

GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND  
ENVIRONMENTAL CONSULTANTS

*A Practicing ASFE Member Firm*



September 8, 2009

O.L.R., LLC  
5169 Summit Bridge Road  
Middletown, Delaware 19709

Attn: Mr. David Hill

Re: Construction Summary and Report of In-Place Density Testing  
*Fulton Hills - Stormwater Management Pond*  
Cecil County, Maryland

Gentlemen:

This letter transmits the results of our observations and testing for the stormwater management facility P-1 and road fill for Fulton Court at the Fulton Hills subdivision, located in Cecil County, Maryland. Our services were provided from August 11 through 17, 2009, to evaluate if the materials were placed and compacted in general accordance with the project specifications. Drawings used for our work consisted of Stormwater Management Plan and Profiles, prepared by McCrone Engineering, dated August 12, 2008.

Prior to placing fill, GTA observed that the organic and loose soils were removed from within the embankment/roadway areas and observed proof-rolling of the subgrade with a smooth drum roller and a loaded construction pan. No pumping or rutting of the subgrade soils was observed under the tires of the roller or pan. Additionally, GTA observed that the cut-off trench was excavated in general accordance with the dimensions required on the referenced plans, and that the embankment subgrade was scarified prior to placement of structural fill. Soils at the fill subgrade generally consisted of natural, tan and orange, medium dense, silty sand.

During the placement of fill for the cut-off trench, impervious core, and embankment, a representative of GTA was on-site to observe lift thicknesses, confirm soil types used for fill, and perform field density testing. GTA observed that soil classified as lean clay with sand (CL) was used for the cut-off trench and impervious core, was placed in 6- to 10-inch thick loose lifts, and was compacted using a sheepsfoot roller, walk behind roller, and jumping jack tamper. Soils classifying as silty sand (SM) were used for the embankment and roadway fill and were compacted with a smooth drum vibratory roller. Each lift was tested for in-place density in accordance with ASTM D1556 or D6938. The field density test results are tabulated on the attached sheets based on ASTM D698 (Standard Proctor) and D1557 (Modified Proctor) maximum dry density. The moisture-density and grain size distribution curves for the soils used as fill are also attached. Test locations were referenced by approximate road station number station numbers with test elevations obtained from the field stakeout provided by others.

18 Boulden Circle, Suite 36, New Castle, DE 19720

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✦ Abingdon, MD ✦ Laurel, MD ✦ Frederick, MD ✦ Waldorf, MD ✦ Sterling, VA ✦ Somerset, NJ  
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O.L.R., LLC

Re: *Fulton Hills - Stormwater Management Pond*

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Additionally, GTA observed the installation of the riser structure, outfall pipe, and anti-seep collar. Pictures taken during installation of these structures have been retained in our files. The results indicate that the tested areas of compacted fill for the cut-off trench, impervious core, and embankment/road fill have been compacted to a minimum of 95 percent of the maximum dry density, in accordance with the reference plans and project specifications. In our professional opinion the stormwater management facility embankment has been constructed in general accordance with the referenced plans and project specifications.

GTA recommends that the roadway subgrade be proofrolled prior to placing crushed stone and asphalt to verify that the compacted fill has not become disturbed by weather or construction equipment. We appreciate the opportunity to be of assistance to you on this project. GTA's work was performed in accordance with generally accepted engineering practice. No warranty, express or implied, is given. Should you have questions or require additional information, please contact the office at (302) 326-2100.

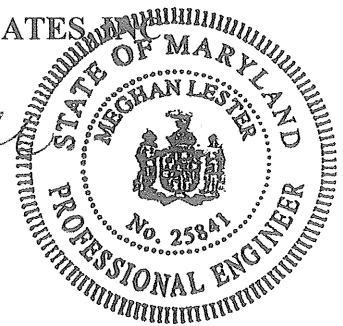
Sincerely,

GEO-TECHNOLOGY ASSOCIATES

Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland. License No.: 25841, Expiration Date: 02/05/2011.

