



# CHAS. H. SELLS, INC.

Consulting Engineers, Surveyors & Photogrammetrists

PRINCIPALS  
STEVEN W. SMITH, P.E.  
SUSAN K. FASNACHT, P.E.  
MOSE D. BUONOCORE, P.E.  
THOMAS NOVELLINO, C.P., P.P.S.  
SENIOR ASSOCIATES  
DAN E. BREWER, P.E.  
C. ROSS MASSEY, P.E.  
DAVID K. BRUBAKER, P.L.S.

*Cameron Johnson*

Fac/Perm/Co ID#	Date	Doc ID#
18-09	1/24/12	DIN



## VOLUME 1 – EARTHWORK CQA REPORT

**DUKE ENERGY CORP.  
MARSHALL STEAM STATION  
FLUE GAS DESULFURIZATION (FGD)  
GYPSUM LANDFILL, PHASE 1  
CATAWBA COUNTY, NC**

October 2006

**APPROVED**  
DIVISION OF WASTE MANAGEMENT  
SOLID WASTE SECTION  
DATE 11/21/06 BY TJ  
1805 A2 DOC 13  
PTO



# CHAS. H. SELLS, INC.

Consulting Engineers, Surveyors & Photogrammetrists

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DAN E. BREWER, P.E.  
C. ROSS MASSEY, P.E.  
DAVID K. BRUBAKER, P.L.S.

October 4, 2006

NCDENR  
Winston-Salem Regional Office  
585 Waighton Street  
Winston-Salem, NC 27107-2241

Attention: Mr. Tim Jewitt

Reference: **Volume 1 - Earthwork CQA Report**  
Marshall FGD Gypsum Landfill  
Catawba County, NC



Gentlemen:

Please find enclosed, Volume 1 – Earthwork CQA Report for the above referenced project. The Volume I Earthwork CQA Report includes the following information:

1. QORE Property Sciences soil density test data and test locations for earth fill.  
-Initial site work for the Subgrade was performed by Earnhardt Grading, Inc. and testing was performed by QORE during March–May 2005
2. ESP soil density test data and test locations for final subgrade preparation.  
-Final site work for the Subgrade was performed by Philips & Jordan and testing was performed by ESP during August 2006
3. ESP Subgrade Certifications
4. Site Photographs
5. As-Built Subgrade Drawing
6. S&ME Geology Report

Based upon our observations and review of the above test data, we find the Earthwork (subgrade) to be constructed in accordance with the approved drawings and technical specifications.

If you have any questions or require additional information, please contact us.

Sincerely,  
Chas. H. Sells, Inc.

Dan E. Brewer, P.E.  
Senior Associate



**APPROVED**  
DIVISION OF WASTE MANAGEMENT  
SOLID WASTE SECTION  
DATE 11-21-06 BY [Signature]  
1809 PTO AD  
DOC 13

cc: Mr. Pat McCabe, Duke Energy Corp.

## INDEX

QORE Drive Tube Density Test Summary	1
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# CHAS. H. SELLS, INC.

Consulting Engineers, Surveyors & Photogrammetrists

128 Overhill Drive, Suite 105, Mooresville, NC 28117

704.662.0100 Fax 704.662.0101

## DRIVE TUBE DENSITY TEST SUMMARY

Project Name:

Marshall Steam Station Gypsum Landfill

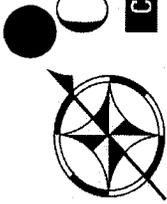
Project Number:

