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SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

September 3, 2010

North Carolina Department of Environment and Natural Resources
Solid Waste Section, Division of Waste Management
Asheville Regional Office
2090 US Highway 70
Swannanoa, NC 28778

Attention: Mr. Larry Frost, P.E.
larry.frost@ncdenr.gov

Reference: **Permit to Operate – Modifications Request**
Retired Ash Basin (RAB) – Ash Landfill (Permit No. 36-12)
Duke Energy - Allen Steam Station, Belmont, NC
S&ME Project No. 1356-10-009, Task 3
North Carolina P.E. Firm License No. F-0176

Dear Mr. Frost:

On behalf of Duke Energy, S&ME, Inc. (S&ME) prepared this letter and related information to request modifications to the Permit to Operate (PTO) for Phase 1 (Cells 1 and 2) of the Retired Ash Basin (RAB) Ash Landfill at Duke Energy's Allen Steam Station (Permit No. 36-12).

We are submitting this letter to request modifications to the PTO for Phase 1 (Cells 1 and 2), which include:

- reducing the field and laboratory testing frequency as defined in Appendix II of the Operations Plan; and
- adding sandblast material as an acceptable waste.

BACKGROUND

Duke Energy has completed construction of the RAB Ash Landfill Cell 2 liner system and submitted the construction documentation in support of obtaining the PTO for Phase 1 (Cells 1 and 2).

Cell 1 has been in operations since the issuance of the PTO on December 9, 2009. Prior to the issuance of the PTO for Cell 1, personnel from North Carolina Department of Environment and Natural Resources (NCDENR), Duke Energy, and S&ME discussed and generally agreed upon the following operations monitoring testing criteria:

- Conducting in-place density tests at a frequency of one test per 20,000 square feet per 12-inch thick lift (or approximately one test per 740 cubic yards);
- Developing one moisture-density relationship (standard Proctor test) at a frequency of one test per 15,000 cubic yards of material placed.

Based on observations, testing results, and design analyses presented herein, we are proposing to reduce the field and laboratory testing frequency for landfill operations.

The waste stream is currently permitted for the disposal of combustion products residuals including fly ash, bottom ash, boiler slag, mill rejects, and flue gas desulfurization (FGD) residue generated at the Allen Steam Station. We are requesting the addition of sandblast material generated at the Allen Steam Station as an acceptable waste to the landfill.

MATERIAL PLACEMENT OBSERVATION AND TESTING RESULTS

Presented within this section is a summary of observations during the monitoring of material placement and compaction, as well as tests results for field and laboratory tests performed during Cell 2 subgrade construction and Cell 1 operations.

Observations

Observations were documented in daily field reports by an S&ME engineering technician during Cell 2 subgrade construction and Cell 1 operations. Generally, material was placed in 12-inch thick lifts. Observations and test results consistently indicate that minimum compaction requirements were generally achieved with two (2) passes (one (1) pass consisted of tracking down and back) of a Caterpillar D6N XL dozer followed by a pass of a Caterpillar CS56 vibratory smooth drum roller. Moisture conditioning and dust control were performed utilizing a 4,000-gallon water truck.

Cell 2 Subgrade Construction – Field Density Testing

Generally, the SEFA Group (SEFA), who is also the operator for the landfill, placed moisture conditioned ash to construct the subgrade for Cell 2A. Subgrade construction of Cell 2A was comprised predominantly of moisture conditioned ash coming from a dry ash handling system at the plant. SEFA placed an estimated 85,000 cubic yards of ash during subgrade construction of Cell 2A. One-hundred and fifteen (115) field density tests were performed during Cell 2 subgrade construction resulting in a frequency of approximately one test per 13,300 square feet per 18-inch thick lift (or 740 cubic yards of material placed).

One-hundred and one (101) field density tests met the density and moisture requirements, while fourteen (14) tests did not meet the density and moisture requirements. Five (5) of the failing tests did not initially meet the minimum specified density of 95 percent of the standard Proctor maximum dry density. This indicates that 95 percent of the tests

initially met the density requirements. The in-place densities of the failing tests varied from 89 to 94 percent of the standard Proctor maximum dry density. These areas were reworked, reconditioned, and retested. The retests indicated densities equaling or exceeding 95 percent of the standard Proctor maximum dry density. Twelve (12) of the failing tests did not meet the specified moisture content range within 3 percent of the optimum moisture content. These areas were not reworked provided that the density requirements were achieved, which was the case for nine (9) of the failing tests.

Cell 2 Subgrade Construction – Laboratory Testing

Nine (9) standard Proctor tests were performed on moisture conditioned ash during Cell 2 subgrade construction resulting in a frequency of approximately one test per 9,500 cubic yards of material placed. Maximum dry densities ranged from 70.4 to 75.4 pounds per cubic foot, while optimum moisture contents ranged from 28.2 to 33.5 percent. Laboratory test results are summarized in the attached summary table provided as Table 1 in Attachment 1.

Cell 1 Operations – Field Density Testing

The waste stream for landfill operations is predominantly comprised of moisture conditioned ash coming from a dry ash handling system at the plant. Cell 1 has been in operations since the issuance of the PTO on December 9, 2009. As of the end of July 2010, SEFA hauled approximately 226,795 tons of material based on SEFA's daily records. Assuming an in-place unit weight of 1.2 tons/cubic yard (approximately 90 lbs/cubic foot), approximately 188,996 cubic yards of material were placed. Therefore, two-hundred and fifty-six (256) field density tests are required to meet the specified field testing frequency of one test per 20,000 square feet per 12-inch thick lift. The in-place unit weight was assumed based on in-place density test results and laboratory test results.

Two-hundred and seventy (270) field density tests were performed during Cell 1 operations resulting in a frequency of approximately one test per 18,900 square feet per 12-inch thick lift. Two-hundred and fifty-three (253) field density tests met the density and moisture requirements, while seventeen (17) tests did not initially meet the requirements. Eleven (11) of the failing tests did not meet the minimum specified density of 95 percent of the standard Proctor maximum dry density. This indicates that 96 percent of the tests initially met the density requirements. The in-place densities of the failing tests varied from 86 to 94 percent of the standard Proctor maximum dry density. These areas were reworked, reconditioned, and retested. The retests indicated densities equaling or exceeding 95 percent of the standard Proctor maximum dry density. Eight (8) of the failing tests did not meet the specified moisture content range within 5 percent of the optimum moisture content. These areas were not reworked provided that the density requirements were achieved, which was the case for six (6) of the failing tests. Field density test results for Cell 1 operations are provided as Attachment 2. Field density test results are summarized in the attached summary table provided as Table 2 in Attachment 1.

Cell 1 Operations – Laboratory Testing

Fifteen (15) standard Proctor tests were performed on moisture conditioned ash during Cell 1 operations resulting in a frequency of approximately one test per 12,600 cubic yards of material placed. Maximum dry densities ranged from 68.0 to 76.6 pounds per cubic foot, while optimum moisture contents ranged from 28.0 to 36.5 percent. Laboratory test results are summarized in the attached summary table provided as Table 1 in Attachment 1.

Testing Summary

To date, an estimated 275,000 cubic yards of material have been placed between Cell 2A subgrade construction and Cell 1 operations. Three-hundred and eighty-five (385) field density tests have been performed with three-hundred and fifty-four (354) tested locations meeting the density and moisture requirements, and thirty-one (31) tests not meeting the requirements. Sixteen (16) of these failing tests did not meet the specified density of 95 percent of the standard Proctor maximum dry density, and three (3) of these failing tests did not meet a density of 90 percent of the standard Proctor maximum dry density. These areas were reworked, reconditioned, and retested.

TESTING FREQUENCY MODIFICATION

Based on previous discussions with NCDENR, we understand that the objective of monitoring and testing during the waste placement is to evaluate if the as constructed waste material properties are consistent with waste material properties assumed during the design analyses. To support an evaluation of as-constructed waste materials properties, S&ME conducted condsolidated-undrained (CU) triaxial shear testing (ASTM D4767) on bulk ash samples remolded at 90 and 95 percent compaction based on an average of standard Proctor tests performed throughout landfill subgrade construction (72.0 pounds per cubic foot maximum dry density at 31.1 percent moisture content). Triaxial shear testing was performed under the confining stress range anticipated throughout the life of the landfill.

Triaxial shear test results indicated that for ash samples compacted to a relative density of 95 percent, the effective friction angle (Φ') was 33.8 degrees. Triaxial shear test results are provided as Attachment 3. The effective friction angle (Φ') assumed for design analyses was 34.0 degrees. Therefore, the laboratory testing supports the slope stability calculations and indicates that samples compacted to 95 percent relative density generally meet the established material strength and slope stability criteria. Additional triaxial shear tests were performed, and results indicated that for samples compacted to 90 percent relative density, the effective friction angle (Φ') was 26.0 degrees.

S&ME performed additional slope stability analyses to back-calculate a minimum effective friction angle (Φ') of the compacted ash to provide a safety factor greater than or equal to 1.5 during static conditions and a safety factor greater than or equal to 1.0 during pseudo-static conditions. The results of the slope stability analyses are provided as Attachment 4. Based on the slope stability analyses, a minimum effective friction angle (Φ') of 27.0 degrees meets the design criteria in both the static and pseudo-static conditions. Slope stability analyses also indicate that both 26.0 and 33.8 degrees meet

the design criteria of a safety factor greater than or equal to 1.5 for static conditions, and a safety factor greater than or equal to 1.0 for pseudo-static conditions.

Field observations and testing results indicate that compaction equal to or exceeding 95 percent of the standard Proctor maximum dry density has been routinely achieved by working the ash with ordinary compaction methods (an average of approximately 96 percent of field density tests performed to date). Additionally, over 99 percent of field density tests performed to date have resulted in relative densities equal to or exceeding 90 percent of the standard Proctor maximum dry density. Based on our observations and the results of our testing and design analyses we propose the following testing criteria:

- Conducting in-place density tests at a frequency of one test per 8,000 cubic yards (or one test per 216,000 square feet per 12-inch thick lift);
- Developing one moisture-density relationship (standard Proctor test) at a frequency of one test per 50,000 cubic yards of material placed.

ADDITIONAL MATERIAL REQUEST MODIFICATION

We are requesting that sandblast material be added as an acceptable waste to the landfill. The sandblast material is generated on-site at Allen Steam Station, and it is anticipated that less than twenty (20) cubic yards of sandblast material will be annually disposed of in the landfill. The waste stream will still predominantly be comprised of moisture conditioned ash coming from a dry ash handling system. Analytical laboratory test results for the sandblast material are provided as Attachment 5.

CONCLUSION

Both of the proposed modifications are incorporated in the revised Operations Plan, which is provided as Attachment 6. Based on our observations, testing, and analyses performed to date, we make the following conclusions:

- Monitoring and testing frequencies during Cell 1 operations met the requirements specified in the approved Operations Plan;
- As-constructed in-place material properties are consistent with design criteria;
- We propose to reduce the field and laboratory in-place operations testing frequency based on the results of previous construction performance testing, and engineering analyses; and
- We request sandblast material be added as an acceptable waste.

CLOSING

We appreciate your cooperation and we believe that the proposed plan revisions and discussion herein address your interests. Please contact us at your earliest convenience if you have any questions or need additional information.

Respectfully submitted,

S&ME, Inc.

NORTH CAROLINA PROFESSIONAL SEAL 032153 ENGINEER KENNETH R. DALY

9/3/10

Kyle Baucom, E.I.
Staff Professional

Kenneth R. Daly, P.E.
Senior Project Engineer
Engineer of Record

Jason S. Reeves, P.E.
Senior Project Engineer
Senior Reviewer

Attachments: 1: Summary Tables
2: Cell 1 Operations Field Density Test Results
3: Triaxial Shear Strength Test Results
4: Global Slope Stability Calculation Package
5: Sandblast Material Analytical Laboratory Test Results
6: Operations Plan, Revised September 3, 2010

Cc: Ed Mussler, NCDENR, Division of Waste Management - Solid Waste Section
Steve McEvoy, NCDENR, Division of Land Resources - Land Quality Section - Dam Safety Program
Ted Manes, Duke Energy
Andy Tinsley, Duke Energy
Jeff Newell, Duke Energy
Chris Ussery, Duke Energy
Don Scruggs, Duke Energy

ATTACHMENT 1

Summary Tables

TABLE 1: LABORATORY TESTING SUMMARY TABLE

Construction Period	Sample No.[1]	USCS Classification	Natural Moisture Content (ASTM D2216)	% Finer No. 200 (ASTM D422)	Atterberg Limits (ASTM D4318)		Proctor Data (ASTM D698)	
					LL	PI	Max. Dry Density (pcf)	Opt. Moisture Content (%)
Cell 2A Subgrade	SG-1	ML	29.8%	86.5%	NP[2]	NP[2]	70.4	33.0%
	SG-2	ML	25.1%	85.9%	NP	NP	70.4	33.0%
	SG-3	ML	35.3%	88.9%	NP	NP	75.4	30.4%
	SG-4	ML	19.8%	87.7%	NP	NP	74.7	29.4%
	SG-5	ML	22.3%	88.9%	NP	NP	73.2	28.2%
	SG-6	ML	32.8%	89.4%	NP	NP	70.9	32.1%
	SG-8	ML	24.5%	89.3%	NP	NP	72.1	30.4%
	SG-10	ML	24.3%	89.5%	NP	NP	71.6	31.0%
	SG-12	ML	33.5%	87.4%	NP	NP	70.6	33.5%
Cell 1 Operations	S-1						72.6	32.2%
	S-2						72.7	31.5%
	S-3						73.6	29.8%
	S-4						76.6	28.0%
	S-5						73.3	29.9%
	S-6						69.3	34.0%
	S-7						69.3	34.4%
	S-8						68.0	36.5%
	S-9						70.8	33.4%
	S-10						71.8	31.8%
	S-11						69.8	35.2%
	S-12						72.6	32.0%
	S-13						72.2	30.5%
	S-14						72.8	31.9%
	S-15						73.4	31.1%

[1] All samples were bulk samples of moisture conditioned ash

[2] NP = non-plastic

Average:	72.0	31.8%
Standard Deviation:	2.0	2.1%

100% Compaction	94.90	pcf
95% Compaction	90.16	pcf

TABLE 2: FIELD DENSITY TESTING FREQUENCY SUMMARY TABLE

Construction Period	Required Testing Frequency	Tests Required[1]	Total Tests Performed	Passing Tests Performed	Failing Tests Performed	Failing Tests Due to Moisture Content Only[2]	Failing Tests Due to Density Only[3]	Failing Tests Due to Both
Cell 2A Subgrade	1 test per acre per 18-inch thick lift	36	115	101	14	9	2	3
Cell 1 Operations	1 test per 20,000 sq. ft. per 12-inch thick lift	256	270	253	17	6	9	2

[1] Based on an estimated 85,000 cubic yards placed during Cell 2A subgrade construction and 190,000 cubic yards during Cell 1 Operations

[2] Within 5 percent of the optimum moisture content for Cell 2A subgrade construction; and within 3 percentof the optimum moisture content for Cell 1 operations

[3] Minimum of 95 percent of the standard Proctor maximum dry density

ATTACHMENT 2

Cell 1 Operations Field Density Test Results

Summary of Density Test Results

Page No. 1
Report Date: August 12, 2010
Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1
Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
1	12/23/09	D 2937	**72.4**	**24.5**	71.7	20.7	D 698	SG-5	75.0	28.0	95	**96**	A2	-9'
2	12/23/09	D 2937	**73.3**	**25.0**			D 698		75.0	28.0	95	**98**	B2	-9'
3	12/30/09	D 2937	**72.2**	**28.5**	70.3	23.5	D 698	SG-5	74.0	28.0	95	**98**	A2	-8'
4	12/30/09	D 2937	**72.4**	**31.9**			D 698	SG-5	74.0	28.0	95	**98**	B2	-8'
5	12/30/09	D 2937	**72.9**	**29.2**			D 698	SG-5	74.0	28.0	95	**99**	A2	-7'
6	12/30/09	D 2937	**72.0**	**28.0**			D 698	SG-5	74.0	28.0	95	**97**	B2	-7'
7	01/04/10	D 2937	**68.5**	**25.5**	67.4	23.8	D 698	SG-8	72.0	30.0	95	**95**	A2	-6'
8	01/04/10	D 2937	**72.3**	**28.0**	70.4	24.5	D 698	SG-5	73.2	28.2	95	**99**	B2	-6'
9	01/04/10	D 2937	**69.9**	**26.7**			D 698	SG-8	72.0	30.0	95	**97**	A2	-5'
10	01/04/10	D 2937	**70.9**	**26.2**			D 698	SG-5	73.2	28.2	95	**97**	B2	-5'
11	01/06/10	D 2937	**68.7**	**27.6**	66.0	23.1	D 698	SG-8	72.0	30.0	95	**95**	A2	-4'
12	01/06/10	D 2937	**68.9**	**26.4**			D 698	SG-8	72.0	30.0	95	**96**	B2	-4'
13	01/06/10	D 2937	**69.5**	**29.0**			D 698	SG-8	72.0	30.0	95	**97**	A2	-3'
14	01/06/10	D 2937	**69.2**	**28.5**			D 698	SG-8	72.0	30.0	95	**96**	B2	-3'
15	01/06/10	D 2937	**72.4**	**30.2**			D 698	SG-8	72.0	30.0	95	**100**	A2	-2'
16	01/06/10	D 2937	**68.1**	**26.1**			D 698	SG-8	72.0	30.0	95	**95**	B2	-2'
17	01/06/10	D 2937	**71.9**	**25.8**	70.7	20.5	D 698	SG-5	74.0	28.0	95	**97**	A2	-1'
18	01/06/10	D 2937	**72.9**	**26.8**			D 698	SG-5	74.0	28.0	95	**98**	B2	-1'
19	01/11/10	D 2937	**71.9**	**27.1**	69.9	24.4	D 698	SG-5	73.3	28.0	95	**98**	B1	-5'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

Kyle Baucom/S&ME, Inc.
Name (Technical Responsibility)

Signature

Staff Professional
Position

S&ME, Inc. 9751 So. Pine Blvd., Charlotte, NC 28273 (704) 523-4726 Fax (704) 525-3953

S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
20	01/11/10	D 2937	**71.3**	**24.3**			D 698	SG-5	73.3	28.0	95	**97**	B1	-4'
21	01/11/10	D 2937	**72.0**	**25.8**			D 698	SG-5	73.3	28.0	95	**98**	B1	-3'
22	01/11/10	D 2937	**72.3**	**27.6**			D 698	SG-5	73.3	28.0	95	**99**	B1	-2'
23	01/11/10	D 2937	**67.7**	**28.6**	66.9	23.4	D 698	SG10	71.5	30.5	95	**95**	B1	-1'
24	01/11/10	D 2937	**68.6**	**29.2**			D 698	SG10	71.5	30.5	95	**96**	B1	SG
25	01/12/10	D 2937	**71.3**	**32.8**	68.9	28.4	D 698	SG10	71.6	31.0	95	**100**	C1	-9'
26	01/12/10	D 2937	**69.0**	**31.8**			D 698	SG10	71.6	31.0	95	**96**	C2	-9'
27	01/12/10	D 2937	**70.9**	**32.0**			D 698	SG10	71.6	31.0	95	**99**	C1	-8'
28	01/12/10	D 2937	**71.6**	**33.1**			D 698	SG10	71.6	31.0	95	**100**	C2	-8'
29	01/13/10	D 2937	**68.3**	**24.3**	66.6	21.6	D 698	SG-5	73.2	28.5	95	**93 ***	C1	-7'
30	01/13/10	D 2937	**69.3**	**25.3**			D 698		73.2	28.5	95	**95**	C2	-7'
31	01/14/10	D 2937	**70.3**	**25.1**	68.1	22.5	D 698	SG-5	73.2	28.2	95	**96**	Retest of #29	-7'
32	01/14/10	D 2937	**70.5**	**26.1**			D 698	SG-5	73.2	28.2	95	**96**	C1	-6'
33	01/14/10	D 2937	**71.6**	**28.3**			D 698	SG-5	73.2	28.2	95	**98**	C2	-6'
34	01/14/10	D 2937	**71.1**	**32.3**	69.1	27.2	D 698	SG10	71.5	30.5	95	**99**	C1	-5'
35	01/14/10	D 2937	**70.5**	**31.4**			D 698	SG10	71.5	30.5	95	**99**	C2	-5'
36	01/15/10	D 2937	**68.7**	**29.5**	67.7	24.1	D 698	SG10	72.0	31.0	95	**95**	C1	-4'
37	01/15/10	D 2937	**68.2**	**29.0**			D 698	SG10	72.0	31.0	95	**95**	C2	-4'
38	01/15/10	D 2937	**70.3**	**31.5**	68.5	25.3	D 698	SG-5	73.2	28.2	95	**96**	C1	-3'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

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Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
39	01/15/10	D 2937	**69.8**	**30.9**			D 698	SG-5	73.2	28.2	95	**95**	C2	-3'
40	01/16/10	D 2937	**69.3**	**28.0**	68.5	26.1	D 698	SG-5	73.2	28.5	95	**95**	C1	-2'
41	01/16/10	D 2937	**69.5**	**28.8**			D 698	SG-5	73.2	28.5	95	**95**	C2	-2'
42	01/28/10	D 2937	**69.5**	**30.2**	66.1	24.4	D 698	SG10	71.5	30.8	95	**97**	C1	-1'
43	01/28/10	D 2937	**69.0**	**28.9**			D 698	SG10	71.5	30.8	95	**96**	C2	-1'
44	01/28/10	D 2937	**69.9**	**28.4**			D 698	SG-5	73.2	28.2	95	**95**	C1	SG
45	01/28/10	D 2937	**70.5**	**30.0**			D 698	SG-5	73.2	28.2	95	**96**	C2	SG
46	01/29/10	D 2937	**72.5**	**32.3**	68.6	25.6	D 698	SG-8	72.0	29.5	95	**100+**	D1	-9'
47	01/29/10	D 2937	**73.7**	**29.6**	68.5	23.9	D 698	SG-3	75.2	30.0	95	**98**	D2	-9'
48	01/29/10	D 2937	**72.0**	**30.9**			D 698	SG-8	72.0	29.5	95	**100**	D1	-8
49	01/29/10	D 2937	**72.9**	**28.3**			D 698	SG-3	75.2	30.0	95	**97**	D2	-8'
50	02/08/10	D 2937	**70.5**	**26.7**	68.5	21.8	D 698	SG-5	73.3	28.5	95	**96**	D1	-7'
51	02/08/10	D 2937	**69.4**	**25.0**			D 698	SG-5	73.3	28.5	95	**95**	D2	-7'
52	02/08/10	D 2937	**70.4**	**27.4**			D 698	SG-5	73.3	28.5	95	**96**	D1	-6'
53	02/08/10	D 2937	**70.7**	**29.2**			D 698	SG-5	73.3	28.5	95	**97**	D2	-6'
54	02/08/10	D 2937	**71.3**	**29.9**	69.5	23.9	D 698	SG-8	72.0	29.2	95	**99**	D1	-5'
55	02/08/10	D 2937	**70.6**	**28.9**			D 698	SG-8	72.0	29.2	95	**98**	D2	-5'
56	02/10/10	D 2937	**71.0**	**28.4**	66.4	22.0	D 698	SG-5	73.2	28.2	95	**97**	D1	-4'
57	02/10/10	D 2937	**74.7**	**30.2**	71.5	24.7	D 698	SG-4	75.0	29.5	95	**100**	D2	-4'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

Kyle Baucom/S&ME, Inc.

Name (Technical Responsibility)

Signature

Staff Professional

Position

S&ME, Inc. 9751 So. Pine Blvd., Charlotte, NC 28273 (704) 523-4726 Fax (704) 525-3953

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
58	02/10/10	D 2937	**73.3**	**28.9**			D 698	SG-4	75.0	29.5	95	**98**	D1	-3'
59	02/10/10	D 2937	**70.5**	**27.5**			D 698	SG-5	73.2	28.2	95	**96**	D2	-3'
60	02/16/10	D 2937	**69.7**	**25.2**	69.2	25.2	D 698	SG-5	73.2	28.2	95	**95**	D1	-2'
61	02/16/10	D 2937	**70.4**	**26.2**			D 698	SG-5	73.2	28.2	95	**96**	D2	-2'
62	02/16/10	D 2937	**68.8**	**24.2**			D 698	SG-5	73.2	28.2	95	**94 ***	D1	-1'
63	02/16/10	D 2937	**68.2**	**23.9**			D 698	SG-5	73.2	28.2	95	**93 ***	D2	-1'
64	02/17/10	D 2937	**70.1**	**29.2**	65.2	23.3	D 698	SG-5	73.3	28.5	95	**96**	Retest of #62	-1'
65	02/17/10	D 2937	**70.4**	**30.1**			D 698	SG-5	73.3	28.5	95	**96**	Retest of #63	-1'
66	02/17/10	D 2937	**71.7**	**31.4**	68.7	24.4	D 698	SG-5	74.0	32.0	95	**97**	D1	SG
67	02/17/10	D 2937	**71.2**	**30.5**			D 698	S-1	74.0	32.0	95	**96**	D2	SG
68	02/17/10	D 2937	**69.5**	**27.2**			D 698	SG-5	73.3	28.5	95	**95**	E1	-9
69	02/17/10	D 2937	**70.1**	**28.6**			D 698	SG-5	73.3	28.5	95	**96**	E2	-9'
70	02/19/10	D 2937	**69.6**	**24.6**	67.4	24.6	D 698	SG-5	73.2	28.2	95	**95**	E1	-8'
71	02/19/10	D 2937	**70.5**	**25.6**			D 698	SG-5	73.2	28.2	95	**96**	E2	-8'
72	02/19/10	D 2937	**71.5**	**27.2**			D 698	SG-5	73.2	28.2	95	**98**	E1	-7'
73	02/19/10	D 2937	**71.0**	**27.0**			D 698	SG-5	73.2	28.2	95	**97**	E2	-7'
74	02/23/10	D 2937	**70.6**	**25.3**	67.5	21.8	D 698	SG-5	73.3	28.5	95	**96**	E1	-6'
75	02/23/10	D 2937	**71.0**	**26.9**			D 698	SG-5	73.3	28.5	95	**97**	E2	-6'
76	02/23/10	D 2937	**70.3**	**31.1**	68.7	24.9	D 698	S-1	73.0	32.5	95	**96**	E1	-5'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

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Position

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
77	02/23/10	D 2937	**70.9**	**32.3**			D 698	S-1	73.0	32.5	95	**97**	E2	-5'
78	02/23/10	D 2937	**69.8**	**30.6**			D 698	S-1	73.0	32.5	95	**96**	E1	-4'
79	02/23/10	D 2937	**69.3**	**28.8**			D 698	S-1	73.0	32.5	95	**95**	E2	-4'
80	02/25/10	D 2937	**70.5**	**26.3**	66.7	19.6	D 698	SG-5	73.2	28.0	95	**96**	E1	-3'
81	02/25/10	D 2937	**69.4**	**31.5**	66.5	26.4	D 698	S-1	70.4	33.0	95	**99**	E2	-3'
82	02/25/10	D 2937	**70.0**	**32.0**			D 698	S-1	70.4	33.0	95	**99**	E1	-2'
83	02/25/10	D 2937	**70.8**	**33.3**			D 698	S-1	70.4	33.0	95	**100+**	E2	-2'
84	03/01/10	D 2937	**70.7**	**30.9**	65.4	21.6	D 698	SG10	71.6	30.8	95	**99**	E1	-1'
85	03/01/10	D 2937	**68.2**	**29.0**			D 698	S-10	71.6	30.8	95	**95**	E2	-1'
86	03/01/10	D 2937	**69.4**	**25.0**	68.2	25.0	D 698	SG-5	73.2	28.2	95	**95**	E1	SG
87	03/01/10	D 2937	**70.2**	**27.2**			D 698	SG-5	73.2	28.2	95	**96**	E2	SG
88	03/01/10	D 2937	**71.1**	**28.6**			D 698	SG-5	73.2	28.2	95	**97**	F1	-9'
89	03/01/10	D 2937	**71.3**	**31.8**			D 698	SG10	71.6	30.8	95	**100**	F2	-9'
90	03/04/10	D 2937	**71.5**	**26.6**	69.7	23.1	D 698	SG-5	73.2	27.5	95	**98**	F1	-8'
91	03/04/10	D 2937	**71.6**	**27.1**			D 698	SG-5	73.2	27.5	95	**98**	F2	-8'
92	03/04/10	D 2937	**70.4**	**25.3**			D 698	SG-5	73.2	27.5	95	**96**	F1	-7'
93	03/04/10	D 2937	**71.4**	**26.0**			D 698	SG-5	73.2	27.5	95	**97**	F2	-7'
94	03/08/10	D 2937	**70.4**	**26.9**	67.4	20.6	D 698	SG-5	73.2	28.2	95	**96**	F1	-6'
95	03/08/10	D 2937	**71.1**	**28.4**			D 698	SG-5	73.2	28.2	95	**97**	F2	-6'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
96	03/17/10	D 2937	**72.1**	**26.0**	70.2	22.2	D 698	SG-5	73.2	27.8	95	**98**	F1	-5'
97	03/17/10	D 2937	**71.6**	**26.2**			D 698	SG-5	73.2	27.8	95	**98**	F2	-5'
98	03/17/10	D 2937	**72.1**	**27.0**			D 698	SG-5	73.2	27.8	95	**98**	F1	-4'
99	03/17/10	D 2937	**71.8**	**25.3**			D 698	SG-5	73.2	27.8	95	**98**	F2	-4'
100	03/25/10	D 2937	**71.8**	**27.8**	70.2	25.2	D 698	SG-5	73.2	28.2	95	**98**	A3	-8'
101	03/25/10	D 2937	**71.5**	**26.9**			D 698	SG-5	73.2	28.2	95	**98**	A4	-8'
102	03/25/10	D 2937	**70.0**	**24.7**			D 698	SG-5	73.2	28.2	95	**96**	A5	-8'
103	03/31/10	D 2937	**72.2**	**27.4**	66.3	21.3	D 698	S-1	75.0	30.0	95	**96**	A3	-1'
104	03/31/10	D 2937	**70.0**	**28.3**	67.2	25.0	D 698	S-2	73.0	31.5	95	**96**	A4	-1'
105	03/31/10	D 2937	**69.3**	**27.2**			D 698	S-2	73.0	31.5	95	**95**	A5	-1'
106	03/31/10	D 2937	**69.9**	**27.8**			D 698	S-2	73.0	31.5	95	**96**	B3	-8'
107	03/31/10	D 2937	**68.7**	**26.7**			D 698	S-2	73.0	31.5	95	**94 ***	B5	-8'
108	03/31/10	D 2937	**69.7**	**27.3**			D 698	S-2	73.0	31.5	95	**95**	Retest of #107	-8'
109	04/07/10	D 2937	**69.9**	**26.5**	65.7	26.5	D 698	S-2	72.7	31.5	95	**96**	B-3	-6'
110	04/07/10	D 2937	**70.2**	**27.1**			D 698	S-2	72.7	31.5	95	**97**	B-4	-6'
111	04/07/10	D 2937	**71.0**	**27.7**			D 698	S-2	72.7	31.5	95	**98**	B-5	-6'
112	04/13/10	D 2937	**72.5**	**28.6**	67.9	21.0	D 698	S-2	73.0	31.0	95	**99**	Cell 1B B3	-4'
113	04/13/10	D 2937	**73.9**	**31.2**			D 698	S-2	73.0	31.0	95	**100+**	Cell 1B B4	-4'
114	04/13/10	D 2937	**72.8**	**26.1**			D 698	S-2	73.0	31.0	95	**100**	Cell 1B B5	-4'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