*Meghan Lester*

Meghan Lester, P.E.  
Associate



*Christopher M. Reith*  
Christopher M. Reith, P.E.  
Principal

EW/ML/CMR/mlm  
090555

Attachments:

- Test Results (#1 through #58)
- Moisture Density Relationship Curves (2)
- Grain Size Distribution Curves (2)

# FIELD DENSITY SUMMARY

PROJECT NAME: FULTON HILLS

PROJECT NUMBER: 090555

COMPACTION STANDARD: STANDARD PROCTOR, ASTM D698; MODIFIED PROCTOR, ASTM D1557

TEST NUMBER	DATE	RETEST NUMBER	DENSITY TEST LOCATION	ELEVATION (ft)	MOISTURE CONTENT (%)	WET DENSITY (pcf)	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	PERCENT COMPACTION	PERCENT REQUIRED	REMARKS
1	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	41.0	14.4	129.3	113.0	118.0	13.5	96	95	
2	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	41.0	13.8	128.9	113.3	118.0	13.5	96	95	
3	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	41.5	14.0	129.9	113.9	118.0	13.5	97	95	
4	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	41.5	13.4	129.3	114.0	118.0	13.5	97	95	
5	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+50	41.5	14.0	129.2	113.3	118.0	13.5	96	95	
6	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	42.0	13.4	129.3	114.0	118.0	13.5	97	95	
7	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	42.0	13.7	127.6	112.2	118.0	13.5	95	95	
8	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+50	42.0	14.0	131.5	115.4	118.0	13.5	98	95	
9	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	42.5	14.4	129.3	113.0	118.0	13.5	96	95	
10	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	42.5	14.0	127.4	111.8	118.0	13.5	95	95	
11	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+50	42.5	13.5	127.2	112.1	118.0	13.5	95	95	
12	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	43.0	13.8	127.5	112.0	118.0	13.5	95	95	
13	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	43.0	15.0	128.6	111.8	118.0	13.5	95	95	
14	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+50	43.0	13.8	128.9	113.3	118.0	13.5	96	95	
15	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	43.5	12.9	126.4	112.0	118.0	13.5	95	95	
16	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	43.5	13.1	126.4	111.8	118.0	13.5	95	95	
17	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+50	43.5	14.7	131.8	114.9	118.0	13.5	97	95	

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18	08/11/09		Cut-Off Trench: Fulton Court, Sta. 4+50	44.0	13.7	131.6	115.7	118.0	13.5	98	95	
19	08/11/09		Cut-Off Trench: Fulton Court, Sta. 5+00	44.0	13.9	132.1	116.0	118.0	13.5	98	95	
20	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	44.5	14.6	132.5	115.6	118.0	13.5	98	95	
21	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	44.5	13.7	132.9	116.9	118.0	13.5	99	95	
22	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	44.5	12.8	128.8	114.2	118.0	13.5	97	95	
23	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	45.0	12.0	129.8	115.9	118.0	13.5	98	95	
24	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	45.0	13.8	131.4	115.5	118.0	13.5	98	95	
25	08/15/09		Impervious Core: Fulton Court: Sta. 6+00	45.5	14.0	129.6	113.7	118.0	13.5	96	95	
26	08/15/09		Impervious Core: Fulton Court: Sta. 6+00	46.0	14.6	130.3	113.7	118.0	13.5	96	95	
27	08/15/09		Impervious Core: Fulton Court: Sta. 5+35	46.5	12.8	131.1	116.2	118.0	13.5	98	95	
28	08/15/09		Impervious Core: Fulton Court: Sta. 5+35	46.5	13.5	130.1	114.6	118.0	13.5	97	95	
29	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	46.5	14.6	122.0	106.5	118.0	13.5	90	95	
30	08/15/09	29	Impervious Core: Fulton Court: Sta. 5+44	46.5	12.2	131.6	117.3	118.0	13.5	99	95	
31	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	47.0	14.1	135.8	119.0	118.0	13.5	100+	95	
32	08/15/09		Impervious Core: Fulton Court: Sta. 5+35	47.0	13.4	130.2	114.8	118.0	13.5	97	95	
33	08/15/09		Impervious Core: Fulton Court: Sta. 5+35	47.5	14.7	133.9	116.7	118.0	13.5	99	95	
34	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	47.5	14.2	131.2	114.9	118.0	13.5	97	95	

