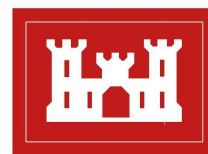




Philadelphia Regional Port Authority
U.S. Army Corps of Engineers – Philadelphia District



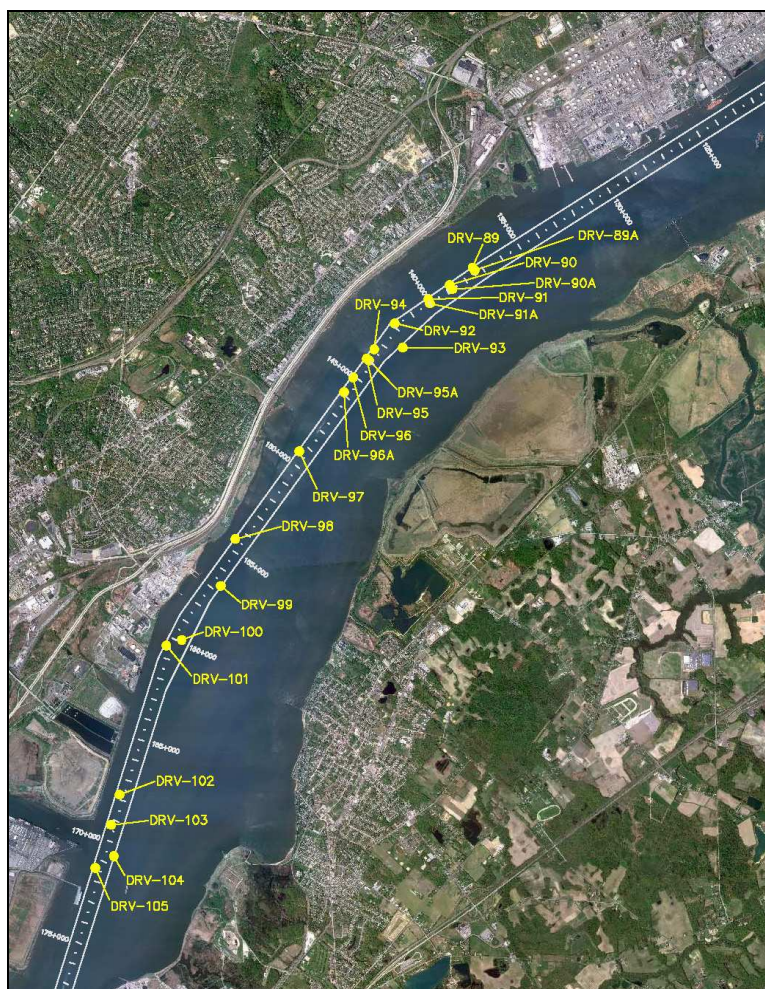
DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Geotechnical Sediment Investigation

Lower Portion of Reach B - Stations 137+000 To 176+000

Final Report

September 2010



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1.0 INTRODUCTION

A geotechnical investigation of the bottom sediments within the Delaware River federal shipping channel for the authorized Delaware River Main Channel Deepening Project (Deepening Project) as shown in Figure 1 was undertaken. The investigation was conducted in the lower portion of Reach B as highlighted in Figure 1.

2.0 PURPOSE

The purpose of this effort was to obtain information on the type, nature, and characteristics of subaqueous materials as well as the extent and conditions of these materials as they exist in locations within the project limits of the Deepening Project. This investigation provides geotechnical information for the sediments that will be encountered during the deepening of the lower portion of Reach B of Delaware River shipping channel from existing grade to a depth of -45 feet Mean Lower Low Water (MLLW) plus one foot of allowable pay over-depth (-46 ft MLLW).

3.0 PROJECT SITE

The area for this investigation is shown on Figure 2 and extends from Station 137+000 to 176+000, approximately 7.4 miles. Within this portion of the channel, the width is 800 feet wide and the river is bordered by New Jersey on the east and Delaware to the west.

4.0 SUBSURFACE CONDITIONS

In the project site, the existing geological data indicate these sediments are recent to Holocene alluvial deposits. The length of the investigation area ranges between silty clays and clayey silts to sands and gravel lens derived from upstream rock formations and other sediments (Blackmer, 2004).

5.0 LOCATIONS OF VIBRACORES

Locations for the proposed vibracore sampling are shown on Figures 3-4 and are detailed in Table 1 below.

Table 1 - Vibrational Core Locations

LOCATION	CORE DESIGNATION	APPROXIMATE STATIONING	EASTING (NJ SP)	NORTHING (NJ SP)	APPROX. DEPTH (MLLW) (FROM USACE SURVEY*)
Delaware	DRV-89	137+300	225899	350184	-41.9
Delaware	DRV-90	138+900	224811	349355	-42.2
Delaware	DRV-91	140+000	223791	348713	-42.2
Delaware	DRV-92	141+900	222208	347561	-43.1
Delaware	DRV-93	142+600	222588	346425	-43.0
Delaware	DRV-94	143+400	221248	346336	-42.3
Delaware	DRV-95	144+000	220877	345904	-42.9
Delaware	DRV-96	145+500	220246	345021	-41.9
Delaware	DRV-97	149+300	217688	341553	-44.1
Delaware	DRV-98	154+500	214662	337428	-41.1
Delaware	DRV-99	156+800	213974	335212	-44.4
Delaware	DRV-100	159+900	212125	332673	-42.4
Delaware	DRV-101	160+400	211400	332416	-41.7
Delaware	DRV-102	167+900	209195	325407	-39.2
Delaware	DRV-103	169+200	208790	323987	-39.7
Delaware	DRV-104	170+600	208920	322519	-40.6
Delaware	DRV-105	171+400	208047	321951	-41.2

* Depths utilized were collected from USACE 2010 July Multi-Beam Survey.

These locations were selected after review and analysis of Corps of Engineers 2010 multi-beam hydrographic surveys. The processed hydrographic survey data and the project dredging template were used to create two digital terrain models. The two modeled surfaces were compared in a software program to provide a difference plot. The difference plot is created by comparing “z” elevations from the two models in the same “x” and “y” position. These differences provide a new “y” value now associated with the “x” and “y”; however the “z” value is no longer an elevation, it is now a thickness (material above the template). This new model can be exported into CAD for use in creating a difference plot. The depicted depth of material to be dredged is color coded to display increments of dredging in plan view (ex. Red indicated 0 to 1 ft of dredging, etc). This plot, in concert with existing vibracore data, was utilized to identify the sampling locations. The difference plots are provided in Section A, Figures 3-4.

6.0 VIBRACORES SAMPLING AND TESTING PROCEDURES

The subsurface conditions within the project area were evaluated by vibracoring to a depth of 20 feet below the mudline of the channel, designated as DRV-89 through DRV-105 as shown in Table 1.

Vibrational core technology was used to continuously sample marine sediments to obtain representative samples for identification and geotechnical testing. The samples were logged, visually identified, and subjected to gradation analysis to determine and document the grain size characteristics of the materials present. The data collection and testing procedures employed for this investigation is summarized below.

6.1 Data Collection

The field sampling began on August 2, 2010 and was completed on August 8, 2010.

Vibracores were completed at a rate of two to four per day by a sub-contractor, Aqua Survey Inc. using the R/V Hayes lift boat. In addition, Aqua Survey provided the vibration units and completed the vibracores under the supervision of both Versar, Inc. and Gahagan and Bryant Associates, Inc.

Positioning at the coring locations was accomplished using a Garmin series differential GPS navigation system, referenced to a local geodetic benchmark, resulting in positioning accuracies of 1 to 3 meters. Water depths were measured with a graduated lead line and corrected to MLLW. After positioning over the core coordinates, the vibracore sampling was conducted.

Aqua Survey, under Captain Collin Clement, operated the lift boat and the vibracoring system. The vibrating unit had two counter-rotating motors encased in waterproof aluminum housing. A 240-volt generator powered the motors. Four inch diameter cores were proposed to be collected continuously to a depth of about 20 feet and a sample target depth of 15 foot was desired. The barrel liners were flexible food-grade polyethylene. The flexible liners were slit with a razor knife, allowing for easy processing. The standard 4-inch diameter sediment core yields about 0.5 gallons of sediment per foot of recovered core.

6.2 Procedure

The vibracore head and tube were lowered overboard via a vessel mounted winch. The core tube was allowed to penetrate the surficial materials below the mudline as far as possible under the static weight of the vibracore unit. The unit was then vibrated until it reaches project depth for volume requirements for the analytical sampling or until the vibracore encountered refusal to further penetration. A rudimentary penetration rate was measured to the first 5 to 6 feet of penetration in which the penetration was governed by the weight of the equipment. However, beyond that depth, due to the strong currents and the stability of the vibracore head, the crane controlled the penetration with a slow controlled release. The initial penetration rate is noted on the logs. If refusal is encountered, then a second or third attempt would be made at a nearby location. If refusal is encountered again, any material obtained will be used for geotechnical testing

and the reason for refusal noted. When penetration of the vibracore was completed, power was shut off to the vibra-head, and the vibracore was brought aboard the vessel. A check valve located on top of the core tube reduced or prevented sediment loss during pull-out. The length of sediment recovered was noted by measuring down the interior of the core tube to the top of the sediment. The core tube was then detached from the vibra-head, and the core cutter and catcher were removed.

Refusals were encountered at five locations. As a result, an attempt was made to drill a vibracore at a nearby location for each vibracore that encountered refusal. Table 2 displays the location of additional cores that were taken.

Table 2 - Additional Vibrational Core Locations

LOCATION	CORE DESIGNATION	APPROXIMATE STATIONING	EASTING (NJ SP)	NORTHING (NJ SP)	APPROX. DEPTH (MLLW) (FROM USACE SURVEY)
Delaware	DRV-89a	137+300	225997	350039	-42.8
Delaware	DRV-90a	138+900	224932	349162	-43.4
Delaware	DRV-91a	140+000	223880	348503	-43.8
Delaware	DRV-95a	144+000	221001	345814	-43.3
Delaware	DRV-96a	145+900	219804	344316	-45.1

The sample recovery was recorded, and the sample was photographed. Each sample was visually classified in accordance with ASTM 2488 visual manual procedure for identification of soils, and recorded on the field logs. A representative portion of the sample was placed in moisture-tight glass jars, which were labeled for future reference. The logs and pictures are provided in Sections B and C of this appendix.

6.3 Results of the Field Work Investigation

The locations of the subsurface investigations conducted as part of this effort are shown on Figure 5 and are summarized in Table 3.

The highlighted stationing on the table indicates locations where the density of material caused either the refusal of the vibracore or a minimum penetration of the unit. The cut-off is 2.6 feet of penetration.

Table 3 - Results of the Field Investigation

LOCATION	CORE DESIGNATION	APPROXIMATE STATIONING	STATE	EASTING	NORTHING	LATITUDE		LONGITUDE		APPROX. DEPTH (MLLW) (From Mapping Data)	LENGTH OF PENETRATION	REFUSAL	VIBRACORE REFUSAL / BOTTOM ELEVATION	NO SAMPLE	GEOTECH SAMPLE	GEOTECH SAMPLE #
Delaware	DRV-89	137+300	NJ	225,899.00	350,184.00	39	47.457828	75	26.847497	-41.9	0.0	yes	-41.9	#		
Delaware	DRV-90	138+900	NJ	224,811.00	349,355.00	39	47.319387	75	27.077908	-42.2	0.0	yes	-42.2	#		
Delaware	DRV-91	140+000	NJ	223,791.00	348,713.00	39	47.211857	75	27.294212	-42.2	2.0	yes	-44.2		yes	1
Delaware	DRV-92	141+900	NJ	222,208.00	347,561.00	39	47.019328	75	27.629528	-43.1	2.0		-45.1		yes	2
Delaware	DRV-93	142+600	NJ	222,558.00	346,425.00	39	46.83289	75	27.54581	-43	20.0		-63.0		yes	3
Delaware	DRV-94	143+400	NJ	221,248.00	346,336.00	39	46.815865	75	27.831654	-42.3	1.8		-44.1		yes	4
Delaware	DRV-95	144+000	NJ	220,877.00	345,904.00	39	46.744054	75	27.909857	-42.9	0.0	yes	-42.9	#		
Delaware	DRV-96	145+500	NJ	220,246.00	345,021.00	39	46.597498	75	28.042517	-41.9	0.0	yes	-41.9	#		
Delaware	DRV-97	149+300	NJ	217,688.00	341,553.00	39	46.02173	75	28.58047	-44.1	2.6		-46.7		yes	5
Delaware	DRV-98	154+500	NJ	214,662.00	337,428.00	39	45.33686	75	29.216601	-41.1	2.0	yes/R-2++	-43.1		yes	6
Delaware	DRV-99	156+800	NJ	213,974.00	335,212.00	39	44.970625	75	29.358193	-44.4	15.6		-60.0		yes	7
Delaware	DRV-100	159+900	NJ	212,125.00	332,673.00	39	44.549066	75	29.746698	-42.4	15.0		-57.4		yes	8
Delaware	DRV-101	160+400	NJ	211,400.00	332,416.00	39	44.505409	75	29.900767	-41.7	7.6		-49.3		yes	9
Delaware	DRV-102	167+900	NJ	209,195.00	325,407.00	39	43.346934	75	30.354416	-39.2	15.0		-54.2		yes	10
Delaware	DRV-103	169+200	NJ	208,790.00	323,987.00	39	43.112304	75	30.437395	-39.7	15.0		-54.7		yes	11
Delaware	DRV-104	170+600	NJ	208,920.00	322,519.00	39	42.870758	75	30.406153	-40.6	12.0		-52.6		yes	12
Delaware	DRV-105	171+400	NJ	208,047.00	321,951.00	39	42.775589	75	30.590968	-41.2	15.0		-56.2		yes	13

Additional Attempts

Delaware	DRV-89A	137+300	NJ	225,997.00	350,039.00	39	n/a	75	n/a	-42.8	1.8		-44.6		yes	14
Delaware	DRV-90A	138+900	NJ	224,932.00	349,162.00	39	n/a	75	n/a	-43.4	1.0		-44.4		yes	15
Delaware	DRV-91A	140+000	NJ	223,880.00	348,503.00	39	n/a	75	n/a	-43.8	0.0	yes	-43.8	#		
Delaware	DRV-95A	144+000	NJ	221,001.00	345,814.00	39	n/a	75	n/a	-43.3	1.0		-44.3		yes	16
Delaware	DRV-96A	145+900	NJ	219,804.00	344,316.00	39	n/a	75	n/a	-45.1	1.0		-46.1		yes	17

Note: The Color coding is meant to highlight areas of poor penetration of the vibracore equipment.

The Orange is where the equipment was refused.

The Yellow is where only limited (2.6' or less) was attained.

++Upstation/down stream 50' from original position. Sample collected from R-1, R-2 failed

- Stationing of suspected very hard gravel lens
- Stationing of suspected very thin alluvial veneer
- Appears to be very decomposed bedrock Saprolite

The area of orange highlight represent refusal of the vibrocore. The yellow represents the poor penetration of the unit. These areas represent either denser alluvial sediments or possible bedrock. The coring of DRV-91 acquired only enough sample volume for geotechnical testing, but the core retainer was lost and this bent the sidewalls of the casing into a square shape. The sample within the casing was a very decomposed saprolitic material with some residual structure. Unfortunately, extracting the sample from the casing walls did not allow for a reliable evaluation of that structure.

7.0 GEOTECHNICAL SOILS LABORATORY TESTING

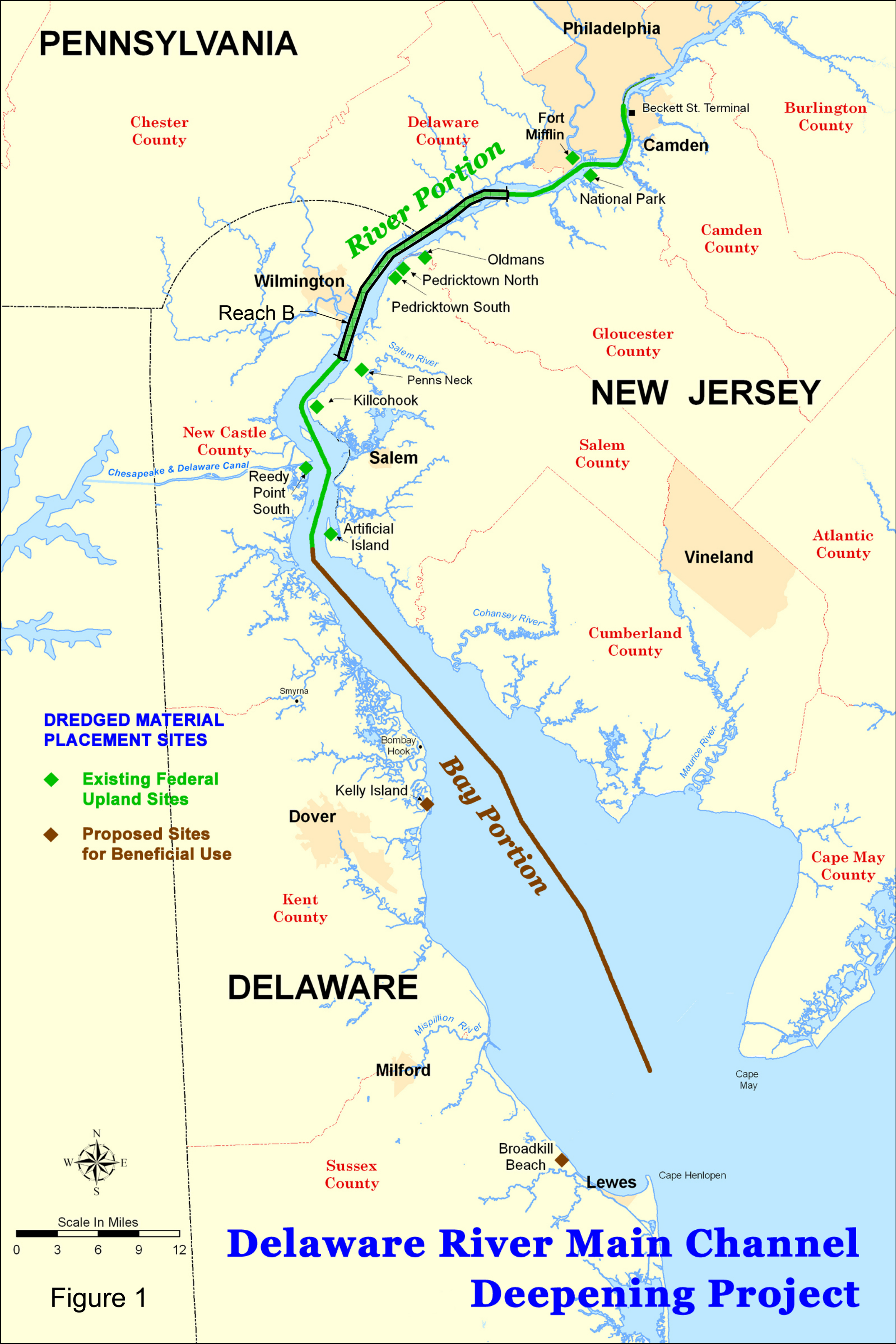
A total of 19 geotechnical sediment samples were obtained from 17 cores and delivered to the Pennoni Associates, Inc. a Corps of Engineers validated laboratory in Bethlehem Pennsylvania. Soil samples testing included moisture content, grain size analysis, specific gravity analysis and hydrometer analysis. All tests were conducted in accordance with current ASTM Standards. The results are summarized in Section D. Of the nineteen samples tested, seven were classified as sand or coarser sediments. These seven samples were classified by ASTM 2487 method. The remaining were classified by ASTM 2488 method and were primarily clay silts with the ratio of clay to silt being very close to 1 to 1. Moisture contents that remained within the samples in the fine samples ranged from 9.6 to 32.2% which is a very broad range for clays and silts. The specific gravity's values ranged from 2.39 to 2.88, with most being in the 2.55 to 2.60 range.

