Jacobs

Geotechnical Report

New Jersey American Water

Jumping Brook Water Treatment Plant
December 2, 2022

Geotechnical Report

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Acronyms and abbreviations

bgs	below ground surface
bpf	blows per foot
ksf	thousand pounds per square foot
ksi	kips per square inch
GDMS	Geotechnical Data Management System
GER	Geotechnical Engineering Report
GWT	Groundwater Table
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
pcf	pounds per cubic foot
psf	pounds per square foot
REC	Core Recovery Percentage
SPT	standard penetration test
SWM	stormwater management
tsf	tons per square foot
USCS	Unified Soil Classification System
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

1. Introduction

Jacobs Engineering Group, Inc. (Jacobs) has prepared this Geotechnical Engineering Report (GER) to present geotechnical investigation results, analyses, design, and construction recommendations for the proposed structure and stormwater management area at the Jumping Brook Water Treatment Plant (WTP) located in Neptune City, NJ,

The geotechnical subsurface exploration and laboratory results were used to characterize subsurface conditions, evaluate soil engineering properties, performed settlement analysis, evaluate corrosion potential, performed deep foundation analysis, and to develop foundation recommendations and construction considerations for this project. The geotechnical subsurface exploration included the following specific items:

- Drilling seven (7) soil borings at the proposed structure
- Drilling five (5) storm water management borings
- Excavating three (3) test pits
- Conducting five (5) permeability tests
- Installing two (2) permanent monitoring wells

1.1 Site location and Proposed Construction

The project site is located in Neptune City, NJ just south of the existing Jumping Brook WTP. The site is bound by Sycamore St to the East, Jumping Brook Reservoir to the West, Old Corlies Ave to the South, and the existing WTP to the north. The site can be accessed via existing bridge. The existing ground surface elevation at the site varies from elevation +15 to +40 feet. Refer to the Figure 1 for site location plan.

The project consists of the construction of a new water treatment structure with main geotechnical foundation features including a clearwell tank mat foundation at the west portion of the building and expected to be bearing at approximate elevation of +0.5 feet, and a chemical room mat foundation and retaining walls at the east portion of the building with foundation elevations varying between +25 and +30 feet. Support of excavation will be required for the construction of the tank.

Other features on the project include the construction of a Stormwater Management (SWM) system, and a Drywell.

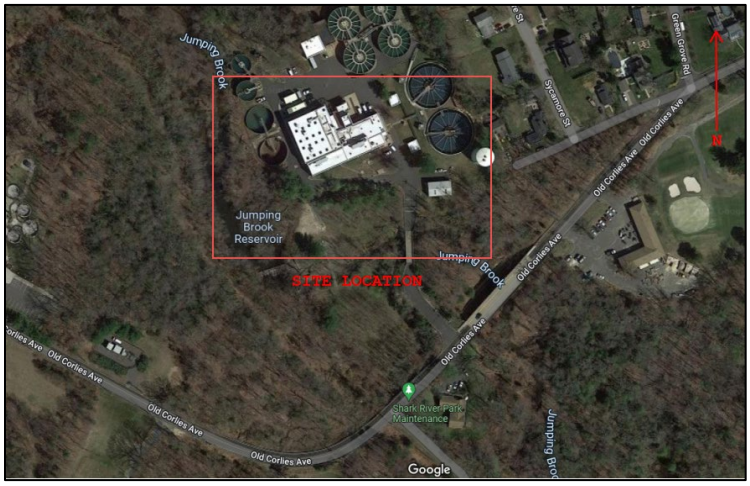

Figure 1: Propose Site Location Plan

2. Site Geology

According to Geology Map of the Asbury Park Quadrangle, Monmouth, and Ocean Counties, New Jersey, the site is located within the Kirkwood Formation. This formation is described as sand, typically light-colored, interbedded with and overlying dark-gray or brown clay silt. The lowermost clay-silt, termed the Asbury Clay or Asbury Park Member of the Kirkwood Formation is a dark, peaty, massive to laminated clay-silt with occasional interbeds of fine sand. Locally, the clay has irregularly shaped sand pockets, which may represent some type of burrow. The site is located within the Coastal Plain physiographic province according to the New Jersey Department of Environmental Protection (NJDEP) GIS data source.

Additionally, the following available resources were reviewed to determine existing soil conditions:

1. New Jersey Department of Transportation (NJDOT) Geotechnical Data Management System (GDMS)

2. Surficial Geology of the Asbury Park Quadrangle Monmouth and Ocean Counties, New Jersey

Based on NJDOT GDMS some existing soil boring records from nearby RT-18 roadway were reviewed. The soil borings were approximately 0.75 to 1 mile away from proposed site. Generally, the upper soils encountered within these borings consist of loose to medium dense sand with varying amount of silt and lower soils consist of medium stiff to stiff Clay and Silt.

Based on the Surficial Geology of the Asbury Park, Quadrangle Monmouth and Ocean Counties, New Jersey OFM 40, the map units in the vicinity of the site describe the surficial soils as Weathered Coastal Plain Formations (Qwcp). This unit is described as exposed sand and clay of Coastal Plain bedrock formations. May be overlain by thin, patchy alluvium and colluvium.

2.1 Seismic Site Class

Based on ASCE 7 Chapter 20 Table 20.3-1 average Standard Penetration Test (SPT) method to determine site class, the site is classified as Site Class E. The average (SPT) blow count for the upper 100 feet of the soil profile was estimated to be less than 15 blow-per-foot (bpf) in the majority of the boring logs.

3. Subsurface Investigation

Subsurface investigation consisted of drilling soil borings, installing monitoring wells, conducting permeability/percolation tests, and excavating test pits to document subsurface soil conditions. The field investigation was performed under the direct supervision of a Jacobs geotechnical engineer who maintained detailed logs of the soil. The samples were examined and visually classified in accordance with ASTM D2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)". Soil samples for borings at the proposed building were visually classified and described on boring logs using Unified Soil Classification System (USCS). The SWM borings and test pits were classified using USDA textural triangle. Representative specimens of the soil samples were labeled and preserved in glass jars for detailed identification and laboratory testing. Borings were backfilled with soil cuttings and sealed with bentonite grout.

As summarized in Table 1, seven soil borings, B-1 through B-7, were drilled within the proposed WTP building footprint. The depth of these borings varied from 50 feet to 72 feet below ground surface elevation. The boring location plan is shown in Appendix A and boring logs included in Appendix B.

TABLE 1: SUMMARY OF SOIL BORINGS FROM JACOBS (2022)

Boring No.	Elevation of Top of Boring (feet)	Termination Depth (feet)	Bottom Elevation (feet)	Water Depth (feet)[1]	GWT Elevation (feet)[2]
B-1	22	52	-30	NR	NR
B-2	22	62	-40	NR	NR
B-3	24	52	-28	NR	NR
B-4	35	52	-17	10	25
B-5	34	72	-38	10	24
B-6	25	72	-47	NR	NR
B-7	22.5	77	-54.5	NR	NR

[1,2] NR- Water Depth was not recorded since the borings were advanced using mud rotary drilling method; GWT – Groundwater table.

Five borings, SWM-1 through SWM-5, were drilled within the designated SWM areas to 20 feet of depth below ground surface. In addition, separate permeability test holes were drilled within 5 feet of the SWM borings to evaluate the hydraulic conductivity values. Two test pits were excavated to a depth of 7 and 10 feet at SWM Area 1 and SWM Area 2, respectively. One future test pit in the drywell area remains to be excavated by the Contractor.

The soil borings were drilled by Craig Test Boring, Inc. of Mays Landing, New Jersey. All borings, except B-6 and B-7 were advanced with a track-mounted CME 75 drill rig, while borings B-6 and B-7 were completed using a track-mounted CME 55 drill rig. All soil borings at the proposed building footprint were advanced using mud rotary drilling technique with Standard Penetration Tests (SPT). SPT were performed in accordance with ASTM D1586 using an automatic hammer. Continuous 24-in split-spoon (SS) sampling was performed in the upper 12 to 15 feet and at 5-foot intervals thereafter. Shelby Tubes samples were retrieved for undisturbed sample testing as directed by the Jacobs geotechnical engineer. The SWM area borings were drilled using hollow stem augers with 6-in ID. Soil samples were obtained using a 24-in SS. The total number of blows required to penetrate the second and third 6-in intervals of a 24-in SS sampler were recorded as the SPT N-value, in blows per foot (bpf).

The monitoring wells were installed within drilled borings. The well installation consisted of using ¼ inch slotted PVC pipe with PVC riser. The PVC was encapsulated in clean sand, and the seal was developed using bentonite within the top 3 feet. A protective casing was installed thereafter.

Test pits were excavated by Northeast Remsco and soil visual observations were logged by Jacobs geotechnical engineer. The test pit at SMW Area 1 was completed to a depth of 7 feet and collapsed as groundwater table was encountered between 5 and 6 feet of depth. The test pit at SWM Area 2 was excavated to approximate depth of 10 feet which corresponded to the excavator's maximum reach. Groundwater was not encountered at this location.

Permeability/percolation testing in the SWM area was conducted based on the Cased Borehole Infiltration Test procedure outlined in the New Jersey Stormwater Best Management Practice Manual – Chapter 12. The field test data was collected by Jacobs geotechnical engineer and hydraulic conductivity value was calculated based on ASTM D6391.

4. Laboratory Testing

Soil samples collected during the subsurface exploration were submitted to the soil testing laboratory along with assignments for testing. A summary of laboratory testing quantities is presented in Table 2.

TABLE 2: SUMMARY OF LABORATORY TESTING QUANTITIES

Test	ASTM Standard	Number of Tests Performed
Sieve Analysis	ASTM D6913	12
Hydrometer	ASTM D4221	15
Atterberg Limits	ASTM D4318	20
Moisture Content	ASTM D2216	19
Percent Passing No. 200 Sieve	ASTM D1140	2
Organic Content	ASTM D2974	1
1-D Consolidation	ASTM D2435	2
Corrosivity: pH, Sulfate, Chloride & Resistivity	ASTM D4972, ASTM C1580, AASHTO 291, AASHTO T288	2

Laboratory tests were performed on selected soil samples assigned by Jacobs geotechnical engineer to verify field classifications and to identify engineering properties. The index laboratory testing results are included on the boring logs in Appendix B, and all laboratory test results are presented in Appendix C.

4.1 Corrosivity Results

Corrosivity tests were performed on soil samples obtained from borings B-6 and B-7. These tests included resistivity, pH, and concentrations of chlorides and sulfates. A summary of the corrosivity results is presented in Table 3.

TABLE 3: SUMMARY OF CORROSIVITY RESULTS

Test	Units	Boring B-6	Boring B-7
Resistivity	ohm-cm	400	600
pH	-	5.4	4.4
Chlorides	ppm	22	<10
Sulfates	ppm	376	368

Corrosion evaluation has been performed based on the following:

- According to AASHTO 2017 LRFD, the effect of corrosion and deterioration from environmental conditions shall be considered in the selection of the foundation type and in the determination of the required foundation cross-section. The following criteria should be considered as indicative of a potential corrosion situation:
    - Resistivity less than 2,000 ohm-centimeters
    - pH less than 5.5

  - pH between 5.5 and 8.5 in soils with high organic content
  - Sulfate concentrations greater than 1,000 parts per million
  - Chloride content greater than 500 parts per million

- Based on DIPRA 10-point soil evaluation, Ductile Iron Pipe Research Association, corrosion should be expected on ductile iron pipe in contact with the ground and special corrosion protection measures should be adopted.
- According to ACI 318, Building Code Requirements for Structural Concrete, the sulfate content summarized above result in an Exposure Category S1 or moderate exposure.

The resistivity and pH classify the soils as highly corrosive. Evaluation of soil corrosivity should be performed by the project durability engineer to determine if additional corrosion control measures are necessary.

4.2 Consolidation Tests Results

One-dimensional consolidation tests were performed on retrieved specimens from the Shelby tube samples collected at borings B-6 and B-7. Consolidation test results are presented in Table 4.

TABLE 4: SUMMARY OF CONSOLIDATION TEST RESULTS

Boring No.	Sample ID	Sample Approx. Depth (ft)	Sample Approx. Elev. (ft)	Moisture Content (%)	LL (%)	PL (%)	Initial void ratio, e_0	Compr. Index, Cc	Re-Compr. Index, Cr	Preconsol. Pressure, Pp (ksf)
B-6	ST-11	32 to 34	-7 to -9	48.5	119	51	1.259	0.45	0.1	8.4
B-7	ST-13	37 to 39	-14.5 to -16.5	46.9	103	42	1.175	0.41	0.1	6.4

5. Subsurface Conditions

5.1 Soil Profile for Proposed WTP Building

The generalized subsurface conditions for the proposed WTP building location can be divided into the layers described below based on borings B-1 through B-7. The characteristics of each layer at the project site are described below from top to bottom of soils encountered. A geotechnical soil profile for this location is presented in Appendix D.

5.1.1 Layer 1 – Fill

Layer 1 was encountered within all soil borings at the proposed building location. The soils encountered within this stratum consisted of fine to coarse sand with varying amount of gravel, silt, clay, and contained deleterious material such as wood, brick, and concrete. The SPT-N values ranged from weight of rod (WR) to greater than 50 blows per foot (bpf) which is indicative of uncontrolled fill placement. The average thickness of this soil layer varies between 15 to 20 feet. It is important to note that borings B-2, B-3, B-6 encountered split spoon refusal at this stratum between 4 to 10 feet of depth from ground surface elevation. In particular, at boring B-6, a concrete obstruction was encountered and drilled through from approximate depth of 6 to 7 feet from ground surface elevation.

5.1.2 Layer 2 – Sand

This layer was encountered below fill material in all borings with average thickness between 5 to 10 feet. The sand material typically contained fine to coarse sand with varying amount of clay, silt, and gravel. The SPT-N value in this layer varied from 7 to 41 bpf with average SPT-N value of 15 indicating medium dense relative density.

5.1.3 Layer 3 – Upper High Plasticity Clay (CH) and Silt (MH)

This stratum was encountered directly below the sand layer with average thickness of approximately 25 feet. The soils encountered within this stratum contained highly plastic silts and clays mixture with trace to little amount of sand. Five (5) out of twelve (12) Atterberg limit laboratory tests performed in this layer resulted in liquid limits in excess of 100 percent which could be indicative of highly sensitive fine-grained soils. The SPT-N values in this stratum varied from 9 to 21 bpf with an average of 12 which indicate soils of medium stiff to stiff soil consistency.

5.1.4 Layer 4 – Lower Clay (CL/CH) and Silt (ML/MH)

This layer was observed to be very similar to Stratum 3 but with a higher sand content. The soils were visually classified as medium to highly plastic silts and clays with sand. Pockets of sand were observed and confirmed with laboratory testing. A noteworthy difference to the overlaying layer was that the SPT-N values within this layer were significantly higher varying from 25 to greater than 100 bpf with average SPT-N value of 40 bpf, and that the laboratory testing resulted lower plasticity soils than Layer 3. The soil consistency of this layer is hard. This layer was encountered to the bottom of the soil exploration depths.

5.2 Soil Profile for Storm Water Management Area

There are two possible locations for the Storm Water Management (SWM) areas, and one drywell. SWM area 1 is located in the south-west corner of the proposed site and SMW Area 2 is located in the northeast of the site near the existing wash-water storage tank. The drywell area is located to the north of the site near the existing residuals handling building. The subsurface soils were visually classified based on USDA Textural Identification. Soil profiles are included in Appendix E.

5.2.1 SWM Area 1

The existing ground surface through Area 1 is relatively flat with grade varying from approximate elevations of 19 to 20 feet. Two soil borings SWM-1 and SWM-2 were drilled at the area to identify the soil profile for permeability/percolation testing. Permeability/percolation testing was conducted in a separate borehole located within 5 feet of the soil boring. Percolation tests PT-1 and PT-2 were performed near SWM-1 and SWM-2, respectively. One test pit TP-1 was excavated within this area to approximate depth of 7 feet below ground surface elevation. The soils visually classified (USDA) as sandy loam, silt loam, and loamy sand.

5.2.2 SWM Area 2

The existing grade at Area 2 is relatively flat with grade elevations ranging from varying from 39 to 40 feet. Soil borings SWM-3 and SWM-4 were conducted to identify the soil profile for permeability/percolation testing. Permeability/percolation testing was conducted in a separate hole located within 5 feet of the drilled boring. Percolation tests PT-3 and PT-4 were conducted near borings SWM-3 and SWM-4, respectively. One test pit TP-2 was excavated in the vicinity to about 11 feet below existing ground elevation. The soils visually classified (USDA) as sandy loam, silt loam, loamy sand, and clay.

5.2.3 Drywell Area 1

The existing grade elevation at the proposed Drywell location varies from elevation 37 to 38 feet. Soil boring SWM-5 was conducted to identify the soil profile for permeability/percolation testing. Permeability/percolation testing was conducted in a separate hole located within 5 feet of the drilled boring. Percolation test PT-5 corresponding to SWM-5 was executed. The proposed test pit at this location has not been excavated. The soil description for this test pit will be updated after the test pit is performed.

5.3 Groundwater

Two permanent monitoring wells were installed at the SMW areas for long term groundwater depth observation. Monitoring wells MW-1 and MW-2 were installed near respective soil borings SWM-1 and SWM-4. Stabilized groundwater depth in MW-1 was 5.33 feet below grade surface or at approximate elevation 14.2 feet. Groundwater in MW-2 was recorded at 9.5 feet below ground surface or at approximate elevation 30.5 feet. A temporary monitoring well was installed in boring SWM-5 located within the drywell area and the stabilized ground water depth was 10 feet below ground surface elevation.

6. SWM Permeability Test

A falling head permeability testing was conducted at SWM soil borings PT-1 through PT-5. The Cased Borehole Test method was used to determine the hydraulic conductivity of subsurface soil layer. It is to be noted that NJDEP has suspended temporarily the use of this test. However, it is still presented for reference only since no additional permeability testing was performed.

The calculated hydraulic conductivity values in borings PT-1 through PT-5 varied between 0.002 in/hour to 0.898 in/hour.

Table 5 below summarizes the results from hydraulic conductivity testing and associated Soil Hydraulic Conductivity Class in accordance with NJSBMP Chapter 12 – Soil Testing Criteria.

TABLE 5: SUMMARY OF HYDRAULIC CONDUCTIVITY TEST RESULTS

Location	Depth (in)	Hydraulic Conductivity, K (in/hr)	Soil Hydraulic Conductivity Class
PT-1	40	0.002	K0
PT-2	40	0.898	K2
PT-3	72	0.375	K1
PT-4	84	0.322	K1
PT-5	75	0.473	K1

The recorded Hydraulic Conductivity Test Results are presented in Appendix F.

7. Geotechnical Design Parameters

Geotechnical design parameters were determined based on the information collected from the subsurface geotechnical investigation and the results from laboratory testing. Field data, such soil sample description, laboratory test results data including moisture content, soil gradation, fines content (material finer than the No. 200 sieve), consolidation tests, and SPT N-values were used to determine the on-site soils engineering properties.

Table 6 presents the recommended shear strength engineering soil properties.

TABLE 6: SUMMARY OF ENGINEERING SOIL SHEAR STRENGTH

Layer	Approximate Elevation (ft)	Min./ Avg./ Max. SPT N_{60} value (bpf)	Unit Weight (pcf) [a]	Undrained Shear Strength, Su (psf)[b]	Effective Friction angle, ϕ' (deg)[c]	Effective cohesion, c' (psf)
Layer 1 – Fill (SP/SM/CL/ML)	GSE to 5	WR / 10 / >50	115	-	28	0
Layer 2 – Sand (SM/SP)	5 to 0	7 / 15 / 41	120	-	32	0
Layer 3 - Upper High Plasticity Clay (CH) and Silt (MH)	0 to -25	9 / 12 / 21	125	1500	25	0
Layer 4 - Lower High Plasticity Clay (CH) and Silt (MH)	-25 to -77 (bottom of exploration)	25 / 40 / >100	130	3500	31	0

[a] Unit weights were estimated based on SPT N60 and correlations by Liang (2002).
[b] Recommended undrained shear strength for fine-grained soils was estimated based on SPT N60 correlations by Liang (2002), and pocket penetrometer data.
[c] Effective friction angles for granular samples were estimated based on SPT N60 and correlations by Liang (2002). Effective peak friction angles for fine-grained soils were correlated with Plasticity Index (Terzaghi, 1996)

Table 7 presents the recommended compressibility engineering properties for the fine-grained soils below the proposed clearwell tank structure.

TABLE 7: SUMMARY OF ENGINEERING COMPRESSIBILITY PROPERTIES OF CLAYS

Layer	Approximate Elevation (ft)	Cc	Cr	e0	Pp (ksf)
Layer 3 - Upper High Plasticity Clay (CH) and Silt (MH)[a]	0 to -25	0.43	0.1	1.22	7.4
Layer 4 - Lower High Plasticity Clay (CH) and Silt (MH)[b]	-25 to -77 (bottom of exploration)	0.33	0.03	0.73	10

[a] Design values selected from consolidation test results at borings B-6 and B-7.
[b] Design values based on correlations with Atterberg limit index properties.

Table 8 presents the recommended soil engineering properties for lateral p-y analysis.

TABLE 8: SUMMARY OF SOIL ENGINEERING PROPERTIES FOR LATERAL P-Y ANALYSIS

Layer	Approximate Elevation (ft)	Lateral k value Above GWT (pci)	Lateral k value Below GWT (pci)	ε_{50}
Layer 1 – Fill (SP/SM/CL/ML)	GSE to 5	40	30	-
Layer 2 – Sand (SM/SP)	5 to 0	70	50	-
Layer 3 - Upper High Plasticity Clay (CH) and Silt (MH)	0 to -25	-	-	0.006
Layer 4 - Lower High Plasticity Clay (CH) and Silt (MH)	-25 to -77 (bottom of exploration)	-	-	0.003

ε 50 and k were calculated based on SPT N60 correlations with Liang (2002).

8. Settlement Evaluation

Settlement analysis was performed as part of this effort to evaluate the feasibility for the use of shallow foundation to support the proposed building. Settlement analysis was performed using RocScience Settle 3 version 5.008. The provided applied bearing pressures, foundation elevation, and corresponding settlement estimates are presented in Table 9.

TABLE 9: SUMMARY OF ESTIMATED SETTLEMENT AT THE PROPOSED BUILDING

Foundation Location	Foundation Type	Bottom of Foundation Elevation (ft)	Estimated Max Bearing Pressure (ksf)	Estimated Settlement (in)
Clearwell Tank	Mat Slab	+1	3.3	> 5
Chemical Room Containment	Mat Slab	+29.67	1.8	2 - 3
Chemical Room East Wall	Strip Footing	+29.67	2.0	2 - 3
Chemical Room South Wall	Retaining Wall	+25 to +27	3.0	2 - 3

Based on the high estimated settlement magnitudes, a deep foundation system is recommended to support all portions of the structure.

9. Foundation Recommendations

Based on the subsurface investigation information and settlement evaluation, a deep foundation system is recommended to support the Clearwell Tank mat foundation and all foundation components of the chemical room. Specifically, the use of Continuous Flight Auger (CFA) Piles are recommended. Driven piles are not recommended due to vibrations concerns since the proposed building location is in close proximity to an existing active water main and existing structures.

CFA piles are constructed by rotating a hollow stem continuous flight auger into the soil to a designed depth. Concrete or grout is pumped through the hollow stem, maintaining static head pressure, to fill the cylindrical cavity created as the auger is slowly removed. The grout pressure and volume must be carefully controlled to construct a continuous pile without defects. The reinforcement cage or center steel bar is placed or vibrated through the freshly placed concrete or grout. For this project, it is recommended that the contractor provides a CFA drill rig with sufficient crowd pressure and torque to be able to reach the proposed tip elevations at the hard bearing layer (Layer 4). A conventional CFA pile rig is not recommended.

The allowable axial geotechnical compressive and uplift capacities for the CFA piles supporting the clearwell tank and chemical room were estimated based on FHWA GEC 8 design methodologies. The estimated capacity is required to be confirmed by performing a static axial load test prior to the installation of production piles.

The CFA piles geotechnical maximum axial compressive and uplift loading for support of the clearwell tank were obtained and evaluated using FB-MultiPier version 5.5 from BSI and are summarized in Table 10. This software performs lateral p-y analysis of proposed pile group and incorporates the overturning moment caused by applied lateral loads on the foundation system, which is necessary to estimate the maximum axial loads on the piles. A 24-in diameter CFA was used for the analysis.

TABLE 10: CLEARWELL TANK CFA PILES

Maximum Estimated Service Axial Load [a] (kip)	Maximum Estimated Factored Shear Load [a] (kip)	Maximum Estimated Factored Moment [a] (kip-ft)	Bottom elevation of proposed clearwell tank Mat Foundation [b] (ft)	Pile Diameter (in)	Estimated Pile Length [c] (ft)	Allowable Geotechnical Axial Compressive Capacity - Estimated (kip)	Estimated Pile Tip Elevation (ft)
Compression: 217 (tank full of water) Tension: 40 (empty tank)	70	347	+0.5	24	51	220	-50.5

[a] The magnitudes are for a specific pile layout that was evaluated after several iterations and in coordination with the Structural Engineer. If the pile layout is modified. The magnitudes will change.

[b] The bottom of tank mat elevation was updated during the pile design effort.

[c] The pile design length is controlled by the compressive axial load. Uplift is satisfied with a pile length of approximately 30 feet.

Based on the loads provided for the chemical room, the CFA pile lengths for the chemical room and retaining wall are controlled by the pile layout spacing at these locations. No uplift is expected for the piles at these locations. The piles are recommended to have a minimum embedment of 6 feet into soil layer no. 4. A summary is provided in Table 11.

TABLE 11: CHEMICAL ROOM CFA PILES

Allowable Axial Capacity (kip)	Pile Diameter (in)	Recommended Pile Tip Elevation (ft)	Estimated Pile Length (ft)
175	24	-31	61 (chemical room) ~58 (retaining wall)

10. Groundwater Control, Dewatering and SOE System

The groundwater depth varies from elevation 16 to 25 feet. Soil layer no. 1 (fill) and layer no. 2 (sand) below groundwater table are expected to contribute to relatively high quantities of groundwater flow into the proposed excavation. Furthermore, if a global dewatering system with the use of well points or deep wells is selected to control groundwater in the excavation, there are concerns with risk associated to dewatering induced settlements at nearby utilities and existing structures. Therefore, a cutoff wall is recommended to be installed for the SOE system. The cutoff wall is expected to extend, as necessary, into Layer 3 - Upper High Plasticity Clay (CH) and Silt (MH) to prevent groundwater inflow into the excavation.

