

## **2018 Geotechnical Data Report Church Rock Mill Site Jetty**

Additional Studies for the  
Northeast Church Rock  
Removal Action Design



Prepared for:  
United Nuclear Corporation and  
the General Electric Company

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## **Executive Summary**

### **Introduction**

This report presents information collected during the geotechnical drilling and field sampling specific to the Pipeline Arroyo and buried rock Jetty area at the United Nuclear Corporation (UNC) Mill Site ("Mill Site"). Field notes, boring logs, and laboratory testing results are included in the appendices. Information collected and presented in this report was used to evaluate the proposed excavation soil as borrow material, and locate material exceeding the radium-226 (Ra-226) activity concentration action level encountered during the 2016 geotechnical evaluation for exclusion from construction.

### **Site Description**

The Mine Site is a former uranium mine operated by UNC. The Mine Site and Mill Site are approximately one-half mile apart, and located approximately 16 miles northeast of Gallup, NM. Upon closure and reclamation of the Mill Site and tailings impoundment, stormwater controls were designed to protect the tailings impoundment. The buried rock "Jetty" was designed as part of this reclamation design (Canonie, 1991) previously approved by the US Nuclear Regulatory Commission (NRC). The Jetty is a buried rock slope located in the vicinity of the Nickpoint within the flow path of the Pipeline Arroyo. The Nickpoint is an area of outcropping sandstone that narrows the flow channel of the arroyo and forces flow eastward toward the tailings area. The existing Jetty consists of basalt riprap with a median rock size ( $D_{50}$ ) of 6 inches. The design of the Jetty currently in-place is intended to prevent headcutting and erosion of the existing flow channel, but not to manage large overtopping flows in the vicinity of the Jetty.

### **Geotechnical Investigation**

The field work for further Jetty area soil characterization took place in April 2018, following US Environmental Protection Agency (USEPA) approval of the Work Plan for Additional Soil Characterization at Proposed Jetty Improvements (Stantec, 2018a). Field activities included drilling and soil sampling. The objective of the field investigation was to collect subsurface soil information in the vicinity of the proposed rock Jetty structure to supplement the existing subsurface information for the area collected in 2016. The intent was to develop a more complete picture of the excavation soil as borrow material to support the design.

### **Conclusions and Recommendations**

Results from geotechnical laboratory testing show that soil material excavated in the Jetty area is suitable as repository cover construction material or as general fill, excluding a zone near borehole B6A. A soil sample collected from borehole B6A exceeded the Ra-226 activity concentration content threshold of 5 pCi/g over background set by Criterion 6 of Appendix A to 10 CFR 40 (NRC, 2018). This was the only sample tested during the field sampling program that exceeded the threshold. Due to the elevated Ra-226 activity concentration results at B6A, an excavation exclusion zone is proposed for the area around this borehole location to separate material that may not be suitable for repository construction, during excavation. The excavation exclusion zone contains approximately 11,000 cubic yards of soil. Stantec recommends that material unsuitable for repository construction be stockpiled near the existing evaporation ponds for use during closure of the ponds. The proposed exclusion zone is shown in Figures 1 and 2.

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Stantec compared the gradations of the Jetty soil with the gradations of the four other borrow sources that were used for ET cover modeling completed for the 95% Design. The existing in-situ water contents of the Jetty soil are on average 7 percent greater than the average in-situ water contents for the original borrow sources. The Atterberg limits data from the Jetty area compared with the four original borrow areas indicates more high-plasticity clay (CH) materials and fewer silt samples (ML) within the proposed Jetty excavation as compared with the original borrow sources.

The percent of fines (silt and clay-size particles by weight) ranges from 6 to 99 percent for the Jetty samples, with an average of 71 percent passing the no. 200 sieve. This is compared with an average of 53 percent fines for the four original borrow sources. The Jetty soil has an average of 50 percent silt-sized particles compared with 68 percent silt for the other four borrow areas. The Jetty soils on average have about 11 percent more clay particles by mass on average, than the samples tested from the other four borrow areas. The Jetty soil has an average of 30 percent clay-sized particles compared with 19 percent clay for the other four borrow areas. The Jetty samples have on average about 19 percent less sand than the average gradation of the original four borrow sources.

Stantec compared the soil-water characteristic curves (SWCC) from both sets of borrow data and plotted them for comparison in this report. Due to the higher fines content of the Jetty samples, the curves indicate higher suction values for similar water contents, compared with the original four borrow sources.

Moisture conditioning, wetting or drying, of the Jetty borrow soils may be required to meet the water content criteria during compaction. Some materials encountered in the proposed Jetty excavation may present challenges for moisture conditioning. These materials will be difficult to work with in wet conditions due to high plasticity (USCS classifications CH) and fines content (90 percent fines or greater).

Stantec recommends GE's cover design subconsultant, Dwyer Engineering, LLC, evaluate the infiltration, erosion protection, and radon emanation design requirements for a cover constructed using Jetty soil.

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## Abbreviations

amsl	above mean sea level
ASTM	American Society for Testing and Materials
bgs	below ground surface
CA	California
CFR	Code of Federal Regulations
CH	high-plasticity clay
CL	low-plasticity clay
CPM	counts per minute
DBS	Daniel B. Stephens and Associates, Inc.
ET	evapotranspiration
ft	feet
g	gram
GE	General Electric Corporation
GPS	global positioning system
HSA	hollow-stem auger
I.D.	inside (inner) diameter
LL	liquid limit
MCS	modified California sample(r)
MH	high-plasticity silt
Mill Site	United Nuclear Corporation Mill Site
Mine Site	Northeast Church Rock Mine Site
ML	low plasticity silt

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mm	millimeter
MWH	MWH Americas, Inc.
ND	non-dispersive
NECR	Northeast Church Rock
NRC	US Nuclear Regulatory Commission
O.D.	outside (outer) diameter
OSHA	Occupational Safety and Health Administration
pCi	picocuries
PI	plasticity index
PL	plastic limit
Psi	pounds per square inch
Ra-226	radium-226
SM	silty sand
SOP	standard operating procedure
SP	poorly-graded sand
SWCC	soil-water characteristic curve
ST	Shelby tube
UNC	United Nuclear Corporation
USCS	unified soil classification system
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

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## 1 INTRODUCTION

### 1.1 PURPOSE

This report has been prepared on behalf of General Electric Company and United Nuclear Corporation (GE/UNC) for submittal to the U.S. Environmental Protection Agency (USEPA), Region 9 as part of the work elements being conducted pursuant to the Administrative Settlement Agreement and Order on Consent for Design and Cost Recovery, United Nuclear Corporation Superfund Site and Northeast Church Rock Mine Removal Site (USEPA, 2015), including the Statement of Work attached as Appendix D to the Administrative Order on Consent. Information collected is being used to evaluate the soil excavated in the proposed rock Jetty area as borrow material for use elsewhere onsite during construction.

The report summarizes the geotechnical investigation and sampling conducted at the UNC Mill Site specific to the Pipeline Arroyo and rock Jetty area at the UNC Mill Site. The field work for the NECR Jetty Investigation was completed in accordance with the USEPA-approved work plan (Stantec, 2018a).

### 1.2 REPORT BACKGROUND

As part of the 30% Design (MWH, 2016a), MWH reviewed existing geotechnical data in the rock Jetty area and determined additional geotechnical characterization data was necessary to complete the design of the erosion protection structures. In November of 2016, MWH (now part of Stantec) conducted a geotechnical evaluation to collect the necessary data to characterize the rock Jetty area (MWH now part of Stantec, 2017). Analytical testing conducted by ACZ Laboratories in Steamboat Springs, CO as part of the 2016 investigation showed a composite soil sample collected from the southeast portion of the Jetty area exceeded the radium-226 (Ra-226) activity concentration action level (MWH now part of Stantec, 2017).

The proposed 95% Design includes replacing the existing rock Jetty structure with a new riprap revetment and weir consisting of larger rock to handle overtopping flows and using the Jetty excavation area as a borrow source for repository cover construction material (soil). Due to the elevated Ra-226 activity concentration result found during the 2016 investigation for one composite sample and limited geotechnical data for evaluation of the Jetty area as a borrow source, Stantec developed a work plan to obtain additional data necessary to complete the design and isolate the soil with elevated Ra-226 activity concentrations (Stantec, 2018a).

### 1.3 REPORT OBJECTIVES AND SCOPE

The objective of this evaluation is to summarize physical and engineering properties of the soil within the Jetty area and to locate material exceeding the Ra-226 action level encountered during the 2016 geotechnical evaluation (MWH now part of Stantec, 2017). This report contains an evaluation of soil

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properties and stratigraphy of the subsurface conditions and their potential use as a borrow source for the remediation activities. Specifically, this report presents the following information:

- A summary of the investigation and sampling conducted
- The results of the investigation – boring logs and laboratory data
- Recommendations for the Jetty excavation soil

The report contents include the following:

- Section 1 – Introduction: background and objectives
- Section 2 – Subsurface Evaluation: drilling and sampling conducted
- Section 3 – Subsurface Conditions: results of the sampling and laboratory testing
- Section 4 – Jetty Borrow Evaluation: materials, design, and construction considerations
- Section 5 – References

Laboratory data reports, drilling logs, and field photographs documenting the investigation and sampling activities at the Mill Site Jetty area are included in the appendices.

## 2 SUBSURFACE EVALUATION

### 2.1 EVALUATION OF JETTY SUBSURFACE CONDITIONS

The NECR Jetty geotechnical evaluation was conducted April 30 to May 4, 2018, following approval of the Work Plan for Additional Soil Characterization at the Proposed Jetty Improvements (Stantec, 2018a). Field activities consisted of drilling and soil sampling.

Activities were conducted in accordance with the work plan and applicable SOPs. Minor changes to drilling locations were implemented due to field conditions and drill rig accessibility. Details of activities conducted and any variations from the Work Plan are described in the following sections.

Drilling in the rock Jetty area was performed by Cascade Drilling LP (Cascade) with a CME-85 truck-mounted drill rig. Eight boreholes along the southeast side of the arroyo were drilled during field work, as described in the work plan. A summary of the completed boreholes is shown in Table 1. The “A” designation denotes a location that was re-drilled during this investigation and was previously sampled during the 2016 sampling program. The borehole locations are shown in Figure 1 along with the 2016 borehole locations.

**Table 1 Summary of Completed Boreholes**

Boring ID	Latitude	Longitude	Surface Elevation (ft amsl)	Depth of Borehole (ft bgs)
B4A	35.6468	-108.5064	6942	59.5
B5A	35.6466	-108.5060	6935	70.5
B6A	35.6462	-108.5068	6934	80.5
B7A	35.6459	-108.5077	6922	95.5
B8	35.6461	-108.5074	6932	40.5
B9	35.6456	-108.5078	6929	55.5
B10	35.6456	-108.5084	6924	50.5
B11	35.6452	-108.5086	6914	50.5

**Note:** amsl = above mean sea level; bgs = below ground surface, ft = feet

#### 2.1.1 Soil Borings

Hollow-stem auger (HSA) drilling methods were used to drill each location, and samples were collected by grab (bulk), continuous core, and modified California sampler drive methods. Drilling depths ranged from 40 feet to 95.5 feet.

Continuous (dry-core) samples (4-inch I.D.) were collected as the primary sampling method. Dry-core samples were scanned upon retrieval with an HP-210L Beta/Gamma and Ludlum Model 12 Rate Meter, logged, and grab samples were collected. Grab samples were placed in plastic sealable bags, labeled,

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and ex-situ screened by AVM Environmental Services, Inc. using a Ludlum Model 19 Exposure Rate Meter. After ex-situ screening, grab samples were subsampled, bagged, and logged for gamma spectroscopy and offsite metals testing. The remaining core sample material was placed in core boxes and photographed. Borehole logs and photographs are provided in Appendices A and B. A technical memorandum describing the ex-situ gamma radiation screening is attached as Appendix D.

Modified California drive samplers were used to conduct blow-count testing at five-foot intervals. A 2.5-inch (O.D.) modified California split-spoon sampler (MCS) was used. MCS blow counts (N-values) were recorded for successive 6-inch increment of 18-inch drives which were driven by an automatic 140-pound hammer falling 30 inches. When recovery was sufficient, undisturbed sleeve samples were collected and logged.

Boreholes B6A and B7A encountered groundwater during drilling. After drilling, these boreholes were backfilled with bentonite grout to at least ten feet above the water table before backfilling with cuttings. Each borehole location was surveyed using a sub-meter handheld global positioning system (GPS) unit after drilling operations were complete.



### 3 SUBSURFACE CONDITIONS

#### 3.1 SITE GEOLOGY

The discussion of geologic conditions contained in this section is based on published information for the site area and is provided for background on the bedrock in the vicinity of the Jetty (New Mexico Bureau of Geology and Mineral Resources, 2016 and USGS, 1987). Subsurface details are based on the previously described geotechnical field exploration and laboratory test results. The NECR site is located on the Colorado Plateau, which consists of sedimentary rocks that have been sculpted into mesas, buttes, and canyons by water erosion. In New Mexico, the Colorado Plateau also includes the San Juan Basin, a source of oil, gas, coal, and uranium. The Jetty area is predominantly alluvial deposits of the Holocene and Pleistocene as part of the Quaternary unit. These alluvial deposits are described by the USGS as pale-yellowish-brown and grayish-orange weathering alluvium deposited in graded stream valleys and on flood plains.

The rock units at the site consist of the Crevasse Canyon Formation and the Gallup Formation (D'Appolonia, 1981 and Canonie, 1987). The uppermost layer is the Dalton Sandstone Member, which is described as a massive clean white to buff, medium to coarse-grained sandstone. This sandstone outcrops at the site. Below the Dalton Sandstone is the Mulatto Tongue and Dilco Coal Member. The Mulatto Tongue is a dark gray mudstone and silty sandstone with scattered thin beds of sandstone. The Dilco Coal Member is comprised of paludal and fluvial deposits and primarily irregular buff to gray medium-grained sandstone, light gray clay, lenticular coal beds, and carbonaceous shales. The Dilco Coal is interfingered with the underlying Gallup Sandstone. The upper Gallup Sandstone Member (Zone 3) is predominantly light gray to buff, fine to coarse-grained sandstone, interbedded with gray siltstone and mudstone, and minor amounts of coal. The Zone 2 material is comprised of sandy marine shales and thin lenticular sandstones. Zone 1 is the lower Gallup Sandstone Member and is generally a buff to light gray, fine-grained and silty becoming gradually finer-grained towards the base. This evaluation did not extend beyond the upper Gallup Sandstone (Zone 3).

#### 3.2 SOIL CONDITIONS

Borings for this evaluation were drilled on the southeast side of the arroyo and southwest of the existing Jetty to characterize subsurface soil conditions. Borehole depths prescribed by the work plan were shallower than the 2016 investigation but were extended below the proposed Jetty design excavation depth.

The borehole locations for this evaluation were predominantly in native soil (alluvium). Borings B4A, B5A, and B8 had approximately 19, 4, and 8 feet of fill overlying the native soil, respectively. The fill consists of clay, silty clay, or clayey sand. The alluvium generally consists of clays with interbedded lenses of sands and silts throughout the boring depths. The sand was predominantly fine-grained, but occasional lenses of coarse-grained sands and gravels were encountered.

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MCS blow counts for the upper 10 feet generally indicated hard consistency and refusal was occasionally met in the first test at the 4-foot depth. The soil in the upper 10 feet of the boreholes was generally dry and indurated. Beyond 10 feet bgs, blow counts showed very stiff (or medium dense) soil consistency.

Site geology information collected from both investigations as well as previous site data is presented in the cross-sections in Figures 2 through 6.

### 3.3 GROUNDWATER CONDITIONS

MWH encountered localized groundwater in three boreholes (B5, B6, and B7) while drilling in 2016 (MWH now part of Stantec, 2017). Groundwater levels encountered at that time were at similar depths and elevations, ranging from 65 feet bgs to 73 feet bgs (6860 to 6869 feet amsl). Groundwater was not encountered in the remaining boreholes during the 2016 drilling.

Stantec encountered groundwater at B6A and B7A (adjacent to B6 and B7 boreholes) at approximately 72 and 71 feet bgs (6862 and 6851 feet amsl), respectively in 2018. Groundwater, where encountered, was within a similar depth range as the 2016 drilling and was not encountered in the remaining boreholes during 2018 drilling.

The 95% Design analyses used groundwater levels from both the PDS report (MWH, 2014) and alluvial wells measured in 2016 (Chester Engineers, personal communication, April 20, 2016, included in Attachment G.2 of the 95% Design). From the PDS report, groundwater was encountered during drilling in two of the boreholes within the repository footprint (TI-B10 and TI-B11). The groundwater elevation in these boreholes was approximately 6,885 feet amsl. Groundwater was also encountered at approximately 6,903 feet amsl while drilling in boring TI-B3.

Site alluvial wells 509D and EPA23 are nearest to the Jetty boring locations. Alluvial wells 509D and EPA23 were measured on January 4, 2016 and showed a groundwater elevation of approximately 6,867 feet amsl. The alluvial wells downstream of the Jetty area (GW 1, GW 2, GW 3, 0632, EPA 25, EPA 28, and 0624) showed groundwater elevations ranging from 6845 to 6855 feet amsl. Water elevations encountered during the 2018 drilling are lower in elevation than the water elevations measured in the alluvial wells and during the drilling investigation in 2016 (Attachment G.2, Stantec, 2018b).

Well locations are shown in Figure 1. Groundwater elevations, where encountered are shown on Figures 2 through 6.

### 3.4 LABORATORY TEST RESULTS

#### 3.4.1 Geotechnical Laboratory Results

Geotechnical laboratory testing on 2018 soil samples was conducted by Daniel B. Stephens & Associates, Inc. (DBS) in Albuquerque, NM and 2016 samples by Ninyo and Moore in Phoenix, AZ. Laboratory testing included sieve analysis with hydrometer, Atterberg limits, moisture and density,

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standard Proctor, pinhole dispersion, double hydrometer dispersion, and specific gravity of select soil samples. Geotechnical laboratory results from both drilling programs are summarized in Table 2. Results, as received, from DBS are included in Appendix C. Particle-size distribution and Atterberg limits plots are also included in Figures 4-1 and 4-2 and Appendix C as figures C.1 and C.2, respectively.

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Table 2 Summary of Geotechnical Laboratory Results

Borehole	Sample	Sample Type <sup>(1)</sup>	Sample Depth Interval (ft)		USCS <sup>(2)</sup>	Water Content (by mass, %)	Dry Density (pcf)	Porosity (%)	Specific Gravity	Standard Proctor (max. dd@opt. w.c.), (pcf @ %)	Atterberg Limits (%) <sup>(3)</sup>			USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	Pinhole Dispersion <sup>(3,4,6)</sup>	Double Hydrometer (% Dispersion) <sup>(5,6)</sup>	Remolded Saturated Hydraulic Conductivity (cm/sec) <sup>(6)</sup>	SWCC: Saturated Water Content (by vol., %) <sup>(6)</sup>
											LL	PL	PI									
B4A	B4A-4A	CA	5.0	5.5	CL	11.2	91.7	44.7	2.66		43	20	23	0.0	7.3	92.7	53.0	39.7				
B4A	B4A-14A	CA	15.0	15.5	CL									0.0	11.0	89.0	64.3	24.6				
B4	B4-16-16.5 <sup>(7)</sup>	CA	16.0	16.5		10.4	77.6															
B4A	B4A-24A	CA	25.0	25.5	CL	13.0	91.3	45.3	2.68		27	16	11	0.0	34.8	65.2	36.9	28.3				
B5	B5-5.5-6 <sup>(7)</sup>	CA	5.5	6.0	SM	9.8	82.4							5.0	77.0	18.0						
B5A	B5A-9A	CA	10.0	10.5	ML	7.5	81.8	50.1	2.63		NP			0.0	41.9	58.1	39.8	18.3	0 (NP)	16	9.2E-05	39.4
B5	B5-10.5-11 <sup>(7)</sup>	CA	10.5	11.0		5.2	82.9															
B5A	B5A-14A	CA	15.0	15.5	CL	14.7	73.4	55.6						0.0	9.9	90.1	57.0	33.1				
B5	B5-TW-25-27 <sup>(7)</sup>	ST	25.0	27.0	CH	21.2	98.8				61	21	40									
B5	B5-30.5-31 <sup>(7)</sup>	CA	30.5	31.0	CL									0.0	14.0	86.0						
B5	B5-40.5-41 <sup>(7)</sup>	CA	40.5	41.0	CL	22.7	99.6				49	20	29	0.0	1.0	99.0						
B6	B6-12.8-13.5 <sup>(7)</sup>	CA	12.8	13.5	SP-SM									5.0	89.0	6.0						
B6	B6-15.5-16 <sup>(7)</sup>	CA	15.5	16.0	CL	10.7	93				42	17	25	0.0	10.0	90.0						
B6A	B6A-19A	CA	20.0	20.5	CH	14.2	111.8	33.3	2.69		51	22	29	0.0	13.3	86.7	44.2	42.5		9	7.0E-05	45.5
B6A	B6A-20-40 (1+2)	Bulk	20.0	40.0	CL				2.69	104.9 @ 17.9	28	17	11	0.0	12.6	87.3	45.1	42.2				
B6	B6-40.5-41 <sup>(7)</sup>	CA	40.5	41.0		17.9	97															
B7	B7-TW-5-6.5 <sup>(7)</sup>	ST	5.0	6.5		6.9	94.3															
B7	B7-10.5-11 <sup>(7)</sup>	CA	10.5	11.0	CL	7.0	99.7							0.0	10.0	90.0						
B7	B7-16-16.5 <sup>(7)</sup>	CA	16.0	16.5	CL	17.8	99.3				35	19	16	1.0	45.0	54.0						
B7	B7-30.5-31 <sup>(7)</sup>	CA	30.5	31.0	CL	16.7	102.5				40	16	24									
B7A	B7A-39A	CA	40.0	40.5	ML	13.6	108.2	35.3			NP			0.3	42.5	57.2	37.4	19.8				
B7A	B7A-0-20 (1+2)	Bulk	0.0	20.0	CL				2.67	114.2 @ 13.7	29	15	14	0.7	37.1	62.2	41.1	21.1		17	8.9E-05	40.3
B7A	B7A-40-60 (1+2)	Bulk	40.0	60.0	CL				2.67	109.9 @ 15.0	37	16	21	0.6	28.3	71.1	40.6	30.5		12	5.9E-04	40.8
B8	B8-9A	CA	10.0	10.5	CH	14.5	102.9	38.3	2.67		54	24	30	0.0	3.1	96.9	48.6	48.3				
B8	B8-24A	CA	25.0	25.5	CH	17.8	105.8	36.0			67	24	43	0.0	0.9	99.1	41.8	57.3				
B8	B8-34A	CA	35.0	35.5	SM	8.3	104.9	36.9	2.67		NP			0.2	62.4	37.4	26.9	10.5				
B9	B9-9A	CA	10.0	10.5	CH	15.1	103.3	38.4	2.69		52	23	29	0.0	3.1	96.9	49.8	47.1				
B9	B9-39A	CA	40.0	40.5	ML	11.6	98.6	40.8	2.67		NP			0.0	31.4	68.6	43.7	24.9				
B9	B9-20-35 (1+2)	Bulk	20.0	35.0	CH				2.71	100.5 @ 20.8	55	21	34	0.0	3.5	96.4	42.6	53.9		5	4.1E-05	45.9

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Borehole	Sample	Sample Type <sup>(1)</sup>	Sample Depth Interval (ft)		USCS <sup>(2)</sup>	Water Content (by mass, %)	Dry Density (pcf)	Porosity (%)	Specific Gravity	Standard Proctor (max. dd@opt. w.c.), (pcf @ %)	Atterberg Limits (%) <sup>(3)</sup>			USCS % Gravel	USCS % Sand	% Passing No. 200 Sieve (fines)	% Silt	USDA % Clay (<0.002 mm)	Pinhole Dispersion <sup>(3,4,6)</sup>	Double Hydrometer (% Dispersion) <sup>(5,6)</sup>	Remolded Saturated Hydraulic Conductivity (cm/sec) <sup>(6)</sup>	SWCC: Saturated Water Content (by vol., %) <sup>(6)</sup>
											LL	PL	PI									
B10	B10-4A	CA	5.0	5.5	CL	10.1	114.6	30.9	2.66		31	15	16	0.3	41.8	57.9	38.3	19.6				
B10	B10-39A	CA	40.0	40.5	CH				2.68		56	21	35	0.0	5.4	94.6	56.5	38.1		15	5.5E-05	46.7
B10	B10-10-25 (1+2)	Bulk	10.0	25.0	CL				2.68	115.5 @ 13.8	45	16	29	1.1	38.3	60.5	38.0	22.5	ND2	0	1.0E-04	40.1
B11	B11-14A	CA	15.0	15.5	CL	7.5	119.9	27.8	2.66		27	15	12	1.1	46.3	52.6	35.3	17.3				
B11	B11-29B	CA	30.0	30.5	CL	15.7	97	41.6	2.67		31	17	14	0.3	33.0	66.7	44.2	22.5				
B11	B11-39A	CA	40.0	40.5	SM	9.5	94.5	42.9	2.66		NP			0.0	64.6	35.4	29.1	6.3	0 (NP)	0	1.0E-03	39.7
B11	B11-0-10 (1+2)	Bulk	0.0	10.0	CL				2.66	113.6 @ 14.8	30	16	14	0.9	35.9	63.2	38.0	25.2				
Composite	Clay	Bulk	-	-	CL	17.6	96.2			106.6 @ 17.7	42	19	24	0.0	20.0	80.0					4.8E-07	37.8
Composite	Sand	Bulk	-	-	SM	14.8	102.0			112.4 @ 14.2				0.0	65.0	35.0					2.5E-05	35.0

- Notes:**
1. Sample Types: CA = California sample, Bulk = bucket/grab sample
  2. USCS = Unified Soil Classification System, material descriptions are based on field observations, and refined with laboratory data, if available. USCS classifications are provided only where sufficient laboratory data are available. CL = low plasticity clay, CH = high plasticity clay, SM = silty sand, ML = silt, SP - SM = poorly graded sand - silty sand
  3. LL = liquid limit, PL = plastic limit, PI = plasticity index, NP = non-plastic
  4. ND2 = nondispersive clay with very slight to no colloidal erosion under 15-inch or 40-inch head (ASTM test method A)
  5. <30% = non-dispersive, 30 to 50% intermediate, >50% dispersive
  6. Specimens remolded to approximately 90% of maximum standard Proctor dry density and between the estimated natural and optimum water contents for the soil. SWCC tests performed with pairs of specimens
  7. 2016 Geotechnical Investigation Sample

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### 3.4.2 Analytical Laboratory Results

Analytical laboratory testing was conducted by ALS Environmental Inc. (ALS) in Fort Collins, CO. Testing included gamma spectroscopy and metals content of select soil samples. Analytical laboratory results are summarized in Table 3, tabulated and results as received from ALS are included in Appendix C.

Analytical testing results of the Jetty area soil samples showed a range of 0.66 to 5.73 pCi/g Ra-226. However, a sample collected from borehole B6A between the depths of 4.5 and 6 feet showed 78.5 pCi/g Ra-226.

**Table 3 Summary of Analytical Laboratory Results**

Depth Range (ft)	Ra-226 Activity Concentration (pCi/g)							
	B4A	B5A	B6A	B7A	B8	B9	B10	B11
0 - 10	1.5	5.7	78.5	1.1		1.4		
10 - 20	2.0	1.9	1.7	1.3	1.5		1.1	1.1
20 - 30	1.6	1.8	1.8	1.4				
30 - 40	1.6	2.2	1.5	1.6	1.6	1.3		
40 - 50	1.4	1.5	1.2	1.3			1.6	1.1
50 - 60	1.8	1.1	1.3	4.6				
60 - 70		1.0	0.9	1.9				
70 - 80			2.0	2.0				
80 - 90				1.8				
90 - 100				0.8				

## 4 JETTY BORROW EVALUATION

### 4.1 MATERIAL CHARACTERISTICS

Stantec used field observations and laboratory data from the 2016 and 2018 Jetty area investigations to evaluate the Jetty area soil as a borrow source. Sections 4.1.1 and 4.1.2 summarize the 2016 and 2018 Jetty area geotechnical and hydraulic data, respectively.

#### 4.1.1 Geotechnical Properties

Jetty area soil samples were classified as fat and lean clays, sandy silt, and silty sand. As-received gravimetric water contents for the samples ranged from 5.2 to 22.7 percent. Dry density ranges between 73.4 and 119.9 pounds per cubic foot. Percent sand ranges between 1 and 89, with a range of 6 to 99 percent passing the No. 200 sieve. The maximum percent gravel is 5 percent, in the samples tested. Plasticity index ranges between non-plastic to 43 percent and a liquid limit ranges from 27 to 67 percent. Maximum dry density ranges between 100.5 and 115.5 pounds per cubic foot, with an optimum water content ranging between 13.7 and 20.8 percent. The Atterberg limits and the particle-size distributions are plotted in Section 4.2 for comparison between the Jetty materials and the properties from the previously evaluated borrow areas.

#### 4.1.2 Hydraulic Properties

Jetty area soil samples were tested for hydraulic properties by saturated hydraulic conductivity, pinhole dispersion, and double hydrometer dispersion. Hydraulic properties testing was conducted on samples remolded to 90 percent of maximum standard Proctor. Saturated hydraulic conductivity ranges between  $9.2 \times 10^{-5}$  and  $1.0 \times 10^{-3}$  centimeters per second. Pinhole dispersion designation show no designation (non-plastic samples) and ND2, or nondispersive. Double hydrometer dispersion results range between 0 and 17 percent, or nondispersive. The soil-water characteristic curves show a range of saturated water content between 35.0 and 46.7 percent for the specimens tested.

### 4.2 DESIGN CONSIDERATIONS FOR JETTY EXCAVATION

#### 4.2.1 Exclusion Material

Criterion 6 of Appendix A to 10 CFR 40 requires long-term stabilization of areas showing byproduct material contamination in excess of 5 pCi/g Ra-226 in soil above background (NRC, 2018). Background Ra-226 for the Jetty area is 1.0 pCi/g (Canonie, 1991).

Material exceeding 6 pCi/g Ra-226 was encountered in a sample taken from borehole B6A between the depths of 4.5 and 6 feet bgs. Analytical results showed 78.5 pCi/g Ra-226 for sample B6A4.5-6.0. Stantec conservatively estimates that an exclusion zone for soil to be excavated containing byproduct material exists to a depth of about eight feet bgs near B6A, and 100 to 130 feet to the southwest and northeast of B6A, respectively. Assuming the exclusion zone extends to the boundaries shown on Figure 1 and the

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area is excavated at a 2H:1V slope, about 11,015 cubic yards of material will be excluded from the borrow. The actual volume will depend on scanning during excavation. Stantec recommends material exceeding counts per minute (CPM) that indicate greater than 6 pCi/g Ra-226 be stockpiled near the evaporation ponds, while soil below the action level of 6 pCi/g Ra-226 may be used as borrow for construction. The approximate extents of the exclusion zone can be seen in Figures 1 and 2.

Using computer aided drafting (CAD) software, the estimated Jetty excavation totals 547,500 bank cubic yards. This estimate consists of 49,000 cubic yards of rock and 498,500 cubic yards of soil. Excluding approximately 12,000 cubic yards of impacted material, an estimated 486,500 bank cubic yards of borrow soil is available.

### 4.2.2 Evaluation of Jetty Area Soil as Cover Construction Material

The evapotranspiration (ET) cover design parameters used in the 95% Design (Stantec, 2018b) were based on the four borrow areas identified near the proposed Repository. Table 4 below compares the cover design properties used for cover design modeling with properties from the four original borrow sources, and the Jetty borrow soil. The design assumptions include borrow soil with about 15 percent less silt and 4 percent more sand-size particles than the averages from the Jetty soil samples. The existing in-situ water contents of the Jetty soil are on average 7 percent greater than the average in-situ water contents for the original borrow sources.

**Table 4 Evapotranspiration Cover Design Parameters and Average Laboratory Results Comparison**

	No. 100 Sieve, Less Clay (%)	No. 4 Sieve (Sand) (%)	Saturated Hydraulic Conductivity (K <sub>s</sub> ) (cm/s) <sup>3</sup>	Saturated Volumetric Moisture Content (θ <sub>s</sub> ) <sup>3</sup>	Air Entry Pressure (α) (cm <sup>-1</sup> ) <sup>3</sup>	Pore Size Distribution (n) <sup>3</sup>
<b>Cover Design Average</b> <sup>(1)</sup>	35	30	1.0E-05	49.5	0.027	1.31
<b>Borrow Sample Average</b> <sup>(2)</sup>	68	45	1.5E-04	49.5	0.027	1.31
<b>Jetty Area Sample Average</b>	50	26	2.1E-04	41.1	0.01	1.26

1. Appendix G.7 of Stantec, 2018b

2. MWH, 2014

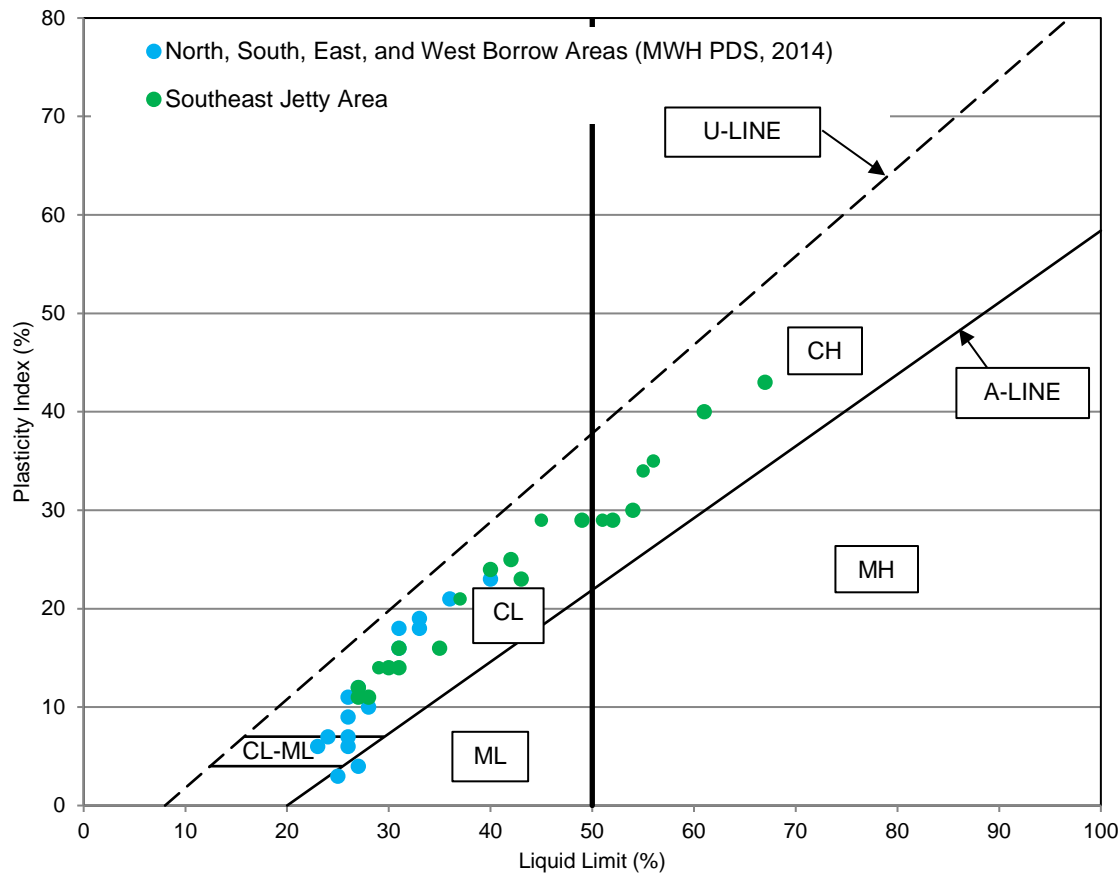
3. Specimens remolded to 90% standard Proctor compaction

The Atterberg limits data from the Jetty area compared with the four original borrow areas (see Figure 4-1 below) indicates more high-plasticity clay (CH) materials and fewer silt samples (ML) within the proposed Jetty excavation as compared with the original borrow sources.



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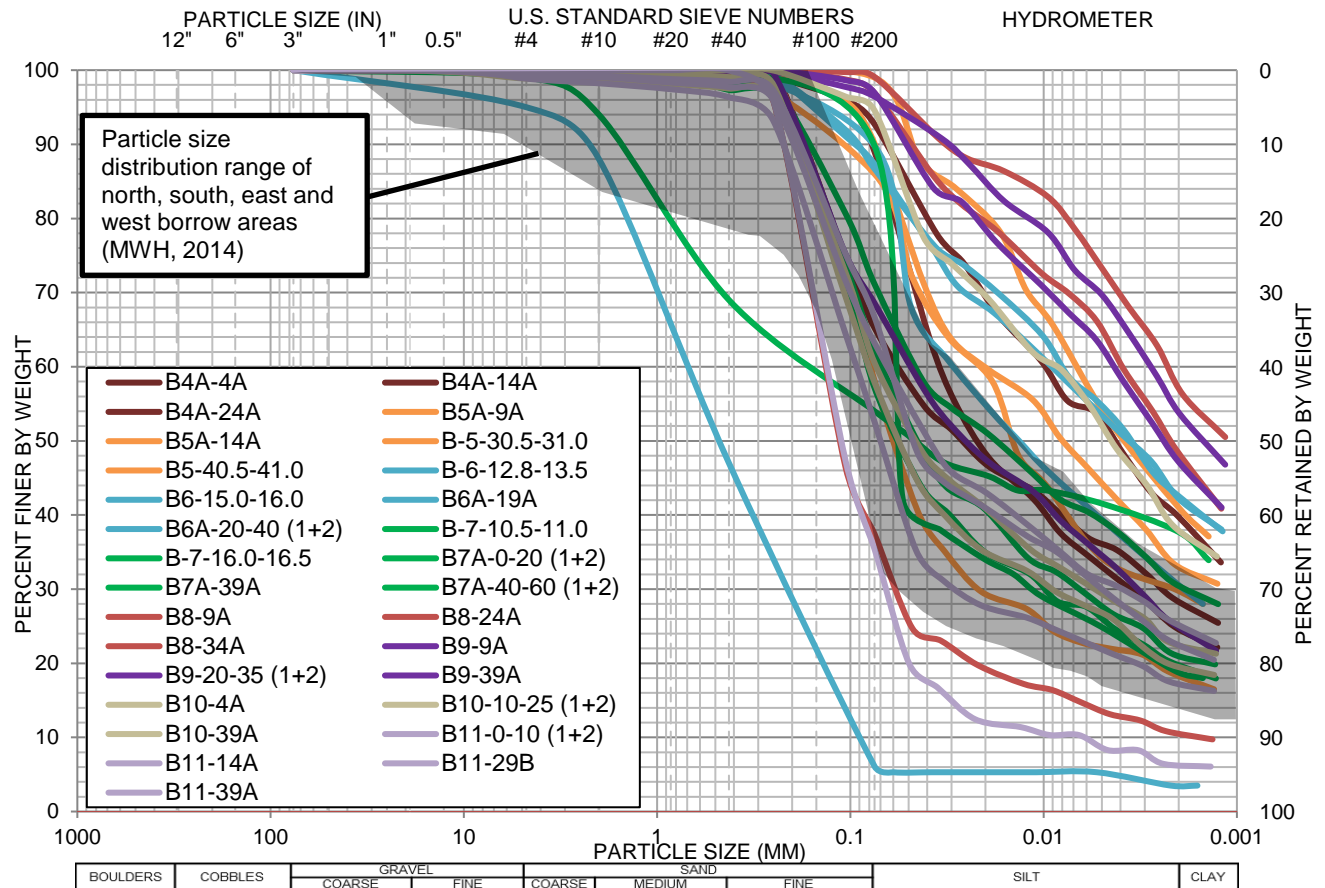


**Figure 4-1 – Atterberg Limits of Borrow Soils**

Figure 4-2 is a comparison between the particle-size distributions for the range of gradations sampled from the original borrow sources versus the particle-size distributions from samples of the Jetty excavation area. The percent of fines (silt and clay-size particles by weight) ranges from 6 to 99 percent for the Jetty samples, with an average of 71 percent passing the no. 200 sieve. This is compared with an average of 53 percent fines for the four original borrow sources. The Jetty soil has an average of 50 percent silt-sized particles compared with 68 percent silt for the other four borrow areas. The Jetty soils on average have about 11 percent more clay particles by mass on average, than the samples tested from the other four borrow areas. The Jetty soil has an average of 30 percent clay-sized particles compared with 19 percent clay for the other four borrow areas.

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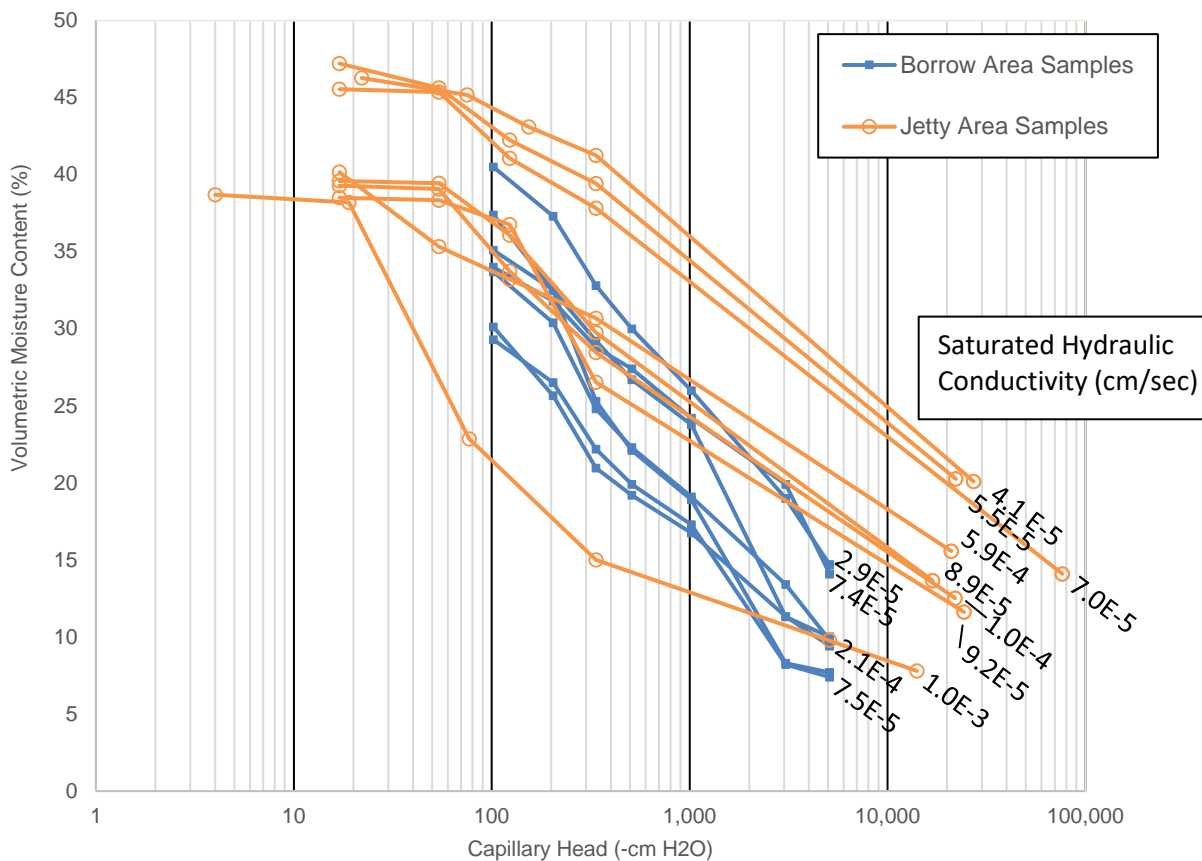


**Figure 4-2 – Particle-size Distribution Comparison of Borrow Soils**

Figure 4-3 compares the soil water characteristic curves (SWCC) for the samples tested from the original four borrow sources with the SWCCs for the additional samples tested from the Jetty. The curves plotted have been truncated to compare similar ranges of capillary head since the more recent data includes points at lower water contents. The lack of Jetty sample data points between -1,000 and -10,000 cm of water is worth mentioning, because it reduces the accuracy of comparison in this region of suction. The SWCCs from the original four borrow sources fall within the overall range of the curves based on the samples collected in the Jetty area, however there is a trend of higher suction values (capillary pressures) for similar volumetric water contents for most of the Jetty curves, due to the finer soil texture of the Jetty samples, by comparison.

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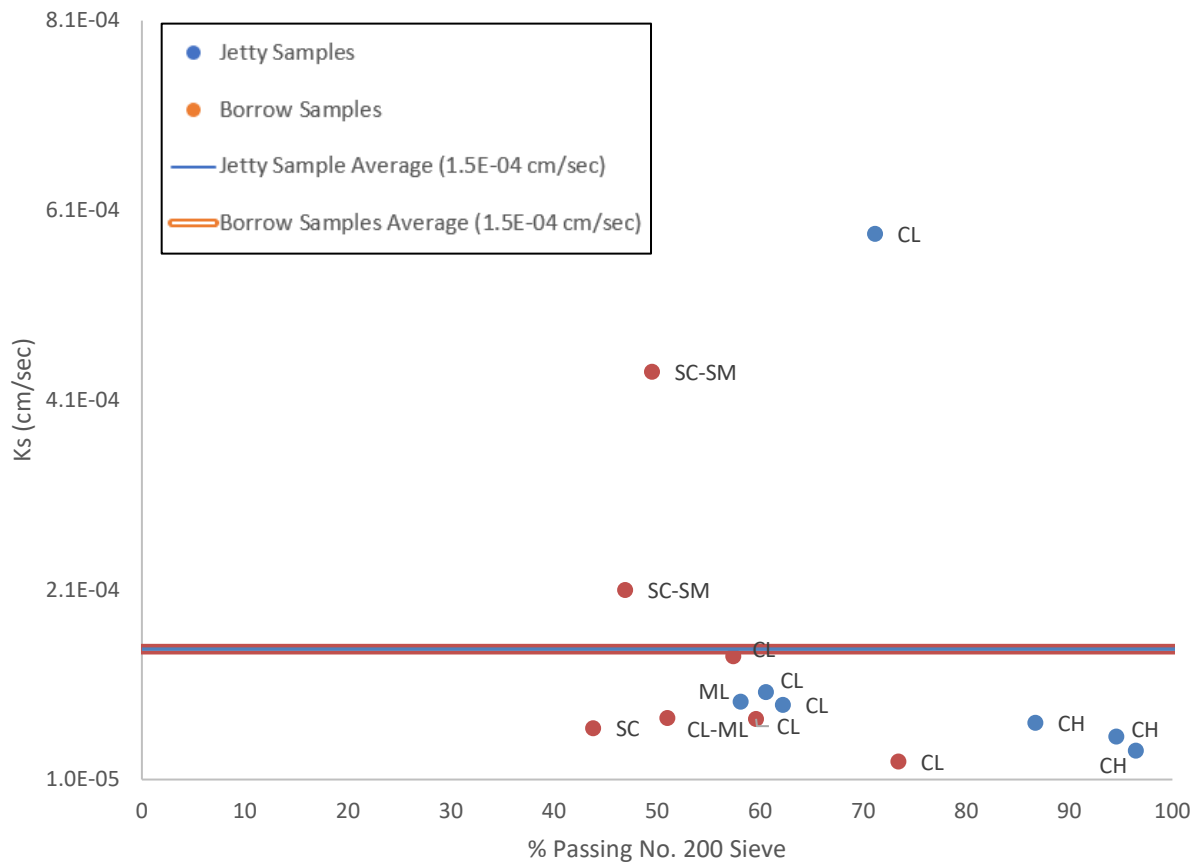


**Figure 4-3 – Soil Water Characteristic Curve (SWCC) Comparison for Borrow Soils**

Figures 4-4 and 4-5 compare saturated hydraulic conductivity ( $K_s$ ) to fines content (% Passing No. 200 Sieve) and remolded dry density, respectively. The Jetty and borrow sources have the same average saturated hydraulic conductivity of  $1.5 \times 10^{-4}$  centimeters per second, with all samples considered. Removing Jetty sample B7A-40-60 (1+2) classified as lean clay (CL) as an outlier, results in an average saturated hydraulic conductivity of  $7.7 \times 10^{-5}$  centimeters per second. Figures 4-4 and 4-5 indicate saturated hydraulic conductivity of the borrow soils is not sensitive to fines content or dry density.

# GEOTECHNICAL DATA REPORT CHURCH ROCK MILL SITE JETTY

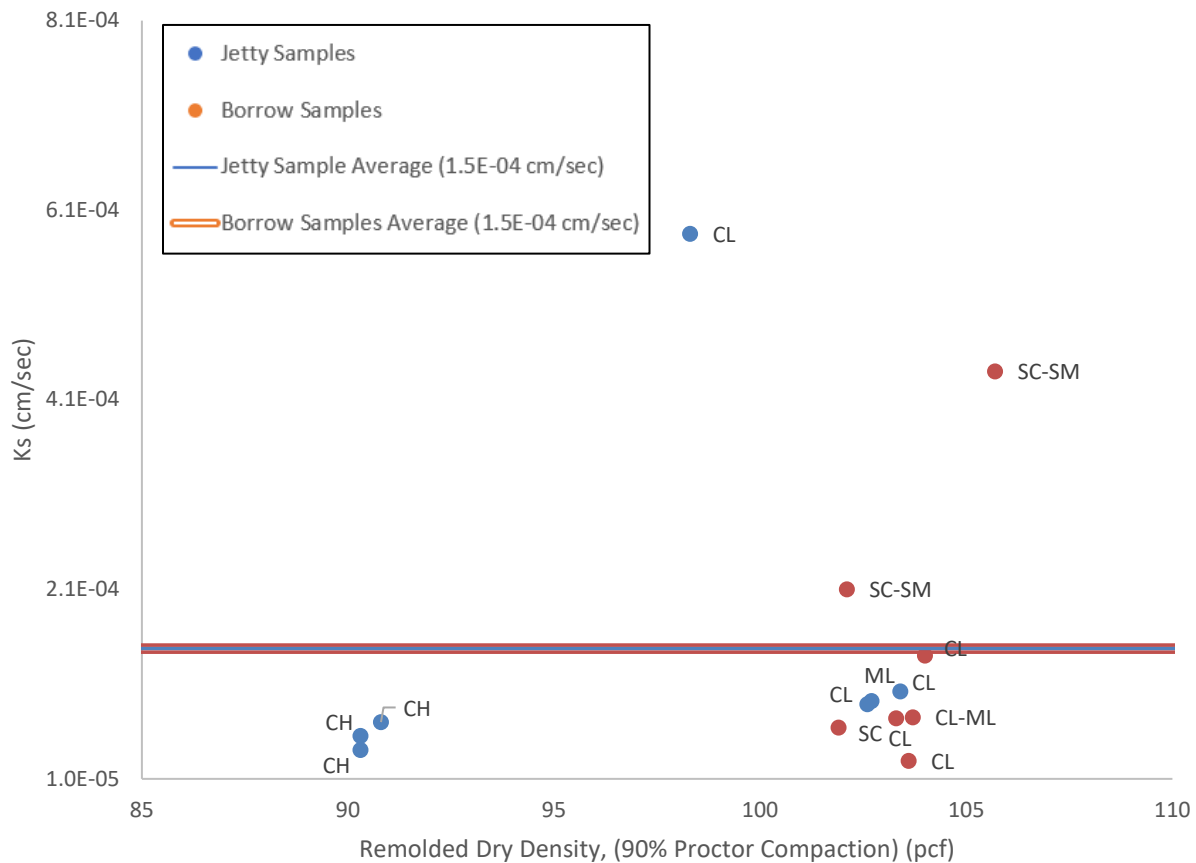
Jetty Borrow Evaluation  
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**Figure 4-4 –Saturated Hydraulic Conductivity and Fines Content Comparison for Borrow Soils**

# GEOTECHNICAL DATA REPORT CHURCH ROCK MILL SITE JETTY

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**Figure 4-5 –Saturated Hydraulic Conductivity and Remolded Dry Density Comparison for Borrow Soils**

## 4.3 RIPRAP CHANNEL SUBGRADES

As part of the 95% Design (Stantec, 2018b), a filter analysis was conducted for select channels located near the repository and the Mine Site. The gradations of the subgrade were used to design filter layers for the rock channels. The filter layers will prevent migration of subgrade particles during flow events. The additional particle-size data indicates the Jetty subgrade is still compatible with the designed filter layers for the Jetty riprap. However, based on the filter design criteria used in the 95% Design and the gradation test results, the Jetty area soil is not suitable as either the Type I or II Filter material specified in the design. Borrow from the Jetty area can be used as cover soil or as General Fill for the project but does not meet the requirements for filter gradations.

