Appendix D
Supplemental Geotechnical Investigations

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Appendix D consists of Appendix D1, As-Built Granular Backfill Investigation, and Appendix D2, Bootlegger Cove Clay Investigation.

Appendix D1

As-Built Granular Backfill Investigation

Evaluation of Backfill Characteristics
Port of Anchorage Intermodal Expansion Project

PREPARED FOR: Port of Anchorage
USACE

PREPARED BY: Michel Bouchedid/CH2M HILL

REVIEWED BY: Don Anderson/CH2M HILL
Douglas Playter/CH2M HILL

COPIES: Bud Alto/CH2M HILL

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1. Introduction

This memorandum presents results from a geotechnical evaluation of the properties of existing soil backfill in the OPEN CELL® sheet pile (OCSP®) bulkhead already constructed for the Port of Anchorage Intermodal Expansion Project. This evaluation supplements the suitability study of the expansion design also conducted by CH2M HILL. The contents of this memorandum include a brief summary of subsurface geotechnical explorations, site characterization information, and the results of the in situ and laboratory testing performed for this evaluation. The geotechnical work summarized in this memorandum was performed in general accordance with USACE Delivery W912PP-09-D-0016 Task Order No. ZJ01-1, authorized on January 28, 2012, as part of the suitability study for the Port of Anchorage Intermodal Expansion Project.

1.1 Project Description

The project site is the Port of Anchorage (POA) North Expansion located north of downtown Anchorage, Alaska. The center for the project site is at a longitude of approximately -149.883 degrees and a latitude of approximately 61.249 degrees.

The explorations performed for the evaluation of the backfill characteristics in North Extension 1 in the vicinity of Section 2-2 and Section 3-3 are shown in Figure D.1-1.

1.2 Purpose and Scope

The purpose of the geotechnical exploration is to evaluate properties of the existing soil backfill in the OCSP® wall system to assist in the suitability study of the expansion design. The strength and stiffness characteristics of the OPEN CELL® backfill are potentially important to the stability of the cell structures during long-term operation and during design seismic events. Therefore, determination of these backfill properties was required.

A significant amount of high-quality geotechnical work had been done during the original design to characterize soil conditions and then evaluate the likely response of the OCSP® structure during seismic loading. Properties used to characterize the native ground and backfill materials were selected by the designers based on expected conditions after the backfill was placed and compacted. Although procedures for placing and compacting backfill material generally appear to have conformed with requirements, there is considerable uncertainty in the "as-built" conditions of the backfill, and whether these as-built conditions are consistent with assumptions made during design. The uncertainty results from several factors: 1) limited records on the variations in grain size of the backfill material being placed, 2) concern that the use of a conventional standard penetration test (SPT) to evaluate the consistency of backfill material after densification may have been affected by the particle size of the backfill material, and 3) absence of any shear wave

velocity (V_s) measurements in the backfill material, which has required use of empirical methods to estimate V_s for the material. These uncertainties have a direct effect on the stiffness and the strength representation of the backfill properties in the numerical models being used to evaluate response of the OCSP® structure, particularly during seismic loading.

The purpose of the field program is to address the uncertainties in the as-built condition by conducting field and laboratory tests on the backfill. The program would also help verify the contact depth between the backfill, estuarine silts, and Bootlegger Cove Formation (BCF) in the sections used for the design. Based on these elements, the scope of geotechnical exploration includes the following:

- Evaluating backfill characteristics by completing 11 borings using SPT and large penetration tests (LPTs) with a 2.4-inch interior diameter (ID) split spoon driven with a 340-pound auto-hammer to obtain representative blowcounts for in situ relative density evaluations in large particle size backfill material. This information is used to obtain an empirical estimate of the consistency and frictional characteristics (ϕ value) of the backfill.
- Performing as many seismic cone penetrometer tests (SCPTs) as soil conditions would allow. This testing would provide an independent estimate of the density and frictional characteristics of the backfill and provide the shear wave velocity (V_s) of the backfill from which values of small-strain shear modulus can be determined for the numerical models.
- Performing laboratory tests to establish the moisture content, grain-size distribution, and compaction characteristics of the backfill. The compaction characteristics include relative density tests.
- Performing laboratory strength tests using a 12x12-inch direct simple shear box.
- Measuring groundwater elevation in the backfill.

2. Subsurface Exploration Program

A subsurface exploration program was conducted for the project to characterize the subsurface soil and groundwater conditions in North Extension 1. Explorations were performed along Section 2-2 and Section 3-3 as shown in Figure D.1-1. The characterization of subsurface conditions used 11 new borings and 3 SCPT attempts to confirm the design soil profiles used in the analysis. The soil profiles include boring log information and the interpretation of subsurface layering of soil deposits based on soil type and the in situ soil condition, as assessed by SPT and LPT N-values (herein referred to as blowcounts). Boring logs are included Attachment D1, and SCPT results are included in Attachment D3.

2.1 Selection of New Subsurface Exploration Locations

The initial step in the subsurface exploration involved selecting 10 boring locations and 10 SCPT locations in the vicinity of Section 2-2 and Section 3-3. The initial exploration locations were distributed near the face of the bulkhead, in the middle of the cell, near the end of the tailwall, and in the backfill east of the cells. For the duration of the exploration program,

conference calls between the field exploration manager and the field crew were arranged at the end of each field day to summarize the accomplishments, address the challenges, and select the next exploration location. Based on this plan, a decision was made each evening on the location that would be explored the following day.

2.2 Drilling and Sampling Methods

Representative samples were collected by conducting a drilling and sampling program. Borings were drilled between February 8 and 22, 2012, at the locations shown in Figure D.1-1. Geotechnical drilling services for this project were provided by Discovery Drilling of Anchorage, Alaska, under the oversight of CH2M HILL. Drilling inspection services and field boring logs were prepared by Tellus, Ltd. of Anchorage, Alaska, under the oversight of CH2M HILL.

Soil drilling was accomplished using a combination of hollow stem auger (HSA) drilling tools with 3.25-inch ID and 7.25-inch outside diameter (OD) and mud rotary drilling systems. A truck-mounted Central Mining Equipment (CME) 75 drill rig was used. Because of time constraints, the borings were required to be completed under a very aggressive schedule so that results from the exploration could potentially be used in the suitability study. Typical Alaska February weather and the tight schedule supported the use of HSA methods for drilling, which is not the best method for advancing soil borings in heaving soils. When heave occurred, the drillers tried to counter the effect by adding water and mud in the HSA, or by shifting to mud rotary drilling.

Soil borings were drilled and sampled to depths ranging from 62 to 97 feet below the ground surface. Representative disturbed soil samples were obtained from the borings using SPT and LPT methods. Disturbed sampling was generally conducted at 5-foot intervals with an automatic-trip hammer and was performed in general accordance with American Society for Testing and Materials (ASTM) D1586, Standard Penetration Test Method for Penetration Test and Split Barrel Sampling of Soils, except that sample liners were not used. Attachment D1 briefly describes the SPT and LPT methods. Soil samples collected from SPTs and LPTs were visually logged and stored in watertight sample bags for laboratory testing. At select locations, relatively undisturbed samples were collected in the estuarine layer and the BCF layer using 3-inch-diameter, thin-walled Shelby tubes.

In addition to the SPT and LPT sampling methods, bulk samples were obtained using 7.25-inch OD solid flight auger tools from three locations X, Y, and Z, near Section 3-3, as shown in Figure D.1-1. Large bulk soil samples were visually logged and stored in watertight 5-gallon buckets for laboratory testing.

2.3 Soil Classification in the Field

Soil samples were visually classified immediately after recovery in general accordance with ASTM D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Details such as large gravels, identification of soil stratigraphy, observation of groundwater, and heave were also noted on the boring logs. The visual field classifications were later revised on the boring logs, as necessary, based on the results of the laboratory testing. Attachment D1 includes the boring logs, and Attachment D2 includes laboratory results.

2.4 Piezometer Installation

Upon completion of drilling, boreholes were either abandoned, or a piezometer was installed in the drilled hole before backfilling it. Piezometers were installed in 10 boreholes for periodic groundwater measurements. Standard piezometer installation consisted of 1-inch polyvinyl chloride (PVC) pipe manually slotted using a hacksaw. Groundwater readings in the installed piezometers are included in the Tellus Report in Attachment D3.

2.5 Survey of Exploration Locations

All exploration and sampling locations were surveyed after completion. The surveying was performed by TWA Surveying of Anchorage, Alaska. The horizontal control used is Alaska State Plane , Zone 4 , NAD 83 in U.S. survey feet. The vertical control for elevations is based on Monument "north end" elevations 41.39'. Horizontal coordinates are included in parenthesis as northing and easting coordinates in the boring logs in Attachment D1. Exploration coordinates are included in Table D.2-1.

3. In Situ Testing

Three SCPT soundings were attempted near Section 3-3 as shown in Figure D.1-1. The soundings were performed by In-Situ Engineering of Snohomish, Washington, using the CME 75 drill rig owned by Discovery Drilling to push the SCPT rods into the ground.

The top 8 feet were generally frozen and were predrilled before the SCPT rods were pushed into the ground. When the SCPT encountered refusal and could not be pushed any further, the rods were pulled out and any obstructions were drilled out before resuming the SCPT soundings. Because of the coarse granular material in the backfill, SCPT could not be advanced continuously through the fill material, which resulted in significantly lowered production rates. Unfortunately, the seismic testing resulted in no interpretable results because the thickness of the frozen layer dampened energy from the surface source. Moreover, the corrected tip resistance for each sounding is also believed to be biased because of the large particle size of the backfill material, and does not provide a good correlation to SPT. The SCPT program was terminated early after the completion of three soundings due to the lack of useful results. Attachment D4 is In-Situ Engineering's report of the SCPT work.

4. Laboratory Testing

Laboratory index and strength tests were conducted on representative soil samples recovered from the field drilling and sampling program. The laboratory index tests were conducted to confirm the field visual classification of soils, and strength tests were performed to provide engineering strength parameters on large bulk samples. Laboratory index tests were performed by DOWL HKM of Anchorage, Alaska, and the strength tests on the bulk samples were performed by GeoTesting Express of Acton, Massachusetts, under subcontracts to CH2M HILL.

Laboratory tests performed by DOWL HKM consisted of the following:

- ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D 4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils (Sieve Analysis)
- ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils (Hydrometer Test)

Laboratory tests performed by GeoTesting Express consisted of the following:

- ASTM D 2216, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils (Sieve Analysis)
- ASTM D 4253, Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibrating Table (Method 1A)
- ASTM D 4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density (Method A)
- ASTM D 3080, Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions (12x12-inch Shear Box)

Attachment D2 briefly describes the procedures used to perform each laboratory test and presents the complete laboratory test results. Table D.4-1 summarizes the index test results obtained from DOWL HKM. Index test results are also shown in the comments column of the boring logs in Attachment D1.

5. Subsurface Characterization

Three SCPTs and nine borings were completed in the vicinity of Section 3-3 to verify that the soil conditions inside the cells are similar to what was shown in Integrated Concepts & Research Corporation, Inc.'s (ICRC's) construction drawings and assumed in CH2M HILL's evaluation. Two borings were drilled in Cell 54 along Section 2-2. Moreover, more than 40 pre- and post-vibracompaction borings were completed in Cells 40 through 60, whereas only 7 were completed in Cells 12 through 32. A memorandum prepared by PND Engineers, Inc. (PND) to ICRC detailing SPT verification pre- and post- vibracompaction is included in Attachment D5.

The driller had a difficult time controlling heaving soils; therefore, drilling techniques were modified to control the heave during drilling. Changes in drilling techniques are noted in the boring logs in Attachment D1 and Tellus' report in Attachment D3. A combination of SPT and LPT were used to evaluate the density of the backfill material. Typically, when the driller got through the granular backfill material, sampling was performed with an SPT.

The soil units were defined on the basis of soil descriptions and anticipated engineering behavior of the materials. Soil descriptions helped in drawing the boundaries between these individual soil units, especially when heaving soils resulted in unreliable N-values and in samples mixed with heaving soils.

In general, the boring logs from the field exploration program performed by CH2M HILL showed consistency with Sections 2-2 and 3-3, which were initially developed from construction drawings. Stick logs summarizing the Unified Soil Classification System (USCS) Group symbol and SPT values from the exploration program are shown in Figures D.5-1 and D.5-2 for Sections 2-2 and 3-3, respectively. Confirming that the profile in the construction drawings represents the as-built condition was critical for the analysis because the explorations performed by Terracon and PND in 2003 and 2008, respectively, were completed before placing the backfill. Thus, there was limited information to verify the thickness of the backfill and how much material was dredged before placing the backfill prior to the exploration program.

Groundwater observations at the time of drilling ranged between about elevation 24 and -2 feet mean lower low water (MLLW) in borings B-4 and B-3, respectively. Boring B-4 was the only boring that had a groundwater elevation higher than elevation 20 feet MLLW at time of drilling. Groundwater measurements performed after the completion of the boring are presented in Table B of the Tellus report in Attachment D3. All borings except B-6 and B-9 had at least one groundwater reading above elevation 20 feet MLLW during the short period they were monitored. Borings B-6 and B-9 are located at the end of the tailwall in Cells 29 and 54, respectively. Groundwater observations between 2/10/2012 and 3/23/2012 in the installed piezometer ranged between about elevation 15 and 28 feet MLLW in borings B-6 and B-15, respectively. For the suitability study, a groundwater elevation of 20 feet MLLW was used in the evaluation, with a sensitivity analysis for groundwater ranging between 17 and 23 feet MLLW.

6. Correlation Between SPT and LPT

SPT was used by PND as the method to estimate density of the compacted granular fill as discussed in the report presented in Attachment D5. However, the PND report recommended that an alternative method to SPT be developed for evaluating deep compaction and improving accuracy in the coarse granular fill because the SPT blowcounts may be artificially high in gravelly soils. For this reason, it was decided to use LPT samplers in the granular fill and SPT in the cohesive soils in the field exploration program conducted by CH2M HILL. The difference in the SPT and LPT sampling methods is presented below:

SPT Sampling Method
- Sampler ID = 1-3/8 inch
- Sampler OD = 2.0 inch
- Weight of Hammer = 140 lb
- Height of Free Fall Drop = 30 inches

LPT Sampling Method
- Sampler ID = 2.4 inch
- Sampler OD = 3.0 inch

Weight of Hammer = 340 lb
Height of Free Fall Drop = 30 inches

The SPT sampling method is a nationwide standard and is described in ASTM D 1586. Therefore, there is a great deal of published information on the correlation between SPT and soil relative density. On the other hand, the LPT is not as widely used as the SPT, and is typically correlated to SPT N-values before being correlated to soil density. The SPT and LPT sampling methods are briefly summarized in Attachment D1.

Several LPTs have been in use, each with different drilling rods, sampler dimensions, and hammer energies; therefore, published correlations between LPT and SPT differ for each system. Table D.6-1 summarizes some LPT to SPT correlation methods published by different researchers and the respective ratio of SPT to LPT for each method.
Based on the review of available correlation information, a ratio of SPT to LPT equal to 1.5 was used in this report.

7. Laboratory Test Results

Laboratory direct shear test results performed on five bulk backfill samples by GeoTesting resulted in friction angles ranging between about 42 and 48 degrees. The direct shear tests were performed in a 12x12-inch shear box, and the tested material was screened so it was smaller than one-tenth of the 12-inch dimension (smaller than about 1.25 inches). The tests were performed at relative densities of 50, 70, and 90 percent. All samples tested at GeoTesting had less than 12 percent fines content. Laboratory test results are included in Attachment D2.

Laboratory test results performed at DOWL HKM were done to confirm the field visual classifications. In general, most samples recovered from SPT and LPT in the backfill material had less than 12 percent fines. A summary of the laboratory results performed by DOWL HKM are presented in Table D.4-1. The full laboratory results from DOWL HKM are included in Attachment D2.

8. Limitations

This memorandum has been prepared for the exclusive use of the POA and the U.S. Army Corps of Engineers (USACE) for specific application to the Port of Anchorage Expansion Project Suitability Study, in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made. Conclusions and recommendations provided in this memorandum are based on the explorations and geotechnical studies completed at the time of this memorandum.

The logs of explorations by CH2M HILL and others indicate the subsurface conditions only at the specific locations and times of sampling, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between exploration locations, nor do they necessarily reflect changes in groundwater conditions with time. If variations in subsurface conditions from those described are noted during construction, this technical memorandum may need to be re-evaluated.

CH2M HILL is not responsible for any claims, damages, or liability associated with the interpretation of subsurface data or reuse of the subsurface data by others without the express written authorization of CH2M HILL.

9. References

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Tables

Table D.2-1. Exploration Coordinates

Boring	Type	Depth (ft bgs)	Northing	Easting	Elevation (ft MLLW)
B-2	Boring	97	2648330.8	1660837.1	35*
B-3	Boring	84	2648304.2	1660899.7	35*
B-5	Boring	64	2648220.3	1661050.1	35*
B-6	Boring	87	2648300.9	1660892.1	35*
B-8	Boring	81	2647669.0	1660547.7	33.5
B-9	Boring	72	2647643.8	1660607.4	34.2
B-13	Boring	90	2648366.8	1660808.2	35*
B-15	Boring	84	2648317.7	1660787.7	35
B-16	Boring	77	2648289.4	1660819.7	35*
B-17	Boring	62	2648336.7	1660913.9	35.2
B-18	Boring	82	2648291.6	1660779.4	35.4
C-2	SCPT	62	2648333.8	1660837.1	35*
C-5	SCPT	28	2648221.3	1661047.2	35*
C-12	SCPT	68	2648310.6	1660850.4	35*
Pt X	Bulk Sample	NA	2648339.8	1660814.0	35.1
Pt Y	Bulk Sample	NA	2648329.5	1660839.4	35.3
Pt Z	Bulk Sample	NA	2648299.0	1660898.9	35

Notes:
bgs = below ground surface.
Northing and Easting based on Alaska State Plane, Zone 4, NAD 83.
Elevations marked with asterisk (*) are estimated.

Table D.4-1. Laboratory Index Results

Boring	Depth (ft)	Sample ID	USCS Classification	Description	Test	Water Content (%)	Grain-Size Distribution			Atterberg Limits		
							Gravel (%)	Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)
B-2	15-17	B	GW-GM	WELL GRADED GRAVEL WITH SILT AND SAND	Gradation	5.0	46.0	41.7	12.3			
B-2	20-22	C			Moisture Content	9.0						
B-2	25-27	D	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL	Gradation	7.0	38.0	56.7	5.3			
B-2	35-37	F			Moisture Content	7.0						
B-2	55-57	J	SM	SILTY SAND WITH GRAVEL	Gradation	9.0	21.0	64.1	14.9			
B-2	86-87	M			Atterberg	22.0				37	19	18
B-3	10-12	A	GW-GM	WELL GRADED GRAVEL WITH SILT AND SAND	Gradation	7.0	49.0	39.6	11.4			
B-3	15-17	B			Moisture Content	4.0						
B-3	20-22	D			Moisture Content	5.0						
B-3	30-32	F	SM	SILTY SAND WITH GRAVEL	Gradation	5.0	42.0	44.9	13.1			
B-3	36-37	H			Moisture Content	27.0						
B-3	40-42	I	ML	SILT WITH SAND	Atterberg and Gradation	27.0	3.0	12.8	84.2	NA	NP	NA
B-3	70-72	L			Moisture Content	20.0						
B-3	75-77	M			Atterberg	27.0				43	21	22
B-5	10-12	A	GM	SILTY GRAVEL WITH SAND	Gradation	5.0	48.0	33.9	18.1			
B-5	15-17	B			Moisture Content	9.0						
B-5	20-25	C			Moisture Content	8.0						

Table D.4-1. Laboratory Index Results

Boring	Depth (ft)	Sample ID	USCS Classification	Description	Test	Water Content (%)	Grain-Size Distribution			Atterberg Limits		
							Gravel (%)	Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)
B-5	30-32	E	SW-SM	WELL GRADED SAND WITH SILT AND GRAVEL	Gradation	12.0	16.0	73.0	11.0			
B-5	45-47	H	SM	SILTY SAND WITH GRAVEL	Gradation	10.0	31.0	43.0	26.0			
B-5	50-52	I			Atterberg	26.0				31	20	11
B-5	55-57	J			Atterberg	25.0				41	20	21
B-6	10-12	A			Moisture Content	6.0						
B-6	15-17	B	GM	SILTY GRAVEL WITH SAND	Gradation	5.0	44.0	42.8	13.2			
B-6	20-22	C	SM	SILTY SAND WITH GRAVEL	Gradation	6.0	38.0	48.2	13.8			
B-6	25-27	D			Moisture Content	7.0						
B-6	35-37	F			Atterberg	33.0				NA	NP	NA
B-6	40-42	G	ML	SILT	Atterberg and Gradation	32.0	1.0	10.3	88.7	NA	NP	NA
B-6	50-52	I	SM	SILTY SAND WITH GRAVEL	Gradation	14.0	22.0	55.3	22.7			
B-6	55-57	J			Moisture Content	17.0						
B-6	60-62	K	SM	SILTY SAND	Gradation	19.0	0.0	75.9	24.1			
B-6	70-72	M			Moisture Content	19.0						
B-6	75-77	N			Atterberg	18.0				19	15	4
B-8	09-11	A	GP-GM	POORLY GRADED GRAVEL WITH SILT AND SAND	Gradation	5.0	49.0	42.2	8.8			
B-8	19-21	C			Moisture Content	8.0						
B-8	24-26	D	GP-GM	POORLY GRADED GRAVEL WITH SILT AND SAND	Gradation	5.0	49.0	40.1	10.9			
B-8	29-31	E			Moisture Content	7.0						
B-8	44-46	H	SM	SILTY SAND WITH GRAVEL	Gradation	10.0	33.0	45.4	21.6			

Table D.4-1. Laboratory Index Results

Boring	Depth (ft)	Sample ID	USCS Classification	Description	Test	Water Content (%)	Grain-Size Distribution			Atterberg Limits		
							Gravel (%)	Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)
B-9	15-17	B			Moisture Content	4.0						
B-9	65-67	L	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL	Gradation	9.0	34.0	57.6	8.4			
B-9	70-72	M			Atterberg	20.0				47.0	21.0	26.0
B-13	10-12	A			Moisture Content	7.0						
B-13	15-17	B	SM	SILTY SAND WITH GRAVEL	Gradation	8.0	27.0	49.3	23.7			
B-13	25-27	D			Moisture Content	6.0						
B-13	40-42	G	GW-GM	WELL-GRADED GRAVEL WITH SILT AND SAND	Gradation	6.0	54.0	36.3	9.7			
B-13	70-72	M	SM	SILTY SAND	Gradation	16.0	10.0	77.3	12.7			
B-13	80-82	O	ML	SANDY SILT	Atterberg and Gradation	20.0	3.0	28.1	68.9	NA	NP	NA
B-15	15-17	C	GM	SILTY GRAVEL WITH SAND	Gradation	6.0	43.0	43.8	13.2			
B-15	20-22	D			Moisture Content	6.0						
B-15	25-27	E	GW-GM	WELL-GRADED GRAVEL WITH SILT AND SAND	Gradation	6.0	47.0	41.1	11.9			
B-15	55-57	K	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL	Gradation	7.0	44.0	47.4	8.6			
B-15	75-77	N	SP-SM	POORLY GRADED SAND WITH SILT	Gradation		1.0	88.2	10.8			
B-15	82-84	O			Atterberg	24.0				38	18	20
B-16	20-22	C	SM	SILTY SAND WITH GRAVEL	Gradation		35.0	49.0	16.0			
B-16	25-27	D	GM	SILTY GRAVEL WITH SAND	Gradation	6.0	45.0	42.2	12.8			
B-16	45-47	H	ML	SILT WITH SAND	Gradation		3.0	15.4	81.6			

Table D.4-1. Laboratory Index Results

Boring	Depth (ft)	Sample ID	USCS Classification	Description	Test	Water Content (%)	Grain-Size Distribution			Atterberg Limits		
							Gravel (%)	Sand (%)	Fines (%)	LL (%)	PL (%)	PI (%)
B-16	50-51.5	I			Moisture Content	24.0						
B-16	55-57	J	SM	SILTY SAND WITH GRAVEL	Gradation	11.0	18.0	55.7	26.3			
B-16	60-62	K	SM	SILTY SAND WITH GRAVEL	Gradation		18.0	60.1	21.9			
B-16	65-67	L			Atterberg	25.0				NA	NP	NA
B-16	70-71.5	M	SM	SILTY SAND	Gradation	24.0	1.0	81.9	17.1			
B-16	75-77	N			Atterberg	16.0				30	18	12
B-17	20-22	C	SW- SM	WELL-GRADED SAND WITH SILT AND GRAVEL	Gradation	5.0	44.0	44.3	11.7			
B-17	25-27	D	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL	Gradation	9.0	43.0	49.0	8.0			
B-17	40-42	G	ML	SILT WITH SAND AND GRAVEL	Atterberg and Gradation	22.0	20.0	19.2	60.8	NA	NP	NA
B-17	50-52	I	SM	SILTY SAND	Gradation	22.0	2.0	84.3	13.7			
B-17	60-62	K			Atterberg	21.0				40	19	21
B-18	25-27	C	GW-GM	WELL-GRADED GRAVEL WITH SILT AND SAND	Gradation	6.0	46.0	43.4	10.6			
B-18	55-57	I	SW-SM	WELL-GRADED SAND WITH SILT AND GRAVEL	Gradation		38.0	51.2	10.8			
B-18	65-67	K	SP-SM	POORLY GRADED SAND WITH SILT AND GRAVEL	Gradation	10.0	36.0	53.3	10.7			
B-18	70-72	L			Atterberg	24.0				36	18	18
B-18	75-77	M	SM	SILTY SAND	Atterberg and Gradation	21.0	1.0	71.9	27.1	NA	NP	NA

Table D.6-1. Correlation Between SPT and LPT		
Reference	**Equation**	**Ratio**
Burmister, 1948	$NS := NL \cdot \left(\frac{WL \cdot HL}{4200}\right) \cdot \left(\frac{2.0^2 - 1.375^2}{DLo^2 - DLi^2}\right)$	NS/NL = 1.581
Lacroix and Horn, 1973	$NS := NL \frac{2 \cdot WL \cdot HL}{175 \cdot DLo^2 \cdot LL}$	NS/NL = 1.08
Winterkorn and Fang, 1976	$RSs := \left(\frac{DSo^3 - DSi^3}{144 \cdot WS \cdot HS}\right)$ $RLs := \left(\frac{DLo^3 - DLi^3}{144 \cdot WL \cdot HL}\right)$	RSs/ RLs = 0.995
Daniel, Howie, and Sy, 2003	$\frac{N60_{SPT}}{N60_{LPT}} = \frac{ENTHRU_{LPT} \cdot ATE_{SPT}}{ENTHRU_{SPT} \cdot ATE_{LPT}}$	$(N_{60})_{SPT}/(N_{60})_{SPT}$ = 1.533
Alaska DOT&PF	Empirical Correlation	2.0
CH2M HILL Borings, 2012	Correlation between consecutive LPT and SPT blowcounts	1.5

Notes:
NS= N-value for SPT
WS= Weight of Hammer for SPT = 140 lb
HS= Height of Drop of Hammer for SPT= 30”
DSo= Outside Diameter for SPT = 2.0”
DLi= Outside Diameter for LPT= 1.375”
RSs = Sampler Hammer Ratio for SPT
NL= N-value for LPT
WL= Weight of Hammer for LPT= 340 lb
HL= Height of Drop of Hammer for LPT= 30”
DLo= Outside Diameter for LPT= 3.0”
DSi= Outside Diameter for SPT= 2.5”
RLs= Sampler Hammer Ratio for LPT
ATE= Effective Sampler Bearing Area
ENTHRU= Penetration Energy
N60= SPT blowcount corrected for hammer efficiency

Figures

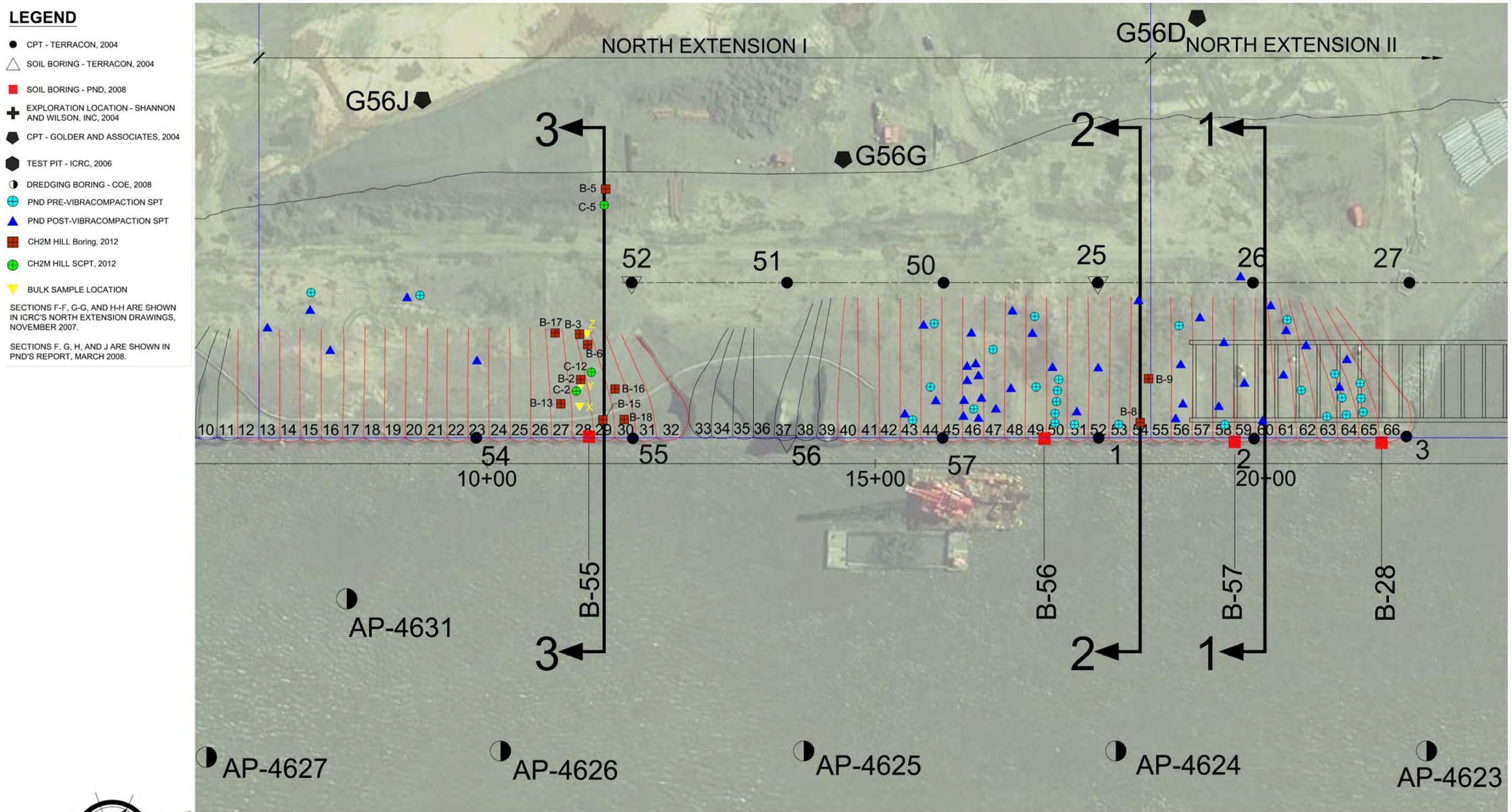


Figure D.1-1: CH2M HILL Exploration in North Extension 1

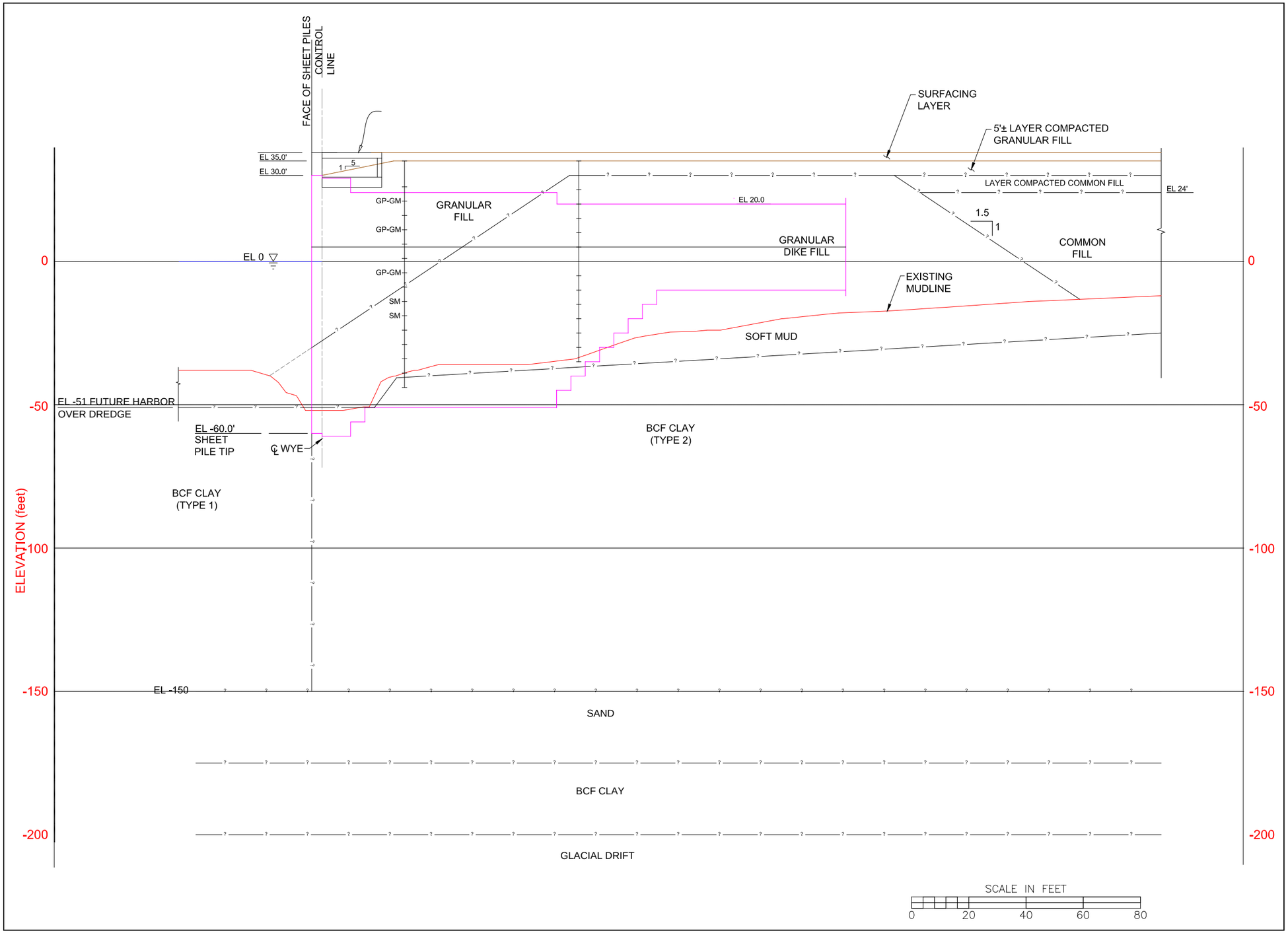


Figure D.5-1: CH2M HILL Borings Along Section 2-2

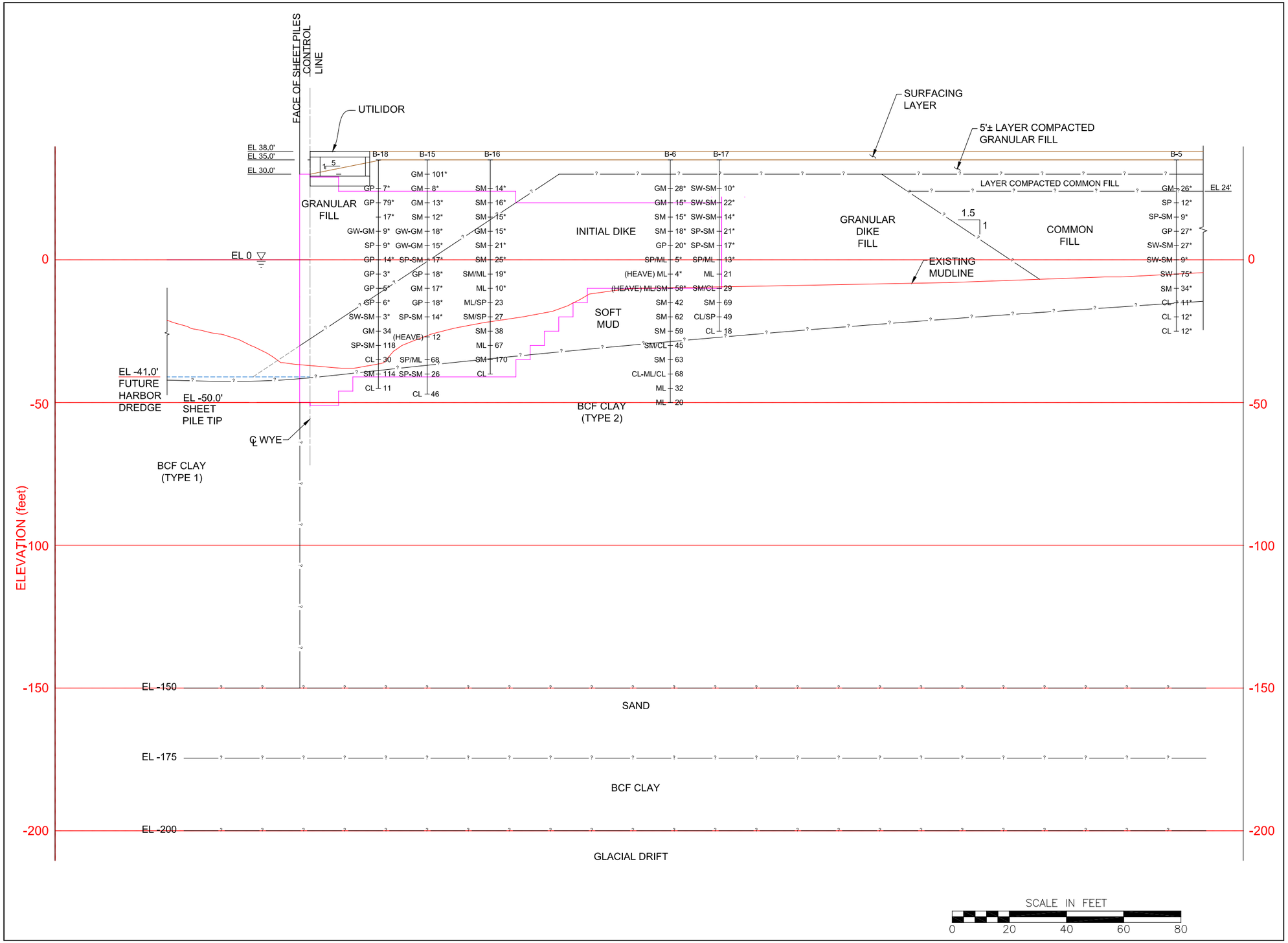


Figure D.5-2: CH2M HILL Borings Along Section 3-3

Attachment D1

Boring Logs

Attachment D1: Boring Logs

This attachment includes a summary of information noted on the borings logs such as the visual soil classification method and abbreviations, the standard penetration test method, tables of the relative density of coarse grained and fine grained soils, and boring logs completed for this phase of the project.

D1.1 Visual Classification Method

Visual classification of soils was performed in the field by a CH2M HILL representative in general accordance with ASTM D 2488, based on the Unified Soil Classification System (USCS). The visual description of soils allows convenient and consistent comparison of soils using a standard method for describing the soil. The use of this method of classification provides a basis for comparison of soils from widespread geographic areas. The USCS soil group symbols are included in parentheses when the classification is based on visual classification alone.

The lines on the boring logs do not define contacts between different soil classifications. The lines are used to separate the descriptions for legibility purposes only.

D1.2 Laboratory Classification System

Laboratory tests were performed on select samples collected during the exploration program in general accordance with ASTM D 2487. The USCS soil classifications reported in laboratory results can be identified from the exploration logs as those not enclosed in parenthesis. A brief description of the procedures to perform each of the tests and complete laboratory results are available in Attachment D2.

D2.3 The Standard Penetration Test (SPT)

The Standard Penetration Test (SPT) is performed by driving a standard split-barrel sampler 18 to 24 inches into undisturbed soil at the bottom of the borehole using a 140-pound guided hammer or ram, falling freely from a height of 30 inches. The SPT inside diameter (ID) is 1.375 inches and has an outside diameter (OD) that is 2 inches. This test is conducted to obtain a measure of the resistance of the soil to penetration of the sampler and to retrieve a disturbed soil sample. The number of blows required to drive the sampler for four, 6-inch intervals, for a total of 18 or 24 inches, are observed and recorded on the soil boring log. The sum of the number of blows required to drive the sampler the second and third 6-inch intervals is considered the Standard Penetration Resistance or the SPT blowcount, "N". When the number of blows required to drive the sampler 6 inches or less exceed 50 blows, the test is terminated and the number of blows and the penetration distance is recorded.

The values of N provide a means for evaluating the relative density of granular (coarse-grained) soils and the consistency of cohesive (fine-grained) soils. Low N-values indicate soft or loose deposits, while high N-values are evidence of hard or dense materials. The criteria used for describing the relative density of coarse-grained soil and the consistency of fine-grained soils based on SPT N-value are presented in Tables D1-1 and D2-2, respectively, of this attachment.

D2.4 The Large Penetration Test (LPT)

Borings for this project phase were completed using a combination of SPT and LPT sampling methods. The LPT sampling method differs from the SPT method in that the split barrel sampler has a 2.4-inch ID, a 3-inch OD, and a 340 lb hammer is used to drive the sampler. Similar to the SPT, the guided hammer is allowed to free fall from a height of 30 inches. N-values obtained from the LPT sampling should be adjusted using a specified factor to correlate to SPT N-values. The factor used for this project phase is discussed in more detail in the report. Sampling obtained via LPT methods are noted with an asterisk (*) next to the blowcounts on the boring logs.

TABLE D1-1
RELATIVE DENSITY OF COARSE-GRAINED SOIL (DEVELOPED FROM SOWERS, 1979)

N (blows/ft)	Relative Density	Field Test
0-4	Very Loose	Easily penetrated with 1/2-in. steel rod pushed by hand
5-10	Loose	Easily penetrated with 1/2-in. steel rod pushed by hand
11-30	Medium Dense	Easily penetrated with 1/2-in. steel rod driven with 5-lb hammer
31-50	Dense	Penetrated a foot with ½-in. steel rod driven with 5-lb hammer
50+ Ver	y Dense	Penetrated only a few inches with 1/2-in. steel rod driven with 5-lb hammer

TABLE D2-2
CONSISTENCY OF FINE-GRAINED SOILS (DEVELOPED FROM SOWERS, 1979)

N (blows/ft)	Consistency	Field Test
< 2	Very Soft	Easily penetrated several inches by fist
2-4	Soft	Easily penetrated several inches by thumb
5-8 Firm		Can be penetrated several inches by thumb with moderate effort
9-15 Stiff		Readily indented by thumb, but penetrated only with great effort
16-30	Very Stiff	Readily indented by thumbnail
30+	Hard	Indented with difficulty by thumbnail

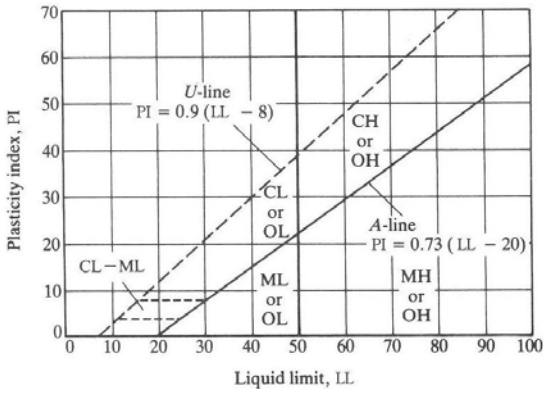
D2.4 Groundwater Level Measurements

The water level noted on the boring logs reflect the groundwater depth at the time of drilling.

D2.5 Survey Coordinate Systems

The surveying was performed by TWA Surveying of Anchorage, Alaska. The horizontal control used is Alaska State Plane, Zone 4, NAD 83 in US survey Feet. The vertical control for elevations is based on Monument "north end" elevations 41.39'.

PLASTICITY CHART



FOR CLASSIFICATION OF FINE-GRAINED SOILS AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS

PLASTICITY DESCRIPTION	
Plasticity Index (PI)	Description
< 1	Non-plastic
1-10	Low plasticity
11-25	Medium plasticity
26-50	High plasticity
> 50	Very high plasticity
PI = LL - PL	

MOISTURE CONDITION	
Dry	Absence of moisture.
Moist	Damp, no visible water.
Wet	Visible free water.

RELATIVE DENSITY OF COARSE GRAINED SOIL	
N (blows/ft)	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
50+	Very Dense
Developed from Sowers, 1979	

CONSISTENCY OF FINE GRAINED SOIL	
N (blows/ft)	Consistency
< 2	Very Soft
2-4	Soft
5-8	Firm
9-15	Stiff
16-30	Very Stiff
30+	Hard
Developed from Sowers, 1979	

GRAIN SIZE TERMINOLOGY	
Sample Component	Size Range
Boulders	Over 12 in
Cobbles	12 in to 3 in
Gravel	3 in to #4 sieve
Sand	#4 to #200 sieve
Silt or Clay	Passing #200 sieve

UNIFIED SOIL CLASSIFICATION SYSTEM – COARSE GRAINED

MAJOR DIVISION				LETTER SYMBOL	GROUP NAME
COARSE GRAINED SOILS CONTAINS LESS THAN 50% FINES	**GRAVEL AND GRAVELLY SOILS** MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVEL WITH < 5% FINES	< 15% SAND	GW	Well-graded GRAVEL
			≥ 15% SAND		Well-graded GRAVEL with sand
			< 15% SAND	GP	Poorly graded GRAVEL
			≥ 15% SAND		Poorly graded GRAVEL with sand
		GRAVEL WITH BETWEEN 5% AND 15% FINES	< 15% SAND	GW-GM	Well-graded GRAVEL with silt
			≥ 15% SAND		Well-graded GRAVEL with silt and sand
			< 15% SAND	GW-GC	Well-graded GRAVEL with clay
			≥ 15% SAND		Well-graded GRAVEL with clay and sand
			< 15% SAND	GP-GM	Poorly graded GRAVEL with silt
			≥ 15% SAND		Poorly graded GRAVEL with silt and sand
			< 15% SAND	GP-GC	Poorly graded GRAVEL with clay
			≥ 15% SAND		Poorly graded GRAVEL with clay and sand
		GRAVEL WITH ≥ 15% FINES	< 15% SAND	GM	Silty GRAVEL
			≥ 15% SAND		Silty GRAVEL with sand
			< 15% SAND	GC	Clayey GRAVEL
			≥ 15% SAND		Clayey GRAVEL with sand
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SAND WITH < 5% FINES	< 15% GRAVEL	SW	Well-graded SAND
			≥ 15% GRAVEL		Well-graded SAND with gravel
			< 15% GRAVEL	SP	Poorly graded SAND
			≥ 15% GRAVEL		Poorly graded SAND with gravel
		SAND WITH BETWEEN 5% AND 15% FINES	< 15% GRAVEL	SW-SM	Well-graded SAND with silt
			≥ 15% GRAVEL		Well-graded SAND with silt and gravel
			< 15% GRAVEL	SW-SC	Well-graded SAND with clay
			≥ 15% GRAVEL		Well-graded SAND with clay and gravel
			< 15% GRAVEL	SP-SM	Poorly graded SAND with silt
			≥ 15% GRAVEL		Poorly graded SAND with silt and gravel
			< 15% GRAVEL	SP-SC	Poorly graded SAND with clay
			≥ 15% GRAVEL		Poorly graded SAND with clay and gravel
		SAND WITH ≥ 15% FINES	< 15% GRAVEL	SM	Silty SAND
			≥ 15% GRAVEL		Silty SAND with gravel
			< 15% GRAVEL	SC	Clayey SAND
			≥ 15% GRAVEL		Clayey SAND with gravel

Notes: Sample descriptions are based on field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487. Fines are material passing U.S. std #200 Sieve.

CH2MHILL

UNIFIED SOIL CLASSIFICATION SYSTEM – FINE GRAINED

MAJOR DIVISION					LETTER SYMBOL	GROUP NAME
FINE GRAINED SOILS CONTAINS MORE THAN 50% FINES	LIQUID LIMIT LESS THAN 50	< 30% PLUS NO. 200	< 15% PLUS NO. 200		CL	Lean CLAY
			15- 25% PLUS NO. 200	% SAND ≥ GRAVEL		Lean CLAY with sand
				% SAND < GRAVEL		Lean CLAY with gravel
		≥ 30% PLUS NO.. 200	% SAND ≥ GRAVEL	< 15% GRAVEL		Sandy lean CLAY
				≥ 15% GRAVEL		Sandy lean CLAY with gravel
			% SAND < GRAVEL	< 15% SAND		Gravelly lean CLAY
				≥ 15% SAND		Gravelly lean CLAY with sand
		< 30% PLUS NO. 200	< 15% PLUS NO. 200		ML	SILT
			15- 25% PLUS NO. 200	% SAND ≥ GRAVEL		SILT with sand
				% SAND < GRAVEL		SILT with gravel
		≥ 30% PLUS NO.. 200	% SAND ≥ GRAVEL	< 15% GRAVEL		Sandy SILT
				≥ 15% GRAVEL		Sandy SILT with gravel
			% SAND < GRAVEL	< 15% SAND		Gravelly SILT
				≥ 15% SAND		Gravelly SILT with sand
		ORGANIC SOIL			OL	Organic SILT with low plasticity
	LIQUID LIMIT GREATER THAN 50	< 30% PLUS NO. 200	< 15% PLUS NO. 200		CH	Fat CLAY
			15- 25% PLUS NO. 200	% SAND ≥ GRAVEL		Fat CLAY with sand
				% SAND < GRAVEL		Fat CLAY with gravel
		≥ 30% PLUS NO.. 200	% SAND ≥ GRAVEL	< 15% GRAVEL		Sandy fat CLAY
				≥ 15% GRAVEL		Sandy fat CLAY with gravel
			% SAND < GRAVEL	< 15% SAND		Gravelly fat CLAY
				≥ 15% SAND		Gravelly fat CLAY with sand
		< 30% PLUS NO. 200	< 15% PLUS NO. 200		MH	Elastic SILT
			15- 25% PLUS NO. 200	% SAND ≥ GRAVEL		Elastic SILT with sand
				% SAND < GRAVEL		Elastic SILT with gravel
		≥ 30% PLUS NO.. 200	% SAND ≥ GRAVEL	< 15% GRAVEL		Sandy elastic SILT
				≥ 15% GRAVEL		Sandy elastic SILT with gravel
			% SAND < GRAVEL	< 15% SAND		Gravelly elastic SILT
				≥ 15% SAND		Gravelly elastic SILT with sand
		ORGANIC SOIL			OH	Organic SILT or CLAY with moderate to high plasticity

Notes: Sample descriptions are based on field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487. Fines are material passing U.S. std #200 Sieve.

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
429235	B-2	SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~65 feet east of Cell 28 Wall Control Line (2648330.8 N, 1660837.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 20 ft bgs at time of drilling.

START : 2/8/2012

END : 2/8/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 8': Frozen poorly graded brown sand with gravel. Fine to coarse. (SP)	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 8' bgs.
10	10.0					
	12.0	0.0	A	23-12-10-10* (22)	NO RECOVERY. Cuttings similar to above.	Sampler could be pushing against rock.
15	15.0					
	17.0	2.0	B	5-9-12-13* (21)	**WELL GRADED GRAVEL WITH SILT AND SAND, GW-GM,** gravels 1/4" to 2" in diameter.	B Index Test Results Gravel = 46.0% P200 = 12.3% Sand = 41.7% M.C. = 5.0%
20	20.0					
	22.0	1.5	C	17-5-6-7* (11)	**20-21': POORLY GRADED SAND WITH GRAVEL (SP),** some silt. **21-22': POORLY GRADED GRAVEL WITH SAND (GP)**.	Groundwater at 20'. C Index Test Results M.C. = 9.0% Clean sandy gravels at 21'. SP/GP
25	25.0					
	27.0	1.5	D	5-8-7-7* (15)	**POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM,** gravels 1/4" to 1.5" diameter.	Added water to counteract heave. D Index Test Results Gravel = 38.0% P200 = 5.3% Sand = 56.7% M.C. = 7.0%
30						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-2	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~65 feet east of Cell 28 Wall Control Line (2648330.8 N, 1660837.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 20 ft bgs at time of drilling.