The cutoff wall will be used for SOE and to control the groundwater. There are various types of cutoff walls systems such as secant pile wall, sheet pile wall, among others. A system requiring driving or vibrating elements into place presents additional risks due to the potential of vibration-induced settlement on adjacent existing utilities and structures. The SOE system is required to be designed to support the retained soil, construction surcharge, and groundwater pressure.

10.1 Lateral Earth Pressures

Due to the significant depth of the proposed excavation which is expected to vary between 25 to 35 feet deep, a multiple level braced SOE system is anticipated to be designed and installed on this project. Therefore, the temporary SOE system must be designed using Apparent Earth Pressure Diagrams (AEPD) for sands as described in the FHWA GEC 4 – ground anchors and anchor systems manual.

Surcharge loads from temporary construction equipment or permanent structures should be added to the lateral earth pressure with an active earth pressure coefficient of 0.36 or an at-rest earth pressure coefficient of 0.53. At a minimum, a surcharge load from temporary construction equipment should be equivalent to 400 pounds per square foot (psf).

Equivalent fluid pressures for the design of the permanent walls at the WTP structure are presented in Table 12.

TABLE 12: SUMMARY OF ESTIMATED SETTLEMENT AT THE PROPOSED BUILDING

Layer	Approximate Elevation (ft)	Active Equivalent Fluid Pressure (pcf)		At-Rest Equivalent Fluid Pressure (pcf)		Passive Equivalent Fluid Pressure (pcf)	
		Above GWT	Below GWT	Above GWT	Below GWT	Above GWT	Below GWT
Layer 1 – Fill (SP/SM/CL/ML)	GSE to 5	45	85	65	95	330	220
Layer 2 – Sand (SM/SP)	5 to 0	30	80	55	90	390	250

11. Construction Considerations

11.1 Subgrade Preparation

Stripping of vegetation, topsoil, soft soil, or other deleterious materials will be required where they are encountered. The extent of topsoil is generally no more than 6 inches thick.

Subgrade soils are clayey or silty in texture and thus are susceptible to disturbance in the presence of moisture and construction traffic. Care should be exercised to maintain subgrade integrity when preparing areas for the placement of fill, excavation, and other earthwork.

The exposed subgrade should be compacted as follow:

- Under Pavement Structure, Floor Slabs On Grade and Structures that are Not Pile Supported, new fill or Granular Fill Under Structures that are Not Pile Supported: Compact the upper 6 inches to minimum of 95 percent relative compaction as determined in accordance with ASTM D698.
- Under Earthfill: Compact upper 6 inches to minimum of 95 percent relative compaction as determined in accordance with ASTM D698.

No compaction of subgrade is necessary under pile supported structures. Areas exhibiting pumping, determined unsuitable by the Engineer or Owner's representative or that cannot be densified in-place, should be over-excavated and replaced with compacted backfill.

11.2 Site Fill

Earthfill is recommended for use as the site fill outside influence areas beneath structures, pavements, sidewalks, curbs, slabs, piping, and other facilities. The major sources of site fill to raise the grade will be material excavated from required excavations free from rock larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials. Material containing more than 10 percent gravel, stones, or shale particles is not acceptable. The maximum LL and PL allowed for site fill are 40 and 20, respectively.

The following recommendations should be followed for site fill placement:

- Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil lift before compaction so that the water content is within 2 percent of the optimum moisture content.
- Allow for 6-inch thickness of topsoil where required.
- Maximum 8-inch-thick lifts are allowed for site fill placement.
- Compact site fill to a minimum of 95 percent relative compaction, as determined by ASTM D698.

11.3 Backfill Under and Around Structures

Use of a minimum of 6 inches of granular fill under non-pile supported structures such as footings, slabs, pavements, sidewalks, curbs, piping, conduits, duct banks, manholes, scum wells, vaults, and other facilities is recommended. Also, fill required to raise the grade to the bottom of all structures is recommended to be granular fill. Granular fill is 1 inch minus crushed gravel or crushed rock containing 8 percent or less fines by weight passing No. 200 sieve. Granular fill should be well graded from coarse to fine and free from dirt, clay balls, and organic material. Granular fill under non-pile supported structures should be placed in 6-inch-thick lifts, maximum, and compacted to a minimum of 95 percent relative compaction, as determined by ASTM D698.

Granular fill is also recommended as the backfill used within influence area around all structures. However, to minimize seepage, the top 1 foot of backfill against structures should be clayey soil sloped to drain away from structures. The backfill around structures should also be placed in lifts of 6 inches or less and compacted to 95 percent relative compaction, as determined by ASTM D698. The use of hand-operated equipment is recommended for compaction within the influence area around the structures.

11.4 Excavation

All excavation, water control, backfilling, compaction, and grading shall be in accordance with the Standard Specifications.

The Contractor is responsible for the stability of all the temporary excavations. All excavations should conform to the requirements of the federal register by the Department of Labor, Occupational Safety and Health Administration (OSHA), 29 CFR Part 1926, for excavations. All ancillary items such as handrails which are required by OSHA, but not shown on the drawings, shall be installed per OSHA standards. Any surface runoff shall be directed away from the excavation.

11.5 Over-excavation and Replacement

All over-excavation and replacement shall be in accordance with the Standard Specifications.

The bottom of the proposed excavation is expected to expose Layer 3 - Upper High Plasticity Clay (CH) and Silt (MH). This layer possesses very high Liquid and Plasticity Indexes and is suspected to be highly sensitive. This layer is expected to present unique challenges for equipment and construction operations at the bottom of the excavation. Therefore, it is recommended that a minimum two (2) feet of this layer is over-excavated and replaced with stone to serve a working platform at the bottom of the excavation.

11.6 Dewatering

The dewatering system should be designed in consideration of the lateral earth support system selected by the Contractor . Since a cutoff wall is recommended for the SOE system, sump pumps are recommended to control the water inside the excavation. During periods where failure of the dewatering system would adversely impact work completed, the Contractor should provide a backup system to ensure continuous operation.

Water pumped from excavation sumps should be discharged into a temporary sedimentation basin, which should be constructed to collect the water as a result of the dewatering operation. The Contractor shall comply with all federal, state, and local regulations for the disposal of water.

11.7 Construction Geotechnical Monitoring

The Contractor is responsible to install instrumentation and perform monitoring in accordance geotechnical instrumentation and monitoring specifications. The monitoring should be performed during the entire excavation, CFA piles installation, and backfill. Remediation actions should be taken if needed as required in the geotechnical instrumentation and monitoring specifications.

11.8 Vibration Monitoring

If an SOE system that require driving or vibrating elements is selected, vibration monitoring shall be implemented. Construction vibrations may cause settlements of existing utilities and adjacent structures during driving activities.

According to American Water, all construction activities shall be performed so that the peak particle velocity (PPV) is maintained at or below a threshold of:

- 2.0 inches/sec for structures (office buildings, tanks, and similar structures)
- 0.6 in/sec to 1.2 in/sec for ductile iron and PCCP pipes for continuous or intermittent vibration types, respectively.

11.9 Continuous Flight Auger (CFA) Piles

The Contractor should provide a CFA drill rig of sufficient power and torque to drill through the subsurface conditions described in this report. The CFA drill rig should be capable of drilling efficiently through Layer 4 – Lower High Plasticity Clay (CH) and Silt (MH) of hard consistency and reach the require pile length.

CFA pile installation should be monitored with a pile installation recorder for auger-cast piles (PIR-A), or equivalent, for each piling rig. The PIR-A should record appropriate information during both the augering phase and the grouting phase to ensure that a minimum grout volume is pumped per unit depth increment and should print the results immediately upon completion of each pile. The PIR-A should have the following minimum components:

- PIR-A display unit
- Depth sensor
- Magnetic flow meter (MFM)
- Field printer
- Grout pressure sensor
- Torque pressure sensor

During drilling, the outlet hole at the bottom of the auger should be closed with a suitable plug or disposable plug material. The depth to auger tip and drilling rate should be displayed during drilling. Auger should be continuously advanced at a constant rate to prevent removal of excess soil.

At the start of pumping grout, the auger should be raised 6 to 12 inches from the pile toe elevation. After the grout pressure has built up sufficiently to blow out the bottom plug and create a head of grout above the discharge point, the auger should again be lowered to the original toe elevation. A positive slow rotation of the auger should be maintained during grout injection and auger withdrawal, without counterclockwise rotation. If the auger jumps upward during withdrawal, the grouting process is interrupted, or there is decreased grouting pressure, the auger should be reinserted to the original toe elevation and the rate of withdrawal should be decreased to prevent further jumping. The depth increment for monitoring grout volume should not exceed 5 feet. The magnetic flow meter and depth sensor information should be sufficient to determine the volume of grout pumped per unit depth increment. This information should be displayed to the crane operator graphically as a bar chart with the minimum grout ratio clearly displayed as a guide. A minimum grout volume of 120 to 150 percent of the theoretical volume should be expected. At the completion of grouting a pile, the PIR-A printout should be inspected prior to moving the rig. If the grout pumped falls below the specified minimum allowable grout ratio for any depth increment, the pile should be re-augered to 5 feet below the defect and re-grouted while the grout is still fluid.

Centralizers should be installed at the top and bottom of rebar cage and at intervals not exceeding 10 feet to make sure the reinforcing cage is centrally placed within the pile and the required concrete cover is satisfied.

Reinforcement must be installed to the required tip elevation in a timely manner. Ensuring the integrity of the reinforcement steel cage during installation and use the appropriate installation method. Piles should be completely installed and protected at the end of each day.

CFA piles construction activities should be performed under the direction and observation of an experienced engineer. The engineer should be present at all times during construction to verify that piles have been constructed as per this report and specifications. Field logs documenting construction procedures should be maintained.

11.9.1 Integrity Testing of CFA Piles

At least ten percent of the CFA piles should be tested using Low Strain Pile Integrity Testing (PIT) technique to confirm that there are no defects along the pile or soft zones at the tip of the pile. The wire for the PIT sensors will need to be wrapped using reinforcing tape before shipped to the site. The engineer will select the piles for PIT testing based on the field logs.

PIT is a low-strain integrity test. It can detect the presence and location of potentially significant defects such as cracks, necking, soil inclusions, or voids and can determine the actual pile length. The equipment and technique are well established, corresponding to ASTM D5882. The top of CFA piles must be accessible to perform this test.

Rejection of piles based on PIT results should be conclusive in terms of evident defects in the piles that will result in unsafe or inadequate performance under service loads. Basis for rejection include, but not limited to, significant reductions in pile cross sectional area (necking) or pile material strength/stiffness above the pile toe, piles with grout volume not meeting the specification requirements, piles of inadequate installation length and piles not meeting the installation tolerances specified. Pile acceptance should be a decision made by the Engineer of Record, based on the results of installation records, grout compressive strength test results and integrity testing.

11.9.2 Static Pile Load Testing

Static pile load testing should be performed on one CFA test pile to verify the axial load capacity and load-settlement response of the CFA piles used in this project. This will be a preproduction verification load test and consequently the contractor should not proceed with installation of production piles until successful static load test results are obtained, reviewed, and approved by the Engineer or Owner's representative. The maximum test load established will be 200% of the design axial compression load or failure, whichever occurs first. The test pile should be installed to the proposed tip elevation. Performing the static load test a minimum of 7 days after CFA test pile installation is recommended, such that grout or concrete in the CFA piles can be cured and any soil setup on the piles can occur.

The load tests should be performed in accordance with ASTM D1143. The tests can be performed by jacking down on the top of the pile with a reaction beam supported on reaction piles. Reaction piles should be designed to safely provide adequate resistance so that reaction piles will not fail before the test pile. The clear distance between reaction piles and the test pile should be at least 5-pile-diameter of largest pile, but no less than 8 feet. The applied loads shall be measured with a recently-calibrated hydraulic jack and an electronic load cell. Pile settlement shall be measured with at least three dial indicators mounted on opposite sides of the piles to compensate for pile tilting during loading. The three dial indicators shall be supported on beams that are staked down at least 10 pile diameters away from the test pile. A backup settlement measurement system consisting of a piano wire, mirror, and engineer's scale shall be installed in case the dial indicator system malfunctions. At a minimum, one of the four reaction piles shall be monitored with regard to its movement using dial indicators. The loads at depths in the pile can be monitored with strain gauges mounted on the center rebar to different depths. These loads can be used to estimate the load transfer distribution on different soil layers along the pile. Davisson's (1973) criterion or the 5% of diameter settlement criterion may be used to interpret the failure loads from load tests.

12. Limitations

The soil borings represent a small statistical sampling of subsurface soils at the Project location, and it is possible that conditions may be encountered in future explorations or during construction that are substantially different from those described in this report. In these instances, adjustments to the design and construction methods may be necessary. Soil stratification, as characterized on the soil boring logs, represent soil conditions at the tested locations; however, variations may occur. The soil descriptions presented on the soil boring logs represent the approximate boundaries between soil types.

Similarly, water level readings measured in the borings represent conditions encountered at the time of measurement and may be influenced by tides, precipitation events, and water introduced by drilling processes.

This report includes both factual and interpreted information. Factual information is defined as objective data based on direct observations, such as boring logs and laboratory testing results. Interpreted information or geotechnical engineering interpretation is based on the engineering judgement, correlation, or extrapolation from factual information. No warranties, explicit or implied, are provided for interpreted information.

13. References

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Sabatini, P.J., Pass, D.G. and Bachus, R.C. (1999). "Ground Anchors and Anchored Systems, Technical Manual", FHWA GEC No. 4.

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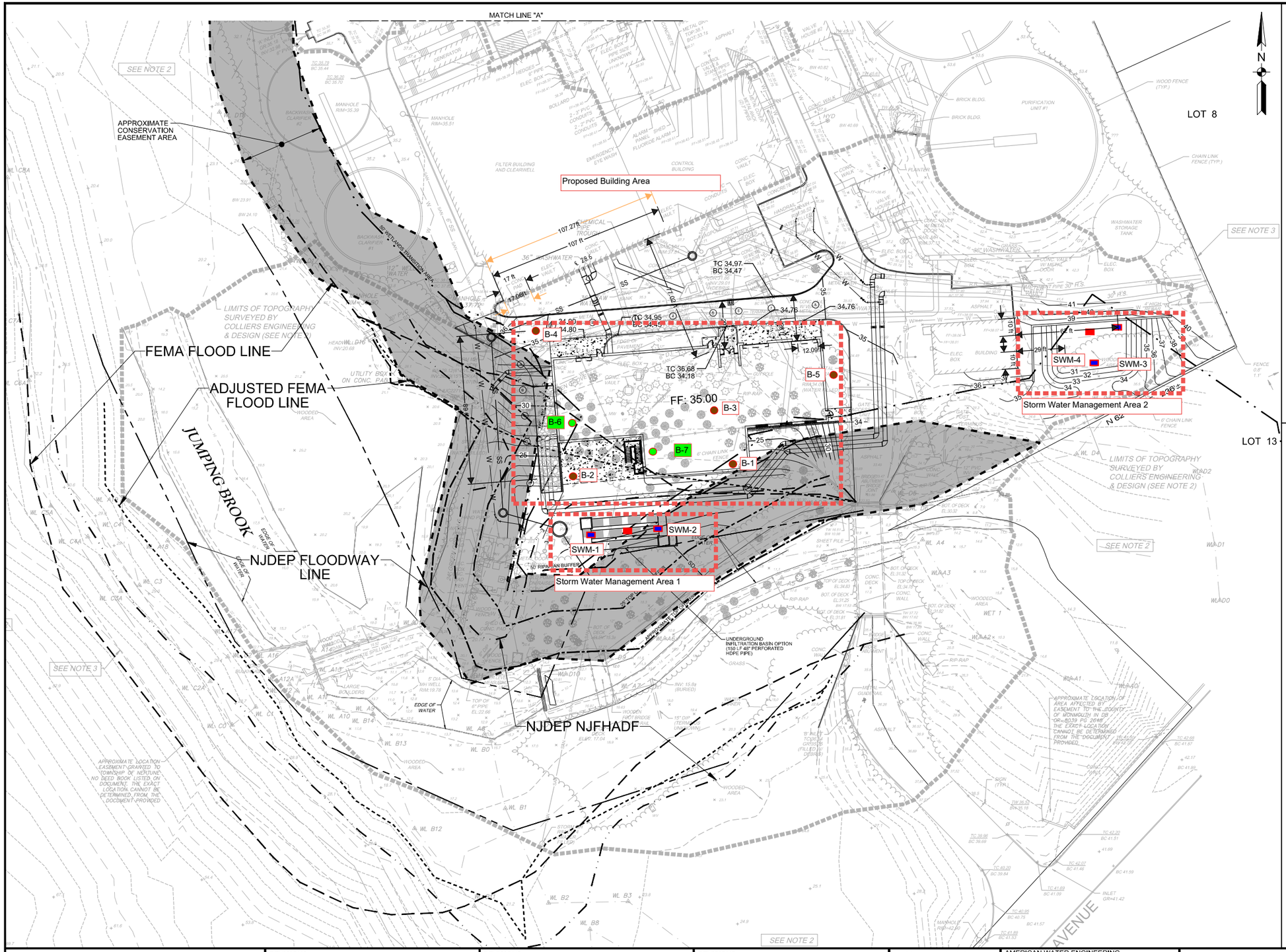
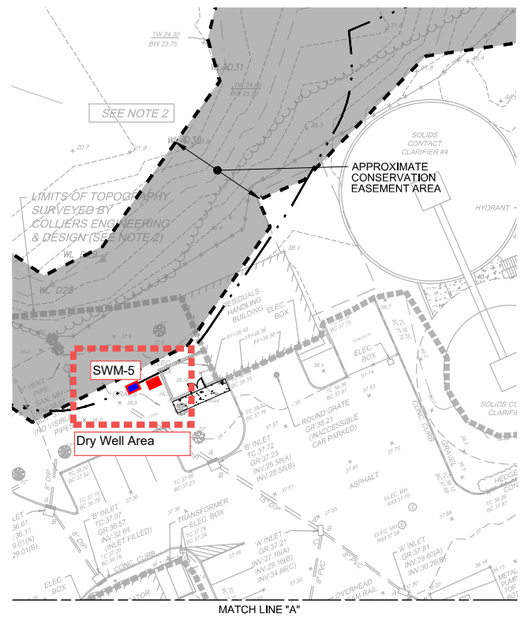
Appendix A. Boring Location Plan





STRUCTURAL BORING

STORMWATER PROFILE BORING

STORMWATER PERCOLATION TEST BORING

SUBSURFACE INVESTIGATION PLAN

Additional Borings:
- B-6: Proposed Drilling Depth 75ft.
- B-7: Proposed Drilling Depth 100ft, or Auger Refusal, whichever comes first.

7.5ft 8ft 30ft 0 15ft 30' 60' SCALE 1"=30'

Jacobs

JACOBS ENGINEERING GROUP INC.
412 MOUNT KEMBLE AVE.
MORRISTOWN, NJ 07960
NJDCA 246A27990200

REVISIONS	REVISIONS	REVISIONS

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CAMDEN, NJ 08102

NEW JERSEY AMERICAN WATER

DRAWN BY #
PROJECT ENG'R #
DATE 11/17/21
PROJECT E6X98900

CLEARWELL / HIGH SERVICE PUMP STATION ADDITION AND CHLORINE CONVERSION CIVIL GRADING PLAN

NEW JERSEY AMERICAN WATER	JUMPING BROOK TREATMENT PLANT	USE DIMENSIONS ONLY SCALE 1"=30'
USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES	CONCEPTUAL	C7

Appendix B. Boring Logs

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-1 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499433.2 N, 613523.3 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
22.0	0.0				0-16' - Brown fine SAND, and Silt, trace medium Gravel, (FILL)		
	2.0	1.5	SS-1	1-2-3-5 (5)			
					2' - Brown fine to medium SAND, some (+) Silt, trace medium Gravel, (FILL)		
	4.0	1.3	SS-2	7-7-10-10 (17)			
					4' - Black Grayish fine to medium SAND, little Silt, some medium Gravel, (FILL)		
5 17.0	6.0	1.0	SS-3	18-27-13-4 (40)			
					6' - Gray Black SILT, and fine Sand, trace fine Gravel, (FILL)		
	8.0	2.0	SS-4	2-2-2-1 (4)			
					8' - Black SILT, and fine Sand, little fine Gravel, (FILL)		
10	10.0	0.8	SS-5	2-1-2-2 (3)			
12.0					10' - Same as Above; (FILL)		
	12.0	0.7	SS-6	1-WR-WR-WR			
15	15.0						
7.0					15' - Top 8" Black organic SILT		
	17.0	1.5	SS-7	WR-WR-1-1 (1)	16-25' - Bottom 10" Brown fine to medium SAND, little Silt		
					17' - Brown fine to coarse SAND, some fine Gravel, trace Silt		
	19.0	1.0	SS-8	3-5-4-6 (9)			
20							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-1 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499433.2 N, 613523.3 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
2.0	20.0	1.0	SS-9	3-5-4-6 (9)	20' - Brown fine to coarse SAND, and fine to medium Gravel		Lab Results 20-22: MC (%) = 17.9
	22.0						
25	25.0						
-3.0		2.0	SS-10	4-4-6-9 (10)	25-30' - Gray Olive Clayey Sand		Lab Results 25-27: LL (%) = 60, PL (%) = 30, PI (%) = 30, MC (%) = 35.7
	27.0						
30	30.0						
-8.0		2.0	SS-11	3-6-6-8 (12)	30-50' - Gray Olive CLAY & SILT, little fine Sand		Lab Results 30-32: LL (%) = 74, PL (%) = 40, PI (%) = 34, MC (%) = 41.4
	32.0						
35	35.0						
-13.0		2.0	SS-12	WR-3-6-8 (9)	35' - Same as Above		
	37.0						
40							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-1 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499433.2 N, 613523.3 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-18.0	40.0	2.0	SS-13	4-5-8-9 (13)	40' - Same as Above		
	42.0						
45	45.0						
-23.0		2.0	SS-14	3-7-8-10 (15)	45' - Same as Above		
	47.0						
50	50.0						
-28.0		1.9	SS-15	9-21-34-50 (55)	50-52' - Gray Olive SILT & CLAY, some (+) fine Sand		Lab Results 50-52: LL (%) = 44, PL (%) = 30, PI (%) = 14, MC (%) = 29.6
	52.0				Bottom of Boring at 52.0 ft bgs on		
55							
-33.0							
60							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-2 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499425.3 N, 613427.4 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
22.0	0.0						
		1.5	SS-1	2-4-7-7 (11)	0-15' - Brown fine to medium SAND, little Silt		
	2.0						
		1.3	SS-2	9-9-5-13 (14)	2' - Black fine to medium SAND, some Silt, little (-) fine Gravel, wood pieces		
	4.0						
		0.0	SS-3	1-50/1 (50/1")	4' - No Recovery		
5 17.0	6.0						
		0.8	SS-4	7-9-9-8 (18)	6' - Gray fine to medium SAND, little (-) Silt, trace fine Gravel		
	8.0						
		0.7	SS-5	9-3-2-3 (5)	8' - Gray fine to medium SAND, some (+) Silt, trace fine Gravel, wood pieces		
10 12.0	10.0						
		0.8	SS-6	1-2-1-1 (3)	10' - Gray SILT, and fine Sand		
	12.0						
15	15.0						
7.0		0.8	SS-7	4-6-10-14 (16)	15-20' - Gray fine to coarse SAND, trace Silt		
	17.0						
20							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-2 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499425.3 N, 613427.4 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
2.0	20.0	2.0	SS-8	2-3-4-6 (7)	20-25' - Dark Gray fine to medium SAND, some Silt & Clay		Lab Results 20-22: MC (%) = 21.9
	22.0						
25	25.0						
-3.0		2.0	SS-9	3-4-6-8 (10)	25-30' - Gray Olive CLAY & SILT, little (-) fine Sand		Lab Results 25-27: LL (%) = 56, PL (%) = 28, PI (%) = 28, MC (%) = 34.8
	27.0						
30	30.0						
-8.0		2.0	SS-10	3-4-5-8 (9)	30-50' - Gray Olive SILT & CLAY, little (-) fine Sand		Lab Results 30-32: LL (%) = 113, PL (%) = 50, PI (%) = 63, MC (%) = 47.3
	32.0						
35	35.0						
-13.0		2.0	SS-11	3-5-9-12 (14)	35' - Same as Above		
	37.0						
40							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-2 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499425.3 N, 613427.4 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-18.0	40.0	2.0	SS-12	3-5-7-11 (12)	40' - Same as Above		
	42.0						
45	45.0						
-23.0		2.0	SS-13	4-7-11-12 (18)	45' - Same as Above		
	47.0						
50	50.0						
-28.0		1.9	SS-14	19-26-38-50 (64)	50-55' - Gray SILT & CLAY, some fine Sand, mica		
	52.0						
55	55.0						
-33.0		1.8	SS-15	15-20-45-50 (65)	55-60' - Gray SILTY SAND, mica		Lab Results 55-57: LL (%) = NP, PL (%) = NP, PI (%) = NP, MC (%) = 24.2
	57.0						
60							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-2 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499425.3 N, 613427.4 E

ELEVATION : 22.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-38.0	60.0	2.0	SS-16	8-12-16-22 (28)	60-62' - Gray SILT & CLAY, some fine Sand, mica		
	62.0				Bottom of Boring at 62.0 ft bgs on		
65 -43.0							
70 -48.0							
75 -53.0							
80							

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PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-3 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499465.6 N, 613511.8 E

ELEVATION : 24.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
24.0	0.0				0-20' - Dark Brown fine to medium SAND, some (+) Silt, trace Gravel		
		0.5	SS-1	3-7-6-7 (13)			
	2.0				2' - Same as Above		
		0.5	SS-2	8-5-6-4 (11)			
	4.0				4' - No Recovery		
5 19.0		0.0	SS-3	WR-1-1-1 (2)			
	6.0				6' - Gray Brown fine to medium SAND, little Silt, trace medium to coarse Gravel		
		0.8	SS-4	7-50/1 (50/1")			
	8.0				8' - No Recovery		
		0.1	SS-5	50/1 (50/1")			
10 14.0	10.0				10' - 21 Inch of Wood Piece in SS		
		1.8	SS-6	20-23-18-20 (41)			
	12.0						
15 9.0	15.0				15' - Wood Pieces		
		2.0	SS-7	3-2-1-3 (3)			
	17.0						
20							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-3 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499465.6 N, 613511.8 E