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TEST NUMBER	DATE	RETEST NUMBER	DENSITY TEST LOCATION	ELEVATION (ft)	MOISTURE CONTENT (%)	WET DENSITY (pcf)	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	PERCENT COMPACTION	PERCENT REQUIRED	REMARKS
35	08/15/09		Impervious Core: Fulton Court: Sta. 5+44	48.0	14.2	132.3	115.8	118.0	13.5	98	95	
36	08/15/09		Embankment/Road: Fulton Court: Sta. 4+50	48.2	9.6	122.4	111.7	118.1	13.9	95	95	
37	08/15/09		Embankment/Road; Fulton Court: Sta. 5+00	48.5	9.2	124.5	114.0	118.1	13.9	97	95	
38	08/15/09		Embankment/Road; Fulton Court: Sta. 6+00	48.5	8.8	123.3	113.3	118.1	13.9	96	95	
39	08/15/09		Impervious Core: Fulton Court: Sta. 5+35	48.0	13.2	129.0	114.0	118.0	13.5	97	95	
40	08/15/09		Impervious Core: Fulton Court: Sta. 5+35	48.5	14.0	130.8	114.7	118.0	13.5	97	95	
41	08/15/09		Embankment/Road: Fulton Court: Sta. 6+00	49.0	13.0	126.2	111.7	118.1	13.9	95	95	
42	08/15/09		Embankment/Road: Fulton Court: Sta. 5+44	49.0	11.6	126.2	113.1	118.1	13.9	96	95	
43	08/15/09		Embankment/Road: Fulton Court: Sta. 5+00	49.2	9.5	122.6	112.0	118.1	13.9	95	95	
44	08/15/09		Embankment/Road: Fulton Court: Sta. 4+50	49.5	10.9	123.8	111.6	118.1	13.9	95	95	
45	08/15/09		Impervious Core: Fulton Court: Sta. 5+40	49.5	14.7	135.5	118.1	118.0	13.5	100	95	
46	08/15/09		Impervious Core: Fulton Court: Sta. 5+40	49.5	15.1	132.1	114.8	118.0	13.5	97	95	
47	08/15/09		Impervious Core: Fulton Court: Sta. 5+40	50.0	14.0	133.8	117.4	118.0	13.5	99	95	
48	08/15/09		Impervious Core: Fulton Court: Sta. 5+40	50.0	14.3	132.4	115.8	118.0	13.5	98	95	
49	08/15/09		Impervious Core: Fulton Court: Sta. 5+40	50.5	14.9	134.5	117.1	118.0	13.5	99	95	
50	08/15/09		Impervious Core: Fulton Court: Sta. 5+40	51.0	13.3	132.7	117.1	118.0	13.5	99	95	
51	08/15/09		Embankment/Road: Fulton Court: Sta. 4+00	50.0	9.1	121.8	111.6	118.1	13.9	95	95	