START : 2/8/2012

END : 2/8/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0	2.0	E	27-10-11-12* (21)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** gravels 1/4" to 2" diameter.	
	32.0					
35	35.0	2.0	F	25-13-14-15* (27)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** gravels 1/4" to 2" diameter.	Adding water to counteract heave. F Index Test Results M.C. = 7.0%
	37.0					
40	40.0	1.0	G	11-8-11-9* (19)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**.	3" diameter gravel jammed in shoe.
	42.0					
45	45.0		H	42-9-7-8* (16)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**.	Drilling rate increased. Very little to no resistance.
	47.0					
50	50.0	1.5	I	18-6-4-4* (10)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)**.	
	52.0					
55	55.0		J	19-16-16-16* (32)	**SILTY SAND WITH GRAVEL, SM,** wet.	Drilling appears to stiffen up at approximately 54'. J Index Test Results Gravel = 21.0% P200 = 14.9% Sand = 64.1% M.C. = 9.0%
	57.0					
60						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-2	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project
LOCATION : ~65 feet east of Cell 28 Wall Control Line (2648330.8 N, 1660837.1 E)
ELEVATION : 35 ft MLLW
DRILLING CONTRACTOR : Discovery Drilling
DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig
WATER LEVELS : 20 ft bgs at time of drilling.
START : 2/8/2012
END : 2/8/2012
LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
60.0					**WELL GRADED SAND WITH SILT (SW-SM),** wet.	Heave.
	2.0	2.0	K	47-17-16-16* (33)		
62.0						
65						3' of heave in augers at 65'. Unable to obtain sample. Drillers adding water to counteract heave.
70	70.0					
	2.0	2.0	L	4-6-6* (12)	**WELL GRADED SAND WITH SILT (SW-SM),** wet.	
71.5						
75						3' of heave in auger at 75'. Drillers adding water to counteract heave.
80						2' of heave in augers. Drillers adding water to counteract heave.
85	85.0					
	2.0	2.0	M	4-4-3-4* (7)	**85-86': WELL GRADED SAND (SW),** wet, fine sand. **86-87': LEAN CLAY, CL,** gray, moist.	No heave. M Index Test Results M.C. = 22.0% LL = 37% PL = 19% PI = 18% BCF contact at approximately 86'.
87.0						
90						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
429235	B-2	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~65 feet east of Cell 28 Wall Control Line (2648330.8 N, 1660837.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 20 ft bgs at time of drilling.

START : 2/8/2012

END : 2/8/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	90.0	2.0	N	6-6-12-11* (18)	**LEAN CLAY (CL),** moist. (BCF)	
	92.0					
95	95.0	2.0	O	15-10-12-14* (22)	**LEAN CLAY (CL),** moist. (BCF)	
	97.0				Bottom of hole at 97.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw.
100						
105						
110						
115						
120						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-3	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~132 feet east of Cell 29 Wall Control Line (2648304.2 N, 1660899.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 37 ft bgs at time of drilling.

START : 2/10/2012

END : 2/10/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					0 to 8': Frozen brown poorly graded gravel with sand. (GP)	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 8' bgs.
5						
10	10.0					
	12.0	2.0	A	9-9-9-10* (18)	**WELL GRADED GRAVEL WITH SILT AND SAND, GW-GM,** brown, dry, gravels 1/4" to 2.5" in diameter.	A Index Test Results Gravel = 49.0% P200 = 11.4% Sand = 39.6% M.C. = 7.0%
15	15.0					
	17.0	2.0	B	13-8-9-9* (17)	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, gravels 1/4" to 2" in diameter.	Broken rock fragments in sampler. B Index Test Results M.C. = 4.0%
20	20.0					
	22.0	2.0	C	4-7-7-7* (14)	**POORLY GRADED SAND WITH GRAVEL (SP),** brown, dry.	
	24.0	1.0	D	7-10-13-15 (23)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown.	D Index Test Results M.C. = 5.0%
25	25.0					
	27.0	2.0	E	4-8-9-10* (17)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, dry.	
30						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
429235	B-3	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~132 feet east of Cell 29 Wall Control Line (2648304.2 N, 1660899.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 37 ft bgs at time of drilling.

START : 2/10/2012

END : 2/10/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0					
		2.0	F	3-10-11-11* (21)	**SILTY SAND WITH GRAVEL, SM,** brown, dry, gravels 1/4" to 1" diameter.	F Index Test Results Gravel = 42.0% P200 = 13.1% Sand = 44.9% M.C. = 5.0%
	32.0					
		2.0	G	14-18-21-17 (39)	**SILTY SAND WITH GRAVEL (SM),** same as above.	
	34.0					
35	35.0					
		1.0	H	3-4-8-7* (12)	**35-36': POORLY GRADED SAND WITH GRAVEL (SP).** **36-37': SILT (ML)** gray, moist.	H (36-37') Index Test Results M.C. = 27.0%
	37.0					Groundwater at 37'.
40	40.0					
		2.0	I	2-3-4-7* (7)	**SILT WITH SAND, ML,** gray, wet, non-plastic.	I Index Test Results Gravel = 3.0% P200 = 84.2% Sand = 12.8% M.C. = 27.0%
	42.0					
		2.0	J	10-17-42-37 (59)	**SILT (ML),** gray, wet, non-plastic, brown sand at 44'.	
	44.0					Hard drilling at 44'.
45	45.0					
		2.0	K	24-33-44-24* (77)	**SILTY SAND WITH GRAVEL (SM),** gray, wet.	
	47.0					
50						Heavy heave encountered from 50 to 70'. Up to 6' of heave inside augers.
55						
60						

PROJECT NUMBER:	BORING NUMBER:
429235	B-3 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~132 feet east of Cell 29 Wall Control Line (2648304.2 N, 1660899.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 37 ft bgs at time of drilling.

START : 2/10/2012

END : 2/10/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
65						
70	70.0					
	72.0	2.0	L	5-10-11-9* (21)	**70-71': SILTY SAND (SM),** gray, wet, fine sand. **71-72': LEAN CLAY (CL),** gray, moist. (BCF)	Drilling rate moderate with heave and silt. L Index Test Results M.C. = 20.0% BCF contact at 71'.
75	75.0					
	77.0	2.0	M	3-5-8-9* (13)	**LEAN CLAY, CL,** gray, moist. (BCF)	M Index Test Results M.C. = 27.0% LL = 43% PL = 21% PI = 22%
80	80.0					
	82.0	2.0	N	5-7-6-7* (13)	**LEAN CLAY (CL),** gray, moist. (BCF)	
	84.0		O	PUSH		Pushed shelby tube 24" using greater than 1,500 psi.
85					Bottom of hole at 84.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 18 to 84'.
90						

PROJECT NUMBER:	BORING NUMBER:
429235	B-5 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~300 feet east of Cell 30 Wall Control Line (2648220.3 N, 1661050.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 15 ft bgs at time of drilling.

START : 2/9/2012

END : 2/9/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 8': Frozen poorly graded gravel with sand. (GP)	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 8' bgs. Cuttings appear to have more sand than gravel.
10	10.0 12.0	2.0	A	8-15-11-11* (26)	**SILTY GRAVEL WITH SAND, GM,** brown, gravels 1/4" to 2" in diameter.	A Index Test Results Gravel = 48.0% P200 = 18.1% Sand = 33.9% M.C. = 5.0%
15	15.0 17.0		B	3-5-7-5* (12)	**POORLY GRADED SAND WITH GRAVEL (SP),** brown, wet.	Groundwater at approximately 15'. B Index Test Results M.C. = 9.0%
20	20.0 22.0	1.0	C	3-5-4-1* (9)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** brown, wet, 1/4" to 1/2" diameter gravels.	B Index Test Results M.C. = 8.0%
25	25.0 27.0	2.0	D	3-27* (27)	**POORLY GRADED GRAVEL (GP),** wet, 1/4" to 3" diameter gravels.	Blows probably indicate pushing rock, blows are questionable. Heave in upper portion of sample.
30						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-5	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~300 feet east of Cell 30 Wall Control Line (2648220.3 N, 1661050.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 15 ft bgs at time of drilling.

START : 2/9/2012

END : 2/9/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
30.0						
	1.0	E	5-20-7-6* (27)		**WELL GRADED SAND WITH SILT AND GRAVEL, SW-SM,** brown, wet, well-graded fine to coarse sand.	Upper part of sample probably heave. E Index Test Results Gravel = 16.0% P200 = 11.0% Sand = 73.0% M.C. = 12.0%
32.0						
						Very soft drilling.
35 35.0						
	2.0	F	2-4-5-3* (9)		**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM),** brown, wet, well-graded fine to coarse sand.	
37.0						
40 40.0						
	1.5	G	5-67-8-6* (75)		**WELL-GRADED SAND (SW),** gray, wet, fine to medium sand.	Blows probably associated with fractured rock. Fractured rock in sampler.
42.0						
45 45.0						
	1.5	H	4-18-16-18* (34)		**SILTY SAND WITH GRAVEL, SM,** wet, fine to medium sand.	H Index Test Results Gravel = 31.0% P200 = 26.0% Sand = 43.0% M.C. = 10.0%
47.0						
50 50.0						
	2.0	I	4-5-6-7* (11)		**SANDY CLAY, CL,** gray, moist, fine sand.	I Index Test Results M.C. = 26.0% LL = 31% PL = 20% PI = 11%
52.0						
55 55.0						
	2.0	J	3-6-6-6* (12)		**LEAN CLAY, CL,** gray, moist. (BCF)	J Index Test Results M.C. = 25.0% LL = 41% PL = 20% PI = 21%
57.0						
60						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
429235	B-5	SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~300 feet east of Cell 30 Wall Control Line (2648220.3 N, 1661050.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 15 ft bgs at time of drilling.

START : 2/9/2012

END : 2/9/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
60.0	2.0	2.0	K	4-5-7-7* (12)	**LEAN CLAY (CL),** gray, moist. (BCF)	
62.0				PUSH	**LEAN CLAY (CL),** gray, moist. (BCF)	Shelby Tube pushed at 1,000 psi.
64.0					Bottom of hole at 64.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 14 to 64'.
65						
70						
75						
80						
85						
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-6	SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~127 feet east of Cell 29 Wall Control Line (2648300.9 N, 1660892.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 36 ft bgs at time of drilling.

START : 2/11/2012

END : 2/11/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 8': Frozen poorly graded sand with gravel. Fine to coarse. (SP)	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 8' bgs.
10	10.0					
	12.0	2.0	A	11-12-16-13* (28)	**SILTY GRAVEL WITH SAND (GM),** brown, gravels 1/4" to 2.5" in diameter.	Broken rock fragments. A Index Test Results M.C. = 6.0%
15	15.0					
	17.0	2.0	B	6-9-6-8* (15)	**SILTY GRAVEL WITH SAND, GM,** brown, gravels 1/4" to 2.5" in diameter.	Broken rock fragments. B Index Test Results Gravel = 44.0% P200 = 13.2% Sand = 42.8% M.C. = 5.0%
20	20.0					
	22.0	2.0	C	8-7-8-8* (15)	**SILTY SAND WITH GRAVEL, SM,** brown.	Broken rock fragments. C Index Test Results Gravel = 38.0% P200 = 13.8% Sand = 48.2% M.C. = 6.0%
25	25.0					
	27.0	2.0	D	6-8-10-8* (18)	**SILTY SAND WITH GRAVEL (SM),** brown, moist.	Moist zone. D Index Test Results M.C. = 7.0%
30						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-6	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~127 feet east of Cell 29 Wall Control Line (2648300.9 N, 1660892.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 36 ft bgs at time of drilling.

START : 2/11/2012

END : 2/11/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
30.0	2.0	2.0	E	5-11-9-10* (20)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, gravels 1/4" to 1.5" in diameter.	Rock fragments present.
32.0						Softer drilling at 33.5' into sandy material.
35 35.0						
	2.0	2.0	F	3-2-3-4* (5)	**35-36': POORLY GRADED SAND (SP),** brown, moist. **36-37': SANDY SILT, ML,** gray, wet, non-plastic, fine sand.	F (36-37') Index Test Results M.C. = 33.0% LL = NA PL = NP PI = NA
37.0						
40 40.0						
	2.0	2.0	G	1-2-2-3* (4)	**SILT, ML,** wet, fine sand.	Heave encountered at 40'. Rods dropped 3' through soil from own weight. Very soft material. G Index Test Results Gravel = 1.0% P200 = 88.7% Sand = 10.3% M.C. = 32.0% LL = NA PL = NP PI = NA
42.0						
45 45.0						
	2.0	2.0	H	4-24-34* (58)	**45-46.5': SILT (ML),** gray, wet. **46.5-47': SILTY SAND (SM),** gray.	Drillers adding water to counteract heave.
47.0						
50 50.0						
	2.0	2.0	I	1-4-38-34 (42)	**SILTY SAND WITH GRAVEL, SM,** gray, moist, 1/4" to 1/2" diameter gravel.	I Index Test Results Gravel = 22.0% P200 = 22.7% Sand = 55.3% M.C. = 14.0%
52.0						
55 55.0						
	2.0	2.0	J	8-24-38-43 (62)	**SILTY SAND (SM),** gray, moist, fine sand.	J Index Test Results M.C. = 17.0%
57.0						
60						

PROJECT NUMBER:	BORING NUMBER:
429235	B-6 SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project
LOCATION : ~127 feet east of Cell 29 Wall Control Line (2648300.9 N, 1660892.1 E)
ELEVATION : 35 ft MLLW
DRILLING CONTRACTOR : Discovery Drilling
DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig
WATER LEVELS : 36 ft bgs at time of drilling.
START : 2/11/2012
END : 2/11/2012
LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0	2.0	K	12-26-33-45 (59)	**SILTY SAND, SM,** gray, moist, fine sand.	K Index Test Results Gravel = 0.0% P200 = 24.1% Sand = 75.9% M.C. = 19.0%
	62.0					
65	65.0					
		2.0	L	10-27-18-28 (45)	**65-66.5': SILTY SAND (SM),** gray, wet, fine sand. **66.5-67': LEAN CLAY (CL),** gray, moist. (BCF)	BCF at 66.5'.
	67.0					
70	70.0					
		2.0	M	8-35-28-50 (63)	**SILTY SAND (SM),** gray, wet, fine sand.	M Index Test Results M.C. = 19.0%
	72.0					
75	75.0					
		2.0	N	6-40-28-50 (68)	**75-76.5': SANDY SILTY CLAY, CL-ML,** gray, wet, fine sand. **76.5.5-77': LEAN CLAY (CL),** gray, moist. (BCF)	Silt possibly moved into auger from 75-85'. N Index Test Results M.C. = 18.0% LL = 19% PL = 15% PI = 4%
	77.0					
80	80.0					
		2.0	O	10-14-18-17 (32)	**SANDY SILT (ML),** gray, moist, fine sand, gray clay in tip.	
	82.0					
85	85.0					
		2.0	P	4-8-12-19 (20)	**SANDY SILT (ML),** gray, moist, fine sand, gray clay in tip.	
	87.0					
					Bottom of hole at 87.0 ft below ground surface.	
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-6	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~127 feet east of Cell 29 Wall Control Line (2648300.9 N, 1660892.1 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 36 ft bgs at time of drilling.

START : 2/11/2012

END : 2/11/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
95						1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 20 to 87'. Approximately 20' of clay on outside of augers during auger removal.
100						
105						
110						
115						
120						

PROJECT NUMBER:	BORING NUMBER:
429235	B-8 SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~5 feet east of Cell 50 Wall Control Line (2647669.0 N, 1660547.7 E)

ELEVATION : 33.5 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 32 ft bgs at time of drilling.

START : 2/21/2012

END : 2/21/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
0					0 to 7': Frozen soil.	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer.
5						
	9.0					
10		1.5	A	7-12-16-10* (28)	**POORLY GRADED GRAVEL WITH SILT AND SAND, GP-GM,** brown.	Rock fragments. A Index Test Results Gravel = 49.0% P200 = 8.8% Sand = 42.2% M.C. = 5.0%
	11.0					
	14.0					
15			B	16-7-8-8* (15)	**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM),** brown.	Rock fragments.
	16.0					
	19.0					
20		1.0	C	7-6-13-13* (19)	**POORLY GRADED SAND WITH GRAVEL (SP),** brown, moist.	C Index Test Results M.C. = 8.0%
	21.0					
	24.0					
25		2.0	D	5-4-6-6* (10)	**POORLY GRADED GRAVEL WITH SILT AND SAND, GP-GM,** brown, moist.	D Index Test Results Gravel = 49.0% P200 = 10.9% Sand = 40.1% M.C. = 5.0%
	26.0					
	29.0					
30				1-5-5-5*	**POORLY GRADED SAND WITH GRAVEL (SP),** brown, moist.	C Index Test Results M.C. = 7.0%

PROJECT NUMBER:	BORING NUMBER:	
429235	B-8	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~5 feet east of Cell 50 Wall Control Line (2647669.0 N, 1660547.7 E)

ELEVATION : 33.5 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 32 ft bgs at time of drilling.

START : 2/21/2012

END : 2/21/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	31.0	1.5	E	(10)		
	34.0					Groundwater at 32'.
35	36.0		F	10-6-4-4* (10)	**SILTY SAND WITH GRAVEL (SM),** wet.	
	39.0					
40	41.0	2.0	G	2-8-11-12* (19)	**POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM),** brown, wet.	
	44.0					
45	46.0	1.5	H	5-11-20-14 (31)	**SILTY SAND WITH GRAVEL, SM,** brown, wet.	H Index Test Results Gravel = 33.0% P200 = 21.6% Sand = 45.4% M.C. = 10.0%
	49.0					
50	51.0	1.0	I	12-23-19-27 (42)	**SILTY SAND WITH GRAVEL (SM),** wet.	
	54.0					
55	56.0	1.5	J	50-57-41-64 (98)	**SILTY SAND WITH GRAVEL (SM),** brown, wet.	
	59.0					
60				15-27-22-31	**WELL GRADED SAND WITH GRAVEL (SW),** wet.	

PROJECT NUMBER:	BORING NUMBER:
429235	B-8 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project
LOCATION : ~5 feet east of Cell 50 Wall Control Line (2647669.0 N, 1660547.7 E)
ELEVATION : 33.5 ft MLLW
DRILLING CONTRACTOR : Discovery Drilling
DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig
WATER LEVELS : 32 ft bgs at time of drilling.
START : 2/21/2012
END : 2/21/2012
LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	61.0	2.0	K	(49)		
	64.0					
65	66.0	1.5	L	21-59-33-39 (92)	**POORLY GRADED SAND WITH GRAVEL (SP),** gray, wet.	
	69.0					
70	71.0	1.0	M	12-16-14-33 (30)	**WELL GRADED SAND (SW),** gray, wet.	
	74.0					
75	76.0	0.5	N	13-21-23-34 (44)	**POORLY GRADED SAND WITH GRAVEL (SP),** gray, wet.	Heave in upper portion of sampler.
	79.0					
80	81.0	1.0	O	5-4-5-9 (9)	**SILT (ML),** gray.	
					Bottom of hole at 81.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 10 to 80'.
85						
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-9	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~85 feet east of Cell 50 Wall Control Line (2647643.8 N, 1660607.4 E)

ELEVATION : 34.2 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25.5 ft bgs at time of drilling.

START : 2/22/2012

END : 2/22/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 7': Frozen soil.	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 7' bgs.
10	10.0					
	12.0	2.0	A	10-9-9-9* (18)	**POORLY GRADED SAND WITH GRAVEL (SP),** brown.	
15	15.0					
	17.0	2.0	B	27-11-11-13* (22)	**SILTY SAND WITH GRAVEL (SM),** brown.	B Index Test Results M.C. = 4.0%
20	20.0					
	22.0	2.0	C	7-7-4-6* (11)	**SILTY SAND WITH GRAVEL (SM),** brown.	
25	25.0					
	27.0	2.0	D	7-6-6-11* (12)	**SILTY SAND WITH GRAVEL (SM),** brown, wet.	Groundwater at 25.5'.
30						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-9	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~85 feet east of Cell 50 Wall Control Line (2647643.8 N, 1660607.4 E)

ELEVATION : 34.2 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25.5 ft bgs at time of drilling.

START : 2/22/2012

END : 2/22/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0				**SILTY SAND WITH GRAVEL (SM),** brown, wet.	
	32.0	2.0	E	16-4-3-3* (7)		
35	35.0					
	37.0	2.0	F	5-5-5-5* (10)	**SILTY GRAVEL WITH SAND (GM),** brown, wet.	
40	40.0					
	42.0	1.5	G	7-7-6-6* (13)	**SILTY SAND WITH GRAVEL (SM),** brown, moist.	
45	45.0					
	47.0	2.0	H	6-8-4-7* (12)	**SILTY SAND WITH GRAVEL (SM),** wet.	
50	50.0					
	52.0	2.0	I	2-2-3-4* (5)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** wet.	
55	55.0					
	57.0	1.0	J	6-9-8-9* (17)	**POORLY GRADED GRAVEL WITH SAND (GP),** wet.	
60						

PROJECT NUMBER:	BORING NUMBER:
429235	B-9 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~85 feet east of Cell 50 Wall Control Line (2647643.8 N, 1660607.4 E)

ELEVATION : 34.2 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25.5 ft bgs at time of drilling.

START : 2/22/2012

END : 2/22/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
60.0	60.0 – 62.0	1.7	K	18-14-10-11* (24)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** wet.	
62.0						
65 65.0						
	65.0 – 67.0	1.5	L	20-9-9-10* (18)	**POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM,** wet, rock fragments in bottom.	L Index Test Results Gravel = 34.0% P200 = 8.4% Sand = 57.6% M.C. = 9.0%
67.0						
70 70.0						
	70.0 – 72.0	2.0	M	13-10-8-9* (18)	**70-70.5': SILT (ML),** gray, wet. **70.5-72': LEAN CLAY, CL,** gray. (BCF)	M Index Test Results M.C. = 20.0% LL = 47% PL = 21% PI = 26%
72.0					Bottom of hole at 72.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 10 to 72'.
75						
80						
85						
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-13	SHEET 1 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~25 feet east of Cell 27 Wall Control Line (2648366.8 N, 1660808.2 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 11 ft bgs at time of drilling.

START : 2/12/2012

END : 2/13/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 7': Frozen brown poorly graded gravel with sand. (GP)	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 7' bgs.
10	10.0					
	12.0	2.0	A	6-8-7-5* (15)	**SILTY SAND WITH GRAVEL (SM),** brown, wet, 1/4" to 2.5" diameter gravel.	A Index Test Results M.C. = 7.0% Groundwater at 11'.
15	15.0					
	17.0	0.5	B	3-8-8-7* (16)	**SILTY SAND WITH GRAVEL, SM,** brown, wet.	Softer drilling. B Index Test Results Gravel = 27.0% P200 = 23.7% Sand = 49.3% M.C. = 8.0%
20	20.0					
	22.0	2.0	C	3-9-8-9* (17)	**SILTY SAND WITH GRAVEL (SM),** brown, wet.	
25	25.0					
	27.0	1.5	D	6-7-9-8* (16)	**POORLY GRADED SAND WITH GRAVEL (SP),** brown, moist.	Rock fragments in shoe. D Index Test Results M.C. = 6.0%
30						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-13	SHEET 2 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~25 feet east of Cell 27 Wall Control Line (2648366.8 N, 1660808.2 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 11 ft bgs at time of drilling.

START : 2/12/2012

END : 2/13/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
30.0					**POORLY GRADED SAND WITH GRAVEL (SP),** brown, wet.	Rock fragments in shoe.
	1.0		E	7-8-7-8* (15)		
32.0						
35 35.0						
	2.0		F	5-9-12-16* (21)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet.	Rock fragments
37.0						
40 40.0						
	2.0		G	9-12-12-12* (24)	**WELL GRADED GRAVEL WITH SILT AND SAND, GW-GM,** brown, wet.	Rock fragments. G Index Test Results Gravel = 54.0% P200 = 9.7% Sand = 36.3% M.C. = 6.0%
42.0						
45 45.0						
	2.0		H	18-13-12-8* (25)	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, wet.	Rock fragments.
47.0						
50 50.0						
	2.0		I	4-7-10-13* (17)	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, wet.	
52.0						
55 55.0						
	2.0		J	16-14-10-10* (24)	**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, wet.	
57.0						
60						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-13	SHEET 3 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~25 feet east of Cell 27 Wall Control Line (2648366.8 N, 1660808.2 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 11 ft bgs at time of drilling.

START : 2/12/2012

END : 2/13/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0				**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, wet.	
		2.0	K	9-12-10-11* (22)		
	62.0					
65	65.0				**WELL GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, wet.	
		2.0	L	29-20-21-10* (41)		
	67.0					
70	70.0					
		2.0	M	12-8-9-11* (17)	**SILTY SAND, SM,** brown, wet.	M Index Test Results Gravel = 10.0% P200 = 12.7% Sand = 77.3% M.C. = 16.0%
	72.0					
75	75.0					
	76.5	1.5	N	5-3-4* (7)	**75-76': WELL GRADED SAND (SW),** gray, wet, fine to coarse sand. **76-76.5': LEAN CLAY (CL),** gray, wet. (BCF)	BCF at 76'.
80	80.0					
		2.0	O	6-17-22-24* (39)	**SANDY SILT, ML,** gray, moist, non-plastic, gray fine sand in bottom 2".	Silt and sand heaving up to 10' into augers from 80-90'. Shelby tube attempts failed. O Index Test Results Gravel = 3.0% P200 = 68.9% Sand = 28.1% M.C. = 20.0% LL = NA PL = NP PI = NA
	82.0					
85						
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-13	SHEET 4 OF 4

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~25 feet east of Cell 27 Wall Control Line (2648366.8 N, 1660808.2 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 11 ft bgs at time of drilling.

START : 2/12/2012

END : 2/13/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					Bottom of hole at 90.0 ft below ground surface.	1" diameter PVC piezometer installed in boring at 63'. PVC manually slotted using a hacksaw from 0 to 63'.
95						
100						
105						
110						
115						
120						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-15	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~30 feet east of Cell 28 Wall Control Line (2648317.7 N, 1660787.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 30 ft bgs at time of drilling.

START : 2/14/2012

END : 2/15/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					0 to 6': Frozen soil.	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 6' bgs.
5 — 5.0						
5.0 – 7.0	2.0	A	12-39-62-42* (101)		**SILTY SAND WITH GRAVEL (GM),** brown, frozen to 6'.	
7.0						
10 — 10.0						
10.0 – 12.0	2.0	B	8-4-4-4* (8)		**SILTY GRAVEL WITH SAND (GM),** brown, moist.	
12.0						
15 — 15.0						
15.0 – 17.0	2.0	C	8-6-7-5* (13)		**SILTY GRAVEL WITH SAND, GM,** brown, moist.	C Index Test Results Gravel = 43.0% P200 = 13.2% Sand = 43.8% M.C. = 6.0%
17.0						
20 — 20.0						
20.0 – 22.0	2.0	D	9-6-6-9* (12)		**SILTY SAND WITH GRAVEL (SM),** brown, moist.	Rock fragments. D Index Test Results M.C. = 6.0%
22.0						
25 — 25.0						
25.0 – 27.0	2.0	E	9-9-9-5* (18)		**WELL GRADED GRAVEL WITH SILT AND SAND, GW-GM,** moist.	E Index Test Results Gravel = 47.0% P200 = 11.9% Sand = 41.1% M.C. = 6.0%
27.0						
30						

PROJECT NUMBER: 429235	BORING NUMBER: B-15	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~30 feet east of Cell 28 Wall Control Line (2648317.7 N, 1660787.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 30 ft bgs at time of drilling.

START : 2/14/2012

END : 2/15/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0	2.0	F	5-7-8-8* (15)	**WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM),** brown, wet.	
	32.0					
35	35.0	2.0	G	13-7-10-11* (17)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** brown, wet.	
	37.0					
40	40.0	2.0	H	3-8-10-11* (18)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet, 2" diameter gravels.	
	42.0					
45	45.0	2.0	I	20-9-8-13* (17)	**SILTY GRAVEL WITH SAND (GM),** brown, wet, poorly graded, 2" diameter gravel in bottom.	
	47.0					
50	50.0	1.0	J	4-8-10-10* (18)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet.	Rock fragments in shoe.
	52.0					
55	55.0	1.5	K	14-7-7-7* (14)	**POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM,** brown, wet.	K Index Test Results Gravel = 44.0% P200 = 8.6% Sand = 47.4% M.C. = 7.0%
	57.0					
60						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-15	SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project
LOCATION : ~30 feet east of Cell 28 Wall Control Line (2648317.7 N, 1660787.7 E)
ELEVATION : 35 ft MLLW
DRILLING CONTRACTOR : Discovery Drilling
DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig
WATER LEVELS : 30 ft bgs at time of drilling.
START : 2/14/2012
END : 2/15/2012
LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	62.0					Encountered fine grained silty sand / sandy silt heave at 60'. Begin mud rotary.
	64.0	1.0	L	6-6-6-4 (12)	Gray silt with drilling mud.	
65						8' of heave in casing at 65'.
70	70.0					
	72.0	2.0	M	36-40-28-25 (68)	**70-71.8': POORLY GRADED SAND WITH GRAVEL (SP),** wet, fine to coarse sand. **71.8-72': SILT (ML),** gray, wet.	
75	75.0					
	77.0	2.0	N	6-10-16-12 (26)	**POORLY GRADED SAND WITH SILT, SP-SM,** gray, wet, fine sand.	N Index Test Results Gravel = 1.0% P200 = 10.8% Sand = 88.2%
80						Drilling change at 78'. BCF at 78'.
	82.0					
	84.0	2.0	O	12-12-34-32 (46)	**LEAN CLAY, CL,** gray, wet. (BCF)	O Index Test Results M.C. = 24.0% LL = 38% PL = 18% PI = 20%
85					Bottom of hole at 84.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 10 to 84'.
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-16	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~63 feet east of Cell 30 Wall Control Line (2648289.4 N, 1660819.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25 ft bgs at time of drilling.

START : 2/16/2012

END : 2/17/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 7': Frozen soil.	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 7' bgs.
10	10.0					
	12.0	2.0	A	9-7-7-5* (14)	**SILTY SAND WITH GRAVEL (SM),** brown, 1/4" to 1.5" diameter gravels.	
15	15.0					
	17.0	2.0	B	9-8-8-9* (16)	**SILTY SAND WITH GRAVEL (SM),** brown, 1/4" to 1.5" diameter gravels.	
20	20.0					
	22.0	2.0	C	9-9-6-7* (15)	**SILTY SAND WITH GRAVEL, SM,** brown, 1/4" to 1" diameter gravels.	C Index Test Results Gravel = 35.0% P200 = 16.0% Sand = 49.0%
25	25.0					
	27.0	2.0	D	7-5-10-27* (15)	**SILTY GRAVEL WITH SAND, GM,** brown, wet.	Groundwater at 25'. D Index Test Results Gravel = 45.0% P200 = 12.8% Sand = 42.2% M.C. = 6.0%
30						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-16	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~63 feet east of Cell 30 Wall Control Line (2648289.4 N, 1660819.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25 ft bgs at time of drilling.

START : 2/16/2012

END : 2/17/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
30.0	2.0	2.0	E	11-11-10-8* (21)	**SILTY SAND WITH GRAVEL (SM),** brown, wet.	
32.0						
35 35.0						
	2.0	2.0	F	11-11-14-14* (25)	**SILTY SAND WITH GRAVEL (SM),** brown, wet.	
37.0						
40 40.0						
	2.0	2.0	G	19-11-8-5* (19)	**40-41.5': SILTY SAND WITH GRAVEL (SM),** brown, wet. **41.5-42': SANDY SILT (ML),** gray, wet.	
42.0						
45 45.0						
	2.0	2.0	H	7-7-3-5* (10)	**SILT WITH SAND, ML,** gray, moist, non-plastic.	H Index Test Results Gravel = 3.0% P200 = 81.6% Sand = 15.4%
47.0						
50 50.0						
	2.0	2.0	I	5-8-15-15 (23)	**50-51.5': SILT WITH SAND (ML),** gray, wet. **51.5-52': POORLY GRADED SAND WITH GRAVEL (SP),** brown, dry.	Different layer at 51.5'. I (50-51.5') Index Test Results M.C. = 24.0%
52.0						
55 55.0						
	2.0	2.0	J	8-13-14-18 (27)	**55-56': SILTY SAND WITH GRAVEL, SM,** gray, moist. **56-57': POORLY GRADED SAND WITH GRAVEL (SP),** brown, moist.	Material change at 56'. J Index Test Results Gravel = 18.0% P200 = 26.3% Sand = 55.7% M.C. = 11.0%
57.0						
60						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-16	SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~63 feet east of Cell 30 Wall Control Line (2648289.4 N, 1660819.7 E)

ELEVATION : 35 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25 ft bgs at time of drilling.

START : 2/16/2012

END : 2/17/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
60.0	2.0	K	5-21-17-17 (38)		**SILTY SAND WITH GRAVEL, SM,** brown, fine gravel.	K Index Test Results Gravel = 18.0% P200 = 21.9% Sand = 60.1%
62.0						
65 65.0						
	2.0	L	21-29-38-39 (67)		**SANDY SILT, ML,** gray, wet, fine sand.	Up to 8' of heave at 65'. Switch to mud rotary. No heave after switch. L Index Test Results M.C. = 25.0% LL = NA PL = NP PI = NA
67.0						
70 70.0						Harder drilling at 68'.
	1.8	M	60-80-90-62/4" (170)		**SILTY SAND, SM,** gray, wet, fine sand.	M Index Test Results Gravel = 1.0% P200 = 17.1% Sand = 81.9% M.C. = 24.0%
71.5						
75 75.0						Drilling change at 73'.
	2.0	N	PUSH		**LEAN CLAY, CL,** gray. (BCF)	N Index Test Results M.C. = 16.0% LL = 30% PL = 18% PI = 12%
77.0						
					Bottom of hole at 77.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 0.5 to 67'.
80						
85						
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-17	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~135 feet east of Cell 27 Wall Control Line (2648336.7 N, 1660913.9 E)

ELEVATION : 35.2 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25 ft bgs at time of drilling.

START : 2/19/2012

END : 2/19/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
5					0 to 7': Frozen brown poorly graded gravel with sand. (GP)	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 7' bgs.
10	10.0					
	12.0	2.0	A	2-5-5-5* (10)	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM),** brown, 1/4" to 2.5" diameter gravels.	
15	15.0					
	17.0	2.0	B	6-13-9-8* (22)	**WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM),** brown.	Rock fragments.
20	20.0					
	22.0	2.0	C	4-7-7-6* (14)	**WELL GRADED SAND WITH SILT AND GRAVEL, SW-SM,** brown.	C Index Test Results Gravel = 44.0% P200 = 11.7% Sand = 44.3% M.C. = 5.0%
25	25.0					
	27.0	2.0	D	5-9-12-10* (21)	**POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM,** brown, wet.	Groundwater at 25'. D Index Test Results Gravel = 43.0% P200 = 8.0% Sand = 49.0% M.C. = 9.0%
30						

PROJECT NUMBER: 429235	BORING NUMBER: B-17	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~135 feet east of Cell 27 Wall Control Line (2648336.7 N, 1660913.9 E)

ELEVATION : 35.2 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25 ft bgs at time of drilling.

START : 2/19/2012

END : 2/19/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0	2.0	E	7-9-8-4* (17)	**POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM),** brown, wet.	Some rock fragments.
	32.0					
35	35.0					
		2.0	F	13-5-8-3* (13)	**35-36': POORLY GRADED SAND (SP),** brown, wet. **36-37': SILT (ML),** gray, wet, slightly plastic.	Switch to mud rotary.
	37.0					
40	40.0					
		2.0	G	14-14-7-6 (21)	**SILT WITH SAND AND GRAVEL, ML,** gray, wet.	G Index Test Results Gravel = 20.0% P200 = 60.8% Sand = 19.2% M.C. = 22.0% LL = NA PL = NP PI = NA
	42.0					
45	45.0					
		2.0	H	28-23-6-11 (29)	**45-46': SILTY SAND WITH GRAVEL (SM),** gray, wet. **46-47': LEAN CLAY (CL),** gray, wet, low plasticity.	
	47.0					
50	50.0					
		2.0	I	24-33-36-32 (69)	**SILTY SAND, SM,** gray, wet, fine sand.	I Index Test Results Gravel = 2.0% P200 = 13.7% Sand = 84.3% M.C. = 22.0%
	52.0					
55	55.0					
		2.0	J	5-17-32-36 (49)	**55-56.5': LEAN CLAY (CL),** gray, wet. **56.5-57': POORLY GRADED SAND (SP),** gray, moist, fine sand.	
	57.0					
60						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
429235	B-17	SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~135 feet east of Cell 27 Wall Control Line (2648336.7 N, 1660913.9 E)

ELEVATION : 35.2 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : 25 ft bgs at time of drilling.

START : 2/19/2012

END : 2/19/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
60.0						
	2.0	2.0	K	7-8-10-10 (18)	**LEAN CLAY, CL,** gray, moist. (BCF)	K Index Test Results M.C. = 21.0% LL = 40% PL = 19% PI = 21%
62.0					Bottom of hole at 62.0 ft below ground surface.	
65						
70						
75						
80						
85						
90						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-18	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~30 feet east of Cell 30 Wall Control Line (2648291.6 N, 1660779.4 E)

ELEVATION : 35.4 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : Not noted.

START : 2/17/2012

END : 2/19/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
					0 to 6': Frozen soil.	Note: Asterisk (*) next to blowcounts means that sample was taken using 2.4" ID sampler with 340 lb hammer. Blowcounts listed without asterisk (*) means sample was taken using standard size SPT sampler with 140 lb hammer. Frozen down to 6' bgs.
5						
10	10.0					
	12.0	1.0	A	4-3-4-5* (7)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet, 1/4" to 2" diameter gravels.	
	15.0					Encountered large diameter rebar at 12'. Moved boring 1.5' and redrilled to 15'.
15						
	17.0	2.0	B	43-45-34-43* (79)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet, 1/4" to 2.5" diameter gravels.	
20	20.0					
	22.0	0.0		9-9-8-6* (17)	NO RECOVERY.	Loose material indicated by fast drilling rate.
25	25.0					
	27.0	2.0	C	3-5-4-4* (9)	**WELL GRADED GRAVEL WITH SILT AND SAND, GW-GM,** brown, wet, 1/4" to 1.5" diameter gravels.	C Index Test Results Gravel = 46.0% P200 = 10.6% Sand = 43.4% M.C. = 6.0%
30						

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	
429235	B-18	SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project
LOCATION : ~30 feet east of Cell 30 Wall Control Line (2648291.6 N, 1660779.4 E)

ELEVATION : 35.4 ft MLLW
DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : Not noted.
START : 2/17/2012
END : 2/19/2012
LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	30.0				**POORLY GRADED SAND WITH GRAVEL (SP),** brown, moist.	Fast drilling rate.
	32.0	1.5	D	3-4-5-4* (9)		
35	35.0					
	37.0	0.7	E	5-7-7-5* (14)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown.	
40	40.0					
	42.0	1.5	F	5-3-0-0* (3)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet.	
45	45.0					
	47.0	0.8	G	1-2-3-1* (5)	**POORLY GRADED GRAVEL WITH SAND (GP),** same as above.	Loose material indicated by fast drilling rate.
50	50.0					
	52.0	1.0	H	2-3-3-3* (6)	**POORLY GRADED GRAVEL WITH SAND (GP),** brown, wet.	
55	55.0					
	57.0	0.8	I	1-2-1-2* (3)	**WELL GRADED SAND WITH SILT AND GRAVEL, SW-SM,** brown, wet.	Switch to mud rotary. I Index Test Results Gravel = 38.0% P200 = 10.8% Sand = 51.2%
60						

PROJECT NUMBER:	BORING NUMBER:	
429235	B-18	SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Port of Anchorage Expansion Project

LOCATION : ~30 feet east of Cell 30 Wall Control Line (2648291.6 N, 1660779.4 E)

ELEVATION : 35.4 ft MLLW

DRILLING CONTRACTOR : Discovery Drilling

DRILLING METHOD AND EQUIPMENT : 7-1/4" OD Diameter Hollow Stem Auger, Mud Rotary, CME 75 Truck-Mounted Drill Rig

WATER LEVELS : Not noted.

START : 2/17/2012

END : 2/19/2012

LOGGER : S. Erdmann

DEPTH BELOW GROUND SURFACE (ft)	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	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
	60.0				**SILTY GRAVEL WITH SAND (GM),** wet.	
	62.0	0.5	J	20-15-19-18 (34)		
65	65.0					
	67.0	1.5	K	23-65-53-69 (118)	**POORLY GRADED SAND WITH SILT AND GRAVEL, SP-SM,** wet.	K Index Test Results Gravel = 36.0% P200 = 10.7% Sand = 53.3% M.C. = 10.0%
70	70.0					Driller reports clay at 68'.
	72.0	1.5	L	12-15-15-30 (30)	**LEAN CLAY, CL,** gray, moist, low plasticity.	L Index Test Results M.C. = 24.0% LL = 36% PL = 18% PI = 18%
75	75.0					
	77.0	1.7	M	35-63-51-47 (114)	**SILTY SAND, SM,** gray, moist, fine sand.	M Index Test Results Gravel = 1.0% P200 = 27.1% Sand = 71.9% M.C. = 21.0% LL = NA PL = NP PI = NA
80	80.0					
	82.0	1.7	N	3-4-7-10 (11)	**LEAN CLAY (CL),** gray, dry, low plasticity.	
85					Bottom of hole at 82.0 ft below ground surface.	1" diameter PVC piezometer installed in boring. PVC manually slotted using a hacksaw from 7 to 82'.
90						

Attachment D2

Laboratory Results

Attachment D2: Introduction to Laboratory Test Results

This attachment includes the laboratory test results performed on select samples collected during the exploration program. DOWL HKM in Anchorage, Alaska and GeoTesting Express in Boston MA provided the laboratory testing services for this project. Tests were performed in general accordance with the American Society for Testing and Materials (ASTM) standards. The samples that were selected for laboratory testing are noted in the comments column of the soil boring logs in Attachment D1 of this report. The USCS soil classifications reported in laboratory results can be identified from the exploration logs as those not enclosed in parenthesis. The laboratory results are organized by type of test. Brief descriptions of the various laboratory tests follow.

D2.1 Visual Description

Visual classification of soils was performed in the field by a CH2M HILL representative in general accordance with ASTM D 2488. The visual description of soils allows convenient and consistent comparison of soils using a standard method for describing the soil. The use of this method of classification provides a basis for comparison of soils from widespread geographic areas.

D2.2 Natural Moisture Content Test

The natural moisture content test determines the weight of water contained in a given weight of soil. The results are usually presented as the weight of water divided by the weight of dry solids, expressed as a percentage. Moisture content (along with unit weight and specific gravity of solids) provides the basis for determining the phase relationships of a soil and may be useful in estimating soil consistency, compressibility, and strength. Natural moisture content was determined in general accordance with ASTM D 2216.

D2.3 Grain size (sieve) analyses

Grain size, or sieve, analyses were conducted in general accordance with ASTM D 422. The lab procedure includes (a) mechanical sieve analysis for samples estimated to contain less than 50 percent fines (material passing the No. 200 sieve), and (b) combined (sieve and hydrometer) analysis for samples estimated to have at least 50 percent fines content. The sieve analysis consists of shaking soil through a stack of progressively smaller opening screens, each with known opening size and determining the portion (by weight) of particles retained on each sieve. The hydrometer analysis is based on Stoke's law for the velocity of a freely falling sphere. The method involves determining the settling rate of soil particles by measuring the density of the soil water solution and calculating the particle size in suspension at particular time intervals.

D2.4 Atterberg Limits

Atterberg Limits test were determined in accordance with ASTM D 4318. The test includes liquid limit (LL), plastic limit (PL), and plasticity index (PI). Liquid limit is the moisture content at which a soil behaves as liquid and flows to close a standard groove when subjected to 25 blows of a standard device. Plastic limit is the moisture content at which the soils becomes plastic as demonstrated by causing incipient crumbling to occur in the soil when it is rolled into one-eighth-inch threads. Plasticity index represents the range of water

content at which the soil behaves like plastic and is obtained as the difference between the liquid limit and plastic limit.

D2.5 Soil Classification Systems

Soil classification systems attempt to group soil with similar engineering behavior based on index tests. A number of classification systems have been developed, usually for a specific application. The system most generally accepted for a wide range of engineering application is the ASTM soil classification system, based on the Unified Soil Classification System (USCS). Soil classification systems generally use index test methods (particle size analysis and Atterberg limits) to permit rational grouping of the soil for engineering purposes. Laboratory classification of soil was performed in general accordance with ASTM D 2487. The corrected soil classifications can be identified from the exploration logs as those not enclosed in parenthesis.

D2.6 Relative Density Test

The relative density tests were performed in accordance with ASTM D 4253 - Method 1A and ASTM D 4254 – Method A which determine the maximum and minimum index density of a free-draining soil, respectively. The maximum density of a given free-draining soil is determined by placing an oven-dried soil in a mold and then applying a dead weight to the surface of the soil. The mold, soil, and surcharge are then vertically vibrated using a vibrating table. The maximum index density is calculated by dividing the oven-dried mass/weight of the densified soil by its volume. The minimum index density represents the loosest condition of a free-draining soil that can be attained in a standard laboratory procedure. The procedure consists of determining the weight of an oven-dried soil placed into a container of a known volume in such a manner that prevents bulking and particle segregation and minimizes compaction.

D2.7 Direct Shear

The direct shear tests were performed in general accordance with ASTM D 3080 using a 12-inch shear box. This test determines the consolidated drained shear strength of soil under direct shear boundary conditions. The test is performed by deforming a specimen at a controlled strain rate on or near a single shear plane determined by the configuration of the apparatus. Three or more specimens were tested, each under a different normal load, to determine the effects upon shear resistance and displacement, and strength properties such as Mohr strength envelopes.

Test materials were screened at 1-inch size to maintain a 10:1 ratio between test container size and maximum particle size. Typically, 70 to 80 percent of the bulk samples were less than 1 inch. The test method differed from requirements in ASTM D 3080 by using a 0.25-inch gap rather than the maximum particle size (that is, 1 inch). The smaller gap avoided loss of specimen during testing. GeoTesting Express had found that using a large (that is, 1-inch) gap with coarse, non-plastic material results in sample loss, which reduces the effective area at the shear plane, changes the actual normal stress, and leads to scattered results. The potential for larger particles getting wedged in the leading edge of the shear plane and creating falsely high strength values is identified by a dramatic spike in the shear stress that is seen on the stress-strain plots. In this case, the test is aborted and run again.

Moisture Content

DOWL HKM

Testing Report Summary

		Date Sample Recv'd	2/24/2012
Client	CH2M HILL	W.O.	A33329
Project	POA	Lab #	See Below
Location	See Below		

All results will be posted to the website for your access and convenience. Samples will be kept for 30 days before being disposed. Please contact us if you would like the remaining material returned.

Sample ID	Test Performed	Test Method	Moisture Content (%)
190 B2-M 86-87	Moisture Content	ASTM D2216	22
197 B3-I 40-42			27
200 B3-M 75-77			27
206 B5-I 50-52			26
207 B5-J 55-57			25
212 B6-F 36-37			33
213 B6-G 40-42			32
218 B6-N 75-77			18
231 B9-M 70-72			20
238 B13-O 80-82			20
247 B15-O 82-84			24
254 B16-L 65-67			25
256 B16-N 75-77			16
259 B17-G 40-42			22
261 B17-K 60-62			21
265 B18-L 70-72			24
266 B18-M 75-77			21

If you have questions regarding this summary report or the test procedures, please contact us.

Maria E. Kampsen, P.E.
Laboratory Supervisor

DOWL HKM

Testing Report Summary

		Date Sample Recv'd	2/24/2012
Client	CH2M HILL	W.O.	A33329
Project	POA	Lab #	See Below
Location	See Below		

All results will be posted to the website for your access and convenience. Samples will be kept for 30 days before being disposed. Please contact us if you would like the remaining material returned.

Sample ID	Test Performed	Test Method	Moisture Content (%)
186 B2-C 20-22	Moisture Content	ASTM D2216	9
188 B2-F 35-37			7
192 B3-B 15-17			4
193 B3-D 20-22			5
196 B3-H 36-37			27
199 B3-L 70-72			20
202 B5-B 15-17			9
203 B5-C 20-25			8
208 B6-A 10-12			6
211 B6-D 25-27			7
215 B6-J 55-57			17
217 B6-M 70-72			19
221 B8-C 19-21			8
223 B8-E 29-31			7
227 B9-B 15-17			4
232 B13-A 10-12			7
234 B13-D 25-27			6
241 B15-D 20-22			6
251 B16-I 50-51.5			24

If you have questions regarding this summary report or the test procedures, please contact us.

Maria E. Kampsen, P.E.
Laboratory Supervisor

Atterberg Limits

DOWL HKM

Testing Report Summary

		Date Sample Recv'd	11/22/2011
Client	Municipality of Anchorage	W.O.	D60556O
Project	Margaret Circle	Lab #	See Below
Location	See Below		

All results will be posted to the website for your access and convenience. Samples will be kept for 30 days before being disposed. Please contact us if you would like the remaining material returned.

Sample ID	Test Performed	Test Method	Results	
190 B2-M 86-87	Plasticity Index	ASTM D4318	Liquid Limit	37
			Plastic Limit	19
			Plasticity Index	18
197 B3-I 40-42	Plasticity Index	ASTM D4318	Non Plastic	
200 B3-M 75-77	Plasticity Index	ASTM D4318	Liquid Limit	43
			Plastic Limit	21
			Plasticity Index	22
206 B5-I 50-52	Plasticity Index	ASTM D4318	Liquid Limit	31
			Plastic Limit	20
			Plasticity Index	11
207 B5-J 55-57	Plasticity Index	ASTM D4318	Liquid Limit	41
			Plastic Limit	20
			Plasticity Index	21
212 B6-F 36-37	Plasticity Index	ASTM D4318	Non Plastic	
213 B6-G 40-42	Plasticity Index	ASTM D4318	Non Plastic	
218 B6-N 75-77	Plasticity Index	ASTM D4318	Liquid Limit	19
			Plastic Limit	15
			Plasticity Index	4
231 B9-M 70-72	Plasticity Index	ASTM D4318	Liquid Limit	47
			Plastic Limit	21
			Plasticity Index	26
238 B13-O 80-82	Plasticity Index	ASTM D4318	Non Plastic	
247 B15-O 82-84	Plasticity Index	ASTM D4318	Liquid Limit	38
			Plastic Limit	18
			Plasticity Index	20
254 B16-L 65-67	Plasticity Index	ASTM D4318	Non Plastic	

256 B16-N 75-77	Plasticity Index	ASTM D4318	Liquid Limit	30
			Plastic Limit	18
			Plasticity Index	12
259 B17-G 40-42	Plasticity Index	ASTM D4318	Non Plastic	
261 B17-K 60-62	Plasticity Index	ASTM D4318	Liquid Limit	40
			Plastic Limit	19
			Plasticity Index	21
265 B18-L 70-72	Plasticity Index	ASTM D4318	Liquid Limit	36
			Plastic Limit	18
			Plasticity Index	18
266 B18-M 75-77	Plasticity Index	ASTM D4318	Non Plastic	

If you have questions regarding this summary report or the test procedures, please contact us.