8.0 REFERENCE

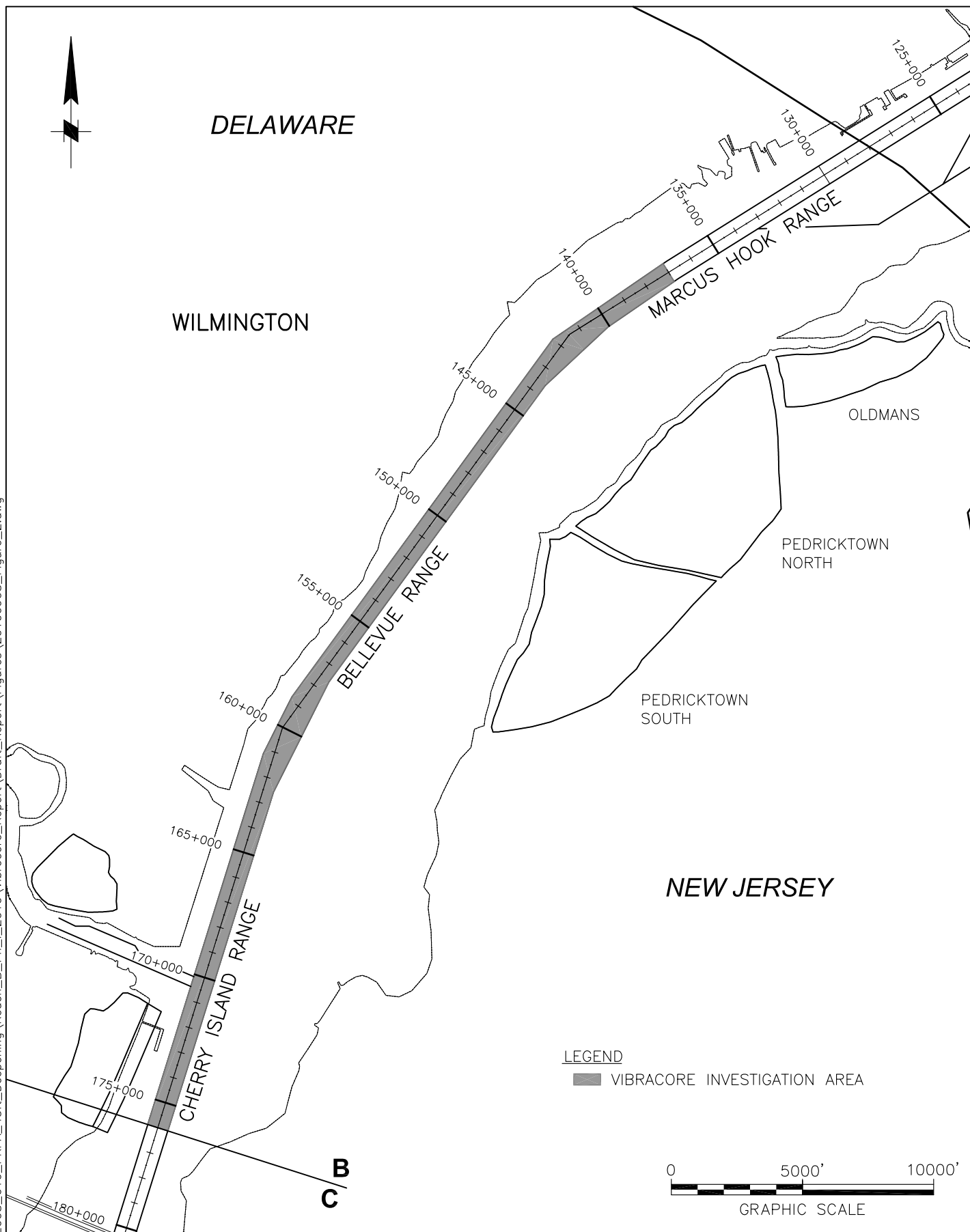
Blackmer, Gale C. 2005 Preliminary Bedrock Geologic Map of a Portion of the Wilmington 30 by 60 Minute Quadrangle, Southeastern Pennsylvania, Pennsylvania Topographic and Geologic Survey OFBM-05-01.0.

SECTION A

Figures



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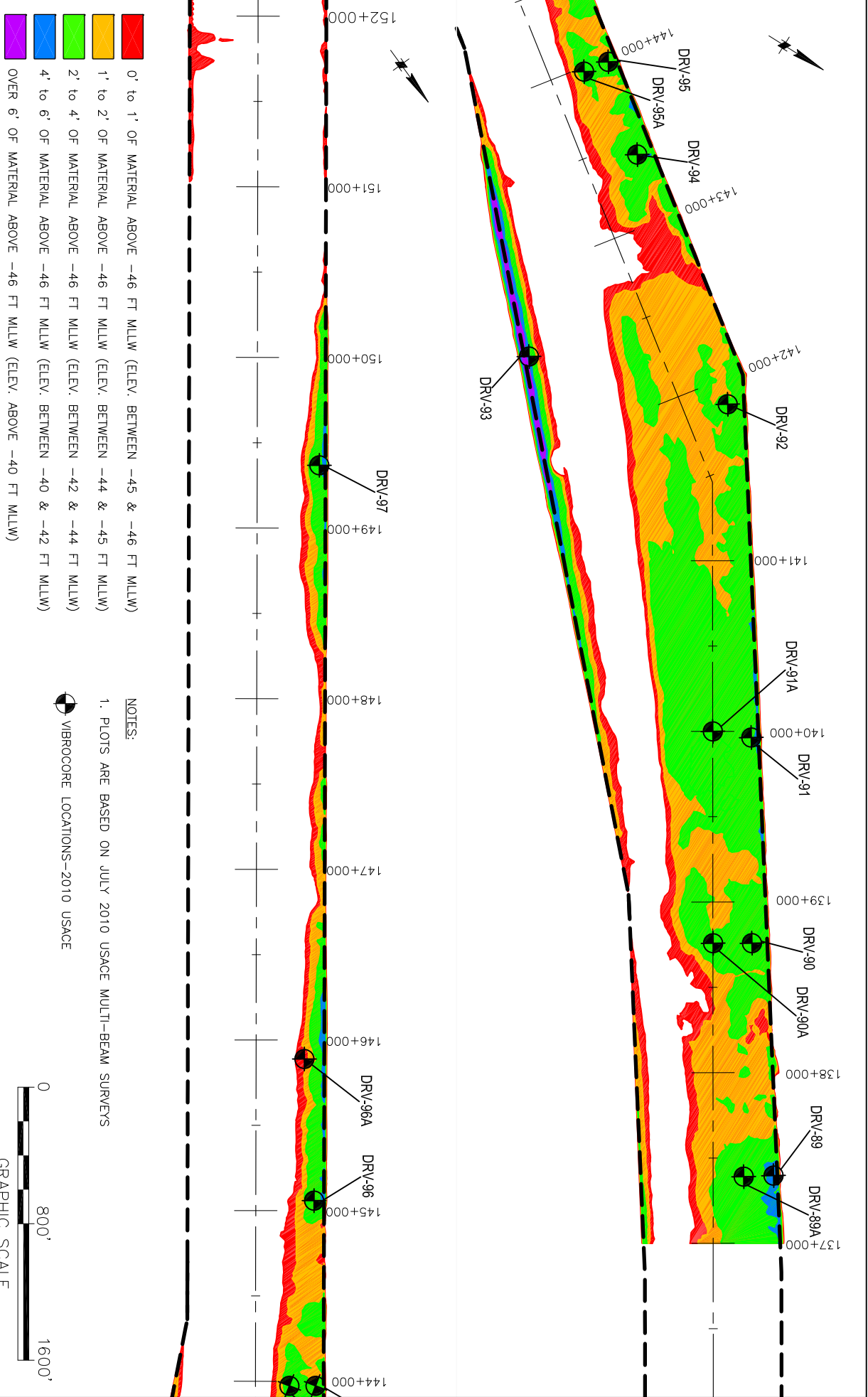


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DELAWARE RIVER
DEEPENING PROJECT

FIGURE 2

Drawing Date:	September 2010
Drawn By:	E. Cook
Checked By:	S. Shaw
Drawing Name:	Figure_2
Drawing Scale:	1"=5000'

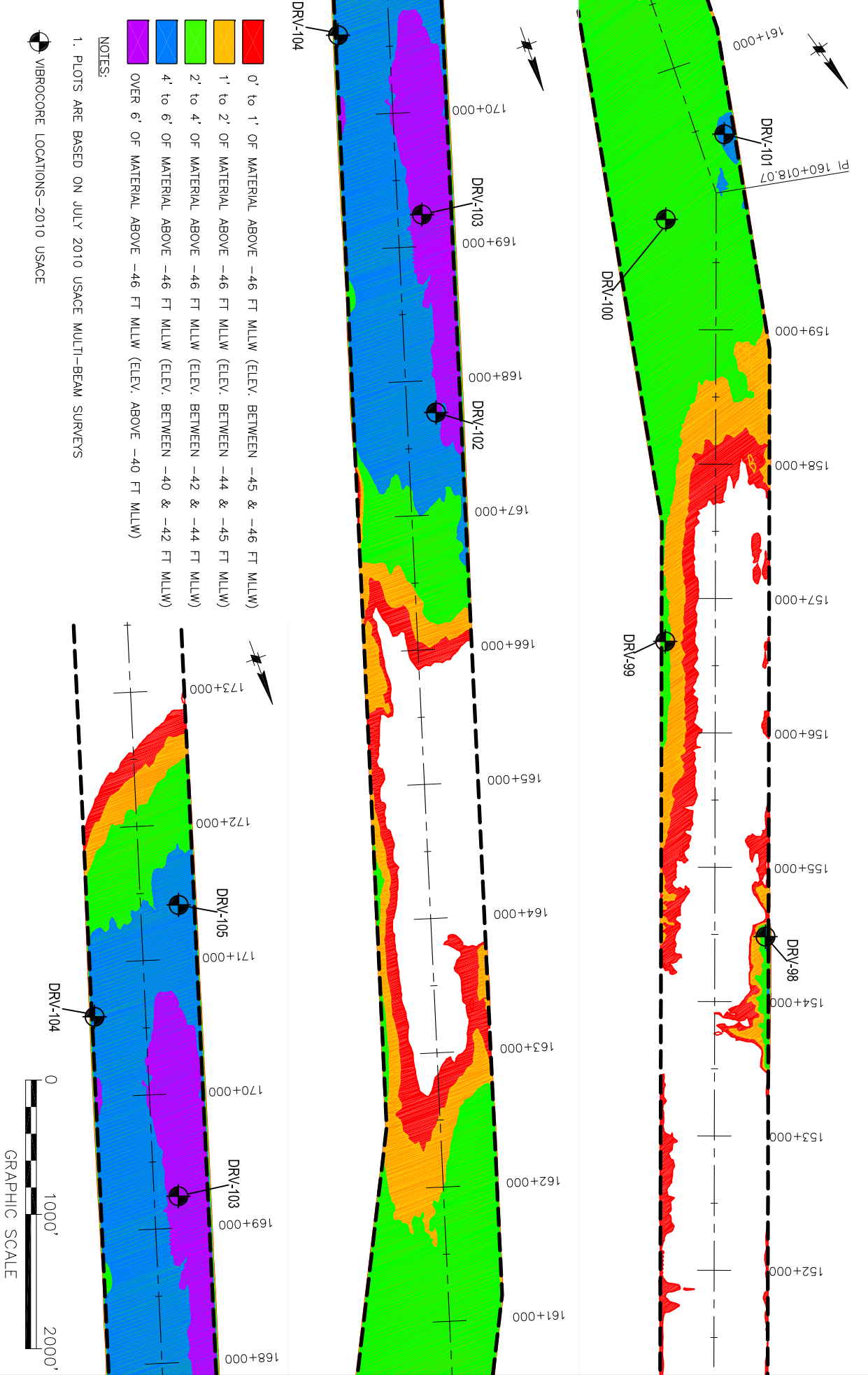


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FIGURE 3

Drawing Date:	September 2010
Drawn By:	E. Cook
Checked By:	S. Shaw
Drawing Name:	Figure-3
Drawing Scale:	1"=800'



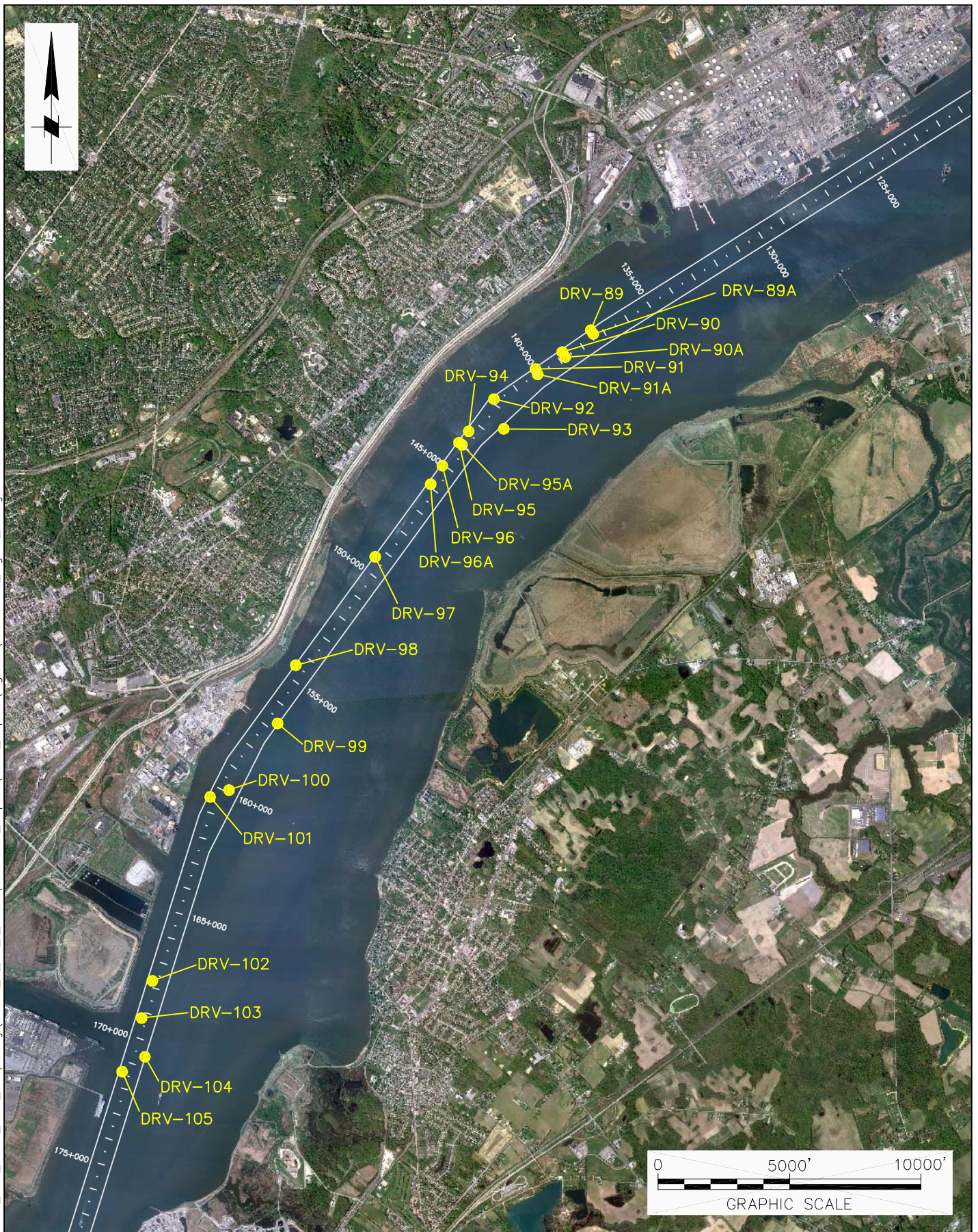
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DELAWARE RIVER
DEEPENING PROJECT

FIGURE 4

Drawing Date:	September 2010
Drawn By:	E. Cook
Checked By:	S. Shaw
Drawing Name:	Figure-3
Drawing Scale:	1"=1000'

P:\Delaware_River\2008_616_PPRA_45ft_Deepening\Reach_B_Ph_I_2010\Vibrocore_Report\Draft_Report\Figures\20100908_Figure_5.dwg



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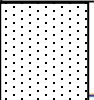

FIGURE 5

Drawing Date:	September 2010
Drawn By:	E. Cook
Checked By:	S. Shaw
Drawing Name:	Figure_5
Drawing Scale:	1"=5000'

SECTION B

Vibracore Logs

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 138+900				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-90a				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100805		STARTED 20100805	COMPLETED 20100805
7. THICKNESS OF OVERBURDEN 1'				17. ELEVATION TOP OF HOLE -44.4' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % N/A			
9. TOTAL DEPTH OF HOLE 1'				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g	
-43.4'	1		0- 1' Gray-Brown well rounded GRAVEL	N/A %	S-1 0-1'	Penetration Rate N/A GP Gravel-89% Sand 11% 0% silt & clay	
-44.4'			Little to trace gray sand			Moisture 2.9%	
			Bottom of Boring 1'				


DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 141+900				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-92				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100803		STARTED 20100803	COMPLETED 20100803
7. THICKNESS OF OVERBURDEN 1'				17. ELEVATION TOP OF HOLE -43.1' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % N/A			
9. TOTAL DEPTH OF HOLE 1'				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g	
-43.1'	1		0- 2' Gray-Brown Medium SAND little well rounded pebbles and gravel	N/A %	S-1 3.3-4'	Penetration Rate 0.5"/Second GP Gravel-54%, Sand 42% silt & clay 4% Moisture 11.8% Specific Gravity 2.66	
-45.1'	2		Bottom of Boring 2'	%		3 run attempts to get enough sample for analytical testing. Third attempt a failure	

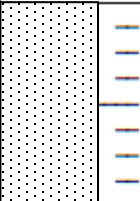
DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1 SHEETS
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B		10. SIZE AND TYPE OF BIT 4"		
2. LOCATION (Coordinates or Station) Station 142+600		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW		
3. DRILLING AGENCY Aqua Survey, Inc.		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-93		14. TOTAL NUMBER CORE BOXES N/A		
5. NAME OF DRILLER Collin Clement		15. ELEVATION GROUND WATER N/A		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.		16. DATE HOLE (YYYYMMDD) 20100803	STARTED 20100803	COMPLETED 20100803
7. THICKNESS OF OVERBURDEN 20'		17. ELEVATION TOP OF HOLE -43' MLLW		
8. DEPTH DRILLED INTO ROCK N/A		18. TOTAL CORE RECOVERY FOR BORING % 100%		
9. TOTAL DEPTH OF HOLE 20'		19. SIGNATURE OF INSPECTOR Gary Kribbs		