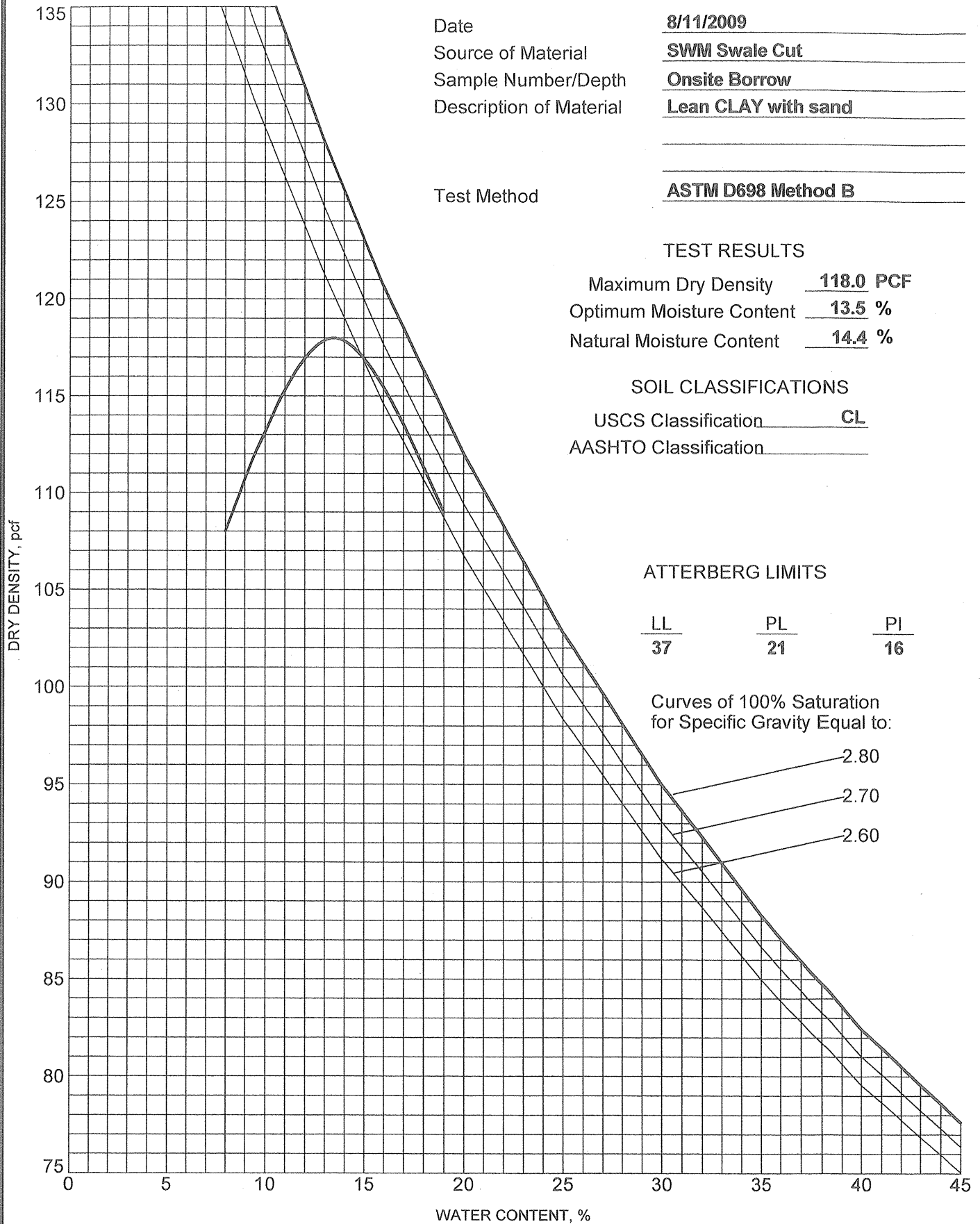
# FIELD DENSITY SUMMARY

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TEST NUMBER	DATE	RETEST NUMBER	DENSITY TEST LOCATION	ELEVATION (ft)	MOISTURE CONTENT (%)	WET DENSITY (pcf)	DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)	PERCENT COMPACTION	PERCENT REQUIRED	REMARKS
52	08/15/09		Embankment/Road: Fulton Court: Sta. 4+50	50.2	10.2	123.0	111.6	118.1	13.9	95	95	
53	08/15/09		Embankment/Road: Fulton Court: Sta. 5+00	50.5	8.7	123.8	113.9	118.1	13.9	96	95	
54	08/17/09		Embankment/Road: Fulton Court: Sta. 4+00	50.5	7.0	119.9	112.1	118.1	13.9	95	95	
55	08/17/09		Embankment/Road: Fulton Court: Sta. 4+50	51.2	10.5	125.4	113.5	118.1	13.9	96	95	
56	08/17/09		Embankment/Road: Fulton Court: Sta. 5+00	51.5	10.1	123.0	111.7	118.1	13.9	95	95	
57	08/17/09		Embankment/Road: Fulton Court: Sta. 5+50	51.0	9.9	125.0	113.7	118.1	13.9	96	95	
58	08/17/09		Embankment/Road: Fulton Court: Sta. 6+00	51.0	11.6	130.5	116.9	118.1	13.9	99	95	