ELEVATION : 24.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
4.0	20.0	0.8	SS-8	8-10-12-12 (22)	20-25' - Gray fine to medium SAND, little Silt		Lab Results 20-22: MC (%) = 17.7
	22.0						
25	25.0						
-1.0		2.0	SS-9	4-4-6-9 (10)	25-45' - Gray Olive SILT & CLAY		Lab Results 25-27: LL (%) = 56, PL (%) = 30, PI (%) = 26, MC (%) = 41.7
	27.0						
30	30.0						
-6.0		2.0	SS-10	3-5-8-10 (13)	30' - Same as Above		
	32.0						
35	35.0						
-11.0		2.0	SS-11	3-6-8-10 (14)	35' - Same as Above		
	37.0						
40							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-3 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499465.6 N, 613511.8 E

ELEVATION : 24.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-16.0	40.0	2.0	SS-12	14-4-6-8 (10)	40' - Same as Above		Lab Results 40-42: LL (%) = 109, PL (%) = 49, PI (%) = 60, MC (%) = 50.5
	42.0						
45	45.0						
-21.0		2.0	SS-13	5-6-8-10 (14)	45-52' - Gray Olive CLAY & SILT, some fine Sand		Lab Results 45-47: LL (%) = 82, PL (%) = 35, PI (%) = 47, MC (%) = 40.7
	47.0						
50	50.0						
-26.0		2.0	SS-14	6-12-13-26 (25)	50' - Same as Above		
	52.0						
					Bottom of Boring at 52.0 ft bgs on		
55							
-31.0							
60							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-4 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499513.2 N, 613404.9 E

ELEVATION : 35.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
35.0	0.0	1.0	SS-1	16-19-17-11 (36)	0-15' - Brown fine to medium SAND, little (-) Silt, trace fine Gravel		
	2.0	1.0	SS-2	18-15-12-11 (27)	2' - Brown fine to medium SAND, little (-) Silt		
	4.0	1.3	SS-3	5-9-11-14 (20)	4' - Same as Above		
5 30.0	6.0	0.7	SS-4	24-16-23-26 (39)	6' - Same as Above		
	8.0	0.8	SS-5	5-27-23-22 (50)	8' - Same as Above		
10 25.0	10.0	0.7	SS-6	50-40-50 (90)	10' - Gray fine to medium SAND, some (-) Silt, little fine to coarse Gravel		
15 20.0	12.0						
	15.0	0.5	SS-7	5-11-7-3 (18)	15-20' - Light Brown fine to coarse GRAVEL, some Silt		
20	17.0						

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-4 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499513.2 N, 613404.9 E

ELEVATION : 35.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
15.0	20.0	0.5	SS-8	3-2-4-8 (6)	20-30' - Gray CLAY & SILT, little (-) fine Sand		
	22.0						
		2.0	ST-1		22' - Same as Above		Lab Results 22-24: MC (%) = 45.4
	24.0						
		2.0	SS-9	3-2-13-6 (15)	24' - Same as Above		
25 10.0	26.0						
30 5.0	30.0						
		2.0	SS-10	14-20-21-21 (41)	30-35' - Gray fine to coarse SAND, little (-) Silt		
	32.0						
35 0.0	35.0						
		2.0	SS-11	7-4-5-7 (9)	35-52' - Gray Olive CLAY & SILT, little (-) fine Sand		Lab Results 35-37: LL (%) = 69, PL (%) = 33, PI (%) = 36, MC (%) = 37.1
	37.0						
40							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-4 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499513.2 N, 613404.9 E

ELEVATION : 35.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-5.0	40.0	2.0	SS-12	4-5-8-9 (13)	40' - Same as Above		Lab Results 40-42: LL (%) = 50, PL (%) = 28, PI (%) = 22, MC (%) = 29.1
	42.0						
45	45.0						
-10.0		2.0	SS-13	3-5-9-10 (14)	45' - Same as Above		
	47.0						
50	50.0						
-15.0		2.0	SS-14	7-8-10-12 (18)	50' - Same as Above		
	52.0						
					Bottom of Boring at 52.0 ft bgs on		
55							
-20.0							
60							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-5 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499486.8 N, 613583.4 E

ELEVATION : 34.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
34.0	0.0						
		1.3	SS-1	3-9-13-10 (22)	0-15' - Brown fine to coarse SAND, little Silt, little medium Gravel		
	2.0						
		1.0	SS-2	10-9-8-7 (17)	2' - Brown fine to coarse SAND, some (-) Silt, little fine Gravel		
	4.0						
5		0.7	SS-3	3-3-2-2 (5)	4' - Brown fine to medium SAND, and Silt, little (+) fine Gravel		
29.0	6.0						
		0.5	SS-4	3-2-3-2 (5)	6' - Same as Above		
	8.0						
		0.5	SS-5	wr-wr-wr-wh	8' - Gray fine SAND, and Silt		
10	10.0						
24.0		1.1	SS-6	wr-wr-wr-wr	10' - Gray SILT, and fine Sand, trace fine Gravel		
	12.0						
15	15.0						
19.0		1.3	SS-7	3-4-5-6 (9)	15-20' - Gray SILT, and fine Sand		
	17.0						
20							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-5 SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499486.8 N, 613583.4 E

ELEVATION : 34.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
14.0	20.0	2.0	SS-8	1-3-4-4 (7)	20-25' - Gray CLAY & SILT, little fine Sand		Lab Results 20-22: MC (%) = 48.4
	22.0						
25	25.0						
9.0		1.3	SS-9	1-4-8-9 (12)	25-35' - Gray fine to coarse SAND, little (-) Silt		
	27.0						
30	30.0						
4.0		2.0	SS-10	8-9-8-8 (17)	30' - Same as Above		Lab Results 30-32: MC (%) = 19.0
	32.0						
35	35.0						
-1.0		2.0	SS-11	2-3-8-9 (11)	35-60' - Gray Olive CLAY & SILT, little (-) fine Sand		
	37.0						
40							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-5 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499486.8 N, 613583.4 E

ELEVATION : 34.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-6.0	40.0	2.0	SS-12	4-7-8-9 (15)	40' - Same as Above		
	42.0						
45	45.0						
-11.0		2.0	SS-13	2-4-6-8 (10)	45' - Same as Above		Lab Results 45-47: LL (%) = 132, PL (%) = 50, PI (%) = 82, MC(%) = 52.8
	47.0						
50	50.0						
-16.0		2.0	SS-14	3-6-6-9 (12)	50' - Same as Above		
	52.0						
55	55.0						
-21.0		2.0	SS-15	3-5-8-11 (13)	55' - Same as Above		
	57.0						
60							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-5 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499486.8 N, 613583.4 E

ELEVATION : 34.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 75, Mud Rotary ORIENTATION : V

WATER LEVELS : 10.0 ft bgs START : END : LOGGER : H. Patel

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-26.0	60.0	2.0	SS-16	10-16-30-45 (46)	60-72' - Gray Green SILT & CLAY, little fine Sand		
	62.0						
65	65.0						
-31.0		1.9	SS-17	12-20-26-50 (46)	65' - Same as Above		
	67.0						
70	70.0						
-36.0		2.0	SS-18	8-14-17-22 (31)	70' - Gray Green SILT & CLAY, some (+) fine Sand		
	72.0						
					Bottom of Boring at 72.0 ft bgs on		
75							
-41.0							
80							

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-6 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499459.5 N, 613426.9 E

ELEVATION : 25.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/5/22 08:04 END : 8/5/22 15:55 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
25.0	0.0	2.0	SS-1	6-9-11-10 (20)	**Clayey Sand (SC)** 0-2' - brown, dry, dense, fine grained, poorly graded			
	2.0							
		0.8	SS-2	4-4-4-4 (8)	**Well Graded Sand (SW)** 2-6' - brown, dry, medium dense			
	4.0							
5		0.3	SS-3	1-2-2-1 (4)				
20.0	6.0							
		0.0	SS-4	0-0-50/0 (50/6")	**Concrete** 6-7' - concrete obstruction			
	8.0				**(CL)** 7-10'			Encountered concrete obstruction. Obstruction was drilled thru and witnessed by Drew Wilson from American Water. The obstruction was approximately 1-ft-thick.
		0.5	SS-5	1-2-1-4 (3)	**Sandy Clay** 8' - black, wet, soft, organics observed and odor			
10	10.0							
15.0		2.0	SS-6	8-7-8-10 (15)	**Sandy Fat Clay (CH)** 10-15' - dark gray, moist, stiff to very stiff		2.0-2.5	Lab Results 10-12: Gravel (%) = 9.7, Sand (%) =39.6, Fines (%) = 50.7
	12.0							
15	15.0							
10.0		1.0	SS-7	5-6-9-12 (15)	**Poorly Graded Sand (SP)** 15-25' - gray, wet, dense, medium grained			
	17.0							
20								

JACOBS®

PROJECT NUMBER:	BORING NUMBER:	
E6X98900	B-6	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499459.5 N, 613426.9 E

ELEVATION : 25.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/5/22 08:04 END : 8/5/22 15:55 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5.0	20.0	1.3	SS-8	6-8-7-6 (15)				Lab Results 20-22: MC (%) = 27.0
	22.0							
25	25.0							
0.0		2.0	SS-9	3-5-6-10 (11)	**Elastic Silt (MH)** 25-50' - gray-green, moist, stiff, high plasticity, little to some silt		2.5-3.0	
	27.0							
30	30.0							
-5.0		2.0	SS-10	5-6-9-13 (15)	30' - same as above, except very stiff		3.0-3.5	
	32.0							
			ST-11	push			3.0-4.0	Lab Results 32-34: Sand (%) =39.8, Fines (%) = 60.2 LL (%) = 119, PL (%) = 51, PI (%) = 68
	34.0							
35		2.0	SS-12	4-5-7-10 (12)	34' - same as above, except with less silt content		3.0	
-10.0	36.0							
40								

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PROJECT NUMBER:	BORING NUMBER:	
E6X98900	B-6	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499459.5 N, 613426.9 E

ELEVATION : 25.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/5/22 08:04 END : 8/5/22 15:55 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-15.0	40.0	2.0	SS-13	9-6-11-14 (17)				Casing was advanced in section following drilling up to approximately 40 feet of depth.
	42.0							Water loss observed on the mud pan at about 40 feet.
45	45.0							
-20.0		2.0	SS-14	3-7-10-11 (17)				Lab Results 45-47: MC (%) = 41.4
	47.0							
50	50.0							
-25.0		2.0	SS-15	8-18-26-31 (44)	**Silt (ML)** 50-70' - light gray and green with black dots, moist, hard, few fine grained sand			
	52.0							
55	55.0							
-30.0		1.7	SS-16	10-23-26-50/3 (49)				Lab Results 55-57: LL (%) = 37, PL (%) = 25, PI (%) = 17, MC (%) = 23.7
	57.0							
60								

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-6 SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499459.5 N, 613426.9 E

ELEVATION : 25.0 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/5/22 08:04 END : 8/5/22 15:55 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-35.0	60.0	2.0	SS-17	16-21-26-50/6 (47)				Lab Results 60-62: MC (%) = 15.5
	62.0							
65	65.0							
-40.0		2.0	SS-18	9-13-15-30 (28)	65' - same as above, except some sand content		3.0	Lab Results 65-67: Fines (%) = 74.1
	67.0							
70	70.0							
-45.0		2.0	SS-19	6-10-13-18 (23)	**Fat Clay (CH)** 70-72' - light gray and green, moist, very stiff			Lab Results 70-72: LL (%) = 71, PL (%) = 29, PI (%) = 42, MC (%) = 35.5
	72.0							
					Bottom of Boring at 72.0 ft bgs on 8/5/22 14:21			End of drilling at 02:21PM. Hole backfilled and completed at 3:55PM.
75 -50.0								
80								

JACOBS®

PROJECT NUMBER:	BORING NUMBER:
E6X98900	B-7 SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499440.5 N, 613472.7 E

ELEVATION : 22.5 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/4/22 08:43 END : 8/4/22 15:00 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
22.5	0.0							
		1.0	SS-1	5-5-9-10 (14)	**Poorly Graded Sand (SP)** 0-6' - brown, dry, dense, medium size grained, trace of small gravel			
	2.0							
		1.0	SS-2	6-6-5-5 (11)	2' - same as above, except moist, trace organics			
	4.0							
5		0.7	SS-3	13-14-12-10 (26)	4' - same as above, except dark gray, medium dense to dense, organic odor, few coarse and angular gravel			
17.5	6.0							
		1.0	SS-4	10-5-4-5 (9)	**Silty Sand (SM)** 6-10' - brown-gray, wet, loose to medium dense, trace of small gravel			
	8.0							
		1.0	SS-5	2-1-1-1 (2)	8' - same as above, except gray, more silt content			
10	10.0							
12.5		2.0	SS-6	WOR-1-2-2 (3)	**Silt (ML)** 10-15' - black-dark gray, wet, soft			
	12.0							
15	15.0							
7.5		2.0	SS-7	1-3-7-4 (10)	**Silty Sand (SM)** 15-20' - brown, wet, medium dense, little rounded small gravel			Lab Results 15-17: Gravel (%) = 12.2, Sand (%) = 61.9, Fines (%) = 25.9
	17.0							
20								

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PROJECT NUMBER:	BORING NUMBER:	
E6X98900	B-7	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499440.5 N, 613472.7 E

ELEVATION : 22.5 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/4/22 08:43 END : 8/4/22 15:00 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
2.5	20.0	1.0	SS-8	2-2-3-7 (5)	**Fat Clay (CH)** 20-37' - gray-green, moist, medium stiff, high plasticity, some silt		2.5-3.0	Blowcounts for SS-8 from 20 to 22 feet may not be representative. Pocket Penetrometer resulted in higher consistency.
	22.0							
	24.0	2.0	ST-9	push			3.5-4.0	Shelby tube was sealed with wax. Lab Results 22-24: LL (%) = 57, PL (%) = 25, PI (%) = 32, MC (%) = 29.9
25 -2.5	26.0	2.0	SS-10	3-3-7-9 (10)	24' - same as above, except stiff			
30 -7.5	30.0	1.0	SS-11	6-6-7-7 (13)	30' - same as above, except with less silt content		1.5-2.0	
	32.0							
35 -12.5	35.0	2.0	SS-12	3-6-8-10 (14)			2.5-3.0	
	37.0	2.0	ST-13	push	**Clayey Sand (SC)** 37-39' - gray-green, moist, high plasticity clay, trace fine gravel		2.0	Shelby tube was sealed with wax. Lab Results 37-39: Gravel (%) = 3.8, Sand (%) = 58.4, Fines (%) = 37.8 LL (%) = 103, PL (%) = 42, PI (%) = 61, MC (%) = 46.7
	39.0							
40				5-9-12-15	**Fat Clay (CH)** 39-45' - gray-green, moist, very stiff, high plasticity, some silt			

JACOBS®

PROJECT NUMBER:	BORING NUMBER:	
E6X98900	B-7	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499440.5 N, 613472.7 E

ELEVATION : 22.5 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/4/22 08:43 END : 8/4/22 15:00 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	COMMENTS: PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-17.5	41.0	2.0	SS-14	(21)			3.0-4.0	
45 -22.5	45.0							
	47.0	2.0	SS-15	6-9-18-30 (27)	**Elastic Silt (MH)** 45-55' - light gray with back dots, moist, very stiff		3.5-4.0	
50 -27.5	50.0							
	52.0	2.0	SS-16	11-12-16-24 (28)	50' - same as above, except with little fine black sand		3.5-4.0	
55 -32.5	55.0							
	57.0	1.0	SS-17	22-38-50/3 (88/9")	**Lean Clay (CL)** 55-60' - light gray with black dots, moist, hard, some fine black sand		4.0	Lab Results 55-57: MC (%) = 21.4, LL (%) = 35, PL (%) = 24, PI (%) = 11
60								

JACOBS®

PROJECT NUMBER:	BORING NUMBER:	
E6X98900	B-7	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Jumping Brook WTP, Neptune City, NJ LOCATION : 499440.5 N, 613472.7 E

ELEVATION : 22.5 ft DRILLING CONTRACTOR : Craig Test Boring Co.

DRILLING METHOD AND EQUIPMENT : CME 55, Mud Rotary ORIENTATION : V

WATER LEVELS : --- START : 8/4/22 08:43 END : 8/4/22 15:00 LOGGER : Ed Carrasco

DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	SYMBOLIC LOG	PP (TSF)	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
-37.5	60.0	2.0	SS-18	8-8-12-16 (20)	**Silty Sand (SM)** 60-65' - light gray and black, wet, dense			Lab Results 60-62: Fines (%) = 38.4
	62.0							
65 -42.5	65.0							
	67.0	2.0	SS-19	8-8-11-14 (19)	**Silty Clay (CL-ML)** 65-77' - light gray, moist to wet, very stiff		2.0-3.0	Significant water loss observed on the mud pan between 65 to 70 feet of depth. Drillers added bentonite to drilling fluid. Lab Results 65-67: MC (%) = 33.6
70 -47.5	70.0							
	72.0	2.0	SS-20	20-14-20-26 (34)	70' - same as above, except hard			Some rig chattering at 70 feet of depth.
75 -52.5	75.0							
	77.0	2.0	SS-21	6-8-12-24 (20)	75' - same as above, except light gray and light green, very stiff		2.0-3.0	Lab Results 75-77: MC (%) = 33.6
80					Bottom of Boring at 77.0 ft bgs on 8/4/22 14:40			End of drilling at 02:40PM. Hole backfilled the next day at 7:00AM.

Appendix C. Laboratory Test Results

5439 Harding Highway
Mays Landing, New Jersey 08330
Main: 877 627 3772
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AASHTO ACCREDITED

Colliers Engineering & Design

US Army Corps of Engineers
VALIDATED LABORATORY

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Craig Test Boring Co., Inc.
5230 Atlantic Ave
Mays Landing, NJ 08330

ATTN: Ms. Kayla Cappadocia

PROJECT: Jumping Brook
Neptune City, NJ

Project # 22004363A

DATE: May 19, 2022

PAGE: 1 of 1

CHECKED BY: Eduardo M. Freire, P.E.

TITLE: Laboratory Manager

SAMPLES RECEIVED: May 6, 2022

SAMPLES TESTED: 5/6/22 - 5/18/22

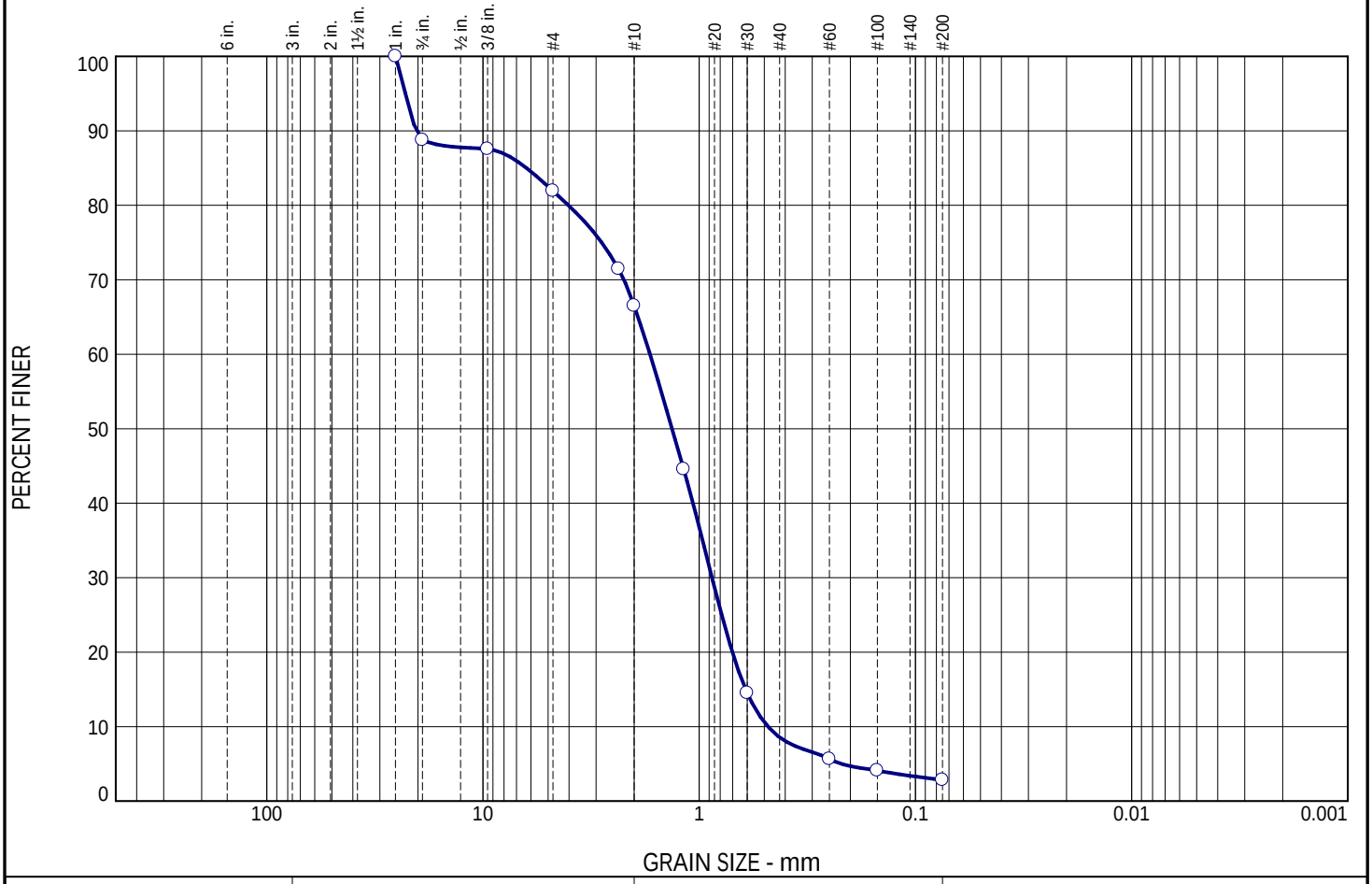
LAB TECHNICIAN(S): J. Veach, K. Perry, N. Freeman

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D6913)	Particle Size Analysis with Hydrometer* (ASTM D6913/D7928)	Unconfined Compression* (ASTM D2166)
				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)			
B-1	S-9	20-22	17.9				PSA-1		
	S-10	25-27	35.1	60	30	30		PSA-2	
B-2	S-8	20-22	21.9				PSA-3		
	S-10	30-32	47.3	113	50	63		PSA-4	
B-3	S-8	20-22	17.7				PSA-5		
	S-12	40-42	50.5	109	49	60		PSA-6	
B-4	UD-1	22-24	45.4	-	Non-Plastic	-		PSA-7	UC-1**
	S-11	35-37	37.1	69	33	36		PSA-8	
B-5	S-8	20-22	48.4	-	Non-Plastic	-			
	S-10	30-32	19.0				PSA-9		
	S-13	45-47	52.8	132	50	82		PSA-10	
Testing Total:			4	7			4	6	1

Comments/Remarks: * See attached Plate(s)

** No suitable sample to perform testing, no intact piece at least 6" long as required by standard. Client approved testing to be performed at L:D ratio less than 2.0.