Maria E. Kampsen, P.E.
Laboratory Supervisor

Gradation

DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

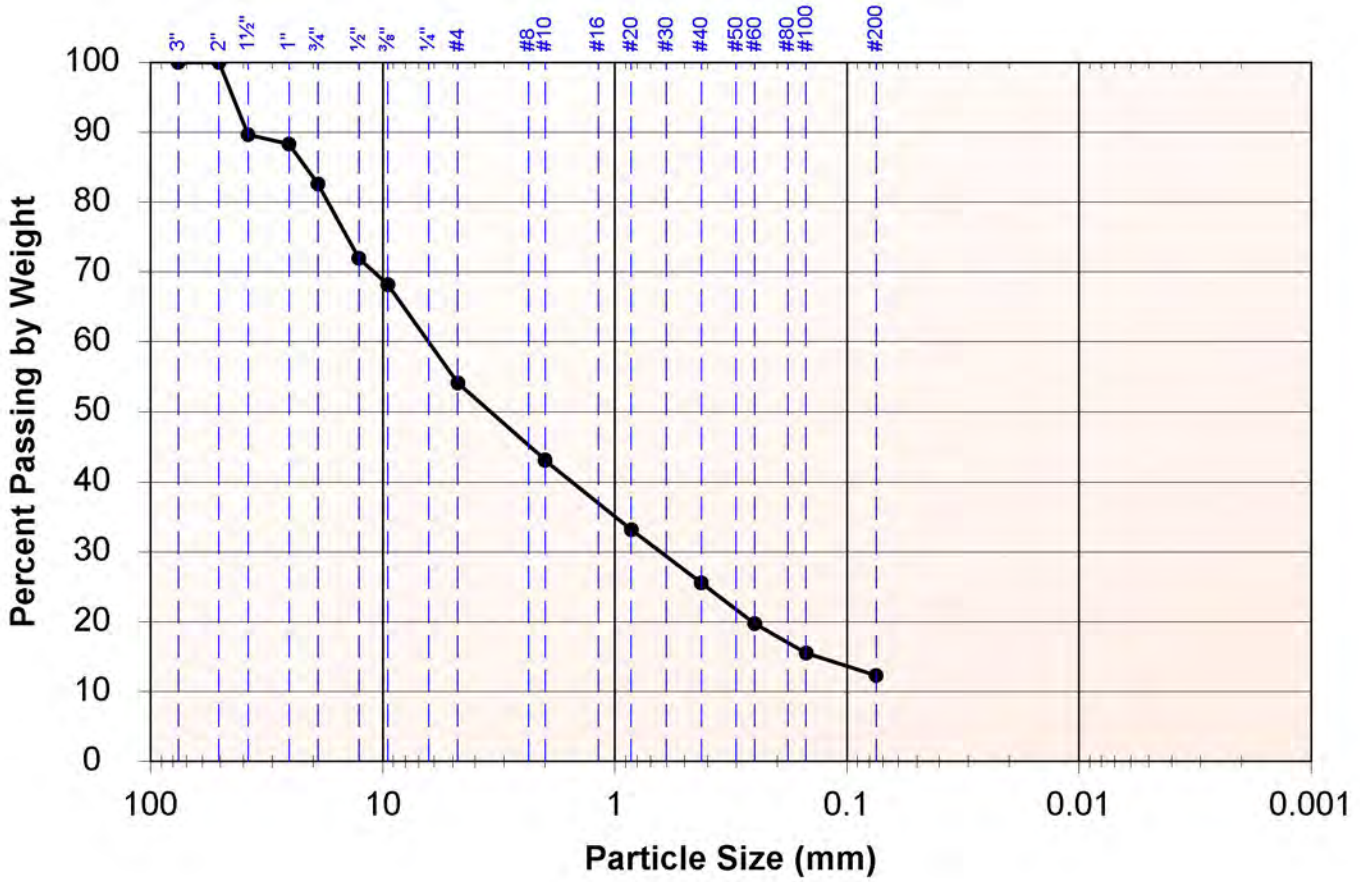
ASTM D422

Location: B2-B 15-17
Moisture as Received = 5%

Lab Number	2012-185
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Gravel with Silt and Sand, GW-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	90%	
1"	88%	
¾"	83%	
½"	72%	
⅜"	68%	
#4	54%	
Total Weight of Coarse Fraction: 2616.6g		
#10	43%	
#20	33%	
#40	26%	
#60	20%	
#100	16%	
#200	12.3%	
Total Weight of Fine Fraction: 357.1g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

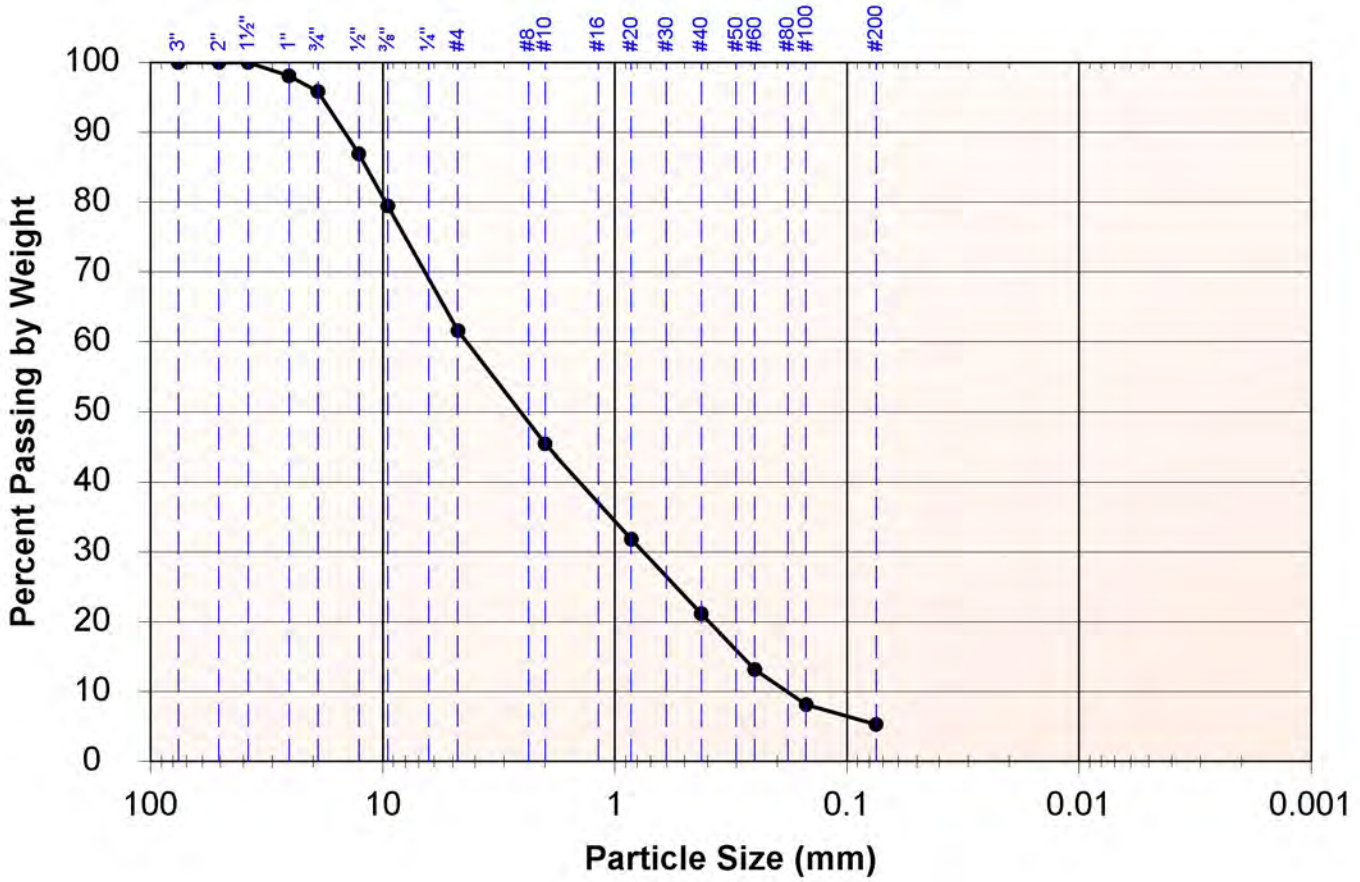
ASTM D422

Location: B2-D 25-27
Moisture as Received = 7%

Lab Number	2012-187
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	98%	
¾"	96%	
½"	87%	
⅜"	79%	
#4	62%	
Total Weight of Coarse Fraction: 1892.9g		
#10	45%	
#20	32%	
#40	21%	
#60	13%	
#100	8%	
#200	5.3%	
Total Weight of Fine Fraction: 477.7g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

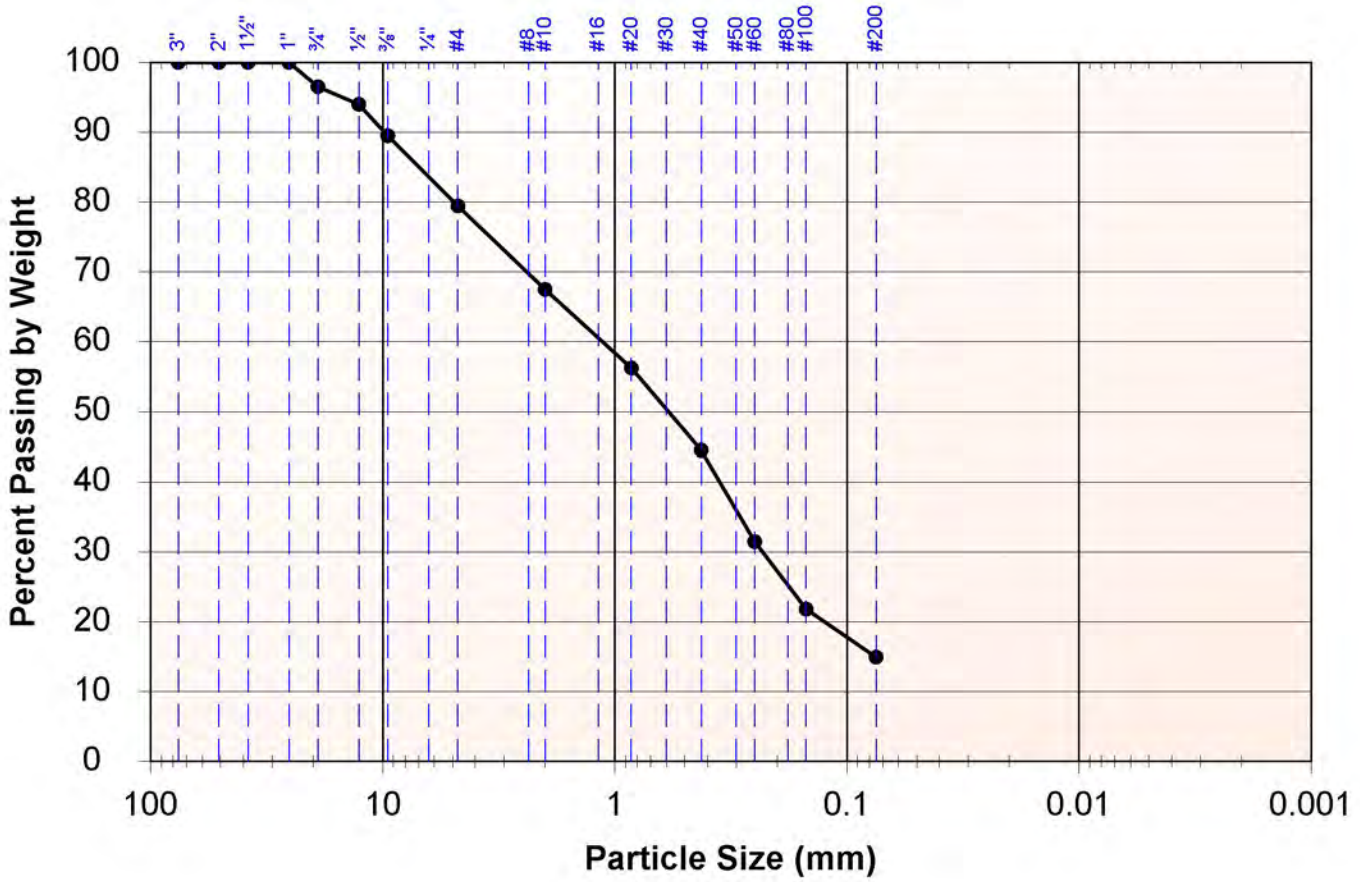
ASTM D422

Location: B2-J 55-57
Moisture as Received = 9%

Lab Number	2012-189
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	97%	
½"	94%	
⅜"	89%	
#4	79%	
Total Weight of Coarse Fraction: 562.7g		
#10	67%	
#20	56%	
#40	45%	
#60	31%	
#100	22%	
#200	14.9%	
Total Weight of Fine Fraction: 447.1g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

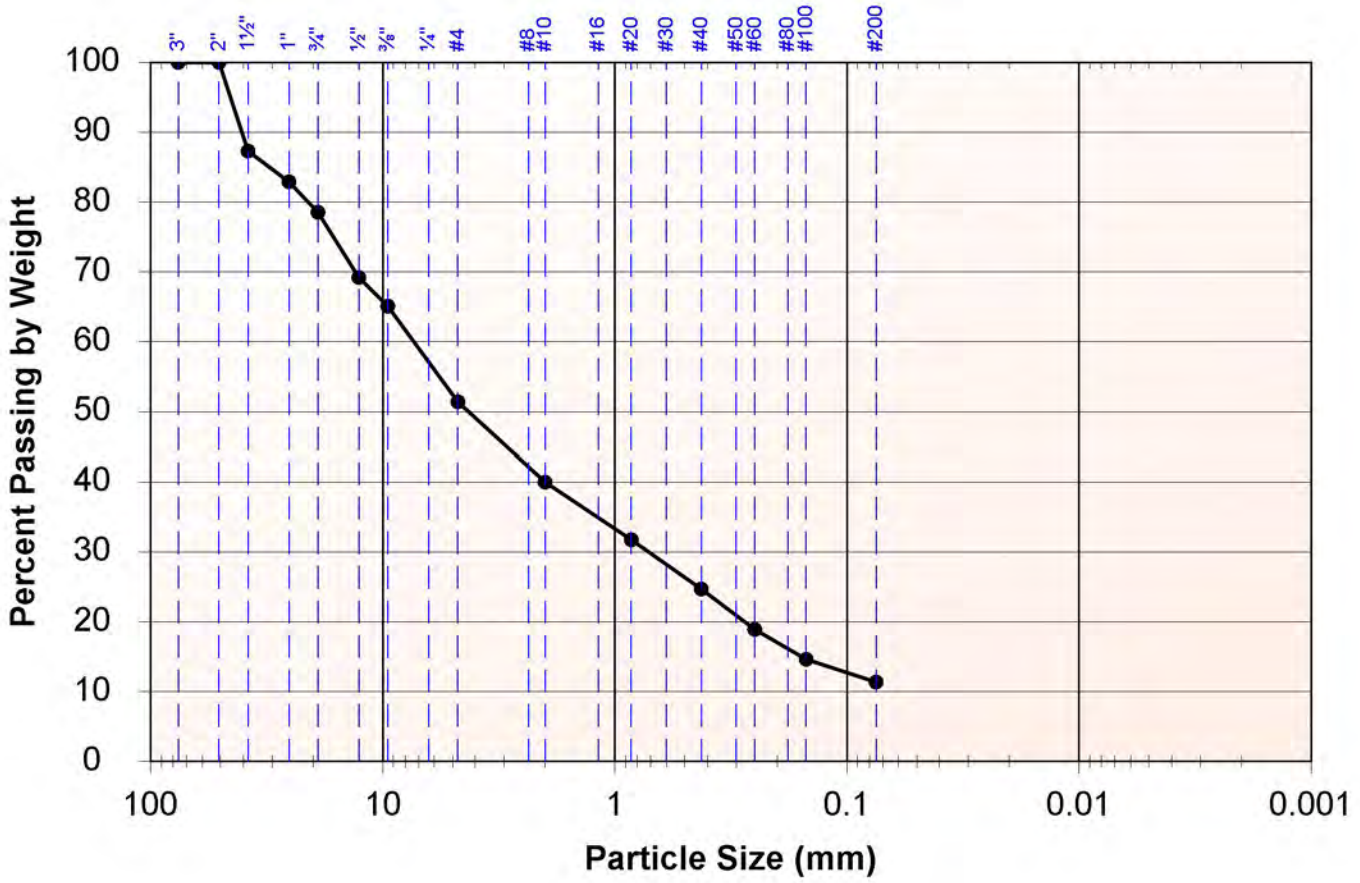
ASTM D422

Location: B3-A 10-12
Moisture as Received = 7%

Lab Number	2012-191
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Gravel with Silt and Sand, GW-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	87%	
1"	83%	
¾"	79%	
½"	69%	
⅜"	65%	
#4	51%	
Total Weight of Coarse Fraction: 2693.7g		
#10	40%	
#20	32%	
#40	25%	
#60	19%	
#100	15%	
#200	11.4%	
Total Weight of Fine Fraction: 333.3g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

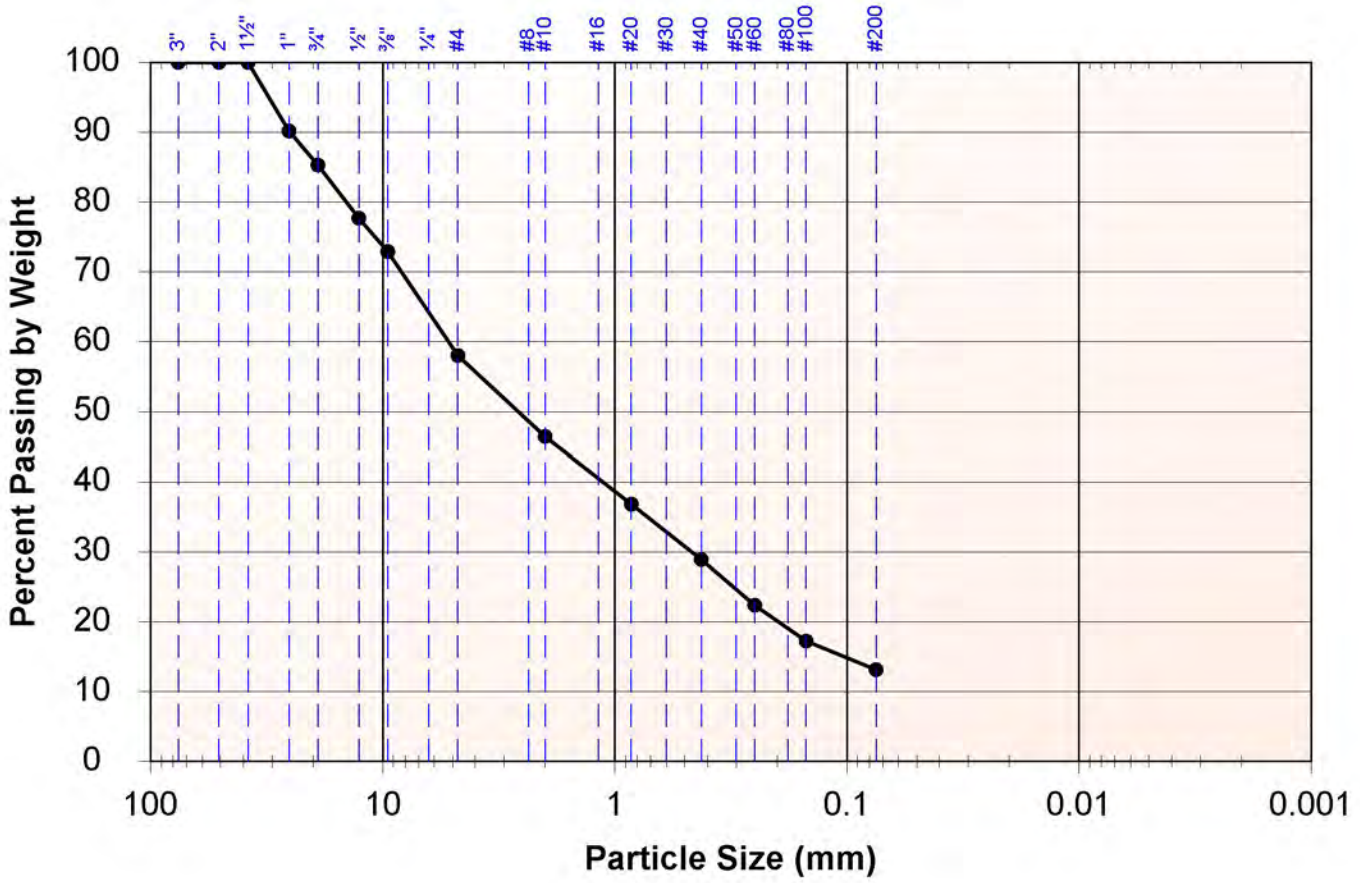
ASTM D422

Location: B3-F 30-32
Moisture as Received = 5%

Lab Number	2012-194
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	90%	
¾"	85%	
½"	78%	
⅜"	73%	
#4	58%	
Total Weight of Coarse Fraction: 2722.8g		
#10	46%	
#20	37%	
#40	29%	
#60	22%	
#100	17%	
#200	13.1%	
Total Weight of Fine Fraction: 385.7g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

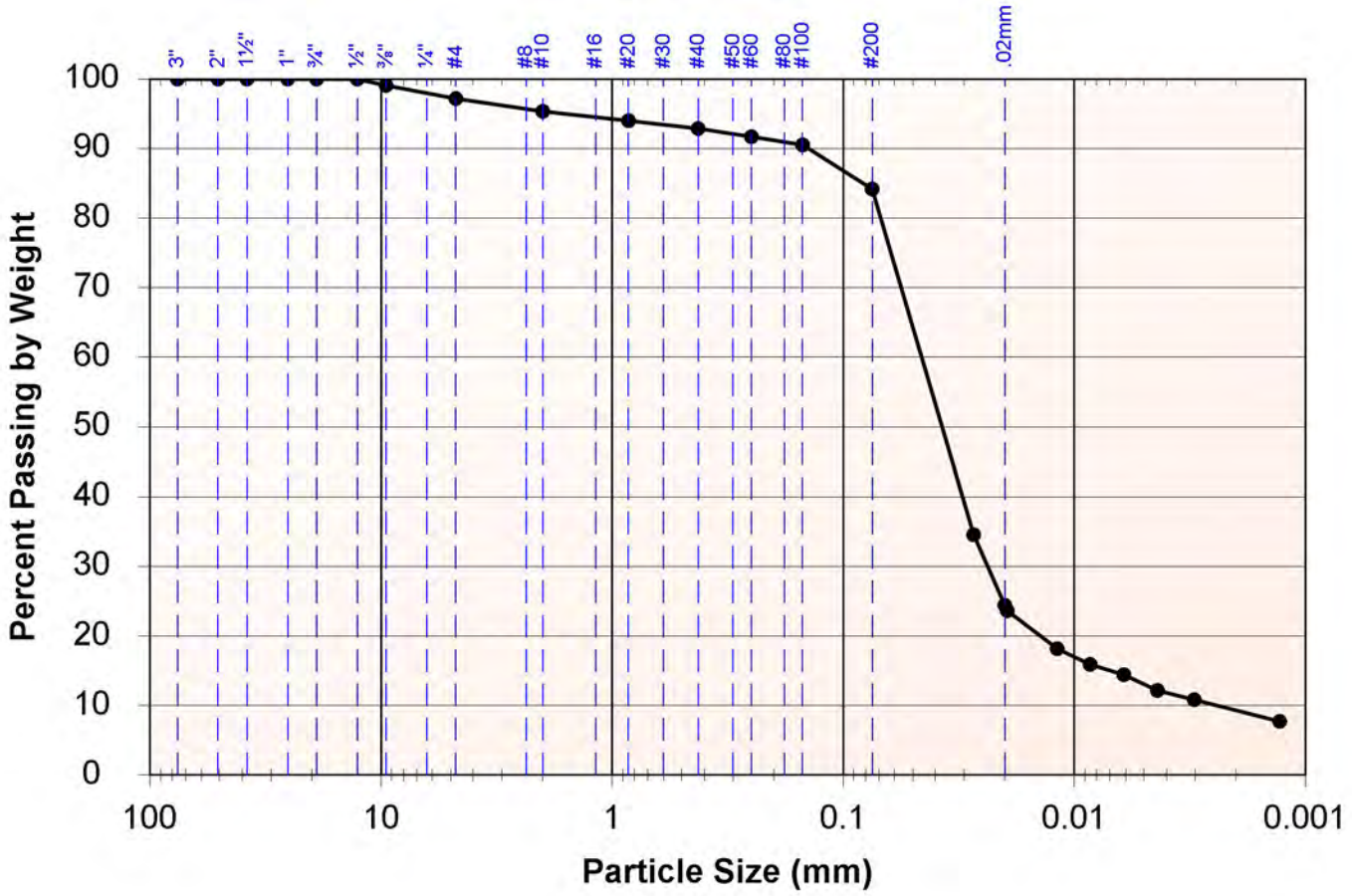
ASTM D422

Location: B3-I 40-42
Moisture as Received = 27.3%

Lab Number	2012-197
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silt with Sand, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	99%	
#4	97%	
Total Weight of Coarse Fraction: 800.7g		
#10	95%	
#20	94%	
#40	93%	
#60	92%	
#100	91%	
#200	84.2%	
Total Weight of Fine Fraction: 397.4g		
0.02 mm	24%	

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

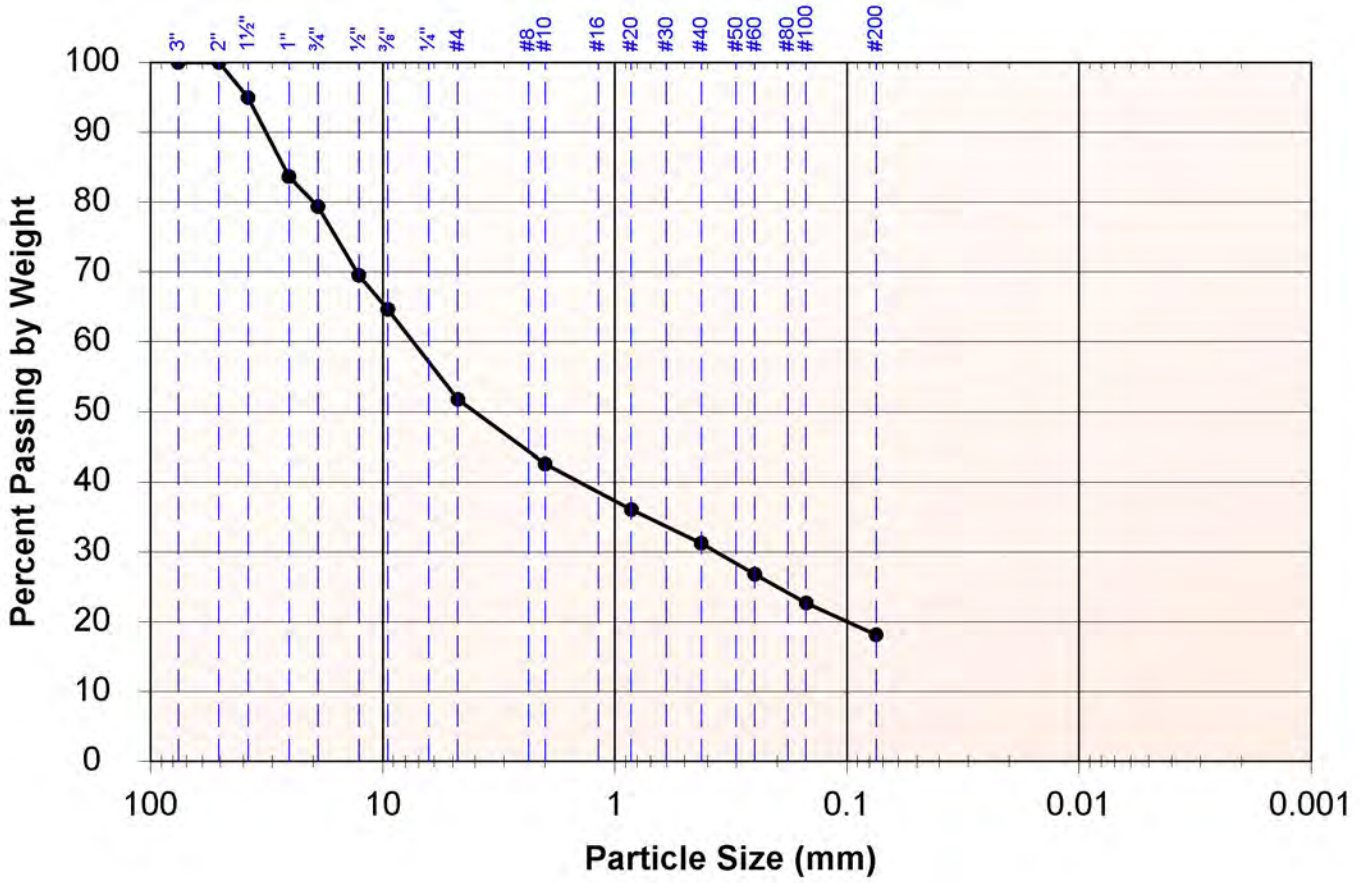
ASTM D422

Location: B5-A 10-12
Moisture as Received = 5%

Lab Number	2012-201
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Gravel with Sand, GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	95%	
1"	84%	
¾"	79%	
½"	70%	
⅜"	65%	
#4	52%	
Total Weight of Coarse Fraction: 2353.8g		
#10	43%	
#20	36%	
#40	31%	
#60	27%	
#100	23%	
#200	18.1%	
Total Weight of Fine Fraction: 300.6g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

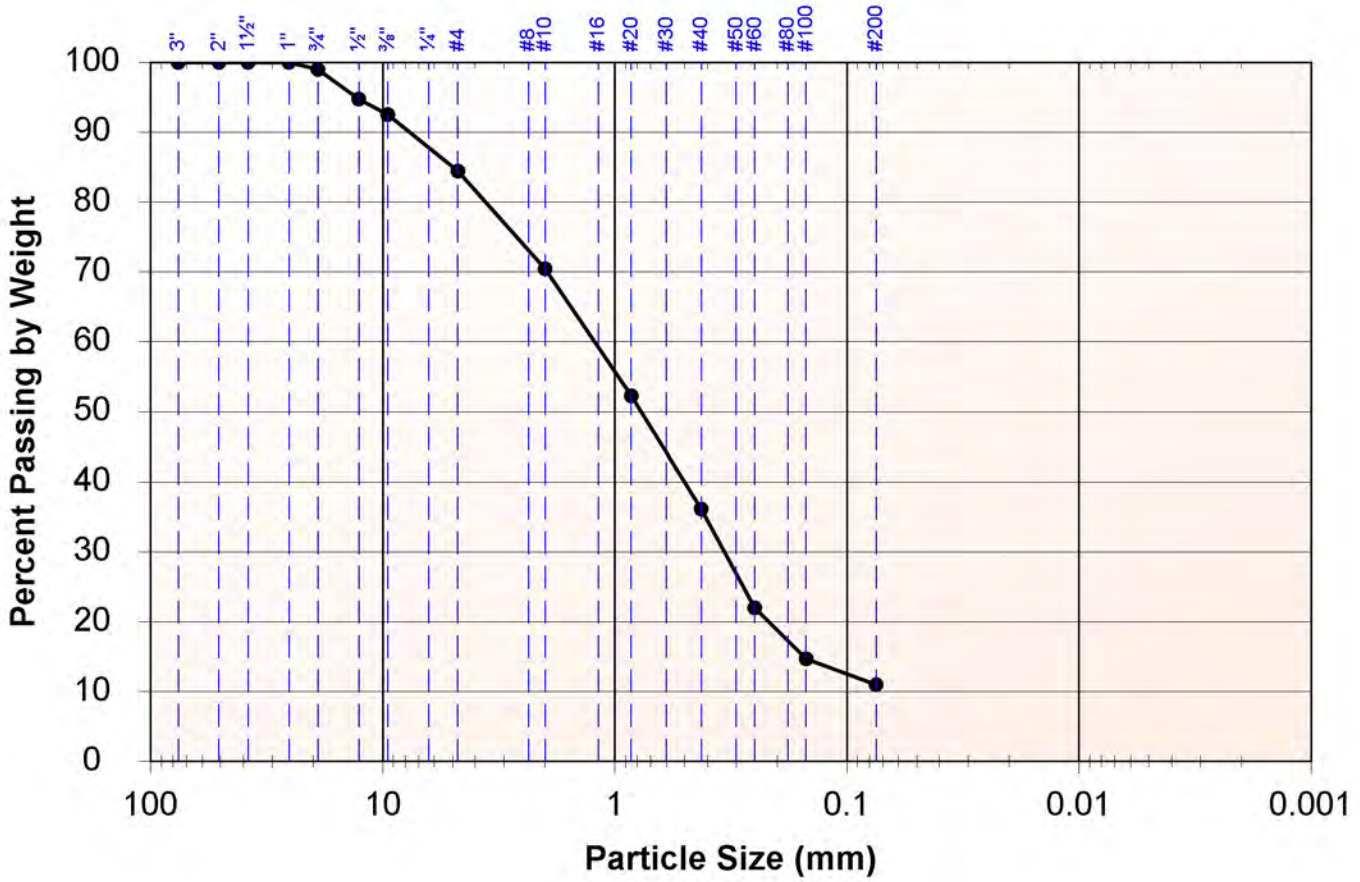
ASTM D422

Location: B5-E 30-32
Moisture as Received = 12%

Lab Number	2012-204
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Sand with Silt and Gravel, SW-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	99%	
½"	95%	
⅜"	93%	
#4	84%	
Total Weight of Coarse Fraction: 1789.5g		
#10	70%	
#20	52%	
#40	36%	
#60	22%	
#100	15%	
#200	11%	
Total Weight of Fine Fraction: 324g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

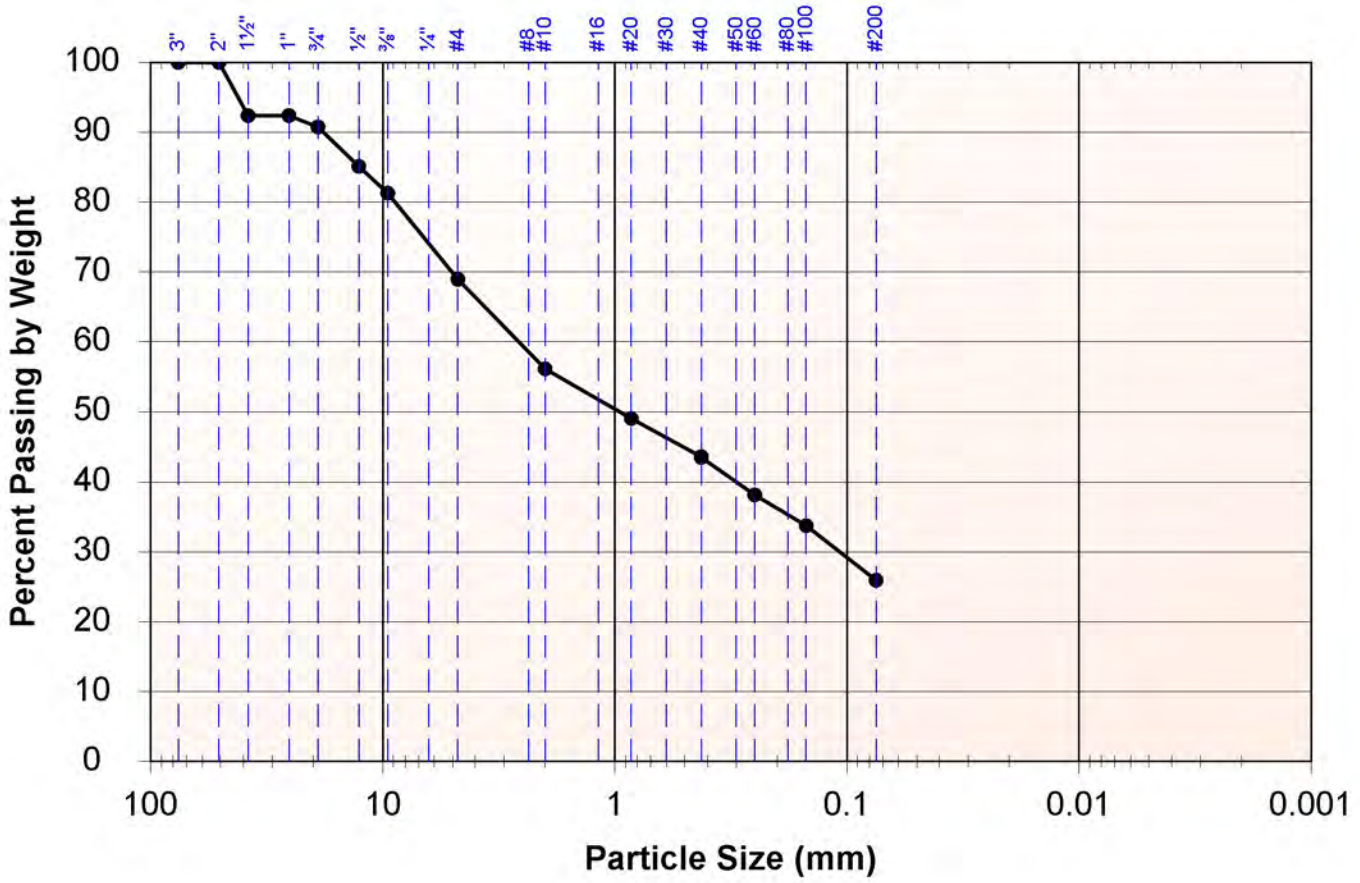
ASTM D422

Location: B5-H 45-47
Moisture as Received = 10%

Lab Number	2012-205
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	92%	
1"	92%	
¾"	91%	
½"	85%	
⅜"	81%	
#4	69%	
Total Weight of Coarse Fraction: 1996.2g		
#10	56%	
#20	49%	
#40	44%	
#60	38%	
#100	34%	
#200	26%	
Total Weight of Fine Fraction: 358.3g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

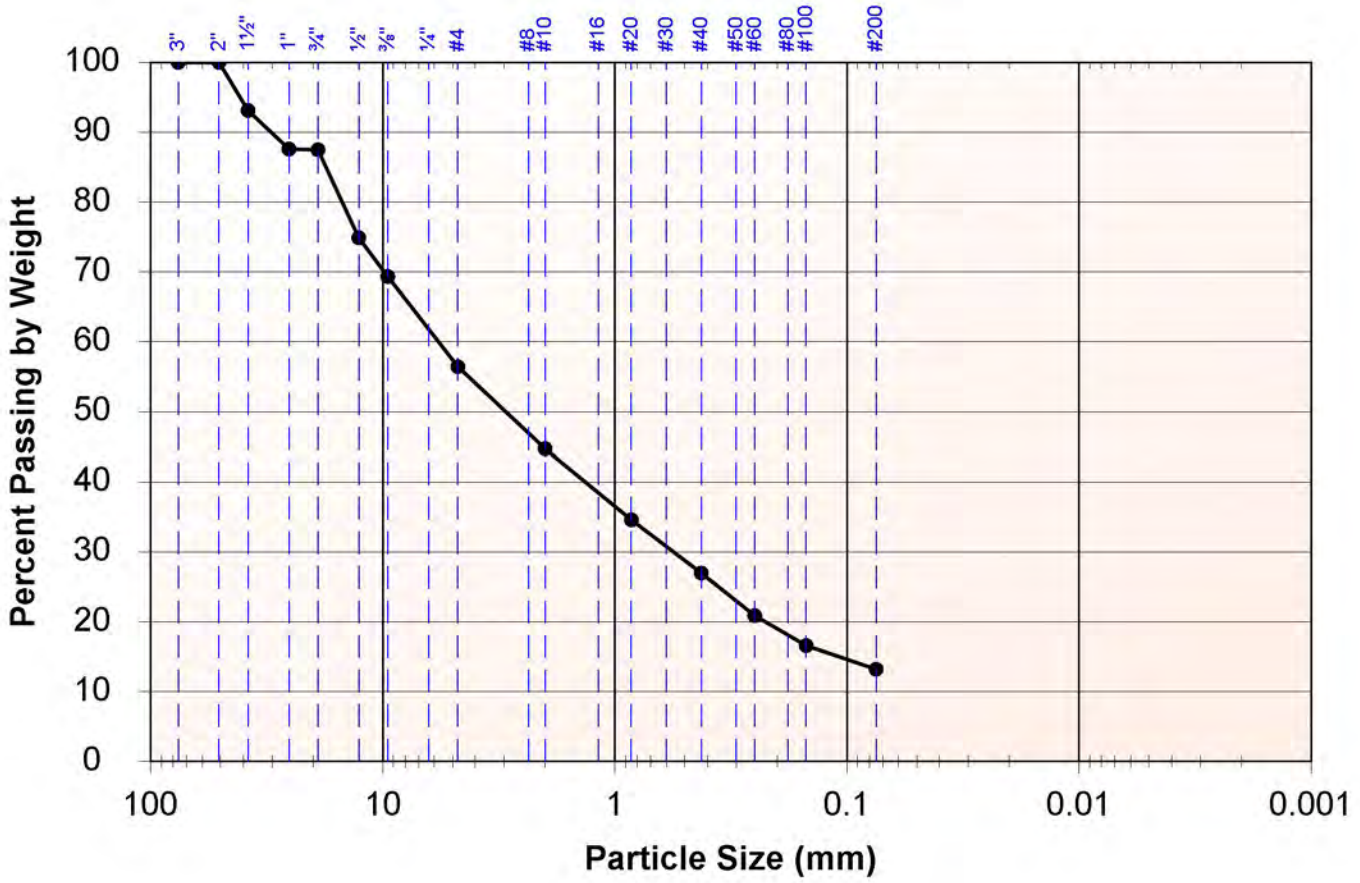
ASTM D422

Location: B6-B 15-17
Moisture as Received = 5%

Lab Number	2012-209
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Gravel with Sand, GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	93%	
1"	88%	
¾"	87%	
½"	75%	
⅜"	69%	
#4	56%	
Total Weight of Coarse Fraction: 2966.1g		
#10	45%	
#20	35%	
#40	27%	
#60	21%	
#100	17%	
#200	13.2%	
Total Weight of Fine Fraction: 375.5g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

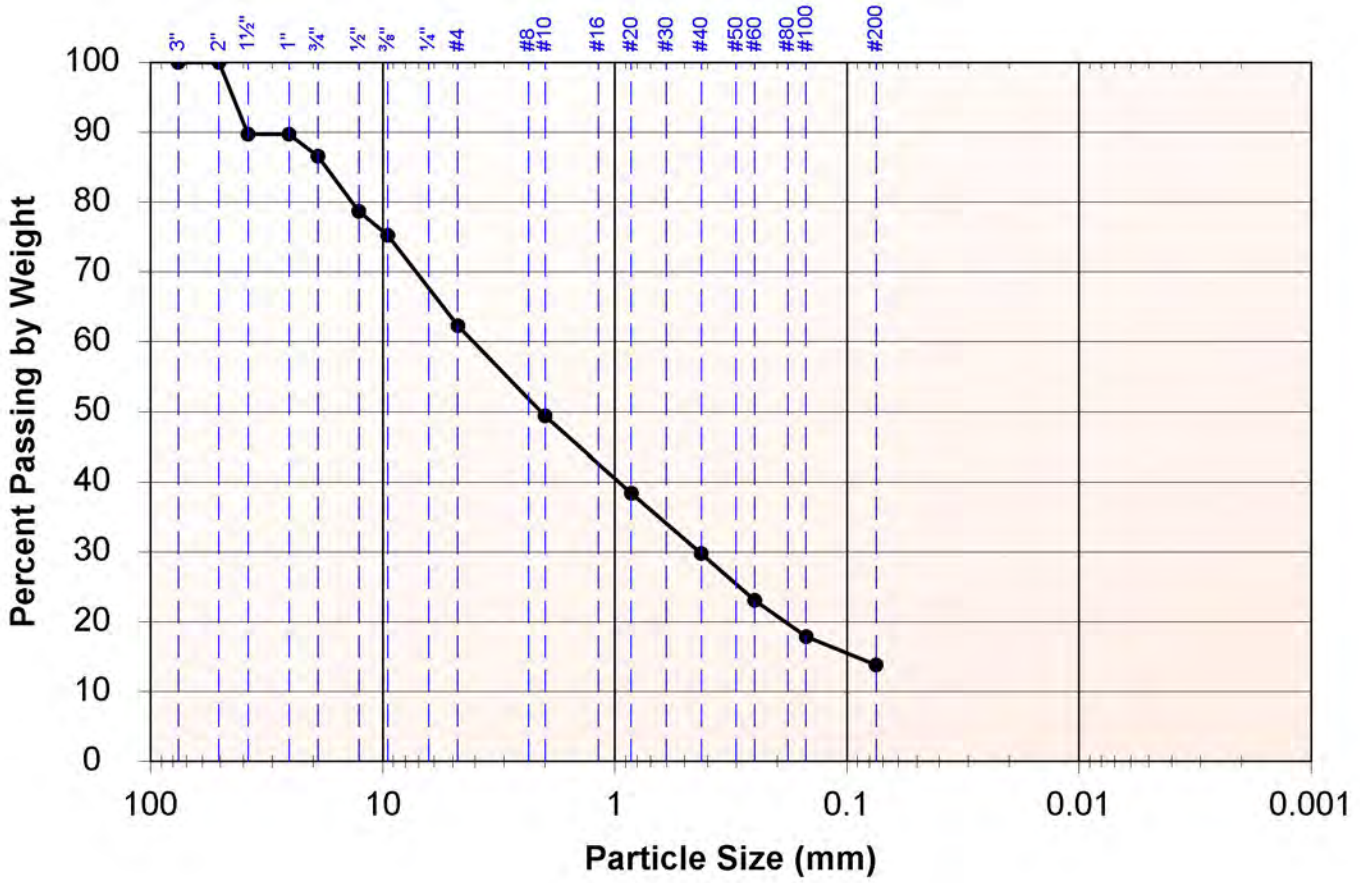
ASTM D422

Location: B6-C 20-22
Moisture as Received = 6%

Lab Number	2012-210
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	90%	
1"	90%	
¾"	87%	
½"	79%	
⅜"	75%	
#4	62%	
Total Weight of Coarse Fraction: 2554.5g		
#10	49%	
#20	38%	
#40	30%	
#60	23%	
#100	18%	
#200	13.8%	
Total Weight of Fine Fraction: 437.5g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

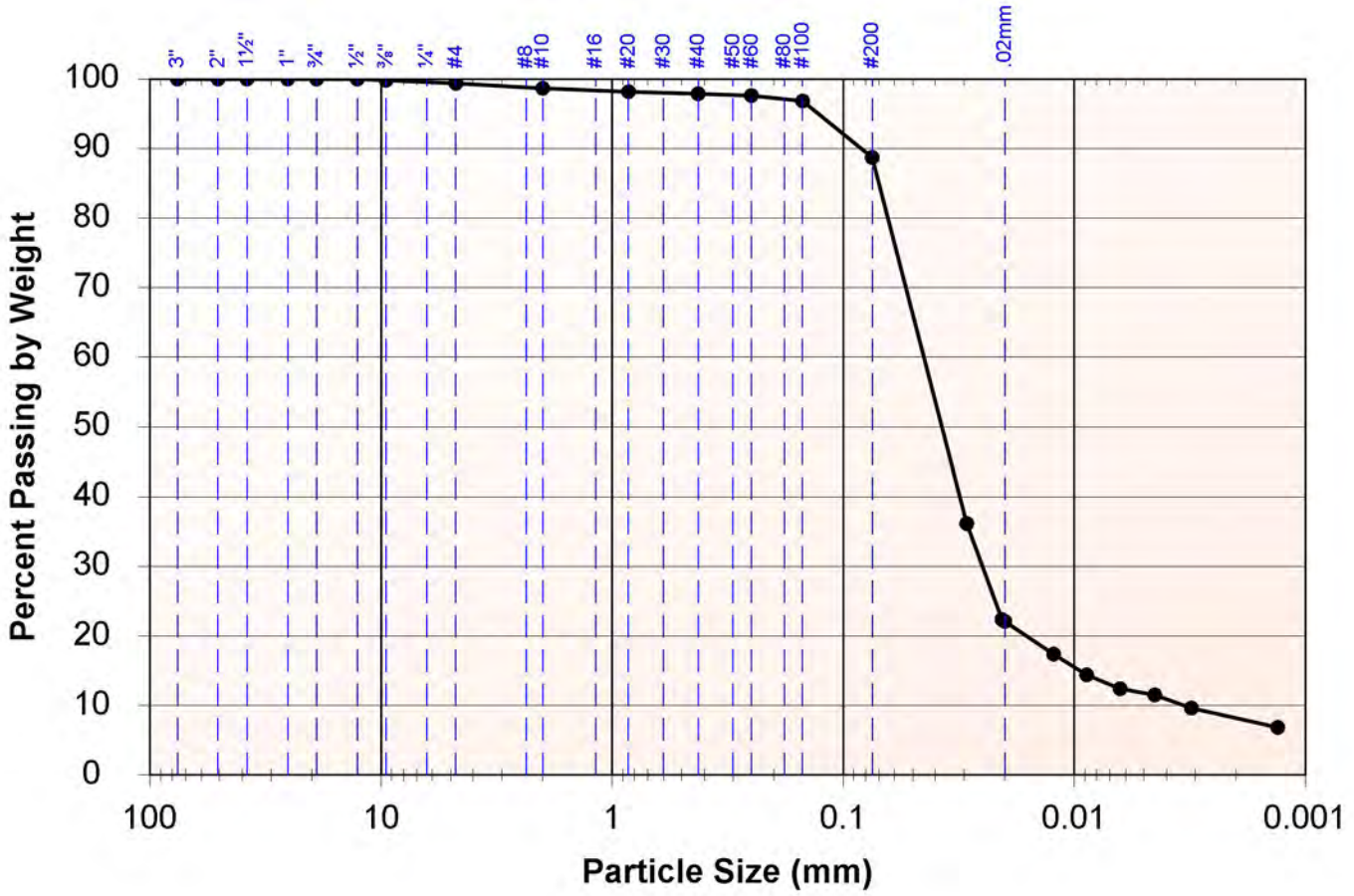
ASTM D422

Location: B6-G 40-42

Lab Number	2012-213
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silt, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	100%	
#4	99%	
Total Weight of Coarse Fraction: 2218g		
#10	99%	
#20	98%	
#40	98%	
#60	98%	
#100	97%	
#200	88.7%	
Total Weight of Fine Fraction: 304.7g		
0.02 mm	22%	

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

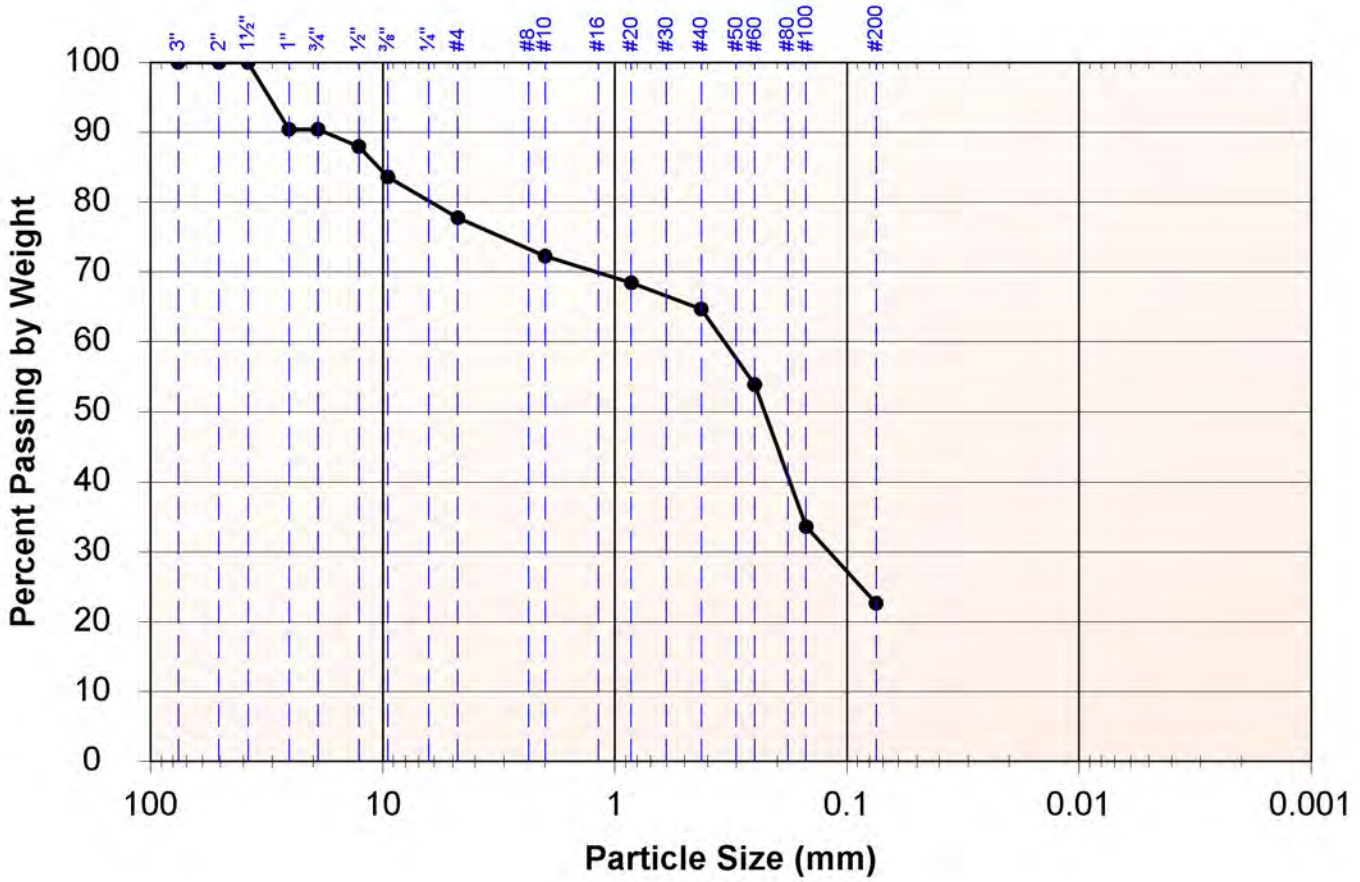
ASTM D422

Location: B6-I 50-52
Moisture as Received = 14%

Lab Number	2012-214
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	90%	
¾"	90%	
½"	88%	
⅜"	84%	
#4	78%	
Total Weight of Coarse Fraction: 410.4g		
#10	72%	
#20	68%	
#40	65%	
#60	54%	
#100	34%	
#200	22.7%	
Total Weight of Fine Fraction: 319.1g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

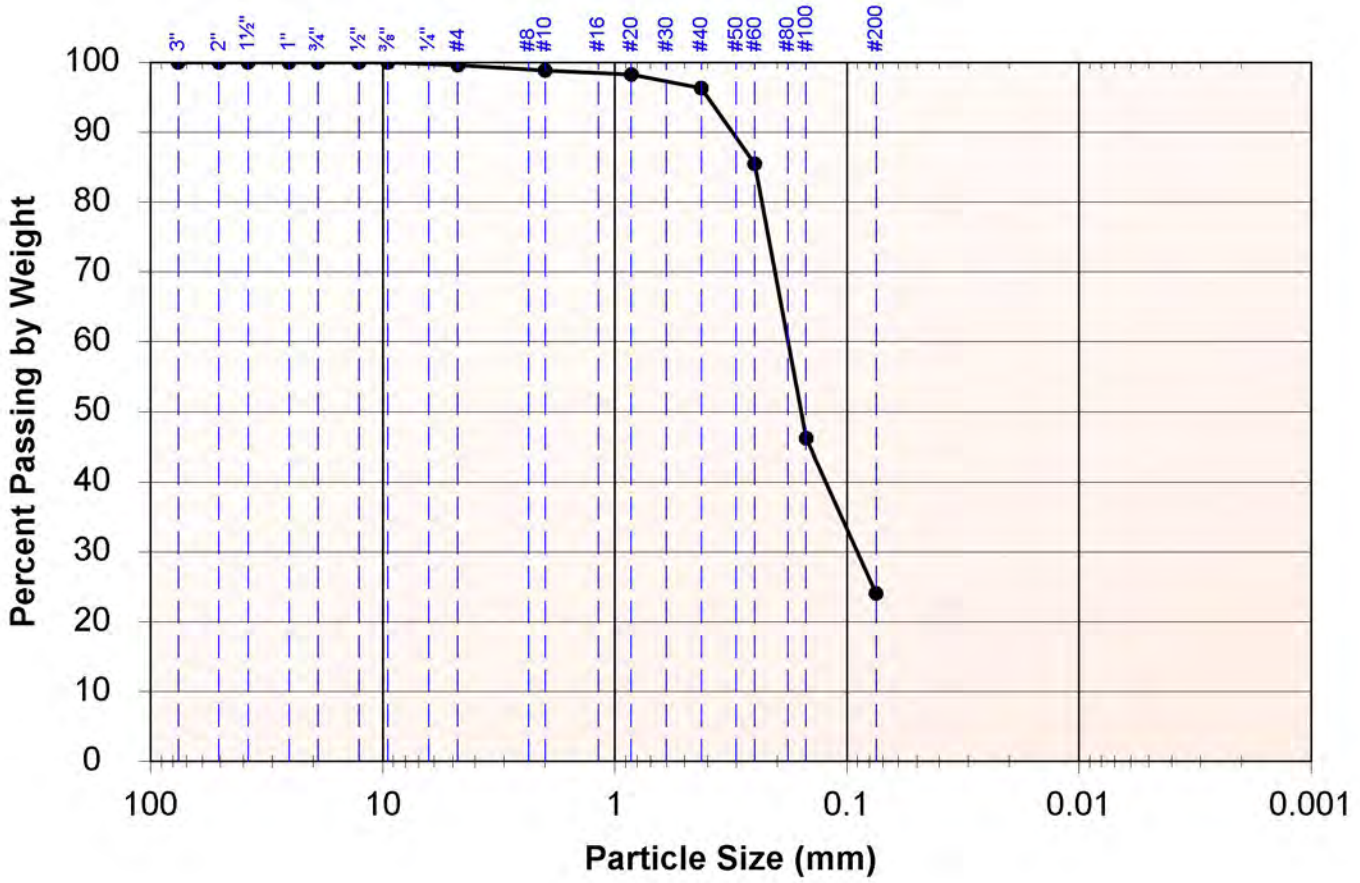
ASTM D422

Location: B6-K 60-62
Moisture as Received = 19%

Lab Number	2012-216
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	100%	
#4	100%	
Total Weight of Coarse Fraction: 595.2g		
#10	99%	
#20	98%	
#40	96%	
#60	85%	
#100	46%	
#200	24.1%	
Total Weight of Fine Fraction: 311.6g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