Digitized by Gary Kribbs
DR-100 Gary Kribbs, or AECW-EG, Inc., or AECW-EG/EGW/EGW/EGW, or AECW-EG
Date: 2010/08/03 12:00:00

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g
-43'	2		0-11.4'	100 %		Penetration rate N/A
	4		Gray (2.5YR 4/4) Clayey SILT	100 %	S-1 3.3'-4.0'	Sand-1%, silt & clay 99% Moisture 4.2% Specific Gravity 2.59
	6			100 %		
	8			100 %		
	10		11.4'-12.1'	100 %		
	12		Gray-white Medium to Course SAND			
	14		12.1'-15' plus Gray 2.5YR 4/4 Clayey SILT	100 %		
	16			100 %		
	18			100 %		
-63.0	20		Bottom of Boring 20'			

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 143+900				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-94				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100803		STARTED 20100803	COMPLETED 20100803
7. THICKNESS OF OVERBURDEN 1.8'				17. ELEVATION TOP OF HOLE -42.3' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % N/A			
9. TOTAL DEPTH OF HOLE 1.8'				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g	
-42.3'			0- 0.5' Gray Fine SAND			Penetration Rate N/A	
-44.1'	1 1.8'		0.5'-1.8 Gray-Brown Med-Coarse SAND & GRAVEL little well rounded pebbles and cobbles	N/A %	S-1 0.5-1.8'	SP Gravel-46% Sand-52% silt & clay 2% Moisture 7.8% Specific Gravity 2.56	
			Bottom of Boring 2'	%			

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 144+000				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-95a				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100805		STARTED 20100805	COMPLETED 20100805
7. THICKNESS OF OVERBURDEN 1.0'				17. ELEVATION TOP OF HOLE -43.3' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % N/A			
9. TOTAL DEPTH OF HOLE 1.0'				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g	
-43.3'	1		0-1.0' Gray-Brown well rounded GRAVEL	N/A %	S-1 0.5-1.8'	Penetration Rate N/A GW Gravel-85%, Sand-15% <2% silt & clay Moisture-8.0%	
-44.3'			Bottom of Boring 1.0				

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 144+000				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-96a				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100805		STARTED 20100805	COMPLETED 20100805
7. THICKNESS OF OVERBURDEN 2.0'				17. ELEVATION TOP OF HOLE -45.1' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % N/A			
9. TOTAL DEPTH OF HOLE 2.0'				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g	
-45.1'	1		0-2.0' 5YR 3/2 Gray-medium SAND with gravel and pebbles	N/A %	S-1 0-2'	Penetration Rate N/A GP Gravel- 59%, Sand-39% 2% silt & clay Moisture-10.4%	
-47.1'	2'		Bottom of Boring 2.0'	%			

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 156+800				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-99				14. TOTAL NUMBER CORE BOXES		N/A	
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER		N/A	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100803		STARTED 20100803	COMPLETED 20100803
7. THICKNESS OF OVERBURDEN 15.6'				17. ELEVATION TOP OF HOLE		-44.4' MLLW	
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING %		100%	
9. TOTAL DEPTH OF HOLE 15.6'				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant)	
a	b	c	d	e	f	g	
-44.4'	2		0'-8.1' Gray (2.5YR 4/4) Clayey SILT 1/4" to 1/2" varves (partings)	100 %	S-1 2'-2.6'	Penetration rate 0.3'/second	
	4			100 %		Sand-26%	
	6			100 %		silt and clay-74%	
	8			100 %		Moisture 24.5%	
	10			100 %		Specific Gravity 2.53	
			8.1'-9.3' Dk Gray Quartz SAND				
			9.3'-10.8' Gray Clayey SILT				
	12		@10.8', 12.5' 14.8' 1/2" thick White-Gray Med-Coarse SAND partings in clayey silt	100 %			
	14			100 %			
	15.6'			14.8'-15.6' Gray (2.5YR 4/4) Clayey SILT			
-60.0			Bottom of Boring 15.6'			Run-1 2.2' in 7 seconds	

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS		
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"				
2. LOCATION (Coordinates or Station) Station 159+900				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW				
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes		
4. HOLE NO. (as shown on drawing title and title number) DRV-100				14. TOTAL NUMBER CORE BOXES N/A				
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A				
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100802		STARTED 20100802		
7. THICKNESS OF OVERBURDEN 15.0'				17. ELEVATION TOP OF HOLE -42.4' MLLW				
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % 100%				
9. TOTAL DEPTH OF HOLE 15.0'				19. SIGNATURE OF INSPECTOR Gary Kribbs				
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant)		
a	b	c	d	e	f	g		
-42.4'	2		0'-8.08' Gray (2.5YR 4/4) Clayey SILT 1/4" to 1/2" varves (partings) occasional 1/8" fines sand varves	100 %		Penetration rate 0.2'/second		
	4			100 %	S-1 5.5'-6'	Sand-4%, silt & clay-96%		
	6			100 %		Moisture-9.6%		
	8					Specific Gravity 2.54		
				8.08'-8.1' V. White Quartz fine -Med SAND				
	10			gray clayey silt between 8.6'-8.7' PEAT zone very woody	100 %			
	12			8.7'-15.0' Gray (2.5YR 4/4) Clayey SILT	100 %			
	14							
-57.4'	15.0'		Bottom of Boring 15'	%		Run-1 2.2' in 7 seconds		
				%				

DRILLING LOG For use of this form, see ER 11 10-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 160+400				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-101				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100802		STARTED 20100802	COMPLETED 20100802
7. THICKNESS OF OVERBURDEN 7.6'				17. ELEVATION TOP OF HOLE -41.7 MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % N/A%			
9. TOTAL DEPTH OF HOLE 7.6'				19. SIGNATURE OF INSPECTOR Gary Kribbs <small>Digitally signed by Gary Kribbs DN: cn=Gary Kribbs, o=ARCO Chemicals, Inc., c=us, email=gkribbs@arconet.net, c=US Date: 2010.08.03 13:22:29 -0400</small>			

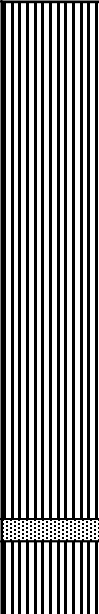
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g
-41.7'	2		0'-5.4' Gray (2.5YR 4/4) Clayey SILT	100 %		Penetration rate 0.65'/second
	4		5.4'-5.5' Gray Coarse SAND	100 %	S-1 4.3'-5.4'	Sand-6% silt & clay-94% Moisture 9.6% Specific Gravity 2.65
-49.3'	6		5.5'-7.6' Red-Gray Brown Sandy, Silty CLAY slight mottling, no apparent structure	100 %	S-2 5.5'-6.5'	Gravel-2%, Sand-45%, silt & clay-53% Moisture 21.4% Specific Gravity 2.67
			Bottom of Boring 7.6'	%		Run-1 2.3' in 1.5 seconds Run-2 2.3' in 1.5 seconds

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 167+900				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-102				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100803		STARTED 20100803	COMPLETED 20100803
7. THICKNESS OF OVERBURDEN 15.0'				17. ELEVATION TOP OF HOLE -39.2' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % 100%			
9. TOTAL DEPTH OF HOLE 15.0'				19. SIGNATURE OF INSPECTOR Gary Kribbs			

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ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
-39.2'	2		0'-15.0' Gray (2.5YR 4/4) Clayey SILT 1/2" to 1" varves (partings)	100 %	S-1 2'-2.6'	Penetration rate 0.3'/second Sand-2% silt & clay-95% Moisture-26.3% Specific Gravity 2.39
	4			100 %		
	6		density visibly increases @6'	100 %		
	8			100 %		
	10			100 %		
	12			100 %		
	14		Gray (2.5YR 4/4) Clayey SILT	100 %		
-54.2'	15.0'		Bottom of Boring 15.0'			Run-1 1.5' in 6 seconds
				%		
				%		

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic		INSTALLATION Philadelphia District		SHEET 1 OF 1 SHEETS	
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B				10. SIZE AND TYPE OF BIT 4"			
2. LOCATION (Coordinates or Station) Station 169+200				11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW			
3. DRILLING AGENCY Aqua Survey, Inc.				13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes	UNDISTURBED
4. HOLE NO. (as shown on drawing title and title number) DRV-103				14. TOTAL NUMBER CORE BOXES N/A			
5. NAME OF DRILLER Collin Clement				15. ELEVATION GROUND WATER N/A			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEG. FROM VERT.				16. DATE HOLE (YYYYMMDD) 20100802		STARTED 20100802	COMPLETED 20100802
7. THICKNESS OF OVERBURDEN 15				17. ELEVATION TOP OF HOLE -39.7' MLLW			
8. DEPTH DRILLED INTO ROCK N/A				18. TOTAL CORE RECOVERY FOR BORING % 100%			
9. TOTAL DEPTH OF HOLE 15				19. SIGNATURE OF INSPECTOR Gary Kribbs			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant)	
a	b	c	d	e	f	g	
-39.7'	2		0-14.1'	100 %		Penetration rate 0.4'/second	
	4			100 %			
	6			100 %	S-1 6.8'-7.3'	Sand-19%, silt & clay-81% Moisture 27.0% Specific Gravity 2.61	
	8			100 %			
	10			100 %			
	12			100 %			
	14		14.1'-15.0' Medium Quartz SAND	100 %	S-2 14.-15.0'	(N/A)	
-54.7'	15						
			Bottom of Boring 15'	%			
				%		Run-1 3.35' in 8 seconds Run-2 2.3' in 6 seconds Lost shoe & Trap	

ELEVATION		DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g	
-40.6'	2		0'-10.1.0'	100 %	S-1 5.8'-6.5'	Penetration rate 0.4'/second Sand-6% silt and clay-94% Moisture 32.2% Specific Gravity 2.65	
	4		Gray (2.5YR 4/4) Clayey SILT fine quartz sand varves	100 %			
	6			100 %			
	8			100 %			
	10		10.1'-10.6' Gray fine to coarse Quartz SAND	100 %			
-52.6'	12		10.6'-12' Gray (2.5YR 4/4) Clayey SILT				
			Bottom of Boring 12.0'	%			
				%			
				%			

DRILLING LOG For use of this form, see ER 1110-1-1901; the proponent agency is CECW-EG		DIVISION North Atlantic	INSTALLATION Philadelphia District	SHEET 1 OF 1 SHEETS
1. PROJECT Delaware River Main Channel Deepening Project Geotechnical Sampling - Lower Reach B		10. SIZE AND TYPE OF BIT 4"		
2. LOCATION (Coordinates or Station) Station 171+400		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL at MLLW		
3. DRILLING AGENCY Aqua Survey, Inc.		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		DISTURBED Yes
4. HOLE NO. (as shown on drawing title and title number) DRV-105		14. TOTAL NUMBER CORE BOXES N/A		
5. NAME OF DRILLER Collin Clement		15. ELEVATION GROUND WATER N/A		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		16. DATE HOLE (YYYYMMDD) 20100802		COMPLETED 20100802
DEG. FROM VERT.		17. ELEVATION TOP OF HOLE -41.2' MLLW		
7. THICKNESS OF OVERBURDEN 15' plus		18. TOTAL CORE RECOVERY FOR BORING % 100%		
8. DEPTH DRILLED INTO ROCK N/A		19. SIGNATURE OF INSPECTOR Gary Kribbs		
9. TOTAL DEPTH OF HOLE 15'		<small>Digitally signed by Gary Kribbs DN: cn=Gary Kribbs, o=ARDC Operations, Inc., email=gkribbs@ardc-inc.com, c=US Date: 2010.08.02 12:30:41 -0400</small>		

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling Time, water loss, depth of weathering, etc., if significant) g
-41.2'	2		0-11.4' Gray (2.5YR 4/4) Clayey SILT	100 %		Penetration rate 0.4"/second
	4			100 %		
	6			100 %	S-1 6.8'-7.3'	Sand-20%, silt & clay-80% Moisture-9.8% Specific Gravity 2.61
	8			100 %		
	10			100 %		
	12		11.4'-12.1' Gray-white Medium to Course SAND		S-2 11-11.5'	Gravel-1%, Sand-88% silt & clay-11% Moisture-23.3% Specific Gravity 2.41
	14		12.1'-15' plus Gray 2.5YR 4/4 Clayey SILT	100 %		
	15					
			Bottom of Boring 15'	100 %		
				%		

SECTION C

Vibracore Photographs

Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-89a



DRV-89a

Run-1 - 1 foot recovery



Run -2 - 2 feet recovery



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-90a



Residual sample in bottom of casing
Run-2 actual recovery approximately 1 foot



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-91



Residual sample in bottom of casing
Sample hand to be spooned out of the bent casing



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-92



Run-2 recovery 2 feet



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

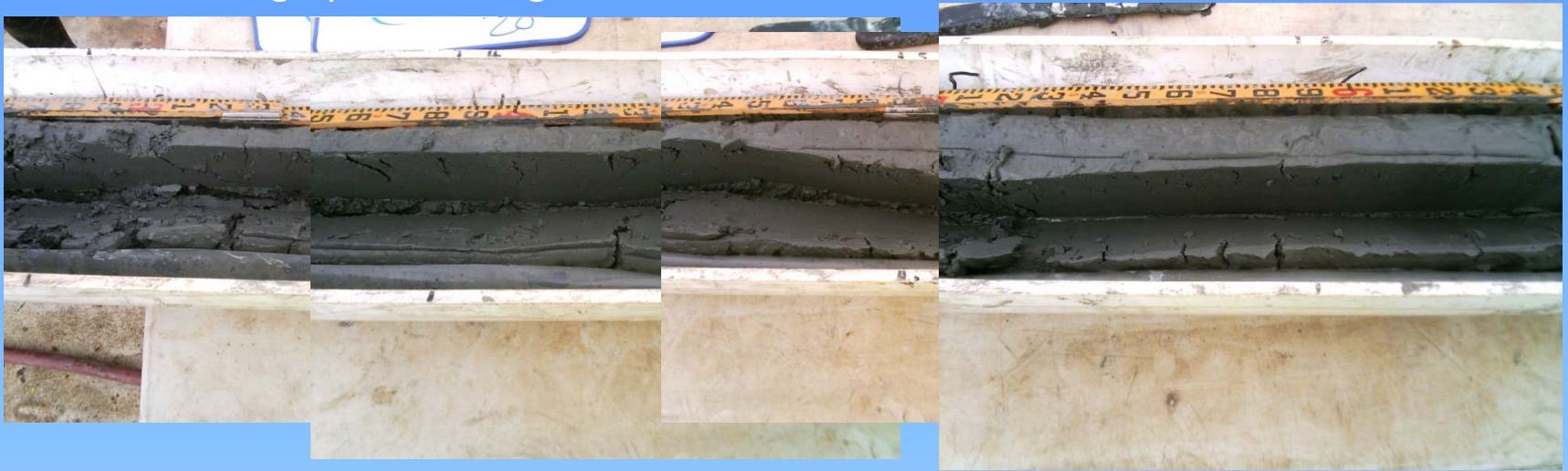
DRV-93



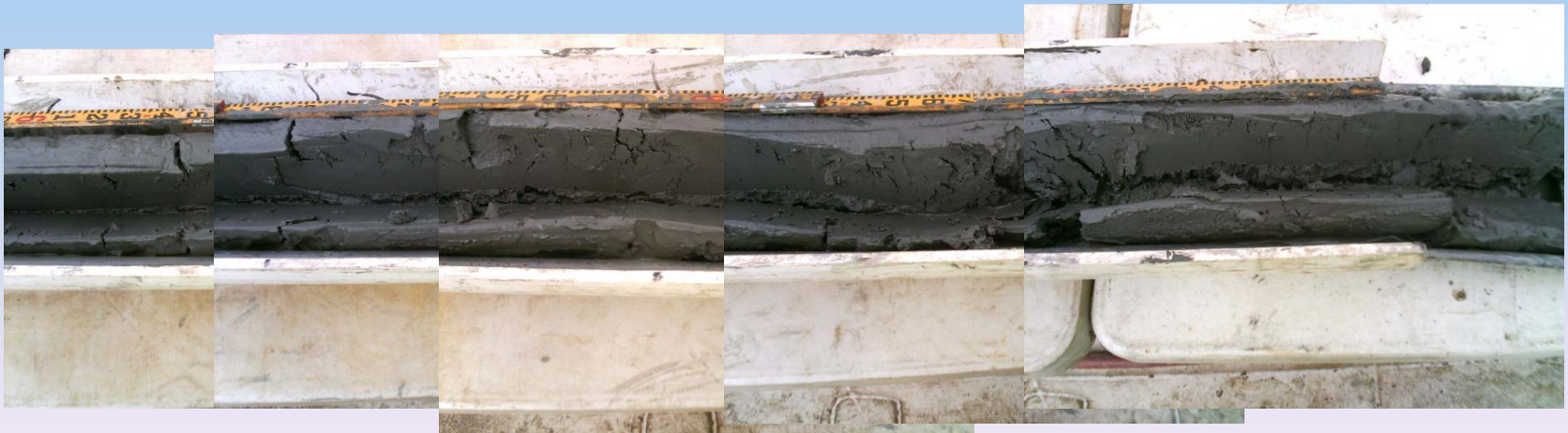
Recovery full penetration and complete
Recovery of sample. 20 feet.
Photographs showing 0 to 3 feet