### 4.3.1 Subgrade Preparation

Prior to placement of the riprap, the subgrade soil should be overexcavated as shown on the design drawings. Once the area is overexcavated and before fill placement, the top 6 inches of the ground

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surface in fill areas should be scarified, moisture conditioned, and compacted per the project specifications (-5% to +2% of optimum moisture content and rolled with heavy compaction equipment to obtain 95 percent of maximum density as determined by the Standard Proctor Test (ASTM D 698).

### 4.3.2 Moisture Conditioning

The soil material to be excavated from the Jetty area is suitable for reuse as engineered backfill and can be used as engineered fill on other areas of the project. Engineered fill placed on-site for construction of the Jetty and riprap weir should be compacted using equipment appropriate for the type of material being placed and capable of producing the compactive energy to meet the requirements in the specifications.

While most of the materials encountered in the vicinity of the Jetty are suitable for reuse as engineered fill, moisture conditioning, wetting or drying, of the soils may be required to meet the water content criteria during compaction. In-situ water contents of samples from the area ranged from 6 to 21 percent which indicates some materials are several percent below the range of optimum water contents for this soil. Some materials encountered in the proposed Jetty excavation may present challenges for moisture conditioning. These materials will be difficult to work with in wet conditions due to high plasticity (USCS classifications CH) and fines content (90 percent fines or greater).

## 4.4 CONSTRUCTION CONSIDERATIONS

### 4.4.1 Area Groundwater Level

Based on groundwater levels encountered during drilling, the proposed excavations would not encounter groundwater during construction. The construction contractor however should anticipate the potential for large temporary stormwater flows in the arroyo when planning work. These conditions could result in fast-moving water, deep flows, and sloughing of the arroyo banks. Additionally, the arroyo banks in the current configuration are unstable. The construction contractor will be required to take precautions to stabilize the area prior to working with heavy equipment and personnel in, or near, the arroyo.

The construction contractor will be required to maintain protections for the existing gas pipeline along the west side of the proposed work area during excavation work. There is also the potential to encounter abandoned pipelines and culverts throughout the Jetty area.

### 4.4.2 East Side of Pipeline Arroyo

The east side of the pipeline arroyo will be cut a maximum of 40 to 50 vertical feet into primarily native soil at a 6.0:1 (H:V) slope. The lower portion of the slope (approximately 10-30 vertical feet from the bottom) will be armored with large riprap as an extension of the riprap layer on the base of the channel. The upper portions of the cut slopes will be armored with smaller rock. Boreholes B4A, B5A, B6A, B7A, and B10 have clay and/or silt at the excavated depth, shown in Figure 6. Boreholes B8, B9, and B11 have sand and or sand-silt-clay mixtures near the excavation depth, shown in Figure 6. These soils will be

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excavatable with typical heavy equipment to the design excavation depths. The proposed 6:1 slopes are anticipated to be stable for temporary and long-term conditions.

### 4.4.3 Excavation and Shoring

It is anticipated that the Jetty excavation will extend through fill and native soils on the east side and decomposed rock progressing to more competent rock on the west. Temporary vertical cuts and excavations may stand for short periods of time but should not be considered stable in any case. All excavations should be sloped, benched, shored, or shielded for the protection of workers. At a minimum, trenching and excavation activities should conform to OSHA Construction Standards for Excavations as well as other federal and local regulations.

The upper soils (sand, silt, and clay) encountered in the borings generally classify as a type "C" soil according to OSHA's Construction Standards for Excavations. In general, the maximum allowable temporary slope for shallow excavations greater than 4 feet and less than 20 feet in a type "C" soil is 1.5H:1V; although other provisions and restrictions may apply. If different soil or bedrock types are encountered, the maximum allowable slopes may be different.

The contractor (or the contractor's Engineer) is responsible for designing any temporary excavation slopes or temporary shoring. The contractor must also be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in federal, state, or local safety regulations, such as OSHA Safety and Health Standards for Excavations, 29 CFR Part 1926, or successor regulations.

Surcharge loads from stockpiled soil and from equipment and vehicles around excavations must be kept a minimum distance of one-half (1/2) the depth of the excavation away from the top edge of the excavation. Excavations extending deeper than 20 feet below the ground surface or requiring surcharge loads within the minimum horizontal distance described will require design by a registered Professional Engineer. Such a design may include temporary earth retention.

## GEOTECHNICAL DATA REPORT CHURCH ROCK MILL SITE JETTY

References  
July 31, 2019

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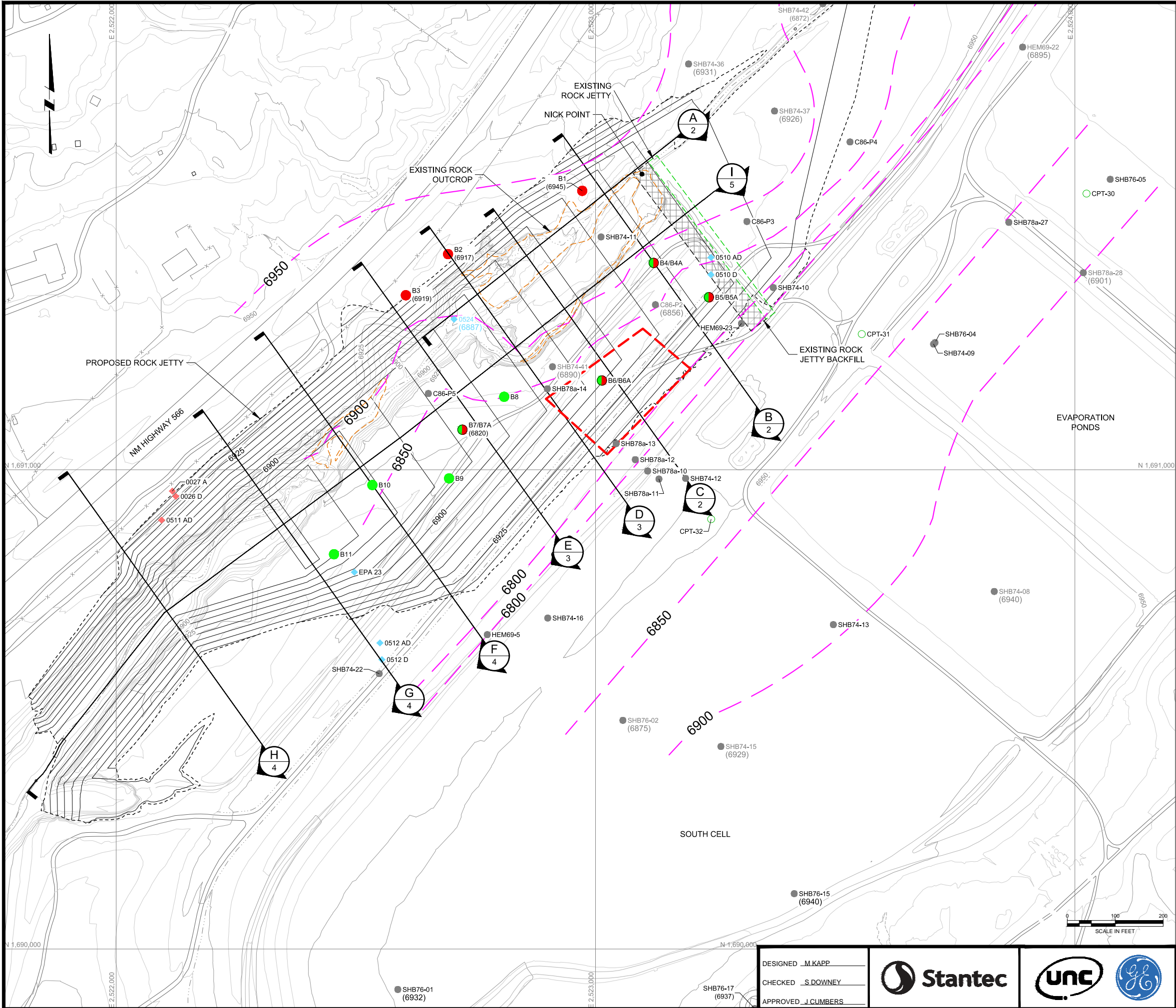
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# **FIGURES AND APPENDICES**

p:\omeview\103.mwhglobal.com\AM\_PROJECTS\02\Documents\General Electric GE\_NECR\_Design\Civil\Figures\2018-01-31\_JETTY\_GEOTECHNICAL\_EVAL1.dwg LAYOUT:Plan PLOT DATE:11/5/2018 11:36 AM BY:KWEED



LEGEND:

- EXISTING GROUND SURFACE CONTOUR & ELEVATION, FEET
- PROPOSED SURFACE CONTOUR & ELEVATION, FEET
- DIVERSION CHANNEL
- ROADS
- NATURAL DRAINAGE
- EXISTING FENCE
- EXISTING ROCK OUTCROP
- EXISTING ROCK JETTY
- ALLUVIUM MONITORING WELL
- ZONE 1 MONITORING WELL
- GEOTECHNICAL BORING (ROCK CONTACT ELEV.) (NOTES 1 AND 2)
- CPT LOCATION (MWH, 2013)
- APPROXIMATE TOP OF ROCK CONTOURS
- BORING LOCATION (MWH, 2016) (ROCK CONTACT ELEVATION)
- BORING LOCATION (STANTEC, 2018)
- REDRILL BORING LOCATION (MWH/STANTEC, 2016/2018)
- PROPOSED JETTY AREA
- EXCLUSION ZONE

NOTE(S):

- WHERE ELEVATIONS ARE NOT SHOWN THE PREVIOUS GEOTECHNICAL BORINGS WERE TERMINATED IN ALLUVIUM.
- SERGEANT, HAUSKINS, AND BECKWITH, 1974 - 1978, CANONIE, 1986 HEMPHILL CORPORATION, 1969. MWH, 2013 MWH, 2016 STANTEC, 2018

POINT TABLE

POINT	LATITUDE	LONGITUDE
B4/B4A	N 35.6468	W 108.5064
B5/B5A	N 35.6466	W 108.5060
B6/B6A	N 35.6462	W 108.5068
B7/B7A	N 35.6459	W 108.5077
B8	N 35.6461	W 108.5074
B9	N 35.6456	W 108.5078
B10	N 35.6456	W 108.5084
B11	N 35.6452	W 108.5086

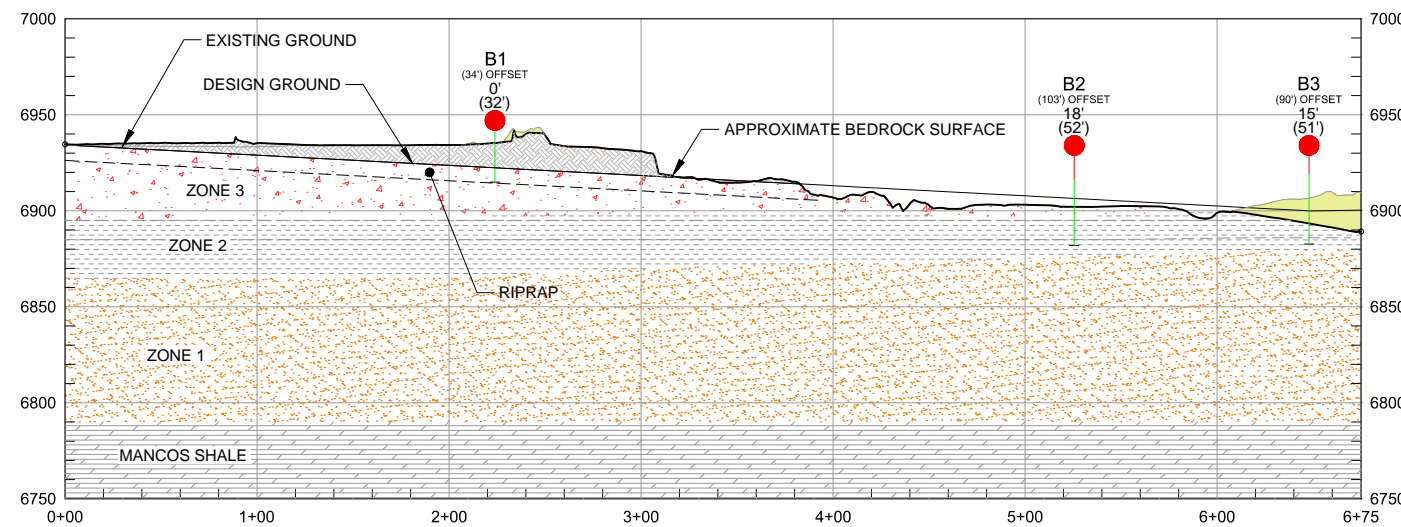
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CHECKED \_S.DOWNEY  
APPROVED \_J.CUMBERS



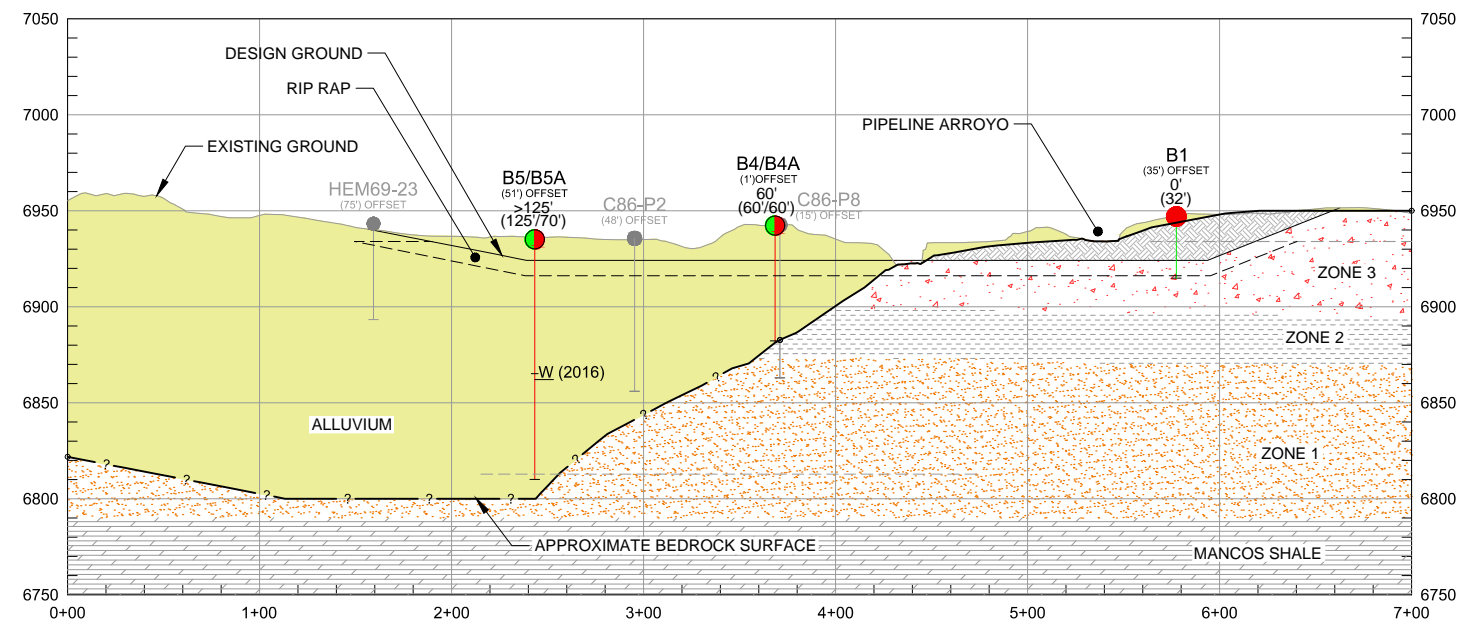
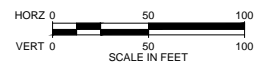
UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE  
MCKINLEY COUNTY, NEW MEXICO  
2018 JETTY GEOTECHNICAL EVALUATION

FIGURE  
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OCT 2018

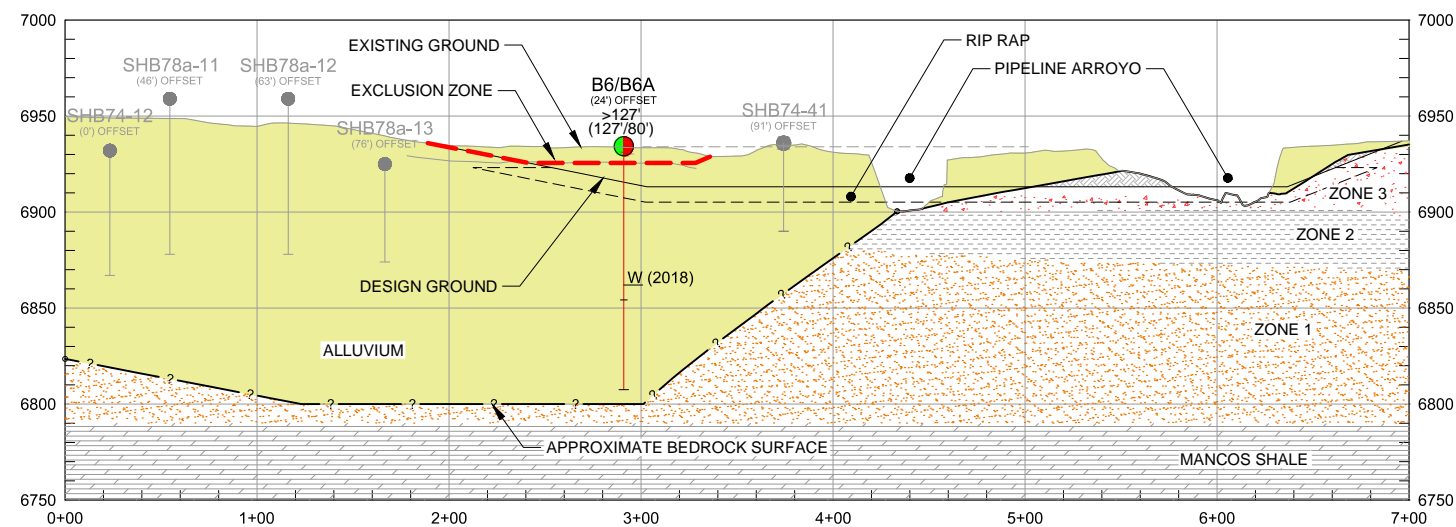
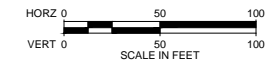
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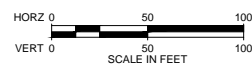
**A** CROSS SECTION A: SE  
1 (LOOKING EAST TOWARDS THE TAILINGS AREA)



**B** CROSS SECTION B: SW  
1 (LOOKING DOWNSTREAM)



**C** CROSS SECTION C: SW  
1 (LOOKING DOWNSTREAM)



**LEGEND:**

- AREAS OF POTENTIAL ROCK EXCAVATION (APPROXIMATE)
- ALLUVIUM / FILL (UNDIFFERENTIATED)
- APPROXIMATE LOCATION OF COAL LAYER
- DESIGN GROUND
- BOTTOM OF RIPRAP
- ZONE 3 SANDSTONE
- ZONE 2 SHALE AND COAL
- ZONE 1 SANDSTONE
- MANCOS SHALE
- BOREHOLE DESIGNATION
- OFFSET
- DEPTH TO BEDROCK
- TOTAL DEPTH (MWH/STANTEC, 2016/2018)
- EXISTING GROUND SURFACE
- DRILLING DEPTH (STANTEC, 2018)
- W WATER ENCOUNTERED DURING DRILLING (MWH/STANTEC, 2016/2018)
- TOP OF BEDROCK
- BOREHOLE EXTENT
- BOREHOLE LOCATION (MWH, 2016) (ROCK CONTACT ELEVATION)
- BOREHOLE LOCATION (STANTEC, 2018)
- REDRILL BOREHOLE LOCATION (MWH/STANTEC, 2016/2018)
- PREVIOUS BORINGS
- EXCLUSION ZONE

**NOTE(S):**

- DEPTHS SHOWN TO BEDROCK ARE APPROXIMATE BASED ON AVAILABLE INFORMATION.
- MWH, 2016  
STANTEC, 2018

DESIGNED \_M.KAPP\_  
CHECKED \_S.DOWNEY\_  
APPROVED \_J.CUMBERS\_



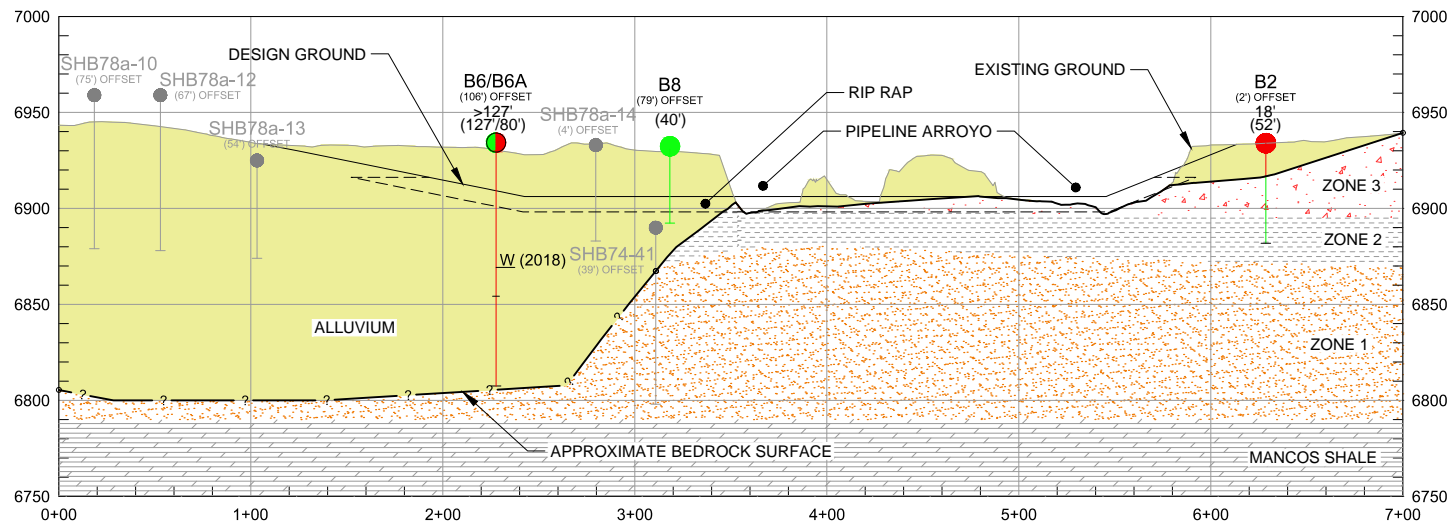
UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE  
McKINLEY COUNTY, NEW MEXICO

2018 JETTY GEOTECHNICAL EVALUATION  
CROSS-SECTIONS (1 OF 4)

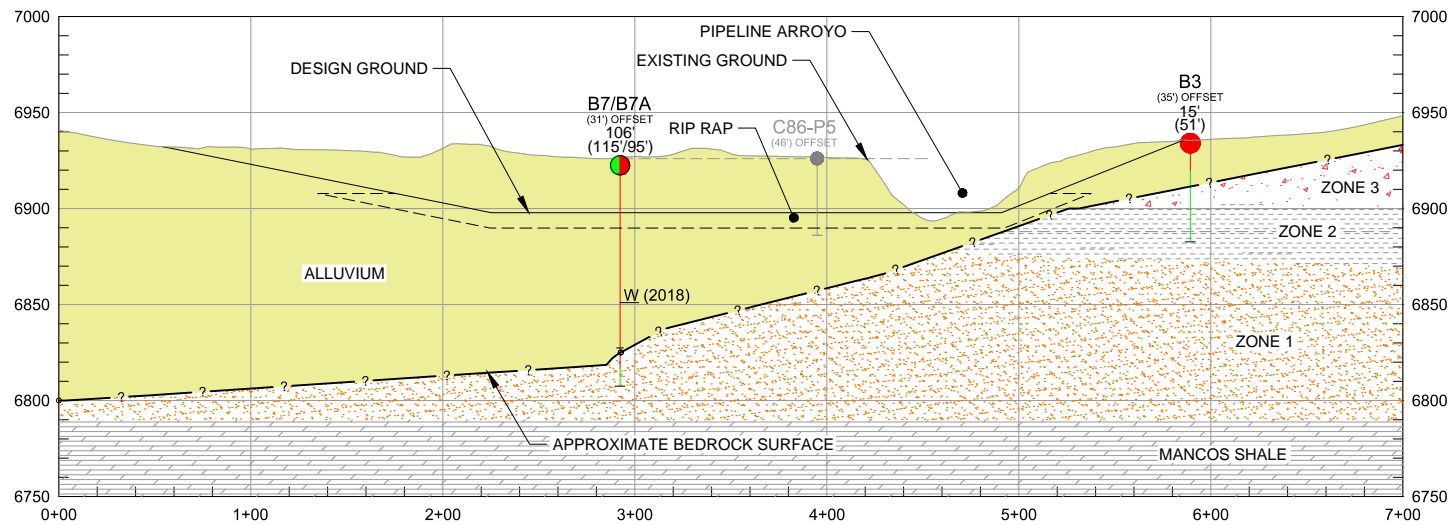
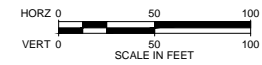
FIGURE  
2  
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OCT 2018



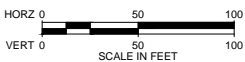
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**D**  
1 CROSS SECTION D: SW  
(LOOKING DOWNSTREAM)



**E**  
1 CROSS SECTION E: SW  
(LOOKING DOWNSTREAM)



**LEGEND:**

- AREAS OF POTENTIAL ROCK EXCAVATION (APPROXIMATE)
- ALLUVIUM / FILL (UNDIFFERENTIATED)
- APPROXIMATE LOCATION OF COAL LAYER
- DESIGN GROUND
- BOTTOM OF RIPRAP
- ZONE 3 SANDSTONE
- ZONE 2 SHALE AND COAL
- ZONE 1 SANDSTONE
- MANCOS SHALE
- BORING LOCATION (MWH, 2016) (ROCK CONTACT ELEVATION)
- BORING LOCATION (STANTEC, 2018)
- REDRILL BORING LOCATION (MWH/STANTEC, 2016/2018)
- PREVIOUS BORINGS

- BOREHOLE DESIGNATION
- OFFSET
- DEPTH TO BEDROCK
- TOTAL DEPTH (MWH/STANTEC, 2016/2018)
- EXISTING GROUND SURFACE
- DRILLING DEPTH (STANTEC, 2018)
- W WATER ENCOUNTERED DURING DRILLING (MWH/STANTEC, 2016/2018)
- TOP OF BEDROCK
- BORING EXTENT

**NOTE(S):**

- DEPTHS SHOWN TO BEDROCK ARE APPROXIMATE BASED ON AVAILABLE INFORMATION.
- MWH, 2016  
STANTEC, 2018

DESIGNED \_M.KAPP\_  
CHECKED \_S.DOWNEY\_  
APPROVED \_J.CUMBERS\_

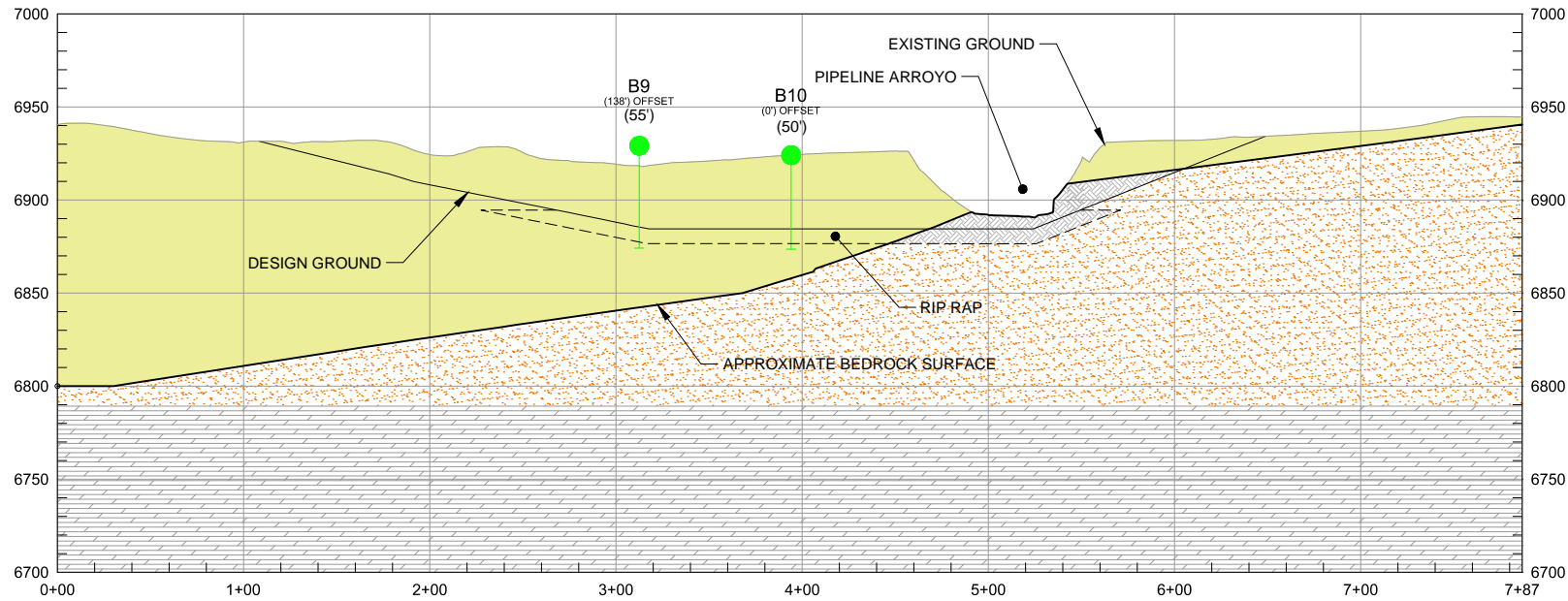


UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE  
McKINLEY COUNTY, NEW MEXICO

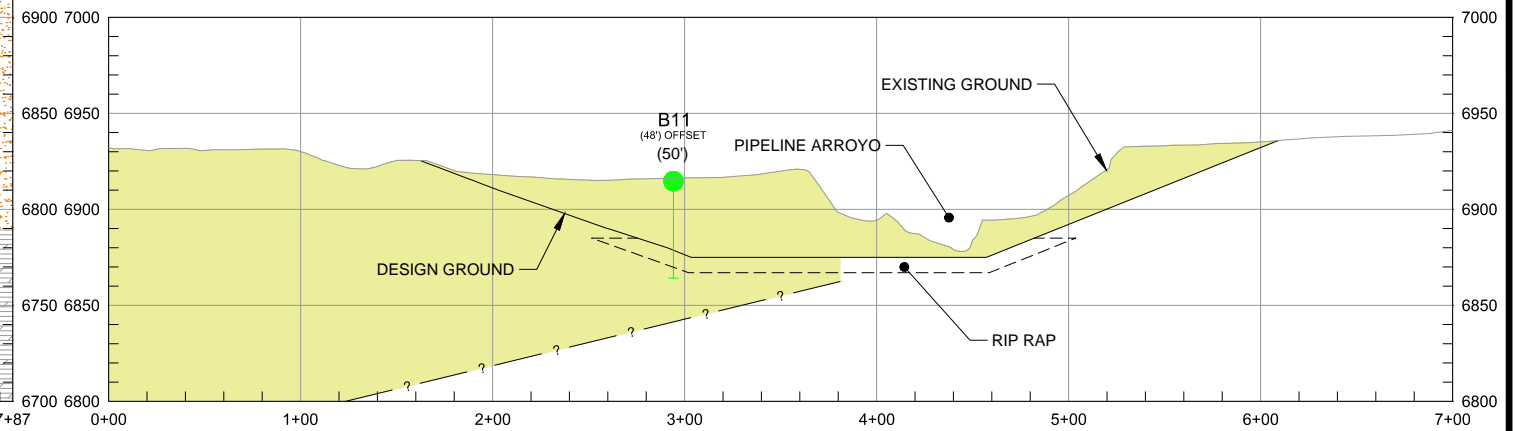
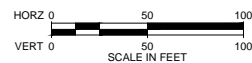
2018 JETTY GEOTECHNICAL EVALUATION  
CROSS-SECTIONS (2 OF 4)

FIGURE  
3  
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OCT 2018

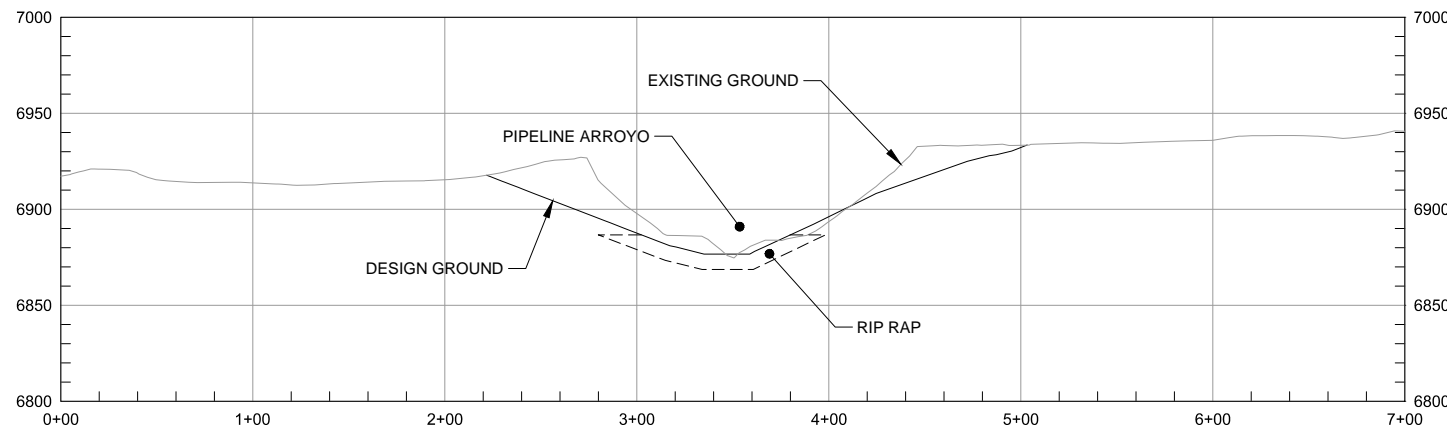
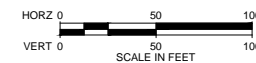
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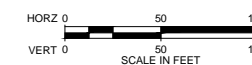
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(LOOKING DOWNSTREAM)



**G**  
1 CROSS SECTION G: SW  
(LOOKING DOWNSTREAM)



**H**  
1 CROSS SECTION H: SW  
(LOOKING DOWNSTREAM)



**LEGEND:**

- AREAS OF POTENTIAL ROCK EXCAVATION (APPROXIMATE)
- ALLUVIUM / FILL (UNDIFFERENTIATED)
- APPROXIMATE LOCATION OF COAL LAYER
- DESIGN GROUND
- BOTTOM OF RIPRAP
- ZONE 3 SANDSTONE
- ZONE 2 SHALE AND COAL
- ZONE 1 SANDSTONE
- MANCOS SHALE
- BORING LOCATION (MWH, 2016) (ROCK CONTACT ELEVATION)
- BORING LOCATION (STANTEC, 2018)
- REDRILL BORING LOCATION (MWH/STANTEC, 2016/2018)
- PREVIOUS BORINGS

- BOREHOLE DESIGNATION
- OFFSET
- DEPTH TO BEDROCK
- TOTAL DEPTH (MWH/STANTEC, 2016/2018)
- EXISTING GROUND SURFACE
- DRILLING DEPTH (STANTEC, 2018)
- W WATER ENCOUNTERED DURING DRILLING (MWH/STANTEC, 2016/2018)
- TOP OF BEDROCK
- BORING EXTENT

**NOTE(S):**

- DEPTHS SHOWN TO BEDROCK ARE APPROXIMATE BASED ON AVAILABLE INFORMATION.
- MWH, 2016  
STANTEC, 2018

DESIGNED \_M.KAPP\_  
CHECKED \_S.DOWNEY\_  
APPROVED \_J.CUMBERS\_



UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE  
McKINLEY COUNTY, NEW MEXICO

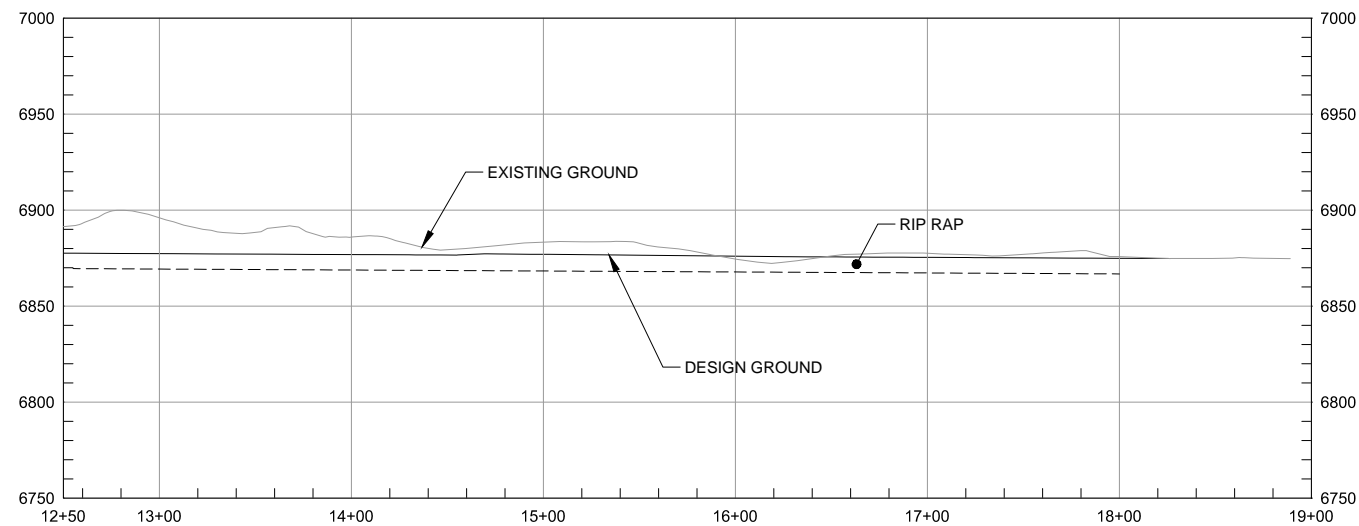
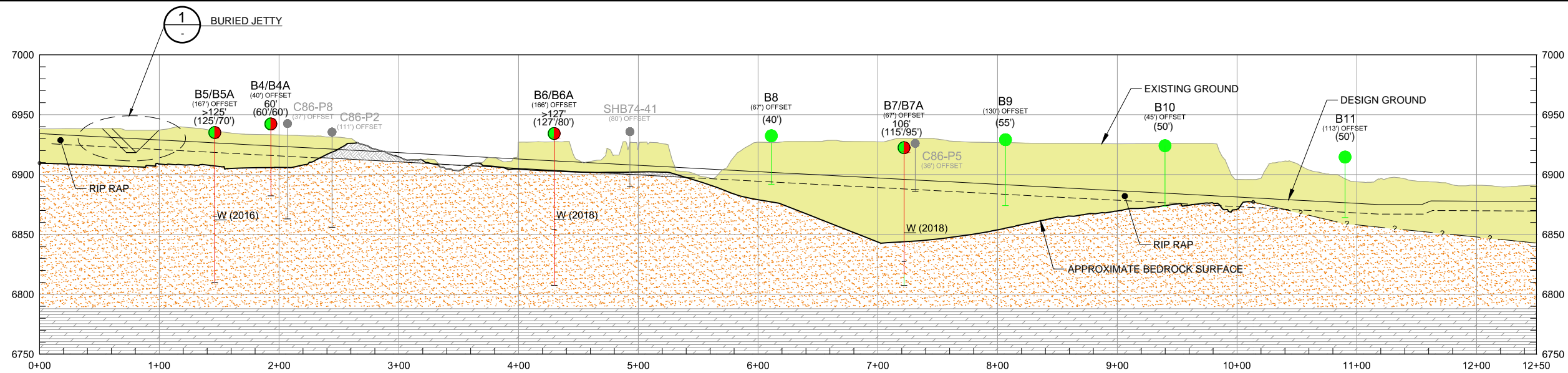
2018 JETTY GEOTECHNICAL EVALUATION  
CROSS-SECTIONS (3 OF 4)

FIGURE

4

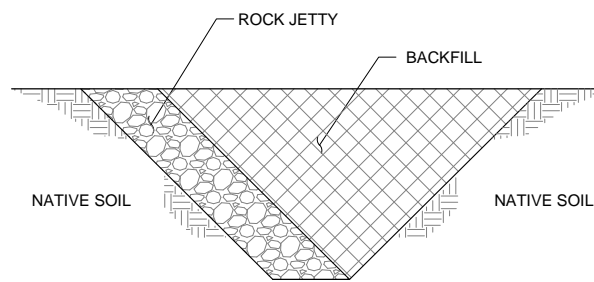
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**CROSS SECTION I: SE**  
(LOOKING EAST TOWARDS THE TAILINGS AREA)

HORIZ 0 50 100  
VERT 0 50 100  
SCALE IN FEET



**BURIED JETTY**

0 10 20  
SCALE IN FEET

**LEGEND:**

- AREAS OF POTENTIAL ROCK EXCAVATION (APPROXIMATE)
- ALLUVIUM / FILL (UNDIFFERENTIATED)
- APPROXIMATE LOCATION OF COAL LAYER
- DESIGN GROUND
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- ZONE 3 SANDSTONE
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- BORING LOCATION (MWH, 2016) (ROCK CONTACT ELEVATION)
- BORING LOCATION (STANTEC, 2018)
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- PREVIOUS BORINGS

- BOREHOLE DESIGNATION
- OFFSET
- DEPTH TO BEDROCK
- TOTAL DEPTH (MWH/STANTEC, 2016/2018)
- EXISTING GROUND SURFACE
- DRILLING DEPTH (STANTEC, 2018)
- W WATER ENCOUNTERED DURING DRILLING (MWH/STANTEC, 2016/2018)
- TOP OF BEDROCK
- BORING EXTENT

**NOTE(S):**

- DEPTHS SHOWN TO BEDROCK ARE APPROXIMATE BASED ON AVAILABLE INFORMATION.
- MWH, 2016  
STANTEC, 2018

DESIGNED M.KAPP  
CHECKED S.DOWNEY  
APPROVED J.CUMBERS

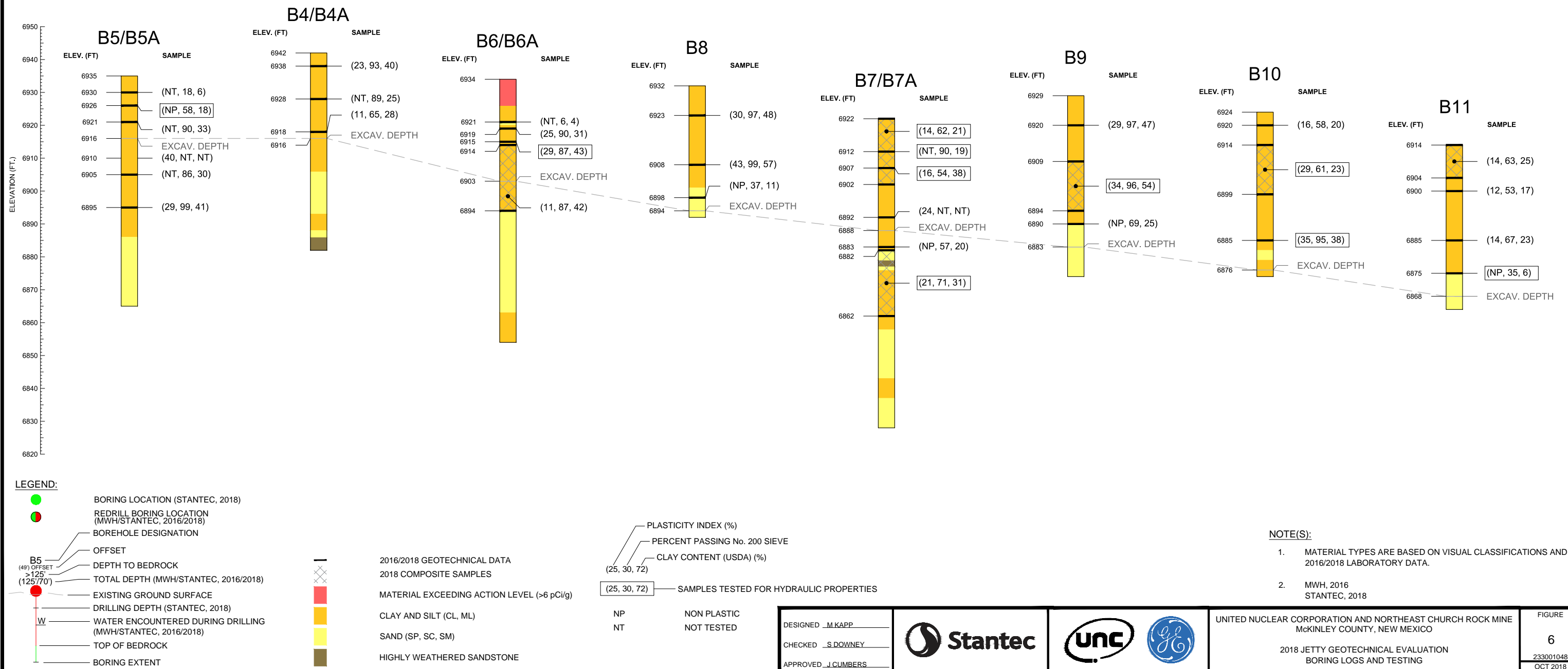
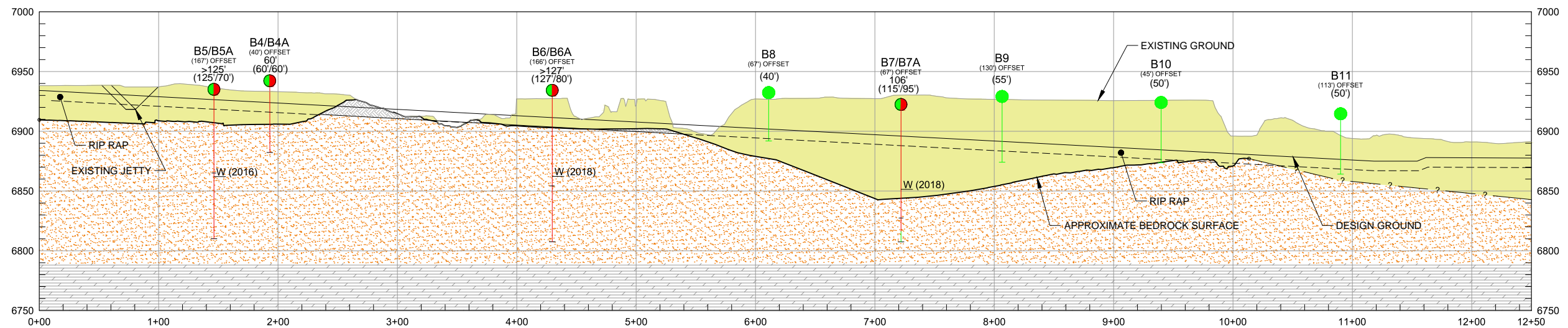


UNITED NUCLEAR CORPORATION AND NORTHEAST CHURCH ROCK MINE  
MCKINLEY COUNTY, NEW MEXICO

2018 JETTY GEOTECHNICAL EVALUATION  
CROSS-SECTIONS (4 OF 4)

FIGURE  
5  
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OCT 2018

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**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix A Boring Logs, Core Photos, and Daily Field Logs  
July 31, 2019

**APPENDIX A      BORING LOGS, CORE PHOTOS, AND DAILY  
FIELD LOGS**



**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix A Boring Logs, Core Photos, and Daily Field Logs  
July 31, 2019

**BORING LOGS**



Sheet 1 of 6 :

Checked By: \_\_\_\_\_

Depth	Type	Number	SAMPLES			Material Description	Remarks	Well Details
			Sampling Resistance, blows / 6 inches	Driven (in)	Recovered (in)			
0						SILTY CLAY (CL) (FILL), BROWN (7.5 yr, 3/4), DRY	BACKGROUND RADIATION: 60-70 cpm	
1								
2								
3								
4								
5	B4A-4A B4A-4B (MCA 2.5")	14 14 13	18" 15"			VERY STIFF	CORE: 40-60 cpm	
6								
7								
8	B4A-7.5-9 B4A-9B (MCA 2.5")	5 6	60" 40"					
9								
10							CORE: 50-60 cpm	





Project:  
Project Location:  
Project Number:

JETTY 2018  
SEE INFO ON PAGE 1

## SOIL LOGGING FORM

BOREHOLE No.: *B4A*  
Sheet *3* of *6* :

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:	
-------------	--

Drillier.

