DWM-SWS
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CONSTRUCTION QUALITY ASSURANCE REPORT
PHASE 2 CELL 1B

CONSTRUCTION AND DEMOLITION DEBRIS LANDFILL FACILITY
PERMIT No. 92-30

Prepared For:

GREENWAY WASTE SOLUTIONS OF APEX, LLC

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
CHARLOTTE, NORTH CAROLINA

CEC Project 111-370.003

November 1, 2012

North Carolina Board of Examiners
For
Engineers and Surveyors
License No. C-3035

NORTH CAROLINA PROFESSIONAL SEAL 026435 ENGINEER SCOTT L. BROWN

November 1, 2012

Scott L B

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1.0 INTRODUCTION

This report describes the results of the construction quality assurance (CQA) for cell construction of Cell 1B of Phase 2 (4.32 acres) at the Greenway Waste Solutions of Apex, LLC facility (Landfill) located in Apex, NC. Specifically, this report will summarize the construction activities and certify that the construction was completed in accordance with:

1. The CQA Plan.
2. The conditions of the Permit to Construct.
3. The Requirements of 15A NCAC 13B .0541.
4. Acceptable engineering practices

2.0 EARTHWORK

The cell subgrade was in cut and no soil testing was required per the CQA Plan. The field description of the soil observed for the subgrade is classified as SM by Enviro-Pro, PC (Appendix A). Though no soil testing was required in the CQA Plan, five soil samples were taken to establish permeability of the subgrade. The permeability of the soil samples were measured by Summit Laboratories with resulting values of 4.03×10^{-5} cm/sec, 1.81×10^{-5} cm/sec, 5.70×10^{-6}, 1.11×10^{-5} and 6.41×10^{-6} cm/sec. Also, Summit Laboratories performed a Particle Size Distribution (USCS) to determine the Grain Size classification. The laboratory classification confirmed the field observation of a silty fine sand (SM). The cap system will be designed and constructed to a permeability less than or equal to these soils underlying the landfill, but not more permeable than 1×10^{-5} cm/sec. Visual inspection by Enviro-Pro, PC of the prepared subgrade verified that:

1. Angular or sharp rocks, rocks larger than the specified diameter, and other debris are not present on the surface.
2. There are no soft or yielding areas.

3.0 SURFACE WATER DRAINAGE STRUCTURES

The Soil Erosion & Sedimentation Control Plan for all of Phase 2 (Cells 1 and 2 total 19.3 Acres) was submitted and approved by the Town of Apex. The design was based on calculations for Phase 2 at build-out, along with the Construction Plans for Phase 2. The erosion control structures were inspected by the Town of Apex and deemed to be constructed in compliance with the approved plans.

4.0 AS-BUILT DRAWINGS

An as-built drawing performed by Patterson Land Surveying, PA is located in Appendix B. Subgrade elevations were verified on a 100-ft grid. Phase 2 Cell 1B will utilize the existing haul road. All locations met the minimum permitted subgrade elevations. Appendix C contains a certification that construction was completed in accordance with:

1. The CQA Plan.
2. The conditions of the Permit to Construct.
3. The Requirements of 15A NCAC 13B .0541.
4. Acceptable engineering practices

5.0 LANDFILL CAPACITY

The following table lists the acreage and capacity for the landfill, both existing and planned. Total gross capacity is defined as the volume measured from the bottom of waste through the top of final cover. The total disposal area of Phases 1 through 3 is 43.8 acres.

Area	Gross Capacity (cy)	Acreage
Phase 1	858,000	17.8
Phase 2 – Total, including Cell 1A* and Cell 1B*	1,100,000	14.8
*Cell 1A only	49,360	1.83
*Cell 1B only	240,810	4.32
Phase 3	900,000	11.2
Totals	2,858,000	43.8

*Total constructed capacity 1,148,170 cy

6.0 MAJOR PROJECT FEATURES

Appendix D consists of pictures of major project features across the 4.32 acre expansion.

Appendix A

ENVIRO-PRO
PROFESSIONAL CORPORATION

October 26, 2012

Mr. Ron Gilkerson
Griffin Brothers Companies
19109 W. Catawba Avenue, Suite 200
Cornelius, North Carolina 28031-5613

RE: Greenway Waste Solutions at Apex, LLC
Highway 55 C&D Landfill
Wake County, North Carolina
Project No. EP-1306

Dear Mr. Gilkerson:

On October 5, 2012 I performed a visual inspection of 4.32 acres of cleared subgrade within the planned Phase II landfilling area at the subject facility. No significant geological features such as bedrock outcrops were exposed on the cleared subgrade area. The subgrade soils appeared to be sandy silts to silty sands.

Five bulk soil samples (SS-1 through SS-5) were collected from the subgrade area and were submitted to Summit Laboratories in Fort Mill, South Carolina for permeability testing. Summit's results are included in the attached Appendix.

Please contact me at (803) 547-4955 if you have any questions concerning this reported information.

Sincerely,
ENVIRO-PRO, P.C.

Thomas H. Bolyard

NORTH CAROLINA LICENSED SEAL 492 GEOLOGIST THOMAS H. BOLYARD

Thomas H. Bolyard, P.G.
Senior Hydrogeologist

2646 Farmlake Lane • Fort Mill, SC 29708 • (803) 547-4955 • Fax (803) 548-2233

SUMMIT
LABORATORIES

October 31, 2012

Mr. Ron Gilkerson
Griffin Bros. Companies
19109 W Catawba Avenue, Suite 200
Cornelius, NC 28031-5611

Subject: **Laboratory Permeability Test Results of Subgrade Soils**
Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
SUMMIT Project No. SL-280-12

Dear Mr. Gilkerson:

Summit Laboratories, LLC. **(SUMMIT)** has completed the requested laboratory testing on the 5 bulk subgrade soil samples submitted to **SUMMIT** on October 24, 2012. Permeability testing was performed on the remolded samples at approximately 95% maximum dry density and optimum moisture content of the standard proctor curve. In addition, USCS classifications were assigned to the soil samples based on laboratory grain size analyses and atterberg tests. The following ASTM tests were performed:

- *ASTM D 5084 - Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeater*
- *ASTM D 698 – Laboratory Compaction Characteristics of Soil Using Standard Effort*
- *ASTM D 2487 – Classification of Soils for Engineering Purposes (USCS)*

The results of the laboratory testing are summarized on the attached Compaction Test Reports (proctors), Permeability Test Reports (hydraulic conductivity), and Particle Size Distribution (USCS).

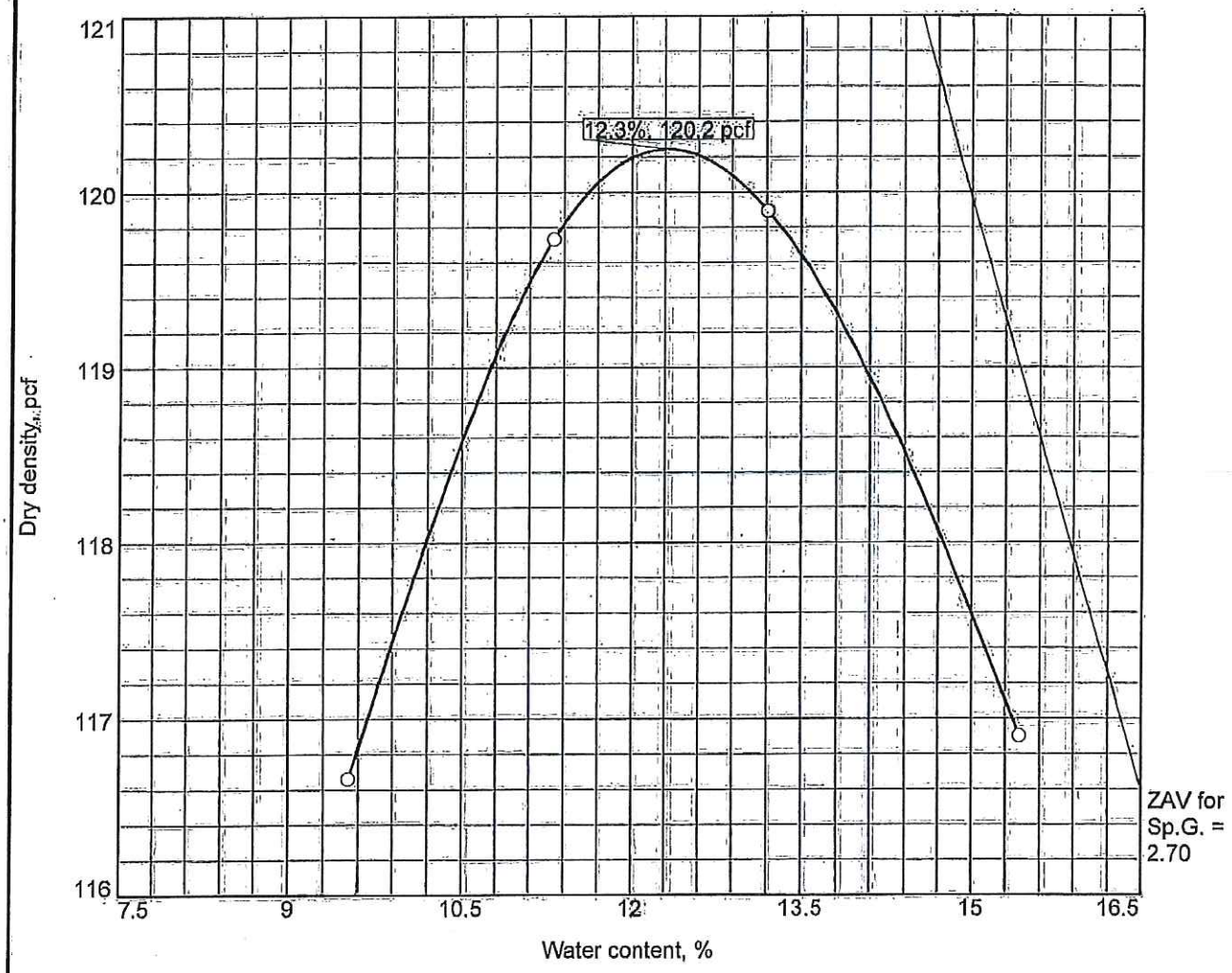
SUMMIT appreciates the opportunity to provide our professional services to you on this project. If you have any questions concerning the information in this report or if we can provide any additional information, please contact me.

Respectfully Submitted,
SUMMIT LABORATORIES, LLC.

Mimi S. Hourani
Laboratory Services Manager

Enclosures: Perm. Report (15 pages)
Proctor (5 pages)
Grain Size (5 pages)

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-2-4(0)			NV	NP	3.2	20.5

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 120.2 pcf Optimum moisture = 12.3 %	Grey-Brown Silty Sand

Project No. SL-280-12 **Client:** Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
○ **Location:** Subgrade Sample #1 **Sample Number:** SS-1

