REPORT

GEOTECHNICAL INVESTIGATION DELOACH AND SHORT WHARVES REPAIR

SUNOCO PHILADELPHIA REFINERY PHILADELPHIA, PENNSYLVANIA

Prepared for
Sunoco, Inc. (R&M)
3144 Passyunk Avenue
Philadelphia, PA 19145

January 10, 2012

URS Corporation
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Suite 300
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19998935.00001

URS

January 10, 2012
19998935.00001

Ms. Jane Chen, PMP
Sunoco, Inc.
3144 Passyunk Avenue
Philadelphia, PA 19145

Subject: Report on Geotechnical Investigation
Proposed Deloach and Short Wharves Repair Project
Sunoco Philadelphia Refinery
Philadelphia, Pennsylvania

Dear Ms. Chen:

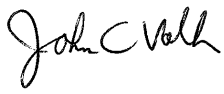
We are pleased to present herein our report of a geotechnical investigation which was performed in connection with the proposed Deloach and Short Wharves Repair Project at the Sunoco Philadelphia Refinery in Philadelphia, Pennsylvania. This investigation was performed in accordance with our proposal dated March 4, 2011, and Sunoco SPO No. 11-PT2087, dated June 21, 2011.

Soil samples which were obtained during the investigation will be retained in our laboratory for a period of three months, after which they will be returned to you for proper disposal.

We sincerely appreciate the opportunity to be of service to you on this project. If you have any questions on the contents of this report, or if we may be of additional service, please give us a call.

Very truly yours,

Yongli Min, P.E.
Principal Engineer/Project Manager



John C. Volk, P.E.
Vice President/Geotechnical Engineering Manager

cc: Neil Scafonas, URS

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The Geotechnical Investigation reported herein was performed at the request of Sunoco, Inc. (Sunoco), in connection with the proposed Deloach and Short Wharves Repair project at the existing Sunoco Philadelphia Refinery in Philadelphia, Pennsylvania. The project location is shown on Plate 1, Regional Location Plan.

The purpose of this investigation was to evaluate the geotechnical conditions of the site and to formulate conclusions and recommendations pertaining to the design and construction of the proposed repairs. Our services consisted of planning the investigation, full-time monitoring of the subsurface exploration program consisting of test borings, laboratory testing of representative soil samples, engineering analysis of the data obtained, and preparation of this report.

A description of the subsurface exploration program and test boring logs are presented in Appendix A. The geotechnical laboratory testing program is described and the results are summarized in Appendix B. Relevant findings, conclusions, and recommendations derived from this investigation are presented in the following sections.

Based on the information from Urban Engineers, Inc. (UEI), the project designer, the proposed repair work may consist of replacing existing bulkhead with a combination of sheetpiles, soldier piles, anchoring systems consisting of concrete deadman or anchoring piles, placing stone riprap, strengthening existing sheet piles, installing new sheet piles and new lateral support structures.

The Deloach and Short Wharfs are a part of the South Yard Terminal which is located on the Schuylkill River, approximately 3¼ miles upriver of the confluence with the Delaware River and approximately ¼ mile downriver of the Passyunk Avenue Bridge, in Philadelphia, Pennsylvania, as shown in Plate 1 and Plate 2.

The South Yard Terminal is an approximately 1050 feet long wharf, consisting of a continuous anchored steel sheet pile bulkhead and is separated into two designated berths, the Short Wharf and Deloach Wharf. The Short Wharf and Deloach Wharf are situated on the upriver portion of the terminal and measure approximately 450 feet long each. The Pollock Street sewage outfall structure and water intake structures are located at approximately 150 feet of the downriver portion of the terminal A deck structure, without an outshore bulkhead fascia exists at the upriver end of the South Yard (beyond the 1050 feet length). The South Yard functions as a berth for marine vessels, typically barges, for the loading and unloading of various petroleum based products.

The original construction of the wharves at the South Yard Terminal varies along its length. From Station 0+00 to approximately Station 1+05, the original wharf consisted of a timber pile supported low level timber deck wharf structure with timber sheeting cut-off wall. From Station 1+05 to Station 9+00, the original wharf consisted of a steel HP-pile supported low level concrete deck with a steel sheet pile cut off wall. Both types of wharf structures support a concrete seawall retaining approximately 8 to 12 feet of fill material. The date of the original construction of these wharf structures is not known. Circa 1980, the terminal structure was modified with a continuous tied-back steel sheet pile bulkhead installed along the outshore face of the wharf. The steel sheet pile bulkhead wall was anchored using anchors located inshore of the face of the bulkhead. The anchor construction varies from steel sheet pile wall, to steel batter pile supported reinforced concrete block, to reinforced concrete deadman along the length of the terminal. The steel sheet pile bulkhead is protected by a timber fender system consisting of timber fender piles spaced at approximately 10 feet 3 inches on centers along the length of the bulkhead. The timber fender piles are attached to the steel sheet piling with chain and pad eye connections. Located between the fender piles and steel sheet piling are two timber chocks and a square rubber fender.

From Station 9+00 to Station 10+50, the original wharf appears to be a steel sheet pile bulkhead with battered steel HP-pile anchors driven through penetrations in the steel sheets and connected directly to the bulkhead. This area had previously supported a boat launch gantry crane system, which was removed due to a bulkhead failure circa 1996.

The existing grade slopes gently downward towards the river and towards south. The elevations of the existing grades are not available as of this writing. The elevation values reported here are based on field measurements by URS, assuming the top of concrete at the northwest corner of the warehouse building to be at El. 100 ft.

A review of available geologic information indicates that the site is underlain by fine-grained alluvial deposits which are underlain by the granular alluvial soils of the Trenton Gravel. The Trenton Gravel formation generally consists of gravelly sand and interbedded sand and clay-silt layers. The bedrock at the site consists of mica schist and gneiss of the Wissahickon Formation. Within the refinery, there is generally a layer of man-made fill over the natural deposits.

The subsurface conditions at the site were explored by means of nine test borings, six of them behind the bulkhead on land and three immediately in front of it in the river. The number and locations of the borings were recommended by UEI. The locations of test borings are shown on Plate 2, Site and Boring Location Plan. The borings were drilled to depths ranging from approximately 80 to 98 feet below the existing grades behind the bulkheads. Logs of the test borings are presented in Appendix A, together with a description of drilling and sampling methods. Geotechnical laboratory test results are presented in Appendix B. Inferred subsurface profiles are shown on Plates 3 through 5. The various strata encountered are described below.

4.1 STRATUM 1 – FILL

The fill stratum was encountered below the ground surface in all borings except Borings B-4 and B-7.

In the three water borings (B-1, B-4, and B-7), the fill was only encountered in Boring B-1 below the mud line, consisting of silty clay with concrete fragments and wood, with a thickness of approximately 9 ft. The standard penetration test (SPT) N-values vary from weight of rods (WOR) to 30 blows per foot (bpf), indicating an erratic density condition.

Significant amount of fill was encountered in the three borings behind the bulkhead (B-2, B-5, and B-8) with a thickness varying between 32 ft in Boring B-2 and 53 ft in Boring B-8. The fill consist of silty coarse to fine sand and gravel on the top, grading into silty medium to fine sand with occasional concrete and brick fragments, and wood. The SPT N-values ranged between 2 to 52 bpf. Typically, the top of the fill stratum is judged to be in a dense condition, and the lower portion of the fill in a loose to medium dense condition.

The fill was also encountered in the three land borings (Borings B-3, B-6, and B-9) with a thickness of approximately 5 to 13 ft, consisting of silty coarse to fine sand and gravel with brick and concrete fragments. Based on the resistance encountered during utility clearing using vacuum extraction method (hydro-excavation), the fill in these three borings is judged to be in a dense condition.

Results of five moisture content tests indicate a moisture content of 14 to 33 percent, averaging 24 percent. Grain-size distribution curves on selected fill samples are shown in Appendix B.

Corrosivity testing on one sample indicates pH value of 7.8, resistivity of 8,200 Ω-cm, and no detectable chloride, sulfate, and sulfide.

Organic vapor concentration of soil samples varies from 14 to over 10,000 parts per million (ppm). The highest reading was recorded in Borings B-3 and B-8.

4.2 STRATUM 2 – UPPER CLAY

This stratum was encountered right below Stratum 1 in Borings B-6 and B-9 with a thickness of approximately 4 and 12 ft. The soils consist of gray fine sandy silty clay. The SPT N-value was 2 bpf. Based on the resistance encountered hydro-excavation, the soils are judged to be firm to stiff condition.

Results of one moisture content test indicate a moisture content of 24 percent. The grain size distribution curve is shown in Appendix B. Results of an Atterberg limit test indicate a liquid limit of 24 percent and a plastic limit of 15 percent.

Organic vapor concentration of soil samples varies from 340 to 800 ppm.

4.3 STRATUM 3 – UPPER SAND AND GRAVEL

This stratum was encountered in Borings B-3, B-6, and B-9 below Stratum 1 or Stratum 2, with a thickness of approximately 5 to 9 ft. The soils consist of gray coarse to fine sand and gravel with trace silt. The SPT N-values range from 23 to 52 bpf, averaging 33 bpf, indicative of a medium dense to dense condition.

Results of one moisture content test indicate a moisture content of 9 percent. The grain size distribution curve is shown in Appendix B.

No organic vapor concentration was detected in the soil samples in this stratum.

4.4 STRATUM 4 – LOWER CLAY

This stratum was encountered below Stratum 1 and Stratum 3 in Borings B-3 through B-6, and B-9. The soils consist of gray sandy silty clay to sandy silt. The thickness of this stratum is approximately 1 ft in Boring B-4, and 12 to 21 ft in other borings. The SPT N-values range from 2 to 20 bpf. The Pocket Penetrometer Resistance (PPR) values typically vary from 0.5 to 1.5 tsf, indicative of a firm to stiff consistency.

Results of moisture content tests indicate that the moisture contents ranged from 24 to 37 percent, averaging 30 percent. Grain size distribution curves are shown in Appendix B. Results of five Atterberg limit tests indicate liquid limits ranging from 24 to 46 percent and plastic limits from 20 to 27 percent.

Three unconsolidated-undrained (UU) triaxial compression tests indicate undrained shear strengths of 500 to 1,700 psf, averaging 1,200 psf, indicative of a firm to stiff consistency. Two consolidation tests indicate preconsolidation pressure of approximately 4 tsf and 5.6 tsf, with compression ratios of 0.19 and 0.17, and recompression ratios of 0.025 and 0.015 (all strain based).

No organic vapor concentration was detected in the soil samples in this stratum.

4.5 STRATUM 5 – LOWER SAND AND GRAVEL

This stratum was encountered beneath Stratum 1 or Stratum 4 in all borings, extending to a depth of approximately 79 to 87 ft below grade. The soils consist of brown medium to fine sand on the top of this stratum, grading into gray and brown silty coarse to fine sand with varying amounts of gravel. SPT N-values range from 7 to 113 bpf. The top portion of the stratum is judged to be in a medium dense condition, and lower portion in a dense to very dense condition.

There are layers of interbeded clay within this stratum, which is described in detail in Section 4.6.

Results of moisture content tests indicate that the moisture contents ranged from 4 to 23 percent, averaging 11 percent. Grain size distribution curves are shown in Appendix B.

No organic vapor concentration was detected in the soil samples in this stratum.

4.6 STRATUM 5A – INTERBEDDED CLAY

This stratum was encountered within Stratum 5. The thickness of the layers ranges from approximately 1 ft to 18.5 ft. Typically, the top of the layer is encountered below a depth of 60 ft. The soils consist of gray clay with thin partings (less than 1/32 inch in thickness) of very fine sand. SPT values of the soils range from 11 to 47 bpf, averaging 25 bpf. The PPR values vary from 1 to 3 tsf, indicative of a stiff to very stiff consistency.

Results of moisture content tests indicate that the moisture contents ranged from 8 to 44 percent. Grain size distribution curves are shown in Appendix B.

No organic vapor concentration was detected in the soil samples in this stratum.

4.7 STRATUM 6 – DECOMPOSED ROCK

This stratum was encountered beneath Stratum 5 or 5A in all borings. This stratum was not fully penetrated in all borings except Borings B-3 and B-9 with a thickness of 4.5 to 6 ft. The decomposed rock consisted of light gray micaceous silty course to fine sand and gravel-size rock fragments. Relict rock structure was apparent in the soil samples. The SPT values are more than 50 bpf, indicative of a very dense condition.

4.8 STRATUM 7 – BEDROCK

The bedrock was cored in two test borings, B-3 and B-9, with a core length of 5 feet each. The bedrock consists of moderately weathered mica schist. The core runs had a recovery of 75 and 52 percent, and the Rock Quality Designation (RQD) of 12 and 13 percent.

4.9 GROUNDWATER

As a part of the investigation, groundwater monitoring well were installed in Borings B-2, B-3, B-5, B-6, B-8, and B-9. The groundwater readings are tabulated in each boring log. The groundwater was observed to be at 7 to 12 ft below grade, corresponding to El. 94 to El. 104 during the field investigation in August 2011. Higher elevations were observed in the borings in the northern portion of the site (B-8 and B-9). It should be noted that groundwater levels are subject to seasonal and long-term variations due to tidal, climatic, and man-made influences.

The subsurface of the project site consists of six different soils strata as described in Section 4. From land side to the river, the soil stratigraphy above Stratum 5 soils change drastically, as the fill thickness increases significantly towards the river. This is illustrated by the three inferred subsurface profiles (Plates 3, 4, and 5).

Per our discussion with UEI, the proposed repair will likely consist of new sheetpiles and soldier piles in the front of the bulkhead, and anchors on the land side to provide lateral support. The anchors could consist of either concrete deadman or battered driven piles, or a combination of both. The piles that are being considered are HP12x53, HP12x74, HP14x73, and 14-inch and 16-inch outside-diameter (OD) open-end steel pipe piles with ½-inch wall thickness. Due to the presence of dense sand and gravel, HP12x53 piles may be too light to penetrate through in order to derive the required tension capacity. The design recommendations are provided in Section 6.

Recommendations pertaining to the design and construction of foundations and earthworks for the proposed repairs are presented below.

6.1 FOUNDATIONS

6.1.1 Design Soil Parameters

The following design soil parameters should be used for the design of the anchor structures:

Table 1 – Foundation Design Parameters

Items	Stratum 1 Fill	Stratum 2 Upper Clay	Stratum 3 S&G	Stratum 4 Lower Clay	Stratum 5 S&G	Stratum 5A Stiff Clay	Stratum 6 Decomposed Bedrock
Total Unit Weight (pcf)	120	110	125	115	125	120	130
Buoyant Unit Weight (pcf) (1)	58	48	63	53	63	58	68
Internal Friction Angle (^{o})	30	0	32	0	32	0	35
Cohesion (psf)	0	500	0	750	0	1,500	0
Active Earth Pressure Coefficient, K_a	0.33	0.5	0.31	0.5	0.31	0.5	0.27
Passive Earth Pressure Coefficient, K_p	4.5	2.5	5.5	2.5	5.5	3.5	6.0
Concrete to Soil Coefficient of Friction	0.35	0.3	N.A.	N.A.	N.A.	N.A.	N.A.
LPILE Soil Type	Sand	Soft Clay	Sand	Clay	Sand	Stiff Clay	Sand
LPILE ε_{50}	N.A.	0.02	N.A.	0.01	N.A.	0.005	N.A.
LPILE Soil Modulus, k (pounds per cubic inch)	40	50	120	100	120	200	200

6.1.2 Pile Foundations

Design: It is understood that the piles to be used may consist of HP 12x74, HP14x73, and 14-inch and 16-inch OD open-end pipe piles with ½ inch walls. The piles should have a minimum yield stress of 36 ksi and meeting requirements of ASTM A36 or A572 steel. All welds (e.g., splices) in the pile should be full-penetration butt welds conforming to the current edition of the Structural Welding Code, D1.1, American Welding Society.

The following design capacities may be used. The tension capacity requires a minimum length of 80 ft below the grade behind the bulkhead.

Table 1 – Pile Design Parameters - Piles on Landside

Pile Type	HP12x74	HP14x73	14-inch OD Open-end Pipe	16-inch OD Open-end Pipe
Allowable Capacity – Compression (tons)	80	90	80	95
Allowable Capacity – Tension (tons)	40	45	40	45

Table 2 – Pile Design Parameters - Piles on Waterside

Pile Type	HP12x74	HP14x73	14-inch OD Open-end Pipe	16-inch OD Open-end Pipe
Allowable Capacity – Compression (tons)	40	40	40	40
Allowable Capacity – Tension (tons)	10	10	10	12

The allowable compression and tension capacities of the pile may be increased by 33 percent for short term loading due to wind and earthquake.

Construction: All piles are expected to be seated into the decomposed rock of Stratum 6 to derive the design capacities. The contractor shall select a hammer capable of delivering sufficient energy to pile tips while not exceeding practical refusal for the hammer and while not exceeding 90 percent of the yield stress of the pile during driving. The Contractor should submit pile hammer and wave equation analysis for the Geotechnical Engineer (URS) to review prior to starting work. The piles are expected to be driven to a depth of approximately 80 feet below the grade behind the bulkhead to derive the required capacities.

All piles should be installed within 3 inches of design location and should not be more than 2 percent out of plumb. Piles should not be collapsed, bent, or otherwise damaged. Any non-conforming piles should be replaced by the contractor at no cost to the owner.

If obstructions are encountered prior to reaching terminal resistance, the pile should be withdrawn or abandoned and a replacement pile driven. In that event, the structural engineer should determine the location of replacement or additional piles and determine if a redesign of the pile cap is required.

Dynamic pile load tests using a Pile Driving Analyzer (PDA) should be used on at least three piles. The PDA tests should confirm a mobilized capacity of at least 2.5 times the design capacities of the pile, as indicated above.

6.2 SEISMIC CRITERIA

Based on the 2009 International Building Code (IBC), Site Class D is recommended.

6.3 STRUCTURAL FILL

Structural fill may be required below and around the anchors, and for replacement of unsuitable materials under loaded areas. All structural fill should be placed and compacted in accordance with the following recommendations.

Materials to be used for structural fill should be well-graded, predominantly granular, and free from roots, vegetation, organic material, trash, wood, or other deleterious matters. The granular portion of the fill may be used as structural fill around the footings and other loaded areas. Below the planes of new foundations, the structural fill should consist of material conforming to the requirements of "Selected Structural Fill" which is defined as Penn DOT Coarse Aggregate No. 2A.

All structural fill should be placed in essentially horizontal lifts, not more than 8 inches in loose thickness. Structural fill for support of foundations should be compacted to not less than 95 percent of the maximum " modified" dry density as defined by ASTM D 1557 or not less than 80 percent of the relative density as determined by ASTM D 4253/ 4254 for free draining fill materials.