Date 8/11/2009  
 Source of Material SWM Swale Cut  
 Sample Number/Depth Onsite Borrow  
 Description of Material Lean CLAY with sand

Test Method ASTM D698 Method B

TEST RESULTS

Maximum Dry Density 118.0 PCF  
 Optimum Moisture Content 13.5 %  
 Natural Moisture Content 14.4 %

SOIL CLASSIFICATIONS

USCS Classification CL  
 AASHTO Classification \_\_\_\_\_

ATTERBERG LIMITS

LL	PL	PI
37	21	16

Curves of 100% Saturation for Specific Gravity Equal to:

2.80  
 2.70  
 2.60

CMT PROCTOR 090555.GPJ US LAB.GDT 8/31/09

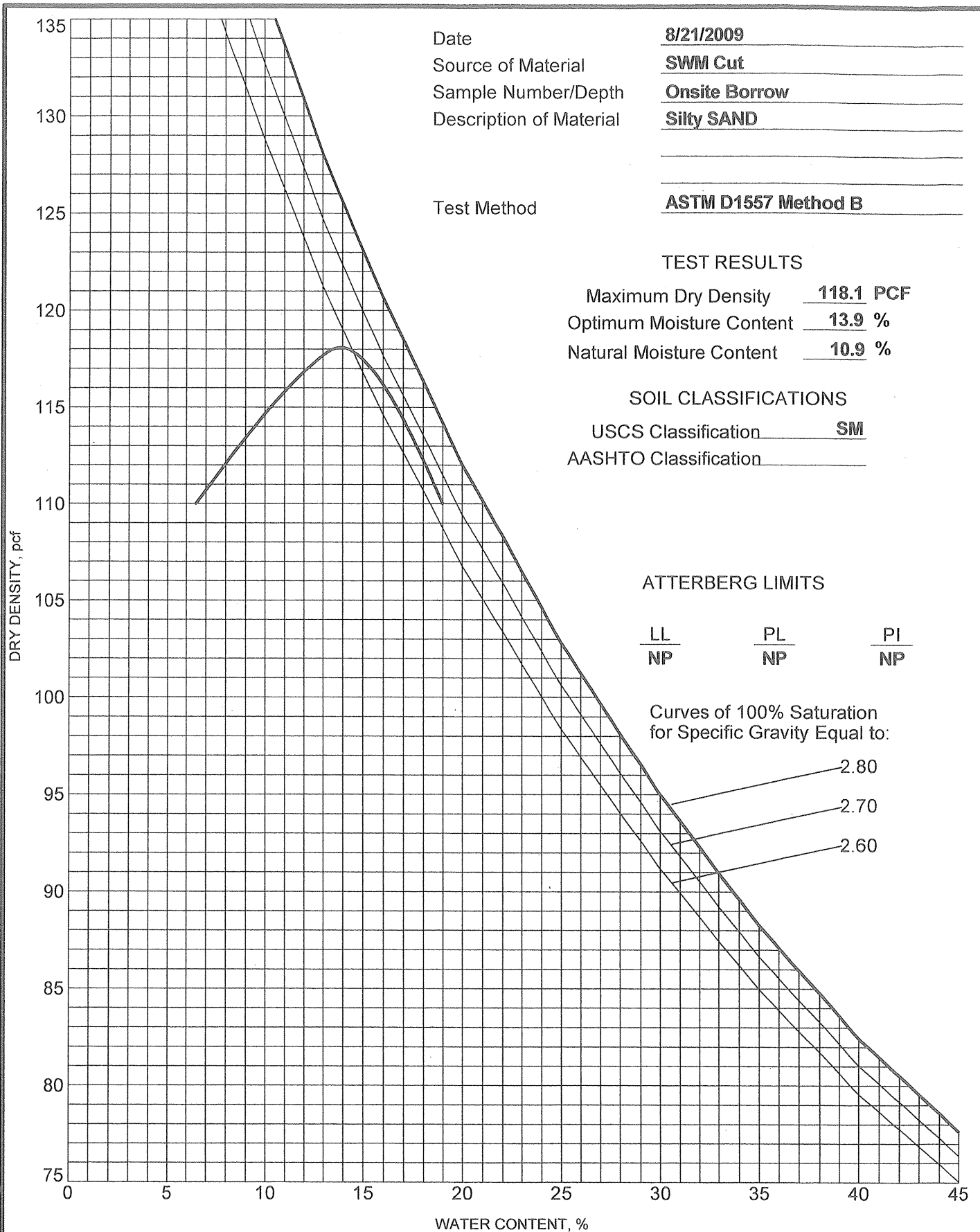


Geo-Technology Associates, Inc.

18 Boulden Circle, Suite 36  
 New Castle, Delaware 19720  
 Telephone: 302-326-2100  
 Fax: 302-326-2399

**MOISTURE-DENSITY RELATIONSHIP**

Project: Fulton Hills  
 Location: Cecil County, Maryland  
 Number: 090555



Date 8/21/2009  
 Source of Material SWM Cut  
 Sample Number/Depth Onsite Borrow  
 Description of Material Silty SAND

Test Method ASTM D1557 Method B

**TEST RESULTS**

Maximum Dry Density 118.1 PCF  
 Optimum Moisture Content 13.9 %  
 Natural Moisture Content 10.9 %

**SOIL CLASSIFICATIONS**

USCS Classification SM  
 AASHTO Classification \_\_\_\_\_

**ATTERBERG LIMITS**

LL	PL	PI
NP	NP	NP
_____	_____	_____

Curves of 100% Saturation for Specific Gravity Equal to:

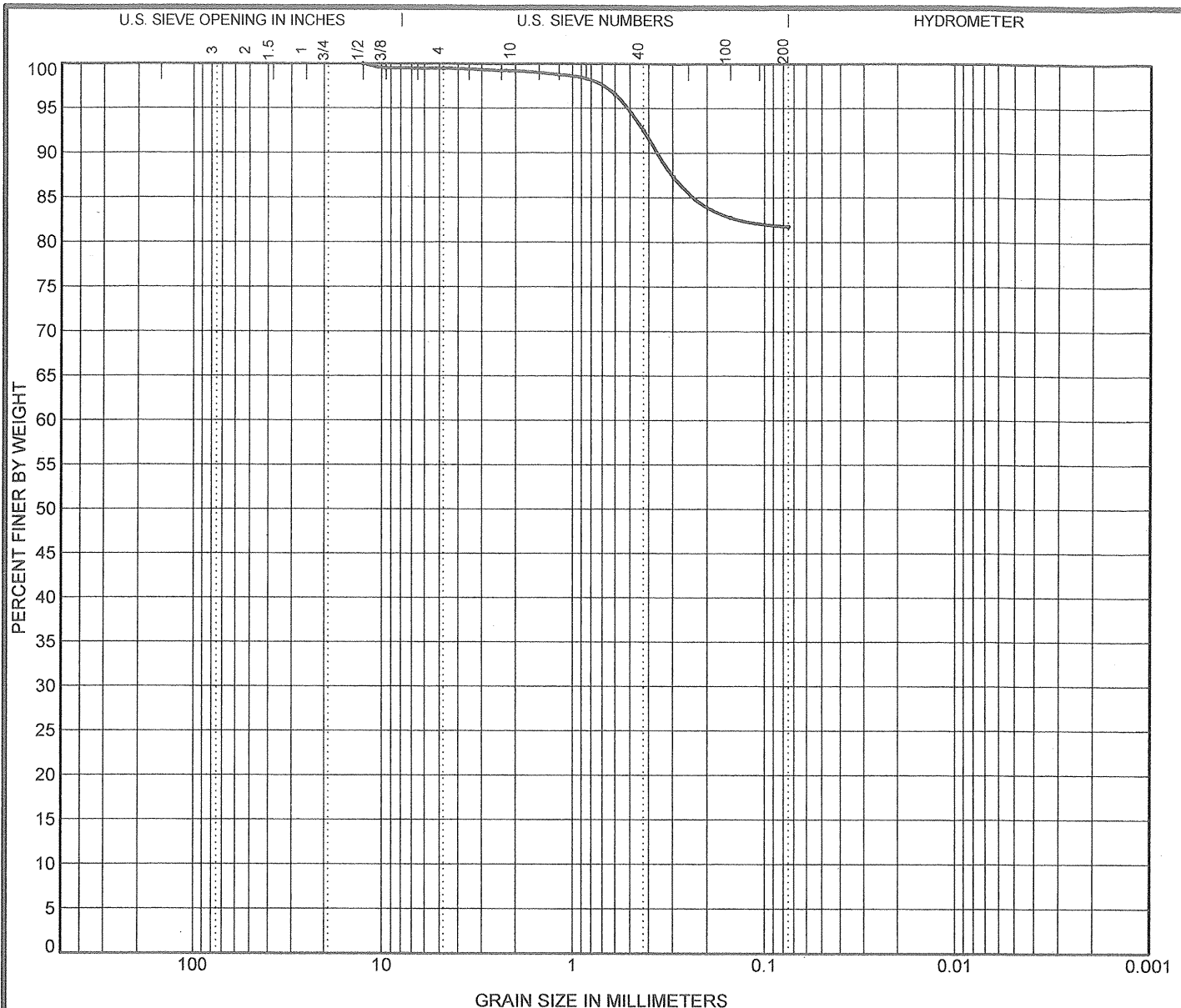
2.80  
 2.70  
 2.60

CMT\_PROCTOR\_090555.GPJ\_US\_LAB.GDT\_8/31/09

**GTA**  
 Geo-Technology Associates, Inc.  
 18 Boulden Circle, Suite 36  
 New Castle, Delaware 19720  
 Telephone: 302-326-2100  