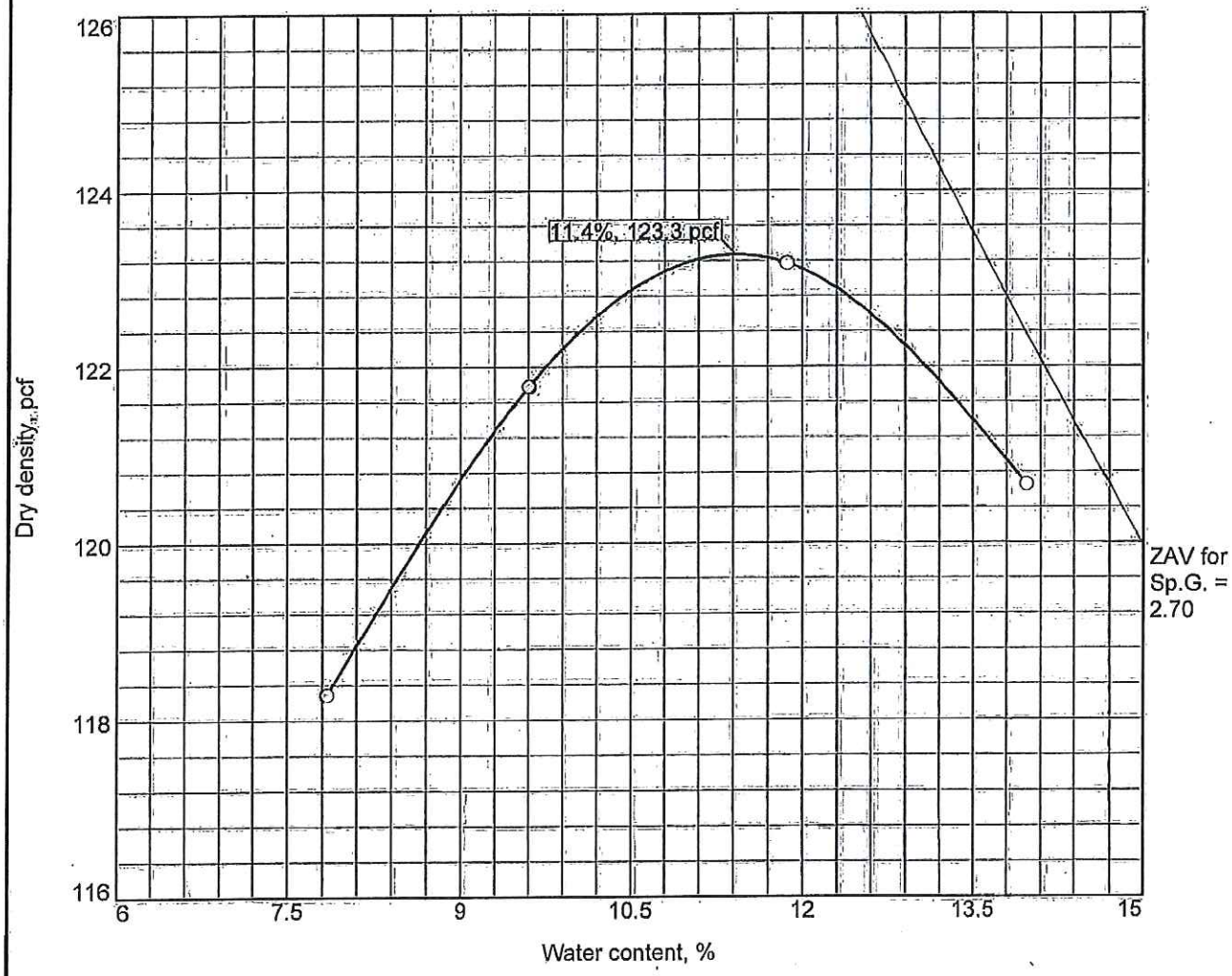
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-1-b			NV	NP	5.0	20.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.3 pcf Optimum moisture = 11.4 %	Grey-Brown Silty Sand

Project No. SL-280-12 **Client:** Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
○ **Location:** Subgrade Sample #2 **Sample Number:** SS-2

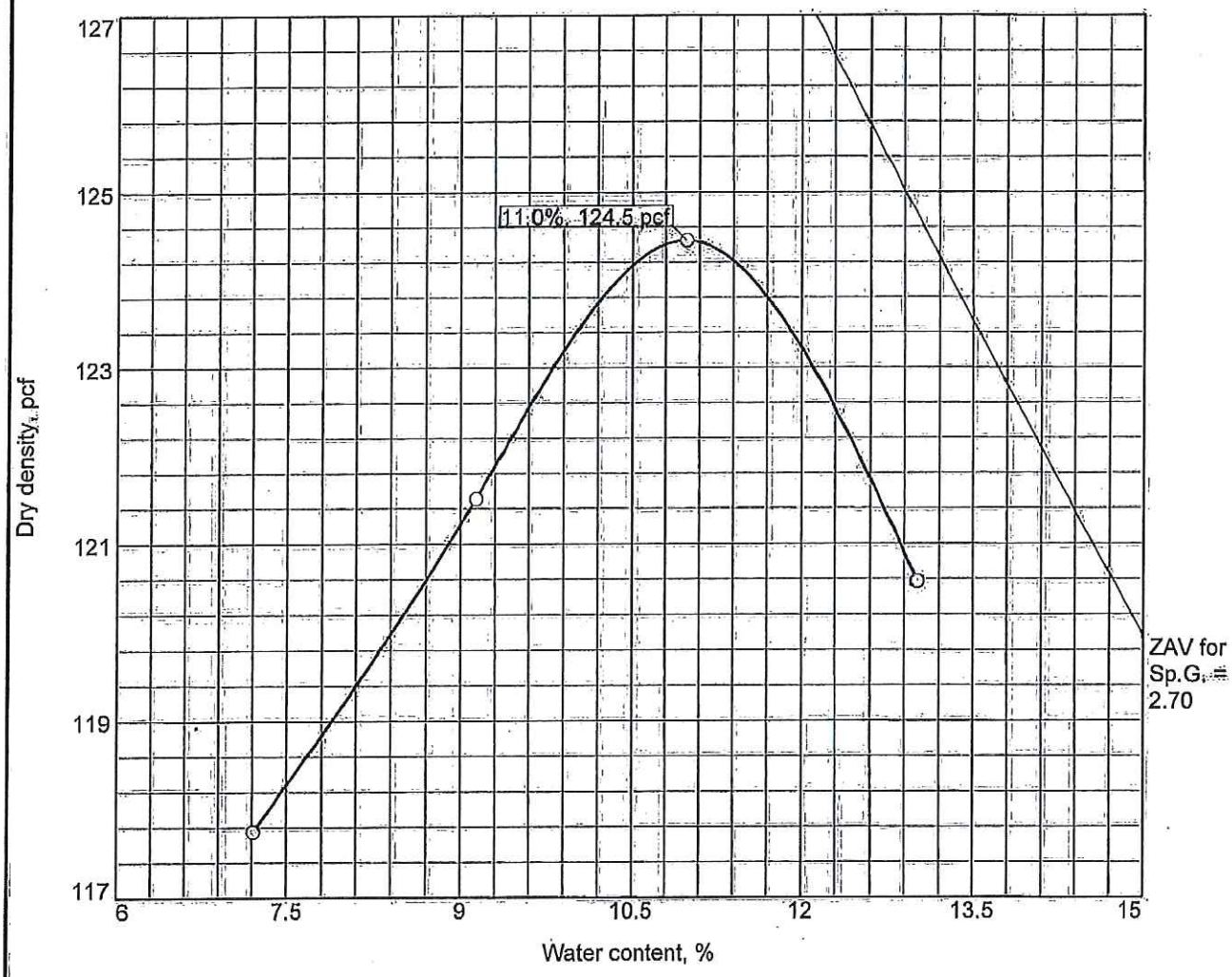
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM				NV	NP	7.7	18.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 124.5 pcf Optimum moisture = 11.0 %	Grey-Brown Silty Sand

Project No. SL-280-12 **Client:** Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
○ **Location:** Subgrade Sample #3 **Sample Number:** SS-3

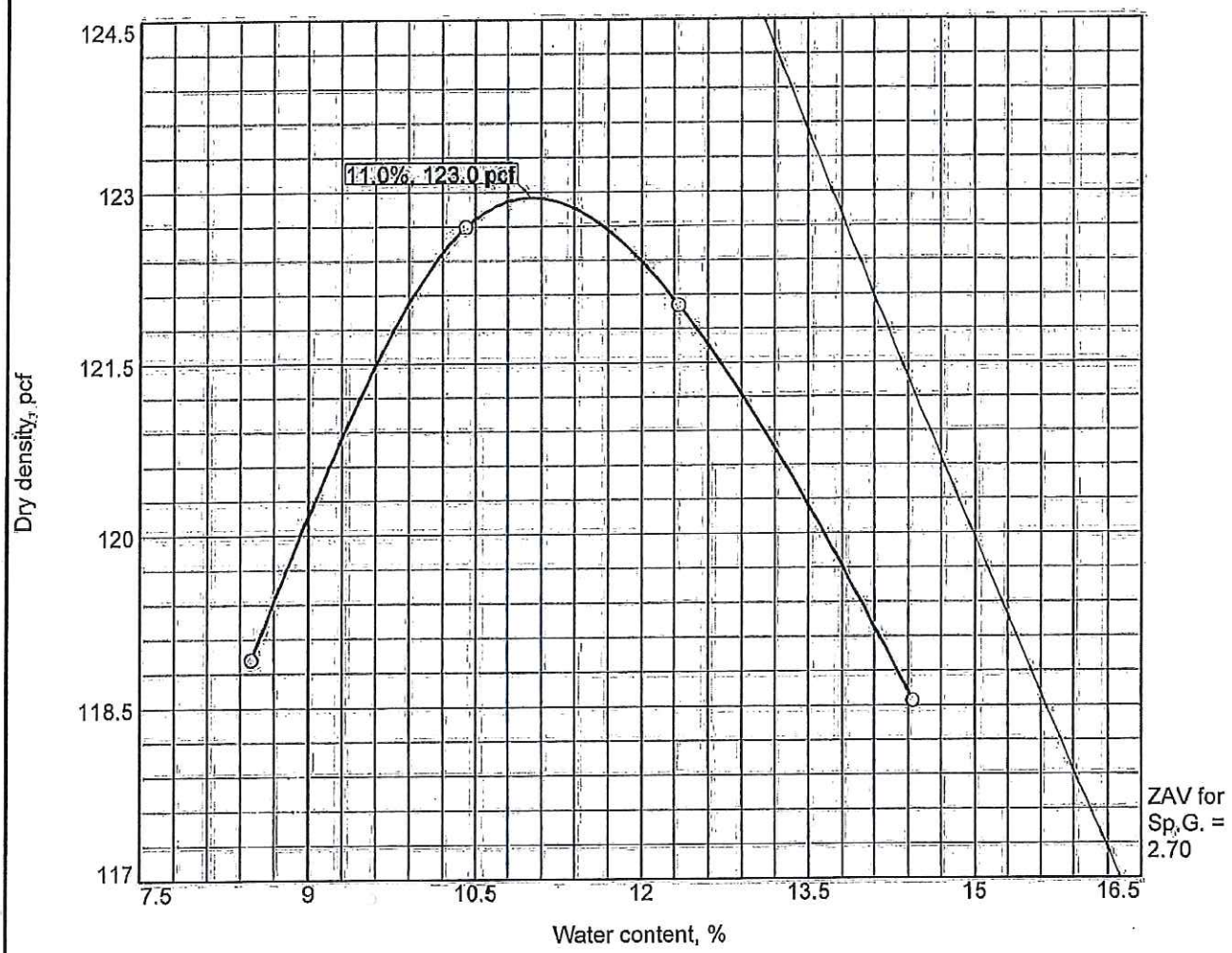
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-1-b			NV	NP	5.6	18.1

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.0 pcf Optimum moisture = 11.0 %	Grey-Brown Silty Sand

Project No. SL-280-12 **Client:** Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
○ **Location:** Subgrade Sample #4 **Sample Number:** SS-4