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Position

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
115	04/19/10	D 2937	**71.5**	**26.1**	67.3	21.3	D 698	S-2	74.0	31.0	95	**97**	B3	-2'
116	04/19/10	D 2937	**72.1**	**26.6**			D 698	S-2	74.0	31.0	95	**97**	B4	-2'
117	04/19/10	D 2937	**71.9**	**26.0**			D 698	S-2	74.0	31.0	95	**97**	B5	-2'
118	04/19/10	D 2937	**72.6**	**27.6**			D 698	S-2	74.0	31.0	95	**98**	C3	-8'
119	04/19/10	D 2937	**72.1**	**26.9**			D 698	S-2	74.0	31.0	95	**97**	C5	-8'
120	05/04/10	D 2937	**68.9**	**27.9**	62.6	20.3	D 698	S-3	73.0	28.0	95	**94 ***	B5	SG
121	05/04/10	D 2937	**71.2**	**32.0**			D 698	S-3	73.0	28.0	95	**98**	C3	-6'
122	05/04/10	D 2937	**69.7**	**30.9**			D 698	S-3	73.0	28.0	95	**95**	C4	-6'
123	05/04/10	D 2937	**69.0**	**28.5**			D 698	S-3	73.0	28.0	95	**95**	C5	-6'
124	05/04/10	D 2937	**69.4**	**28.4**			D 698	S-3	73.0	28.0	95	**95**	Retest of #120	SG
125	05/12/10	D 2937	**70.8**	**28.2**	66.8	20.3	D 698	S-5	73.3	29.9	95	**97**	Cell 1B B-3	-1'
126	05/12/10	D 2937	**69.5**	**27.1**			D 698	S-5	73.3	29.9	95	**95**	Cell 1B B-3	SG
127	05/12/10	D 2937	**69.6**	**28.8**			D 698	S-5	73.3	29.9	95	**95**	Cell 1B B-4	-1'
128	05/12/10	D 2937	**70.0**	**27.5**			D 698	S-5	73.3	29.9	95	**96**	Cell 1B B-4	SG
129	05/12/10	D 2937	**70.7**	**29.0**			D 698	S-5	73.3	29.9	95	**96**	Cell 1B B-5	-1'
130	05/12/10	D 2937	**71.0**	**31.1**			D 698	S-5	73.3	29.9	95	**97**	Cell 1B C-3	-7'
131	05/12/10	D 2937	**70.4**	**29.5**			D 698	S-5	73.3	29.9	95	**96**	Cell 1B C-4	-7'
132	05/12/10	D 2937	**71.6**	**32.2**			D 698	S-5	73.3	29.9	95	**98**	Cell 1B C-5	-7
133	05/12/10	D 2937	**70.5**	**31.0**			D 698	S-5	73.3	29.9	95	**96**	Cell 1B D-3	-9'

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All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
134	05/13/10	D 2937	**70.5**	**29.6**	64.8	19.9	D 698	S-5	73.2	29.0	95	**96**	Cell 1B D-3	-8'
135	05/13/10	D 2937	**70.0**	**27.0**			D 698	S-5	73.2	29.0	95	**96**	Cell 1B D-4	-9'
136	05/13/10	D 2937	**69.5**	**26.1**			D 698	S-5	73.2	29.0	95	**95**	Cell 1B D-5	-9'
137	05/13/10	D 2937	**70.2**	**28.1**			D 698	S-5	73.2	29.0	95	**96**	Cell 1B C-3	-5'
138	05/13/10	D 2937	**71.1**	**30.2**			D 698	S-5	73.2	29.0	95	**97**	Cell 1B C-4	-5'
139	05/13/10	D 2937	**70.1**	**28.5**			D 698	S-5	73.2	29.0	95	**96**	Cell 1B C-5	-5'
140	05/13/10	D 2937	**71.3**	**31.1**			D 698	S-5	73.2	29.0	95	**97**	Cell 1B D-4	-8'
141	05/13/10	D 2937	**72.1**	**32.1**			D 698	S-5	73.2	29.0	95	**98**	Cell 1B D-5	-8'
142	05/18/10	D 2937	**69.1**	**27.2**	65.7	22.0	D 698	S-2	73.0	31.0	95	**95**	Cell 1B D3	-7'
143	05/18/10	D 2937	**69.3**	**28.8**			D 698	S-2	73.0	31.0	95	**95**	Cell 1B D4	-7'
144	05/18/10	D 2937	**69.8**	**30.2**			D 698	S-2	73.0	31.0	95	**96**	Cell 1B D5	-7'
145	05/18/10	D 2937	**70.5**	**32.6**			D 698	S-1	72.6	32.2	95	**97**	Cell 1B C3	-4'
146	05/18/10	D 2937	**70.1**	**30.6**			D 698	S-1	72.6	32.2	95	**97**	Cell 1B C4	-4'
147	05/18/10	D 2937	**70.7**	**32.9**			D 698	S-1	72.6	32.2	95	**97**	Cell 1B C5	-4'
148	05/18/10	D 2937	**70.4**	**31.0**			D 698	S-1	72.6	32.2	95	**97**	Cell 1B C3	-3'
149	05/18/10	D 2937	**71.6**	**33.8**			D 698	S-1	72.6	32.2	95	**99**	Cell 1B C4	-3'
150	05/18/10	D 2937	**70.8**	**33.0**			D 698	S-1	72.6	32.2	95	**98**	Cell 1B C5	-3'
151	05/19/10	D 2937	**71.2**	**29.2**			D 698	S-5	73.3	30.0	95	**97**	Cell 1B C3	-2'
152	05/19/10	D 2937	**73.1**	**33.0**			D 698	S-5	73.3	30.0	95	**100**	Cell 1B C4	-2'

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Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

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Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
153	05/19/10	D 2937	**70.6**	**28.3**			D 698	S-5	73.3	30.0	95	**96**	Cell 1B C5	-2'
154	05/19/10	D 2937	**70.3**	**27.9**			D 698	S-5	73.3	30.0	95	**96**	Cell 1B D3	-6
155	05/19/10	D 2937	**71.0**	**28.5**			D 698	S-5	73.3	30.0	95	**97**	Cell 1B D4	-6'
156	05/19/10	D 2937	**69.4**	**26.4**			D 698	S-5	73.3	30.0	95	**95**	Cell 1B D5	-6'
157	05/24/10	D 2937	**73.0**	**31.0**	67.7	24.0	D 698	S-5	73.2	30.0	95	**100**	Cell 1B C3	-1'
158	05/24/10	D 2937	**73.5**	**31.5**			D 698	S-5	73.2	30.0	95	**100**	Cell 1B C4	-1'
159	05/24/10	D 2937	**71.0**	**28.4**			D 698	S-5	73.2	30.0	95	**97**	Cell 1B C5	-1'
160	05/24/10	D 2937	**71.8**	**29.8**			D 698		73.2	30.0	95	**98**	Cell 1B C3	
161	05/24/10	D 2937	**70.8**	**27.5**			D 698	S-5	73.2	30.0	95	**97**	Cell 1B C4	SG
162	05/24/10	D 2937	**71.3**	**28.1**			D 698	S-5	73.2	30.0	95	**97**	Cell 1B C5	SG
163	06/02/10	D 2937	**69.7**	**32.5**	66.8	27.6	D 698	S-2	73.0	32.0	95	**95**	Cell 1B D5	-5'
164	06/02/10	D 2937	**70.3**	**32.9**			D 698	S-2	73.0	32.0	95	**96**	Cell 1B D4	-5'
165	06/02/10	D 2937	**70.2**	**32.4**			D 698	S-2	73.0	32.0	95	**96**	Cell 1B D3	-5'
166	06/04/10	D 2937	**72.0**	**33.7**	68.2	27.5	D 698	S-1	72.6	32.2	95	**99**	Cell 1B E5	-9'
167	06/04/10	D 2937	**70.9**	**31.7**			D 698	S-1	72.6	32.2	95	**98**	Cell 1B E4	-9'
168	06/04/10	D 2937	**69.9**	**29.6**			D 698	S-1	72.6	32.2	95	**96**	Cell 1B E3	-9'
169	06/08/10	D 2937	**64.8**	**28.7**	63.0	25.2	D 698	SG10	71.5	30.5	95	**91 ***	Cell 1B D3	-4'
170	06/08/10	D 2937	**68.2**	**31.2**			D 698	SG10	71.5	30.5	95	**95**	Cell 1B D4	-4'
171	06/08/10	D 2937	**68.7**	**31.5**			D 698	SG10	71.5	30.5	95	**96**	Cell 1B D5	-4'

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

Kyle Baucom/S&ME, Inc.

Name (Technical Responsibility)

Signature

Staff Professional

Position

S&ME, Inc. 9751 So. Pine Blvd., Charlotte, NC 28273 (704) 523-4726 Fax (704) 525-3953

S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
172	06/08/10	D 2937	**67.8**	**30.3**			D 698	SG10	71.5	30.5	95	**95**	Cell 1B E5	-8'
173	06/08/10	D 2937	**69.3**	**32.0**	65.7	24.7	D 698	S-1	72.5	31.5	95	**96**	Cell 1B E4	-8'
174	06/08/10	D 2937	**67.1**	**30.3**			D 698	S-1	72.5	31.5	95	**93 ***	Cell 1B E3	-8'
175	06/09/10	D 2937	**68.2**	**30.6**	62.3	21.3	D 698	SG10	71.6	31.0	95	**95**	Retest of #169	-4'
176	06/09/10	D 2937	**68.7**	**31.1**			D 698	SG10	71.6	31.0	95	**96**	Retest of #174, Cell 1B	-8'
177	06/23/10	D 2937	**70.5**	**27.4**	67.6	28.1	D 698	SG-8	72.1	30.4	95	**98**	Grid 3E Ref. NW corner 20' South 46' East	-3
178	06/23/10	D 2937	**69.9**	**26.8**			D 698	SG-8	72.1	30.4	95	**97**	Grid 3E Ref. NW corner 20' South 125' East	-3
179	06/23/10	D 2937	**68.8**	**29.6**			D 698	SG-8	72.1	30.4	95	**95**	Grid 3E Ref. NW corner 20' South 200' East	-3
180	06/23/10	D 2937	**72.6**	**26.3**	70.6	27.6	D 698	S-3	73.6	29.8	95	**99**	Grid 3E Ref. NW corner 20' South 275' East	-3
181	06/23/10	D 2937	**69.3**	**26.3**			D 698	S-3	72.1	30.4	95	**96**	Grid 3E Ref. NW corner 70' South 50' East	-3
182	06/23/10	D 2937	**72.2**	**27.2**			D 698	S-3	73.6	29.8	95	**98**	Grid 3E Ref. NW corner 70' South 95' East	-3
183	06/23/10	D 2937	**71.9**	**26.9**			D 698	S-3	73.6	29.8	95	**98**	Ref. NW corner Cell 1 @ 3E 70' South 150' East	-3
184	06/23/10	D 2937	**68.4**	**27.1**			D 698	SG-8	72.1	30.4	95	**95**	Ref. NW corner Cell 1 @ 3E 70' South 225' East	-3
185	06/28/10	D 2937	**69.3**	**30.2**	68.7	24.2	D 698	S-1	72.6	32.2	95	**95**	E5 NW corner 60' S 20' E	-2
186	06/28/10	D 2937	**70.3**	**27.3**			D 698	S-1	72.6	32.2	95	**97**	E4 NE corner 60' S 50' W	-2
187	06/28/10	D 2937	**68.7**	**28.4**			D 698	S-1	72.6	32.2	95	**95**	E4 NW corner 60' S 30' E	-2
188	06/28/10	D 2937	**68.9**	**28.2**			D 698	S-1	72.6	32.2	95	**95**	E3 NE corner 60' S 50' W	-2
189	07/07/10	D 2937	**61.2**	**30.0**	65.4	24.5	D 698		71.0	33.1	95	**86 ***	D3	-3
190	07/07/10	D 2937	**62.9**	**29.8**			D 698		71.0	33.1	95	**89 ***	D4	-3

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

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Signature

Staff Professional

Position

S&ME, Inc. 9751 So. Pine Blvd., Charlotte, NC 28273 (704) 523-4726 Fax (704) 525-3953

S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
191	07/07/10	D 2937	**72.3**	**25.4**			D 698	S-3	73.6	29.8	95	**98**	D5	-3
192	07/07/10	D 2937	**70.2**	**21.7**			D 698	SG10	71.2	30.0	95	**99**	E3	-7
193	07/07/10	D 2937	**69.8**	**24.6**			D 698	S-3	73.6	29.8	95	**95**	E4	-7
194	07/07/10	D 2937	**70.4**	**25.8**			D 698	S-3	73.6	29.8	95	**96**	E5	-7
195	07/07/10	D 2937	**71.4**	**28.0**	68.7	13.5	D 698	S-3	73.6	29.8	95	**97**	D3	-2
196	07/07/10	D 2937	**66.4**	**21.3**			D 698	SG10	71.2	30.0	95	**93 ***	D4	-2
197	07/07/10	D 2937	**67.7**	**25.8**	60.3	21.3	D 698	SG10	71.2	30.0	95	**95**	D5	-2
198	07/07/10	D 2937	**64.8**	**19.7**			D 698	SG10	71.2	30.0	95	**91 ***	E3	-6
199	07/07/10	D 2937	**71.3**	**23.8**	64.4	22.1	D 698	S-3	73.0	28.0	95	**98**	E4	-6
200	07/07/10	D 2937	**69.9**	**31.6**			D 698	S-3	73.0	28.0	95	**96**	E5	-6
201	07/08/10	D 2937	**68.0**	**29.7**	67.0	25.5	D 698	S-9	71.7	32.7	95	**95**	D-3, Retest of 189	SG
202	07/08/10	D 2937	**69.5**	**30.0**			D 698	S-9	71.7	32.7	95	**97**	D-4, Retest of 190	SG
203	07/08/10	D 2937	**69.6**	**29.4**			D 698	S-9	71.7	32.7	95	**97**	D-4, Retest of 196	SG
204	07/08/10	D 2937	**69.0**	**30.5**			D 698	S-9	71.7	32.7	95	**96**	E-3, Retest of 198	SG
205	07/08/10	D 2937	**70.5**	**30.2**			D 698	S-9	71.7	32.7	95	**98**	E-3	SG
206	07/08/10	D 2937	**67.9**	**30.4**			D 698	S-9	71.7	32.7	95	**95**	F-5	SG
207	07/08/10	D 2937	**69.2**	**29.6**			D 698	S-9	71.7	32.7	95	**97**	F-5	-6
208	07/08/10	D 2937	**68.7**	**29.9**			D 698	S-9	71.7	32.7	95	**96**	F-5	-6
209	07/08/10	D 2937	**69.1**	**29.3**			D 698	S-9	71.7	32.7	95	**96**	F-4	-6

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Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
210	07/08/10	D 2937	**67.4**	**29.6**			D 698	S-9	71.7	32.7	95	**94 ***	F-4	-6
211	07/08/10	D 2937	**70.4**	**29.5**			D 698	S-9	71.7	32.7	95	**98**	F-4	-6
212	07/08/10	D 2937	**69.4**	**31.2**			D 698	S-9	71.7	32.7	95	**97**	F-3	-6
213	07/08/10	D 2937	**69.5**	**31.6**			D 698	S-9	71.7	32.7	95	**97**	Retest of 2-10 F-4	-6
214	07/09/10	D 2937	**71.8**	**28.2**	67.2	23.4	D 698	S-9	72.0	32.0	95	**100**	E-5	-5
215	07/09/10	D 2937	**70.8**	**30.2**			D 698	S-9	72.0	32.0	95	**98**	E-5	-5
216	07/09/10	D 2937	**71.1**	**28.7**			D 698	S-9	72.0	32.0	95	**99**	E-5	-5
217	07/09/10	D 2937	**72.6**	**30.7**			D 698	S-9	72.0	32.0	95	**100+**	E-4	-5
218	07/09/10	D 2937	**71.4**	**30.3**			D 698	S-9	72.0	32.0	95	**99**	E-4	-5
219	07/09/10	D 2937	**70.7**	**31.3**			D 698	S-9	72.0	32.0	95	**98**	E-4	-5
220	07/09/10	D 2937	**70.2**	**23.6**			D 698	S-9	72.0	32.0	95	**97**	Cell E-3	-5
221	07/09/10	D 2937	**72.3**	**24.7**			D 698	S-9	72.0	32.0	95	**100**	Cell E-3	-5
222	07/09/10	D 2937	**73.3**	**27.4**			D 698	S-9	72.0	32.0	95	**100+**	Cell E-3	-5
223	07/09/10	D 2937	**69.7**	**28.7**	67.8	24.4	D 698	S-9	71.7	31.8	95	**97**	E-4	-6
224	07/09/10	D 2937	**67.8**	**28.9**			D 698	S-9	71.7	31.8	95	**95**	E-3	-6
225	07/09/10	D 2937	**73.2**	**31.1**			D 698	S-9	71.7	31.8	95	**100+**	E-5	-6
226	07/09/10	D 2937	**71.4**	**32.0**			D 698	S-9	71.7	31.8	95	**100**	F-3	-0
227	07/09/10	D 2937	**69.4**	**30.3**			D 698	S-9	71.7	31.8	95	**97**	F-3	-3
228	07/09/10	D 2937	**69.8**	**29.9**			D 698	S-9	71.7	31.8	95	**97**	F-3	-5

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Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010

Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1

Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
229	07/09/10	D 2937	**70.7**	**30.4**			D 698	S-9	71.7	31.8	95	**99**	F-4	-5
230	07/09/10	D 2937	**70.4**	**31.2**			D 698	S-9	71.7	31.8	95	**98**	F-4	-0
231	07/09/10	D 2937	**69.6**	**30.8**			D 698	S-9	71.7	31.8	95	**97**	F-4	-3
232	07/09/10	D 2937	**69.7**	**30.5**			D 698	S-9	71.7	31.8	95	**97**	F-5	-5
233	07/09/10	D 2937	**69.8**	**31.1**			D 698	S-9	71.7	31.8	95	**97**	F-5	-3
234	07/09/10	D 2937	**69.2**	**30.2**			D 698	S-9	71.7	31.8	95	**97**	F-5	-0
235	07/13/10	D 2937	**69.5**	**29.9**	64.1	20.3	D 698	S-5	73.1	29.0	95	**95**	F3 Cell 1B	-2
236	07/13/10	D 2937	**70.5**	**30.6**			D 698	S-5	73.1	29.0	95	**96**	F4 Cell 1B	-2
237	07/13/10	D 2937	**72.1**	**31.6**			D 698	S-5	73.1	29.0	95	**99**	F5 Cell 1B	-2
238	07/16/10	D 2937	**74.3**	**28.2**	70.2	21.4	D 698	S-4	76.6	28.0	95	**97**	E5	-5
239	07/16/10	D 2937	**73.2**	**27.1**			D 698	S-4	76.6	28.0	95	**96**	E4	-5
240	07/16/10	D 2937	**72.8**	**26.6**			D 698	S-4	76.6	28.0	95	**95**	E-3	-5
241	07/16/10	D 2937	**67.6**	**29.6**	64.7	24.3	D 698	SG-1	70.4	33.0	95	**96**	F3	-1
242	07/16/10	D 2937	**68.1**	**30.5**			D 698	SG-1	70.4	33.0	95	**97**	F-4	-1
243	07/16/10	D 2937	**68.3**	**31.9**			D 698	SG-1	70.4	33.0	95	**97**	F-5	-1
244	07/20/10	D 2937	**69.7**	**25.2**	68.2	21.9	D 698	S-5	73.3	29.9	95	**95**	F3	0
245	07/20/10	D 2937	**71.2**	**27.6**			D 698	S-5	73.3	29.9	95	**97**	F4	0
246	07/20/10	D 2937	**71.8**	**28.9**			D 698	S-5	73.3	29.9	95	**98**	F5	0
247	07/20/10	D 2937	**69.1**	**33.2**	63.7	25.7	D 698	S-6	69.3	34.2	95	**100**	E5	-9

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Notes:

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S&ME

Summary of Density Test Results

Report Date: August 12, 2010
Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1
Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
248	07/20/10	D 2937	**68.0**	**31.9**			D 698	S-6	69.3	34.2	95	**98**	E4	-9
249	07/20/10	D 2937	**71.1**	**27.1**			D 698	S-5	73.3	29.9	95	**97**	E3	-9
250	07/20/10	D 2937	**69.7**	**35.0**	66.2	29.2	D 698	S-9	70.5	34.0	95	**99**	F1	-9
251	07/20/10	D 2937	**69.2**	**33.6**			D 698	S-9	70.5	34.0	95	**98**	F2	-9
252	07/22/10	D 2937	**66.4**	**27.2**	67.3	26.0	D 698	S-6	68.0	35.6	95	**98**	F-5 NE corner 30' South 120' West	-9
253	07/22/10	D 2937	**73.8**	**26.2**	68.5	27.3	D 698	S-4	76.6	28.0	95	**96**	F-5 NE corner 130' West 130' South	-9
254	07/22/10	D 2937	**65.0**	**26.6**			D 698	S-6	68.0	36.5	95	**96**	F-5 NE corner 30' South 30' West	-9
255	07/22/10	D 2937	**73.8**	**27.0**			D 698	S-4	76.6	28.0	95	**96**	F-5 NE corner 130' South 30' West	-9
256	07/28/10	D 2937	**68.4**	**34.6**	66.4	30.1	D 698	S-9	70.8	33.4	95	**97**	Cell 1A F3	-8
257	07/28/10	D 2937	**68.3**	**28.8**			D 698	S-9	70.8	33.4	95	**96**	Cell 1A F2	-8
258	07/28/10	D 2937	**68.7**	**30.0**			D 698	S-9	70.8	33.4	95	**97**	Cell 1A F1	-8
259	07/28/10	D 2937	**70.0**	**29.5**	66.2	23.3	D 698	S-6	70.0	33.5	95	**100**	Cell 1B F4	-8
260	07/28/10	D 2937	**69.9**	**31.0**			D 698	S-6	70.0	33.5	95	**100**	Cell 1B F5	-8
261	07/28/10	D 2937	**69.0**	**28.6**			D 698	S-6	70.0	33.5	95	**99**	Cell 1B E3	-9
262	07/28/10	D 2937	**70.3**	**32.2**			D 698	S-6	70.0	33.5	95	**100**	Cell 1B E4	-9
263	07/28/10	D 2937	**70.5**	**34.9**			D 698	S-6	70.0	33.5	95	**100+**	Cell 1B E5	-9
264	07/29/10	D 2937	**71.2**	**30.1**	65.2	21.1	D 698	S-10	72.0	32.0	95	**99**	Cell 1B F3	-7
265	07/29/10	D 2937	**74.3**	**30.0**	70.9	23.1	D 698	S-5	73.2	30.5	95	**100+**	Cell 1B F4	-7
266	07/29/10	D 2937	**72.9**	**28.2**			D 698	S-5	73.2	30.5	95	**100**	Cell 1B F5	-7

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

Kyle Baucom/S&ME, Inc.
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S&ME

Summary of Density Test Results

Report Date: August 12, 2010
Project No.: 1356-10-009C1

Project Name: Duke - RAB LF Cell 1
Client: Duke Energy

Test		In-Place Density Test			Check Plug Data		Reference Standard				Compaction		Location	Elevation or Stone Depth
No.	Date	Type	Dry Density	Moisture Content	Dry Density	Moisture Content	Type	Ref. Curve	MDD	Optimum Moisture Content	Percent Specified	Percent In-Place		
267	07/29/10	D 2937	**70.7**	**29.4**			D 698	S-9	72.0	32.0	95	**98**	Cell 1B E3	-8
268	07/29/10	D 2937	**67.8**	**32.7**	64.6	24.5	D 698	S-11	70.0	35.0	95	**97**	Cell 1B E4	-8
269	07/29/10	D 2937	**66.9**	**31.2**			D 698	S-11	70.0	35.0	95	**96**	Cell 1B E5	-8
270	07/29/10	D 2937	**68.8**	**32.5**			D 698	S-11	70.0	35.0	95	**98**	Cell 1B E3	-7

* = Failed Specified Compaction, ** = Failed Specified Moisture Content

All Test Locations and Elevations are Approximate

Notes:

References: ASTM D 2937: Density of Soil In Place by the Drive Cylinder Method, ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Distribution:

Kyle Baucom/S&ME, Inc.
Name (Technical Responsibility)

Signature

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Position

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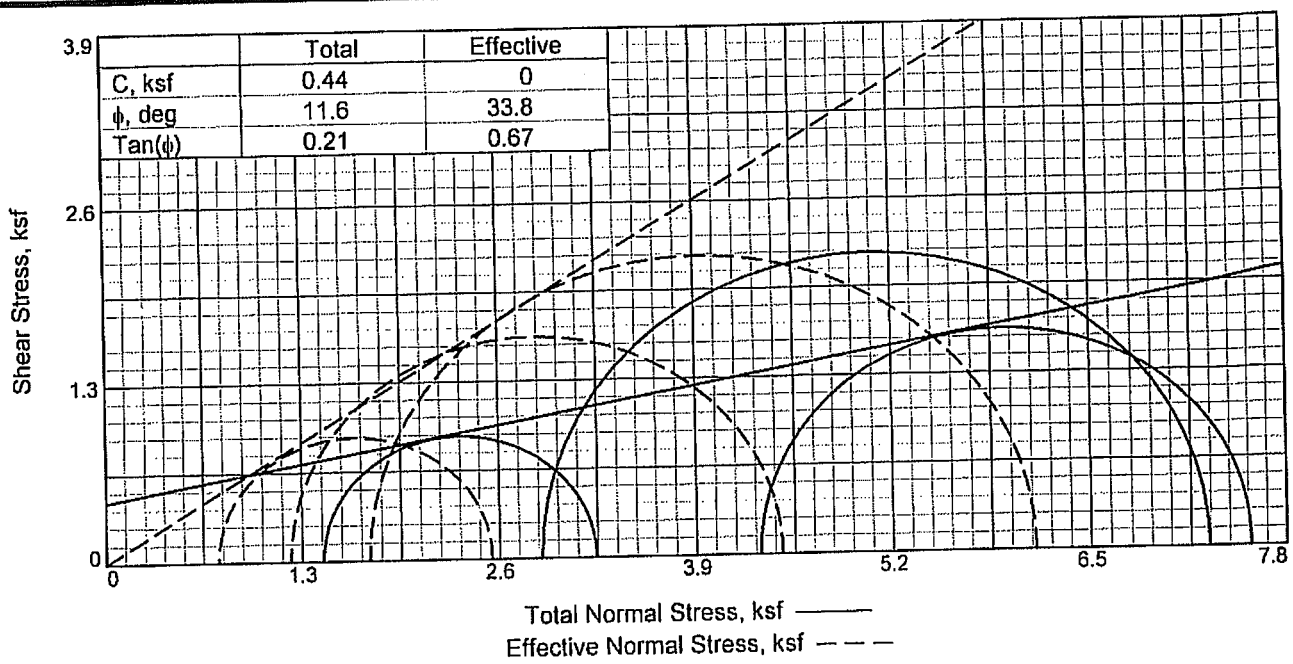
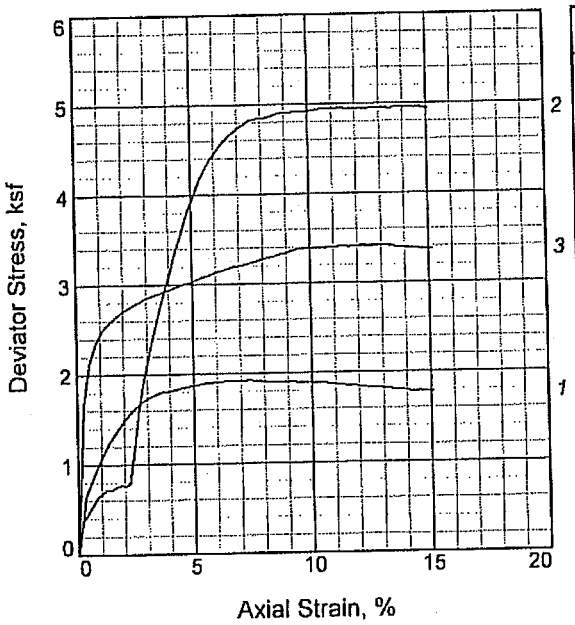
ATTACHMENT 3