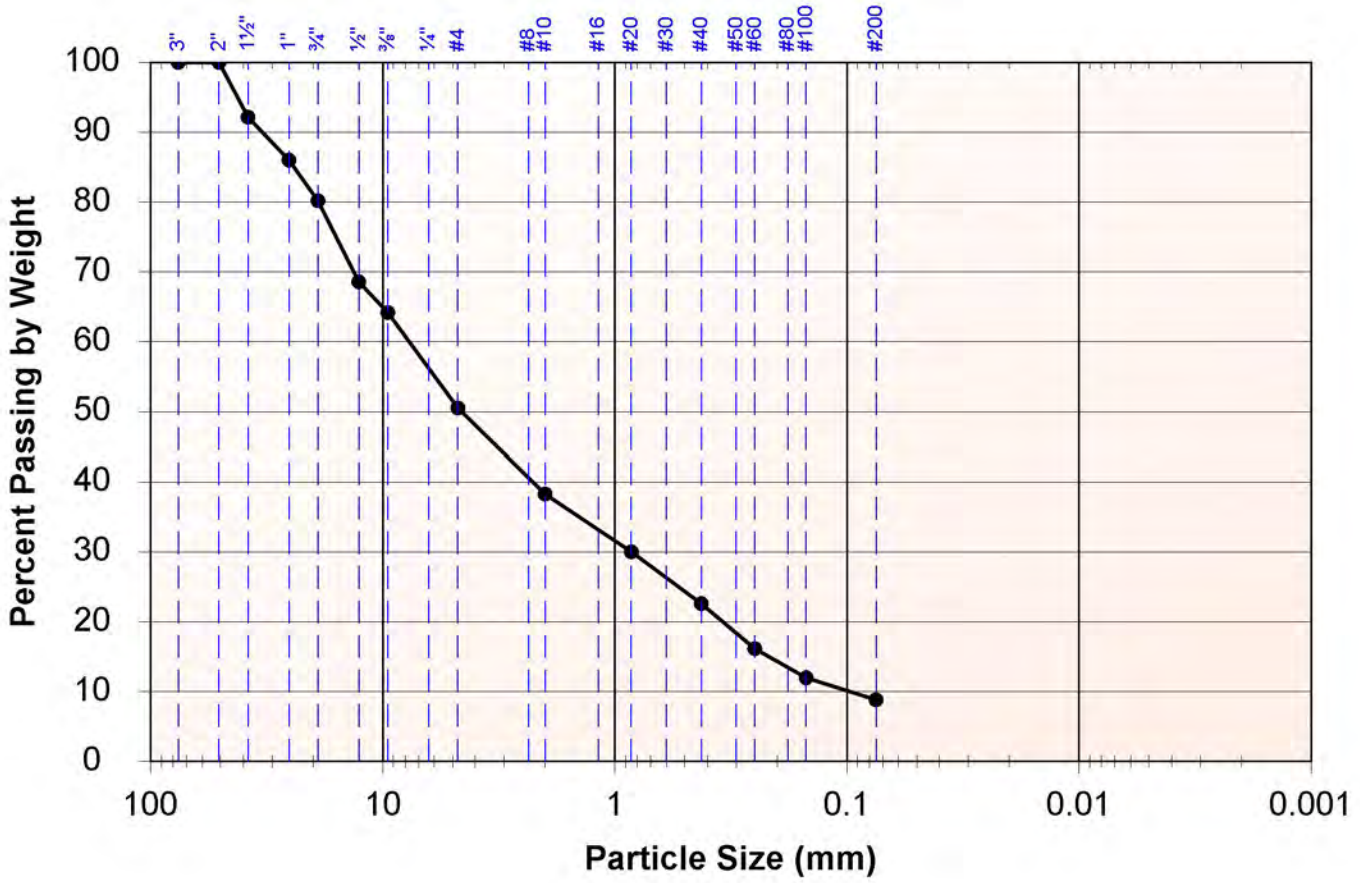
ASTM D422

Location: B8-A 9-11
Moisture as Received = 5%

Lab Number	2012-220
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Gravel with Silt and Sand, GP-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	92%	
1"	86%	
¾"	80%	
½"	69%	
⅜"	64%	
#4	51%	
Total Weight of Coarse Fraction: 2546.8g		
#10	38%	
#20	30%	
#40	23%	
#60	16%	
#100	12%	
#200	8.8%	
Total Weight of Fine Fraction: 330.9g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

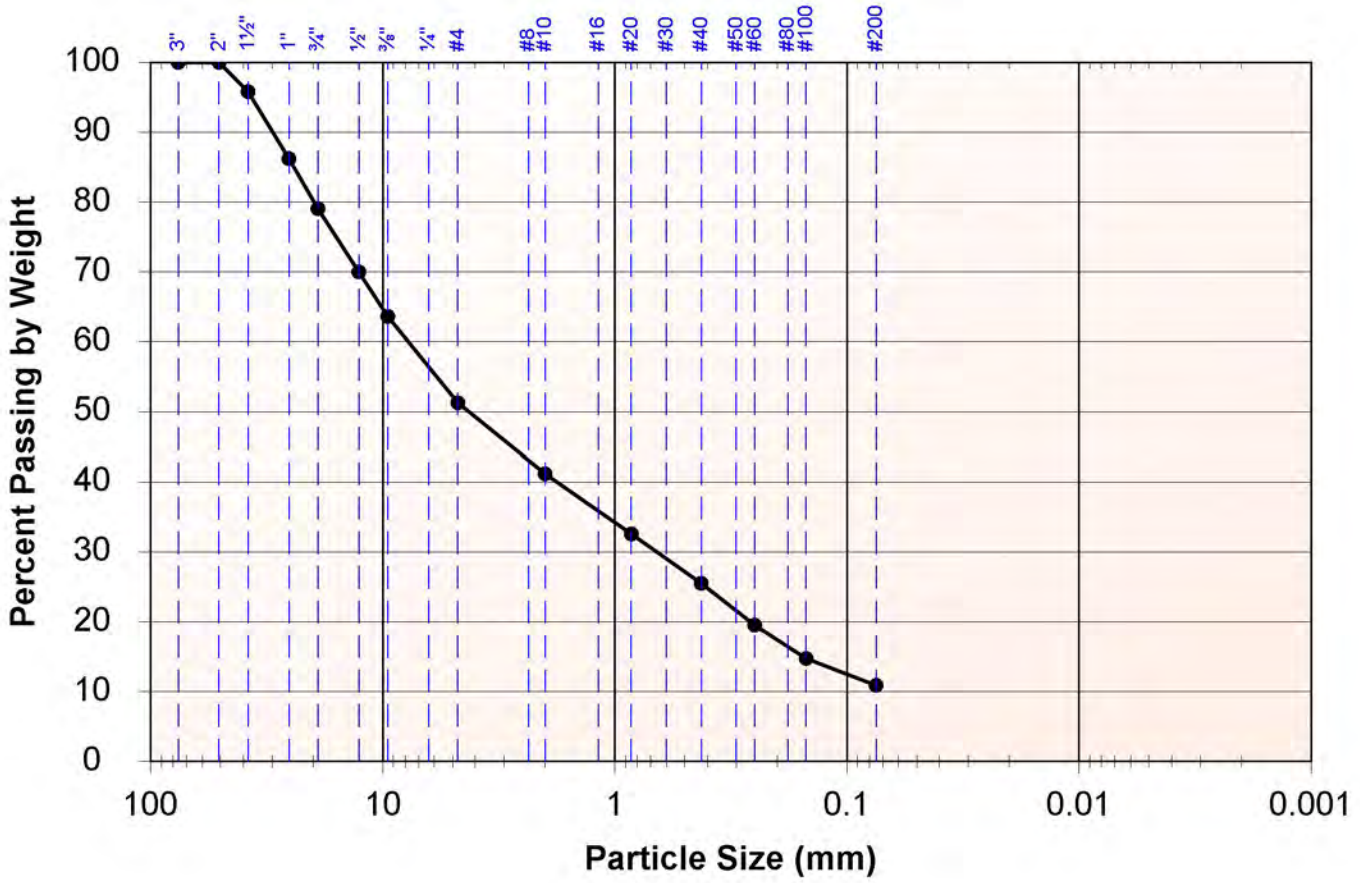
ASTM D422

Location: B8-D 24-26
Moisture as Received = 5%

Lab Number	2012-222
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Gravel with Silt and Sand, GP-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	96%	
1"	86%	
¾"	79%	
½"	70%	
⅜"	64%	
#4	51%	
Total Weight of Coarse Fraction: 3011.1g		
#10	41%	
#20	33%	
#40	26%	
#60	20%	
#100	15%	
#200	10.9%	
Total Weight of Fine Fraction: 419.3g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

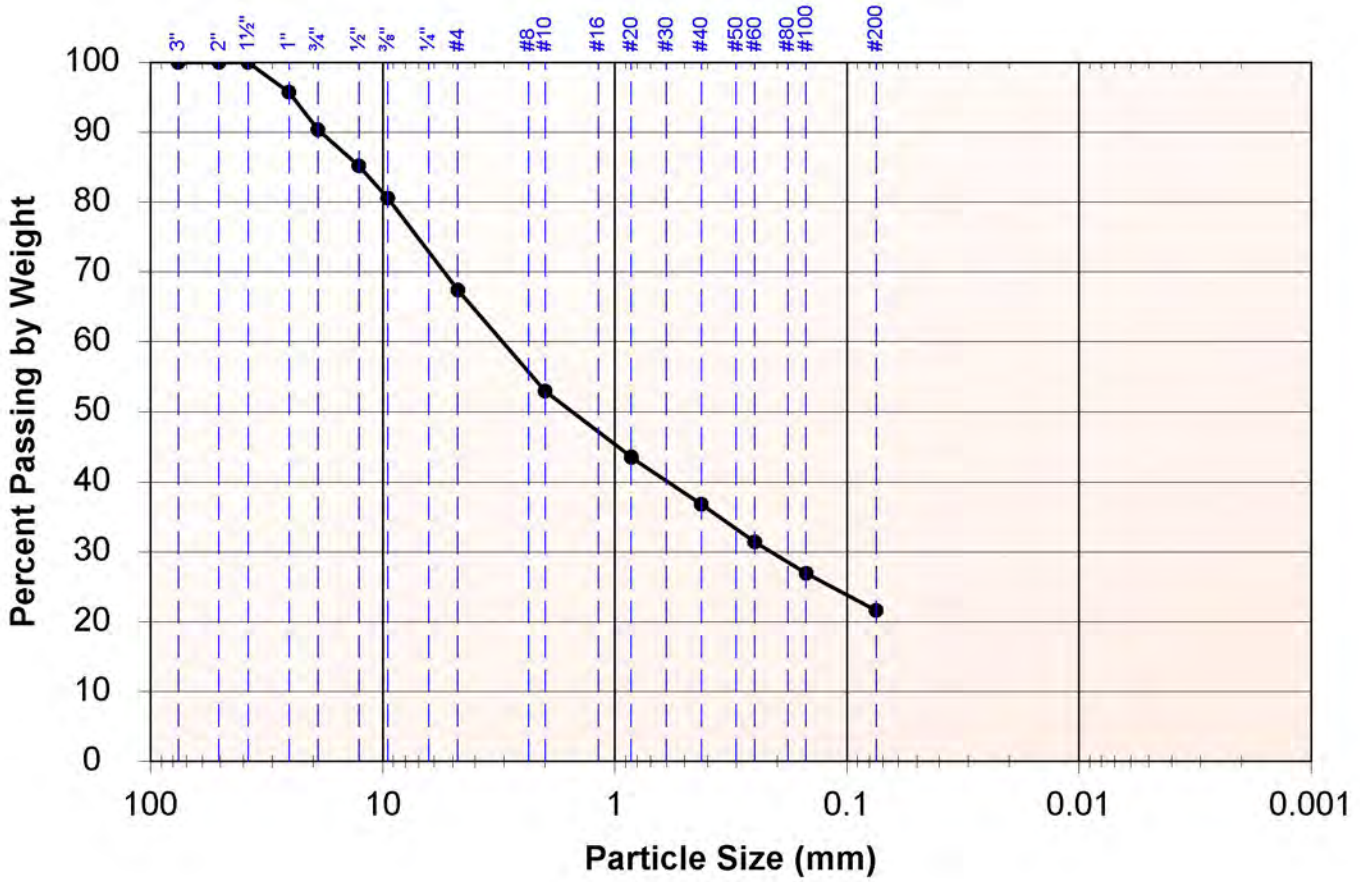
ASTM D422

Location: B8-H 44-46
Moisture as Received = 10%

Lab Number	2012-224
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	96%	
¾"	90%	
½"	85%	
⅜"	81%	
#4	67%	
Total Weight of Coarse Fraction: 820.8g		
#10	53%	
#20	44%	
#40	37%	
#60	31%	
#100	27%	
#200	21.6%	
Total Weight of Fine Fraction: 397.9g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

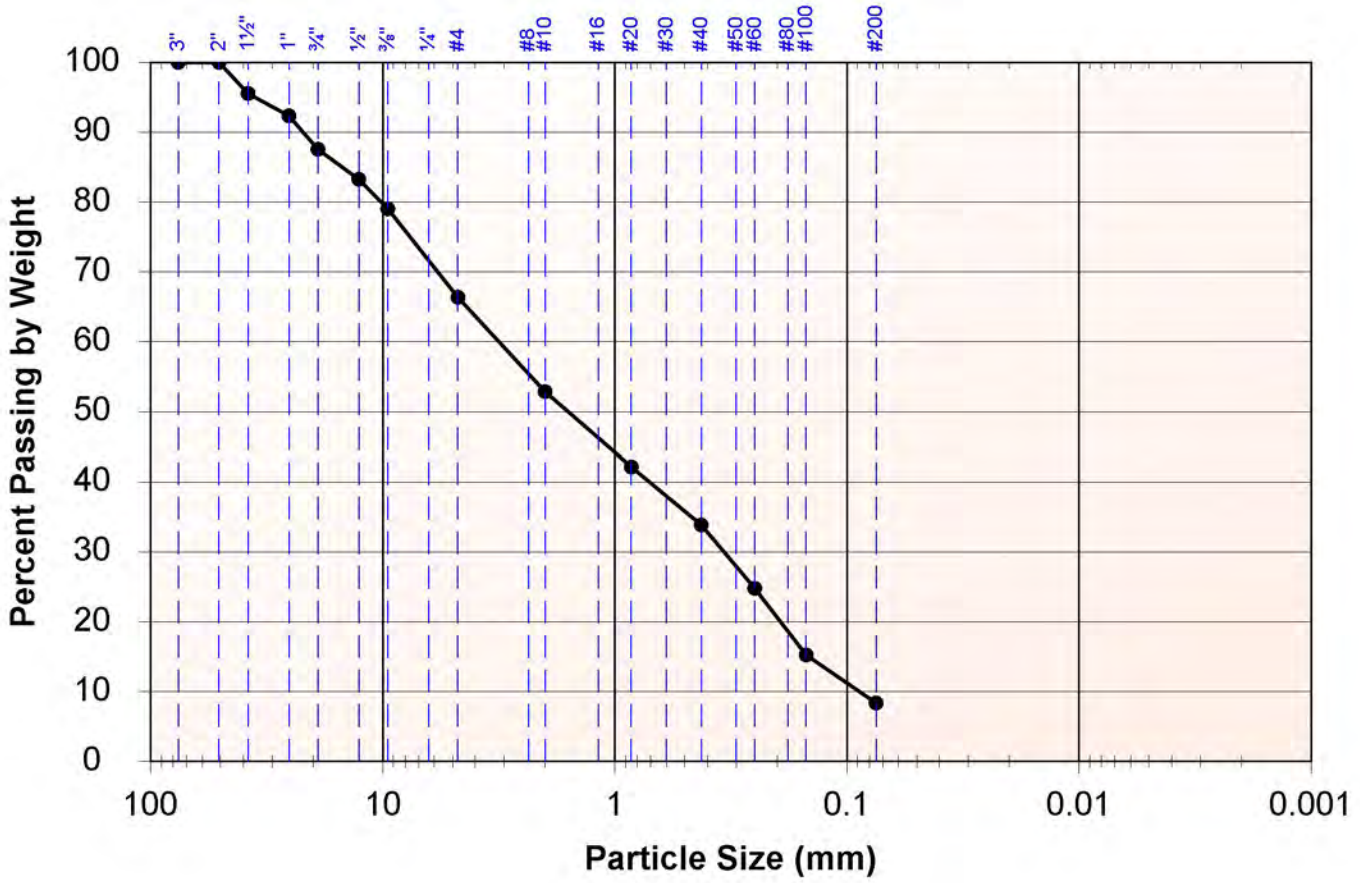
ASTM D422

Location: B9-L 65-67
Moisture as Received = 9%

Lab Number	2012-230
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	96%	
1"	92%	
¾"	88%	
½"	83%	
⅜"	79%	
#4	66%	
Total Weight of Coarse Fraction: 2287.2g		
#10	53%	
#20	42%	
#40	34%	
#60	25%	
#100	15%	
#200	8.4%	
Total Weight of Fine Fraction: 409.4g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

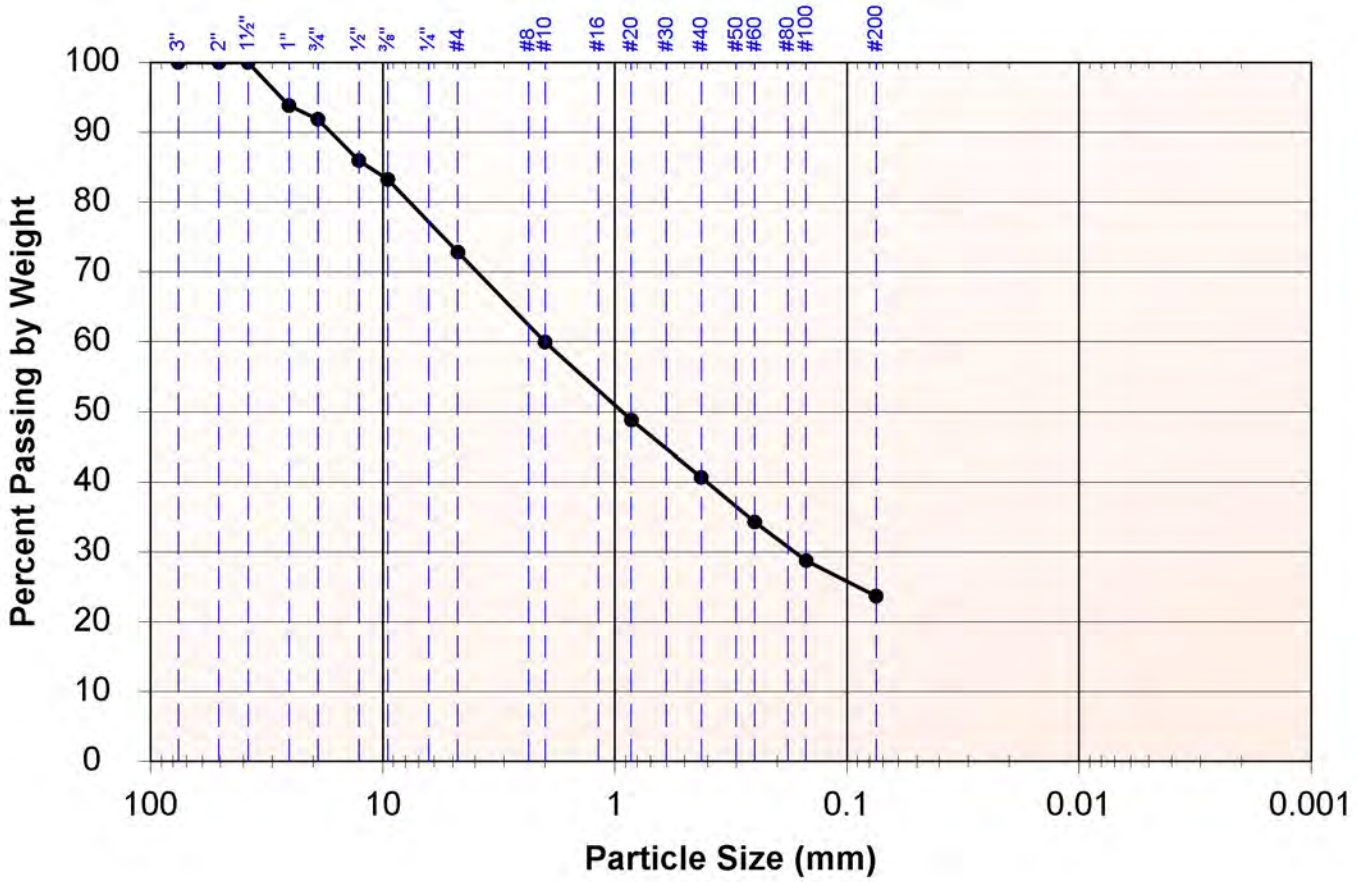
ASTM D422

Location: B13-B 15-17
Moisture as Received = 8%

Lab Number	2012-233
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	94%	
¾"	92%	
½"	86%	
⅜"	83%	
#4	73%	
Total Weight of Coarse Fraction: 626.8g		
#10	60%	
#20	49%	
#40	41%	
#60	34%	
#100	29%	
#200	23.7%	
Total Weight of Fine Fraction: 456.6g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

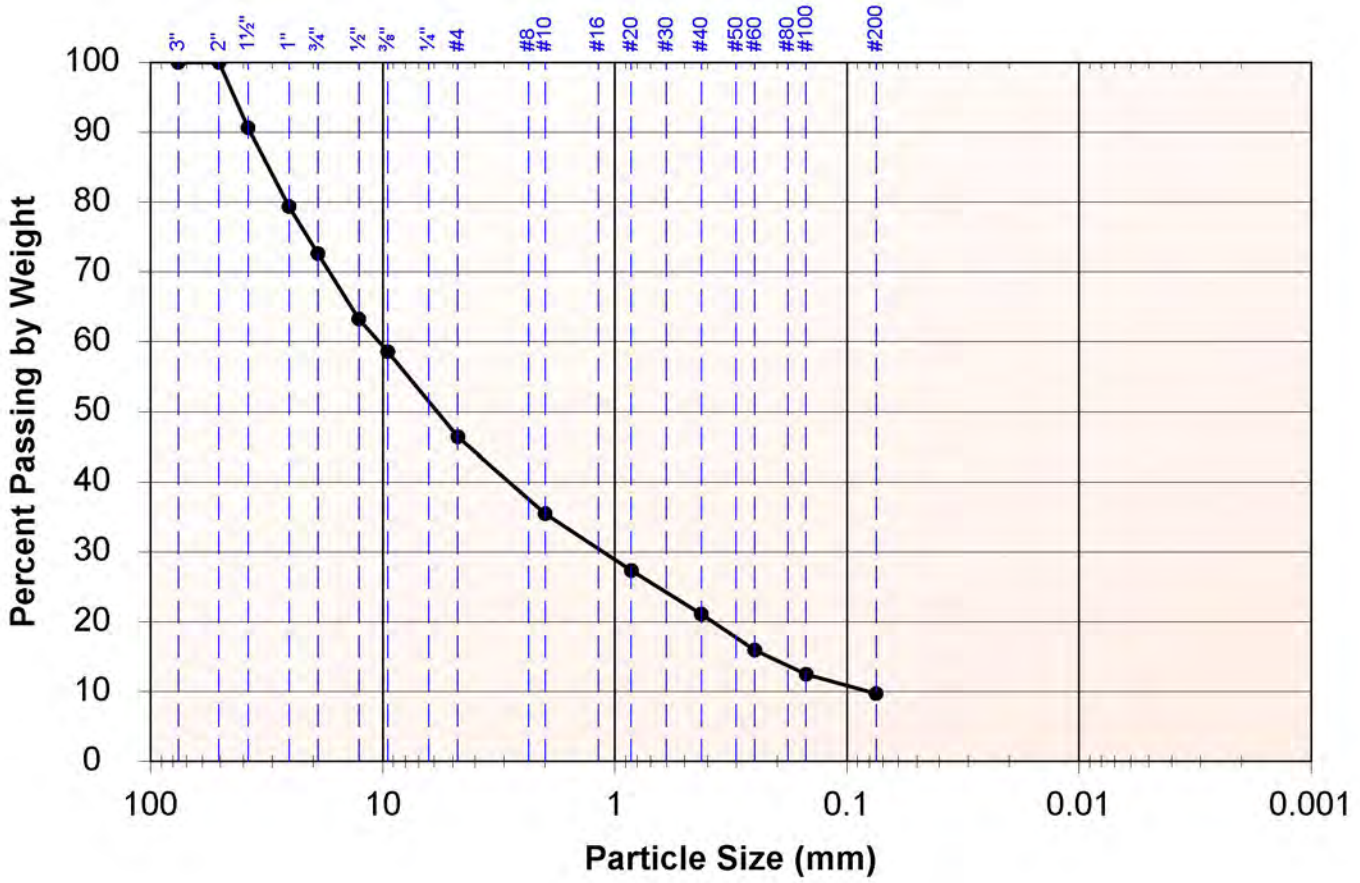
ASTM D422

Location: B13-G 40-42
Moisture as Received = 6%

Lab Number	2012-236
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Gravel with Silt and Sand, GW-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	91%	
1"	79%	
¾"	73%	
½"	63%	
⅜"	59%	
#4	46%	
Total Weight of Coarse Fraction: 2366.3g		
#10	35%	
#20	27%	
#40	21%	
#60	16%	
#100	12%	
#200	9.7%	
Total Weight of Fine Fraction: 412.3g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

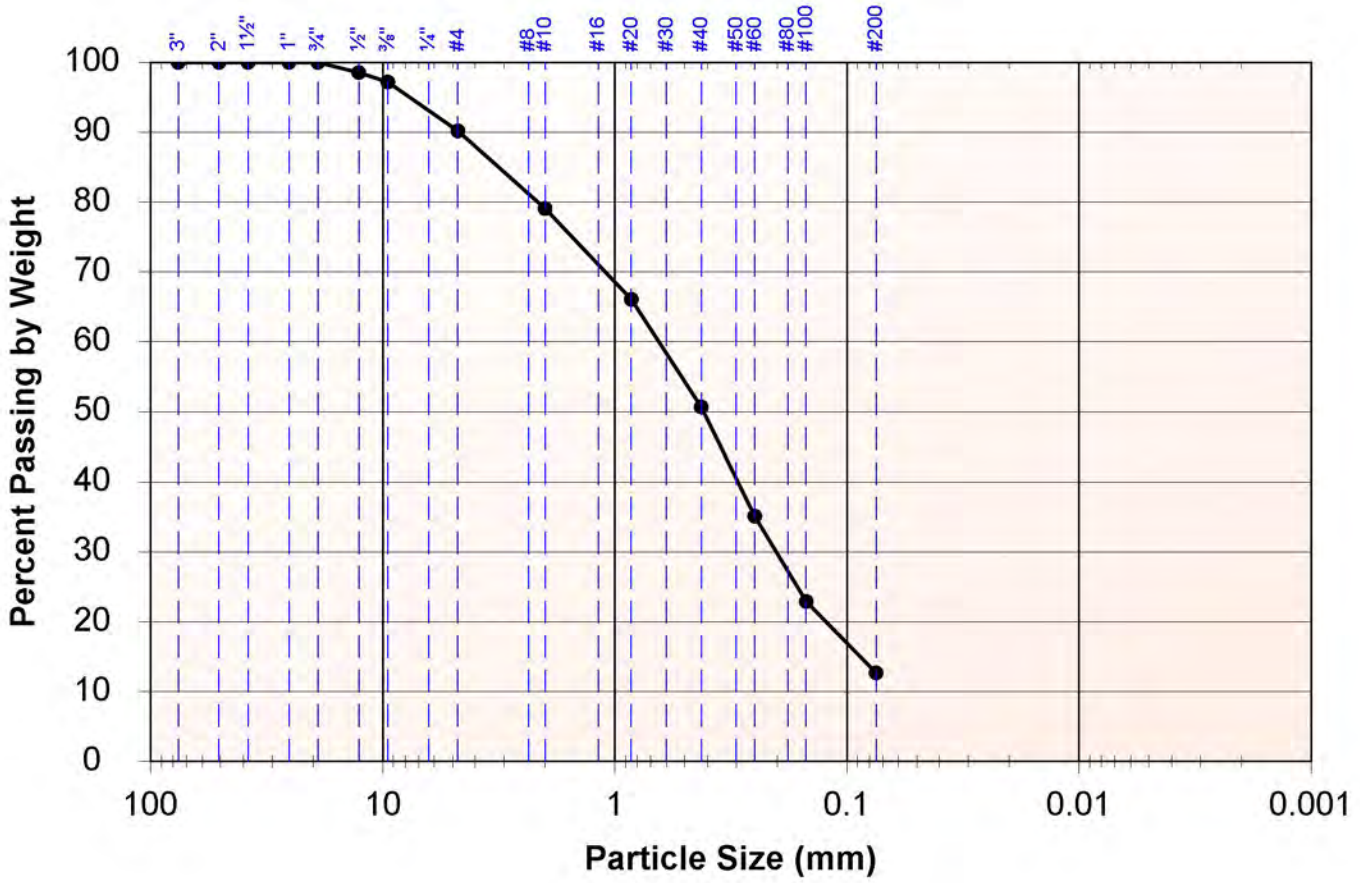
ASTM D422

Location: B13-M 70-72
Moisture as Received = 16%

Lab Number	2012-237
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	99%	
⅜"	97%	
#4	90%	
Total Weight of Coarse Fraction: 890.5g		
#10	79%	
#20	66%	
#40	51%	
#60	35%	
#100	23%	
#200	12.7%	
Total Weight of Fine Fraction: 409.8g		

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Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

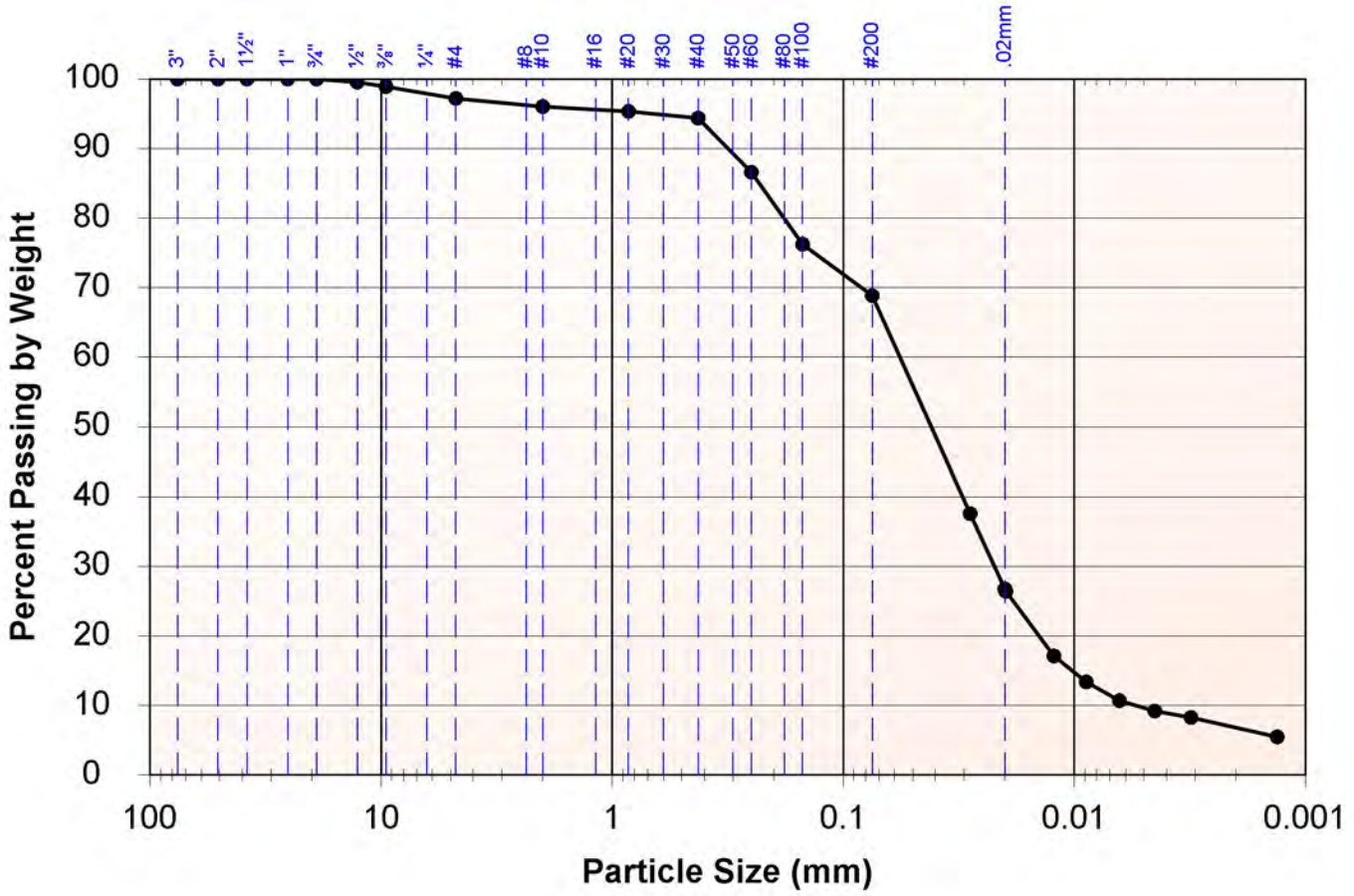
ASTM D422

Location: B13-O 80-82

Lab Number	2012-238
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Sandy Silt, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	99%	
#4	97%	
Total Weight of Coarse Fraction: 2172.3g		
#10	96%	
#20	95%	
#40	94%	
#60	87%	
#100	76%	
#200	68.9%	
Total Weight of Fine Fraction: 382.8g		
0.02 mm	27%	

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Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

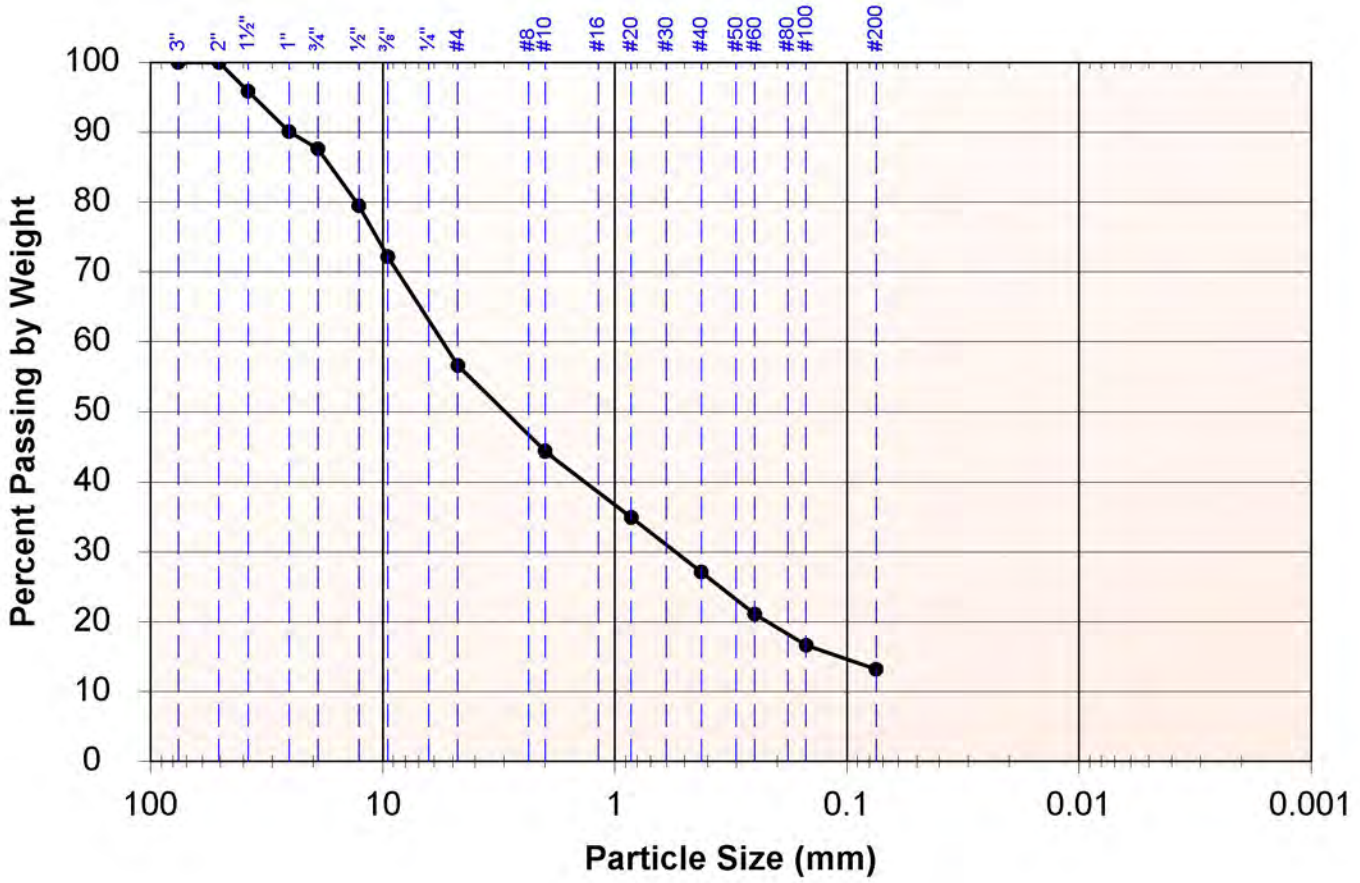
ASTM D422

Location: B15-C 15-17
Moisture as Received = 6%

Lab Number	2012-240
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Gravel with Sand, GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	96%	
1"	90%	
¾"	88%	
½"	79%	
⅜"	72%	
#4	57%	
Total Weight of Coarse Fraction: 2701.8g		
#10	44%	
#20	35%	
#40	27%	
#60	21%	
#100	17%	
#200	13.2%	
Total Weight of Fine Fraction: 426.2g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

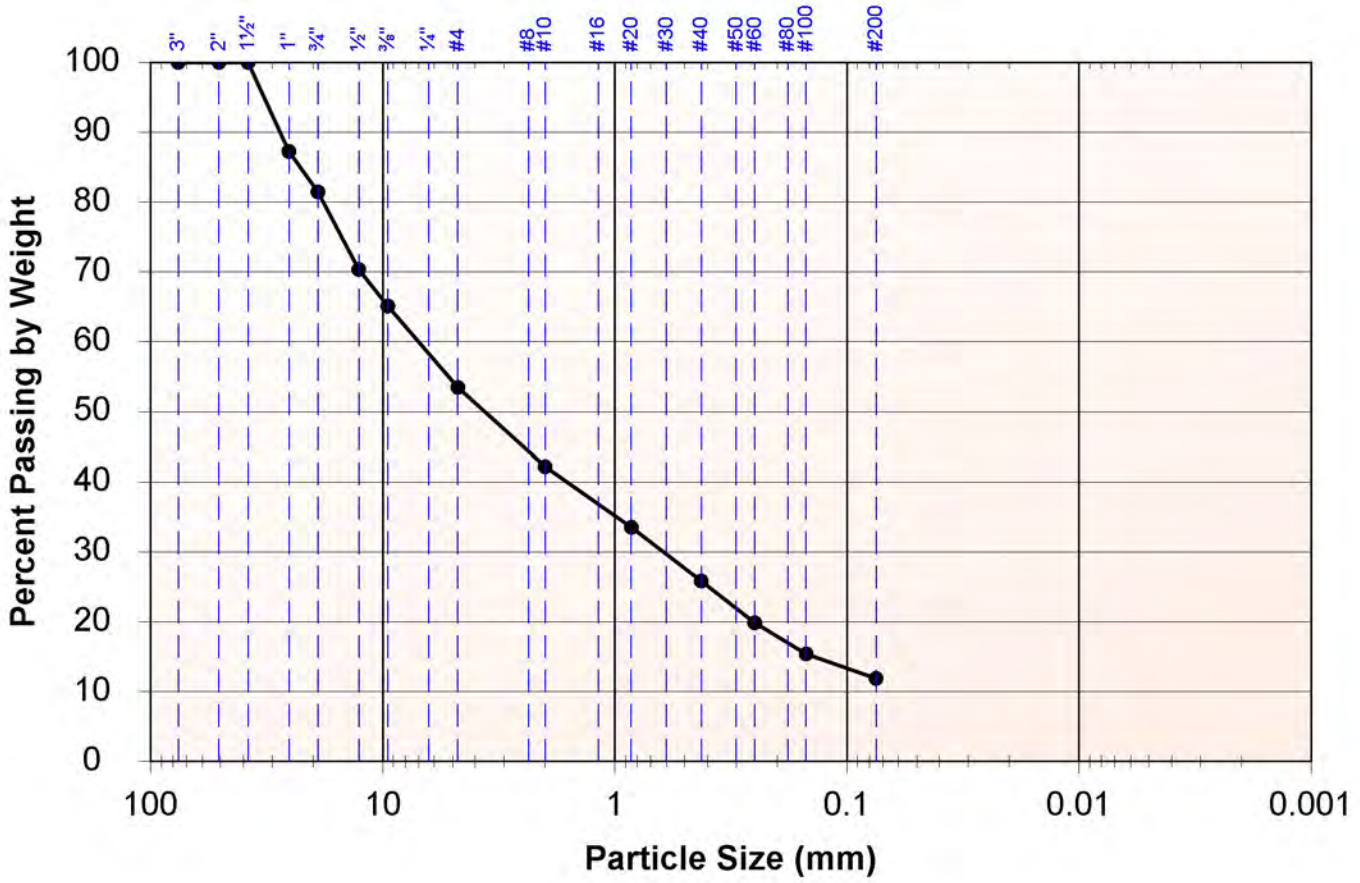
ASTM D422

Location: B15-E 25-27
Moisture as Received = 6%

Lab Number	2012-242
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Gravel with Silt and Sand, GW-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	87%	
¾"	81%	
½"	70%	
⅜"	65%	
#4	53%	
Total Weight of Coarse Fraction: 2771.4g		
#10	42%	
#20	34%	
#40	26%	
#60	20%	
#100	15%	
#200	11.9%	
Total Weight of Fine Fraction: 384.8g		

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Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

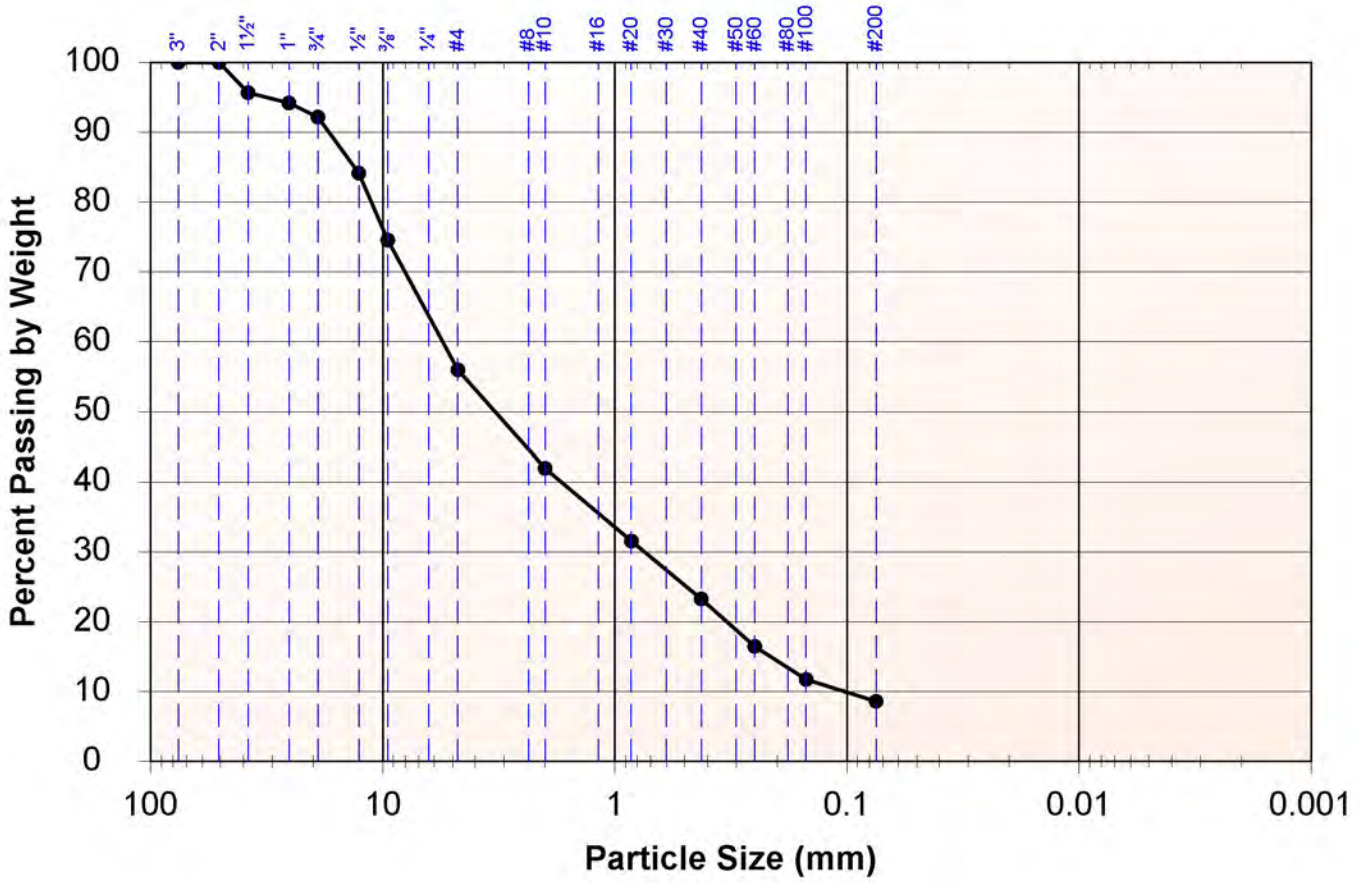
ASTM D422

Location: B15-K 55-57
Moisture as Received = 7%

Lab Number	2012-243
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	96%	
1"	94%	
¾"	92%	
½"	84%	
⅜"	75%	
#4	56%	
Total Weight of Coarse Fraction: 2822.1g		
#10	42%	
#20	32%	
#40	23%	
#60	16%	
#100	12%	
#200	8.6%	
Total Weight of Fine Fraction: 465.0g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

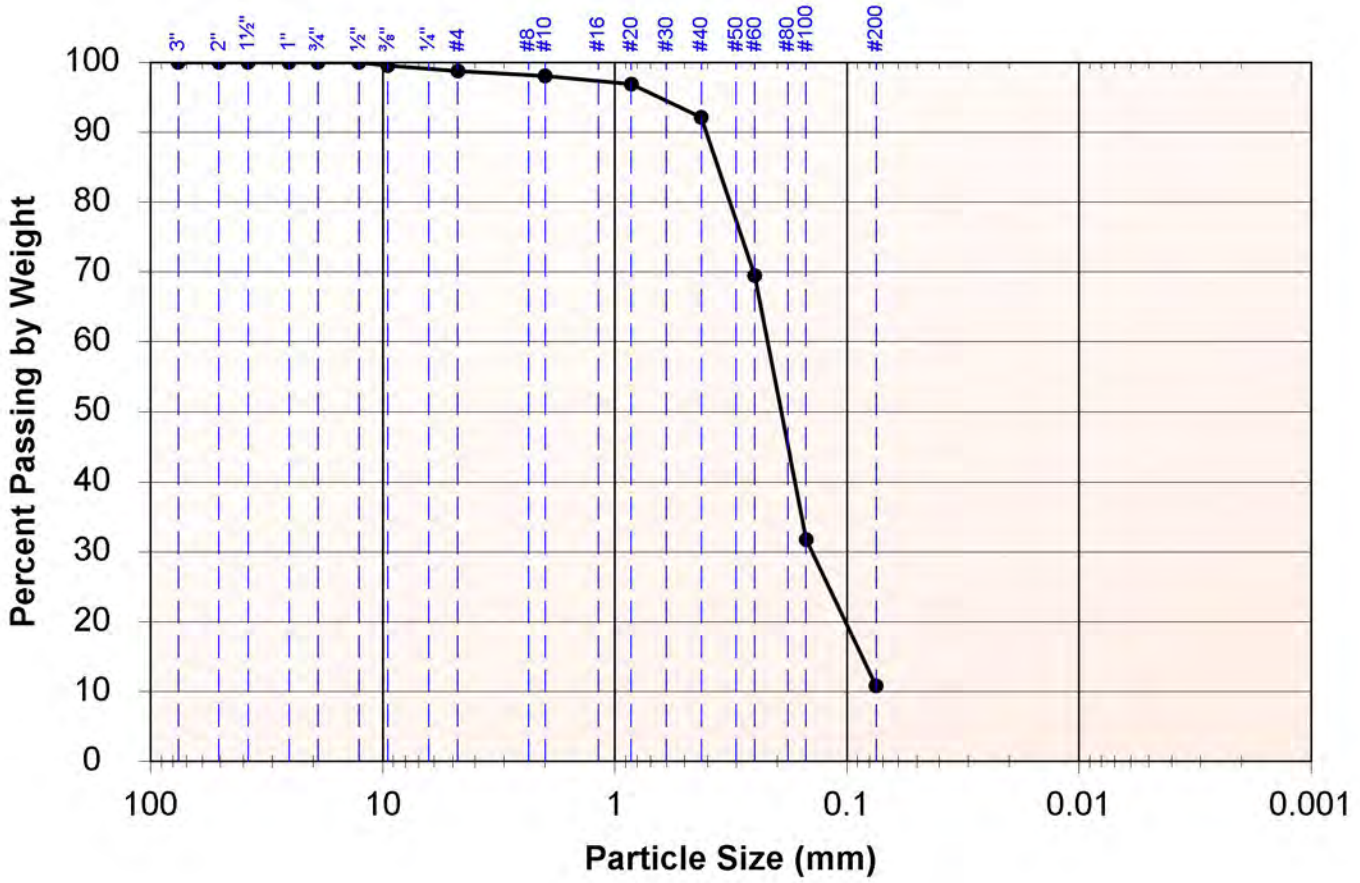
ASTM D422

Location: B15-N 75-77

Lab Number	2012-246
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Poorly Graded Sand with Silt, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	100%	
#4	99%	
Total Weight of Coarse Fraction: 968.8g		
#10	98%	
#20	97%	
#40	92%	
#60	69%	
#100	32%	
#200	10.8%	
Total Weight of Fine Fraction: 481.4g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