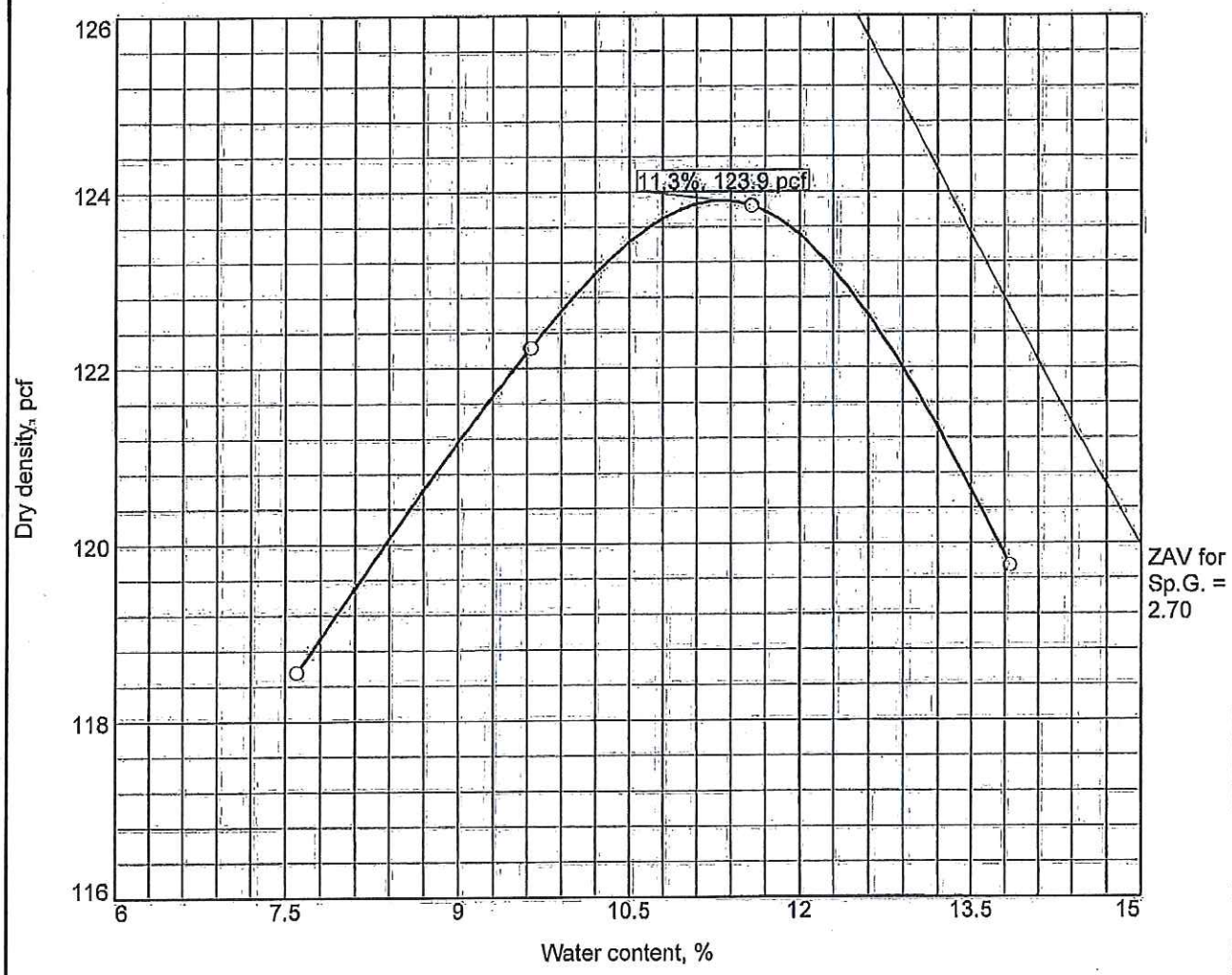
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

COMPACTION TEST REPORT



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
	SM	A-1-b			NV	NP	5.7	20.6

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 123.9 pcf Optimum moisture = 11.3 %	Grey-Brown Silty Sand

Project No. SL-280-12 **Client:** Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
Location: Subgrade Sample #5 **Sample Number:** SS-5

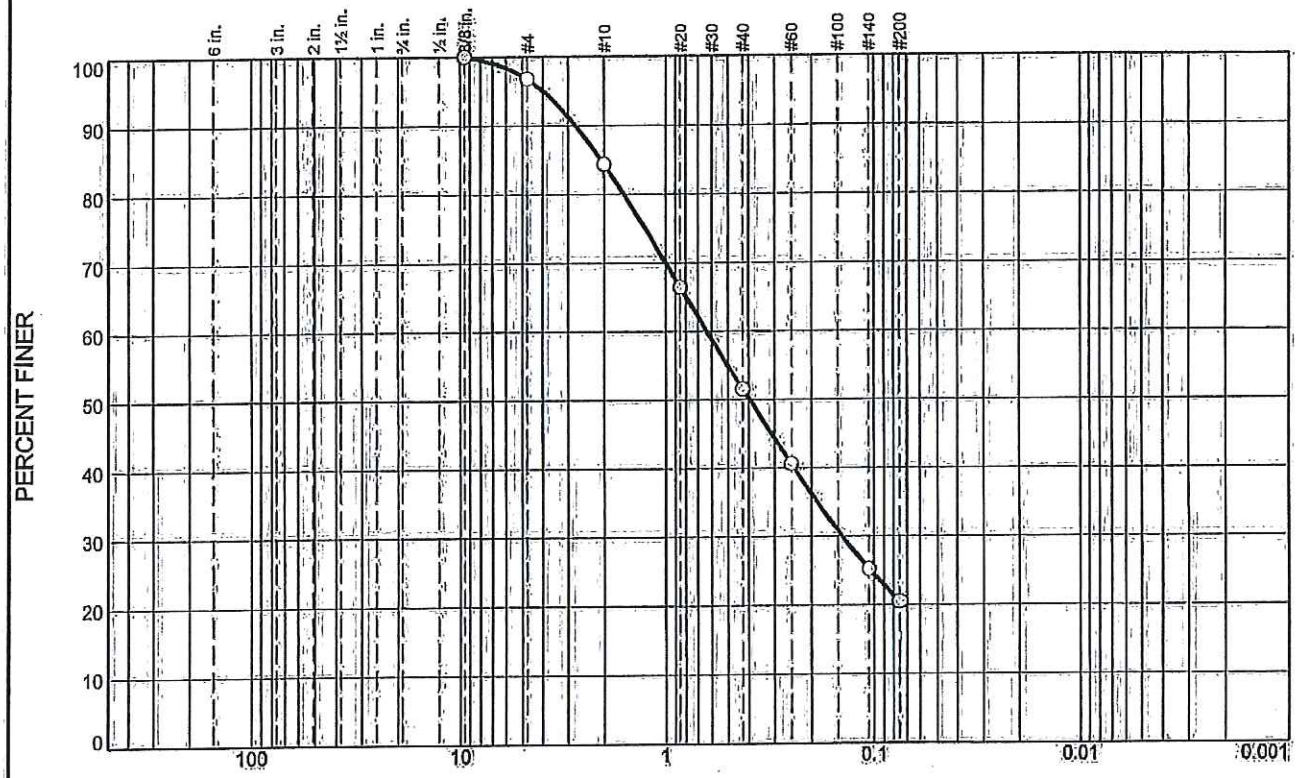
Remarks:

Summit Engineering

Ft. Mill, South Carolina

Figure

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.2	12.5	32.7	31.1	20.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	96.8		
#10	84.3		
#20	66.4		
#40	51.6		
#60	40.6		
#140	25.2		
#200	20.5		

* (no specification provided)

Material Description

Grey-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.7595 D_{85}= 2.0707 D_{60}= 0.6316
D_{50}= 0.3946 D_{30}= 0.1425 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Location: Subgrade Sample #1
Sample Number: SS-1

Date: 10-29-12

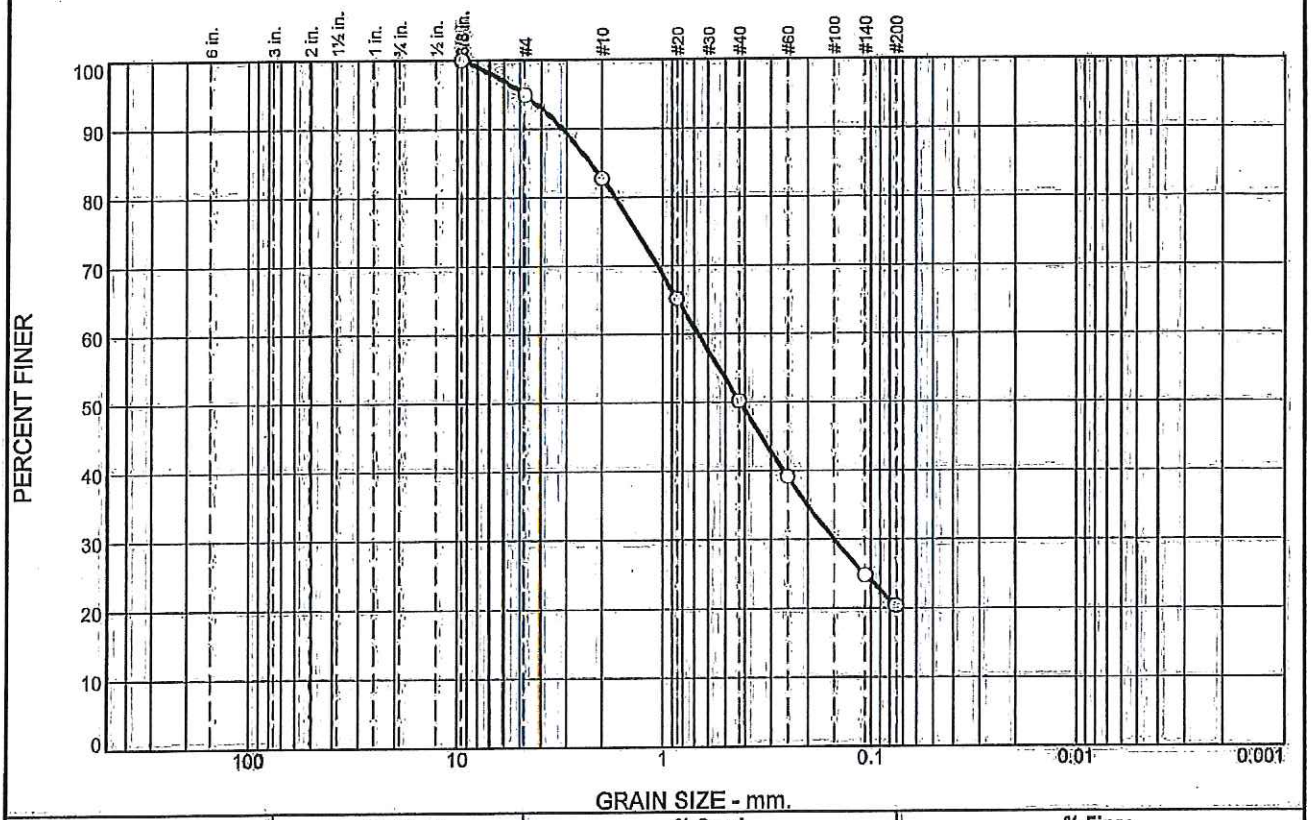
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
Project No: SL-280-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.0	12.2	32.6	29.8	20.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	95.0		
#10	82.8		
#20	65.2		
#40	50.2		
#60	39.1		
#140	24.8		
#200	20.4		

* (no specification provided)

Material Description

Grey-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 3.1283 D_{85}= 2.2680 D_{60}= 0.6697
D_{50}= 0.4215 D_{30}= 0.1503 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: Subgrade Sample #2
Sample Number: SS-2

Date: 10-29-12

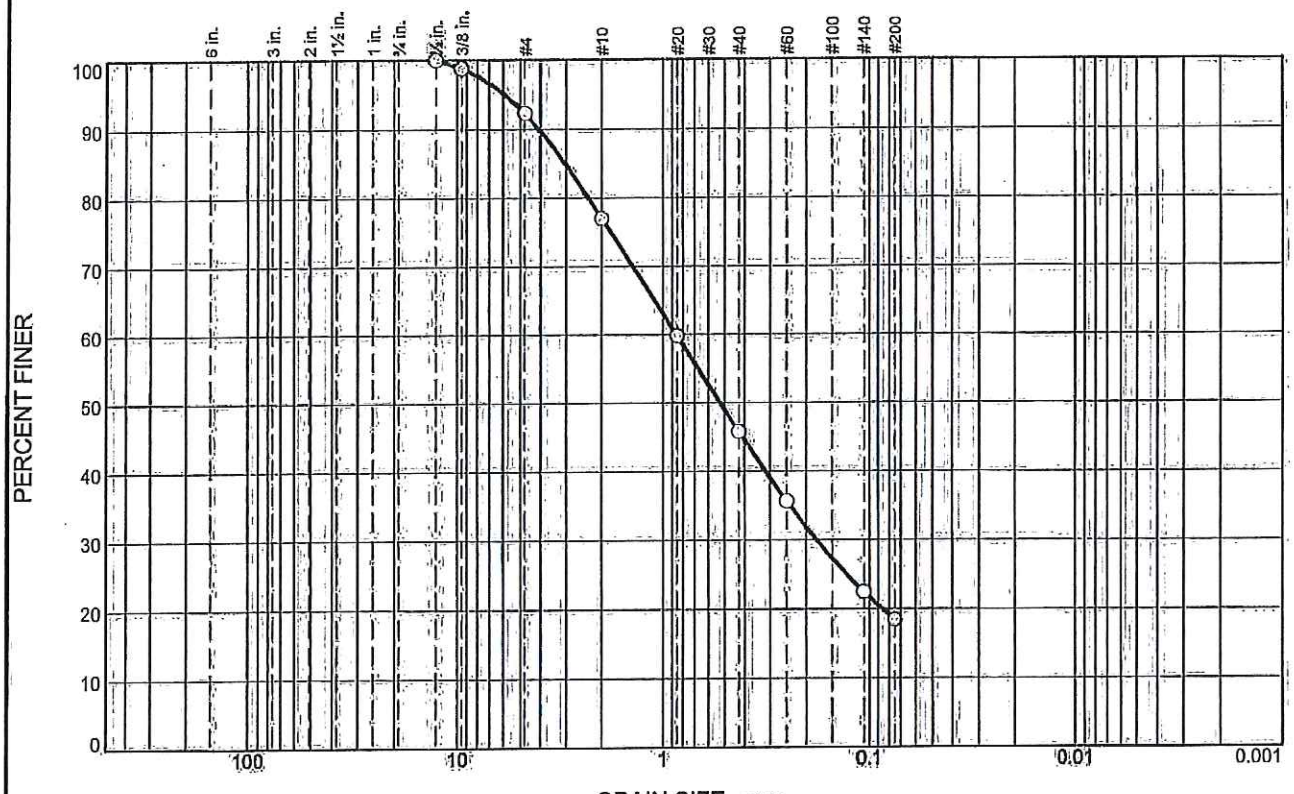
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
Project No: SL-280-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.7	15.3	31.3	27.3	18.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.5	100.0		
0.375	98.7		
#4	92.3		
#10	77.0		
#20	59.8		
#40	45.7		
#60	35.6		
#140	22.5		
#200	18.4		