Triaxial Shear Strength Test Results



	Total	Effective
C, ksf	0.44	0
ϕ, deg	11.6	33.8
Tan(ϕ)	0.21	0.67



Sample No.		1	2	3
Initial	Water Content, %	31.4	31.4	31.4
	Dry Density, pcf	68.6	68.5	68.1
	Saturation, %	68.8	68.7	68.0
	Void Ratio	1.0035	1.0053	1.0157
	Diameter, in.	2.865	2.865	2.866
	Height, in.	6.000	6.000	6.031
At Test	Water Content, %	41.3	40.7	40.5
	Dry Density, pcf	72.0	72.4	72.6
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9084	0.8963	0.8912
	Diameter, in.	2.819	2.812	2.805
	Height, in.	5.904	5.890	5.905
Strain rate, in./min.		0.010	0.006	0.008
Back Pressure, ksf		10.08	10.08	10.08
Cell Pressure, ksf		11.52	12.96	14.40
Fail. Stress, ksf		1.80	4.39	3.24
Total Pore Pr., ksf		10.77	11.22	13.18
Ult. Stress, ksf				
Total Pore Pr., ksf				
$\bar{\sigma}_1$ Failure, ksf		2.55	6.14	4.47
$\bar{\sigma}_3$ Failure, ksf		0.75	1.74	1.22

Type of Test:
CU with Pore Pressures
Sample Type: Remolded
Description: Fly Ash

Assumed Specific Gravity= 2.2
Remarks: Remolded to 95% MDD (72 pcf) at Optimum Moisture (31.1%)

Plate SG-13 95%

Client: Duke Power

Project: Allen Steam Station Retired Ash Basin

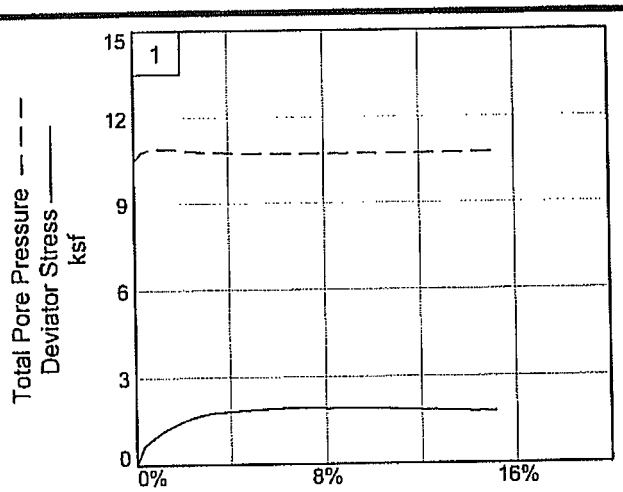
Sample Number: SG-13 **Depth:** Bulk 95%

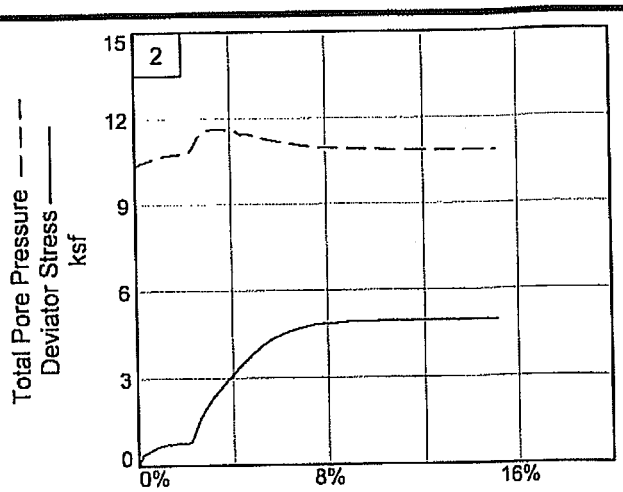
Proj. No.: 1356-06-825 Phase 9 **Date Sampled:**

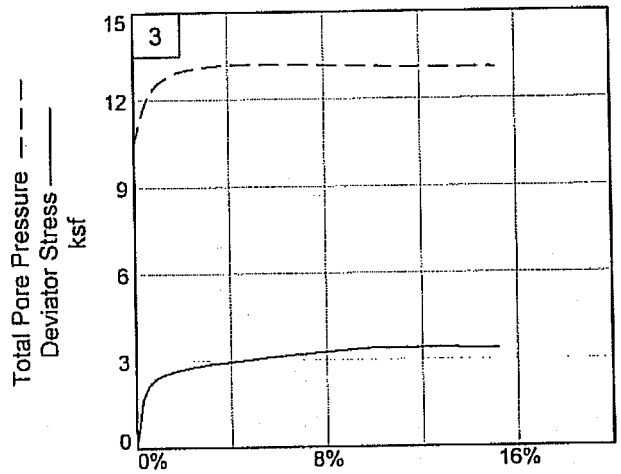
TRIAXIAL SHEAR TEST REPORT

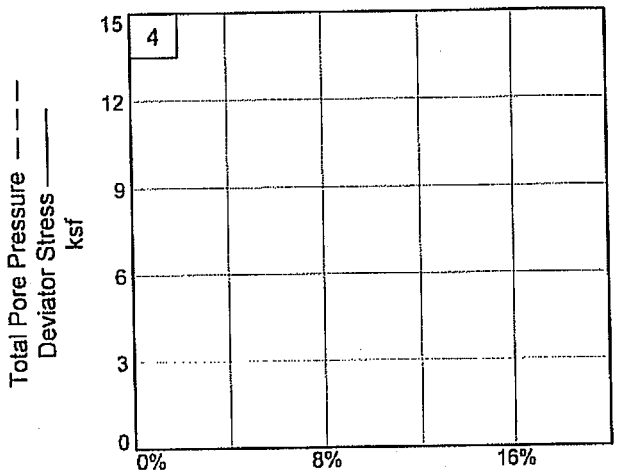
S & ME, INC.

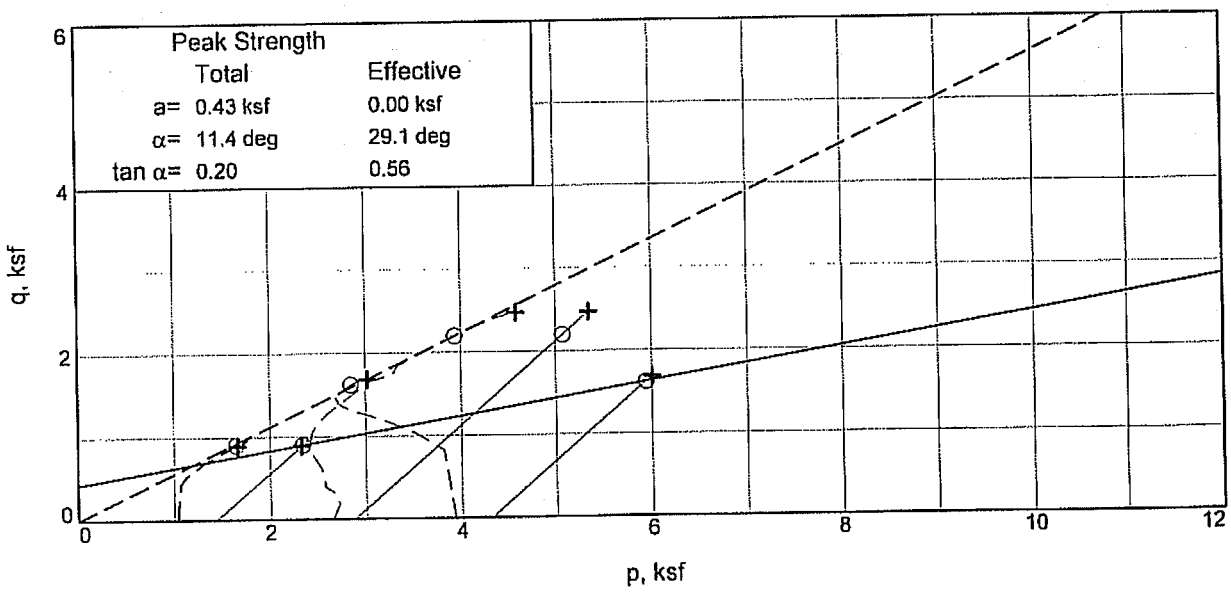
Tested By: KMW **Checked By:** JSR











Stress Paths: Total ——— Effective — — —

Client: Duke Power
Project: Allen Steam Station Retired Ash Basin
Depth: Bulk 95% **Sample Number:** SG-13
Project No.: 1356-06-825 Phase 9 **Plate** SG-13 95%

S & ME, INC.

Tested By: KMW **Checked By:** JSR

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

7/7/2010
4:15 PM

Date:
Client: Duke Power
Project: Allen Steam Station Retired Ash Basin
Project No.: 1356-06-825 Phase 9
Depth: Bulk 95% **Sample Number:** SG-13
Description: Fly Ash
Remarks: Remolded to 95% MDD (72 pcf) at Optimum Moisture (31.1%)
Type of Sample: Remolded
Assumed Specific Gravity=2.2 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	336.560			978.460
Moisture content: Dry soil+tare, gms.	276.060			703.730
Moisture content: Tare, gms.	83.270			69.760
Moisture, %	31.4	45.2	41.3	43.3
Moist specimen weight, gms.	914.44			
Diameter, in.	2.865	2.861	2.819	
Area, in.^{2}	6.447	6.427	6.240	
Height, in.	6.000	5.991	5.904	
Net decrease in height, in.		0.009	0.087	
Wet Density, pcf	90.1	100.0	101.7	
Dry density, pcf	68.6	68.9	72.0	
Void ratio	1.0035	0.9945	0.9084	
Saturation, %	68.8	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 80.00 psi (11.52 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 1.44 ksf
Strain rate, in./min. = 0.010
Fail. Stress = 1.80 ksf **at reading no.** 11

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	16.100	0.0	0.0	0.00	1.04	1.04	1.00	72.80	1.04	0.00
1	0.0190	44.200	28.1	0.3	0.65	0.73	1.38	1.88	74.90	1.06	0.32
2	0.0390	53.900	37.8	0.7	0.87	0.63	1.50	2.37	75.60	1.07	0.43
3	0.0590	62.600	46.5	1.0	1.06	0.60	1.67	2.76	75.80	1.14	0.53
4	0.0780	70.200	54.1	1.3	1.23	0.62	1.85	2.99	75.70	1.24	0.62
5	0.1000	76.700	60.6	1.7	1.37	0.63	2.01	3.17	75.60	1.32	0.69
6	0.1200	82.300	66.2	2.0	1.50	0.66	2.16	3.26	75.40	1.41	0.75
7	0.1400	87.100	71.0	2.4	1.60	0.69	2.29	3.31	75.20	1.49	0.80
8	0.1600	90.900	74.8	2.7	1.68	0.72	2.40	3.33	75.00	1.56	0.84
9	0.1800	93.800	77.7	3.0	1.74	0.73	2.47	3.37	74.90	1.60	0.87
10	0.1990	95.700	79.6	3.4	1.77	0.75	2.52	3.37	74.80	1.64	0.89
11	0.2180	97.200	81.1	3.7	1.80	0.75	2.55	3.41	74.80	1.65	0.90
12	0.2380	98.000	81.9	4.0	1.81	0.76	2.58	3.38	74.70	1.67	0.91
13	0.2580	99.200	83.1	4.4	1.83	0.76	2.60	3.40	74.70	1.68	0.92
14	0.2790	100.500	84.4	4.7	1.86	0.78	2.63	3.39	74.60	1.71	0.93
15	0.3000	101.600	85.5	5.1	1.87	0.78	2.65	3.41	74.60	1.71	0.94
16	0.3200	102.700	86.6	5.4	1.89	0.78	2.67	3.43	74.60	1.72	0.95
17	0.3400	103.400	87.3	5.8	1.90	0.79	2.69	3.40	74.50	1.74	0.95
18	0.3610	104.200	88.1	6.1	1.91	0.79	2.70	3.41	74.50	1.75	0.95
19	0.3790	104.800	88.7	6.4	1.92	0.79	2.71	3.42	74.50	1.75	0.96
20	0.4000	105.300	89.2	6.8	1.92	0.79	2.71	3.42	74.50	1.75	0.96
21	0.4190	105.600	89.5	7.1	1.92	0.81	2.73	3.38	74.40	1.77	0.96
22	0.4370	106.000	89.9	7.4	1.92	0.79	2.71	3.43	74.50	1.75	0.96
23	0.4590	105.900	89.8	7.8	1.91	0.79	2.70	3.41	74.50	1.75	0.96
24	0.4790	105.800	89.7	8.1	1.90	0.81	2.71	3.36	74.40	1.76	0.95
25	0.4990	106.200	90.1	8.5	1.90	0.79	2.70	3.40	74.50	1.74	0.95
26	0.5210	106.200	90.1	8.8	1.90	0.81	2.70	3.35	74.40	1.75	0.95
27	0.5410	106.540	90.4	9.2	1.90	0.79	2.69	3.39	74.50	1.74	0.95
28	0.5610	106.800	90.7	9.5	1.89	0.80	2.69	3.37	74.45	1.75	0.95
29	0.5810	107.100	91.0	9.8	1.89	0.79	2.69	3.39	74.50	1.74	0.95
30	0.6000	107.100	91.0	10.2	1.89	0.81	2.69	3.34	74.40	1.75	0.94
31	0.6190	107.600	91.5	10.5	1.89	0.81	2.70	3.34	74.40	1.75	0.95
32	0.6380	107.000	90.9	10.8	1.87	0.81	2.68	3.32	74.40	1.74	0.94
33	0.6580	107.200	91.1	11.1	1.87	0.79	2.66	3.36	74.50	1.73	0.93
34	0.6780	106.900	90.8	11.5	1.85	0.81	2.66	3.30	74.40	1.73	0.93
35	0.7000	106.800	90.7	11.9	1.84	0.79	2.64	3.33	74.50	1.71	0.92
36	0.7200	106.600	90.5	12.2	1.83	0.79	2.63	3.32	74.50	1.71	0.92
37	0.7400	106.600	90.5	12.5	1.83	0.79	2.62	3.31	74.50	1.71	0.91
38	0.7610	106.800	90.7	12.9	1.82	0.79	2.62	3.30	74.50	1.70	0.91
39	0.7800	106.600	90.5	13.2	1.81	0.78	2.59	3.33	74.60	1.68	0.91
40	0.7990	106.700	90.6	13.5	1.81	0.79	2.60	3.28	74.50	1.70	0.90
41	0.8190	106.600	90.5	13.9	1.80	0.78	2.58	3.31	74.60	1.68	0.90
42	0.8400	106.000	89.9	14.2	1.78	0.78	2.56	3.29	74.60	1.67	0.89
43	0.8600	106.700	90.6	14.6	1.79	0.78	2.56	3.30	74.60	1.67	0.89
44	0.8800	106.500	90.4	14.9	1.78	0.78	2.55	3.28	74.60	1.67	0.89
45	0.8920	106.800	90.7	15.1	1.78	0.78	2.55	3.28	74.60	1.67	0.89

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	336.560			938.810
Moisture content: Dry soil+tare, gms.	276.060			680.780
Moisture content: Tare, gms.	83.270			72.280
Moisture, %	31.4	44.9	40.7	42.4
Moist specimen weight, gms.	913.63			
Diameter, in.	2.865	2.857	2.812	
Area, in.²	6.447	6.410	6.210	
Height, in.	6.000	5.983	5.890	
Net decrease in height, in.		0.017	0.093	
Wet Density, pcf	90.0	100.1	101.9	
Dry density, pcf	68.5	69.1	72.4	
Void ratio	1.0053	0.9883	0.8963	
Saturation, %	68.7	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 90.00 psi (12.96 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 2.88 ksf

Strain rate, in./min. = 0.006

Fail. Stress = 4.39 ksf at reading no. 29

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0010	12.400	0.0	0.0	0.00	2.65	2.65	1.00	71.60	2.65	0.00
1	0.0130	28.400	16.0	0.2	0.37	2.53	2.90	1.15	72.40	2.72	0.19
2	0.0240	31.900	19.5	0.4	0.45	2.48	2.93	1.18	72.80	2.70	0.23
3	0.0370	36.200	23.8	0.6	0.55	2.42	2.97	1.23	73.20	2.69	0.27
4	0.0480	39.800	27.4	0.8	0.63	2.35	2.98	1.27	73.70	2.66	0.32
5	0.0610	41.700	29.3	1.0	0.67	2.30	2.98	1.29	74.00	2.64	0.34
6	0.0730	43.900	31.5	1.2	0.72	2.26	2.98	1.32	74.30	2.62	0.36
7	0.0840	43.500	31.1	1.4	0.71	2.25	2.96	1.32	74.40	2.60	0.36
8	0.0970	45.400	33.0	1.6	0.75	2.22	2.97	1.34	74.60	2.59	0.38
9	0.1100	46.200	33.8	1.9	0.77	2.20	2.97	1.35	74.70	2.59	0.38
10	0.1210	45.700	33.3	2.0	0.76	2.19	2.95	1.35	74.80	2.57	0.38
11	0.1320	47.500	35.1	2.2	0.80	2.17	2.97	1.37	74.90	2.57	0.40
12	0.1440	65.200	52.8	2.4	1.19	1.94	3.14	1.61	76.50	2.54	0.60
13	0.1550	82.700	70.3	2.6	1.59	1.64	3.23	1.97	78.60	2.44	0.79
14	0.1660	95.700	83.3	2.8	1.88	1.48	3.36	2.27	79.70	2.42	0.94
15	0.1780	106.600	94.2	3.0	2.12	1.38	3.50	2.53	80.40	2.44	1.06
16	0.1890	117.000	104.6	3.2	2.35	1.34	3.69	2.75	80.70	2.51	1.17
17	0.2020	126.500	114.1	3.4	2.56	1.32	3.88	2.93	80.80	2.60	1.28
18	0.2140	135.600	123.2	3.6	2.75	1.34	4.09	3.06	80.70	2.72	1.38
19	0.2270	144.600	132.2	3.8	2.95	1.35	4.30	3.18	80.60	2.83	1.47
20	0.2400	153.500	141.1	4.1	3.14	1.38	4.52	3.27	80.40	2.95	1.57
21	0.2510	162.200	149.8	4.2	3.33	1.41	4.74	3.36	80.20	3.07	1.66
22	0.2630	170.100	157.7	4.4	3.49	1.54	5.03	3.27	79.30	3.29	1.75
23	0.2750	178.100	165.7	4.7	3.66	1.50	5.16	3.45	79.60	3.33	1.83
24	0.2860	185.300	172.9	4.8	3.82	1.54	5.36	3.48	79.30	3.45	1.91
25	0.2990	192.000	179.6	5.1	3.95	1.58	5.54	3.50	79.00	3.56	1.98
26	0.3100	198.500	186.1	5.2	4.09	1.63	5.72	3.51	78.70	3.67	2.04

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
27	0.3210	203.800	191.4	5.4	4.20	1.67	5.87	3.51	78.40	3.77	2.10
28	0.3340	209.400	197.0	5.7	4.31	1.71	6.02	3.51	78.10	3.87	2.15
29	0.3450	213.600	201.2	5.8	4.39	1.74	6.14	3.52	77.90	3.94	2.20
30	0.3580	217.600	205.2	6.1	4.47	1.79	6.26	3.50	77.60	4.02	2.23
31	0.3690	221.300	208.9	6.2	4.54	1.81	6.36	3.50	77.40	4.08	2.27
32	0.3820	224.700	212.3	6.5	4.60	1.84	6.45	3.50	77.20	4.15	2.30
33	0.3950	227.800	215.4	6.7	4.66	1.87	6.53	3.49	77.00	4.20	2.33
34	0.4070	230.200	217.8	6.9	4.70	1.90	6.60	3.47	76.80	4.25	2.35
35	0.4190	232.800	220.4	7.1	4.75	1.93	6.68	3.46	76.60	4.30	2.37
36	0.4310	234.900	222.5	7.3	4.78	1.94	6.73	3.46	76.50	4.34	2.39
37	0.4420	237.100	224.7	7.5	4.82	1.97	6.79	3.44	76.30	4.38	2.41
38	0.4550	238.300	225.9	7.7	4.83	1.99	6.82	3.43	76.20	4.40	2.42
39	0.4680	239.300	226.9	7.9	4.84	2.00	6.85	3.42	76.10	4.42	2.42
40	0.4790	239.900	227.5	8.1	4.85	2.00	6.85	3.42	76.10	4.43	2.42
41	0.4920	241.000	228.6	8.3	4.86	2.02	6.87	3.41	76.00	4.45	2.43
42	0.5040	242.400	230.0	8.5	4.88	2.02	6.89	3.42	76.00	4.45	2.44
43	0.5160	243.700	231.3	8.7	4.89	2.03	6.92	3.41	75.90	4.48	2.45
44	0.5280	244.900	232.5	8.9	4.91	2.03	6.94	3.42	75.90	4.48	2.45
45	0.5400	245.300	232.9	9.2	4.91	2.04	6.95	3.40	75.80	4.50	2.45
46	0.5520	246.100	233.7	9.4	4.91	2.04	6.96	3.40	75.80	4.50	2.46
47	0.5630	246.900	234.5	9.5	4.92	2.06	6.98	3.39	75.70	4.52	2.46
48	0.5750	247.300	234.9	9.7	4.92	2.06	6.98	3.39	75.70	4.52	2.46
49	0.5870	247.900	235.5	9.9	4.92	2.06	6.98	3.39	75.70	4.52	2.46
50	0.6000	248.800	236.4	10.2	4.92	2.06	6.98	3.39	75.70	4.52	2.46
51	0.6130	249.900	237.5	10.4	4.93	2.07	7.01	3.38	75.60	4.54	2.47
52	0.6250	251.000	238.6	10.6	4.95	2.07	7.02	3.39	75.60	4.55	2.47
53	0.6380	251.400	239.0	10.8	4.94	2.09	7.03	3.37	75.50	4.56	2.47
54	0.6490	252.300	239.9	11.0	4.95	2.09	7.04	3.37	75.50	4.56	2.48
55	0.6620	252.900	240.5	11.2	4.95	2.09	7.04	3.37	75.50	4.56	2.48
56	0.6740	253.400	241.0	11.4	4.95	2.09	7.04	3.37	75.50	4.56	2.47
57	0.6870	253.800	241.4	11.6	4.95	2.09	7.03	3.37	75.50	4.56	2.47
58	0.6980	254.200	241.8	11.8	4.94	2.09	7.03	3.37	75.50	4.56	2.47
59	0.7100	254.900	242.5	12.0	4.95	2.10	7.05	3.35	75.40	4.58	2.47
60	0.7210	255.200	242.8	12.2	4.94	2.09	7.03	3.37	75.50	4.56	2.47
61	0.7340	255.900	243.5	12.4	4.94	2.10	7.05	3.35	75.40	4.57	2.47
62	0.7450	256.700	244.3	12.6	4.95	2.10	7.05	3.35	75.40	4.58	2.47
63	0.7560	257.200	244.8	12.8	4.95	2.10	7.05	3.35	75.40	4.58	2.47
64	0.7680	257.800	245.4	13.0	4.95	2.10	7.05	3.35	75.40	4.58	2.47
65	0.7800	258.630	246.2	13.2	4.95	2.10	7.06	3.36	75.40	4.58	2.48
66	0.7930	258.500	246.1	13.4	4.94	2.10	7.04	3.35	75.40	4.57	2.47
67	0.8060	260.100	247.7	13.7	4.96	2.12	7.08	3.34	75.30	4.60	2.48
68	0.8180	260.800	248.4	13.9	4.96	2.10	7.06	3.36	75.40	4.58	2.48
69	0.8290	260.900	248.5	14.1	4.95	2.12	7.07	3.34	75.30	4.59	2.48
70	0.8420	261.700	249.3	14.3	4.96	2.12	7.07	3.34	75.30	4.59	2.48
71	0.8550	262.300	249.9	14.5	4.95	2.12	7.07	3.34	75.30	4.59	2.48
72	0.8660	262.900	250.5	14.7	4.96	2.12	7.07	3.34	75.30	4.59	2.48
73	0.8790	262.900	250.5	14.9	4.94	2.12	7.06	3.33	75.30	4.59	2.47

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
74	0.8890	263.300	250.9	15.1	4.94	2.12	7.06	3.33	75.30	4.59	2.47

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	336.560			943.710
Moisture content: Dry soil+tare, gms.	276.060			683.370
Moisture content: Tare, gms.	83.270			70.950
Moisture, %	31.4	44.9	40.5	42.5
Moist specimen weight, gms.	914.23			
Diameter, in.	2.866	2.853	2.805	
Area, in.^{2}	6.451	6.391	6.182	
Height, in.	6.031	6.003	5.905	
Net decrease in height, in.		0.028	0.098	
Wet Density, pcf	89.5	100.1	102.0	
Dry density, pcf	68.1	69.1	72.6	
Void ratio	1.0157	0.9877	0.8912	
Saturation, %	68.0	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 100.00 psi (14.40 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 4.32 ksf

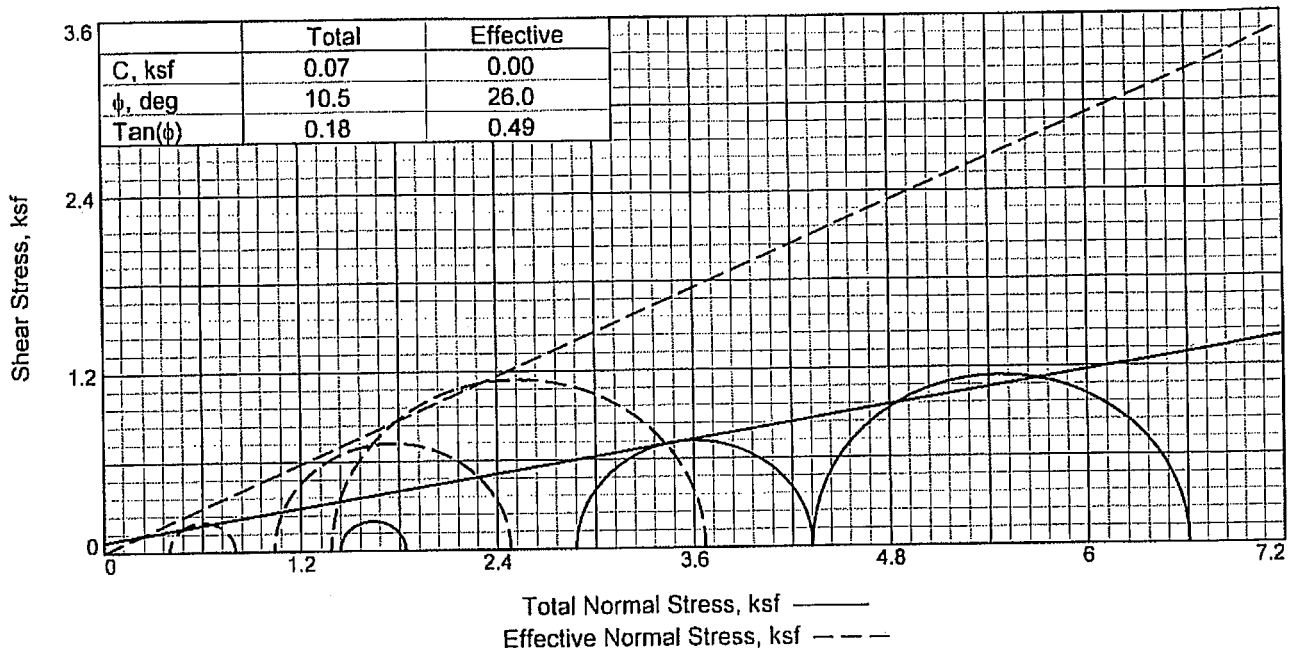
Strain rate, in./min. = 0.008

Fail. Stress = 3.24 ksf at reading no. 28

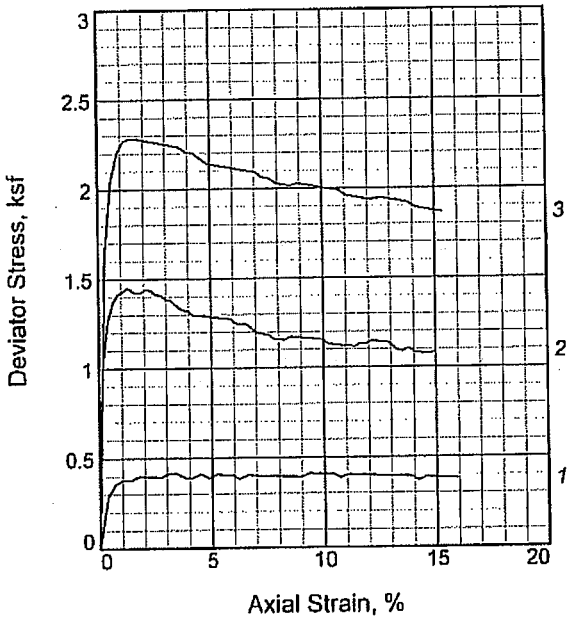
No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0000	15.200	0.0	0.0	0.00	3.93	3.93	1.00	72.70	3.93	0.00
1	0.0160	86.100	70.9	0.3	1.65	3.00	4.64	1.55	79.20	3.82	0.82
2	0.0320	107.400	92.2	0.5	2.14	2.39	4.53	1.89	83.40	3.46	1.07
3	0.0480	117.100	101.9	0.8	2.35	2.03	4.38	2.16	85.90	3.21	1.18
4	0.0640	123.300	108.1	1.1	2.49	1.80	4.29	2.38	87.50	3.05	1.25
5	0.0810	127.100	111.9	1.4	2.57	1.64	4.21	2.57	88.60	2.93	1.29
6	0.0960	130.100	114.9	1.6	2.63	1.53	4.16	2.73	89.40	2.84	1.32
7	0.1120	132.900	117.7	1.9	2.69	1.44	4.13	2.87	90.00	2.78	1.34
8	0.1290	135.100	119.9	2.2	2.73	1.38	4.11	2.98	90.40	2.75	1.37
9	0.1450	137.400	122.2	2.5	2.78	1.34	4.12	3.07	90.70	2.73	1.39
10	0.1610	139.400	124.2	2.7	2.81	1.30	4.11	3.17	91.00	2.70	1.41
11	0.1760	141.400	126.2	3.0	2.85	1.28	4.13	3.23	91.10	2.71	1.43
12	0.1930	143.000	127.8	3.3	2.88	1.25	4.13	3.30	91.30	2.69	1.44
13	0.2080	144.100	128.9	3.5	2.90	1.24	4.14	3.34	91.40	2.69	1.45
14	0.2240	145.600	130.4	3.8	2.92	1.22	4.15	3.39	91.50	2.69	1.46
15	0.2400	147.100	131.9	4.1	2.95	1.22	4.17	3.41	91.50	2.70	1.47
16	0.2560	148.600	133.4	4.3	2.97	1.21	4.18	3.46	91.60	2.70	1.49
17	0.2720	150.300	135.1	4.6	3.00	1.21	4.21	3.48	91.60	2.71	1.50
18	0.2890	151.500	136.3	4.9	3.02	1.20	4.21	3.53	91.70	2.71	1.51
19	0.3050	153.400	138.2	5.2	3.05	1.21	4.26	3.52	91.60	2.74	1.53
20	0.3200	154.900	139.7	5.4	3.08	1.20	4.27	3.58	91.70	2.73	1.54
21	0.3370	156.300	141.1	5.7	3.10	1.21	4.31	3.56	91.60	2.76	1.55