DRV-93 Photographs showing 3 feet to 6 feet



DRV-93 Photographs showing 6 feet to 10 feet



DRV-93 Photographs showing 10 feet to 15 feet



DRV-93 Photographs showing 15 feet to 20 feet



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-94



Run-1 1.8 feet of recovery



Note: shape of vibracore barrel

Delaware Main Channel Deepening Project Geotechnical Sampling – Lower Reach B

DRV-95a

The photograph for this sample was
corrupted and unsalvageable

Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-96a



Run-1 2.0 feet of recovery



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-97



Run-1 2.6 feet of recovery



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-98



Run-1 2.0 feet of recovery

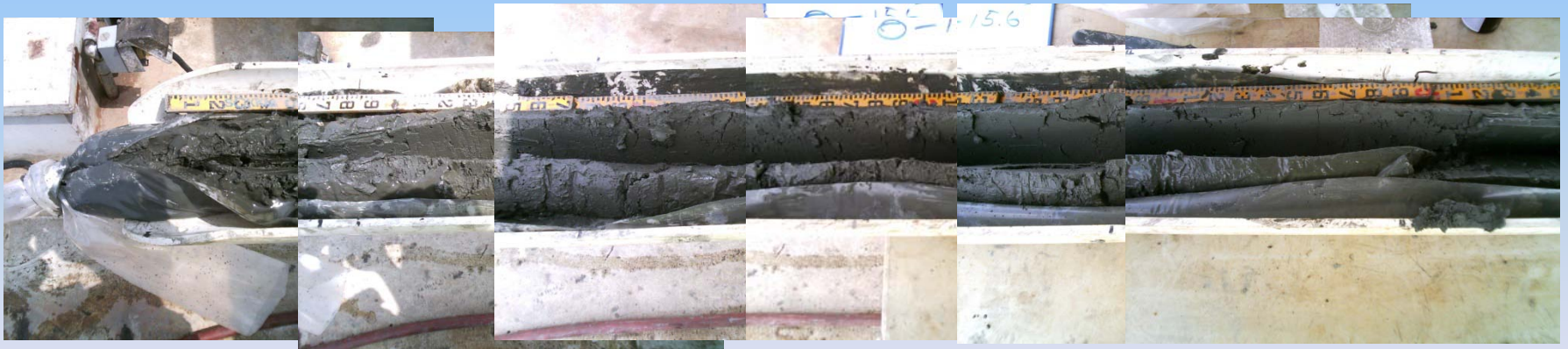


Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-99



Recovery of sample. 15.6 feet.
Photographs showing 0 to 5 feet



DRV-99 Photographs showing 5 feet to 10 feet

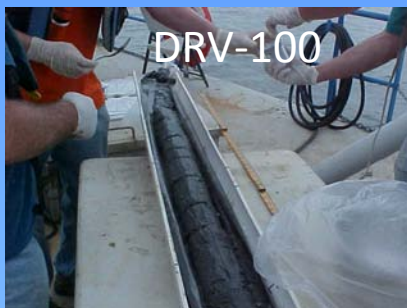


DRV-99 Photographs showing 10 feet to 15.6 feet



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-100



Recovery of sample. 15.0 feet.
Photographs showing 0 to 5 feet



DRV-100 Photographs showing 5 feet to 10 feet



DRV-100 Photographs showing 10 feet to 15.0 feet



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

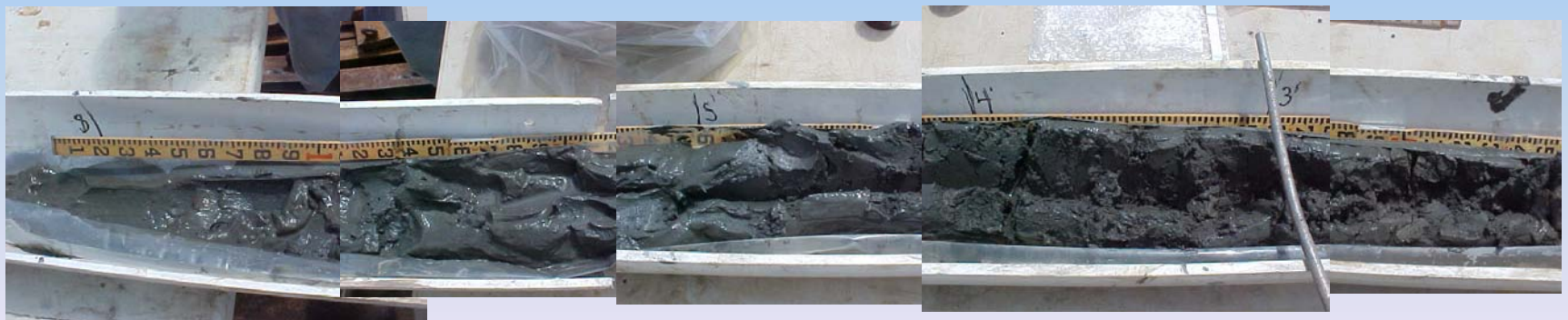
DRV-101



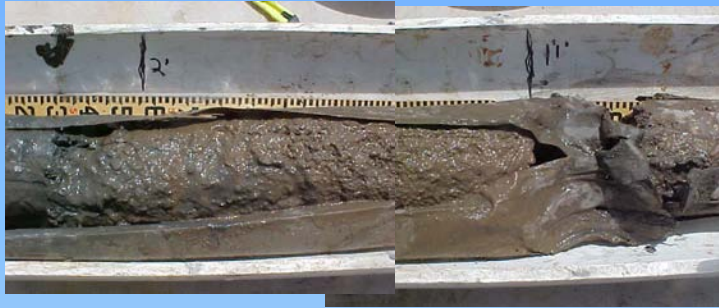
DRV-101

Penetration 10.6 feet

Recovery of sample. 7.6 feet.
Photographs showing 0 to 5 feet



DRV-101 Photographs showing 5 feet
to 7.6 feet
Core uncut



End of core
barrel shoe

DRV-101 Core cut open

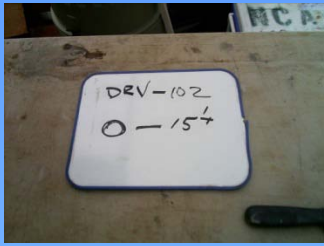


Sample removed and
placed in strata column



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-102



DRV-102

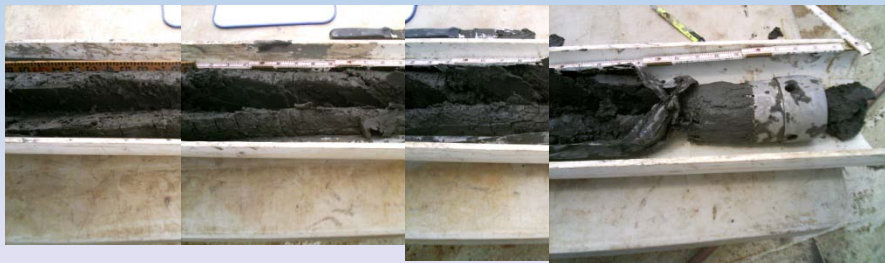
Recovery of sample. 15.0 feet.
Photographs showing 0 to 5 feet



DRV- 102 Photographs showing 5 feet to 10 feet

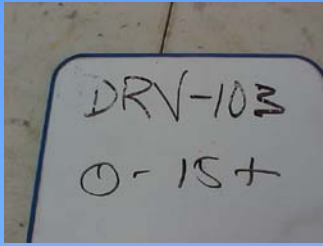


DRV -102 Photographs showing 10 feet to 15.0 feet



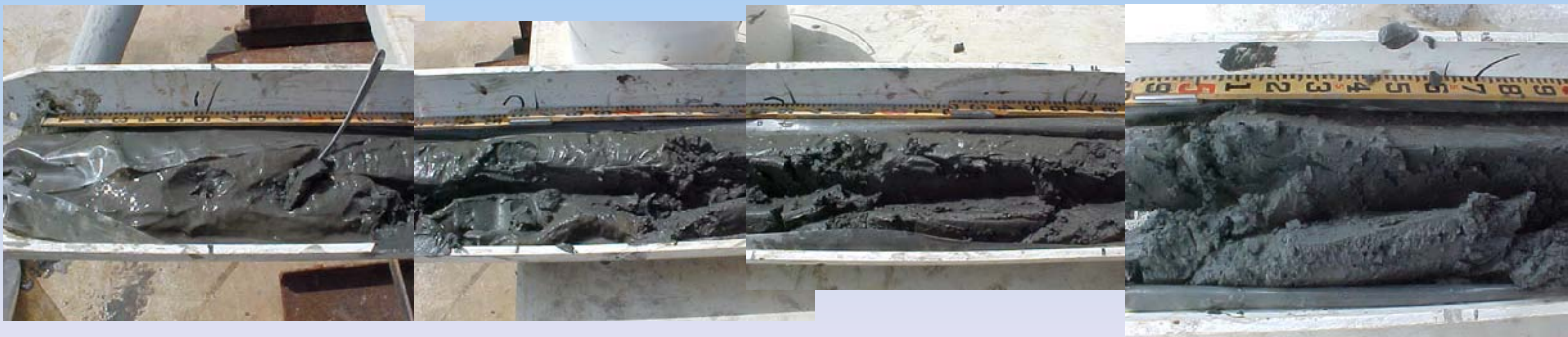
Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-103



DRV-103

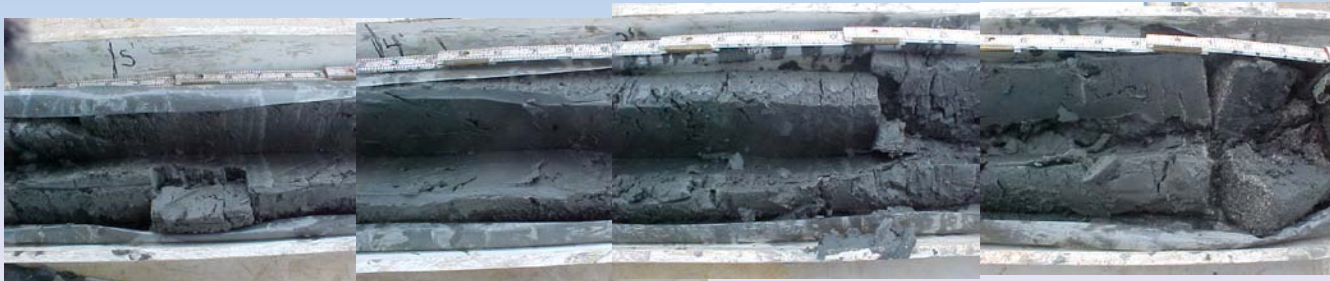
Recovery full penetration and complete
Recovery of sample. 15 feet.
Photographs showing 0 to 5 feet



DRV-103 Photographs showing 5 feet to 10 feet



DRV-103 Photographs showing 10 feet to 15 feet (incomplete sequence)



Enlargement of sand
Layer



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-104

DRV-104
0-12.8

DRV-104
12.8' penetration

Recovery full penetration and complete
Recovery of sample. 12 feet.
Photographs showing 0 to 5 feet



DRV-104 Photographs showing 5 feet to 10 feet



DRV-104 Photographs showing 10 feet to 12 feet



Intact sausage tube sample



Delaware Main Channel
Deepening Project
Geotechnical Sampling –
Lower Reach B

DRV-105



DRV-105

Recovery full penetration and complete
Recovery of sample. 15 feet.
Photographs showing 0 to 5 feet



DRV-105 Photographs showing 5 feet to 10 feet



DRV-105 Photographs showing 10 feet to 15 feet



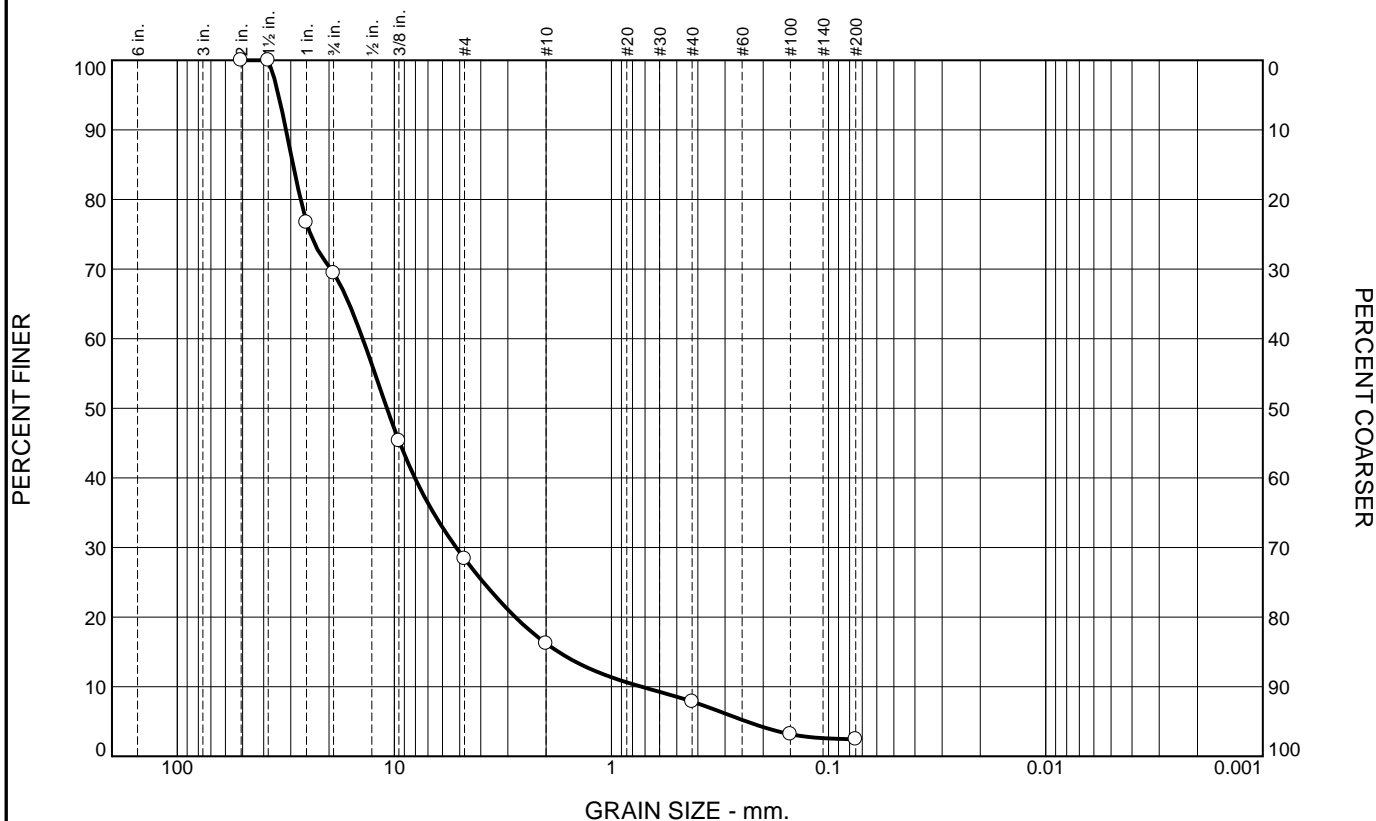
SECTION D

Sediment Laboratory Testing Results

SUMMARY OF LABORATORY DATA

BORING NUMBER	SAMPLE NUMBER	DEPTH (ft)	SOIL GROUP SYMBOL	GRAIN SIZE DISTRIBUTION			PLASTICITY				MOISTURE CONTENT w %	VOLUMETRIC				COMPACTION DATA			PERMEABILITY (E-6 CM/SEC)	FALLING/CONSTANT HEAD	CALIFORNIA BEARING RATIO (CBR) %	SHEAR STRENGTH			
				GRAVEL %	SAND %	SILT/CLAY %	LIQUID LIMIT w _l	PLASTIC LIMIT wp	PLASTICITY INDEX I _p	LIQUIDITY INDEX I _L		SPECIFIC GRAVITY (G)	DRY UNIT WEIGHT (pcf)	VOID RATIO (e)	DEGREE OF SATURATION %	MAXIMUM DRY DENSITY (psf)	OPTIMUM MOISTURE CONTENT %	STANDARD/MODIFIED				UNCONFINED COMPRESSIVE STRENGTH (tsf)	COHESION (tsf)	AXIAL STRAIN (%)	
DVR	89a	0-1.8'	GW	72	26	3					3.1	n/a													
DVR	90a	0-1'	GP	89	11	0					2.9	n/a													
DVR	95a	0-1'	GW	83	15	2					8.0	n/a													
DVR	96a	0-2'	GP	59	39	2					10.4	n/a													
DVR	94	0.5-1.5'	SP	46	52	2					7.8	2.56													
DVR	91	0-2'	ML	0	30	70					24.1	2.88													
DVR	92	3.3-4.0'	GP	54	42	4					11.8	2.66													
DVR	93	3.3-4.0'	ML	0	1	99					4.2	2.59													
DVR	97	2.4-2.6'	SP	34	62	4					12.8	2.67													
DVR	98a	1.0-2.0'	SM-ML	20	43	37					13.8	2.65													
DVR	99	2.2-2.6'	SM-ML	0	26	74					24.5	2.53													
DVR	100	5.5-6.0'	CL	0	4	96					9.6	2.54													
DVR	101	S-1 4.3-5.4	CL	0	6	94					13.2	2.65													
DVR	101	S-2 5.5-6.5	ML	2	45	53					21.4	2.67													
DVR	102	6.8-7.0'	CL	0	5	95					26.3	2.39													
DVR	103	6.8-7.0'	ML	0	19	81					27.0	2.61													
DVR	104	5.8-6.6'	ML	0	6	94					32.2	2.65													
DVR	105	S-1 6.8-7.3	ML	0	20	80					9.8	2.61													
DVR	105	S-2 11-11.5	SC	1	88	11					23.3	2.41													
PENNONI ASSOCIATES INC.				DRAWN BY: RJR		DATE: 8/16/2010		PROJECT: AEON GEOSCIENCE LAB TESTS				JOB No.: AEON-1001				TABLE No.: L 1									
				CHECKED BY:		DATE: 8/16/2010		LOCATION: 10-1013																	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	30.6	41.0	12.2	8.3	5.4	2.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	76.7		
.75"	69.4		
.375"	45.3		
#4	28.4		
#10	16.2		
#40	7.9		
#100	3.2		
#200	2.5		

* (no specification provided)

Soil Description		
<p>PL= Atterberg Limits PI=</p> <p>LL=</p> <p>Coefficients</p> <p>D₉₀= 31.5338 D₈₅= 29.2734 D₆₀= 13.9893</p> <p>D₅₀= 10.8171 D₃₀= 5.1839 D₁₅= 1.7532</p> <p>D₁₀= 0.7264 C_u= 19.26 C_c= 2.64</p> <p>Classification</p> <p>USCS= GW AASHTO=</p> <p>Remarks</p>		

Source of Sample: DVR
Sample Number: 89a (1.0-1.8') ASTM 2487 GW Brown Sandy Well graded Gravel

Date: 8/16/10

PENNONI ASSOCIATES INC.

