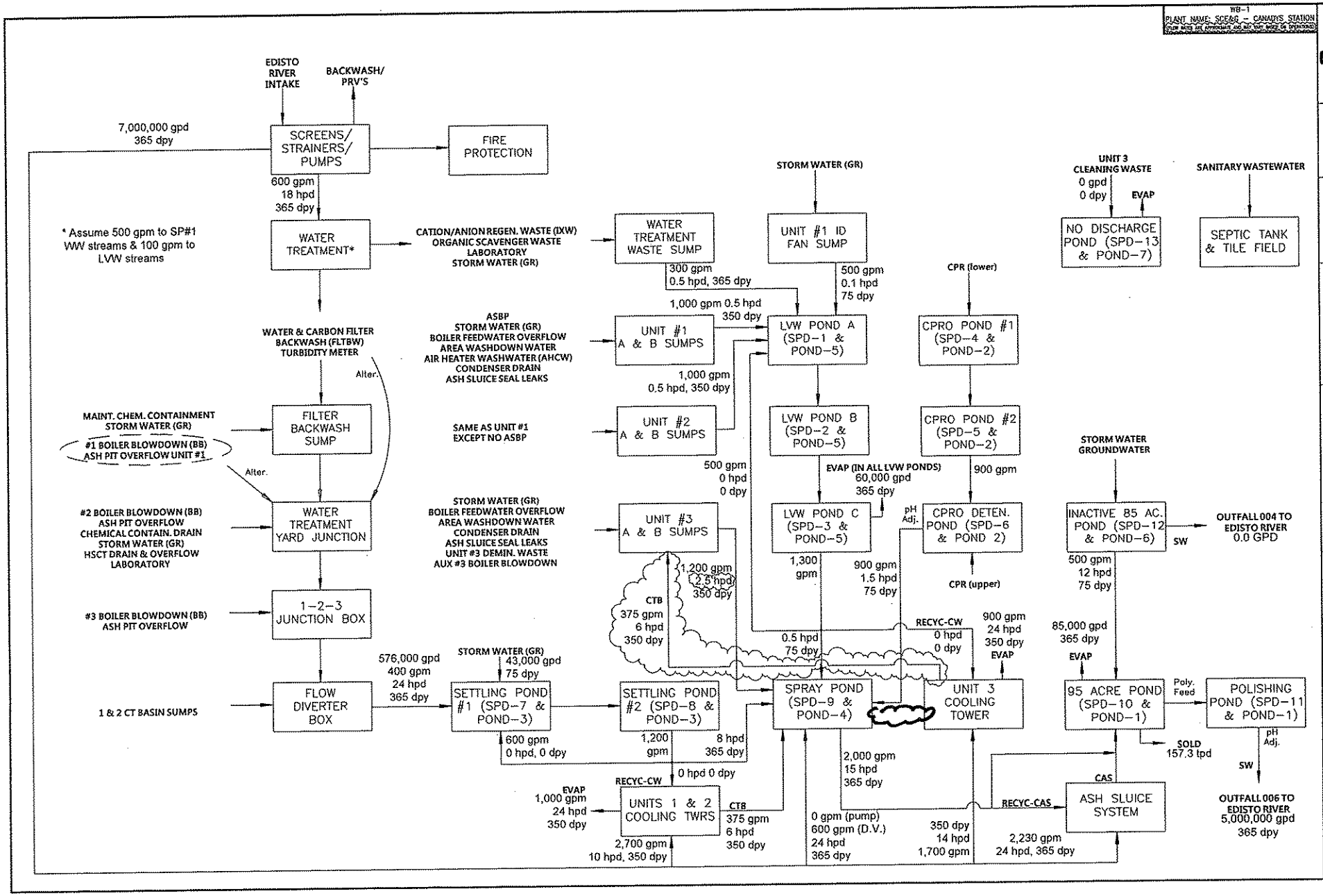
9.3.1 Adequacy of Inspection Program

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

9.3.2 Adequacy of Instrumentation Monitoring Program

No instrumentation is present at the Active Ash Pond, Inactive Ash Pond or Polishing Pond.

WB-1
PLANT NAME: SCE&G – CANADYS STATION
(THE NOTES BY ARCHITECT ARE NOT THE NOTES ON DRAWINGS)



E2S ENVIRONMENTAL ENGINEERING SCIENCES, LLC

REVISIONS

No.	By:	Date:
1	JKD	5/12/11

Issued for: Review / X Permitting / Bidding / Construction / As-Built
By: JKD
Date: 9-30-10