Hammer Data:

Water Level:

Finish Date:

Drilling Method:

Nothing:

Date:

Total Depth	10.00
-------------	-------

Drilling Rig:	
Drill Bit Type/Size:	

Easting:	
Elevation:	

Time:  
Casing Depth:

Logged By:	
Checked By:	

[illegible]



**Stantec**

Project:  
Project Location:  
Project Number:

JETTY 2018  
SEE INFO ON PAGE 1

**SOIL LOGGING  
FORM**

BOREHOLE No: **B4A**

Sheet **4** of **6**

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured		Start Date:
Driller:	Hammer Data:	Water Level:		Finish Date:
Drilling Method:	Nothing:	Date:		Total Depth:
Drilling Rig:	Easting:	Time:		Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth:		Checked By:

Depth	SAMPLES			Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches			
30			9	CL	CLAY WITH FEW FINE SAND (CL) (CONT'D)	
31					STIFF	
32						
33						
34						
35						
36						
37						
38						
39						
40						

GRAVELS with fine or no fines fraction passes #4 sieve	GRAVELS with fine or no fines fraction passes #4 sieve	Well-sorted: gravels, gravel-sand mixtures, little or no fines. Poorly-sorted: gravels, gravel-sand mixtures, little or no fines. Silty gravels, poorly-sorted: gravel-sand-clay mixtures. Clayey gravels, poorly-sorted: gravel-sand-clay mixtures.	GW GP GM GC SW SM SP SC ML MH CH PT	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Field Test	Term	Field Test
SANDS with fine or no fines fraction passes #4 sieve	SANDS with fine or no fines fraction passes #4 sieve	Well-sorted: sands, gravelly sands, little or no fines. Poorly-sorted: sands, gravelly sands, little or no fines. Silty sands, poorly-sorted: sand-gravel-silt mixtures. Clayey sands, poorly-sorted: sand-gravel-silt mixtures. Inorganic silty-sand, silty or clayey fine sands, silts with slight plasticity. Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	GW GP GM GC SW SM SP SC ML MH CH PT	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Field Test	Term	Field Test
SILTS AND CLAYS liquid limit <50	SILTS AND CLAYS liquid limit <50	Organic silts and clays of low plasticity. Inorganic silts, micaceous or macromicaceous fine sand or silt. Inorganic clays of high plasticity, fat clays. Organic silts and clays of medium to high plasticity. Peat, humus, swamp soils with high organic content.	GW GP GM GC SW SM SP SC ML MH CH PT	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Field Test	Term	Field Test
SILTS AND CLAYS liquid limit >50	SILTS AND CLAYS liquid limit >50	Organic silts and clays of medium to high plasticity. Peat, humus, swamp soils with high organic content.	GW GP GM GC SW SM SP SC ML MH CH PT	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Blows/ft (SPT) 1.4'ID 2.0'ID 2.5'ID	Term	Field Test	Term	Field Test



LETTY 2018  
SEE INFO ON PAGE 7

BOREHOLE No.: B4A  
Sheet 5 of 6:

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured				Start Date:
Drillier:	Hammer Data:	Water Level:				Finish Date:
Drilling Method:	Nothing:	Date:				Total Depth:
Drilling Rig:	<b>Easting:</b>	Time:				<b>Logged By:</b>
Drill Bit Type/Size:	Elevation:	Casing Depth				Checked By:

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)				
40			9		SM	SILTY SAND (SM) (CONT'D)		
41						LOOSE		
42								
43								
44						VERY MOIST		
45								
46						LOOSE		
47								
48						CLAY SAND (SC), DARK BROWN (7.5 <sub>4</sub> R, 3/3), MOIST, TRACE FINE GRAVEL		
49								
50						SILTY CLAY (CL), DARK BROWN (7.5 <sub>4</sub> R, 3/3), MOIST, SOME SAND, TRACE FINE GRAVEL		

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured					Start Date:
Drillier:	Hammer Data:	Water Level:					Finish Date:
Drilling Method:	Northing:	Date:					Total Depth:
Drilling Rig:	Easting:	Time:					Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth					Checked By:

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)				
50			7		CL	SILTY CLAY (CL) (CONT'D)		
51						STIFF		
52								
53	B4A-525-54 (BAG)	5-MAY-2018						
54	B4A-54A B4A-54B (MCA 2.5")	J	18"		SP	FINE TO MED. SAND (SP), BROWN (7.5YR, 3/4), MOIST, FEW COARSE SAND, TRACE SILT	CORE : 60-80 cpm	
55	B4A-54A B4A-54B (MCA 2.5")	J	18"					
56			4		CL	SILTY CLAY (CL), DARK BROWN (7.5YR, 3/3), MOIST, SOME FINE TO MED. SAND, TRACE COARSE SAND, STIFF		
57								
58						HIGHLY WEATHERED (W4) FINE GRAINED SANDSTONE, LIGHT GRAY (10YR, 7/1), OXIDIZED, VERY WEAK	CORE : 60-80 cpm	
59	B4A-57A B4A-57B (MCA 2.5")	50	2" 4"			NO RECOVERY		
60						TOTAL DEPTH = 59.5 FT BGS		











JETTY 2018  
SEE INFO ON PAGE 7

BOREHOLE No: B54  
Sheet 3 of 7:

[illegible]



JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: 85A  
Sheet 4 of 7:

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured					Start Date:
Drillier:	Hammer Data:	Water Level:					Finish Date:
Drilling Method:	Northing:	Date:					Total Depth:
Drilling Rig:	Easting:	Time:					Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth					Checked By:

Depth	SAMPLES					Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)	Recovered (in)			
30	BSA-30-31.5 (BAG) 30-APRIL-2018	13				CLAY WITH SILT (CL) (CONT'D)		
31						VERY STIFF		
32								
33								
34	BSA-34A BSA-34B (MCA 2.5")	8				SILTY CLAY (CL), MOIST, BROWN	CORE ! 60-80 (34'-35') 50-60 (35'-39')	
35		11				(10YR, 4/3), TRACE FINE SAND, OCC. COAL PARTINGS		
36		12				VERY STIFF		
37	BSA-36-37.5 (BAG) 30-APRIL-2018					FINE SANDS (SP), MOIST, LIGHT BROWN		
38						SILTY CLAY (CL), MOIST, BROWN, TRACE FINE SAND		
39	BSA-39A BSA-39B (MCA 2.5")	4				FINE SAND (SP), MOIST, LIGHT BROWN		
40		9				SILTY CLAY (CL), MOIST, BROWN, TRACE FINE SAND, OCC. COAL PARTINGS	CORE ! 60-70 cpm	

[illegible]

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:
-------------

Drillier.

Hammer Data:

Water Level:

Finish Date:	
--------------	--

Drilling Method:

Northing:

Date:

Total Depth:	
--------------	--

Drilling Rig:

Easting:

Time: \_\_\_\_\_

Logged By:
------------

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)				
40			11		CL	SILTY CLAY (CL) (CONT'D)		
41						- OCC. COAL PARTINGS -		
42						VERY STIFF		
43								
44								
45								
46								
47								
48								
49								
50								



JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: B5A  
Sheet 6 of 7:

Start Date:	
Finish Date:	
Total Depth:	
Logged By:	
Checked By:	

[illegible]





JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No: B54  
Sheet 7 of 7:

Start Date:
Finish Date:
Total Depth:
Logged By:
Checked By:

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)				
60		21				FINE SAND (SP) (CONT'D)		
61						MEDIUM DENSE		
62				60"	38"			
63						FEW COARSE SAND		
64						SOME GRAVEL		
65						FINE TO MED. SAND (SP), MOIST, BROWN (10YR, 5/3), FEW FINE TO COARSE GRAVEL, MED. DENSE	CORE: 50-60 cpm	
66								
67				60"	40"			
68						CLAY WITH GRAVEL AND WEATHERED CLAY STONE (CL), MOIST, BROWN TO DARK BROWN, OXIDATION		
69						FINE TO COARSE SAND (SP), MOIST, BROWN, SOME FINE TO COARSE GRAVEL, MED. DENSE		
70						TOTAL DEPTH 70.5 FT BGS		



Project:  
Project Location:  
Project Number:

JETTY 2018 GE/UNC  
IECR, NM

## SOIL LOGGING FORM

BOREHOLE No: *B6A*

Sheet 1 of 8

Drilling Company: CASCADE

Sampling Method(s): MCA 2.5<sup>21</sup>

Groundwater Level &amp; Date Measured

Start Date: 5-3-18

Driller: M. CAIN

Hammer Data:

Water Level:	72' BGS
--------------	---------

Finish Date:	5-3-18
--------------	--------

Drilling Method: HSA

Northing

Date:	5-3-18
-------	--------

Total Depth:	80.5'
--------------	-------

Drilling Rig: CME 85

Easting

Time:	1445
-------	------

Logged By:

Drill Bit Type/Size: 8, 25"

Elevation

Casing Depth	74' BGS
--------------	---------

Checked By: \_\_\_\_\_

Depth	Type Number	SAMPLING		Driven (in)	Recovered (in)	Graphic Log	Material Description	Remarks	Well Details
		Sampling Resistance, blows / 6 inches							
	B6A-2.5-4 ← (BAG) → 3-MAY-2018					CL	SILTY CLAY (CL), STRONG BROWN (7.5yr, 5/6), SLIGHTLY MOIST TO DRY	BACKGROUND: 40-60cpm CORE: 60-80 cpm	
	B6A-4.5-6 ← (BAG) → 3-MAY-2018					SP	FINE SAND (SP), LIGHT GRAY (10yr, 7/2), DRY, VERY HARD NO RECOVERY	CORE: 300-370 cpm (4'-6')	
	B6A-7.5-9 ← (BAG) → 3-MAY-2018					CL	SANDY CLAY (CL), DARK BROWN (10yr, 3/6), SLIGHTLY MOIST, SOME COARSE SAND, TRACE FINE GRAVEL	CORE: 60-80 cpm (6'-9')	
	B6A-9A B6A-9B (MCA 2.5") → 3-MAY-2018							CORE: 100-120 cpm (9'-11')	



JETTY 2018  
SEE INFO ON PAGE 7

BOREHOLE No: B6A  
Sheet 2 of 8 :

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)				
			26		CL	SANDY CLAY (CL) (CONT'D)		
						HARD		
	B6A-12, S-14 (BAG)	3-MAY-2018					CORE: 60-80cpm (11'-14')	
				60" 48"				
	B6A-12, S-14 (BAG)	3-MAY-2018			SP	SAND (SP), BROWNISH YELLOW (10yr, 6/8), MOIST		
	B6A-14A B6A-14B (MCA 2.5")	13 22 32	18" 12"		CL	SILTY CLAY (CL), BROWN (10yr, 5/3), MOIST	CORE: 60-80cpm	
						HARD		
				60" 46"				
	B6A-17, S-19 (BAG)	3-MAY-2018						
	B6A-19A B6A-19B (MCA 2.5")	22 25	18" 11"				CORE: 80-100cpm	

[illegible]





Project:  
Project Location:  
Project Number:

JETTY 2018

SEE INFO ON PAGE 7

## SOIL LOGGING FORM

BOREHOLE No.: B6A

Sheet 3 of 8

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:

Drillier:

### Hammer Data

Water Level:

Finish Date:

Drilling Method:

Northing:

Date:

Total Depth:

Drilling Rig:

Easting:

Time:

Logged By:

Drill Bit Type/Size:

Elevation

Casing Depth

Checked By:

Depth	SAMPLES				Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)			
20		40			SILTY CLAY (CL) (CONT'D)	CUTTINGS SAMPLE B6A-20-40 (BUCKET) 3-MAY-2018	
21					HARD		
22							
23							
24						CORE: 80-100 cpm	
25							
26							
27							
28						CORE: 60-100 cpm	
29							
30							
31							



**Stantec**Project:  
Project Location:  
Project Number:JETTY 2018  
SEE INFO ON PAGE 1**SOIL LOGGING  
FORM**

BOREHOLE No.: B6A

Sheet 5 of 8

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured:	Start Date:
Driller:	Hammer Data:	Water Level:	Finish Date:
Drilling Method:	Northings:	Date:	Total Depth:
Drilling Rig:	Easting:	Time:	Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth:	Checked By:

Depth	SAMPLES					Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)	Recovered (in)				
40			11			SM	SILTY SAND (SM) (CONT'D)		
41							LOOSE TO MEDIUM DENSE		
42									
43									
44									
45									
46									
47									
48									
49									
50									

<b>GRAVELS</b> 450% coarse fraction passes #4 sieve	<b>GRAVELS</b> with little or no fines	Well-graded: gravel, gravel-sand mixtures, little or no fines	GW
<b>SANDS</b> 450% coarse fraction passes #4 sieve	<b>SANDS</b> with little or no fines	Poorly-graded: gravel, gravel-sand mixtures, little or no fines	GP
<b>SILTS AND CLAYS</b> liquid limit <50	<b>SILTS AND CLAYS</b> with little or no fines	Clayey gravel, poorly-graded: gravel-sand-clay mixtures	GC
<b>SILTS AND CLAYS</b> liquid limit >50	<b>SILTS AND CLAYS</b> with little or no fines	Well-graded: sand, gravelly sands, little or no fines	SW
<b>HIGHLY ORGANIC SOILS</b>	<b>HIGHLY ORGANIC SOILS</b>	Poorly-graded: sand, gravelly sands, little or no fines	SP
		Silty sand, poorly-graded: sand-gravel-silt mixtures	SM
		Clayey sand, poorly-graded: sand-gravel-clay mixtures	SC
		Inorganic silty-sand, silty or clayey fine sand, silty with slight plasticity	ML
		Inorganic silty-sand of low to medium plasticity: gravelly silty sand, silty sand, silty clay	CL
		lean clay	OL
		Organic silt and clay of low plasticity	OH
		Inorganic silt, medium to high plasticity: fine sand or silt	MI
		Inorganic clay of high plasticity, fat clay	CH
		Organic silt and clay of medium to high plasticity	OH
		Peat, humus, swamp soils with high organic content	PT

Term	Blows/ft			Term	Blows/ft		
	(SPT)	1.4'0"	2.0'0"		(SPT)	1.4'0"	2.0'0"
very soft	0-2	0-2	0-2	very loose	0-4	0-5	0-7
soft	2-4	2-4	2-4	loose	4-10	5-12	7-18
medium stiff	4-8	4-8	4-8	medium dense	10-30	12-37	18-51
stiff	8-15	9-17	9-18	dense	30-50	37-50	51-86
very stiff	15-30	17-39	18-42	very dense	>50	>60	>86
hard	30-60	39-76	42-65				
very hard	>60	>78	>85				

Term	Size (mm)		Term	Size (mm)	
	mm	inches		mm	inches
Boulders	>300	>12	trace	<5	<0.2
Cobbles	75 to 300	3 to 12	little	5-15	0.2-0.6
Coarse gravel	19 to 75	3/4 to 3	some	15-30	0.6-1.2
Fine gravel	4.75 to 19	3/16 to 3/4	trace	<5	<0.2
Coarse sand	2.0 to 4.75	1/16 to 3/16	little	5-15	0.2-0.6
Medium sand	0.425 to 2.0	1/64 to 1/16	some	15-30	0.6-1.2
Fine sand	0.075 to 0.425	0.003 to 1/64	trace	<5	<0.2
Silt / clay (fines)	<0.075	<0.003	sandy / gravelly	>30	>1.2



Project:  
Project Location:  
Project Number:

JETTY 2018  
SEE INFO ON PAGE 1

## SOIL LOGGING FORM

BOREHOLE No.: B6A

Sheet 6 of 8

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:

Drillier:

Hammer Data:

Water Level:

Finish Date:

Drilling Method:

Northina

Date:

Total Depth:

Drilling Rig:  
Drill Bit Type/Size:

Easting:	
Elevation:	

Time:
Casing Depth

Logged By:	
Checked By:	

[illegible]





Project:  
Project Location:  
Project Number:

JETTY 20/8

SEE INFO ON PAGE 1

## SOIL LOGGING FORM

BOREHOLE No: B6A

Sheet 8 of 8 :

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:	
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Drillier:

Hammer Data:

Water Level:	72' BLS
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Finish Date:

Drilling Method:

Northina

Date:	5-3-11
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Total Depth:	
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Drilling Rig:

Easting:

Date:	2-2-78
Time:	1445

Loaded By:	
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Drill Bit Type/Size:

Elevation

Casing Depth	74' BGL
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Checked By \_\_\_\_\_

Depth	SAMPLES				Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)			
70			19		FINE SAND (SP) (CONT'D)		
71					MED. DENSE		
72					WET		
73					SANDY CLAY (CL), MOIST, BROWN	CUTTINGS SAMPLE BLA-60-80 (BUCKET) 3-MAY-2018	
74					CLAY (CL), MOIST, BROWN		
75			7		CLAYEY SAND (SC), GRAYISH BROWN, MOIST TO WET	CORE: 40-80 cpm	
76			16	18"	MED. DENSE		
77			16	16"	SANDY CLAY (CL), GRAYISH BROWN, MOIST, STIFF TO VERY STIFF		
78							
79							
80							
				</			











JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: 57A  
Sheet 3 of 10:

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)				
		25			SM	SILTY SAND (SM) (CONT'D)		
						MEDIUM DENSE		
	B7A-22.5-24 ← (BAG) → 2-MAY-2018							
	B7A-24A B7A-24B (MCA 2.5")	17 25 41	18" 14"			DENSE	CORE : 40-60 cpm	
	B7A-27.5-29 ← (BAG) → 2-MAY-2018							
	B7A-29A (MCA 2.5")	13 15	18" 9"				CORE : 60-80 cpm	

[illegible]

**Stantec**Project:  
Project Location:  
Project Number:JETTY 2018  
SEE INFO ON PAGE 7**SOIL LOGGING  
FORM**BOREHOLE No.: B7A  
Sheet 4 of 10

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured				Start Date:
Driller:	Hammer Data:	Water Level:				Finish Date:
Drilling Method:	Nothing:	Date:				Total Depth:
Drilling Rig:	Easting:	Time:				Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth:				Checked By:

Depth	SAMPLES					Material Description	Remarks	Well Details																																																																																																																																							
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)	Recovered (in)																																																																																																																																										
30			22			SILTY SAND (SM) (CONT'D)																																																																																																																																									
						MEDIUM DENSE																																																																																																																																									
31				60"	50"	SANDY CLAY (CL), DARK BROWN (7.5 <sub>4</sub> R, 3/3), MOIST																																																																																																																																									
32																																																																																																																																															
33	B7A-32.5-34 (BAG)	2-MAY-2018																																																																																																																																													
34																																																																																																																																															
35	B7A-34.4 (MCA 2.5")		13	18"	9"		CORE: 60-80 cpm																																																																																																																																								
			18																																																																																																																																												
			26																																																																																																																																												
36						HARD																																																																																																																																									
37																																																																																																																																															
38	B7A-37.5-39 (BAG)	2-MAY-2018				SAND LAYER																																																																																																																																									
39																																																																																																																																															
40	B7A-39A B7A-39B (MCA 2.5")		10	18"	12"	FEW FINE GRAVEL	CORE: 60-80 cpm																																																																																																																																								
			12																																																																																																																																												
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sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with
GRAVELS with 50% coarse fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve	GRAVELS with 10% fine fraction passes #4 sieve																																																																																																																																							

**Stantec**Project:  
Project Location:  
Project Number:JETTY 2018  
SEE INFO ON PAGE 1**SOIL LOGGING  
FORM**BOREHOLE No.: **87A**Sheet **5** of **10**

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:

Driller:

Hammer Data:

Water Level:

Finish Date:

Drilling Method:

Northing:

Date:

Total Depth:

Drilling Rig:

Easting:

Time:

Logged By:

Drill Bit Type/Size:

Elevation:

Casing Depth:

Checked By:

Depth	SAMPLES			Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches				
40			14		CLAYEY SAND (SC), MOIST, DARK BROWN (7.5 YR, 3/3), MED. DENSE		
41							
42						CUTTINGS SAMPLE B7A-40-60 (BUCKET) 2-MAY-2018	
43							
44							
45			17				
46			15				
47			20				
48							
49							
50			8				
			12				

GRAVELS	SANDS	SILTS AND CLAYS	SOIL TYPE	GRAIN SIZE	TERMS	FIELD TEST
GRAVELS with little or no fines No. 4 sieve with +15% fines	SANDS with little or no fines No. 4 sieve with +15% fines	SILTS AND CLAYS liquid limit <50	GRAVELS with little or no fines No. 4 sieve with +15% fines	GRAIN SIZE Boulders >300 Cobbles 75 to 300 Coarse gravel 19 to 75 Fine gravel 4.75 to 19 Coarse sand 2.0 to 4.75 Medium sand 0.425 to 2.0 Fine sand 0.075 to 0.425 Silt / clay (fines) <0.075	TERMS very loose loose medium dense dense very dense	FIELD TEST Absence of moisture, dry to touch Damp, does not wet palm Visible Free Water
GRAVELS with little or no fines No. 4 sieve with +15% fines	SANDS with little or no fines No. 4 sieve with +15% fines	SILTS AND CLAYS liquid limit >50	GRAVELS with little or no fines No. 4 sieve with +15% fines	GRAIN SIZE Boulders >300 Cobbles 75 to 300 Coarse gravel 19 to 75 Fine gravel 4.75 to 19 Coarse sand 2.0 to 4.75 Medium sand 0.425 to 2.0 Fine sand 0.075 to 0.425 Silt / clay (fines) <0.075	TERMS very loose loose medium dense dense very dense	FIELD TEST Absence of moisture, dry to touch Damp, does not wet palm Visible Free Water



## SOIL LOGGING FORM

BOREHOLE No.: B7A  
Sheet 6 of 10:

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured				Start Date:
Drillier:	Hammer Data:	Water Level:				Finish Date:
Drilling Method:	Northing:	Date:				Total Depth:
Drilling Rig:	Easting:	Time:				Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth				Checked By:

[illegible]









LETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: B7A  
Sheet 9 of 10:

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured				Start Date:
Driller:	Hammer Data:	Water Level:				Finish Date:
Drilling Method:	Nothing:	Date:				Total Depth:
Drilling Rig:	Easting:	Time:				Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth				Checked By:

Depth	SAMPLES				Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)			
80			13		CLAY (CL) (CONT'D)		
81					VERY STIFF		
82							
83	B7A-82.5-84 (BAG)	3-MAY-2018					
84	B7A-84B B7A-84C (UCA 2.5")		7 8 13	18" 16"		CORE! 60-80 cpm	
85					VERY STIFF		
86					CLAYEY SAND (SC), GRAY (7.5 <sub>yR</sub> , 5%), MOIST		
87					SAND LEUSE		
88	B7A-87.5-89 (BAG)	3-MAY-2018					
89	B7A-89B B7A-89C (UCA 2.5")		3 7	18" 16"	SAND (SP), BROWN (7.5 <sub>yR</sub> , 5%), WET	CORE! 40-60 cpm	
90							



JETTY 2018  
SEE INFO ON PAGE 1

## SOIL LOGGING FORM

Sheet 10 of 10:

Start Date:

Finish Date:

Total Depth:	
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Logged By:

Checked By \_\_\_\_\_

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)				
90		9						
91								
92								
93								
94								
95								
96								
97								
98								
99								
100								

GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVELS	GRAVEL
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Project:  
Project Location:  
Project Number:

JETTY 2018 GE/UNC  
NECR, NM

## SOIL LOGGING FORM

BOREHOLE No.: B8

Sheet / of 4 :

Drilling Company:	CASCADE
Driller:	M. CAIN
Drilling Method:	HSA
Drilling Rig:	CME 85
Drill Bit Type/Size:	8.25"

Sampling Method(s): *MICA 2.5"*  
 Hammer Data:  
 Northing:  
 Easting:  
 Elevation:

Groundwater Level & Date Measured				
Water Level:				
Date:				
Time:				
Casing Depth				

Start Date:	5-2-18
Finish Date:	5-2-18
Total Depth:	40.5'
Logged By:	M. KAPP
Checked By:	

[illegible]



JETTY 2018  
SEE INFO ON PAGE 1

## SOIL LOGGING FORM

BOREHOLE No.: B8  
Sheet 2 of 4

Start Date:	
Finish Date:	
Total Depth:	
Logged By:	
Checked By:	

[illegible]



Project: JETTY 2018  
Project Location:  
Project Number: SEE INFO ON PAGE 1

## SOIL LOGGING FORM

BOREHOLE No.: 38  
Sheet 3 of 4

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured					Start Date:
Drillier:	Hammer Data:	Water Level:					Finish Date:
Drilling Method:	Nothing:	Date:					Total Depth:
Drilling Rig:	Eastings:	Time:					Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth					Checked By:

[illegible]

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:

Drillier

Hammer Data:

Water Level:

Finish Date:

Drilling Method:

Nothing

Date:

Total Depth:

Drilling Rig:

Easting:

Time:

Logged By:

Depth	Type	Number	SAMPLES		Graphic Log	Material Description	Remarks	Well Details
			Sampling Resistance, blows / 6 inches	Driven (in) / Recovered (in)				
30			50 1/2"			SILTY CLAY (CL) (CONT'D)		
31						VERY HARD		
32				60" / 57"				
33						(ESTIMATED)		
34						SILTY SAND (SM), BROWNISH YELLOW (104R, 4/6), DRY		
35	BB-34A BB-34B (MCA 2.5")	11 17 22		18" / 11"			CORE: 40-60 cpm	
36						MEDIUM DENSE		
37								
38	BB-37.5-39 BB-38-39 BB-39A (MCA 2.5")	11 19 20		18" / 8"				
39						MED. DENSE		
40						TOTAL DEPTH 40.5 FT BGS		













JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: B9  
Sheet 4 of 6:

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured				Start Date:
Drillier:	Hammer Data:	Water Level:				Finish Date:
Drilling Method:	Nothing:	Date:				Total Depth:
Drilling Rig:	Easting:	Time:				Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth				Checked By:

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)				
30			39			SILTY SAND (SM) (CONT'D)		
31						DENSE		
32				60" 50"		SILTY SAND (SM), YELLOWISH BROWN (104R, 5/4), SLIGHTLY MOIST, CEMENTED STRUCTURE	CUTTINGS SAMPLE B9-20-35 (BUCKET) 1-MAY-2018	
33								
34								
35	B9-34A B9-34B (NCA 2.5")	8 9 12	18" 11"			MEDIUM DENSE	CORE: 60-100 cpm	
36								
37				60" 48"		CLEAN SAND		
38	B9-37A B9-37B B9-37C B9-37D B9-37E B9-37F B9-37G B9-37H B9-37I B9-37J B9-37K B9-37L B9-37M B9-37N B9-37O B9-37P B9-37Q B9-37R B9-37S B9-37T B9-37U B9-37V B9-37W B9-37X B9-37Y B9-37Z B9-37AA B9-37AB B9-37AC B9-37AD B9-37AE B9-37AF B9-37AG B9-37AH B9-37AI B9-37AJ B9-37AK B9-37AL B9-37AM B9-37AN B9-37AO B9-37AP B9-37AQ B9-37AR B9-37AS B9-37AT B9-37AU B9-37AV B9-37AW B9-37AX B9-37AY B9-37AZ B9-37BA B9-37BB B9-37BC B9-37BD B9-37BE B9-37BF B9-37BG B9-37BH B9-37BI B9-37BJ B9-37BK B9-37BL B9-37BM B9-37BN B9-37BO B9-37BP B9-37BQ B9-37BR B9-37BS B9-37BT B9-37BU B9-37BV B9-37BW B9-37BX B9-37BY B9-37BZ B9-37CA B9-37CB B9-37CC B9-37CD B9-37CE B9-37CF B9-37CG B9-37CH B9-37CI B9-37CJ B9-37CK B9-37CL B9-37CM B9-37CN B9-37CO B9-37CP B9-37CQ B9-37CR B9-37CS B9-37CT B9-37CU B9-37CV B9-37CW B9-37CX B9-37CY B9-37CZ B9-37DA B9-37DB B9-37DC B9-37DD B9-37DE B9-37DF B9-37DG B9-37DH B9-37DI B9-37DJ B9-37DK B9-37DL B9-37DM B9-37DN B9-37DO B9-37DP B9-37DQ B9-37DR B9-37DS B9-37DT B9-37DU B9-37DV B9-37DW B9-37DX B9-37DY B9-37DZ B9-37EA B9-37EB B9-37EC B9-37ED B9-37EE B9-37EF B9-37EG B9-37EH B9-37EI B9-37EJ B9-37EK B9-37EL B9-37EM B9-37EN B9-37EO B9-37EP B9-37EQ B9-37ER B9-37ES B9-37ET B9-37EU B9-37EV B9-37EW B9-37EX B9-37EY B9-37EZ B9-37FA B9-37FB B9-37FC B9-37FD B9-37FE B9-37FF B9-37FG B9-37FH B9-37FI B9-37FJ B9-37FK B9-37FL B9-37FM B9-37FN B9-37FO B9-37FP B9-37FQ B9-37FR B9-37FS B9-37FT B9-37FU B9-37FV B9-37FW B9-37FX B9-37FY B9-37FZ B9-37GA B9-37GB B9-37GC B9-37GD B9-37GE B9-37GF B9-37GG B9-37GH B9-37GI B9-37GJ B9-37GK B9-37GL B9-37GM B9-37GN B9-37GO B9-37GP B9-37GQ B9-37GR B9-37GS B9-37GT B9-37GU B9-37GV B9-37GW B9-37GX B9-37GY B9-37GZ B9-37HA B9-37HB B9-37HC B9-37HD B9-37HE B9-37HF B9-37HG B9-37HH B9-37HI B9-37HJ B9-37HK B9-37HL B9-37HM B9-37HN B9-37HO B9-37HP B9-37HQ B9-37HR B9-37HS B9-37HT B9-37HU B9-37HV B9-37HW B9-37HX B9-37HY B9-37HZ B9-37IA B9-37IB B9-37IC B9-37ID B9-37IE B9-37IF B9-37IG B9-37IH B9-37II B9-37IJ B9-37IK B9-37IL B9-37IM B9-37IN B9-37IO B9-37IP B9-37IQ B9-37IR B9-37IS 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B9-37NR B9-37NS B9-37NT B9-37NU B9-37NV B9-37NW B9-37NX B9-37NY B9-37NZ B9-37OA B9-37OB B9-37OC B9-37OD B9-37OE B9-37OF B9-37OG B9-37OH B9-37OI B9-37OJ B9-37OK B9-37OL B9-37OM B9-37ON B9-37OO B9-37OP B9-37OQ B9-37OR B9-37OS B9-37OT B9-37OU B9-37OV B9-37OW B9-37OX B9-37OY B9-37OZ B9-37PA B9-37PB B9-37PC B9-37PD B9-37PE B9-37PF B9-37PG B9-37PH B9-37PI B9-37PJ B9-37PK B9-37PL B9-37PM B9-37PN B9-37PO B9-37PP B9-37PQ B9-37PR B9-37PS B9-37PT B9-37PU B9-37PV B9-37PW B9-37PX B9-37PY B9-37PZ B9-37QA B9-37QB B9-37QC B9-37QD B9-37QE B9-37QF B9-37QG B9-37QH B9-37QI B9-37QJ B9-37QK B9-37QL B9-37QM B9-37QN B9-37QO B9-37QP B9-37QQ B9-37QR B9-37QS B9-37QT B9-37QU B9-37QV B9-37QW B9-37QX B9-37QY B9-37QZ B9-37RA B9-37RB B9-37RC B9-37RD B9-37RE B9-37RF B9-37RG B9-37RH B9-37RI B9-37RJ B9-37RK B9-37RL B9-37RM B9-37RN B9-37RO B9-37RP B9-37RQ B9-37RR B9-37RS B9-37RT B9-37RU B9-37RV B9-37RW B9-37RX B9-37RY B9-37RZ B9-37SA B9-37SB B9-37SC B9-37SD B9-37SE B9-37SF B9-37SG B9-37SH B9-37SI B9-37SJ B9-37SK B9-37SL 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B9-37XH B9-37XI B9-37XJ B9-37XK B9-37XL B9-37XM B9-37XN B9-37XO B9-37XP B9-37XQ B9-37XR B9-37XS B9-37XT B9-37XU B9-37XV B9-37XW B9-37XX B9-37XY B9-37XZ B9-37YA B9-37YB B9-37YC B9-37YD B9-37YE B9-37YF B9-37YG B9-37YH B9-37YI B9-37YJ B9-37YK B9-37YL B9-37YM B9-37YN B9-37YO B9-37YP B9-37YQ B9-37YR B9-37YS B9-37YT B9-37YU B9-37YV B9-37YW B9-37YX B9-37YY B9-37YZ B9-37ZA B9-37ZB B9-37ZC B9-37ZD B9-37ZE B9-37ZF B9-37ZG B9-37ZH B9-37ZI B9-37ZJ B9-37ZK B9-37ZL B9-37ZM B9-37ZN B9-37ZO B9-37ZP B9-37ZQ B9-37ZR B9-37ZS B9-37ZT B9-37ZU B9-37ZV B9-37ZW B9-37ZX B9-37ZY B9-37ZZ							
39	B9-39A (NCA 2.5")	9 12	18" 8"			SANDY SILT (ML), BROWNISH YELLOW (104R, 6/6), SLIGHTLY MOIST	CORE: 60-80 cpm	
40								

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured				Start Date:
Driller:	Hammer Data:	Water Level:				Finish Date:
Drilling Method:	Northing:	Date:				Total Depth:
Drilling Rig:	Easting:	Time:				Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth				Checked By:

Depth	SAMPLES				Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)			
40			17		SANDY SILT (ML) (CONT'D)		
41					MEDIUM DENSE		
42				60" 50"			
43					SAND (SP), LIGHT GRAY (10yr, 7/2), SLIGHTLY MOIST		
44							
45	B9-44A B9-44B (MCA 2.5")	6 9 13	18" 14"		MEDIUM DENSE	BACKGROUND RADIATION: 60-80 cpm CORE: 60-80cpm	
46							
47				60" 41"			
48	B9-47.5-49 (BAG) → ← (BAG) 2-MAY-2018						
49	B9-49A B9-49B (MCA 2.5")	8 15				CORE: 60-80cpm	
50							



Project:  
Project Location:  
Project Number:

## SOIL LOGGING FORM

BOREHOLE No: **B9**  
Sheet **6** of **6** :

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured					Start Date:
Drillier:	Hammer Data:	Water Level:					Finish Date:
Drilling Method:	Nothing:	Date:					Total Depth:
Drilling Rig:	Easting:	Time:					Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth					Checked By:

[illegible]

Drilling Company: **CASCADE**  
Drillier: **M. CAIN**  
Drilling Method: **USA**  
Drilling Rig: **CME 85**  
Drill Bit Type/Size: **B. 25"**

Sampling Method(s):	MCA 2.5"
Hammer Data:	
Northing:	
Easting:	
Elevation:	

Groundwater Level & Date Measured				
Water Level:				
Date:				
Time:				
Casing Depth				

Start Date:	5-1-18
Finish Date:	5-1-18
Total Depth:	50.5'
Logged By:	M. KAPP
Checked By:	

Depth	Type Number	SAMPLES		Graphic Log	Material Description	Remarks	Well Details
		Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)				
0					SPARSE VEGETATION AT SURFACE	BACKGROUND RADIATION!	
1					CLAYEY SILT (ML), SLIGHTLY MOIST, LIGHT BROWN (7.5 <sub>yR</sub> , 6/3), TRACE FINE SAND AND GRAVEL	CORE: 60-80 cpm	
2							
3	B10-2.5-4 ← (BAG) → 1-MAY-2018						
4							
5	B10-4A B10-4B (MCA 2.5")	20 28 39	18" 15"		DENSE	CORE: 60-80 cpm	
6							
7					CLAYEY FINE SAND (SC), BROWN (7.5 <sub>yR</sub> , 5/3), SOME SILT		
8							
9							
10	B10-9A B10-9B (MCA 2.5")	20 26	18" 18"			CORE: 60-80 cpm	





Project:  
Project Location:  
Project Number:

JETTY 2018  
SEE INFO ON PAGE 1

## SOIL LOGGING FORM

BOREHOLE No.: B10

Sheet 3 of 5 :

Drilling Company:

Sampling Method(s):

Groundwater Level &amp; Date Measured

Start Date:

Drillier.

Hammer Data:

Water Level:

Finish Date:

Drilling Method:

Nothing:

Date:

Total Depth:

Drilling Rig:  
Drill Bit Type/Size:

Easting:   
 Elevation:Time: \_\_\_\_\_  
Casing Depth \_\_\_\_\_

Logged By:	
Checked By:	

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in)				
20		18			SM	FINE SAND SOME SILT (SM) (CONT'D)		
21						MEDIUM DENSE		
22						TRACE FINE GRAVEL		
23								
24						ROOTS		
25								
26						MEDIUM DENSE		
27						TRACE TO SOME CLAY		
28								
29								
30								

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JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: B10  
Sheet 5 of 5:

Start Date:	
Finish Date:	
Total Depth:	
Logged By:	
Checked By:	

Depth	SAMPLES				Graphic Log	Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)				
40			17		CL	CLAY (CL) (CONT'D)		
41						MEDIUM DENSE		
42								
43								
44								
45								
46								
47								
48								
49								
50								

[illegible]







LETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No.: B11  
Sheet 3 of 5:

Start Date:	
Finish Date:	
Total Depth:	
Logged By:	
Checked By:	

Depth	SAMPLES				Material Description	Remarks	Well Details
	Type Number	Sampling Resistance, blows / 6 inches	Driven (in)	Recovered (in)			
20		31			SANDY CLAY (CL) (CONT'D)		
21					HARD		
22							
23							
24	B11-22.5-24 B11-24B (MCA 2.5")	6 9 17	18" 18"			CORE : 60-80cm	
25					VERY STIFF		
26					CLAYEY SAND (SC), VERY DARK BROWN (7.5 yr, 2 1/3), MOIST, FEW FINE GRAVEL, FEW SILT		
27							
28							
29	B11-29A B11-29B (MCA 2.5")	6 12	18" 12"			CORE : 60-80 cm	
30							

Drilling Company:	Sampling Method(s):	Groundwater Level & Date Measured					Start Date:
Drillier:	Hammer Data:	Water Level:					Finish Date:
Drilling Method:	Northing:	Date:					Total Depth:
Drilling Rig:	Easting:	Time:					Logged By:
Drill Bit Type/Size:	Elevation:	Casing Depth					Checked By:

[illegible]



JETTY 2018  
SEE INFO ON PAGE 1

BOREHOLE No: B11  
Sheet 5 of 5:

Start Date:

Checked By	
------------	--

Depth	SAMPLES				Material Description	Remarks	Well Details
	Type	Number	Sampling Resistance, blows / 6 inches	Driven (in) Recovered (in)			
	B11-47.5-49 ← (BAG) → 1-MAY-2018				SILTY CLAY (CL) (CONT'D)		
	B11-44A B11-44B (MCA 2.5")	3 10 12	18" 17"		VERY STIFF		
	B11-42.5-44 ← (BAG) → 1-MAY-2018				FINE SAND LAYER, TRACE SILT, LIGHT BROWN (7.5 yr, 6/4)		
	B11-49A B11-49B (MCA 2.5")	3 8 12	18" 17"		SANDY CLAY (CL), MOIST, BROWN (7.5 yr, 4/3), SOME SILT, OCC. COAL INCLUSION	CORE: 60-80 CPM	
					VERY STIFF		
TOTAL DEPTH 50.5 FT BAG							

**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix A Boring Logs, Core Photos, and Daily Field Logs  
July 31, 2019

**CORE PHOTOS**





1. B4A – 0 ft bgs to 25 ft bgs



2. B4A – 25 ft bgs to 49 ft bgs





3. B5A – 0 ft bgs to 25 ft bgs



4. B5A – 25 ft bgs to 54 ft bgs





5. B5A - 54 ft bgs to 69 ft bgs



6. B6A – 0 ft bgs to 24.5 ft bgs





7. B6A – 24.5 ft bgs to 55 ft bgs



8. B6A – 55 ft bgs to 79 ft bgs





9. B7A – 0 ft bgs to 17 ft bgs



10. B7A – 17 ft bgs to 36 ft bgs





11. B7A – 36 ft bgs to 69 ft bgs



12. B7A – 69 ft bgs – 86 ft bgs





13. B7A – 86 ft bgs to 94 ft bgs



14. B8 – 0 ft bgs to 12.5 ft bgs





15. B8 – 12.5 ft bgs to 25.5 ft bgs



16. B8 – 25.5 ft bgs to 39 ft bgs





17. B9 – 0 ft bgs to 15 ft bgs



18. B9 – 15 ft bgs to 29.5 ft bgs





19. B9 – 25.5 ft bgs to 42 ft bgs



20. B9 – 42 ft bgs – 54 ft bgs





21. B10 – 0 ft bgs to 12 ft bgs



22. B10 – 12 ft bgs to 28 ft bgs





23. B10 – 28 ft bgs to 39 ft bgs



24. B10 – 39 ft bgs to 49 ft bgs





25. B11 – 0 ft bgs to 16.5 ft bgs



26. B11 – 16.5 ft bgs to 34.5





27. B11 – 34.5 ft bgs to 49 ft bgs



**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix A Boring Logs, Core Photos, and Daily Field Logs  
July 31, 2019

**DAILY FIELD LOGS**

# Daily Field Report

Date Mon, 4/30/2018

PROJECT: NECR Jetty 2018

JOB NO: 233001048

CLIENT: GE/UNC

CONTRACTOR: Stantec

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.	
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	1	

Onsite Personnel			
Name	Company	Position	Remarks
Matthew Kapp	Stantec	Field Manager	
Jason Cumbers	Stantec	Technical Lead	
Matt Cain	Cascade	Drill Operator	
Forrest Chattin	Cascade	Drill Helper	
Matt Sanchez	Cascade	Drill Helper	
Wayne Carrier	Cascade	Drill Helper	
Victor Patel	AVM	Analytical Sampler	
Nat Patel	AVM	Analytical Sampler	
Lane Andress	EA	Drilling Oversight	
Janet Brooks	EPA	Drilling Oversight	
R.J. Evans	NRC	Drilling Oversight	

Equipment		
Item	Company	Op Hrs
CME 85 Drill Rig	Cascade	6
Fork Lift	Cascade	1
Ludlum Model 12 Ratemeter & HP-210L Beta/Gamma	Avm/Stantec	9

## Safety:

No incidents reported

## Activities Summary:

Stantec arrived on-site at approximately 0715. Cascade drill crew arrived at about 0730. Site specific training was presented to Stantec and Cascade at 0800. Stantec located and marked borehole locations B4A, B5A, and B6A after the site specific training was completed. Cascade prepared their equipment and initiated drilling at B5A borehole at approximately 1000. B5A borehole was completed, drilled to a depth of 70.5 feet below ground surface (bgs), at approximately 1400. Cascade mobilized the drill rig to B4A borehole and were drilling at that location at approximately 1430. At 1700 a depth of 50.5 feet bgs was reached at B4A, which concluded drilling for the day. B5A borehole location was collected with a sub-meter handheld GPS device.

A total of 121 feet were drilled. Twenty four SPT drives were conducted. Gamma scanning was conducted on each core sample.

By: M. Kapp

Title: Field Manager

Date Tue, 5/1/2018

PROJECT: NECR Jetty 2018

JOB NO: 233001048

CLIENT: GE/UNC

CONTRACTOR: Stantec

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.	
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	2	

Onsite Personnel			
Name	Company	Position	Remarks
Matthew Kapp	Stantec	Field Manager	
Jason Cumbers	Stantec	Technical Lead	
Matt Cain	Cascade	Drill Operator	
Forrest Chattin	Cascade	Drill Helper	
Matt Sanchez	Cascade	Drill Helper	
Wayne Carrier	Cascade	Drill Helper	
Victor Patel	AVM	Analytical Sampler	
Nat Patel	AVM	Analytical Sampler	
Lane Andress	EA	Drilling Oversight	
Janet Brooks	EPA	Drilling Oversight	
R.J. Evans	NRC	Drilling Oversight	

Equipment		
Item	Company	Op Hrs
CME 85 Drill Rig	Cascade	9
Fork Lift	Cascade	1
Ludlum Model 12 Ratemeter & HP-210L Beta/Gamma	Avm/Stantec	9

## Safety:

No incidents reported

## Activities Summary:

Stantec arrived on-site at approximately 0730. Cascade drill crew arrived at about 0730 as well. Safety tailgate meeting was held in conjunction with the Cascade drill crew. Drilling recommenced around 0830 at borehole B4A and was completed, drilled to a depth of 60.5 feet below ground surface (bgs), at approximately 0930. The drill rig was mobilized to borehole B11 and drilling began around 1015. Borehole B11 was completed around 1200, drilled to a depth of 50.5 feet bgs. The drill rig was mobilized to borehole B10 and drilling began at approximately 1245. Borehole B10 was completed, drilled to a depth of 50.5 feet bgs, at approximately 1500. By 1545, the drill rig was mobilized and drilling at borehole B9. 45.5 feet were drilled at B9. B4A, B11, and B10 borehole locations were recorded using a sub-meter handheld GPS unit. Stantec and Cascade left the site at approximately 1700.

A total of 155.5 feet were drilled. Thirty one SPT drives were conducted. Six 5 gallon buckets of cuttings were collected (2 buckets each of 0-10 at B11, 20-35 at B9, and 10-25 feet at B10). Gamma scanning was conducted on each core sample.

By: M. Kapp

Title: Field Manager

# Daily Field Report

Date Wed, 5/2/2018

PROJECT: NECR Jetty 2018

JOB NO: 233001048

CLIENT: GE/UNC

CONTRACTOR: Stantec

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input checked="" type="checkbox"/> Over-cast	<input checked="" type="checkbox"/> Rain	<input checked="" type="checkbox"/> Snow
Temp. °F	<input type="checkbox"/> <32	<input checked="" type="checkbox"/> 32-50	<input type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100
Wind	<input type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input checked="" type="checkbox"/> High	Report No.	
Humidity	<input type="checkbox"/> Dry	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> Humid	3	

Onsite Personnel			
Name	Company	Position	Remarks
Matthew Kapp	Stantec	Field Manager	
Jason Cumbers	Stantec	Technical Lead	
Matt Cain	Cascade	Drill Operator	
Forrest Chattin	Cascade	Drill Helper	
Matt Sanchez	Cascade	Drill Helper	
Wayne Carrier	Cascade	Drill Helper	
Victor Patel	AVM	Analytical Sampler	
Nat Patel	AVM	Analytical Sampler	
Lane Andress	EA	Drilling Oversight	
Janet Brooks	EPA	Drilling Oversight	

Equipment			
Item	Company	Op Hrs	
CME 85 Drill Rig	Cascade	8	
Fork Lift	Cascade	1	
Ludlum Model 12 Ratemeter & HP-210L Beta/Gamma	Avm/Stantec	8	

## Safety:

No incidents reported

## Activities Summary:

Stantec arrived on-site at approximately 0730. Cascade drill crew arrived at about 0730 as well. Safety tailgate meeting was held in conjunction with the Cascade drill crew. Drilling recommenced around 0830 at borehole B9 and was completed at approximately 0900, to a depth of 55.5 feet below ground surface (bgs). The drill rig was mobilized to borehole B8 and the crew started drilling at approximately 0930. B8 was completed, to a depth of 40.5 feet bgs, at approximately 1100. The drill rig was then mobilized to B7A borehole location and drilling commenced at approximately 1130. Drilling at B7A was stopped at 1615, at a depth of 75.5 feet bgs, due to thunderstorms and hail.

A total of 126 feet were drilled. Twenty five SPT drives were conducted. Four 5 gallon buckets cuttings were collected at B7A (2 buckets each of 0'-20' and 40'-60'). Gamma scanning was conducted on each core sample.

By: M. Kapp

Title: Field Manager

# Daily Field Report

Date Thu, 5/3/2018

PROJECT: NECR Jetty 2018

JOB NO: 233001048

CLIENT: GE/UNC

CONTRACTOR: Stantec

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input type="checkbox"/> Sunny	<input checked="" type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100
Wind	<input type="checkbox"/> Still	<input checked="" type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.	
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	4	

Onsite Personnel			
Name	Company	Position	Remarks
Matthew Kapp	Stantec	Field Manager	
Matt Cain	Cascade	Drill Operator	
Forrest Chatten	Cascade	Drill Helper	
Matt Sanchez	Cascade	Drill Helper	
Wayne Carrier	Cascade	Drill Helper	
Victor Patel	AVM	Analytical Sampler	
Nat Patel	AVM	Analytical Sampler	
Lane Address	EA	Drilling Oversight	
Janet Brooks	EPA	Drilling Oversight	

Equipment			
Item	Company	Op Hrs	
CME 85 Drill Rig	Cascade	7	
Fork Lift	Cascade	1	
Ludlum Model 12 Ratemeter & HP-210L Beta/Gamma	Avm/Stantec	7	

## Safety:

No incidents reported

## Activities Summary:

Stantec arrived on-site at approximately 0730. Cascade drill crew arrived at about 0730 as well. Safety tailgate meeting was held in conjunction with the Cascade drill crew. Drilling recommenced around 0830 at borehole B7A and was completed to a depth of 95.5 feet below ground surface (bgs) at approximately 0945. B7A was grouted to approximately 50 feet bgs. The drill rig was mobilized to borehole B6A and drilling began around 1130, with B6A drilling complete at approximately 1515 to a depth of 80.5 feet bgs. B6A was grouted to a depth of approximately 60 feet bgs. Stantec and Cascade left the site at approximately 1630.

A total of 101 feet were drilled. Sixteen SPT drives were conducted. Four 5 gallon buckets of cuttings were collected at B6A (2 buckets each of 20-40 and 60-80 feet). Gamma scanning was conducted on each core sample. Gamma scanning was conducted on each core sample.

By: M. Kapp

Title: Field Manager

# Daily Field Report

Date Fri, 5/4/2018

PROJECT: NECR Jetty 2018

JOB NO: 233001048

CLIENT: GE/UNC

CONTRACTOR: Stantec

PROJECT MANAGER: Melanie Davis

Weather	<input type="checkbox"/> Bright Sun	<input checked="" type="checkbox"/> Sunny	<input type="checkbox"/> Over-cast	<input type="checkbox"/> Rain	<input type="checkbox"/> Snow
Temp. °F	<input type="checkbox"/> <32	<input type="checkbox"/> 32-50	<input checked="" type="checkbox"/> 50-70	<input type="checkbox"/> 70-85	<input type="checkbox"/> 85-100
Wind	<input checked="" type="checkbox"/> Still	<input type="checkbox"/> Moder.	<input type="checkbox"/> High	Report No.	
Humidity	<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Moder.	<input type="checkbox"/> Humid	5	

Onsite Personnel			
Name	Company	Position	Remarks
Matthew Kapp	Stantec	Field Manager	
Jason Cumbers	Stantec	Technical Lead	
Matt Cain	Cascade	Drill Operator	
Forrest Chattin	Cascade	Drill Helper	
Matt Sanchez	Cascade	Drill Helper	
Wayne Carrier	Cascade	Drill Helper	

Equipment		
Item	Company	Op Hrs
CME 85 Drill Rig	Cascade	0
Fork Lift	Cascade	N/A

## Safety:

No incidents reported

## Activities Summary:

Stantec arrived on-site at approximately 0700. Soil samples were loaded onto a truck for delivery. Stantec left the site at approximately 1130. Grab samples for gamma testing were shipped by FedEx to ALS in Fort Collins, CO from Gallup, NM. Buckets of drill cuttings and Modified California sleeve samples were delivered to D.B. Stephens in Albuquerque, NM at approximately 1530.