046003.001

Test No.	Date Tested	Elevation	SAMPLE DATA				PROCTOR DATA			RESULTS		Location of test & Comments
			Wet Density (lb/ft <sup>3</sup> )	Moisture Content (%)	Dry Density (lb/ft <sup>3</sup> )	Max. Dry Density (lb/ft <sup>3</sup> )	Optimum Moisture (%)	% Compaction	(P)ass or (F)ail			
1	8/2/2006	Subgrade	113.4	27.1	89.2	93.4	25.3	95.5	P			
2	8/2/2006	Subgrade	115.8	27.4	90.9	93.4	25.3	97.3	P			
3	8/2/2006	Subgrade	112.2	25.8	89.2	93.4	25.3	95.5	P			
4	8/2/2006	Subgrade	115.2	26.7	90.9	93.4	25.3	97.3	P			
5	8/7/2006	Subgrade	119.7	25.9	95.1	98.8	23	96.2	P			
6	8/7/2006	Subgrade	116.4	25.4	92.8	96.3	23	96.4	P			
7	8/7/2006	Subgrade	114.6	26.4	90.7	93.4	25.3	97.1	P			
8	8/7/2006	Subgrade	117.9	26.6	93.1	96.3	23	96.7	P			
9	8/7/2006	Subgrade	116.7	27.9	91.2	93.4	25.3	97.7	P			
10	8/8/2006	Subgrade	114.6	24.5	92.0	96.3	23	95.6	P			
11	8/8/2006	Subgrade	116.7	23.7	94.3	98.8	23	95.5	P			
12	8/8/2006	Subgrade	112.8	24.2	90.8	93.4	25.3	97.2	P			
13	8/8/2006	Subgrade	113.7	24.3	91.5	96.3	23	95.0	P			
14	8/8/2006	Subgrade	114.9	25.1	91.8	96.3	23	95.4	P			
15	8/8/2006	Subgrade	115.5	26.7	91.2	93.4	25.3	97.6	P			
16	8/8/2006	Subgrade	114.6	25.4	91.4	93.4	25.3	97.8	P			
17	8/8/2006	Subgrade	110.1	26.3	87.2	93.4	25.3	93.3	F			
18	8/15/2006	Subgrade	118.2	28.2	92.2	96.3	23	95.7	F			
19	8/15/2006	Subgrade	116.7	25.7	92.8	96.3	23	96.4	P			
20	8/15/2006	Subgrade	116.7	25.3	93.1	96.3	23	96.7	P			

Reference: Raw Test Data Provided by ESP Associates, Project No. UG45.400

Density tests performed in accordance with ASTM D-2937-83



# CHAS. H. SELLS, INC.

Consulting Engineers, Surveyors & Photogrammetrists

128 Overhill Drive, Suite 105, Mooresville, NC 28117  
 704.662.0100 Fax 704.662.0101

## DRIVE TUBE DENSITY TEST SUMMARY

Project Name:  
 Project Number:

Marshall Steam Station Gypsum Landfill  
 046003.003

Test No.	Date Tested	Elevation	SAMPLE DATA			PROCTOR DATA			RESULTS		Location of test & Comments
			Wet Density (lb/ft <sup>3</sup> )	Moisture Content	Dry Density (lb/ft <sup>3</sup> )	Max. Dry Density (lb/ft <sup>3</sup> )	Optimum Moisture (%)	% Compaction	(P)ass or (F)ail		
21	8/15/2006	Subgrade	117.3	24.8	94.0	98.8	23	95.1	P		
22	8/17/2006	Subgrade	115.2	26.3	91.2	93.4	25.3	97.7	P	RETEST #17	
23	8/17/2006	Subgrade	117.6	24.8	94.2	98.8	23	95.4	P		
24	8/17/2006	Subgrade	117.0	25.8	93.0	96.3	23	96.6	P		
25	8/17/2006	Subgrade	114.9	25.3	91.7	96.3	23	95.2	P		
26	8/17/2006	Subgrade	113.7	24.9	91.0	93.4	25.3	97.5	P		
27	8/17/2006	Subgrade	115.8	23.9	93.5	96.3	23	97.1	P	RETEST #18	
28	8/17/2006	Subgrade	114.6	24.8	91.8	96.3	23	95.4	P		
29	8/17/2006	Subgrade	116.7	26.2	92.5	96.3	23	96.0	P		
30	8/17/2006	Subgrade	115.5	25.1	92.3	96.3	23	95.9	P		
31	8/18/2006	Subgrade	117.0	21.8	96.1	98.8	23	97.2	P		
32	8/18/2006	Subgrade	118.5	22.8	96.5	98.8	23	97.7	P		
33	8/18/2006	Subgrade	115.8	22.1	94.8	98.8	23	96.0	P		
34	8/18/2006	Subgrade	117.3	23.5	95.0	96.6	23	98.3	P		
35	8/18/2006	Subgrade	117.9	24.6	94.6	96.6	23	98.0	P		
36	8/18/2006	Subgrade	113.7	22.3	93.0	96.6	23	96.2	P		
37	8/18/2006	Subgrade	115.5	24.6	92.7	96.6	23	96.0	P		
38	8/18/2006	Subgrade	112.8	22.8	91.9	93.4	25.3	98.3	P		
39	8/20/2006	Subgrade	114.9	25.0	91.9	93.4	25.3	98.4	P		
40	8/20/2006	Subgrade	113.7	22.1	93.1	96.3	23	96.7	P		

Reference: Raw Data Provided by ESP Associates, Project No. UG45.400

Density tests performed in accordance with ASTM D-2937-83



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ESP ASSOCIATES, P.A.  
engineering • surveying • planning

### SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: Hallen

Date: 8-25-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- T-1 through P- T-42

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

\_\_\_\_\_

DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

\_\_\_\_\_

R. C. R.  
INSTALLER'S PERSONNEL

[Signature]  
COA PERSONNEL



# SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: Halloran

Date: 8-26-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- S-1 through P- S-15