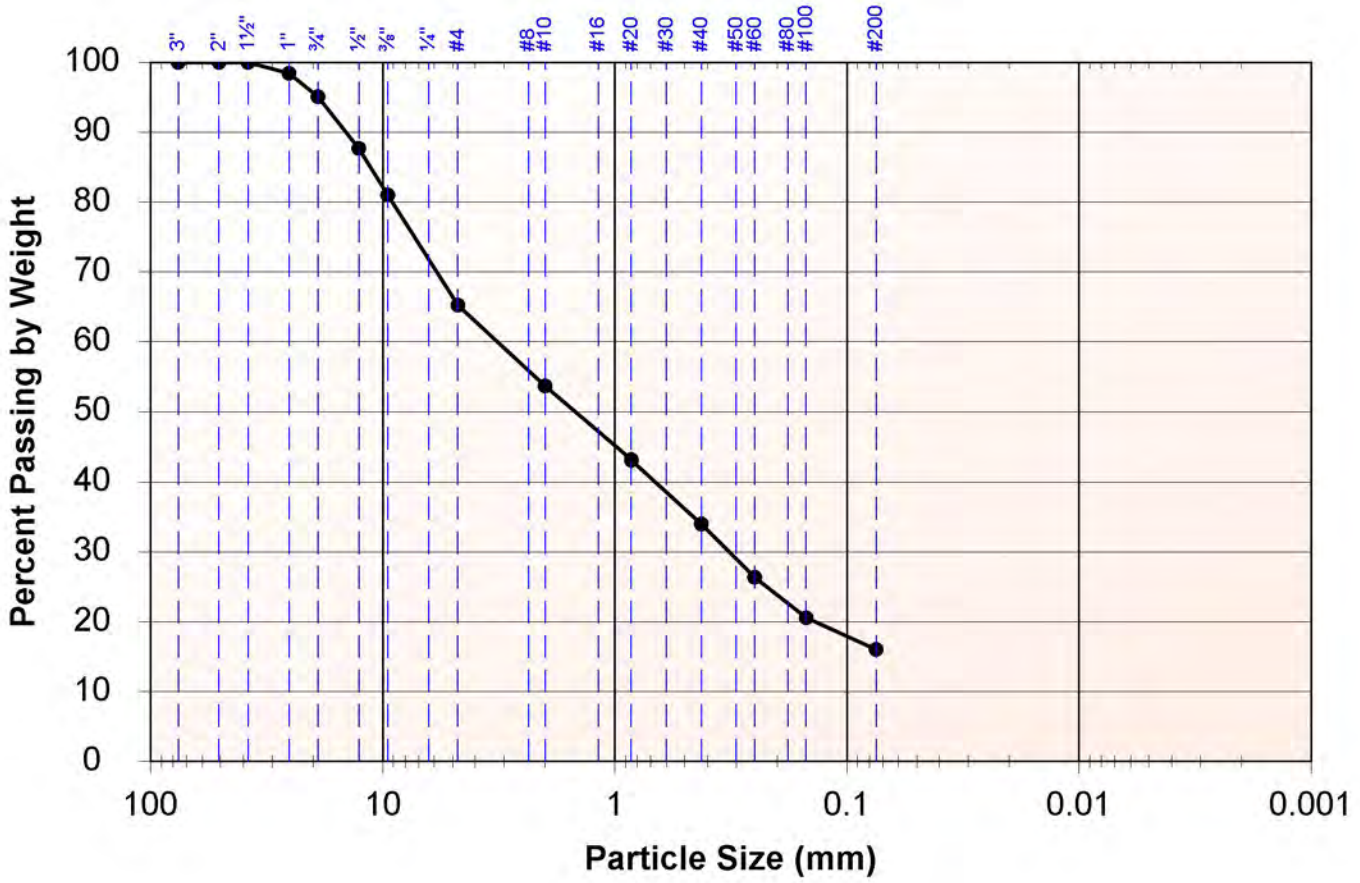
ASTM D422

Location: B16-C 20-22

Lab Number	2012-248
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	98%	
¾"	95%	
½"	88%	
⅜"	81%	
#4	65%	
Total Weight of Coarse Fraction: 2427g		
#10	54%	
#20	43%	
#40	34%	
#60	26%	
#100	21%	
#200	16%	
Total Weight of Fine Fraction: 398.5g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

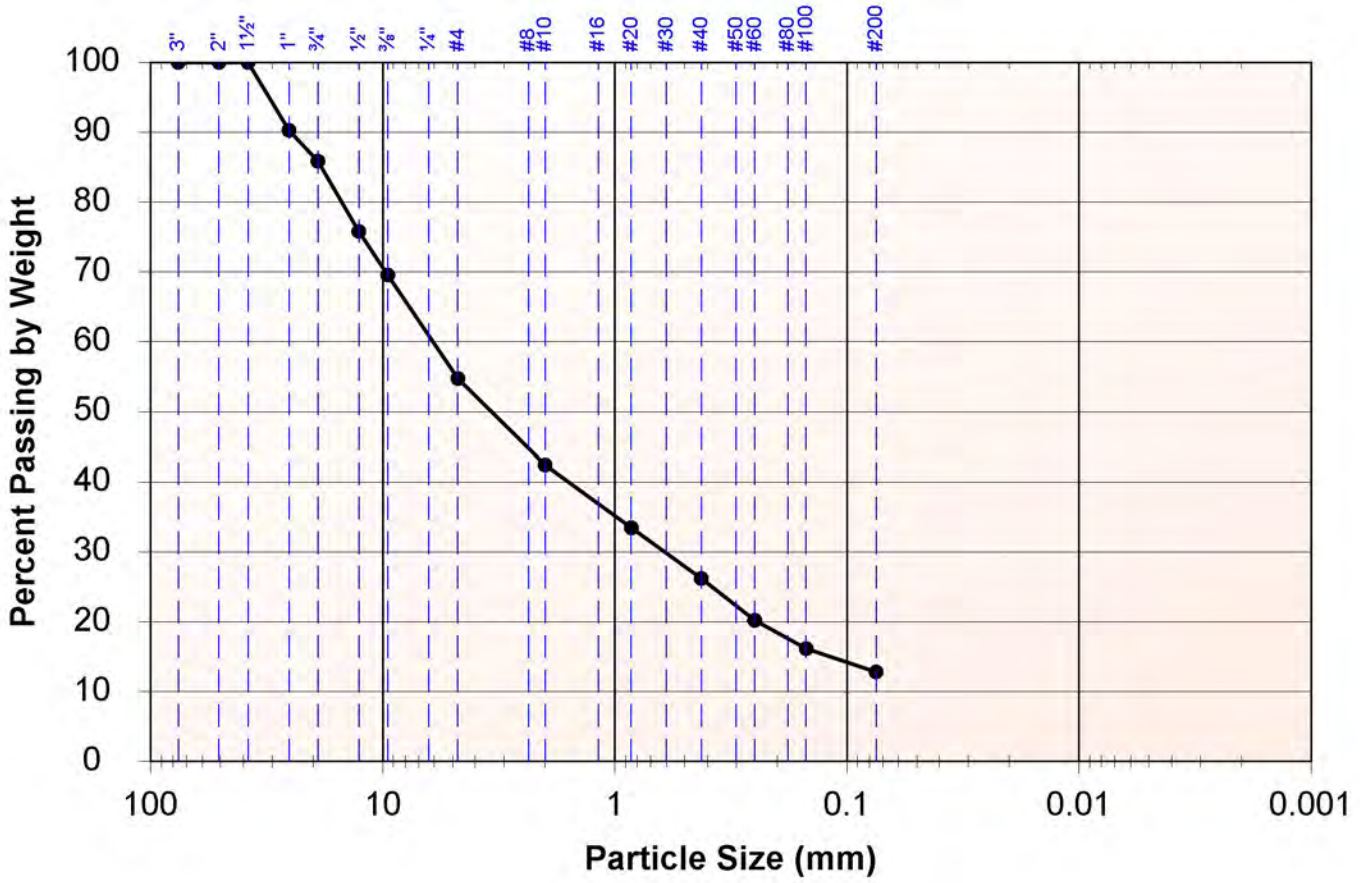
ASTM D422

Location: B16-D 25-27
Moisture as Received = 6%

Lab Number	2012-249
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Gravel with Sand, GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	90%	
¾"	86%	
½"	76%	
⅜"	70%	
#4	55%	
Total Weight of Coarse Fraction: 1877.6g		
#10	42%	
#20	33%	
#40	26%	
#60	20%	
#100	16%	
#200	12.8%	
Total Weight of Fine Fraction: 486.6g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

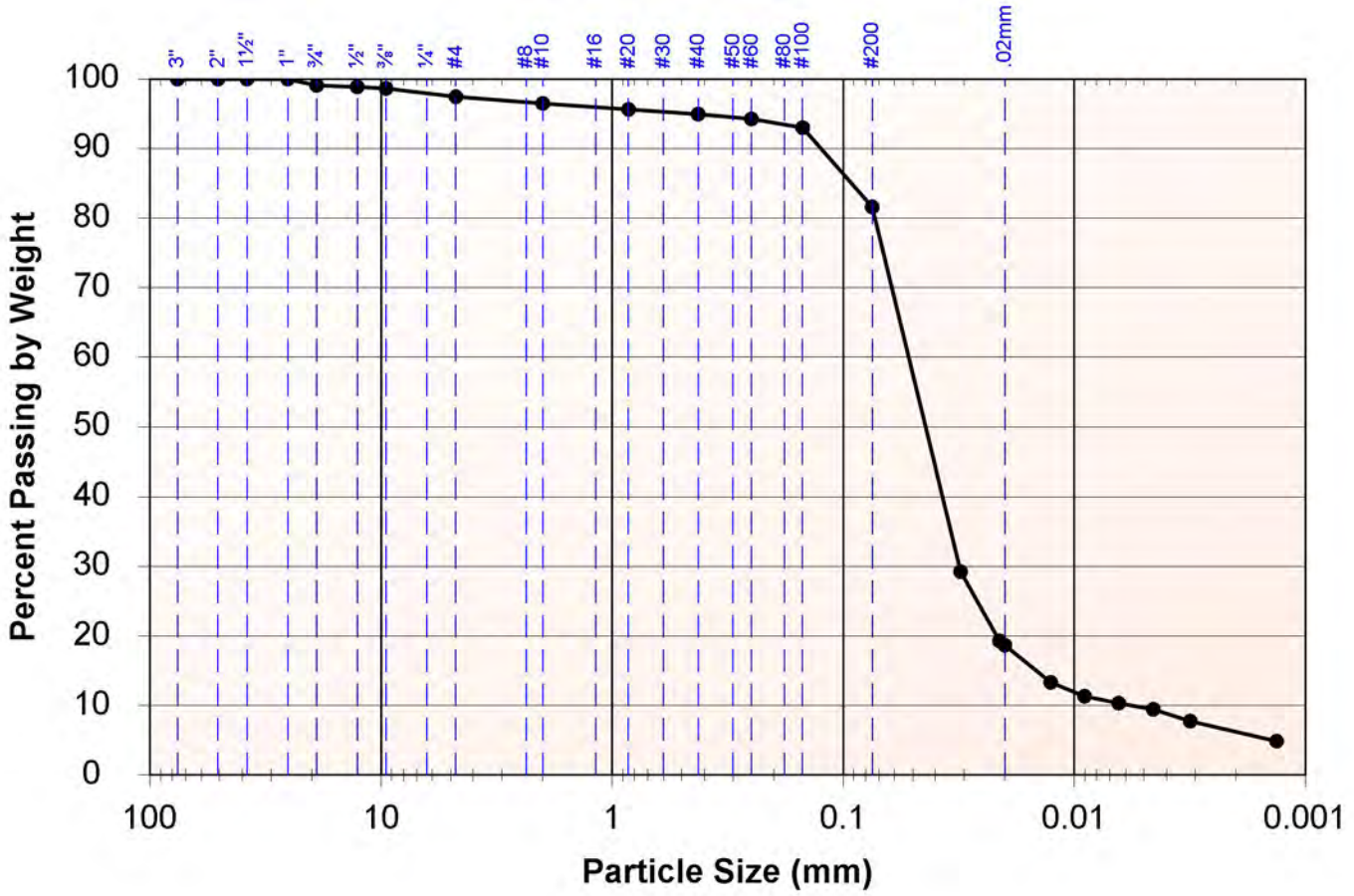
ASTM D422

Location: B16-H 45-47

Lab Number	2012-250
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silt with Sand, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	99%	
½"	99%	
⅜"	99%	
#4	97%	
Total Weight of Coarse Fraction: 2306g		
#10	96%	
#20	96%	
#40	95%	
#60	94%	
#100	93%	
#200	81.6%	
Total Weight of Fine Fraction: 341.8g		
0.02 mm	19%	

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

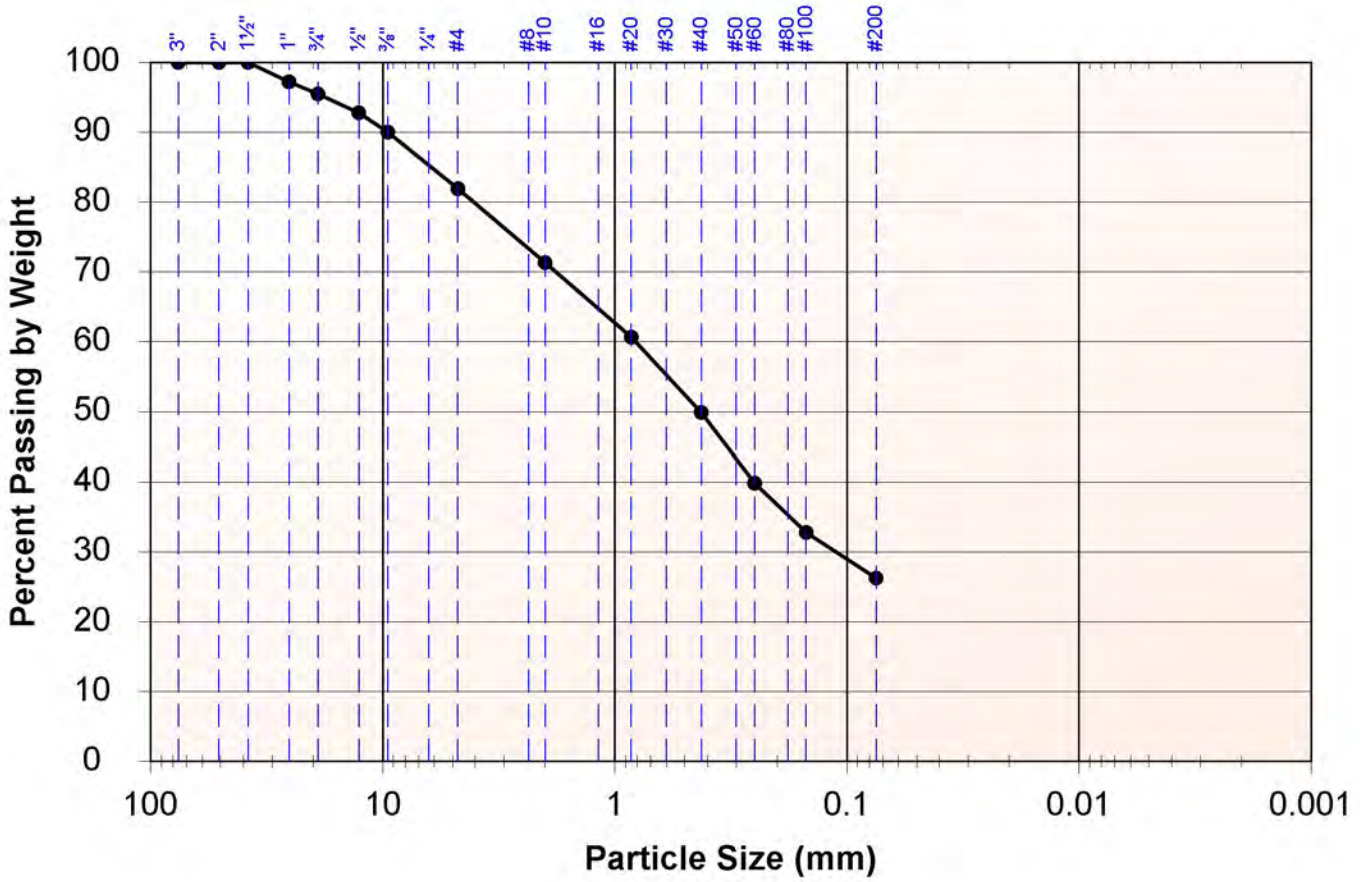
ASTM D422

Location: B16-J 55-57
Moisture as Received = 11%

Lab Number	2012-252
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	97%	
¾"	95%	
½"	93%	
⅜"	90%	
#4	82%	
Total Weight of Coarse Fraction: 1241g		
#10	71%	
#20	61%	
#40	50%	
#60	40%	
#100	33%	
#200	26.3%	
Total Weight of Fine Fraction: 492.1g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

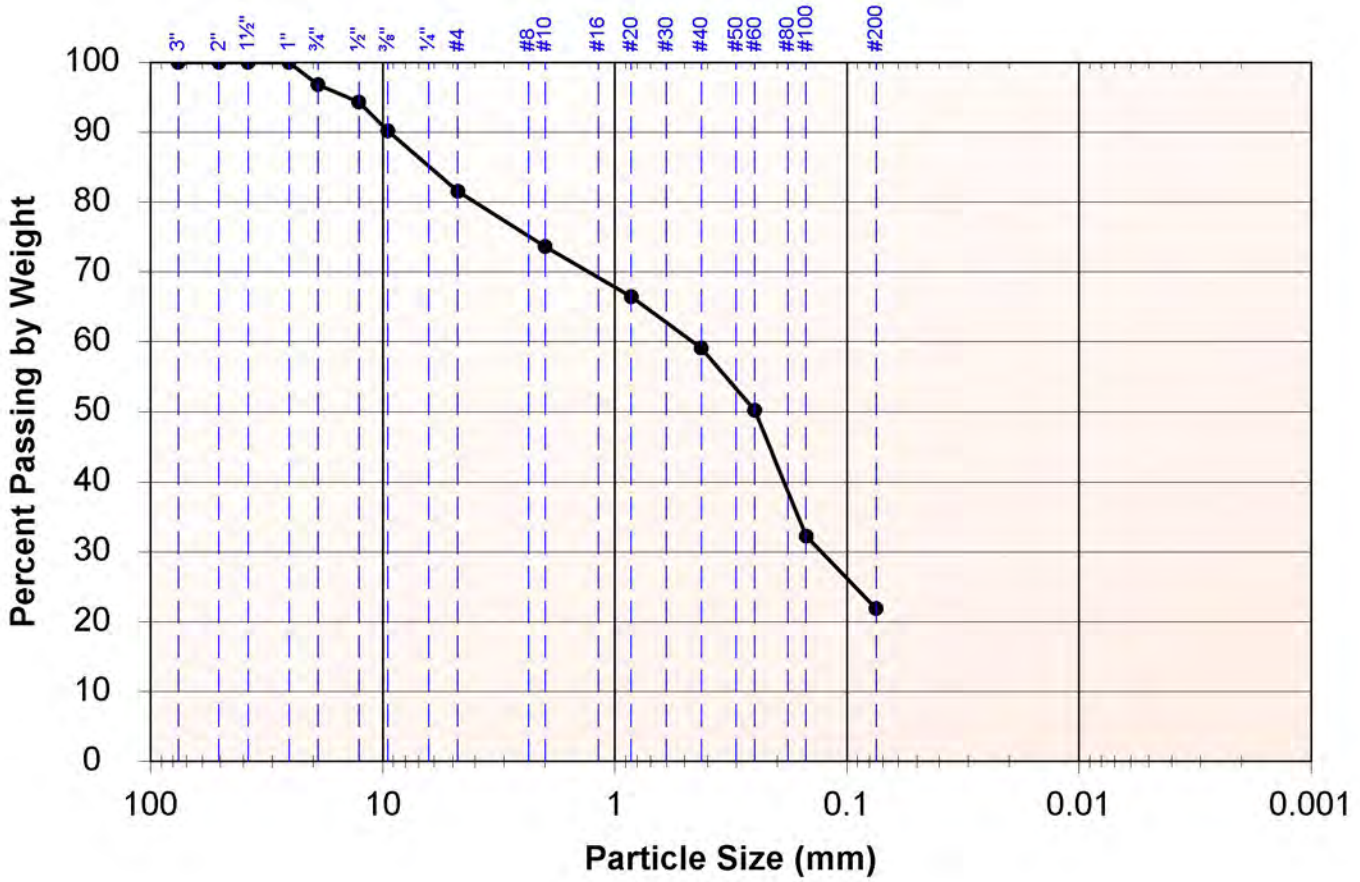
ASTM D422

Location: B16-K 60-62

Lab Number	2012-253
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silty Sand with Gravel, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	97%	
½"	94%	
⅜"	90%	
#4	82%	
Total Weight of Coarse Fraction: 1222.3g		
#10	74%	
#20	66%	
#40	59%	
#60	50%	
#100	32%	
#200	21.9%	
Total Weight of Fine Fraction: 477.8g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

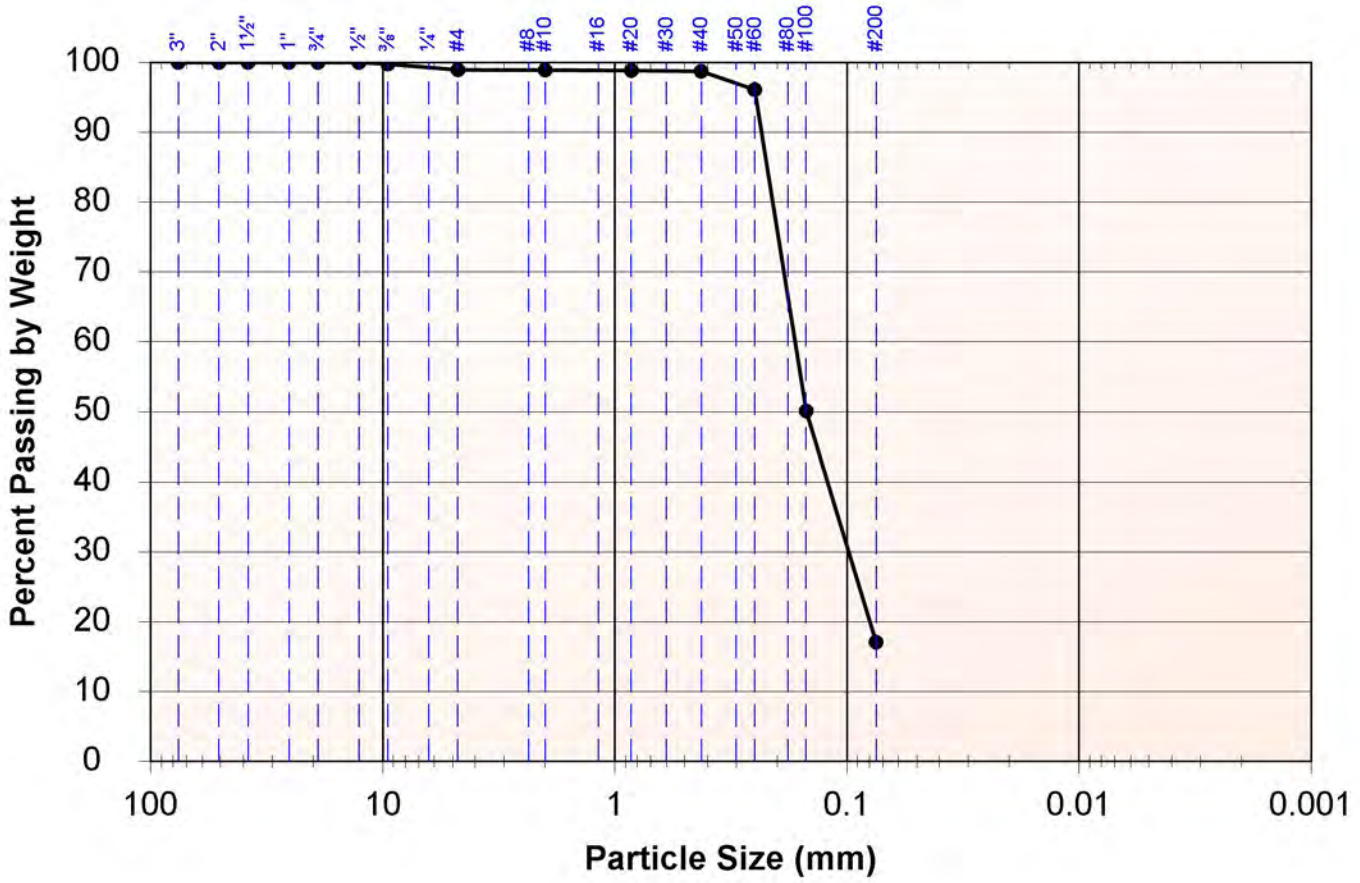
ASTM D422

Location: B16-M 70-71.5
Moisture as Received = 24%

Lab Number	2012-255
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	100%	
#4	99%	
Total Weight of Coarse Fraction: 956.1g		
#10	99%	
#20	99%	
#40	99%	
#60	96%	
#100	50%	
#200	17.1%	
Total Weight of Fine Fraction: 404.9g		

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Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

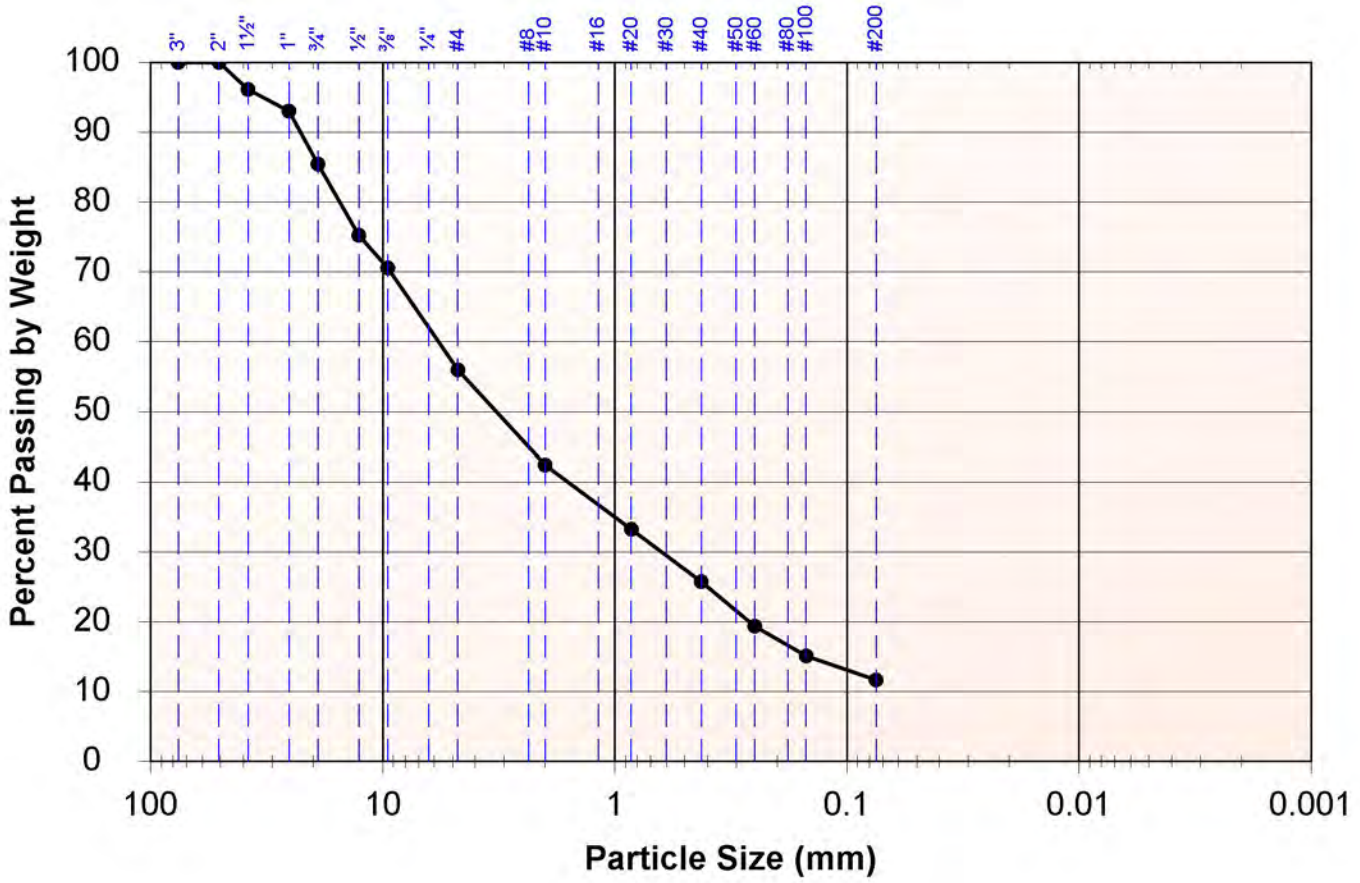
ASTM D422

Location: B17-C 20-22
Moisture as Received = 5%

Lab Number	2012-257
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Sand with Silt and Gravel, SW-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	96%	
1"	93%	
¾"	85%	
½"	75%	
⅜"	71%	
#4	56%	
Total Weight of Coarse Fraction: 2511g		
#10	42%	
#20	33%	
#40	26%	
#60	19%	
#100	15%	
#200	11.7%	
Total Weight of Fine Fraction: 395.8g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

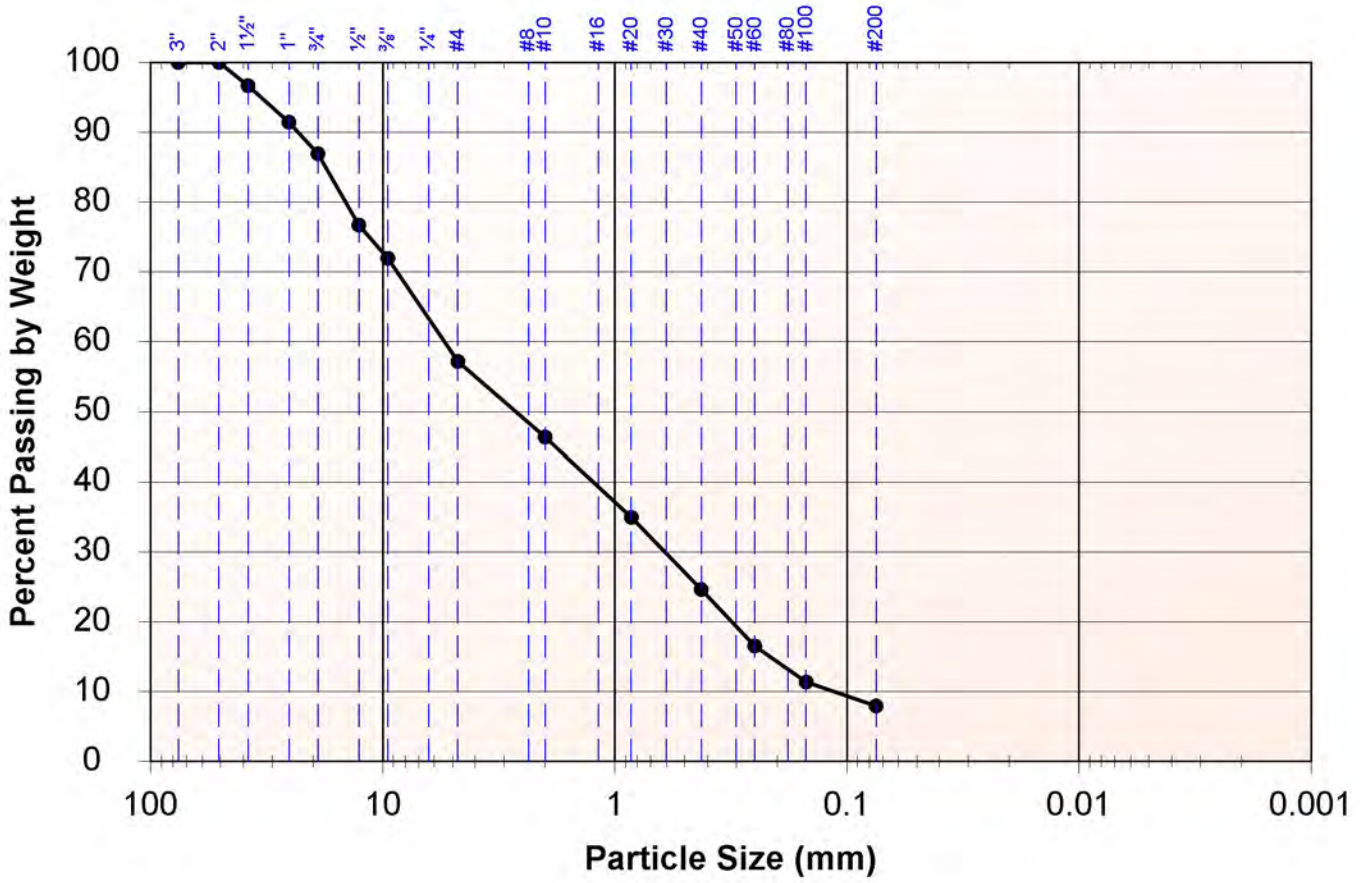
ASTM D422

Location: B17-D 25-27
Moisture as Received = 9

Lab Number	2012-258
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	97%	
1"	91%	
¾"	87%	
½"	77%	
⅜"	72%	
#4	57%	
Total Weight of Coarse Fraction: 3220.5g		
#10	46%	
#20	35%	
#40	25%	
#60	17%	
#100	11%	
#200	8%	
Total Weight of Fine Fraction: 493.3g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

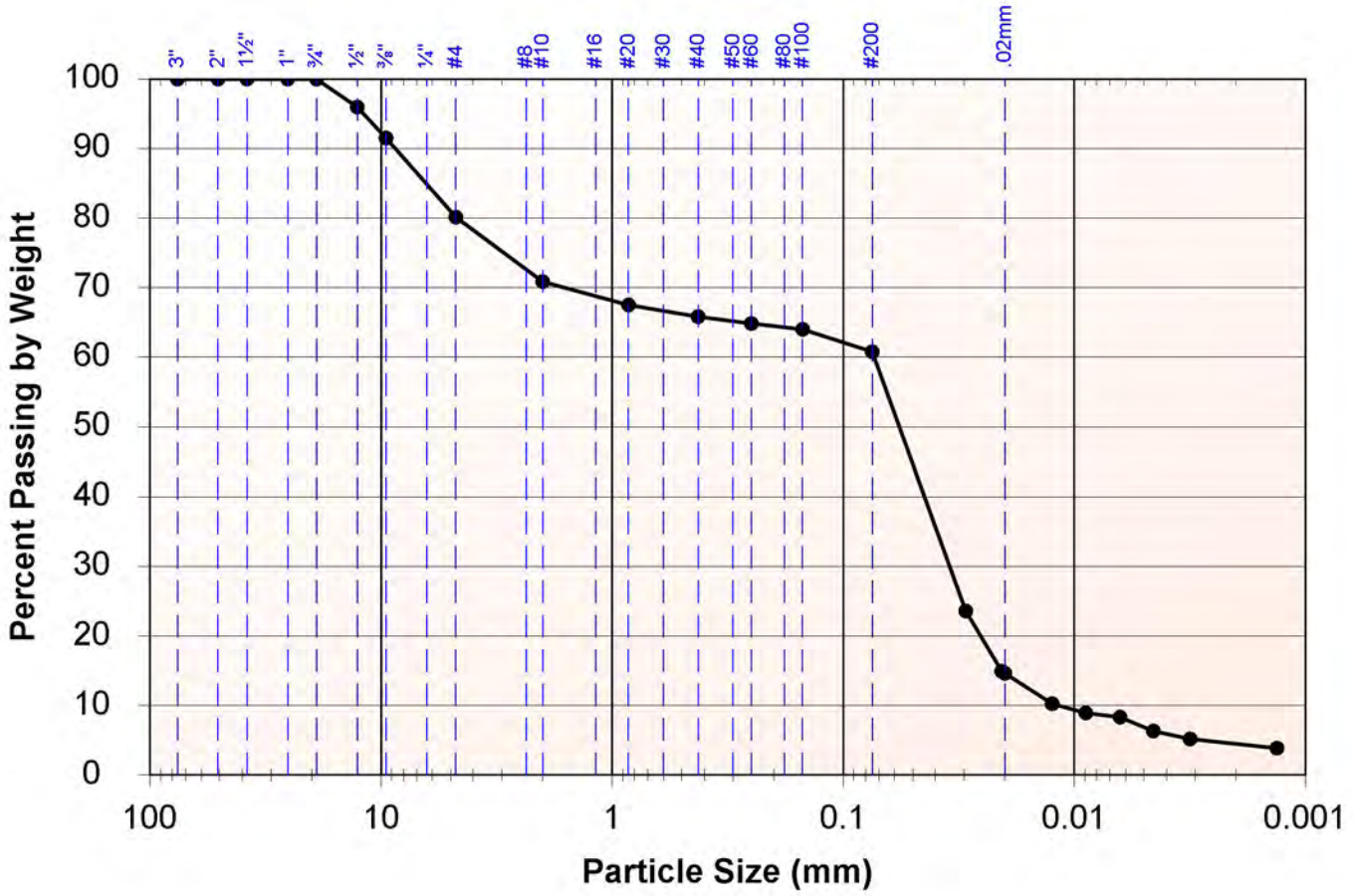
ASTM D422

Location: B17-G 40-42

Lab Number	2012-259
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Gravelly Silt with Sand, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	96%	
⅜"	92%	
#4	80%	
#10	71%	
Total Weight of Coarse Fraction: 747.2g		
#20	68%	
#40	66%	
#60	65%	
#100	64%	
#200	60.8%	
Total Weight of Fine Fraction: 101.3g		
0.02 mm	15%	

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

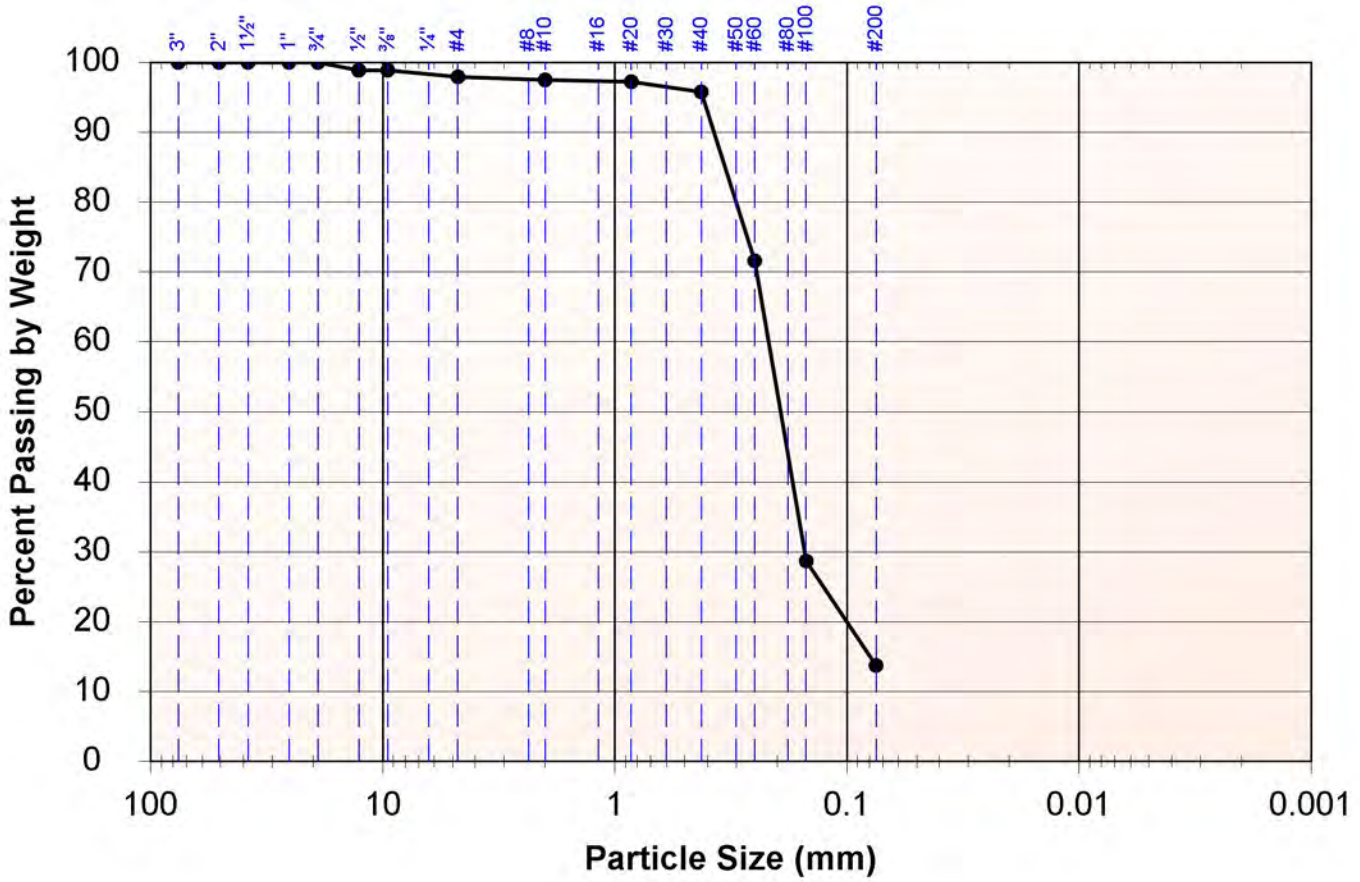
ASTM D422

Location: B17-I 50-52
Moisture as Received = 22%

Lab Number	2012-260
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Silty Sand, SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	99%	
⅜"	99%	
#4	98%	
Total Weight of Coarse Fraction: 816.8g		
#10	97%	
#20	97%	
#40	96%	
#60	72%	
#100	29%	
#200	13.7%	
Total Weight of Fine Fraction: 363.3g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

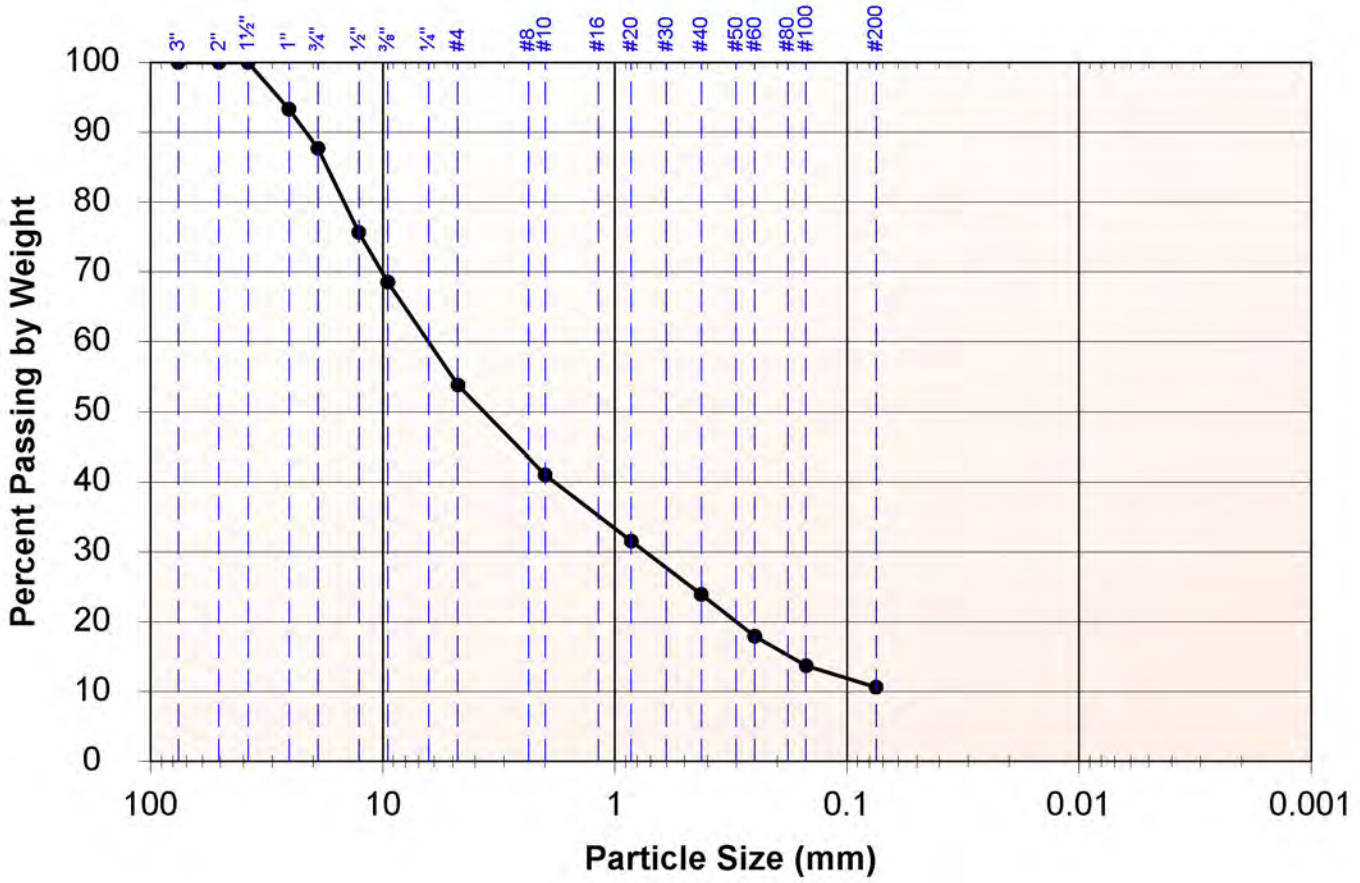
ASTM D422

Location: B18-C 25-27
Moisture as Received = 6%

Lab Number	2012-262
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Gravel with Silt and Sand, GW-GM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	93%	
¾"	88%	
½"	76%	
⅜"	69%	
#4	54%	
Total Weight of Coarse Fraction: 2656.8g		
#10	41%	
#20	32%	
#40	24%	
#60	18%	
#100	14%	
#200	10.6%	
Total Weight of Fine Fraction: 371.6g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

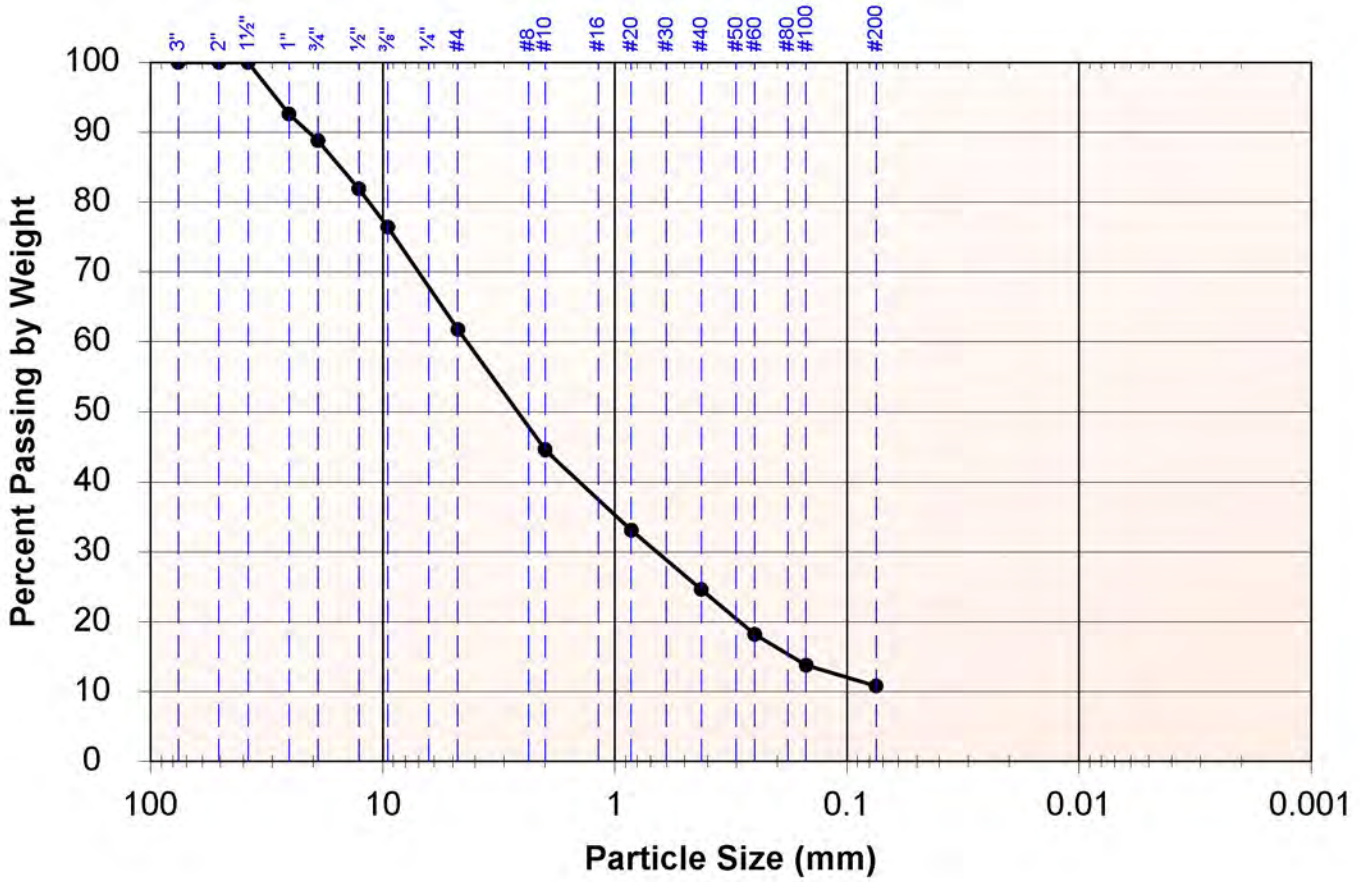
ASTM D422

Location: B18-I 55-57
Moisture as Received =

Lab Number	2012-263
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Well Graded Sand with Silt and Gravel, SW-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	93%	
¾"	89%	
½"	82%	
⅜"	76%	
#4	62%	
Total Weight of Coarse Fraction: 1236.1g		
#10	45%	
#20	33%	
#40	25%	
#60	18%	
#100	14%	
#200	10.8%	
Total Weight of Fine Fraction: 350.7g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

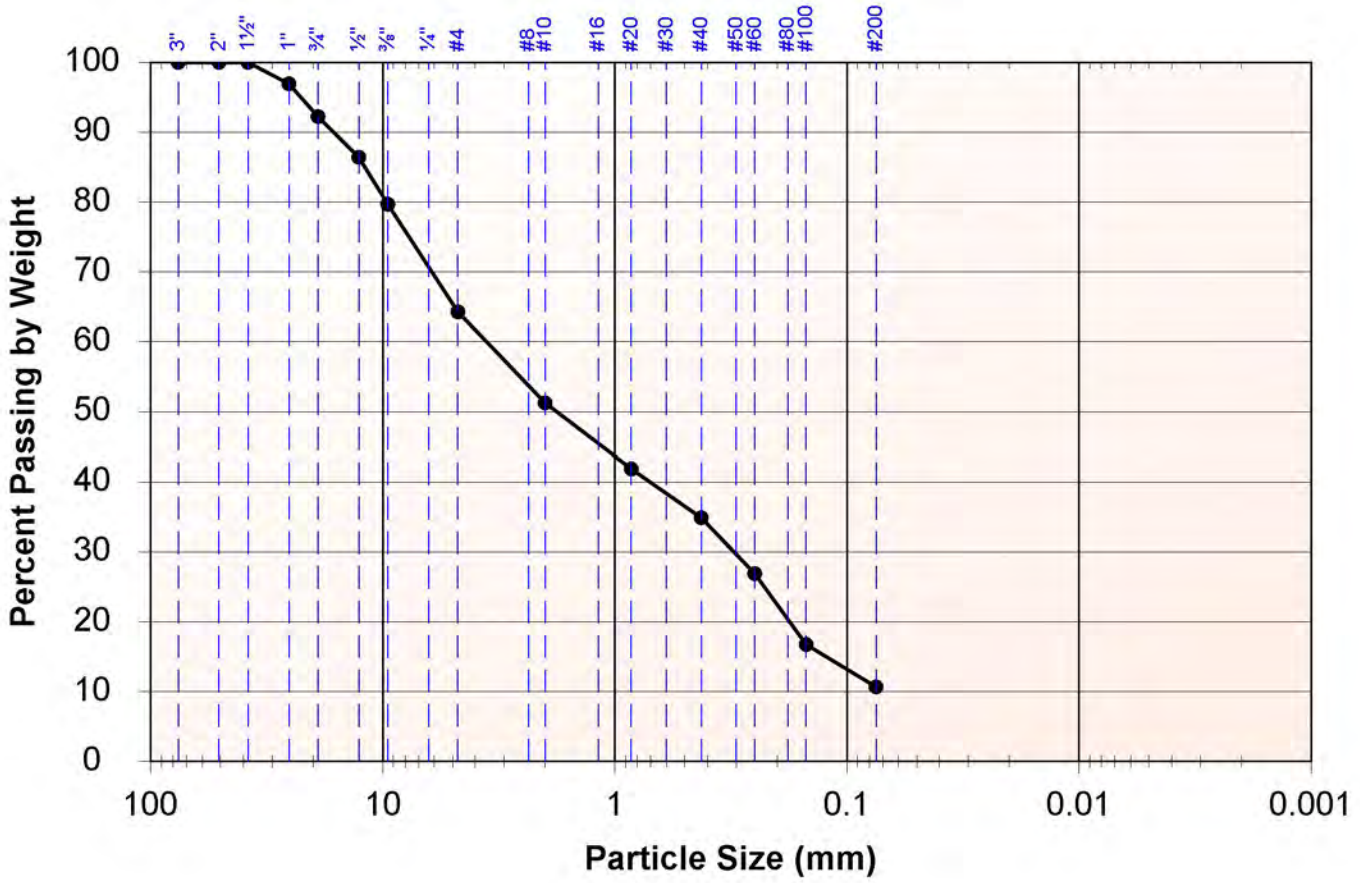
ASTM D422

Location: B18-K 65-67
Moisture as Received = 10%

Lab Number	2012-264
Received	2/24/2012
Reported	3/1/2012

Engineering Classification: **Poorly Graded Sand with Silt and Gravel, SP-SM**

Frost Classification: **Not Measured**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	97%	
¾"	92%	
½"	86%	
⅜"	80%	
#4	64%	
Total Weight of Coarse Fraction: 934.8g		
#10	51%	
#20	42%	
#40	35%	
#60	27%	
#100	17%	
#200	10.7%	
Total Weight of Fine Fraction: 478.7g		