Drilling was completed on 5/3/2018, no drilling was completed on this day.

By: M. Kapp

Title: Field Manager



**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix B Field Photos  
July 31, 2019

**APPENDIX B      FIELD PHOTOS**



Photograph 1. CME 85 drill rig



Photograph 2. Typical drilling and sampling station setup



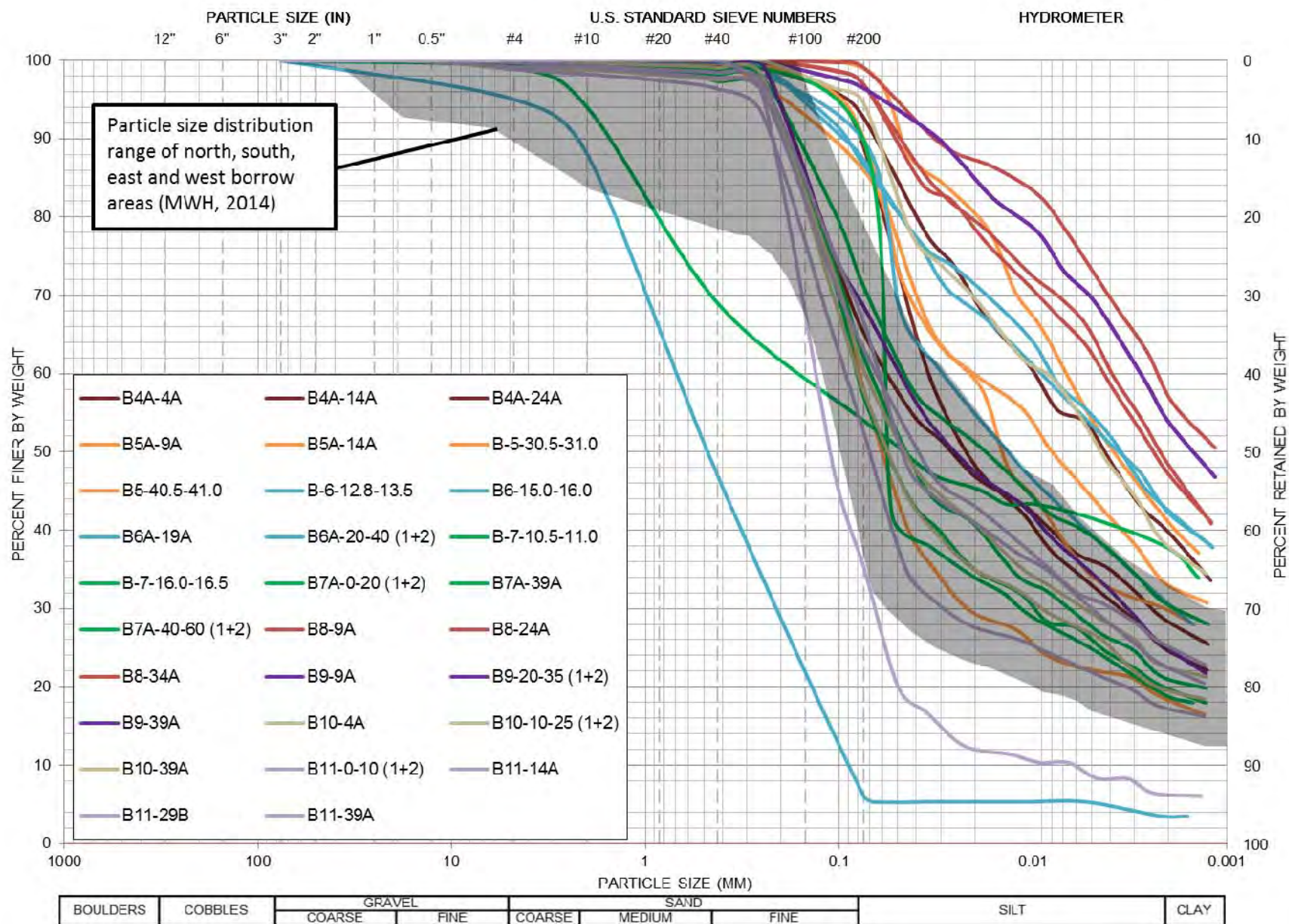
Photograph 3. Drill Auger Decontamination

**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix C Geotechnical Laboratory Data  
July 31, 2019

## **APPENDIX C      GEOTECHNICAL LABORATORY DATA**



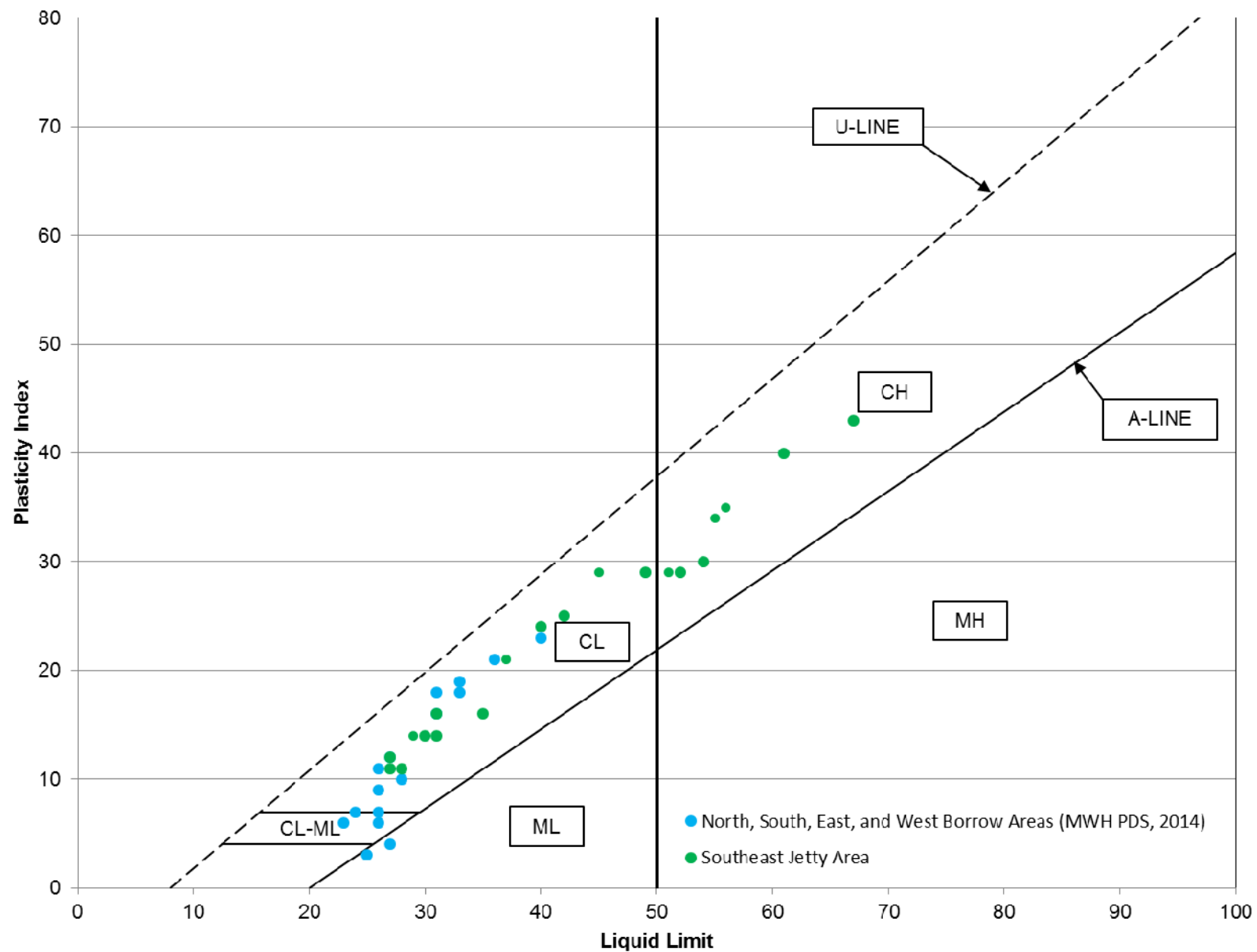


# PARTICLE SIZE DISTRIBUTION RESULTS Southeast Jetty Area



Oct. 2018

FIGURE C.1



### ATTERBERG TEST RESULTS Southeast Jetty and Borrow Areas



Oct. 2018

FIGURE C.2



# **Laboratory Report for Stantec Consulting Services Inc.**

**NECR Jetty '18**

**June 22, 2018**



***Daniel B. Stephens & Associates, Inc.***

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



June 22, 2018

Jason Cumbers  
Stantec Consulting Services Inc.  
3325 South Timberline Road Suite 150  
Fort Collins, CO 80525  
(970) 212-2755

Re: DBS&A Laboratory Report for the Stantec Consulting Services Inc. NECR Jetty '18 Project

Dear Mr. Cumbers:

Enclosed is the report for the Stantec Consulting Services Inc. NECR Jetty '18 project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Stantec Consulting Services Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.  
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines  
Laboratory Manager

Enclosure

*Daniel B. Stephens & Associates, Inc.*  
**Soil Testing & Research Laboratory**

4400 Alameda Blvd. NE, Suite C  
Albuquerque, NM 87113

505-889-7752  
FAX 505-889-0258

## Summaries



## Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>								Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		Air Perm- eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F	C			
B4A-4A	X	X													X	X	X				X	
B4A-14A															X	X						
B4A-24A	X	X													X	X	X				X	
B5A-9A	X	X													X	X	X				X	
B5A-14A	X	X													X	X						
B6A-19A	X	X													X	X	X				X	
B6A-20-40 (1+2)															X	X	X				X	X
B7A-39A	X	X													X	X					X	
B7A-0-20 (1+2)															X	X	X				X	X
B7A-40-60 (1+2)															X	X	X				X	X
B8-9A	X	X													X	X	X				X	
B8-24A	X	X													X	X					X	
B8-34A	X	X													X	X	X				X	
B9-9A	X	X													X	X	X				X	
B9-39A	X	X													X	X	X				X	

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)



### Summary of Tests Performed (Continued)

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>								Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		Air Perm- eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F	C			
B9-20-35 (1+2)															X	X	X				X	X
B10-4A	X	X													X	X	X				X	
B10-39A															X	X	X				X	
B10-10-25 (1+2)															X	X	X				X	X
B11-14A	X	X													X	X	X				X	
B11-29B	X	X													X	X	X				X	
B11-39A	X	X													X	X	X				X	
B11-0-10 (1+2)															X	X	X				X	X

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box,  
EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)



## **Notes**

### **Sample Receipt:**

Two hundred sixty three samples were hand-delivered on May 4, 2018. Six samples of the samples were each received in two full 5-gallon buckets sealed with lids, and the remaining two hundred fifty seven samples were each received in a 2" x 6" brass sleeve sealed with end caps. All samples were received in good order.

### **Sample Preparation and Testing Notes:**

Twenty three samples were selected for testing. All twenty three samples were subjected to particle size analysis testing; and, twenty one were subjected to Atterberg limits testing, nineteen were subjected to specific gravity testing, fifteen were subjected to initial properties analysis, and the six bucket samples were subjected to standard proctor compaction testing.

Porosity calculations, and the particle diameter calculations in the hydrometer portion of the particle size analysis testing, are based on the measured specific gravity test result of the <4.75mm fraction, or an assumed value of 2.65 for samples that did not receive specific gravity testing.



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
B4A-4A	11.2	16.4	---	---	1.47	1.63	44.7
B4A-24A	13.0	19.0	---	---	1.46	1.65	45.3
B5A-9A	7.5	9.9	---	---	1.31	1.41	50.1
B5A-14A	14.7	17.3	---	---	1.18	1.35	55.6
B6A-19A	14.2	25.3	---	---	1.79	2.04	33.3
B7A-39A	13.6	23.6	---	---	1.73	1.97	35.3
B8-9A	14.5	23.8	---	---	1.65	1.89	38.3
B8-24A	17.8	30.2	---	---	1.69	2.00	36.0
B8-34A	8.3	14.0	---	---	1.68	1.82	36.9
B9-9A	15.1	25.0	---	---	1.65	1.90	38.4
B9-39A	11.6	18.3	---	---	1.58	1.76	40.8
B10-4A	10.1	18.6	---	---	1.84	2.02	30.9

NA = Not analyzed

--- = This sample was not remolded





**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%) (%, g/g)	Volumetric (%) (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%) (%, g/g)	Volumetric (%) (%, cm <sup>3</sup> /cm <sup>3</sup> )			
B11-14A	7.5	14.4	---	---	1.92	2.06	27.8
B11-29B	15.7	24.3	---	---	1.55	1.80	41.6
B11-39A	9.5	14.4	---	---	1.51	1.66	42.9

NA = Not analyzed

--- = This sample was not remolded



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
B4A-4A	0.00017	0.0043	0.0098	58	0.48	WS/H	Lean clay (CL)	Silty Clay Loam	(Est)
B4A-14A	0.00013	0.022	0.034	262	2.9	WS/H	Classification by ASTM 2487 requires Atterberg test Sandy lean clay s(CL)	Loam	(Est)
B4A-24A	0.00010	0.026	0.056	560	1.0	WS/H		Clay Loam	(Est)
B5A-9A	0.00030	0.059	0.078	260	21	WS/H	Sandy silt s(ML)	Sandy Loam	(Est)
B5A-14A	2.3E-05	0.0080	0.020	870	2.6	WS/H	Classification by ASTM 2487 requires Atterberg test Fat clay (CH)	Clay Loam	(Est)
B6A-19A	5.5E-05	0.0035	0.0080	145	0.57	WS/H		Clay	(Est)
B6A-20-40 (1+2)	3.9E-05	0.0036	0.0091	233	0.57	WS/H	Lean clay (CL)	Clay	(Est)
B7A-39A	0.00019	0.055	0.080	421	6.2	WS/H	Sandy silt s(ML)	Sandy Clay Loam	(Est)
B7A-0-20 (1+2)	4.1E-05	0.045	0.068	1659	15	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B7A-40-60 (1+2)	4.6E-05	0.018	0.046	1000	1.5	WS/H	Lean clay with sand (CL)s	Clay Loam	(Est)
B8-9A	0.00015	0.0022	0.0039	26	0.58	WS/H	Fat clay (CH)	Silty Clay	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



### Summary of Particle Size Characteristics (Continued)

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
B8-24A	3.2E-05	0.0011	0.0023	72	0.49	WS/H	Fat clay (CH)	Clay	(Est)
B8-34A	0.0015	0.11	0.13	87	17	WS/H	Silty sand (SM)	Sandy Loam	
B9-9A	9.1E-05	0.0024	0.0043	47	0.59	WS/H	Fat clay (CH)	Silty Clay	(Est)
B9-39A	0.00025	0.025	0.049	196	0.89	WS/H	Sandy silt s(ML)	Loam	(Est)
B9-20-35 (1+2)	6.3E-05	0.0015	0.0028	44	0.51	WS/H	Fat clay (CH)	Clay	(Est)
B10-4A	6.0E-05	0.055	0.080	1333	17	WS/H	Sandy lean clay s(CL)	Sandy Loam	(Est)
B10-39A	6.1E-05	0.0044	0.0086	141	1.0	WS/H	Fat clay (CH)	Silty Clay Loam	(Est)
B10-10-25 (1+2)	2.4E-05	0.046	0.073	3042	17	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B11-14A	9.4E-05	0.070	0.093	989	90	WS/H	Sandy lean clay s(CL)	Sandy Loam	(Est)
B11-29B	0.00016	0.047	0.062	388	2.5	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B11-39A	0.0062	0.11	0.13	21	5.2	WS/H	Silty sand (SM)	Loamy Sand	
B11-0-10 (1+2)	0.00013	0.039	0.064	492	1.8	WS/H	Sandy lean clay s(CL)	Loam	(Est)

d<sub>50</sub> = Median particle diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
B4A-4A	0.0	7.3	53.0	39.7
B4A-14A	0.0	11.0	64.3	24.6
B4A-24A	0.0	34.8	36.9	28.3
B5A-9A	0.0	41.9	39.8	18.3
B5A-14A	0.0	9.9	57.0	33.1
B6A-19A	0.0	13.3	44.2	42.5
B6A-20-40 (1+2)	0.0	12.6	45.1	42.2
B7A-39A	0.3	42.5	37.2	20.0
B7A-0-20 (1+2)	0.7	37.1	41.1	21.1
B7A-40-60 (1+2)	0.6	28.3	40.6	30.5
B8-9A	0.0	3.1	48.6	48.3
B8-24A	0.0	0.9	41.8	57.3
B8-34A	0.2	62.4	26.9	10.5
B9-9A	0.0	3.1	49.8	47.1
B9-39A	0.0	31.4	43.7	24.9
B9-20-35 (1+2)	0.0	3.5	42.6	53.9

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.





**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
B10-4A	0.3	41.8	38.3	19.6
B10-39A	0.0	5.4	56.5	38.1
B10-10-25 (1+2)	1.1	38.3	38.0	22.5
B11-14A	1.1	46.3	35.3	17.3
B11-29B	0.3	33.0	44.2	22.5
B11-39A	0.0	64.6	29.1	6.3
B11-0-10 (1+2)	0.9	35.9	38.0	25.2

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
B4A-4A	43	20	23	CL
B4A-24A	27	16	11	CL
B5A-9A	---	---	---	ML
B6A-19A	51	22	29	CH
B6A-20-40 (1+2)	28	17	11	CL
B7A-39A	---	---	---	ML
B7A-0-20 (1+2)	29	15	14	CL
B7A-40-60 (1+2)	37	16	21	CL
B8-9A	54	24	30	CH
B8-24A	67	24	43	CH
B8-34A	---	---	---	ML
B9-9A	52	23	29	CH
B9-39A	---	---	---	ML
B9-20-35 (1+2)	55	21	34	CH
B10-4A	31	15	16	CL
B10-39A	56	21	35	CH
B10-10-25 (1+2)	45	16	29	CL
B11-14A	27	15	12	CL
B11-29B	31	17	14	CL
B11-39A	---	---	---	ML
B11-0-10 (1+2)	30	16	14	CL

--- = Soil requires visual-manual classification due to non-plasticity



### Summary of Specific Gravity Tests

Sample Number	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity <sup>1</sup>
B4A-4A	2.66	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.66
B4A-24A	2.68	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.68
B5A-9A	2.63	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.63
B6A-19A	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B6A-20-40 (1+2)	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B7A-0-20 (1+2)	2.67	<4.75 mm	99.3%	NA	>4.75 mm	0.7%	2.67
B7A-40-60 (1+2)	2.67	<4.75 mm	99.4%	NA	>4.75 mm	0.6%	2.67
B8-9A	2.67	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.67
B8-34A	2.67	<4.75 mm	99.8%	NA	>4.75 mm	0.2%	2.67
B9-9A	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B9-39A	2.67	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.67
B9-20-35 (1+2)	2.71	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.71
B10-4A	2.66	<4.75 mm	99.7%	NA	>4.75 mm	0.3%	2.66
B10-39A	2.68	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.68
B10-10-25 (1+2)	2.68	<4.75 mm	98.9%	NA	>4.75 mm	1.1%	2.68
B11-14A	2.66	<4.75 mm	98.9%	NA	>4.75 mm	1.1%	2.66
B11-29B	2.67	<4.75 mm	99.7%	NA	>4.75 mm	0.3%	2.67
B11-39A	2.66	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.66
B11-0-10 (1+2)	2.66	<4.75 mm	99.1%	NA	>4.75 mm	0.9%	2.66

<sup>1</sup>Based on the <4.75mm material

NA = Not Applicable since specified fraction is less than 5% of composite sample mass

NR = Test not Requested



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
B6A-20-40 (1+2)	17.9	1.68	---	---
B7A-0-20 (1+2)	13.7	1.83	---	---
B7A-40-60 (1+2)	15.0	1.76	---	---
B9-20-35 (1+2)	20.8	1.61	---	---
B10-10-25 (1+2)	13.8	1.85	---	---
B11-0-10 (1+2)	14.8	1.82	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

## **Initial Properties**





**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
B4A-4A	11.2	16.4	---	---	1.47	1.63	44.7
B4A-24A	13.0	19.0	---	---	1.46	1.65	45.3
B5A-9A	7.5	9.9	---	---	1.31	1.41	50.1
B5A-14A	14.7	17.3	---	---	1.18	1.35	55.6
B6A-19A	14.2	25.3	---	---	1.79	2.04	33.3
B7A-39A	13.6	23.6	---	---	1.73	1.97	35.3
B8-9A	14.5	23.8	---	---	1.65	1.89	38.3
B8-24A	17.8	30.2	---	---	1.69	2.00	36.0
B8-34A	8.3	14.0	---	---	1.68	1.82	36.9
B9-9A	15.1	25.0	---	---	1.65	1.90	38.4
B9-39A	11.6	18.3	---	---	1.58	1.76	40.8
B10-4A	10.1	18.6	---	---	1.84	2.02	30.9

NA = Not analyzed

--- = This sample was not remolded



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity (Continued)**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%) (g/g)	Volumetric (%) (cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%) (g/g)	Volumetric (%) (cm <sup>3</sup> /cm <sup>3</sup> )			
B11-14A	7.5	14.4	---	---	1.92	2.06	27.8
B11-29B	15.7	24.3	---	---	1.55	1.80	41.6
B11-39A	9.5	14.4	---	---	1.51	1.66	42.9

NA = Not analyzed

--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B4A-4A  
*Project Name:* NECR Jetty '18  
*Depth:* 5'-5.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	17-May-18	---
<i>Field weight* of sample (g):</i>	915.67	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	268.91	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	581.72	
<i>Sample volume (cm<sup>3</sup>):</i>	395.95	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.66	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	11.2	
<i>Volumetric Moisture Content (% vol):</i>	16.4	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.47	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.63	
<i>Calculated Porosity (% vol):</i>	44.7	
<i>Percent Saturation:</i>	36.7	

*Laboratory analysis by:* D.O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B4A-24A  
*Project Name:* NECR Jetty '18  
*Depth:* 25'-25.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	684.57	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	606.05	
<i>Sample volume (cm<sup>3</sup>):</i>	414.22	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.68	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	13.0	
<i>Volumetric Moisture Content (% vol):</i>	19.0	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.46	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.65	
<i>Calculated Porosity (% vol):</i>	45.3	
<i>Percent Saturation:</i>	41.8	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B5A-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	649.54	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	604.00	
<i>Sample volume (cm<sup>3</sup>):</i>	460.74	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.63	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	7.5	
<i>Volumetric Moisture Content (% vol):</i>	9.9	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.31	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.41	
<i>Calculated Porosity (% vol):</i>	50.1	
<i>Percent Saturation:</i>	19.7	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded





*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B5A-14A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	439.32	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	265.78	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	151.31	
<i>Sample volume (cm<sup>3</sup>):</i>	128.72	
<i>Assumed particle density (g/cm<sup>3</sup>):</i>	2.65	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	14.7	
<i>Volumetric Moisture Content (% vol):</i>	17.3	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.18	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.35	
<i>Calculated Porosity (% vol):</i>	55.6	
<i>Percent Saturation:</i>	31.0	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B6A-19A  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-20.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	459.34	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	213.46	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	215.40	
<i>Sample volume (cm<sup>3</sup>):</i>	120.28	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.69	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	14.2	
<i>Volumetric Moisture Content (% vol):</i>	25.3	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.79	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	2.04	
<i>Calculated Porosity (% vol):</i>	33.3	
<i>Percent Saturation:</i>	76.0	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	871.40	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	766.99	
<i>Sample volume (cm<sup>3</sup>):</i>	442.70	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.68	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	13.6	
<i>Volumetric Moisture Content (% vol):</i>	23.6	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.73	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.97	
<i>Calculated Porosity (% vol):</i>	35.3	
<i>Percent Saturation:</i>	66.8	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B8-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	830.49	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	725.60	
<i>Sample volume (cm<sup>3</sup>):</i>	440.37	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.67	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	14.5	
<i>Volumetric Moisture Content (% vol):</i>	23.8	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.65	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.89	
<i>Calculated Porosity (% vol):</i>	38.3	
<i>Percent Saturation:</i>	62.3	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B8-24A  
*Project Name:* NECR Jetty '18  
*Depth:* 25'-25.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	438.96	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	209.15	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	195.07	
<i>Sample volume (cm<sup>3</sup>):</i>	115.10	
<i>Assumed particle density (g/cm<sup>3</sup>):</i>	2.65	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	17.8	
<i>Volumetric Moisture Content (% vol):</i>	30.2	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.69	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	2.00	
<i>Calculated Porosity (% vol):</i>	36.0	
<i>Percent Saturation:</i>	83.7	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded





*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B8-34A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	804.72	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	742.81	
<i>Sample volume (cm<sup>3</sup>):</i>	442.03	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.66	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	8.3	
<i>Volumetric Moisture Content (% vol):</i>	14.0	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.68	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.82	
<i>Calculated Porosity (% vol):</i>	36.9	
<i>Percent Saturation:</i>	38.0	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	823.58	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	715.55	
<i>Sample volume (cm<sup>3</sup>):</i>	432.43	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.68	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	15.1	
<i>Volumetric Moisture Content (% vol):</i>	25.0	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.65	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.90	
<i>Calculated Porosity (% vol):</i>	38.4	
<i>Percent Saturation:</i>	65.1	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	782.61	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	701.39	
<i>Sample volume (cm<sup>3</sup>):</i>	443.87	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.67	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	11.6	
<i>Volumetric Moisture Content (% vol):</i>	18.3	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.58	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.76	
<i>Calculated Porosity (% vol):</i>	40.8	
<i>Percent Saturation:</i>	44.9	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-4A  
*Project Name:* NECR Jetty '18  
*Depth:* 5'-5.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	890.53	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	808.66	
<i>Sample volume (cm<sup>3</sup>):</i>	440.46	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.66	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	10.1	
<i>Volumetric Moisture Content (% vol):</i>	18.6	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.84	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	2.02	
<i>Calculated Porosity (% vol):</i>	30.9	
<i>Percent Saturation:</i>	60.2	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-14A  
*Project Name:* NECR Jetty '18  
*Depth:* 15'-15.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	912.32	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	848.63	
<i>Sample volume (cm<sup>3</sup>):</i>	441.92	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.66	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	7.5	
<i>Volumetric Moisture Content (% vol):</i>	14.4	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.92	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	2.06	
<i>Calculated Porosity (% vol):</i>	27.8	
<i>Percent Saturation:</i>	51.8	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded





*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-29B  
*Project Name:* NECR Jetty '18  
*Depth:* 29.5'-30'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	701.11	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	606.23	
<i>Sample volume (cm<sup>3</sup>):</i>	390.33	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.66	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	15.7	
<i>Volumetric Moisture Content (% vol):</i>	24.3	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.55	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.80	
<i>Calculated Porosity (% vol):</i>	41.6	
<i>Percent Saturation:</i>	58.4	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	761.72	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	695.51	
<i>Sample volume (cm<sup>3</sup>):</i>	459.51	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.65	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	9.5	
<i>Volumetric Moisture Content (% vol):</i>	14.4	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.51	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.66	
<i>Calculated Porosity (% vol):</i>	42.9	
<i>Percent Saturation:</i>	33.6	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded

## **Particle Size Analysis**



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
B4A-4A	0.00017	0.0043	0.0098	58	0.48	WS/H	Lean clay (CL)	Silty Clay Loam	(Est)
B4A-14A	0.00013	0.022	0.034	262	2.9	WS/H	Classification by ASTM 2487 requires Atterberg test Sandy lean clay s(CL)	Loam	(Est)
B4A-24A	0.00010	0.026	0.056	560	1.0	WS/H		Clay Loam	(Est)
B5A-9A	0.00030	0.059	0.078	260	21	WS/H	Sandy silt s(ML)	Sandy Loam	(Est)
B5A-14A	2.3E-05	0.0080	0.020	870	2.6	WS/H	Classification by ASTM 2487 requires Atterberg test Fat clay (CH)	Clay Loam	(Est)
B6A-19A	5.5E-05	0.0035	0.0080	145	0.57	WS/H		Clay	(Est)
B6A-20-40 (1+2)	3.9E-05	0.0036	0.0091	233	0.57	WS/H	Lean clay (CL)	Clay	(Est)
B7A-39A	0.00019	0.055	0.080	421	6.2	WS/H	Sandy silt s(ML)	Sandy Clay Loam	(Est)
B7A-0-20 (1+2)	4.1E-05	0.045	0.068	1659	15	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B7A-40-60 (1+2)	4.6E-05	0.018	0.046	1000	1.5	WS/H	Lean clay with sand (CL)s	Clay Loam	(Est)
B8-9A	0.00015	0.0022	0.0039	26	0.58	WS/H	Fat clay (CH)	Silty Clay	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



### Summary of Particle Size Characteristics (Continued)

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
B8-24A	3.2E-05	0.0011	0.0023	72	0.49	WS/H	Fat clay (CH)	Clay	(Est)
B8-34A	0.0015	0.11	0.13	87	17	WS/H	Silty sand (SM)	Sandy Loam	
B9-9A	9.1E-05	0.0024	0.0043	47	0.59	WS/H	Fat clay (CH)	Silty Clay	(Est)
B9-39A	0.00025	0.025	0.049	196	0.89	WS/H	Sandy silt s(ML)	Loam	(Est)
B9-20-35 (1+2)	6.3E-05	0.0015	0.0028	44	0.51	WS/H	Fat clay (CH)	Clay	(Est)
B10-4A	6.0E-05	0.055	0.080	1333	17	WS/H	Sandy lean clay s(CL)	Sandy Loam	(Est)
B10-39A	6.1E-05	0.0044	0.0086	141	1.0	WS/H	Fat clay (CH)	Silty Clay Loam	(Est)
B10-10-25 (1+2)	2.4E-05	0.046	0.073	3042	17	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B11-14A	9.4E-05	0.070	0.093	989	90	WS/H	Sandy lean clay s(CL)	Sandy Loam	(Est)
B11-29B	0.00016	0.047	0.062	388	2.5	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B11-39A	0.0062	0.11	0.13	21	5.2	WS/H	Silty sand (SM)	Loamy Sand	
B11-0-10 (1+2)	0.00013	0.039	0.064	492	1.8	WS/H	Sandy lean clay s(CL)	Loam	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material





**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
B4A-4A	0.0	7.3	53.0	39.7
B4A-14A	0.0	11.0	64.3	24.6
B4A-24A	0.0	34.8	36.9	28.3
B5A-9A	0.0	41.9	39.8	18.3
B5A-14A	0.0	9.9	57.0	33.1
B6A-19A	0.0	13.3	44.2	42.5
B6A-20-40 (1+2)	0.0	12.6	45.1	42.2
B7A-39A	0.3	42.5	37.2	20.0
B7A-0-20 (1+2)	0.7	37.1	41.1	21.1
B7A-40-60 (1+2)	0.6	28.3	40.6	30.5
B8-9A	0.0	3.1	48.6	48.3
B8-24A	0.0	0.9	41.8	57.3
B8-34A	0.2	62.4	26.9	10.5
B9-9A	0.0	3.1	49.8	47.1
B9-39A	0.0	31.4	43.7	24.9
B9-20-35 (1+2)	0.0	3.5	42.6	53.9

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



**Percent Gravel, Sand, Silt and Clay\* (Continued)**

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
B10-4A	0.3	41.8	38.3	19.6
B10-39A	0.0	5.4	56.5	38.1
B10-10-25 (1+2)	1.1	38.3	38.0	22.5
B11-14A	1.1	46.3	35.3	17.3
B11-29B	0.3	33.0	44.2	22.5
B11-39A	0.0	64.6	29.1	6.3
B11-0-10 (1+2)	0.9	35.9	38.0	25.2

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-4A  
Project Name: NECR Jetty '18  
Depth: 5'-5.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 294.01  
Weight Passing #10 (g): 293.78  
Weight Retained #10 (g): 0.23  
Weight of Hydrometer Sample (g): 64.30  
Calculated Weight of Sieve Sample (g): 64.35

Shape: Angular  
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	294.01	100.00
	2"	50	0.00	0.00	294.01	100.00
	1.5"	38.1	0.00	0.00	294.01	100.00
	1"	25	0.00	0.00	294.01	100.00
	3/4"	19.0	0.00	0.00	294.01	100.00
	3/8"	9.5	0.00	0.00	294.01	100.00
	4	4.75	0.00	0.00	294.01	100.00
	10	2.00	0.23	0.23	293.78	99.92
-10	(Based on calculated sieve wt.)					
	20	0.85	0.22	0.27	64.08	99.58
	40	0.425	0.19	0.46	63.89	99.28
	60	0.250	0.16	0.62	63.73	99.04
	140	0.106	1.97	2.59	61.76	95.97
	200	0.075	2.10	4.69	59.66	92.71
	dry pan		0.32	5.01	59.34	
	wet pan			59.34	0.00	

d<sub>10</sub> (mm): 0.00017      d<sub>50</sub> (mm): 0.0043  
d<sub>16</sub> (mm): 0.00028      d<sub>60</sub> (mm): 0.0098  
d<sub>30</sub> (mm): 0.00089      d<sub>84</sub> (mm): 0.048

Median Particle Diameter--d<sub>50</sub> (mm): 0.0043  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 58  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.48  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.018

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)  
USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-4A  
Project Name: NECR Jetty '18  
Depth: 5'-5.5'

Test Date: 7-Jun-18  
Start Time: 9:00

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.66

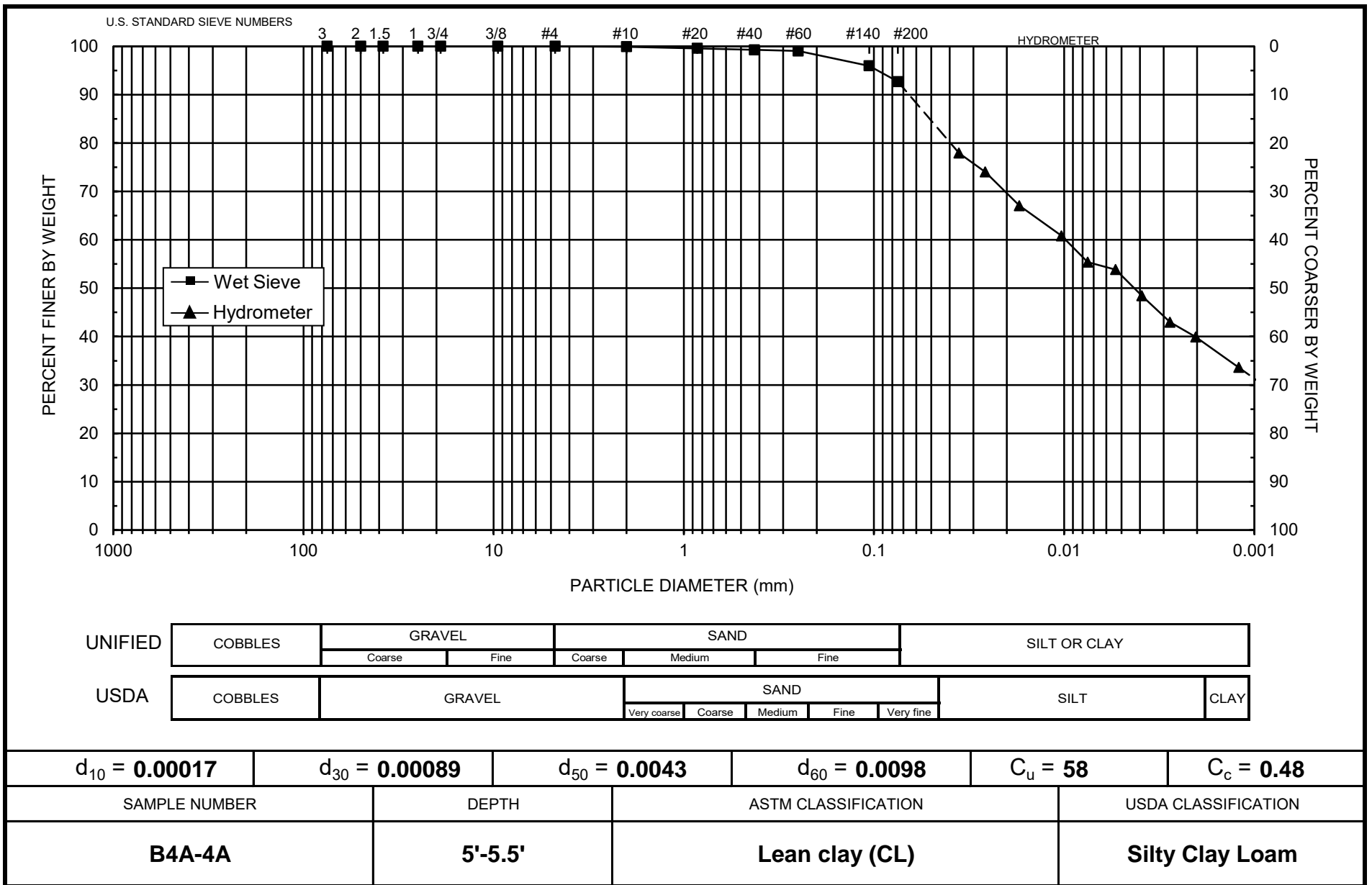
Initial Wt. (g): 64.30  
Total Sample Wt. (g): 294.01  
Wt. Passing #10 (g): 293.78

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	55.5	5.4	50.1	7.2	0.03572	78.0	77.9
	2	21.7	53.0	5.4	47.6	7.6	0.02597	74.1	74.0
	5	21.7	48.5	5.4	43.1	8.3	0.01720	67.1	67.0
	15	21.7	44.5	5.4	39.1	9.0	0.01032	60.9	60.8
	30	21.7	41.0	5.4	35.6	9.6	0.00752	55.4	55.4
	60	21.8	40.0	5.4	34.7	9.7	0.00536	53.9	53.8
	120	21.8	36.5	5.4	31.2	10.3	0.00390	48.4	48.4
	250	21.8	33.0	5.4	27.7	10.9	0.00277	43.0	43.0
	472	22.5	31.0	5.3	25.7	11.2	0.00203	40.0	39.9
8-Jun-18	1453	21.5	27.0	5.4	21.6	11.9	0.00121	33.6	33.6

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*







Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-14A  
Project Name: NECR Jetty '18  
Depth: 15'-15.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 181.44  
Weight Passing #10 (g): 181.44  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 64.83  
Calculated Weight of Sieve Sample (g): 64.83

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	181.44	100.00
	2"	50	0.00	0.00	181.44	100.00
	1.5"	38.1	0.00	0.00	181.44	100.00
	1"	25	0.00	0.00	181.44	100.00
	3/4"	19.0	0.00	0.00	181.44	100.00
	3/8"	9.5	0.00	0.00	181.44	100.00
	4	4.75	0.00	0.00	181.44	100.00
	10	2.00	0.00	0.00	181.44	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	64.83	100.00
	40	0.425	0.05	0.05	64.78	99.92
	60	0.250	0.10	0.15	64.68	99.77
	140	0.106	2.66	2.81	62.02	95.67
	200	0.075	4.33	7.14	57.69	88.99
	dry pan		0.58	7.72	57.11	
	wet pan			57.11	0.00	

d<sub>10</sub> (mm): 0.00013      d<sub>50</sub> (mm): 0.022  
d<sub>16</sub> (mm): 0.00041      d<sub>60</sub> (mm): 0.034  
d<sub>30</sub> (mm): 0.0036      d<sub>84</sub> (mm): 0.066

Median Particle Diameter--d<sub>50</sub> (mm): 0.022  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 262  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 2.9  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.029

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-14A  
Project Name: NECR Jetty '18  
Depth: 15'-15.5'  
Test Date: 12-Jun-18  
Start Time: 9:00

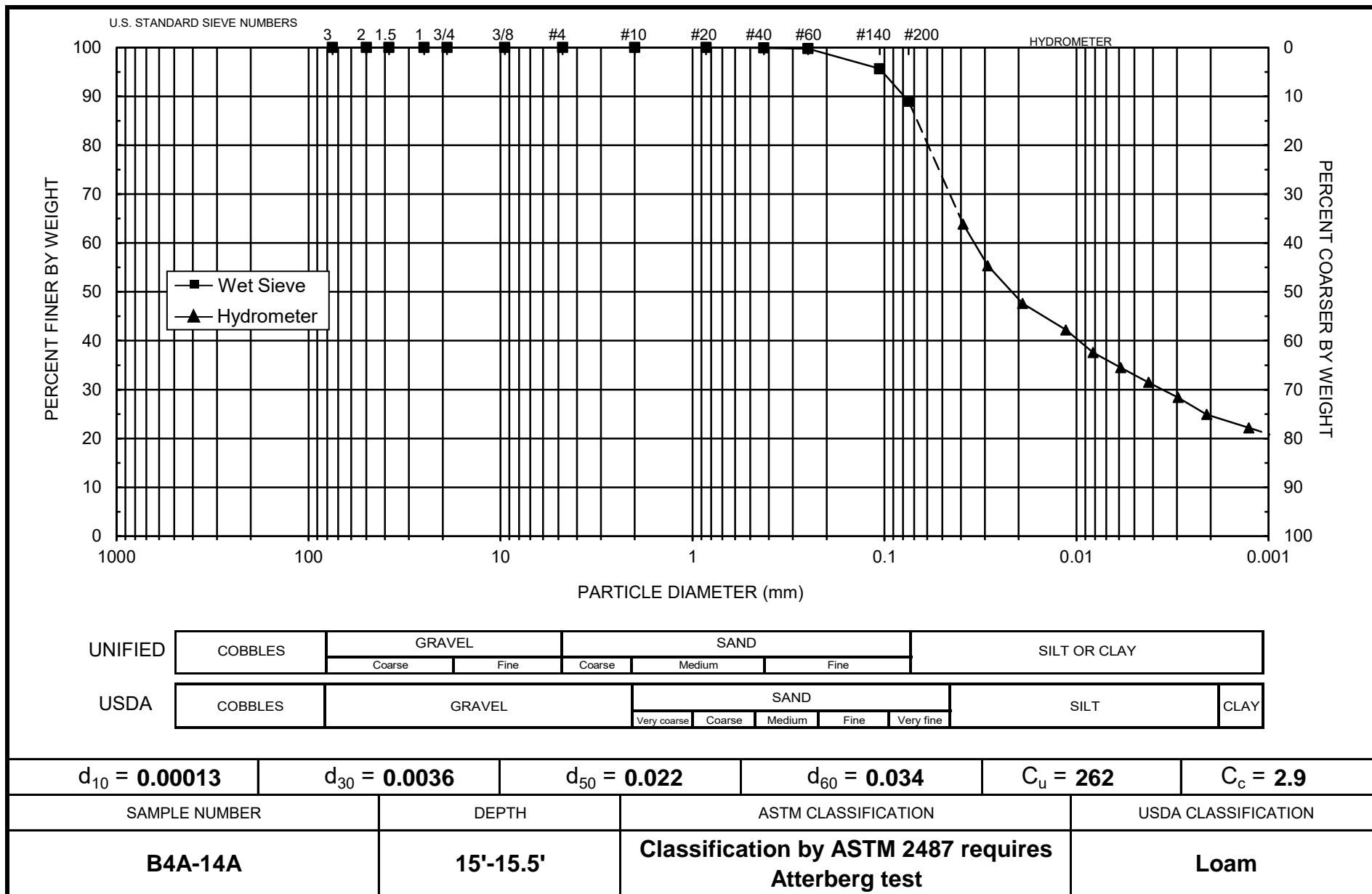
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Assumed particle density: 2.65  
Initial Wt. (g): 64.83  
Total Sample Wt. (g): 181.44  
Wt. Passing #10 (g): 181.44

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.7	47.5	6.1	41.4	8.5	0.03894	63.8	63.8
	2	21.7	42.0	6.1	35.9	9.4	0.02895	55.3	55.3
	5	21.7	37.0	6.1	30.9	10.2	0.01909	47.6	47.6
	15	21.6	33.5	6.1	27.4	10.8	0.01134	42.2	42.2
	30	21.6	30.5	6.1	24.4	11.3	0.00820	37.6	37.6
	60	21.6	28.5	6.1	22.4	11.6	0.00588	34.5	34.5
	120	21.8	26.5	6.1	20.4	12.0	0.00421	31.5	31.5
	250	21.8	24.5	6.1	18.4	12.3	0.00295	28.4	28.4
	500	22.9	22.0	5.9	16.1	12.7	0.00210	24.9	24.9
13-Jun-18	1448	21.6	20.5	6.1	14.4	12.9	0.00126	22.2	22.2

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-24A  
Project Name: NECR Jetty '18  
Depth: 25'-25.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 182.38  
Weight Passing #10 (g): 182.38  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 60.82  
Calculated Weight of Sieve Sample (g): 60.82

Shape: Rounded  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	182.38	100.00
	2"	50	0.00	0.00	182.38	100.00
	1.5"	38.1	0.00	0.00	182.38	100.00
	1"	25	0.00	0.00	182.38	100.00
	3/4"	19.0	0.00	0.00	182.38	100.00
	3/8"	9.5	0.00	0.00	182.38	100.00
	4	4.75	0.00	0.00	182.38	100.00
	10	2.00	0.00	0.00	182.38	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	60.82	100.00
	40	0.425	0.00	0.00	60.82	100.00
	60	0.250	0.05	0.05	60.77	99.92
	140	0.106	15.31	15.36	45.46	74.75
	200	0.075	5.78	21.14	39.68	65.24
	dry pan		0.52	21.66	39.16	
	wet pan			39.16	0.00	

d<sub>10</sub> (mm): 0.00010      d<sub>50</sub> (mm): 0.026  
d<sub>16</sub> (mm): 0.00027      d<sub>60</sub> (mm): 0.056  
d<sub>30</sub> (mm): 0.0024      d<sub>84</sub> (mm): 0.15

Median Particle Diameter--d<sub>50</sub> (mm): 0.026  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 560  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.0  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.059

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)  
USDA Soil Classification: Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-24A  
Project Name: NECR Jetty '18  
Depth: 25'-25.5'

Test Date: 7-Jun-18  
Start Time: 9:06

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.68

Initial Wt. (g): 60.82  
Total Sample Wt. (g): 182.38  
Wt. Passing #10 (g): 182.38

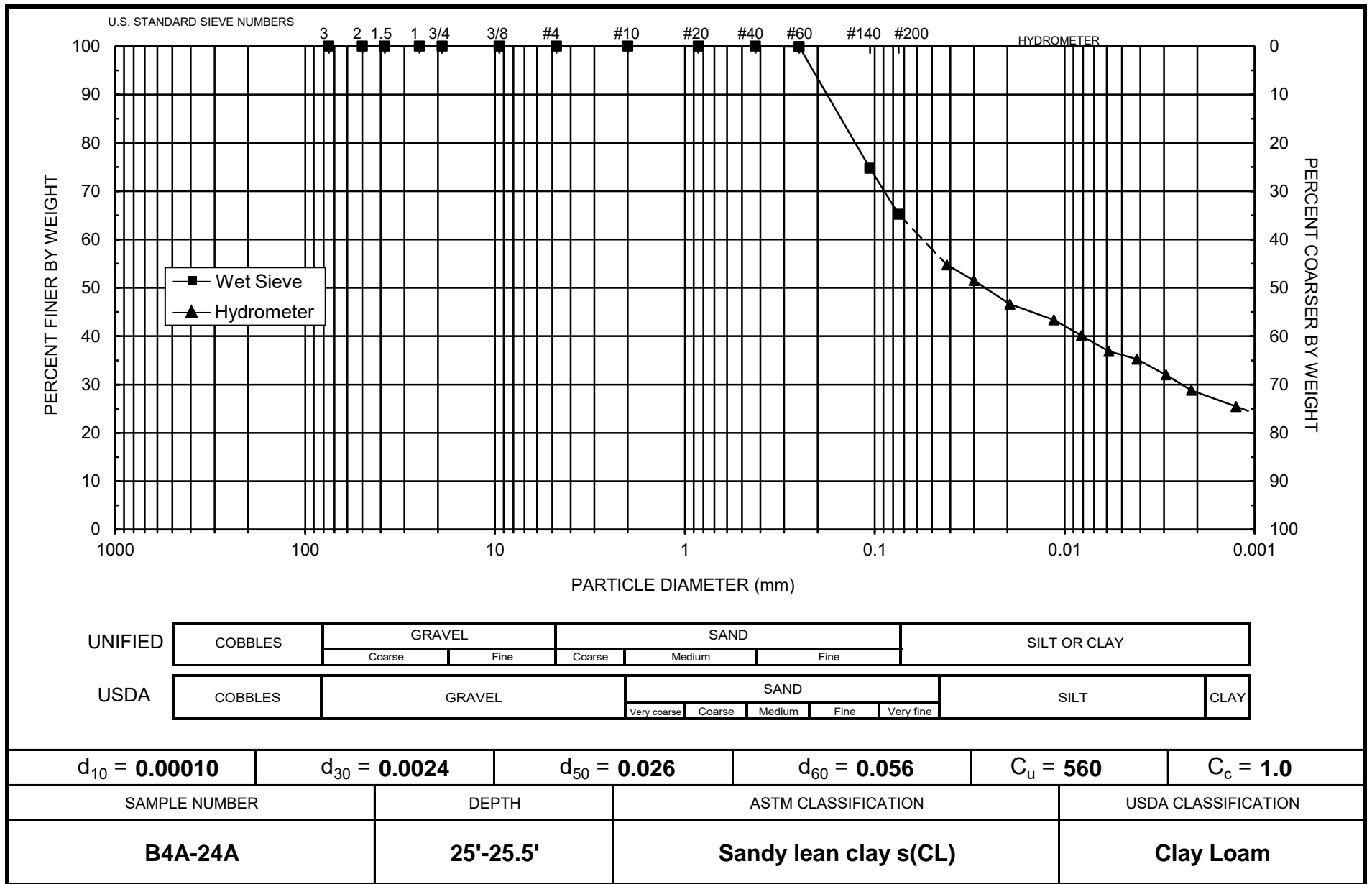
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	39.0	5.4	33.6	9.9	0.04169	54.8	54.8
	2	21.7	37.0	5.4	31.6	10.2	0.02996	51.5	51.5
	5	21.7	34.0	5.4	28.6	10.7	0.01940	46.6	46.6
	15	21.7	32.0	5.4	26.6	11.1	0.01138	43.4	43.4
	30	21.7	30.0	5.4	24.6	11.4	0.00816	40.1	40.1
	60	21.8	28.0	5.4	22.7	11.7	0.00585	36.9	36.9
	120	21.8	27.0	5.4	21.7	11.9	0.00416	35.2	35.2
	250	21.8	25.0	5.4	19.7	12.2	0.00292	32.0	32.0
	467	22.5	23.0	5.3	17.7	12.5	0.00215	28.8	28.8
8-Jun-18	1448	21.5	21.0	5.4	15.6	12.9	0.00125	25.4	25.4

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 207.02  
Weight Passing #10 (g): 207.02  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 64.50  
Calculated Weight of Sieve Sample (g): 64.50