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

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[Signature]  
INSTALLER'S PERSONNEL

[Signature]  
CQA PERSONNEL



# SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: HALLATON

Date: 8-27-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- S16 through P- S39

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

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R/C 12  
INSTALLER'S PERSONNEL

[Signature]  
CQA PERSONNEL



**SUBGRADE CERTIFICATION**

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: HALLAM

Date: 8-28-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- T-43 through P- T-73  
S-40 S-45

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

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[Signature]  
INSTALLER'S PERSONNEL

[Signature]  
CQA PERSONNEL



# SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: \_\_\_\_\_

Date: 8-29-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- S-46  
T-74 through P- S-63  
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THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

\_\_\_\_\_

  
\_\_\_\_\_  
INSTALLER'S PERSONNEL

  
\_\_\_\_\_  
CQA PERSONNEL



# SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agri America  
Installer: Hallaton

Date: 8-30-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- T-96 through P- T-109

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

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\_\_\_\_\_  
INSTALLER'S PERSONNEL

  
\_\_\_\_\_  
CQA PERSONNEL



**SUBGRADE CERTIFICATION**

**Material:** 60-mil HDPE  
**Manufacturer:** Agru America  
**Installer:** \_\_\_\_\_

**Date:** 9-8-06  
**ESP Project Number:** UG45.400  
**Project Name:** Marshall Steam Station  
**Project Location:** Catawba County, NC  
**Page:** \_\_\_\_\_

P- T-110  
S-54 through P- T-135  
S-64

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

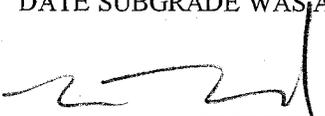
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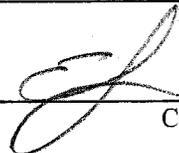
DATE CORRECTIVE ACTION WAS IMPLEMENTED:

\_\_\_\_\_

DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

\_\_\_\_\_

  
\_\_\_\_\_  
INSTALLER'S PERSONNEL

  
\_\_\_\_\_  
CQA PERSONNEL



SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: \_\_\_\_\_

Date: 9-9-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: \_\_\_\_\_

P- 5-65  
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THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

\_\_\_\_\_

[Signature]  
INSTALLER'S PERSONNEL

[Signature]  
CQA PERSONNEL



# SUBGRADE CERTIFICATION

Material: 60-mil HDPE  
Manufacturer: Agru America  
Installer: \_\_\_\_\_

Date: 9-10-06  
ESP Project Number: UG45.400  
Project Name: Marshall Steam Station  
Project Location: Catawba County, NC  
Page: 1

P- S76 through P- S-81

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

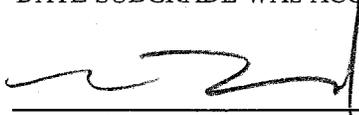
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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED: \_\_\_\_\_

DATE SUBGRADE WAS ACCEPTED BY INSTALLER: \_\_\_\_\_

  
\_\_\_\_\_  
INSTALLER'S PERSONNEL

  
\_\_\_\_\_  
CQA PERSONNEL



**SUBGRADE CERTIFICATION**

**Material:** 60-mil HDPE  
**Manufacturer:** Agru America  
**Installer:** HAILATON

**Date:** 9-11-06  
**ESP Project Number:** UG45.400  
**Project Name:** Marshall Steam Station  
**Project Location:** Catawba County, NC  
**Page:** 1

P- T-151 through P- T-161

THE SUBGRADE THAT THE ABOVE LISTED PANELS ARE TO BE DEPLOYED UPON WAS INSPECTED AND DETERMINED TO BE SUITABLE IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS

IF THE SUBGRADE IS NOT SUITABLE, STATE REASONS:

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CORRECTIVE ACTION:

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DATE CORRECTIVE ACTION WAS IMPLEMENTED:

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DATE SUBGRADE WAS ACCEPTED BY INSTALLER:

\_\_\_\_\_

[Signature]  
\_\_\_\_\_  
INSTALLER'S PERSONNEL

[Signature]  
\_\_\_\_\_  
CQA PERSONNEL

4

**Subgrade North Slope**



**Subgrade South Slope**



**Subgrade facing North Slope    Anchor Trench**



**Subgrade facing North Slope**



5

Drawing Under Seperate Cover

6



August 21, 2006

Duke Energy  
526 South Church Street  
Mail Code: EC12ZB  
Charlotte, North Carolina 28201-1006

Attention: Mr. Richard Baker, P.E.