 Fax: 302-326-2399

**MOISTURE-DENSITY RELATIONSHIP**  
 Project: Fulton Hills  
 Location: Cecil County, Maryland  
 Number: 090555






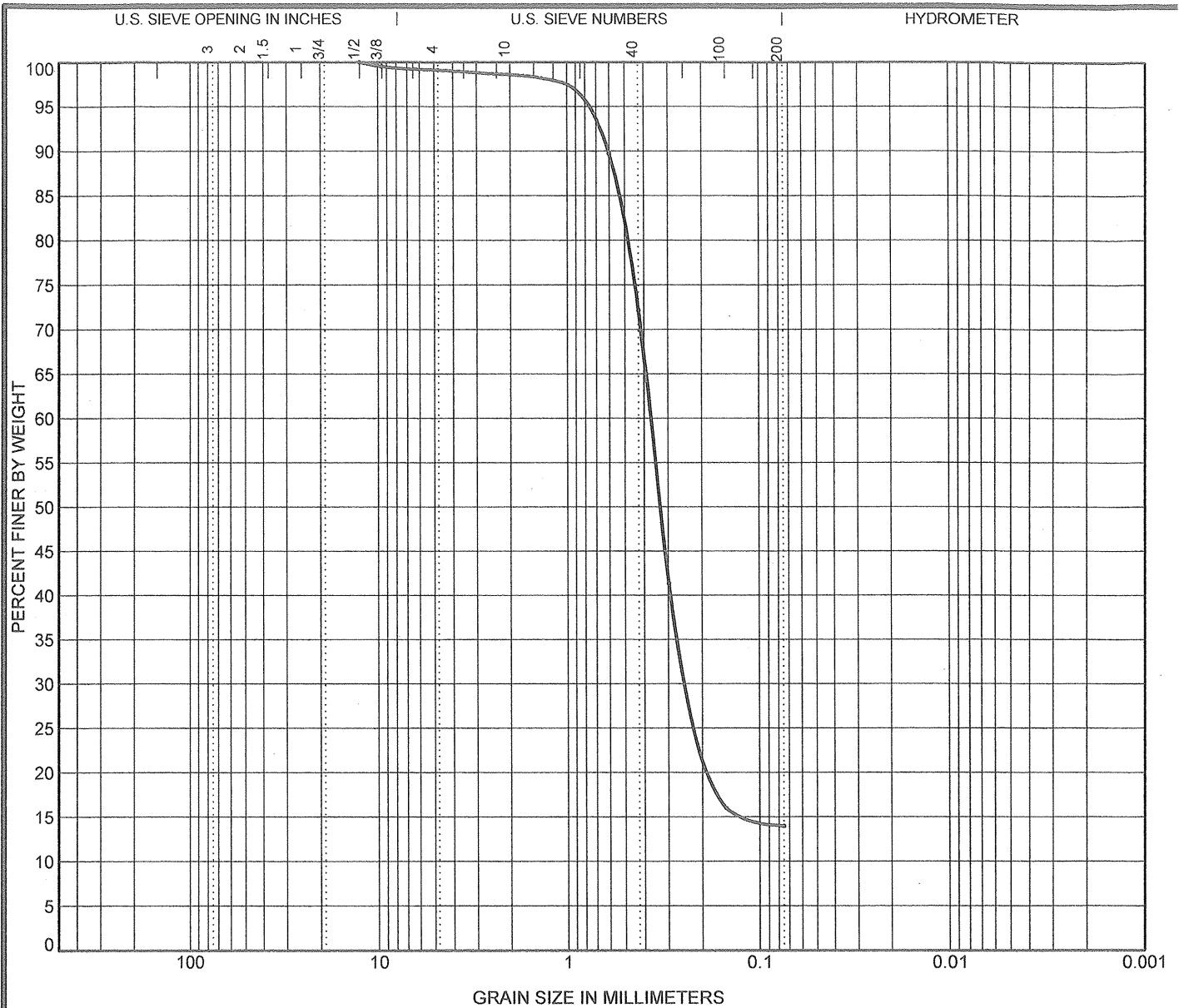
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