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	207.02	100.00
	2"	50	0.00	0.00	207.02	100.00
	1.5"	38.1	0.00	0.00	207.02	100.00
	1"	25	0.00	0.00	207.02	100.00
	3/4"	19.0	0.00	0.00	207.02	100.00
	3/8"	9.5	0.00	0.00	207.02	100.00
	4	4.75	0.00	0.00	207.02	100.00
	10	2.00	0.00	0.00	207.02	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	64.50	100.00
	40	0.425	0.01	0.01	64.49	99.98
	60	0.250	0.16	0.17	64.33	99.74
	140	0.106	16.85	17.02	47.48	73.61
	200	0.075	10.01	27.03	37.47	58.09
	dry pan		1.21	28.24	36.26	
	wet pan			36.26	0.00	

d<sub>10</sub> (mm): 0.00030      d<sub>50</sub> (mm): 0.059  
d<sub>16</sub> (mm): 0.0012      d<sub>60</sub> (mm): 0.078  
d<sub>30</sub> (mm): 0.022      d<sub>84</sub> (mm): 0.15

Median Particle Diameter--d<sub>50</sub> (mm): 0.059  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 260  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 21  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.070

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines (visual method): ML

ASTM Soil Classification: Sandy silt s(ML)  
USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'

Test Date: 7-Jun-18  
Start Time: 9:12

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.63

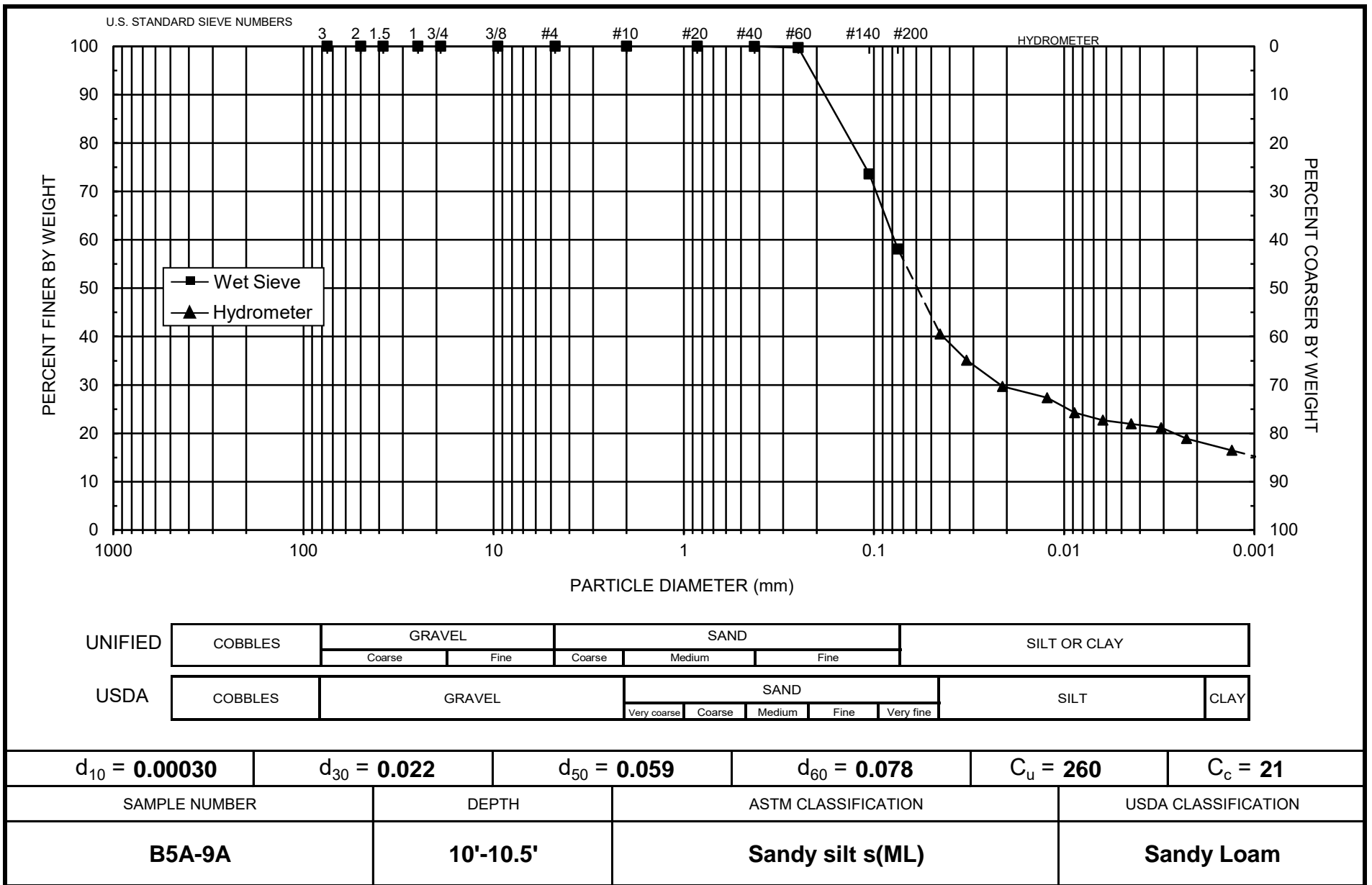
Initial Wt. (g): 64.50  
Total Sample Wt. (g): 207.02  
Wt. Passing #10 (g): 207.02

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	31.5	5.4	26.1	11.1	0.04487	40.5	40.5
	2	21.7	28.0	5.4	22.6	11.7	0.03255	35.1	35.1
	5	21.7	24.5	5.4	19.1	12.3	0.02109	29.7	29.7
	15	21.7	23.0	5.4	17.6	12.5	0.01229	27.3	27.3
	30	21.7	21.0	5.4	15.6	12.9	0.00880	24.2	24.2
	60	21.8	20.0	5.4	14.7	13.0	0.00626	22.7	22.7
	120	21.8	19.5	5.4	14.2	13.1	0.00444	21.9	21.9
	250	21.8	19.0	5.4	13.7	13.2	0.00308	21.2	21.2
	462	22.5	17.5	5.3	12.2	13.4	0.00227	18.9	18.9
8-Jun-18	1443	21.5	16.0	5.4	10.6	13.7	0.00131	16.5	16.5

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-14A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 151.31  
Weight Passing #10 (g): 151.31  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 48.37  
Calculated Weight of Sieve Sample (g): 48.37

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	151.31	100.00
	2"	50	0.00	0.00	151.31	100.00
	1.5"	38.1	0.00	0.00	151.31	100.00
	1"	25	0.00	0.00	151.31	100.00
	3/4"	19.0	0.00	0.00	151.31	100.00
	3/8"	9.5	0.00	0.00	151.31	100.00
	4	4.75	0.00	0.00	151.31	100.00
	10	2.00	0.00	0.00	151.31	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.02	0.02	48.35	99.96
	40	0.425	0.12	0.14	48.23	99.71
	60	0.250	0.12	0.26	48.11	99.46
	140	0.106	1.77	2.03	46.34	95.80
	200	0.075	2.76	4.79	43.58	90.10
	dry pan		0.43	5.22	43.15	
	wet pan			43.15	0.00	

$d_{10}$  (mm): 2.3E-05       $d_{50}$  (mm): 0.0080  
 $d_{16}$  (mm): 7.3E-05       $d_{60}$  (mm): 0.020  
 $d_{30}$  (mm): 0.0011       $d_{84}$  (mm): 0.062

Median Particle Diameter-- $d_{50}$  (mm): 0.0080  
Uniformity Coefficient,  $C_u$ -- $[d_{60}/d_{10}]$  (mm): 870  
Coefficient of Curvature,  $C_c$ -- $[(d_{30})^2/(d_{10} \cdot d_{60})]$  (mm): 2.6  
Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.023

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

ASTM Soil Classification: Classification by ASTM 2487 requires Atterberg test  
USDA Soil Classification: Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-14A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 12-Jun-18  
Start Time: 9:06

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Assumed particle density: 2.65  
Initial Wt. (g): 48.37  
Total Sample Wt. (g): 151.31  
Wt. Passing #10 (g): 151.31

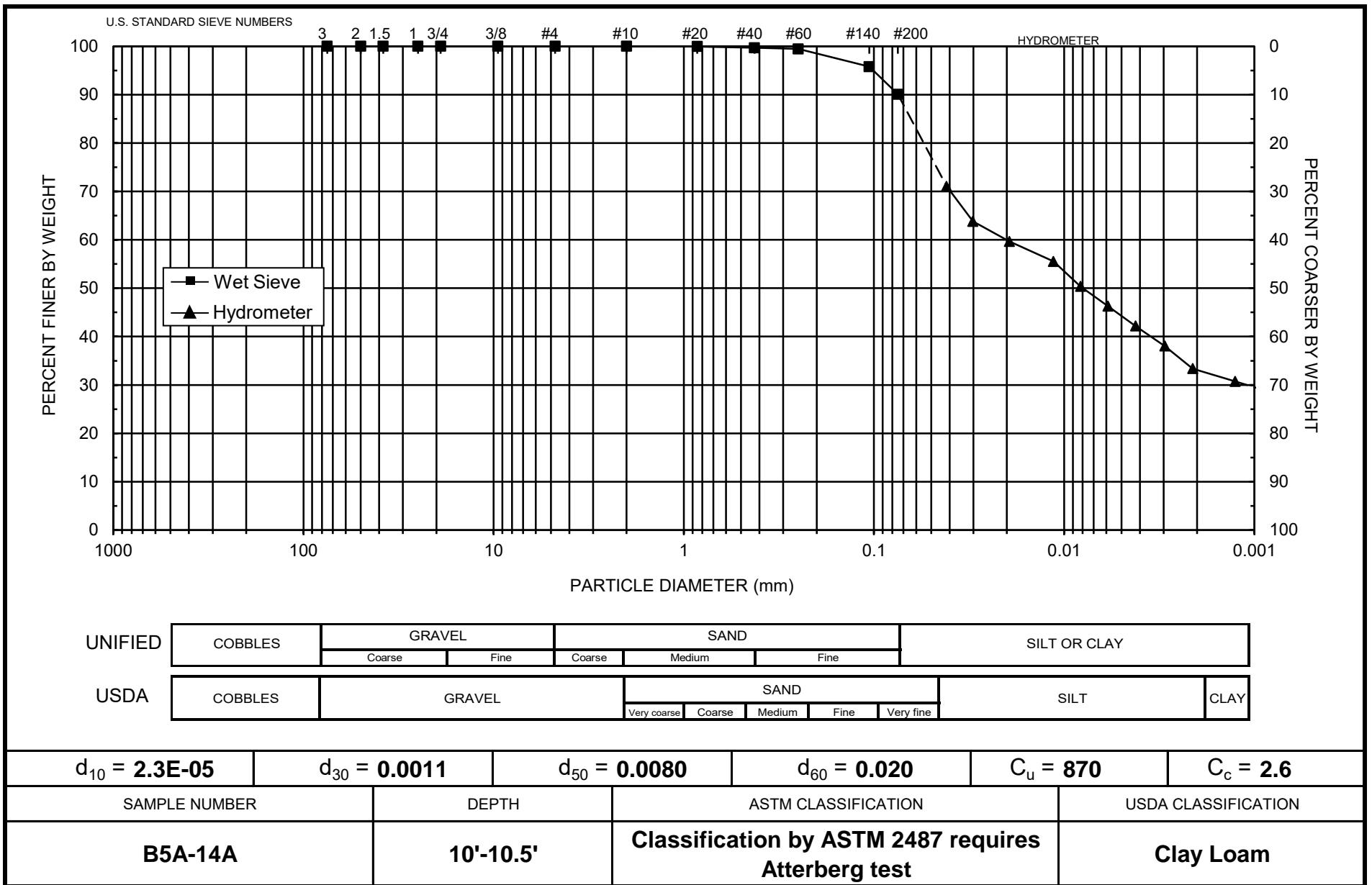
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.7	40.5	6.1	34.4	9.7	0.04150	71.1	71.1
	2	21.7	37.0	6.1	30.9	10.2	0.03021	63.8	63.8
	5	21.6	35.0	6.1	28.9	10.6	0.01942	59.7	59.7
	15	21.6	33.0	6.1	26.9	10.9	0.01138	55.5	55.5
	30	21.6	30.5	6.1	24.4	11.3	0.00820	50.4	50.4
	60	21.7	28.5	6.1	22.4	11.6	0.00587	46.3	46.3
	120	21.8	26.5	6.1	20.4	12.0	0.00421	42.2	42.2
	250	21.8	24.5	6.1	18.4	12.3	0.00295	38.0	38.0
	495	22.9	22.0	5.9	16.1	12.7	0.00211	33.4	33.4
13-Jun-18	1443	21.6	21.0	6.1	14.9	12.9	0.00126	30.7	30.7

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 215.40  
Weight Passing #10 (g): 215.40  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 61.90  
Calculated Weight of Sieve Sample (g): 61.90

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	215.40	100.00
	2"	50	0.00	0.00	215.40	100.00
	1.5"	38.1	0.00	0.00	215.40	100.00
	1"	25	0.00	0.00	215.40	100.00
	3/4"	19.0	0.00	0.00	215.40	100.00
	3/8"	9.5	0.00	0.00	215.40	100.00
	4	4.75	0.00	0.00	215.40	100.00
	10	2.00	0.00	0.00	215.40	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.04	0.04	61.86	99.94
	40	0.425	0.07	0.11	61.79	99.82
	60	0.250	0.35	0.46	61.44	99.26
	140	0.106	4.52	4.98	56.92	91.95
	200	0.075	3.26	8.24	53.66	86.69
	dry pan		0.37	8.61	53.29	
	wet pan			53.29	0.00	

d<sub>10</sub> (mm): 5.5E-05      d<sub>50</sub> (mm): 0.0035  
d<sub>16</sub> (mm): 0.00011      d<sub>60</sub> (mm): 0.0080  
d<sub>30</sub> (mm): 0.00050      d<sub>84</sub> (mm): 0.062

Median Particle Diameter--d<sub>50</sub> (mm): 0.0035  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 145  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.57  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.022

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



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### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'  
Test Date: 7-Jun-18  
Start Time: 9:18

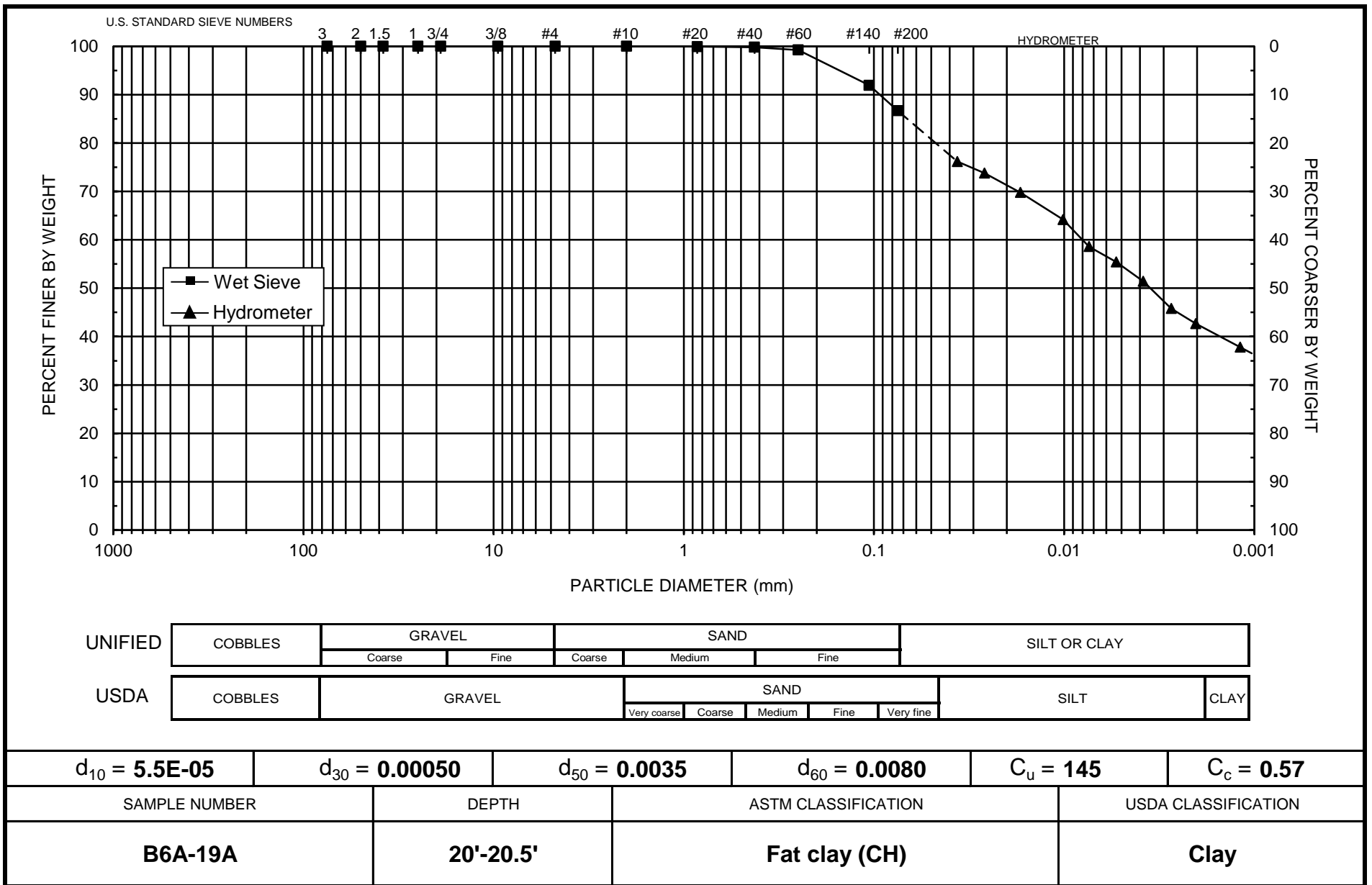
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.69  
Initial Wt. (g): 61.90  
Total Sample Wt. (g): 215.40  
Wt. Passing #10 (g): 215.40

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	53.0	5.4	47.6	7.6	0.03644	76.2	76.2
	2	21.7	51.5	5.4	46.1	7.9	0.02618	73.8	73.8
	5	21.7	49.0	5.4	43.6	8.3	0.01697	69.8	69.8
	15	21.7	45.5	5.4	40.1	8.8	0.01013	64.2	64.2
	30	21.7	42.0	5.4	36.6	9.4	0.00739	58.6	58.6
	60	21.8	40.0	5.4	34.7	9.7	0.00531	55.4	55.4
	120	21.8	37.5	5.4	32.2	10.2	0.00384	51.4	51.4
	250	21.8	34.0	5.4	28.6	10.7	0.00273	45.8	45.8
	457	22.5	32.0	5.3	26.7	11.1	0.00203	42.7	42.7
8-Jun-18	1438	21.5	29.0	5.4	23.6	11.5	0.00119	37.8	37.8

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-20-40 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-40'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 36584.09  
Weight Passing #10 (g): 36547.75  
Weight Retained #10 (g): 36.34  
Weight of Hydrometer Sample (g): 54.23  
Calculated Weight of Sieve Sample (g): 54.28

Shape: Angular  
Hardness: Weathered and friable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	36584.09	100.00
	2"	50	0.00	0.00	36584.09	100.00
	1.5"	38.1	0.00	0.00	36584.09	100.00
	1"	25	0.00	0.00	36584.09	100.00
	3/4"	19.0	0.00	0.00	36584.09	100.00
	3/8"	9.5	7.79	7.79	36576.30	99.98
	4	4.75	10.27	18.06	36566.03	99.95
	10	2.00	18.28	36.34	36547.75	99.90
-10	(Based on calculated sieve wt.)					
	20	0.85	0.04	0.09	54.19	99.83
	40	0.425	0.07	0.16	54.12	99.70
	60	0.250	0.29	0.45	53.83	99.16
	140	0.106	4.39	4.84	49.44	91.08
	200	0.075	2.03	6.87	47.41	87.34
	dry pan		0.23	7.10	47.18	
	wet pan			47.18	0.00	

$d_{10}$  (mm): 3.9E-05       $d_{50}$  (mm): 0.0036  
 $d_{16}$  (mm): 8.1E-05       $d_{60}$  (mm): 0.0091  
 $d_{30}$  (mm): 0.00045       $d_{84}$  (mm): 0.061

Median Particle Diameter-- $d_{50}$  (mm): 0.0036  
Uniformity Coefficient,  $C_u$ -- $[d_{60}/d_{10}]$  (mm): 233  
Coefficient of Curvature,  $C_c$ -- $[(d_{30})^2/(d_{10} \cdot d_{60})]$  (mm): 0.57  
Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.022

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay (CL)  
USDA Soil Classification: Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-20-40 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-40'

Test Date: 12-Jun-18  
Start Time: 9:12

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.68

Initial Wt. (g): 54.23  
Total Sample Wt. (g): 36584.09  
Wt. Passing #10 (g): 36547.75

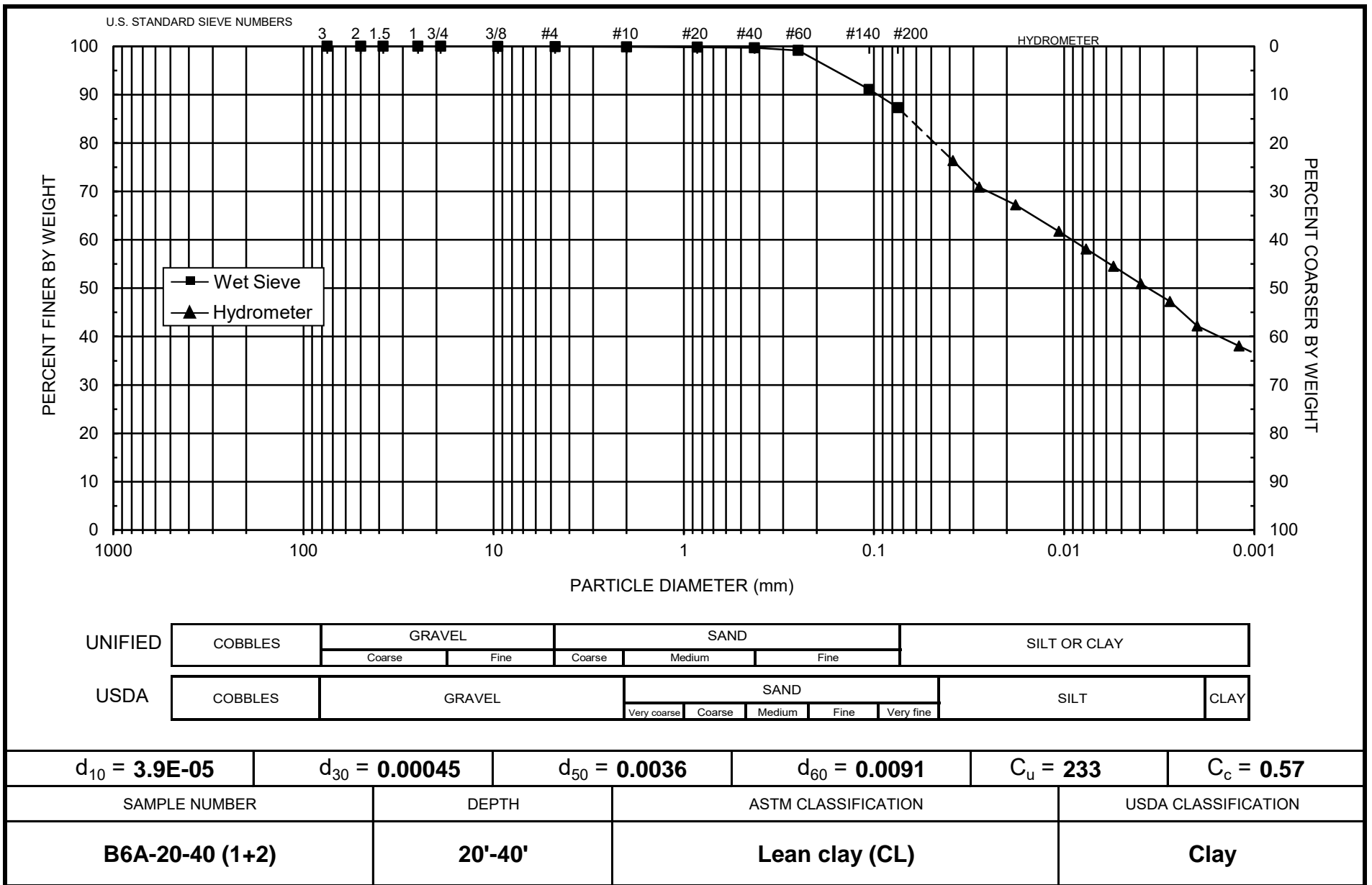
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	48.0	6.1	41.9	8.4	0.03839	76.4	76.3
	2	21.6	45.0	6.1	38.9	8.9	0.02793	70.9	70.9
	5	21.6	43.0	6.1	36.9	9.3	0.01799	67.3	67.2
	15	21.6	40.0	6.1	33.9	9.7	0.01066	61.8	61.8
	30	21.6	38.0	6.1	31.9	10.1	0.00766	58.2	58.1
	60	21.7	36.0	6.1	29.9	10.4	0.00550	54.5	54.5
	120	21.8	34.0	6.1	27.9	10.7	0.00394	50.9	50.9
	250	21.8	32.0	6.1	25.9	11.1	0.00277	47.3	47.2
	490	22.9	29.0	5.9	23.1	11.5	0.00200	42.2	42.2
13-Jun-18	1438	21.6	27.0	6.1	20.9	11.9	0.00120	38.1	38.0

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 229.78  
Weight Passing #10 (g): 228.48  
Weight Retained #10 (g): 1.30  
Weight of Hydrometer Sample (g): 66.53  
Calculated Weight of Sieve Sample (g): 66.91

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	229.78	100.00
	2"	50	0.00	0.00	229.78	100.00
	1.5"	38.1	0.00	0.00	229.78	100.00
	1"	25	0.00	0.00	229.78	100.00
	3/4"	19.0	0.00	0.00	229.78	100.00
	3/8"	9.5	0.00	0.00	229.78	100.00
	4	4.75	0.80	0.80	228.98	99.65
	10	2.00	0.50	1.30	228.48	99.43
-10	(Based on calculated sieve wt.)					
	20	0.85	0.81	1.19	65.72	98.22
	40	0.425	0.60	1.79	65.12	97.33
	60	0.250	0.76	2.55	64.36	96.19
	140	0.106	16.50	19.05	47.86	71.53
	200	0.075	9.62	28.67	38.24	57.15
	dry pan		1.43	30.10	36.81	
	wet pan			36.81	0.00	

d<sub>10</sub> (mm): 0.00019      d<sub>50</sub> (mm): 0.056  
d<sub>16</sub> (mm): 0.00080      d<sub>60</sub> (mm): 0.080  
d<sub>30</sub> (mm): 0.0098      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.056  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 421  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 6.3  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.072

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines (visual method): ML

ASTM Soil Classification: Sandy silt s(ML)  
USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 7-Jun-18  
Start Time: 9:24

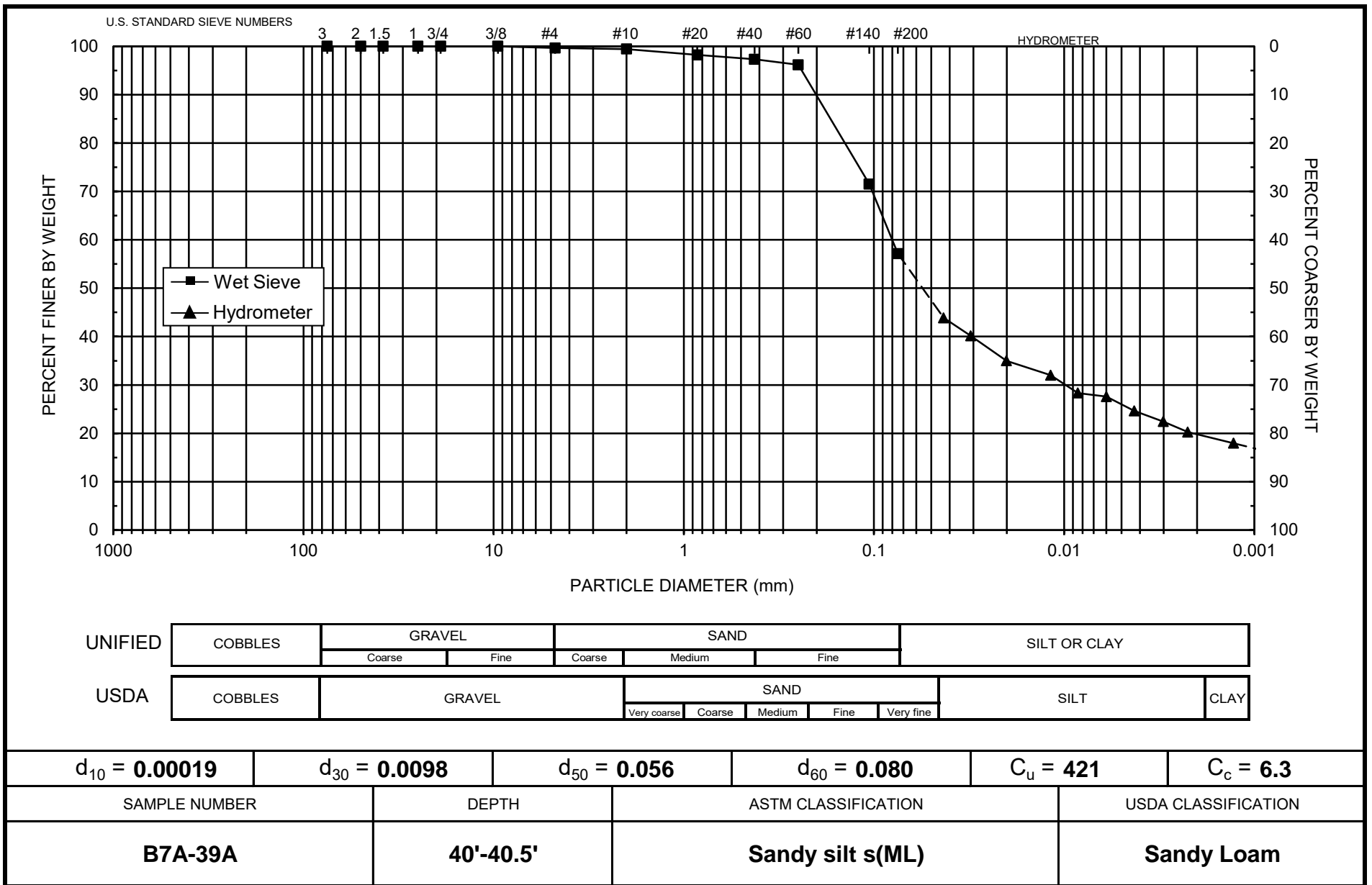
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.68  
Initial Wt. (g): 66.53  
Total Sample Wt. (g): 229.78  
Wt. Passing #10 (g): 228.48

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	35.0	5.4	29.6	10.6	0.04301	44.1	43.9
	2	21.7	32.5	5.4	27.1	11.0	0.03100	40.4	40.2
	5	21.7	29.0	5.4	23.6	11.5	0.02011	35.2	35.0
	15	21.7	27.0	5.4	21.6	11.9	0.01177	32.2	32.0
	30	21.7	24.5	5.4	19.1	12.3	0.00847	28.5	28.3
	60	21.8	24.0	5.4	18.7	12.4	0.00600	27.8	27.6
	121	21.8	22.0	5.4	16.7	12.7	0.00428	24.8	24.6
	250	21.8	20.5	5.4	15.2	12.9	0.00301	22.5	22.4
	452	22.5	19.0	5.3	13.7	13.2	0.00224	20.4	20.3
8-Jun-18	1433	21.5	17.5	5.4	12.1	13.4	0.00128	18.1	17.9

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 43348.48  
Weight Passing #10 (g): 42914.02  
Weight Retained #10 (g): 434.46  
Weight of Hydrometer Sample (g): 51.68  
Calculated Weight of Sieve Sample (g): 52.20

Shape: Angular  
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	43348.48	100.00
	2"	50	0.00	0.00	43348.48	100.00
	1.5"	38.1	0.00	0.00	43348.48	100.00
	1"	25	0.00	0.00	43348.48	100.00
	3/4"	19.0	9.44	9.44	43339.04	99.98
	3/8"	9.5	98.42	107.86	43240.62	99.75
	4	4.75	214.77	322.63	43025.85	99.26
	10	2.00	111.83	434.46	42914.02	99.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.23	0.75	51.45	98.56
	40	0.425	0.18	0.93	51.27	98.21
	60	0.250	0.49	1.42	50.78	97.27
	140	0.106	12.35	13.77	38.43	73.62
	200	0.075	5.96	19.73	32.47	62.20
	dry pan		0.51	20.24	31.96	
	wet pan			31.96	0.00	

d<sub>10</sub> (mm): 4.1E-05      d<sub>50</sub> (mm): 0.045  
d<sub>16</sub> (mm): 0.00034      d<sub>60</sub> (mm): 0.068  
d<sub>30</sub> (mm): 0.0065      d<sub>84</sub> (mm): 0.15

Median Particle Diameter--d<sub>50</sub> (mm): 0.045  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1659  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 15  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.065

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)

USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

Test Date: 12-Jun-18  
Start Time: 9:18

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67

Initial Wt. (g): 51.68  
Total Sample Wt. (g): 43348.48  
Wt. Passing #10 (g): 42914.02

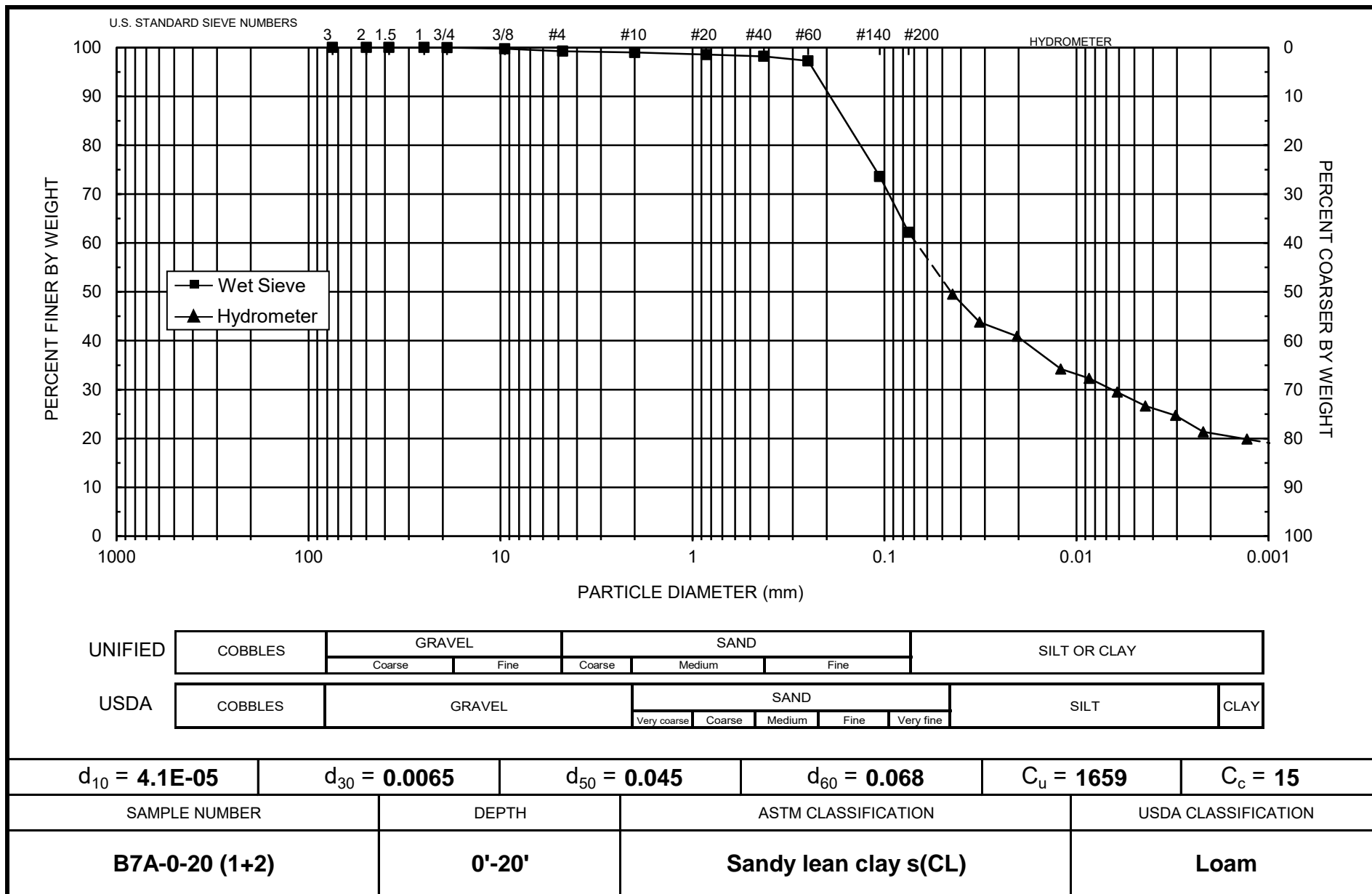
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	32.0	6.1	25.9	11.1	0.04420	50.0	49.5
	2	21.6	29.0	6.1	22.9	11.5	0.03194	44.2	43.8
	5	21.6	27.5	6.1	21.4	11.8	0.02041	41.3	40.9
	15	21.6	24.0	6.1	17.9	12.4	0.01207	34.6	34.2
	30	21.6	23.0	6.1	16.9	12.5	0.00859	32.6	32.3
	60	21.7	21.5	6.1	15.4	12.8	0.00613	29.8	29.5
	120	21.8	20.0	6.1	13.9	13.0	0.00437	26.9	26.6
	250	21.8	19.0	6.1	12.9	13.2	0.00305	25.0	24.7
	485	22.9	17.0	5.9	11.1	13.5	0.00219	21.6	21.3
13-Jun-18	1433	21.6	16.5	6.1	10.4	13.6	0.00129	20.0	19.8

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

Test Date: 18-Jun-18

Initial Dry Weight of Sample (g): 34688.11  
Weight Passing #10 (g): 34472.55  
Weight Retained #10 (g): 215.56  
Weight of Hydrometer Sample (g): 56.27  
Calculated Weight of Sieve Sample (g): 56.62

Shape: Rounded  
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	34688.11	100.00
	2"	50	0.00	0.00	34688.11	100.00
	1.5"	38.1	0.00	0.00	34688.11	100.00
	1"	25	0.00	0.00	34688.11	100.00
	3/4"	19.0	0.00	0.00	34688.11	100.00
	3/8"	9.5	83.77	83.77	34604.34	99.76
	4	4.75	124.81	208.58	34479.53	99.40
	10	2.00	6.98	215.56	34472.55	99.38
(Based on calculated sieve wt.)						
-10	20	0.85	0.21	0.56	56.06	99.01
	40	0.425	0.17	0.73	55.89	98.71
	60	0.250	0.47	1.20	55.42	97.88
	140	0.106	9.74	10.94	45.68	80.68
	200	0.075	5.40	16.34	40.28	71.14
	dry pan		0.87	17.21	39.41	
	wet pan			39.41	0.00	

d<sub>10</sub> (mm): 4.6E-05      d<sub>50</sub> (mm): 0.018  
d<sub>16</sub> (mm): 0.00014      d<sub>60</sub> (mm): 0.046  
d<sub>30</sub> (mm): 0.0018      d<sub>84</sub> (mm): 0.13

Median Particle Diameter--d<sub>50</sub> (mm): 0.018  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1000  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.5  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.049

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay with sand (CL)s  
USDA Soil Classification: Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

Test Date: 14-Jun-18  
Start Time: 9:00

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67

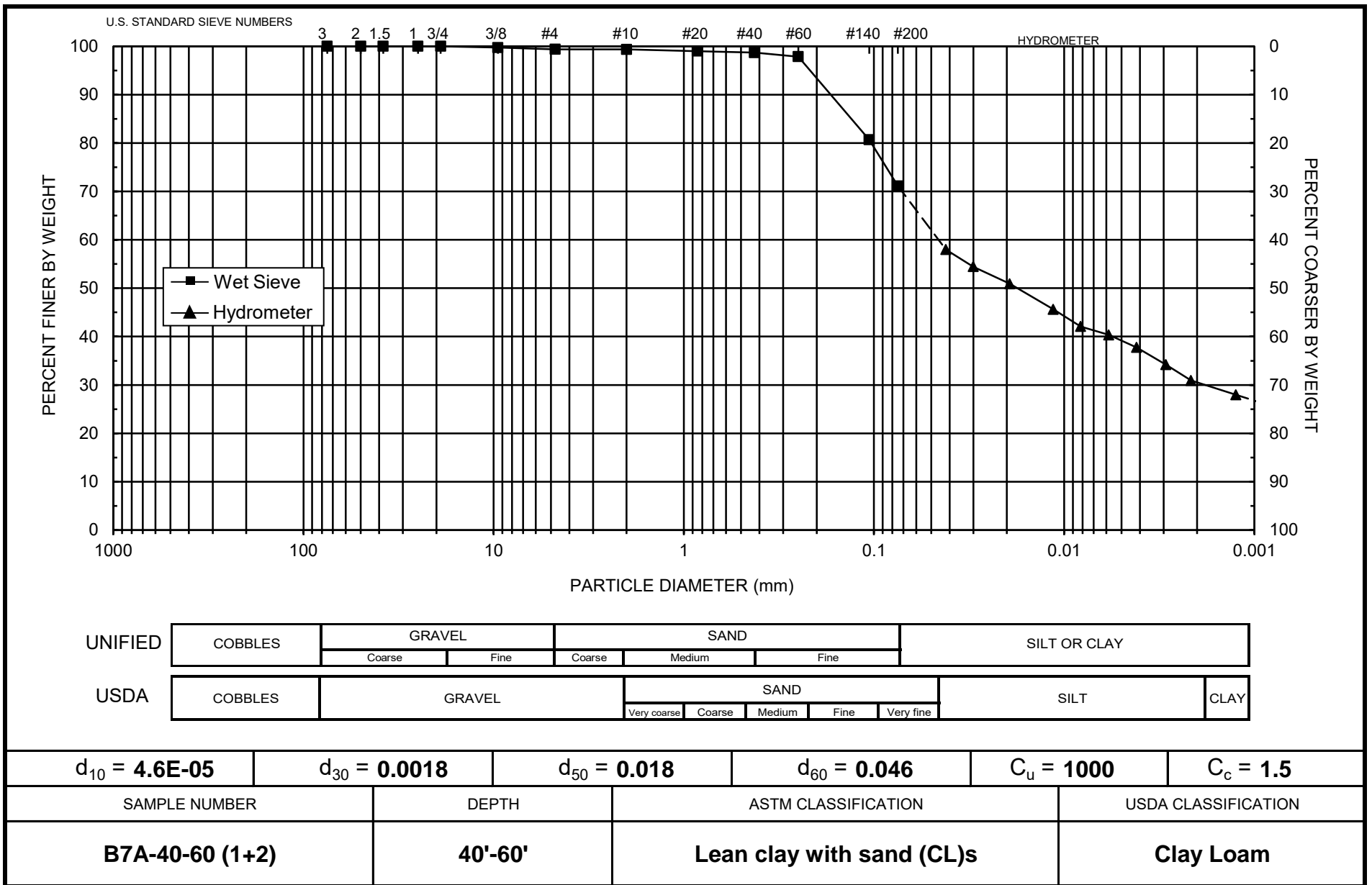
Initial Wt. (g): 56.27  
Total Sample Wt. (g): 34688.11  
Wt. Passing #10 (g): 34472.55

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
14-Jun-18	1	21.5	39.0	6.2	32.8	9.9	0.04185	58.3	58.0
	2	21.5	37.0	6.2	30.8	10.2	0.03008	54.8	54.4
	5	21.5	35.0	6.2	28.8	10.6	0.01933	51.2	50.9
	15	21.5	32.0	6.2	25.8	11.1	0.01142	45.9	45.6
	30	21.5	30.0	6.2	23.8	11.4	0.00819	42.3	42.1
	60	21.6	29.0	6.2	22.8	11.5	0.00583	40.6	40.3
	120	21.7	27.5	6.1	21.4	11.8	0.00416	38.0	37.8
	250	21.7	25.5	6.1	19.4	12.1	0.00292	34.4	34.2
	466	22.3	23.5	6.0	17.5	12.4	0.00215	31.1	30.9
15-Jun-18	1433	21.6	22.0	6.2	15.8	12.7	0.00125	28.1	28.0

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 257.61  
Weight Passing #10 (g): 257.61  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 53.47  
Calculated Weight of Sieve Sample (g): 53.47

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	257.61	100.00
	2"	50	0.00	0.00	257.61	100.00
	1.5"	38.1	0.00	0.00	257.61	100.00
	1"	25	0.00	0.00	257.61	100.00
	3/4"	19.0	0.00	0.00	257.61	100.00
	3/8"	9.5	0.00	0.00	257.61	100.00
	4	4.75	0.00	0.00	257.61	100.00
	10	2.00	0.00	0.00	257.61	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	53.47	100.00
	40	0.425	0.00	0.00	53.47	100.00
	60	0.250	0.04	0.04	53.43	99.93
	140	0.106	0.63	0.67	52.80	98.75
	200	0.075	0.98	1.65	51.82	96.91
	dry pan		0.31	1.96	51.51	
	wet pan			51.51	0.00	

d<sub>10</sub> (mm): 0.00015      d<sub>50</sub> (mm): 0.0022  
d<sub>16</sub> (mm): 0.00022      d<sub>60</sub> (mm): 0.0039  
d<sub>30</sub> (mm): 0.00058      d<sub>84</sub> (mm): 0.032

Median Particle Diameter--d<sub>50</sub> (mm): 0.0022  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 26  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.58  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.011

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Silty Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 11-Jun-18  
Start Time: 9:06

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67  
Initial Wt. (g): 53.47  
Total Sample Wt. (g): 257.61  
Wt. Passing #10 (g): 257.61

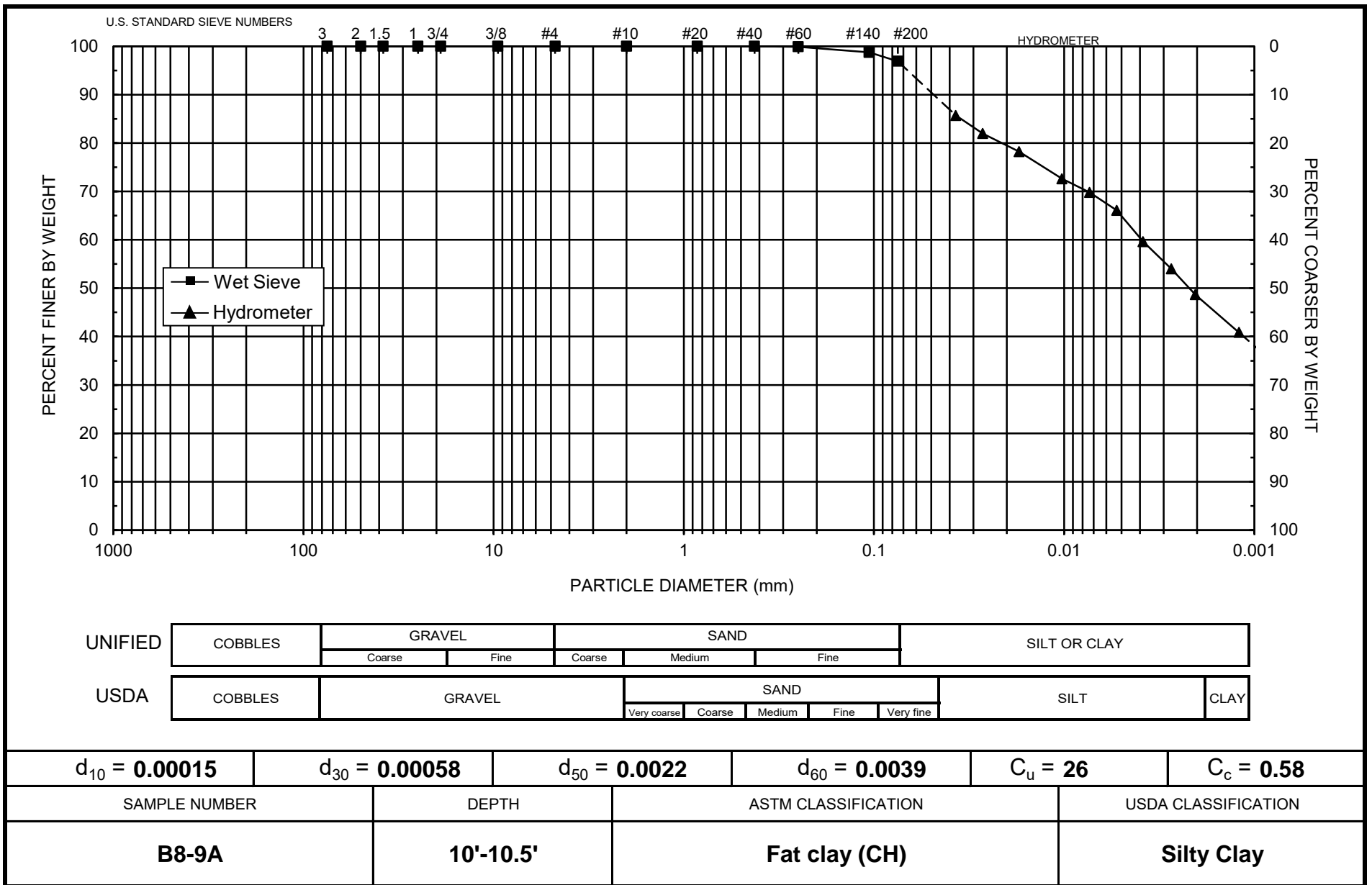
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
14-Jun-18	1	21.5	52.0	6.2	45.8	7.8	0.03710	85.7	85.7
	2	21.5	50.0	6.2	43.8	8.1	0.02678	82.0	82.0
	5	21.5	48.0	6.2	41.8	8.4	0.01727	78.2	78.2
	15	21.5	45.0	6.2	38.8	8.9	0.01026	72.6	72.6
	30	21.5	43.5	6.2	37.3	9.2	0.00735	69.8	69.8
	60	21.6	41.5	6.2	35.3	9.5	0.00529	66.1	66.1
	120	21.7	38.0	6.1	31.9	10.1	0.00384	59.6	59.6
	250	21.7	35.0	6.1	28.9	10.6	0.00273	54.0	54.0
	461	22.3	32.0	6.0	26.0	11.1	0.00204	48.6	48.6
15-Jun-18	1428	21.6	28.0	6.2	21.8	11.7	0.00120	40.8	40.8

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: C. Krous  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-24A  
Project Name: NECR Jetty '18  
Depth: 25'-25.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 195.07  
Weight Passing #10 (g): 195.07  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 57.14  
Calculated Weight of Sieve Sample (g): 57.14