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
22	0.3530	158.100	142.9	6.0	3.13	1.21	4.34	3.59	91.60	2.77	1.56
23	0.3680	159.400	144.2	6.2	3.15	1.21	4.36	3.60	91.60	2.78	1.57
24	0.3840	160.700	145.5	6.5	3.17	1.21	4.38	3.62	91.60	2.79	1.58
25	0.4000	162.100	146.9	6.8	3.19	1.22	4.41	3.61	91.50	2.82	1.60
26	0.4160	163.100	147.9	7.0	3.20	1.22	4.43	3.62	91.50	2.83	1.60
27	0.4320	164.300	149.1	7.3	3.22	1.22	4.44	3.63	91.50	2.83	1.61
28	0.4480	165.800	150.6	7.6	3.24	1.22	4.47	3.65	91.50	2.85	1.62
29	0.4640	167.100	151.9	7.9	3.26	1.24	4.50	3.63	91.40	2.87	1.63
30	0.4800	168.600	153.4	8.1	3.28	1.24	4.52	3.65	91.40	2.88	1.64
31	0.4970	169.700	154.5	8.4	3.30	1.25	4.55	3.63	91.30	2.90	1.65
32	0.5120	171.200	156.0	8.7	3.32	1.25	4.57	3.65	91.30	2.91	1.66
33	0.5280	172.500	157.3	8.9	3.34	1.25	4.59	3.66	91.30	2.92	1.67
34	0.5430	173.900	158.7	9.2	3.36	1.27	4.62	3.65	91.20	2.95	1.68
35	0.5600	175.500	160.3	9.5	3.38	1.27	4.65	3.67	91.20	2.96	1.69
36	0.5760	176.200	161.0	9.8	3.38	1.28	4.67	3.64	91.10	2.97	1.69
37	0.5910	177.100	161.9	10.0	3.39	1.28	4.68	3.65	91.10	2.98	1.70
38	0.6080	177.800	162.6	10.6	3.38	1.30	4.68	3.61	91.00	2.99	1.69
39	0.6230	178.100	162.9	10.6	3.39	1.30	4.69	3.62	91.00	2.99	1.70
40	0.6390	178.800	163.6	10.8	3.40	1.31	4.71	3.59	90.90	3.01	1.70
41	0.6550	179.300	164.1	11.1	3.40	1.31	4.71	3.59	90.90	3.01	1.70
42	0.6710	180.400	165.2	11.4	3.41	1.31	4.72	3.60	90.90	3.02	1.71
43	0.6870	180.600	165.4	11.6	3.40	1.31	4.72	3.60	90.90	3.01	1.70
44	0.7020	181.200	166.0	11.9	3.41	1.31	4.72	3.60	90.90	3.01	1.70
45	0.7190	182.200	167.0	12.2	3.42	1.31	4.73	3.61	90.90	3.02	1.71
46	0.7360	182.700	167.5	12.5	3.42	1.32	4.74	3.58	90.80	3.03	1.71
47	0.7600	183.800	168.6	13.0	3.42	1.32	4.74	3.58	90.80	3.03	1.71
48	0.7840	184.300	169.1	13.3	3.42	1.32	4.74	3.58	90.80	3.03	1.71
49	0.8000	184.000	168.8	13.5	3.40	1.32	4.72	3.57	90.80	3.02	1.70
50	0.8160	184.100	168.9	13.8	3.39	1.32	4.72	3.56	90.80	3.02	1.70
51	0.8320	184.300	169.1	14.1	3.38	1.34	4.72	3.53	90.70	3.03	1.69
52	0.8480	184.700	169.5	14.4	3.38	1.32	4.71	3.55	90.80	3.02	1.69
53	0.8640	185.000	169.8	14.6	3.38	1.34	4.72	3.52	90.70	3.03	1.69
54	0.8810	185.300	170.1	14.9	3.37	1.32	4.70	3.54	90.80	3.01	1.69
55	0.8960	185.600	170.4	15.2	3.37	1.34	4.71	3.51	90.70	3.02	1.68



	Total	Effective
C, ksf	0.07	0.00
ϕ, deg	10.5	26.0
Tan(ϕ)	0.18	0.49



Sample No.		1	2	3
Initial	Water Content, %	31.0	31.4	30.7
	Dry Density, pcf	65.3	64.6	65.0
	Saturation, %	61.9	61.3	60.7
	Void Ratio	1.1039	1.1266	1.1128
	Diameter, in.	2.862	2.865	2.865
	Height, in.	6.000	6.031	6.031
At Test	Water Content, %	41.2	42.8	42.5
	Dry Density, pcf	72.0	70.8	71.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9062	0.9410	0.9354
	Diameter, in.	2.769	2.779	2.782
	Height, in.	5.808	5.852	5.859
Strain rate, in./min.		0.010	0.007	0.009
Back Pressure, ksf		10.08	10.08	10.08
Cell Pressure, ksf		11.52	12.96	14.40
Fail. Stress, ksf		0.40	1.44	2.29
Total Pore Pr., ksf		11.12	11.92	13.02
Ult. Stress, ksf				
Total Pore Pr., ksf				
$\bar{\sigma}_1$ Failure, ksf		0.80	2.48	3.67
$\bar{\sigma}_3$ Failure, ksf		0.40	1.04	1.38

Type of Test:
CU with Pore Pressures
Sample Type: Remolded
Description: Fly Ash

Assumed Specific Gravity= 2.2
Remarks: Remolded to 90% MDD (72pcf) at Optimum Moisture (31.1%)

Plate SG-13 90%

Client: Duke Power

Project: Allen Steam Station Retired Ash Basin

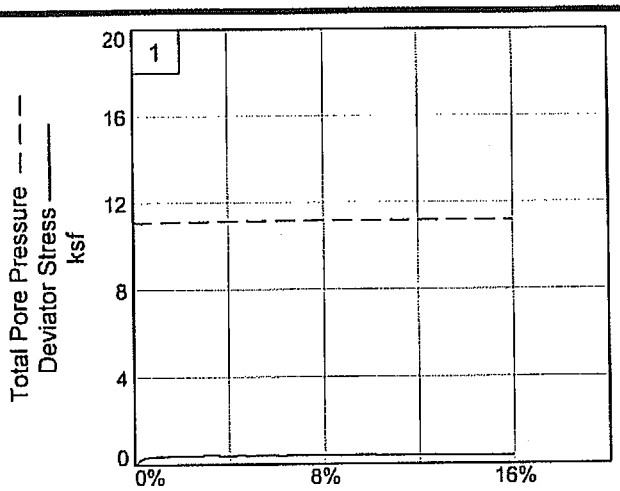
Sample Number: SG-13 **Depth:** Bulk 90%

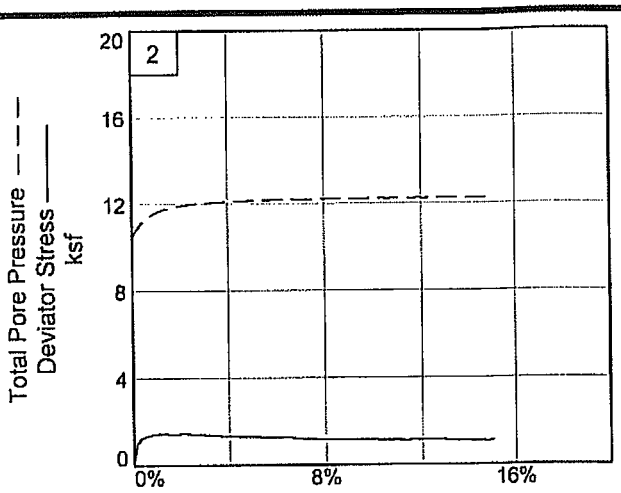
Proj. No.: 1356-06-825 Phase 9 **Date Sampled:**

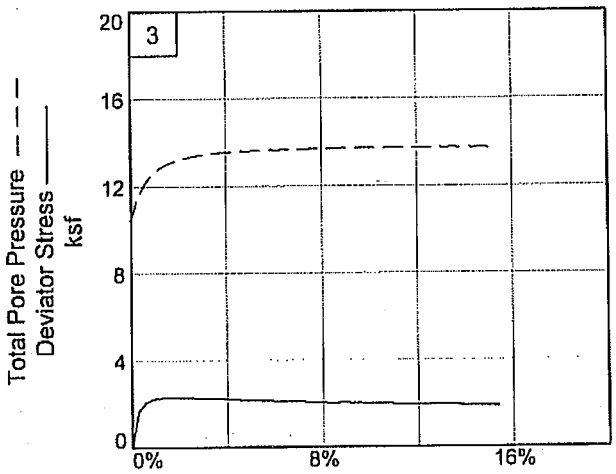
TRIAXIAL SHEAR TEST REPORT

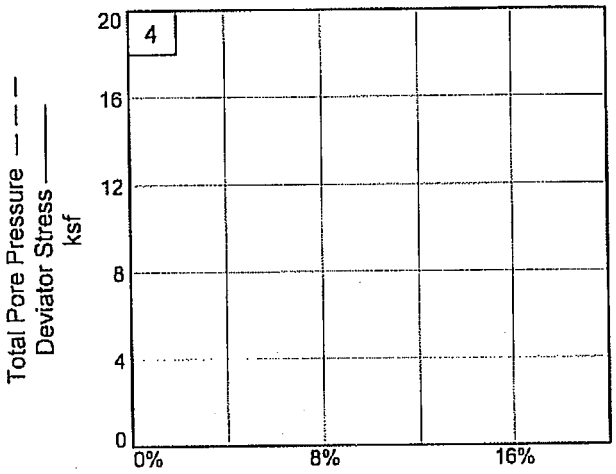
S & ME, INC.

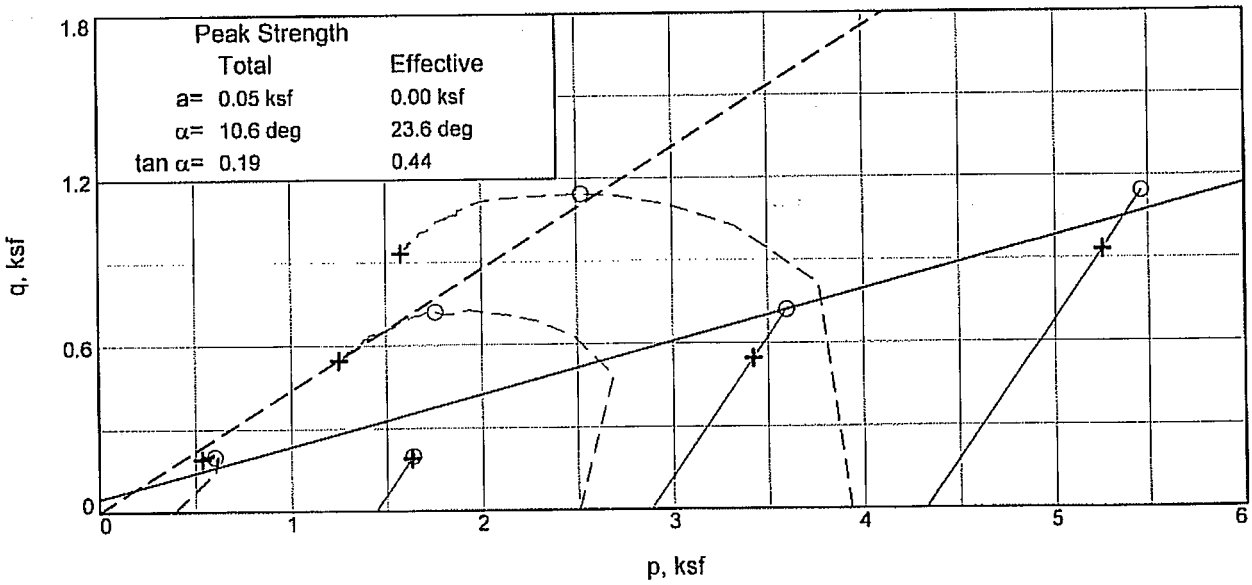
Tested By: KMW **Checked By:** JSR











Client: Duke Power
Project: Allen Steam Station Retired Ash Basin
Depth: Bulk 90% **Sample Number:** SG-13
Project No.: 1356-06-825 Phase 9 **Plate** SG-13 90%

S & ME, INC.

Tested By: KMW **Checked By:** JSR

TRIAXIAL COMPRESSION TEST

CU with Pore Pressures

7/7/2010
4:15 PM

Date:
Client: Duke Power
Project: Allen Steam Station Retired Ash Basin
Project No.: 1356-06-825 Phase 9
Depth: Bulk 90% **Sample Number:** SG-13
Description: Fly Ash
Remarks: Remolded to 90% MDD (72pcf) at Optimum Moisture (31.1%)
Type of Sample: Remolded
Assumed Specific Gravity=2.2 **LL=** **PL=** **PI=**
Test Method: COE uniform strain

Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	247.580			1024.390
Moisture content: Dry soil+tare, gms.	208.530			743.830
Moisture content: Tare, gms.	82.730			84.200
Moisture, %	31.0	48.8	41.2	42.5
Moist specimen weight, gms.	866.75			
Diameter, in.	2.862	2.849	2.769	
Area, in.^{2}	6.433	6.373	6.022	
Height, in.	6.000	5.972	5.808	
Net decrease in height, in.		0.028	0.164	
Wet Density, pcf	85.5	98.5	101.7	
Dry density, pcf	65.3	66.2	72.0	
Void ratio	1.1039	1.0745	0.9062	
Saturation, %	61.9	100.0	100.0	

Test Readings for Specimen No. 1

Consolidation cell pressure = 80.00 psi (11.52 ksf)
Consolidation back pressure = 70.00 psi (10.08 ksf)
Consolidation effective confining stress = 1.44 ksf
Strain rate, in./min. = 0.010
Fail. Stress = 0.40 ksf **at reading no.** 7

Test Readings for Specimen No. 1

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0050	22.000	0.0	0.0	0.00	0.39	0.39	1.00	77.30	0.39	0.00
1	0.0250	34.000	12.0	0.3	0.29	0.46	0.75	1.62	76.80	0.60	0.14
2	0.0450	37.000	15.0	0.7	0.36	0.43	0.79	1.82	77.00	0.61	0.18
3	0.0650	38.000	16.0	1.0	0.38	0.43	0.81	1.88	77.00	0.62	0.19
4	0.0860	38.000	16.0	1.4	0.38	0.42	0.79	1.90	77.10	0.61	0.19
5	0.1060	39.000	17.0	1.7	0.40	0.42	0.82	1.96	77.10	0.62	0.20
6	0.1240	39.000	17.0	2.0	0.40	0.39	0.79	2.02	77.30	0.59	0.20
7	0.1440	39.000	17.0	2.4	0.40	0.40	0.80	1.98	77.20	0.60	0.20
8	0.1640	39.000	17.0	2.7	0.40	0.39	0.78	2.02	77.30	0.59	0.20
9	0.1850	40.000	18.0	3.1	0.42	0.39	0.81	2.07	77.30	0.60	0.21
10	0.2050	40.000	18.0	3.4	0.42	0.37	0.79	2.11	77.40	0.58	0.21
11	0.2260	39.000	17.0	3.8	0.39	0.39	0.78	2.01	77.30	0.58	0.20
12	0.2450	39.000	17.0	4.1	0.39	0.37	0.76	2.04	77.40	0.57	0.19
13	0.2660	40.000	18.0	4.5	0.41	0.37	0.79	2.10	77.40	0.58	0.21
14	0.2870	39.000	17.0	4.9	0.39	0.36	0.75	2.07	77.50	0.55	0.19
15	0.3070	40.000	18.0	5.2	0.41	0.37	0.78	2.09	77.40	0.58	0.20
16	0.3270	40.000	18.0	5.5	0.41	0.36	0.77	2.13	77.50	0.56	0.20
17	0.3470	40.000	18.0	5.9	0.41	0.36	0.77	2.13	77.50	0.56	0.20
18	0.3660	39.000	17.0	6.2	0.38	0.36	0.74	2.06	77.50	0.55	0.19
19	0.3860	40.000	18.0	6.6	0.40	0.36	0.76	2.12	77.50	0.56	0.20
20	0.4060	40.000	18.0	6.9	0.40	0.36	0.76	2.11	77.50	0.56	0.20
21	0.4260	40.000	18.0	7.2	0.40	0.36	0.76	2.11	77.50	0.56	0.20
22	0.4460	40.000	18.0	7.6	0.40	0.35	0.74	2.15	77.60	0.54	0.20
23	0.4670	40.000	18.0	8.0	0.40	0.35	0.74	2.15	77.60	0.54	0.20
24	0.4880	40.000	18.0	8.3	0.39	0.35	0.74	2.14	77.60	0.54	0.20
25	0.5078	40.000	18.0	8.7	0.39	0.35	0.74	2.14	77.60	0.54	0.20
26	0.5280	40.000	18.0	9.0	0.39	0.35	0.74	2.13	77.60	0.54	0.20
27	0.5470	41.000	19.0	9.3	0.41	0.35	0.76	2.19	77.60	0.55	0.21
28	0.5670	41.000	19.0	9.7	0.41	0.35	0.76	2.19	77.60	0.55	0.21
29	0.5870	41.000	19.0	10.0	0.41	0.35	0.75	2.18	77.60	0.55	0.20
30	0.6070	41.000	19.0	10.4	0.41	0.35	0.75	2.18	77.60	0.55	0.20
31	0.6280	40.000	18.0	10.7	0.38	0.35	0.73	2.11	77.60	0.54	0.19
32	0.6480	41.000	19.0	11.1	0.40	0.35	0.75	2.17	77.60	0.55	0.20
33	0.6680	41.000	19.0	11.4	0.40	0.35	0.75	2.16	77.60	0.55	0.20
34	0.6890	41.000	19.0	11.8	0.40	0.35	0.75	2.16	77.60	0.55	0.20
35	0.7090	41.000	19.0	12.1	0.40	0.35	0.74	2.16	77.60	0.55	0.20
36	0.7290	41.000	19.0	12.5	0.40	0.35	0.74	2.15	77.60	0.54	0.20
37	0.7480	41.000	19.0	12.8	0.40	0.35	0.74	2.15	77.60	0.54	0.20
38	0.7690	41.000	19.0	13.2	0.39	0.35	0.74	2.14	77.60	0.54	0.20
39	0.7880	41.000	19.0	13.5	0.39	0.35	0.74	2.14	77.60	0.54	0.20
40	0.8090	41.000	19.0	13.8	0.39	0.35	0.74	2.13	77.60	0.54	0.20
41	0.8280	40.000	18.0	14.2	0.37	0.35	0.72	2.07	77.60	0.53	0.18
42	0.8480	41.000	19.0	14.5	0.39	0.35	0.73	2.12	77.60	0.54	0.19
43	0.8690	41.000	19.0	14.9	0.39	0.35	0.73	2.12	77.60	0.54	0.19
44	0.8890	41.000	19.0	15.2	0.39	0.35	0.73	2.11	77.60	0.54	0.19
45	0.9100	41.000	19.0	15.6	0.38	0.35	0.73	2.11	77.60	0.54	0.19
46	0.9304	41.000	19.0	15.9	0.38	0.35	0.73	2.11	77.60	0.54	0.19

Parameters for Specimen No. 2

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	267.680			1019.450
Moisture content: Dry soil+tare, gms.	223.370			739.950
Moisture content: Tare, gms.	82.210			74.140
Moisture, %	31.4	50.7	42.8	42.0
Moist specimen weight, gms.	866.04			
Diameter, in.	2.865	2.860	2.779	
Area, in.^{2}	6.447	6.423	6.064	
Height, in.	6.031	6.020	5.852	
Net decrease in height, in.		0.011	0.168	
Wet Density, pcf	84.9	97.8	101.0	
Dry density, pcf	64.6	64.9	70.8	
Void ratio	1.1266	1.1149	0.9410	
Saturation, %	61.3	100.0	100.0	

Test Readings for Specimen No. 2

Consolidation cell pressure = 90.00 psi (12.96 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 2.88 ksf

Strain rate, in./min. = 0.007

Fail. Stress = 1.44 ksf at reading no. 9

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0030	16.000	0.0	0.0	0.00	2.51	2.51	1.00	72.60	2.51	0.00
1	0.0110	57.000	41.0	0.1	0.97	2.20	3.18	1.44	74.70	2.69	0.49
2	0.0250	69.000	53.0	0.4	1.25	1.86	3.11	1.67	77.10	2.48	0.63
3	0.0390	74.000	58.0	0.6	1.37	1.61	2.98	1.85	78.80	2.30	0.68
4	0.0520	76.000	60.0	0.8	1.41	1.44	2.85	1.98	80.00	2.15	0.71
5	0.0670	77.000	61.0	1.1	1.43	1.31	2.74	2.09	80.90	2.03	0.72
6	0.0810	78.000	62.0	1.3	1.45	1.21	2.66	2.20	81.60	1.94	0.73
7	0.0950	77.000	61.0	1.6	1.43	1.14	2.56	2.25	82.10	1.85	0.71
8	0.1090	77.000	61.0	1.8	1.42	1.08	2.50	2.32	82.50	1.79	0.71
9	0.1230	78.000	62.0	2.1	1.44	1.04	2.48	2.39	82.80	1.76	0.72
10	0.1370	78.000	62.0	2.3	1.44	0.99	2.43	2.45	83.10	1.71	0.72
11	0.1510	77.000	61.0	2.5	1.41	0.96	2.38	2.46	83.30	1.67	0.71
12	0.1650	77.000	61.0	2.8	1.41	0.94	2.34	2.50	83.50	1.64	0.70
13	0.1780	76.000	60.0	3.0	1.38	0.92	2.30	2.50	83.60	1.61	0.69
14	0.1920	76.000	60.0	3.2	1.38	0.91	2.29	2.52	83.70	1.60	0.69
15	0.2070	75.000	59.0	3.5	1.35	0.88	2.23	2.54	83.90	1.55	0.68
16	0.2210	74.000	58.0	3.7	1.33	0.88	2.20	2.51	83.90	1.54	0.66
17	0.2350	74.000	58.0	4.0	1.32	0.85	2.17	2.56	84.10	1.51	0.66
18	0.2490	73.000	57.0	4.2	1.30	0.85	2.15	2.53	84.10	1.50	0.65
19	0.2640	73.000	57.0	4.5	1.29	0.84	2.13	2.55	84.20	1.48	0.65
20	0.2780	73.000	57.0	4.7	1.29	0.84	2.13	2.54	84.20	1.48	0.64
21	0.2920	73.000	57.0	4.9	1.29	0.82	2.11	2.57	84.30	1.46	0.64
22	0.3060	73.000	57.0	5.2	1.28	0.81	2.09	2.59	84.40	1.45	0.64
23	0.3200	73.000	57.0	5.4	1.28	0.79	2.07	2.62	84.50	1.43	0.64
24	0.3340	73.000	57.0	5.7	1.28	0.79	2.07	2.61	84.50	1.43	0.64
25	0.3470	73.000	57.0	5.9	1.27	0.78	2.05	2.64	84.60	1.41	0.64
26	0.3610	72.000	56.0	6.1	1.25	0.78	2.03	2.61	84.60	1.40	0.62

Test Readings for Specimen No. 2

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
27	0.3750	72.000	56.0	6.4	1.25	0.76	2.01	2.63	84.70	1.39	0.62
28	0.3890	72.000	56.0	6.6	1.24	0.76	2.01	2.63	84.70	1.38	0.62
29	0.4030	71.000	55.0	6.8	1.22	0.76	1.98	2.59	84.70	1.37	0.61
30	0.4180	70.000	54.0	7.1	1.19	0.76	1.95	2.56	84.70	1.36	0.60
31	0.4320	70.000	54.0	7.3	1.19	0.76	1.95	2.56	84.70	1.36	0.59
32	0.4460	70.000	54.0	7.6	1.19	0.76	1.95	2.55	84.70	1.36	0.59
33	0.4600	69.000	53.0	7.8	1.16	0.75	1.91	2.55	84.80	1.33	0.58
34	0.4740	69.000	53.0	8.0	1.16	0.75	1.91	2.55	84.80	1.33	0.58
35	0.4880	69.000	53.0	8.3	1.15	0.73	1.89	2.57	84.90	1.31	0.58
36	0.5020	70.000	54.0	8.5	1.17	0.73	1.91	2.60	84.90	1.32	0.59
37	0.5160	70.000	54.0	8.8	1.17	0.73	1.90	2.59	84.90	1.32	0.58
38	0.5300	70.000	54.0	9.0	1.17	0.73	1.90	2.59	84.90	1.32	0.58
39	0.5440	70.000	54.0	9.2	1.16	0.73	1.90	2.58	84.90	1.32	0.58
40	0.5580	70.000	54.0	9.5	1.16	0.73	1.90	2.58	84.90	1.31	0.58
41	0.5720	70.000	54.0	9.7	1.16	0.73	1.89	2.58	84.90	1.31	0.58
42	0.5860	70.000	54.0	10.0	1.15	0.72	1.87	2.60	85.00	1.30	0.58
43	0.6000	69.000	53.0	10.2	1.13	0.72	1.85	2.57	85.00	1.29	0.57
44	0.6140	69.000	53.0	10.4	1.13	0.72	1.85	2.57	85.00	1.28	0.56
45	0.6280	69.000	53.0	10.7	1.12	0.73	1.86	2.53	84.90	1.30	0.56
46	0.6420	69.000	53.0	10.9	1.12	0.72	1.84	2.56	85.00	1.28	0.56
47	0.6560	69.000	53.0	11.2	1.12	0.72	1.84	2.55	85.00	1.28	0.56
48	0.6700	69.000	53.0	11.4	1.12	0.72	1.84	2.55	85.00	1.28	0.56
49	0.6850	70.000	54.0	11.7	1.13	0.73	1.87	2.54	84.90	1.30	0.57
50	0.6990	70.000	54.0	11.9	1.13	0.72	1.85	2.57	85.00	1.28	0.56
51	0.7130	71.000	55.0	12.1	1.15	0.73	1.88	2.56	84.90	1.31	0.57
52	0.7270	71.000	55.0	12.4	1.14	0.72	1.86	2.59	85.00	1.29	0.57
53	0.7410	71.000	55.0	12.6	1.14	0.72	1.86	2.59	85.00	1.29	0.57
54	0.7550	71.000	55.0	12.9	1.14	0.72	1.86	2.58	85.00	1.29	0.57
55	0.7690	70.000	54.0	13.1	1.11	0.72	1.83	2.55	85.00	1.28	0.56
56	0.7820	69.000	53.0	13.3	1.09	0.71	1.80	2.55	85.10	1.25	0.55
57	0.7960	69.000	53.0	13.6	1.09	0.72	1.81	2.51	85.00	1.26	0.54
58	0.8100	70.000	54.0	13.8	1.11	0.71	1.81	2.57	85.10	1.26	0.55
59	0.8240	69.000	53.0	14.0	1.08	0.72	1.80	2.50	85.00	1.26	0.54
60	0.8390	69.000	53.0	14.3	1.08	0.71	1.78	2.53	85.10	1.24	0.54
61	0.8530	69.000	53.0	14.5	1.08	0.71	1.78	2.52	85.10	1.24	0.54
62	0.8670	69.000	53.0	14.8	1.07	0.71	1.78	2.52	85.10	1.24	0.54
63	0.8810	70.000	54.0	15.0	1.09	0.71	1.80	2.54	85.10	1.25	0.54