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	12.4	21.1	52.0	8.8	2.9	2.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	88.7		
.375	87.6		
#4	81.9		
#8	71.4		
#10	66.5		
#16	44.6		
#30	14.5		
#60	5.7		
#100	4.1		
#200	2.8		

* (no specification provided)

Material Description

Dark brown dark gray coarse to medium SAND, some medium to fine Gravel, trace [Fines: (Silt/Clay)]

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 6.2862 D_{60}= 1.6894 D_{50}= 1.3371
D_{30}= 0.8724 D_{15}= 0.6103 D_{10}= 0.4804
C_u= 3.52 C_c= 0.94

Classification

USCS= SP

Remarks

Water Content (WC): 17.9%

Source of Sample: B-1 Depth: 20'-22'
Sample Number: S-9

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

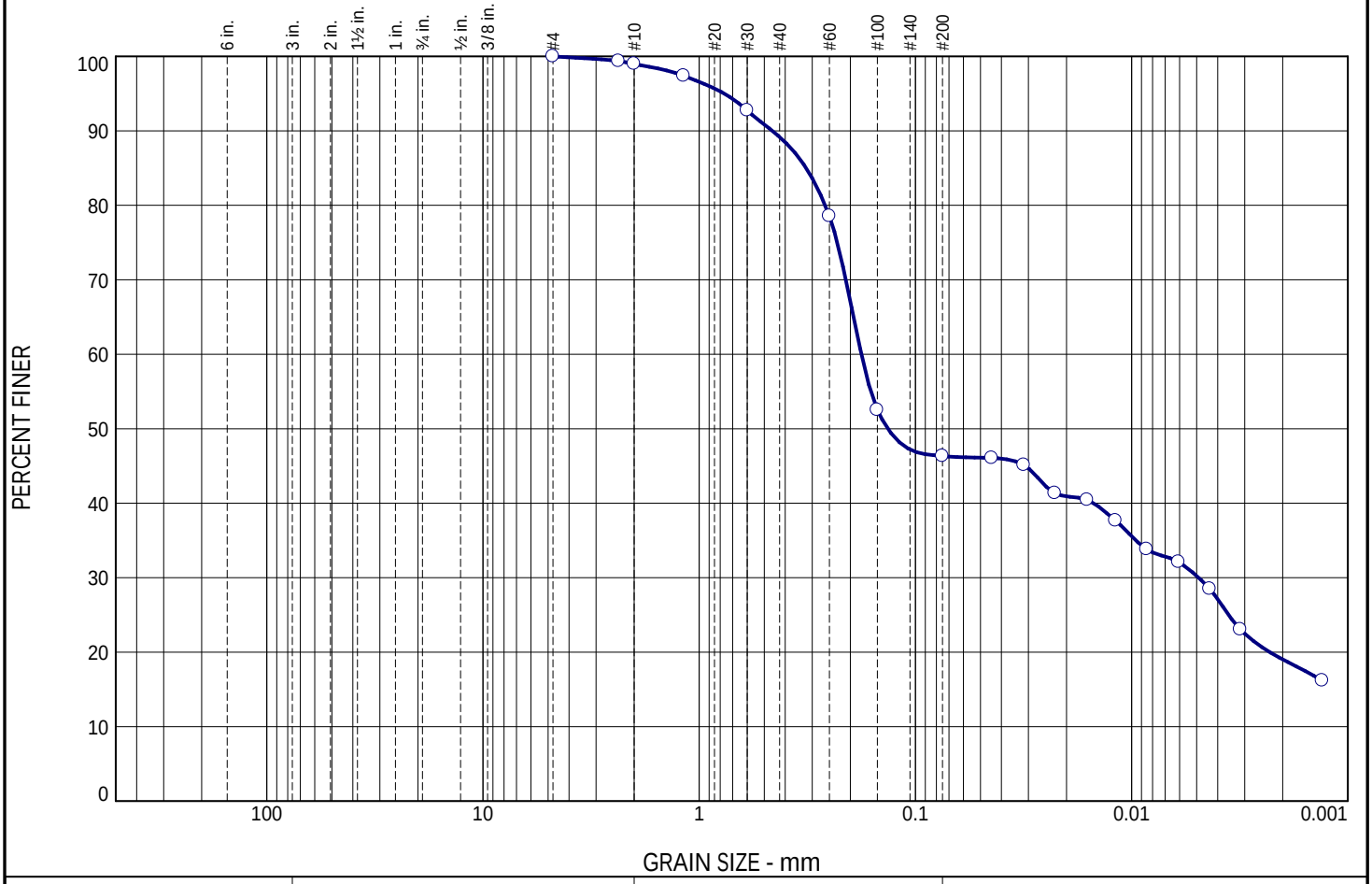
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-1

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	1.0	6.3	14.2	32.2	46.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.4		
#10	99.0		
#16	97.4		
#30	92.7		
#60	78.5		
#100	52.5		
#200	46.3		

* (no specification provided)

Material Description

Black coarse to fine SAND, and Silty Clay, trace fine Gravel

Atterberg Limits

LL= 60 PL= 30 PI= 30

Coefficients

D_{85}= 0.3202 D_{60}= 0.1778 D_{50}= 0.1341
D_{30}= 0.0049 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC

Remarks

WC: 35.1%

Source of Sample: B-1 Depth: 25'-27'
Sample Number: S-10

Date: 5/18/22

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Main: 877 627 3772

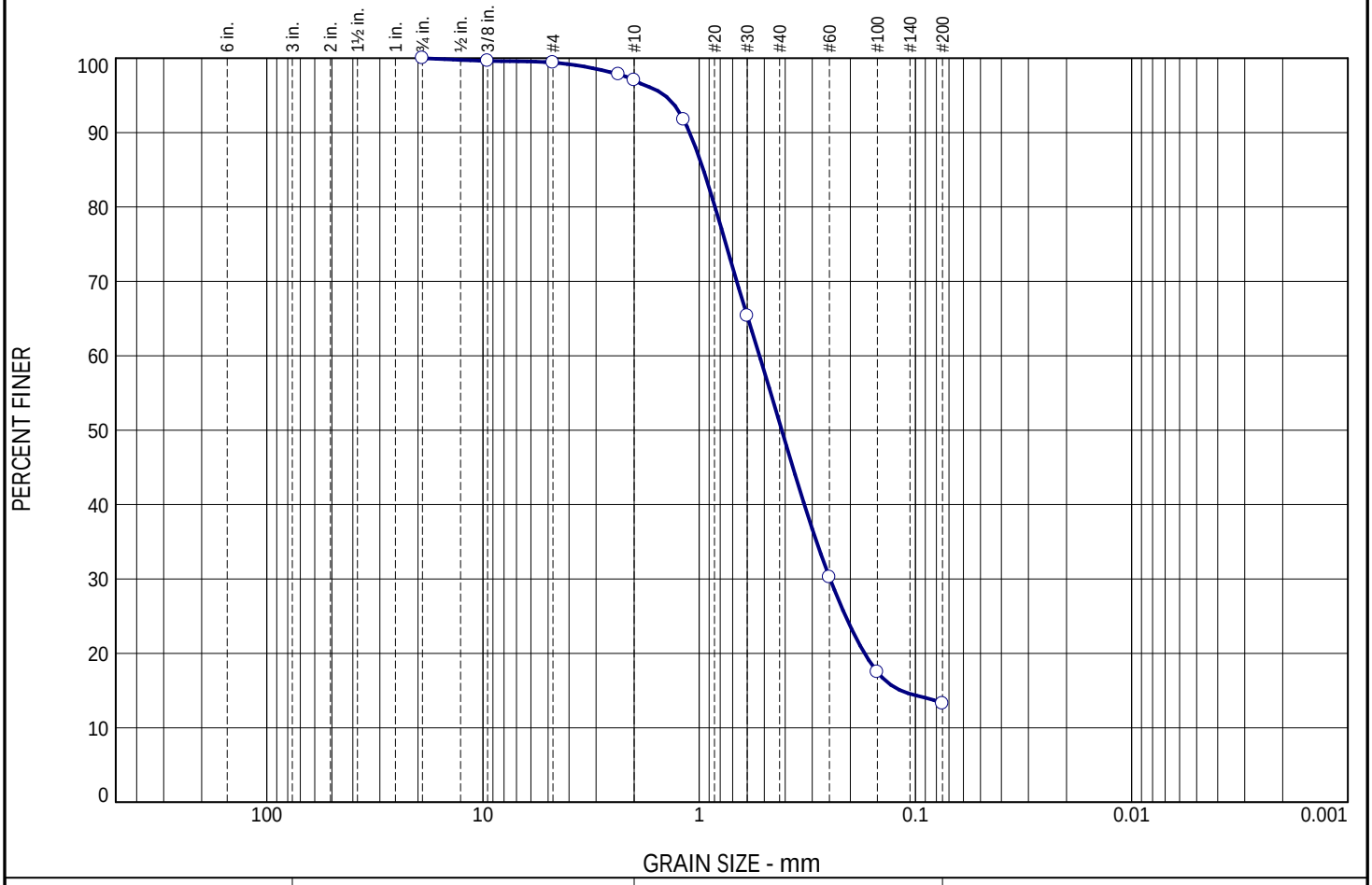
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-2

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.4	2.6	31.6	35.2	16.9	13.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	99.6		
#4	99.4		
#8	97.8		
#10	97.0		
#16	91.7		
#30	65.4		
#60	30.2		
#100	17.5		
#200	13.3		

* (no specification provided)

Material Description

Black coarse to fine SAND, little [Fines: (Silt/Clay)], trace medium to fine Gravel

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 0.9559 D_{60}= 0.5258 D_{50}= 0.4154
D_{30}= 0.2481 D_{15}= 0.1166 D_{10}=
C_u= C_c=

Classification

USCS= SM\SC

Remarks

WC: 21.9%

Source of Sample: B-2 Depth: 20'-22'
Sample Number: S-8

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

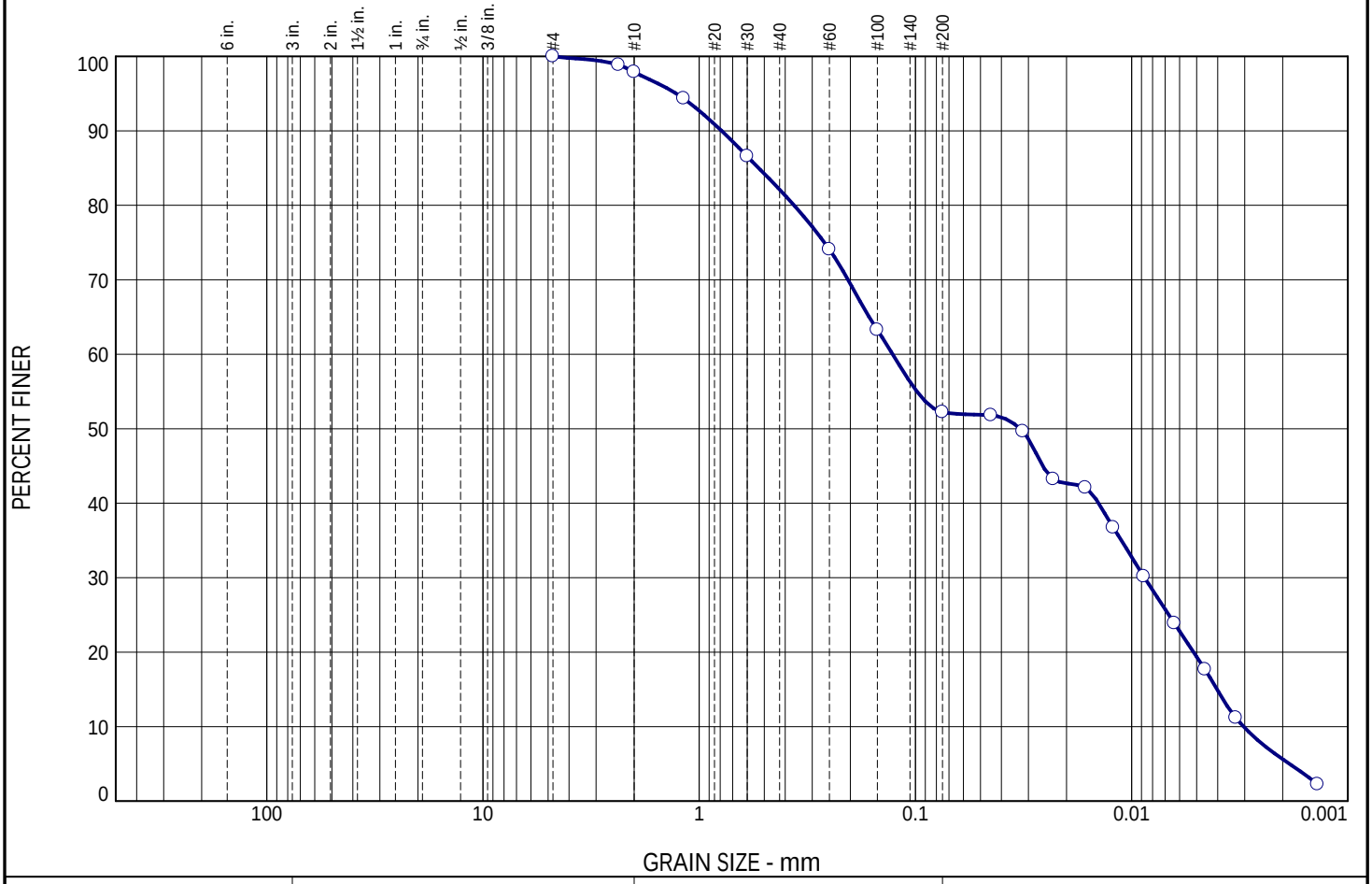
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-3

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	2.1	11.3	12.5	21.9	52.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	98.8		
#10	97.9		
#16	94.3		
#30	86.6		
#60	74.1		
#100	63.3		
#200	52.2		

* (no specification provided)

Material Description

Black CLAY, and coarse to fine Sand, trace fine Gravel

Atterberg Limits

LL= 113 PL= 50 PI= 63

Coefficients

D_{85}= 0.5304 D_{60}= 0.1274 D_{50}= 0.0328
D_{30}= 0.0087 D_{15}= 0.0040 D_{10}= 0.0030
C_u= 41.99 C_c= 0.20

Classification

USCS= MH

Remarks

WC: 47.3%

Source of Sample: B-2 Depth: 30'-32'
Sample Number: S-10

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

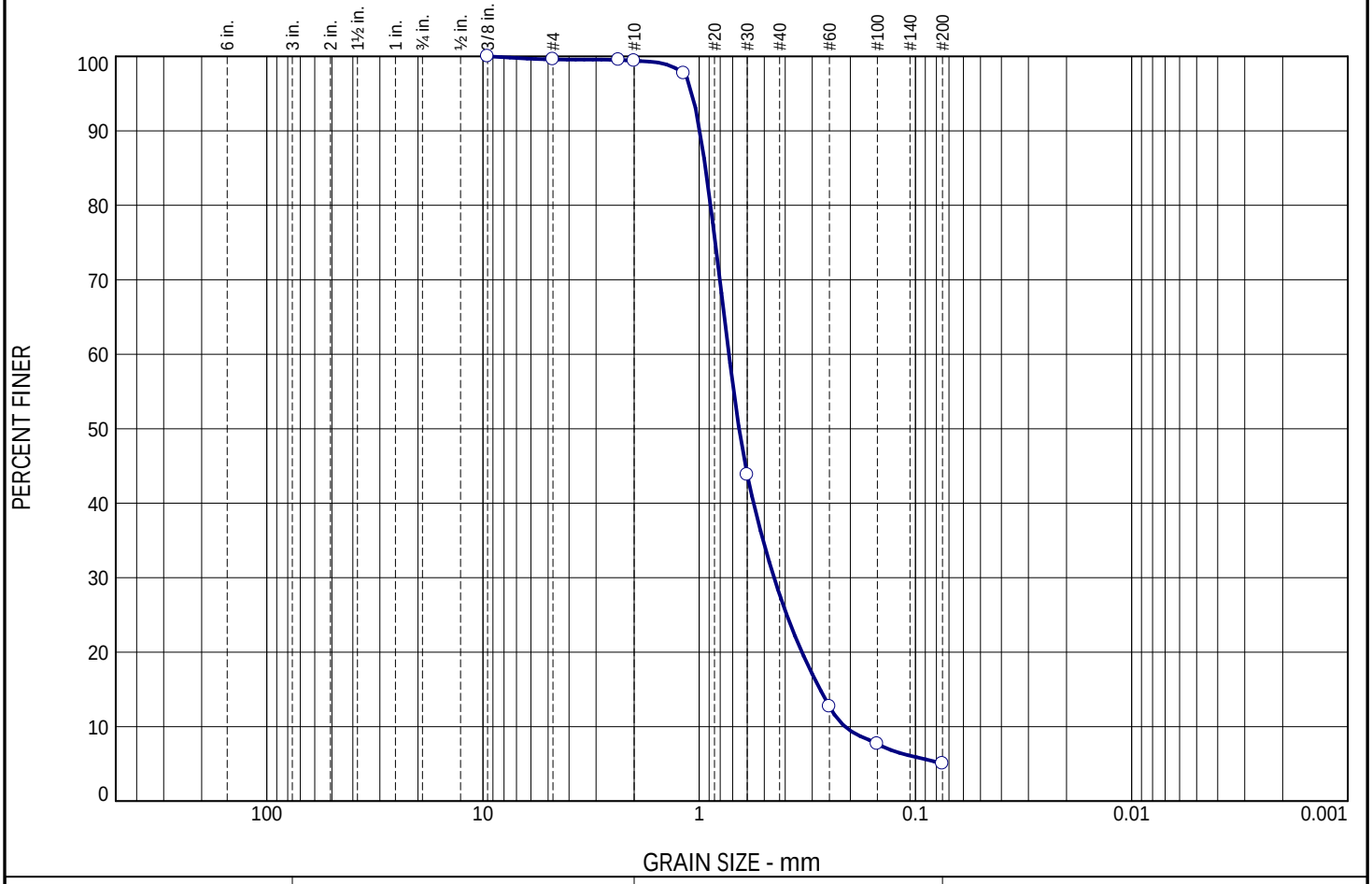
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-4

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.6	55.6	31.1	7.7	5.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.6		
#8	99.5		
#10	99.4		
#16	97.7		
#30	43.8		
#60	12.7		
#100	7.7		
#200	5.0		

* (no specification provided)

Material Description

Black coarse to medium SAND, trace [Fines: (Silt/Clay)]

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 0.9343 D_{60}= 0.7292 D_{50}= 0.6547
D_{30}= 0.4510 D_{15}= 0.2759 D_{10}= 0.2118
C_u= 3.44 C_c= 1.32

Classification

USCS= SP-SM\SC

Remarks

WC: 17.7%

Source of Sample: B-3 Depth: 20'-22'
Sample Number: S-8

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

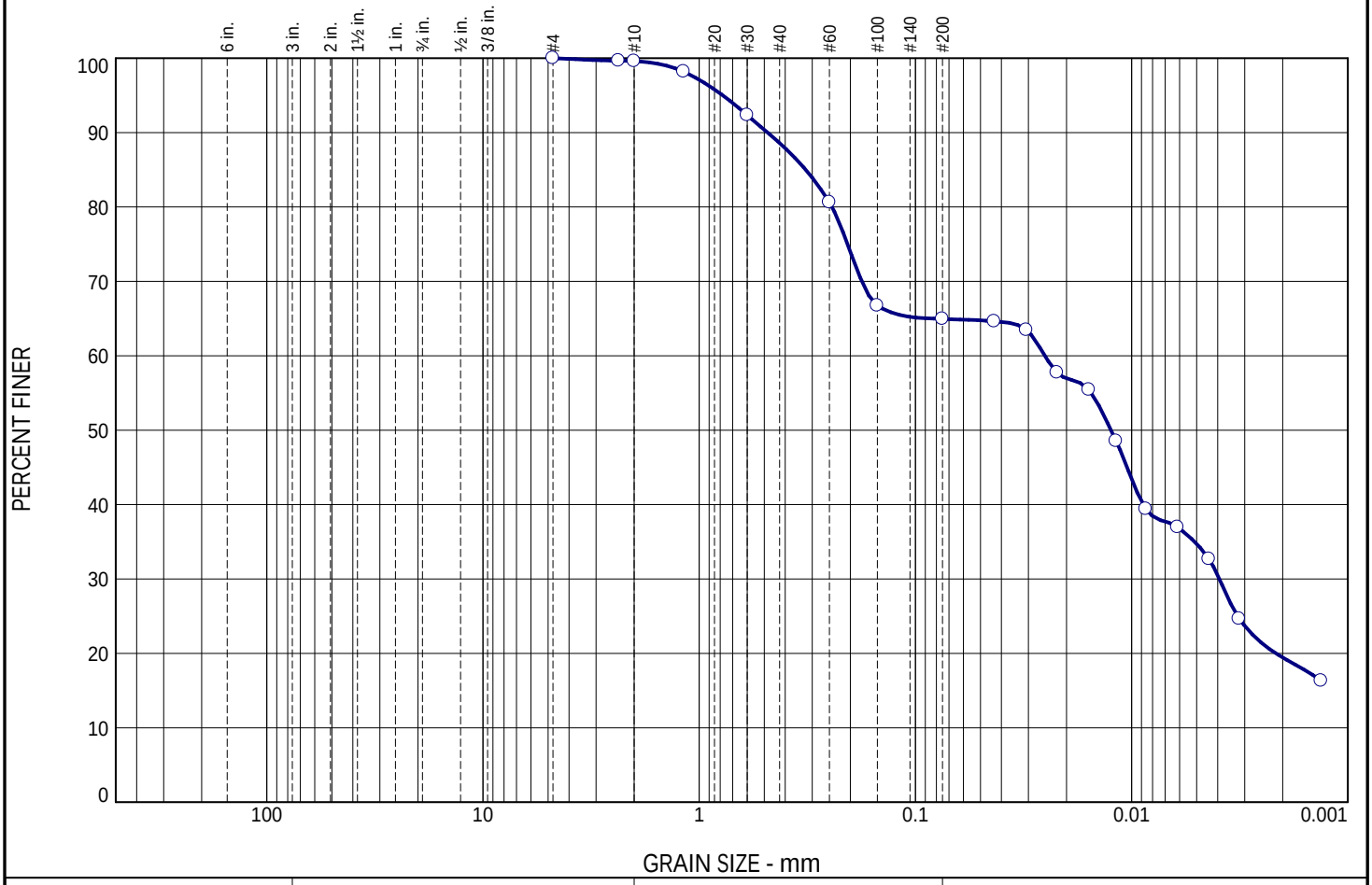
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-5

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.4	7.3	11.7	15.6	65.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.7		
#10	99.6		
#16	98.2		
#30	92.3		
#60	80.6		
#100	66.7		
#200	65.0		

* (no specification provided)

Material Description

Dark gray CLAY, some coarse to fine Sand

Atterberg Limits

LL= 109 PL= 49 PI= 60

Coefficients

D_{85}= 0.3217 D_{60}= 0.0252 D_{50}= 0.0125
D_{30}= 0.0039 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH

Remarks

WC: 50.5%

Source of Sample: B-3 Depth: 40'-42'
Sample Number: S-12

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

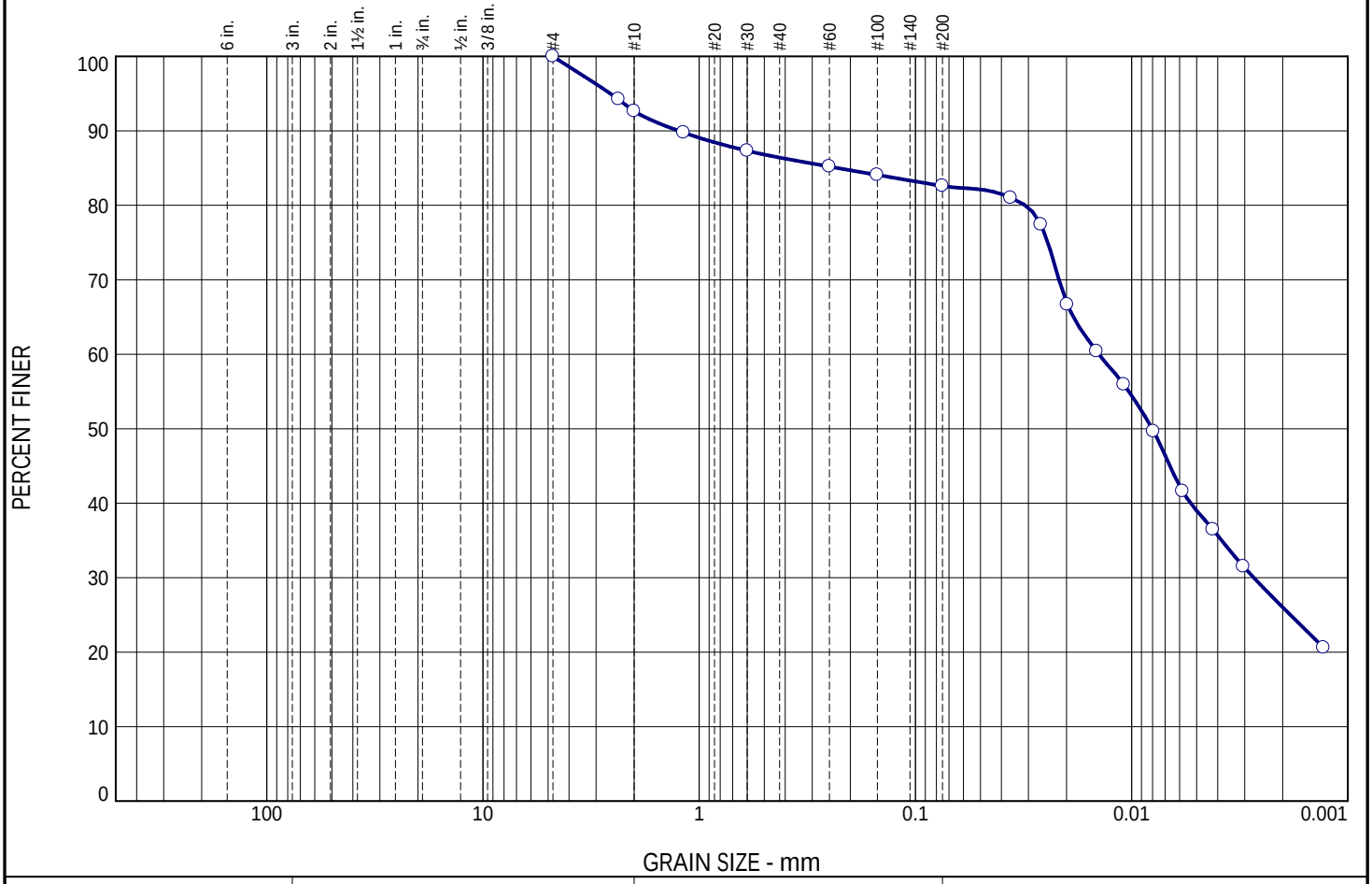
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-6

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	7.4	5.3	2.1	2.6	82.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	94.2		
#10	92.6		
#16	89.8		
#30	87.3		
#60	85.2		
#100	84.1		
#200	82.6		

* (no specification provided)

Material Description

Dark gray SILT, little coarse to fine Sand, trace fine Gravel

Atterberg Limits

LL= PL= NP PI=

Coefficients

D_{85}= 0.2288 D_{60}= 0.0142 D_{50}= 0.0080
D_{30}= 0.0027 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL:H\ML:H

Remarks

WC: 45.4%%
NP: Non-Plastic

Source of Sample: B-4 Depth: 22'-24'
Sample Number: UD-1

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

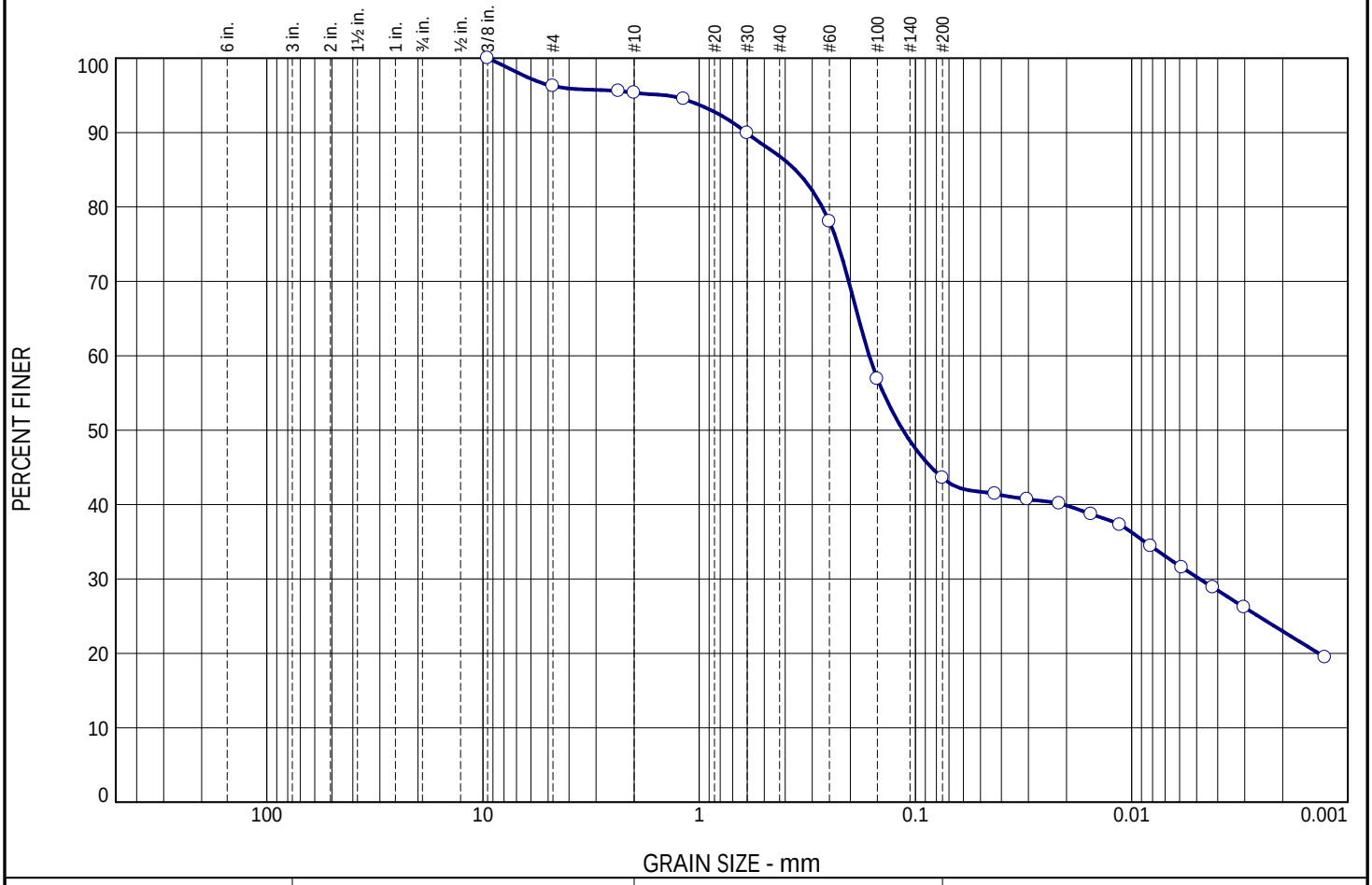
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-7