<b>Specimen Identification</b>		<b>Classification</b>				<b>LL</b>	<b>PL</b>	<b>PI</b>	<b>Cc</b>	<b>Cu</b>
●	SWM Swale Cut	Lean CLAY with sand				37	21	16		
	8/11/2009									
<b>USCS Classification</b>		CL								
<b>Natural Moisture</b>		14.4								
<b>Specimen Identification</b>		<b>D100</b>	<b>D60</b>	<b>D30</b>	<b>D10</b>	<b>%Gravel</b>	<b>%Sand</b>	<b>%Silt</b>	<b>%Clay</b>	
●	SWM Swale Cut	12.5				0.5	17.7	81.7		

ASTM Specifications Performed May Include: D421, D422, D2216, D2217, D4318

 <b>Geo-Technology Associates, Inc.</b> 18 Boulden Circle, Suite 36 New Castle, Delaware 19720 Telephone: 302-326-2100 Fax: 302-326-2399	<b>GRAIN SIZE DISTRIBUTION</b>	
	Project: Fulton Hills Location: Cecil County, Maryland Number: 090555	

GSA 090555.GPJ US LAB.GDT 8/31/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

<b>Specimen Identification</b>		<b>Classification</b>				<b>LL</b>	<b>PL</b>	<b>PI</b>	<b>Cc</b>	<b>Cu</b>
●	SWM Cut	Silty SAND				NP	NP	NP		
	8/21/2009									
<b>USCS Classification</b>		SM								
<b>Natural Moisture</b>		10.9								
<b>Specimen Identification</b>		<b>D100</b>	<b>D60</b>	<b>D30</b>	<b>D10</b>	<b>%Gravel</b>	<b>%Sand</b>	<b>%Silt</b>	<b>%Clay</b>	
●	SWM Cut	12.5	0.369	0.219		0.9	85.1	14.0		

ASTM Specifications Performed May Include: D421, D422, D2216, D2217, D4318

GSA\_090555.GP.J\_US\_LAB.GDT\_8/31/09



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### GRAIN SIZE DISTRIBUTION

Project: Fulton Hills  
 Location: Cecil County, Maryland  
 Number: 090555