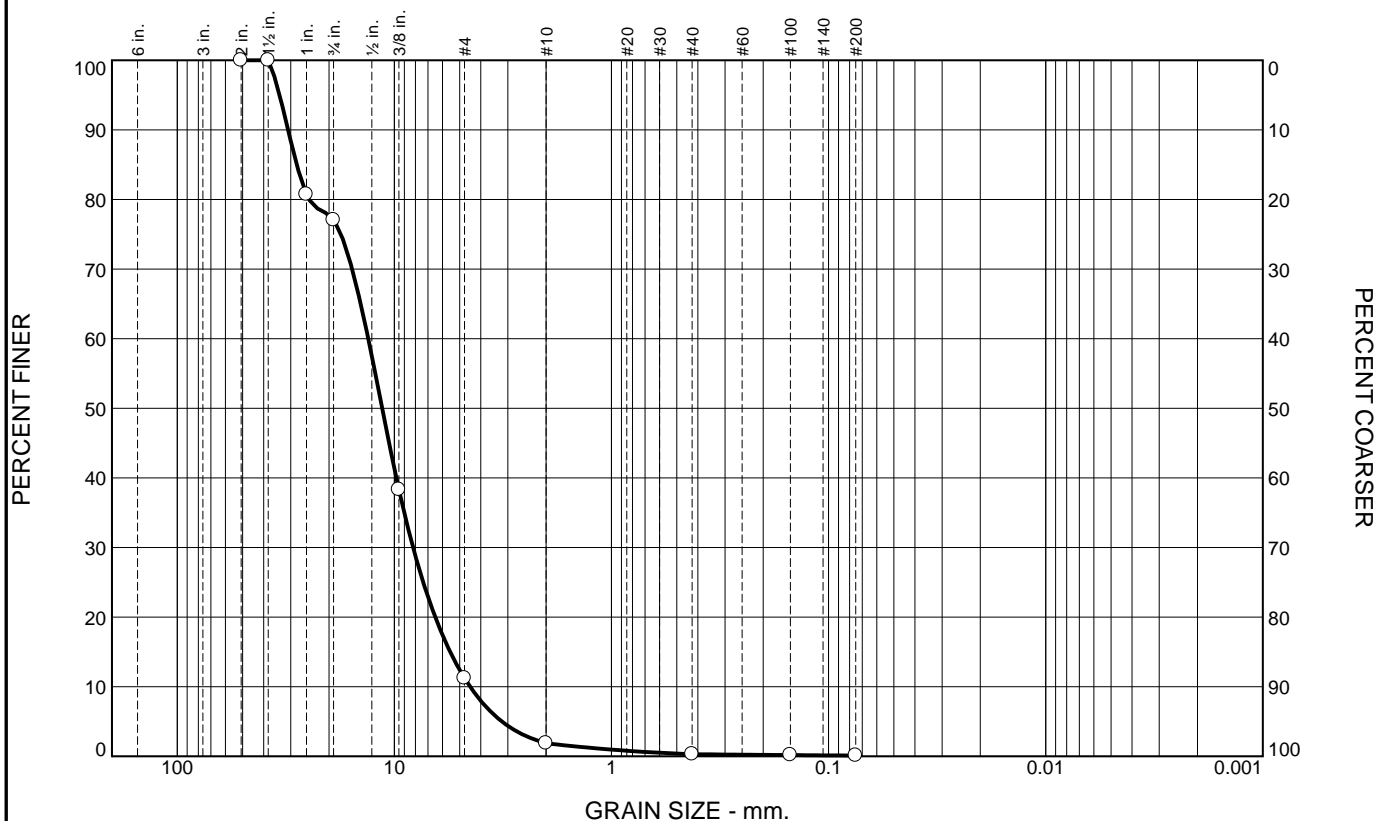
Bethlehem, PA

Client: AEON Geoscience, Inc.
Project: 10-1013

Project No: AEON-1001

Figure 85688-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	23.0	65.8	9.3	1.6	0.2	0.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	80.7		
.75"	77.0		
.375"	38.3		
#4	11.2		
#10	1.9		
#40	0.3		
#100	0.2		
#200	0.1		

Soil Description		
Atterberg Limits PL= LL= PI=		
Coefficients D ₉₀ = 30.8556 D ₈₅ = 28.1681 D ₆₀ = 13.1923 D ₅₀ = 11.3768 D ₃₀ = 8.1988 D ₁₅ = 5.5325 D ₁₀ = 4.4756 C _u = 2.95 C _c = 1.14		
Classification USCS= GP AASHTO=		
Remarks		

* (no specification provided)

Source of Sample: DVR
 Sample Number: 90a (0-1.0') ASTM 2487 GP Multi-Colored Poorly graded Gravel

Date: 8/16/10

PENNONI ASSOCIATES INC.

Client: AEON Geoscience, Inc.
 Project: 10-1013

Bethlehem, PA

Project No: AEON-1001

Figure 85688-2

PERCENT FINER

PERCENT COARSER

GRAIN SIZE - mm.

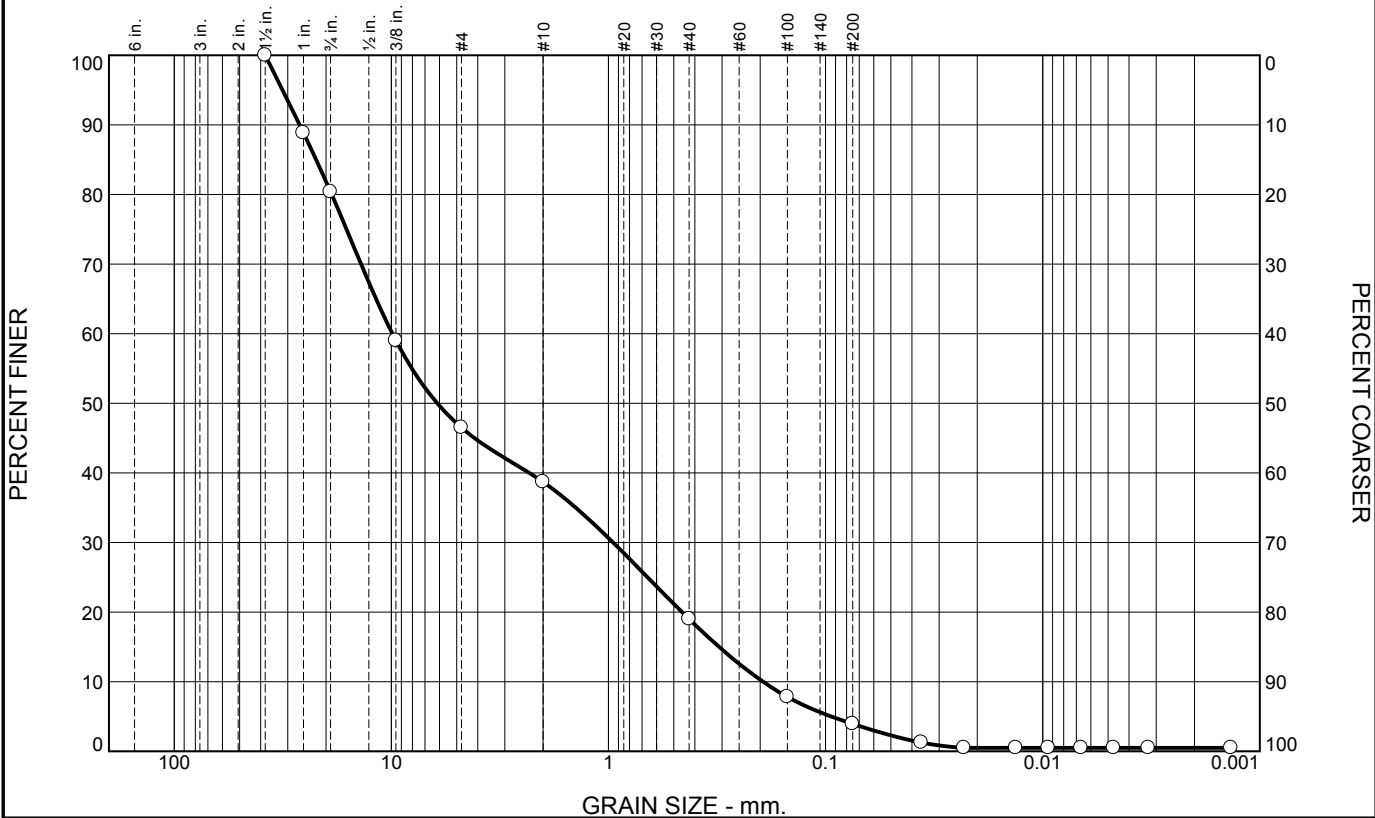
Grain Size (mm)	Percent Finer (%)	Percent Coarser (%)
100	100	0
10	100	0
1	100	0
0.85	100	0
0.75	100	0
0.6	100	0
0.425	100	0
0.3	100	0
0.25	100	0
0.2	100	0
0.15	100	0
0.106	90	10
0.075	71	29
0.05	45	55
0.0375	33	67
0.025	1	99
0.018	1	99
0.015	0	100
0.0125	0	100
0.0106	0	100
0.0085	0	100
0.0075	0	100
0.006	0	100
0.00425	0	100
0.003	0	100
0.0025	0	100
0.002	0	100
0.0015	0	100
0.00106	0	100
0.00075	0	100
0.0005	0	100
0.000425	0	100
0.0003	0	100
0.00025	0	100
0.0002	0	100
0.00015	0	100
0.000106	0	100
0.000085	0	100
0.000075	0	100
0.00006	0	100
0.0000425	0	100
0.00003	0	100
0.000025	0	100
0.00002	0	100
0.000015	0	100
0.0000106	0	100
0.0000085	0	100
0.0000075	0	100
0.000006	0	100
0.00000425	0	100
0.000003	0	100
0.0000025	0	100
0.000002	0	100
0.0000015	0	100
0.00000106	0	100
0.00000085	0	100
0.00000075	0	100
0.0000006	0	100
0.000000425	0	100
0.0000003	0	100
0.00000025	0	100
0.0000002	0	100
0.00000015	0	100
0.000000106	0	100
0.000000085	0	100
0.000000075	0	100
0.00000006	0	100
0.0000000425	0	100
0.00000003	0	100
0.000000025	0	100
0.00000002	0	100
0.000000015	0	100
0.0000000106	0	100
0.0000000085	0	100
0.0000000075	0	100
0.000000006	0	100
0.00000000425	0	100
0.000000003	0	100
0.0000000025	0	100
0.000000002	0	100
0.0000000015	0	100
0.00000000106	0	100
0.00000000085	0	100
0.00000000075	0	100
0.0000000006	0	100
0.000000000425	0	100
0.0000000003	0	100
0.00000000025	0	100
0.0000000002	0	100
0.00000000015	0	100
0.000000000106	0	100
0.000000000085	0	100
0.000000000075	0	100
0.00000000006	0	100
0.0000000000425	0	100
0.00000000003	0	100
0.000000000025	0	100
0.00000000002	0	100
0.000000000015	0	100
0.0000000000106	0	100
0.0000000000085	0	100
0.0000000000075	0	100
0.		

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.5		
#100	89.2		
#200	70.4		
0.0299 mm.	44.5		
0.0197 mm.	32.7		
0.0125 mm.	1.3		
0.0088 mm.	1.3		
0.0063 mm.	0.3		
0.0044 mm.	0.3		
0.0031 mm.	0.3		
0.0013 mm.	0.3		

<u>Soil Description</u>		
<u>Atterberg Limits</u>		
PL=	LL=	PI=
<u>Coefficients</u>		
D ₉₀ = 0.1566	D ₈₅ = 0.1245	D ₆₀ = 0.0544
D ₅₀ = 0.0386	D ₃₀ = 0.0189	D ₁₅ = 0.0156
D ₁₀ = 0.0146	C _u = 3.73	C _c = 0.45
<u>Classification</u>		
USCS= ML	AASHTO=	
<u>Remarks</u>		

Figure 85687-2

Du h WY G n Y 8 j g h j Vi h c b F Y d c f h



i ' ž ' ~	i ' ; fUjY		i ' GUbX			i ' ; jbYg	
	7cUfgY	: jbY	7cUfgY	AYXji a	: jbY	Gj'h	7`Um
202	3; 8	550	90	3; 9	3702	507	207

G-9 J9	D9F79BH	GD97 '4	D5 GG3
G-N9	: -B9F	D9F79BH	fL1BCŁ
307\$	32202		
3\$: : 0		
07\$: 206		
097\$	7; 02		
%6	6807		
%02	5: 09		
%62	3; 02		
%022	90		
%422	602		
202584% 0 0	305		
202452% 0 0	207		
202355% 0 0	207		
2022; 6% 0 0	207		
202288% 0 0	207		
202269% 0 0	207		
202255% 0 0	207		
202236% 0 0	207		

Gc j ' 8 YgW j d h c b

PL= 5 H h f V Y f [' @ a] h g LL= PI=

7 c Y Z W Y b h g

D90= 4806849 D85= 4404383 D60= : 0 ; 42

D50= 8064: D30= 20 73; D15= 2052; 3

D10= 208; 5; C u = 73023 C c = 2069

7 ' U g g j Z W h c b

USCS= I R AASHTO=

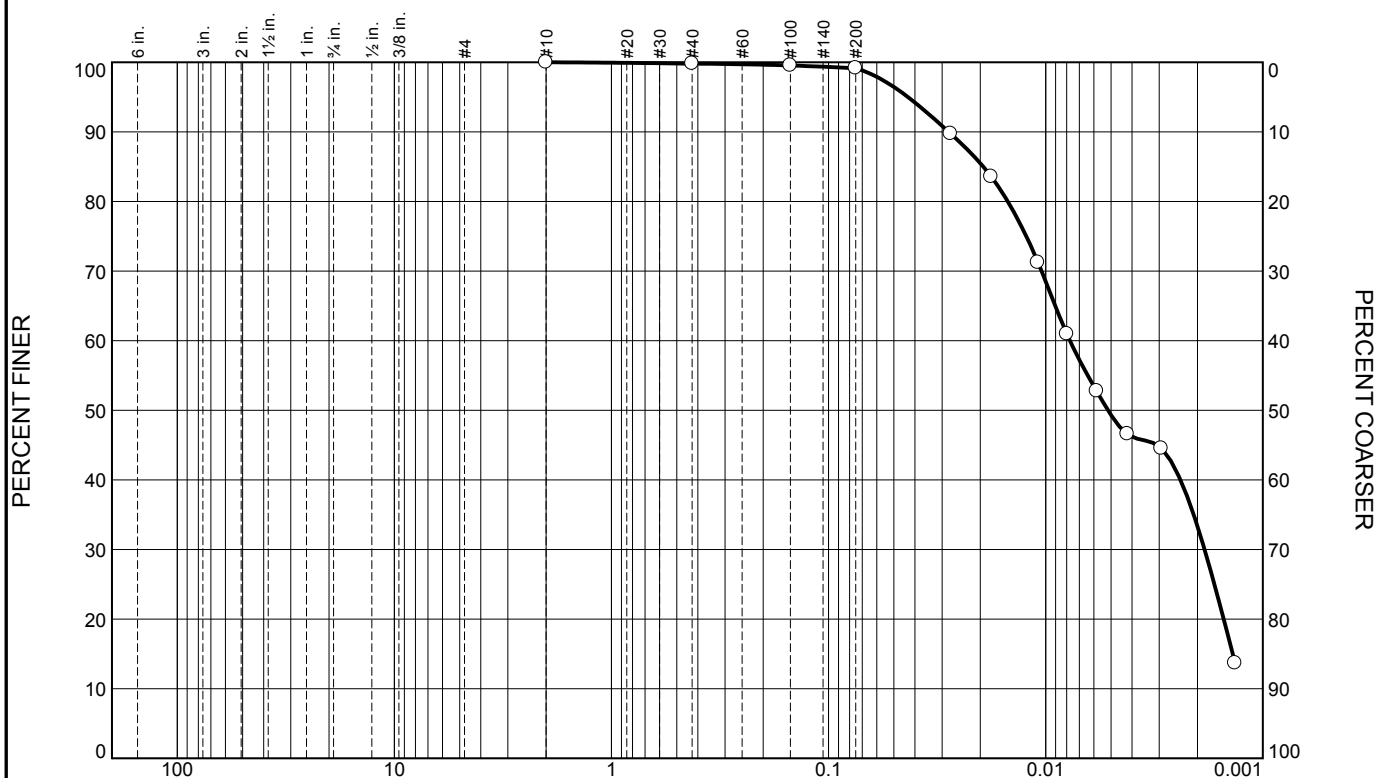
F Y a U _ g

* p q ' i r g e k h e c v k p ' r t q x k f g f +

G c i f W ' c Z G U a d ' Y . F X T
G U a d ' Y B i a V Y f . ; 4 ' * 5 (5 / 6 0) - # C U V O ' 4 6 : 9 ' I R ' I t c { / D t q y p ' U c p f { ' R q q t n { ' i t c f g f ' I t c x g n i 8 U H . ' , # % # \$

D9BBCB=5 GGC7 5 H9 G =B7 "	7 ' J Y b h C G Q P ' I g u e l g p e g . ' k p e 0 D f c ' Y W h 32/3235
6 Y h ' Y l Y a Z D 5	D f c ' Y W i B c . C G Q P / 3223 : j i f Y : 78: 8/3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.2	0.7	49.8	49.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.8		
#100	99.5		
#200	99.1		
0.0274 mm.	89.7		
0.0178 mm.	83.6		
0.0108 mm.	71.2		
0.0080 mm.	61.0		
0.0058 mm.	52.7		
0.0042 mm.	46.6		
0.0029 mm.	44.5		
0.0013 mm.	13.7		

* (no specification provided)

Soil Description		
<p>PL= Atterberg Limits PI=</p> <p>LL=</p> <p>Coefficients</p> <p>D₉₀= 0.0280 D₈₅= 0.0194 D₆₀= 0.0077</p> <p>D₅₀= 0.0052 D₃₀= 0.0019 D₁₅= 0.0014</p> <p>D₁₀= C_u= C_c=</p> <p>USCS= ML Classification AASHTO=</p> <p>Remarks</p>		

Source of Sample: DVR
Sample Number: 93 (3.3-4.0') ASTM 2488 ML Gray Clayey Silt

Date: 8/16/110

PENNONI ASSOCIATES INC.

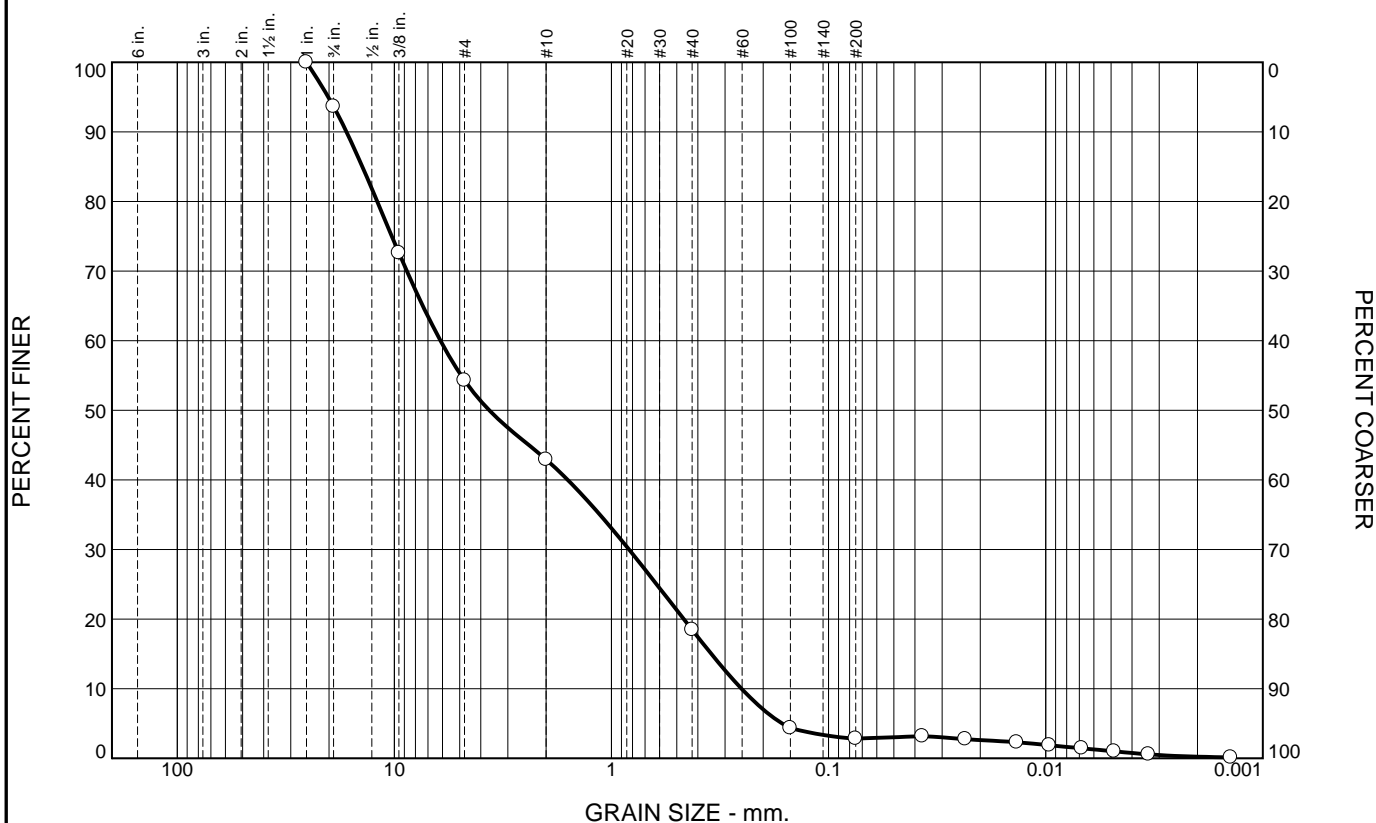
Client: AEON Geoscience, Inc.
Project: 10-1013

Bethlehem, PA

Project No: AEON-1001

Figure 85686-2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.3	39.4	11.4	24.4	15.7	1.7	1.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	93.7		
.375"	72.6		
#4	54.3		
#10	42.9		
#40	18.5		
#100	4.4		
#200	2.8		
0.0370 mm.	3.2		
0.0234 mm.	2.8		
0.0136 mm.	2.3		
0.0096 mm.	1.9		
0.0068 mm.	1.4		
0.0048 mm.	1.0		
0.0034 mm.	0.6		
0.0014 mm.	0.1		

* (no specification provided)

Soil Description		
<p>PL= Atterberg Limits PI=</p> <p>LL=</p> <p>Coefficients</p> <p>D₉₀= 16.6096 D₈₅= 14.0420 D₆₀= 6.1328</p> <p>D₅₀= 3.6529 D₃₀= 0.8300 D₁₅= 0.3466</p> <p>D₁₀= 0.2516 C_u= 24.38 C_c= 0.45</p> <p>Classification</p> <p>USCS= SP AASHTO=</p> <p>Remarks</p>		

Source of Sample: DVR

Sample Number: 94 (0.5-1.5') ASTN 2487 SP Brownish Multi-Colored Gravelly Poorly graded Sand

Date: 8/16/10

PENNONI ASSOCIATES INC.