Reference: **SITE GEOLOGY**  
**Duke Power – Marshall Steam Station, FGD Landfill**  
Terrell, North Carolina  
S&ME Project No. 1356-06-728

Dear Mr. Baker:

S&ME, Inc. (S&ME), in accordance to the facility's Permit to Construct, made periodic site inspections during grading activities for the construction of the FGD Landfill for the purpose of observing geologic site conditions within the cell. An initial site visit was made on July 31, 2006 for the northern portion of the cell floor and side slopes, another site visit was made on August 2, 2006 for the southern portion of the cell floor. A final inspection was made on August 18, 2006 for the southern side slopes of the cell.

### **Observed Geologic Structure**

During the July 31, 2006, August 2, 2006, and August 18, 2006 site visits, several geologic features were observed and measured for orientation, which are shown on the attached pictures. The general geology in the FGD Landfill grading area consisted of red to tan, micaceous, sandy, clayey silts with manganese oxide bands and weathered white granitic saprolite bands, shown in the attached pictures. The orientation of the soil structures observed trended generally in the northeast-southwest direction, with strike values ranging from North to N72°E. No rock pinnacles or partially weathered rock lenses were observed during the site visits, and no features

were observed that would suggest a benefit for relocating the proposed monitoring well locations.

S&ME appreciates this and every opportunity we have to be of service to you and Duke Energy. We trust this information is responsive to your needs at this time. If you require any additional information regarding the site's geology please contact us at your convenience. Thank you for choosing S&ME.

Sincerely,

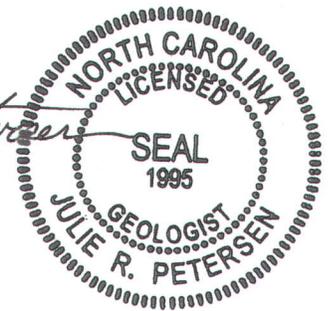
S&ME, Inc.

*Courtney R. Withers*

Courtney R. Withers  
Staff Professional

*Julie R. Petersen*

Julie R. Petersen, P.G.  
Project Manager



*Christopher J.L. Stahl*

Christopher J.L. Stahl, P.E.  
Senior Project Manager

Attachments: Figure 1 – Geologic Structure Observations  
Site Photographs

cc: Thomas D. Graham, P.E., Chas. H. Sells, Inc.



## SITE PHOTOGRAPHS

Marshall Steam Station - FGD Landfill

Photographs taken for Geologic Report  
Sheet 1 of 6



**PICTURE 1**

**Date of Photograph:** July 31, 2006

**Description:**

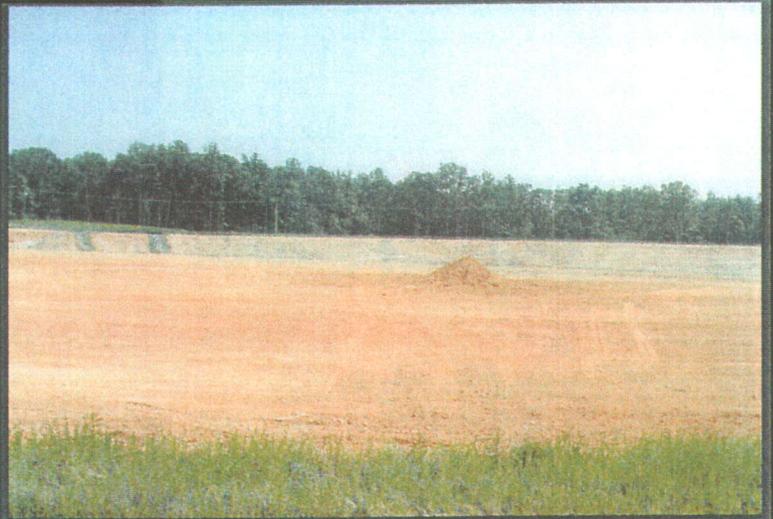
Picture taken standing on western side slope of FGD landfill facing southeast. Picture shows grading activities in the southeastern portion of the cell floor.

**PICTURE 2**

**Date of Photograph:** July 31, 2006

**Description:**

Picture taken standing on western side slope of FGD landfill facing east. Picture shows cleared eastern side slopes and cell floor in the central portion of the cell.



**PICTURE 3**

**Date of Photograph:** July 31, 2006

**Description:**

Picture taken on western side slope of FGD landfill facing northeast. Picture shows cleared side slopes and cell floor in the northeastern portion of the cell.