6.4 GROUNDWATER CONTROL

Groundwater may be encountered during construction excavation. The contractor should be prepared to perform dewatering or other appropriate groundwater control measures upon free water encountered during construction.

6.5 EXCAVATION SLOPES

Temporary excavations above the groundwater level should have side slopes not steeper than 1.5H:1V. Pertinent OSHA and local regulations should be followed where they require flatter side slopes than given above. Sheeting and shoring for excavations, if required, should be designed by an engineer registered in the Commonwealth of Pennsylvania.

6.6 CORROSION POTENTIAL

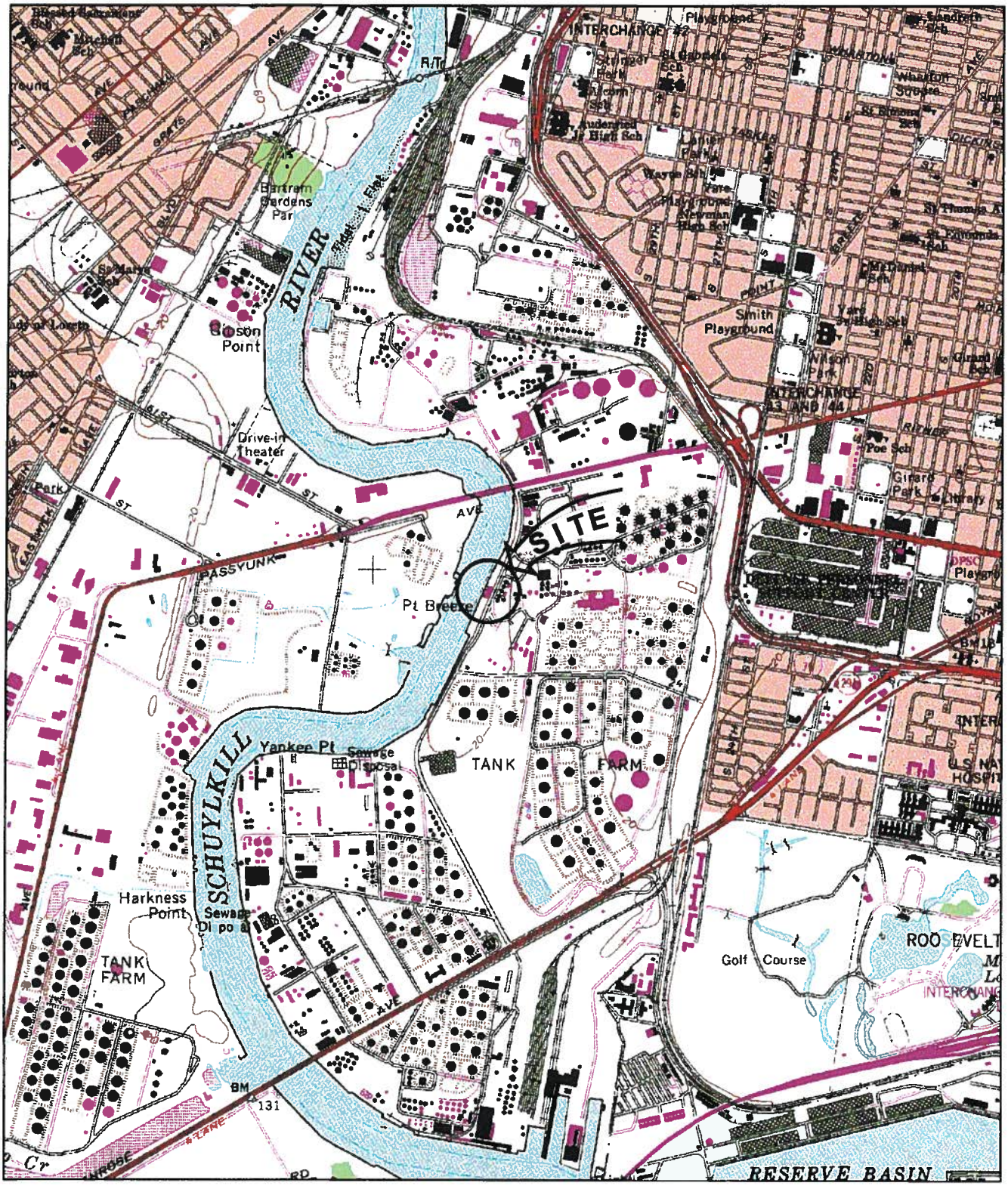
Corrosivity of steel should be evaluated by the structural and utility designers.

6.7 CONSTRUCTION OBSERVATION

It is recommended that full-time construction observation be provided during foundation and earthworks construction by URS Corporation or a qualified geotechnical engineering firm that is familiar with the subsurface conditions and the foundation design criteria. The items which should be observed, monitored, and/or tested include subgrade preparation, placement and compaction of structural fill, and pile construction.

The services described in this report were provided in accordance with reasonable and accepted engineering practice. No warranty or guarantee, expressed or implied, is intended. The conclusions and recommendations are based on the assumptions that the subsurface conditions do not deviate appreciably from those encountered in the test borings and pits and that the loads are similar to these given in the project description. If the structure is moved or loads have changed, URS should be given the opportunity to modify recommendations accordingly. The conclusions and recommendations are also based on competent field engineering, monitoring, and testing during construction. The recommendations presented in this report are solely for the use of our client for the design of this particular project. Any re-use of this document, particularly by third parties, without the express written permission of URS is solely at their own risk.

Plates



PENNSYLVANIA

QUADRANGLE LOCATION

SCALE: 1 INCH=2000 FEET

0 2000 4000

MAP SOURCE

PHILADELPHIA, PA. QUADRANGLE, U.S. GEOLOGICAL SURVEY, 1967 REVISED, 1994

Job: 19998935.00004	
Prepared by: TP	
Checked by: YM	
Date: 09/14/2011	

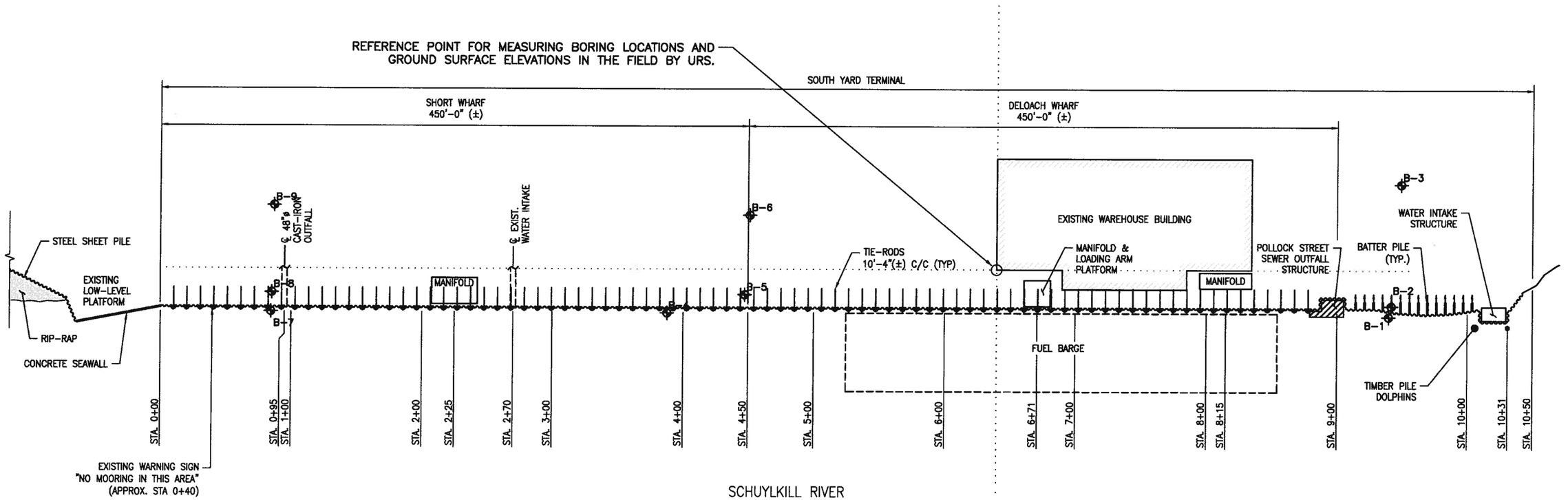
REGIONAL LOCATION PLAN

DELOACH AND SHORT WHARVES REPAIR
SUNOCO PHILADELPHIA REFINERY
PHILADELPHIA, PENNSYLVANIA

PLATE 1

Drawing Location & Name: K:\Sunoco-Philadelphia\19998935.00004\reg.dwg

Drawn By & Date/Time: thomas_powers Sep 14, 2011 - 3:46pm



NOTES:

1) BASE DRAWING WAS PROVIDED BY URBAN ENGINEERING, INC.

2) THE TEST BORING LOCATIONS AND GROUND SURFACE ELEVATIONS ARE BASED ON FIELD MEASUREMENTS BY URS, AND THEREFORE ARE APPROXIMATE.

SCALE: 1 INCH=80 FEET

80' 0 80'

Job: 19998935.00004	**BORING LOCATION PLAN**
Prepared by: TFP	DELOACH AND SHORT WHAVES REPAIR
Checked by:	SUNOCO PHILADELPHIA REFINERY
Date: 09/14/2011	PHILADELPHIA, PENNSYLVANIA
	PLATE 2

URS

A

A'

B-1

B-2

B-3

EXISTING GROUND SURFACE

EXISTING BULKHEAD

RIVER BOTTOM

ELEVATION, feet

110
100
90
80
70
60
50
40
30
20

B-1: 5, WOR, 30 (1), 17, 19, 12, 22, 34 (5), 28, 18, 80, 63-50/2", 22 (5A), 100/4" (5), (6), 66-100/5"

B-2: 20, 12, 14 (1), 7, .P., 7, 22, 7, 19, 15-50/3" (5), 34, 28, 39, 23 (5A), 60-50/3" (5), 85 (6)

B-3: (1), 22, 26, (3), 52, 9, P, 15, (4), 11, 25, 22, 22, (5), 39, 34, 30, 20 (5A), 100/6", (5), 70, 50/1", (6), NQ/75, (7)

0 10 20 30 40 50 60 70 80 90

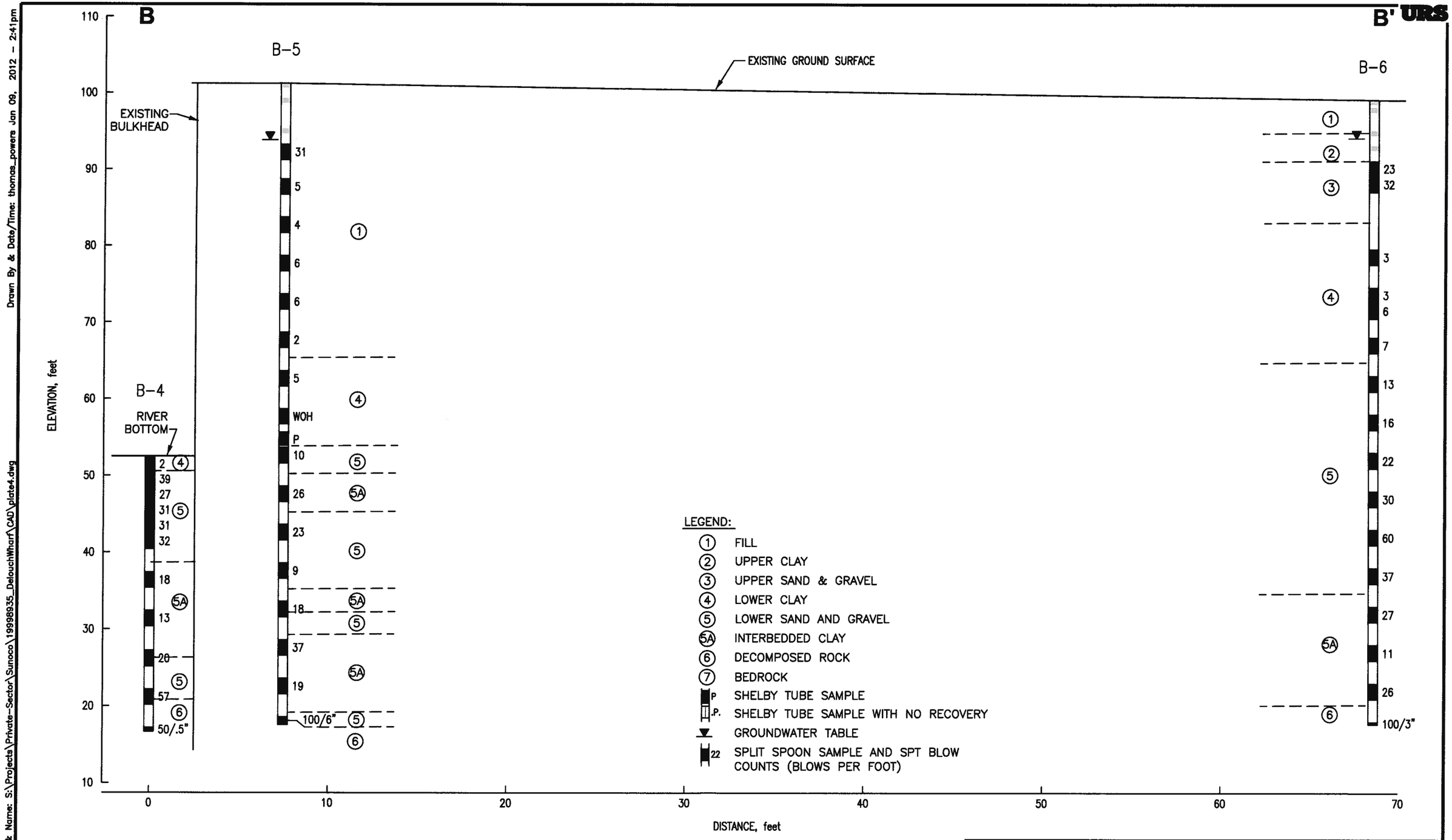
DISTANCE, feet

LEGEND:

(1)	FILL
(3)	UPPER SAND & GRAVEL
(4)	LOWER CLAY
(5)	LOWER SAND & GRAVEL
(5A)	INTERBEDDED CLAY
(6)	DECOMPOSED ROCK
(7)	BEDROCK
P	SHELBY TUBE SAMPLE
.P.	SHELBY TUBE SAMPLE WITH NO RECOVERY
▼	GROUNDWATER TABLE
22	SPLIT SPOON SAMPLE AND SPT BLOW COUNTS (BLOWS PER FOOT)

NOTE: THE GROUND SURFACE ELEVATION AND LOCATIONS OF EACH BORING ARE BASED ON FIELD MEASUREMENTS BY URS AND ARE APPROXIMATE.

Job: 19999032.00001	INFERRED SUBSURFACE PROFILE A-A'
Prepared by: TFP	SUNOCO DELOACH AND SHORT WHARVES REPAIR
Checked by:	PHILADELPHIA, PA
Date: 11/23/2011	PLATE 3



NOTE: THE GROUND SURFACE ELEVATION AND LOCATIONS OF EACH BORING ARE BASED ON FIELD MEASUREMENTS BY URS AND ARE APPROXIMATE.

Job: 19998935.00001	**INFERRED SUBSURFACE PROFILE B-B'**
Prepared by: TFP	SUNOCO DELOACH AND SHORT WHARVES REPAIR
Checked by:	PHILADELPHIA, PA
Date: 11/17/2011	PLATE 4

C

C'

B-8

B-7

B-9

EXISTING GROUND SURFACE

EXISTING BULKHEAD

RIVER BOTTOM

ELEVATION, feet

110
100
90
80
70
60
50
40
30
20

0
10
20
30
40
50
60
70

DISTANCE, feet

B-8: 4, 4, 5, 6, 4, 30, 52, 35, 8, 15, 38, 15, 28, 29, 47, 17, 98

B-7: 41, 43, 35, 65, 13, 36, 36, 38, 18, 68

B-9: 2 .P., 30, 8 P, 11, 11, 20, 18, 11, 16, 53, 28, 15, 31, 23, 42, 100/4", 50/1", NQ/52

LEGEND:

1. FILL
2. UPPER CLAY
3. UPPER SAND & GRAVEL
4. LOWER CLAY
5. LOWER SAND AND GRAVEL
5A. INTERBEDDED CLAY
6. DECOMPOSED ROCK
7. BEDROCK

P — SHELBY TUBE SAMPLE

.P. — SHELBY TUBE SAMPLE WITH NO RECOVERY

GROUNDWATER TABLE

22 — SPLIT SPOON SAMPLE AND SPT BLOW COUNTS (BLOWS PER FOOT)

NOTE: THE GROUND SURFACE ELEVATION AND LOCATIONS OF EACH BORING ARE BASED ON FIELD MEASUREMENTS BY URS AND ARE APPROXIMATE.

Job: 19998935.00001	
Prepared by: TFP	
Checked by:	
Date: 11/23/2011	

INFERRED SUBSURFACE PROFILE C–C'
SUNOCO DELOACH AND SHORT WHARVES REPAIR
PHILADELPHIA, PA

PLATE 5

URS

Drawn By & Date/Time: thomas_powers Jan 09, 2012 - 2:43pm

Drawing Location & Name: S:\Projects\Private-Sector\Sunoco\19998935_DelouchWharf\CAD\plate5.dwg

Appendix A
Subsurface Exploration

The subsurface exploration consisted of nine test borings located as shown on Plate 2, Site and Boring Location Plan. The borings were drilled between July 19 and August 26, 2011, by Parratt-Wolff Inc., East Syracuse, New York. The test borings were conducted under full-time technical supervision of URS. The test borings were located in the field by URS with assistance from Sunoco personnel. Utility clearance was conducted by Sunoco using vacuum extraction techniques (hydro-excavation) at the top 10 feet of each boring on land. Test borings locations and elevations were interpreted based on field measurements by URS and are therefore approximate. The northwest corner of the existing maintenance warehouse was taken as El. +100 feet.

The soil conditions at the top ten feet of each land boring were evaluated through probing using a hand probe. Soil samples were obtained with a hand auger at various depths.

The test borings were performed using a truck-mounted CME 75 drilling rig and were advanced by mud-rotary drilling techniques and 4 inch OD casings. Samples of the subsoils were obtained from the borings for identification and classification purposes by means of a 2-inch O.D. split-barrel sampler driven 24 inches by a 140-pound hammer freely falling 30 inches (the Standard Penetration Test, ASTM D 1586). The number of hammer blows required driving the sampler during the interval from 6 to 18 inches, or fraction thereof, is reported on the test boring logs as the sampling resistance. Relatively undisturbed samples of fine-grained soils were recovered using a 3-inch O.D. thin-walled Osterberg tube sampler in general accordance with ASTM D 1587.