Parameters for Specimen No. 3

Specimen Parameter	Initial	Saturated	Consolidated	Final
Moisture content: Moist soil+tare, gms.	263.520			1030.860
Moisture content: Dry soil+tare, gms.	221.160			741.540
Moisture content: Tare, gms.	83.190			81.560
Moisture, %	30.7	49.7	42.5	43.8
Moist specimen weight, gms.	867.13			
Diameter, in.	2.865	2.856	2.782	
Area, in.²	6.447	6.406	6.079	
Height, in.	6.031	6.012	5.859	
Net decrease in height, in.		0.019	0.153	
Wet Density, pcf	85.0	98.2	101.1	
Dry density, pcf	65.0	65.6	71.0	
Void ratio	1.1128	1.0928	0.9354	
Saturation, %	60.7	100.0	100.0	

Test Readings for Specimen No. 3

Consolidation cell pressure = 100.00 psi (14.40 ksf)

Consolidation back pressure = 70.00 psi (10.08 ksf)

Consolidation effective confining stress = 4.32 ksf

Strain rate, in./min. = 0.009

Fail. Stress = 2.29 ksf at reading no. 5

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
0	0.0080	21.000	0.0	0.0	0.00	3.93	3.93	1.00	72.70	3.93	0.00
1	0.0240	90.000	69.0	0.3	1.63	2.95	4.58	1.55	79.50	3.77	0.82
2	0.0420	108.000	87.0	0.6	2.05	2.30	4.35	1.89	84.00	3.33	1.02
3	0.0590	115.000	94.0	0.9	2.21	1.87	4.08	2.18	87.00	2.98	1.10
4	0.0770	118.000	97.0	1.2	2.27	1.58	3.85	2.43	89.00	2.72	1.14
5	0.0960	119.000	98.0	1.5	2.29	1.38	3.67	2.65	90.40	2.53	1.14
6	0.1150	119.000	98.0	1.8	2.28	1.25	3.53	2.82	91.30	2.39	1.14
7	0.1330	119.000	98.0	2.1	2.27	1.14	3.41	3.00	92.10	2.27	1.14
8	0.1510	119.000	98.0	2.4	2.26	1.07	3.33	3.13	92.60	2.20	1.13
9	0.1690	119.000	98.0	2.7	2.26	0.99	3.25	3.27	93.10	2.12	1.13
10	0.1870	119.000	98.0	3.1	2.25	0.95	3.20	3.37	93.40	2.08	1.13
11	0.2040	119.000	98.0	3.3	2.24	0.91	3.15	3.47	93.70	2.03	1.12
12	0.2220	119.000	98.0	3.7	2.24	0.88	3.12	3.55	93.90	2.00	1.12
13	0.2390	118.000	97.0	3.9	2.21	0.84	3.04	3.64	94.20	1.94	1.10
14	0.2580	118.000	97.0	4.3	2.20	0.84	3.03	3.63	94.20	1.94	1.10
15	0.2760	117.000	96.0	4.6	2.17	0.79	2.96	3.74	94.50	1.88	1.09
16	0.2950	116.000	95.0	4.9	2.14	0.81	2.95	3.65	94.40	1.88	1.07
17	0.3130	116.000	95.0	5.2	2.13	0.76	2.90	3.80	94.70	1.83	1.07
18	0.3320	116.000	95.0	5.5	2.13	0.79	2.92	3.68	94.50	1.85	1.06
19	0.3490	116.000	95.0	5.8	2.12	0.75	2.87	3.83	94.80	1.81	1.06
20	0.3670	116.000	95.0	6.1	2.11	0.76	2.88	3.77	94.70	1.82	1.06
21	0.3850	116.000	95.0	6.4	2.11	0.73	2.84	3.87	94.90	1.79	1.05
22	0.4030	116.000	95.0	6.7	2.10	0.73	2.83	3.86	94.90	1.78	1.05
23	0.4210	116.000	95.0	7.0	2.09	0.72	2.81	3.91	95.00	1.77	1.05
24	0.4380	115.000	94.0	7.3	2.06	0.72	2.78	3.87	95.00	1.75	1.03
25	0.4570	115.000	94.0	7.7	2.06	0.71	2.76	3.91	95.10	1.73	1.03
26	0.4750	114.000	93.0	8.0	2.03	0.71	2.73	3.87	95.10	1.72	1.01

Test Readings for Specimen No. 3

No.	Def. Dial in.	Load Dial	Load lbs.	Strain %	Deviator Stress ksf	Minor Eff. Stress ksf	Major Eff. Stress ksf	1:3 Ratio	Pore Press. psi	P ksf	Q ksf
27	0.4930	114.000	93.0	8.3	2.02	0.69	2.71	3.92	95.20	1.70	1.01
28	0.5120	114.000	93.0	8.6	2.01	0.69	2.70	3.91	95.20	1.70	1.01
29	0.5300	115.000	94.0	8.9	2.03	0.68	2.71	4.00	95.30	1.69	1.01
30	0.5480	115.000	94.0	9.2	2.02	0.69	2.71	3.92	95.20	1.70	1.01
31	0.5660	115.000	94.0	9.5	2.01	0.68	2.69	3.98	95.30	1.68	1.01
32	0.5840	115.000	94.0	9.8	2.01	0.68	2.68	3.97	95.30	1.68	1.00
33	0.6020	115.000	94.0	10.1	2.00	0.68	2.68	3.96	95.30	1.68	1.00
34	0.6200	115.000	94.0	10.4	1.99	0.68	2.67	3.95	95.30	1.67	1.00
35	0.6370	115.000	94.0	10.7	1.99	0.68	2.66	3.94	95.30	1.67	0.99
36	0.6550	114.000	93.0	11.0	1.96	0.68	2.64	3.90	95.30	1.66	0.98
37	0.6730	114.000	93.0	11.4	1.95	0.66	2.62	3.95	95.40	1.64	0.98
38	0.6920	114.000	93.0	11.7	1.95	0.66	2.61	3.94	95.40	1.64	0.97
39	0.7100	114.000	93.0	12.0	1.94	0.66	2.60	3.93	95.40	1.63	0.97
40	0.7200	114.000	93.0	12.2	1.94	0.66	2.60	3.92	95.40	1.63	0.97
41	0.7470	115.000	94.0	12.6	1.95	0.66	2.61	3.94	95.40	1.64	0.97
42	0.7650	115.000	94.0	12.9	1.94	0.65	2.59	3.99	95.50	1.62	0.97
43	0.7830	115.000	94.0	13.2	1.93	0.66	2.59	3.92	95.40	1.63	0.97
44	0.8000	115.000	94.0	13.5	1.93	0.65	2.57	3.97	95.50	1.61	0.96
45	0.8180	115.000	94.0	13.8	1.92	0.66	2.58	3.90	95.40	1.62	0.96
46	0.8360	114.000	93.0	14.1	1.89	0.65	2.54	3.92	95.50	1.59	0.95
47	0.8540	114.000	93.0	14.4	1.88	0.66	2.55	3.85	95.40	1.60	0.94
48	0.8720	114.000	93.0	14.7	1.88	0.65	2.53	3.90	95.50	1.59	0.94
49	0.8910	114.000	93.0	15.1	1.87	0.66	2.53	3.82	95.40	1.60	0.94
50	0.9090	114.000	93.0	15.4	1.86	0.65	2.51	3.88	95.50	1.58	0.93

ATTACHMENT 4

Global Slope Stability Calculation Package

S&ME

PROJECT NO. 1356-10-009-03

SHEET NO. 1 / 4

DATE August 25, 2010

JOB NAME Duke Energy – Allen Steam Station Ash Landfill

COMPUTED BY KB

SUBJECT Global Slope Stability Calculation

CHECKED BY

COMPUTATIONS BY: Signature Date 9/3/10

Name Kyle Baucom, E.I.

Title Staff Professional

ASSUMPTIONS AND PROCEDURES CHECKED BY: Signature Date 9/3/10

Name Kenneth Daly, P.E.

Title Sr. Project Engineer

COMPUTATIONS CHECKED BY: Signature Date 9/3/2010

Name William Harrison, E.I.

Title Staff Professional

REVIEWED BY: Signature Date 9/3/2010

Name Jason Reeves, P.E.

Title Sr. Project Engineer

REVIEW NOTES / COMMENTS:

OBJECTIVE:

Evaluate the global slope stability of the ash landfill over the Retired Ash Basin (RAB) at Allen Steam Station based on recent consolidated-undrained (CU) triaxial shear test results from tests performed on ash placed in the landfill. Global slope stability analyses will be similar to the analyses originally developed for the calculation package submitted in the Permit to Construct (PTC) Application. However, material shear strengths for the ash fill in the landfill will vary, analyses will be performed for post-construction conditions only including static and pseudo-static (seismic) slope stability analyses. A peak horizontal ground acceleration of 0.10g will be used as referenced in the "Revised Liquefaction Potential Analyses" calculation package dated April 30, 2010.

METHOD:

Analyze the static and seismic slope stability of two representative cross-sections identified as the north-south cross-section and the east-west cross-section. The seismic stability was analyzed using a pseudo-static approach (i.e., static with the addition of a seismic force coefficient). Two conditions were analyzed: Post-Construction Static and Post-Construction Pseudo-Static. Geostudio's SLOPE/W computer program was used, running Spencer's Method, to analyze the static and pseudo-static slope stability.

CALCULATIONS:

Design Criterion

The target factor of safety for Post-Construction Static (final, long-term) analyses was adapted from USACE (2003) documents as 1.5. For the Post-Construction Pseudo-Static analyses, the target factor of safety was 1.0 as presented in EPA (1995) documents.

Cross Sections

Subsurface data including stratigraphy and location of the water table were obtained from soil test boring logs and observation well logs developed by S&ME (2007). Supplemental historic data was obtained from previous reports conducted at the site [LAW (1982, 1998), MACTEC (2003) and Shield (2004)].

Two general cross-sections were developed for slope stability analyses and the locations are illustrated on Figure 1. The sections are indentified as the North-South section (or A-A') and the East-West section (or B-B'). The North-South cross section is shown in Figure 2. The East-West cross section is shown in Figure 3. The proposed ash fill will be placed on top of the RAB. The RAB contains fly and bottom ash ranging in thickness from about 15 to 55 feet.

The RAB is surrounded by earthen dikes on the North, East, South and West sides. During ash basin operations, the dikes were constructed in sequential stages. Each new stage was constructed on top of the previous stage by adding fill to both the upstream and downstream sides and raising the dike elevations by approximately 20 feet. Dikes to the North and East consisted of two stages. The dike to the South consists of a third stage. A cross section illustrating the south dike stratigraphy (C-C') is provided in Figure 4. We understand the West dike consists of only a single stage.

The RAB is underlain by saprolite. The East dike is partially underlain with saprolite, partially underlain with alluvium, and buttressed by fill. The alluvium borders the Catawba River and is underlain by saprolite. For the East-West cross section the water table was assumed to start approximately 12 feet below the surface of the RAB and decrease in elevation until it reaches the river water surface elevation. The South dike is underlain by saprolite.

For the North-South cross section the water table was assumed to start at the surface of the active ash basin (located south of the RAB), decrease in elevation through the South dike, and reach a constant depth of approximately 12 ft.

Material Parameters

The generalized cross-sections consist of 8 material types: ash fill (being placed in the active landfill), RAB ash (existing ash below the landfill subgrade), Dike I, Dike II, Dike III, fill, alluvium, and saprolite. The unit weight, effective strength cohesion (c') and effective stress friction angle (Φ') were estimated for each material. In addition, the undrained shear strength of RAB ash with respect to depth was estimated to account for consolidation strength gain.

The only change in material properties from those used in the PTC global slope stability calculation package is the effective stress friction angle (Φ') for the ash fill (being placed in the active landfill). S&ME performed triaxial tests on ash samples compacted to 90 and 95 percent standard Proctor relative density. Table 1 summarizes the ash fill material shear strengths for various scenarios based on published literature and S&ME laboratory testing.

TABLE 1: ASH FILL MATERIAL SHEAR STRENGTHS

Condition	Effective Strength		Source or Comment
	c' (psf)	Φ' (degrees)	
Original Design (PTC Calculation)	0	34	Table 5.2 Oweis et. Al. 1998
95 Percent Relative Density	0	33.8	S&ME Triaxial Test Results
90 Percent Relative Density	0	26	S&ME Triaxial Test Results

Analyses

Static and Pseudo-Static

Slope stability analyses were performed on the north-south and the east-west cross sections using SLOPE/W for the final (post-construction) condition. Both static and pseudo-static conditions were evaluated using Spencer's analysis with circular and non-circular failure surfaces. Pseudo-static conditions assumed a peak ground acceleration of 0.10g as discussed in the "Revised Liquefaction Potential Analyses" calculation package dated April 30, 2010.

The user defined entrance and exit method was used to randomly generate 1,000 potential failure surfaces. After these potential failure surfaces were analyzed, the critical surface was then refined by running an optimization algorithm for 2,000 iterations. The post-construction static and pseudo-static conditions were modeled by assuming a deep-seated circular potential failure surface passing through the ash and dikes.

Results

The slope stability analysis results are summarized in the Table below. The output figures and files for the slope stability analyses are provided in Attachment 1.

TABLE 2: POST-CONSTRUCTION STABILITY

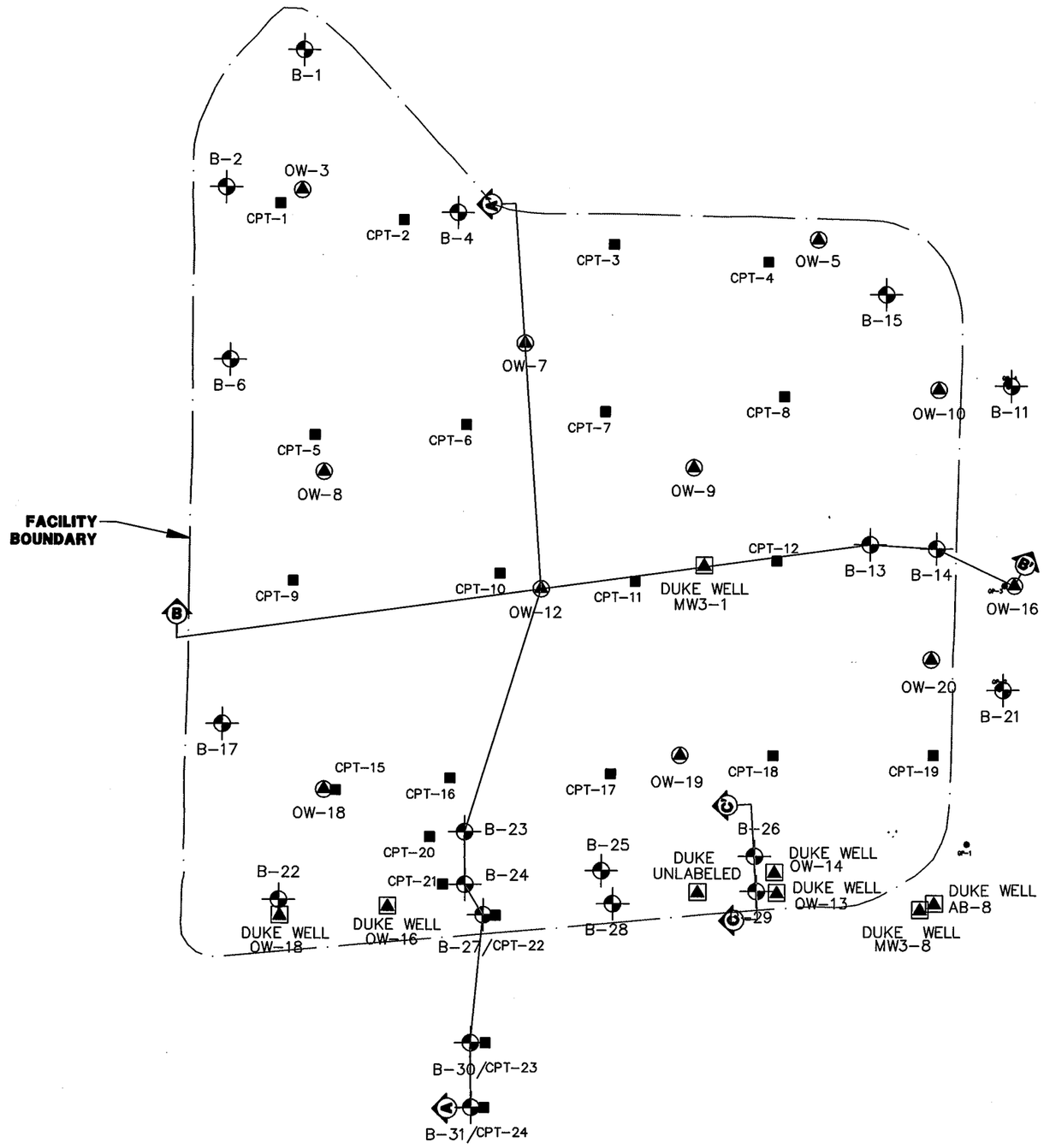
Cross Section	Loading Condition	Material Property Condition	Φ' (degrees)	Safety Factor	Design Criteria Safety Factor	Check	Results Figure
East / West	Static	Design Assumption	34	1.990	1.5	OK	5
		95 Percent Compaction	33.8	1.985	1.5	OK	6
		90 Percent Compaction	26	1.532	1.5	OK	7
North / South	Static	Design Assumption	34	1.725	1.5	OK	8
		95 Percent Compaction	33.8	1.720	1.5	OK	9
		90 Percent Compaction	26	1.530	1.5	OK	10
East / West	Pseudo-static	Design Assumption	34	1.452	1.0	OK	11
		95 Percent Compaction	33.8	1.447	1.0	OK	12
		90 Percent Compaction	26	1.117	1.0	OK	13
North / South	Pseudo-static	Design Assumption	34	1.457	1.0	OK	14
		95 Percent Compaction	33.8	1.454	1.0	OK	15
		90 Percent Compaction	26	1.153	1.0	OK	16

CONCLUSIONS:

Results indicate that static and pseudo-static slope stability factors of safety exceed the minimum factor of safety for the design analyses conditions and ash material strengths. Based on the analyses, acceptable factors of safety were achieved using the representative shear strength results for the compacted ash structural fill for both 95 percent and 90 percent standard Proctor relative density.

REFERENCES:

1. "Global Slope Stability Calculation" Permit to Construct Application. March 3, 2008.
2. GeoSlope 2007, v. 7.11, Geo-Slope International, Ltd.
3. "Engineering and Design: Slope Stability" EM 1110-2-1902. U.S. Army Corps of Engineers. October 31, 2003.
4. "RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities" EPA/600/R-95/051. United States Environmental Protection Agency. April 1995.



LEGEND

KEY TO BORING LOG (BL)

TOPSOIL	ORGANIC	CLAYEY SAND
GRAVEL	SANDY	SANDY SILT
SAND	SILTY	CLAYEY SILT
SILT	CLAYEY	SANDY CLAY
CLAY	SILTY SAND	SILTY CLAY

KEY TO WELL LOG (WL)

FILTER SAND	GROUT
BENTONITE	
ASH	PARTILLAY WEATHERED ROCK
FILL	BEDROCK
SAPROLITE	

DATE: 1/05/08
DRAWN BY: CLD
CHECKED BY: ZDS
SCALE: N.T.S.
PROJECT NO. 1356-06-825

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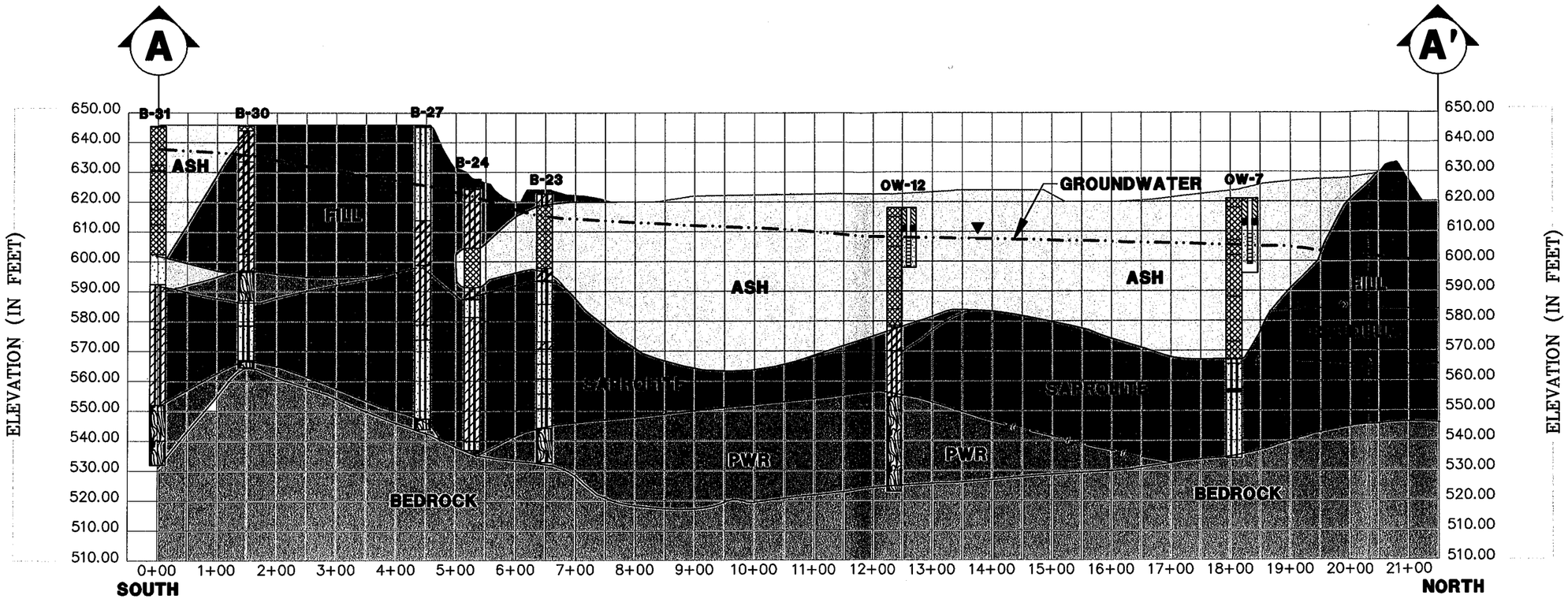
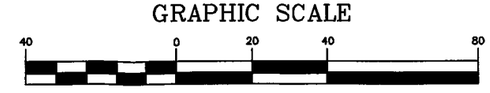
CROSS SECTION LOCATION

ALLEN STEAM STATION – RETIRED ASH BASIN
BELMONT, NORTH CAROLINA

FIGURE NO.
1

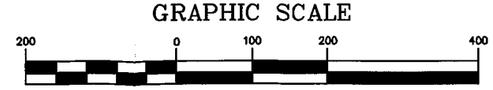


VERTICAL
GRAPHIC SCALE



(IN FEET)

HORIZONTAL
GRAPHIC SCALE



(IN FEET)

SCALE: AS SHOWN	DATE: 1/05/08
PROJECT NO. 1356-06-825	DRAWN BY: CLD
	CHECKED BY: ZDS

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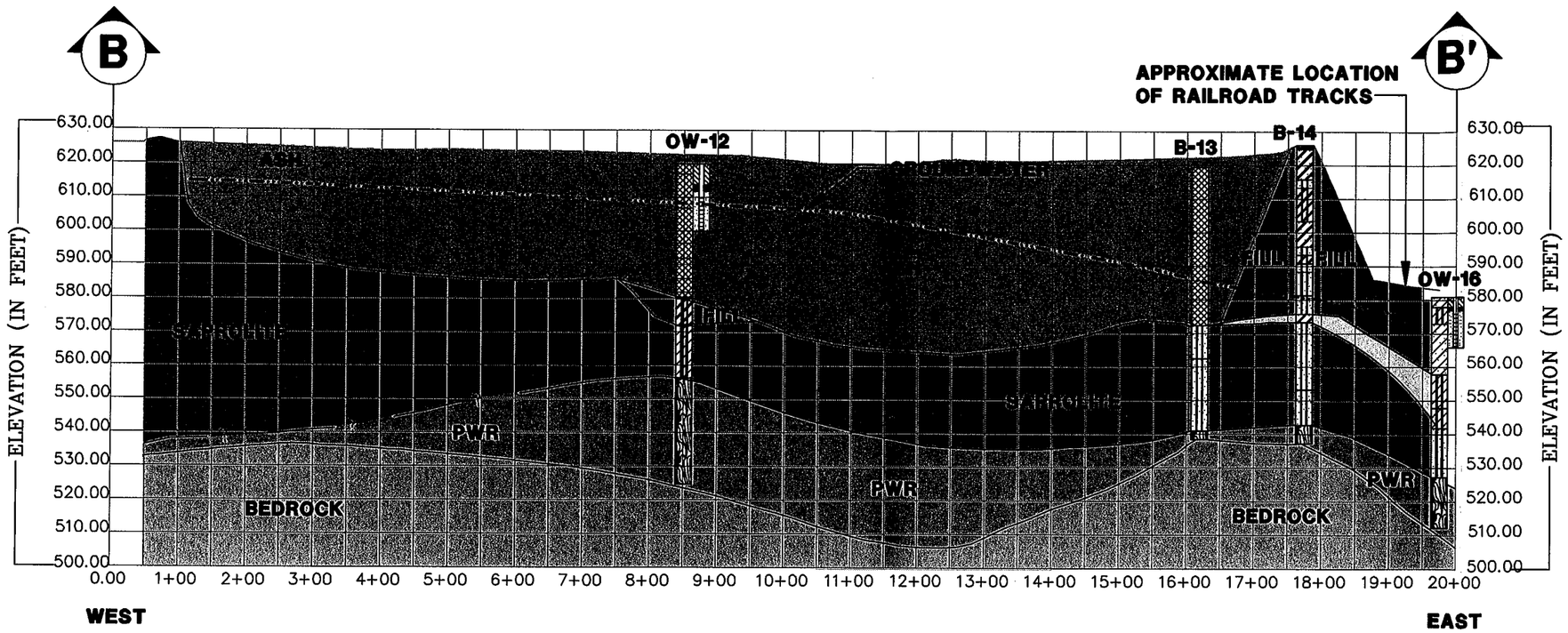
CROSS SECTION A - A'
NORTH - SOUTH

ALLEN STEAM STATION – RETIRED ASH BASIN
BELMONT, NORTH CAROLINA

FIGURE NO.
2



VERTICAL
GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

HORIZONTAL
GRAPHIC SCALE

200 0 100 200 400

(IN FEET)

SCALE: AS SHOWN

PROJECT NO. 1356-06-825

DATE: 1/05/08

DRAWN BY: CLD

CHECKED BY: ZDS

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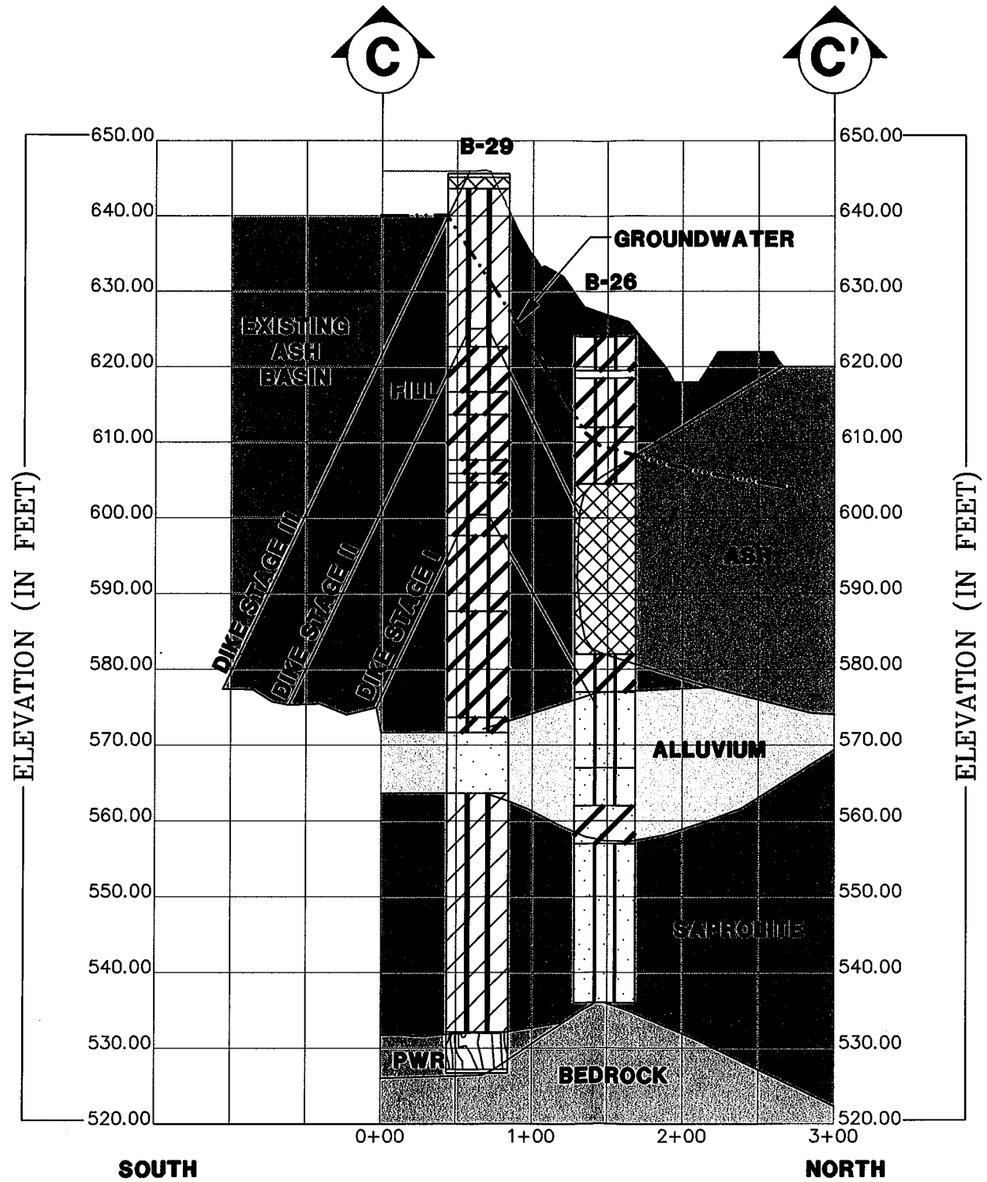
CROSS SECTION B - B'
EAST - WEST

ALLEN STEAM STATION – RETIRED ASH BASIN
BELMONT, NORTH CAROLINA

FIGURE NO.