## SITE PHOTOGRAPHS

Marshall Steam Station - FGD Landfill

Photographs taken for Geologic Report

Sheet 2 of 6



**PICTURE 4**

**Date of Photograph:** July 31, 2006

**Description:**

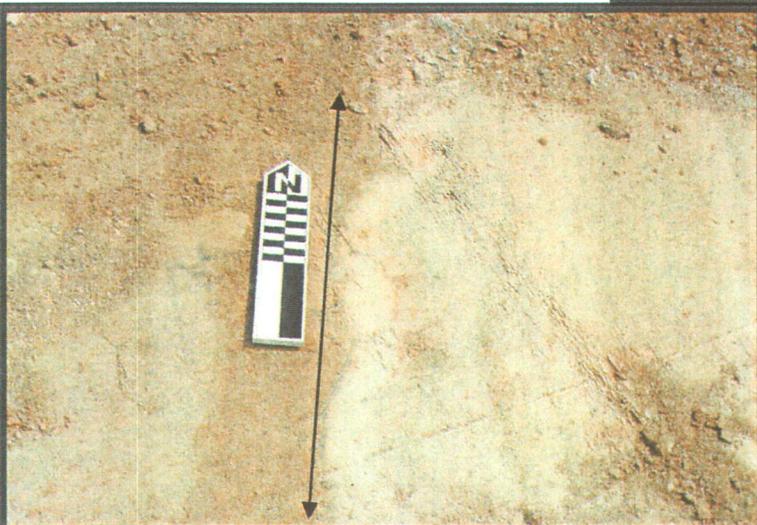
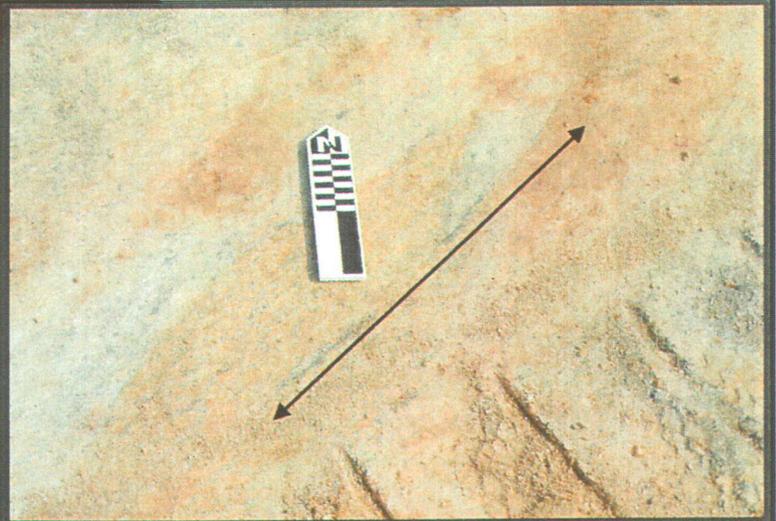
Picture taken standing on northern side slope facing south. Picture shows that the southern side slopes had not been cleared at time of photo.

**PICTURE 5**

**Date of Photograph:** July 31, 2006

**Description:**

Northern floor of cell. Soil structure is a manganese band trending N 50° E.



**PICTURE 6**

**Date of Photograph:** July 31, 2006

**Description:**

Northern side slope of cell. Soil structure is a feldspar band trending North.