* (no specification provided)

Material Description

Grey-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 4.0558 D_{85}= 3.0245 D_{60}= 0.8592
D_{50}= 0.5257 D_{30}= 0.1792 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Location: Subgrade Sample #3
Sample Number: SS-3

Date: 10-29-12

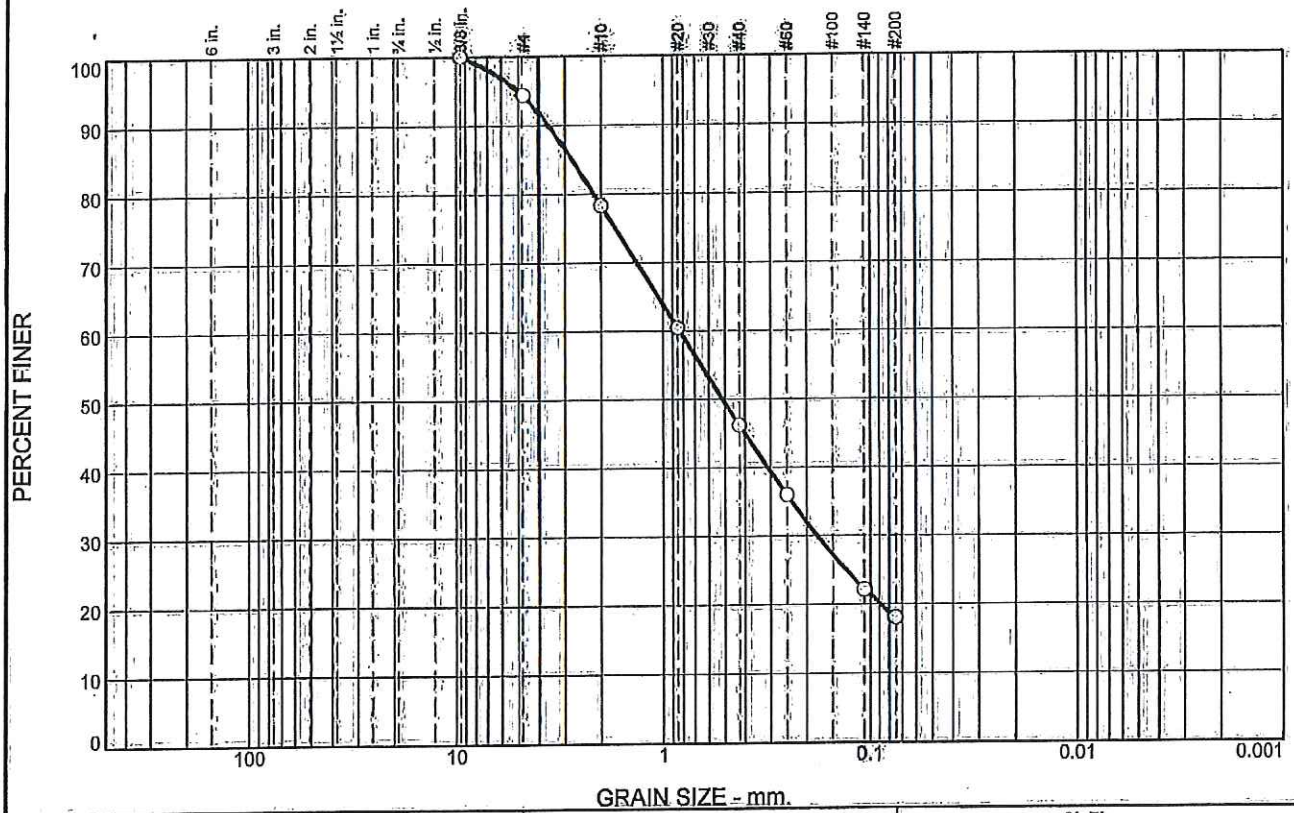
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
Project No: SL-280-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.6	16.1	32.1	28.1	18.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	94.4		
#10	78.3		
#20	60.5		
#40	46.2		
#60	36.0		
#140	22.2		
#200	18.1		

* (no specification provided)

Material Description

Grey-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 3.5755 D_{85}= 2.7520 D_{60}= 0.8301
D_{50}= 0.5126 D_{30}= 0.1784 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: Subgrade Sample #4
Sample Number: SS-4

Date: 10-29-12

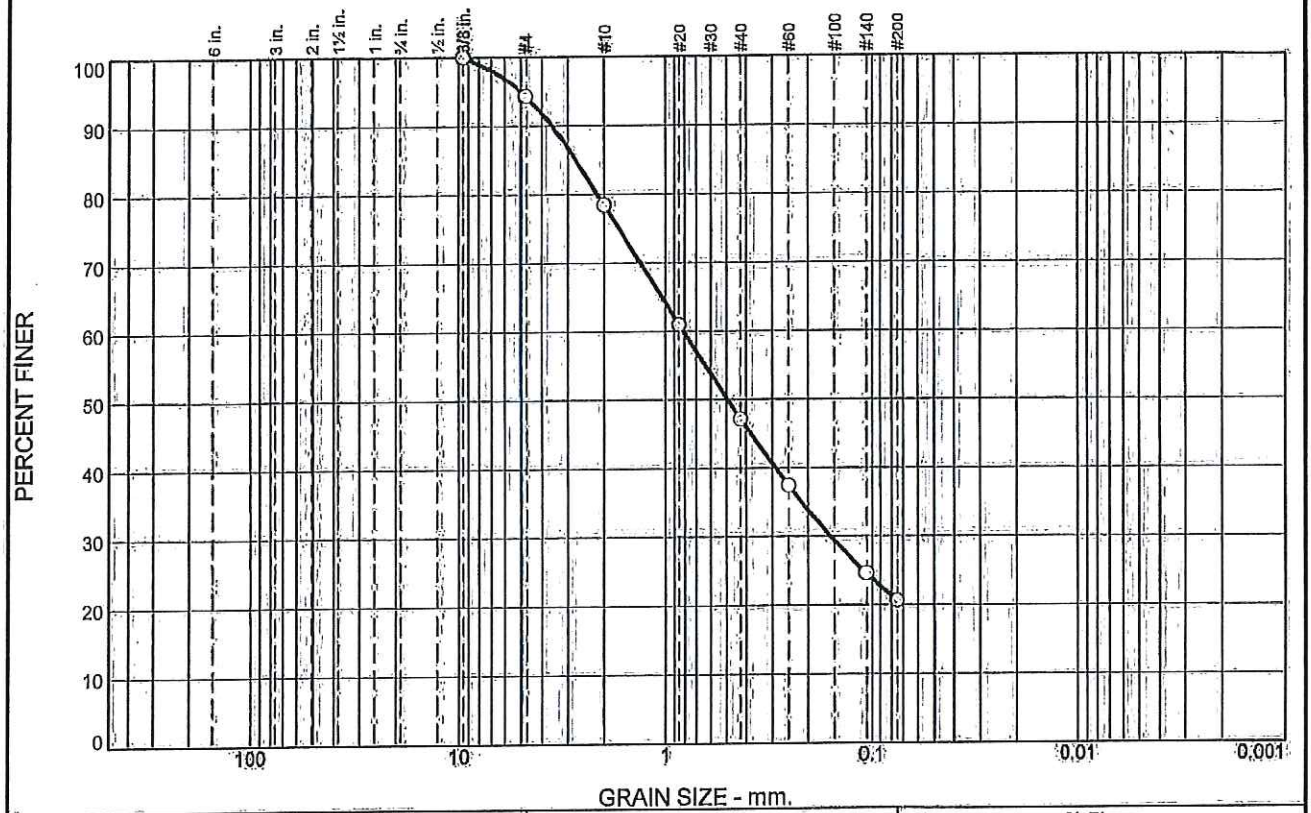
Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
Project No: SL-280-12 **Figure**

Tested By: Mimi Hourani

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.7	15.8	31.3	26.6	20.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.375	100.0		
#4	94.3		
#10	78.5		
#20	61.0		
#40	47.2		
#60	37.5		
#140	24.6		
#200	20.6		

* (no specification provided)

Material Description

Grey-Brown Silty Sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 3.5769 D_{85}= 2.7445 D_{60}= 0.8101
D_{50}= 0.4913 D_{30}= 0.1572 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: Subgrade Sample #5
Sample Number: SS-5

Date: 10-31-12

Summit Engineering

Ft. Mill, South Carolina

Client: Griffin Brothers Companies
Project: Greenway Waste Solutions of Apex, Phase II
HWY 55 C&D Landfill
Project No: SL-280-12 **Figure**

Tested By: Mimi Hourani

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.39
Specimen Diameter (cm): 7.28
Dry Unit Weight (pcf): 117.0
Moisture Before Test (%): 11.9
Moisture After Test (%): 14.6

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	1.0	
Flow Rate (cc/sec):	1.63×10^{-2}	
Perm. (cm/sec):	4.03×10^{-5}	

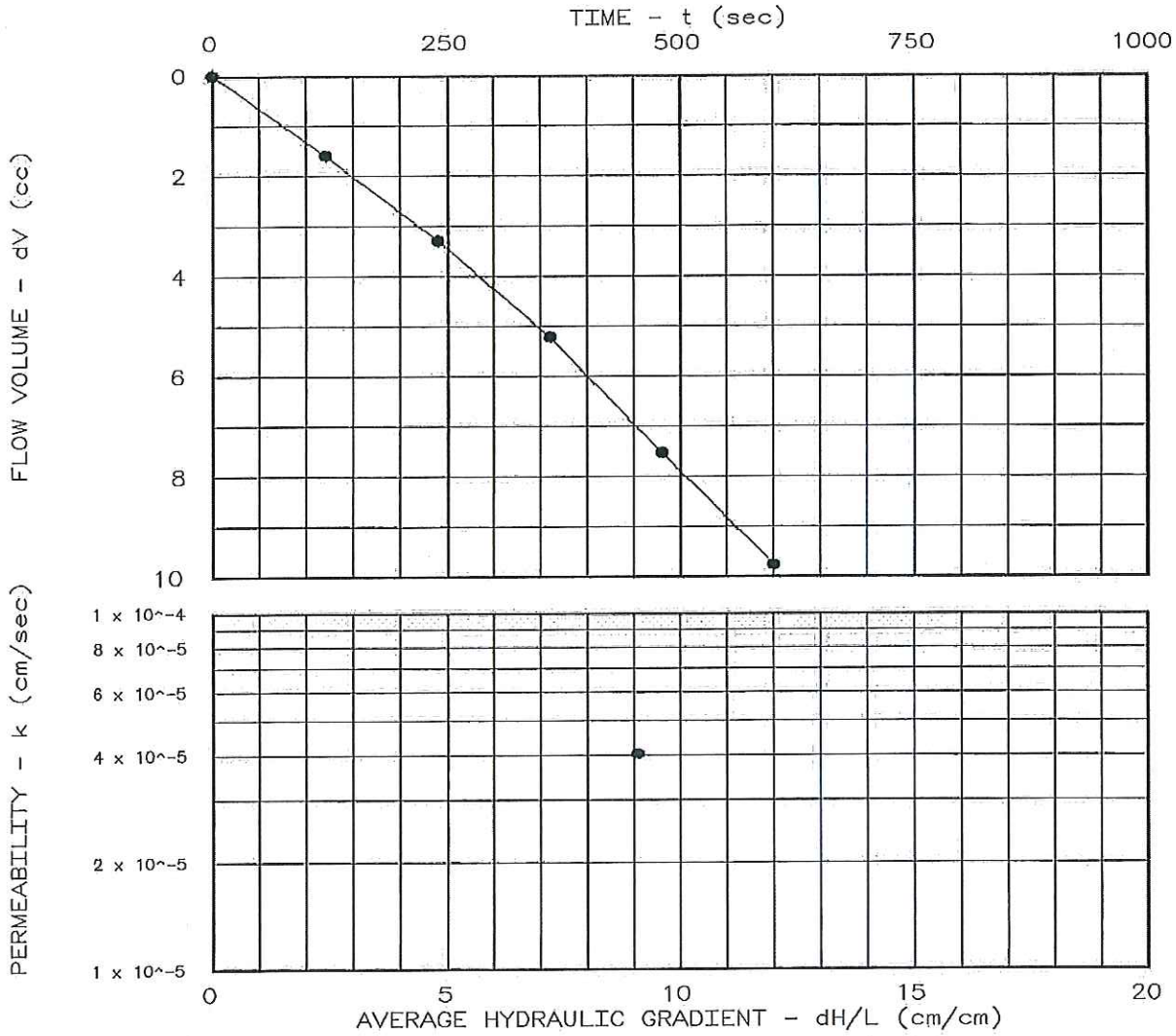
SAMPLE DATA:

Sample Identification: Subgrade Sample #1

Visual Description: Grey-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 120.2
Optimum Moisture Content (%): 12.3
ASTM(D698)
Percent Compaction: 97.3%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: Greenway Waste solutions of Apex Ph.II
Location: HWY 55 C&D Landfill
Date: 10-31-12

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: SL-280-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	Greenway Waste solutions of Apex Ph.II
File No.:	
Project Location:	HWY 55 C&D Landfill
Project No.:	SL-280-12
Sample Identification:	Subgrade Sample #1
Lab No.:	
Description:	Grey-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	120.2
Method (D1557/D698):	D698
Opt. Water Content:	12.3
Date:	10-31-12
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.868 in	in		2.851 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.87 in	7.28 cm		2.85 in	7.24 cm	
Length:	1	2	3	1	2	3
	2.908 in	in	in	2.909 in	in	in
Average:	2.91 in	7.39 cm		2.91 in	7.39 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.65		
Wet Wt. & Tare:	645.41		661.18
Dry Wt. & Tare:	576.77		576.77
Tare Wt.:	0.00		0.00
Moisture Content:	11.9 %		14.6 %
Dry Unit Weight:	117.0 pcf	97.3 % of max	118.3 pcf
Porosity:	0.2930		0.2848
Saturation:	76.1 %		97.4 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1 Panel No.: 1 Positions:

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	10/31/12	9:33:00	0	71.0	70.0	5.00	5.00	0.00
	10/31/12	9:35:00	120	71.0	70.0	6.60	3.40	1.00
R						6.60	3.40	
R						5.00	5.00	
	10/31/12	9:37:00	240	71.0	70.0	6.70	3.30	1.00
R						6.70	3.30	
R						5.00	5.00	
	10/31/12	9:39:00	360	71.0	70.0	6.92	3.08	1.00
R						6.92	3.08	
R						5.00	5.00	
	10/31/12	9:41:00	480	71.0	70.0	7.32	2.68	1.00
R						7.32	2.68	
R						5.00	5.00	
	10/31/12	9:43:00	600	71.0	70.0	7.22	2.78	1.00

Test Pressure = 71.0 psi Differential Head = 1.0 psi, 67.1 cm H2O
Gradient = 9.078E 00 Flow rate = 1.632E-02 cc/sec R squared = 0.99426
Permeability, K22.8° = 4.313E-05 cm/sec, K20° = 4.035E-05 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.63
Specimen Diameter (cm): 7.27
Dry Unit Weight (pcf): 117.2
Moisture Before Test (%): 10.8
Moisture After Test (%): 15.0

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	1.0	
Flow Rate (cc/sec):	7.17 x 10^-3	
Perm. (cm/sec):	1.81 x 10^-5	

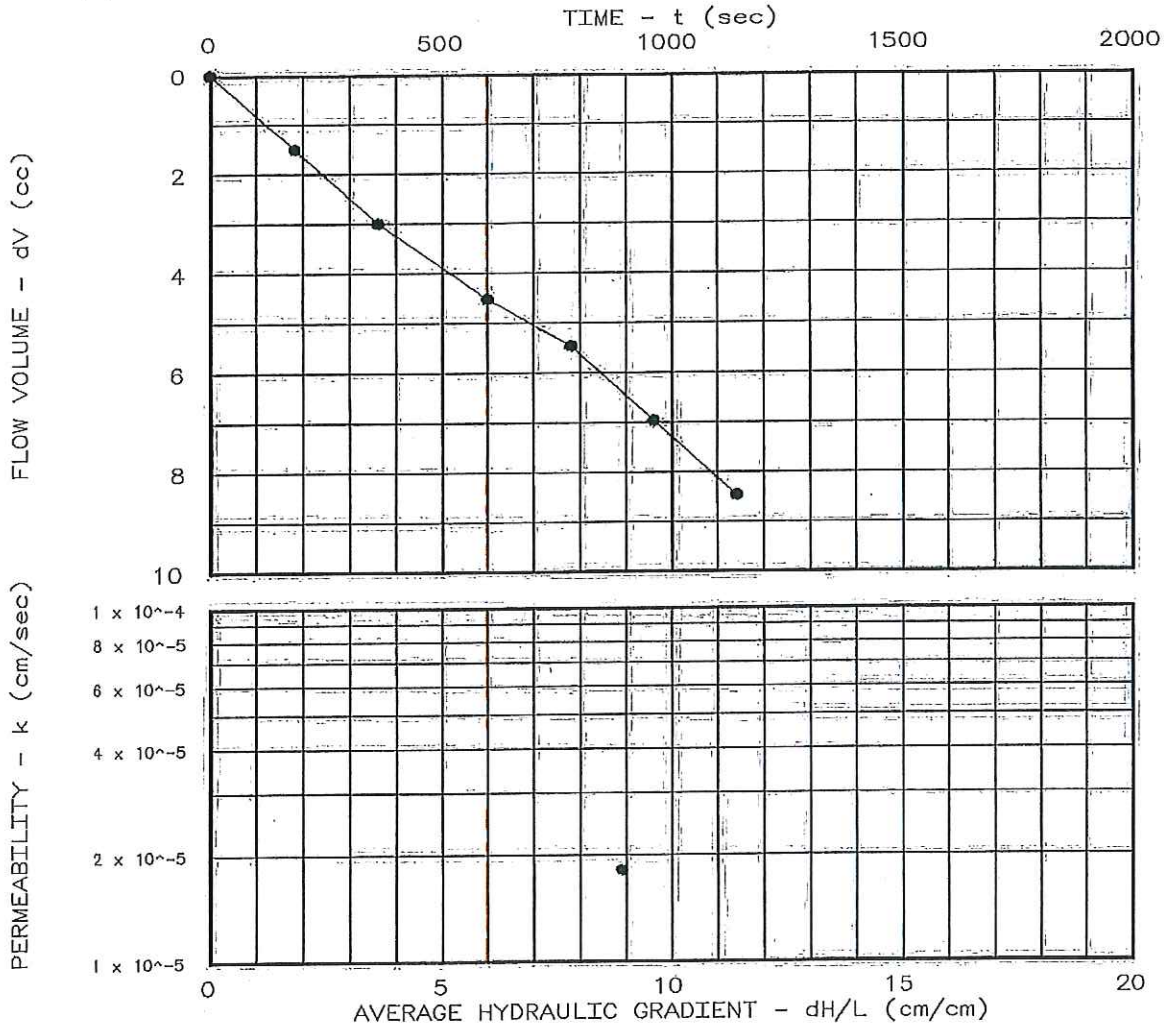
SAMPLE DATA:

Sample Identification: Subgrade Sample #2

Visual Description: Grey-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 123.3
Optimum Moisture Content (%): 11.4
ASTM(D698)
Percent Compaction: 95.1%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: Greenway Waste solutions of Apex Ph.II
Location: HWY 55 C&D Landfill
Date: 10-31-12

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: SL-280-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	Greenway Waste solutions of Apex Ph.II
File No.:	
Project Location:	HWY 55 C&D Landfill
Project No.:	SL-280-12
Sample Identification:	Subgrade Sample #2
Lab No.:	
Description:	Grey-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	123.3
Method (D1557/D698):	D698
Opt. Water Content:	11.4
Date:	10-31-12
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.864 in	in		2.864 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.86 in	7.27 cm		2.86 in	7.27 cm	
Length:	1	2	3	1	2	3
	3.003 in	in	in	3.003 in	in	in
Average:	3.00 in	7.63 cm		3.00 in	7.63 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.65		
Wet Wt. & Tare:	659.67		684.47
Dry Wt. & Tare:	595.37		595.37
Tare Wt.:	0.00		0.00
Moisture Content:	10.8 %		15.0 %
Dry Unit Weight:	117.2 pcf	95.1 % of max	117.2 pcf
Porosity:	0.2913		0.2913
Saturation:	69.6 %		96.5 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 2 Panel No.: 2 Positions: 1

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	10/31/12	9:33:00	0	71.0	70.0	5.00	5.00	0.00
	10/31/12	9:36:00	180	71.0	70.0	6.50	3.50	1.00
R						6.50	3.50	
R						5.00	5.00	
	10/31/12	9:39:00	360	71.0	70.0	6.50	3.50	1.00
R						6.50	3.50	
R						5.00	5.00	
	10/31/12	9:43:00	600	71.0	70.0	6.52	3.48	1.00
R						6.52	3.48	
R						5.00	5.00	
	10/31/12	9:46:00	780	71.0	70.0	5.94	4.06	1.00
R						5.94	4.06	
R						5.00	5.00	
	10/31/12	9:49:00	960	71.0	70.0	6.50	3.50	1.00
R						6.50	3.50	
R						5.00	5.00	
	10/31/12	9:52:00	1,140	71.0	70.0	6.50	3.50	1.00

Test Pressure = 71.0 psi Differential Head = 1.0 psi, 67.9 cm H2O
Gradient = 8.900E 00 Flow rate = 7.168E-03 cc/sec R squared = 0.99616
Permeability, K22.8° = 1.938E-05 cm/sec, K20° = 1.812E-05 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.71
Specimen Diameter (cm): 7.26
Dry Unit Weight (pcf): 117.2
Moisture Before Test (%): 10.7
Moisture After Test (%): 15.8

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	1.0	
Flow Rate (cc/sec):	2.27×10^{-3}	
Perm. (cm/sec):	5.70×10^{-6}	