NQ-size rock cores (1-7/8-inch diameter), approximately 5 feet in total length were obtained in two borings upon encountering bedrock. After coring, the Rock Quality Designation (RQD) was determined as the total length of all naturally segmented recovered rock core segments equal to or greater than 4 inches in length divided by the total length of each core run, expressed as a percentage. The RQD and the percent core recovery are presented on the boring logs.

Organic vapor monitoring was conducted during hydro-excavation and drilling operation by URS using a MiniRAE PID five gas monitor. The values of concentrations of organic vapor (in ppm) are shown on the boring logs under “Other Tests”.

Where fine-grained materials were encountered, Pocket Penetrometer Resistance (PPR) readings were taken to obtain an indication of the unconfined compressive strength of cohesive soils. These values are shown on the boring logs under "Pocket Penetrometer (tsf)".

At the completion of the test borings, the boreholes were backed-filled with bentonite/cement grout.

A "Key to Soil Symbols and Terms" used in this report is included on page A-2. The logs of the test borings are presented on Pages A-3 through A-29.

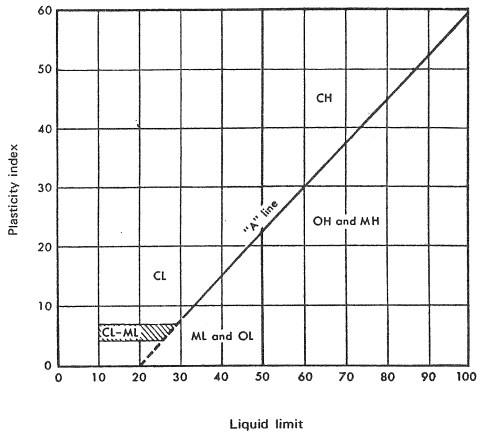
Major Divisions			Group symbols	Typical names	Laboratory classification criteria
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixture, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM* d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM* d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. > than 7
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		Pt	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
- Less than 5 per cent . . . . . GW, GP, SW, SP
- More than 12 per cent . . . . . GM, GC, SM, SC
- 5 to 12 per cent . . . . . *Borderline* cases requiring dual symbols**

Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols

Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.

Particle Size	Sieve Size	
	<#200	#200 To #40
mm	<0.074	0.074 To 0.42
		0.42 To 2.00
		2.00 To 4.76
Material	Silt or Clay	
	Sand	
	Fine	
	Med.	
	Coarse	



Plasticity Chart

Particle Size	Sieve	
	#4 To 3/4 In.	
	3/4 In To 3 In.	
	3 In. To 12 In.	
	12 In. To 36 In.	
mm	4.76 To 19.1	
	19.1 To 76.2	
	76.2 To 304.8	
	304.8 To 914.4	
Material	Gravel	
	Fine	
	Coarse	
	Cobbles	
	Boulders	

KEY TO SOIL SYMBOLS AND TERMS

Terms used in this report for describing soils according to their texture or grain size distribution are in accordance with the Unified Soil Classification System, as described in Technical Memorandum No. 3-357, Waterways Experiment Station, March 1953.

TERMS DESCRIBING CONSISTENCY OR CONDITION

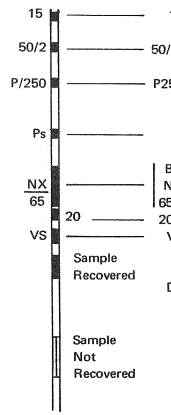
COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) clean gravels and (2) silty or clayey gravels and sands. Condition is rated according to relative density[1] as determined by laboratory tests or standard penetration resistance tests.

Descriptive Term	Relative Density
Very loose	0 to 15%
Loose	15 to 35%
Medium dense	35 to 65%
Dense	65 to 85%
Very dense	85 to 100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	Unconfined Compression Strength, tons/sq. ft.
Very soft	less than 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.00
Stiff	1.00 to 2.00
Very stiff	2.00 to 4.00
Hard	4.00 and higher

TEST AND SAMPLE IDENTIFICATION



15 — 15 — The number of blows (15) of a 140-pound hammer falling 30 inches used to drive a 2" O. D. split-barrel sampler for the last 12 inches of penetration.

50/2 — Number of blows (50) used to drive the split-barrel a certain number of inches (2).

P — Thin-wall tube sample.

P250 — Thin-wall tube pushed hydraulically, using a certain pressure (250 psi) to push the last 6 inches.

C_1 — Denison or Pitcher-Type — core-barrel sample.

Ps — Piston sample.

A — Augar sample.

BX — Rock cored with BX core barrel, which obtains a 1-5/8" diameter core.

NX — Rock cored with NX core barrel, which obtains a 2-1/8" diameter core.

65% — Percentage (65) of rock core recovered.

20% — Rock Quality Designation (RQD)[2]

VS — Vane Shear Test.

Laboratory Test Performed:

C — Consolidation and specific gravity tests.
D — Maximum & minimum density.
DS — Direct Shear test.
G — Specific gravity test.
K — Permeability test.
M — Mechanical (sieve or hydrometer) analysis.
T — Triaxial compression test
U — Unconfined compression test.
W — Unit weight & natural moisture content.
X — Special tests performed — see Laboratory test results.

*Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

**Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

[2] RQD = $\frac{\sum \text{Core Segments} > 4 \text{ Inches} \times 100}{\text{Core Interval}}$ Where Segmentation Is Not Caused By Drilling Effects

[1] ASTM 2049-69

A-2

LOG of BORING No. B-1

DATE 08/18/11 SURFACE ELEVATION 105.7 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0				Top of Bulkhead						
25				Mudline	78.7					
		5	SS	Firm gray silty CLAY, trace fine sand (Fill)		0.5				
30		WOR	SS			0.5				
		30	SS	- wood and concrete fragments						
35		17	SS	(Stratum 1)	69.7					
		19	SS	Medium dense to dense brown silty medium to fine SAND		1.0				
		12	SS	- thin layers of silty clay						
40				(Stratum 5)						
		22	SS	- trace silt						

(Continue on Sheet 2 of 3)

Completion Depth: 84.0 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

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LOG of BORING No. B-1

Sheet 2 of 3

DATE 08/18/11 SURFACE ELEVATION 105.7 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				Medium dense to dense brown coarse to fine SAND with varying amounts of gravel, trace silt						
		34	SS							
50										
		28	SS							
55										
		18	SS	- thin layers of silty clay						
60										
		80	SS	- sand and gravel						
65										
		63-50/2"	SS	(Stratum 5)	36.2					
70				Stiff to very stiff gray CLAY with thin partings of fine sand						
		22	SS			1.5-2.0				
75				(Stratum 5A)	28.2					
		100/4"	SS	- very dense gravel						
				(Stratum 5)	25.7					
80				Very dense micaceous coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock)						
		66-100/5"	SS	(Stratum 6)	21.7					
85										

(Continue on Sheet 3 of 3)

Completion Depth: 84.0 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT DELOACH WHARVES.GPJ

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LOG of BORING No. B-1

Sheet 3 of 3

DATE 08/18/11 SURFACE ELEVATION 105.7 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90			Notes: 1. The drilling began at approximately 27 ft below the top of the bulkhead. All depths indicated in this log are from the top of the bulkhead. 2. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm).						
95									
100									
105									
110									
115									
120									
125									
130									

Completion Depth: 84.0 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-2

DATE 08/16/11 SURFACE ELEVATION 104.5 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			AU	Dense brown silty coarse to fine SAND and GRAVEL (Fill)						14
5			AU							
10		20	SS							
		12	SS	- trace wood chips						
15										
20		14	SS	- trace wood chips, concrete fragments						
25		7	SS	- firm to stiff brown silty clay/clayey silt, trace fine sand						
		.P.	.P.							
		7	SS	- brown medium to fine sand, trace silt, wood chips						
30				(Stratum 1)	73.0					
		22	SS	Medium dense to dense brown coarse to fine SAND with varying amounts of gravel, trace silt						
35										
		7	SS	- sandy silty clay						
40										
		19	SS	(Stratum 5)						

(Continue on Sheet 2 of 3)

Completion Depth: 80.3 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

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LOG of BORING No. B-2

DATE 08/16/11 SURFACE ELEVATION 104.5 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				Medium dense to dense brown coarse to fine SAND with varying amounts of gravel, trace silt						
50		15-50/3"	SS							
55		34	SS	- medium to fine sand with thin layers of silty clay						
60		28	SS							
65		39	SS							
				(Stratum 5)	37.5					
70		23	SS	Stiff to very stiff gray CLAY with thin partings of fine sand		2.5-3.0				
				(Stratum 5A)	32.5					
75		60-50/3"	SS	Very dense gray coarse to fine SAND and GRAVEL						
				(Stratum 5)	25.0					
80		85	SS	Very dense micaceous coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock)	24.2					
				(Stratum 6)						
85										

(Continue on Sheet 3 of 3)

Completion Depth: 80.3 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

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LOG of BORING No. B-2

Sheet 3 of 3

DATE 08/16/11 SURFACE ELEVATION 104.5 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90			Notes: 1. The boring was advanced to approximately 10 ft depth using vacuum excavation method (hydro-excavation). The soils resistance was evaluated using a hand probe. Samples were obtained using a hand auger at various depths. 2. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm). 3. Groundwater was measured in the monitoring well. Date / GW Depth (ft) / GW Elev (ft) 8/23/2011 / 9.9 / 94.6 8/26/2011 / 9.3 / 95.2						
95									
100									
105									
110									
115									
120									
125									
130									

Completion Depth: 80.3 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT DELOACH WHARVES.GPJ

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LOG of BORING No. B-3

Sheet 1 of 3

DATE 07/21/11 SURFACE ELEVATION 109.4 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			AU	Dense brown silty coarse to fine SAND and GRAVEL, brick and concrete fragments (Fill)						
			AU							10000
5			AU							2900
			AU							4000
10		22	SS	- wood and brick fragments						
				(Stratum 1)	96.4					
				Medium dense brown medium to fine SAND, trace silt						
15		26	SS							
		52	SS	- becoming very dense brown coarse to fine sand and gravel						
20				(Stratum 3)	87.4					
				Stiff gray fine sandy silty CLAY						
25		9	SS			1.25-1.5				
		P	P			1.5-1.75	26.3	42	25	M T C
		15	SS	- becoming fine sandy silt						
30										
		11	SS							
35				(Stratum 4)	72.9					
				Medium dense brown medium to fine SAND, trace silt						
		25	SS							
40										
				(Stratum 5)						
		22	SS							

(Continue on Sheet 2 of 3)

Completion Depth: 88.6 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

URS

LOG of BORING No. B-3

DATE 07/21/11 SURFACE ELEVATION 109.4 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				Medium dense brown medium to fine SAND, trace silt						
		22	SS	- with thin layers of silty clay						
50				(Stratum 5)	57.9					
		39	SS	Dense brown coarse to fine SAND with variable amounts of gravel, trace silt						
55										
		34	SS							
60										
		30	SS							
65										
					40.9					
		20	SS	Stiff gray CLAY with thin partings of fine sand	39.9	1.5 -1.75				
70				Dense brown coarse to fine SAND with variable amounts of gravel, trace silt						
		100/6"	SS							
75										
				(Stratum 5)	30.4					
		70	SS							
80				Very dense micaceous coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock)						
				(Stratum 6)	25.9					
		50/1"	SS							
85				Medium hard gray/brown moderately weathered Mica Schist, laminations at 30 degrees from horizontal, fractures along laminations						
		NQ 75	NQ							RQD 12
				(Stratum 7)	20.8					

(Continue on Sheet 3 of 3)

Completion Depth: 88.6 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

URS

LOG of BORING No. B-3

Sheet 3 of 3

DATE 07/21/11 SURFACE ELEVATION 109.4 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90				Notes: 1. The boring was advanced to approximately 10 ft depth using vacuum excavation method (hydro-excavation). The soils resistance was evaluated using a hand probe. Samples were obtained using a hand auger at various depths. 2. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm). 3. Groundwater was measured in the monitoring well.						
95										
100										
105										
110										
115										
120										
125										
130										

Date	GW Depth (ft)	GW Elev (ft)
8/12/2011	11.7	97.7
8/18/2011	11.5	97.9
8/23/2011	9.6	99.8
8/26/2011	10.0	99.4

Completion Depth: 88.6 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT DELOACH WHARVES.GPJ

URS

LOG of BORING No. B-4

Sheet 1 of 3

DATE 07/29/11 SURFACE ELEVATION 104.0 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Top of Bulkhead						
5									
10									
15									
20									
25									
30									
35									
40									

(Continue on Sheet 2 of 3)

Completion Depth: 87.2 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935.SHORT DELOACH WHARVES.GPJ

URS

LOG of BORING No. B-4

DATE 07/29/11 SURFACE ELEVATION 104.0 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45										
50				Mudline	52.5					
		2	SS	Very soft to soft brown silty CLAY, trace organic		0.5				
				(Stratum 4)	50.5					
		39	SS	Stiff to very stiff brown silty CLAY, trace fine sand	49.5					
55		27	SS	Medium dense to dense gray coarse to fine SAND with varying amounts of gravel, trace silt						
		31	SS							
60		31	SS							
		32	SS							
				(Stratum 5)	39.0					
65		18	SS	Stiff to very stiff dark gray CLAY with thin partings of fine sand		1.5				
70		13	SS			1.5-2.0				
75				(Stratum 5A)	26.3					
		20	SS			0.5-1.0				
80				Medium dense to very dense gray coarse to fine SAND and GRAVEL, trace silt, occasional thin layers of silty clay						
		57	SS	(Stratum 5)	20.8					
85				Very dense micaceous coarse to fine sand and gravel-sized rock fragments (Decomposed Rock)						
		50/.5"	SS	(Stratum 6)	16.8					

(Continue on Sheet 3 of 3)

Completion Depth: 87.2 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

URS

LOG of BORING No. B-4

Sheet 3 of 3

DATE 07/29/11 SURFACE ELEVATION 104.0 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90			Notes: 1. The drilling began at approximately 51.5 ft below the top of the bulkhead. All depths indicated in this log are from the top of the bulkhead. 2. Drilling resistance (i.e., rig chatter) was encountered at approximately 83 ft depth. 3. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm).						
95									
100									
105									
110									
115									
120									
125									
130									

Completion Depth: 87.2 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

11/27/11 BORLOGR 19998935-SHORT_DELOACH_WHARVES.GPJ

URS

LOG of BORING No. B-5

Sheet 1 of 3

DATE 08/10/11 SURFACE ELEVATION 103.2 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			AU	Dense gray silty medium to fine SAND with GRAVEL (Fill)						0
5			AU							0
			AU							0
10		31	SS	- wood from 11 to 11.5 ft depth, petroleum odor						
15		5	SS	- becoming loose brown medium to fine sand, trace silt and gravel						
20		4	SS							
25		6	SS							
30		6	SS							
35		2	SS							
				(Stratum 1)	65.2					
40		5	SS	Soft to firm gray silty CLAY/clayey SILT, trace fine sand						
				(Stratum 4)						

(Continue on Sheet 2 of 3)

Completion Depth: 85.5 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-5

Sheet 2 of 3

DATE 08/10/11 SURFACE ELEVATION 103.2 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		WOH	SS	Soft to firm gray silty CLAY, trace fine sand						
		P	P	(Stratum 4)	53.7	0.5	32.8	30	22	M T
50		10	SS	Medium dense brown silty coarse to fine SAND, with thin layers of silty clay						
				(Stratum 5)	50.2					
55		26	SS	Very stiff dark brown CLAY, trace fine sand		2.5-3.0				
				(Stratum 5A)	45.2					
60		23	S3	Medium dense brown coarse to fine SAND and GRAVEL, trace silt with thin layers of silty clay						
65		9	SS	- becoming loose medium to fine sand						
				(Stratum 5)	35.2					
				Stiff to very stiff dark gray CLAY, trace fine sand						
70		18	SS	(Stratum 5A)	32.2	1.5-1.75				
				Medium dense dark gray medium to fine SAND, trace silt						
				(Stratum 5)	30.2					
75		37	SS	Stiff to very stiff gray CLAY, trace fine sand with thin partings of fine sand, and occasional thin layers of coarse to fine sand		1.5				
80		19	SS			1.75-2.5				
				(Stratum 5A)	20.2					
				Very dense gray coarse to fine SAND and GRAVEL, trace silt (Stratum 5)	18.2					
85		100/6"	SS	Very dense micaceous coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock)	17.7					
				(Stratum 6)						

Completion Depth: 85.5 ft.
Project No.: 19998935.00001
Project Name: Sunoco Deloach and Short Wharves Repair
Drilling Method: Mud Rotary

Water Depth: See Notes ft., After hrs.
ft., After hrs.
ft., After hrs.
ft., After hrs.