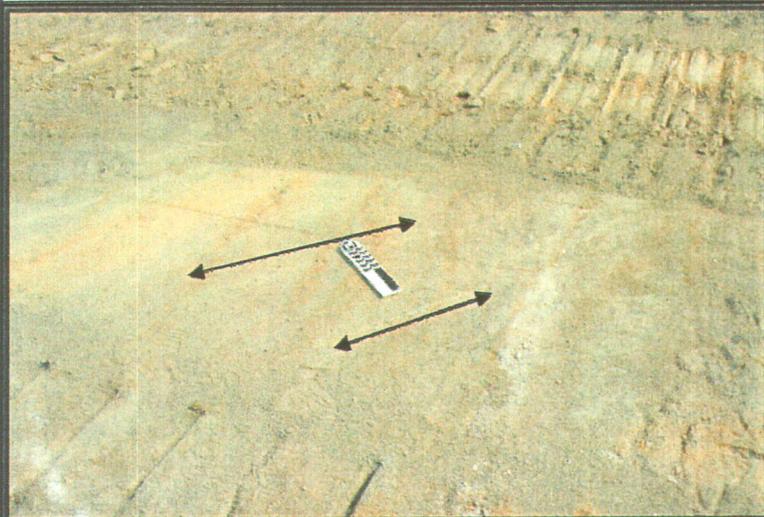


## SITE PHOTOGRAPHS

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**PICTURE 7**

**Date of Photograph:** July 31, 2006

**Description:**

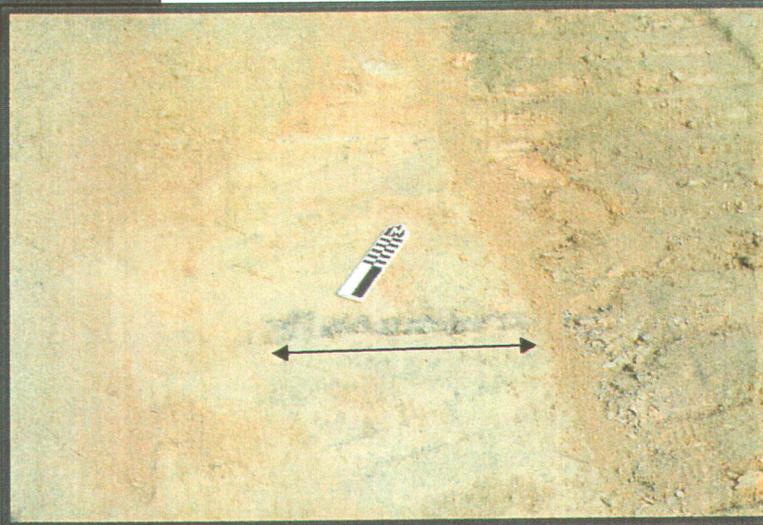
Floor of cell near eastern side slope. Soil structures are weathered granitic saprolite bands trending N 87° E.

**PICTURE 8**

**Date of Photograph:** July 31, 2006

**Description:**

Floor in center of cell. Soil structure is a manganese band trending N 72° E.

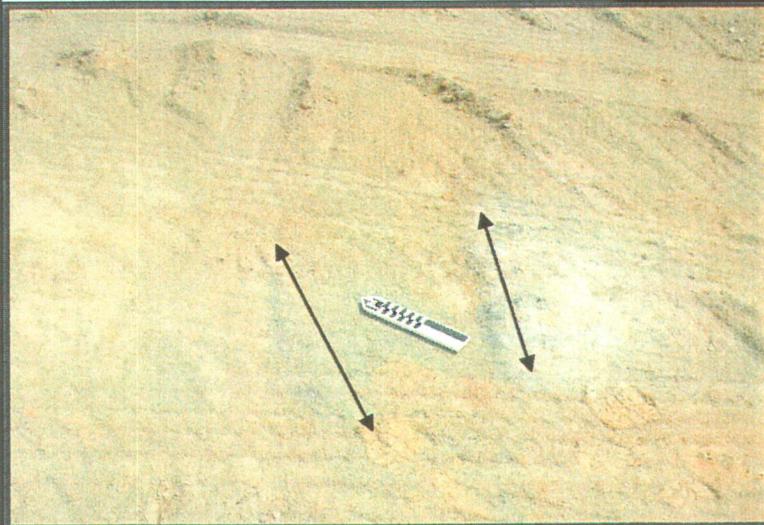


**PICTURE 9**

**Date of Photograph:** July 31, 2006

**Description:**

Floor in center of cell. Soil structures are manganese bands trending N 56° E.