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

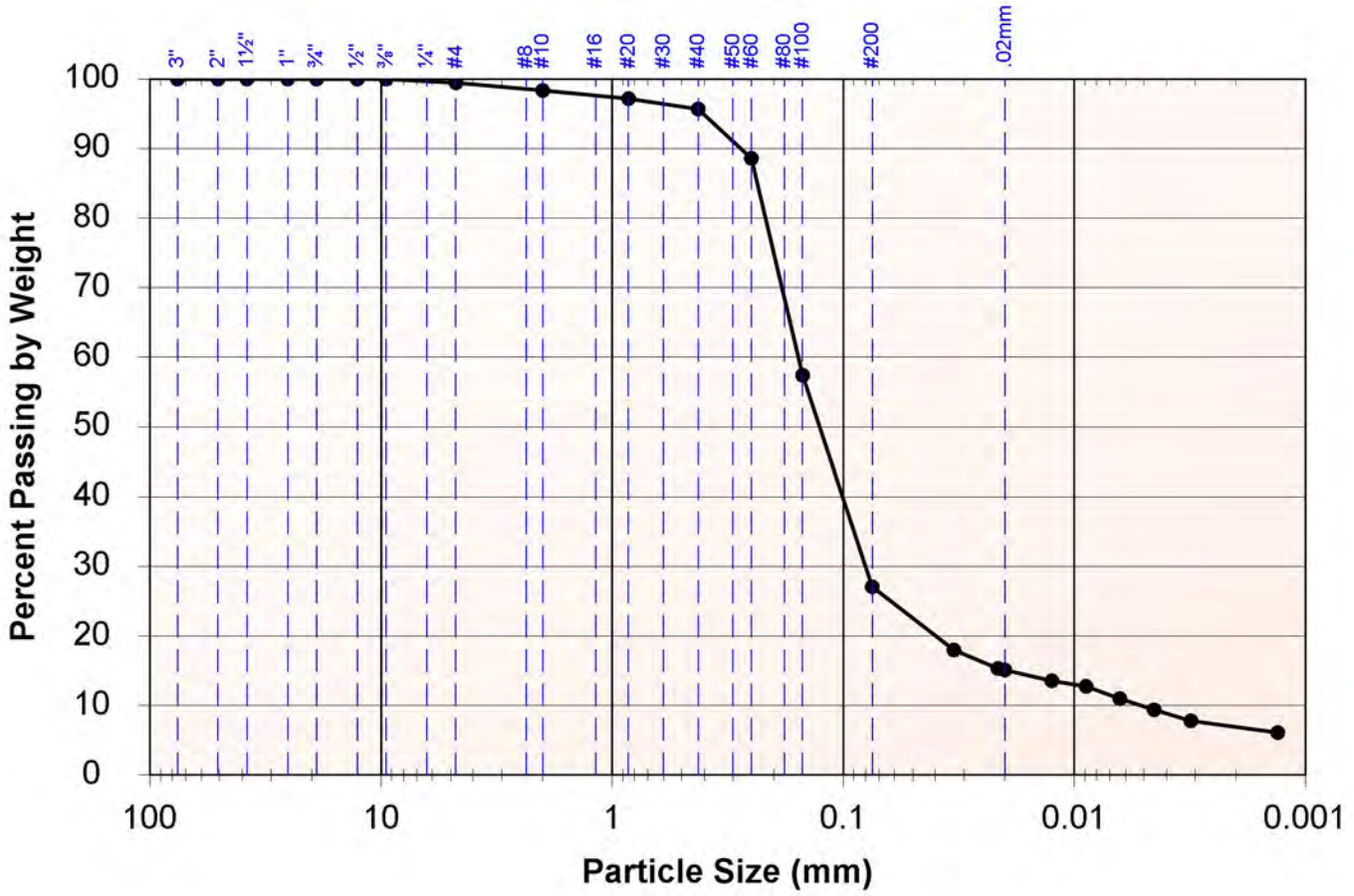
ASTM D422

Location: B18-M 75-77

Lab Number	2012-266
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silty Sand, SM**

Frost Classification: **F2**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	100%	
#4	99%	
#10	98%	
Total Weight of Coarse Fraction: 927.1g		
#20	97%	
#40	96%	
#60	89%	
#100	57%	
#200	27.1%	
Total Weight of Fine Fraction: 109.7g		
0.02 mm	15%	

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

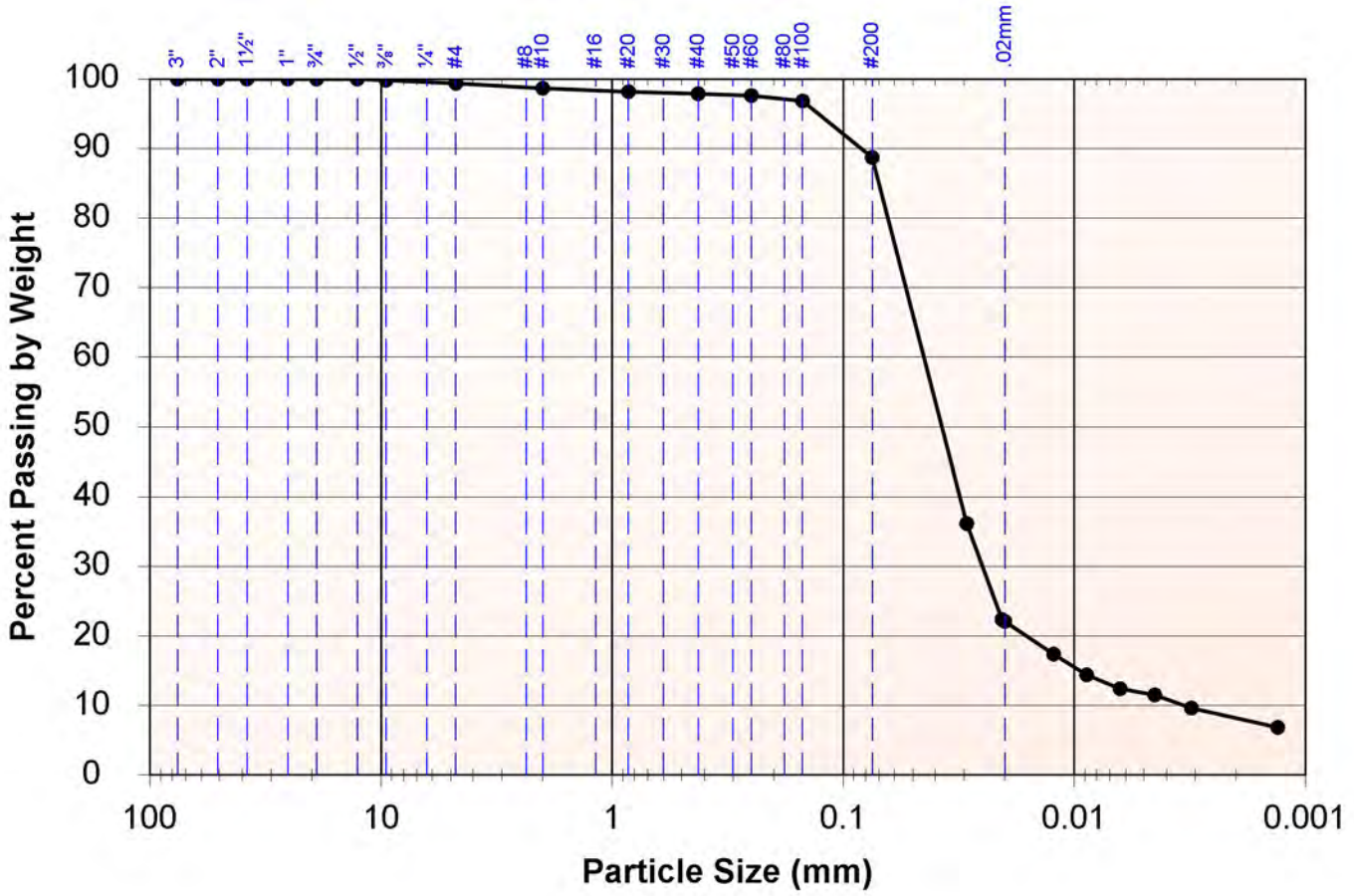
ASTM D422

Location: B6-G 40-42

Lab Number	2012-213
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silt, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	100%	
#4	99%	
Total Weight of Coarse Fraction: 2218g		
#10	99%	
#20	98%	
#40	98%	
#60	98%	
#100	97%	
#200	88.7%	
Total Weight of Fine Fraction: 304.7g		
0.02 mm	22%	

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DOWL HKM

Client: CH2M Hill
Project: POA USACE ZJ01, MOD 01
Work Order: A33329

Particle Size Distribution

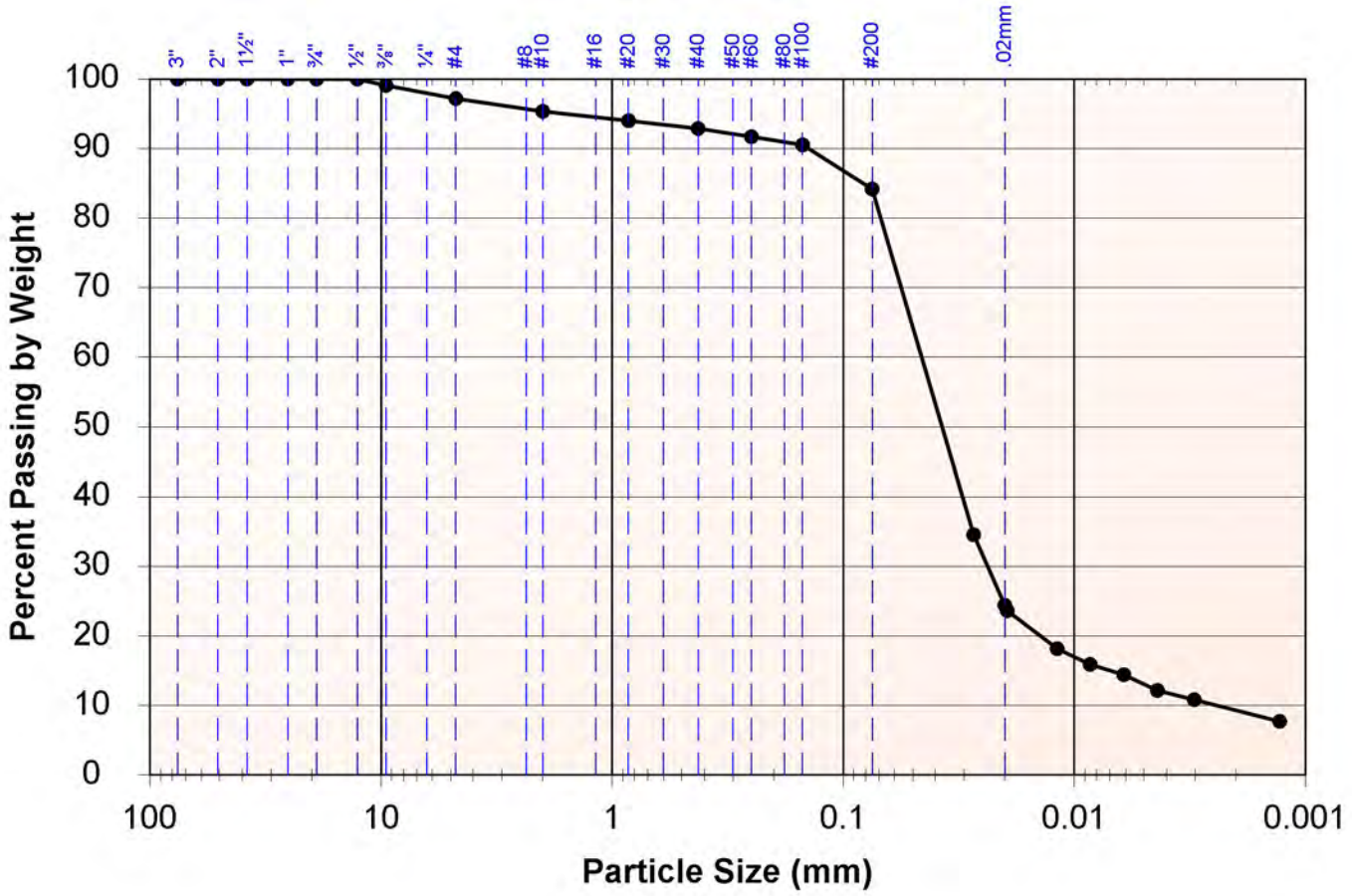
ASTM D422

Location: B3-I 40-42
Moisture as Received = 27.3%

Lab Number	2012-197
Received	2/24/2012
Reported	3/6/2012

Engineering Classification: **Silt with Sand, ML**

Frost Classification: **F4**



Size	Passing	Specification
3"	100%	
2"	100%	
1½"	100%	
1"	100%	
¾"	100%	
½"	100%	
⅜"	99%	
#4	97%	
Total Weight of Coarse Fraction: 800.7g		
#10	95%	
#20	94%	
#40	93%	
#60	92%	
#100	91%	
#200	84.2%	
Total Weight of Fine Fraction: 397.4g		
0.02 mm	24%	

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GeoTesting EXPRESS

125 Nagog Park
Acton, MA 01720
978 635 0424 Tel
978 635 0266 Fax

Transmittal

TO:

Michel Bouchedid, P.E.
CH2M Hill
1100 112th Avenue NE, Suite 400
Bellevue, WA 98004

DATE: 3/19/2012	GTX NO: 11559
RE: Port of Anchorage Expansion	

COPIES	DATE	DESCRIPTION
	3/19/2012	**March 2012 Laboratory Test Report**

REMARKS:

SIGNED: Joe Tomei, Laboratory Manager

CC:

APPROVED BY: Nancy Hubbard, Project Manager

GeoTesting EXPRESS

Boston
Atlanta
New York

www.geotesting.com

March 19, 2012

Michel Bouchedid, P.E.
CH2M Hill
1100 112th Avenue NE
Bellevue, WA 98004

RE: Port of Anchorage Expansion, Anchorage, AK (GTX-11559)

Dear Michel:

Enclosed are the test results you requested for the above referenced project. GeoTesting Express, Inc. (GTX) received five samples from you on 2/21/2012. These samples were labeled as follows:

Boring	Sample	Depth
X	S-1, 2, 3, 4	10-20 ft
X	S-1, 2, 3, 4	20-30 ft
Y	S-1, 2, 3, 4	10-20 ft
Z	S-1, 2, 3, 4	10-20 ft
Z	S-1, 2, 3, 4	20-25 ft

GTX performed the following tests on these samples:

5 ASTM D 2216 - Moisture Content
5 ASTM D 422 - Sieve Analysis
5 ASTM D 4253/D 4254 - Relative Density
11 ASTM D 3080 - Direct Shear Test Points (12-inch shear box)

As requested, the direct shear test specimens were compacted to the specified percent relative density at the as-received moisture content and tested at the requested series of normal loads. See the direct shear test reports for sample specific parameters.

The results presented in this report apply only to the items tested. This report shall not be reproduced except in full, without written approval from GeoTesting Express. The remainder of these samples will be retained for a period of sixty (60) days and will then be discarded unless otherwise notified by you. Please call me if you have any questions or require additional information. Thank you for allowing GeoTesting Express the opportunity of providing you with testing services. We look forward to working with you again in the future.

Respectfully yours,

Joe Tomei
Laboratory Manager

GeoTesting
EXPRESS

125 Nagog Park
Acton, MA 01720
978 635 0424 Tel
978 635 0266 Fax

Geotechnical Test Report

3/19/2012

GTX-11559
Port of Anchorage Expansion

Anchorage, AK

Client Project No.: 429235

Prepared for:

CH2M Hill

GeoTesting EXPRESS

Client:	CH2M Hill				
Project:	Port of Anchorage Expansion				
Location:	Anchorage, AK			Project No:	GTX-11559
Boring ID:	---	Sample Type:	---	Tested By:	jek
Sample ID:	---	Test Date:	03/14/12	Checked By:	jdt
Depth :	---	Sample Id:	---		

Moisture Content of Soil - ASTM D 2216-05

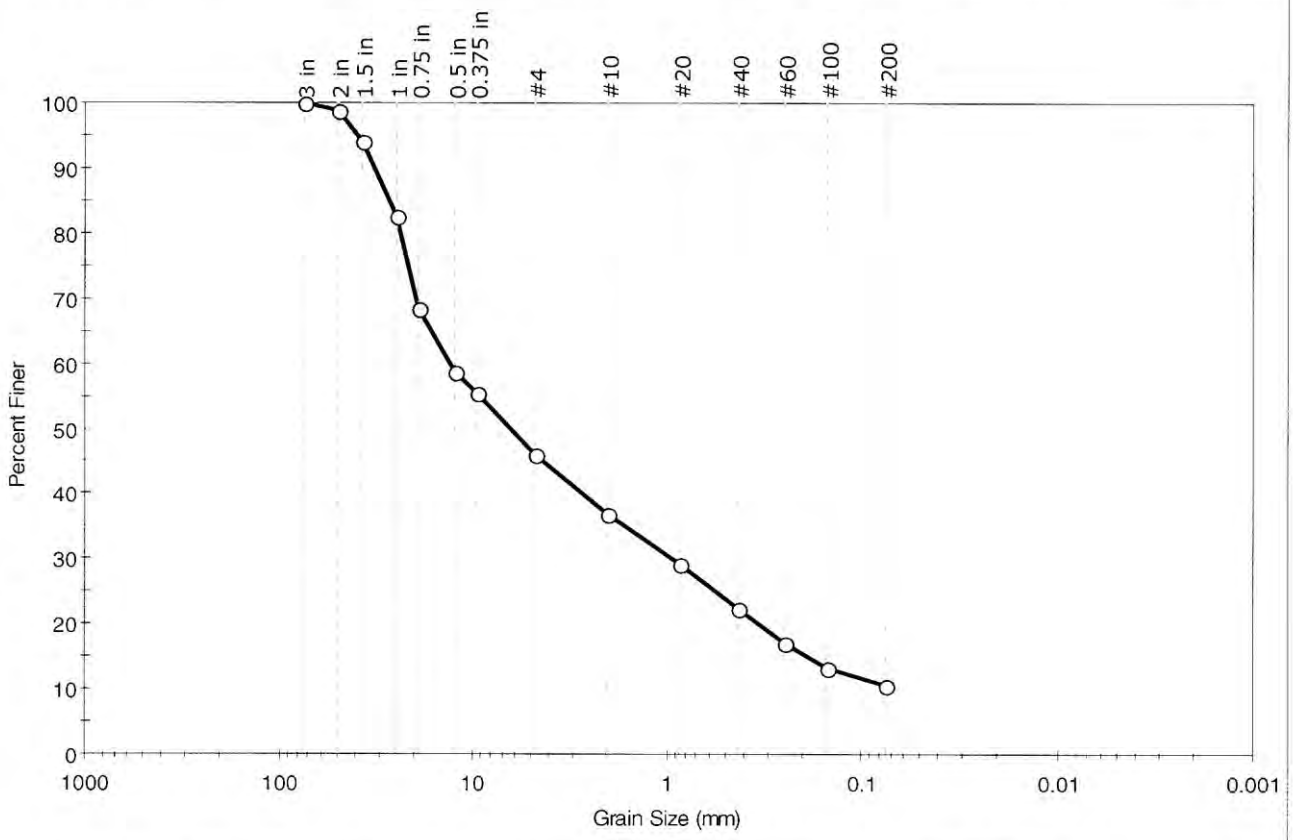
Boring ID	Sample ID	Depth	Description	Moisture Content,%
X	S-1, 2, 3, 4	10-20 ft	Moist, brown gravel with silt and sand	4.7
X	S-1, 2, 3, 4	20-30 ft	Moist, brown sand with silt and gravel	6.1
Y	S-1, 2, 3, 4	10-20 ft	Moist, brown gravel with sand	4.4
Z	S-1, 2, 3, 4	10-20 ft	Moist, brown gravel with silt and sand	4.7
Z	S-1, 2, 3, 4	20-25 ft	Moist, brown gravel with silt and sand	6.5

Notes: Temperature of Drying : 110° Celsius

GeoTesting EXPRESS

Client:	CH2M Hill				
Project:	Port of Anchorage Expansion				
Location:	Anchorage, AK			Project No:	GTX-11559
Boring ID:	X	Sample Type:	bucket	Tested By:	jbr
Sample ID:	S-1, 2, 3, 4	Test Date:	02/29/12	Checked By:	jdt
Depth :	10-20 ft	Test Id:	230861		
Test Comment:	---				
Sample Description:	Moist, brown gravel with silt and sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	53.9	35.5	10.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	99		
1.5 in	37.50	94		
1 in	25.00	83		
0.75 in	19.00	68		
0.5 in	12.50	59		
0.375 in	9.50	55		
#4	4.75	46		
#10	2.00	37		
#20	0.85	29		
#40	0.42	22		
#60	0.25	17		
#100	0.15	13		
#200	0.075	11		

Coefficients

D_{85} = 27.2347 mm	D_{30} = 0.9403 mm
D_{60} = 13.1867 mm	D_{15} = 0.1876 mm
D_{50} = 6.3379 mm	D_{10} = 0.0637 mm
C_u = 207.013	C_c = 1.053

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

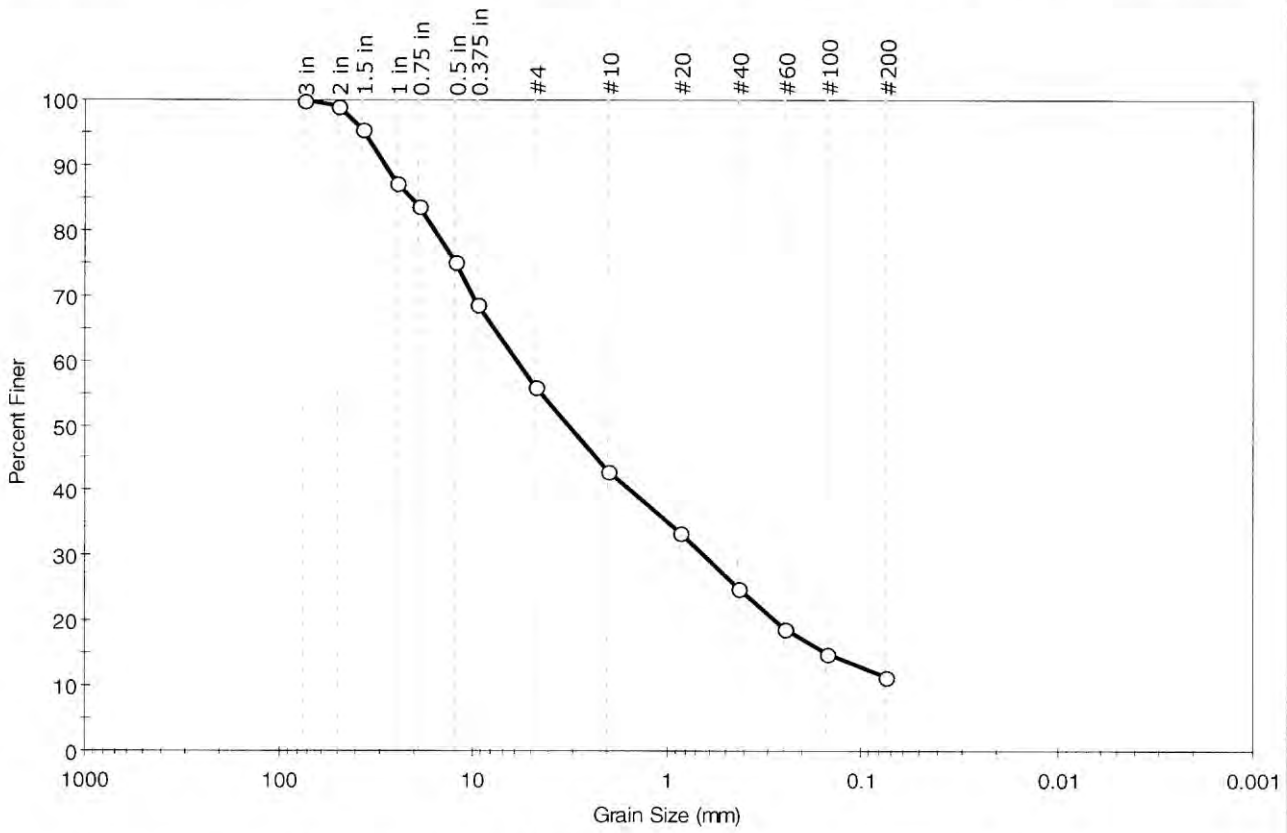
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	CH2M Hill				
Project:	Port of Anchorage Expansion				
Location:	Anchorage, AK			Project No:	GTX-11559
Boring ID:	X	Sample Type:	bucket	Tested By:	jbr
Sample ID:	S-1, 2, 3, 4	Test Date:	03/02/12	Checked By:	jdt
Depth :	20-30 ft	Test Id:	230862		
Test Comment:	---				
Sample Description:	Moist, brown sand with silt and gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	43.8	44.6	11.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	99		
1.5 in	37.50	95		
1 in	25.00	87		
0.75 in	19.00	84		
0.5 in	12.50	75		
0.375 in	9.50	69		
#4	4.75	56		
#10	2.00	43		
#20	0.85	34		
#40	0.42	25		
#60	0.25	19		
#100	0.15	15		
#200	0.075	12		

Coefficients

D_{85} = 20.8726 mm	D_{30} = 0.6312 mm
D_{60} = 5.8713 mm	D_{15} = 0.1519 mm
D_{50} = 3.1508 mm	D_{10} = 0.0539 mm
C_u = 108.929	C_c = 1.259

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

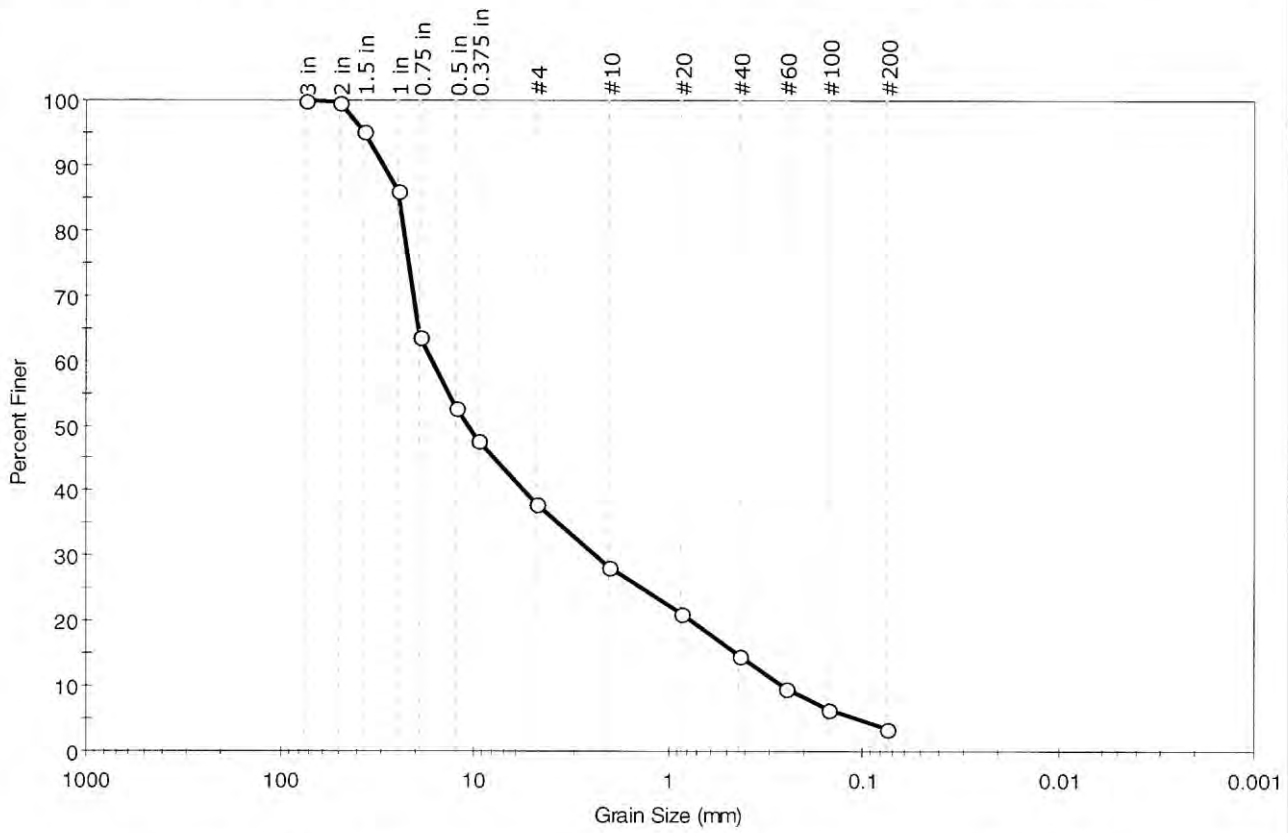
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	CH2M Hill				
Project:	Port of Anchorage Expansion				
Location:	Anchorage, AK			Project No:	GTX-11559
Boring ID:	Y	Sample Type:	bucket	Tested By:	jbr
Sample ID:	S-1, 2, 3, 4	Test Date:	03/02/12	Checked By:	jdt
Depth :	10-20 ft	Test Id:	230863		
Test Comment:	---				
Sample Description:	Moist, brown gravel with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	61.9	34.6	3.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	100		
1.5 in	37.50	95		
1 in	25.00	86		
0.75 in	19.00	64		
0.5 in	12.50	53		
0.375 in	9.50	48		
#4	4.75	38		
#10	2.00	28		
#20	0.85	21		
#40	0.42	15		
#60	0.25	10		
#100	0.15	6		
#200	0.075	4		

Coefficients

D_{85} = 24.6686 mm D_{30} = 2.3349 mm
D_{60} = 16.4672 mm D_{15} = 0.4392 mm
D_{50} = 10.7257 mm D_{10} = 0.2569 mm
C_u = 64.100 C_c = 1.289

Classification

ASTM Well-graded gravel with sand (GW)

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

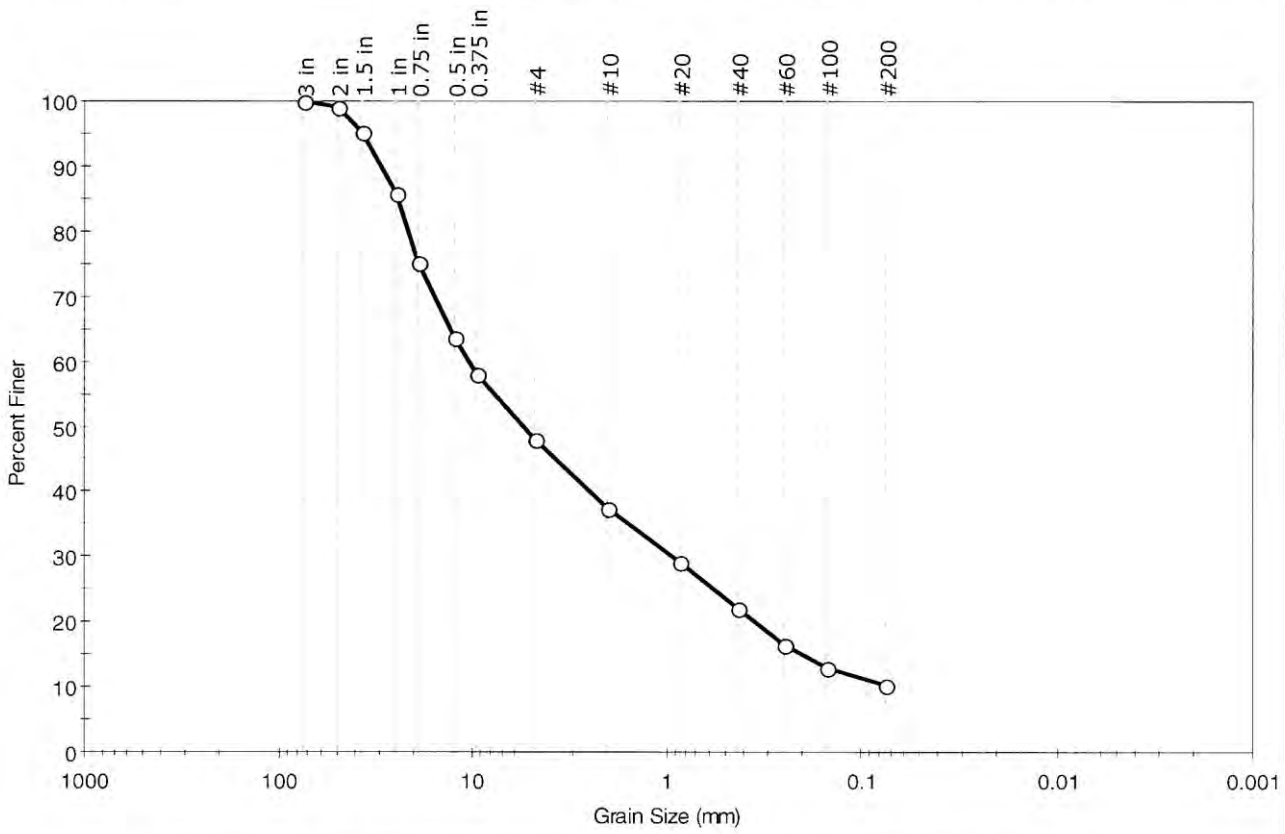
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	CH2M Hill				
Project:	Port of Anchorage Expansion				
Location:	Anchorage, AK			Project No:	GTX-11559
Boring ID:	Z	Sample Type:	bucket	Tested By:	jbr
Sample ID:	S-1, 2, 3, 4	Test Date:	03/02/12	Checked By:	jdt
Depth :	10-20 ft	Test Id:	230864		
Test Comment:	---				
Sample Description:	Moist, brown gravel with silt and sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	51.8	37.9	10.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	99		
1.5 in	37.50	95		
1 in	25.00	86		
0.75 in	19.00	75		
0.5 in	12.50	64		
0.375 in	9.50	58		
#4	4.75	48		
#10	2.00	38		
#20	0.85	29		
#40	0.42	22		
#60	0.25	17		
#100	0.15	13		
#200	0.075	10		

Coefficients

D_{85} = 24.4625 mm D_{30} = 0.9225 mm
D_{60} = 10.4185 mm D_{15} = 0.1999 mm
D_{50} = 5.3952 mm D_{10} = 0.0696 mm
C_u = 149.691 C_c = 1.174

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

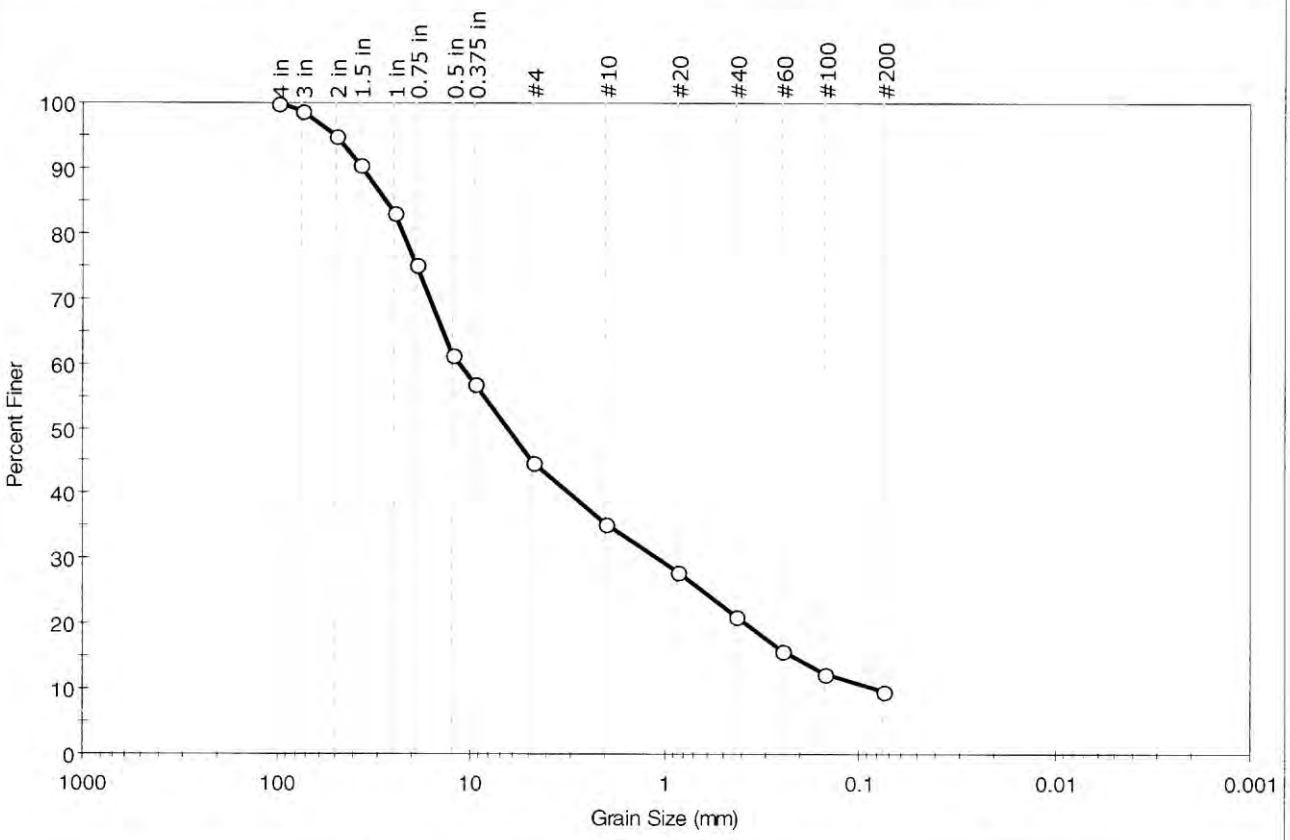
Sand/Gravel Particle Shape : ROUNDED

Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	CH2M Hill				
Project:	Port of Anchorage Expansion				
Location:	Anchorage, AK			Project No:	GTX-11559
Boring ID:	Z	Sample Type:	bucket	Tested By:	jbr
Sample ID:	S-1, 2, 3, 4	Test Date:	03/02/12	Checked By:	jdt
Depth :	20-25 ft	Test Id:	230865		
Test Comment:	---				
Sample Description:	Moist, brown gravel with silt and sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D 422-63 (reapproved 2002)



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	55.2	35.0	9.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
4 in	100.00	100		
3 in	75.00	99		
2 in	50.00	95		
1.5 in	37.50	91		
1 in	25.00	83		
0.75 in	19.00	75		
0.5 in	12.50	61		
0.375 in	9.50	57		
#4	4.75	45		
#10	2.00	35		
#20	0.85	28		
#40	0.42	21		
#60	0.25	16		
#100	0.15	12		
#200	0.075	10		

Coefficients

D_{85} = 27.7197 mm	D_{30} = 1.0851 mm
D_{60} = 11.4503 mm	D_{15} = 0.2166 mm
D_{50} = 6.4003 mm	D_{10} = 0.0799 mm
C_u = 143.308	C_c = 1.287

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (0))

Sample/Test Description

Sand/Gravel Particle Shape : ROUNDED

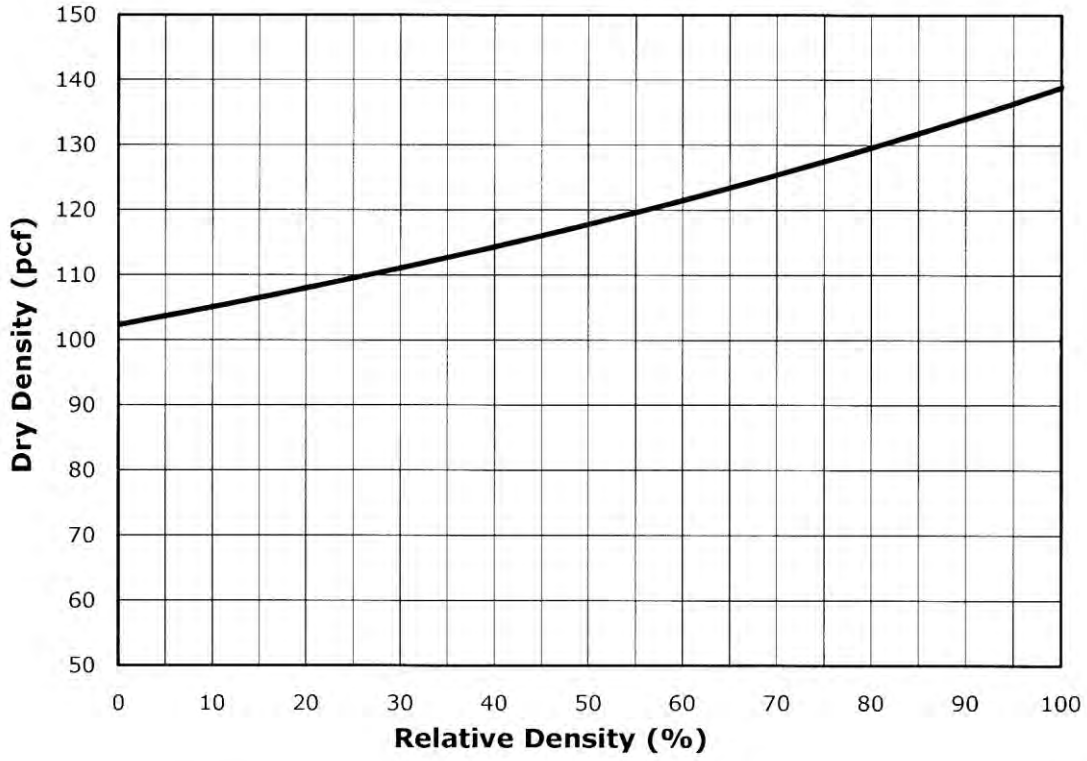
Sand/Gravel Hardness : HARD

GeoTesting EXPRESS

Client:	CH2M Hill
Project Name:	Port of Anchorage Expansion
Project Location:	Archorage, AK
GTX #:	11559
Test Date:	3/2/2012
Tested By:	mgd
Checked By:	jdt
Boring ID:	X
Sample ID:	S-1, 2, 3, 4
Depth, ft.:	10-20

Relative Density Test by ASTM D 4253 / 4254

Relative Density - Dry Method



Minimum Density		102.3	pcf
Maximum Density	Dry Method	138.8	pcf
	Wet Method	---	pcf

Notes: Only Dry Method performed.

GeoTesting EXPRESS

Client:	CH2M Hill	Test Date:	03/02/12
Project Name:	Port of Anchorage Expansion	Tested By:	mgd
Project Location:	Anchorage, AK	Checked By:	jdt
GTX #:	11559		

Minimum Index Density and Unit Weight of Soils by ASTM D 4254 and Maximum Index Density and Unit Weight of Soils Using a Vibratory Table by ASTM D 4253

Boring ID	Sample ID	Depth, ft	Visual Description	Minimum Index Unit Weight, lb/ft^3	Maximum Index Unit Weight, lb/ft^3
X	S-1, 2, 3, 4	10-20	Moist, brown gravel with silt and sand	102.3	138.8

Notes: Minimum index unit weight determined on a dry sample using Method A using a 0.100 ft^3 mold

Maximum index unit weight determined on a dry sample using Method 1A using a 0.100 ft^3 mold

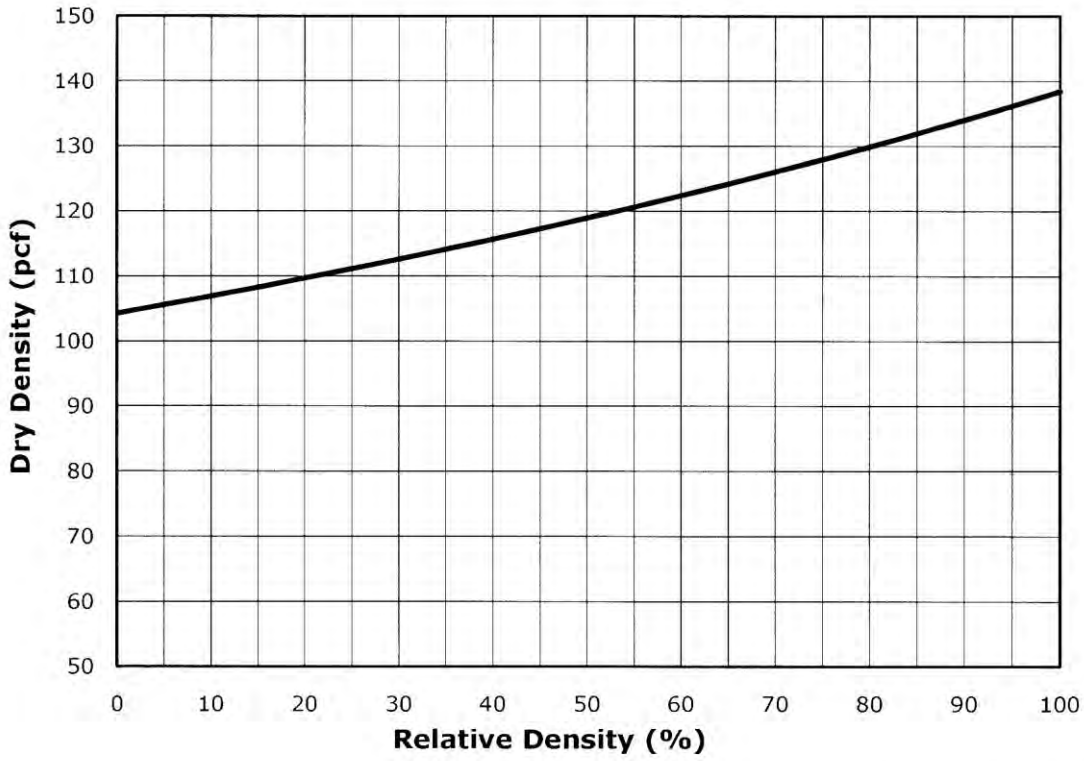
The double amplitude of vertical vibration used to determine the maximum index density was the standard 0.019 $\pm$ 0.003 in.

GeoTesting EXPRESS

Client:	CH2M Hill
Project Name:	Port of Anchorage Expansion
Project Location:	Archorage, AK
GTX #:	11559
Test Date:	3/8/2012
Tested By:	kdm
Checked By:	jdt
Boring ID:	X
Sample ID:	S-1, 2, 3, 4
Depth, ft.:	20-30

Relative Density Test by ASTM D 4253 / 4254

Relative Density - Dry Method



Minimum Density		104.3	pcf
Maximum Density	Dry Method	138.4	pcf
	Wet Method	---	pcf

Notes: Only Dry Method performed.

GeoTesting EXPRESS

Client:	CH2M Hill	Test Date:	03/08/12
Project Name:	Port of Anchorage Expansion	Tested By:	kdm
Project Location:	Anchorage, AK	Checked By:	jdt
GTX #:	11559		

Minimum Index Density and Unit Weight of Soils by ASTM D 4254 and Maximum Index Density and Unit Weight of Soils Using a Vibratory Table by ASTM D 4253

Boring ID	Sample ID	Depth, ft	Visual Description	Minimum Index Unit Weight, lb/ft^3	Maximum Index Unit Weight, lb/ft^3
X	S-1, 2, 3, 4	20-30	Moist, brown sand with silt and gravel	104.3	138.4

Notes: Minimum index unit weight determined on a dry sample using Method A using a 0.100 ft^3 mold

Maximum index unit weight determined on a dry sample using Method 1A using a 0.100 ft^3 mold

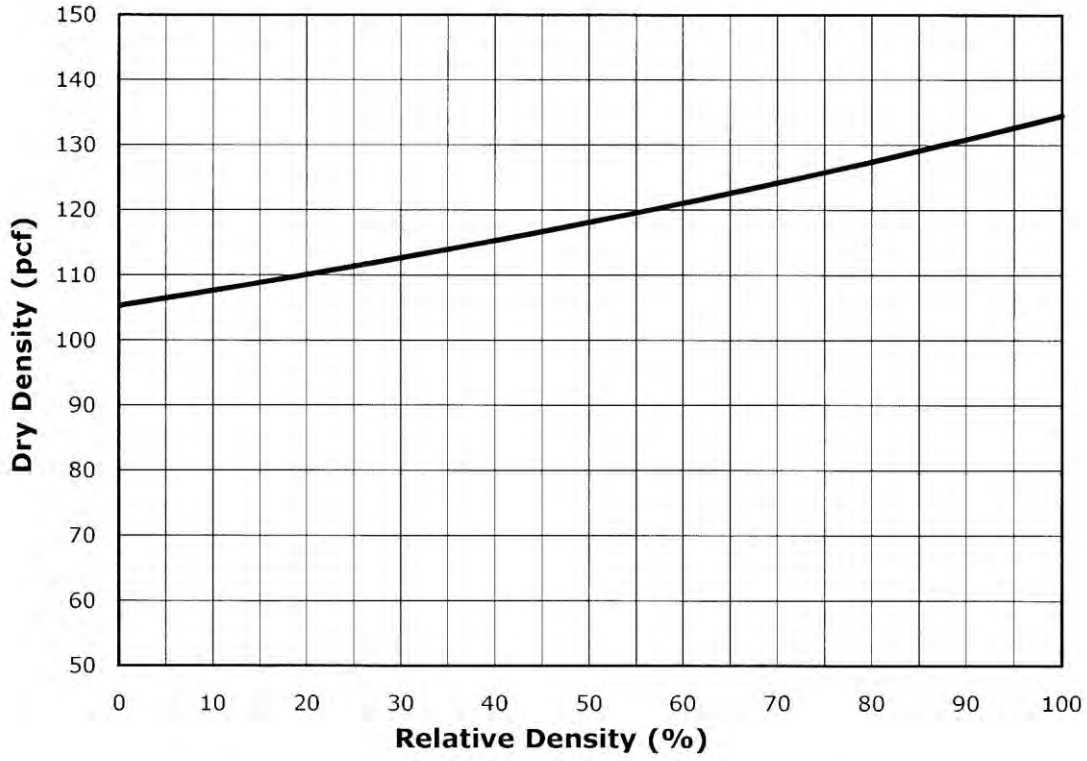
The double amplitude of vertical vibration used to determine the maximum index density was the standard 0.019 $\pm$ 0.003 in.

GeoTesting EXPRESS

Client:	CH2M Hill
Project Name:	Port of Anchorage Expansion
Project Location:	Archorage, AK
GTX #:	11559
Test Date:	3/8/2012
Tested By:	kdm
Checked By:	jdt
Boring ID:	Y
Sample ID:	S-1, 2, 3, 4
Depth, ft.:	10-20

Relative Density Test by ASTM D 4253 / 4254

Relative Density - Dry Method



Minimum Density		105.3	pcf
Maximum Density	Dry Method	134.5	pcf
	Wet Method	---	pcf

Notes: Only Dry Method performed.

GeoTesting EXPRESS

Client:	CH2M Hill	Test Date:	03/08/12
Project Name:	Port of Anchorage Expansion	Tested By:	kdm
Project Location:	Anchorage, AK	Checked By:	jdt
GTX #:	11559		

Minimum Index Density and Unit Weight of Soils by ASTM D 4254 and Maximum Index Density and Unit Weight of Soils Using a Vibratory Table by ASTM D 4253

Boring ID	Sample ID	Depth, ft	Visual Description	Minimum Index Unit Weight, lb/ft^3	Maximum Index Unit Weight, lb/ft^3
Y	S-1, 2, 3, 4	10-20	Moist, brown gravel with sand	105.3	134.5

Notes: Minimum index unit weight determined on a dry sample using Method A using a 0.100 ft^3 mold

Maximum index unit weight determined on a dry sample using Method 1A using a 0.100 ft^3 mold

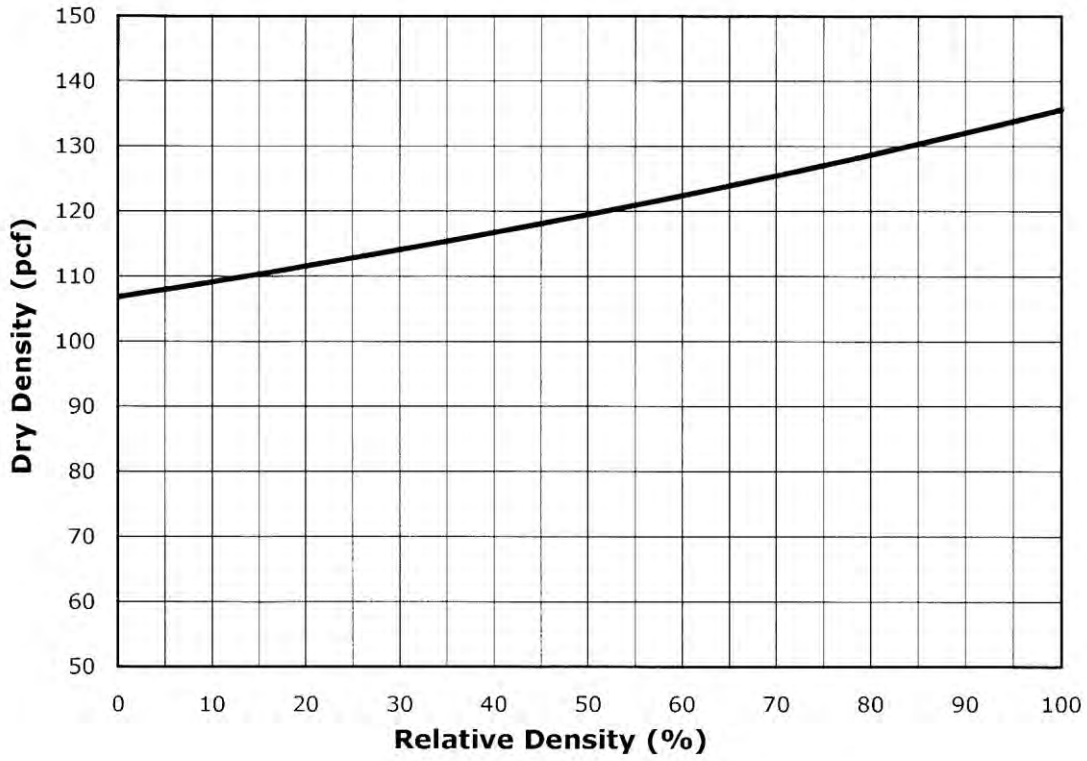
The double amplitude of vertical vibration used to determine the maximum index density was the standard 0.019 $\pm$ 0.003 in.