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LOG of BORING No. B-5

Sheet 3 of 3

DATE 08/10/11 SURFACE ELEVATION 103.2 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90				Notes: 1. The boring was advanced to approximately 10 ft depth using vacuum excavation method (hydro-excavation). The soils resistance was evaluated using a hand probe. Samples were obtained using a hand auger at various depths. 2. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm). 3. Groundwater was measured in the monitoring well. Date GW Depth (ft) GW Elev (ft) 8/23/2011 9.3 93.9 8/26/2011 9.6 93.6						
95										
100										
105										
110										
115										
120										
125										
130										

Completion Depth: 85.5 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-6

Sheet 1 of 3

DATE 06/27/11 SURFACE ELEVATION 101.1 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			AU	Dense brown silty coarse to fine SAND and GRAVEL (Fill)						
			AU							300
5			AU	(Stratum 1)	94.6					400
				Firm to stiff dark gray sandy silty CLAY						
			AU							800
10		23	SS	(Stratum 2)	91.1					
		32	SS	Medium dense to dense brown coarse to fine SAND and GRAVEL, trace silt						
15				(Stratum 3)	83.1					
20				Soft to firm gray silty CLAY/clayey SILT, trace fine sand						
		3	SS			0.5				
25		3	SS	- fine sandy silt		0.5				
30		6	SS	- fine sandy silt		0.5				
		7	SS	- clayey silt		0.5				
35				(Stratum 4)	64.6					
		13	SS	Medium dense brown medium to fine SAND, trace silt, occasional thin layers of silty clay						
40				(Stratum 5)						
		16	SS							

(Continue on Sheet 2 of 3)

Completion Depth: 83.3 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-6

Sheet 2 of 3

DATE 06/27/11 SURFACE ELEVATION 101.1 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				Medium dense brown medium to fine SAND, trace silt, occasional thin layers of silty clay						
		22	SS							
50				(Stratum 5)						
		30	SS	- becoming dense to very dense gray coarse to fine sand with variable amounts of gravel, trace silt						
55										
		60	SS							
60										
		37	SS	- becoming medium to fine sand						
65				(Stratum 5)	34.6					
				Very stiff dark gray CLAY with thin partings of fine sand						
		27	SS							
70										
		11	SS							
75										
		26	SS							
80				(Stratum 5A)	20.1					
				Very dense micaceous coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock)						
		100/3"	SS	(Stratum 6)	17.8					
85										

(Continue on Sheet 3 of 3)

Completion Depth: 83.3 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-6

Sheet 3 of 3

DATE 06/27/11 SURFACE ELEVATION 101.1 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90			Notes: 1. The boring was advanced to approximately 10 ft depth using vacuum excavation method (hydro-excavation). The soils resistance was evaluated using a hand probe. Samples were obtained using a hand auger at various depths. 2. No sampling between 14 ft and 21.5 ft due to high LEL readings. 3. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in PPM). 4. Groundwater was measured in the monitoring well. Date GW Depth (ft) GW Elev (ft) 8/23/2011 7.1 94.0						
95									
100									
105									
110									
115									
120									
125									
130									

Completion Depth: 83.3 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-7

Sheet 1 of 3

DATE 07/27/11 SURFACE ELEVATION 109.8 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			Top of Bulkhead						
5									
10									
15									
20									
25									
30									
35									
40									

(Continue on Sheet 2 of 3)

Completion Depth: 84.0 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-7

DATE 07/27/11 SURFACE ELEVATION 109.8 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45										
50				Mudline	57.4					
		41	SS	Dense brown silty coarse to fine SAND and GRAVEL			7.4			M
55		43	SS				11.2			M
		35	SS	- becoming dense coarse to fine sand, trace silt, gravel						
		65	SS				11.8			M
60		13	SS	- medium dense			15.6			M
		36	SS				10.5			M
65				(Stratum 5)	43.8					
				Very stiff dark gray CLAY with thin partings of fine sand						
		36	SS	(Stratum 5A)	41.3	1.75-2.0	39.0	62	25	M
70				Dense gray coarse to fine SAND, trace silt, gravel						
		38	SS	- sand and gravel			12.2			M
75				(Stratum 5)	33.8					
				Stiff to very stiff gray clay with thin layers of fine sand						
		18	SS				27.8	53	20	M
80				(Stratum 5A)	28.8					
				Very dense SAND and GRAVEL						
		68	SS	(Stratum 5)	26.3		11.7			M
85				Very dense micaceous coarse to fine sand and gravel-sized rock fragments (Decomposed Rock) (Stratum 6)	25.8					

(Continue on Sheet 3 of 3)

Completion Depth: 84.0 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-7

Sheet 3 of 3

DATE 07/27/11 SURFACE ELEVATION 109.8 LOCATION See Plate 2

DEPTH, FT. / SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90			Notes: 1. The drilling began at approximately 52.4 ft below the top of the bulkhead. All depths indicated in this log are from the top of the bulkhead. 2. Loss of drilling fluid noted at approximatley 61 ft and 81 ft depths.						
95									
100									
105									
110									
115									
120									
125									
130									

Completion Depth: 84.0 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-8

Sheet 1 of 3

DATE 06/27/11 SURFACE ELEVATION 109.8 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			AU	Dense brown silty coarse to fine SAND and GRAVEL (Fill)						1000
			AU	- brown silty coarse to fine sand						1000
5			AU	- medium dense sand and gravel						3000
10		4	SS	- becoming loose silty fine sand			20.8			M
15		4	SS							
20		5	SS	- trace clay						
25		6	SS				27.8			M
30		4	SS							
35		30	SS	- approximately 6" of wood						
		52	SS	- concrete and brick fragments						
40		35	SS	- concrete and brick fragments			14.1			M
				(Stratum 1)						

(Continue on Sheet 2 of 3)

Completion Depth: 84.2 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-8

DATE 06/27/11 SURFACE ELEVATION 109.8 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45		8	SS	- brown sandy silt			32.7	37	25	M
50		15	SS	- medium dense brown silty sand with concrete/brick fragments						
				(Stratum 1)	57.3					
55		38	SS	Medium dense to dense coarse to fine SAND with varying amounts of gravel, trace silt						
60		15	SS				8.2			M
65		28	SS							
				(Stratum 5)	42.3					
				Stiff silty CLAY with fine sand (Stratum 5A)	40.8					
70		29	SS	Medium dense dark gray silty coarse to fine SAND						
				(Stratum 5)	38.8					
75		47	SS	Very stiff dark gray silty CLAY with thin partings of fine sand		1.0-1.75	43.7	61	26	M
80		17	SS			1.75-2.0				
				(Stratum 5A)	28.3					
		98	SS	Very dense coarse to fine SAND and GRAVEL, trace of silt (Stratum 5)	25.8		8.9			M
85				Very dense micaceous coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock) (Stratum 6)	25.6					

(Continue on Sheet 3 of 3)

Completion Depth: 84.2 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-8

Sheet 3 of 3

DATE 06/27/11 SURFACE ELEVATION 109.8 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90				Notes: 1. The boring was advanced to approximately 10 ft depth using vacuum excavation method (hydro-excavation). The soils resistance was evaluated using a hand probe. Samples were obtained using a hand auger at various depths. 2. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm). 3. Drilling resistance (i.e., rig chatter) was encountered at approximately 36 ft and 41.5 ft depth. 4. Groundwater was measured in the monitoring well. Date GW Depth (ft) GW Elev (ft) 8/18/2011 9.3 100.5 8/23/2011 9.3 100.5 8/26/2011 9.8 100.0						
95										
100										
105										
110										
115										
120										
125										
130										

Completion Depth: 84.2 ft. Water Depth: See ft., After ____ hrs.

Project No.: 19998935.00001 Notes ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-9

Sheet 1 of 3

DATE 07/19/11 SURFACE ELEVATION 114.0 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
0			AU	Dense brown silty coarse to fine SAND and GRAVEL (Fill)						450
				(Stratum 1)	109.5					
5			AU							20
			AU	Firm to stiff dark gray sandy silty CLAY						400
			AU							340
10			AU							420
			AU				24.3	24	15	400
		2	SS							M
15		.P.	.P.							
				(Stratum 2)	97.5					
		30	SS	Medium dense to dense brown silty SAND and GRAVEL						M
20				(Stratum 3)	92.5					
				Firm to stiff gray silty CLAY						
		8	SS				36.8	46	27	M
25		P	P			1.5-1.75	33.7	28	22	M T C
		11	SS	- becoming sandy silty CLAY						
30										
		11	SS			0.75-1.0				M
35										
		20	SS			0.75-1.0				
40				(Stratum 4)	72.0					
				Medium dense to dense brown silty coarse to fine SAND						
		18	SS	(Continue on Sheet 2 of 3)			22.6			M

Completion Depth: 98.1 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-9

DATE 07/19/11 SURFACE ELEVATION 114.0 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
45				Medium dense to dense brown silty coarse to fine SAND						
50		11	SS							
				- becoming medium dense to dense sand and gravel, trace silt						
55		16	SS				8.6			M
60		53	SS							
65		28	SS				3.6			M
				(Stratum 5)	47.0					
				Stiff to very stiff gray CLAY with thin partings of fine sand						
70		15	SS			1.0-1.25	35.6	56	20	M
75		31	SS			1.75-2.0				M
				(Stratum 5A)	37.0					
				Medium dense to dense gray coarse to fine SAND and GRAVEL						
80		23	SS				9.1	NP	NP	
85		42	SS							
				(Stratum 5)	27.0					
				Very dense micaceous brown coarse to fine SAND and gravel-sized rock fragments (Decomposed Rock)						

(Continue on Sheet 3 of 3)

Completion Depth: 98.1 ft. Water Depth: See Notes ft., After ____ hrs.

Project No.: 19998935.00001 ____ ft., After ____ hrs.

Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.

Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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LOG of BORING No. B-9

Sheet 3 of 3

DATE 07/19/11 SURFACE ELEVATION 114.0 LOCATION See Plate 2

DEPTH, FT.	SAMPLES	SAMPLING RESISTANCE	SAMPLE TYPE	DESCRIPTION	STRATUM ELEVATION	POCKET PENETROMETER (TSF)	WATER CONTENT, %	LIQUID LIMIT, %	PLASTIC LIMIT, %	OTHER TESTS
90		100/4"	SS	Very dense micaceous brown coarse to fine sand and gravel-sized rock fragments. (Decomposed Rock)			5.7			M
				(Stratum 6)	21.0					
		50/1"	SS	Medium hard to soft, coarse-grained, moderately to highly weathered Mica Schist, laminations approximately 30 degrees from horizontal, fractures along laminations						
95		NQ 52	NQ							RQD 13
				(Stratum 7)	15.9					
100										
105										
110										
115										
120										
125										
130										

Notes:
1. The boring was advanced to approximately 10 ft depth using vacuum excavation method (hydro-excavation). The soils resistance was evaluated using a hand probe. Samples were obtained using a hand auger at various depths.
2. Unless otherwise indicated, numerical values under "Other Tests" are PID readings from head space of sample jars (in ppm).
3. Groundwater was measured in the monitoring well.

Date	GW Depth (ft)	GW Elev (ft)
8/12/2011	10.5	103.5
8/18/2011	10.3	103.7
8/23/2011	10.7	103.3
8/26/2011	10.5	103.5

Completion Depth: 98.1 ft. Water Depth: See Notes ft., After ____ hrs.
Project No.: 19998935.00001 ____ ft., After ____ hrs.
Project Name: Sunoco Deloach and Short Wharves Repair ____ ft., After ____ hrs.
Drilling Method: Mud Rotary ____ ft., After ____ hrs.

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Appendix B
Laboratory Testing

Physical property tests were conducted in the laboratory on selected representative soil samples to aid in classification and for correlation with engineering behavior of the soils. These tests included natural water content (ASTM D 2216), liquid and plastic limits (ASTM D 4318), grain size distribution (ASTM D 422). Three unconsolidated-undrained (UU) triaxial compression tests (ASTM D 2850) and two consolidation tests (ASTM D 2435) were performed on relatively undisturbed Shelby tube samples. One sample was tested for corrosivity evaluation, including pH, resistivity, chlorides, and sulfates.

The numerical results are summarized on Pages B-2 and B-3 and are also shown on the appropriate boring logs. Grain size distribution curves are shown on Pages B-4 through B-14. UU triaxial test results are presented on Pages B-15 through B-17, and consolidation test results on Pages B-18 and B-19.

Project: Sunoco: Deloach and Short Wharves
Project No.: 19998935

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SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Analytical Results (ppm)			Triaxial Compression		Resistivity (Ohm-cm)	pH
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Chloride	Sulfate	Sulfide	UU	UC		
B-3 ST-1	26.0-28.0	Gray SANDY LEAN CLAY	CL	26.3		42	25			62	10									
B-3 ST-1	26.0-28.0			31.1	90.9								*							
B-3 ST-1	26.0-28.0			27.3	98.1												*			
B-5 ST-1	47.5-49.5	Brown LEAN CLAY with SAND	CL	32.8	88.0	30	22			84	19						*			
B-7 S-1	52.4-54.4	Brown SILTY GRAVEL with SAND	GM	7.4						15										
B-7 S-2	54.4-56.4	Brown SILTY SAND with GRAVEL	SM	11.2						21										
B-7 S-4	58.1-60.1	Gray POORLY GRADED SAND with SILT	SP-SM	11.8						6										
B-7 S-5	60.2-62.2	Gray POORLY GRADED SAND	SP	15.6						5										
B-7 S-6	62.2-64.2	Gray POORLY GRADED SAND with GRAVEL	SP	10.5						5										
B-7 S-7A	67.5-68.5	Gray FAT CLAY	CH	39.0		62	25			97										
B-7 S-7B	68.5-69.5	Gray POORLY GRADED SAND with SILT	SP-SM	15.4						5										
B-7 S-8	72.5-74.5	Gray POORLY GRADED SAND with SILT and GRAVEL	SP-SM	12.2						8										
B-7 S-9	77.5-79.5	Gray CLAYEY SAND	SC	27.8		53	20			35										
B-7 S-10A	82.5-83.5	Gray POORLY GRADED SAND with SILT and GRAVEL	SP-SM	11.7						5										
B-7 S-10B	83.5-84.5	Gray WELL-GRADED SAND	SW	10.3						4										
B-8 S-1&S-2	10.0-14.0			20.8	106.7									ND	ND	ND			8200	7.8
B-8 S-1&S-2	10.0-16.0	Brown gray SILTY SAND	SM	24.0						19										
B-8 S-4	24.0-26.0	Brown gray SILTY SAND	SM	27.8						29										
B-8 S-8	39.0-41.0	Gray WELL-GRADED GRAVEL with SAND	GW	14.1						0										

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves

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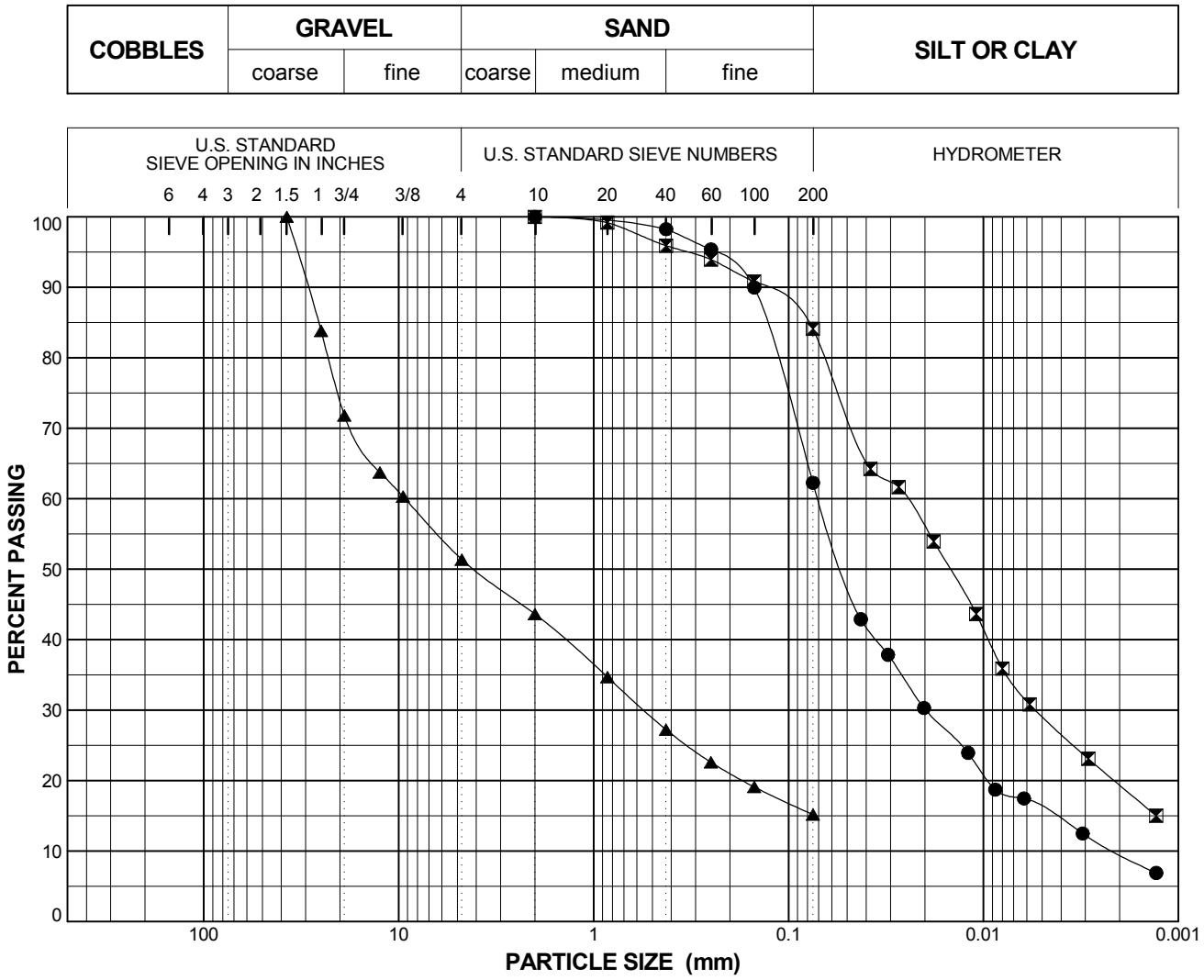
SUMMARY OF LABORATORY TEST RESULTS

Boring and Sample Number	Depth (feet)	Classification	USCS Symbol	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits		Specific Gravity	Organic Content (%)	Grain Size		Compaction	Consolidation	Analytical Results (ppm)			Triaxial Compression		Resistivity (Ohm-cm)	pH
						Liquid Limit	Plastic Limit			<#200 (%)	<2μ (%)			Chloride	Sulfate	Sulfide	UU	UC		
B-8 S-9	44.0-46.0	Brown SANDY SILT	ML	32.7		37	25			51										
B-8 S-12	59.0-61.0	Gray POORLY GRADED GRAVEL with SAND	GP	8.2						2										
B-8 S-15A	73.0-73.3	Gray FAT CLAY	CH	43.7		61	26			100										
B-8 S-15B	73.3-73.8	Gray POORLY GRADED SAND with SILT and GRAVEL	SP-SM	8.5		NP	NP			5										
B-8 S-15C	73.8-74.2	Gray FAT CLAY	CH	37.4		66	26			96										
B-8 S-17A	83.0-85.0	Gray POORLY GRADED SAND with GRAVEL	SP	8.9						4										
B-9 S-1	11-13	Brown gray LEAN CLAY with SAND	CL	24.3		24	15			75										
B-9 S-2	17-19.5	Brown SILTY SAND with GRAVEL	SM	8.9						14										
B-9 S-3	23.4-25.4	Gray LEAN CLAY	CL	36.8		46	27			96										
B-9 ST-2	26.0-28.0	Gray SILTY CLAY	CL-ML	33.7		28	22			93	14									
B-9 ST-2	26.0-28.0			35.0	86.4								*							
B-9 ST-2	26.0-28.0			26.8	96.8												*			
B-9 S-5	33.5-35.5	Brown SANDY SILTY CLAY	CL-ML	24.2		24	20			56										
B-9 S-7	43.3-45.3	Brown WELL-GRADED SAND with SILT	SW-SM	22.6						11										
B-9 S-9	53.3-55.3	Brown WELL-GRADED GRAVEL with SAND	GW	8.6						3										
B-9 S-11	63.5-65.5	Brown POORLY GRADED GRAVEL	GP	3.6						0										
B-9 S-12	68.5-70.5	Gray FAT CLAY	CH	35.6		56	20			100										
B-9 S-14	78.5-80.5	Gray POORLY GRADED GRAVEL with SILT and SAND	GP-GM	9.1		NP	NP			7										
B-9 S-16	89-91	Gray WELL-GRADED GRAVEL with SAND	GW	5.7						4										

Note: The soil classification is based partially on visual classification unless both grain size and Atterberg limits are performed.