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	4.7	5.4	11.9	34.4	43.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.3		
#8	95.6		
#10	95.3		
#16	94.5		
#30	89.9		
#60	78.0		
#100	56.9		
#200	43.6		

* (no specification provided)

Material Description

Dark gray coarse to fine SAND, and Silty Clay, trace fine Gravel

Atterberg Limits

LL= 69 PL= 33 PI= 36

Coefficients

D_{85}= 0.3593 D_{60}= 0.1636 D_{50}= 0.1141
D_{30}= 0.0048 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC

Remarks

WC: 37.1%

Source of Sample: B-4 Depth: 35'-37'
Sample Number: S-11

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

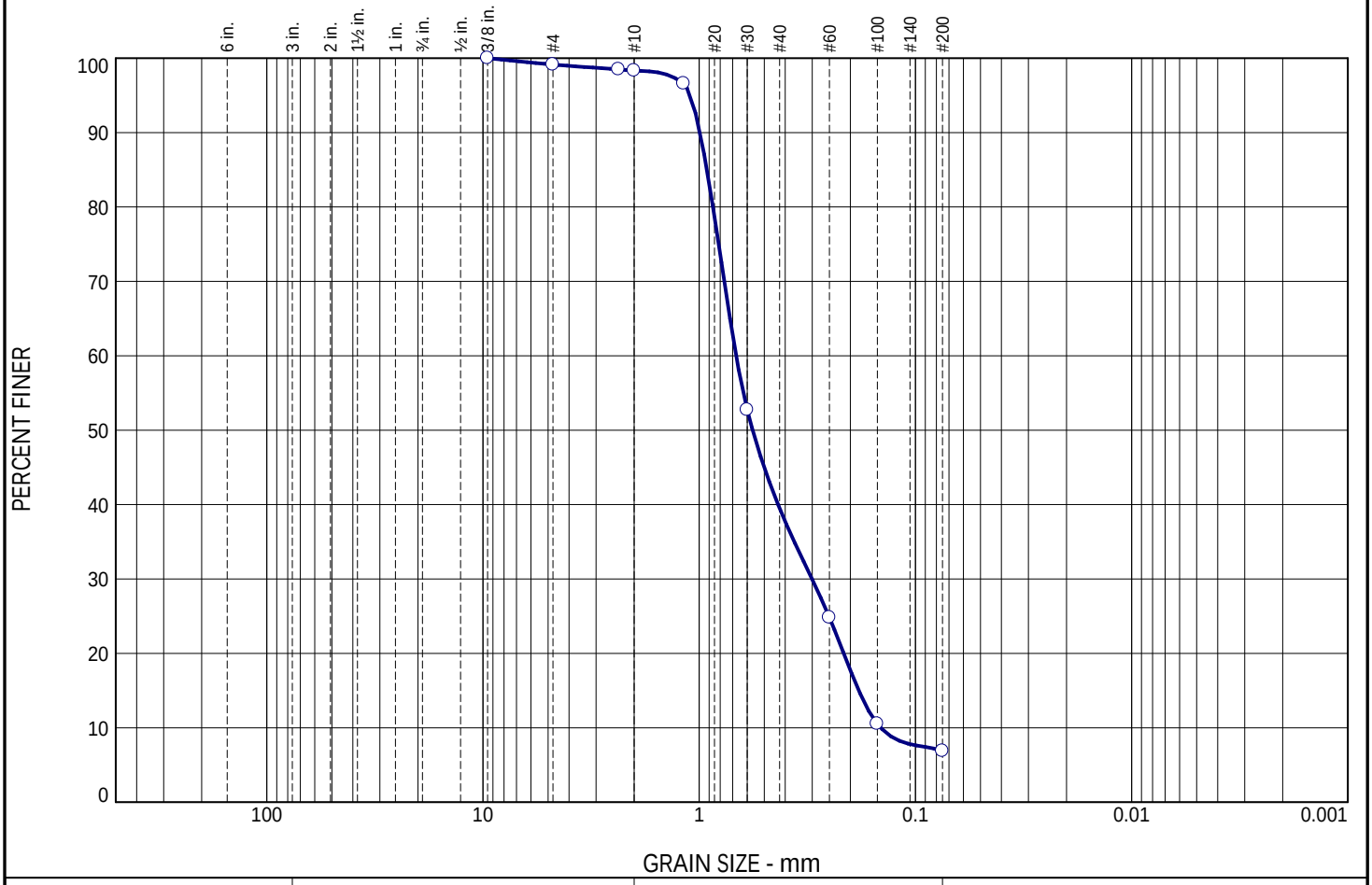
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-8

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	1.7	45.6	27.9	17.9	6.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.1		
#8	98.5		
#10	98.3		
#16	96.6		
#30	52.7		
#60	24.8		
#100	10.5		
#200	6.9		

* (no specification provided)

Material Description

Black coarse to fine SAND, trace [Fines: (Silt/Clay)], trace fine Gravel

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 0.9208 D_{60}= 0.6753 D_{50}= 0.5657
D_{30}= 0.3009 D_{15}= 0.1828 D_{10}= 0.1446
C_u= 4.67 C_c= 0.93

Classification

USCS= SP-SM\SC

Remarks

WC: 19.0%

Source of Sample: B-5 Depth: 30'-32'
Sample Number: S-10

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

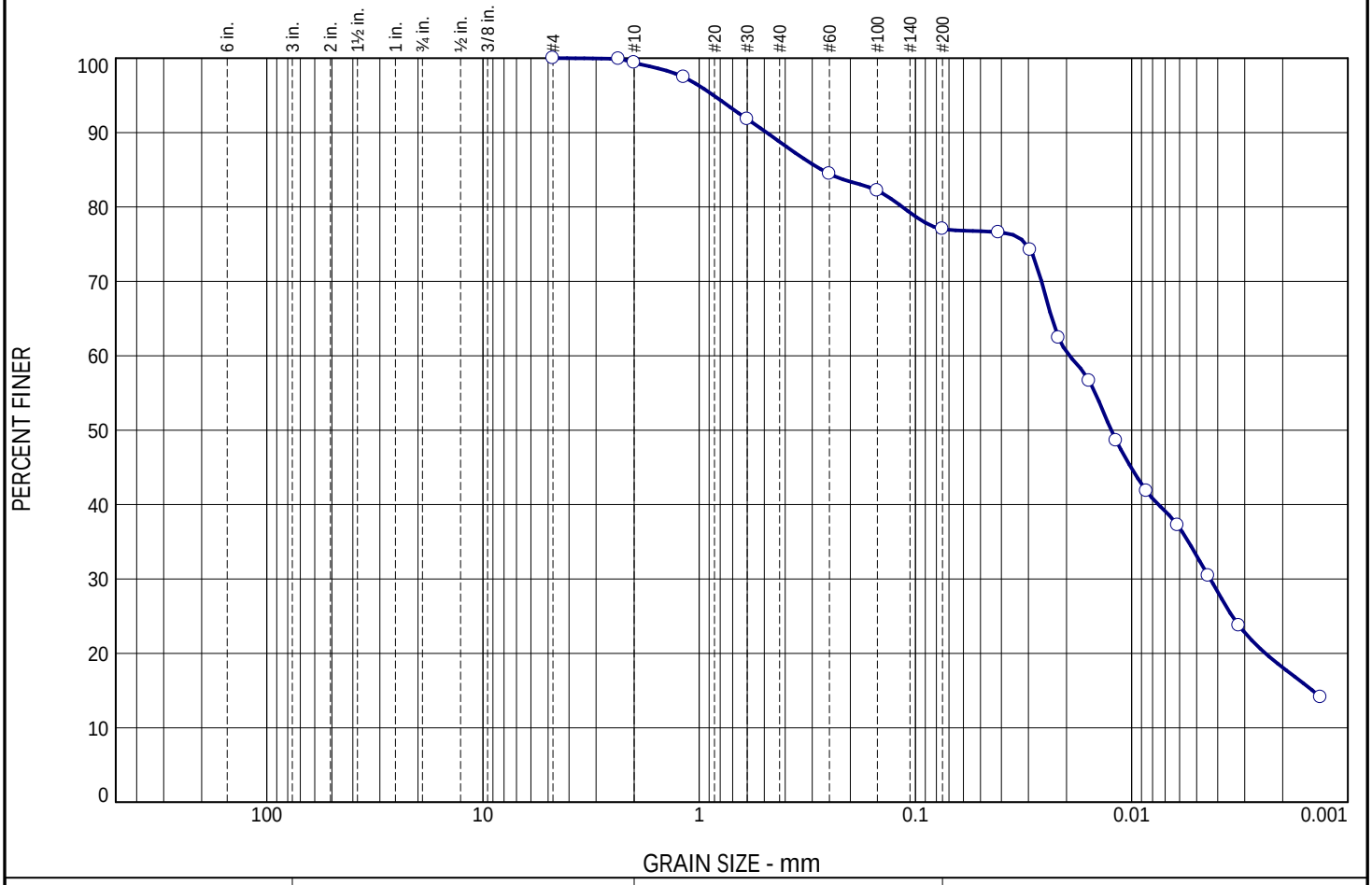
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-9

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	0.6	7.6	7.3	7.5	77.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	99.9		
#10	99.4		
#16	97.5		
#30	91.8		
#60	84.5		
#100	82.2		
#200	77.0		

* (no specification provided)

Material Description

Black CLAY, some coarse to fine Sand

Atterberg Limits

LL= 132 PL= 50 PI= 82

Coefficients

D_{85}= 0.2708 D_{60}= 0.0194 D_{50}= 0.0124
D_{30}= 0.0043 D_{15}= 0.0015 D_{10}=
C_u= C_c=

Classification

USCS= CH

Remarks

WC: 52.8%

Source of Sample: B-5 Depth: 45'-47'
Sample Number: S-13

Date: 5/18/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

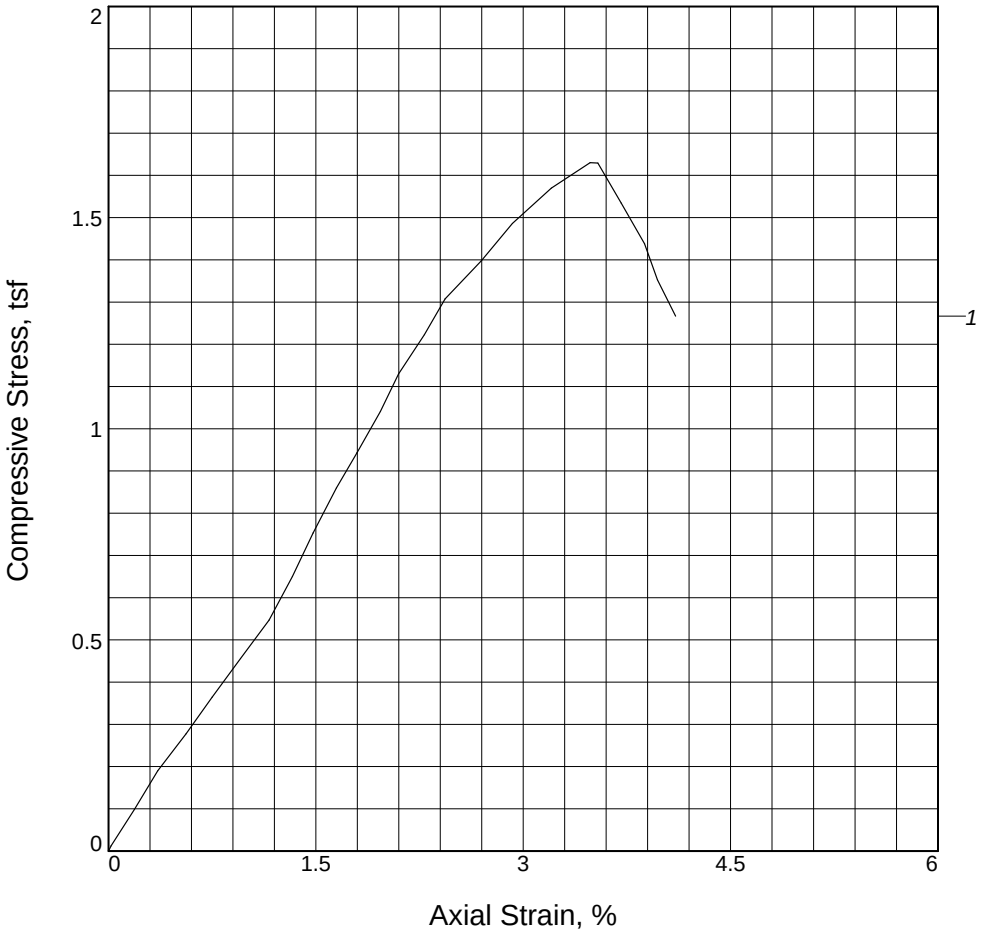
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jumping Brook
Neptune City, NJ

Project No: 22004363A Plate PSA-10

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.630			
Undrained shear strength, tsf	0.815			
Failure strain, %	3.5			
Strain rate, in./min.	0.053			
Water content, %	45.4			
Wet density, pcf	108.4			
Dry density, pcf	74.5			
Saturation, %	98.9			
Void ratio	1.2126			
Specimen diameter, in.	2.86			
Specimen height, in.	5.34			
Height/diameter ratio	1.87			

Description: Dark gray SILT, little coarse to fine Sand, trace fine Gravel

LL =	**PL =**	**PI =**	**GS=** 2.642	**Type:** Undisturbed

Project No.: 22004363A

Date Sampled: 5/18/22

Remarks:
Sample did not meet the 2 to 2.5 length to diameter ratio per the standard, client still requested testing to be completed on the sample (Sample ratio was 1.868)

Plate UC-1

Client: Craig Test Boring Co., Inc.

Project: Jumping Brook
Neptune City, NJ

Source of Sample: B-4 **Depth:** 22'-24'

Sample Number: UD-1

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Colliers Engineering & Design

US Army Corps of Engineers
VALIDATED LABORATORY

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Craig Test Boring Co., Inc.
5230 Atlantic Ave
Mays Landing, NJ 08330

ATTN: Mrs. Kayla Cappadocia

PROJECT: Jumping Brook - Neptune, NJ

Project # 22004363A **DATE:** August 3, 2022
PAGE: 1 of 1

CHECKED BY: Jason Veach
TITLE: Laboratory Supervisor

SAMPLES RECEIVED: July 21, 2022 **SAMPLES TESTED:** 7/21/22 - 8/1/22 **LAB TECHNICIAN(S):** K. Perry

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D6913)	%Passing #200 Sieve (ASTM D1140)	Organic Content (%) (ASTM D2974)	Sulfate (ppm (mg/kg)) (ASTM D516)	Chloride (ppm (mg/kg)) (ASTM D512B)	pH of Soil (ASTM G51)	Consolidation* (ASTM D2435)	UU Triaxial* (ASTM D2850)	CU Triaxial* (ASTM D4767)	Soil Perm. Class Rating (NJAC 7:9A-6.3)					
				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)										A	B				
B-1	S-11	30-32	41.4	74	40	34															
	S-15	50-52	29.6	44	30	14															
B-2	S-9	25-27	34.8	56	28	28															
	S-15	55-57	24.2	-	Non-Plastic	-															
B-3	S-9	25-27	41.7	56	30	26															
	S-13	45-47	40.7	82	35	47															
B-4	S-12	40-42	29.1	50	28	22															
Testing Total:			**0**	**7**																	

Comments/Remarks: * See attached Plate(s)

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Main: 877 627 3772
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Colliers Engineering & Design

US Army Corps of Engineers
VALIDATED LABORATORY

GEOTECHNICAL LABORATORY TESTING RESULTS

CLIENT: Craig Test Boring Co., Inc.
5230 Atlantic Ave
Mays Landing, NJ 08330

ATTN: Mrs. Kayla Cappadocia

PROJECT: Jumping Brook - Neptune, NJ

Project # 22004363A (C)

DATE: August 31, 2022

PAGE: 1 of 1

CHECKED BY: Eduardo M. Freire, P.E.

TITLE: Laboratory Manager

SAMPLES RECEIVED: August 10, 2022

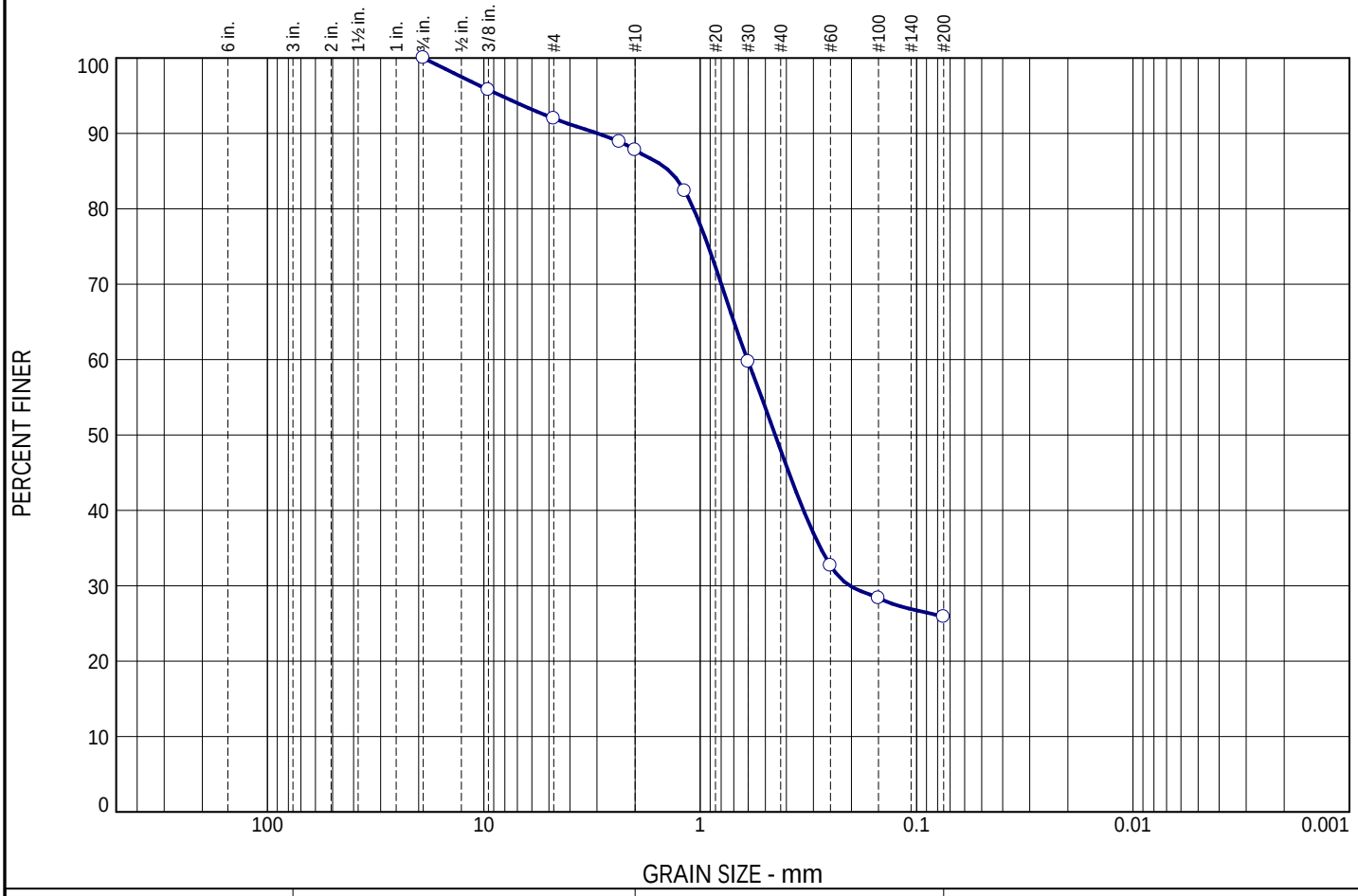
SAMPLES TESTED: 8/10/22 - 8/29/22

LAB TECHNICIAN(S): J. Veach,, K. Perry & N. Freeman

Test Boring No.	Sample No.	Depth (ft)	Water Content (%) (ASTM D2216)	Atterberg Limits (ASTM D4318)			Particle Size Analysis (Sieve Only)* (ASTM D6913)	%Passing #200 Sieve (ASTM D1140)	Particle Size Analysis with Hydrometer* (ASTM D6913/D7928)	Sulfate (ppm (mg/kg)) (ASTM C1580)	Chloride (ppm (mg/kg)) (AASHTO T-291)	pH of Soil (ASTM D 4972)	Consolidation* (ASTM D2435)	Soil Resistivity (Ω-cm) (AASHTO T-288)	Organic Content (%) (ASTM D2974)						
				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)															
B-7	SS-3	4-6													2.8						
	SS-7	15-17					PSA-1														
	ST-9	22-24	29.9	57	25	32				368	<10	4.4		600							
	ST-13	37-39	46.7	103	42	61			PSA-2				CON 1-5								
	SS-17	55-57	21.4	35	24	11															
	SS-18	60-62						38.4													
	SS-19	65-67	33.6																		
	SS-21	75-77	39.3																		
B-6	SS-1	0-2																			
	SS-2	2-4																			
	SS-3	4-6								376	22	5.4		400							
	SS-4	6-8																			
	SS-5	8-10																			
	SS-6	10-12					PSA-3														
	SS-8	20-22	27.0																		
	ST-11	32-34	42.9	119	51	68			PSA-4				CON 6-10								
	SS-14	45-47	41.4																		
	SS-16	55-57	23.7	37	25	12															
	SS-17	60-62	15.5																		
	SS-18	65-67						74.1													
	SS-19	70-72	35.5	71	29	42															
Testing Total:			**5**	**6**			**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**1**						

Comments/Remarks: * See attached Plate(s)

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	4.2	8.0	28.1	27.0	6.8	25.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	95.8		
#4	92.0		
#8	88.9		
#10	87.8		
#16	82.4		
#30	59.7		
#60	32.7		
#100	28.4		
#200	25.9		

* (no specification provided)

Material Description

Brown coarse to fine SAND, some [Fines: (Silt/Clay)], little medium to fine Gravel

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 1.3870 D_{60}= 0.6050 D_{50}= 0.4505
D_{30}= 0.2034 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM\SC

Remarks

Source of Sample: B-7 Depth: 15'-17'
Sample Number: SS-7

Date: 8/22/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

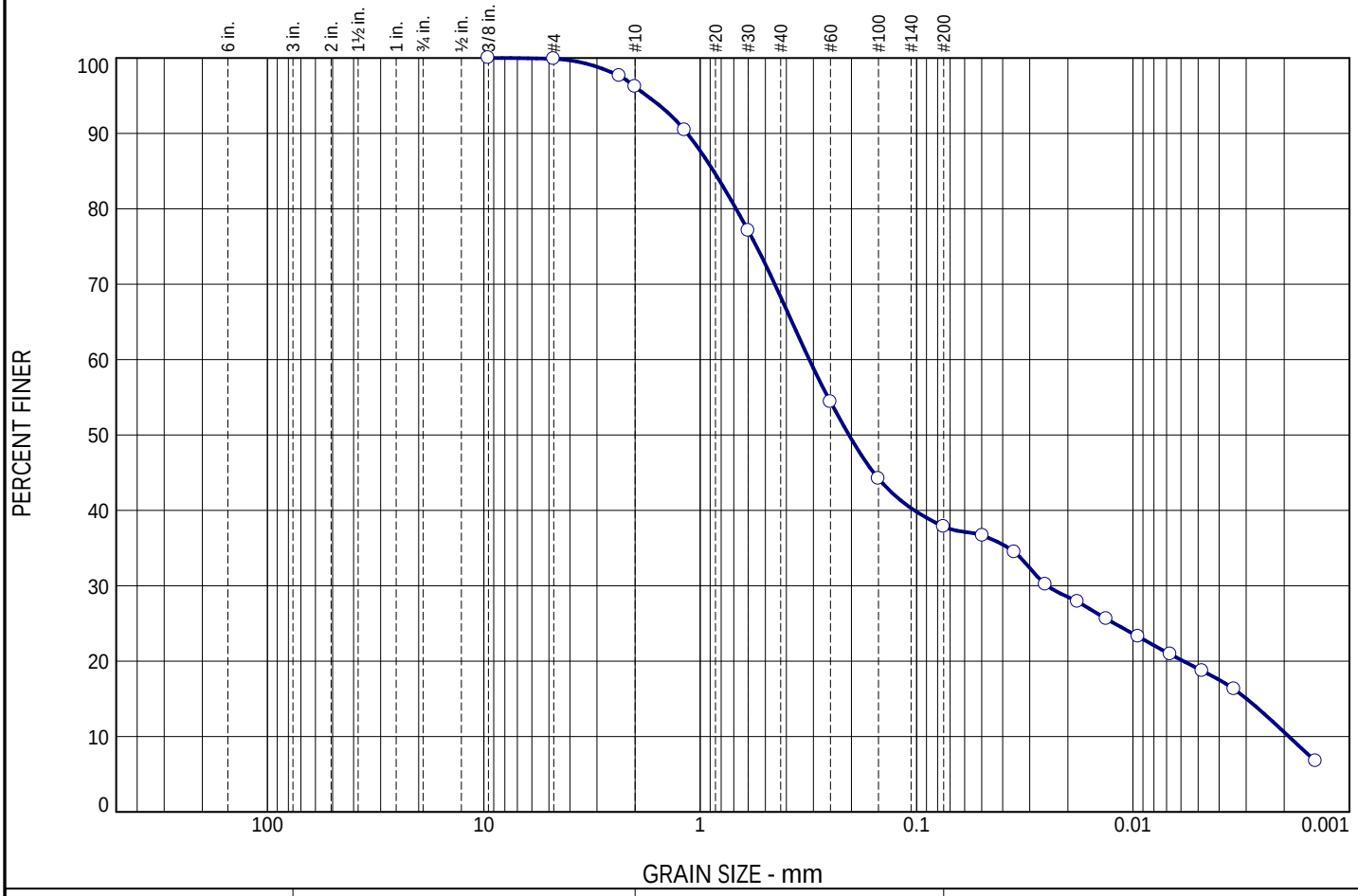
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jacobs - Jumping Brook - Neptune, NJ