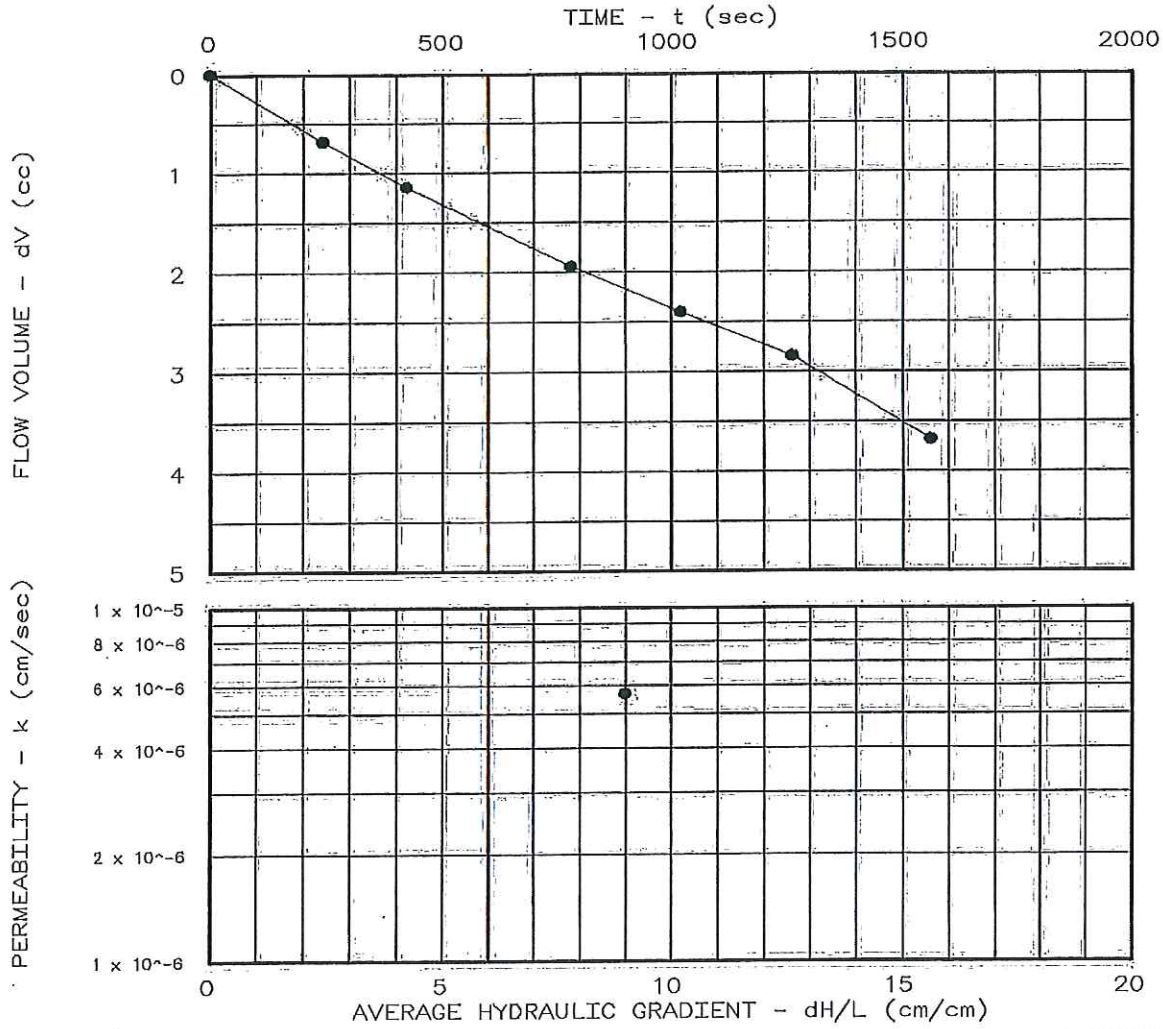
SAMPLE DATA:

Sample Identification: Subgrade Sample #3

Visual Description: Grey-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 124.5
Optimum Moisture Content (%): 11.0
ASTM(D698)
Percent Compaction: 94.1%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: Greenway Waste solutions of Apex Ph.II
Location: HWY 55 C&D Landfill
Date: 10-31-12

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: SL-280-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	Greenway Waste solutions of Apex Ph.II
File No.:	
Project Location:	HWY 55 C&D Landfill
Project No.:	SL-280-12
Sample Identification:	Subgrade Sample #3
Lab No.:	
Description:	Grey-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	124.5
Method (D1557/D698):	D698
Opt. Water Content:	11.0
Date:	10-31-12
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.860 in	in		2.862 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.86 in	7.26 cm		2.86 in	7.27 cm	
Length:	1	2	3	1	2	3
	3.036 in	in	in	3.060 in	in	in
Average:	3.04 in	7.71 cm		3.06 in	7.77 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.65		
Wet Wt. & Tare:	664.31		694.65
Dry Wt. & Tare:	600.10		600.10
Tare Wt.:	0.00		0.00
Moisture Content:	10.7 %		15.8 %
Dry Unit Weight:	117.2 pcf	94.1 % of max	116.1 pcf
Porosity:	0.2915		0.2980
Saturation:	68.9 %		98.3 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 3 Panel No.: 3 Positions: 1

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	OUT	BURET READING-cc IN	OUT	OUTFLOW/ INFLOW RATIO
S	10/31/12	9:33:00	0	71.0	70.0	5.00	5.00	0.00
	10/31/12	9:37:00	240	71.0	70.0	5.68	4.32	1.00
R						5.68	4.32	
R						5.00	5.00	
	10/31/12	9:40:00	420	71.0	70.0	5.46	4.54	1.00
R						5.46	4.54	
R						5.00	5.00	
	10/31/12	9:46:00	780	71.0	70.0	5.80	4.20	1.00
R						5.80	4.20	
R						5.00	5.00	
	10/31/12	9:50:00	1,020	71.0	70.0	5.46	4.54	1.00
R						5.46	4.54	
R						5.00	5.00	
	10/31/12	9:54:00	1,260	71.0	70.0	5.44	4.56	1.00
R						5.44	4.56	
R						5.00	5.00	
	10/31/12	9:59:00	1,560	71.0	70.0	5.84	4.16	1.00

Test Pressure = 71.0 psi Differential Head = 1.0 psi, 69.3 cm H2O
Gradient = 8.981E 00 Flow rate = 2.268E-03 cc/sec R squared = 0.99600
Permeability, K22.8° = 6.094E-06 cm/sec, K20° = 5.700E-06 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.63
Specimen Diameter (cm): 7.27
Dry Unit Weight (pcf): 116.7
Moisture Before Test (%): 10.0
Moisture After Test (%): 15.5

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	1.0	
Flow Rate (cc/sec):	4.42 x 10^-3	
Perm. (cm/sec):	1.11 x 10^-5	

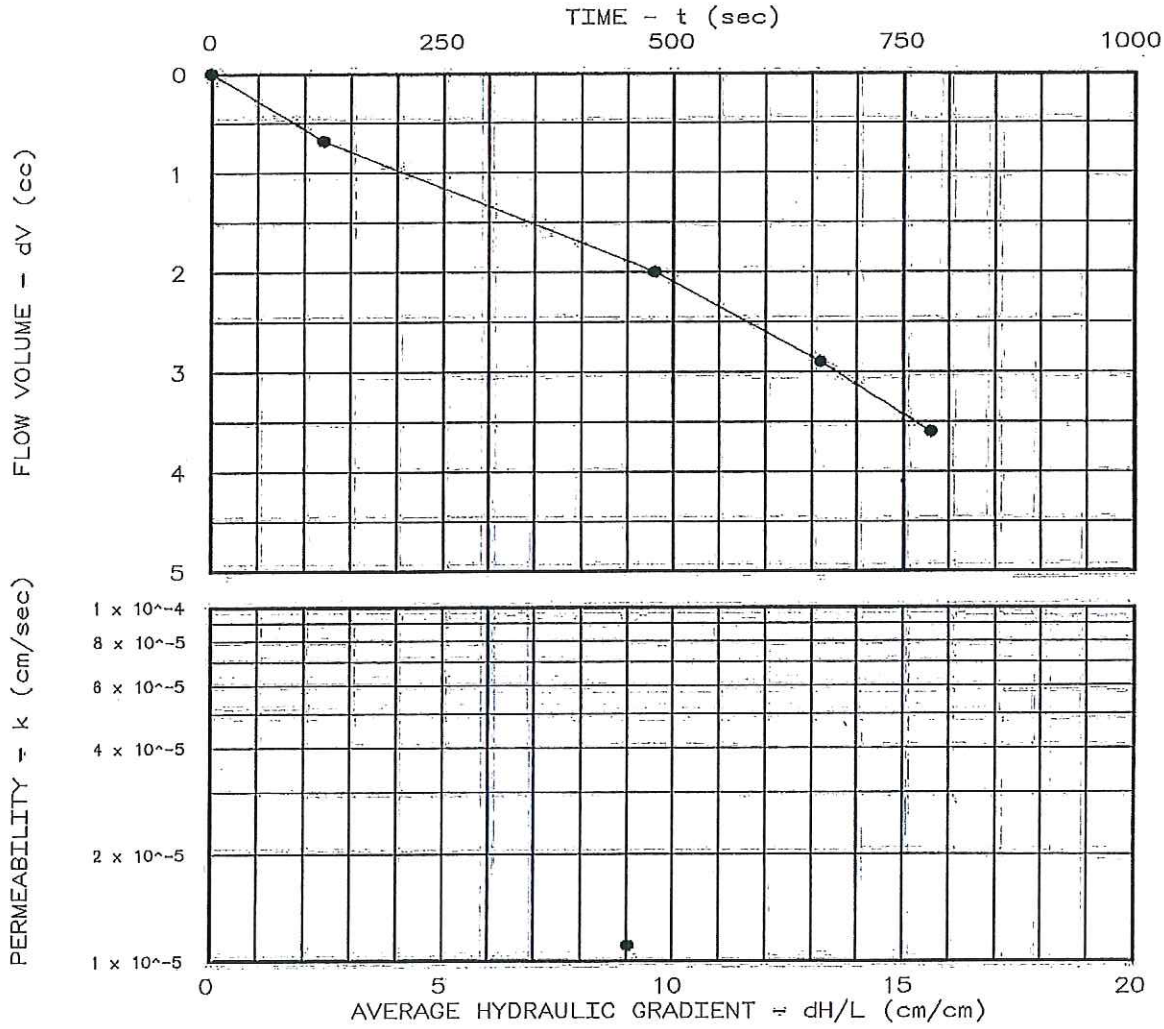
SAMPLE DATA:

Sample Identification: Subgrade Sample #4

Visual Description: Grey-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 123.0
Optimum Moisture Content (%): 11.0
ASTM(D698)
Percent Compaction: 94.9%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: Greenway Waste solutions of Apex Ph.II
Location: HWY 55 C&D Landfill
Date: 10-31-12

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: SL-280-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	Greenway Waste solutions of Apex Ph.II
File No.:	
Project Location:	HWY 55 C&D Landfill
Project No.:	SL-280-12
Sample Identification:	Subgrade Sample #4
Lab No.:	
Description:	Grey-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	123.0
Method (D1557/D698):	D698
Opt. Water Content:	11.0
Date:	10-31-12
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.861 in	in		2.861 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.86 in	7.27 cm		2.86 in	7.27 cm	
Length:	1	2	3	1	2	3
	3.004 in	in	in	3.016 in	in	in
Average:	3.00 in	7.63 cm		3.02 in	7.66 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.65		
Wet Wt. & Tare:	650.63		683.29
Dry Wt. & Tare:	591.48		591.48
Tare Wt.:	0.00		0.00
Moisture Content:	10.0 %		15.5 %
Dry Unit Weight:	116.7 pcf	94.9 % of max	117.8 pcf
Porosity:	0.2947		0.2975
Saturation:	63.4 %		97.1 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 4 Panel No.: 4 Positions: 1

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.7 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	10/31/12	9:46:00	0	71.0	70.0	5.00	5.00	0.00
	10/31/12	9:48:00	120	71.0	70.0	5.68	4.32	1.00
R						5.68	4.32	
R						5.00	5.00	
	10/31/12	9:54:00	480	71.0	70.0	6.32	3.68	1.00
R						6.32	3.68	
R						5.00	5.00	
	10/31/12	9:57:00	660	71.0	70.0	5.90	4.10	1.00
R						5.90	4.10	
R						5.00	5.00	
	10/31/12	9:59:00	780	71.0	70.0	5.70	4.30	1.00

Test Pressure = 71.0 psi Differential Head = 1.0 psi, 68.9 cm H2O
Gradient = 9.026E 00 Flow rate = 4.421E-03 cc/sec R squared = 0.99383
Permeability, K22.7° = 1.181E-05 cm/sec, K20° = 1.107E-05 cm/sec

PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.67
Specimen Diameter (cm): 7.26
Dry Unit Weight (pcf): 117.3
Moisture Before Test (%): 10.3
Moisture After Test (%): 15.3

Run Number:	1 ●	2 ▲
Cell Pressure (psi):	77.0	
Test Pressure(psi):	71.0	
Back Pressure(psi):	70.0	
Diff. Head (psi):	1.0	
Flow Rate (cc/sec):	2.55×10^{-3}	
Perm. (cm/sec):	6.41×10^{-6}	