* Refer to Laboratory Test Curves



SYMBOL	●	⊠	▲
Boring	B-3	B-5	B-7
Sample	ST-1	ST-1	S-1
Spec			
Depth (ft)	26.0-28.0	47.5-49.5	52.4-54.4
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	48.6
% Sand	37.7	15.9	36.2
% Fines	62.3	84.1	15.2
% -2μ	9.7	19.3	
Cc	2.63		
Cu	33.33		
LL	42	30	
PL	25	22	
PI	17	8	
USCS	CL	CL	GM
w (%)	26.3	32.8	7.4

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			100.0
3/4"			71.8
3/8"			60.3
4			51.4
10	100.0	100.0	43.6
20		99.2	34.7
40	98.2	95.9	27.2
60	95.4	93.9	22.6
100	90.0	90.8	19.1
200	62.3	84.1	15.2

SYMBOL	DESCRIPTION AND REMARKS
●	Gray SANDY LEAN CLAY (CL)
⊠	Brown LEAN CLAY with SAND (CL)
▲	Brown SILTY GRAVEL with SAND (GM)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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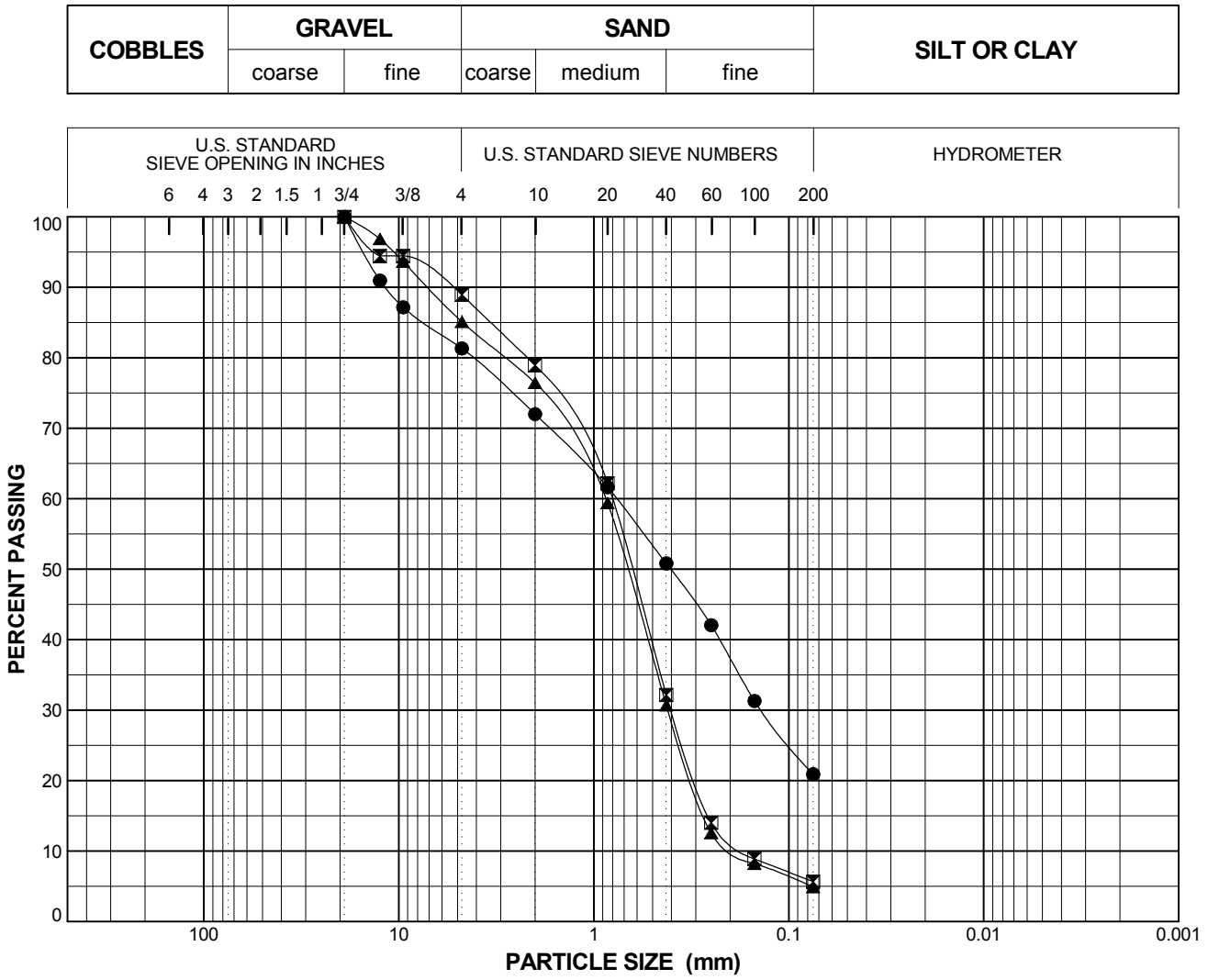

SYMBOL	●	⊠	▲
Boring	B-7	B-7	B-7
Sample	S-2	S-4	S-5
Spec			
Depth (ft)	54.4-56.4	58.1-60.1	60.2-62.2
% +3"	0.0	0.0	0.0
% Gravel	18.7	11.1	14.9
% Sand	60.4	83.3	80.2
% Fines	20.9	5.7	4.9
% -2μ			
Cc		1.18	1.07
Cu		4.82	4.72
LL			
PL			
PI			
USCS	SM	SP-SM	SP
w (%)	11.2	11.8	15.6

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			
3/4"	100.0	100.0	100.0
3/8"	87.2	94.5	93.6
4	81.3	88.9	85.1
10	72.0	78.9	76.4
20	61.6	62.2	59.4
40	50.8	32.1	30.7
60	42.1	14.0	12.5
100	31.3	8.9	8.2
200	20.9	5.7	4.9

SYMBOL	DESCRIPTION AND REMARKS
●	Brown SILTY SAND with GRAVEL (SM)
⊠	Gray POORLY GRADED SAND with SILT (SP-SM)
▲	Gray POORLY GRADED SAND (SP)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

Project Number		
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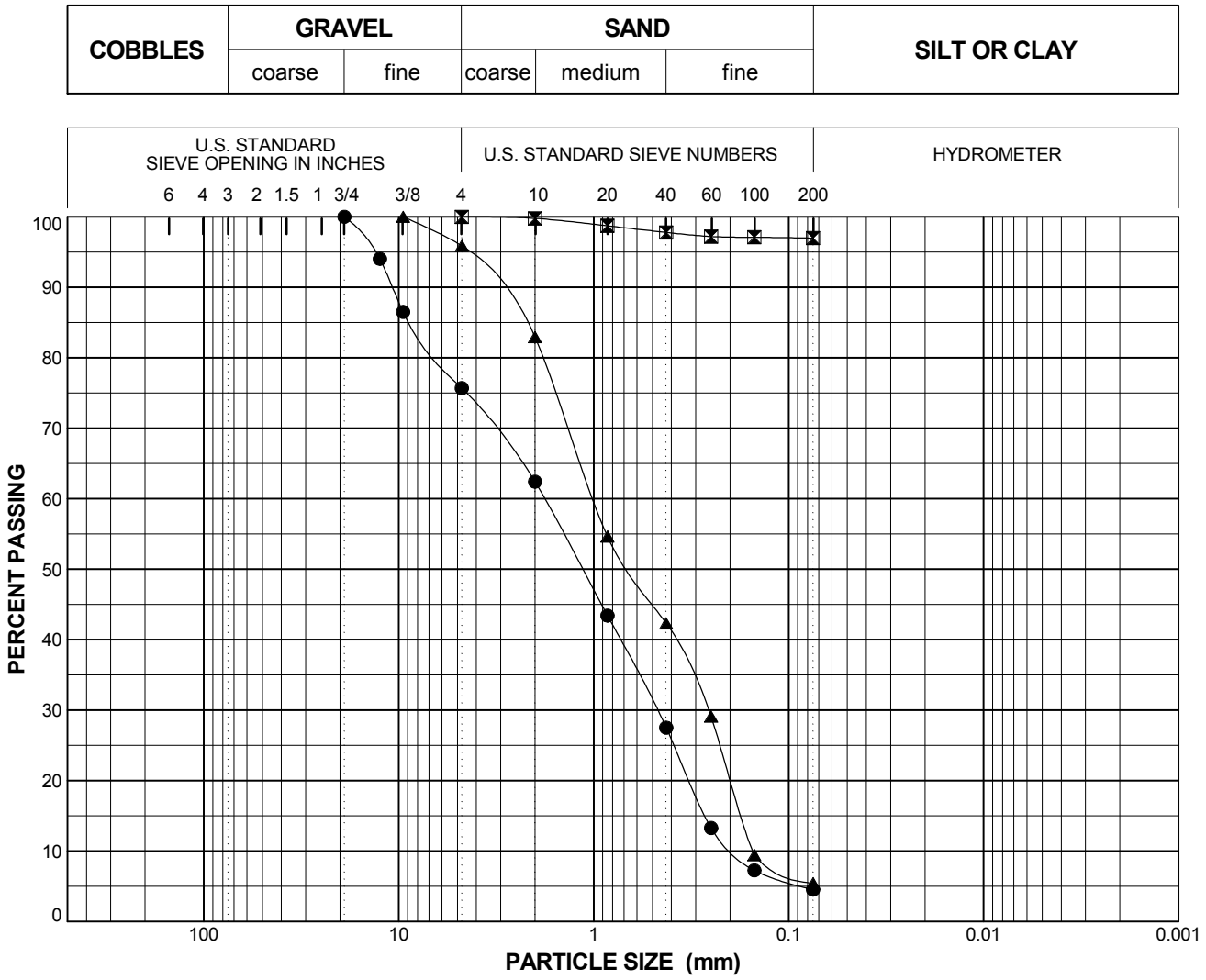

SYMBOL	●	⊠	▲
Boring	B-7	B-7	B-7
Sample	S-6	S-7A	S-7B
Spec			
Depth (ft)	62.2-64.2	67.5-68.5	68.5-69.5
% +3"	0.0	0.0	0.0
% Gravel	24.3	0.0	4.1
% Sand	71.2	3.0	90.5
% Fines	4.5	97.0	5.4
% -2μ			
Cc	0.66		0.44
Cu	9.47		6.57
LL		62	
PL		25	
PI		37	
USCS	SP	CH	SP-SM
w (%)	10.5	39.0	15.4

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			
3/4"	100.0		
3/8"	86.5		100.0
4	75.7	100.0	95.9
10	62.4	99.8	82.9
20	43.4	98.7	54.6
40	27.5	97.8	42.3
60	13.3	97.2	29.1
100	7.3	97.1	9.4
200	4.5	97.0	5.4

SYMBOL	DESCRIPTION AND REMARKS
●	Gray POORLY GRADED SAND with GRAVEL (SP)
⊠	Gray FAT CLAY (CH)
▲	Gray POORLY GRADED SAND with SILT (SP-SM)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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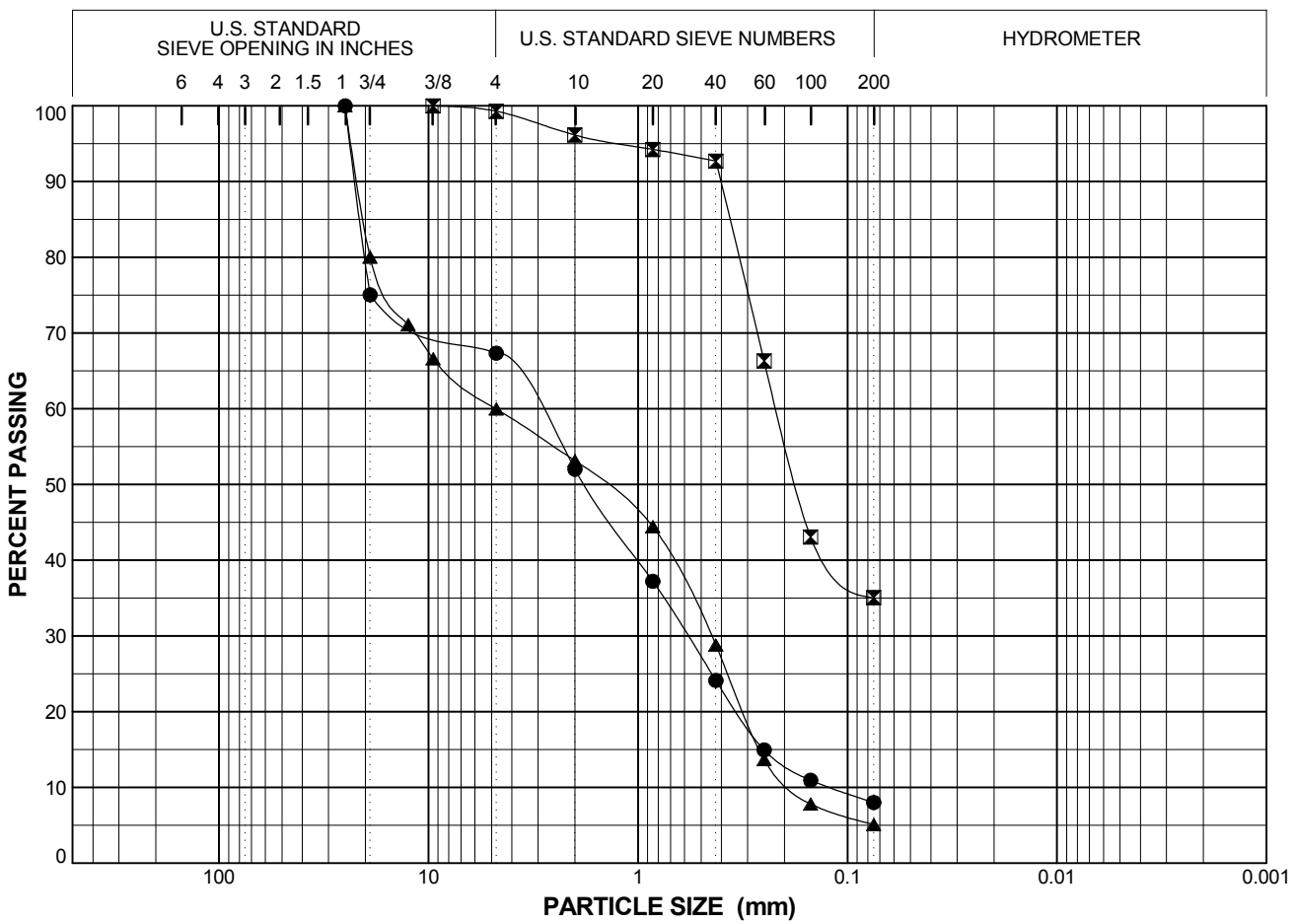

SYMBOL	●	⊠	▲
Boring	B-7	B-7	B-7
Sample	S-8	S-9	S-10A
Spec			
Depth (ft)	72.5-74.5	77.5-79.5	82.5-83.5
% +3"	0.0	0.0	0.0
% Gravel	32.7	0.7	40.0
% Sand	59.3	64.2	54.9
% Fines	8.0	35.0	5.1
% -2μ			
Cc	0.89		0.23
Cu	26.15		26.26
LL		53	
PL		20	
PI		33	
USCS	SP-SM	SC	SP-SM
w (%)	12.2	27.8	11.7

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			
3/4"	75.0		80.0
3/8"		100.0	66.6
4	67.3	99.3	60.0
10	52.0	96.1	53.1
20	37.2	94.2	44.4
40	24.1	92.7	28.8
60	14.9	66.3	13.7
100	10.9	43.1	7.8
200	8.0	35.0	5.1

SYMBOL	DESCRIPTION AND REMARKS
●	Gray POORLY GRADED SAND with SILT and GRAVEL (SP-SM)
⊠	Gray CLAYEY SAND (SC)
▲	Gray POORLY GRADED SAND with SILT and GRAVEL (SP-SM)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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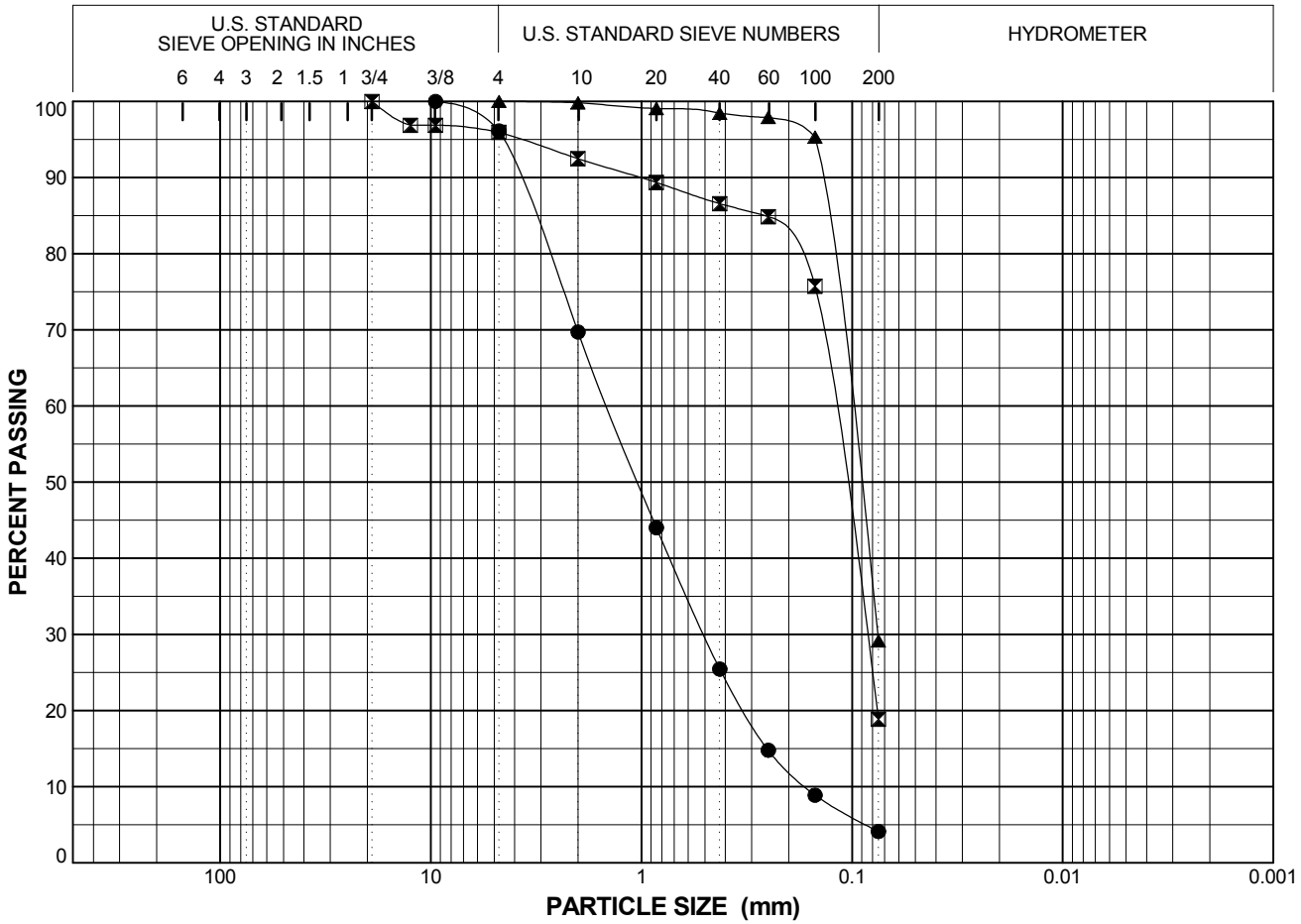
COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