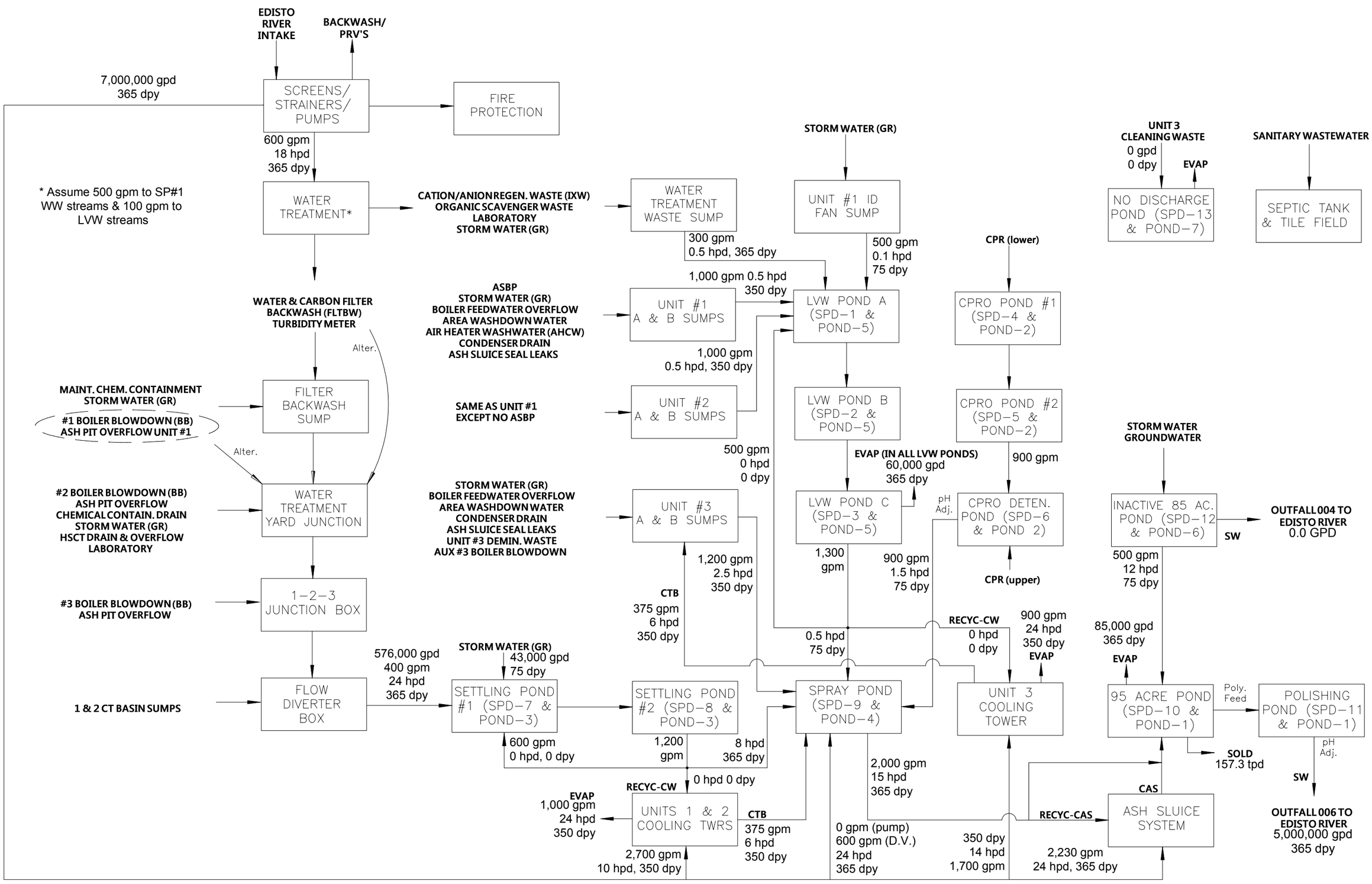
SCE&G® A SCANA COMPANY

SOUTH CAROLINA ELECTRIC & GAS
CANADYS STATION
WATER FLOW DIAGRAM

Drafter: JKD
Designer: JKD

WB-1

WB-1
PLANT NAME: SCE&G – CANADYS STATION
(FLOW RATES ARE APPROXIMATE AND MAY VARY BASED ON OPERATIONS)



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REVISIONS

No.	By:	Date:

Issued for: By: Date:
Review
X Permitting JKD 5-23-11
Bidding
Construction
As Built

SCE&G® A SCANA COMPANY

SOUTH CAROLINA ELECTRIC & GAS
CANADYS STATION
WATER FLOW DIAGRAM

Drafter: JKD
Designer: JKD

WB-1

NOTE

Subject: EPA Comments on South Carolina Electric & Gas Co, Canadys Steam Power Station, Canadys, SC
Round 9 Draft Assessment Report

To: File

Date: October 20, 2011

1. On p. ii, INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS, second paragraph, replace "Section 1.2.5" with "Section 1.2.3."

2. On p. 1-7, in the table of contents for Appendices A and B, both have a document 12. Please replace "Doc 12" in Appendix B with "Doc 13" and renumber the next two documents.

3. On p. 1-2, section 1.1.8, each individual unit must receive a condition rating, please refrain from rating the facility as a whole. Please provide a condition rating for each unit.

4. On pp. 5-3 and 5-4, Section 5.3 Inactive Ash Pond. Were there any photos taken of the inactive ash pond? Please add photos here.

5. Section 7.2 and 7.3: In one section, the report says that the supporting documentation is acceptable and in the other it says that the supporting documentation reveals unacceptable factors of safety for seismic loading conditions. This needs to be clarified. Additionally, either in these sections or the recommendation section, measures the facility can take to improve their seismic factors of safety should be discussed.

6. Appendix A, please identify each document prior to the document inclusion in Appendix A.

7. The following was not addressed in the report for either pond: "Is any part of the impoundment built over wet ash, slag, or other unsuitable materials (like TVA)?" Please address for each Pond.

M E M O R A N D U M

TO: Jana Englander

FROM: Jerry Strauss

cc:

Date: December 02, 2011

SUBJECT: SCE&G, Canadys, Response to Comments

EPA Comments:

- made editorial changes; added photo of inactive pond
- Revised Sections 1.1, 1.2, 7.2 and 7.3 to reflect that SCE&G is performing geotechnical studies and re-analysis of the stability of its dikes. SCE&G has committed to reconstructing their dikes, as necessary, to meet minimum FoS
- Cover page before each Appendix A document
- Added last page to each checklist answering the 3 questions.

Utility Comments:

SCE&G provided their comments by changing the document itself. We accepted all their changes which addressed: how the ash is handled before discharge to the impoundments or re-sale; their approach to doing more studies and then re-constructing the dikes as necessary; and clarifying the spillway description.