3



VERTICAL GRAPHIC SCALE

20 0 10 20 40

(IN FEET)

HORIZONTAL GRAPHIC SCALE

100 0 50 100 200

(IN FEET)

SCALE:	AS SHOWN
PROJECT NO.	1356-06-825
DATE:	1/05/08
DRAWN BY:	CLD
CHECKED BY:	ZDS

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CROSS SECTION C - C'
SOUTH DIKE STRATIGRAPHY

ALLEN STEAM STATION – RETIRED ASH BASIN
BELMONT, NORTH CAROLINA

FIGURE NO.

4

Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike I Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 600 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike II Model: Mohr-Coulomb Unit Weight: 115 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Fill Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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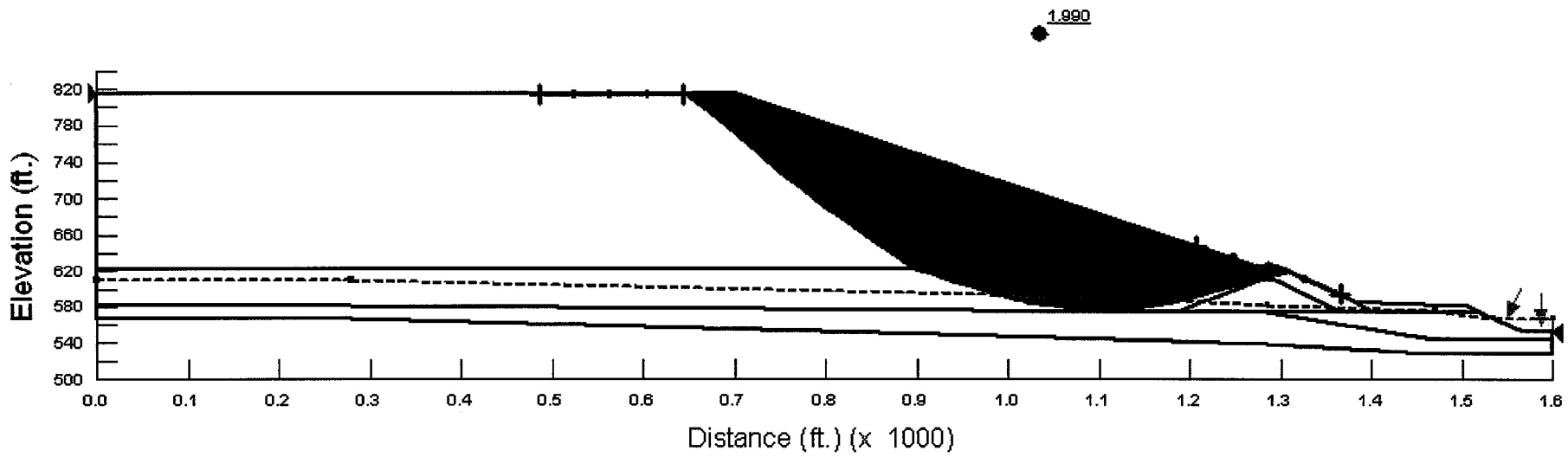

SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (E-W, Static, Φ' = 34.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	5
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 33.8 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike I Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 600 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike II Model: Mohr-Coulomb Unit Weight: 115 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Fill Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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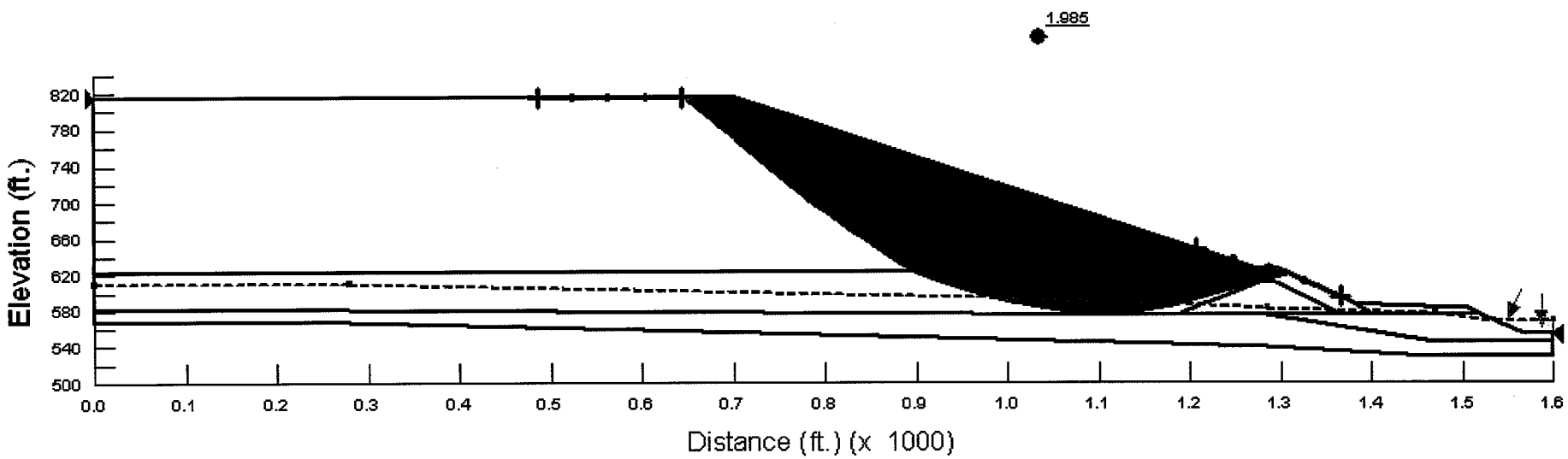

SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (E-W, Static, Φ' = 33.8°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	6
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

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Name: Dike I Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 600 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike II Model: Mohr-Coulomb Unit Weight: 115 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Fill Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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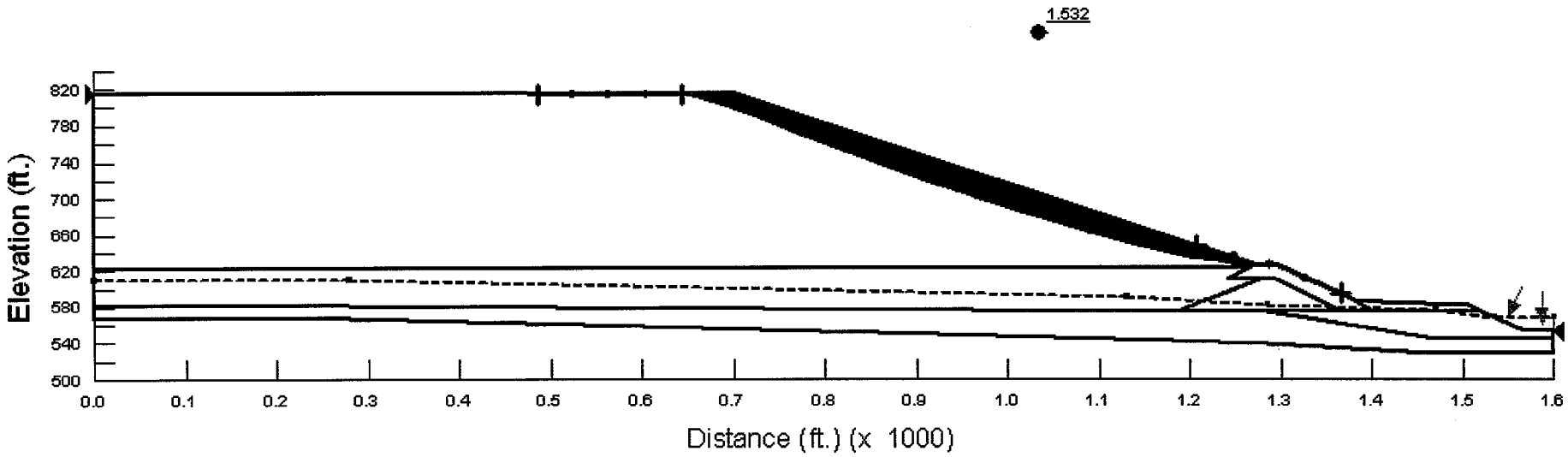

SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (E-W, Static, Φ' = 26.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	7
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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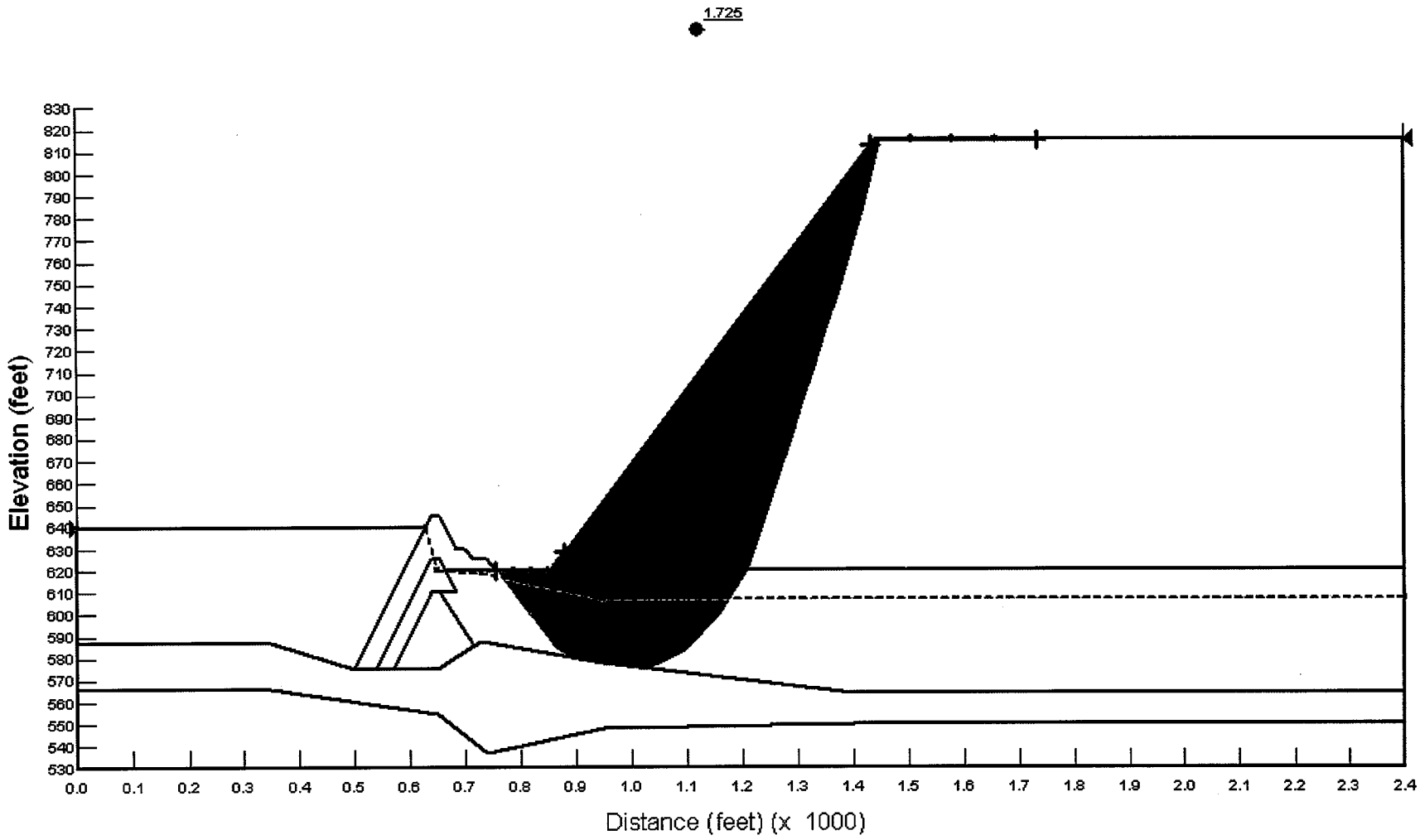
Name: Dike III Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1



SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (N-S, Static, Φ' = 34.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	8
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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Name: PWR Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 500 Phi: 45 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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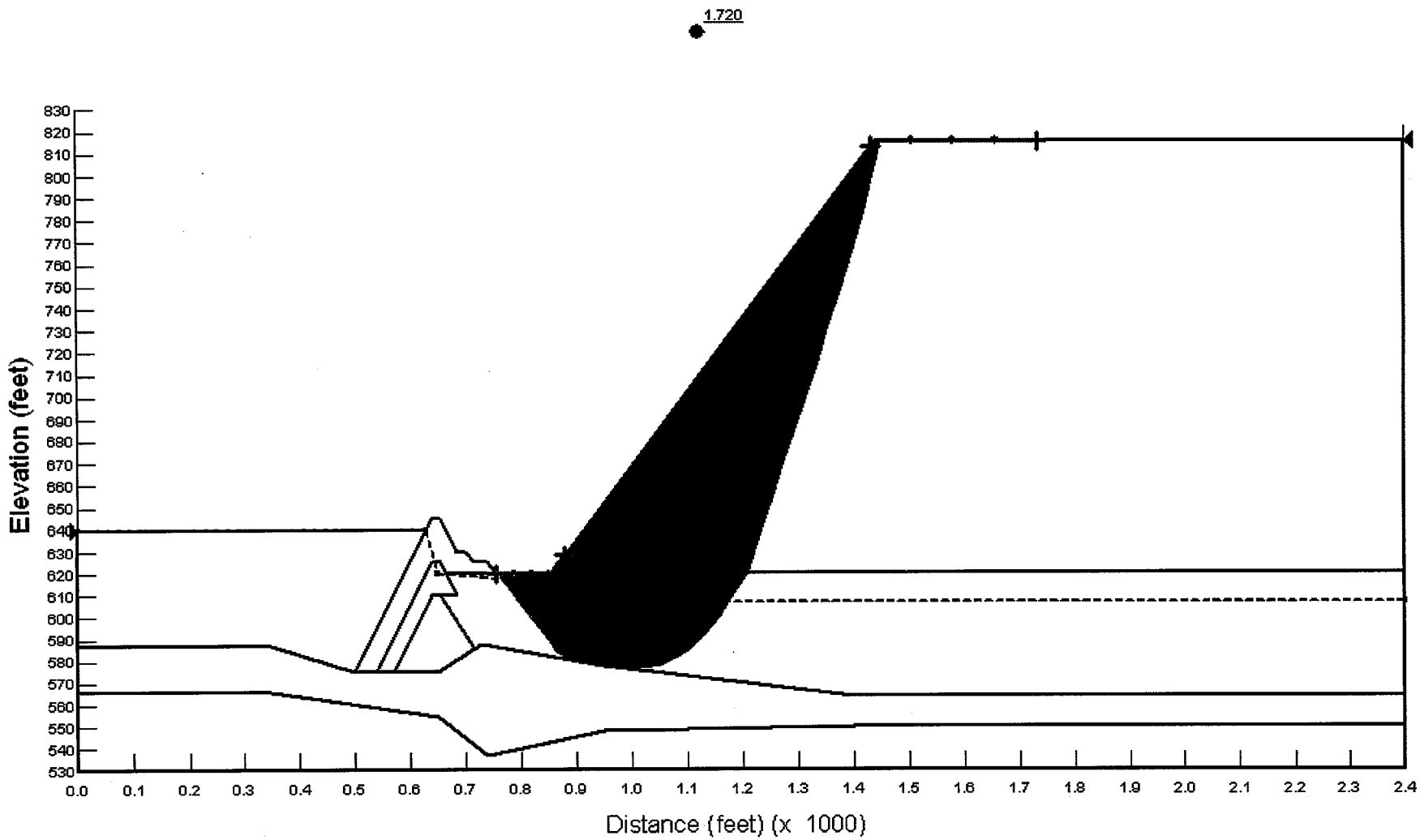

SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (N-S, Static, Φ' = 33.8°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	9
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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Name: Saprolite Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 70 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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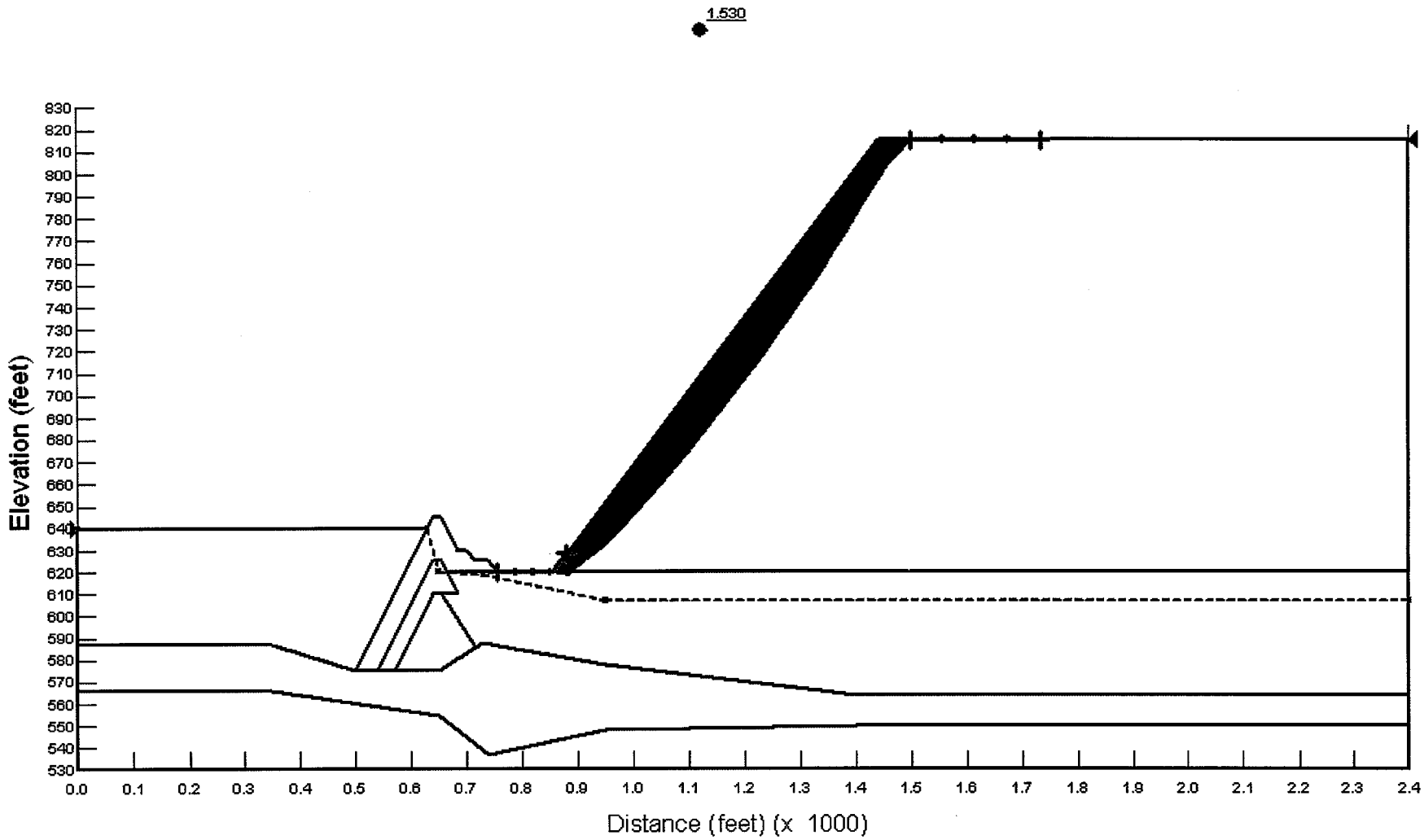

SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (N-S, Static, Φ' = 26.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	10
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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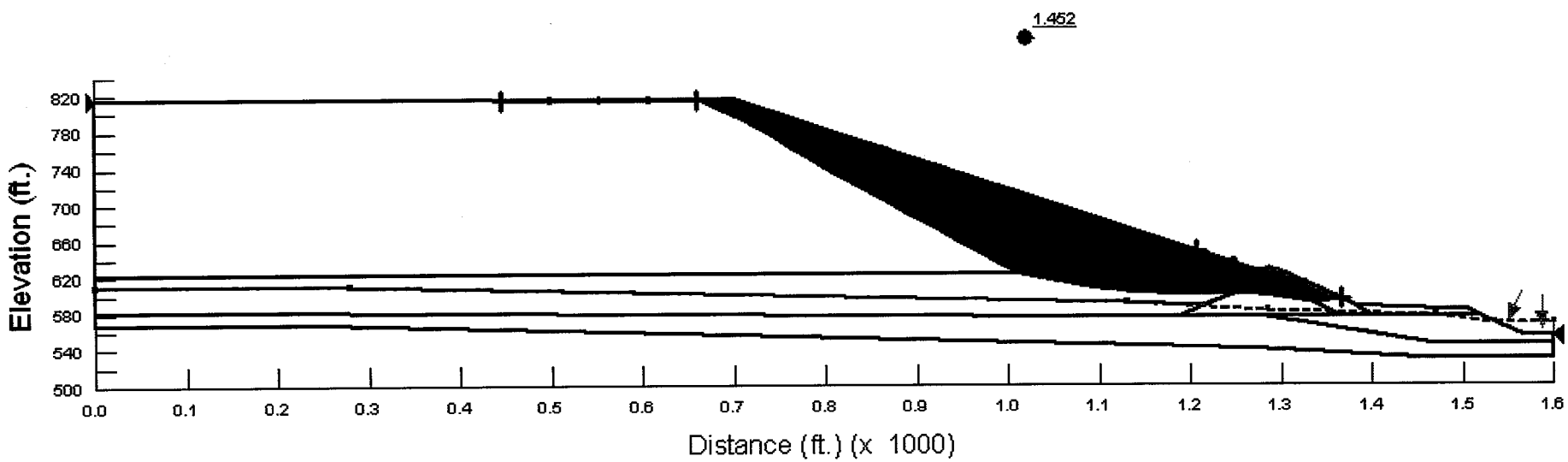
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Saprolite Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 70 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash (Wet) Model: S=f(datum) Unit Weight: 90 C-Datum: 5078.7 C-Rate of Increase: 7.5 Limiting C: 6500 Elevation: 598 Piezometric Line: 1

Horizontal Seismic Load = 0.10g



SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (E-W, Pseudo-Static, Φ' = 34.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	11
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 33.8 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
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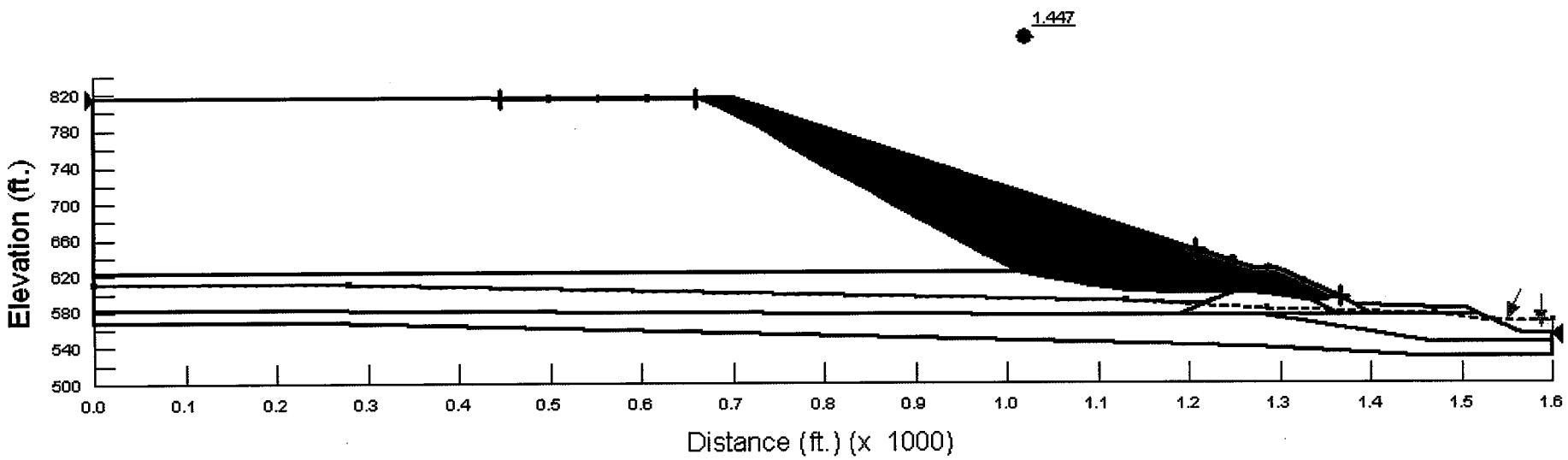
Name: Ash (Wet) Model: S=f(datum) Unit Weight: 90 C-Datum: 5078.7 C-Rate of Increase: 7.5 Limiting C: 6500 Elevation: 598 Piezometric Line: 1

Horizontal Seismic Load = 0.10g



SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (E-W, Pseudo-Static, Φ' = 33.8°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	12
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