SYMBOL	●	⊠	▲
Boring	B-7	B-8	B-8
Sample	S-10B	S-1&S-2	S-4
Spec			
Depth (ft)	83.5-84.5	10.0-16.0	24.0-26.0
% +3"	0.0	0.0	0.0
% Gravel	3.9	4.1	0.0
% Sand	92.0	77.1	70.8
% Fines	4.1	18.9	29.2
% -2μ			
Cc	1.06		
Cu	8.76		
LL			
PL			
PI			
USCS	SW	SM	SM
w (%)	10.3	24.0	27.8

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			
3/4"		100.0	
3/8"	100.0	96.9	
4	96.1	95.9	100.0
10	69.7	92.5	99.8
20	44.0	89.3	99.1
40	25.4	86.6	98.4
60	14.8	84.9	97.9
100	8.9	75.7	95.3
200	4.1	18.9	29.2

SYMBOL	DESCRIPTION AND REMARKS
●	Gray WELL-GRADED SAND (SW)
⊠	Brown gray SILTY SAND (SM)
▲	Brown gray SILTY SAND (SM)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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B-8

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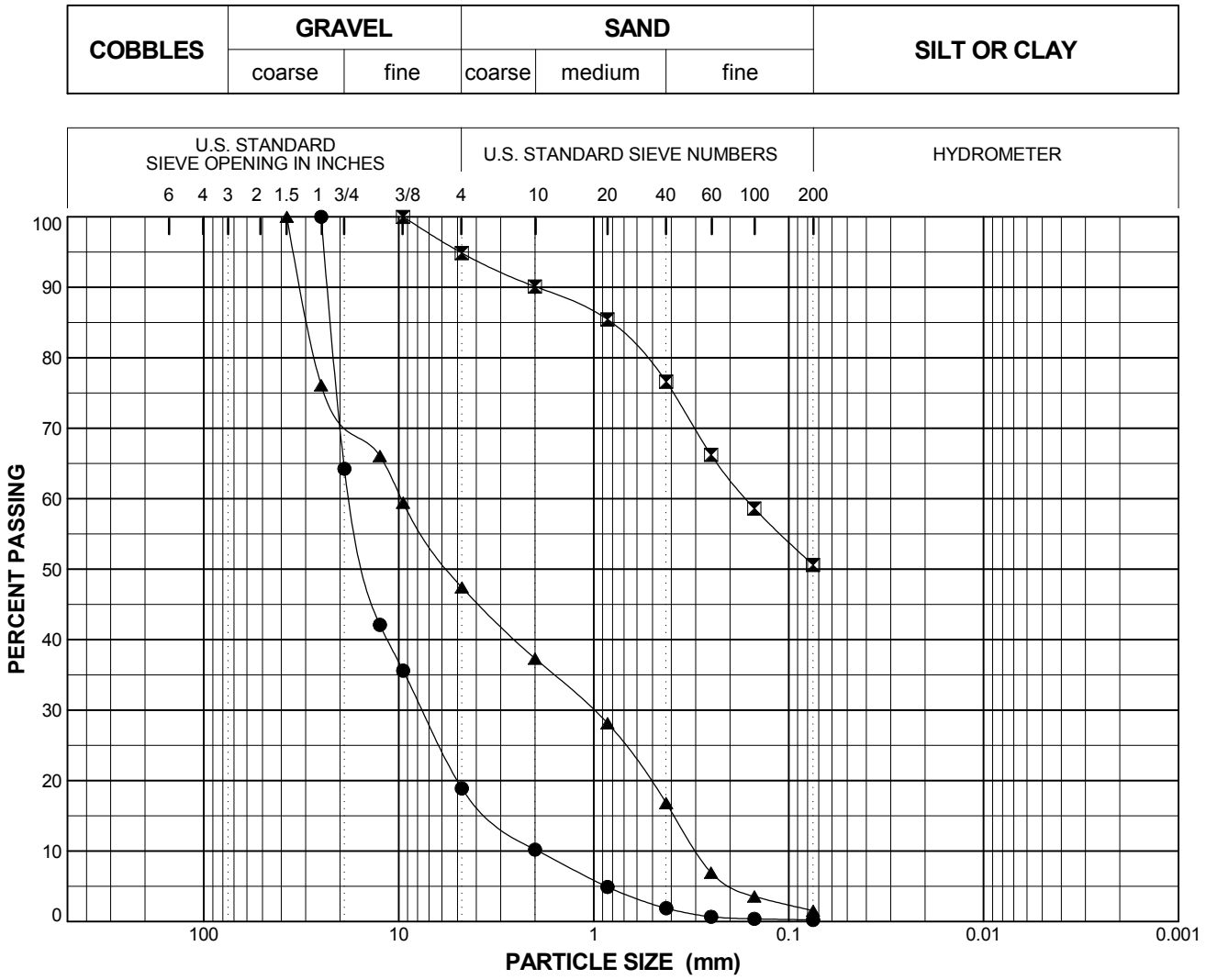

SYMBOL	●	⊠	▲
Boring	B-8	B-8	B-8
Sample	S-8	S-9	S-12
Spec			
Depth (ft)	39.0-41.0	44.0-46.0	59.0-61.0
% +3"	0.0	0.0	0.0
% Gravel	81.1	5.1	52.6
% Sand	18.7	44.2	45.9
% Fines	0.2	50.6	1.5
% -2μ			
Cc	1.67		0.36
Cu	9.06		32.98
LL		37	
PL		25	
PI		12	
USCS	GW	ML	GP
w (%)	14.1	32.7	8.2

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			100.0
3/4"	64.2		
3/8"	35.6	100.0	59.4
4	18.9	94.9	47.4
10	10.2	90.1	37.3
20	4.9	85.4	28.1
40	1.9	76.6	16.8
60	0.7	66.2	6.9
100	0.4	58.6	3.5
200	0.2	50.6	1.5

SYMBOL	DESCRIPTION AND REMARKS
●	Gray WELL-GRADED GRAVEL with SAND (GW)
⊠	Brown SANDY SILT (ML)
▲	Gray POORLY GRADED GRAVEL with SAND (GP)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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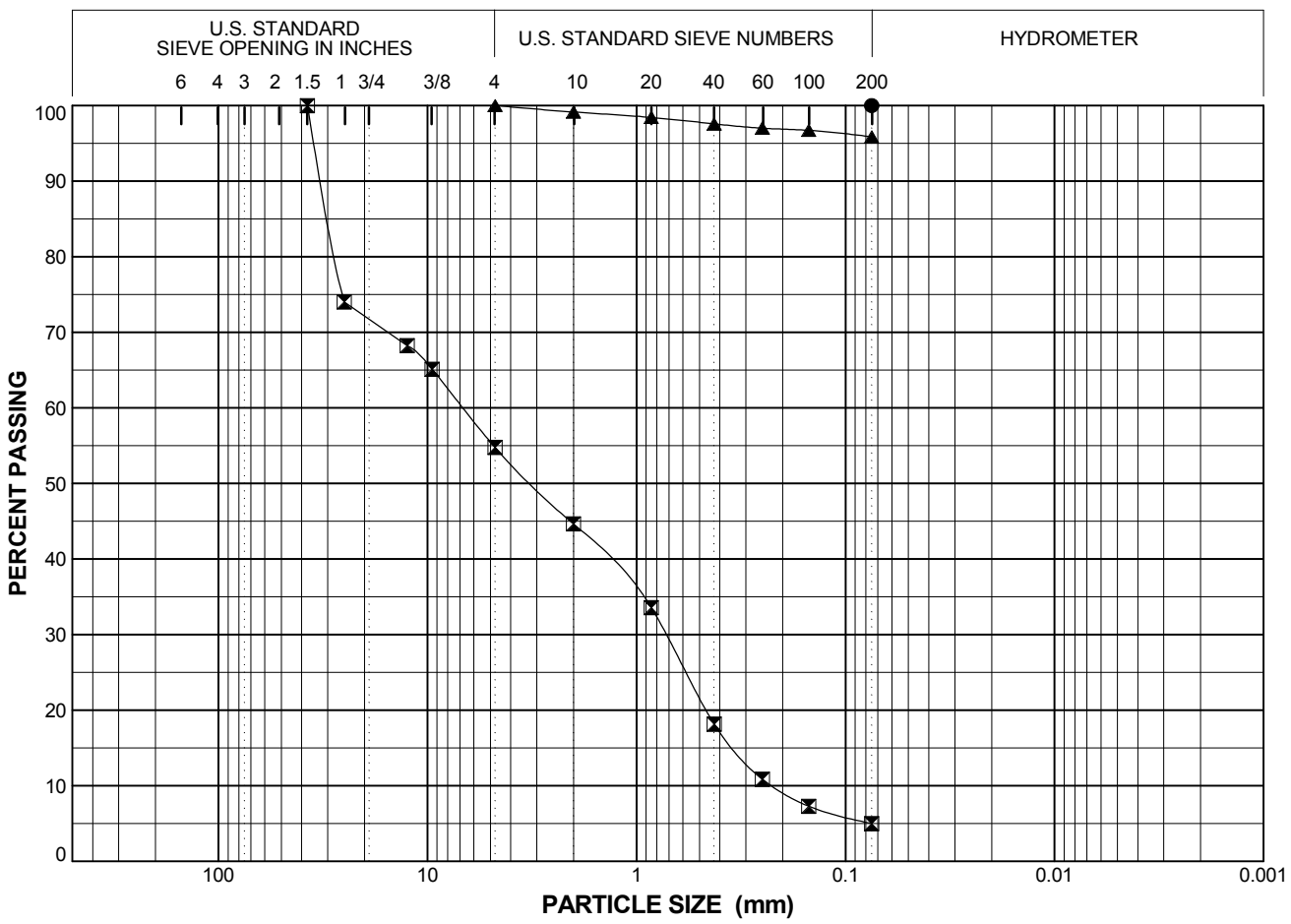

SYMBOL	●	⊠	▲
Boring	B-8	B-8	B-8
Sample	S-15A	S-15B	S-15C
Spec			
Depth (ft)	73.0-73.3	73.3-73.8	73.8-74.2
% +3"	0.0	0.0	0.0
% Gravel	0.0	45.2	0.0
% Sand	0.0	49.8	4.1
% Fines	100.0	5.0	95.9
% -2μ			
Cc		0.35	
Cu		30.52	
LL	61	NP	66
PL	26	NP	26
PI	35	NP	40
USCS	CH	SP-SM	CH
w (%)	43.7	8.5	37.4

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"		100.0	
3/4"			
3/8"		65.1	
4		54.8	100.0
10		44.6	99.1
20		33.6	98.4
40		18.1	97.6
60		10.9	97.0
100		7.3	96.7
200	100.0	5.0	95.9

SYMBOL	DESCRIPTION AND REMARKS
●	Gray FAT CLAY (CH)
⊠	Gray POORLY GRADED SAND with SILT and GRAVEL (SP-SM)
▲	Gray FAT CLAY (CH)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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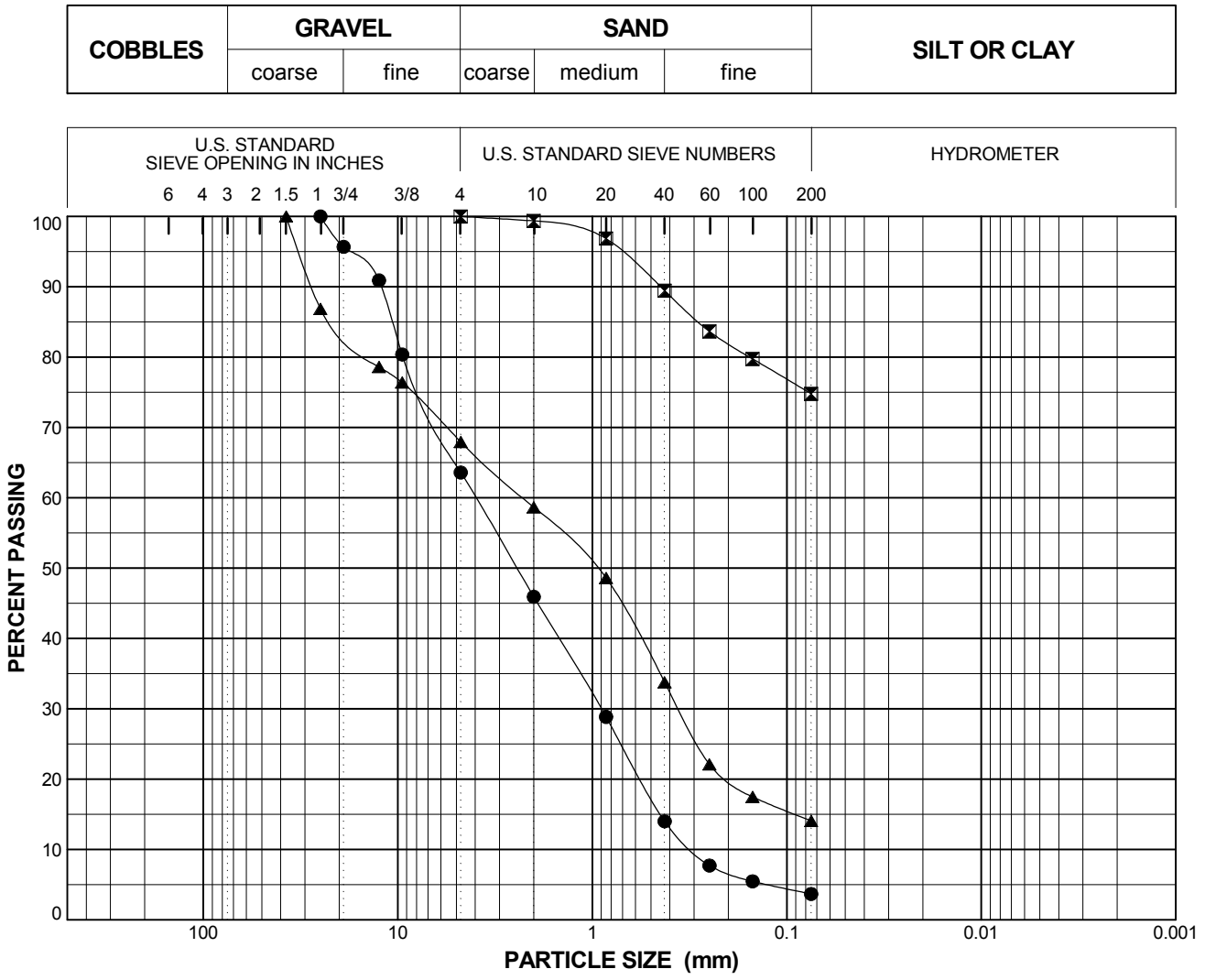

SYMBOL	●	⊠	▲
Boring	B-8	B-9	B-9
Sample	S-17A	S-1	S-2
Spec			
Depth (ft)	83.0-85.0	11-13	17-19.5
% +3"	0.0	0.0	0.0
% Gravel	36.4	0.0	32.1
% Sand	59.9	25.2	53.9
% Fines	3.7	74.8	14.1
% -2μ			
Cc	0.67		
Cu	13.14		
LL		24	
PL		15	
PI		9	
USCS	SP	CL	SM
w (%)	8.9	24.3	8.9

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			100.0
3/4"	95.7		
3/8"	80.4		76.4
4	63.6	100.0	67.9
10	45.9	99.4	58.7
20	28.9	96.8	48.6
40	14.0	89.5	33.8
60	7.7	83.6	22.1
100	5.5	79.7	17.5
200	3.7	74.8	14.1