GeoTesting EXPRESS

Client:	CH2M Hill
Project Name:	Port of Anchorage Expansion
Project Location:	Archorage, AK
GTX #:	11559
Test Date:	3/9/2012
Tested By:	kdm
Checked By:	jdt
Boring ID:	Z
Sample ID:	S-1, 2, 3, 4
Depth, ft.:	10-20

Relative Density Test by ASTM D 4253 / 4254

Relative Density - Dry Method



Minimum Density		106.8	pcf
Maximum Density	Dry Method	135.6	pcf
	Wet Method	---	pcf

Notes: Only Dry Method performed.

GeoTesting EXPRESS

Client:	CH2M Hill	Test Date:	03/09/12
Project Name:	Port of Anchorage Expansion	Tested By:	kdm
Project Location:	Anchorage, AK	Checked By:	jdt
GTX #:	11559		

Minimum Index Density and Unit Weight of Soils by ASTM D 4254 and Maximum Index Density and Unit Weight of Soils Using a Vibratory Table by ASTM D 4253

Boring ID	Sample ID	Depth, ft	Visual Description	Minimum Index Unit Weight, lb/ft^3	Maximum Index Unit Weight, lb/ft^3
Z	S-1, 2, 3, 4	10-20	Moist, brown gravel with silt and sand	106.8	135.6

Notes: Minimum index unit weight determined on a dry sample using Method A using a 0.100 ft^3 mold

Maximum index unit weight determined on a dry sample using Method 1A using a 0.100 ft^3 mold

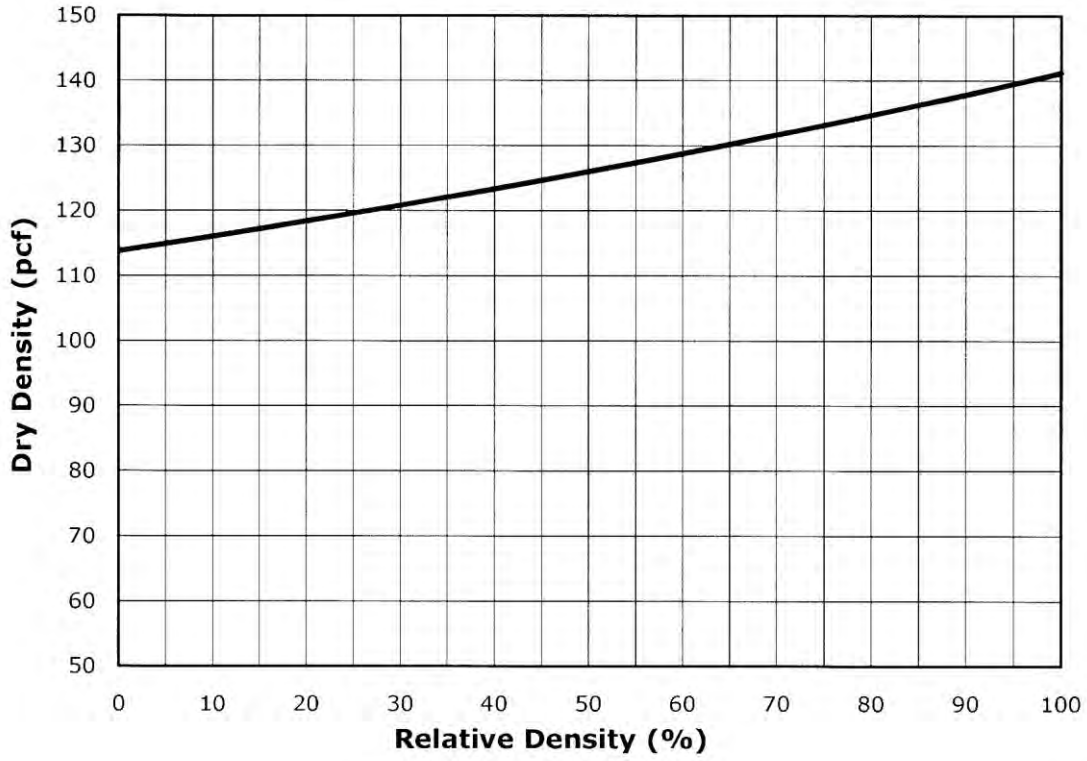
The double amplitude of vertical vibration used to determine the maximum index density was the standard 0.019 $\pm$ 0.003 in.

GeoTesting EXPRESS

Client:	CH2M Hill
Project Name:	Port of Anchorage Expansion
Project Location:	Archorage, AK
GTX #:	11559
Test Date:	3/9/2012
Tested By:	kdm
Checked By:	jdt
Boring ID:	Z
Sample ID:	S-1, 2, 3, 4
Depth, ft.:	20-25

Relative Density Test by ASTM D 4253 / 4254

Relative Density - Dry Method



Minimum Density		113.8	pcf
Maximum Density	Dry Method	141.2	pcf
	Wet Method	---	pcf

Notes: Only Dry Method performed.

GeoTesting EXPRESS

Client:	CH2M Hill	Test Date:	03/09/12
Project Name:	Port of Anchorage Expansion	Tested By:	kdm
Project Location:	Anchorage, AK	Checked By:	jdt
GTX #:	11559		

Minimum Index Density and Unit Weight of Soils by ASTM D 4254 and Maximum Index Density and Unit Weight of Soils Using a Vibratory Table by ASTM D 4253

Boring ID	Sample ID	Depth, ft	Visual Description	Minimum Index Unit Weight, lb/ft^3	Maximum Index Unit Weight, lb/ft^3
Z	S-1, 2, 3, 4	20-25	Moist, brown gravel with silt and sand	113.8	141.2

Notes: Minimum index unit weight determined on a dry sample using Method A using a 0.100 ft^3 mold

Maximum index unit weight determined on a dry sample using Method 1A using a 0.100 ft^3 mold

The double amplitude of vertical vibration used to determine the maximum index density was the standard 0.019 $\pm$ 0.003 in.

GeoTesting EXPRESS

Client:	CH2M Hill		
Project Name:	Port of Anchorage Expansion		
Project Location:	Anchorage, AK		
GTX #:	11559		
Start Date:	02/29/12	Tested By:	bfs
End Date:	03/05/12	Checked By:	jdt
Boring ID:	X		
Sample ID:	S-1, 2, 3, 4		
Depth:	10-20 ft.		
Soil Description:	Moist, brown gravel with silt and sand		

Direct Shear Test Series by ASTM D 3080

Soil Preparation:	Test specimens compacted to 90% Relative Density at the as-received moisture content. All material greater than 1-inch screened out of sample prior to testing.		
Compaction Characteristics:	Minimum Index Unit Weight (ASTM D 4254)	102.3 pcf	
	Maximum Index Unit Weight (ASTM D 4253)	138.8 pcf	
Test Equipment:	Top box = 12 in x 12 in; Bottom box = 16 in x 12 in; Load cells and LVDTs connected to data acquisition system for shear force, normal load and horizontal displacement readings; surface area = 144 in^2		
Maximum Particle Size Used, in:	1	Horizontal Displacement, in/min:	0.02
Soil Height, in:	6	Test Condition:	inundated
Gap Between Boxes, in:	0.25		

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Initial Moisture Content, %	5.1	5.0	5.1	---	---	---
Initial Dry Density, pcf	134	134	134	---	---	---
Relative Density, %	90	90	90	---	---	---
Normal Compressive Stress, psi	10	25	45	---	---	---
Peak Shear Stress, psi	12	34	45	---	---	---
Post Peak Shear Stress, psi	---	---	---	---	---	---
Final Moisture Content, %	7.1	7.7	4.2	---	---	---

Notes:

Peak Friction Angle:	**43.2**	**degrees**
Peak Cohesion:	**5.4**	**psi**
Post Peak Friction Angle:	**---**	**degrees**
Post Peak Cohesion:	**---**	**psi**

Figure a. Shear Force vs. Horizontal Displacement

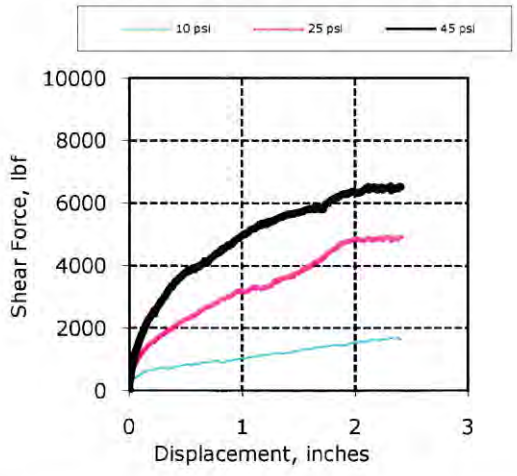
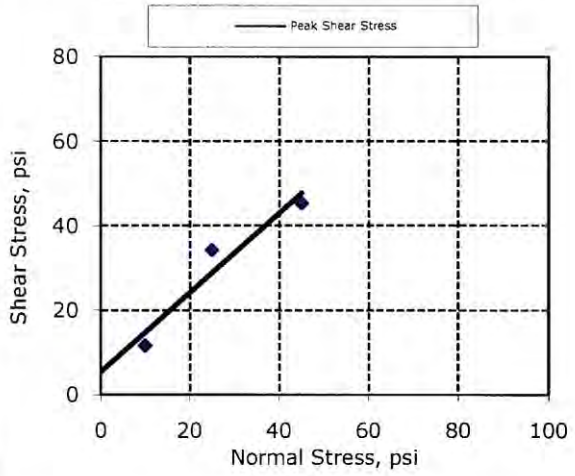


Figure b. Shear Stress vs. Normal Stress



Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material. Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

GeoTesting EXPRESS

Client:	CH2M Hill		
Project Name:	Port of Anchorage Expansion		
Project Location:	Anchorage, AK		
GTX #:	11559		
Start Date:	03/08/12	Tested By:	bfs
End Date:	03/12/12	Checked By:	jdt
Boring ID:	X		
Sample ID:	S-1, 2, 3, 4		
Depth:	20-30 ft		
Soil Description:	Moist, brown sand with silt and gravel		

Direct Shear Test Series by ASTM D 3080

Soil Preparation:	Test specimens compacted to 90% Relative Density at the as-received moisture content. All material greater than 1-inch screened out of sample prior to testing.		
Compaction Characteristics:	Minimum Index Unit Weight (ASTM D 4254)	104.3 pcf	
	Maximum Index Unit Weight (ASTM D 4253)	138.4 pcf	
Test Equipment:	Top box = 12 in x 12 in; Bottom box = 16 in x 12 in; Load cells and LVDTs connected to data acquisition system for shear force, normal load and horizontal displacement readings; surface area = 144 in^2		
Maximum Particle Size Used, in:	1	Horizontal Displacement, in/min:	0.02
Soil Height, in:	6	Test Condition:	inundated
Gap Between Boxes, in:	0.25		

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Initial Moisture Content, %	5.3	5.5	5.7	5.2	---	---
Initial Dry Density, pcf	135	134	134	135	---	---
Relative Density, %	90	90	90	90	---	---
Normal Compressive Stress, psi	10	25	35	50	---	---
Peak Shear Stress, psi	12	30	37	53	---	---
Post Peak Shear Stress, psi	---	---	---	---	---	---
Final Moisture Content, %	7.8	7.6	7.6	7.5	---	---

Notes:

Peak Friction Angle:	**45.4**	**degrees**
Peak Cohesion:	**2.7**	**psi**
Post Peak Friction Angle:	**---**	**degrees**
Post Peak Cohesion:	**---**	**psi**

Figure a. Shear Force vs. Horizontal Displacement

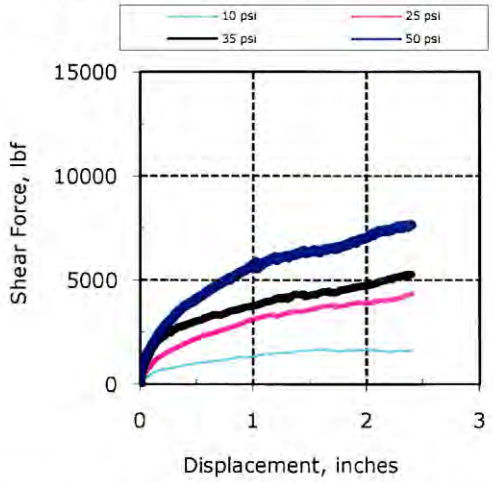
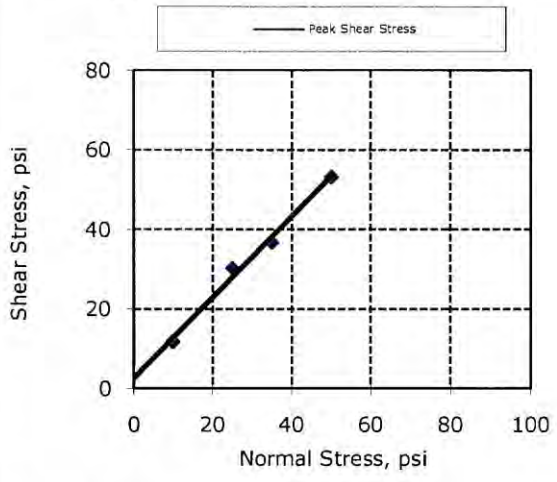


Figure b. Shear Stress vs. Normal Stress



Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material. Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

GeoTesting EXPRESS

Client:	CH2M Hill		
Project Name:	Port of Anchorage Expansion		
Project Location:	Anchorage, AK		
GTX #:	11559		
Start Date:	03/07/12	Tested By:	bfs
End Date:	03/09/12	Checked By:	jdt
Boring ID:	Y		
Sample ID:	S-1, 2, 3, 4		
Depth:	10-20 ft		
Soil Description:	Moist, brown gravel with sand		

Direct Shear Test Series by ASTM D 3080

Soil Preparation:	Test specimens compacted to 70% Relative Density at the as-received moisture content. All material greater than 1-inch screened out of sample prior to testing.		
Compaction Characteristics:	Minimum Index Unit Weight (ASTM D 4254)	105.3 pcf	
	Maximum Index Unit Weight (ASTM D 4253)	134.5 pcf	
Test Equipment:	Top box = 12 in x 12 in; Bottom box = 16 in x 12 in; Load cells and LVDTs connected to data acquisition system for shear force, normal load and horizontal displacement readings; surface area = 144 in^2		
Maximum Particle Size Used, in:	1	Horizontal Displacement, in/min:	0.02
Soil Height, in:	6	Test Condition:	inundated
Gap Between Boxes, in:	0.25		

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Initial Moisture Content, %	4.4	4.4	4.3	---	---	---
Initial Dry Density, pcf	124	124	124	---	---	---
Relative Density, %	70	70	70	---	---	---
Normal Compressive Stress, psi	10	25	45	---	---	---
Peak Shear Stress, psi	21	29	52	---	---	---
Post Peak Shear Stress, psi	---	---	---	---	---	---
Final Moisture Content, %	7.5	6.5	5.5	---	---	---

Notes:

Peak Friction Angle:	**41.9**	**degrees**
Peak Cohesion:	**10.1**	**psi**
Post Peak Friction Angle:	**---**	**degrees**
Post Peak Cohesion:	**---**	**psi**

Figure a. Shear Force vs. Horizontal Displacement

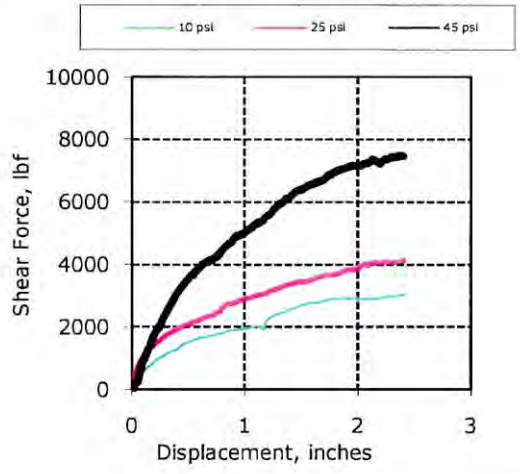
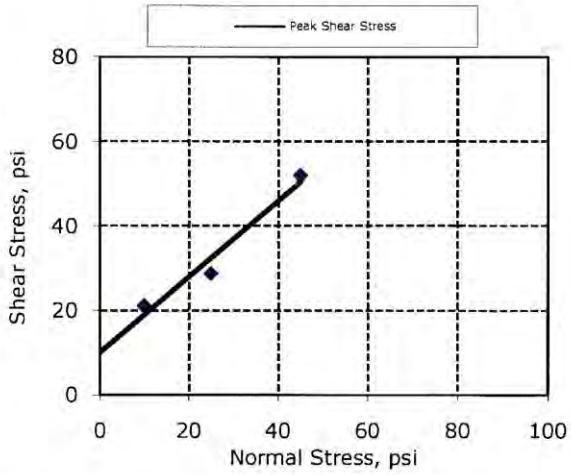


Figure b. Shear Stress vs. Normal Stress



Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material. Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

GeoTesting EXPRESS

Client:	CH2M Hill		
Project Name:	Port of Anchorage Expansion		
Project Location:	Anchorage, AK		
GTX #:	11559		
Start Date:	03/08/12	Tested By:	bfs
End Date:	03/13/12	Checked By:	jdt
Boring ID:	Z		
Sample ID:	S-1, 2, 3, 4		
Depth:	10-20 ft		
Soil Description:	Moist, brown gravel with silt and sand		

Direct Shear Test Series by ASTM D 3080

Soil Preparation:	Test specimens compacted to 50% Relative Density at the as-received moisture content. All material greater than 1-inch screened out of sample prior to testing.		
Compaction Characteristics:	Minimum Index Unit Weight (ASTM D 4254)	106.8 pcf	
	Maximum Index Unit Weight (ASTM D 4253)	135.6 pcf	
Test Equipment:	Top box = 12 in x 12 in; Bottom box = 16 in x 12 in; Load cells and LVDTs connected to data acquisition system for shear force, normal load and horizontal displacement readings; surface area = 144 in^2		
Maximum Particle Size Used, in:	1	Horizontal Displacement, in/min:	0.02
Soil Height, in:	6	Test Condition:	inundated
Gap Between Boxes, in:	0.25		

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Initial Moisture Content, %	4.7	4.7	4.7	---	---	---
Initial Dry Density, pcf	119	119	119	---	---	---
Relative Density, %	50	50	50	---	---	---
Normal Compressive Stress, psi	10	25	45	---	---	---
Peak Shear Stress, psi	16	26	48	---	---	---
Post Peak Shear Stress, psi	---	---	---	---	---	---
Final Moisture Content, %	7.8	7.4	7.1	---	---	---

Notes:

Peak Friction Angle:	**42.8**	**degrees**
Peak Cohesion:	**5.4**	**psi**
Post Peak Friction Angle:	**---**	**degrees**
Post Peak Cohesion:	**---**	**psi**

Figure a. Shear Force vs. Horizontal Displacement

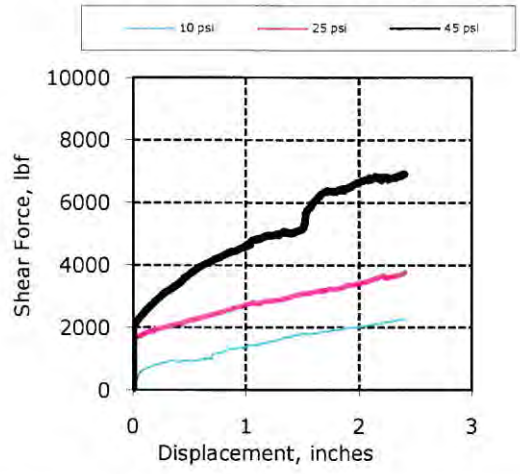
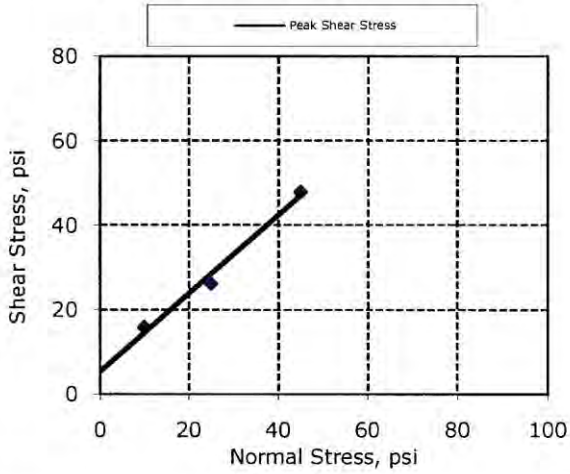


Figure b. Shear Stress vs. Normal Stress



Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material. Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

GeoTesting EXPRESS

Client:	CH2M Hill		
Project Name:	Port of Anchorage Expansion		
Project Location:	Anchorage, AK		
GTX #:	11559		
Start Date:	03/09/12	Tested By:	bfs
End Date:	03/14/12	Checked By:	jdt
Boring ID:	Z		
Sample ID:	S-1, 2, 3, 4		
Depth:	20-25 ft		
Soil Description:	Moist, brown gravel with silt and sand		

Direct Shear Test Series by ASTM D 3080

Soil Preparation:	Test specimens compacted to 70% Relative Density at the as-received moisture content. All material greater than 1-inch screened out of sample prior to testing.		
Compaction Characteristics:	Minimum Index Unit Weight (ASTM D 4254)	113.8 pcf	
	Maximum Index Unit Weight (ASTM D 4253)	141.2 pcf	
Test Equipment:	Top box = 12 in x 12 in; Bottom box = 16 in x 12 in; Load cells and LVDTs connected to data acquisition system for shear force, normal load and horizontal displacement readings; surface area = 144 in^2		
Maximum Particle Size Used, in:	1	Horizontal Displacement, in/min:	0.02
Soil Height, in:	6	Test Condition:	inundated
Gap Between Boxes, in:	0.25		

Parameter	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Initial Moisture Content, %	6.5	6.5	6.5	6.5	---	---
Initial Dry Density, pcf	133	133	133	133	---	---
Relative Density, %	70	70	70	70	---	---
Normal Compressive Stress, psi	10	25	35	50	---	---
Peak Shear Stress, psi	13	34	47	56	---	---
Post Peak Shear Stress, psi	---	---	---	---	---	---
Final Moisture Content, %	8.2	7.9	7.4	7.0	---	---

Notes:

Peak Friction Angle:	**47.6**	**degrees**
Peak Cohesion:	**4.5**	**psi**
Post Peak Friction Angle:	**---**	**degrees**
Post Peak Cohesion:	**---**	**psi**

Figure a. Shear Force vs. Horizontal Displacement

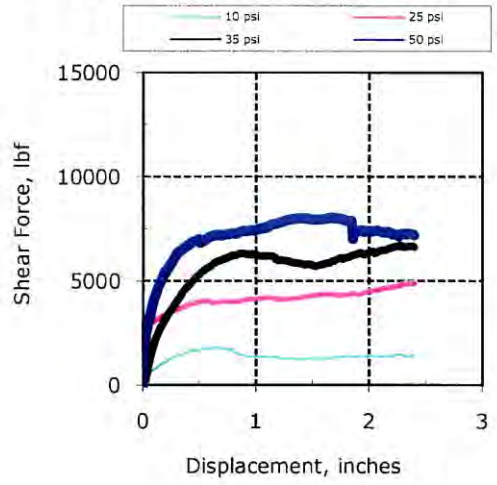
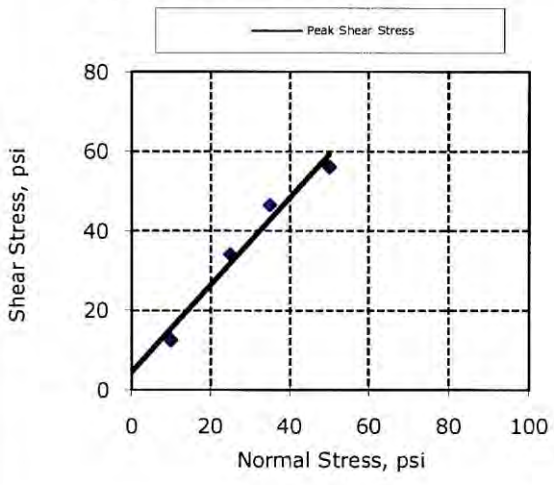


Figure b. Shear Stress vs. Normal Stress



Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material. Values for cohesion and friction angle determined from best-fit straight line to the data for the specific test conditions. Actual strength parameters may vary and should be determined by an engineer for site-specific conditions.

GeoTesting EXPRESS

WARRANTY and LIABILITY

GeoTesting Express (GTX) warrants that all tests it performs are run in general accordance with the specified test procedures and accepted industry practice. GTX will correct or repeat any test that does not comply with this warranty. GTX has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

GTX may report engineering parameters that require us to interpret the test data. Such parameters are determined using accepted engineering procedures. However, GTX does not warrant that these parameters accurately reflect the true engineering properties of the *in situ* material. Responsibility for interpretation and use of the test data and these parameters for engineering and/or construction purposes rests solely with the user and not with GTX or any of its employees.

GTX's liability will be limited to correcting or repeating a test which fails our warranty. GTX's liability for damages to the Purchaser of testing services for any cause whatsoever shall be limited to the amount GTX received for the testing services. GTX will not be liable for any damages, or for any lost benefits or other consequential damages resulting from the use of these test results, even if GTX has been advised of the possibility of such damages. GTX will not be responsible for any liability of the Purchaser to any third party.

Commonly Used Symbols

A	pore pressure parameter for $\Delta\sigma_1 - \Delta\sigma_3$
B	pore pressure parameter for $\Delta\sigma_3$
CIU	isotropically consolidated undrained triaxial shear test
CR	compression ratio for one dimensional consolidation
C_c	coefficient of curvature, $(D_{30})^2 / (D_{10} \times D_{60})$
C_u	coefficient of uniformity, D_{60}/D_{10}
C_c	compression index for one dimensional consolidation
C_α	coefficient of secondary compression
c_v	coefficient of consolidation
c	cohesion intercept for total stresses
c'	cohesion intercept for effective stresses
D	diameter of specimen
D_{10}	diameter at which 10% of soil is finer
D_{15}	diameter at which 15% of soil is finer
D_{30}	diameter at which 30% of soil is finer
D_{50}	diameter at which 50% of soil is finer
D_{60}	diameter at which 60% of soil is finer
D_{85}	diameter at which 85% of soil is finer
d_{50}	displacement for 50% consolidation
d_{90}	displacement for 90% consolidation
d_{100}	displacement for 100% consolidation
E	Young's modulus
e	void ratio
e_c	void ratio after consolidation
e_o	initial void ratio
G	shear modulus
G_s	specific gravity of soil particles
H	height of specimen
PI	plasticity index
i	gradient
K_o	lateral stress ratio for one dimensional strain
k	permeability
LI	Liquidity Index
m_v	coefficient of volume change
n	porosity
PI	plasticity index
P_c	preconsolidation pressure
p	$(\sigma_1 + \sigma_3) / 2$, $(\sigma_v + \sigma_h) / 2$
p'	$(\sigma'_1 + \sigma'_3) / 2$, $(\sigma'_v + \sigma'_h) / 2$
p'_c	p' at consolidation
Q	quantity of flow
q	$(\sigma_1 - \sigma_3) / 2$
q_f	q at failure
q_o, q_i	initial q
q_c	q at consolidation
S	degree of saturation
SL	shrinkage limit
s_u	undrained shear strength
T	time factor for consolidation
T	temperature
t	time
U, UC	unconfined compression test
UU, Q	unconsolidated undrained triaxial test
u_a	pore gas pressure
u_e	excess pore water pressure
u, u_w	pore water pressure
V	total volume
V_g	volume of gas
V_s	volume of solids
V_v	volume of voids
V_w	volume of water
V_o	initial volume
v	velocity
W	total weight
W_s	weight of solids
W_w	weight of water
w	water content
w_c	water content at consolidation
w_f	final water content
w_l	liquid limit
w_n	natural water content
w_p	plastic limit
w_s	shrinkage limit
w_o, w_i	initial water content
α	slope of q_f versus p_f
α'	slope of q_f versus p_f'
γ_t	total unit weight
γ_d	dry unit weight
γ_s	unit weight of solids
γ_w	unit weight of water
ε	strain
ε_{vol}	volume strain
ε_h, ε_v	horizontal strain, vertical strain
μ	Poisson's ratio, also viscosity
σ	normal stress
σ'	effective normal stress
σ_c, σ'_c	consolidation stress in isotropic stress system
σ_h, σ'_h	horizontal normal stress
σ_v, σ'_v	vertical normal stress
σ_1	major principal stress
σ_2	intermediate principal stress
σ_3	minor principal stress
τ	shear stress
φ	friction angle based on total stresses
φ'	friction angle based on effective stresses
φ'_r	residual friction angle
φ_{ult}	φ for ultimate strength

Attachment D3

Field Exploration Summary

Field Methodology Summary
For
Port of Anchorage
Intermodal Expansion Project
Subsurface Investigation
Anchorage, Alaska

Prepared For:

CH2M Hill
949 East 36th Avenue
Suite 500
Anchorage, Alaska 99508

Prepared By:

TELLUS, Ltd.
2551 Susitna Drive
Anchorage, Alaska 99517
(907) 248-8055

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12-002

1.0 Introduction

CH2M Hill was contracted by the United States Army Corps of Engineers (USACE) to coordinate, manage and interpret the results derived from this subsurface soils investigation program. Both TELLUS, Ltd. and Discovery Drilling were under subcontract to CH2M Hill during this project.

2.0 Drilling Rig Utilization

Discovery Drilling was the subsurface drilling contractor utilized during this subsurface soils investigation program. Discovery Drilling is headquartered in Anchorage, Alaska but provides drilling services throughout the entire state.

During this project, Discovery Drilling provided two (2) truck-mounted CME 75 drill rigs. The trucks employed were heavy duty all-wheel drive carriers capable of hauling one rig and all of the associated drilling tools for that rig. Since the work site was relatively flat, the truck-mounted rigs were adequate in accessing the soil boring locations and minimizing travel time between locations. Two (2) heavy duty flatbed support trucks were also utilized during this program to haul required supplies and water. The drill rigs were left onsite each night while the crews travelled to and from the work site via the support trucks each day.

At the start of this program, one drilling rig was set up to perform cone penetrometer testing (CPT) while the second rig was scheduled to provide subsurface boring and sampling services using hollow stem auger tools. After four and one half days, CPT testing was concluded and the CPT drilling rig was utilized for bulk soil sampling services using a 7.25-inch outside diameter solid flight auger tool setup. After completing the single day of solid flight auger drilling associated with subsurface material bulk sampling, this drilling rig was demobed from the work site.

Mid-winter conditions existed during the completion of this field program. Two days with winds from the north provided the coldest effects. It is not believed that a significant decrease in productivity occurred other than the impact of drilling in February as opposed to July. Efforts were expended to heat items (water, tools, steel, etc.) and be aware of and compensate for, the presence of ice and snow while working. This subsurface drilling program was completed over fifteen (15) consecutive field days.

3.0 Subsurface Drilling Methodologies

Hollow stem auger drilling tools measuring 3.25-inches inside diameter and 7.25-inches outside diameter were utilized to advance all of the soil borings during this program except the borings installed in order to obtain bulk material samples. The bulk material sample borings (X, Y and Z) were installed using 7.25-inch outside diameter solid flight auger tools.

Solid wall steel casing was driven inside of the hollow stem auger flytes in soil borings B15 (85.0 feet), B16 (77.0 feet), B17 (60.0 feet) and B18 (80.0 feet) in order to attempt to counteract the heaving silts encountered at depths ranging from 55.0 feet to 80.0 feet below ground surface.

Drilling rates were significantly decreased when casing was driven in conjunction with hollow stem auger drilling methods. The decreased footage rate was caused by the increase in handling efforts associated with setting up the steel casing and driving it with the rig's 340 pound auto hammer. Each five foot piece of casing was threaded into the string and then driven down hole. The additional work associated with utilizing, advancing, removing, and re-staging drill casing, increased the time required to complete a soil boring from approximately one (1) day to two (2) days.

In instances where heaving silts were encountered, attempts to counteract the infiltration of fine grained particles into the center of the auger included: addition of water to create a hydraulic head, addition of drilling mud to create an increased hydraulic head, driving of steel casing to seal off the surrounding formation from allowing fine grained particles to flow (heave up) into the auger, and the circulation of drilling mud to clean out the inside of the auger and condition the boring.

4.0 Soil Sampling Methodologies

Subsurface soil sampling was performed by using splitspoon sampling tools. Two types of splitspoon samplers were utilized during this program. The only soil samples that were collected not using splitspoon sampling tools were: three (3) shelby tubes that were pushed into and then extracted (using the drilling rig's head / hydraulics) from the subsurface native clay formation, and the bulk material samples that were collected as cuttings that were spun up from depth using the solid flight auger tools.

A large splitspoon sampler (LPT) measuring 3.0-inches outside diameter / 2.4-inches inside diameter by 24-inches in length was utilized for primary soil sample collection. This sampler was driven into the undisturbed subsurface soils ahead of the lead auger / drill bit by using a 340 pound hydraulic auto-hammer. The hammer's drop height was a consistent thirty (30) inches.

A standard splitspoon sampler (SPT) measuring 2.0-inches outside diameter / 1.375-inches inside diameter by 24-inches in length was utilized for sample collection within the fine-grained and saturated zones of the soil borings. Additional SPT sampler drives were also conducted to

provide data intended to be used for correlation purposes associated with the previous LPT sampler drives. This smaller diameter sampler was also driven into the undisturbed subsurface soils ahead of the lead auger / drill bit by using a 140 pound hydraulic auto-hammer. The hammer's drop height was a consistent thirty (30) inches.

Procedures associated with switching between the LPT and SPT splitspoon sampling tools involved selecting the desired sampling device and replacing the solid steel hammer weight inside of the auto-hammer device. The LPT was only driven with the 340 pound weight hammer while the SPT was only driven with the 140 pound weight hammer.

When the desired depth for sampling was reached, the drilling crew removed the inner drilling rod from inside of the hollow stem auger. Once the inner rod was pulled, the lead bit (center-piece) was removed from the lead rod and replaced with the splitspoon sampler. The sampler was then lowered into the boring down through the center of the hollow stem auger. Once the sampler reached the bottom of the boring, the hammer was swung into place atop the inner rod and used to drive the inner rod with the attached splitspoon sampler to a depth of 24-inches below the existing bottom of the soil boring. This procedure was repeated for every five (5) foot subsurface interval (i.e.: 10, 15, 20, 25, 30, etc.) down to the completed total depth of each soil boring.

After the sample interval was obtained, the process for removing the inner drill rod was repeated, the splitspoon sampler was removed, and the lead bit was reinstalled and drilling resumed to the next desired sampling interval. The splitspoon sampler is a barrel-shaped, steel, cylindrical device with solid piece ends that thread on over the split sides of the sampler. Once the sampler is opened, the obtained sample media can be examined, photographed, logged using the Unified Soil Classification System (USCS) and collected for analysis.

5.0 Piezometer Installation Methodology

Piezometers installed during this program were fabricated from 1-inch diameter PVC solid conduit. The PVC conduit was manually cut using a hacksaw to install multiple slots along the conduit so water could infiltrate, collect inside and the static level could then be measured. The PVC conduit pieces were fastened together using PVC couplers and epoxy. The piezometers were completed and left accessible by allowing the PVC conduit to stick up above grade. A PVC slip cap was set atop the conduit for an adequate seal and the conduit was labeled with the identifying soil boring number.

6.0 Fluid Levels Within Piezometers

Fluid levels within the piezometers were measured using an electric down-hole water level indicator. All measurements obtained from piezometers that were installed without the use of drilling mud (B2, B5, and B6) appeared to become static overnight. While the piezometers

installed in the borings drilled with the use of drilling mud had not yet stabilized by the time the field efforts were completed. It was believed the fluid level readings from the piezometers installed with drilling mud were suspect at the time of the initial readings. Table A lists fluid level measurements collected during the field portion of this program.

During the cycle when a high tide was present, seawater with floating ice was observed to be near the top of the existing sheet pile wall. During both high and low tides, the groundwater flow direction was recorded as being towards Cook Inlet.

7.0 Soil Profile Generalization

Drilling activities revealed that the ground onsite was observed to be frozen to depths ranging between 6.0 and 8.0 feet below ground surface. The imported fill material section was logged to range between 36.0 (B17) and 65.0 (B9 & B13) feet in thickness across the eleven (11) borings that were installed during this program. Native soils that varied significantly in composition and thickness were encountered beneath the imported fill section and directly above the native clay layer found to be present across the site between depths of 60.0 and 86.0 feet below ground surface. In most of the borings, a saturated silt was observed directly atop the gray plastic clay (Bootlegger Cove Unit). Table B provides a generalized soil profile summary.

8.0 Soil Boring Summaries

Soil Boring B2 – Installed on 2/8/12 down to a total depth of 97.0' bgs.
Only hollow stem auger tools and 2.5-inch inside diameter (ID) LPT samplers were used.
Groundwater encountered at 20.0' bgs at the time of drilling.
Only water used to counteract heaving fines which were present from 25.0' bgs.
Sampling intervals at 65', 75' and 80' missed due to excessive heave in auger.
A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B5 – Installed on 2/9/12 down to a total depth of 64.0' bgs.
Only hollow stem auger tools and 2.5-inch inside diameter (ID) LPT samplers were used.
A Shelby tube was pushed at 62' to 64' bgs into the native gray clay.
Groundwater encountered at 15.0' bgs at the time of drilling.
Water used to counteract heaving fines which were present from 25.0' bgs.
No sampling intervals were missed during this boring.

A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B3 – Installed on 2/10/12 down to a total depth of 84.0' bgs.
Hollow stem auger tools and both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes.
Groundwater encountered at 37.0' bgs at the time of drilling.
Drilling mud used to counteract heaving fines present from 40.0' bgs.
Sampling intervals from 50' to 70' missed due to excessive heave in auger.
A shelby tube was pushed at 82' to 84' bgs into the native gray clay.
A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B6 – Installed on 2/11/12 down to a total depth of 87.0' bgs.
Hollow stem auger tools and both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes as well as attempting to minimize heave travel into / up the auger stem.
Groundwater encountered at approximately 25.0' bgs at the time of drilling.
Water used to counteract heaving fines present from 40.0' bgs.
No sampling intervals missed during the installation of this boring.
A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B13 – Installed on 2/12/12 and 2/13/12 down to a total depth of 90.0' bgs.
Only hollow stem auger tools and 2.5-inch ID LPT samplers were used.
Began boring with 4.25-inch inside diameter auger tools. Switched back to 3.25-inch inside diameter auger tools due to the inability of the 4.25-inch auger to spin up cuttings. The 4.25-inch auger has smaller flytes that are unable to advance the lead flyte / drill bit. Drilling improves after changing.
Two failed shelby tube attempts at 90' bgs. Only heave recovered in tubes.
Groundwater encountered at 11.0' bgs at the time of drilling.
Drilling mud used to counteract heaving fines encountered at 85.0' bgs.

The sampling interval at 85.0' bgs was missed during this boring.
A 1-inch diameter piezometer was installed down to a total depth of 63.0' bgs upon boring completion.

Soil Boring B15 – Installed on 2/14/12 and 2/15/12 down to a total depth of 84.0' bgs.
Hollow stem auger tools with casing driven to 82.0' bgs.
Both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes as well as attempt to minimize heave travel into / up the auger stem.
Groundwater encountered at 25.0' bgs at the time of drilling.

Drilling mud used to counteract heaving fines encountered at 60.0' bgs.
The sampling interval at 65.0' bgs was missed during this boring.
A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B16 – Installed on 2/16/12 and 2/17/12 down to a total depth of 77.0' bgs.
Hollow stem auger tools with casing driven to 75.0' bgs.
Both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes as well as attempt to minimize heave travel into / up the auger stem.
Groundwater encountered at 25.0' bgs at the time of drilling.
Drilling mud was used to counteract heaving fines encountered at 40.0' bgs.
No sampling intervals were missed during this boring.
A 1-inch diameter piezometer was installed down to a total depth of 67.0' bgs upon boring completion.

Soil Boring B18 – Installed on 2/17/12 through 2/19/12 down to a total depth of 82.0' bgs.
Hollow stem auger tools with casing driven to 80.0' bgs.
Both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes as well as attempt to minimize heave travel into / up the auger stem.
Groundwater encountered at 40.0' bgs at the time of drilling.
Drilling mud used to counteract heaving fines encountered at 60.0' bgs.
No sampling intervals were missed during this boring.
A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B17 – Installed on 2/19/12 and 2/20/12 down to a total depth of 62.0' bgs.
Hollow stem auger tools with casing driven to 60.0' bgs.
Both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes as well as attempt to minimize heave travel into / up the auger stem.
Groundwater encountered at 25.0' bgs at the time of drilling.
Drilling mud used to counteract heaving fines encountered at 36.0' bgs.
No sampling intervals were missed during this boring.
No piezometer was installed in this boring.

Soil Boring B8 – Installed on 2/21/12 down to a total depth of 80.0' bgs.
Only hollow stem auger tools were used during this boring.
Both 1.375-inch ID SPT & 2.5-inch ID LPT samplers were used.
Dual samplers were used to provide data for correlation purposes as well as

attempt to minimize heave travel into / up the auger stem.
Groundwater encountered at 32.0’ bgs at the time of drilling.
Water was used to counteract heaving fines encountered at 34.0’ bgs.
No sampling intervals were missed during this boring although the interval was offset by -1.0’.
A 1-inch diameter piezometer was installed upon boring completion.

Soil Boring B9 – Installed on 2/22/12 down to a total depth of 72.0’ bgs.
Hollow stem auger tools & 2.5-inch ID LPT samplers were used during this boring.
Groundwater encountered at 25.5’ bgs at the time of drilling.
Water was used to counteract heaving fines encountered at 26.0’ bgs.
No sampling intervals were missed during this boring.
A 1-inch diameter piezometer was installed upon boring completion.

TABLE A - POA INTERMODAL EXPANSION PROJECT # 12-00
FLUID LEVEL MEASUREMENTS FROM PIEZOMETERS
PORT OF ANCHORAGE, ANCHORAGE, ALASKA.
MARCH 2012

FLUID LEVEL MEASUREMENTS			Columns added by CH2M HILL	
BORING LOCATION / PIEZOMETER	DATE & TIME MEASURED	FLUID LEVEL READING (Feet BGS)	Boring Elevation (Feet MLLW)	FLUID LEVEL ELEVALTION (Feet MLLW)
B2	2/10/12 @ 1230 Hrs	16.4	35.0	18.6
	2/11/12 @ 1035 Hrs	15.4		19.6
	2/12/12 @ 1310 Hrs	15.0		20.0
	2/18/12 @ 1245 Hrs	12.2		22.8
	3/23/12 @ 1105 Hrs	10.2		24.8
B5	2/10/12 @ 1235 Hrs	14.9	35.0	20.1
	2/11/12 @ 1040 Hrs	14.4		20.7
	2/12/12 @ 1320 Hrs	14.8		20.2
	2/18/12 @ 1230 Hrs	15.6		19.4
	3/23/12 @ 1020 Hrs	16.1		18.9
B3	2/11/12 @ 1050 Hrs	12.2	35.0	22.8
	2/12/12 @ 1315 Hrs	15.0		20.0
	2/18/12 @ 1235 Hrs	19.7		15.3
	3/23/12 @ 1040 Hrs	14.8		20.2
B6	2/12/12 @ 1317 Hrs	15.4	35.0	19.6
	2/18/12 @ 1239 Hrs	20.0		15.0
	3/23/12 @ 1055 Hrs	16.0		19.0
B13	2/15/12 @ 1100 Hrs	16.1	35.0	18.9
	2/18/12 @ 1300 Hrs	19.4		15.6
	3/23/12 @ 1110 Hrs	13.5		21.5
B15	2/18/12 @ 1310 Hrs	6.8	35.0	28.2
	3/23/12 @ 1205 Hrs	8.6		26.4
B16	2/18/12 @ 1315 Hrs	11.3	35.0	23.7
	3/23/12 @ 1155 Hrs	9.5		25.5
B18	3/23/12 @ 1215 Hrs	10.8	35.4	24.7
B9	3/23/12 @ 1230 Hrs	17.3	34.2	16.9
B8	3/23/12 @ 1240 Hrs	13.3	33.5	20.2
Location / ID	Date & Time	Reading		

NOTES:
1) Fluid level readings were measured using a new Solinst Model 102M down hole water level me
2) Borings / piezometers installed using drilling mud were: B3, B13, B15, B16 & B18.
3) Measured fluid levels in piezometers believed to be influenced by drilling mud

TABLE B - POA INTERMODAL EXPANSION PROJECT # 12-00
GENERALIZED SOIL PROFILE SUMMARY
PORT OF ANCHORAGE, ANCHORAGE, ALASKA.
FEBRUARY 2012

GENERALIZED SOIL PROFILE		
SOIL BORING LOCATION	**DEPTH RANGE (Feet BGS)**	**MATERIAL DESCRIPTION**
B2	0.0' - 8.0'	Frozen - Brown Sandy / Gravelly Soils
	8.0' - 35.0'	Groundwater @ 20.0' - Brown Sandy / Gravelly Soils
	35.0' - 85.0'	Saturated Gray Sandy / Gravelly Soils
	85.0' - 86.0'	Saturated Gray Fine Sand
	86.0' - 97.0'	Dense Gray Clay
B5	0.0' - 8.0'	Frozen - Brown Sandy / Gravelly Soils
	8.0' - 40.0'	Groundwater @ 15.0' - Brown Sandy Soils
	40.0' - 50.0'	Saturated Gray Sandy Soils
	50.0' - 55.0'	Moist Gray Sandy Silt
	55.0' - 62.0'	Dense Gray Clay
B3	0.0' - 8.0'	Frozen - Brown Sandy / Gravelly Soils
	8.0' - 36.0'	Brown Sandy / Gravelly Soils
	36.0' - 44.0'	Groundwater @ 37.0' - Saturated Gray Silty Soils
	44.0' - 71.0'	Saturated Sandy Soils
	71.0' - 84.0'	Dense Gray Clay
B6	0.0' - 8.0'	Frozen - Brown Sandy / Gravelly Soils
	8.0' - 36.0'	Groundwater @ 25.0' - Brown Sandy / Gravelly Soils
	36.0' - 66.5'	Saturated Gray Silty Sandy Soils
	66.5' - 87.0'	Dense Gray Clay
B13	0.0' - 7.0'	Frozen - Brown Sandy / Gravelly Soils
	7.0' - 75.0'	Groundwater @ 11.0' - Brown Sandy / Gravelly Soils
	75.0' - 76.0'	Saturated Gray Sand
	76.0' - 90.0'	Gray Clay
B15	0.0' - 6.0'	Frozen - Brown Sandy / Gravelly Soils
	6.0' - 60.0'	Groundwater @ 25.0' - Brown Sandy / Gravelly Soils
	60.0' - 78.0'	Saturated Gray Sandy Silty Soils
	78.0' - 84.0'	Gray Clay
B16	0.0' - 7.0'	Frozen - Brown Sandy / Gravelly Soils
	7.0' - 41.5'	Groundwater @ 25.0' - Brown Sandy / Gravelly Soils
	41.5' - 51.5'	Saturated Gray Silt
	51.5' - 65.0'	Interbedded Gray Silt & Brown Sandy Soils
	65.0' - 73.0'	Wet Gray Sandy Silt
	73.0' - 77.0'	Gray Clay
B18	0.0' - 6.0'	Frozen - Brown Sandy / Gravelly Soils
	6.0' - 57.0'	Groundwater @ 25.0' - Brown Sandy / Gravelly Soils
	57.0' - 68.0'	Saturated Silty Sandy Gravelly Soils
	68.0' - 82.0'	Dense Gray Clay
B17	0.0' - 7.0'	Frozen - Brown Sandy / Gravelly Soils
	7.0' - 36.0'	Groundwater @ 25.0' - Brown Sandy / Gravelly Soils
	36.0' - 55.0'	Saturated Gray Silty Soils
	55.0' - 62.0'	Gray Clay
B8	0.0' - 7.0'	Frozen - Brown Sandy / Gravelly Soils
	7.0' - 59.0'	Groundwater @ 32.0' - Brown Sandy / Gravelly Soils
	59.0' - 79.0''	Saturated Gray Sandy Soils
	79.0' - 80.0'	Saturated Gray Silt
B9	0.0' - 7.0'	Frozen - Brown Sandy / Gravelly Soils
	7.0' - 70.0'	Groundwater @ 25.5' - Sandy / Gravelly Soils
	70.0' - 70.5'	Wet Gray Silt
	70.5' - 72.0'	Dense Gray Clay

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking West

February 8, 2012
1205 Hours

Drill crew set up and beginning to install Boring B2.

Photo No. P1020657

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

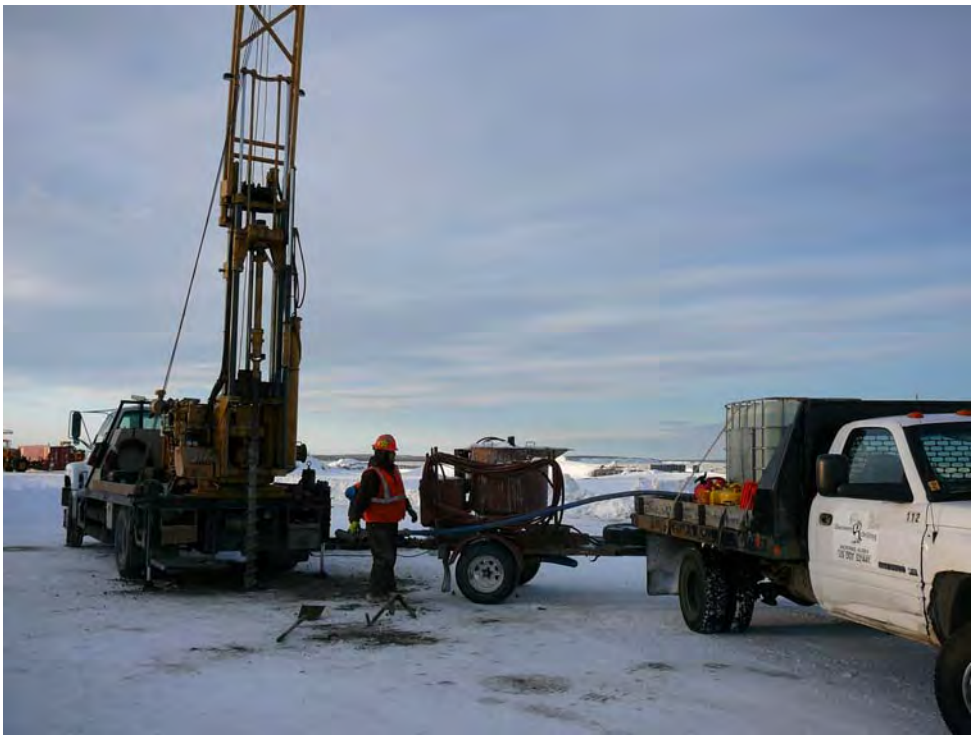
CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Southwest

February 9, 2012
1101 Hours

Drill crew installing Boring B5. Water tank & mud mixer onsite.

Photo No. P1020680



Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 8, 2012
1218 Hours

LPT sampler collected from Boring B2.

Photo No. P1020660

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 8, 2012
1320 Hours

LPT sampler collected from Boring B2.

Photo No. P1020667

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 9, 2012
1707 Hours

LPT sampler collected from Boring B5.

Photo No. P1020693

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

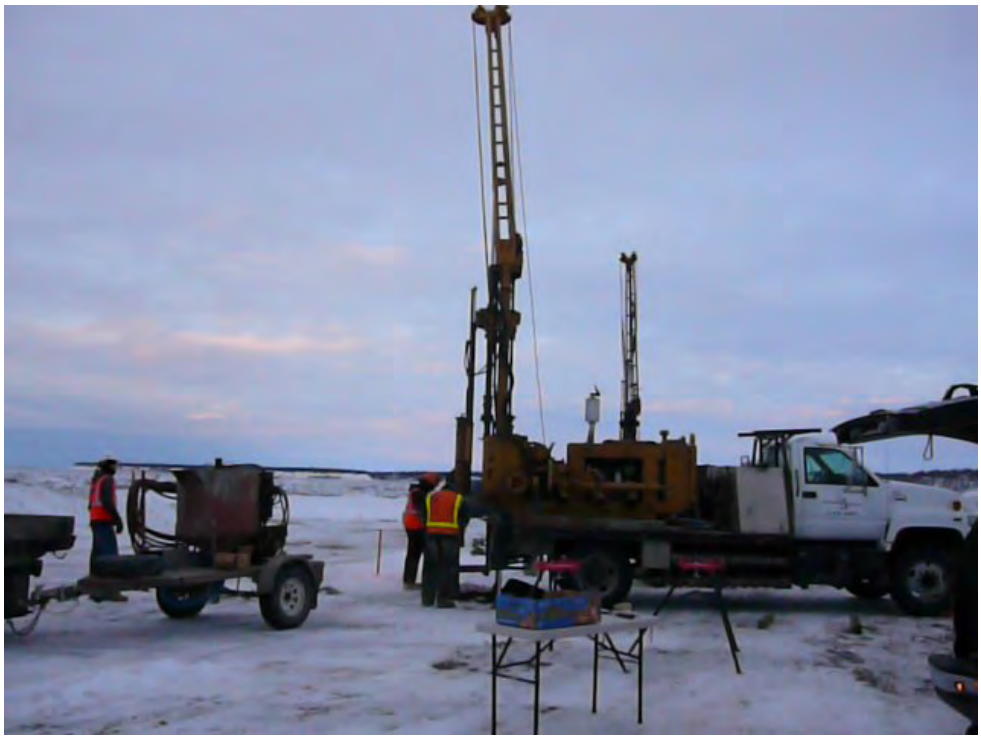
CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking West

February 10, 2012
0959 Hours

Two drilling rigs working on onsite.