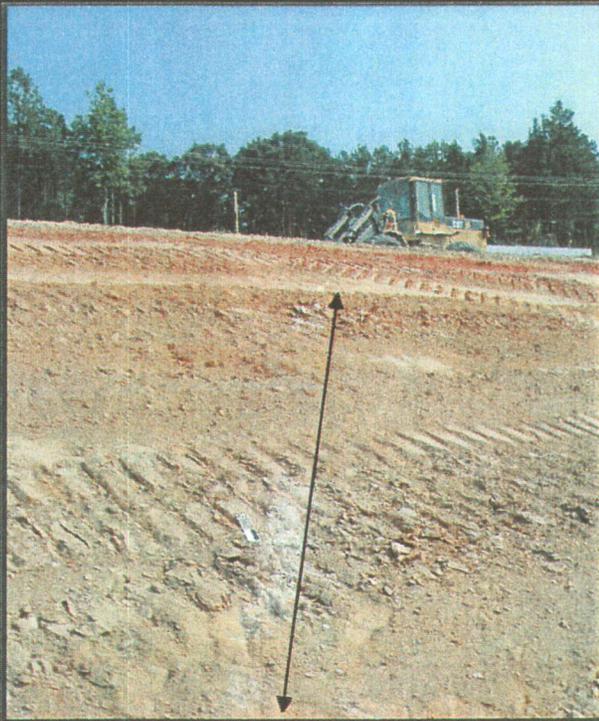




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**PICTURE 10**

**Date of Photograph:** July 31, 2006

**Description:**

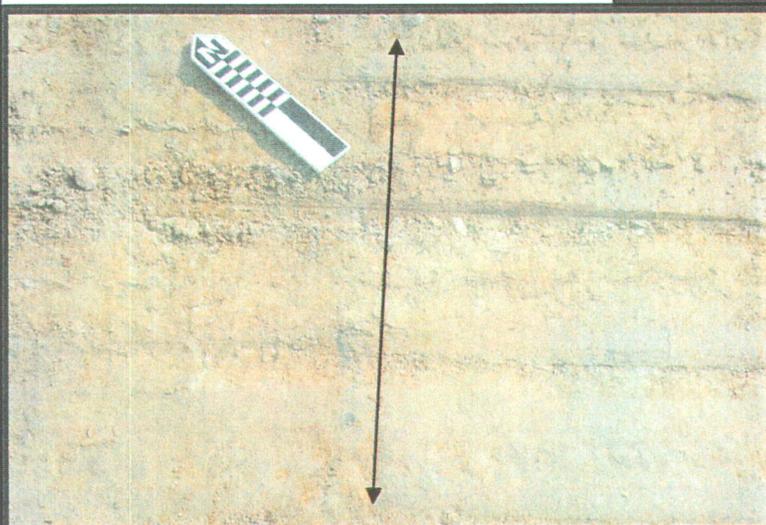
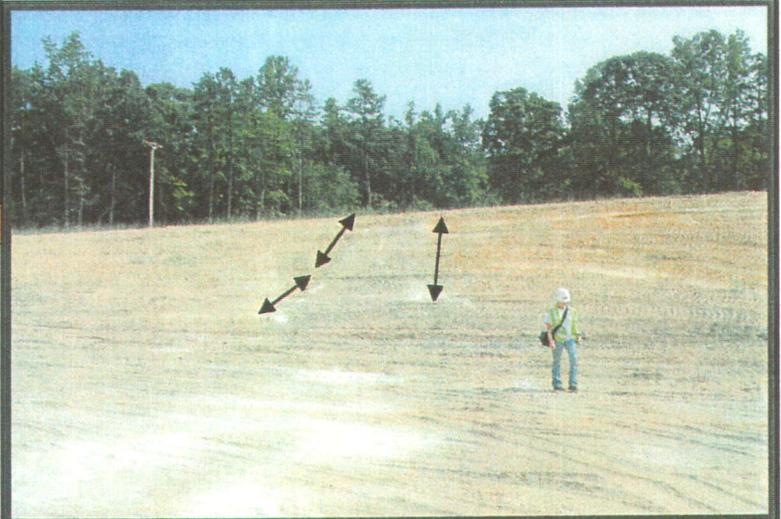
Northern side slope of cell. Soil structure is a weathered granitic saprolite band trending N 17° E.

**PICTURE 11**

**Date of Photograph:** July 31, 2006

**Description:**

Eastern floor and side slope of cell. Soil structures are weathered granitic saprolite bands trending N 23° E.



**PICTURE 12**

**Date of Photograph:** August 2, 2006

**Description:**

Southwestern floor of cell. Soil structure is a manganese band trending N 46° E.

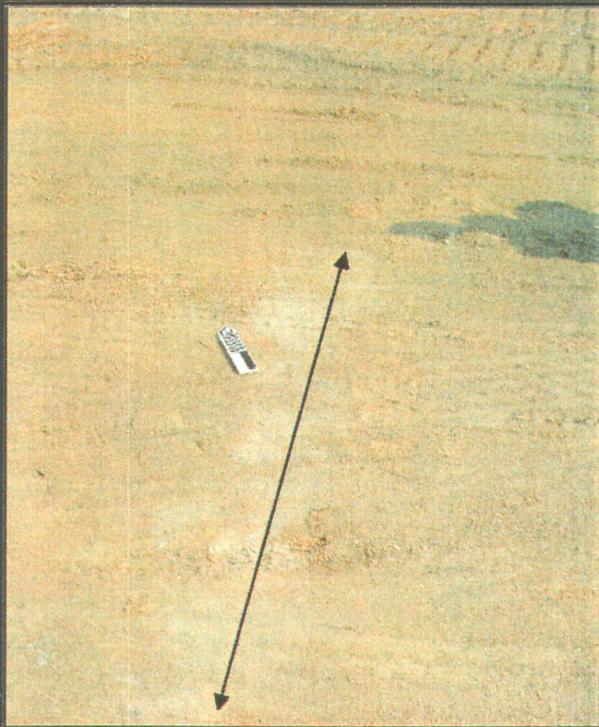


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**PICTURE 13**

**Date of Photograph:**

July 31, 2006

**Description:**

Eastern floor of cell. Soil structure is a weathered granitic saprolite band trending N 20° E.