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	195.07	100.00
	2"	50	0.00	0.00	195.07	100.00
	1.5"	38.1	0.00	0.00	195.07	100.00
	1"	25	0.00	0.00	195.07	100.00
	3/4"	19.0	0.00	0.00	195.07	100.00
	3/8"	9.5	0.00	0.00	195.07	100.00
	4	4.75	0.00	0.00	195.07	100.00
	10	2.00	0.00	0.00	195.07	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	57.14	100.00
	40	0.425	0.02	0.02	57.12	99.96
	60	0.250	0.00	0.02	57.12	99.96
	140	0.106	0.13	0.15	56.99	99.74
	200	0.075	0.37	0.52	56.62	99.09
	dry pan		0.08	0.60	56.54	
	wet pan			56.54	0.00	

$d_{10}$  (mm): 3.2E-05       $d_{50}$  (mm): 0.0011  
 $d_{16}$  (mm): 5.5E-05       $d_{60}$  (mm): 0.0023  
 $d_{30}$  (mm): 0.00019       $d_{84}$  (mm): 0.011

Median Particle Diameter-- $d_{50}$  (mm): 0.0011  
Uniformity Coefficient,  $C_u$ -- $[d_{60}/d_{10}]$  (mm): 72  
Coefficient of Curvature,  $C_c$ -- $[(d_{30})^2/(d_{10} \cdot d_{60})]$  (mm): 0.49  
Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.0041

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-24A  
Project Name: NECR Jetty '18  
Depth: 25'-25.5'

Test Date: 12-Jun-18  
Start Time: 9:24

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Assumed particle density: 2.65

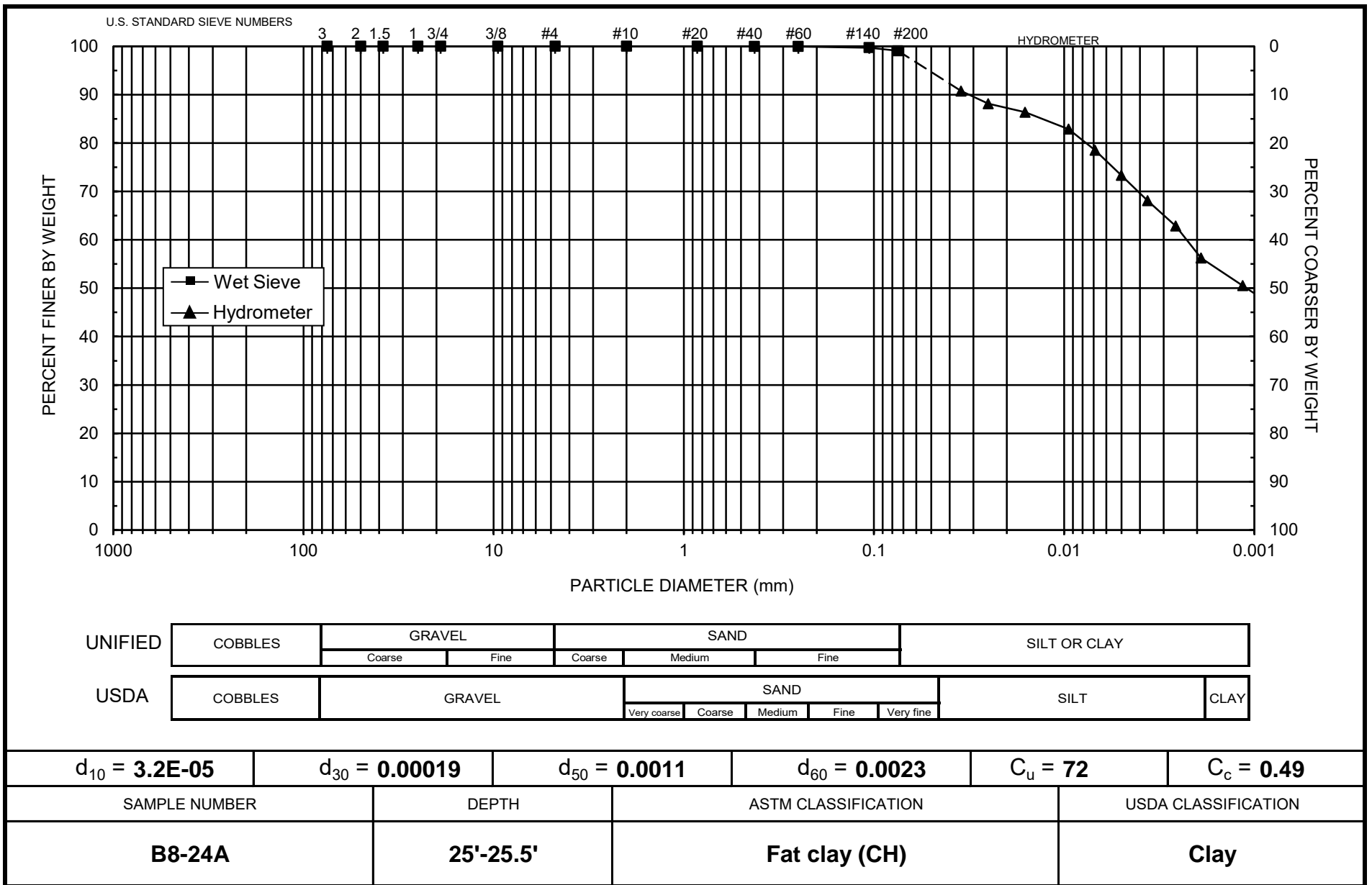
Initial Wt. (g): 57.14  
Total Sample Wt. (g): 195.07  
Wt. Passing #10 (g): 195.07

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	58.0	6.1	51.9	6.8	0.03482	90.8	90.8
	2	21.6	56.5	6.1	50.4	7.0	0.02506	88.1	88.1
	5	21.6	55.5	6.1	49.4	7.2	0.01604	86.4	86.4
	15	21.6	53.5	6.1	47.4	7.5	0.00947	82.9	82.9
	30	21.6	51.0	6.1	44.9	7.9	0.00687	78.5	78.5
	60	21.8	48.0	6.1	41.9	8.4	0.00500	73.3	73.3
	120	21.8	45.0	6.1	38.9	8.9	0.00363	68.1	68.1
	250	21.8	42.0	6.1	35.9	9.4	0.00259	62.8	62.8
	480	22.9	38.0	5.9	32.1	10.1	0.00191	56.2	56.2
13-Jun-18	1428	21.6	35.0	6.1	28.9	10.6	0.00115	50.5	50.5

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-34A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 18-Jun-18

Initial Dry Weight of Sample (g): 234.80  
Weight Passing #10 (g): 234.27  
Weight Retained #10 (g): 0.53  
Weight of Hydrometer Sample (g): 59.89  
Calculated Weight of Sieve Sample (g): 60.03

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	234.80	100.00
	2"	50	0.00	0.00	234.80	100.00
	1.5"	38.1	0.00	0.00	234.80	100.00
	1"	25	0.00	0.00	234.80	100.00
	3/4"	19.0	0.00	0.00	234.80	100.00
	3/8"	9.5	0.00	0.00	234.80	100.00
	4	4.75	0.40	0.40	234.40	99.83
	10	2.00	0.13	0.53	234.27	99.77
-10	(Based on calculated sieve wt.)					
	20	0.85	0.08	0.22	59.81	99.64
	40	0.425	0.14	0.36	59.67	99.41
	60	0.250	2.17	2.53	57.50	95.79
	140	0.106	29.61	32.14	27.89	46.46
	200	0.075	5.42	37.56	22.47	37.43
	dry pan		0.54	38.10	21.93	
	wet pan			21.93	0.00	

d<sub>10</sub> (mm): 0.0015      d<sub>50</sub> (mm): 0.11  
d<sub>16</sub> (mm): 0.0083      d<sub>60</sub> (mm): 0.13  
d<sub>30</sub> (mm): 0.058      d<sub>84</sub> (mm): 0.20

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 87  
Coefficient of Curvature, Cc--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 17  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.11

Classification of fines (visual method): ML

ASTM Soil Classification: Silty sand (SM)  
USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-34A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 14-Jun-18  
Start Time: 9:12

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.66  
Initial Wt. (g): 59.89  
Total Sample Wt. (g): 234.80  
Wt. Passing #10 (g): 234.27

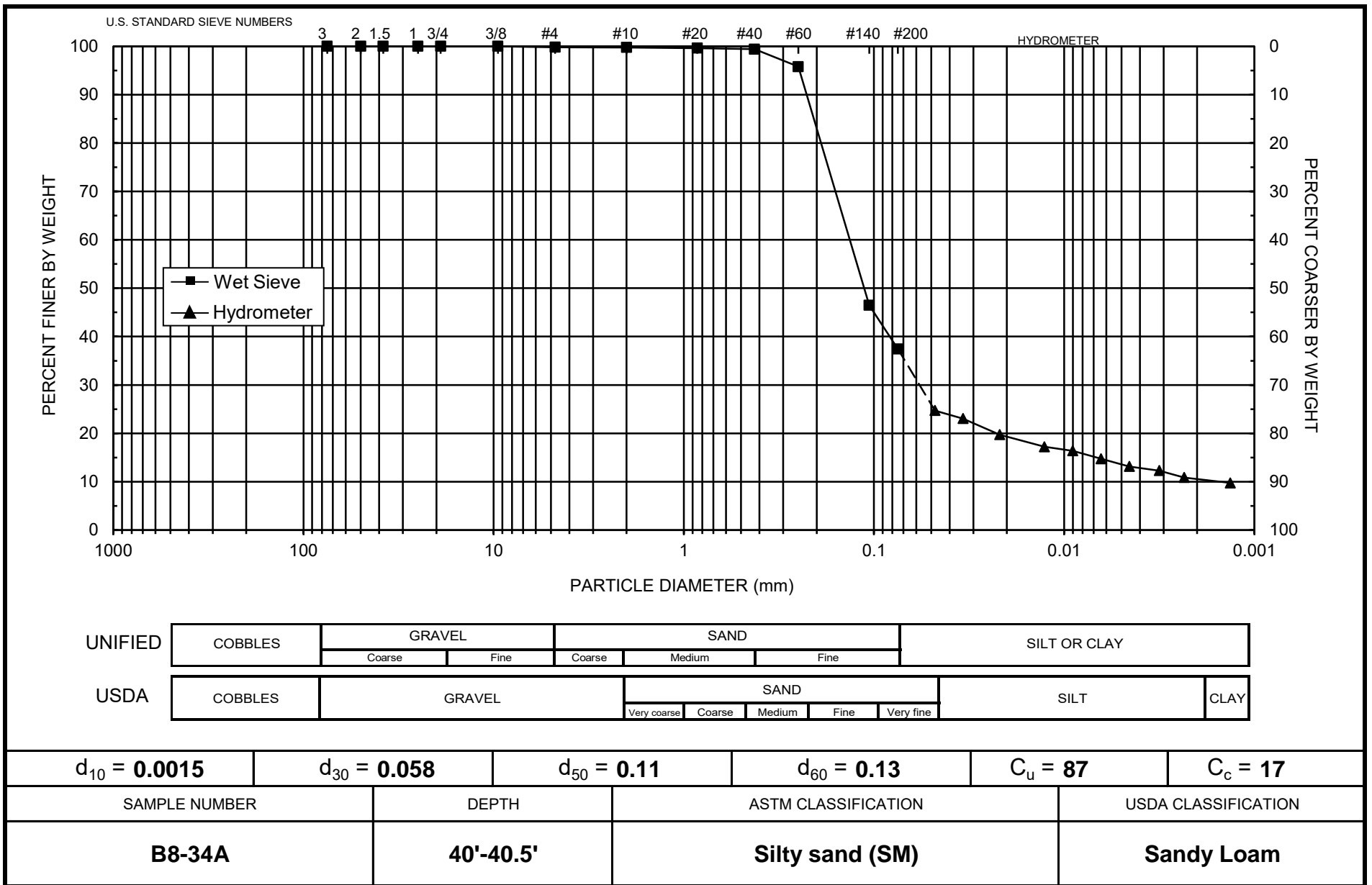
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
14-Jun-18	1	21.5	21.0	6.2	14.8	12.9	0.04779	24.8	24.7
	2	21.5	20.0	6.2	13.8	13.0	0.03401	23.1	23.0
	5	21.5	18.0	6.2	11.8	13.3	0.02178	19.8	19.7
	15	21.5	16.5	6.2	10.3	13.6	0.01269	17.2	17.2
	30	21.5	16.0	6.2	9.8	13.7	0.00900	16.4	16.4
	60	21.6	15.0	6.2	8.8	13.8	0.00640	14.8	14.7
	120	21.7	14.0	6.1	7.9	14.0	0.00454	13.2	13.1
	250	21.7	13.5	6.1	7.4	14.1	0.00316	12.3	12.3
	456	22.3	12.5	6.0	6.5	14.3	0.00233	10.9	10.8
15-Jun-18	1423	21.6	12.0	6.2	5.8	14.3	0.00134	9.8	9.7

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines





Daniel B. Stephens & Associates, Inc.



Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 238.13  
Weight Passing #10 (g): 238.13  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 52.78  
Calculated Weight of Sieve Sample (g): 52.78

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	238.13	100.00
	2"	50	0.00	0.00	238.13	100.00
	1.5"	38.1	0.00	0.00	238.13	100.00
	1"	25	0.00	0.00	238.13	100.00
	3/4"	19.0	0.00	0.00	238.13	100.00
	3/8"	9.5	0.00	0.00	238.13	100.00
	4	4.75	0.00	0.00	238.13	100.00
	10	2.00	0.00	0.00	238.13	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	52.78	100.00
	40	0.425	0.00	0.00	52.78	100.00
	60	0.250	0.01	0.01	52.77	99.98
	140	0.106	0.71	0.72	52.06	98.64
	200	0.075	0.89	1.61	51.17	96.95
	dry pan		0.16	1.77	51.01	
	wet pan			51.01	0.00	

d<sub>10</sub> (mm): 9.1E-05      d<sub>50</sub> (mm): 0.0024  
d<sub>16</sub> (mm): 0.00015      d<sub>60</sub> (mm): 0.0043  
d<sub>30</sub> (mm): 0.00048      d<sub>84</sub> (mm): 0.036

Median Particle Diameter--d<sub>50</sub> (mm): 0.0024  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 47  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.59  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.013

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Silty Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 12-Jun-18  
Start Time: 9:30

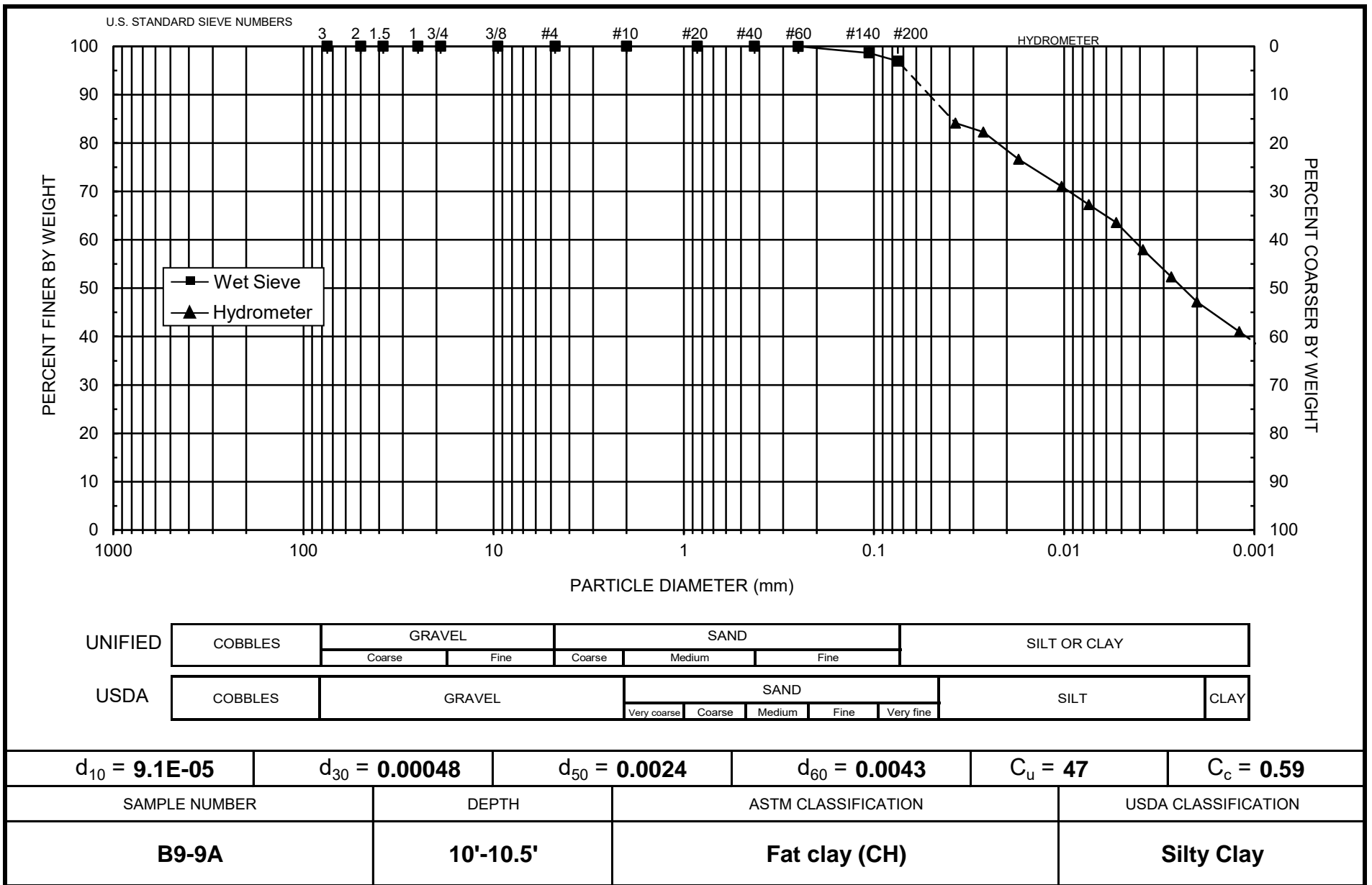
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.68  
Initial Wt. (g): 52.78  
Total Sample Wt. (g): 238.13  
Wt. Passing #10 (g): 238.13

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	51.0	6.1	44.9	7.9	0.03726	84.1	84.1
	2	21.6	50.0	6.1	43.9	8.1	0.02662	82.3	82.3
	5	21.6	47.0	6.1	40.9	8.6	0.01734	76.6	76.6
	15	21.6	44.0	6.1	37.9	9.1	0.01029	71.0	71.0
	30	21.6	42.0	6.1	35.9	9.4	0.00741	67.3	67.3
	60	21.8	40.0	6.1	33.9	9.7	0.00532	63.6	63.6
	120	21.8	37.0	6.1	30.9	10.2	0.00385	58.0	58.0
	250	21.8	34.0	6.1	27.9	10.7	0.00273	52.3	52.3
	475	22.9	31.0	5.9	25.1	11.2	0.00200	47.2	47.2
13-Jun-18	1423	21.6	28.0	6.1	21.9	11.7	0.00120	41.0	41.0

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 247.49  
Weight Passing #10 (g): 247.49  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 62.85  
Calculated Weight of Sieve Sample (g): 62.85

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	247.49	100.00
	2"	50	0.00	0.00	247.49	100.00
	1.5"	38.1	0.00	0.00	247.49	100.00
	1"	25	0.00	0.00	247.49	100.00
	3/4"	19.0	0.00	0.00	247.49	100.00
	3/8"	9.5	0.00	0.00	247.49	100.00
	4	4.75	0.00	0.00	247.49	100.00
	10	2.00	0.00	0.00	247.49	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.01	0.01	62.84	99.98
	40	0.425	0.01	0.02	62.83	99.97
	60	0.250	0.27	0.29	62.56	99.54
	140	0.106	15.29	15.58	47.27	75.21
	200	0.075	4.17	19.75	43.10	68.58
	dry pan		0.57	20.32	42.53	
	wet pan			42.53	0.00	

d<sub>10</sub> (mm): 0.00025      d<sub>50</sub> (mm): 0.025  
d<sub>16</sub> (mm): 0.00058      d<sub>60</sub> (mm): 0.049  
d<sub>30</sub> (mm): 0.0033      d<sub>84</sub> (mm): 0.14

Median Particle Diameter--d<sub>50</sub> (mm): 0.025  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 196  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.89  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.055

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines (visual method): ML

ASTM Soil Classification: Sandy silt s(ML)  
USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

Test Date: 7-Jun-18  
Start Time: 9:42

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67

Initial Wt. (g): 62.85  
Total Sample Wt. (g): 247.49  
Wt. Passing #10 (g): 247.49

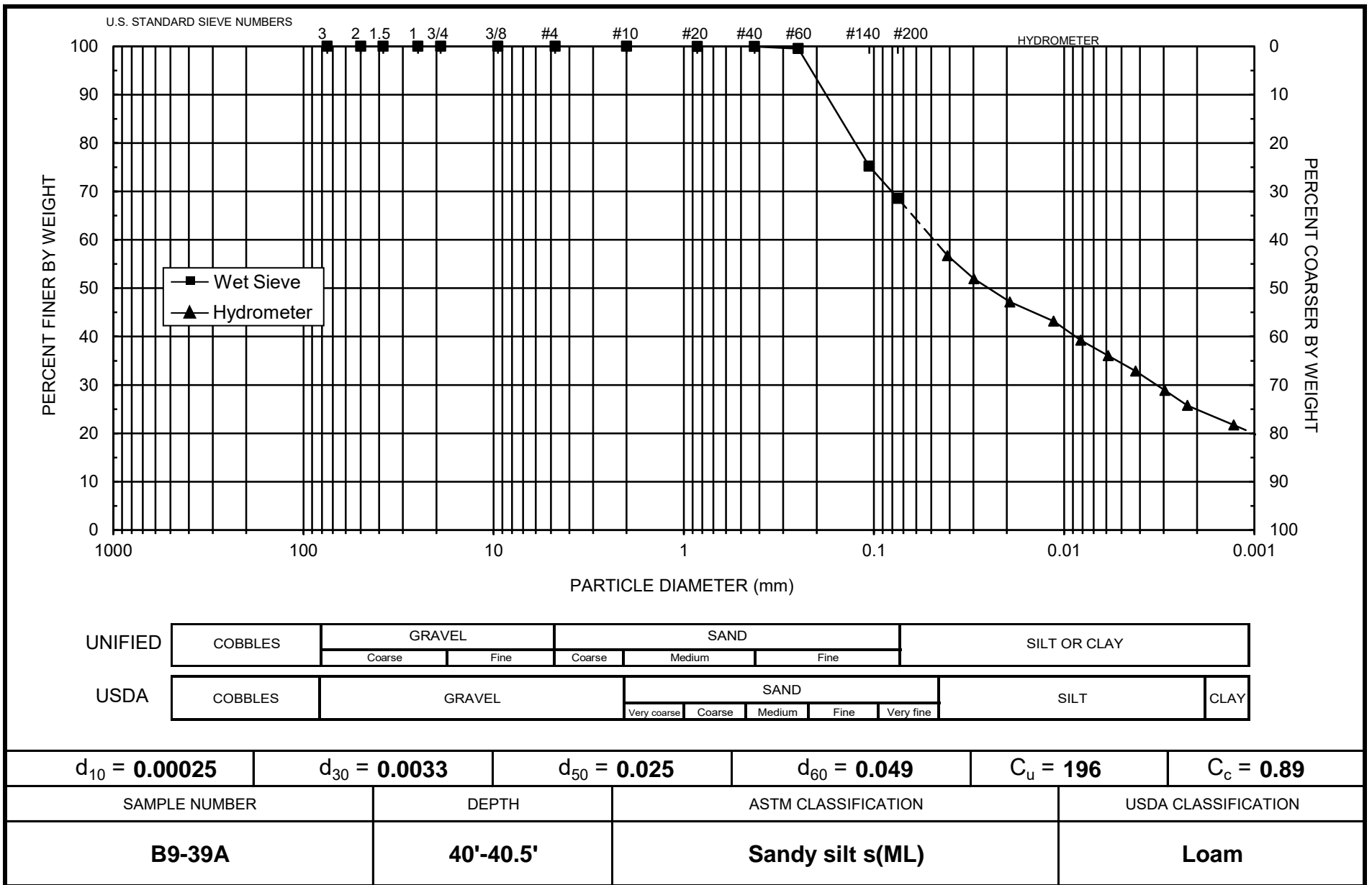
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	41.0	5.4	35.6	9.6	0.04107	56.7	56.7
	2	21.7	38.0	5.4	32.6	10.1	0.02978	51.9	51.9
	5	21.7	35.0	5.4	29.6	10.6	0.01929	47.2	47.2
	15	21.7	32.5	5.4	27.1	11.0	0.01135	43.2	43.2
	30	21.8	30.0	5.4	24.7	11.4	0.00816	39.2	39.2
	60	21.8	28.0	5.4	22.7	11.7	0.00586	36.0	36.0
	120	21.7	26.0	5.4	20.6	12.0	0.00420	32.8	32.8
	250	21.9	23.5	5.4	18.2	12.4	0.00295	28.9	28.9
	437	22.5	21.5	5.3	16.2	12.8	0.00225	25.8	25.8
8-Jun-18	1418	21.6	19.0	5.4	13.6	13.2	0.00128	21.7	21.7

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 39884.70  
Weight Passing #10 (g): 39868.26  
Weight Retained #10 (g): 16.43  
Weight of Hydrometer Sample (g): 58.46  
Calculated Weight of Sieve Sample (g): 58.48

Shape: Rounded  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
<b>+10</b>						
	3"	75	0.00	0.00	39884.70	100.00
	2"	50	0.00	0.00	39884.70	100.00
	1.5"	38.1	0.00	0.00	39884.70	100.00
	1"	25	0.00	0.00	39884.70	100.00
	3/4"	19.0	0.00	0.00	39884.70	100.00
	3/8"	9.5	1.44	1.44	39883.26	100.00
	4	4.75	12.19	13.63	39871.07	99.97
	10	2.00	2.80	16.43	39868.26	99.96
<b>-10</b>						
			(Based on calculated sieve wt.)			
	20	0.85	0.02	0.04	58.44	99.92
	40	0.425	0.01	0.05	58.43	99.91
	60	0.250	0.07	0.12	58.36	99.79
	140	0.106	1.20	1.32	57.16	97.74
	200	0.075	0.76	2.08	56.40	96.44
	dry pan		0.10	2.18	56.30	
	wet pan			56.30	0.00	

$d_{10}$  (mm): 6.3E-05       $d_{50}$  (mm): 0.0015  
 $d_{16}$  (mm): 0.00010       $d_{60}$  (mm): 0.0028  
 $d_{30}$  (mm): 0.00030       $d_{84}$  (mm): 0.018

Median Particle Diameter-- $d_{50}$  (mm): 0.0015  
 Uniformity Coefficient,  $C_u$ -- $[d_{60}/d_{10}]$  (mm): 44  
 Coefficient of Curvature,  $C_c$ -- $[(d_{30})^2/(d_{10} \cdot d_{60})]$  (mm): 0.51  
 Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.0065

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)

USDA Soil Classification: Clay

Laboratory analysis by: Z. Calhoun  
 Data entered by: M. Garcia  
 Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

Test Date: 7-Jun-18  
Start Time: 9:36

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.71

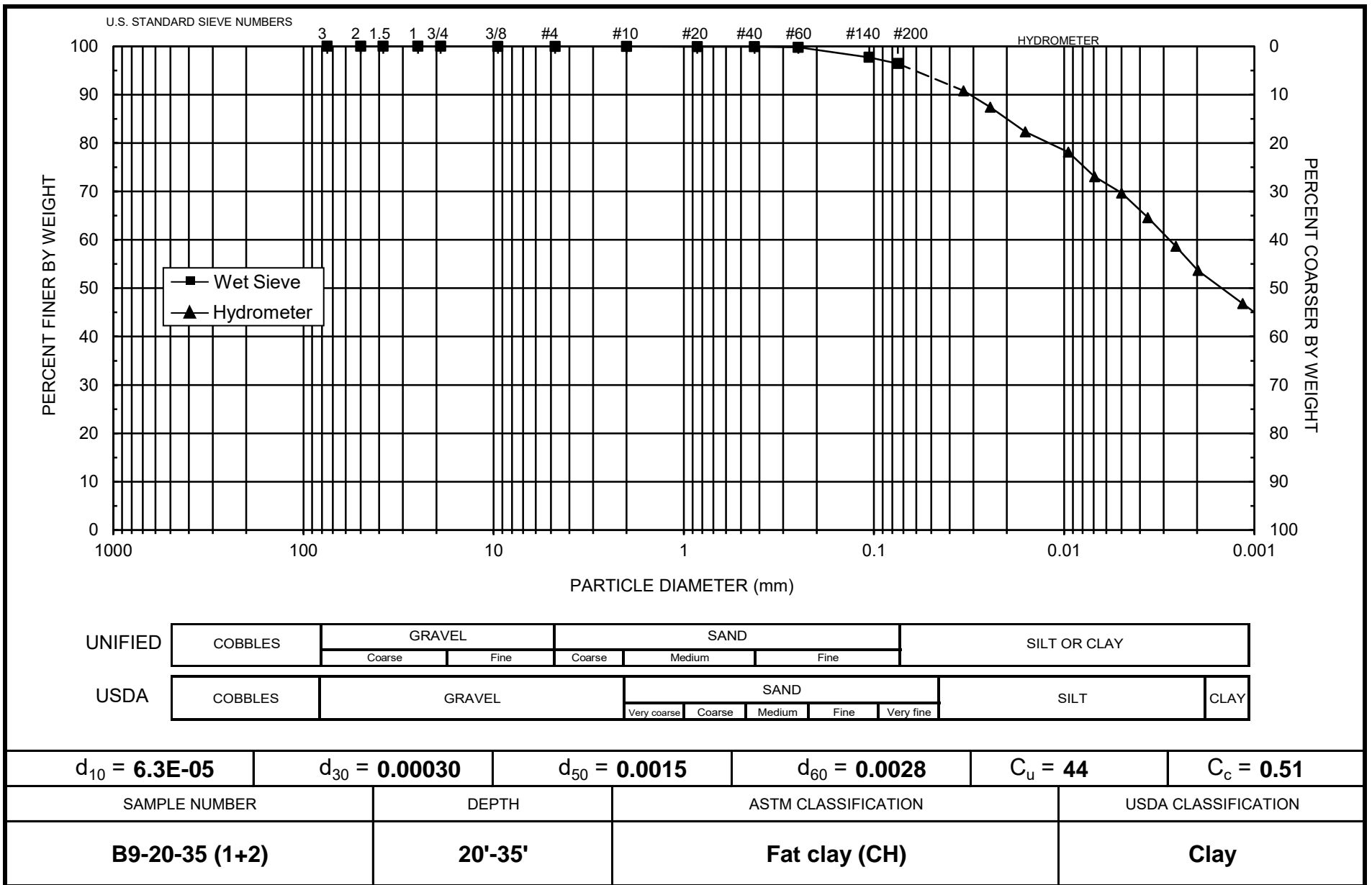
Initial Wt. (g): 58.46  
Total Sample Wt. (g): 39884.70  
Wt. Passing #10 (g): 39868.26

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	59.0	5.4	53.6	6.6	0.03377	90.8	90.8
	2	21.7	57.0	5.4	51.6	7.0	0.02446	87.5	87.4
	5	21.7	54.0	5.4	48.6	7.4	0.01601	82.4	82.3
	15	21.7	51.5	5.4	46.1	7.9	0.00949	78.1	78.1
	30	21.8	48.5	5.4	43.2	8.3	0.00691	73.1	73.0
	60	21.8	46.5	5.4	41.2	8.7	0.00498	69.7	69.7
	120	21.7	43.5	5.4	38.1	9.2	0.00363	64.6	64.6
	250	21.9	40.0	5.4	34.7	9.7	0.00258	58.7	58.7
	442	22.5	37.0	5.3	31.7	10.2	0.00198	53.7	53.6
8-Jun-18	1423	21.6	33.0	5.4	27.6	10.9	0.00115	46.8	46.8

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Daniel B. Stephens & Associates, Inc.





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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-4A  
Project Name: NECR Jetty '18  
Depth: 5'-5.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 283.09  
Weight Passing #10 (g): 282.18  
Weight Retained #10 (g): 0.91  
Weight of Hydrometer Sample (g): 53.35  
Calculated Weight of Sieve Sample (g): 53.52

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	283.09	100.00
	2"	50	0.00	0.00	283.09	100.00
	1.5"	38.1	0.00	0.00	283.09	100.00
	1"	25	0.00	0.00	283.09	100.00
	3/4"	19.0	0.00	0.00	283.09	100.00
	3/8"	9.5	0.00	0.00	283.09	100.00
	4	4.75	0.76	0.76	282.33	99.73
	10	2.00	0.15	0.91	282.18	99.68
-10	(Based on calculated sieve wt.)					
	20	0.85	0.16	0.33	53.19	99.38
	40	0.425	0.17	0.50	53.02	99.06
	60	0.250	0.56	1.06	52.46	98.02
	140	0.106	15.28	16.34	37.18	69.47
	200	0.075	6.20	22.54	30.98	57.88
	dry pan		0.55	23.09	30.43	
	wet pan			30.43	0.00	

d<sub>10</sub> (mm): 6.0E-05      d<sub>50</sub> (mm): 0.055  
d<sub>16</sub> (mm): 0.00054      d<sub>60</sub> (mm): 0.080  
d<sub>30</sub> (mm): 0.0090      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.055  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1333  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 17  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.072

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)  
USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-4A  
Project Name: NECR Jetty '18  
Depth: 5'-5.5'

Test Date: 12-Jun-18  
Start Time: 9:36

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.66

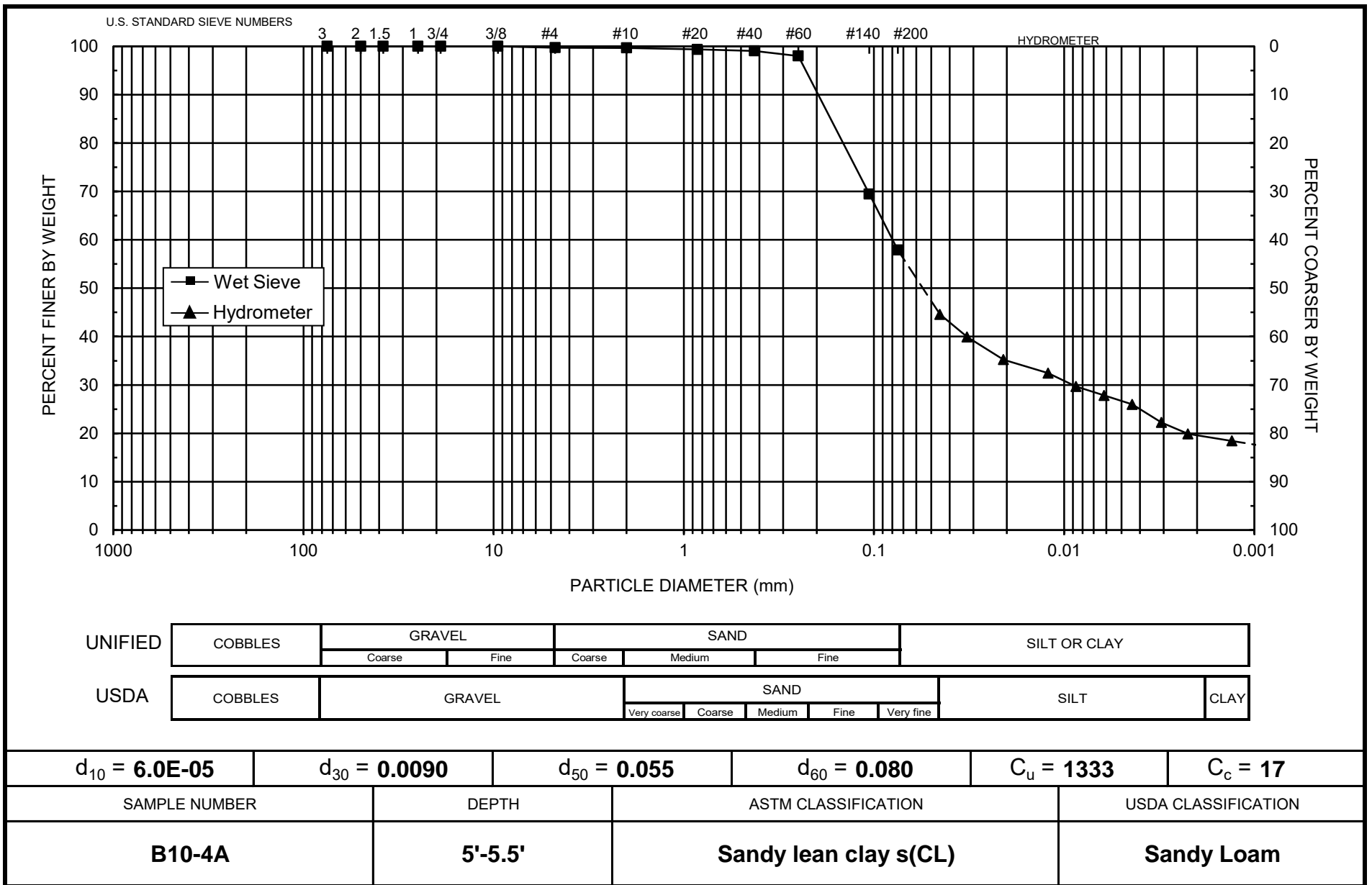
Initial Wt. (g): 53.35  
Total Sample Wt. (g): 283.09  
Wt. Passing #10 (g): 282.18

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	30.0	6.1	23.9	11.4	0.04499	44.7	44.6
	2	21.6	27.5	6.1	21.4	11.8	0.03238	40.0	39.9
	5	21.6	25.0	6.1	18.9	12.2	0.02083	35.4	35.2
	15	21.6	23.5	6.1	17.4	12.4	0.01215	32.5	32.4
	30	21.7	22.0	6.1	15.9	12.7	0.00866	29.8	29.7
	60	21.8	21.0	6.1	14.9	12.9	0.00616	27.9	27.8
	120	21.8	20.0	6.1	13.9	13.0	0.00438	26.1	26.0
	250	21.8	18.0	6.1	11.9	13.3	0.00307	22.3	22.2
	470	22.9	16.5	5.9	10.6	13.6	0.00223	19.9	19.9
13-Jun-18	1418	21.6	16.0	6.1	9.9	13.7	0.00131	18.5	18.4

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*







*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 151.12  
Weight Passing #10 (g): 151.12  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 41.33  
Calculated Weight of Sieve Sample (g): 41.33

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	151.12	100.00
	2"	50	0.00	0.00	151.12	100.00
	1.5"	38.1	0.00	0.00	151.12	100.00
	1"	25	0.00	0.00	151.12	100.00
	3/4"	19.0	0.00	0.00	151.12	100.00
	3/8"	9.5	0.00	0.00	151.12	100.00
	4	4.75	0.00	0.00	151.12	100.00
	10	2.00	0.00	0.00	151.12	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	41.33	100.00
	40	0.425	0.00	0.00	41.33	100.00
	60	0.250	0.02	0.02	41.31	99.95
	140	0.106	1.45	1.47	39.86	96.44
	200	0.075	0.78	2.25	39.08	94.56
	dry pan		0.13	2.38	38.95	
	wet pan			38.95	0.00	

$d_{10}$  (mm): 6.1E-05       $d_{50}$  (mm): 0.0044  
 $d_{16}$  (mm): 0.00013       $d_{60}$  (mm): 0.0086  
 $d_{30}$  (mm): 0.00073       $d_{84}$  (mm): 0.052

Median Particle Diameter-- $d_{50}$  (mm): 0.0044  
Uniformity Coefficient,  $C_u$ -- $[d_{60}/d_{10}]$  (mm): 141  
Coefficient of Curvature,  $C_c$ -- $[(d_{30})^2/(d_{10} \cdot d_{60})]$  (mm): 1.0  
Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.019

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

Test Date: 12-Jun-18  
Start Time: 9:42

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.68

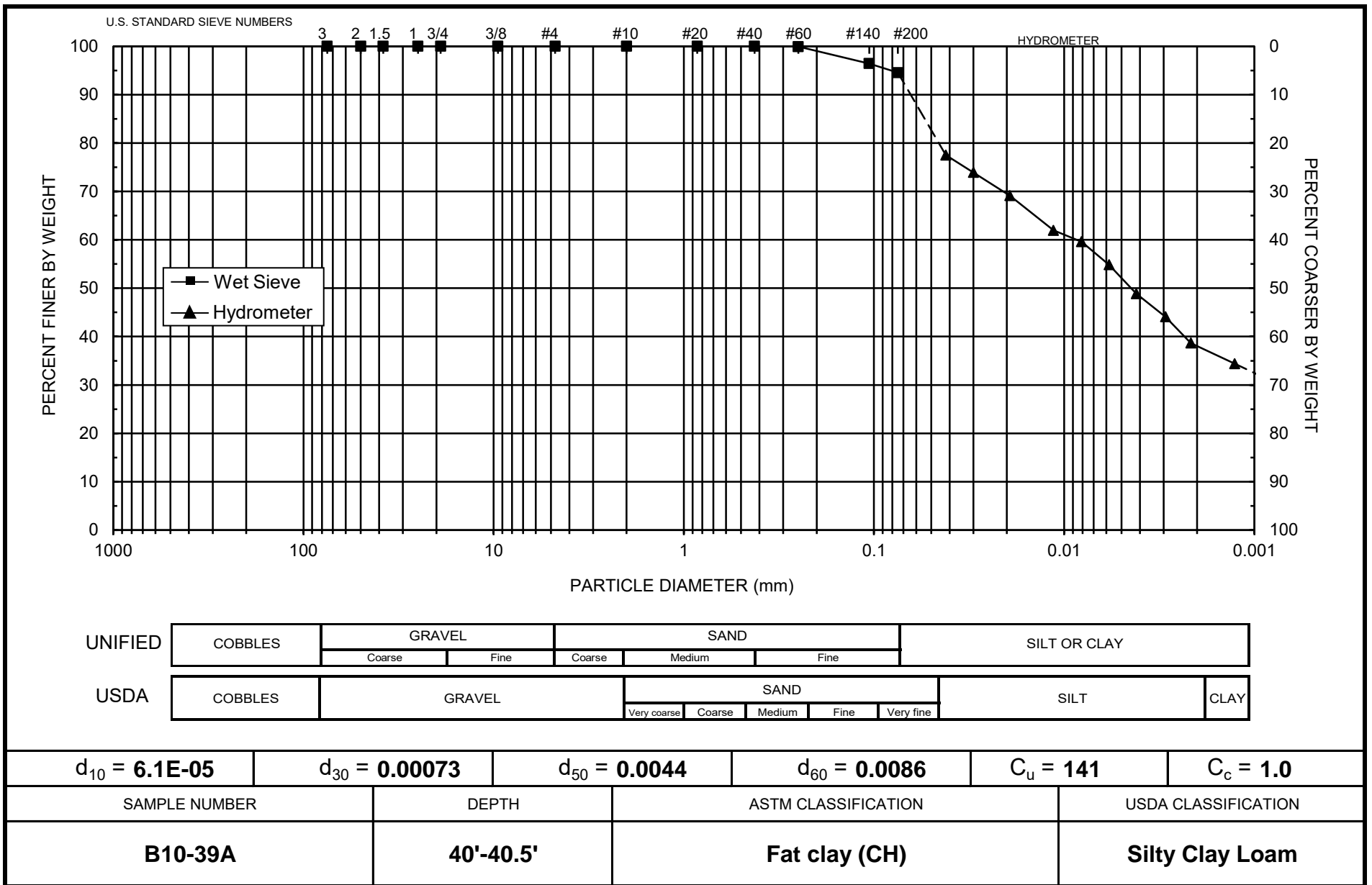
Initial Wt. (g): 41.33  
Total Sample Wt. (g): 151.12  
Wt. Passing #10 (g): 151.12

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	38.5	6.1	32.4	10.0	0.04189	77.5	77.5
	2	21.6	37.0	6.1	30.9	10.2	0.02999	73.9	73.9
	5	21.6	35.0	6.1	28.9	10.6	0.01927	69.1	69.1
	15	21.6	32.0	6.1	25.9	11.1	0.01138	61.9	61.9
	30	21.7	31.0	6.1	24.9	11.2	0.00810	59.6	59.6
	60	21.8	29.0	6.1	22.9	11.5	0.00580	54.8	54.8
	120	21.8	26.5	6.1	20.4	12.0	0.00417	48.9	48.9
	250	21.8	24.5	6.1	18.4	12.3	0.00293	44.1	44.1
	465	22.9	22.0	5.9	16.1	12.7	0.00216	38.7	38.7
13-Jun-18	1413	21.6	20.5	6.1	14.4	12.9	0.00127	34.4	34.4

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 38094.17  
Weight Passing #10 (g): 37631.25  
Weight Retained #10 (g): 462.92  
Weight of Hydrometer Sample (g): 63.31  
Calculated Weight of Sieve Sample (g): 64.09

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	38094.17	100.00
	2"	50	0.00	0.00	38094.17	100.00
	1.5"	38.1	0.00	0.00	38094.17	100.00
	1"	25	0.00	0.00	38094.17	100.00
	3/4"	19.0	13.52	13.52	38080.65	99.96
	3/8"	9.5	140.65	154.17	37940.00	99.60
	4	4.75	274.69	428.86	37665.31	98.87
	10	2.00	34.06	462.92	37631.25	98.78
-10	(Based on calculated sieve wt.)					
	20	0.85	0.41	1.19	62.90	98.15
	40	0.425	0.40	1.59	62.50	97.52
	60	0.250	0.68	2.27	61.82	96.46
	140	0.106	15.21	17.48	46.61	72.73
	200	0.075	7.81	25.29	38.80	60.54
	dry pan		0.83	26.12	37.97	
	wet pan			37.97	0.00	

d<sub>10</sub> (mm): 2.4E-05      d<sub>50</sub> (mm): 0.046  
d<sub>16</sub> (mm): 0.00020      d<sub>60</sub> (mm): 0.073  
d<sub>30</sub> (mm): 0.0054      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.046  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 3042  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 17  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.069

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)

USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

Test Date: 7-Jun-18  
Start Time: 9:48

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67

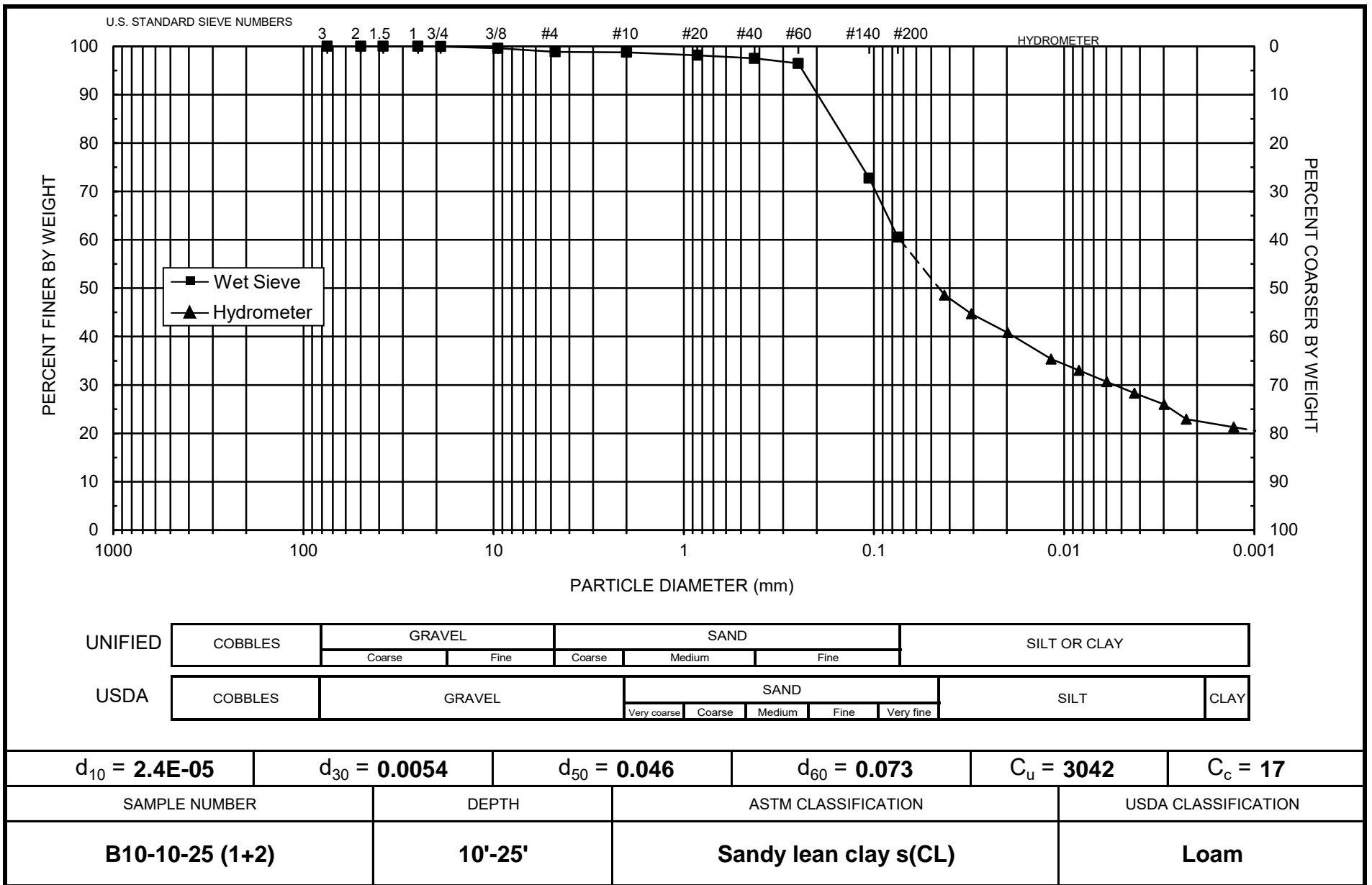
Initial Wt. (g): 63.31  
Total Sample Wt. (g): 38094.17  
Wt. Passing #10 (g): 37631.25

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	36.5	5.4	31.1	10.3	0.04257	49.2	48.6
	2	21.7	34.0	5.4	28.6	10.7	0.03069	45.2	44.7
	5	21.7	31.5	5.4	26.1	11.1	0.01978	41.3	40.8
	15	21.8	28.0	5.4	22.7	11.7	0.01170	35.8	35.3
	30	21.8	26.5	5.4	21.2	12.0	0.00836	33.4	33.0
	60	21.8	25.0	5.4	19.7	12.2	0.00597	31.0	30.7
	120	21.7	23.5	5.4	18.1	12.4	0.00427	28.7	28.3
	250	21.9	22.0	5.4	16.7	12.7	0.00298	26.3	26.0
	432	22.5	20.0	5.3	14.7	13.0	0.00228	23.2	22.9
8-Jun-18	1413	21.6	19.0	5.4	13.6	13.2	0.00128	21.5	21.3