Bethlehem, PA

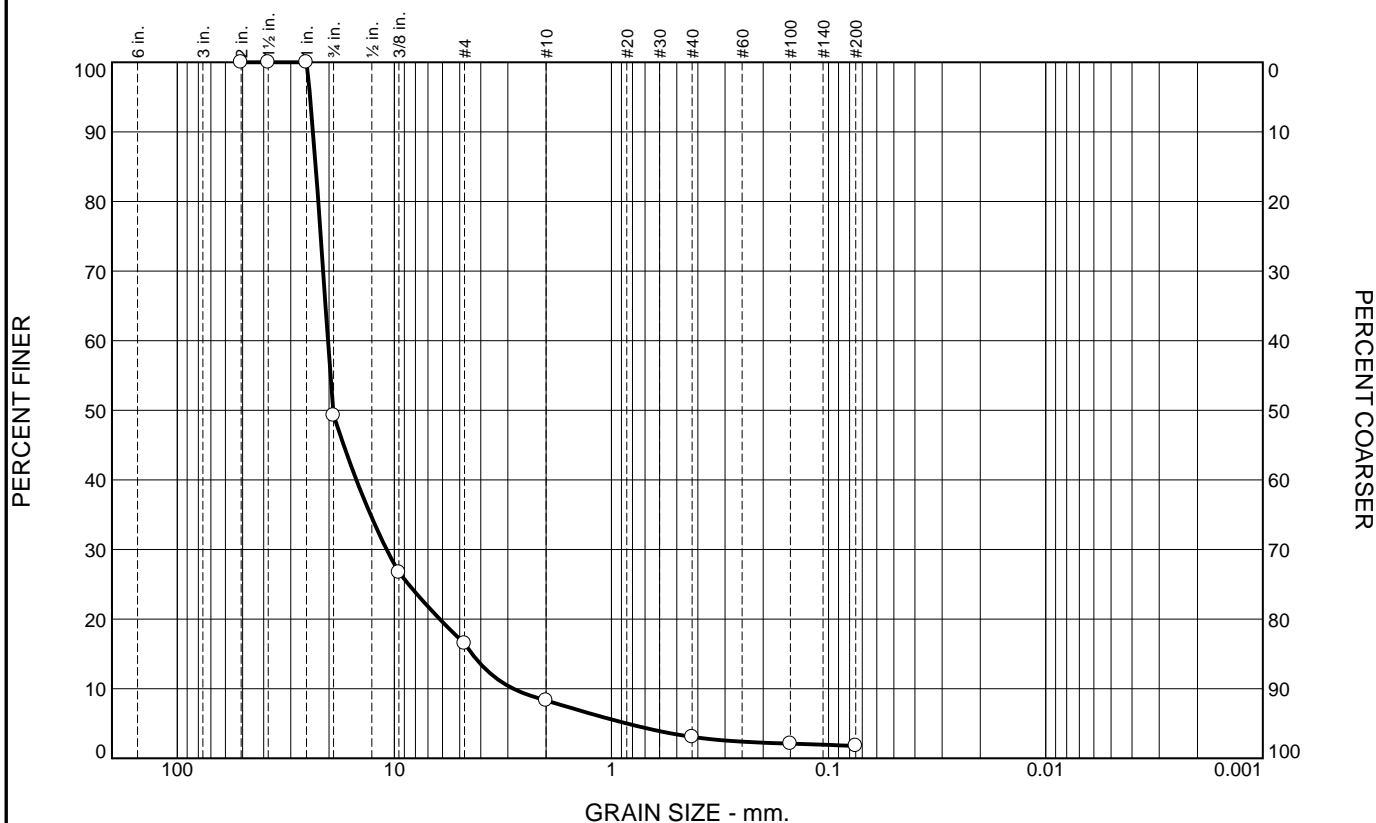
Client: AEON Geoscience, Inc.

Project: 10-1013

Project No: AEON-1001

Figure 85687-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	50.7	32.8	8.2	5.2	1.3		1.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	100.0		
.75"	49.3		
.375"	26.7		
#4	16.5		
#10	8.3		
#40	3.1		
#100	2.1		
#200	1.8		

* (no specification provided)

Soil Description
 1. Jar was broken in shipment.

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 23.6777 D₈₅= 23.0113 D₆₀= 20.2288
 D₅₀= 19.1326 D₃₀= 10.8485 D₁₅= 4.3836
 D₁₀= 2.8257 C_u= 7.16 C_c= 2.06

Classification
 USCS= GW AASHTO=

Remarks

Source of Sample: DVR

Sample Number: 95a (0-1.0') ASTM 2487 GW Dark Multi-Colored Sandy Well Graded Gravel

Date: 8/16/10

PENNONI ASSOCIATES INC.

Bethlehem, PA

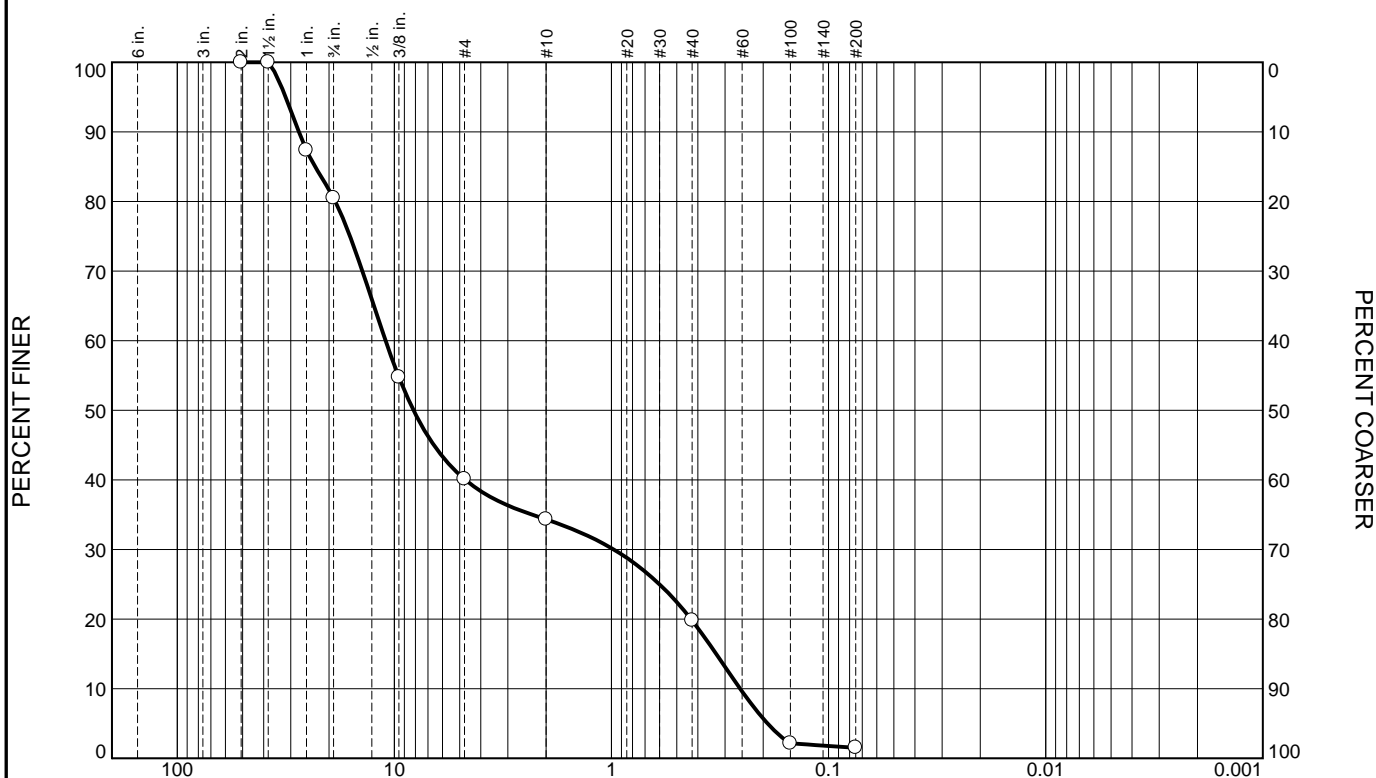
Client: AEON Geoscience, Inc.

Project: 10-1013

Project No: AEON-1001

Figure 85688-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	19.5	40.4	5.8	14.5	18.3		1.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100.0		
1.5"	100.0		
1"	87.4		
.75"	80.5		
.375"	54.8		
#4	40.1		
#10	34.3		
#40	19.8		
#100	2.2		
#200	1.5		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 27.5421 D₈₅= 23.1886 D₆₀= 10.9726
 D₅₀= 8.1584 D₃₀= 0.9755 D₁₅= 0.3293
 D₁₀= 0.2552 C_u= 43.00 C_c= 0.34

Classification
 USCS= GP AASHTO=

Remarks

Source of Sample: DVR
 Sample Number: 96a (0-2.0') ASTM 2487 GP Gray-Brown Poorly graded Gravel

Date: 8/16/10

PENNONI ASSOCIATES INC.

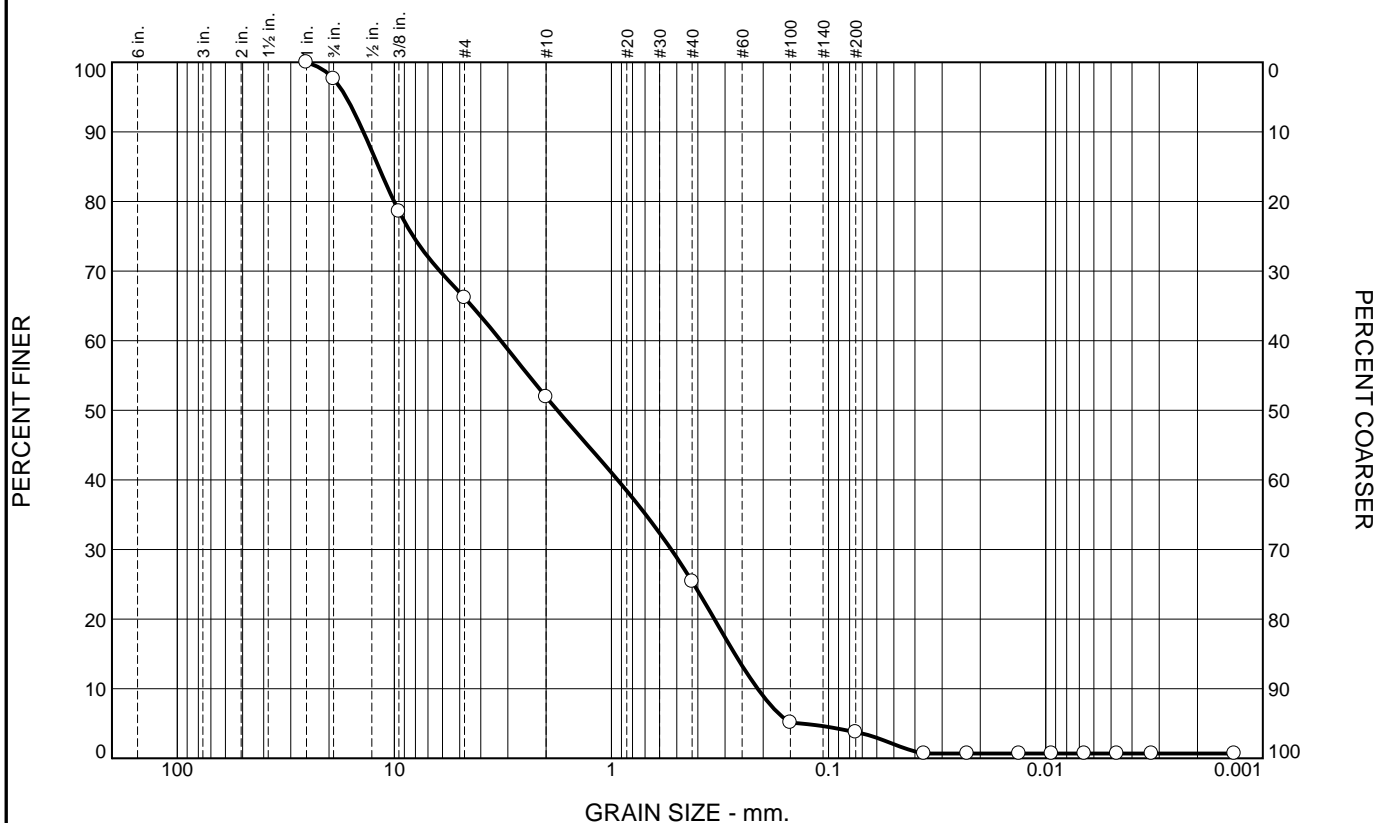
Bethlehem, PA

Client: AEON Geoscience, Inc.
 Project: 10-1013

Project No: AEON-1001

Figure 85688-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.4	31.4	14.3	26.5	21.7	3.0	0.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	97.6		
.375"	78.6		
#4	66.2		
#10	51.9		
#40	25.4		
#100	5.1		
#200	3.7		
0.0363 mm.	0.7		
0.0230 mm.	0.7		
0.0133 mm.	0.7		
0.0094 mm.	0.7		
0.0066 mm.	0.7		
0.0047 mm.	0.7		
0.0032 mm.	0.7		
0.0014 mm.	0.7		

* (no specification provided)

Soil Description		
<p>PL= Atterberg Limits PI=</p> <p>LL=</p> <p>Coefficients</p> <p>D₉₀= 13.8862 D₈₅= 11.8289 D₆₀= 3.2317</p> <p>D₅₀= 1.7751 D₃₀= 0.5304 D₁₅= 0.2701</p> <p>D₁₀= 0.2122 C_u= 15.23 C_c= 0.41</p> <p>USCS= SP Classification AASHTO=</p> <p>Remarks</p>		

Source of Sample: DVR

Sample Number: 97 (2.4-2.6') ASTM 2487 SP Dark Gray Gravelly poorly graded Sand

Date: 8/16/10

PENNONI ASSOCIATES INC.

Bethlehem, PA

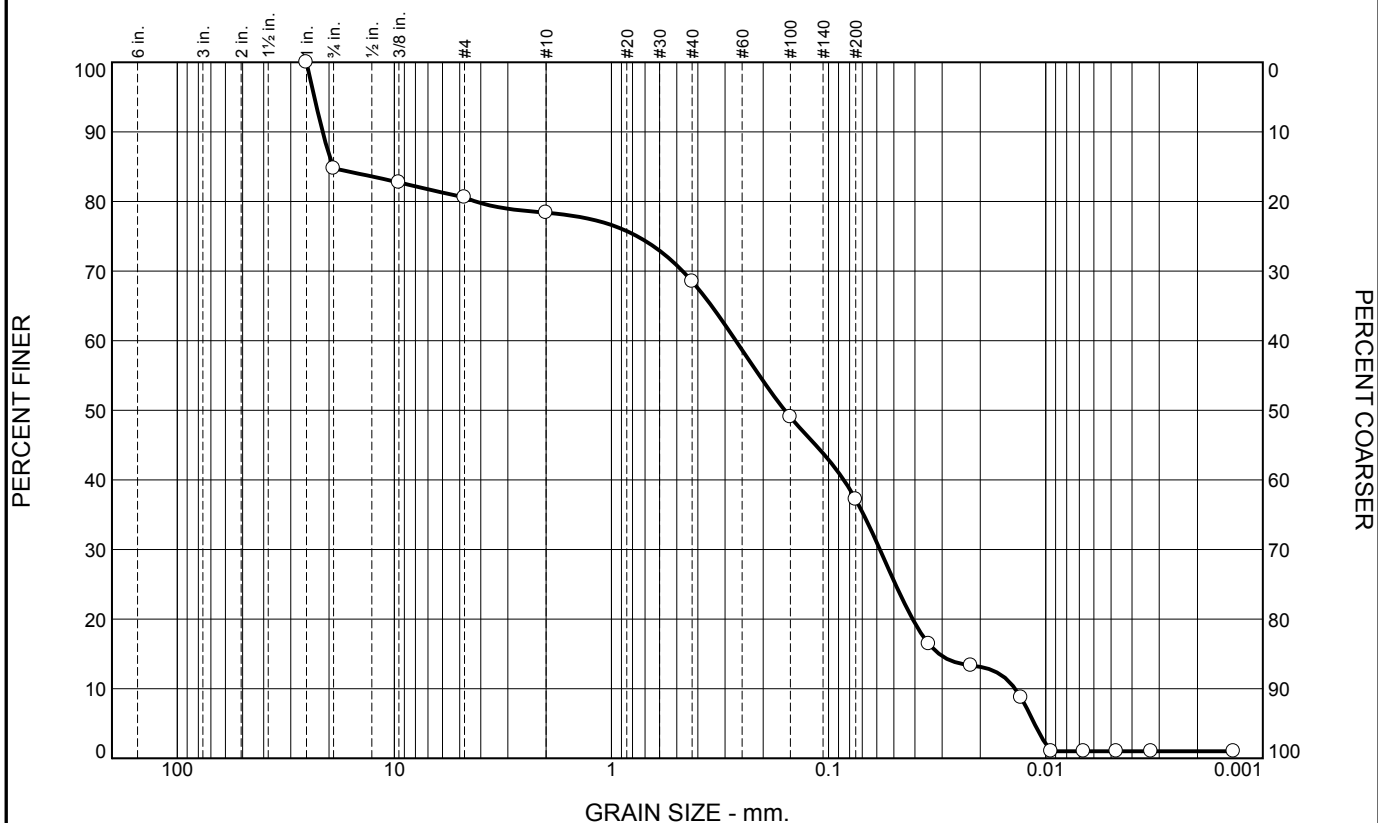
Client: AEON Geoscience, Inc.