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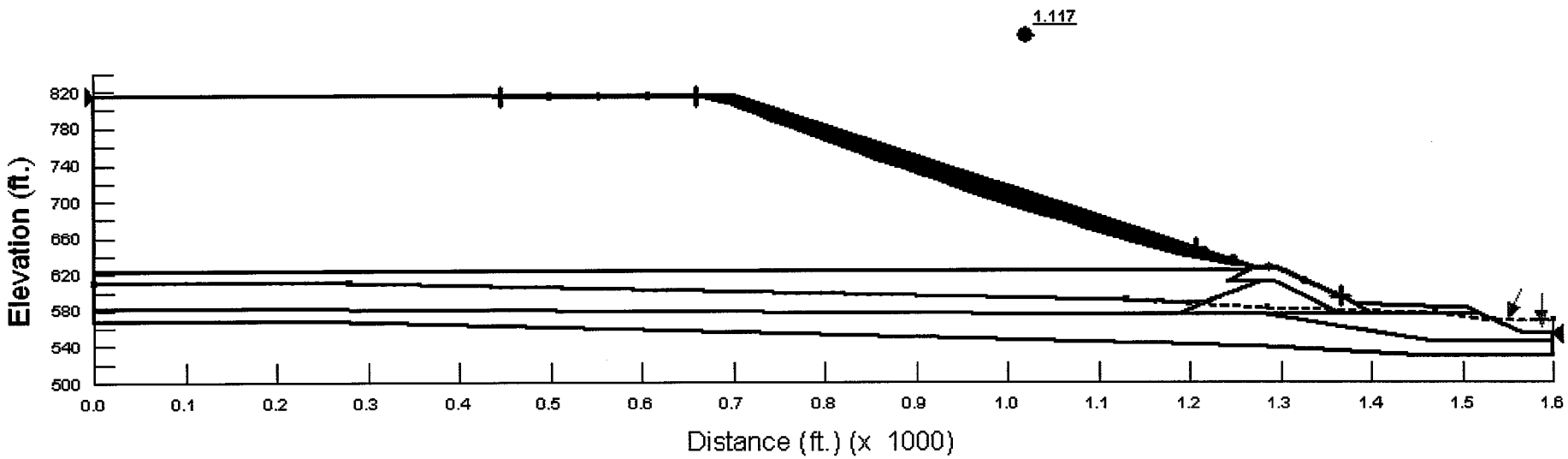
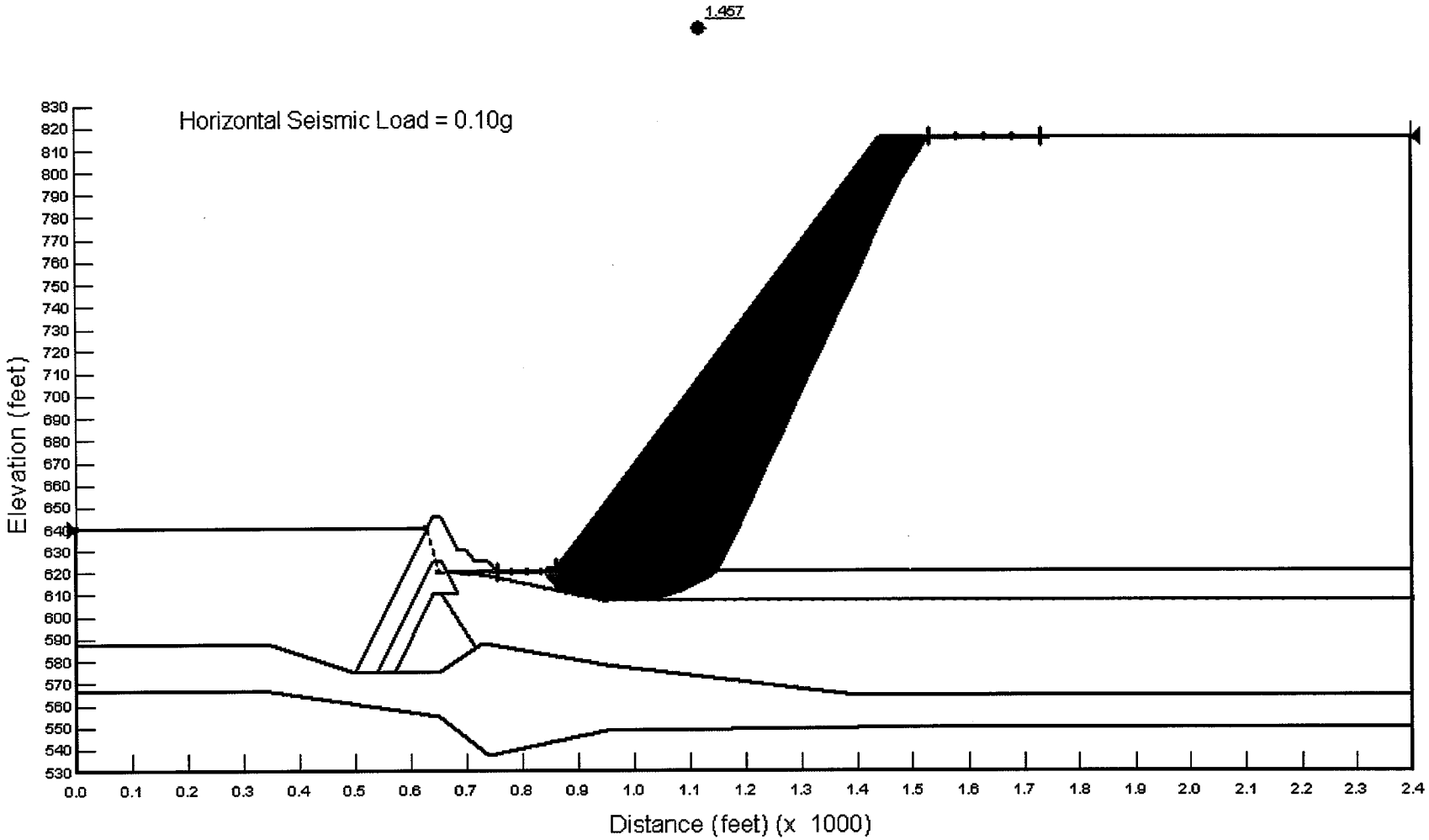
Horizontal Seismic Load = 0.10g



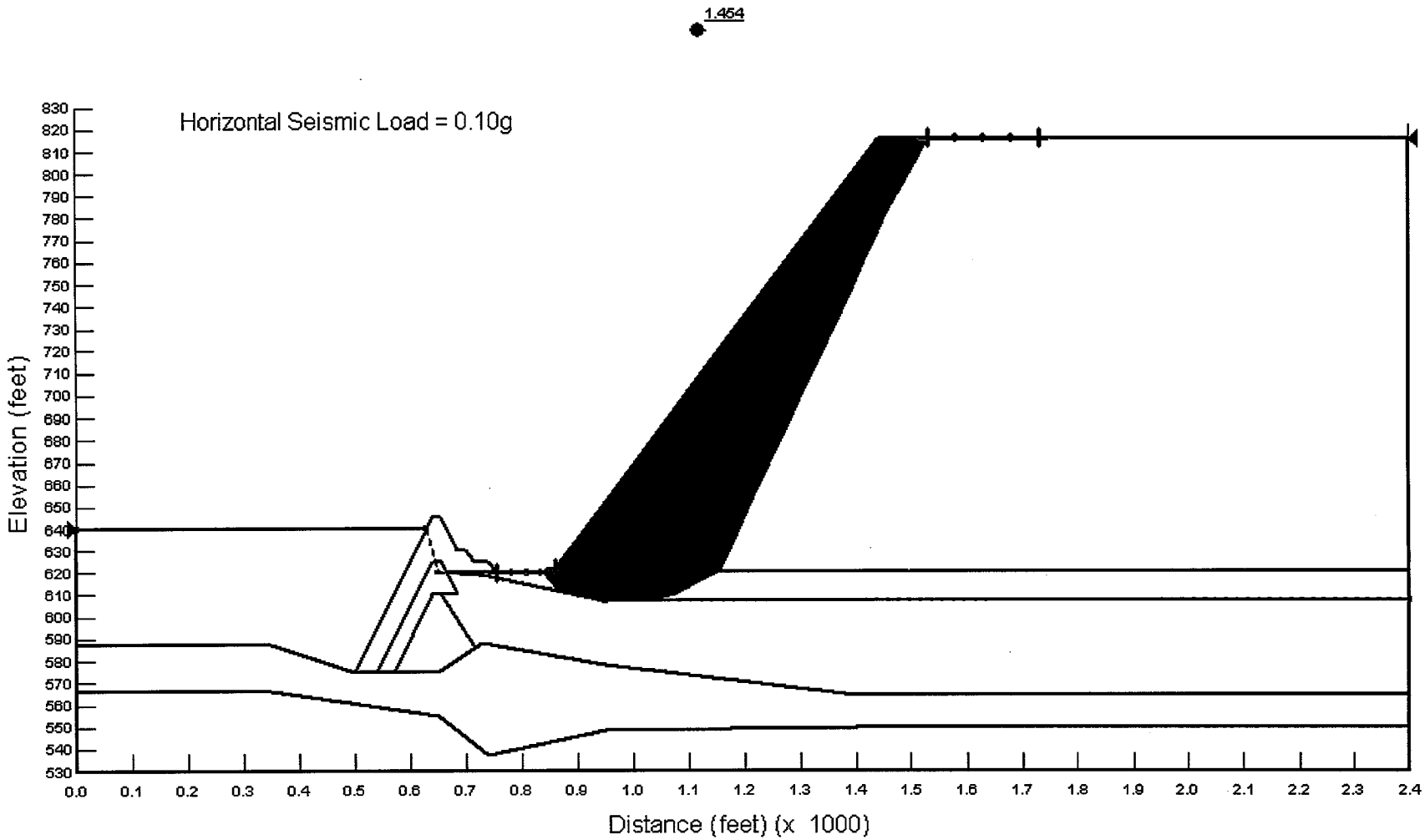
SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (E-W, Pseudo-Static, Φ' = 26.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	13
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike II Model: Mohr-Coulomb Unit Weight: 115 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike I Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 600 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Fill Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Saprolite Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 70 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: PWR Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 500 Phi: 46 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike III Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash (Wet) Model: S=f(datum) Unit Weight: 90 C-Datum: 5078.7 C-Rate of Increase: 7.5 Limiting C: 6500 Elevation: 607 Piezometric Line: 1



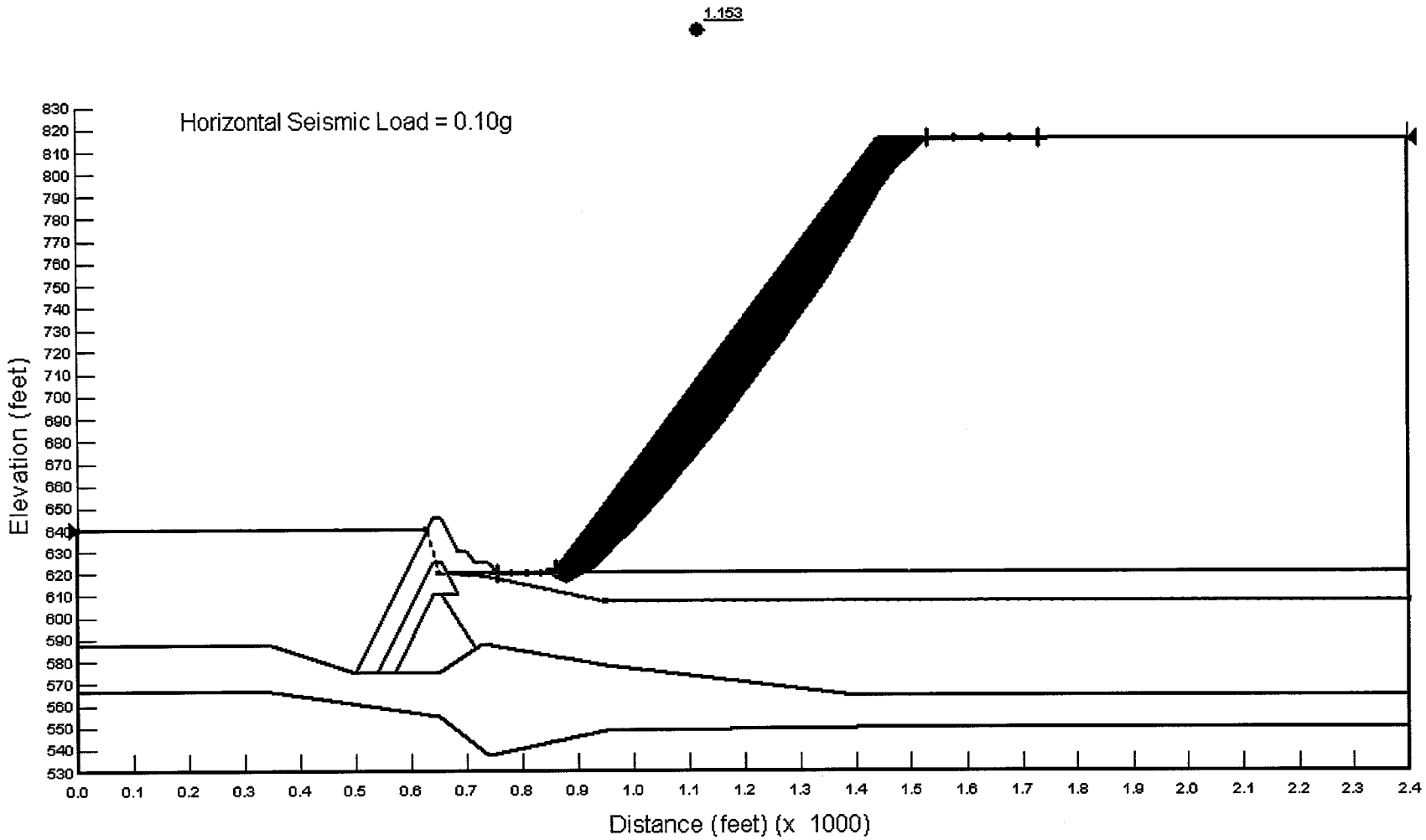
SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (N-S, Pseudo-Static, Φ' = 34.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	14
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 33.8 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike II Model: Mohr-Coulomb Unit Weight: 115 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike I Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 600 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Fill Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Saprolite Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 70 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: PWR Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 500 Phi: 45 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike III Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash (Wet) Model: S=f(datum) Unit Weight: 90 C-Datum: 5078.7 C-Rate of Increase: 7.5 Limiting C: 6500 Elevation: 607 Piezometric Line: 1



SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (N-S, Pseudo-Static, Φ' = 33.8°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	15
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

Name: RAB Ash Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 25 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash Fill Model: Mohr-Coulomb Unit Weight: 90 Cohesion: 0 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike II Model: Mohr-Coulomb Unit Weight: 115 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike I Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 600 Phi: 26 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Fill Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Alluvium Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 100 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Saprolite Model: Mohr-Coulomb Unit Weight: 110 Cohesion: 70 Phi: 32 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: PWR Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 500 Phi: 45 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Dike III Model: Mohr-Coulomb Unit Weight: 120 Cohesion: 0 Phi: 34 Phi-B: 0 C-Phi Correlation Coef.: 0 Piezometric Line: 1
Name: Ash (Wet) Model: S=f(datum) Unit Weight: 90 C-Datum: 5078.7 C-Rate of Increase: 7.5 Limiting C: 6500 Elevation: 607 Piezometric Line: 1



SCALE: AS SHOWN	S&ME ENGINEERING • TESTING ENVIRONMENTAL SERVICES	**Global Slope Stability Analysis (N-S, Pseudo-Static, Φ' = 26.0°)**	FIGURE NO.
DRAWN BY: KB		**Allen Steam Station**	16
CHECKED BY:		253 Plant Allen Rd.	
DATE: 8/20/10		BELMONT, NORTH CAROLINA	
		JOB NO.: 1356-10-009 Ph. 03	

EM 1110-2-1902
31 Oct 2003

US Army Corps
of Engineers®

ENGINEERING AND DESIGN

Slope Stability

ENGINEER MANUAL

Table 3-1
Minimum Required Factors of Safety: New Earth and Rock-Fill Dams

Analysis Condition[1]	Required Minimum Factor of Safety	Slope
End-of-Construction (Including staged construction)[2]	1.3	Upstream and Downstream
Long-term (Steady seepage, maximum storage pool, spillway crest or top of gates)	1.5	Downstream
Maximum surcharge pool[3]	1.4	Downstream
Rapid drawdown	1.1-1.3[4,5]	Upstream

[1] For earthquake loading, see ER 1110-2-1806 for guidance. An Engineer Circular, "Dynamic Analysis of Embankment Dams," is still in preparation.

[2] For embankments over 50 feet high on soft foundations and for embankments that will be subjected to pool loading during construction, a higher minimum end-of-construction factor of safety may be appropriate.

[3] Pool thrust from maximum surcharge level. Pore pressures are usually taken as those developed under steady-state seepage at maximum storage pool. However, for pervious foundations with no positive cutoff steady-state seepage may develop under maximum surcharge pool.

[4] Factor of safety (FS) to be used with improved method of analysis described in Appendix G.

[5] FS = 1.1 applies to drawdown from maximum surcharge pool; FS = 1.3 applies to drawdown from maximum storage pool.

For dams used in pump storage schemes or similar applications where rapid drawdown is a routine operating condition, higher factors of safety, e.g., 1.4-1.5, are appropriate. If consequences of an upstream failure are great, such as blockage of the outlet works resulting in a potential catastrophic failure, higher factors of safety should be considered.

(1) During construction of embankments, materials should be examined to ensure that they are consistent with the materials on which the design was based. Records of compaction, moisture, and density for fill materials should be compared with the compaction conditions on which the undrained shear strengths used in stability analyses were based.

(2) Particular attention should be given to determining if field compaction moisture contents of cohesive materials are significantly higher or dry unit weights are significantly lower than values on which design strengths were based. If so, undrained (UU, Q) shear strengths may be lower than the values used for design, and end-of-construction stability should be reevaluated. Undisturbed samples of cohesive materials should be taken during construction and unconsolidated-undrained (UU, Q) tests should be performed to verify end-of-construction stability.

d. Pore water pressure. Seepage analyses (flow nets or numerical analyses) should be performed to estimate pore water pressures for use in long-term stability computations. During operation of the reservoir, especially during initial filling and as each new record pool is experienced, an appropriate monitoring and evaluation program must be carried out. This is imperative to identify unexpected seepage conditions, abnormally high piezometric levels, and unexpected deformations or rates of deformations. As the reservoir is brought up and as higher pools are experienced, trends of piezometric levels versus reservoir stage can be used to project piezometric levels for maximum storage and maximum surcharge pool levels. This allows comparison of anticipated actual performance to the piezometric levels assumed during original design studies and analysis. These projections provide a firm basis to assess the stability of the downstream slope of the dam for future maximum loading conditions. If this process indicates that pore water pressures will be higher than those used in design stability analyses, additional analyses should be performed to verify long-term stability.

e. Loads on slopes. Loads imposed on slopes, such as those resulting from structures, vehicles, stored materials, etc. should be accounted for in stability analyses.

United States
Environmental Protection
Agency

Office of Research and
Development
Washington DC 20460

EPA/600/R-95/051
April 1995

EPA

RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities

OII landfill. . Observations of the satisfactory performance of the OII landfill slopes in recent earthquakes combined with this plot indicate that the dynamic shear strength of MSW mobilized during seismic loading is greater than the values indicated in Figure 6.3.

6.1.6 Sensitivity Studies

It is strongly recommended that all stability analyses of MSW landfills be performed using parametric studies to clearly identify the sensitivity of the performance of the landfill to the material properties used in the analysis. If performance depends significantly on a given parameter, then additional laboratory or field testing may be required to better define appropriate properties for design.

6.2 Seismic Stability and Deformation Analysis

A prerequisite for performing a seismic slope stability and deformation analysis is performance of a static slope stability analysis. The seismic stability and deformation analysis is carried out using the same basic model(s) of landfill (waste mass and foundation) and containment system used in the static analysis. The following steps are used in a typical seismic slope stability and deformation analysis:

Step 1: Reinterpret the cross-sections analyzed in the static stability analysis and assign appropriate dynamic strength parameters. In cases where it is not clear whether drained or undrained shear strength parameters are appropriate for the dynamic analysis, follow guidelines presented in Duncan (1992).

Step 2: Evaluate the seismic coefficient, k_s. There are many different views on how to define k_s (e.g., Seed and Martin, 1966; Seed, 1979; Marcuson, 1981; Hynes and Franklin, 1984). The most reasonable definition appears to be one that regards the seismic coefficient as an empirical factor. This definition recognizes the limitations of the pseudo-static slope stability analysis in representing the actual effects of an earthquake on the slope. Unfortunately, this definition provides no guidance to selection of an appropriate value of k_s. Seed (1979) reports that clay slopes and embankments designed with a minimum pseudo-static factor of safety of 1.15 using a seismic coefficient of 0.15 have experienced "acceptable" deformations in earthquakes of magnitude less than 7.5 and intensity less than 0.75 g. However, Seed's definition of acceptable deformations appears to include deformations of over one meter in some cases.

Figure 6.5 shows the results of Newmark seismic deformation analyses performed by Hynes and Franklin (1984) using 387 strong motion records and 6 artificial accelerograms. Based upon this data and their experience with seismic response analyses of slopes and embankments, Hynes and Franklin (1984) concluded that slopes and embankments with a yield acceleration equal to half the peak ground acceleration would experience permanent seismic deformations of less than one meter (3 ft) in any earthquake, even for embankments where amplification of acceleration by a factor of three occurs. In the absence of amplification, or if amplification is taken into account in determining the peak acceleration, the Hynes and Franklin data suggest that deformations will remain less than 0.3 m (1 ft) for yield accelerations less than or equal to one-half the peak acceleration. Therefore, based upon the work of Hynes and Franklin, it appears that the maximum value of k_s may be determined as $k_s = 0.5 \cdot a_{max}/g$ to limit permanent seismic deformations to less than 0.3 m (1 ft), where a_{max} is peak horizontal acceleration at the ground surface for analyses of the liner system and at the top of the landfill for analyses of the cover system. a_{max} can be estimated either using the simplified methods presented in Section 4 of this guidance document or from the results of a seismic response analysis.

Step 3: Perform the pseudo-static stability analysis. If the minimum factor of safety, FS_{min}, exceeds 1.0 and 0.3 m (1 ft) of deformation is acceptable, the seismic stability analysis is completed.

Step 4: If the pseudo-static factor of safety is less than 1.0 or the acceptable deformation is less than 0.3 m (1 ft), perform a Newmark deformation analysis. This is done with the following three steps:

1) Calculate the yield acceleration, k_y. The yield acceleration is usually calculated in pseudo-static analyses using a trial and error procedure in which the seismic coefficient is varied until $FS_{min} = 1.0$ is obtained. The lowest yield acceleration for all possible failure surfaces passing through the liner, cover, and/or waste mass should be evaluated.

2) Calculate the permanent seismic deformation. The permanent seismic deformation may be calculated using either simplified design charts (e.g., Hynes and Franklin, 1984; Makdisi and Seed, 1978) or a formal time-history analysis in which the excursions of the average acceleration time history above the yield acceleration are double integrated.

3) Compare the calculated permanent seismic deformation to the allowable maximum permanent displacement, u_{max}. Seed and Bonaparte (1992) report that u_{max} values of 0.15 to 0.3 meters (0.5 to 1.0 feet) are typically used in practice for design of geosynthetic liner systems. For cover systems, where permanent seismic deformations may be observed in post-earthquake inspections and damage to components can be repaired, larger permanent deformations may be considered acceptable. In fact, some regulatory agencies consider seismic deformations of the landfill cover system primarily a maintenance problem.

Several investigators have presented simplified charts based upon the results of Newmark deformation analyses for estimating permanent seismic deformations. Makdisi and Seed (1978) developed the chart shown in Figure 6.6 from the results of two-dimensional finite element analyses of embankments founded upon rock. This chart includes the effect of amplification of seismic motions by an embankment and provides upper and lower bounds on the permanent deformation as a function of magnitude. Hynes and Franklin (1984) developed the chart shown in Figure 6.5 from classical Newmark "sliding block on a plane" analyses. The Hynes and Franklin chart does not consider amplification or magnitude effects but includes time histories which encompass a wide range of soil conditions. Due to the uncertainties in using a simplified design chart and the characteristics and limitations discussed above, the use of the upper bound curves from Makdisi and Seed (Figure 6.6) for simplified analysis of the permanent seismic deformation potential of the waste mass and liner system. The *mean* + curve from Hynes and Franklin (Figure 6.5) is recommended for simplified permanent seismic deformation analysis of the cover system.

If a seismic response analysis has been performed, a formal Newmark seismic deformation analysis can be performed by using the acceleration or shear stress time histories from the response analysis. Jibson (1993) describes the analytical procedure for performing such an analysis. To evaluate the permanent displacement of the landfill mass, the average acceleration time history of mass above the critical failure plane (the failure surface with the lowest yield acceleration) should be used. The average acceleration time history may be calculated as the average of the acceleration time history of each layer above the interface weighted according to the unit weight and thickness of each layer. Alternatively, the average acceleration time history may be calculated from the shear stress at the interface divided by the total vertical stress above the interface, as described by Repetto et al. (1993). To calculate the permanent deformation of the landfill final cover, either the average acceleration time history of the cover or the shear stress time history at the cover-waste interface divided by the total vertical stress at the interface should be used in the Newmark analysis. Particularly for landfills in the eastern United States, where the earthquake acceleration time history may contain relatively enriched high frequencies, the

ATTACHMENT 5

Sandblast Material Analytical Laboratory Test Results

Duke Energy®
Rev 07-09-07

Analytical Laboratory
13339 Hagers Ferry Road
Huntersville, NC 28078-7929
McGuire Nuclear Complex – MG03A2
Phone: 704-875-5245 Fax: 704-875-4349

Job Summary Report

Job Number:	09-NOV-0122
Project Name:	RCRA
Customer Name:	Don Scruggs
Copy To:	Bob Wolfe
Customer Address:	Allen Steam Station
Lab Contact:	Jay Perkins
Lab Contact Phone:	704-875-5348

Report Authorized By: (Printed Name) JAY PERKINS

Report Authorized By: (Signature) _____ Date: 11-24-09

Data Package

This data package includes analytical results that are applicable only to the samples described in this narrative. An estimation of the uncertainty of measurement for the results in the report is available upon request. This report shall not be reproduced, except in full, without the written consent of the Analytical Laboratory. Please contact the Analytical Laboratory with any questions. The order of individual sections within this report is as follows:

Job Summary Report
Analytical Laboratory Certificate of Analysis
Analytical Laboratory QC Reports (if applicable)
Sub-contracted Laboratory Results
Customer Specific Data Sheets, Reports & Documentation (if applicable)
Customer Database Entries
Test Case Narratives
Chain of Custody (COC)

Duke Energy®
Rev 07-09-07

Analytical Laboratory
13339 Hagers Ferry Road
Huntersville, NC 28078-7929
McGuire Nuclear Complex – MG03A2
Phone: 704-875-5245 Fax: 704-875-4349

Job Summary Report

Certification

The Analytical Laboratory holds the following Certifications:

New York State Department of Health Certification # 11717(NELAC)
North Carolina Department of Health & Human Services Certification # 37804
South Carolina (DHEC) Laboratory ID # 99005
North Carolina (DENR) Certification # 248

Analytical results listed in this report may not be certified by the authorities referenced above. Contact the Analytical Laboratory for definitive information about the certification status of specific methods. The results meet all requirements of NELAC except where deviations are noted in this report.

Data Flags

Any analytical tests or individual analytes within a test flagged with an "X" or a "1" indicate a deviation from the method quality system or quality control requirement.

Calculations

All results are reported on a wet weight basis unless otherwise noted.

Sample ID's & Descriptions:

Sample ID	Plant/Station	Collection Date	Collected By	Sample Description
29025630	FOSSIL	11/05/2009	ROBERT WOLFE	ALLEN TAR UNKNOWN
29025631	FOSSIL	11/05/2009	ROBERT WOLFE	SANDBLAST MATERIA - ALLEN SS

2 TOTAL SAMPLES

Duke Energy®
Rev 07-09-07

Analytical Laboratory
13339 Hagers Ferry Road
Huntersville, NC 28078-7929
McGuire Nuclear Complex – MG03A2
Phone: 704-875-5245 Fax: 704-875-4349

Job Summary Report

Validation of Analytical Data Package

i)	COC and .pdf report are in agreement with sample totals and analyses (compliance programs and procedures).	☑ Yes	☐ No
ii)	All results are less than the laboratory reporting limits.	☐ Yes	☑ No
iii)	All laboratory QA/QC requirements are acceptable.	☑ Yes	☐ No
iv)	NPDES and TCLP results are below permit or regulatory limits respectively.	☑ Yes	☐ No

If **iv)** above is No, document below:

Variable	Result	Permit Limit	Notes

v)	Components of the Job Summary Report arranged in order stipulated on page one.	☑ Yes	☐ No

Indicate components included:

- ☑ Job Summary Report
- ☐ Analytical Laboratory Certificate of Analysis
- ☐ Analytical Laboratory QC Report (if applicable)
- ☑ Sub-contracted Laboratory Results
- ☐ Customer Specific Data Sheets, Reports & Documentation (if applicable)
- ☐ Customer Database Entries
- ☐ Test Case Narratives
- ☑ Chain of Custody

vi) Notes and Additional Information

NON HAZARDOUS

SHEALY ENVIRONMENTAL SERVICES, INC.

Report of Analysis

Duke Energy Corporate EHS
13339 Hagers Ferry Rd
Bldg 7405
Huntersville, NC 28078
Attention: Jay Perkins

Project Name: **Allen SS**

Project Number: **09-NOV-0122**

Lot Number: **KK06043**

Date Completed: **11/23/2009**

Grant Wilton
Project Manager

This report shall not be reproduced, except in its entirety, without the written approval of Shealy Environmental Services, Inc.

The following non-paginated documents are considered part of this report: Chain of Custody Record and Sample Receipt Checklist.

• • • • • • • • •

SHEALY ENVIRONMENTAL SERVICES, INC.

SC DHEC No: 32010 NELAC No: E87653 NC DEHNR No: 329

Case Narrative
Duke Energy Corporate EHS
Lot Number: KK06043

This Report of Analysis contains the analytical result(s) for the sample(s) listed on the Sample Summary following this Case Narrative. The sample receiving date is documented in the header information associated with each sample.

Sample receipt, sample analysis, and data review have been performed in accordance with the most current approved NELAC standards, the Shealy Environmental Services, Inc. ("Shealy") Quality Assurance Management Plan (QAMP), standard operating procedures (SOPs), and Shealy policies. Any exceptions to the NELAC standards, the QAMP, SOPs or policies are qualified on the results page or discussed below.

If you have any questions regarding this report please contact the Shealy Project Manager listed on the cover page.

SHEALY ENVIRONMENTAL SERVICES, INC.

Sample Summary
Duke Energy Corporate EHS
Lot Number: KK06043

Sample Number	Sample ID	Matrix	Date Sampled	Date Received
001	Allen Tar Unknown	Solid	11/05/2009 0800	11/06/2009
002	Sand Blast Material	Solid	11/05/2009 0830	11/06/2009

(2 samples)

SHEALY ENVIRONMENTAL SERVICES, INC.