Project No: 22004363A (C) Plate PSA-1

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	3.8	19.1	22.7	16.6	37.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#8	97.6		
#10	96.2		
#16	90.4		
#30	77.1		
#60	54.4		
#100	44.2		
#200	37.8		

* (no specification provided)

Material Description

Dark Gray coarse to fine SAND, and Clay, trace fine Gravel

Atterberg Limits

LL= 103 PL= 42 PI= 61

Coefficients

D_{85}= 0.8673 D_{60}= 0.3132 D_{50}= 0.2053
D_{30}= 0.0249 D_{15}= 0.0030 D_{10}= 0.0019
C_u= 164.56 C_c= 1.04

Classification

USCS= SC

Remarks

Water Content (WC): 46.7%

Source of Sample: B-7 Depth: 37'-39'
Sample Number: ST-13

Date: 8/22/22

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Mays Landing New Jersey 08330
Main: 877 627 3772

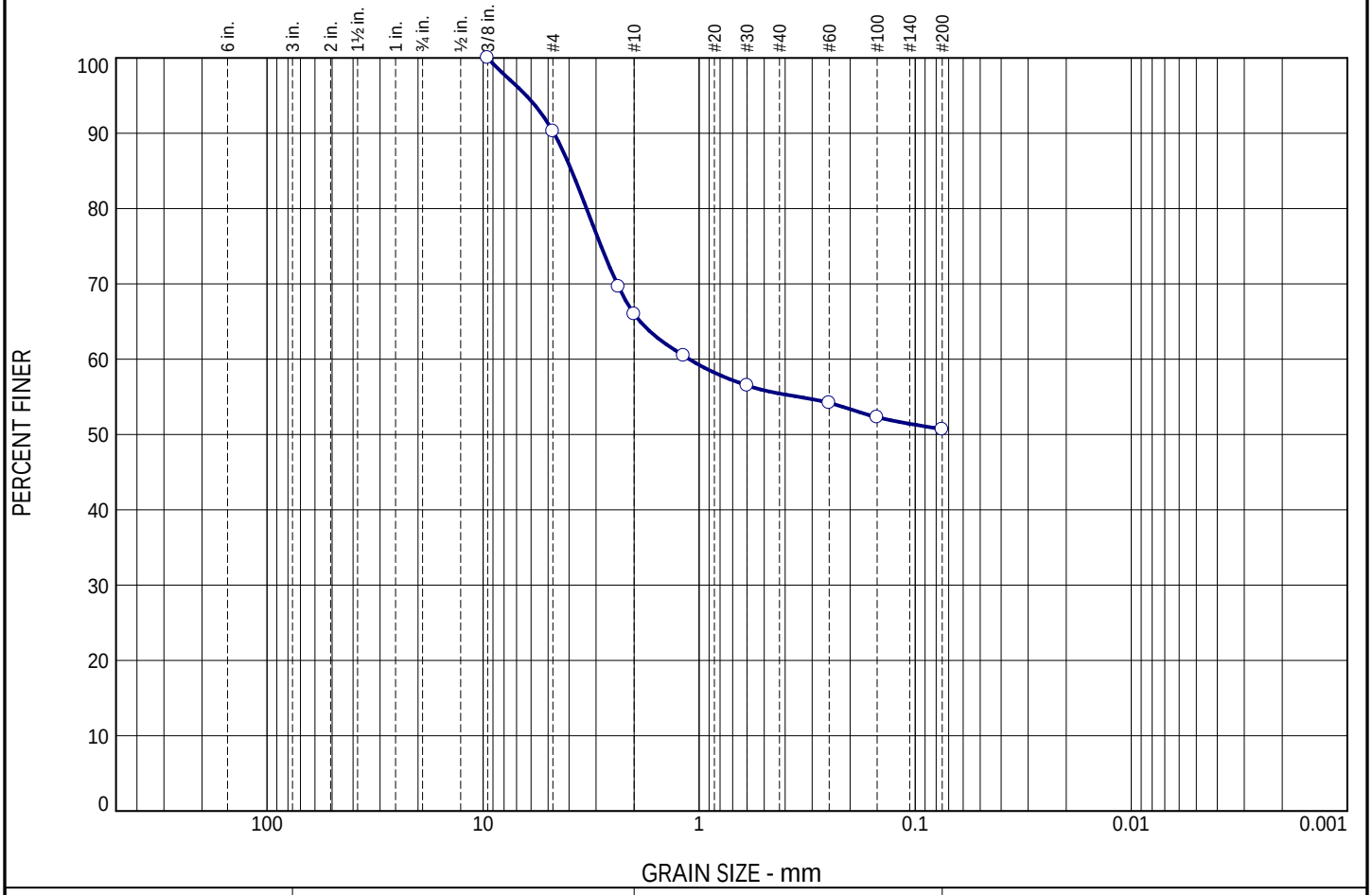
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jacobs - Jumping Brook - Neptune, NJ

Project No: 22004363A (C) Plate PSA-2

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	34.0	9.5	2.3	3.5	50.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	90.3		
#8	69.6		
#10	66.0		
#16	60.5		
#30	56.5		
#60	54.2		
#100	52.3		
#200	50.7		

* (no specification provided)

Material Description

Brown Dark Gray [FINES: (SILT/CLAY)], and fine Gravel, little course to fine Sand

Atterberg Limits

LL= PL= PI=

Coefficients

D_{85}= 3.8886 D_{60}= 1.1118 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL:H\ML:H

Remarks

Source of Sample: B-6 Depth: 10'-12'
Sample Number: SS-6

Date: 8/22/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

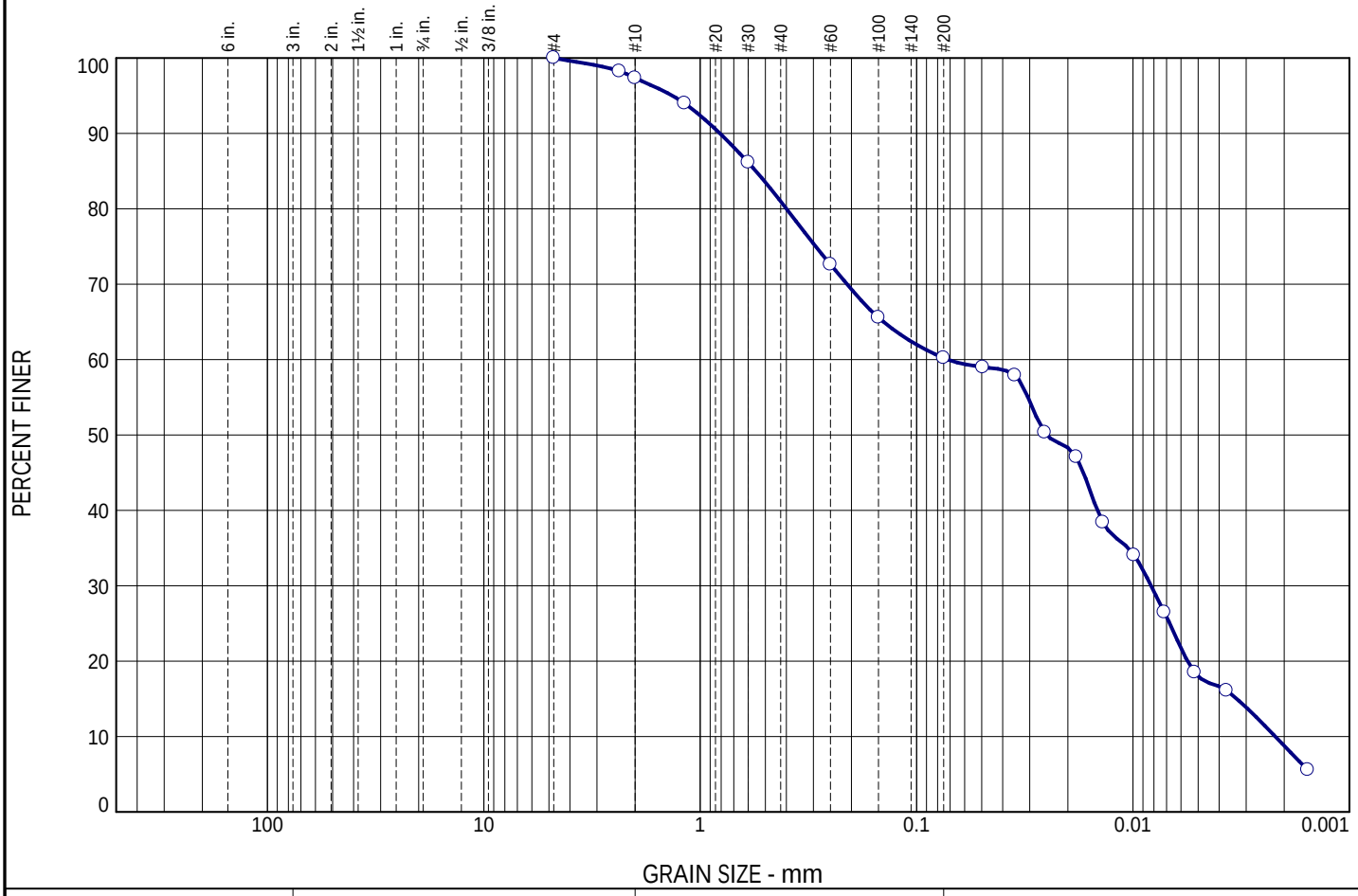
Geotechnical Laboratory

Colliers Engineering & Design

Client: Craig Test Boring Co., Inc.
Project: Jacobs - Jumping Brook - Neptune, NJ

Project No: 22004363A (C) Plate PSA-3

Particle Size Distribution Report



% Cobbles	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	2.7	11.2	13.5	12.4	60.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	98.3		
#10	97.3		
#16	94.0		
#30	86.1		
#60	72.6		
#100	65.6		
#200	60.2		

* (no specification provided)

Material Description

Dark Gray CLAY, and coarse to fine Sand, trace fine Gravel

Atterberg Limits

LL= 119 PL= 51 PI= 68

Coefficients

D_{85}= 0.5529 D_{60}= 0.0719 D_{50}= 0.0250
D_{30}= 0.0082 D_{15}= 0.0033 D_{10}= 0.0022
C_u= 32.70 C_c= 0.43

Classification

USCS= MH

Remarks

WC: 42.9%

Source of Sample: B-6 Depth: 32'-34'
Sample Number: ST-11

Date: 8/22/22

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

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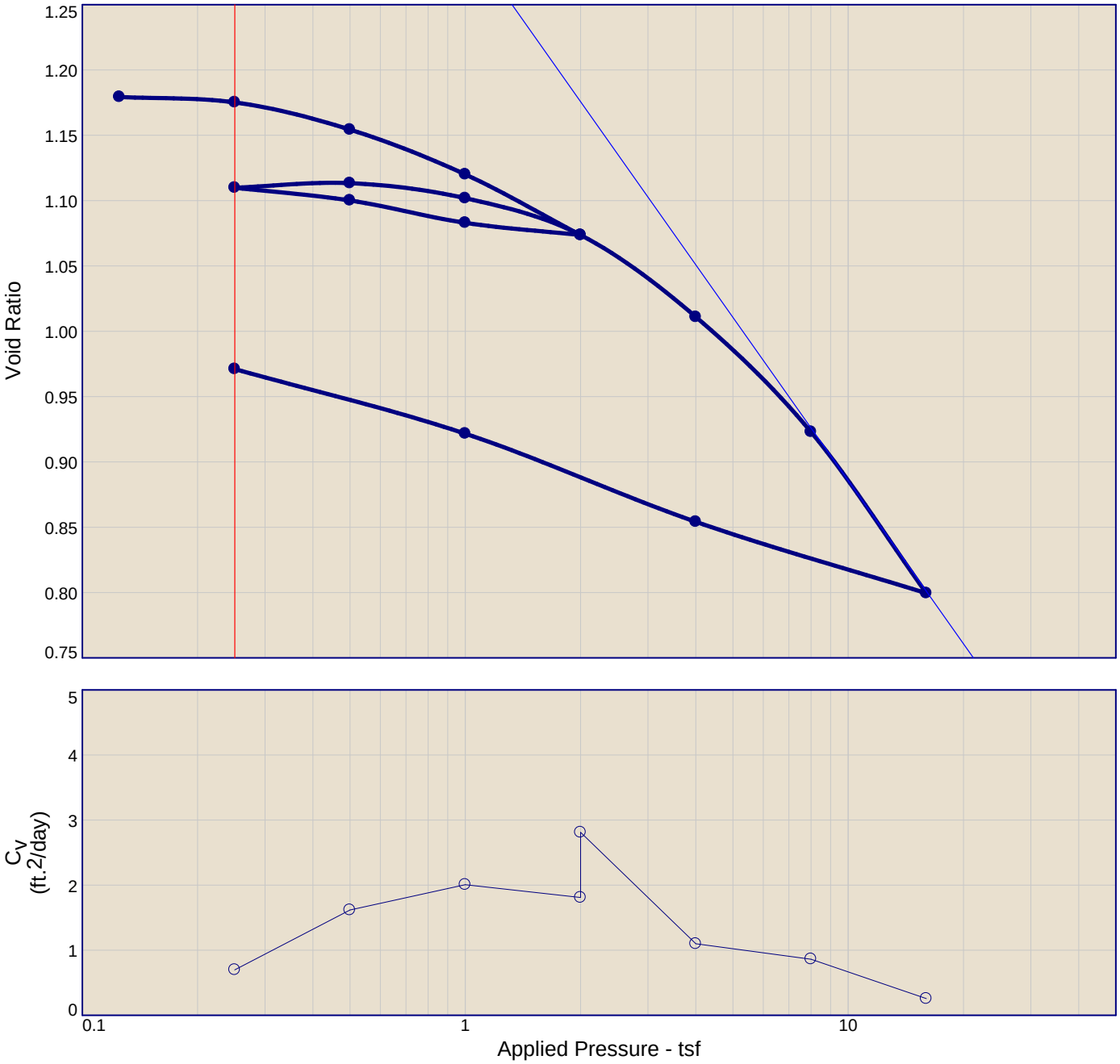
Client: Craig Test Boring Co., Inc.
Project: Jacobs - Jumping Brook - Neptune, NJ

Project No: 22004363A (C) Plate PSA-4

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
99.6 %	46.9 %	71.6	103	61	2.496	2.2	0.41	1.175

MATERIAL DESCRIPTION	USCS	AASHTO
Dark Gray coarse to fine SAND, and Clay, trace fine Gravel	SC	A-7-5(13)

Project No. 22004363A **Client:** Craig Test Boring Co., Inc.

Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-7 **Depth:** 37'-39' **Sample Number:** ST-13

Remarks:

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

Geotechnical Laboratory

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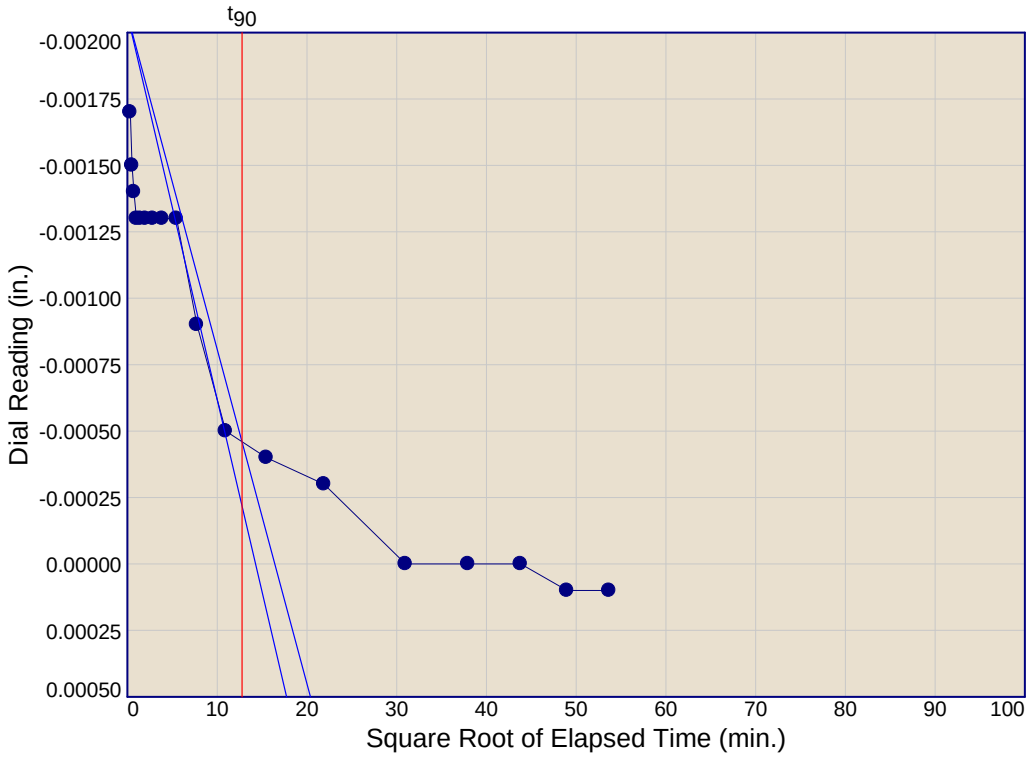
Plate CON 1

Dial Reading vs. Time

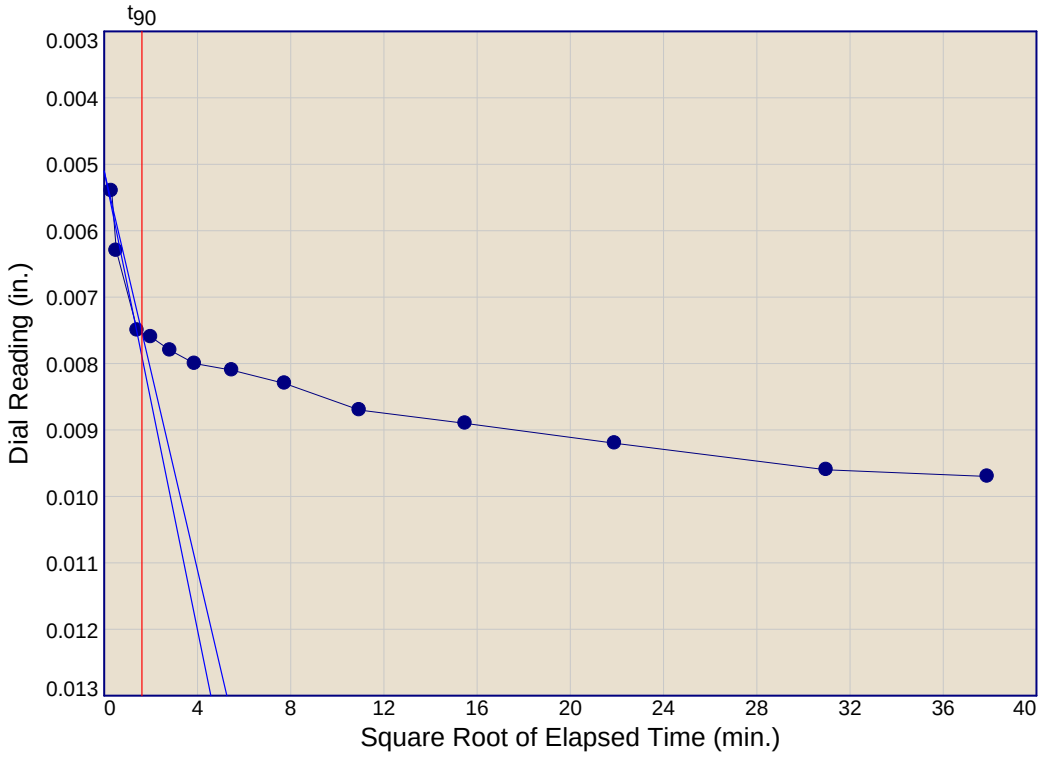
Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-7 Depth: 37'-39' Sample Number: ST-13



Load No.= 2
Load= 0.25 tsf
D_0 = -0.0021
D_{50} = -0.0005
D_{100} = -0.0003
T_{50} = 0.71 min.

C_v @ T_{50}
0.698 ft.^{2}/day



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0051
D_{50} = 0.0075
D_{100} = 0.0078
T_{50} = 0.30 min.

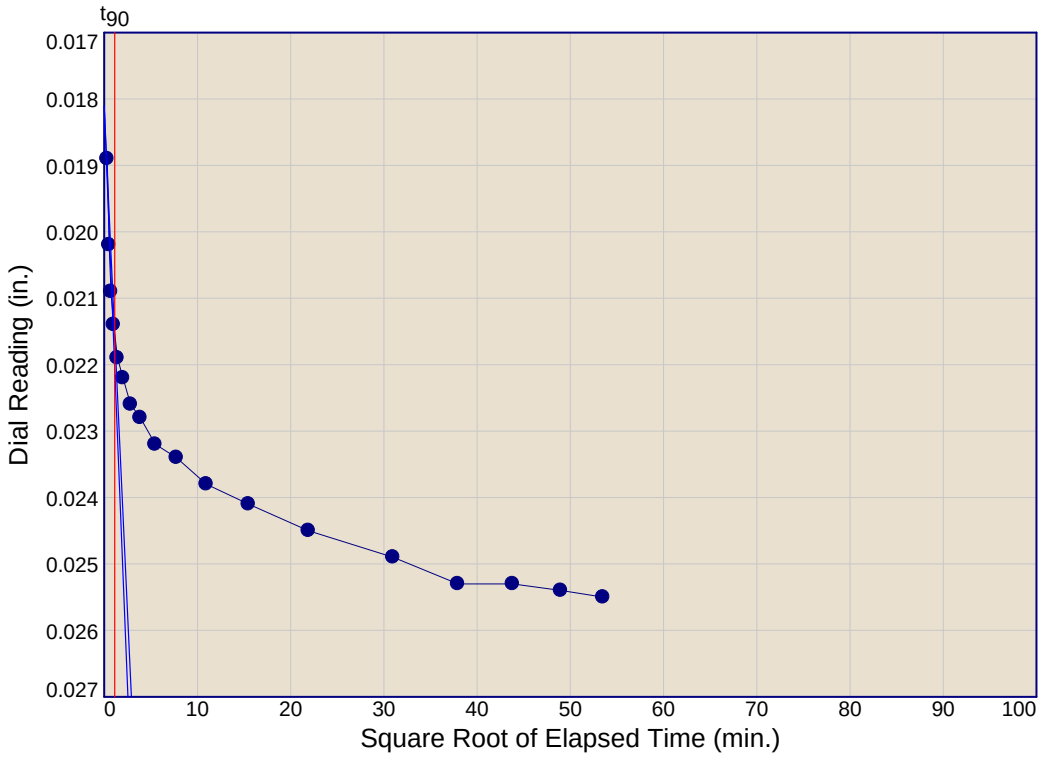
C_v @ T_{50}
1.618 ft.^{2}/day

Plate CON 2

Dial Reading vs. Time

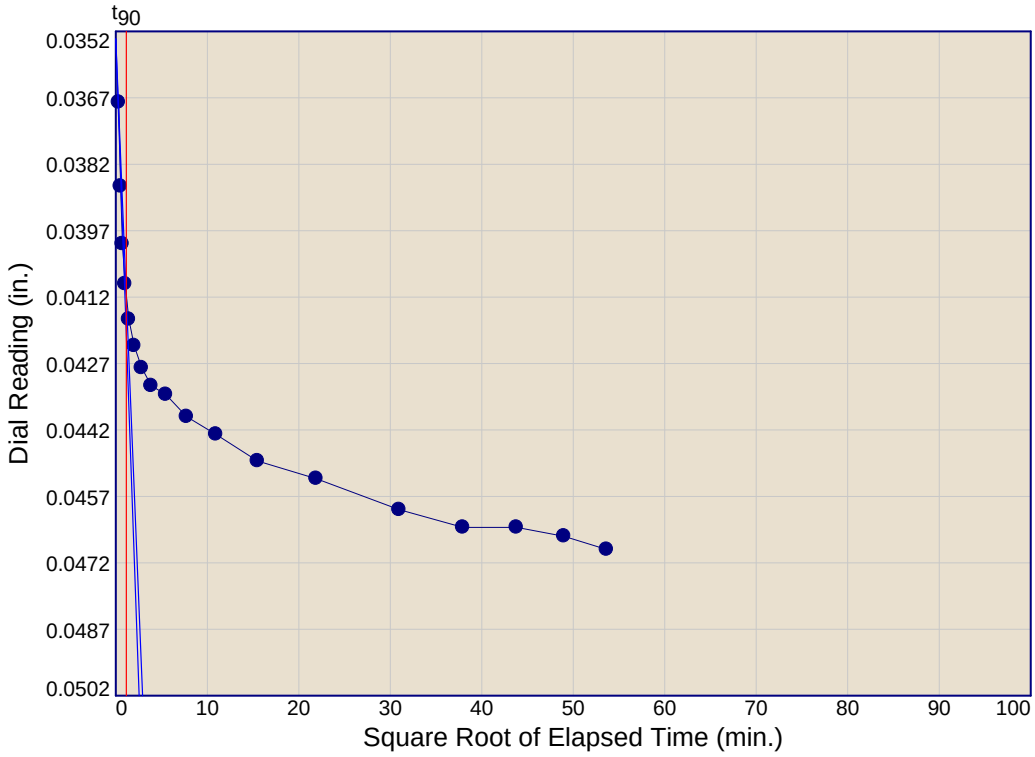
Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-7 Depth: 37'-39' Sample Number: ST-13



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0181
D_{50} = 0.0215
D_{100} = 0.0219
T_{50} = 0.24 min.