Project: 10-1013

Project No: AEON-1001

Figure 85686-3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.2	4.2	2.2	9.9	31.3	36.2	1.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
.75"	84.8		
.375"	82.7		
#4	80.6		
#10	78.4		
#40	68.5		
#100	49.0		
#200	37.2		
0.0345 mm.	16.4		
0.0221 mm.	13.4		
0.0130 mm.	8.7		
0.0094 mm.	1.0		
0.0067 mm.	1.0		
0.0047 mm.	1.0		
0.0033 mm.	1.0		
0.0014 mm.	1.0		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 21.3909 D₈₅= 19.1752 D₆₀= 0.2673
 D₅₀= 0.1590 D₃₀= 0.0580 D₁₅= 0.0310
 D₁₀= 0.0138 C_u= 19.35 C_c= 0.91

Classification
 USCS= SM-ML AASHTO=

Remarks

Source of Sample: DVR
 Sample Number: 98a (1.0-2.0') ASTM 2488 SM-ML Brown Sandy Silt

Date: 8/16/10

PENNONI ASSOCIATES INC.

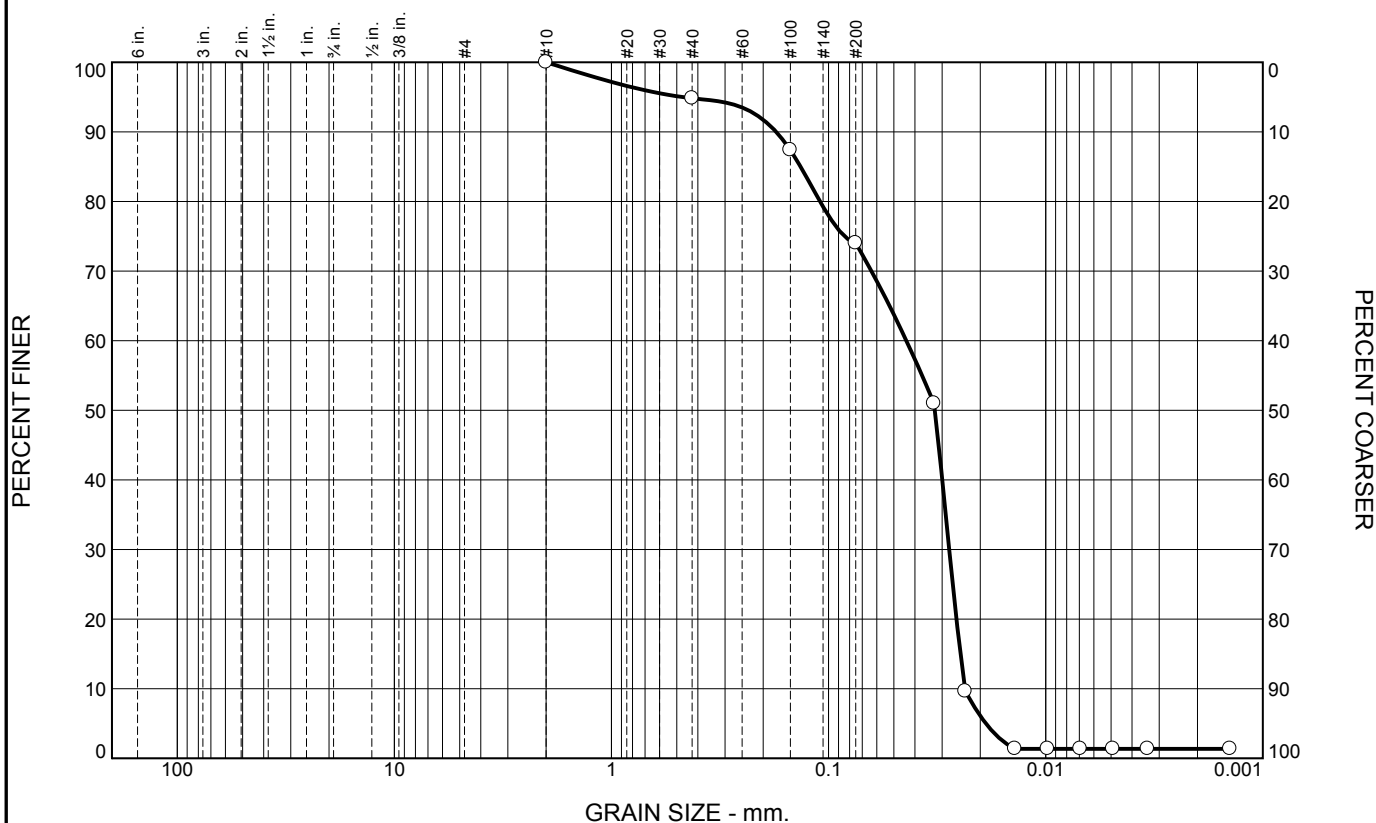
Client: AEON Geoscience, Inc.
 Project: 10-1013

Bethlehem, PA

Project No: AEON-1001

Figure 85686-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	5.2	20.8	72.6	1.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	94.8		
#100	87.4		
#200	74.0		
0.0327 mm.	51.0		
0.0234 mm.	9.6		
0.0138 mm.	1.4		
0.0098 mm.	1.4		
0.0069 mm.	1.4		
0.0049 mm.	1.4		
0.0034 mm.	1.4		
0.0014 mm.	1.4		

Soil Description		
Atterberg Limits PL= LL= PI=		
Coefficients D ₉₀ = 0.1742 D ₈₅ = 0.1346 D ₆₀ = 0.0438 D ₅₀ = 0.0324 D ₃₀ = 0.0278 D ₁₅ = 0.0247 D ₁₀ = 0.0235 C _u = 1.86 C _c = 0.75		
Classification USCS= SM-ML AASHTO=		
Remarks		

* (no specification provided)

Source of Sample: DVR
 Sample Number: 99 (2.0-2.6') ASTM 2488 SM-ML Gray Snady Silt

Date: 8/16/10

PENNONI ASSOCIATES INC.

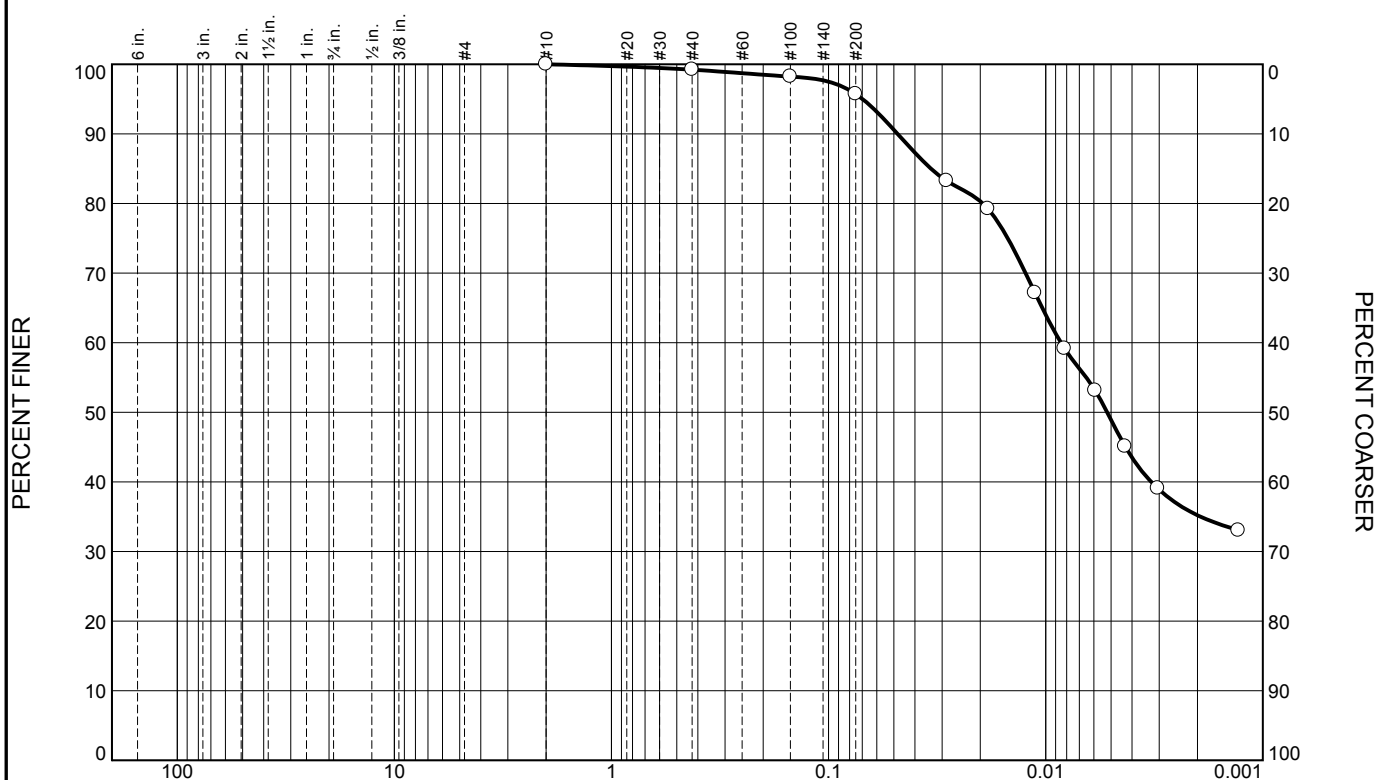
Client: AEON Geoscience, Inc.
 Project: 10-1013

Bethlehem, PA

Project No: AEON-1001

Figure 85686-5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.8	3.5	46.8	48.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.2		
#100	98.2		
#200	95.7		
0.0286 mm.	83.2		
0.0184 mm.	79.2		
0.0112 mm.	67.2		
0.0082 mm.	59.2		
0.0059 mm.	53.1		
0.0043 mm.	45.1		
0.0030 mm.	39.1		
0.0013 mm.	33.0		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 0.0481 D₈₅= 0.0337 D₆₀= 0.0085
 D₅₀= 0.0052 D₃₀= D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= CL AASHTO=

Remarks

Source of Sample: DVR
 Sample Number: 100 (5.5-6.0') ASTM 2488 CL Gray Silty Clay

Date: 8/16/10

PENNONI ASSOCIATES INC.

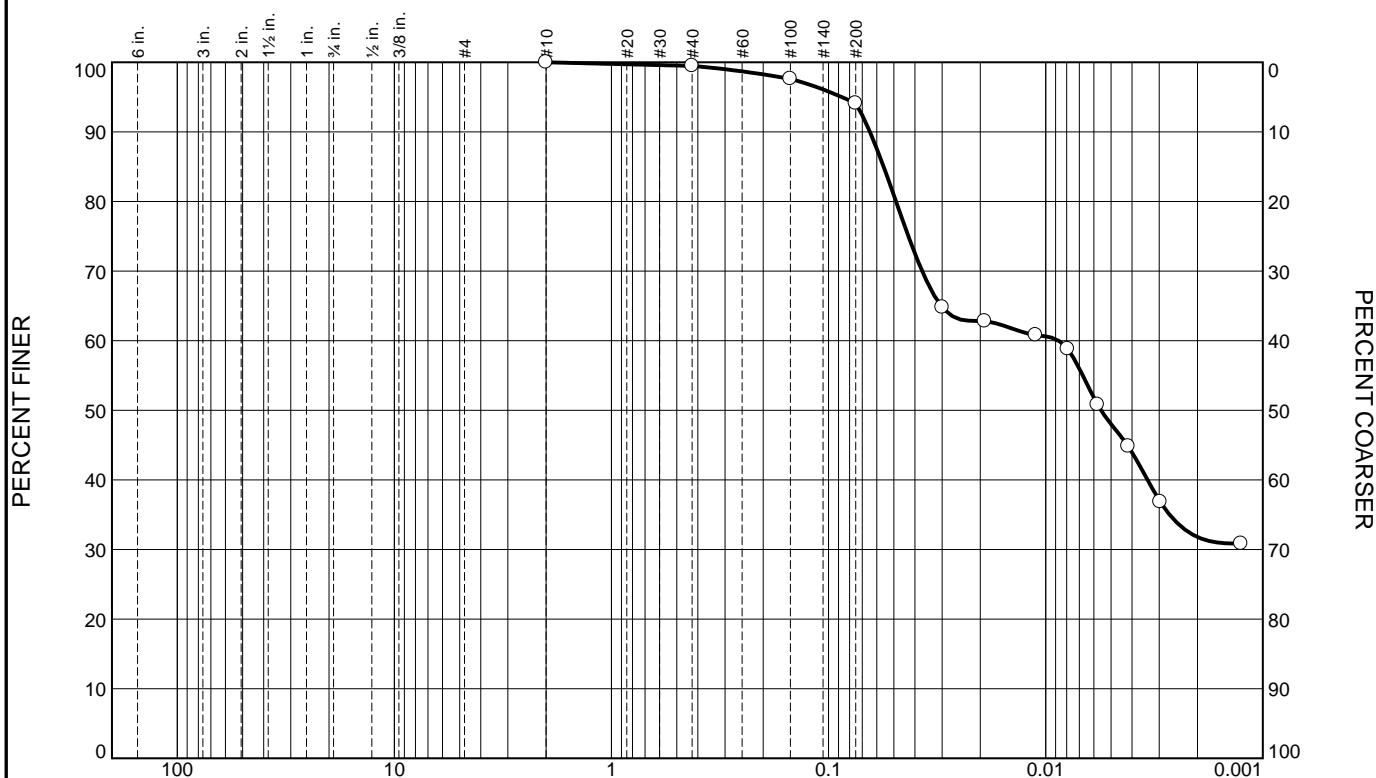
Bethlehem, PA

Client: AEON Geoscience, Inc.
 Project: 10-1013

Project No: AEON-1001

Figure 85685-1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.5	5.4	46.1	48.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	99.5		
#100	97.6		
#200	94.1		
0.0299 mm.	64.8		
0.0191 mm.	62.8		
0.0111 mm.	60.8		
0.0079 mm.	58.8		
0.0058 mm.	50.8		
0.0042 mm.	44.8		
0.0030 mm.	36.8		
0.0013 mm.	30.9		

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 0.0645 D₈₅= 0.0558 D₆₀= 0.0087
 D₅₀= 0.0056 D₃₀= D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= ~~AS~~ AASHTO=

Remarks

* (no specification provided)

Source of Sample: DVR
 Sample Number: 101 S-1 (4.3-5.4') ASTM 2488 CL Gray Silty Clay

Date: 8/16/10

PENNONI ASSOCIATES INC.

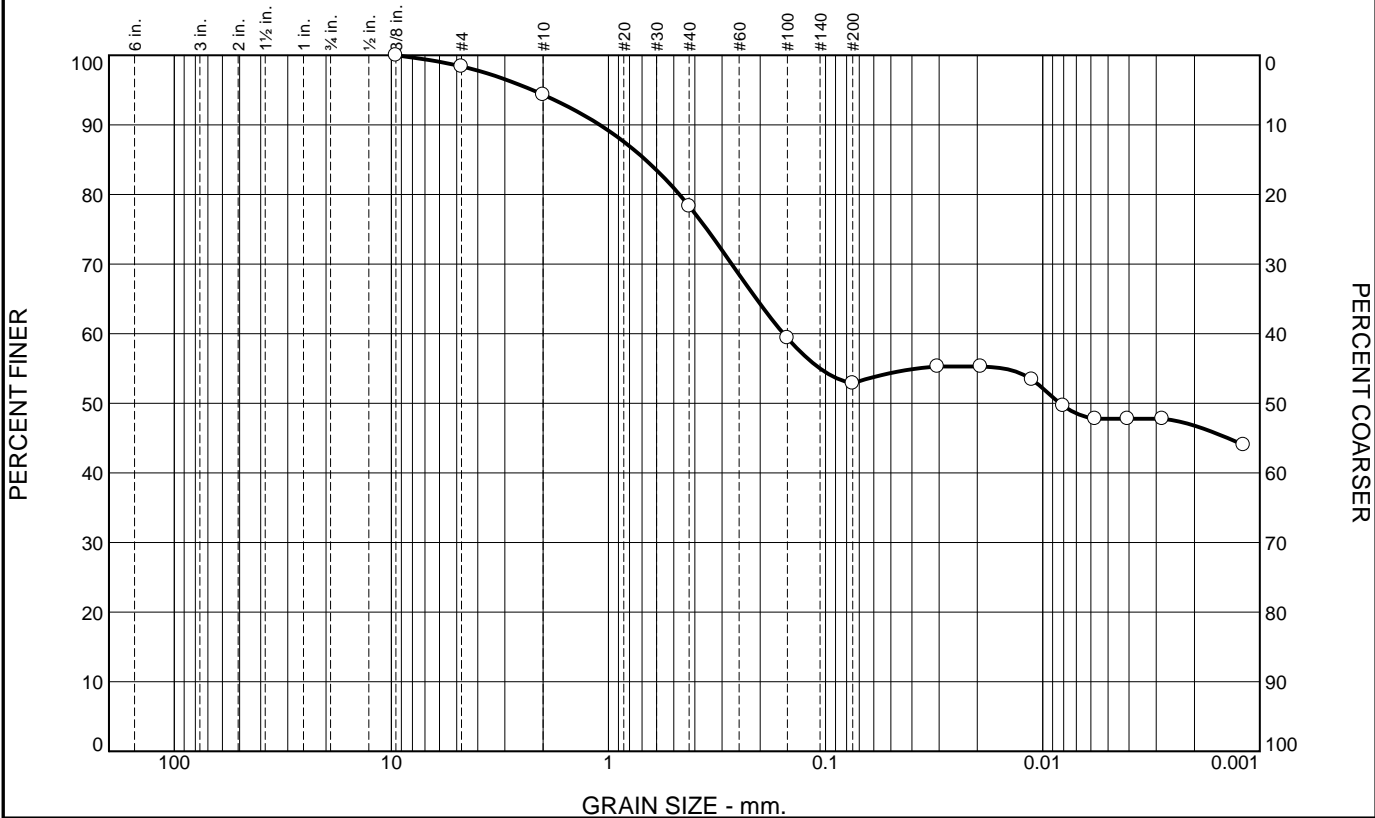
Client: AEON Geoscience, Inc.
 Project: 10-1013

Bethlehem, PA

Project No: AEON-1001

Figure 85685-2

DUFjWY'G]nY'8]ghf]Vi h]cb'F Ydcfh



i'Z'~	i'; fUjY		i'GubX			i'; jbyg	
	7cUfgY	: jby	7cUfgY	AYXji a	: jby	Gj'h	7'Um
202	202	308	608	3802	4706	708	690

G-9 J9	D9F79BH	GD97'4	D5 GG3
G-N9	: -B9F	D9F79BH	fl1BCŁ
0597\$	32202		
%6	: : 06		
%32	: 605		
%62	9: 05		
%22	7: 06		
%422	74Q		
202527"o o 0	7705		
2023; 5"o o 0	7705		
202334"o o 0	7506		
2022: 3"o o 0	6; 09		
202279"o o 0	690		
202263"o o 0	690		
20224: "o o 0	690		
202234"o o 0	6602		