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-14A  
Project Name: NECR Jetty '18  
Depth: 15'-15.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 249.69  
Weight Passing #10 (g): 245.28  
Weight Retained #10 (g): 4.41  
Weight of Hydrometer Sample (g): 59.55  
Calculated Weight of Sieve Sample (g): 60.62

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	249.69	100.00
	2"	50	0.00	0.00	249.69	100.00
	1.5"	38.1	0.00	0.00	249.69	100.00
	1"	25	0.00	0.00	249.69	100.00
	3/4"	19.0	0.00	0.00	249.69	100.00
	3/8"	9.5	0.00	0.00	249.69	100.00
	4	4.75	2.84	2.84	246.85	98.86
	10	2.00	1.57	4.41	245.28	98.23
-10	(Based on calculated sieve wt.)					
	20	0.85	0.49	1.56	59.06	97.43
	40	0.425	0.65	2.21	58.41	96.35
	60	0.250	1.95	4.16	56.46	93.14
	140	0.106	17.39	21.55	39.07	64.45
	200	0.075	7.21	28.76	31.86	52.56
	dry pan		0.89	29.65	30.97	
	wet pan			30.97	0.00	

d<sub>10</sub> (mm): 9.4E-05      d<sub>50</sub> (mm): 0.070  
d<sub>16</sub> (mm): 0.0012      d<sub>60</sub> (mm): 0.093  
d<sub>30</sub> (mm): 0.028      d<sub>84</sub> (mm): 0.19

Median Particle Diameter--d<sub>50</sub> (mm): 0.070  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 989  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 90  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.087

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)  
USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-14A  
Project Name: NECR Jetty '18  
Depth: 15'-15.5'

Test Date: 12-Jun-18  
Start Time: 9:48

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.66

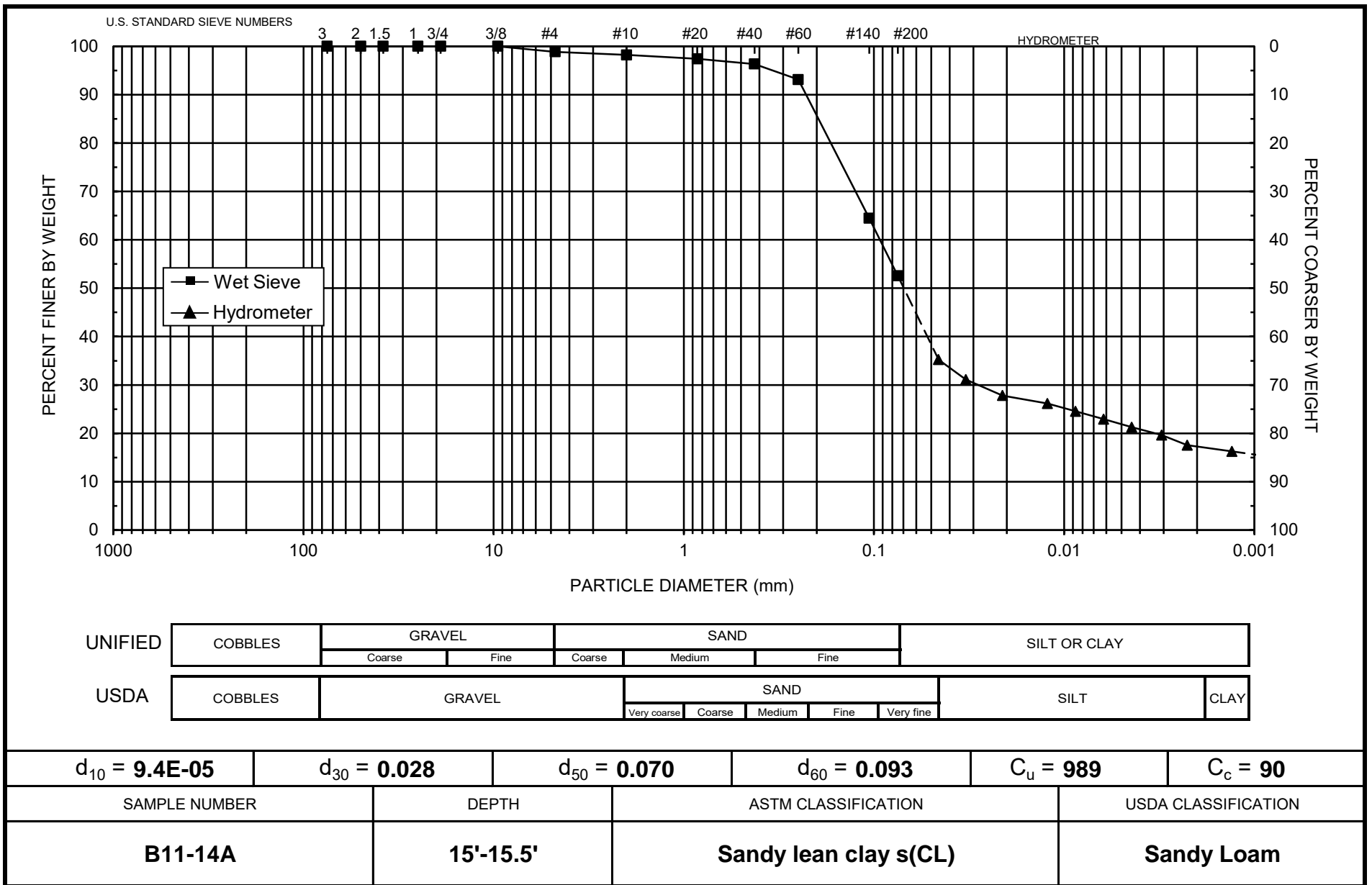
Initial Wt. (g): 59.55  
Total Sample Wt. (g): 249.69  
Wt. Passing #10 (g): 245.28

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	27.5	6.1	21.4	11.8	0.04574	35.9	35.2
	2	21.6	25.0	6.1	18.9	12.2	0.03290	31.7	31.1
	5	21.6	23.0	6.1	16.9	12.5	0.02109	28.3	27.8
	15	21.6	22.0	6.1	15.9	12.7	0.01225	26.6	26.2
	30	21.7	21.0	6.1	14.9	12.9	0.00871	25.0	24.5
	60	21.8	20.0	6.1	13.9	13.0	0.00619	23.3	22.9
	120	21.8	19.0	6.1	12.9	13.2	0.00441	21.6	21.3
	250	21.8	18.0	6.1	11.9	13.3	0.00307	20.0	19.6
	460	22.9	16.5	5.9	10.6	13.6	0.00226	17.9	17.6
13-Jun-18	1408	21.6	16.0	6.1	9.9	13.7	0.00131	16.6	16.3

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-29B  
Project Name: NECR Jetty '18  
Depth: 29.5'-30'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 218.53  
Weight Passing #10 (g): 216.96  
Weight Retained #10 (g): 1.57  
Weight of Hydrometer Sample (g): 47.86  
Calculated Weight of Sieve Sample (g): 48.21

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	218.53	100.00
	2"	50	0.00	0.00	218.53	100.00
	1.5"	38.1	0.00	0.00	218.53	100.00
	1"	25	0.00	0.00	218.53	100.00
	3/4"	19.0	0.00	0.00	218.53	100.00
	3/8"	9.5	0.00	0.00	218.53	100.00
	4	4.75	0.57	0.57	217.96	99.74
	10	2.00	1.00	1.57	216.96	99.28
-10	(Based on calculated sieve wt.)					
	20	0.85	0.23	0.58	47.63	98.80
	40	0.425	0.18	0.76	47.45	98.43
	60	0.250	0.56	1.32	46.89	97.27
	140	0.106	10.63	11.95	36.26	75.22
	200	0.075	4.10	16.05	32.16	66.71
	dry pan		0.33	16.38	31.83	
	wet pan			31.83	0.00	

d<sub>10</sub> (mm): 0.00016      d<sub>50</sub> (mm): 0.047  
d<sub>16</sub> (mm): 0.00053      d<sub>60</sub> (mm): 0.062  
d<sub>30</sub> (mm): 0.0050      d<sub>84</sub> (mm): 0.15

Median Particle Diameter--d<sub>50</sub> (mm): 0.047  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 388  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 2.5  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.066

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)  
USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-29B  
Project Name: NECR Jetty '18  
Depth: 29.5'-30'  
Test Date: 12-Jun-18  
Start Time: 9:54

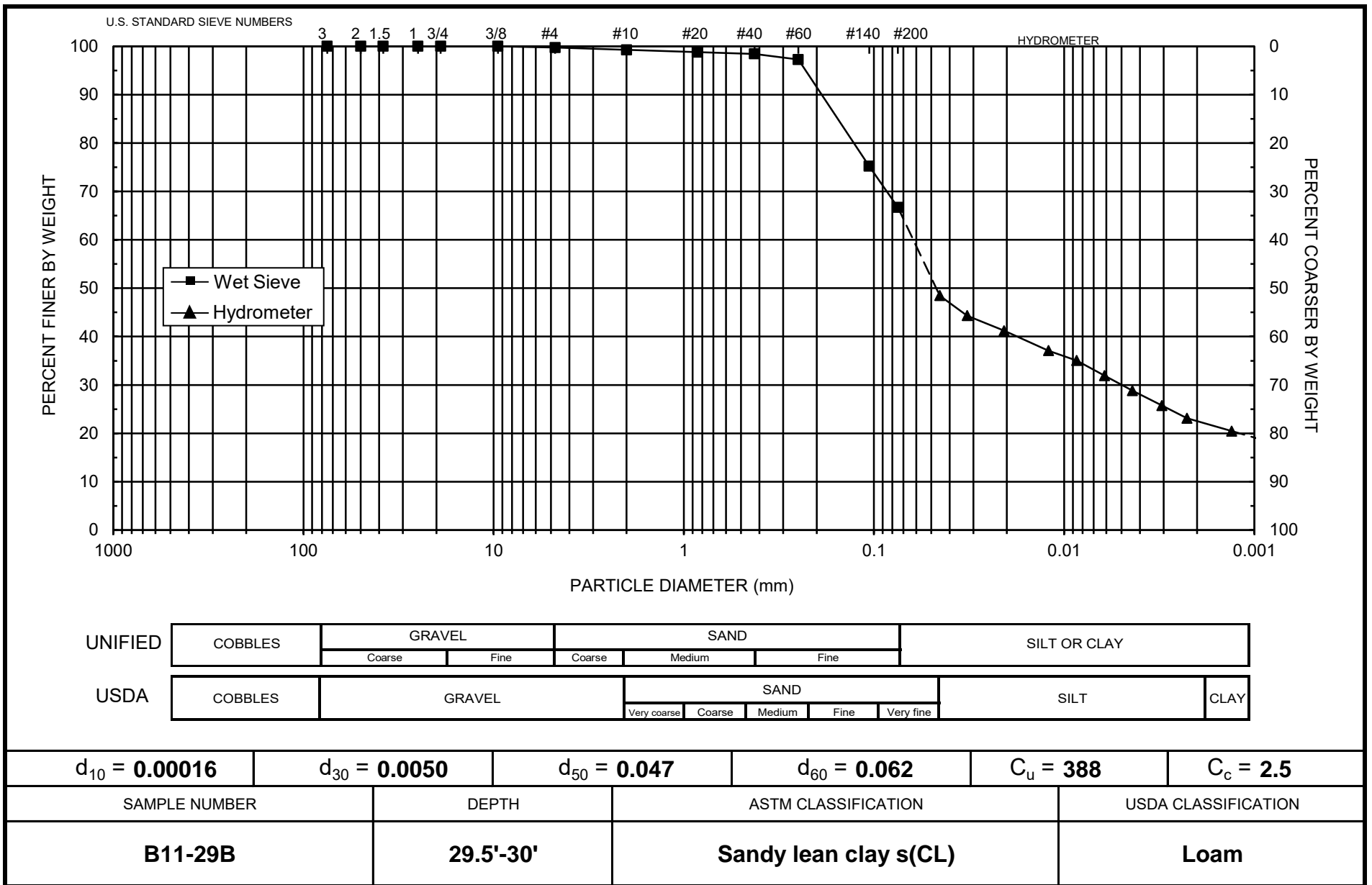
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.66  
Initial Wt. (g): 47.86  
Total Sample Wt. (g): 218.53  
Wt. Passing #10 (g): 216.96

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	29.5	6.1	23.4	11.5	0.04509	48.8	48.5
	2	21.6	27.5	6.1	21.4	11.8	0.03233	44.6	44.3
	5	21.6	26.0	6.1	19.9	12.0	0.02066	41.5	41.2
	15	21.7	24.0	6.1	17.9	12.4	0.01208	37.4	37.1
	30	21.8	23.0	6.1	16.9	12.5	0.00859	35.3	35.0
	60	21.8	21.5	6.1	15.4	12.8	0.00613	32.2	31.9
	120	21.8	20.0	6.1	13.9	13.0	0.00438	29.0	28.8
	250	21.8	18.5	6.1	12.4	13.3	0.00306	25.9	25.7
	455	22.9	17.0	5.9	11.1	13.5	0.00226	23.3	23.1
13-Jun-18	1403	21.6	16.0	6.1	9.9	13.7	0.00131	20.6	20.5

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





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### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 18-Jun-18

Initial Dry Weight of Sample (g): 271.00  
Weight Passing #10 (g): 271.00  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 46.83  
Calculated Weight of Sieve Sample (g): 46.83

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	271.00	100.00
	2"	50	0.00	0.00	271.00	100.00
	1.5"	38.1	0.00	0.00	271.00	100.00
	1"	25	0.00	0.00	271.00	100.00
	3/4"	19.0	0.00	0.00	271.00	100.00
	3/8"	9.5	0.00	0.00	271.00	100.00
	4	4.75	0.00	0.00	271.00	100.00
	10	2.00	0.00	0.00	271.00	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	46.83	100.00
	40	0.425	0.03	0.03	46.80	99.94
	60	0.250	1.93	1.96	44.87	95.81
	140	0.106	22.69	24.65	22.18	47.36
	200	0.075	5.60	30.25	16.58	35.40
	dry pan		0.85	31.10	15.73	
	wet pan			15.73	0.00	

d<sub>10</sub> (mm): 0.0062      d<sub>50</sub> (mm): 0.11  
d<sub>16</sub> (mm): 0.033      d<sub>60</sub> (mm): 0.13  
d<sub>30</sub> (mm): 0.065      d<sub>84</sub> (mm): 0.20

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 21  
Coefficient of Curvature, Cc--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 5.2  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.11

Classification of fines (visual method): ML

ASTM Soil Classification: Silty sand (SM)  
USDA Soil Classification: Loamy Sand

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 14-Jun-18  
Start Time: 9:18

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.65  
Initial Wt. (g): 46.83  
Total Sample Wt. (g): 271.00  
Wt. Passing #10 (g): 271.00

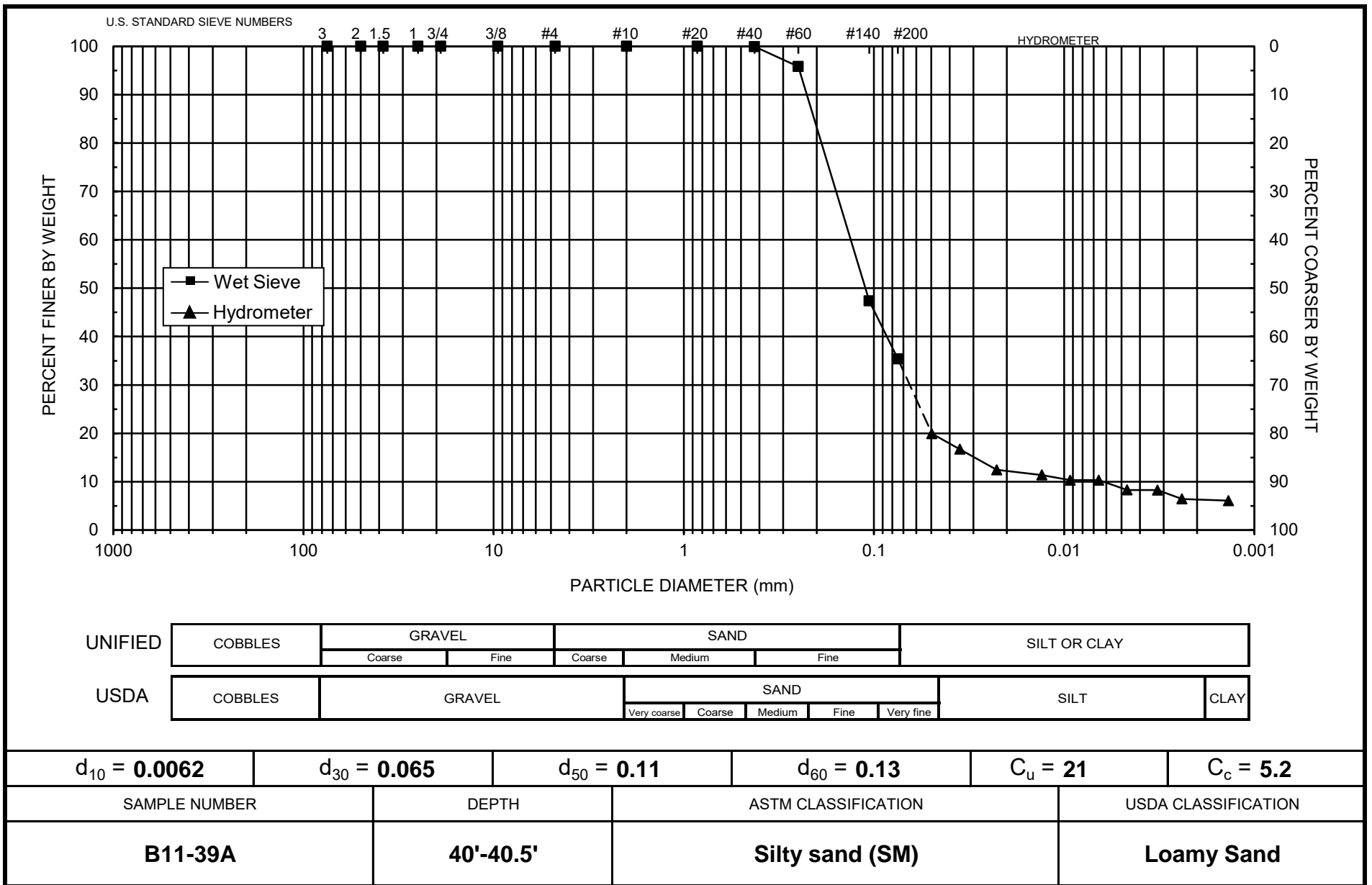
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
14-Jun-18	1	21.5	15.5	6.2	9.3	13.8	0.04958	19.9	19.9
	2	21.5	14.0	6.2	7.8	14.0	0.03537	16.7	16.7
	5	21.5	12.0	6.2	5.8	14.3	0.02263	12.4	12.4
	15	21.5	11.5	6.2	5.3	14.4	0.01310	11.4	11.4
	30	21.5	11.0	6.2	4.8	14.5	0.00929	10.3	10.3
	60	21.6	11.0	6.2	4.8	14.5	0.00657	10.3	10.3
	120	21.7	10.0	6.1	3.9	14.7	0.00466	8.3	8.3
	250	21.7	10.0	6.1	3.9	14.7	0.00323	8.3	8.3
	451	22.3	9.0	6.0	3.0	14.8	0.00240	6.4	6.4
	1418	21.6	9.0	6.2	2.8	14.8	0.00137	6.1	6.1
15-Jun-18	1418	21.6	9.0	6.2	2.8	14.8	0.00137	6.1	6.1

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines





Daniel B. Stephens & Associates, Inc.



Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-0-10 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-10'

Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 44304.85  
Weight Passing #10 (g): 43884.82  
Weight Retained #10 (g): 420.03  
Weight of Hydrometer Sample (g): 63.80  
Calculated Weight of Sieve Sample (g): 64.41

Shape: Rounded  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	44304.85	100.00
	2"	50	0.00	0.00	44304.85	100.00
	1.5"	38.1	0.00	0.00	44304.85	100.00
	1"	25	0.00	0.00	44304.85	100.00
	3/4"	19.0	0.00	0.00	44304.85	100.00
	3/8"	9.5	122.96	122.96	44181.89	99.72
	4	4.75	262.44	385.40	43919.45	99.13
	10	2.00	34.63	420.03	43884.82	99.05
-10	(Based on calculated sieve wt.)					
	20	0.85	0.47	1.08	63.33	98.32
	40	0.425	0.40	1.48	62.93	97.70
	60	0.250	1.12	2.60	61.81	95.96
	140	0.106	15.69	18.29	46.12	71.60
	200	0.075	5.41	23.70	40.71	63.20
	dry pan		0.59	24.29	40.12	
	wet pan			40.12	0.00	

d<sub>10</sub> (mm): 0.00013      d<sub>50</sub> (mm): 0.039  
d<sub>16</sub> (mm): 0.00038      d<sub>60</sub> (mm): 0.064  
d<sub>30</sub> (mm): 0.0039      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.039  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 492  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.8  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.066

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)  
USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-0-10 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-10'

Test Date: 7-Jun-18  
Start Time: 9:54

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.66

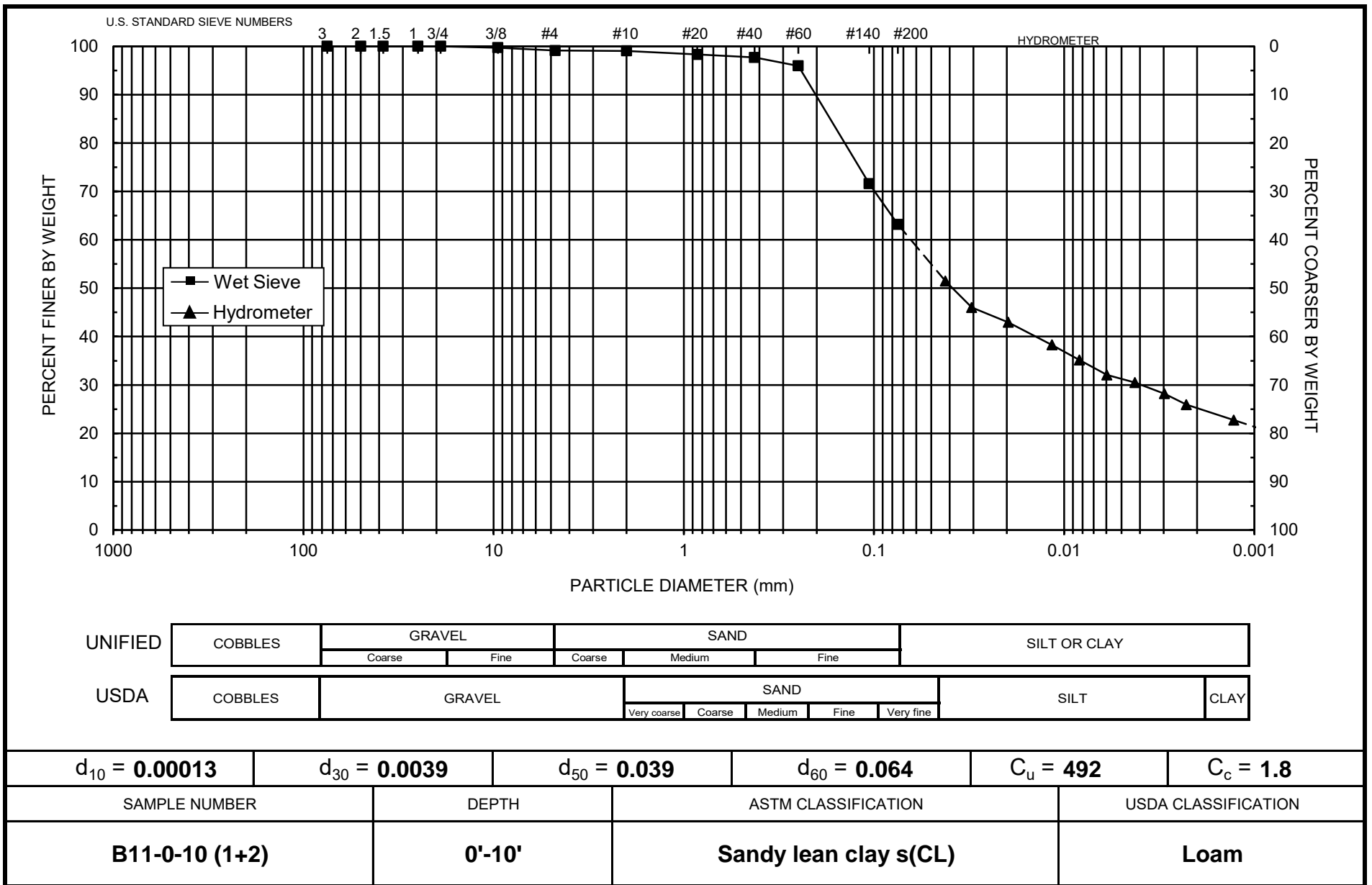
Initial Wt. (g): 63.80  
Total Sample Wt. (g): 44304.85  
Wt. Passing #10 (g): 43884.82

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	38.5	5.4	33.1	10.0	0.04210	51.9	51.5
	2	21.7	35.0	5.4	29.6	10.6	0.03061	46.5	46.0
	5	21.8	33.0	5.4	27.7	10.9	0.01965	43.3	42.9
	15	21.8	30.0	5.4	24.7	11.4	0.01159	38.6	38.3
	30	21.8	28.0	5.4	22.7	11.7	0.00831	35.5	35.2
	60	21.8	26.0	5.4	20.7	12.0	0.00596	32.4	32.1
	120	21.7	25.0	5.4	19.6	12.2	0.00425	30.8	30.5
	250	21.9	23.5	5.4	18.2	12.4	0.00297	28.4	28.2
	427	22.5	22.0	5.3	16.7	12.7	0.00227	26.2	25.9
8-Jun-18	1408	21.6	20.0	5.4	14.6	13.0	0.00128	22.9	22.7

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*



## **Atterberg Limits/ Identification of Fines**



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
B4A-4A	43	20	23	CL
B4A-24A	27	16	11	CL
B5A-9A	---	---	---	ML
B6A-19A	51	22	29	CH
B6A-20-40 (1+2)	28	17	11	CL
B7A-39A	---	---	---	ML
B7A-0-20 (1+2)	29	15	14	CL
B7A-40-60 (1+2)	37	16	21	CL
B8-9A	54	24	30	CH
B8-24A	67	24	43	CH
B8-34A	---	---	---	ML
B9-9A	52	23	29	CH
B9-39A	---	---	---	ML
B9-20-35 (1+2)	55	21	34	CH
B10-4A	31	15	16	CL
B10-39A	56	21	35	CH
B10-10-25 (1+2)	45	16	29	CL
B11-14A	27	15	12	CL
B11-29B	31	17	14	CL
B11-39A	---	---	---	ML
B11-0-10 (1+2)	30	16	14	CL

--- = Soil requires visual-manual classification due to non-plasticity



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-4A  
Project Name: NECR Jetty '18  
Depth: 5'-5.5'  
Test Date: 25-May-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	28	21
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	125.35	123.64	128.09
Weight of pan plus dry soil (g)	122.22	120.45	124.12
Weight of pan (g):	114.25	112.84	115.11
Gravimetric moisture content (% g/g):	39.27	41.92	44.06
Liquid Limit:	43		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	124.12	124.12
Weight of pan plus dry soil (g)	122.95	122.83
Weight of pan (g):	117.13	116.40
Gravimetric moisture content (% g/g):	20.10	20.06
Plastic Limit:	20	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 43  
Plastic Limit: 20  
Plasticity Index: 23  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garcia  
Checked by: J. Hines





## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-24A  
Project Name: NECR Jetty '18  
Depth: 25'-25.5'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	34	25	18
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	125.72	131.18	128.01
Weight of pan plus dry soil (g):	123.22	127.87	124.64
Weight of pan (g):	113.46	115.77	113.09
Gravimetric moisture content (% g/g):	25.61	27.36	29.18
Liquid Limit:	27		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	124.39	127.53
Weight of pan plus dry soil (g):	123.16	126.04
Weight of pan (g):	115.28	116.62
Gravimetric moisture content (% g/g):	15.61	15.82
Plastic Limit:	16	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 27  
Plastic Limit: 16  
Plasticity Index: 11  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## **Data for Description and Identification of Fines (Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B5A-9A  
*Project:* NECR Jetty '18  
*Depth:* 10'-10.5'  
*Test Date:* 7-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

### **Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

### **Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B6A-19A  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-20.5'  
*Test Date:* 8-Jun-18

### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	25	18
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	124.91	123.71	124.76
<i>Weight of pan plus dry soil (g)</i>	120.98	120.20	120.76
<i>Weight of pan (g):</i>	112.97	113.35	113.37
<i>Gravimetric moisture content (% g/g):</i>	49.06	51.24	54.13
<i>Liquid Limit:</i>	51		

### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	124.81	128.06
<i>Weight of pan plus dry soil (g)</i>	123.21	126.17
<i>Weight of pan (g):</i>	116.09	117.65
<i>Gravimetric moisture content (% g/g):</i>	22.47	22.18
<i>Plastic Limit:</i>	22	

## **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 51  
*Plastic Limit:* 22  
*Plasticity Index:* 29  
*Classification:* CH

### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-20-40 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-40'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	19
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.78	126.16	129.84
Weight of pan plus dry soil (g)	124.43	123.20	127.46
Weight of pan (g):	115.70	112.86	119.34
Gravimetric moisture content (% g/g):	26.92	28.63	29.31
Liquid Limit:	28		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	127.08	121.62
Weight of pan plus dry soil (g)	125.69	120.27
Weight of pan (g):	117.41	112.26
Gravimetric moisture content (% g/g):	16.79	16.85
Plastic Limit:	17	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 28  
Plastic Limit: 17  
Plasticity Index: 11  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## **Data for Description and Identification of Fines (Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-39A  
*Project:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 7-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

### **Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

### **Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

### **Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines





## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.30	128.60	129.26
Weight of pan plus dry soil (g):	123.03	125.44	125.82
Weight of pan (g):	110.57	114.24	114.49
Gravimetric moisture content (% g/g):	26.24	28.21	30.36
Liquid Limit:	29		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	121.72	125.62
Weight of pan plus dry soil (g):	120.54	124.14
Weight of pan (g):	112.52	113.98
Gravimetric moisture content (% g/g):	14.71	14.57
Plastic Limit:	15	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 29  
Plastic Limit: 15  
Plasticity Index: 14  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'  
Test Date: 11-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	33	25	18
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	122.53	126.19	132.85
Weight of pan plus dry soil (g):	119.39	122.98	127.78
Weight of pan (g):	110.57	114.24	114.49
Gravimetric moisture content (% g/g):	35.60	36.73	38.15
Liquid Limit:	37		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	120.95	123.87
Weight of pan plus dry soil (g):	119.77	122.49
Weight of pan (g):	112.52	113.98
Gravimetric moisture content (% g/g):	16.28	16.22
Plastic Limit:	16	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 37  
Plastic Limit: 16  
Plasticity Index: 21  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B8-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'  
*Test Date:* 11-Jun-18

### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	25	17
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	125.08	123.29	135.59
<i>Weight of pan plus dry soil (g):</i>	121.84	119.63	129.77
<i>Weight of pan (g):</i>	115.70	112.86	119.34
<i>Gravimetric moisture content (% g/g):</i>	52.77	54.06	55.80
<i>Liquid Limit:</i>	54		

### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	126.16	120.15
<i>Weight of pan plus dry soil (g):</i>	124.45	118.61
<i>Weight of pan (g):</i>	117.41	112.26
<i>Gravimetric moisture content (% g/g):</i>	24.29	24.25
<i>Plastic Limit:</i>	24	

## **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 54  
*Plastic Limit:* 24  
*Plasticity Index:* 30  
*Classification:* CH

### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



*Daniel B. Stephens & Associates, Inc.*

### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B8-24A  
*Project Name:* NECR Jetty '18  
*Depth:* 25'-25.5'  
*Test Date:* 8-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	35	26	20
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	121.26	126.02	124.94
<i>Weight of pan plus dry soil (g):</i>	117.02	121.33	120.69
<i>Weight of pan (g):</i>	110.52	114.24	114.49
<i>Gravimetric moisture content (% g/g):</i>	65.23	66.15	68.55
<i>Liquid Limit:</i>	67		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	122.14	123.79
<i>Weight of pan plus dry soil (g):</i>	120.28	121.89
<i>Weight of pan (g):</i>	112.52	113.98
<i>Gravimetric moisture content (% g/g):</i>	23.97	24.02
<i>Plastic Limit:</i>	24	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 67  
*Plastic Limit:* 24  
*Plasticity Index:* 43  
*Classification:* CH

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-34A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B8-34A  
*Project:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 7-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'  
*Test Date:* 11-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	26	20
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	125.35	126.58	132.39
<i>Weight of pan plus dry soil (g)</i>	121.22	122.04	125.72
<i>Weight of pan (g):</i>	112.97	113.35	113.37
<i>Gravimetric moisture content (% g/g):</i>	50.06	52.24	54.01
<i>Liquid Limit:</i>	52		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	127.01	129.01
<i>Weight of pan plus dry soil (g)</i>	124.95	126.87
<i>Weight of pan (g):</i>	116.09	117.65
<i>Gravimetric moisture content (% g/g):</i>	23.25	23.21
<i>Plastic Limit:</i>	23	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 52  
*Plastic Limit:* 23  
*Plasticity Index:* 29  
*Classification:* CH

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



*Daniel B. Stephens & Associates, Inc.*

### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 7-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>			
<i>Pan number:</i>			
<i>Weight of pan plus moist soil (g):</i>			
<i>Weight of pan plus dry soil (g)</i>			
<i>Weight of pan (g):</i>			
<i>Gravimetric moisture content (% g/g):</i>	---	---	---
<i>Liquid Limit:</i>	---		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>		
<i>Weight of pan plus moist soil (g):</i>		
<i>Weight of pan plus dry soil (g)</i>		
<i>Weight of pan (g):</i>		
<i>Gravimetric moisture content (% g/g):</i>	---	---
<i>Plastic Limit:</i>	---	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* ---  
*Plastic Limit:* ---  
*Plasticity Index:* ---  
*Classification (Visual Method):* ML

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines





**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-39A  
*Project:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 7-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

**Preliminary Identification:**

Dry Strength: Low  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'  
Test Date: 8-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	32	26	19
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	128.01	126.70	124.24
Weight of pan plus dry soil (g)	124.38	122.98	119.90
Weight of pan (g):	117.59	116.23	112.26
Gravimetric moisture content (% g/g):	53.46	55.11	56.81
Liquid Limit:	55		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	125.00	125.83
Weight of pan plus dry soil (g)	123.49	124.21
Weight of pan (g):	116.39	116.57
Gravimetric moisture content (% g/g):	21.27	21.20
Plastic Limit:	21	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 55  
Plastic Limit: 21  
Plasticity Index: 34  
Classification: CH

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-4A  
*Project Name:* NECR Jetty '18  
*Depth:* 5'-5.5'  
*Test Date:* 6-Jun-18

### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	25	18
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	124.25	125.97	127.67
<i>Weight of pan plus dry soil (g):</i>	121.70	123.00	124.18
<i>Weight of pan (g):</i>	112.97	113.35	113.37
<i>Gravimetric moisture content (% g/g):</i>	29.21	30.78	32.28
<i>Liquid Limit:</i>	31		

### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	124.93	127.15
<i>Weight of pan plus dry soil (g):</i>	123.78	125.95
<i>Weight of pan (g):</i>	116.09	117.65
<i>Gravimetric moisture content (% g/g):</i>	14.95	14.46
<i>Plastic Limit:</i>	15	

## **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 31  
*Plastic Limit:* 15  
*Plasticity Index:* 16  
*Classification:* CL

### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 11-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	34	27	21
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.92	124.52	125.51
Weight of pan plus dry soil (g)	122.10	122.07	121.01
Weight of pan (g):	113.14	117.65	113.15
Gravimetric moisture content (% g/g):	53.79	55.43	57.25
Liquid Limit:	56		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	121.43	125.24
Weight of pan plus dry soil (g)	119.89	123.88
Weight of pan (g):	112.63	117.42
Gravimetric moisture content (% g/g):	21.21	21.05
Plastic Limit:	21	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 56  
Plastic Limit: 21  
Plasticity Index: 35  
Classification: CH

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	34	24	15
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	131.38	128.69	131.93
Weight of pan plus dry soil (g):	126.91	124.86	127.66
Weight of pan (g):	116.79	116.44	118.65
Gravimetric moisture content (% g/g):	44.17	45.49	47.39
Liquid Limit:	45		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	121.91	124.01
Weight of pan plus dry soil (g):	120.81	123.06
Weight of pan (g):	114.08	117.13
Gravimetric moisture content (% g/g):	16.34	16.02
Plastic Limit:	16	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 45  
Plastic Limit: 16  
Plasticity Index: 29  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-14A  
*Project Name:* NECR Jetty '18  
*Depth:* 15'-15.5'  
*Test Date:* 7-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	24	16
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	130.57	131.23	133.73
<i>Weight of pan plus dry soil (g)</i>	127.76	128.09	130.01
<i>Weight of pan (g):</i>	116.57	116.64	116.98
<i>Gravimetric moisture content (% g/g):</i>	25.11	27.42	28.55
<i>Liquid Limit:</i>	27		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	125.16	126.72
<i>Weight of pan plus dry soil (g)</i>	124.01	125.38
<i>Weight of pan (g):</i>	116.39	116.58
<i>Gravimetric moisture content (% g/g):</i>	15.09	15.23
<i>Plastic Limit:</i>	15	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 27  
*Plastic Limit:* 15  
*Plasticity Index:* 12  
*Classification:* CL

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-29B  
Project Name: NECR Jetty '18  
Depth: 29.5'-30'  
Test Date: 11-Jun-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	24	16
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	132.43	126.95	128.26
Weight of pan plus dry soil (g):	130.52	124.11	124.48
Weight of pan (g):	124.06	115.15	113.21
Gravimetric moisture content (% g/g):	29.57	31.70	33.54
Liquid Limit:	31		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	127.85	123.81
Weight of pan plus dry soil (g):	126.38	122.21
Weight of pan (g):	117.63	112.69
Gravimetric moisture content (% g/g):	16.80	16.81
Plastic Limit:	17	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 31  
Plastic Limit: 17  
Plasticity Index: 14  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 8-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines





**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-39A  
*Project:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 8-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Grayish Brown (2.5Y 4/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

**Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-0-10 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-10'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	33	24	15
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	136.38	127.31	126.60
Weight of pan plus dry soil (g):	133.65	124.43	123.30
Weight of pan (g):	124.06	115.15	113.21
Gravimetric moisture content (% g/g):	28.47	31.03	32.71
Liquid Limit:	30		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	127.74	121.40
Weight of pan plus dry soil (g):	126.33	120.18
Weight of pan (g):	117.63	112.69
Gravimetric moisture content (% g/g):	16.21	16.29
Plastic Limit:	16	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 30  
Plastic Limit: 16  
Plasticity Index: 14  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines

## **Specific Gravity**



### Summary of Specific Gravity Tests

Sample Number	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity <sup>1</sup>
B4A-4A	2.66	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.66
B4A-24A	2.68	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.68
B5A-9A	2.63	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.63
B6A-19A	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B6A-20-40 (1+2)	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B7A-0-20 (1+2)	2.67	<4.75 mm	99.3%	NA	>4.75 mm	0.7%	2.67
B7A-40-60 (1+2)	2.67	<4.75 mm	99.4%	NA	>4.75 mm	0.6%	2.67
B8-9A	2.67	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.67
B8-34A	2.67	<4.75 mm	99.8%	NA	>4.75 mm	0.2%	2.67
B9-9A	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B9-39A	2.67	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.67
B9-20-35 (1+2)	2.71	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.71
B10-4A	2.66	<4.75 mm	99.7%	NA	>4.75 mm	0.3%	2.66
B10-39A	2.68	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.68
B10-10-25 (1+2)	2.68	<4.75 mm	98.9%	NA	>4.75 mm	1.1%	2.68
B11-14A	2.66	<4.75 mm	98.9%	NA	>4.75 mm	1.1%	2.66
B11-29B	2.67	<4.75 mm	99.7%	NA	>4.75 mm	0.3%	2.67
B11-39A	2.66	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.66
B11-0-10 (1+2)	2.66	<4.75 mm	99.1%	NA	>4.75 mm	0.9%	2.66

<sup>1</sup>Based on the <4.75mm material

NA = Not Applicable since specified fraction is less than 5% of composite sample mass

NR = Test not Requested



### Data for Specific Gravity of Sample: B4A-4A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B4A-4A  
Project Name: NECR Jetty '18  
Depth: 5'-5.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	90.96	90.89
Weight of pycnometer filled w/soil (g):	140.18	139.29
Weight of pycnometer filled w/soil & water (g):	370.87	370.35
Weight of pycnometer filled w/water (g):	340.11	340.12
Specific Gravity (g/g):	2.67	2.66
Observed temperature (°C):	22.80	22.60
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.66	2.66
Average Specific Gravity (g/g):	2.66	
Average Particle Density (g/cm <sup>3</sup> ):	2.66	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.66**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.66**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



## Data for Specific Gravity of Sample: B4A-24A

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B4A-24A  
 Project Name: NECR Jetty '18  
 Depth: 25'-25.5'

### ASTM D854 (<4.75mm Fraction)

	Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0		
Percent of Bulk Sample (% g/g):	100.0		
	Trial 1	Trial 2	
Weight of pycnometer filled w/air (g):	90.84	90.97	
Weight of pycnometer filled w/soil (g):	140.06	142.75	
Weight of pycnometer filled w/soil & water (g):	370.87	372.80	
Weight of pycnometer filled w/water (g):	340.00	340.34	
Specific Gravity (g/g):	2.68	2.68	
Observed temperature (°C):	23.10	23.10	
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9975	0.9975	
Correction factor, K:	0.9993	0.9993	
Specific Gravity at 20°C (g/g):	2.68	2.68	
Average Specific Gravity (g/g):	2.68		
Average Particle Density (g/cm <sup>3</sup> ):	2.68		

### ASTM C127 (>4.75mm) Fraction

	Test Date:	NA	Test unnecessary since
Percent of Test Sample (% g/g):	0.0		fraction is less than 5% of
Percent of Bulk Sample (% g/g):	0.0		bulk sample mass
Tare Weight (g):	---		
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---		
Saturated Apparent mass in Water & Tare (g):	---		
Oven Dry (OD) mass in Air & Tare (g):	---		
SSD Specific Gravity (g/g):	---		
Apparent Specific Gravity (g/g):	---		
OD Specific Gravity (g/g):	---		
Percent Absorption (%):	---		
Observed Temperature (°C):	---		
Density of water at observed temperature (g/m <sup>3</sup> ):	---		
Correction Factor, K:	---		
Specific Gravity (Apparent), Corrected to 20° C:	---		
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---		

**Specific Gravity (Apparent) of Sample\*: 2.68**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.68**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



### Data for Specific Gravity of Sample: B5A-9A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	90.93	88.30
Weight of pycnometer filled w/soil (g):	141.96	138.83
Weight of pycnometer filled w/soil & water (g):	371.83	368.96
Weight of pycnometer filled w/water (g):	340.21	337.61
Specific Gravity (g/g):	2.63	2.63
Observed temperature (°C):	22.90	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.63	2.63
Average Specific Gravity (g/g):	2.63	
Average Particle Density (g/cm <sup>3</sup> ):	2.63	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.63</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.63	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B6A-19A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	22-Jun-18	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	92.38	89.53
Weight of pycnometer filled w/soil (g):	142.42	139.90
Weight of pycnometer filled w/soil & water (g):	373.09	370.49
Weight of pycnometer filled w/water (g):	341.60	338.85
Specific Gravity (g/g):	2.70	2.69
Observed temperature (°C):	22.45	22.05
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9977	0.9978
Correction factor, K:	0.9995	0.9996
Specific Gravity at 20°C (g/g):	2.70	2.69
Average Specific Gravity (g/g):	2.69	
Average Particle Density (g/cm <sup>3</sup> ):	2.69	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.69**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.69**

\* Based on <4.75mm Fraction

Laboratory analysis by: D. O'Dowd  
Data entered by: M. Garica  
Checked by: J. Hines





### Data for Specific Gravity of Sample: B6A-20-40 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-20-40 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-40'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	90.43	99.58
Weight of pycnometer filled w/soil (g):	142.54	150.27
Weight of pycnometer filled w/soil & water (g):	372.49	380.65
Weight of pycnometer filled w/water (g):	339.77	348.77
Specific Gravity (g/g):	2.69	2.69
Observed temperature (°C):	22.80	22.40
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9977
Correction factor, K:	0.9994	0.9995
Specific Gravity at 20°C (g/g):	2.69	2.69
Average Specific Gravity (g/g):	2.69	
Average Particle Density (g/cm <sup>3</sup> ):	2.68	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.69</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.68	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B7A-0-20 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	99.3	
Percent of Bulk Sample (% g/g):	99.3	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	89.25	90.51
Weight of pycnometer filled w/soil (g):	137.24	139.46
Weight of pycnometer filled w/soil & water (g):	368.47	370.45
Weight of pycnometer filled w/water (g):	338.43	339.81
Specific Gravity (g/g):	2.67	2.67
Observed temperature (°C):	23.00	23.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9975	0.9975
Correction factor, K:	0.9993	0.9993
Specific Gravity at 20°C (g/g):	2.67	2.67
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.7	
Percent of Bulk Sample (% g/g):	0.7	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.67**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.67**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B7A-40-60 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	99.4	
Percent of Bulk Sample (% g/g):	99.4	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.68	92.07
Weight of pycnometer filled w/soil (g):	139.38	138.19
Weight of pycnometer filled w/soil & water (g):	371.53	370.23
Weight of pycnometer filled w/water (g):	342.94	341.32
Specific Gravity (g/g):	2.67	2.68
Observed temperature (°C):	22.75	22.65
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.67	2.68
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.6	
Percent of Bulk Sample (% g/g):	0.6	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.67**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.67**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B8-9A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.58	91.30
Weight of pycnometer filled w/soil (g):	144.83	141.36
Weight of pycnometer filled w/soil & water (g):	374.80	371.86
Weight of pycnometer filled w/water (g):	342.74	340.49
Specific Gravity (g/g):	2.67	2.68
Observed temperature (°C):	22.75	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.67	2.68
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.67**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.67**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B8-34A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B8-34A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	99.8	
Percent of Bulk Sample (% g/g):	99.8	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	89.08	91.35
Weight of pycnometer filled w/soil (g):	139.40	141.67
Weight of pycnometer filled w/soil & water (g):	369.85	372.18
Weight of pycnometer filled w/water (g):	338.39	340.71
Specific Gravity (g/g):	2.67	2.67
Observed temperature (°C):	23.05	23.10
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9975	0.9975
Correction factor, K:	0.9993	0.9993
Specific Gravity at 20°C (g/g):	2.67	2.67
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.66	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.2	
Percent of Bulk Sample (% g/g):	0.2	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.67**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.66**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



## Data for Specific Gravity of Sample: B9-9A

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B9-9A  
 Project Name: NECR Jetty '18  
 Depth: 10'-10.5'

### ASTM D854 (<4.75mm Fraction)

	Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0		
Percent of Bulk Sample (% g/g):	100.0		
	Trial 1	Trial 2	
Weight of pycnometer filled w/air (g):	88.25	90.57	
Weight of pycnometer filled w/soil (g):	140.37	135.98	
Weight of pycnometer filled w/soil & water (g):	370.32	368.37	
Weight of pycnometer filled w/water (g):	337.56	339.85	
Specific Gravity (g/g):	2.69	2.69	
Observed temperature (°C):	22.80	22.30	
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9977	
Correction factor, K:	0.9994	0.9995	
Specific Gravity at 20°C (g/g):	2.69	2.69	
Average Specific Gravity (g/g):	2.69		
Average Particle Density (g/cm <sup>3</sup> ):	2.68		

### ASTM C127 (>4.75mm) Fraction

	Test Date:	NA	Test unnecessary since
Percent of Test Sample (% g/g):	0.0		fraction is less than 5% of
Percent of Bulk Sample (% g/g):	0.0		bulk sample mass
Tare Weight (g):	---		
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---		
Saturated Apparent mass in Water & Tare (g):	---		
Oven Dry (OD) mass in Air & Tare (g):	---		
SSD Specific Gravity (g/g):	---		
Apparent Specific Gravity (g/g):	---		
OD Specific Gravity (g/g):	---		
Percent Absorption (%):	---		
Observed Temperature (°C):	---		
Density of water at observed temperature (g/m <sup>3</sup> ):	---		
Correction Factor, K:	---		
Specific Gravity (Apparent), Corrected to 20° C:	---		
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---		

**Specific Gravity (Apparent) of Sample\*: 2.69**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.68**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



### Data for Specific Gravity of Sample: B9-39A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.68	94.99
Weight of pycnometer filled w/soil (g):	142.88	142.09
Weight of pycnometer filled w/soil & water (g):	373.69	373.67
Weight of pycnometer filled w/water (g):	342.88	344.18
Specific Gravity (g/g):	2.68	2.68
Observed temperature (°C):	22.90	22.80
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.67	2.67
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.67**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.67**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B9-20-35 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	91.50	93.69
Weight of pycnometer filled w/soil (g):	141.16	147.42
Weight of pycnometer filled w/soil & water (g):	372.01	376.81
Weight of pycnometer filled w/water (g):	340.62	342.89
Specific Gravity (g/g):	2.72	2.71
Observed temperature (°C):	22.95	22.25
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9977
Correction factor, K:	0.9993	0.9995
Specific Gravity at 20°C (g/g):	2.72	2.71
Average Specific Gravity (g/g):	2.71	
Average Particle Density (g/cm <sup>3</sup> ):	2.71	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.71**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.71**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines





### Data for Specific Gravity of Sample: B10-4A

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B10-4A  
 Project Name: NECR Jetty '18  
 Depth: 5'-5.5'

#### ASTM D854 (<4.75mm Fraction)

	Test Date:	11-Jun-18	
	Percent of Test Sample (% g/g):	99.7	
	Percent of Bulk Sample (% g/g):	99.7	
		<i>Trial 1</i>	<i>Trial 2</i>
	Weight of pycnometer filled w/air (g):	90.89	92.13
	Weight of pycnometer filled w/soil (g):	142.18	141.90
	Weight of pycnometer filled w/soil & water (g):	372.26	372.40
	Weight of pycnometer filled w/water (g):	340.24	341.31
	Specific Gravity (g/g):	2.66	2.66
	Observed temperature (°C):	23.10	23.10
	Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9975	0.9975
	Correction factor, K:	0.9993	0.9993
	Specific Gravity at 20°C (g/g):	2.66	2.66
	Average Specific Gravity (g/g):	2.66	
	Average Particle Density (g/cm <sup>3</sup> ):	2.66	