C_v @ T_{50}
2.006 ft.^{2}/day



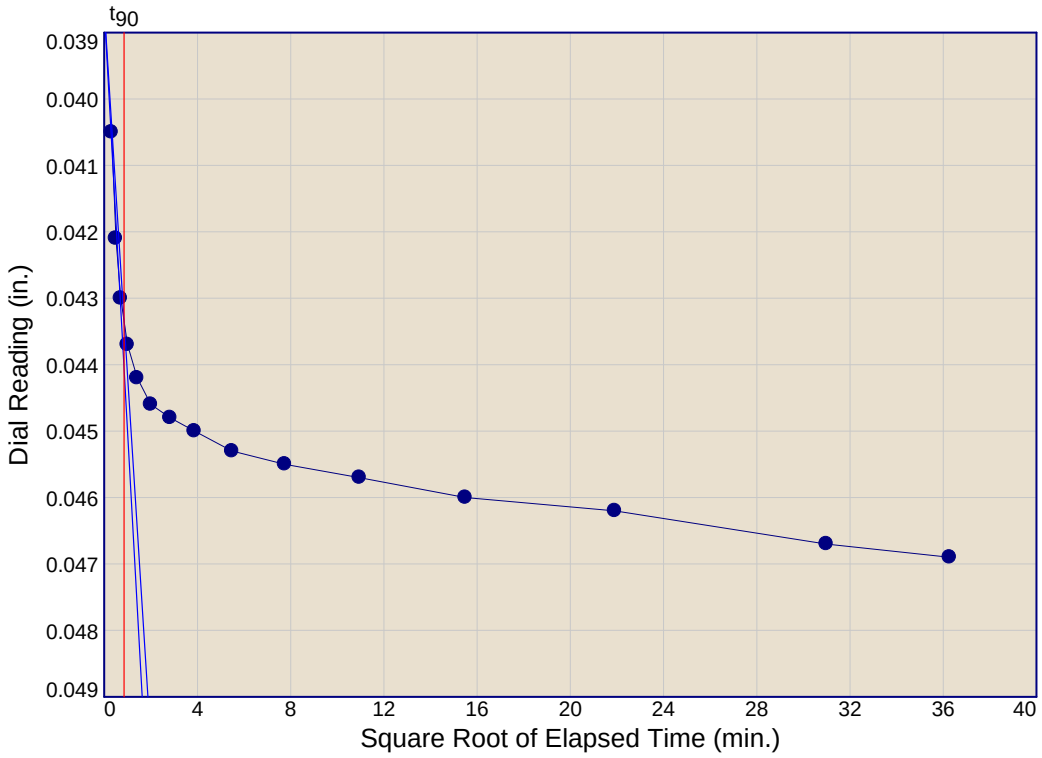
Load No.= 5
Load= 2.00 tsf
D_0 = 0.0354
D_{50} = 0.0412
D_{100} = 0.0418
T_{50} = 0.25 min.

C_v @ T_{50}
1.810 ft.^{2}/day

Dial Reading vs. Time

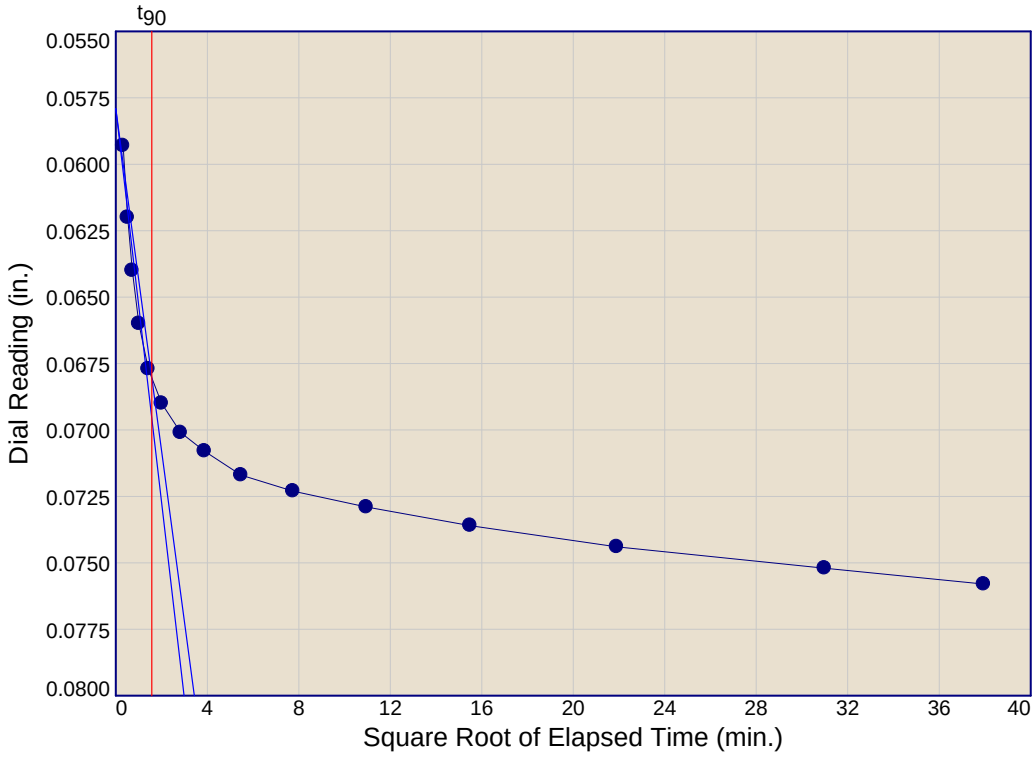
Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-7 Depth: 37'-39' Sample Number: ST-13



Load No.= 11
Load= 2.00 tsf
D_0 = 0.0386
D_{50} = 0.0433
D_{100} = 0.0439
T_{50} = 0.16 min.

C_v @ T_{50}
2.811 ft.^{2}/day



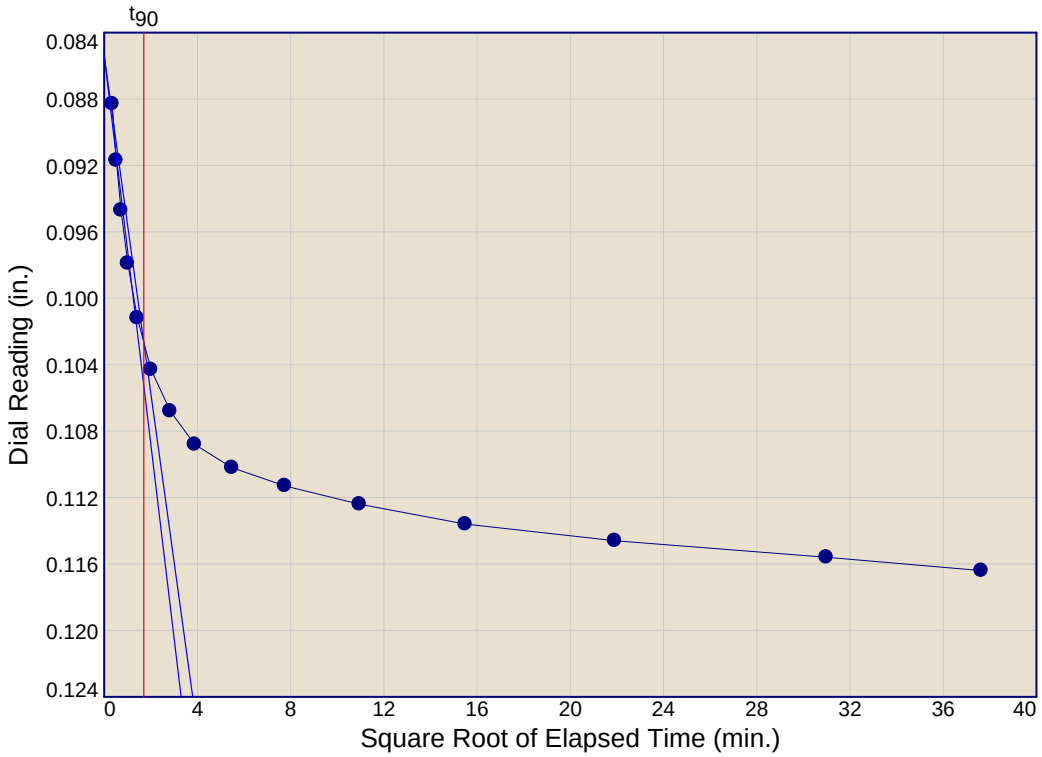
Load No.= 12
Load= 4.00 tsf
D_0 = 0.0579
D_{50} = 0.0680
D_{100} = 0.0692
T_{50} = 0.40 min.

C_v @ T_{50}
1.099 ft.^{2}/day

Dial Reading vs. Time

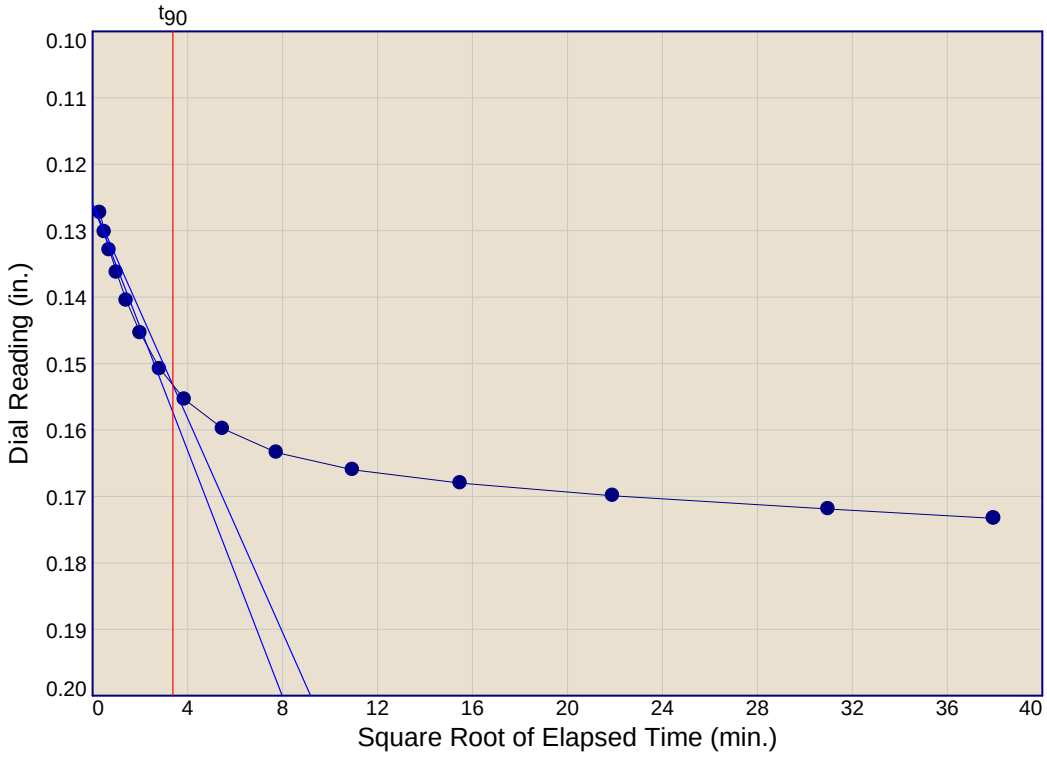
Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-7 Depth: 37'-39' Sample Number: ST-13



Load No.= 13
Load= 8.00 tsf
D_0 = 0.0854
D_{50} = 0.1027
D_{100} = 0.1046
T_{50} = 0.47 min.

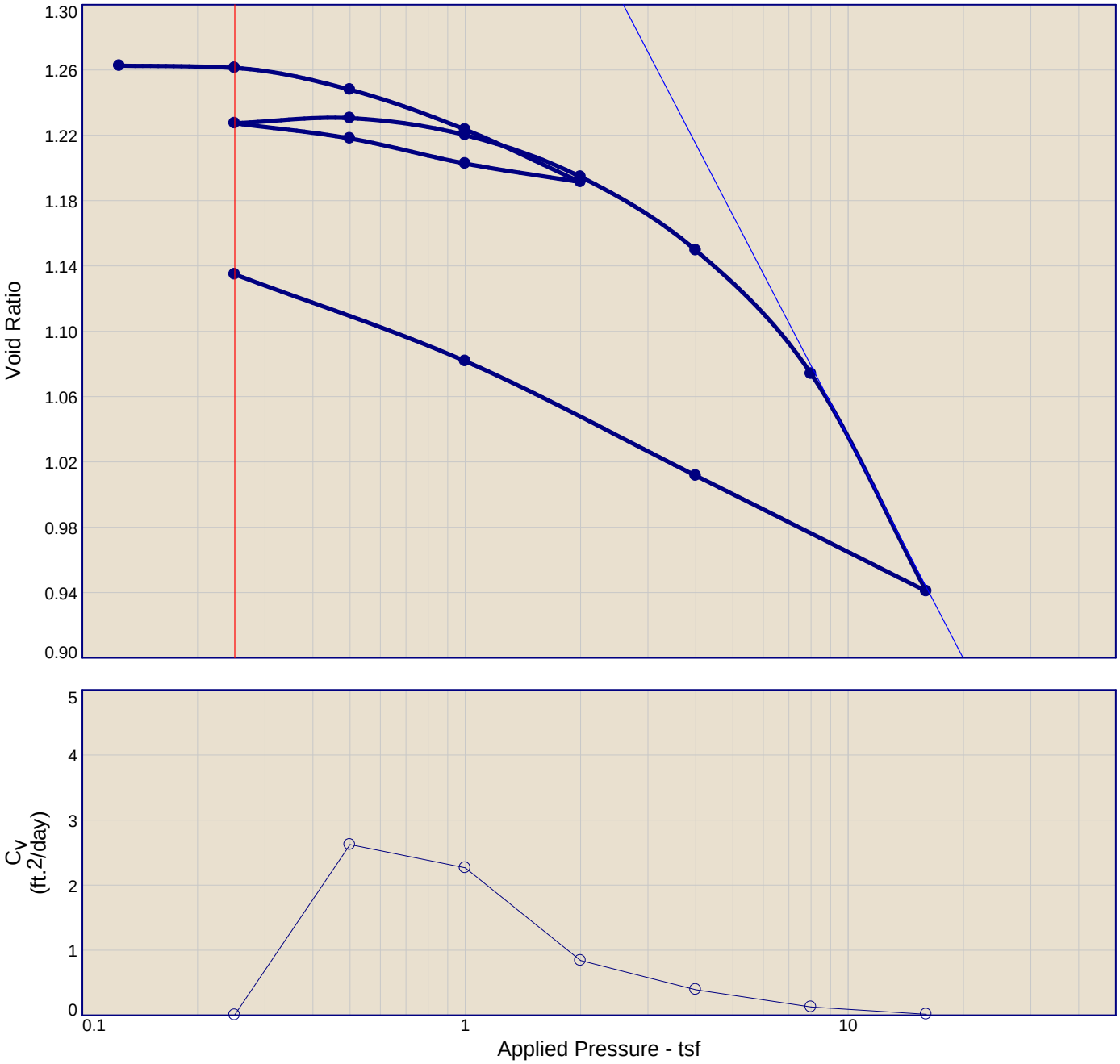
C_v @ T_{50}
0.862 ft.^{2}/day



Load No.= 14
Load= 16.00 tsf
D_0 = 0.1260
D_{50} = 0.1532
D_{100} = 0.1562
T_{50} = 1.42 min.

C_v @ T_{50}
0.256 ft.^{2}/day

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	P_c (tsf)	C_c	Initial Void Ratio
Saturation	Moisture							
99.2 %	48.5 %	71.2	119	68	2.576	3.4	0.45	1.259

MATERIAL DESCRIPTION	USCS	AASHTO
Dark Gray CLAY, and coarse to fine Sand, trace fine Gravel	MH	A-7-5(41)

Project No. 22004363A **Client:** Craig Test Boring Co., Inc.

Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-6 **Depth:** 32'-34' **Sample Number:** ST-11

Remarks:

5439 Harding Highway
Mays Landing New Jersey 08330
Main: 877 627 3772

Geotechnical Laboratory

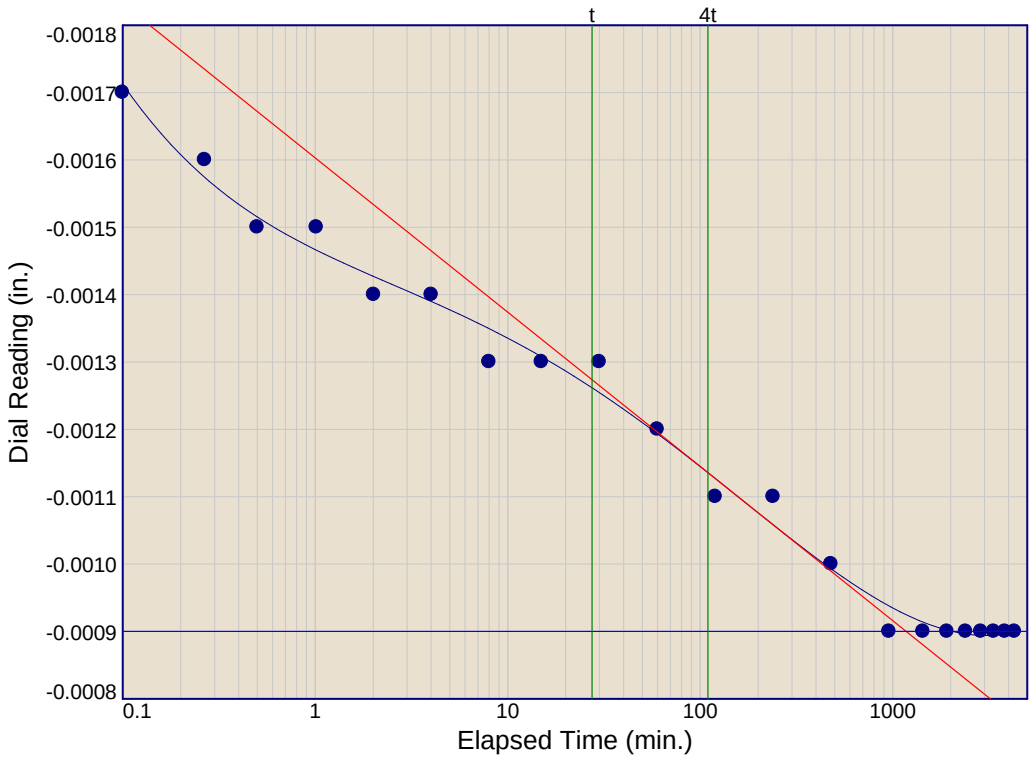
Colliers Engineering & Design

Plate CON 6

Dial Reading vs. Time

Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

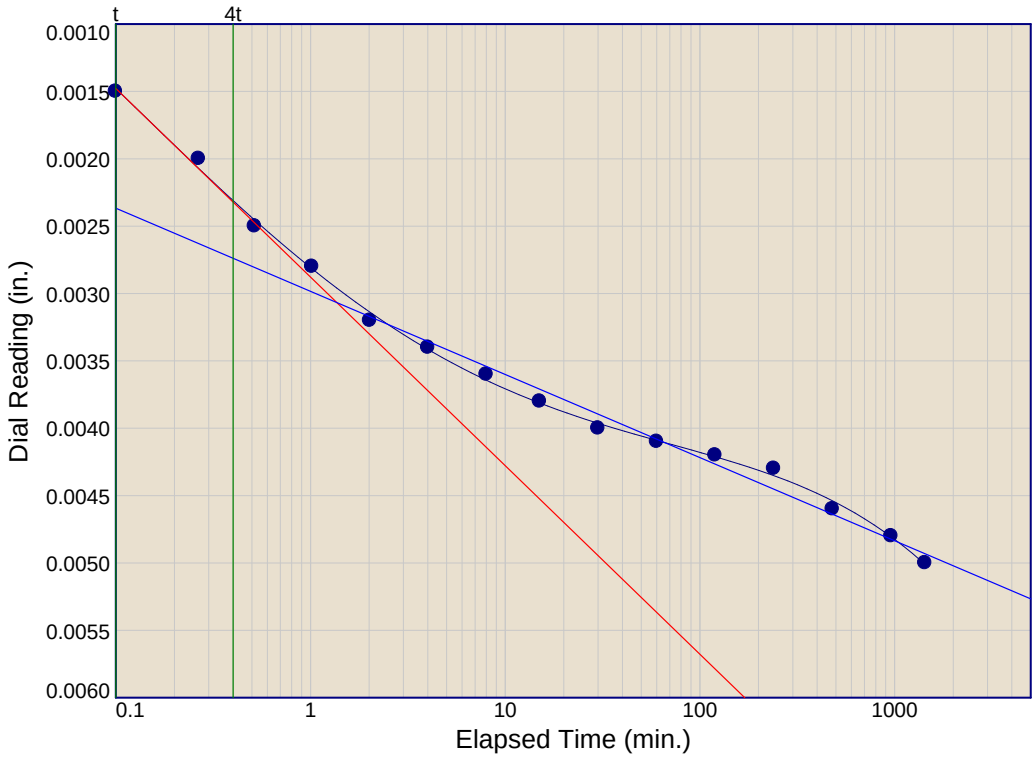
Source of Sample: B-6 Depth: 32'-34' Sample Number: ST-11



Load No.= 2
Load= 0.25 tsf
D_0 = -0.0014
D_{50} = -0.0011
D_{100} = -0.0009
T_{50} = 100.86 min.

C_v @ T_{50}
0.005 ft.^{2}/day

C_α = 0.000



Load No.= 3
Load= 0.50 tsf
D_0 = 0.0006
D_{50} = 0.0019
D_{100} = 0.0031
T_{50} = 0.19 min.

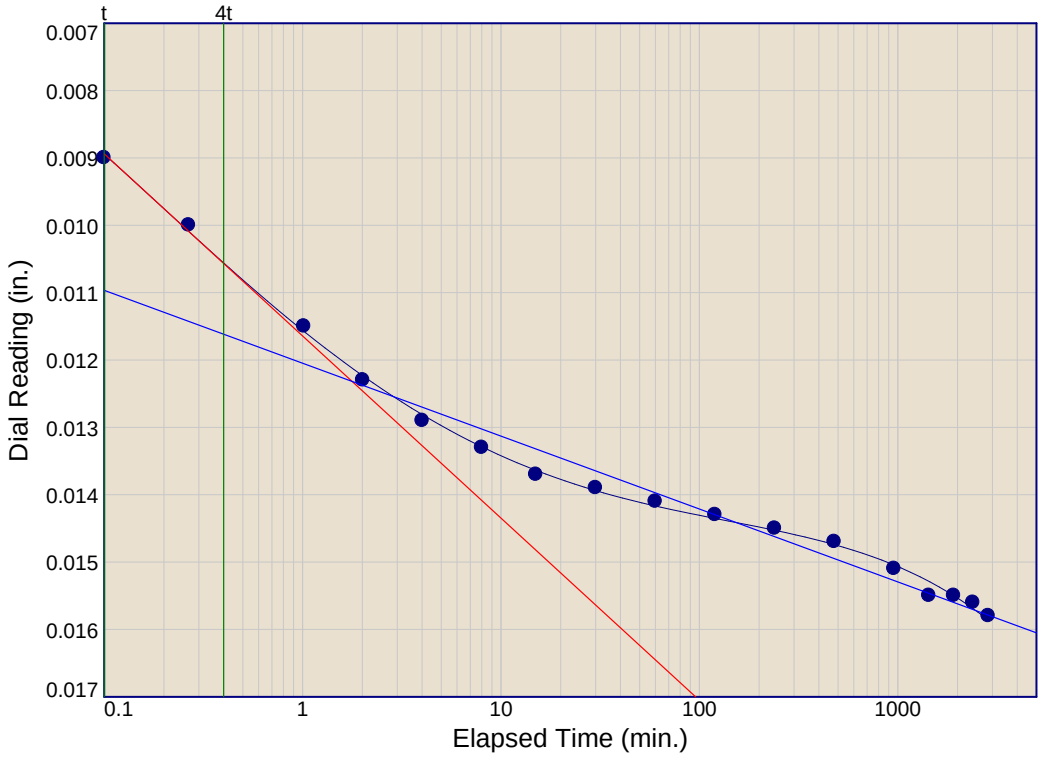
C_v @ T_{50}
2.623 ft.^{2}/day

C_α = 0.001

Dial Reading vs. Time

Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

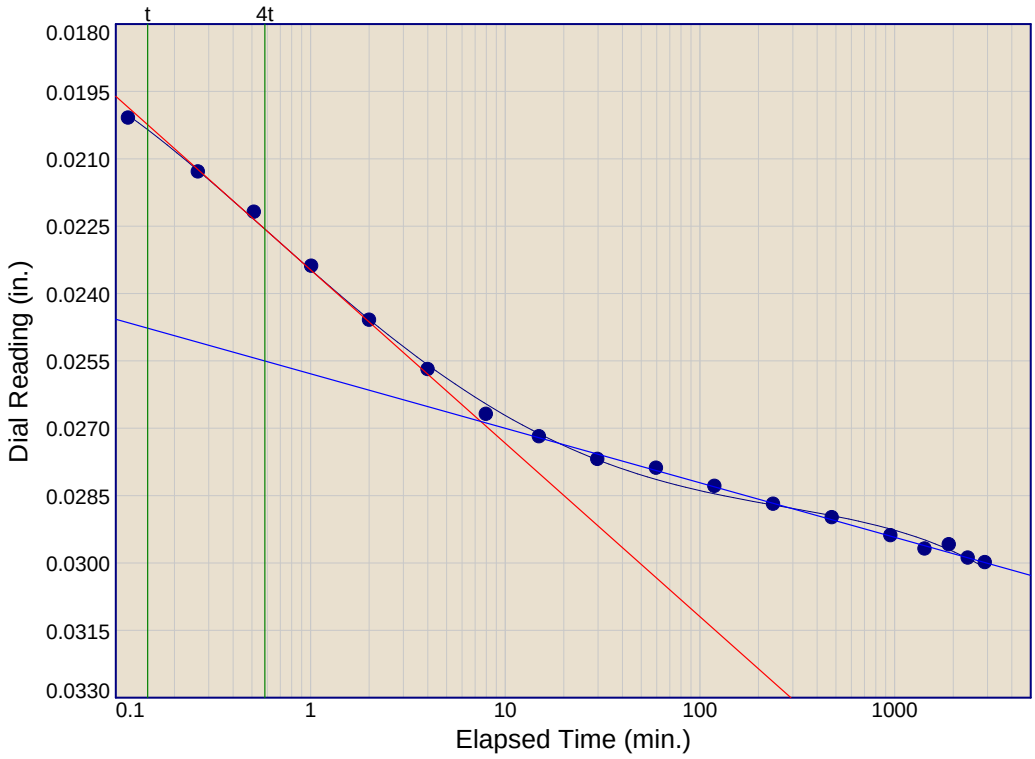
Source of Sample: B-6 Depth: 32'-34' Sample Number: ST-11



Load No.= 4
Load= 1.00 tsf
D_0 = 0.0073
D_{50} = 0.0098
D_{100} = 0.0123
T_{50} = 0.21 min.