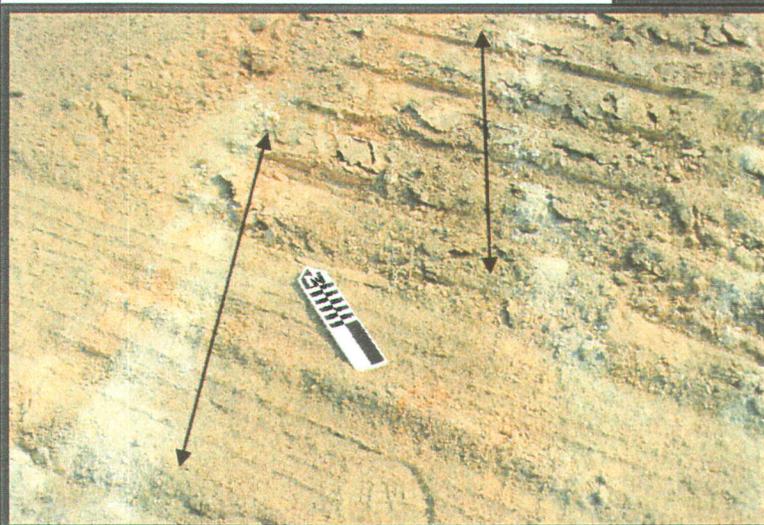
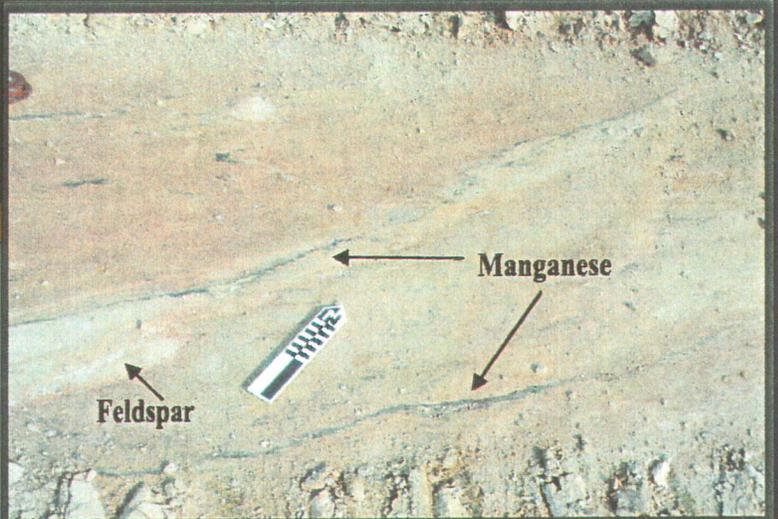
**PICTURE 14**

**Date of Photograph:**

August 2, 2006

**Description:**

Central floor of cell. Soil structures are manganese bands trending N 45° E and a weathered granitic saprolite band trending N 23° E.



**PICTURE 15**

**Date of Photograph:**

August 2, 2006

**Description:**

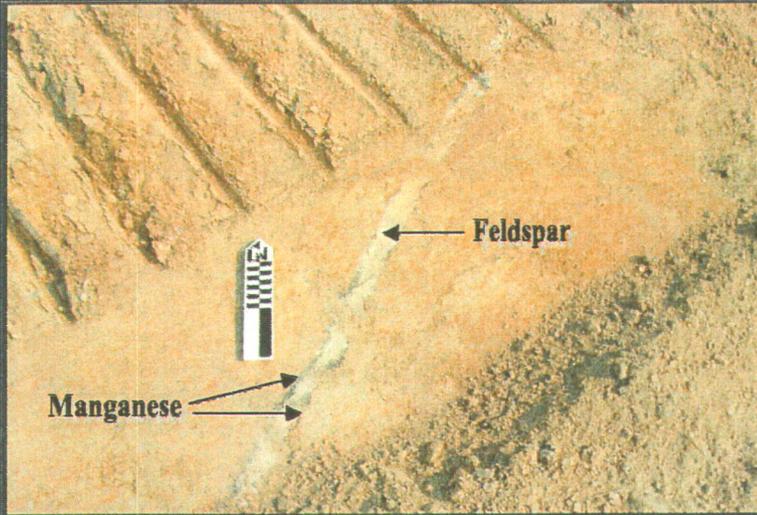
Southeastern floor of cell. Soil structures are weathered granitic saprolite bands trending N 35° E.



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**PICTURE 16**

**Date of Photograph:** August 2, 2006

**Description:**

Southeastern floor of cell. Soil structure is a weathered granitic saprolite band bound on each side by manganese bands, all trending N 30° E.

**PICTURE 17**

**Date of Photograph:** August 18, 2006

**Description:**

Southern side slope of cell. Soil structure is a manganese band trending N 25° E.