Photo No. P1020695



Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 10, 2012
1118 Hours

LPT sampler collected from Boring B3.

Photo No. P1020699

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 11, 2012
1201 Hours

LPT sampler collected from Boring B6.

Photo No. P1020714

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking West

February 12, 2012
0939 Hours

Rig set up for bulk material sampling effort.

Photo No. P1020725

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 12, 2012
1020 Hours

Solid flyte auger in ground during bulk sampling effort.

Photo No. P1020740

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking South

February 12, 2012
1641 Hours

Bulk sample material pails from Borings X, Y & Z.

Photo No. P1020756

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking West

February 12, 2012
1401 Hours

Dual drilling crews working onsite.

Photo No. P1020753

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking North

February 14, 2012
1456 Hours

Drilling crew installing Boring B15.

Photo No. P1020774

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking East

February 15, 2012
0924 Hours

Drilling equipment being used onsite at Boring B15.

Photo No. P1020777

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking South

February 15, 2012
0926 Hours

Drilling crew circulating mud within Boring B15.

Photo No. P1020779

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Down

February 16, 2012
1207 Hours

SPT sampler collected from Boring B16.

Photo No. P1020791

Port of Anchorage
Intermodal Expansion
Project - Subsurface
Soil Investigation
Anchorage, Alaska

CH2M Hill / TELLUS,
Ltd. / Discovery
Drilling

Looking Down

February 17, 2012
1313 Hours

Shelby Tube collected
from Boring B16.

Photo No. P1020798

Port of Anchorage
Intermodal Expansion
Project - Subsurface
Soil Investigation
Anchorage, Alaska

CH2M Hill / TELLUS,
Ltd. / Discovery
Drilling

Looking Down

February 18, 2012
1413 Hours

SPT sampler collected
from Boring B18.

Photo No. P1020807

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking East

February 14, 2012
1350 Hours

Drill casing used during mud rotary drilling and circulation.

Photo No. P1020772

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking Southwest

February 10, 2012
1806 Hours

Manual slotting of PVC piping (piezometer) material.

Photo No. P1020706

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking West

February 13, 2012
1641 Hours

Typically installed PVC piezometer.

Photo No. P1020759

Port of Anchorage Intermodal Expansion Project - Subsurface Soil Investigation Anchorage, Alaska

CH2M Hill / TELLUS, Ltd. / Discovery Drilling

Looking West

February 22, 2012
1340 Hours

Installed PVC piezometer with attached snow pole.

Photo No. P1020857

Attachment D4

SCPT Report

Report of Port of Anchorage Geotechnical Investigation

Conducted for:
CH2M-Hill, Alaska

Submitted to:

CH2M-Hill, Inc.

In Situ Engineering Project Number: 1037
Date: February, 2012

Testing conducted and report prepared by:

In Situ Engineering
6232 195th Avenue SE
Snohomish, WA 98290 360-568-2807

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APPENDICES

1.0 INTRODUCTION

This report contains the test results for electronic Cone Penetrometer Testing (CPT) performed at the Port of Anchorage in Anchorage, AK. The Port of Anchorage is currently expanding northward into an area where backfill has been placed inside of open cell sheetpile structures. The work was performed under contract to CH2M-Hill and was at the direction of Army Corp. of Engineers.

As part of the port expansion, fill was placed to depths of up to 85 feet thick and consisted of silt through boulder sized material. Material placed in the water received no initial compaction. Material placed above the water was compacted with vibratory drum rollers. After placement of the fill, the entire fill depth was treated with vibrocompaction on 10 foot centers.

The drilling on the project was performed by Discovery Drilling of Anchorage, Alaska using a CME truck mounted drilling rig. Testing was performed in three different locations labeled C-2, C-5, and C-12. The field work was carried out of February 8 to 11, 2012

2.0 PURPOSE

The purpose of this investigation is to provide geotechnical information on the backfill within the sheetpile structures in the Intermodal Suitability Study, Port of Anchorage, Alaska. Strength information of the backfill is critical to the stability evaluation of the cell structures. Consultants who performed previous studies at the site commented that conducting standard penetration testing provided less than optimum results. Responding to this observation, CH2M-Hill and the United States Army Corps of Engineers (USACE) determined that to try SCPT may be beneficial. The following information will be provided in this report gathered using a Seismic Cone Penetrometer Testing (SCPT): tip resistance corrected for pore pressure effects, friction resistance, friction ratio, porewater pressure, shear wave velocity, subsurface stratigraphy, and equivalent SPT blow counts. Other drilling and sampling concurrent with the SCPT included standard penetration testing (SPT), Shelby tubes sampling, and bulk sampling. Drilling logs for this work are not included in this report.

3.0 CONE PENETROMETER TESTING

Three CPTs were conducted to depths of 28, 61, and 68 feet at test locations C-2, C-5 and C-12 respectively. The tests depth of zero was referenced to the ground surface in each test. At each location the frozen ground surface was drilled out with hollow stem auger to 9 feet before the SCPT was advanced into the ground. The SCPT was advanced until refusal at which point it was removed and the obstruction drilled out with an auger. Following obstruction drilling, casing was placed in the hole, the CPT rods reinserted to the new drilled out depth and SCPT resumed.

3.1 CPT Instrumentation and Equipment

The CME drilling rig hydraulic ram was used to advance standard one meter CPT rods with a $10cm^2$ cross sectional area. The axial load capacity of the rods is 20 tons. The rods were stored in the back of a Full Sized SUV and were pre-strung with a 125 foot data cable through the testing rods. The cable sent data from the instrument to a junction box at the surface via an electronic signal. This junction box communicated with an attached laptop computer to provide real time results so the engineer performing the test can communicate with the driller operating the drilling rig.

To stabilize the CPT rods and prevent buckling in the predrilled areas, the drillers used a BQ wireline casing. The casing has an outside diameter of 2.19 inches and an inside diameter of 1.8 inches. The casing was used from the ground surface to the bottom of the augered out portion of the hole.

The CPT instrument which was used is a 10 ton digital subtraction type piezocone manufactured by the Vertek Company of Randolph, Vermont. The instrument measures tip resistance (0- 1000 tsf), sleeve friction (0 – 10 tsf), pore pressure (0 – 500 psi), inclinometer (0 -15 degrees) and shear waveforms (0 – 800 ms). The pore pressure element is in what is known as the #2 position.

Readings were taken at 5 cm intervals of the tip pressure, friction and pore pressure as the rods were advanced using a string pot depth encoder which recorded the depth as rods were advanced. The data was immediately stored on the hard drive of the computer at every reading interval.

One instrument was damaged during testing when it was bent on a presumably cobble or boulder sized obstruction. A data cable was also damaged during SCPT when it was cut by drilling equipment.

3.2 CPT Procedure

CPT testing was performed in general accordance with ASTM D 5778. Each hole was pre-drilled to a depth below the frost line. The frost line was estimated to be more than 8 feet but not more than 9 feet below grade. The cone was then advanced until refusal. The cone was then pulled out of the hole so the drillers could drill past the depth of refusal and the cone was then advanced starting from the bottom of the predrilled hole.

Once the cone was below the ground water table (GWT) dissipation tests were performed. This was done at the discretion of the on-site engineer. The dissipation tests were performed in areas where the pore water pressure would stabilize rapidly to minimize down time.

Down hole Seismic testing was performed in general accordance with ASTM D 7400. Shear (S) waves and compression (P) waves were taken every meter in C-2, C-5, and C-12. The S waves were obtained by hitting the sides of a beam that was placed under the drill rig's jack stands.

The P waves were obtained by hitting the top of the same beam. This process was repeated several times at each depth to amplify the waves.

3.3 CPT Data Presentation and Analysis

Plots of the CPT results are presented in Appendix I. These plots include columns for corrected tip resistance (Qt), Friction Ratio (Fs/Qc), Pore Pressure, an interpreted soil behavior type, and an equivalent Standard Penetration Test (SPT) N value. The interpreted soil behavior type and equivalent N value are based upon correlations outlined in the Robertson and Campanella reference cited in Section 6.0. The plot is standard output from a software program provided by Vertek, the instrument manufacturer. A second CPT plot has a remarks section that depicts where drilling was performed to help advance the cone.

Dissipation plots of C-2 and C-5 are presented in Appendix II. These plots include a graph of pore water pressure verse log (base 10) of time.

Seismic plots are presented in Appendix III. These plots are filtered and enhanced.

4.0 ELECTRONIC DATA FILES

Electronic data files are provided for the CPT. The files can be read in a text reader such as MS Notepad or imported into spreadsheets such as MS-Excel. CPT data files are a text file with a *.txt format. The CPT data files have headers and are self explanatory.

5.0 SUMMARY

SCPT was not able to be advanced continuously through the fill material. The corrected tip resistance for each sounding is also believed to be biased high due to the large particle size of fill material. The resulting tip values for the SCPT do not correlate with SPT values. The frequently encountered obstructions resulted in significantly lowered production rates due to the drilling out and casing process. Seismic testing resulted in no interpretable results. The lack of seismic response is believed to be due to the large frozen layer thickness which dampened energy from the surface source. Waves observed on the instrument are interpreted to be predominately waves passing down the steel cone penetrometer rods. The SCPT program was terminated early due to the lack of useful results.

6.0 REFERENCES

ASTM D 4700. 2007. Standard Test Methods for Downhole Seismic Testing.

ASTM D 5778. 2007. Standard Test Methods for Piezocone Penetration Testing of Soil.

Robertson. P.K., and Campanella, R. G., 1983, 1989. Guidelines for Geotechnical Design using the Cone Penetrometer Test and CPT with Pore Pressure Measurement. Hogentogler and Company, Columbia, MD

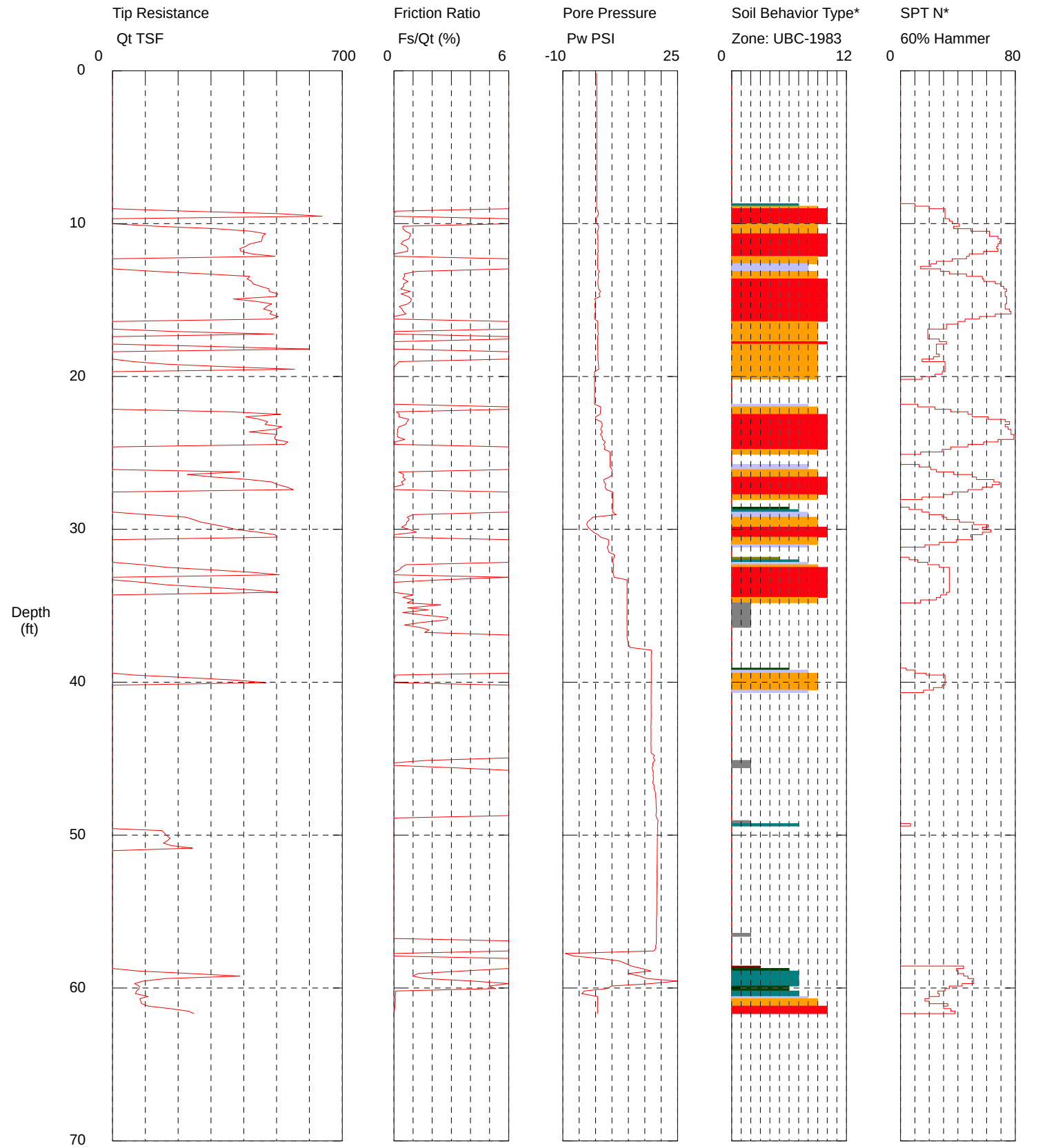
Riaud, J. and Miran, J., 1992. The Cone Penetrometer Test. FHWA Report #FHWA-SA-91-043.

Appendix I CPT Data

CH2M Hill

Operator: Gerdes
Sounding: CPT-02
Cone Used: DPG1015

CPT Date/Time: 2/9/2012 10:56:32 AM
Location: Port of Anchorage
Job Number:



Maximum Depth = 61.68 feet

Depth Increment = 0.164 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

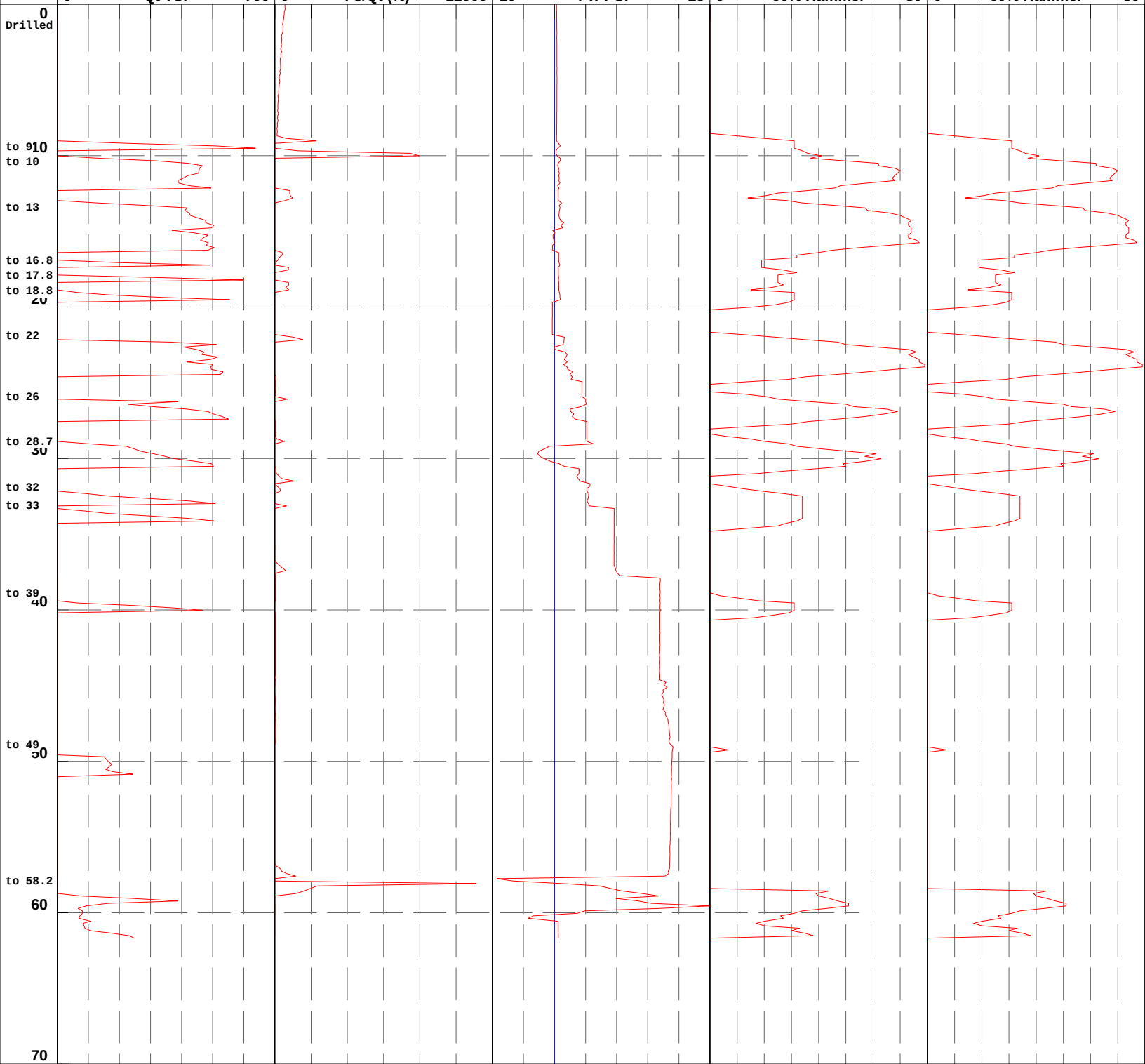
InSitu Engineering

*Soil behavior type and SPT based on data from UBC-1983

Port of Anchorage Geotechnical Investigation

Gerdes	2/9/2012 10:56:32 AM
CPT-02	Anchorage, Alaska
DPG1015	Port of Anchorage

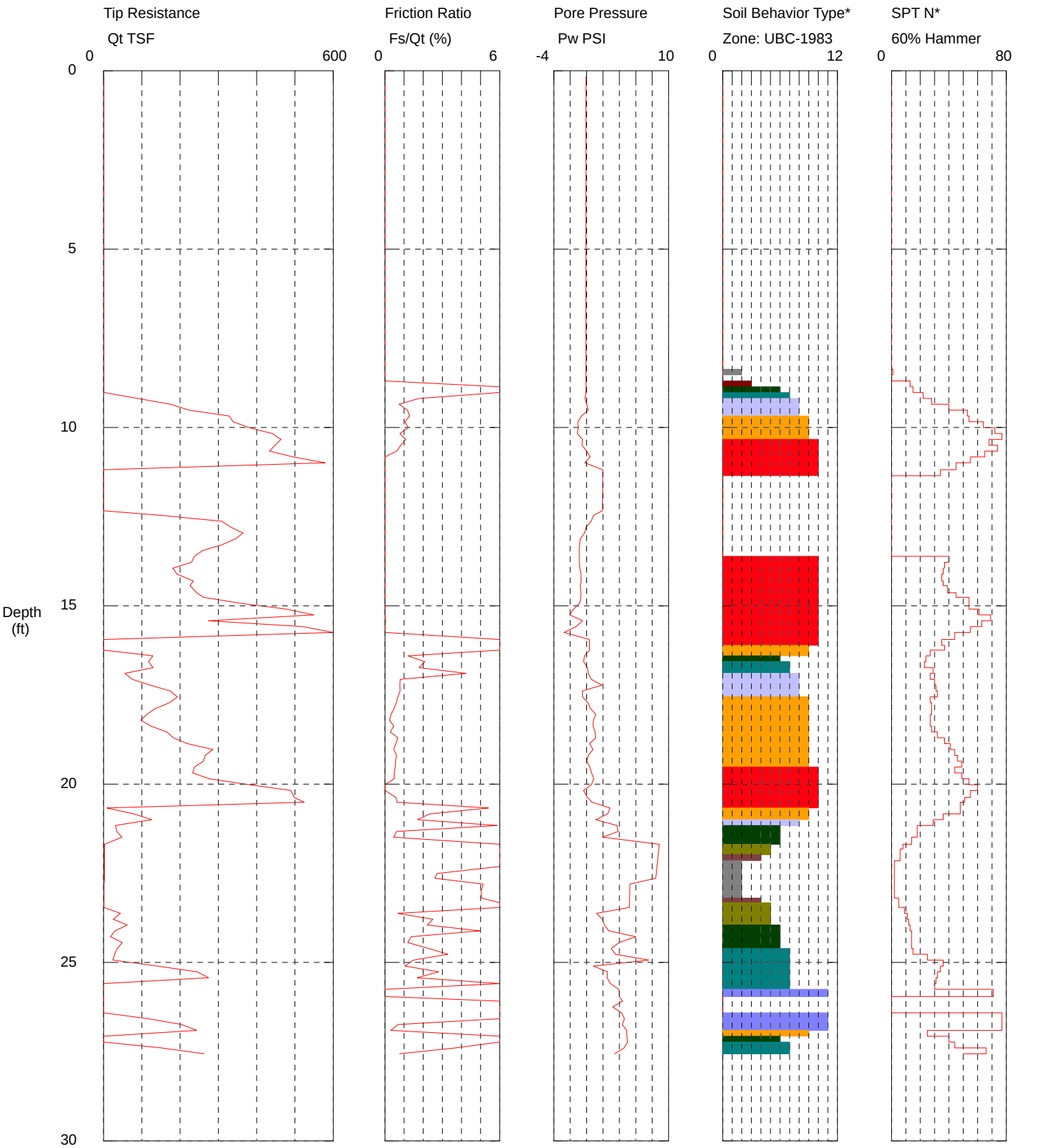
CPT DATA



CH2M Hill

Operator: Gerdes
Sounding: CPT-05
Cone Used: DSG1079

CPT Date/Time: 2/8/2012 1:38:47 PM
Location: Port of Anchorage
Job Number:



Maximum Depth = 27.56 feet

Depth Increment = 0.164 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

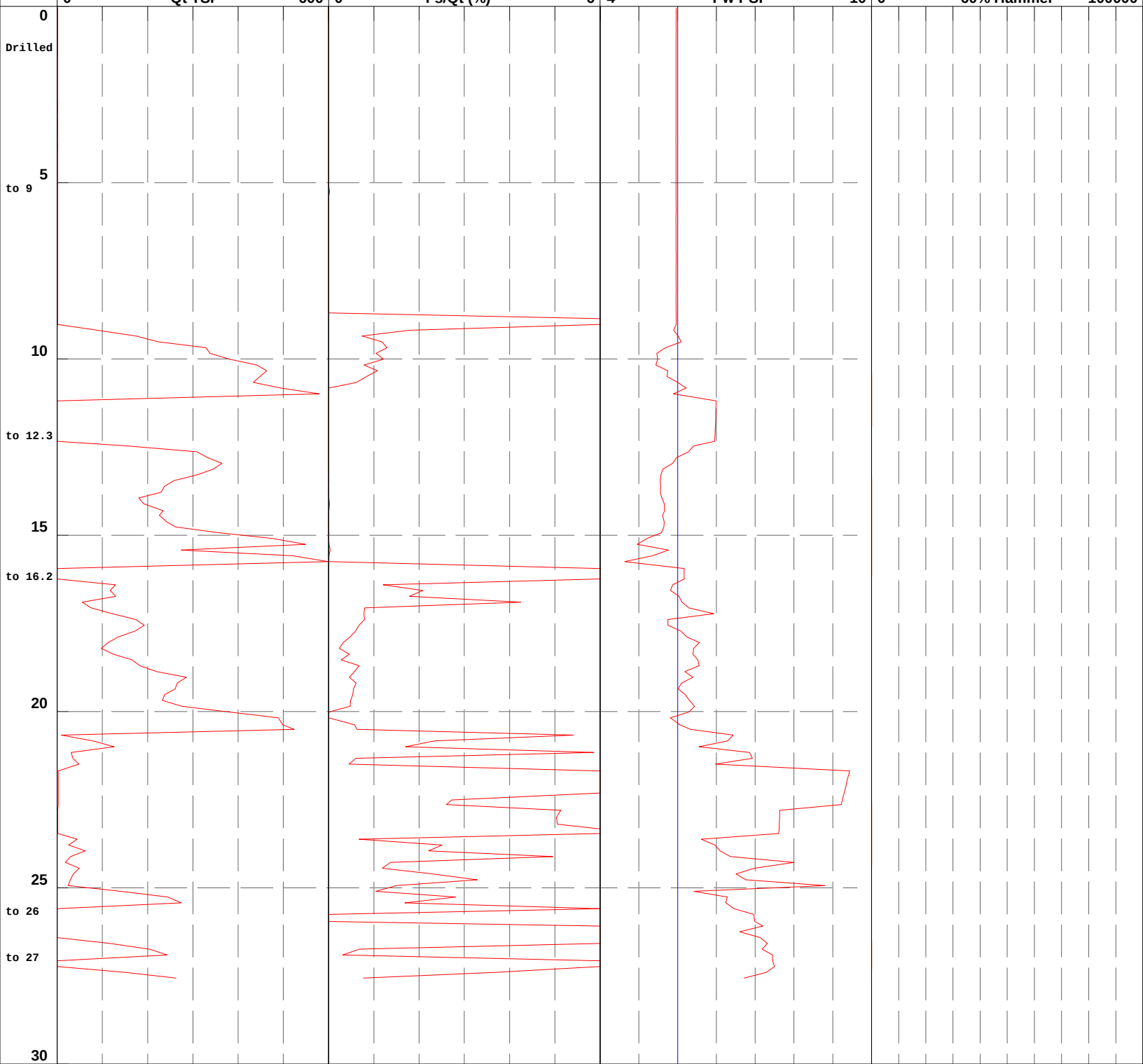
InSitu Engineering

*Soil behavior type and SPT based on data from UBC-1983

Port of Anchorage Geotechnical Investigation

Gerdes	2/8/2012 1:38:47 PM
CPT-05	Anchorage, Alaska
DSG1079	Port of Anchorage

CPT DATA

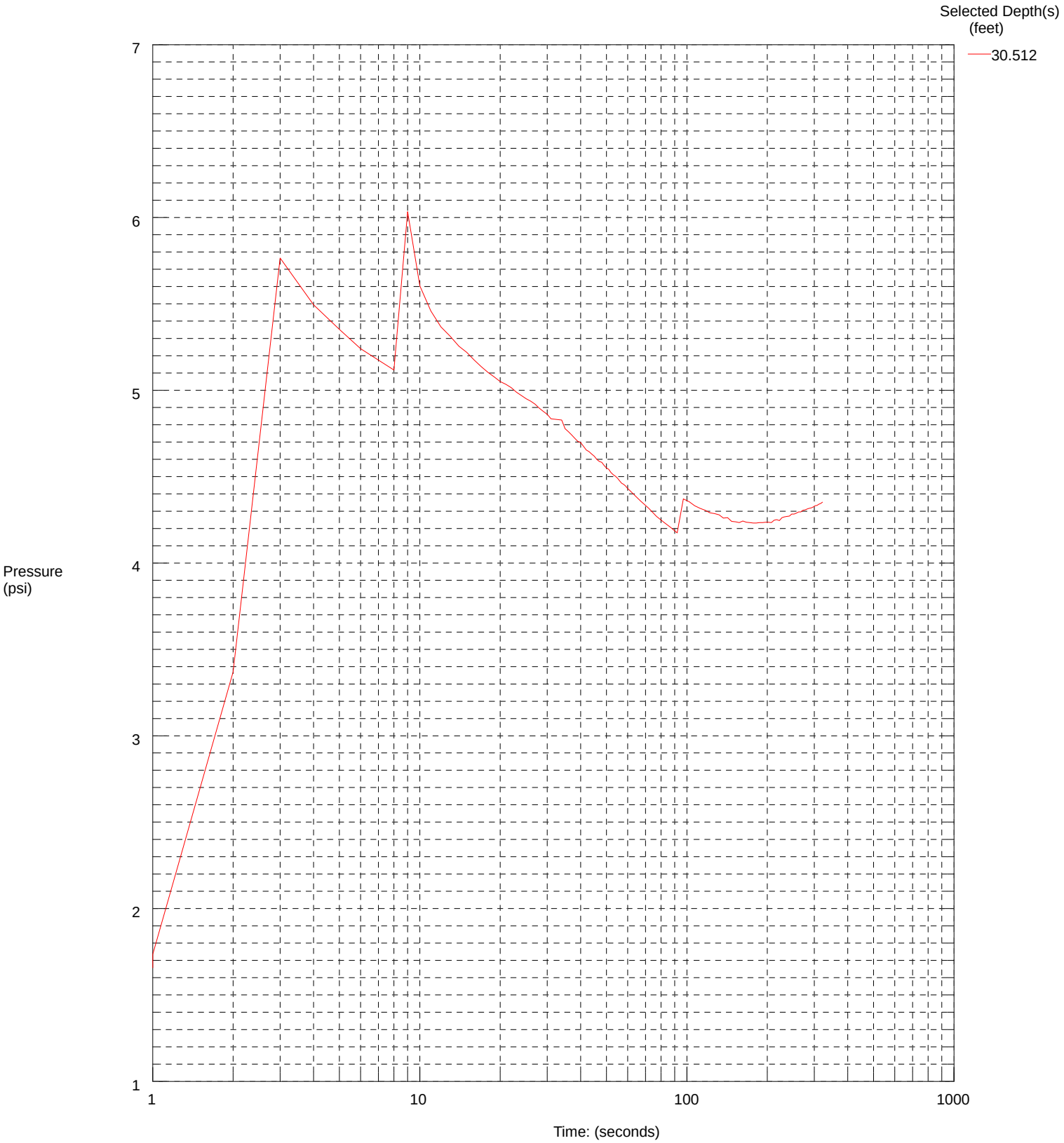


Appendix II Dissipation Data

CH2M Hill

Operator Gerdes
Sounding: CPT-02
Cone Used: DPG1015

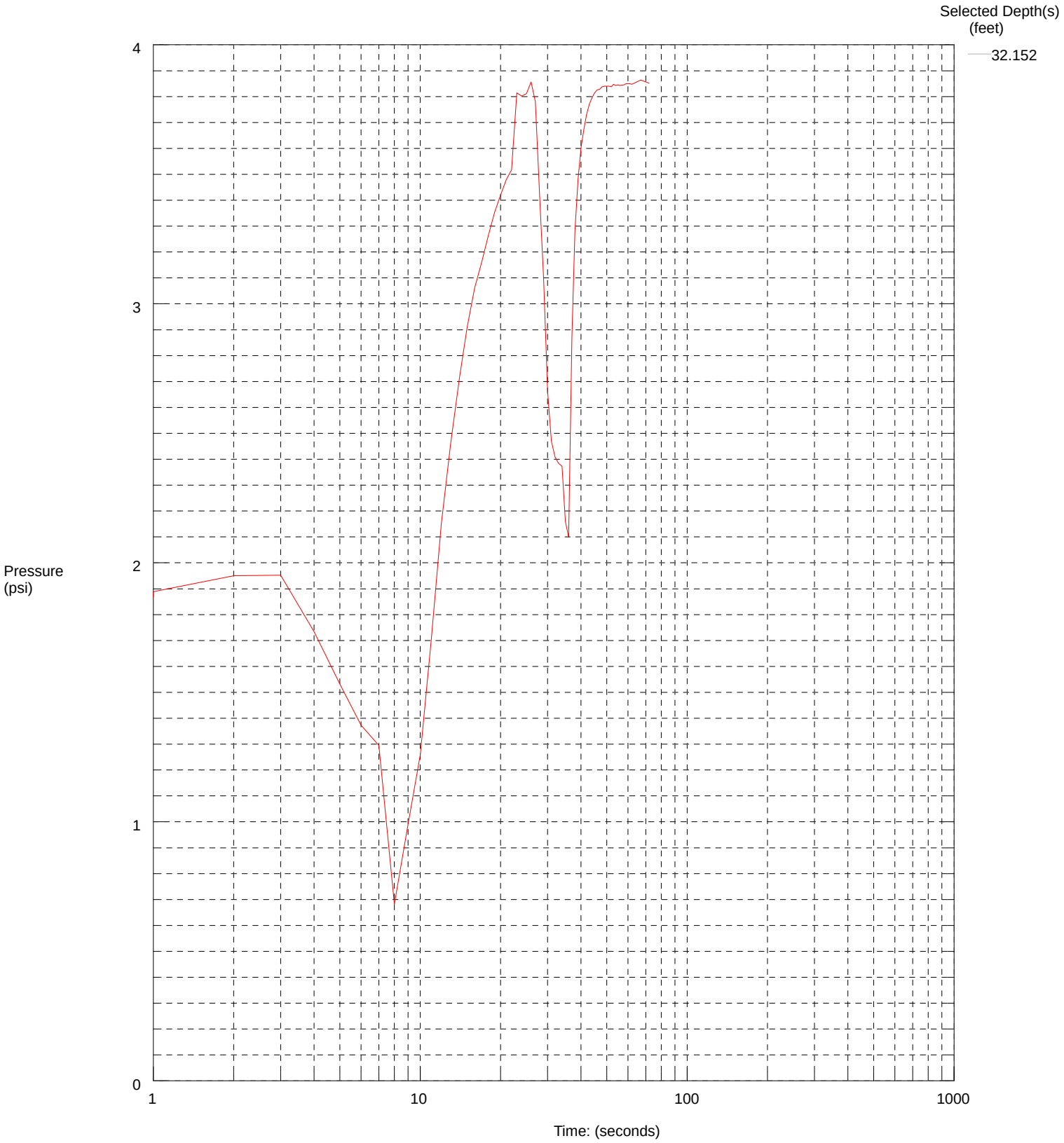
CPT Date/Time: 2/9/2012 10:56:32 AM
Location: Anchorage
Job Number: Port of Anchorage



CH2M Hill

Operator Gerdes
Sounding: CPT-02
Cone Used: DPG1015

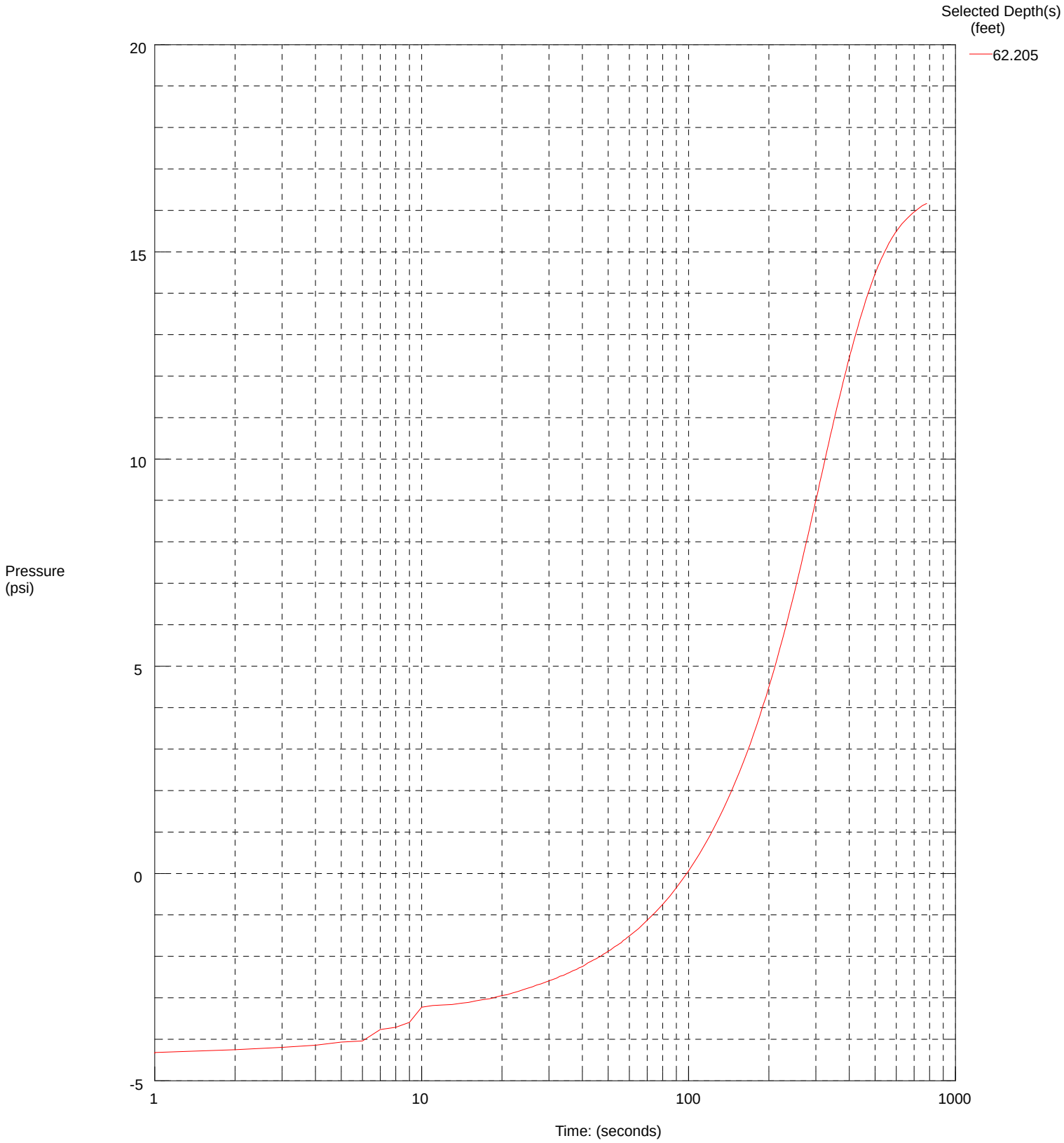
CPT Date/Time: 2/9/2012 10:56:32 AM
Location: Anchorage
Job Number: Port of Anchorage



CH2M Hill

Operator Gerdes
Sounding: CPT-02
Cone Used: DPG1015

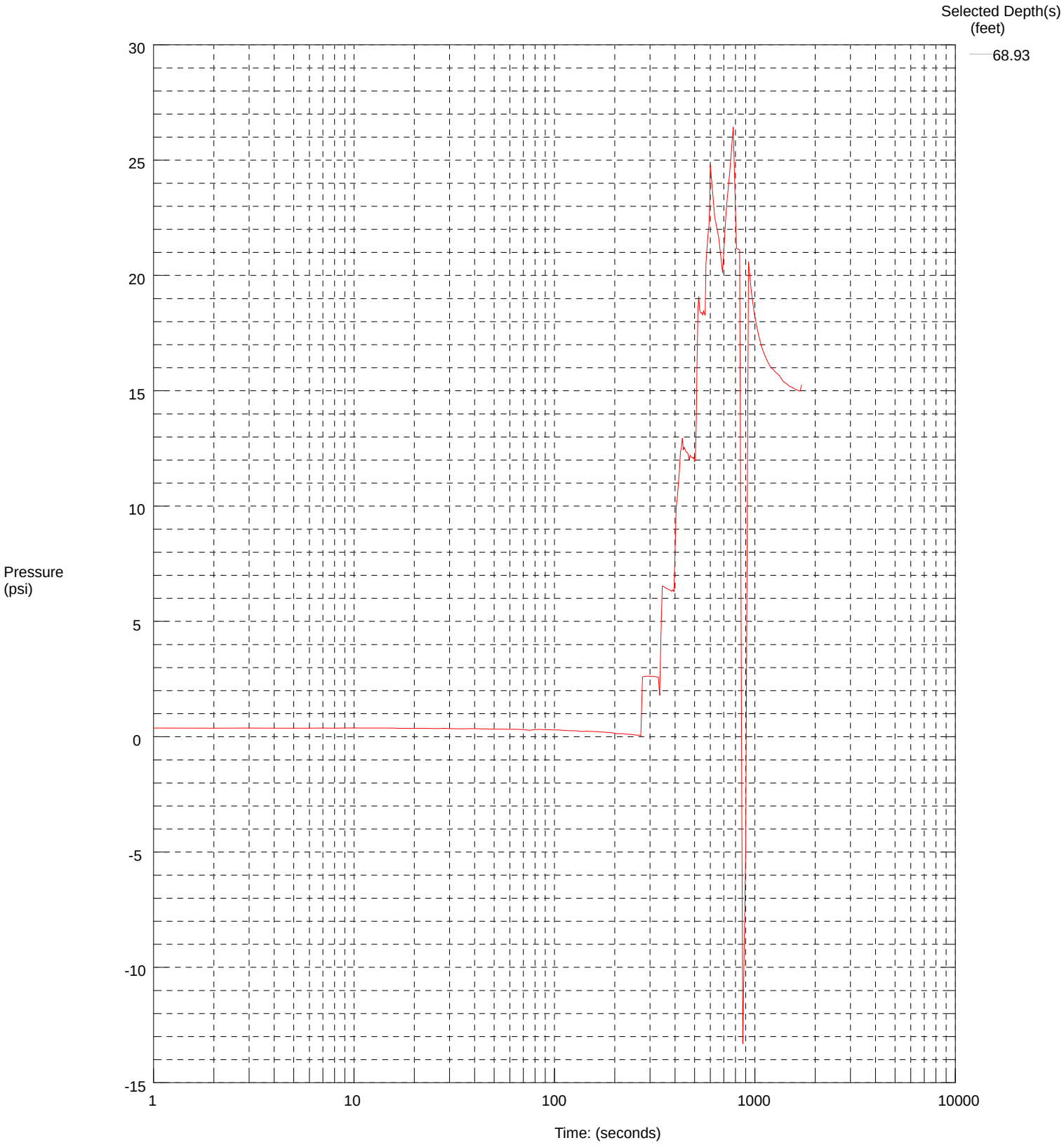
CPT Date/Time: 2/10/2012 10:25:08 AM
Location: Anchorage
Job Number: Port of Anchorage



CH2M Hill

Operator Gerdes
Sounding: CPT-02
Cone Used: DPG1015

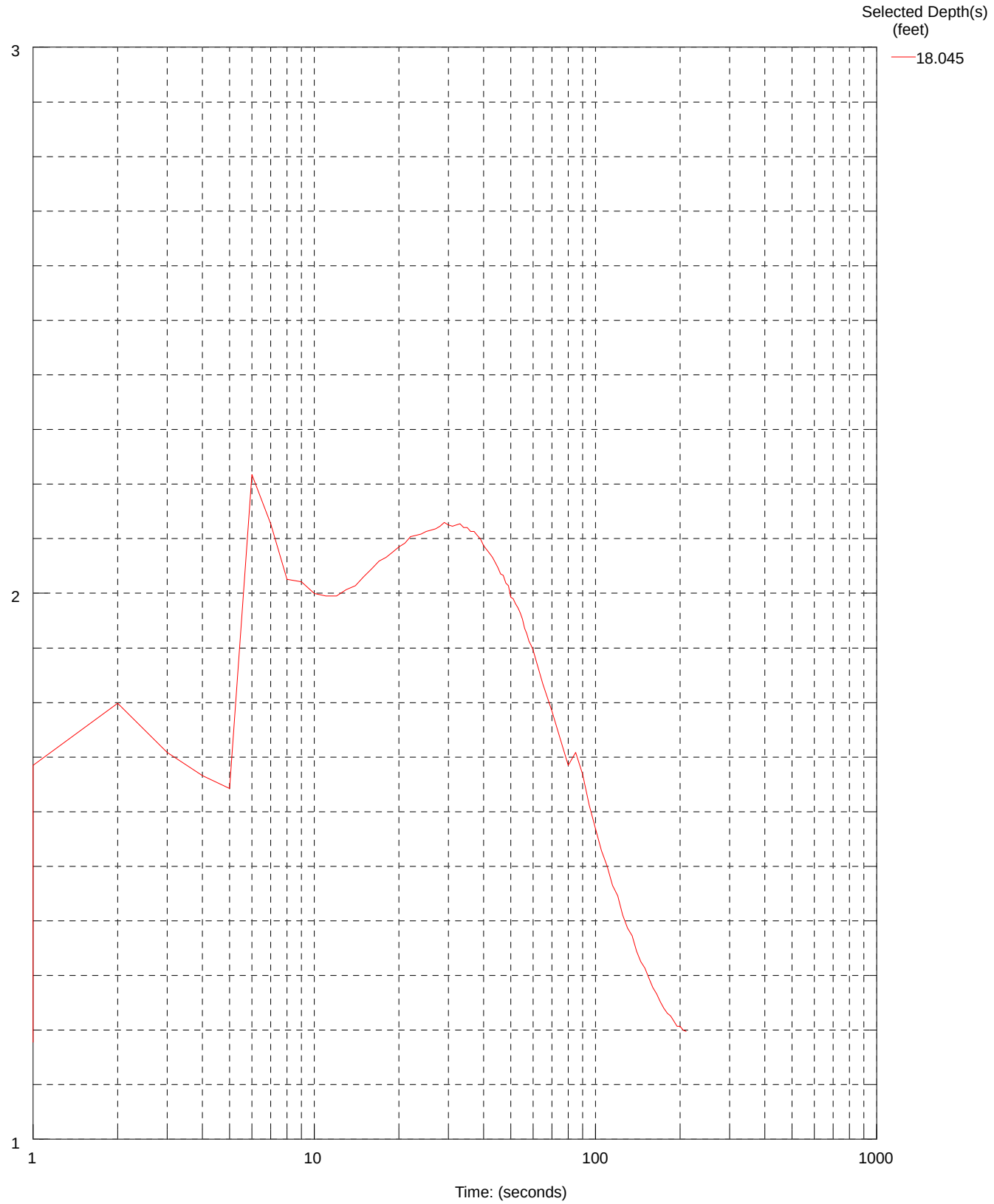
CPT Date/Time: 2/10/2012 10:25:08 AM
Location: Anchorage
Job Number: Port of Anchorage



CH2M Hill

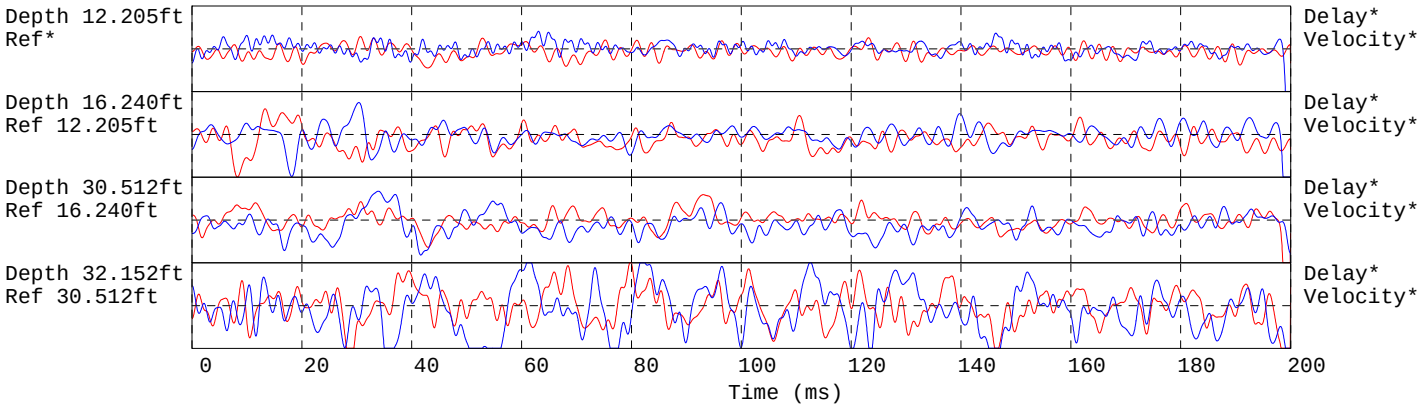
Operator Gerdes
Sounding: CPT-05
Cone Used: DSG1079

CPT Date/Time: 2/8/2012 1:38:47 PM
Location: Anchorage
Job Number: Port of Anchorage



Appendix III Seismic Data

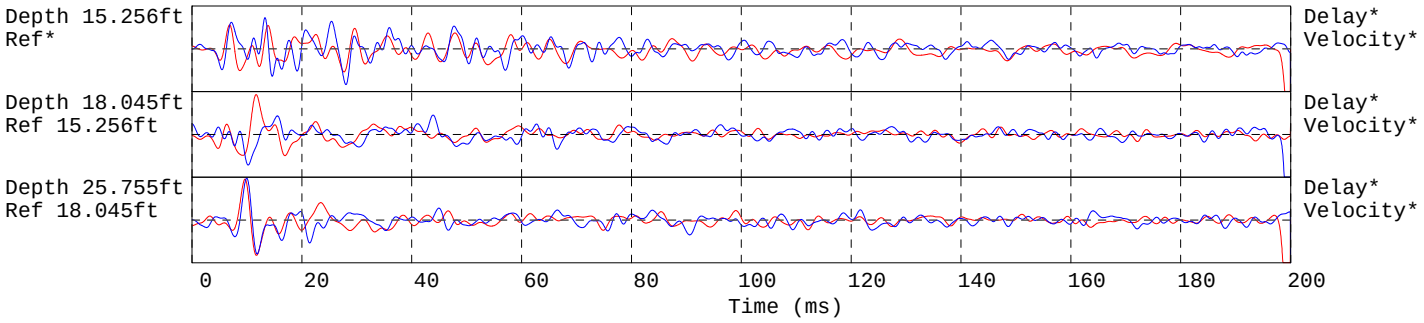
Seismic Plot C-2
Port of Anchorage, Alaska



Hammer to Rod String Distance 0.333 (m)
* = Not Determined

Red - Right Shear Wave
Blue - Left Shear Wave

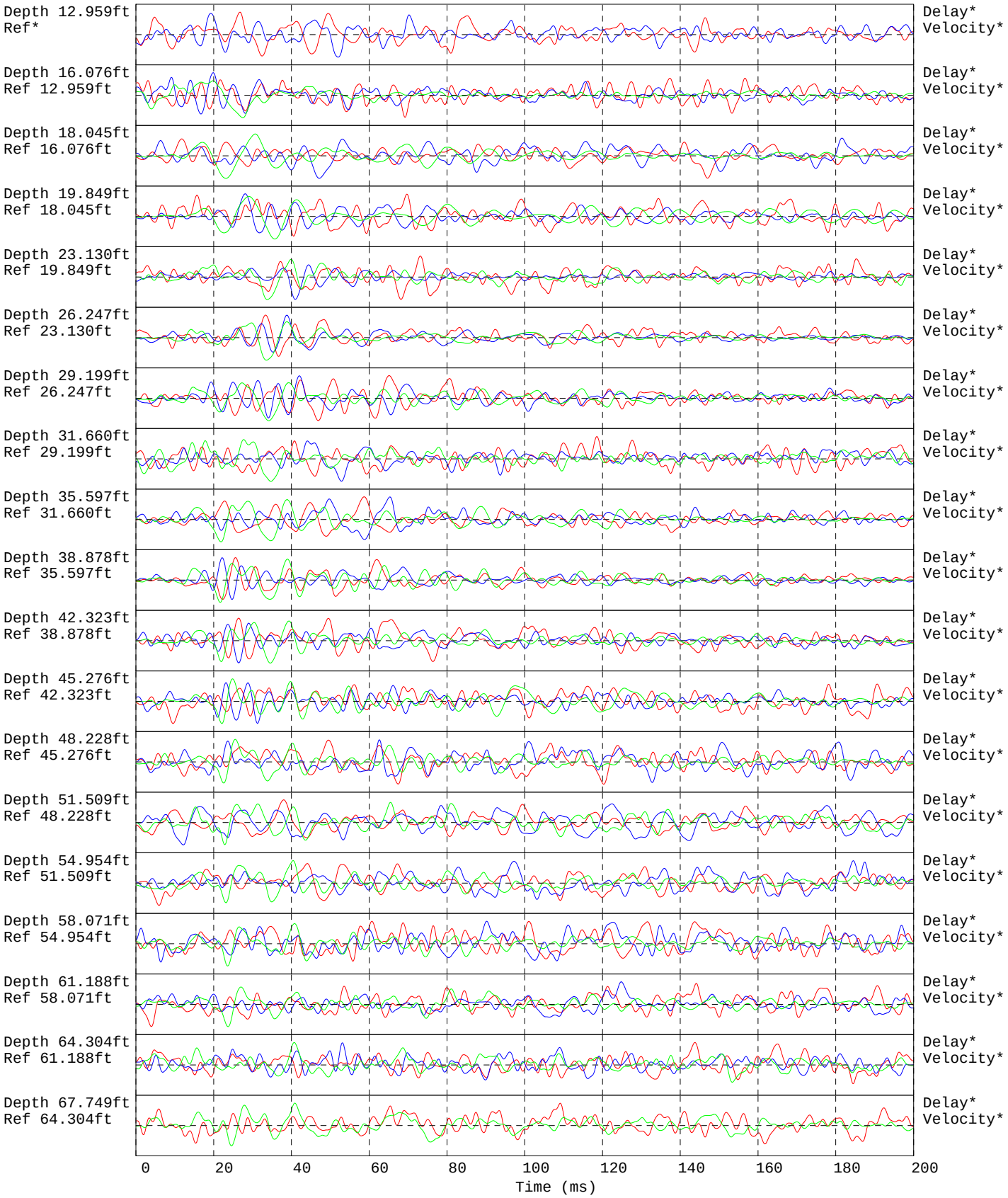
Seismic Plot C-5
Port of Anchorage, Alaska



Hammer to Rod String Distance 0.333 (m)
* = Not Determined

Red - Right Shear Wave
Blue - Left Shear Wave

Seismic Plot C-12
Port of Anchorage, Alaska



Hammer to Rod String Distance 0.333 (m)
* = Not Determined

Red - Right Shear Wave
Blue - Left Shear Wave

Green - Compression Wave