SYMBOL	DESCRIPTION AND REMARKS
●	Gray POORLY GRADED SAND with GRAVEL (SP)
⊠	Brown gray LEAN CLAY with SAND (CL)
▲	Brown SILTY SAND with GRAVEL (SM)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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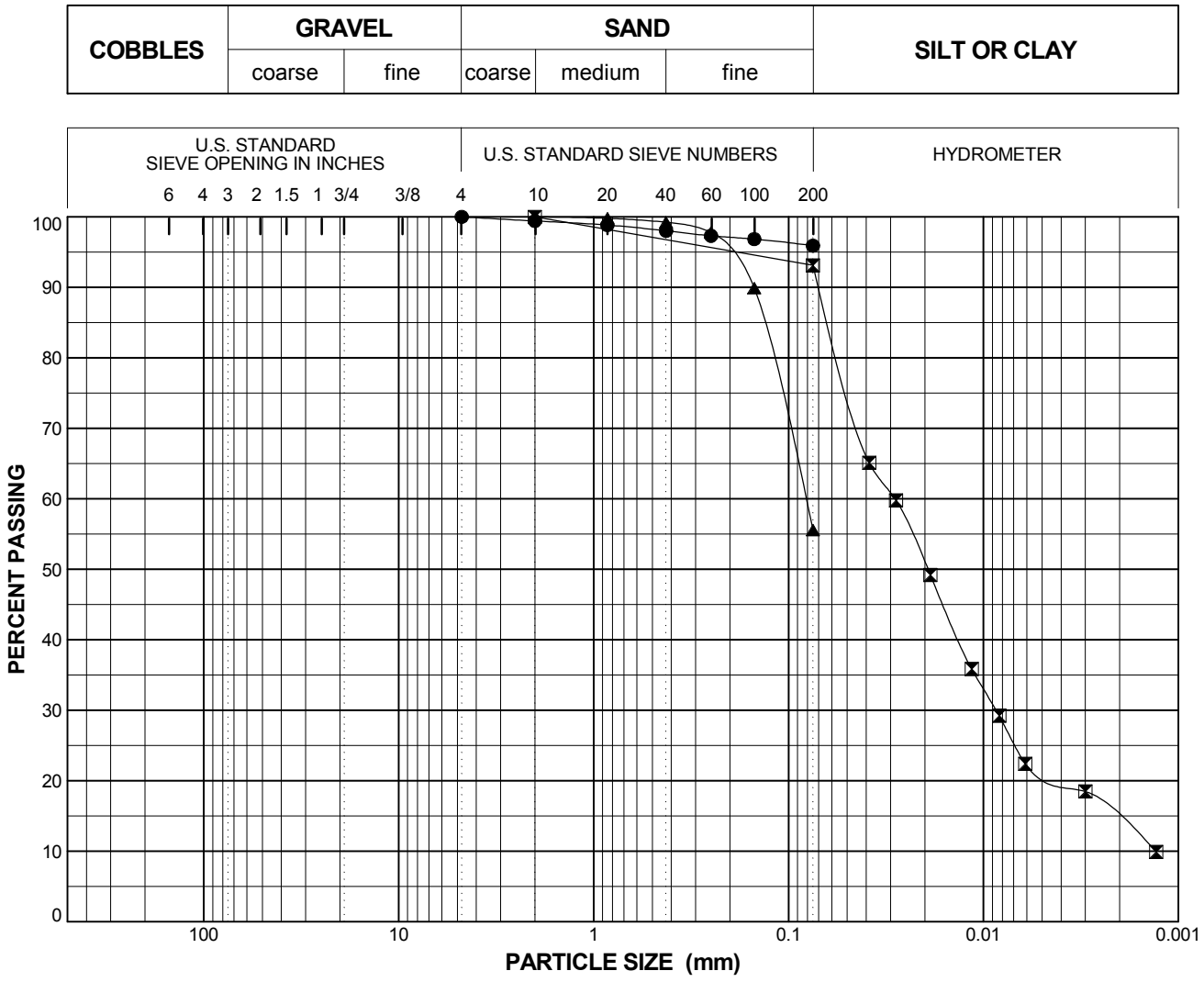

SYMBOL	●	⊠	▲
Boring	B-9	B-9	B-9
Sample	S-3	ST-2	S-5
Spec			
Depth (ft)	23.4-25.4	26.0-28.0	33.5-35.5
% +3"	0.0	0.0	0.0
% Gravel	0.0	0.0	0.0
% Sand	4.1	6.9	44.4
% Fines	95.9	93.1	55.6
% -2μ		14.3	
Cc		2.00	
Cu		21.71	
LL	46	28	24
PL	27	22	20
PI	19	6	4
USCS	CL	CL-ML	CL-ML
w (%)	36.8	33.7	24.2

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"			
3/4"			
3/8"			
4	100.0		
10	99.4	100.0	100.0
20	98.8		99.8
40	98.0		99.2
60	97.3		97.8
100	96.8		89.9
200	95.9	93.1	55.6

SYMBOL	DESCRIPTION AND REMARKS
●	Gray LEAN CLAY (CL)
⊠	Gray SILTY CLAY (CL-ML)
▲	Brown SANDY SILTY CLAY (CL-ML)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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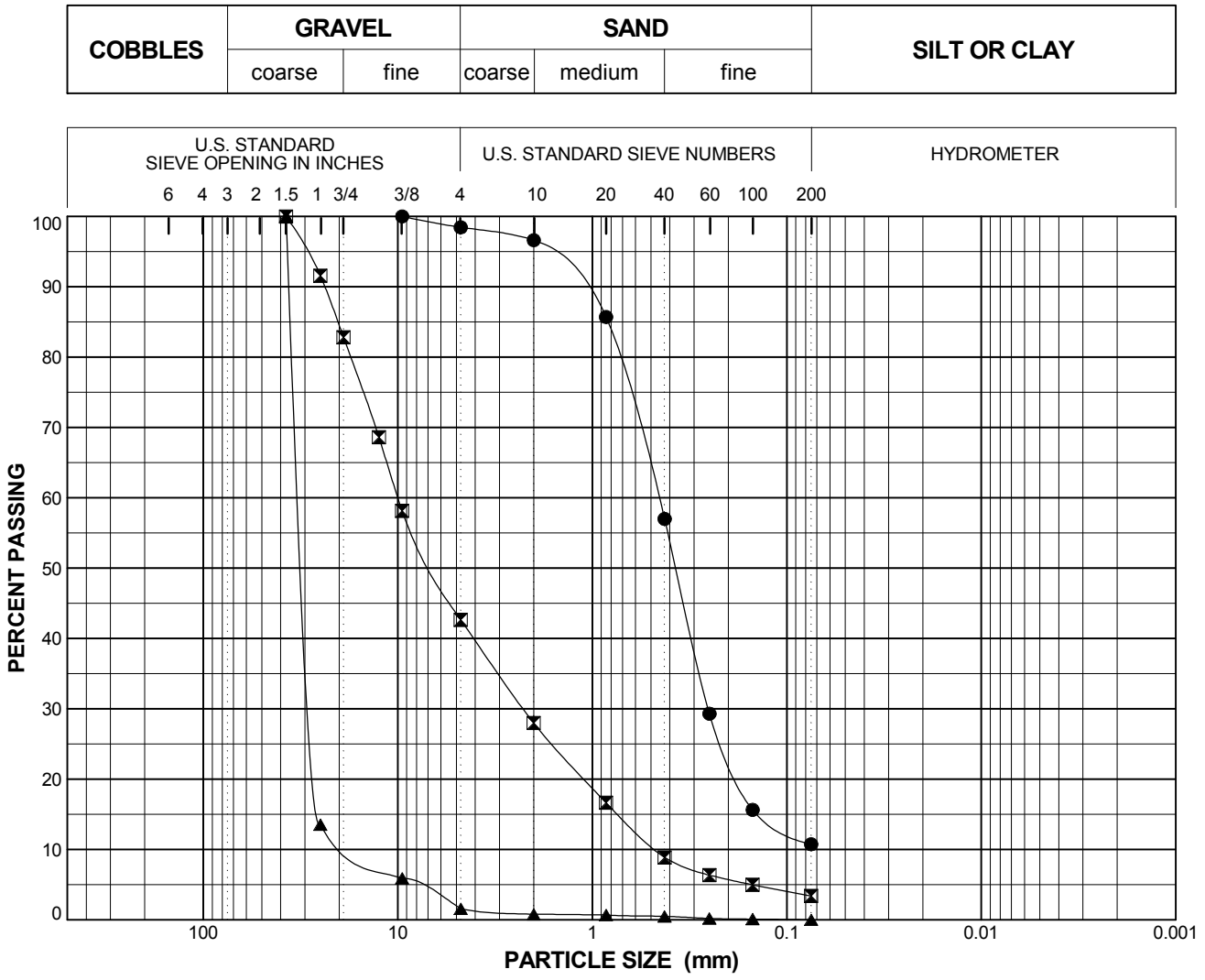

SYMBOL	●	⊠	▲
Boring	B-9	B-9	B-9
Sample	S-7	S-9	S-11
Spec			
Depth (ft)	43.3-45.3	53.3-55.3	63.5-65.5
% +3"	0.0	0.0	0.0
% Gravel	1.6	57.4	98.4
% Sand	87.7	39.2	1.6
% Fines	10.7	3.4	0.0
% -2μ			
Cc	2.08	1.09	1.47
Cu	6.77	21.22	1.94
LL			
PL			
PI			
USCS	SW-SM	GW	GP
w (%)	22.6	8.6	3.6

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"		100.0	100.0
3/4"		82.8	
3/8"	100.0	58.2	5.9
4	98.4	42.6	1.6
10	96.6	28.0	0.8
20	85.7	16.6	0.7
40	57.0	8.9	0.5
60	29.3	6.3	0.2
100	15.6	5.0	0.1
200	10.7	3.4	0.0

SYMBOL	DESCRIPTION AND REMARKS
●	Brown WELL-GRADED SAND with SILT (SW-SM)
⊠	Brown WELL-GRADED GRAVEL with SAND (GW)
▲	Brown POORLY GRADED GRAVEL (GP)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

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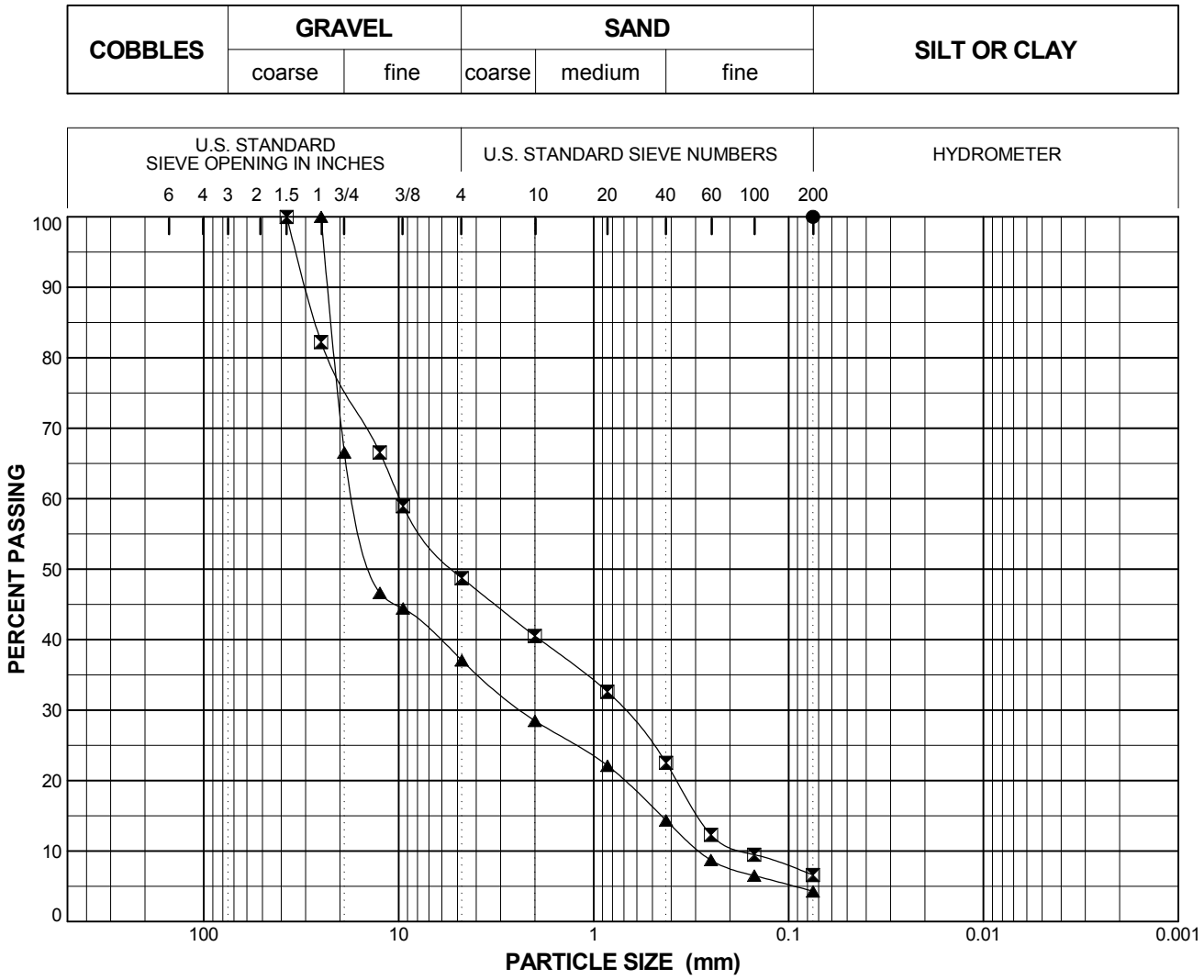
SIEVE_BLUEBELL 19998935 NO.2011-08-10 SUNOCO DELOACH & SHORT WHARVES 8-16-2011.GPJ URS_BLUE.GDT 11/8/11



SYMBOL	●	⊠	▲
Boring	B-9	B-9	B-9
Sample	S-12	S-14	S-16
Spec			
Depth (ft)	68.5-70.5	78.5-80.5	89-91
% +3"	0.0	0.0	0.0
% Gravel	0.0	51.3	62.9
% Sand	0.0	42.1	32.8
% Fines	100.0	6.6	4.3
% -2μ			
Cc		0.31	1.16
Cu		59.92	58.65
LL	56	NP	
PL	20	NP	
PI	36	NP	
USCS	CH	GP-GM	GW
w (%)	35.6	9.1	5.7

Particle Size (Sieve #)	PERCENT FINER ●	⊠	▲
4"			
3"			
1-1/2"		100.0	
3/4"			66.6
3/8"		58.9	44.4
4		48.7	37.1
10		40.5	28.5
20		32.6	22.1
40		22.5	14.3
60		12.3	8.7
100		9.5	6.5
200	100.0	6.6	4.3

SYMBOL	DESCRIPTION AND REMARKS
●	Gray FAT CLAY (CH)
⊠	Gray POORLY GRADED GRAVEL with SILT and SAND (GP-GM)
▲	Gray WELL-GRADED GRAVEL with SAND (GW)

PARTICLE SIZE DISTRIBUTION

Sunoco: Deloach and Short Wharves

Project Number		
19998935	August 2011	

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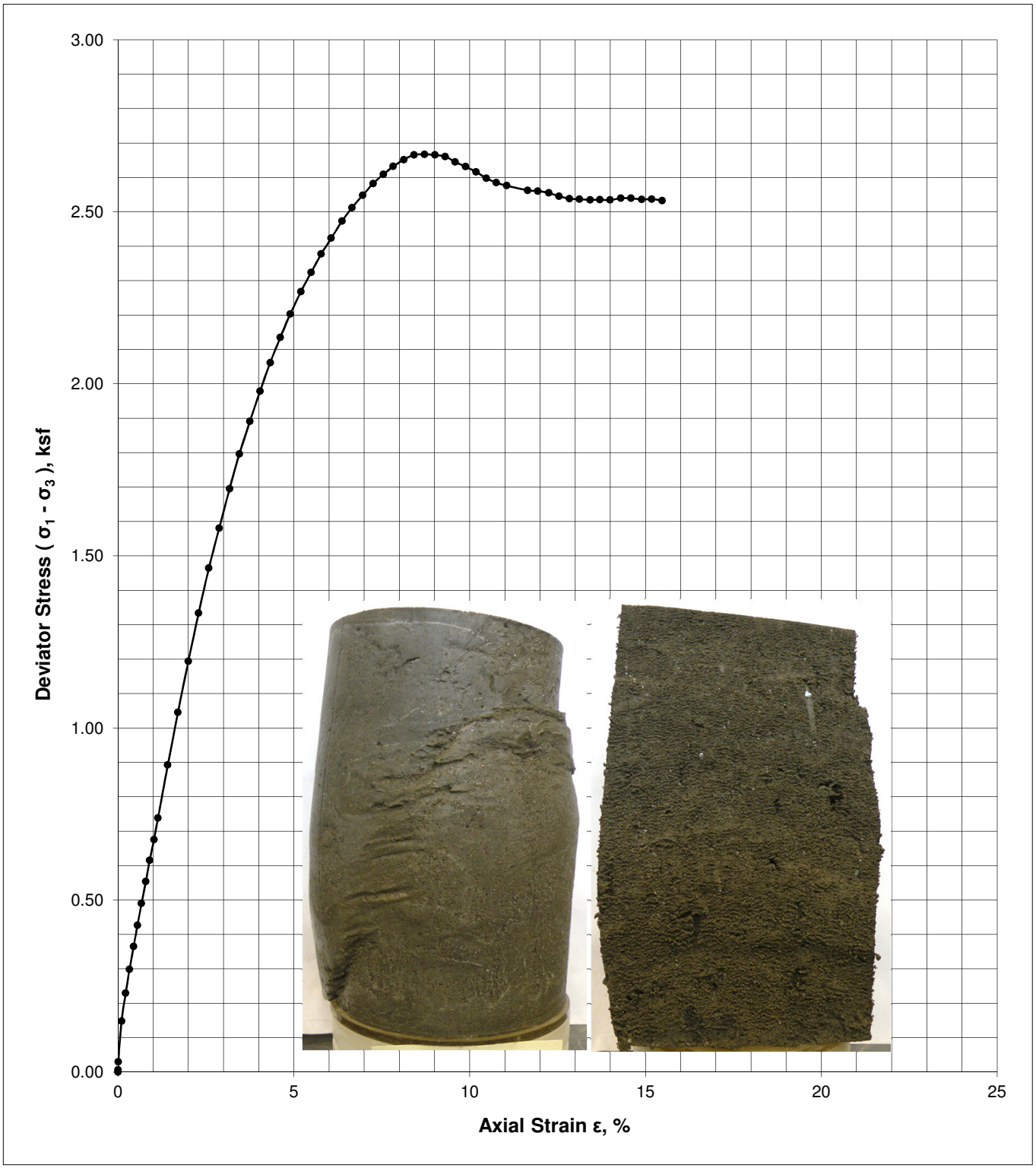

Specimen Information							Test Summary			
Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Initial Length (in)	Initial Dia. (in)	σ_3 (ksf)	$(\sigma_1 - \sigma_3)_{max}$ (ksf)	ε_f %	Strain Rate (% / min)
27.3	124.9	98.1	42	25	5.59	2.88	1.25	2.67	8.7	1.0
Description:	Gray SANDY LEAN CLAY (CL)						Tested by: RM		Reviewed by: EM	

Project No.:	Project Name:	Unconsolidated-Undrained Triaxial Compression (UU) Test ASTM D 2850	
19998935	**Sunoco Deloach & Short Wharves**		
Boring No.: B-3	Sample No.: ST-1	Sample Depth (ft): 26.0-28.0	Date: 8/10/2011