Executive Summary
Duke Energy Corporate EHS
Lot Number: KK06043

Sample	Sample ID	Matrix	Parameter	Method	Result	Q	Units	Page
001	Allen Tar Unknown	Solid	BTU	D2382	7110		BTU/lb	5
001	Allen Tar Unknown	Solid	Ignitability (Pensky-Martens Closed-	1010A	>140		° F	5
001	Allen Tar Unknown	Solid	2-Butanone (MEK)	8260B	1.6		mg/L	6
001	Allen Tar Unknown	Solid	Barium	6010C	0.61		mg/L	8
002	Sand Blast Material	Solid	Barium	6010C	0.33		mg/L	9
002	Sand Blast Material	Solid	Chromium	6010C	0.21		mg/L	9

(6 detections)

Inorganic non-metals

Client: **Duke Energy Corporate EHS**
Description: **Allen Tar Unknown**
Date Sampled: **11/05/2009 0800**
Date Received: **11/06/2009**

Laboratory ID: **KK06043-001**
Matrix: **Solid**
% Solids: **79.9** **11/06/2009 2245**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch
1		(BTU) D2382	1	11/12/2009 1842	PMM		
1		(Ignitability) 1010A	1	11/10/2009 1629	PMM		

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
BTU		**D2382**	**7110**		**1000**	**BTU/lb**	**1**
Ignitability (Pensky-Martens Closed-Cup)		**1010A**	**>140**			**° F**	**1**

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

B = Detected in the method blank
J = Estimated result < PQL and ≥ MDL

E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
H = Out of holding time

TCLP Volatiles

Client: **Duke Energy Corporate EHS**
Description: **Allen Tar Unknown**
Date Sampled: **11/05/2009 0800**
Date Received: **11/06/2009**

Laboratory ID: **KK06043-001**
Matrix: **Solid**
% Solids: **79.9** **11/06/2009 2245**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1311/5030B	8260B	10	11/17/2009 1034	DLB		21922	11/10/2009 1555

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Benzene	71-43-2	8260B	ND		0.050	mg/L	1
2-Butanone (MEK)	**78-93-3**	**8260B**	**1.6**		**0.10**	**mg/L**	**1**
Carbon tetrachloride	56-23-5	8260B	ND		0.050	mg/L	1
Chlorobenzene	108-90-7	8260B	ND		0.050	mg/L	1
Chloroform	67-66-3	8260B	ND		0.050	mg/L	1
1,2-Dichloroethane	107-06-2	8260B	ND		0.050	mg/L	1
1,1-Dichloroethene	75-35-4	8260B	ND		0.050	mg/L	1
Tetrachloroethene	127-18-4	8260B	ND		0.050	mg/L	1
Trichloroethene	79-01-6	8260B	ND		0.050	mg/L	1
Vinyl chloride	75-01-4	8260B	ND		0.010	mg/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
1,2-Dichloroethane-d4		87	70-130
Bromofluorobenzene		102	70-130
Toluene-d8		100	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

B = Detected in the method blank
J = Estimated result < PQL and ≥ MDL

E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
H = Out of holding time

TCLP Semivolatiles

Client: **Duke Energy Corporate EHS**
Description: **Allen Tar Unknown**
Date Sampled: **11/05/2009 0800**
Date Received: **11/06/2009**

Laboratory ID: **KK06043-001**
Matrix: **Solid**
% Solids: **79.9** **11/06/2009 2245**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1311/3520C	8270D	1	11/21/2009 1955	GLR	11/12/2009 2230	21613	11/10/2009 1555

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
1,4-Dichlorobenzene	106-46-7	8270D	ND		0.050	mg/L	1
2,4-Dinitrotoluene	121-14-2	8270D	ND		0.10	mg/L	1
Hexachlorobenzene	118-74-1	8270D	ND		0.050	mg/L	1
Hexachlorobutadiene	87-68-3	8270D	ND		0.050	mg/L	1
Hexachloroethane	67-72-1	8270D	ND		0.050	mg/L	1
2-Methylphenol	95-48-7	8270D	ND		0.050	mg/L	1
3 & 4-Methylphenol	106-44-5	8270D	ND		0.10	mg/L	1
Nitrobenzene	98-95-3	8270D	ND		0.050	mg/L	1
Pentachlorophenol	87-86-5	8270D	ND		0.25	mg/L	1
Pyridine	110-86-1	8270D	ND		0.050	mg/L	1
2,4,5-Trichlorophenol	95-95-4	8270D	ND		0.050	mg/L	1
2,4,6-Trichlorophenol	88-06-2	8270D	ND		0.050	mg/L	1

Surrogate	Q	Run 1 % Recovery	Acceptance Limits
2,4,6-Tribromophenol		94	41-144
2-Fluorobiphenyl		89	37-129
2-Fluorophenol		83	24-127
Nitrobenzene-d5		87	38-127
Phenol-d5		82	28-128
Terphenyl-d14		85	10-148

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"
B = Detected in the method blank
J = Estimated result < PQL and ≥ MDL
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
H = Out of holding time

TCLP Metals

Client: **Duke Energy Corporate EHS**
Description: **Allen Tar Unknown**
Date Sampled: **11/05/2009 0800**
Date Received: **11/06/2009**

Laboratory ID: **KK06043-001**
Matrix: **Solid**
% Solids: **79.9** **11/06/2009 2245**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1311/7470A	7470A	1	11/11/2009 2303	BNW	11/11/2009 1900	21483	11/10/2009 1555
1	1311/3010A	6010C	10	11/12/2009 1847	KJC	11/11/2009 1900	21486	11/10/2009 1555

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Arsenic	7440-38-2	6010C	ND		0.10	mg/L	1
Barium	**7440-39-3**	**6010C**	**0.61**		**0.25**	**mg/L**	**1**
Cadmium	7440-43-9	6010C	ND		0.020	mg/L	1
Chromium	7440-47-3	6010C	ND		0.050	mg/L	1
Lead	7439-92-1	6010C	ND		0.10	mg/L	1
Mercury	7439-97-6	7470A	ND		0.00020	mg/L	1
Selenium	7782-49-2	6010C	ND		0.10	mg/L	1
Silver	7440-22-4	6010C	ND		0.050	mg/L	1

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"
B = Detected in the method blank
J = Estimated result < PQL and ≥ MDL
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
H = Out of holding time

TCLP Metals

Client: **Duke Energy Corporate EHS**
Description: **Sand Blast Material**
Date Sampled: **11/05/2009 0830**
Date Received: **11/06/2009**

Laboratory ID: **KK06043-002**
Matrix: **Solid**
% Solids: **99.9** **11/06/2009 2245**

Run	Prep Method	Analytical Method	Dilution	Analysis Date	Analyst	Prep Date	Batch	Leachate Date
1	1311/7470A	7470A	1	11/11/2009 2306	BNW	11/11/2009 1900	21483	11/10/2009 1555
1	1311/3010A	6010C	10	11/12/2009 1850	KJC	11/11/2009 1900	21486	11/10/2009 1555

Parameter	CAS Number	Analytical Method	Result	Q	PQL	Units	Run
Arsenic	7440-38-2	6010C	ND		0.10	mg/L	1
Barium	**7440-39-3**	**6010C**	**0.33**		**0.25**	**mg/L**	**1**
Cadmium	7440-43-9	6010C	ND		0.020	mg/L	1
Chromium	**7440-47-3**	**6010C**	**0.21**		**0.050**	**mg/L**	**1**
Lead	7439-92-1	6010C	ND		0.10	mg/L	1
Mercury	7439-97-6	7470A	ND		0.00020	mg/L	1
Selenium	7782-49-2	6010C	ND		0.10	mg/L	1
Silver	7440-22-4	6010C	ND		0.050	mg/L	1

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
B = Detected in the method blank
J = Estimated result < PQL and ≥ MDL
E = Quantitation of compound exceeded the calibration range
P = The RPD between two GC columns exceeds 40%
N = Recovery is out of criteria
H = Out of holding time
Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

QC Summary

TCLP Volatiles - MB

Sample ID: KQ21922-001
Batch: 21922
Analytical Method: 8260B

Matrix: Solid
Prep Method: 1311/5030B
Leachate Date: 11/10/2009 1555

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Benzene	ND		10	0.050	mg/L	11/17/2009 1013
2-Butanone (MEK)	ND		10	0.10	mg/L	11/17/2009 1013
Carbon tetrachloride	ND		10	0.050	mg/L	11/17/2009 1013
Chlorobenzene	ND		10	0.050	mg/L	11/17/2009 1013
Chloroform	ND		10	0.050	mg/L	11/17/2009 1013
1,2-Dichloroethane	ND		10	0.050	mg/L	11/17/2009 1013
1,1-Dichloroethene	ND		10	0.050	mg/L	11/17/2009 1013
Tetrachloroethene	ND		10	0.050	mg/L	11/17/2009 1013
Trichloroethene	ND		10	0.050	mg/L	11/17/2009 1013
Vinyl chloride	ND		10	0.010	mg/L	11/17/2009 1013

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		98	70-130
1,2-Dichloroethane-d4		96	70-130
Toluene-d8		104	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Volatiles - LCS

Sample ID: KQ21922-002
Batch: 21922
Analytical Method: 8260B

Matrix: Solid
Prep Method: 1311/5030B
Leachate Date: 11/10/2009 1555

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Benzene	0.50	0.45		10	89	72-127	11/17/2009 0952
2-Butanone (MEK)	1.0	0.78		10	78	60-140	11/17/2009 0952
Carbon tetrachloride	0.50	0.41		10	83	37-166	11/17/2009 0952
Chlorobenzene	0.50	0.46		10	93	78-129	11/17/2009 0952
Chloroform	0.50	0.39		10	78	63-123	11/17/2009 0952
1,2-Dichloroethane	0.50	0.36		10	71	59-143	11/17/2009 0952
1,1-Dichloroethene	0.50	0.43		10	85	50-132	11/17/2009 0952
Tetrachloroethene	0.50	0.50		10	100	70-130	11/17/2009 0952
Trichloroethene	0.50	0.45		10	89	73-124	11/17/2009 0952
Vinyl chloride	0.50	0.34		10	68	29-159	11/17/2009 0952

Surrogate	Q	% Rec	Acceptance Limit
Bromofluorobenzene		87	70-130
1,2-Dichloroethane-d4		81	70-130
Toluene-d8		90	70-130

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Semivolatiles - MB

Sample ID: KQ21613-001
Batch: 21613
Analytical Method: 8270D

Matrix: Solid
Prep Method: 1311/3520C
Prep Date: 11/12/2009 2230 **Leachate Date:** 11/10/2009 1555

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
1,4-Dichlorobenzene	ND		1	0.050	mg/L	11/19/2009 2005
2,4,5-Trichlorophenol	ND		1	0.050	mg/L	11/19/2009 2005
2,4,6-Trichlorophenol	ND		1	0.050	mg/L	11/19/2009 2005
2,4-Dinitrotoluene	ND		1	0.10	mg/L	11/19/2009 2005
2-Methylphenol	ND		1	0.050	mg/L	11/19/2009 2005
3 & 4-Methylphenol	ND		1	0.10	mg/L	11/19/2009 2005
Hexachlorobenzene	ND		1	0.050	mg/L	11/19/2009 2005
Hexachlorobutadiene	ND		1	0.050	mg/L	11/19/2009 2005
Hexachloroethane	ND		1	0.050	mg/L	11/19/2009 2005
Nitrobenzene	ND		1	0.050	mg/L	11/19/2009 2005
Pentachlorophenol	ND		1	0.25	mg/L	11/19/2009 2005
Pyridine	ND		1	0.050	mg/L	11/19/2009 2005

Surrogate	Q	% Rec	Acceptance Limit
2,4,6-Tribromophenol		91	41-144
2-Fluorobiphenyl		90	37-129
2-Fluorophenol		91	24-127
Nitrobenzene-d5		87	38-127
Phenol-d5		83	28-128
Terphenyl-d14		91	10-148

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Semivolatiles - LCS

Sample ID: KQ21613-002
Batch: 21613
Analytical Method: 8270D

Matrix: Solid
Prep Method: 1311/3520C
Prep Date: 11/12/2009 2230 **Leachate Date:** 11/10/2009 1555

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
1,4-Dichlorobenzene	1.0	0.91		1	91	30-130	11/19/2009 2026
2,4,5-Trichlorophenol	1.0	1.0		1	101	30-130	11/19/2009 2026
2,4,6-Trichlorophenol	1.0	0.83		1	83	30-130	11/19/2009 2026
2,4-Dinitrotoluene	1.0	0.82		1	82	30-130	11/19/2009 2026
2-Methylphenol	1.0	0.91		1	91	30-130	11/19/2009 2026
3 & 4-Methylphenol	2.0	1.7		1	87	30-130	11/19/2009 2026
Hexachlorobenzene	1.0	1.0		1	100	30-130	11/19/2009 2026
Hexachlorobutadiene	1.0	0.96		1	96	30-130	11/19/2009 2026
Hexachloroethane	1.0	0.85		1	85	30-130	11/19/2009 2026
Nitrobenzene	1.0	0.92		1	92	30-130	11/19/2009 2026
Pentachlorophenol	1.0	0.77		1	77	30-130	11/19/2009 2026
Pyridine	1.0	0.59		1	59	30-130	11/19/2009 2026

Surrogate	Q	% Rec	Acceptance Limit
2,4,6-Tribromophenol		87	41-144
2-Fluorobiphenyl		88	37-129
2-Fluorophenol		89	24-127
Nitrobenzene-d5		94	38-127
Phenol-d5		87	28-128
Terphenyl-d14		89	10-148

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Metals - MB

Sample ID: KQ21486-001
Batch: 21486
Analytical Method: 6010C

Matrix: Solid
Prep Method: 1311/3010A
Prep Date: 11/11/2009 1900 **Leachate Date:** 11/10/2009 1555

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Arsenic	ND		10	0.10	mg/L	11/12/2009 1822
Barium	ND		10	0.25	mg/L	11/12/2009 1822
Cadmium	ND		10	0.020	mg/L	11/12/2009 1822
Chromium	ND		10	0.050	mg/L	11/12/2009 1822
Lead	ND		10	0.10	mg/L	11/12/2009 1822
Selenium	ND		10	0.10	mg/L	11/12/2009 1822
Silver	ND		10	0.050	mg/L	11/12/2009 1822

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Metals - LCS

Sample ID: KQ21486-002
Batch: 21486
Analytical Method: 6010C

Matrix: Solid
Prep Method: 1311/3010A
Prep Date: 11/11/2009 1900 **Leachate Date:** 11/10/2009 1555

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Arsenic	5.0	5.0		10	101	80-120	11/12/2009 1826
Barium	10	11		10	113	80-120	11/12/2009 1826
Cadmium	1.0	1.1		10	109	80-120	11/12/2009 1826
Chromium	5.0	5.3		10	105	80-120	11/12/2009 1826
Lead	5.0	5.4		10	107	80-120	11/12/2009 1826
Selenium	1.0	1.1		10	107	80-120	11/12/2009 1826
Silver	5.0	5.3		10	106	80-120	11/12/2009 1826

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Metals - LCSD

Sample ID: KQ21486-003
Batch: 21486
Analytical Method: 6010C

Matrix: Solid
Prep Method: 1311/3010A
Prep Date: 11/11/2009 1900 **Leachate Date:** 11/10/2009 1555

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
Arsenic	5.0	5.1		10	101	0.79	80-120	20	11/12/2009 1830
Barium	10	11		10	110	2.9	80-120	20	11/12/2009 1830
Cadmium	1.0	1.1		10	109	0.15	80-120	20	11/12/2009 1830
Chromium	5.0	5.2		10	104	1.4	80-120	20	11/12/2009 1830
Lead	5.0	5.3		10	106	1.6	80-120	20	11/12/2009 1830
Selenium	1.0	1.0		10	102	5.3	80-120	20	11/12/2009 1830
Silver	5.0	5.4		10	108	2.0	80-120	20	11/12/2009 1830

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Metals - MB

Sample ID: KQ21483-001
Batch: 21483
Analytical Method: 7470A

Matrix: Solid
Prep Method: 1311/7470A
Prep Date: 11/11/2009 1900 **Leachate Date:** 11/10/2009 1555

Parameter	Result	Q	Dil	PQL	Units	Analysis Date
Mercury	ND		1	0.00020	mg/L	11/11/2009 2241

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Metals - LCS

Sample ID: KQ21483-002
Batch: 21483
Analytical Method: 7470A

Matrix: Solid
Prep Method: 1311/7470A
Prep Date: 11/11/2009 1900 **Leachate Date:** 11/10/2009 1555

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% Rec Limit	Analysis Date
Mercury	0.0020	0.0018		1	91	85-115	11/11/2009 2243

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

TCLP Metals - LCSD

Sample ID: KQ21483-003
Batch: 21483
Analytical Method: 7470A

Matrix: Solid
Prep Method: 1311/7470A
Prep Date: 11/11/2009 1900 **Leachate Date:** 11/10/2009 1555

Parameter	Spike Amount (mg/L)	Result (mg/L)	Q	Dil	% Rec	% RPD	% Rec Limit	% RPD Limit	Analysis Date
Mercury	0.0020	0.0020		1	100	9.4	85-115	20	11/11/2009 2251

PQL = Practical quantitation limit
ND = Not detected at or above the PQL
P = The RPD between two GC columns exceeds 40%
J = Estimated result < PQL and ≥ MDL
N - Recovery is out of criteria
+ - RPD is out of criteria

Where applicable, all soil sample analysis are reported on a dry weight basis unless flagged with a "W"

Note: Calculations are performed before rounding to avoid round-off errors in calculated results

SHEALY ENVIRONMENTAL SERVICES, INC.

Shealy Environmental Services, Inc.
Document Number: F-AD-018
Revision Number: 6

Page 1 of 1
Replaces Date: 05/2006
Effective Date: 06/29/07

Sample Receipt Checklist (SRC)

Client: Duke Energy Cooler Inspected by/date: DMP, 11/6/ Lot #: KK0643

Means of receipt: ☐ SESI ☐ Client ☐ UPS ☑ FedEx ☐ Airborne Exp ☐ Other

Yes ☐	No ☑	NA ☐	1. Were custody seals present on the cooler?
Yes ☐	No ☐	NA ☑	2. If custody seals were present, were they intact and unbroken?

Cooler ID/temperature upon receipt 4.4 °C ___/___ °C ___/___ °C ___/___ °C ___/___ °C ___/___ °C ___/___ °C ___/___ °C

Method: ☐ Temperature Blank ☑ Against Bottles
Method of coolant: ☑ Wet Ice ☐ Blue Ice ☐ Dry Ice ☐ None

If response is No for Yes for 14, 15, 16, an explanation/resolution must be provided.

Yes ☐	No ☐	NA ☑	3. If temperature of any cooler exceeded 6.0°C, was Project Manager notified? PM notified by SRC, phone, note (circle one), other: ___ (For coolers received via commercial courier, PMs are to be notified immediately.
Yes ☐	No ☑	NA ☐	4. Is the commercial courier's packing slip attached to this form?
Yes ☐	No ☑	NA ☐	5. Were proper custody procedures (relinquished/received) followed?
Yes ☑	No ☐	NA ☐	6. Were sample IDs listed?
Yes ☑	No ☐	NA ☐	7. Was collection date & time listed?
Yes ☑	No ☐	NA ☐	8. Were tests to be performed listed on the COC or was quote # provided?
Yes ☑	No ☐	NA ☐	9. Did all samples arrive in the proper containers for each test?
Yes ☑	No ☐	NA ☐	10. Did all container label information (ID, date, time) agree with COC?
Yes ☑	No ☐	NA ☐	11. Did all containers arrive in good condition (unbroken, lids on, etc.)?
Yes ☑	No ☐	NA ☐	12. Was adequate sample volume available?
Yes ☑	No ☐	NA ☐	13. Were all samples received within ½ the holding time or 48 hours, whichever comes first?
Yes ☐	No ☑	NA ☐	14. Were any samples containers missing?
Yes ☐	No ☑	NA ☐	15. Were there any excess samples not listed on COC?
Yes ☐	No ☐	NA ☑	16. Were bubbles present >"pea-size" (¼" or 6mm in diameter) in any VOA vials?
Yes ☐	No ☐	NA ☑	17. Were all metals/O&G/HEM/nutrient samples received at a pH of <2?
Yes ☐	No ☐	NA ☑	18. Were all cyanide and/or sulfide samples received at a pH >12?
Yes ☐	No ☐	NA ☑	19. Were all applicable NH3/TKN/cyanide/phenol/BNA/pest/PCB/herb (<0.2mg/L) and toxicity (<0.1mg/L) samples free of residual chlorine?
Yes ☐	No ☐	NA ☑	20. Were collection temperatures documented on the COC for NC samples?

Sample Preservation (Must be completed for any sample(s) incorrectly preserved or with headspace.)*

Sample(s) ___ were received incorrectly preserved and were adjusted accordingly in sample receiving with ___ (H_2SO_4,HNO_3,HCl,NaOH) with the SR # (number)

Sample(s) ___ were received with bubbles >6 mm in diameter.

Sample(s) ___ were received with TRC >0.2 mg/L for NH3/TKN/cyanide/BNA/pest/PCB/herb.

Toxicity sample(s) ___ were received with TRC >0.1 mg/L and were analyzed by method 330.5.

Corrective Action taken, if necessary:

Was client notified: Yes ☐ No ☐ Did client respond: Yes ☐ No ☐

SESI employee: ___ Date of response: ___

Comments: ___

MINNESOTA VALLEY TESTING LABORATORIES, INC.
1126 N. Front St. ~ New Ulm, MN 56073 ~ 800-782-3557 ~ Fax 507-359-2890
1411 S. 12th St. ~ Bismarck, ND 58502 ~ 800-279-6885 ~ Fax 701-258-9724
51 L Avenue ~ Nevada, IA 50201 ~ 800-362-0855 ~ Fax 515-382-3885
www.mvtl.com

MEMBER ACIL

Report Date: 16 Nov 09
Lab Number: 09-M3770
Work Order #:81-1469
Account #: 022080
Date Sampled: 5 Nov 09 8:00
Date Received: 10 Nov 09 10:00
PO #: KK06043

Grant Wilton
Shealy Environmental
106 Vantage Point Drive
West Columbia SC 29172

Sample Description: KK06043

	As Received Result		Method RL	Method Reference	Date Analyzed.	Analyst
Ash	35.49	wt. %	0.01	ASTM D3174	16 Nov 09 16:00	SC
Total Sulfur	0.10	wt. %	0.01	ASTM D4239	12 Nov 09 9:30	Mary

Approved by: D. Zander

RL = Method Reporting Limit

Elevated "Less Than Result" (<): @ = Due to sample matrix
! = Due to sample quantity
= Due to sample concentration
+ = Due to extract volume

CERTIFICATION: MN LAB # 038-999-267 ND # ND-00016

MVTL guarantees the accuracy of the analysis done on the sample submitted for testing. It is not possible for MVTL to guarantee that a test result obtained on a particular sample will be the same on any other sample unless all conditions affecting the sample are the same, including sampling by MVTL. As a mutual protection to clients, the public and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions or extracts from or regarding our reports is reserved pending our written approval.

AN EQUAL OPPORTUNITY EMPLOYER

SHEALY **Chain of Custody Record**

SHEALY ENVIRONMENTAL SERVICES, INC.
106 Vantage Point Drive
West Columbia, South Carolina 29172
Telephone No. (803) 791-9700 Fax No. (803) 791-9111

81-1469
M3770

To: MVTL

Number 102457

Client	Report to Contact: Grant Wilton	Telephone No. / Fax No. / E-mail	Quote No.
Address	Sampler's Signature	Waybill No.	Page 1 of 1
City / State / Zip Code	X_____ Printed Name	Analysis (Attach list if more space is needed.)	
Project Name			
Project No.	P.O. No. KK 06043		Lot No. KK06043

Sample ID / Description (Containers for each sample may be combined on one line.)	Date	Time	G=Grab C=Composite	Matrix: Aqueous	Solid	Non-Aqueous	No. of Containers by Preservative Type: Unpres.	H2SO4	HNO3	HCl	NaOH	5035 Kit	% Sulfur	% Ash	Remarks / Cooler I.D.
Allen Tan Unknown	11/5/09	08W			✓		1						✓	✓	

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison ☑ Unknown

Sample Disposal: ☐ Return to Client ☑ Disposal by Lab

Note: All samples are retained for six weeks from receipt unless other arrangements are made.

Turn Around Time Required (Prior lab approval required for expedited TAT.): ☑ Standard ☐ Rush (Specify)

QC Requirements (Specify)

		Date	Time
1. Relinquished by	[signature]	11/4/09	18W
2. Relinquished by			
3. Relinquished by			

		Date	Time
1. Received by	FEDEX	11-9-09	18W
2. Received by			
3. Laboratory received by	[signature]	10 Nov 2009	1000

Comments

LAB USE ONLY
Received on ice (Circle) Yes No Ice Pack

Receipt Temp. _____ °C

DISTRIBUTION: WHITE & YELLOW-Return to laboratory with Sample(s); PINK-Field/Client Copy

Document Number: F-AD-012 Effective Date: 08-04-02

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM

Duke Energy

Duke Energy Analytical Laboratory
Mail Code MG03A2 (Building 7405)
13339 Hagers Ferry Rd
Huntersville, N.C. 28078
(704) 875-5245
Fax: (704) 875-4349

Analytical Laboratory Use Only

Lab # 09-Nov-0122
Sample Class RCRA
Samples Originating From NC ___ SC ___
Logged By
Date & Time 11-05-09 1337
Vendor Shealy ISW01.1502
PO #
Cooler Temp (C)
[15] Preserv: 1=HCL 2=H_2SO_4 3=HNO_3 4=Ice 5=None
SAMPLE PROGRAM: Ground Water ___ NPDES ___ Drinking Water ___ UST ___ RCRA Waste ✓

Page 1 of 1
DISTRIBUTION ORIGINAL to LAB. COPY to CLIENT

KK06043

Customer fills in Collective

1) Project Name: Allen SS
2) Phone No:
3) Client: Don Sanders
4) Fax No:
5) Business Unit:
6) Process: Benuwis
7) Comp. Center No: A500
8) Project ID:
9) Activity ID:
10) Mail Code: Allen SS

MR #

Customer to complete all appropriate non-shaded areas.

LAB USE ONLY [11] Lab ID	[12] Chem Desktop No.	[13] Sample Description or ID	[14] Collection Information Date	Time	Signature	[17] Comp.	[18] Grab	[19] Analyses Required: TCLP Metals	Temp Sensitive	TCLP Volatiles	TCHEM
2902 5630		* Allen Tar Unknown	11/5/09	0830	[signature]			1	1	1	1
11 5631		Sandblast Material	11/5/09	0830	[signature]			1			
		* TCHEM Parameters = % sulfur, BTU, Ash, Ignitability									

Please! Send pdf and excel spreadsheet of vendor results to labcustomer@duke-energy.com

Customer to sign & date below. Fill out form with ink only.

1) Relinquished By: [signature] Date/Time 11/5/09 1330
2) Accepted By: [signature] Date/Time 11-5-09 13:30
3) Relinquished By: S.B. Cordon 11-5-09 1400
4) Accepted By: Date/Time
5) Relinquished By: Date/Time
6) Accepted By: Date/Time
7) Relinquished By: Fedex 11-6-09 0840
8) Accepted By: Date/Time
9) Seal/Lock Opened By: Date/Time
10) Seal/Lock Opened By: [signature] 11-6-09 0840
11) Seal/Locked By: S.B. Cordon 11-5-09 1349
Date/Time

Customer, IMPORTANT! Please indicate desired turnaround.

[22] Requested Turnaround: In or before 11-18

T = 9.4

Comments:

Shealy Environmental Services, Inc.
106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700 Fax (803) 791-9111 www.shealylab.com

Level 1 Report v2.1

SHEALY ENVIRONMENTAL SERVICES, INC.

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM

Duke Energy

Duke Energy Analytical Laboratory
Mail Code MGO3A2 (Building 7405)
13339 Hagers Ferry Rd
Huntersville, N. C. 28078
(704) 875-5245
Fax: (704) 875-4349

Analytical Laboratory Use Only

LIMS #: 09-Nov-0122
Sample Class: RCRA
Samples Originating From: NC ✓ SC
Logged By: EB
Date & Time: 11-05-09 1337
Vendor: Shealy ISW01.1502
Cooler Temp (C): 11 °C
PO #:
MR #:
SAMPLE PROGRAM: Ground Water ___ NPDES ___ Drinking Water ___ UST ___ RCRA Waste ✓

[19]Page 1 of 1
DISTRIBUTION
ORIGINAL to LAB, COPY to CLIENT

Customer must Complete

1)Project Name: Allen SS
2)Phone No:
2) Client: Don Scruggs
4)Fax No:
5)Business Unit:
6)Process: BENVW S
7)Resp. Center To: A500
8)Project ID:
9)Activity ID:
10)Mail Code: Allen SS

Customer to complete all appropriate non-shaded areas.

[15]Preserv.:1=HCL 2=H_2SO_4 3=HNO_3 4=Ice 5=None

[16]Analyses Required

LAB USE ONLY [11]Lab ID	[12]Chem Desktop No.	[13]Sample Description or ID	[14]Collection Information Date	Time	Signature	[17]Comp.	[18]Grab	TCLP Metals	TCLP Semivol	TCLP Volatiles	TCHEM
290256 30	*	Allen Tar unknown	11/5/09	0800	[signature]			1	1	1	1
11 5631		Sandblast Material	11/5/09	0830	[signature]			1			
	*	TCHEM Parameters = % sulfur, BTU, Ash, Ignitability									

Customer to complete appropriate columns to right

Customer to sign & date below - fill out from left to right.

1) Relinquished By: [signature]	Date/Time: 11/5/09 1330	2) Accepted By: [signature]	Date/Time: 11-5-09 13:30
3) Relinquished By: EB Cheldu	Date/Time: 11-5-09 1400	4) Accepted By	Date/Time
5)Relinquished By	Date/Time	6)Accepted By:	Date/Time
7)Relinquished By	Date/Time	8)Accepted By:	Date/Time
9)Seal/Locked By: EB Cheldu	Date/Time: 11-5-09 1349	10) Seal/Lock Opened By	Date/Time
11)Seal/Locked By	Date/Time	12)Seal/Lock Opened By	Date/Time

Comments

Customer, IMPORTANT! Please indicate desired turnaround.

[22]Requested Turnaround
14 Days ✓ 11-19
*7 Days ___
*48 Hr ___
*Other ___
* Add. Cost Will Apply

ATTACHMENT 6

Operations Plan, Revised September 3, 2010

(Sent separately under separate cover)