Gc]'8 YgW]dh]cb

PL= 5 HhfVYf['@a]hg LL= PI=

7 c YZ]WYb]g

D90= 302: 84 D85= 208979 D60= 208783

D50= 2022: 5 D30= D15=

D10= Cu= Cc=

USCS=Á Š 7`Ugg]Z]W]h]cb AASHTO=

F Ya Uf_g

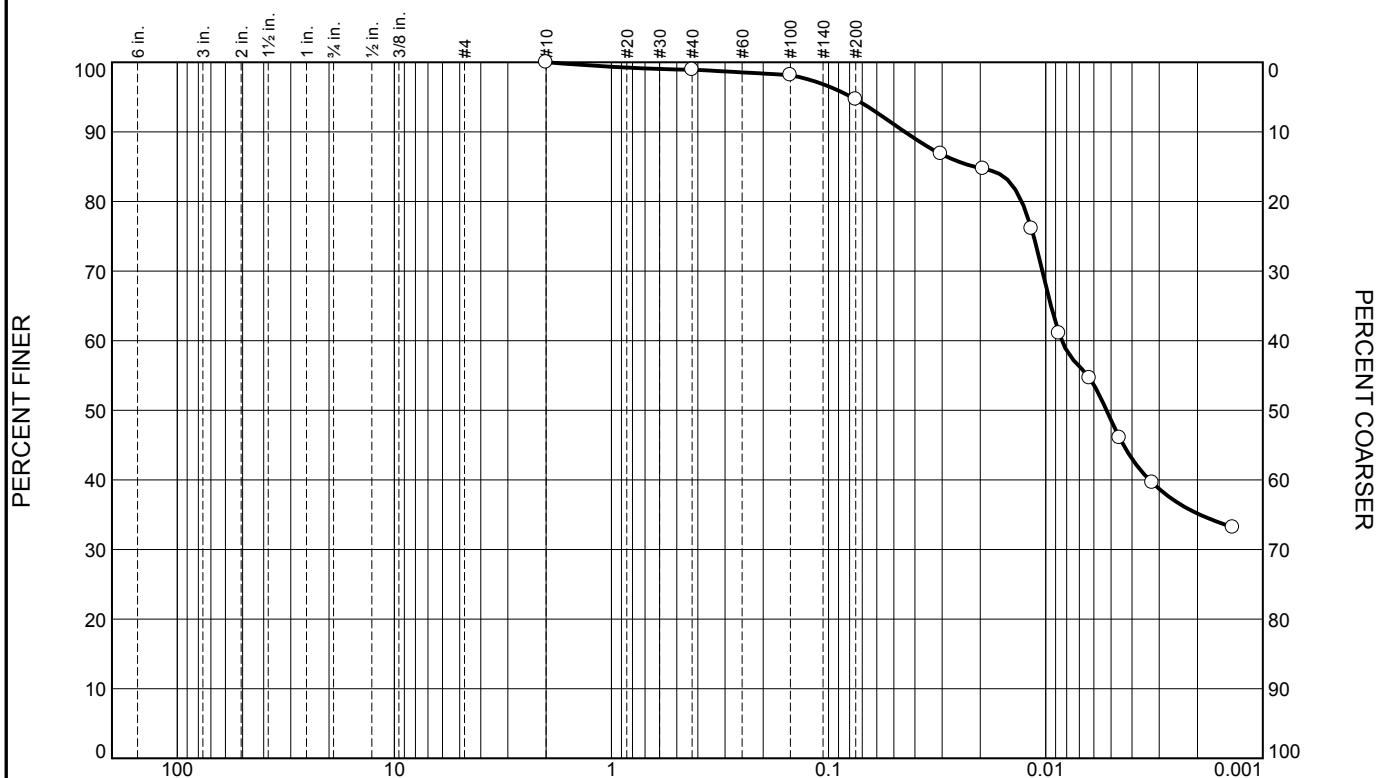
*pq'lr gekhecvqp'r tqxkf gf +

Gci fW'cZGUa d'Y. FXT
GUa d'YBi a VYf. '323'U/4'70/80)'O N'Tgf /Dtqy p'Ucpf { 'Er{

8 UHY. , #/5 #/5

D9BBCB=5 GGC7 5 H9 G'B7 "	7`Ybh CGQP 'I gquelgpeg. 'Ipe0 Dfc'YWh 32/3235
6 YH `Yl Ya žD5	Dfc'YWiBc. CGQP/3223 : i i fY : 78: 7/5

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.1	4.2	46.1	48.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	98.9		
#100	98.2		
#200	94.7		
0.0304 mm.	86.8		
0.0194 mm.	84.7		
0.0116 mm.	76.1		
0.0087 mm.	61.1		
0.0063 mm.	54.6		
0.0046 mm.	46.1		
0.0032 mm.	39.6		
0.0014 mm.	33.2		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 0.0445 D₈₅= 0.0213 D₆₀= 0.0084
 D₅₀= 0.0052 D₃₀= D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= CL AASHTO=

Remarks

Source of Sample: DVR
 Sample Number: 102 (6.8-7.0') ASTM 2488 Gray Silty Clay

Date: 8/16/10

PENNONI ASSOCIATES INC.

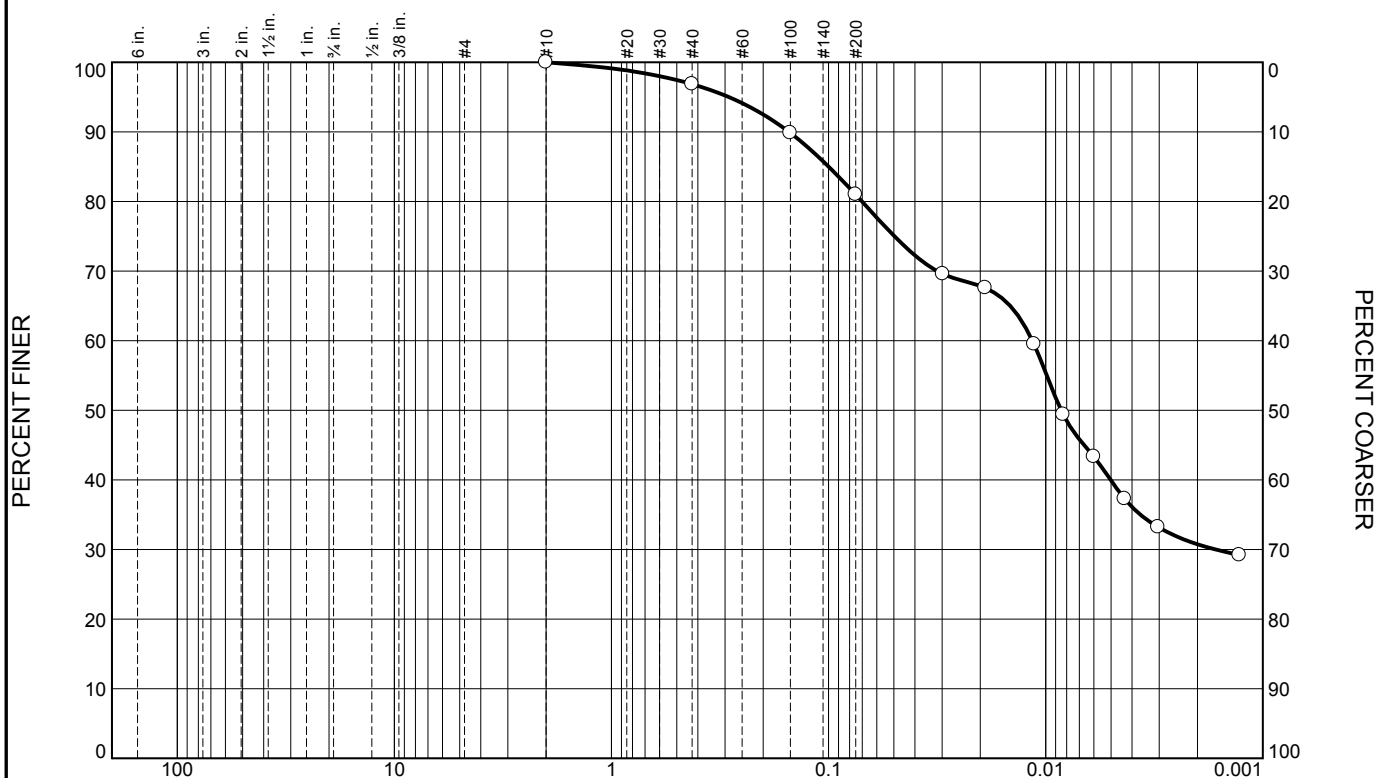
Bethlehem, PA

Client: AEON Geoscience, Inc.
 Project: 10-1013

Project No: AEON-1001

Figure 85685-4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	3.1	15.9	41.1	39.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	96.9		
#100	89.9		
#200	81.0		
0.0298 mm.	69.6		
0.0190 mm.	67.6		
0.0113 mm.	59.5		
0.0083 mm.	49.4		
0.0060 mm.	43.3		
0.0043 mm.	37.3		
0.0030 mm.	33.2		
0.0013 mm.	29.2		

* (no specification provided)

Soil Description

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 0.1521 D₈₅= 0.0999 D₆₀= 0.0115
 D₅₀= 0.0085 D₃₀= 0.0016 D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= ML AASHTO=

Remarks

Source of Sample: DVR
 Sample Number: 103 (6.8-7.3') ASTM 2488 ML Gray Clayey Silty

Date: 8/16/10

PENNONI ASSOCIATES INC.

Bethlehem, PA

Client: AEON Geoscience, Inc.
 Project: 10-1013

Project No: AEON-1001

Figure 85685-5

YOU OOP VAZOU



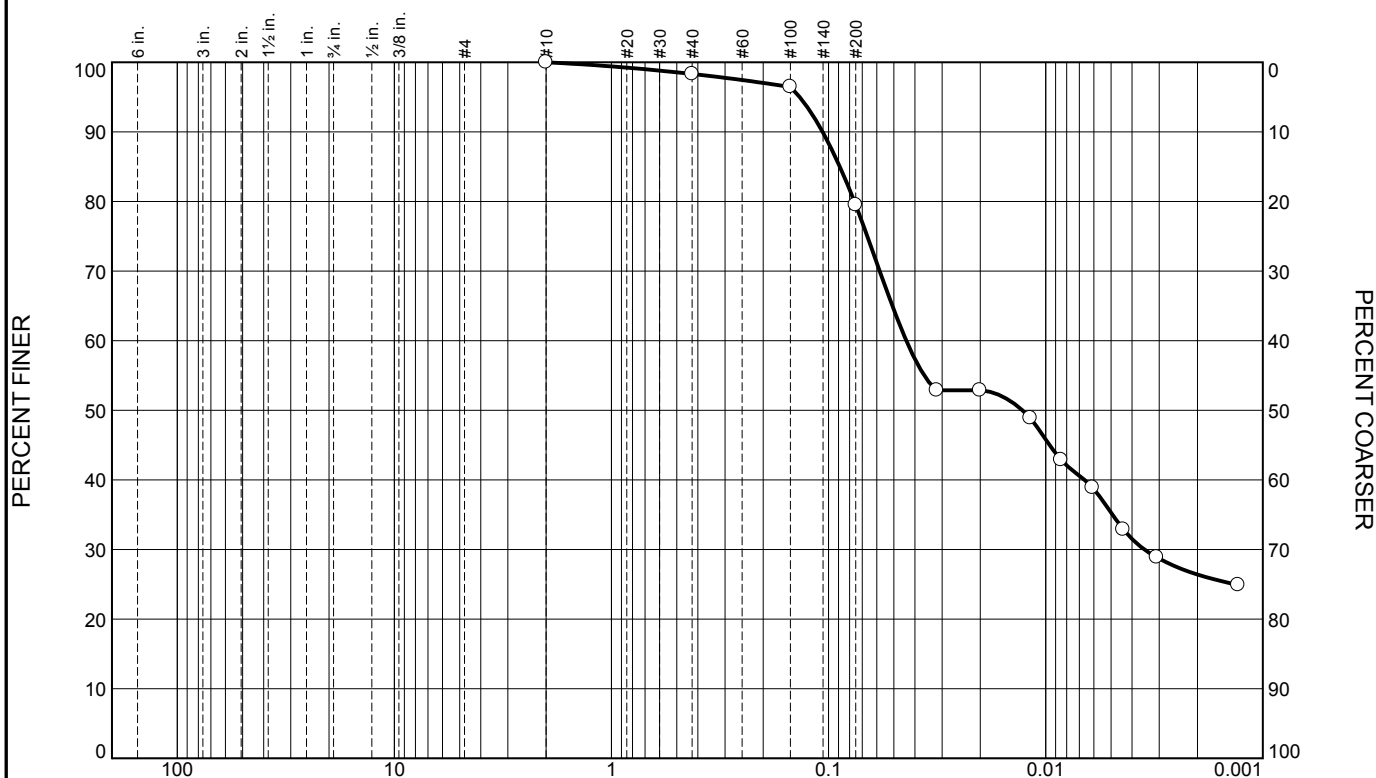
i ʒi	i ʒi fUjY		i ʒi GUbX			i ʒi jbYg	
	7cUfGy	: jbY	7cUfGy	AYXji a	: jbY	Gj'h	7'Um
20	20	20	20	30	60	720	650

Gc]`8 YgWjdljcb
 ÚŠM
 5 HrfVYf[`@a_lhg
 SSM
 ÚQM
 Öj€M 2027; :
 Öj€M 20288
 Öf€M
 Öj€M 2027: :
 Öf€M
 Ö&M
 7`UggiZWUhc b
 WÜÖUÄ Š
 ÖEUPVUM
FYa Uf_g

8 UNY., #/% #/\$

: J i fY : 78: 7/8

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	1.7	18.8	44.2	35.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#40	98.3		
#100	96.5		
#200	79.5		
0.0317 mm.	52.9		
0.0201 mm.	52.9		
0.0118 mm.	48.9		
0.0085 mm.	42.9		
0.0061 mm.	38.9		
0.0044 mm.	32.9		
0.0031 mm.	28.9		
0.0013 mm.	24.9		

* (no specification provided)

Soil Description

PL= **Atterberg Limits** PI=

LL=

Coefficients

D₉₀= 0.1065 D₈₅= 0.0888 D₆₀= 0.0438

D₅₀= 0.0128 D₃₀= 0.0035 D₁₅=

D₁₀= C_u= C_c=

USCS= ML **Classification** AASHTO=

Remarks

Source of Sample: DVR
Sample Number: 105 S-1 (6.8-7.3') ASTM 2488 ML Gray Sandy Clayey Silt

Date: 8/16/10

PENNONI ASSOCIATES INC.

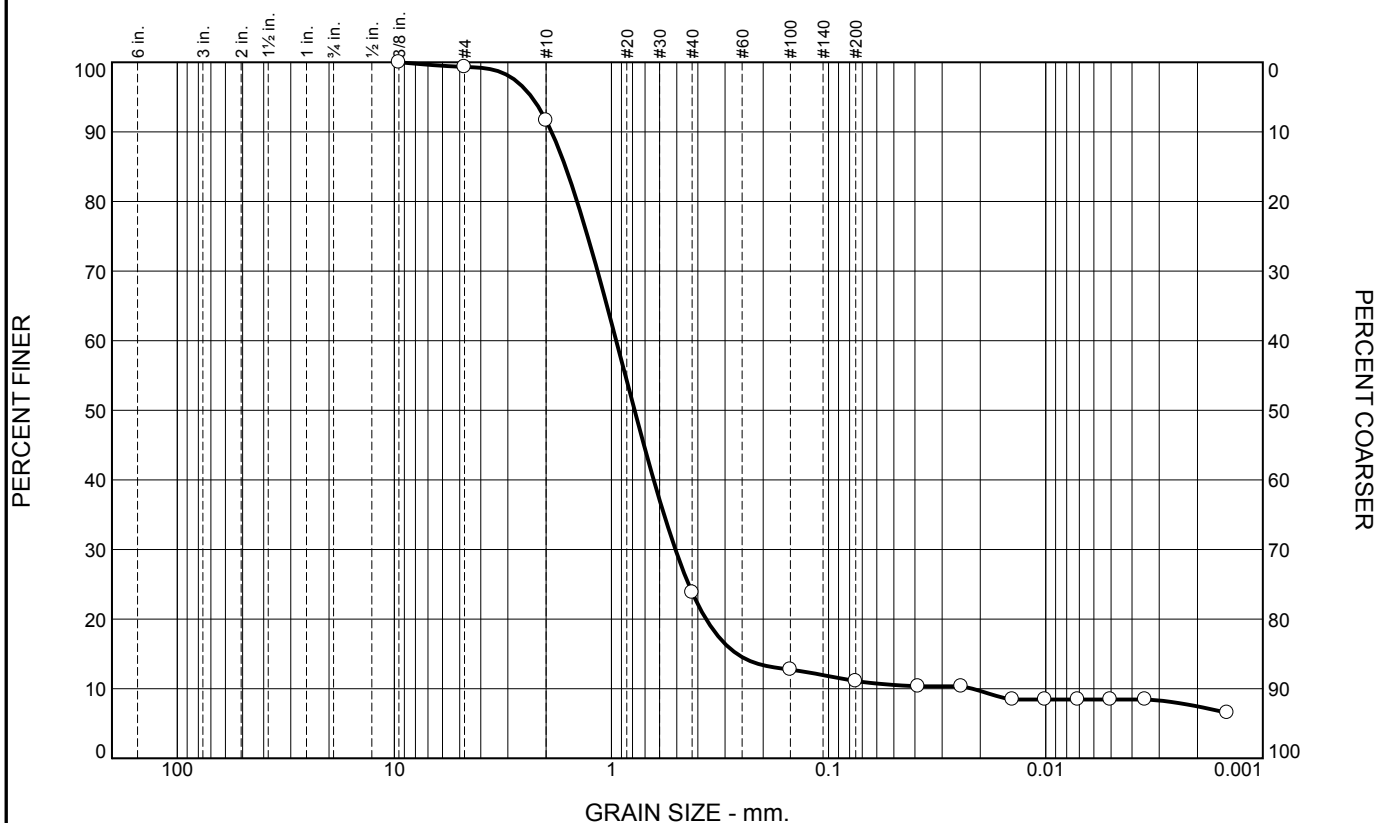
Bethlehem, PA

Client: AEON Geoscience, Inc.
Project: 10-1013

Project No: AEON-1001

Figure 85685-7

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.7	7.7	67.8	12.7	2.6	8.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375"	100.0		
#4	99.3		
#10	91.6		
#40	23.8		
#100	12.8		
#200	11.1		
0.0387 mm.	10.4		
0.0245 mm.	10.4		
0.0142 mm.	8.5		
0.0101 mm.	8.5		
0.0071 mm.	8.5		
0.0050 mm.	8.5		
0.0035 mm.	8.5		
0.0015 mm.	6.6		

* (no specification provided)

Soil Description		
<p>PL= Atterberg Limits PI=</p> <p>LL=</p> <p>Coefficients</p> <p>D₉₀= 1.8876 D₈₅= 1.6293 D₆₀= 0.9507</p> <p>D₅₀= 0.7825 D₃₀= 0.5074 D₁₅= 0.2638</p> <p>D₁₀= 0.0217 C_u= 43.82 C_c= 12.48</p> <p>USCS= SC Classification AASHTO=</p> <p>Remarks</p>		

Source of Sample: DVR
Sample Number: 105 S-2 (11-11.5') ASTM 2488 SC Gray Clayey Sand

Date: 8/16/10

PENNONI ASSOCIATES INC.

Client: AEON Geoscience, Inc.
Project: 10-1013

Bethlehem, PA

Project No: AEON-1001

Figure 85685-8