C_v @ T_{50}
2.265 ft.^{2}/day

C_α = 0.002



Load No.= 5
Load= 2.00 tsf
D_0 = 0.0181
D_{50} = 0.0225
D_{100} = 0.0268
T_{50} = 0.56 min.

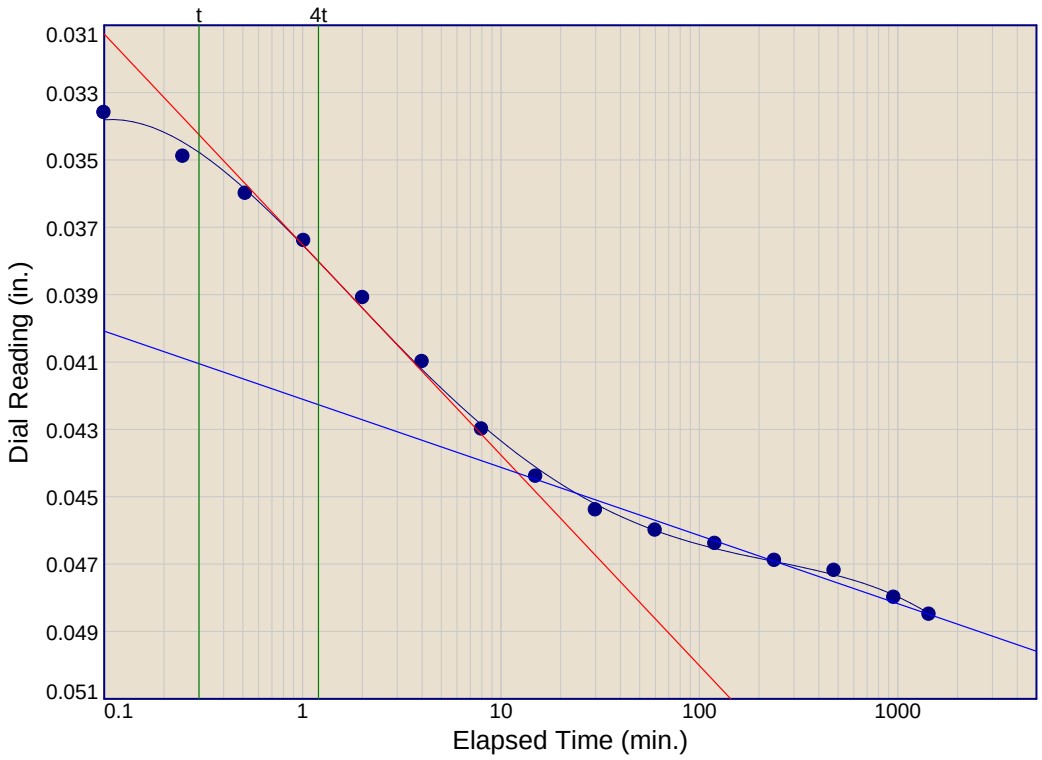
C_v @ T_{50}
0.841 ft.^{2}/day

C_α = 0.003

Dial Reading vs. Time

Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

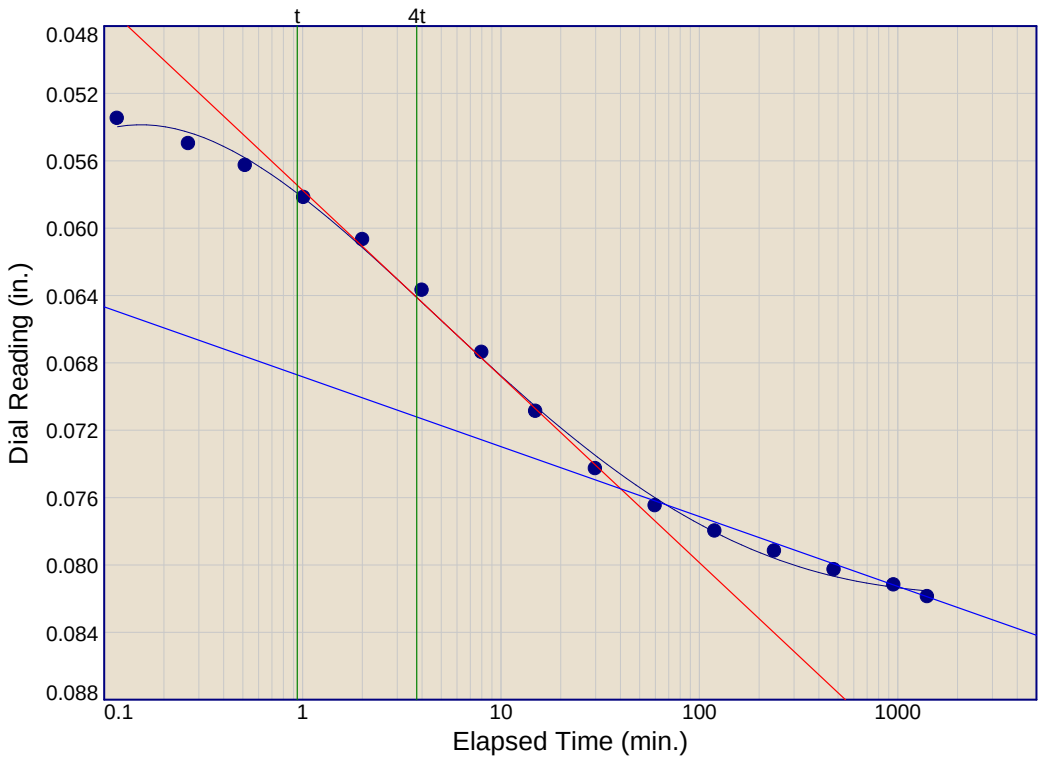
Source of Sample: B-6 Depth: 32'-34' Sample Number: ST-11



Load No.= 12
Load= 4.00 tsf
D_0 = 0.0315
D_{50} = 0.0379
D_{100} = 0.0443
T_{50} = 1.16 min.

C_v @ T_{50}
0.392 ft.^{2}/day

C_α = 0.005



Load No.= 13
Load= 8.00 tsf
D_0 = 0.0517
D_{50} = 0.0636
D_{100} = 0.0755
T_{50} = 3.38 min.

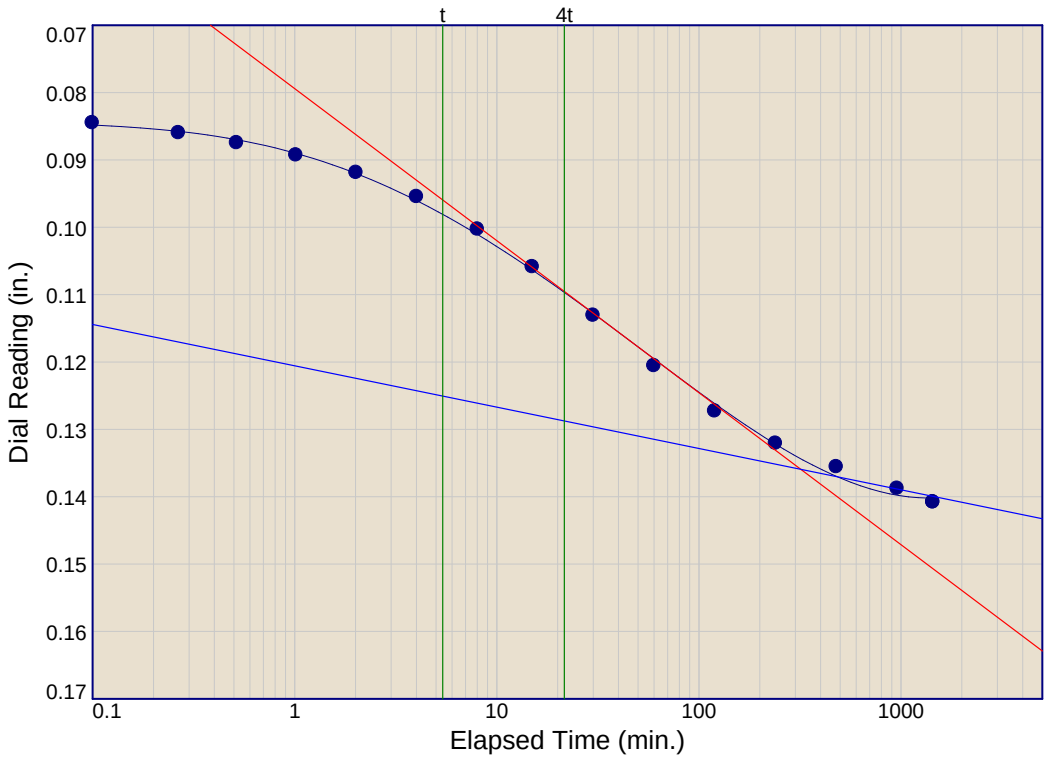
C_v @ T_{50}
0.127 ft.^{2}/day

C_α = 0.009

Dial Reading vs. Time

Project No.: 22004363A (C)
Project: Jacobs - Jumping Brook - Neptune, NJ

Source of Sample: B-6 Depth: 32'-34' Sample Number: ST-11



Load No.= 14
Load= 16.00 tsf
D_0 = 0.0865
D_{50} = 0.1112
D_{100} = 0.1359
T_{50} = 25.45 min.

C_v @ T_{50}
0.015 $ft.^2$/day

C_α = 0.014

Appendix D. Geotechnical Soil Profile at the proposed WTP Building

Depth (ft)

0

10

35

60

110

Elevation (ft)

Chemical MAT at 29.67' elev.

Clearwell MAT at +0.5ft.

consol

consol

B-4
GSE = 35 ft
Depth = 52 ft
Elevation = -17 ft

B-6
GSE = 25 ft
Depth = 72 ft
Elevation = -47 ft
8/5/2022 2:21:00 PM

B-2
GSE = 22 ft
Depth = 62 ft
Elevation = -40 ft

B-7
GSE = 22.5 ft
Depth = 77 ft
Elevation = -54.5 ft
8/4/2022 2:40:00 PM

B-3
GSE = 24 ft
Depth = 52 ft
Elevation = -28 ft

B-1
GSE = 22 ft
Depth = 52 ft
Elevation = -30 ft

B-5
GSE = 34 ft
Depth = 72 ft
Elevation = -38 ft

Distance (ft)

VERTICAL SCALE: 1" = 14.6'
HORIZONTAL SCALE: 1" = 14.0'

11X17 STICK LOG WITH LEGEND_JUMPING BROOK WTP_AUGUST 2022.GPJ_CH2M GEOTECH-REVISED.GDT_9/1/22

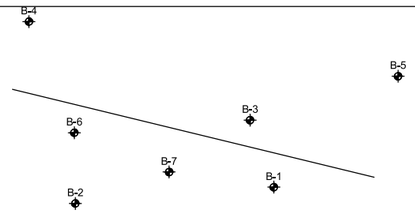
JACOBS®

LITHOLOGY GRAPHICS

- Fill
- Poorly Graded Sand
- Clayey Sand
- Elastic Silt
- Silt
- Silty Sand
- Fat Clay
- Silty Gravel
- Well-Graded Sand
- Concrete
- Lean Clay
- Silt

BOREHOLE LEGEND

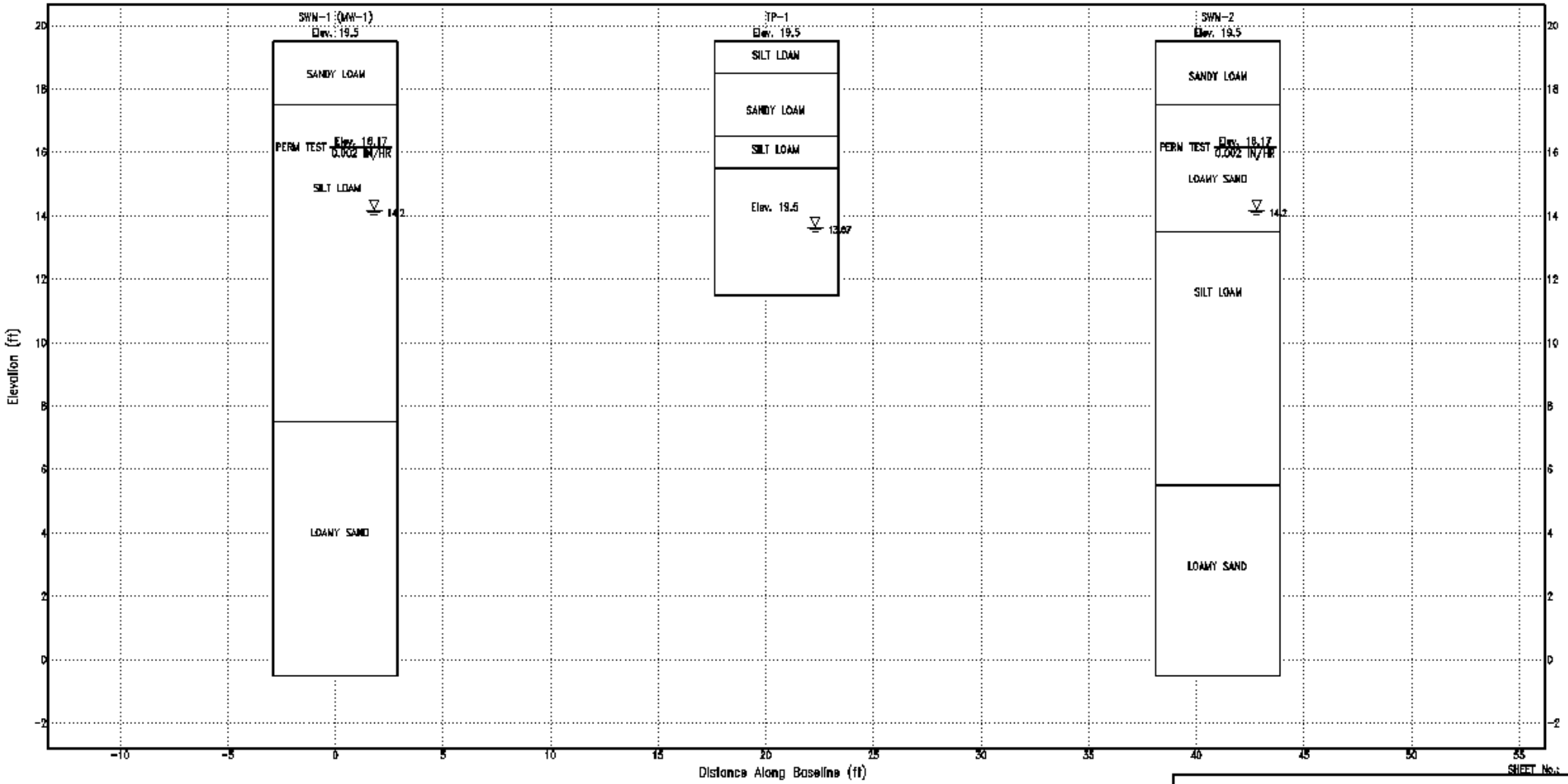
B-1 — BOREHOLE NUMBER
GSE = 172.5 ft — GROUND SURFACE ELEVATION
ML — USCS CLASSIFICATION
5 — LAYER BREAK DEPTH
LITHOLOGY GRAPHIC COLUMN
16 / 69 / 50/2" — SPT N-VALUE (blows per foot)
100/66 — RECOVERY (%) / RQD (%)
GROUNDWATER LEVEL
DEPTH AND ELEVATION OF BOTTOM OF HOLE, AND DATE AND TIME BORING COMPLETED: Depth = 59 ft, Elevation = 113.5 ft, 8/23/2007 10:45:00 AM



Jumping Brook WTP
Neptune City, NJ

Project Number: E6X98900

Appendix E. Soil Profiles at the proposed SWM areas



SHEET No.:

▽ – Water Level Reading

American Water
Jumping Brook
Neptune City, NJ

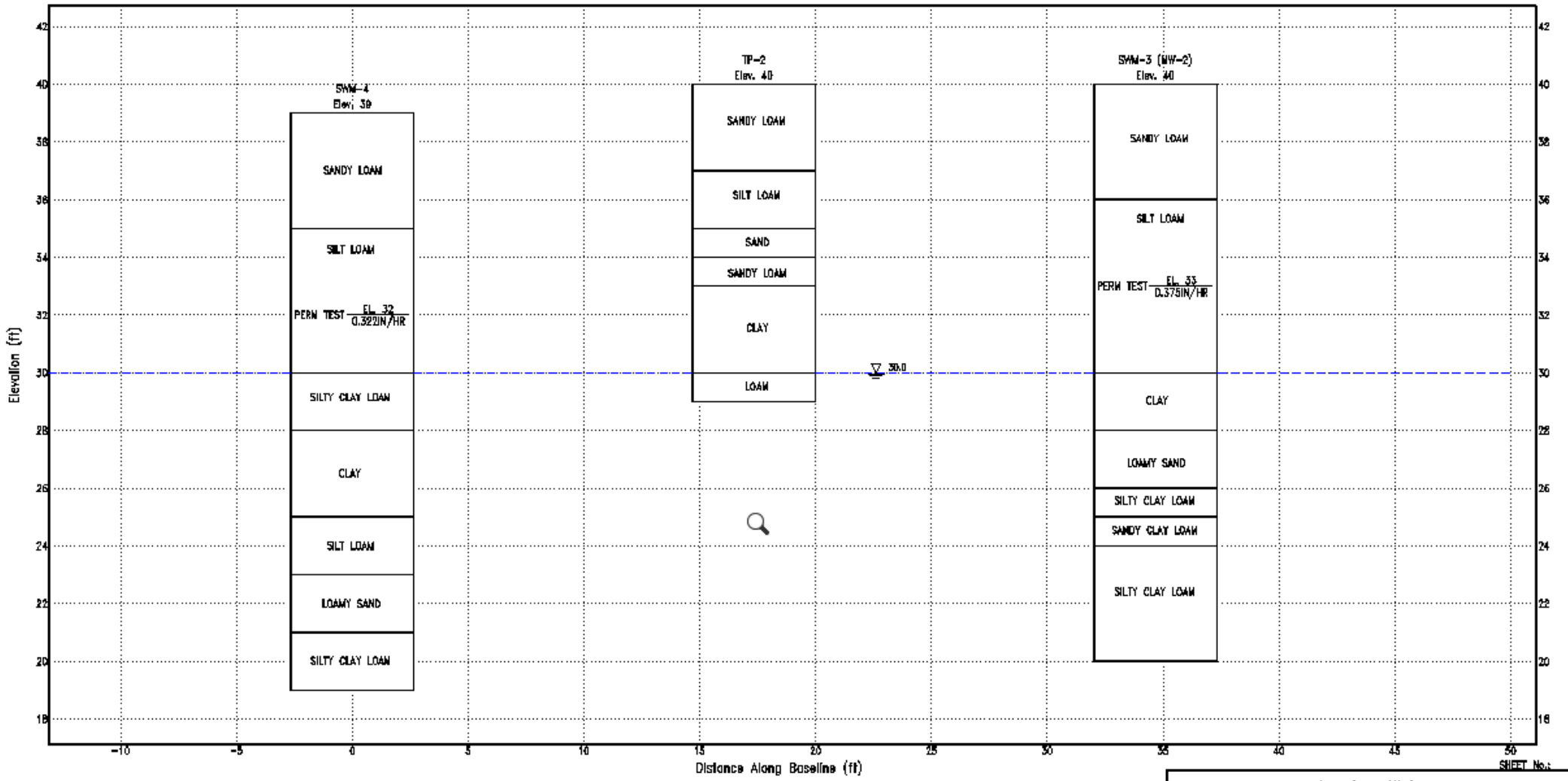
CONTRACT NO: E6X98900

SUBSURFACE PROFILE
SWM Area 1

JAC085

	BY	DATE
MADE		6/6/2022
TRACED		
CHECKED		
SUPERVISED		

No.	DATE	REVISION



SHEET No.:

American Water
Jumping Brook
Neptune City, NJ

CONTRACT NO: E6X98900

SUBSURFACE PROFILE
SWM Area 2

JACOBS

▽ – Water Level Reading

	BY	DATE
MADE		6/6/2022
TRACED		
CHECKED		
SUPERVISED		

No.	DATE	REVISION

Appendix F. Hydraulic Conductivity Test Results

Cased Borehole Hydraulic Conductivity Test Data Sheet

Project:

Municipality: Date:

Test Hole Dimensions

Borehole # **SWM-1** Surface Elev.

Trial No. **PT-1**

Borehole Inner Diameter (D1)	4	inch
Thickness of tested layer between bottom of casing and top of underlying stratum (b1)	8	inch
Testing Pipe Length	76	inch
Tested Soil Layer Depth (L)	24	inch
Tested soil textual classification (select from drop down menu)	**Silty Loam**	
Temperature (Fahrenheit)	50	°F
a value	-1	
Rt	1.31979664	
G1	0.99959766	

Test Time (minutes)	Z (in)	K1* (in/hr)
0	75.500	
30	75.375	0.004
60	75.313	0.002
90	75.250	0.002
120	75.250	-

"-" indicates negative or zero value, which is ignored from the calculation.

Tested Vertical Saturated Hydraulic Conductivity, K1 = 0.002

time-weighted average calculated as ASTM D6391 equation (9)

Cased Borehole Hydraulic Conductivity Test Data Sheet

Project:

Municipality: Date:

Test Hole Dimensions

Borehole # **SWM-2** Surface Elev.

Trial No. **PT-2**

Borehole Inner Diameter (D1)	4 inch
Thickness of tested layer between bottom of casing and top of underlying stratum (b1)	9 inch
Testing Pipe Length	64 inch
Tested Soil Layer Depth (L)	24 inch
Tested soil textual classification (select from drop down menu)	**Silty Loam**
Temperature (Fahrenheit)	50 °F
a value	-1
Rt	1.31979664
G1	1.01546429

Test Time (minutes)	Z (in)	K1* (in/hr)
0	64.000	
10	47.000	2.483
20	40.000	1.297
30	37.000	0.627
40	33.400	0.823
50	31.600	0.445
60	29.200	0.635
70	28.000	0.337
80	26.200	0.534

"-" indicates negative or zero value, which is ignored from the calculation.

Tested Vertical Saturated Hydraulic Conductivity, K1 = 0.898

time-weighted average calculated as ASTM D6391 equation (9)

Cased Borehole Hydraulic Conductivity Test Data Sheet

Project:

Municipality: Date:

Test Hole Dimensions

Borehole # **SWM-3** Surface Elev. **39**

Trial No. **PT-3**

Borehole Inner Diameter (D1)	4 inch
Thickness of tested layer between bottom of casing and top of underlying stratum (b1)	36 inch
Testing Pipe Length	90 inch
Tested Soil Layer Depth (L)	48 inch
Tested soil textual classification (select from drop down menu)	**Silty Loam**
Temperature (Fahrenheit)	50 °F
a value	-1
Rt	1.31979664
G1	1.11066407

Test Time (minutes)	Z (in)	K1* (in/hr)
0	90.000	
10	75.600	1.533
20	72.600	0.356
30	70.800	0.221
40	69.600	0.150
50	68.400	0.153
60	67.800	0.077
70	66.000	0.237
80	64.000	0.271

"-" indicates negative or zero value, which is ignored from the calculation.

Tested Vertical Saturated Hydraulic Conductivity, K1 = 0.375

time-weighted average calculated as ASTM D6391 equation (9)

Cased Borehole Hydraulic Conductivity Test Data Sheet

Project:

Municipality: Date:

Test Hole Dimensions

Borehole # **SWM-4** Surface Elev. **39**

Trial No. **PT-4**

Borehole Inner Diameter (D1)	4 inch
Thickness of tested layer between bottom of casing and top of underlying stratum (b1)	24 inch
Testing Pipe Length	102 inch
Tested Soil Layer Depth (L)	60 inch
Tested soil textual classification (select from drop down menu)	**Silty Loam**
Temperature (Fahrenheit)	50 °F
a value	-1
Rt	1.31979664
G1	1.09479744

Test Time (minutes)	Z (in)	K1* (in/hr)
0	102.000	
10	97.000	0.436
20	93.000	0.365
30	89.000	0.381
40	86.400	0.257
50	83.400	0.306
60	80.400	0.318
70	78.000	0.263
80	75.800	0.248

"-" indicates negative or zero value, which is ignored from the calculation.

Tested Vertical Saturated Hydraulic Conductivity, K1 = 0.322

time-weighted average calculated as ASTM D6391 equation (9)

Cased Borehole Hydraulic Conductivity Test Data Sheet

Project:

Municipality: Date:

Test Hole Dimensions

Borehole # **SWM-5** Surface Elev.

Trial No. **PT-5**

Borehole Inner Diameter (D1)	4 inch
Thickness of tested layer between bottom of casing and top of underlying stratum (b1)	60 inch
Testing Pipe Length	90 inch
Tested Soil Layer Depth (L)	72 inch
Tested soil textual classification (select from drop down menu)	**Silty Loam**
Temperature (Fahrenheit)	50 °F
a value	-1
Rt	1.31979664
G1	1.12335737

Test Time (minutes)	Z (in)	K1* (in/hr)
0	90.000	
10	78.000	1.273
20	70.800	0.862
30	67.200	0.464
40	64.800	0.324
50	63.000	0.251
60	61.800	0.171
70	60.000	0.263
80	58.800	0.180

"-" indicates negative or zero value, which is ignored from the calculation.

Tested Vertical Saturated Hydraulic Conductivity, K1 = 0.473

time-weighted average calculated as ASTM D6391 equation (9)