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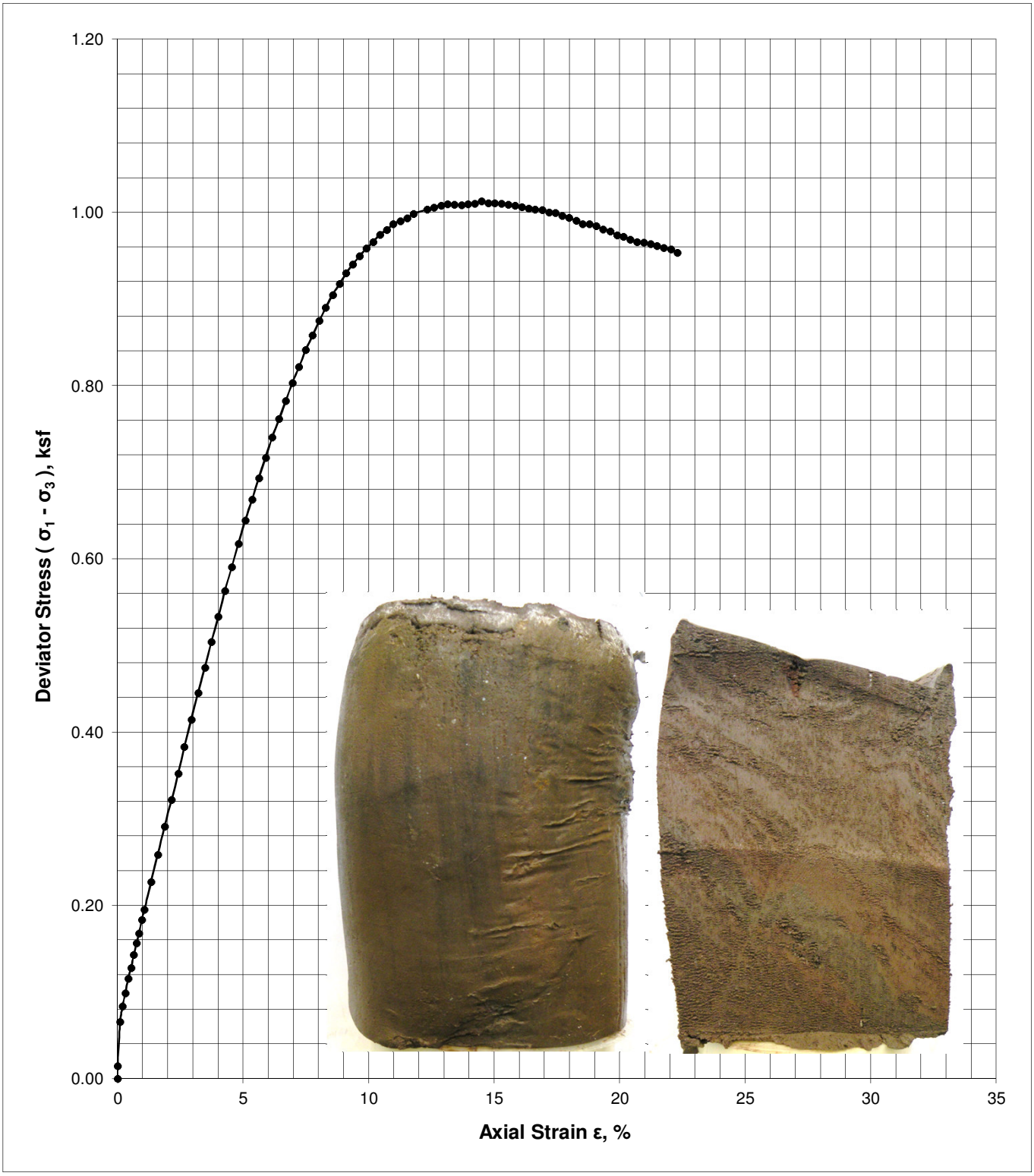

Specimen Information							Test Summary			
Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Initial Length (in)	Initial Dia. (in)	σ_3 (ksf)	$(\sigma_1 - \sigma_3)_{max}$ (ksf)	ε_f %	Strain Rate (% / min)
32.8	116.9	88.0	30	22	5.59	2.88	2.0	1.0	14.5	1.0
Description:	Brown Lean CLAY with Sand						Tested by: TV		Reviewed by: EM	

Project No.:	Project Name:	Unconsolidated-Undrained Triaxial Compression (UU) Test ASTM D 2850	
19998935	**Sunoco Deloach & Short Wharves**		
Boring No.: B-5	Sample No.: ST-1	Sample Depth (ft): 47.5-49.5	Date: 9/14/2011

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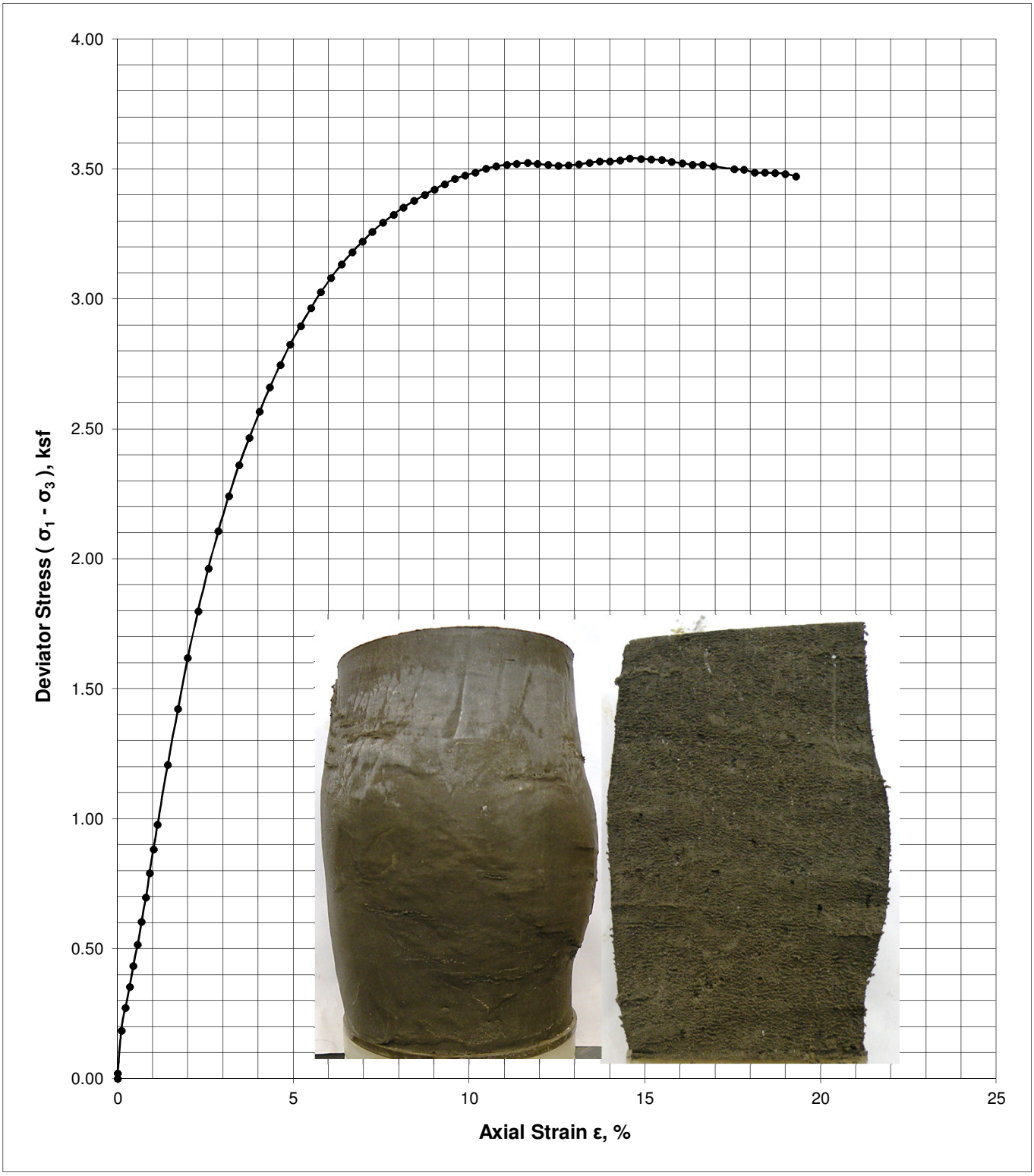

Specimen Information							Test Summary			
Water Content (%)	Wet Unit Weight (pcf)	Dry Unit Weight (pcf)	Atterberg Limits LL	Atterberg Limits PL	Initial Length (in)	Initial Dia. (in)	σ_3 (ksf)	$(\sigma_1 - \sigma_3)_{max}$ (ksf)	ε_f %	Strain Rate (% / min)
26.8	122.7	96.8	28	22	5.59	2.85	1.25	3.54	14.6	1.0
Description:	Gray SILTY CLAY (CL-ML)						Tested by: RM		Reviewed by: EM	

Project No.:	Project Name:	Unconsolidated-Undrained Triaxial Compression (UU) Test ASTM D 2850	
19998935	**Sunoco Deloach & Short Wharves**		
Boring No.: B-9	Sample No.: ST-2	Sample Depth (ft): 26.0-28.0	Date: 8/10/2011

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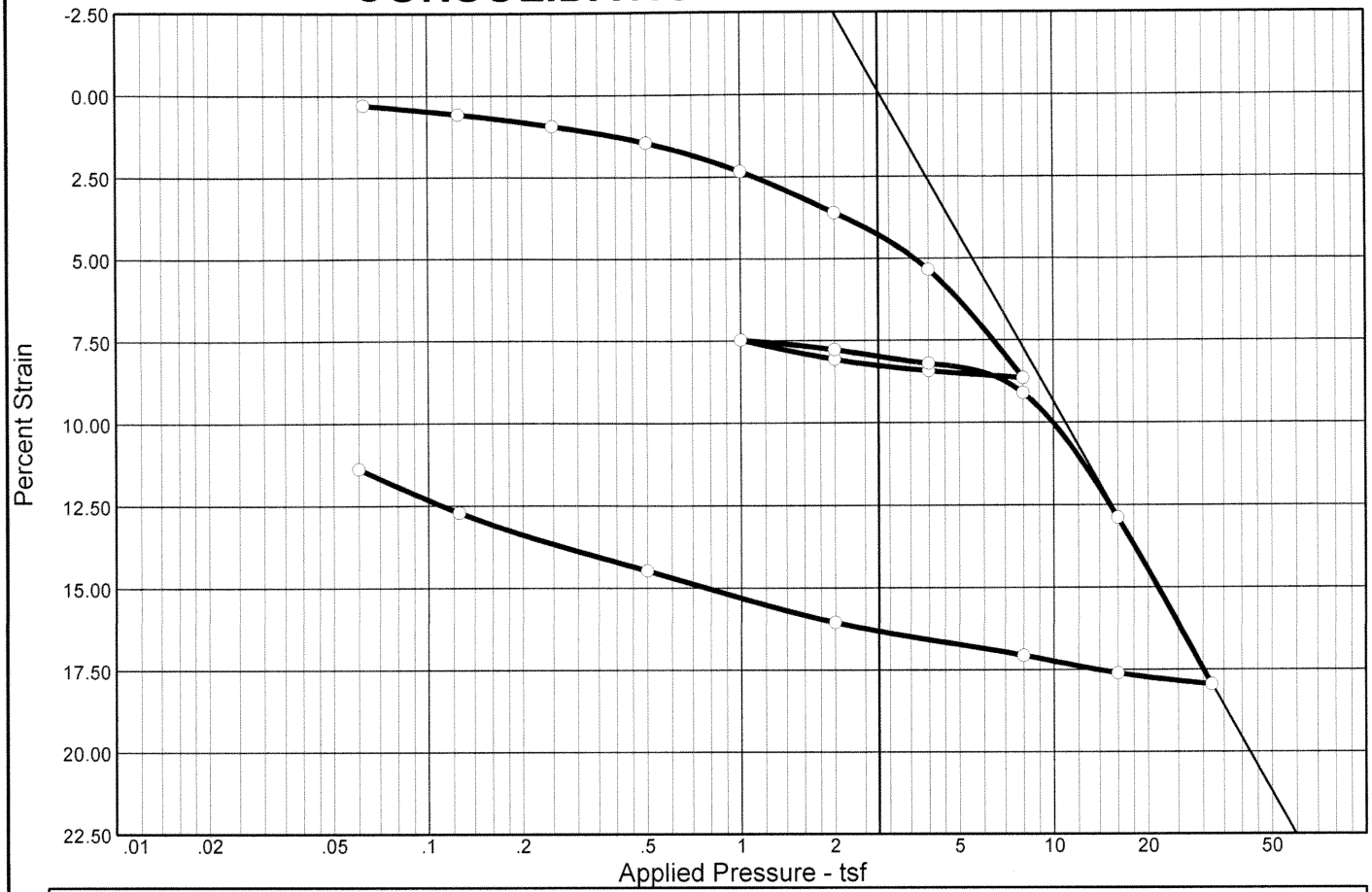
CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	C_v (ft.2/day)	C_α	No.	Load (tsf)	C_v (ft.2/day)	C_α	No.	Load (tsf)	C_v (ft.2/day)	C_α
3	0.25	0.31		16	32.00	5.08	0.005				
4	0.50	0.65									
5	1.00	2.29									
6	2.00	0.21	0.001								
7	4.00	5.57	0.002								
8	8.00	3.49	0.004								
12	2.00	3.94	0.000								
13	4.00	4.57	0.000								
14	8.00	1.71	0.001								
15	16.00	2.68	0.004								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
95.0 %	31.1 %	90.9	42	17	2.78		5.62	0.32	0.03	0.910

MATERIAL DESCRIPTION	USCS	AASHTO
Gray Sandy Lean CLAY	CL	

Project No. 19998935 **Client:** Sunoco

Project: Sunoco Deloach & Short Wharves

Source: B-3 **Sample No.:** ST-1 **Elev./Depth:** 26.0-28.0

Remarks:

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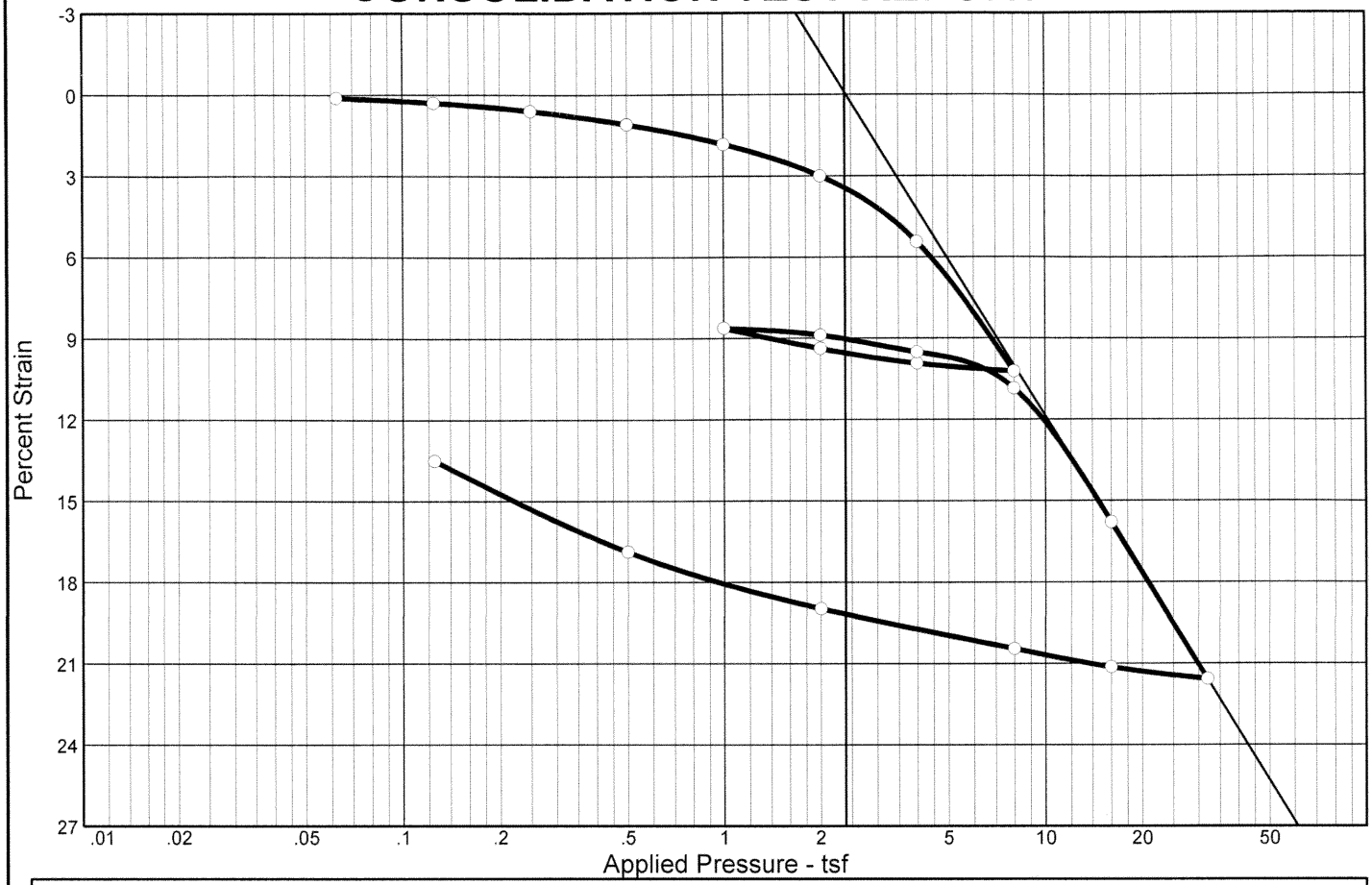
Fort Washington, PA

Plate

CONSOLIDATION TEST REPORT



Coefficients of Consolidation and Secondary Consolidation

No.	Load (tsf)	C_v (ft.2/day)	C_α	No.	Load (tsf)	C_v (ft.2/day)	C_α	No.	Load (tsf)	C_v (ft.2/day)	C_α
2	0.13	0.06	0.000	16	32.00	1.22	0.007				
3	0.25	0.03	0.001								
4	0.50	6.52	0.000								
6	2.00	6.65	0.001								
7	4.00	2.50	0.003								
8	8.00	1.58	0.005								
12	2.00	2.03									
13	4.00	3.56									
14	8.00	1.92									
15	16.00	1.37	0.007								

Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
97.5 %	35.0 %	86.4	28	6	2.75		3.96	0.38	0.05	0.987

MATERIAL DESCRIPTION	USCS	AASHTO
Gray Silty CLAY	CL-ML	

Project No. 19998935 **Client:** Sunoco

Project: Sunoco Deloach & Short Wharves

Source: B-9 **Sample No.:** ST-2 **Elev./Depth:** 26.0-28.0

URS CORPORATION

Fort Washington, PA

Remarks:

Plate