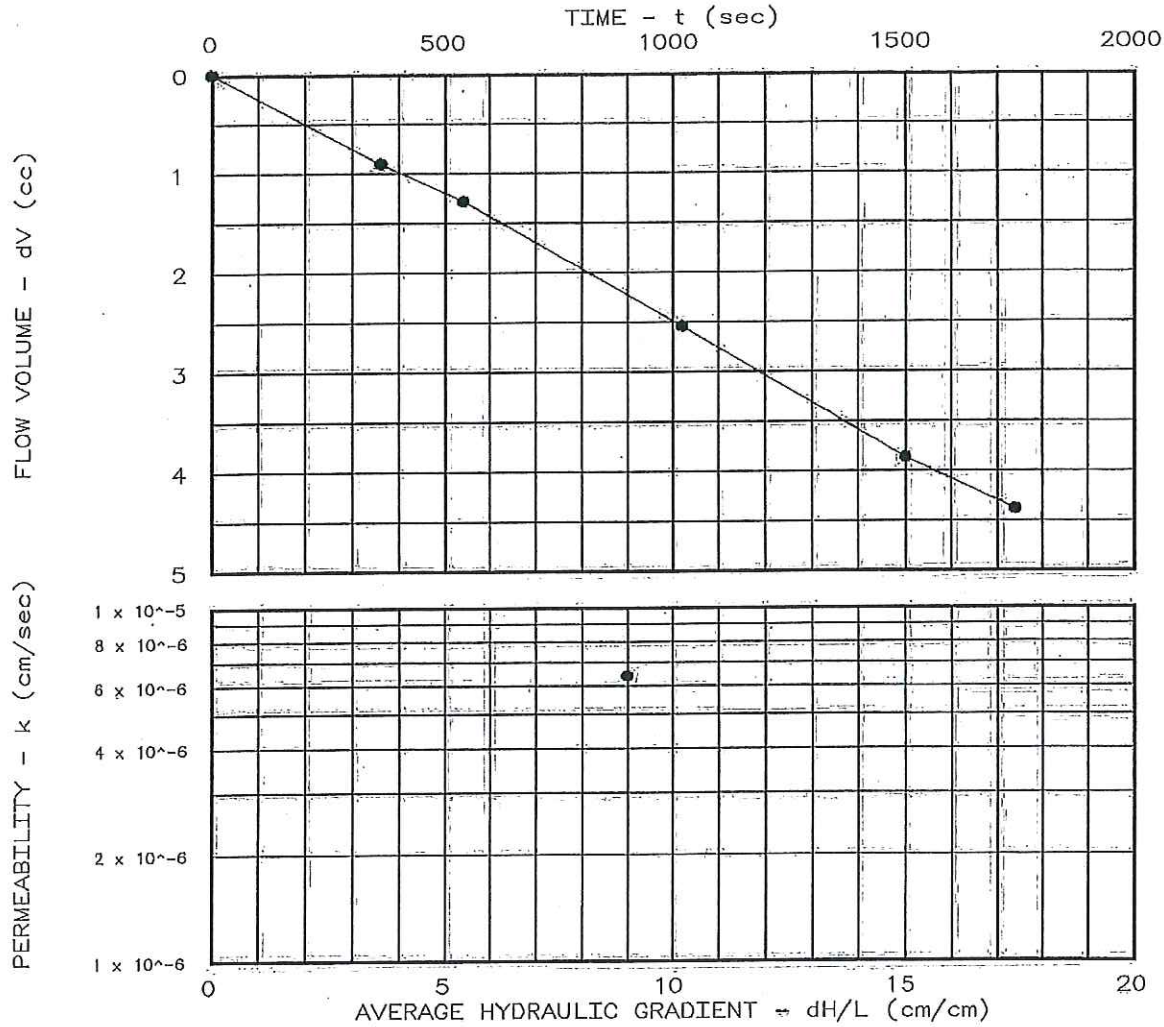
SAMPLE DATA:

Sample Identification: Subgrade Sample #5

Visual Description: Grey-Brown Silty Sand

Remarks:

Maximum Dry Density (pcf): 123.9
Optimum Moisture Content (%): 11.3
ASTM(D698)
Percent Compaction: 94.7%
Permeameter type: Flexible Wall
Sample type: Remolded



Project: Greenway Waste solutions of Apex Ph.II
Location: HWY 55 C&D Landfill
Date: 10-31-12

PERMEABILITY TEST REPORT

SUMMIT ENG. & CONST. SERV., INC.

Project No.: SL-280-12
File No.:
Lab No.:
Tested by: MH
Checked by: CPT
Test: CH - Constant head

PERMEABILITY TEST DATA

PROJECT DATA

Project Name:	Greenway Waste solutions of Apex Ph.II
File No.:	
Project Location:	HWY 55 C&D Landfill
Project No.:	SL-280-12
Sample Identification:	Subgrade Sample #5
Lab No.:	
Description:	Grey-Brown Silty Sand
Sample Type:	Remolded
Max. Dry Dens.:	123.9
Method (D1557/D698):	D698
Opt. Water Content:	11.3
Date:	10-31-12
Remarks:	
Permeameter Type:	Flexible Wall
Tested by:	MH
Checked by:	CPT
Test type:	CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	2.860 in	in		2.862 in	in	
Middle:	in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.86 in	7.26 cm		2.86 in	7.27 cm	
Length:	1	2	3	1	2	3
	3.018 in	in	in	3.040 in	in	in
Average:	3.02 in	7.67 cm		3.04 in	7.72 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.65		
Wet Wt. & Tare:	658.34		688.27
Dry Wt. & Tare:	596.86		596.86
Tare Wt.:	0.00		0.00
Moisture Content:	10.3 %		15.3 %
Dry Unit Weight:	117.3 pcf	94.7 % of max	116.3 pcf
Porosity:	0.2911		0.2972
Saturation:	66.5 %		96.0 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 5 Panel No.: 5 Positions: 1

Run Number:	1	2
Cell Pressure:	77.0 psi	0.0 psi
Saturation Pressure:	70.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.8 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi IN	GAUGE PRESSURE-psi OUT	BURET READING-cc IN	BURET READING-cc OUT	OUTFLOW/ INFLOW RATIO
S	10/31/12	9:49:00	0	71.0	70.0	5.00	5.00	0.00
	10/31/12	9:55:00	360	71.0	70.0	5.90	4.10	1.00
R						5.90	4.10	
R						5.00	5.00	
	10/31/12	9:58:00	540	71.0	70.0	5.38	4.62	1.00
R						5.38	4.62	
R						5.00	5.00	
	10/31/12	10:06:00	1,020	71.0	70.0	6.26	3.74	1.00
R						6.26	3.74	
R						5.00	5.00	
	10/31/12	10:14:00	1,500	71.0	70.0	6.32	3.68	1.00
R						6.32	3.68	
R						5.00	5.00	
	10/31/12	10:18:00	1,740	71.0	70.0	5.52	4.48	1.00

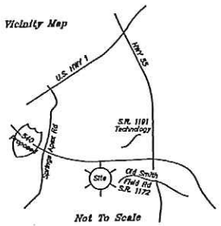
Test Pressure = 71.0 psi Differential Head = 1.0 psi, 68.8 cm H2O
Gradient = 8.981E 00 Flow rate = 2.551E-03 cc/sec R squared = 0.99924
Permeability, K22.8° = 6.853E-06 cm/sec, K20° = 6.411E-06 cm/sec

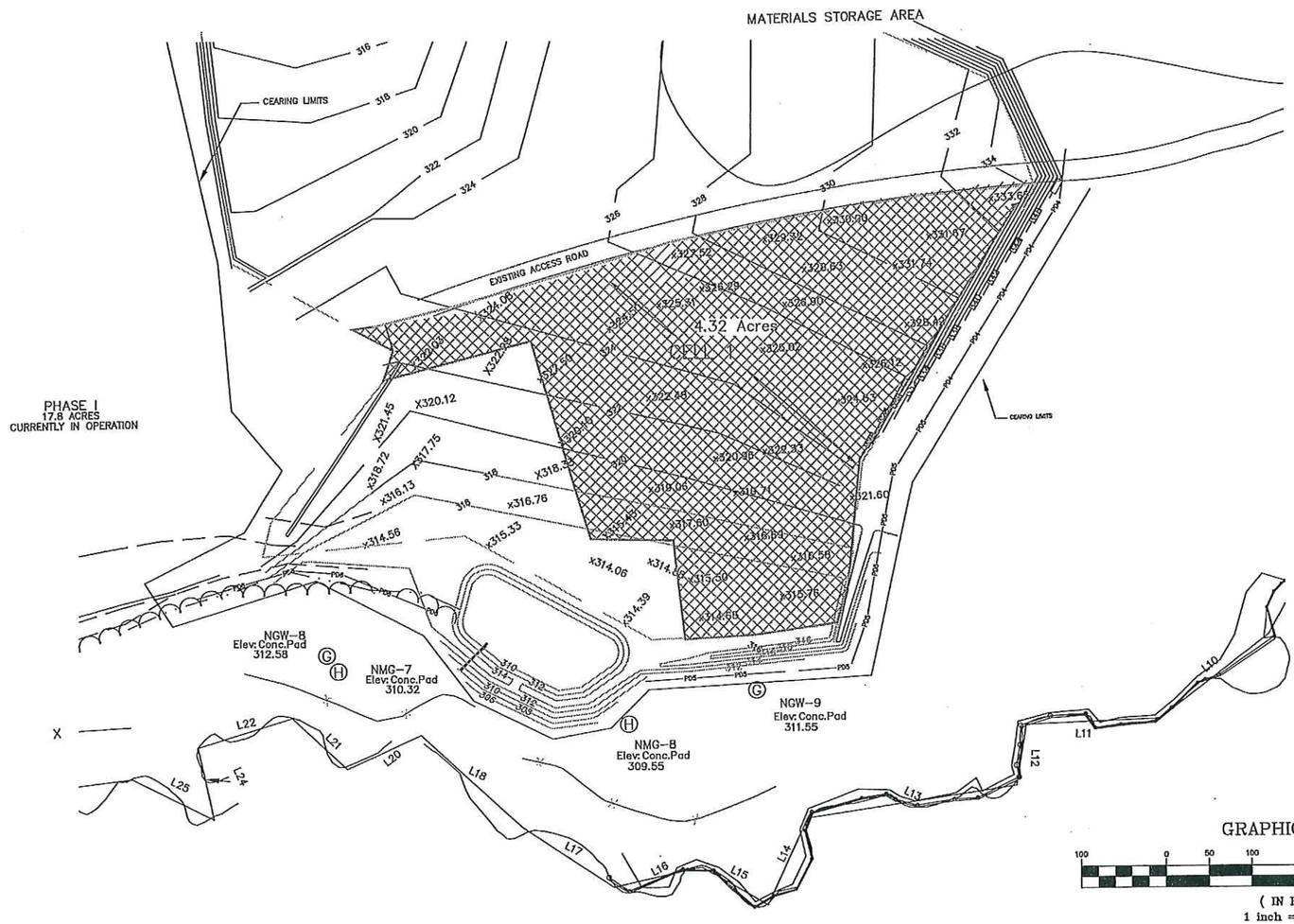
Appendix B

I Joel H. Patterson III, certify that this plat was drawn under my supervision from an actual topographical survey made under my supervision that the ratio of precision is one half the contour interval as shown.
Witness my original signature, registration number and seal.
This 25 day of OCTOBER, 2012.

NORTH CAROLINA PROFESSIONAL SEAL L-3717 LAND SURVEYOR JOEL H. PATTERSON, III

JOEL H. PATTERSON III, PLS
LICENSE NUMBER: L-3717





LINE TABLE		
LINE	LENGTH	BEARING
L10	168.59	S52°26'45"W
L11	135.62	S91°53'40"W
L12	72.11	S00°57'16"W
L13	244.85	S81°09'40"W
L14	112.16	S23°58'09"W
L15	69.80	N09°36'51"W
L16	104.07	S76°53'03"W
L17	128.36	N56°18'48"W
L18	160.15	N47°52'00"W
L20	93.59	S43°28'08"W
L21	97.66	N45°48'22"W
L22	114.69	S78°28'27"W
L24	87.25	S12°12'19"E
L25	106.40	N63°18'19"W
L26	152.16	S82°24'23"W

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

Land Surveying by:
PATTERSON LAND SURVEYING, PA
C-3390
P.O. Box 5010, Mooresville, NC 28117
704/361-0415 * Fax 704/799-8565

JOB NAME:	TOPOGRAPHICAL OF A PORTION OF CELL 1 OF *"GREENWAY WASTE OF APEX"*		
LOCATION:	WAKE COUNTY, NORTH CAROLINA	DRAWN BY: JHP	CHECKED BY: JHP
		SCALE: 1" = 100'	
OWNER:	GREENWAY OF APEX 19109 W. CATAWBA AVE. SUITE 200 CORNELIUS, NC 28031-5611	DATE OF FIELD SURVEY: OCTOBER, 2012	
		DATE OF MAP: OCTOBER 25, 2012	
		JOB NUMBER: 10006	BOOK NO:

Appendix C

November 1, 2012

John Murray, PE
NC DENR – DWM
610 East Center Avenue, Suite 301
Mooresville, NC 28115
Phone: (704) 235-2163

Dear John:

Subject: Certification Phase 2, Cell 1B
Greenway Waste Solutions of Apex, LLC
Permit No. 92-30
CEC Project No. 111-370

Civil & Environmental Consultants, Inc. has verified subgrade elevations on a 100-ft grid of the as-built survey for the 4.32 acre cell. All point locations met the minimum permitted subgrade elevations. The construction was completed in accordance with:

1. The CQA Plan.
2. The conditions of the Permit to Construct.
3. The Requirements of 15A NCAC 13B .0541.
4. Acceptable engineering practices

Please let me know if you have any questions or comments. I can be reached at (704) 773-6465.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Scott L. Brown, PE
Project Manager

NORTH CAROLINA PROFESSIONAL SEAL 026435 ENGINEER SCOTT L. BROWN

Cc: Mr. Ron Gilkerson, Greenway Waste Solutions of Apex, LLC.

Charlotte 2030 S. Tryon Street, Suite 3E
Charlotte, North Carolina 28203
Ph: 980-224-8104
E-mail: sbrown@cecinc.com
www.cecinc.com

Appendix D

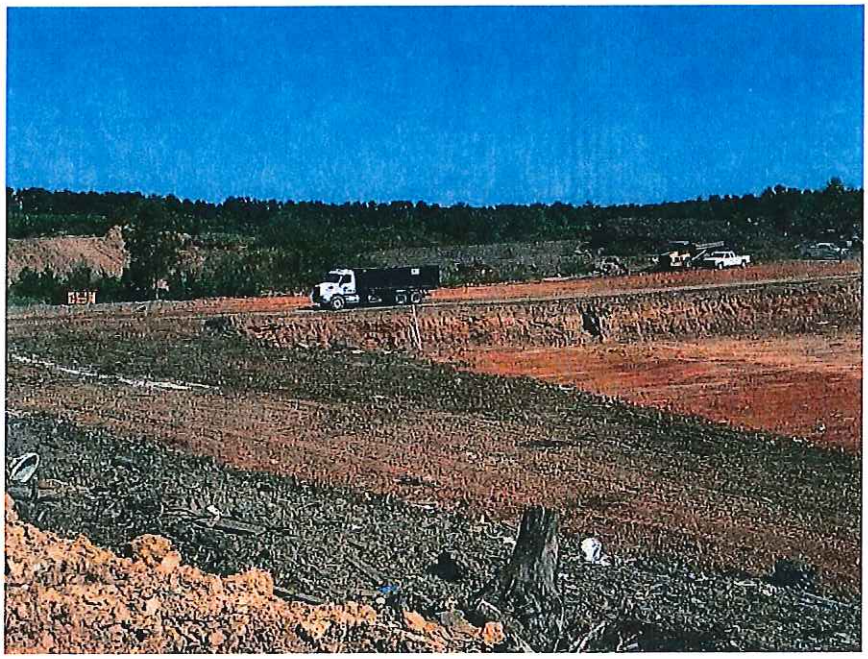


Photo Number: 1

Description:

Phase 2 Cell 1B certification area, looking northeast from Phase 2 Cell 1A. Taken 9.25.12.

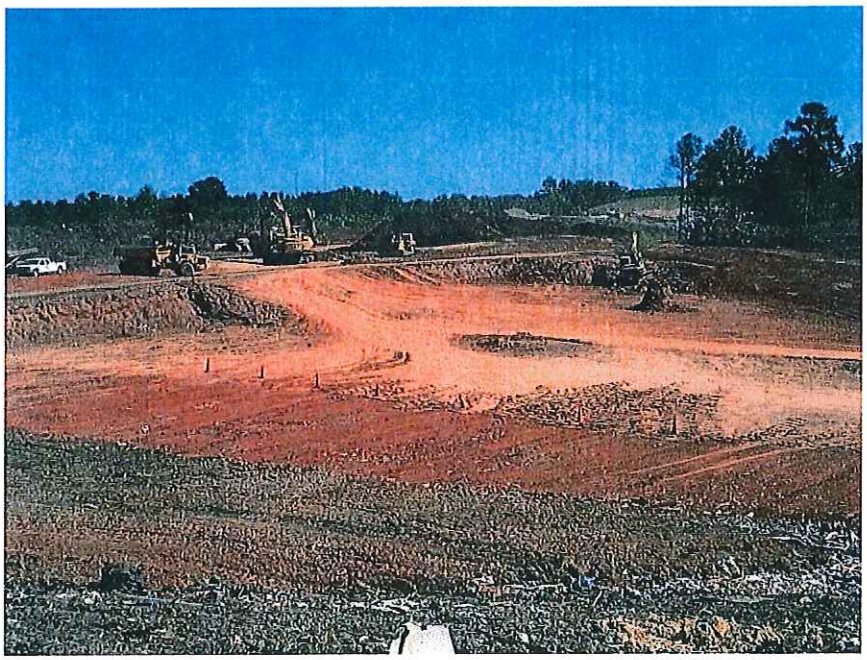


Photo Number: 2

Description:

Phase 2 Cell 1B certification area, looking northeast from Phase 2 Cell 1A. Taken 9.25.12.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of Apex, LLC
Phase 2 Cell 1B Certification

Client Name:	GWS of Apex
Project Number:	111-370.003
Author:	T. Gingerich
Photographs Taken on:	Sept./Oct. 2012

Photo Number: 3

Description:

Phase 2 Cell 1B certification area looking east from Cell 1A area. Taken 9.25.12.

Photo Number: 4

Description:

Phase 2 Cell 1B certification area looking east from Cell 1A. Taken 10.4.12.

Civil & Environmental Consultants, Inc.
Charlotte, NC
Ph: 980-224-8124 Toll Free: 855-859-9932
www.cecinc.com

Greenway Waste Solutions of Apex, LLC
Phase 2 Cell 1B Certification

Client Name:	GWS of Apex
Project Number:	111-370.003
Author:	T. Gingerich
Photographs Taken on:	Sept./Oct. 2012

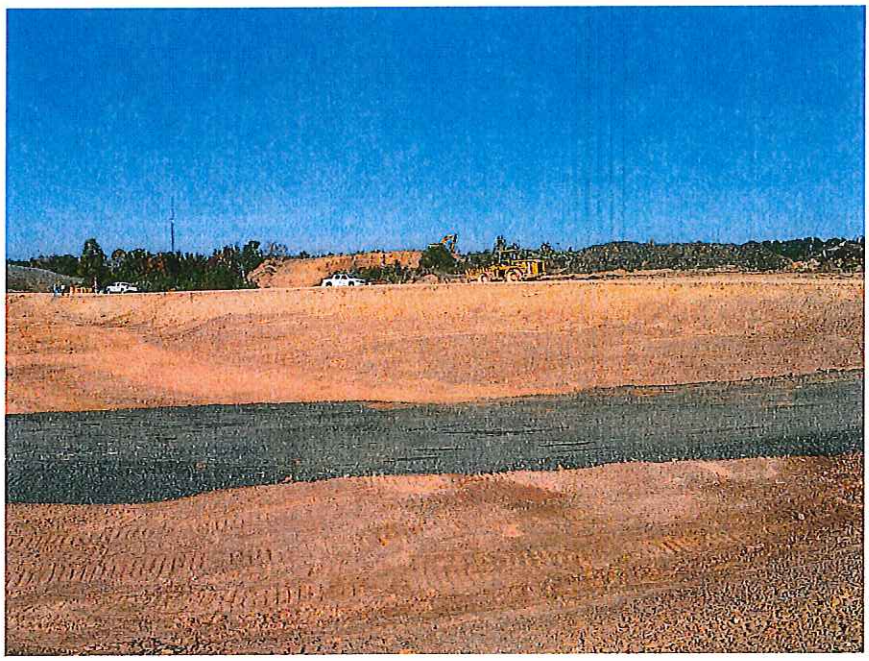


Photo Number: 5

Description:

Phase 2 Cell 1B certification area and haul road-looking west. Taken 10.23.12.

Photo Number: 6

Description:

Phase 2 Cell 1B certification area looking east from haul road. Taken 10.23.12.

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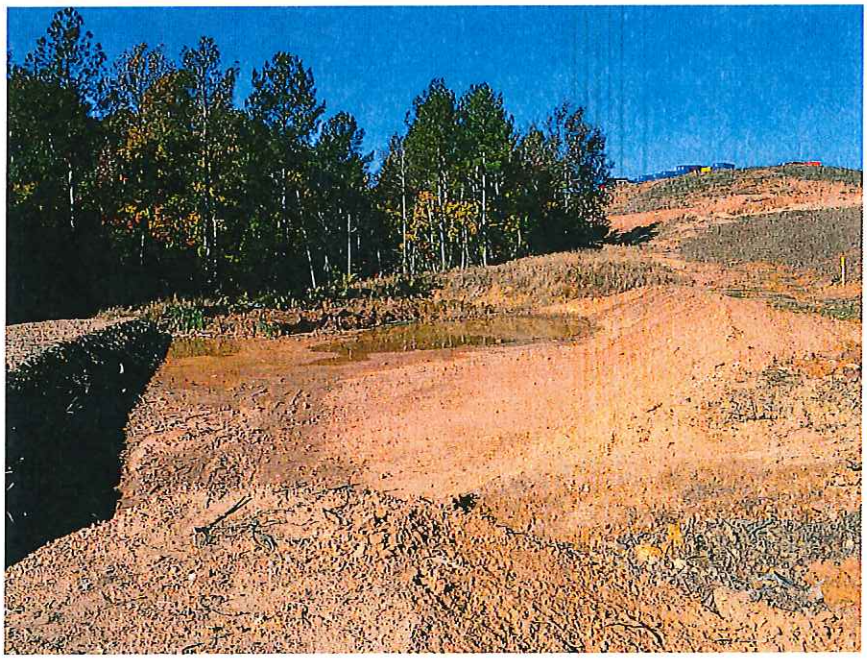

Photo Number: 7

Description:

Sediment Basin 1 southern end of Phase 2 Cell 1. Taken 10.23.12.

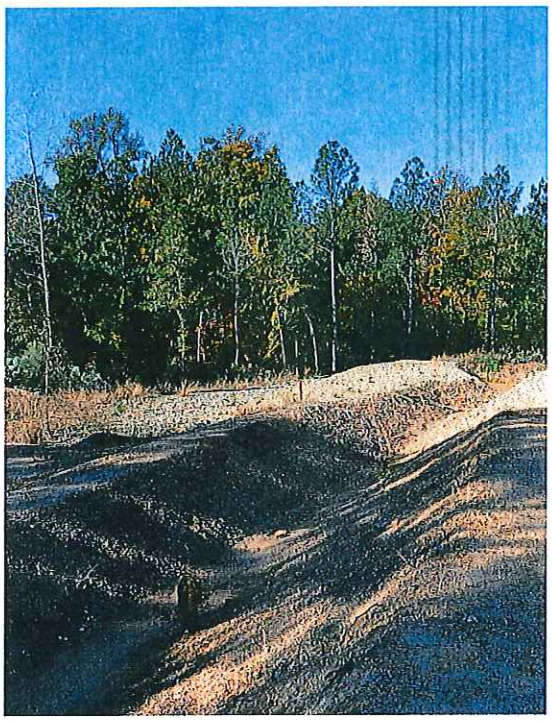

Photo Number: 8

Description:

Berm and swale constructed along southern end of Phase 2 cell 1, looking west towards sediment basin. Taken 10.23.12.

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Photographs Taken on:	Sept./Oct. 2012

Photo Number: 9

Description:

Berm constructed along southern end of Phase 2 Cell 1, looking west. Edge of waste stake. Taken 10.23.12.

Photo Number: 10

Description:

Edge of waste stakes along southern end of Phase 2 cell 1A, looking west. Taken 10.23.12.

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