#### ASTM C127 (>4.75mm) Fraction

	Test Date:	NA	Test unnecessary since
	Percent of Test Sample (% g/g):	0.3	fraction is less than 5% of
	Percent of Bulk Sample (% g/g):	0.3	bulk sample mass
	Tare Weight (g):	---	
	Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
	Saturated Apparent mass in Water & Tare (g):	---	
	Oven Dry (OD) mass in Air & Tare (g):	---	
	SSD Specific Gravity (g/g):	---	
	Apparent Specific Gravity (g/g):	---	
	OD Specific Gravity (g/g):	---	
	Percent Absorption (%):	---	
	Observed Temperature (°C):	---	
	Density of water at observed temperature (g/m <sup>3</sup> ):	---	
	Correction Factor, K:	---	
	Specific Gravity (Apparent), Corrected to 20° C:	---	
	Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.66**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.66**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



### Data for Specific Gravity of Sample: B10-39A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	92.37	92.44
Weight of pycnometer filled w/soil (g):	138.65	141.42
Weight of pycnometer filled w/soil & water (g):	370.54	372.46
Weight of pycnometer filled w/water (g):	341.50	341.75
Specific Gravity (g/g):	2.68	2.68
Observed temperature (°C):	22.90	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.68	2.68
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm <sup>3</sup> ):	2.68	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.68</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.68	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B10-10-25 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	98.9	
Percent of Bulk Sample (% g/g):	98.9	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	94.22	93.97
Weight of pycnometer filled w/soil (g):	145.98	143.85
Weight of pycnometer filled w/soil & water (g):	375.86	374.41
Weight of pycnometer filled w/water (g):	343.40	343.16
Specific Gravity (g/g):	2.68	2.68
Observed temperature (°C):	22.70	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.68	2.68
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	1.1	
Percent of Bulk Sample (% g/g):	1.1	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.68**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.67**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



## Data for Specific Gravity of Sample: B11-14A

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B11-14A  
 Project Name: NECR Jetty '18  
 Depth: 15'-15.5'

### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	98.9	
Percent of Bulk Sample (% g/g):	98.9	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.61	92.32
Weight of pycnometer filled w/soil (g):	146.83	143.11
Weight of pycnometer filled w/soil & water (g):	375.98	373.21
Weight of pycnometer filled w/water (g):	342.71	341.48
Specific Gravity (g/g):	2.67	2.67
Observed temperature (°C):	22.80	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.67	2.66
Average Specific Gravity (g/g):	2.66	
Average Particle Density (g/cm <sup>3</sup> ):	2.66	

### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	1.1	
Percent of Bulk Sample (% g/g):	1.1	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.66**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.66**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



## Data for Specific Gravity of Sample: B11-29B

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B11-29B  
 Project Name: NECR Jetty '18  
 Depth: 29.5'-30'

### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	99.7	
Percent of Bulk Sample (% g/g):	99.7	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	89.94	90.89
Weight of pycnometer filled w/soil (g):	142.40	140.58
Weight of pycnometer filled w/soil & water (g):	371.99	371.20
Weight of pycnometer filled w/water (g):	339.20	340.13
Specific Gravity (g/g):	2.67	2.67
Observed temperature (°C):	23.10	23.10
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9975	0.9975
Correction factor, K:	0.9993	0.9993
Specific Gravity at 20°C (g/g):	2.67	2.67
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.66	

### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.3	
Percent of Bulk Sample (% g/g):	0.3	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.67**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.66**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



### Data for Specific Gravity of Sample: B11-39A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.56	92.20
Weight of pycnometer filled w/soil (g):	144.25	142.49
Weight of pycnometer filled w/soil & water (g):	374.36	372.76
Weight of pycnometer filled w/water (g):	342.71	341.41
Specific Gravity (g/g):	2.66	2.66
Observed temperature (°C):	22.85	22.60
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.66	2.65
Average Specific Gravity (g/g):	2.66	
Average Particle Density (g/cm <sup>3</sup> ):	2.65	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.66**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.65**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B11-0-10 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-0-10 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-10'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	99.1	
Percent of Bulk Sample (% g/g):	99.1	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.55	89.53
Weight of pycnometer filled w/soil (g):	144.68	139.70
Weight of pycnometer filled w/soil & water (g):	374.75	370.11
Weight of pycnometer filled w/water (g):	342.80	338.80
Specific Gravity (g/g):	2.67	2.66
Observed temperature (°C):	22.90	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.66	2.66
Average Specific Gravity (g/g):	2.66	
Average Particle Density (g/cm <sup>3</sup> ):	2.66	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.9	
Percent of Bulk Sample (% g/g):	0.9	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.66**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.66**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines

## **Proctor Compaction**





### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
B6A-20-40 (1+2)	17.9	1.68	---	---
B7A-0-20 (1+2)	13.7	1.83	---	---
B7A-40-60 (1+2)	15.0	1.76	---	---
B9-20-35 (1+2)	20.8	1.61	---	---
B10-10-25 (1+2)	13.8	1.85	---	---
B11-0-10 (1+2)	14.8	1.82	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 18.06
Sample Number: B6A-20-40 (1+2)	Mass of fines material (g): 36566.03
Project Name: NECR Jetty '18	Mold weight (g): 4226
Depth: 20'-40'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 11-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5866	900.73	825.18	289.66	1.52	14.11
2	5955	954.63	866.47	300.22	1.59	15.57
3	6093	929.92	830.05	270.65	1.68	17.85
4	6084	1016.02	897.59	290.43	1.65	19.51
5	6078	1056.87	919.32	286.81	1.61	21.75

Soil Fractions  
 Coarse Fraction (% g/g): 0.0  
 Fines Fraction (% g/g): 100.0

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



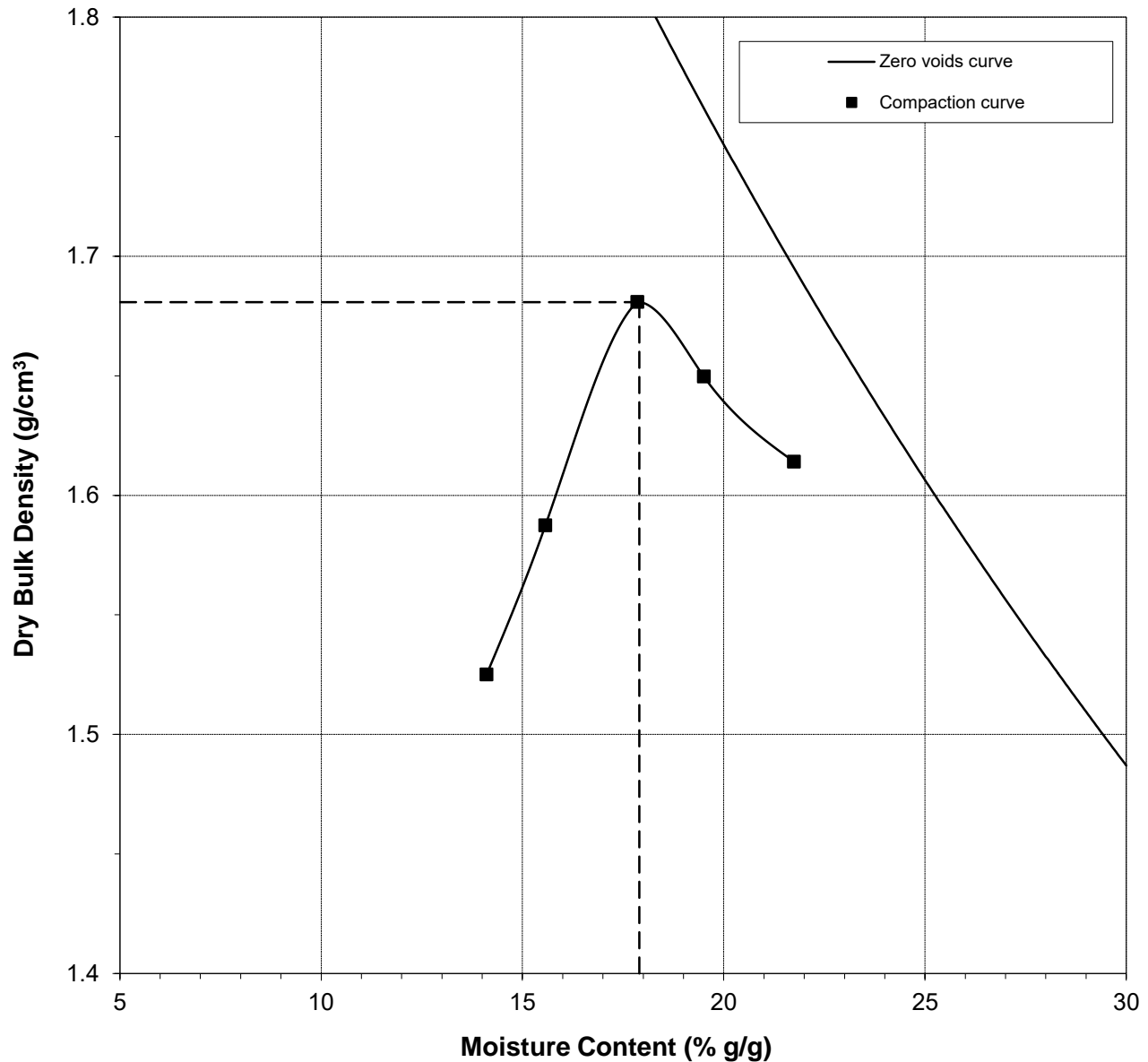
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B6A-20-40 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	17.9	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.68	---

Test Date: 11-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'  
Test Date: 11-Jun-18

Split (3/4", 3/8", #4): #4  
Mass of coarse material (g): 322.63  
Mass of fines material (g): 43025.85  
Mold weight (g): 4226  
Mold volume (cm<sup>3</sup>): 942.46  
Compaction Method: Standard A  
Preparation Method: Dry  
Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5980	1169.70	1096.92	288.45	1.71	9.00
2	6060	1150.34	1066.77	294.38	1.76	10.82
3	6168	1009.96	925.40	267.81	1.83	12.86
4	6197	1003.64	908.75	267.60	1.82	14.80
5	6135	980.40	877.20	284.08	1.73	17.40

### Soil Fractions

Coarse Fraction (% g/g): 0.7  
Fines Fraction (% g/g): 99.3

### Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



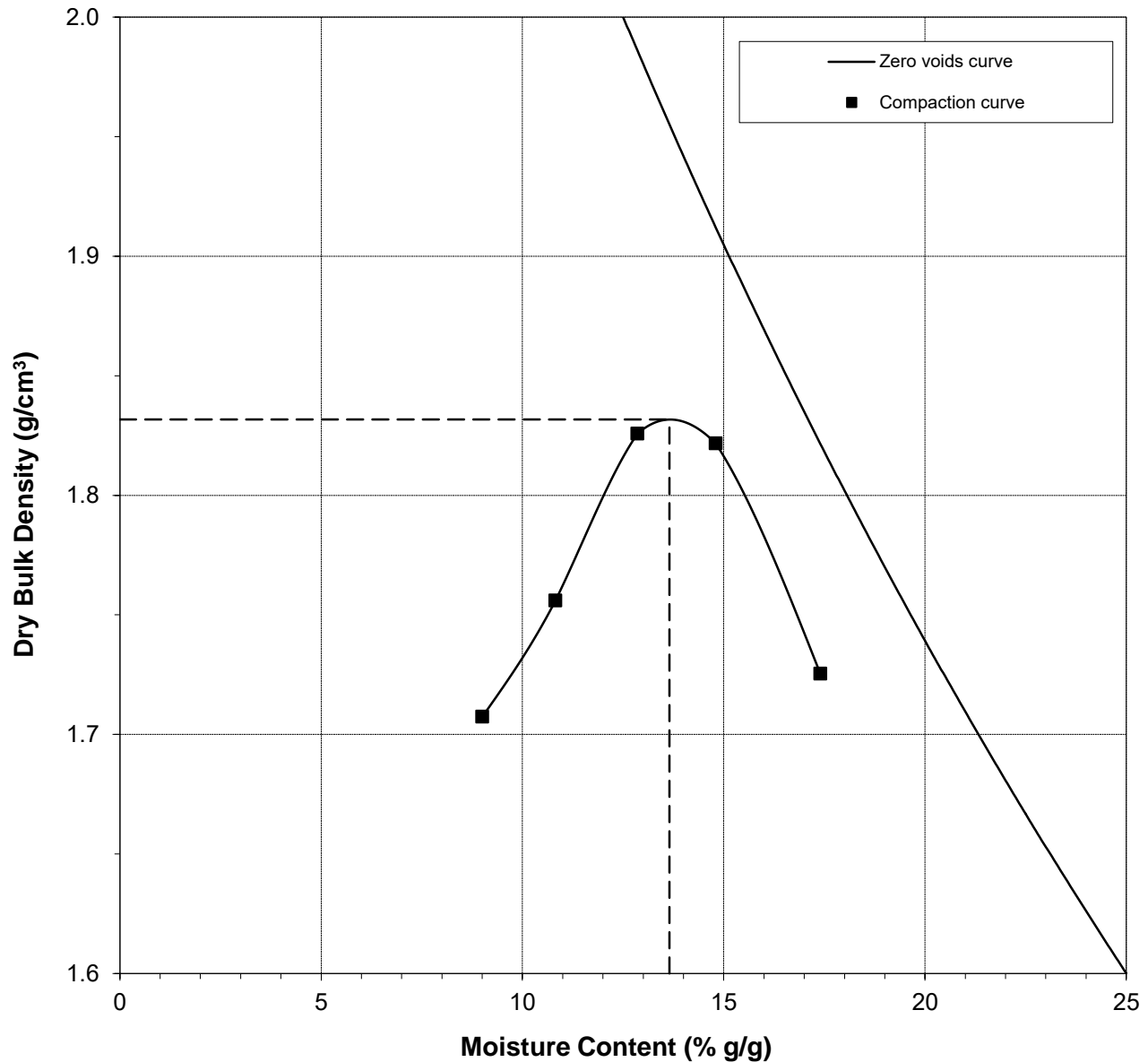
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B7A-0-20 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.7	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.83	---

Test Date: 11-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Proctor Compaction Data

<i>Job Name:</i> Stantec Consulting Services Inc.	<i>Split (3/4", 3/8", #4):</i> #4
<i>Job Number:</i> DB18.1176.00	<i>Mass of coarse material (g):</i> 208.58
<i>Sample Number:</i> B7A-40-60 (1+2)	<i>Mass of fines material (g):</i> 34479.53
<i>Project Name:</i> NECR Jetty '18	<i>Mold weight (g):</i> 4226
<i>Depth:</i> 40'-60'	<i>Mold volume (cm<sup>3</sup>):</i> 942.46
<i>Test Date:</i> 12-Jun-18	<i>Compaction Method:</i> Standard A
	<i>Preparation Method:</i> Dry
<i>As Received Moisture Content (% g/g):</i> NA	<i>Type of Rammer:</i> Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5891	1019.73	953.54	296.02	1.61	10.07
2	5975	1003.78	927.55	286.62	1.66	11.89
3	6109	953.82	872.92	301.49	1.75	14.16
4	6135	1033.05	924.64	286.96	1.73	17.00
5	6106	1066.29	943.86	293.34	1.68	18.82

### Soil Fractions

*Coarse Fraction (% g/g):* 0.6  
*Fines Fraction (% g/g):* 99.4

### Properties of Coarse Material

*Assumed particle density (g/cm<sup>3</sup>):* 2.65  
*Assumed Initial Moisture Content (% g/g):* 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



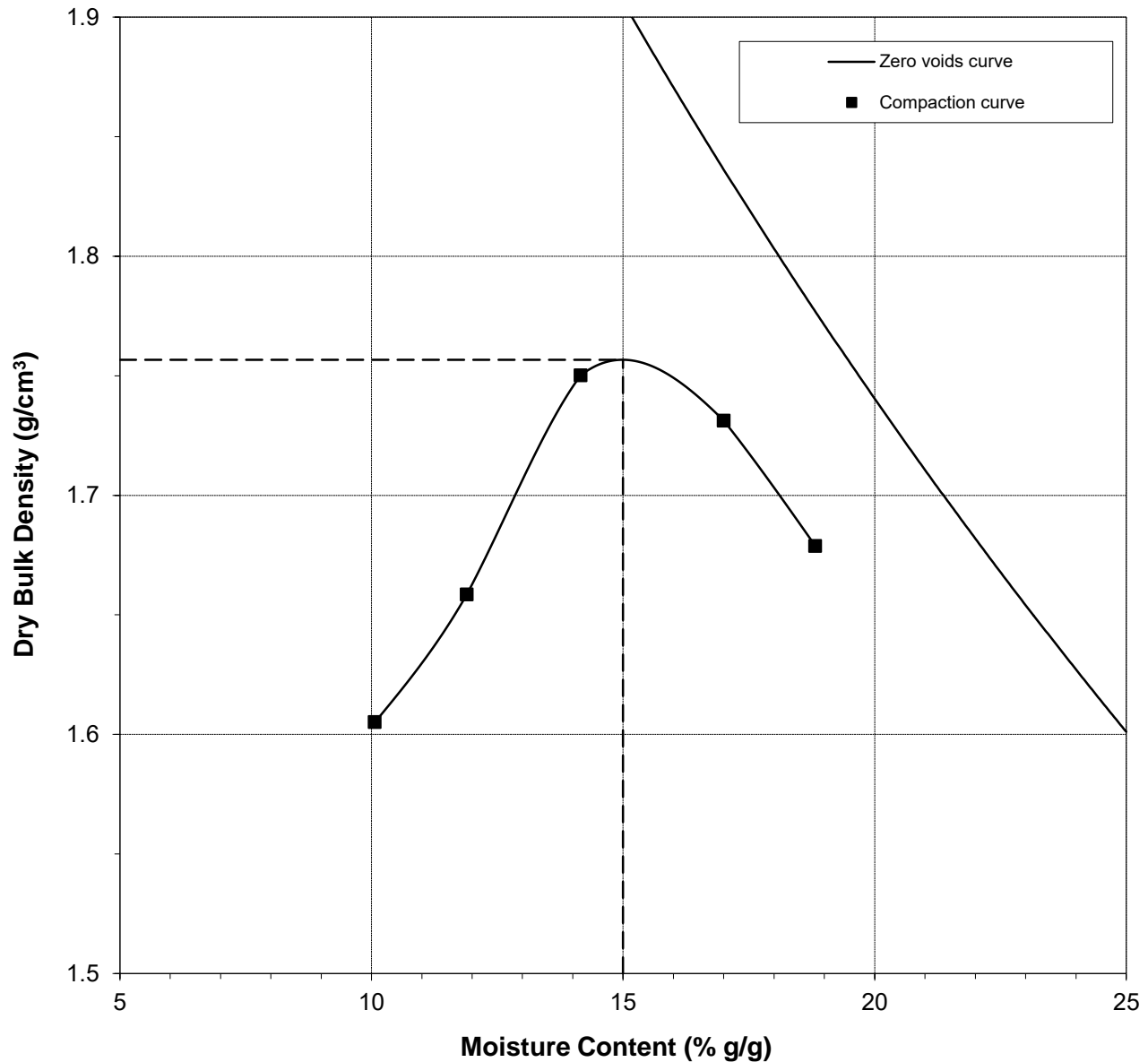
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B7A-40-60 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	15.0	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.76	---

Test Date: 12-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 13.63
Sample Number: B9-20-35 (1+2)	Mass of fines material (g): 39871.07
Project Name: NECR Jetty '18	Mold weight (g): 4227
Depth: 20'-35'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 8-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5914	1000.49	902.36	269.60	1.55	15.51
2	5972	918.60	822.86	293.44	1.57	18.08
3	6064	957.65	839.32	271.83	1.61	20.85
4	6042	1017.16	879.83	269.87	1.57	22.51
5	6025	947.73	813.10	270.66	1.53	24.82

Soil Fractions  
 Coarse Fraction (% g/g): 0.0  
 Fines Fraction (% g/g): 100.0

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines





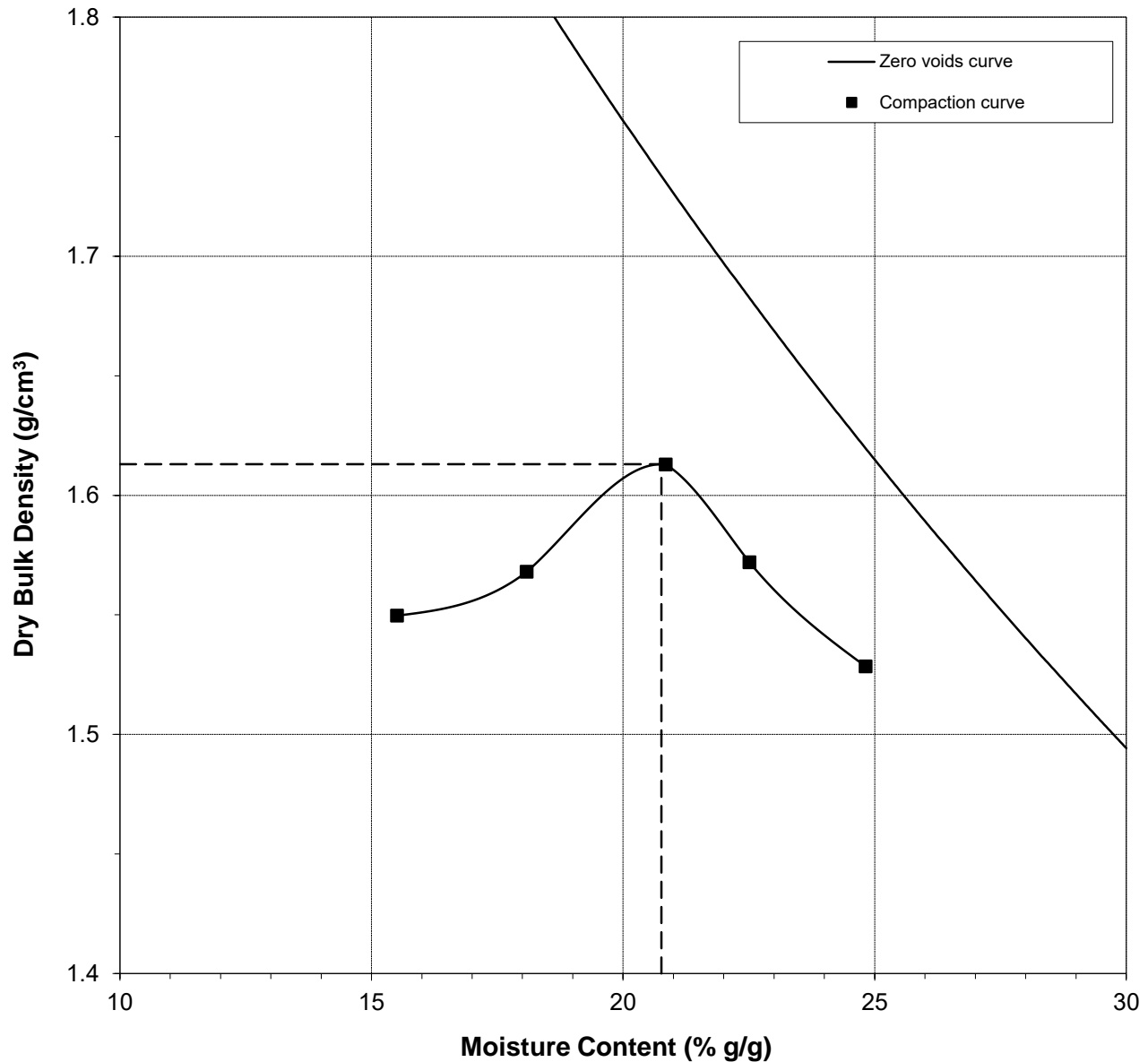
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B9-20-35 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	20.8	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.61	---

Test Date: 8-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'  
Test Date: 8-Jun-18

Split (3/4", 3/8", #4): #4  
Mass of coarse material (g): 428.86  
Mass of fines material (g): 37665.31  
Mold weight (g): 4227  
Mold volume (cm<sup>3</sup>): 942.46  
Compaction Method: Standard A  
Preparation Method: Dry  
Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6023	1029.32	959.97	283.81	1.73	10.26
2	6148	1123.31	1031.12	284.66	1.81	12.35
3	6212	1055.01	959.91	269.95	1.85	13.78
4	6207	1067.64	965.23	282.61	1.83	15.00
5	6084	948.77	838.53	268.35	1.65	19.33

### Soil Fractions

Coarse Fraction (% g/g): 1.1  
Fines Fraction (% g/g): 98.9

### Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



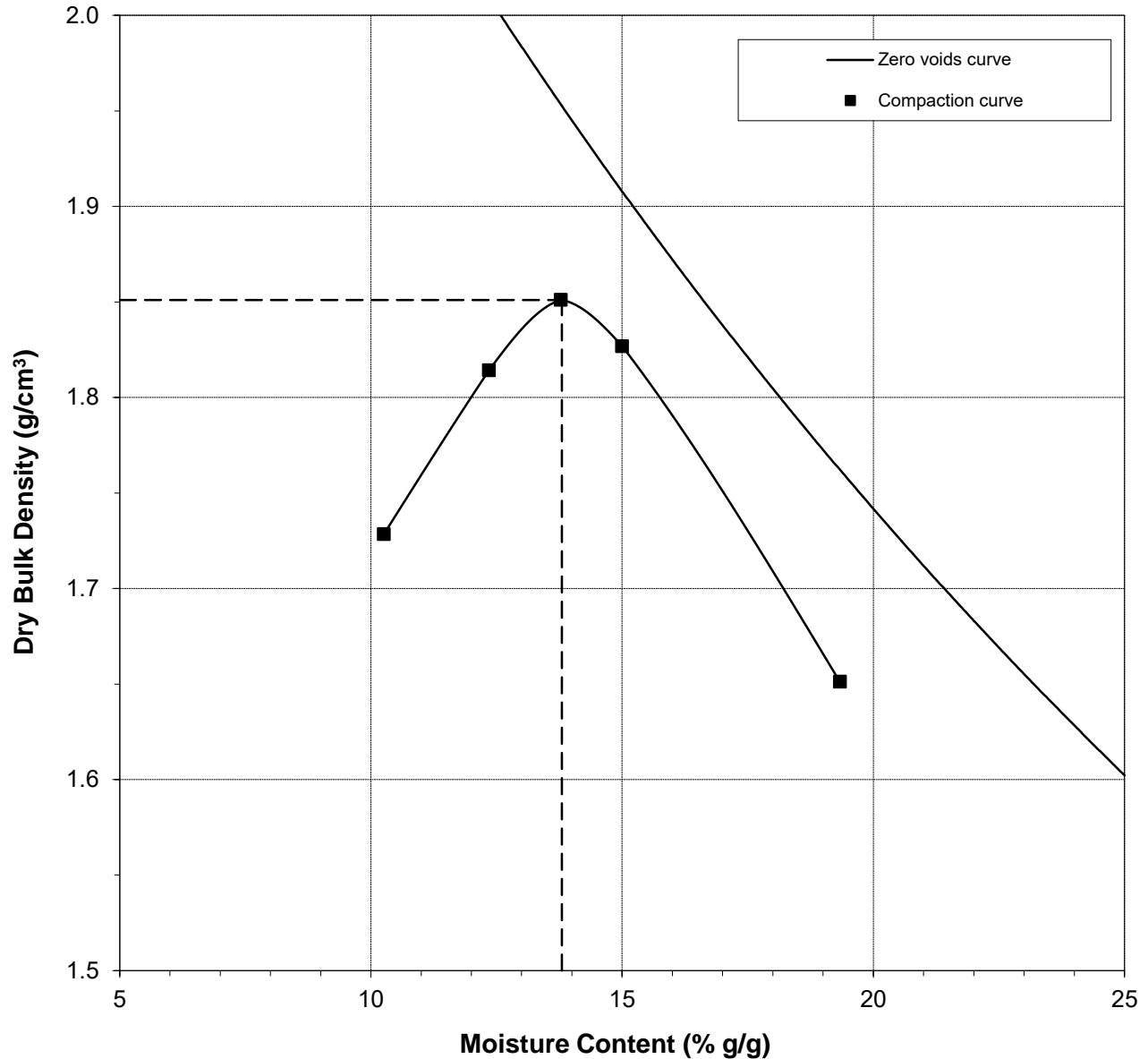
Daniel B. Stephens & Associates, Inc.

### Proctor Compaction Data Points with Fitted Curve

Sample Number: B10-10-25 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.8	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.85	---

Test Date: 8-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 385.40
Sample Number: B11-0-10 (1+2)	Mass of fines material (g): 43919.45
Project Name: NECR Jetty '18	Mold weight (g): 4226
Depth: 0'-10'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 8-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6056	1071.54	994.74	293.71	1.75	10.96
2	6158	1047.98	957.18	283.37	1.81	13.48
3	6200	1069.13	963.73	269.66	1.82	15.19
4	6139	1058.78	946.20	284.27	1.73	17.01
5	6077	924.27	818.81	268.28	1.65	19.16

Soil Fractions  
 Coarse Fraction (% g/g): 0.9  
 Fines Fraction (% g/g): 99.1

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



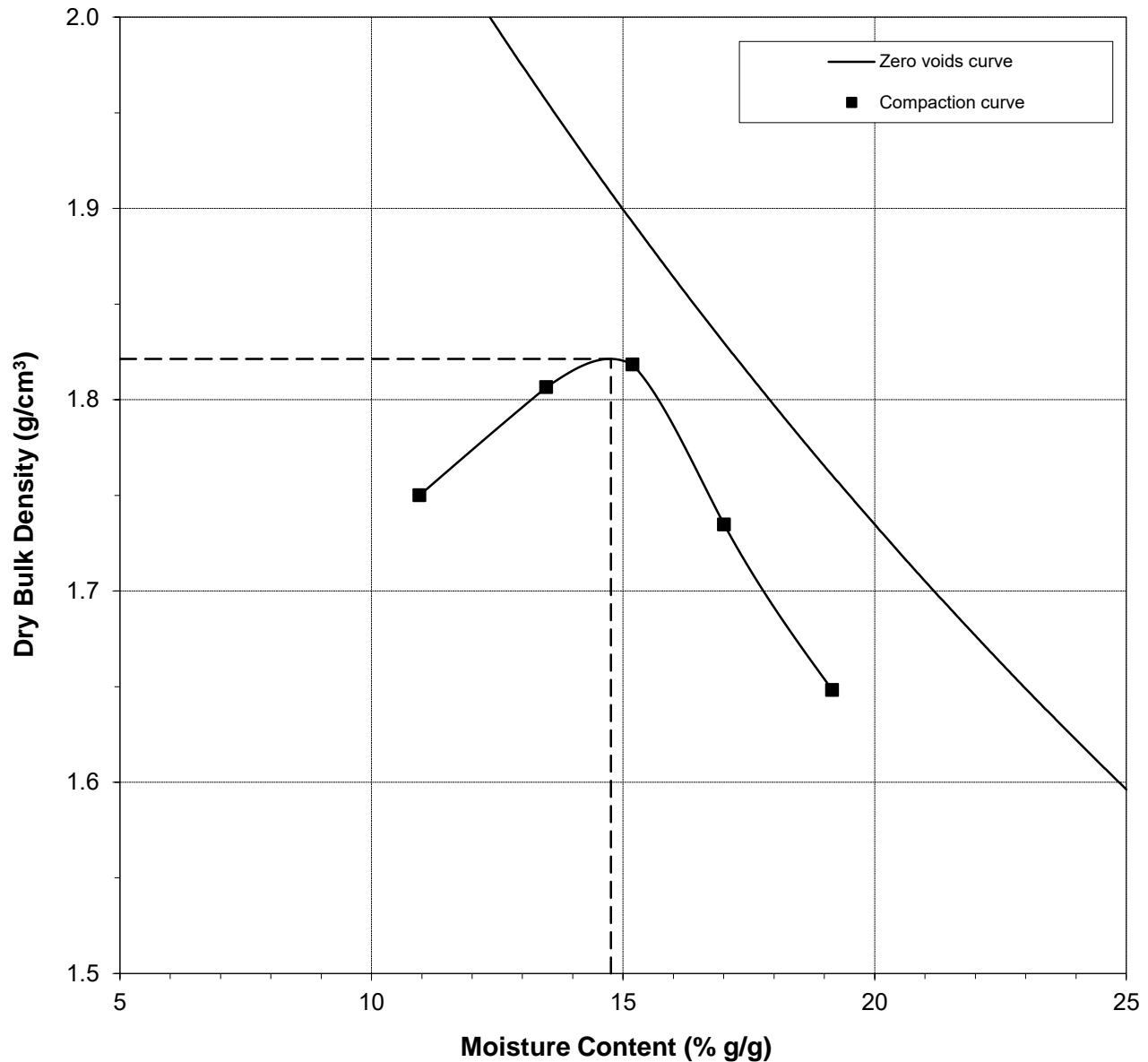
Daniel B. Stephens & Associates, Inc.

### Proctor Compaction Data Points with Fitted Curve

Sample Number: B11-0-10 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	14.8	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.82	---

Test Date: 8-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines

## **Laboratory Tests and Methods**



## **Tests and Methods**

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Specific Gravity Fine:	ASTM D854
Particle Size Analysis:	ASTM D7928, ASTM D6913
USCS (ASTM) Classification:	ASTM D7928, ASTM D6913, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Visual-Manual Description:	ASTM D2488
Standard Proctor Compaction:	ASTM D698

# **Laboratory Report for Stantec Consulting Services Inc.**

**NECR Jetty '18**

**September 13, 2018**



***Daniel B. Stephens & Associates, Inc.***

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113





September 13, 2018

Jason Cumbers  
Stantec Consulting Services Inc.  
3325 South Timberline Road Suite 150  
Fort Collins, CO 80525  
(970) 212-2755

Re: DBS&A Laboratory Report for the Stantec Consulting Services Inc. NECR Jetty '18 Project

Dear Mr. Cumbers:

Enclosed is the report for the Stantec Consulting Services Inc. NECR Jetty '18 project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Stantec Consulting Services Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.  
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines  
Laboratory Manager

Enclosure

*Daniel B. Stephens & Associates, Inc.*  
**Soil Testing & Research Laboratory**

4400 Alameda Blvd. NE, Suite C  
Albuquerque, NM 87113

505-889-7752  
FAX 505-889-0258

## Summaries



## Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>								Particle Size <sup>4</sup>				Specific Gravity <sup>5</sup>		Pinhole Dispersion	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	DH	F	C			
B5A-9A	X	X														X	X	X	X		X	X	
B5A-9A (102.7 pcf)	X	X				X	X	X		X	X			X									
B6A-19A	X	X														X	X	X	X			X	
B6A-19A (90.8 pcf)	X	X				X	X	X		X	X			X									
B7A-0-20 (1+2)																X	X	X	X			X	X
B7A-0-20 (1+2) (102.6 pcf)	X	X				X	X	X		X	X			X									
B7A-40-60 (1+2)																X	X	X	X			X	X
B7A-40-60 (1+2) (98.3 pcf)	X	X				X	X	X		X	X			X									
B9-20-35 (1+2)																X	X	X	X			X	X
B9-20-35 (1+2) (90.3 pcf)	X	X				X	X	X		X	X			X									
B10-39A																X	X	X	X			X	
B10-39A (90.3 pcf)	X	X				X	X	X		X	X			X									
B10-10-25 (1+2)																X	X	X	X		X	X	X
B10-10-25 (1+2) (103.4 pcf)	X	X				X	X	X		X	X			X									
B11-39A	X	X														X	X	X	X		X	X	
B11-39 (104.2 pcf)	X	X		X			X	X		X	X			X									

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer, DH = Double Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)



## **Notes**

### **Sample Receipt:**

Two hundred sixty three samples were hand-delivered on May 4, 2018. Six samples of the samples were each received in two full 5-gallon buckets sealed with lids, and the remaining two hundred fifty seven samples were each received in a 2" x 6" brass sleeve sealed with end caps. All samples were received in good order. Twenty three samples were selected for testing. All twenty three samples were subjected to particle size analysis testing; and, twenty one were subjected to Atterberg limits testing, nineteen were subjected to specific gravity testing, fifteen were subjected to initial properties analysis, and the six bucket samples were subjected to standard proctor compaction testing. These test results were included in the laboratory report dated June 22, 2018.

### **Sample Preparation and Testing Notes:**

Eight samples were then selected for additional testing. Initial testing results for these samples are included again in this report, in addition to the test results for the testing described below.

All eight samples were subjected to particle size analysis using the double hydrometer method, and three of the samples were subjected to pinhole dispersion testing.

Each of the eight samples were also subjected to hydraulic properties testing, using one of two preparation methods. 1) A portion of each of the four bucket samples was remolded into a testing ring to target 90% of the respective maximum dry bulk density at 3% below the respective optimum moisture content, based on standard proctor compaction testing results. 2) The four core samples were each extruded and all homogenous sample material was composited. A portion of each homogenized sample was remolded into a testing ring to target client provided densities and moisture contents. The actual density achieved (in pcf) was added to each of the sub-sample ID's. Each of the eight prepared sub-samples was subjected to initial properties analysis, saturation, and the hanging column and pressure chamber portions of the moisture retention testing. Secondary sub-samples were also prepared using the same target remold parameters, for each sample except B11-39. The secondary sub-samples were then extruded from the testing ring and were subjected to saturated hydraulic conductivity testing via the flexible wall method. Sample B11-39 was not cohesive enough to be analyzed using the flexible wall method, a rigid wall method was used for saturated hydraulic conductivity testing for this sample.

Separate sub-samples were obtained for the dewpoint potentiometer and relative humidity chamber portions of the moisture retention testing.

Based on the proctor compaction method, material larger than 4.75mm was removed from the sample material prior to compaction and remolding. Oversize correction calculations are not presented since the fraction removed was less than 5% of the bulk sample mass.

Volumetric water contents were adjusted for changes in volume, where applicable. Due to the irregularities formed on the sample surfaces during swelling, volume measurements obtained after the initial reading should be considered estimates.

Two samples were calculated to be less than 95% saturated at the saturated stage. Potential causes of low saturation values can include: over estimation of the saturated sample volume, the loss of some water prior to measuring the saturated sample mass, and/or the loss of some sample mass during the saturated hydraulic conductivity test.



## Summary of Sample Preparation/Volume Changes

Sample ID	Proctor Data			Target Remold Parameters <sup>1</sup>				Actual Remold Data				Volume Change Post Saturation <sup>2</sup>				Volume Change Post Drying Curve <sup>3</sup>			
	Opt. Moist. Cont.	Max. Dry Density	Max. Dry Density	Moist. Cont.	Dry Bulk Density	Dry Bulk Density	% of Max. Density	Moist. Cont.	Dry Bulk Density	Dry Bulk Density	% of Max. Density	Dry Bulk Density	Dry Bulk Density	% Volume Change	% of Max. Density	Dry Bulk Density	Dry Bulk Density	% Volume Change	% of Max. Density
	(%, g/g)	(g/cm <sup>3</sup> )	(pcf)	(%, g/g)	(g/cm <sup>3</sup> )	(pcf)	(%)	(%, g/g)	(g/cm <sup>3</sup> )	(pcf)	(%)	(g/cm <sup>3</sup> )	(pcf)	(%)	(%)	(g/cm <sup>3</sup> )	(pcf)	(%)	(%)
B7A-0-20 (1+2) (102.6 pcf)	13.7	1.83	114.3	10.7	1.65	102.9	90%	11.2	1.64	102.6	89.7%	1.61	100.3	+2.3%	87.7%	1.61	100.8	+1.8%	88.1%
B7A-40-60 (1+2) (98.3 pcf)	15.0	1.76	109.7	12.0	1.58	98.7	90%	12.6	1.57	98.3	89.7%	1.53	95.6	+2.9%	87.1%	1.54	96.2	+2.2%	87.7%
B9-20-35 (1+2) (90.3 pcf)	20.8	1.61	100.7	17.8	1.45	90.6	90%	18.3	1.45	90.3	89.7%	1.38	86.3	+4.6%	85.7%	1.38	86.3	+4.6%	85.7%
B10-10-25 (1+2) (103.4 pcf)	13.8	1.85	115.6	10.8	1.67	104.0	90%	11.6	1.66	103.4	89.5%	1.62	101.0	+2.4%	87.4%	1.63	101.8	+1.6%	88.1%

<sup>1</sup>Target Remold Parameters: Provided by the client: 90% of the maximum dry bulk density at 3% below the optimum moisture content based on standard proctor compaction testing.

<sup>2</sup>Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

<sup>3</sup>Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

### Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.



### Summary of Sample Preparation/Volume Changes

Sample Number	Target Remold Parameters <sup>1</sup>			Actual Remold Data				Volume Change Post Saturation <sup>2</sup>				Volume Change Post Drying Curve <sup>3</sup>			
	Moist. Cont.	Dry Bulk Density	Dry Bulk Density	Moist. Cont.	Dry Bulk Density	Dry Bulk Density	% of Target Density	Dry Bulk Density	Dry Bulk Density	% Volume Change	% of Initial Density	Dry Bulk Density	Dry Bulk Density	% Volume Change	% of Initial Density
	(%, g/g)	(g/cm <sup>3</sup> )	(pcf)	(%, g/g)	(g/cm <sup>3</sup> )	(pcf)	(%)	(g/cm <sup>3</sup> )	(pcf)	(%)	(%)	(g/cm <sup>3</sup> )	(pcf)	(%)	(%)
B5A-9A (102.7 pcf)	10.7	1.65	102.9	10.6	1.65	102.7	99.8%	1.59	99.54	+3.2%	96.9%	1.62	100.85	+1.9%	98.2%
B6A-19A (90.8 pcf)	17.8	1.45	90.6	17.8	1.46	90.8	100.3%	1.39	86.61	+4.9%	95.3%	1.41	88.29	+2.9%	97.2%
B10-39A (90.3 pcf)	17.8	1.45	90.6	18.3	1.45	90.3	99.7%	1.40	87.56	+3.2%	96.9%	1.41	87.84	+2.8%	97.2%
B11-39 (104.2 pcf)	9.7	1.69	105.6	10.4	1.67	104.2	98.6%	1.67	104.16	---	100.0%	1.67	104.16	---	100.0%

<sup>1</sup>Target Remold Parameters: Provided by the client.

<sup>2</sup>Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

<sup>3</sup>Volume Change Post Drying Curve: Volume change measurements were obtained throughout hanging column and pressure plate testing. The 'Volume Change Post Drying Curve' values represent the final sample dimensions after the last pressure plate point.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Dry Bulk Density (pcf)	Wet Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (pcf)	Calculated Porosity (%)
	As Received		Remolded						
	Gravimetric (% g/g)	Volumetric (% cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (% g/g)	Volumetric (% cm <sup>3</sup> /cm <sup>3</sup> )					
B5A-9A	7.5	9.9	---	---	1.31	81.8	1.41	88.0	50.1
B5A-9A (102.7 pcf)	NA	NA	10.6	17.4	1.65	102.7	1.82	113.6	37.3
B6A-19A	14.2	25.3	---	---	1.79	111.8	2.04	127.6	33.3
B6A-19A (90.8 pcf)	NA	NA	17.8	26.0	1.46	90.8	1.71	107.0	45.8
B7A-0-20 (1+2) (102.6 pcf)	NA	NA	11.2	18.4	1.64	102.6	1.83	114.1	38.4
B7A-40-60 (1+2) (98.3 pcf)	NA	NA	12.6	19.8	1.57	98.3	1.77	110.7	41.0
B9-20-35 (1+2) (90.3 pcf)	NA	NA	18.3	26.5	1.45	90.3	1.71	106.8	46.6
B10-39A (90.3 pcf)	NA	NA	18.3	26.5	1.45	90.3	1.71	106.9	45.9
B10-10-25 (1+2) (103.4 pcf)	NA	NA	11.6	19.2	1.66	103.4	1.85	115.4	38.0
B11-39A	9.5	14.4	---	---	1.51	94.5	1.66	103.5	42.9
B11-39 (104.2 pcf)	NA	NA	10.4	17.3	1.67	104.2	1.84	115.0	37.1

NA = Not analyzed

--- = This sample was not remolded



## Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K <sub>sat</sub> (cm/sec)	Oversize Corrected K <sub>sat</sub> (cm/sec)	Method of Analysis	
			Constant Head Rigid Wall	Falling Head Flexible Wall
B5A-9A (103.2 pcf)	9.2E-05	---		X
B6A-19A (90.5 pcf)	7.0E-05	---		X
B7A-0-20 (1+2) (102.8 pcf)	8.9E-05	---		X
B7A-40-60 (1+2) (98.7 pcf)	5.9E-04	---		X
B9-20-35 (1+2) (90.4 pcf)	4.1E-05	---		X
B10-39A (90.9 pcf)	5.5E-05	---		X
B10-10-25 (1+2) (103.6 pcf)	1.0E-04	---		X
B11-39 (104.2 pcf)	1.0E-03	---	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable





**Summary of Moisture Characteristics  
of the Initial Drainage Curve**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
B5A-9A (102.7 pcf)	0	38.2 #
	17	38.5 #
	54	38.3 #
	123	36.8 #
	337	26.5 #
	24373	11.6 #
	91578	8.2 #
	395580	5.7 #
	845560	4.6 #
B6A-19A (90.8 pcf)	0	44.8 #
	17	45.5 #
	54	45.4 #
	123	41.1 #
	337	37.8 #
	76485	14.1 #
	269737	9.6 #
	678881	7.0 #
	845560	6.5 #
B7A-0-20 (1+2) (102.6 pcf)	0	39.5 #
	17	39.6 #
	54	39.5 #
	123	36.1 #
	337	29.7 #
	16929	13.7 #
	75975	9.2 #
	273612	6.3 #
	845560	4.9 #

---

# Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics  
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
B7A-40-60 (1+2) (98.3 pcf)	0	41.4 #
	17	40.2 #
	54	35.3 #
	123	33.2 #
	337	30.7 #
	21008	15.6 #
	78423	10.7 #
	258009	6.9 #
	845560	5.2 #
B9-20-35 (1+2) (90.3 pcf)	0	45.9 #
	22	46.3 #
	75	45.2 #
	154	43.1 #
	337	41.2 #
	27229	20.1 #
	94433	14.7 #
	225580	12.0 #
	845560	7.4 #
B10-39A (90.3 pcf)	0	46.5 #
	17	47.2 #
	54	45.6 #
	123	42.2 #
	337	39.4 #
	22130	20.3 #
	86785	14.2 #
	258927	10.3 #
	845560	6.8 #

---

# Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics  
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
B10-10-25 (1+2) (103.4 pcf)	0	39.2 ‡
	17	39.3 ‡
	54	39.1 ‡
	123	33.7 ‡
	337	28.5 ‡
	21926	12.5 ‡
	73936	9.2 ‡
	187643	7.1 ‡
	845560	5.0 ‡
B11-39 (104.2 pcf)	0	38.7
	4	38.7
	19	38.2
	77	22.8
	337	15.0
	14073	7.8
	43036	5.7
	333169	3.3
	845560	2.5

---

‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).



## Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	$\alpha$ (cm <sup>-1</sup> )	N (dimensionless)	$\theta_r$ (% vol)	$\theta_s$ (% vol)	Oversize Corrected	
					$\theta_r$ (% vol)	$\theta_s$ (% vol)
B5A-9A (102.7 pcf)	0.0072	1.3012	2.66	39.35	NA	NA
B6A-19A (90.8 pcf)	0.0049	1.2175	0.00	45.53	NA	NA
B7A-0-20 (1+2) (102.6 pcf)	0.0074	1.2353	0.00	40.29	---	---
B7A-40-60 (1+2) (98.3 pcf)	0.0153	1.1909	0.00	40.80	---	---
B9-20-35 (1+2) (90.3 pcf)	0.0023	1.2148	0.00	45.90	---	---
B10-39A (90.3 pcf)	0.0046	1.2040	0.00	46.70	---	---
B10-10-25 (1+2) (103.4 pcf)	0.0104	1.2238	0.00	40.09	---	---
B11-39 (104.2 pcf)	0.0315	1.5127	4.02	39.70	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
B5A-9A	0.00030	0.059	0.078	260	21	WS/H	Sandy silt s(ML)	Sandy Loam	(Est)
B6A-19A	5.5E-05	0.0035	0.0080	145	0.57	WS/H	Fat clay (CH)	Clay	(Est)
B7A-0-20 (1+2)	4.1E-05	0.045	0.068	1659	15	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B7A-40-60 (1+2)	4.6E-05	0.018	0.046	1000	1.5	WS/H	Lean clay with sand (CL)s	Clay Loam	(Est)
B9-20-35 (1+2)	6.3E-05	0.0015	0.0028	44	0.51	WS/H	Fat clay (CH)	Clay	(Est)
B10-39A	6.1E-05	0.0044	0.0086	141	1.0	WS/H	Fat clay (CH)	Silty Clay Loam	(Est)
B10-10-25 (1+2)	2.4E-05	0.046	0.073	3042	17	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B11-39A	0.0062	0.11	0.13	21	5.2	WS/H	Silty sand (SM)	Loamy Sand	

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
B5A-9A	0.0	41.9	39.8	18.3
B6A-19A	0.0	13.3	44.2	42.5
B7A-0-20 (1+2)	0.7	37.1	41.1	21.1
B7A-40-60 (1+2)	0.6	28.3	40.6	30.5
B9-20-35 (1+2)	0.0	3.5	42.6	53.9
B10-39A	0.0	5.4	56.5	38.1
B10-10-25 (1+2)	1.1	38.3	38.0	22.5
B11-39A	0.0	64.6	29.1	6.3

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



### Summary of Percent Dispersion by Double Hydrometer

Sample Number	Percent Finer Than 2- $\mu$ m, Not Dispersed	Percent Finer Than 2- $\mu$ m, Dispersed <sup>1</sup>	Percent Dispersion	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line <sup>1</sup>	Dispersiveness Classification
B5A-9A	3	18	16	No	Nondispersive
B6A-19A	4	42	9	Yes	Nondispersive
B7A-0-20 (1+2)	4	21	17	Yes	Nondispersive
B7A-40-60 (1+2)	4	30	12	Yes	Nondispersive
B9-20-35 (1+2)	3	54	5	Yes	Nondispersive
B10-39A	6	38	15	Yes	Nondispersive
B10-10-25 (1+2)	0	22	0	Yes	Nondispersive
B11-39A	0	6	0	No	Nondispersive

<sup>1</sup> This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer than 2- $\mu$ m when dispersant is used.



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
B5A-9A	---	---	---	ML
B6A-19A	51	22	29	CH
B7A-0-20 (1+2)	29	15	14	CL
B7A-40-60 (1+2)	37	16	21	CL
B9-20-35 (1+2)	55	21	34	CH
B10-39A	56	21	35	CH
B10-10-25 (1+2)	45	16	29	CL
B11-39A	---	---	---	ML

---

--- = Soil requires visual-manual classification due to non-plasticity





### Summary of Specific Gravity Tests

Sample Number	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity <sup>1</sup>
B5A-9A	2.63	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.63
B6A-19A	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B7A-0-20 (1+2)	2.67	<4.75 mm	99.3%	NA	>4.75 mm	0.7%	2.67
B7A-40-60 (1+2)	2.67	<4.75 mm	99.4%	NA	>4.75 mm	0.6%	2.67
B9-20-35 (1+2)	2.71	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.71
B10-39A	2.68	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.68
B10-10-25 (1+2)	2.68	<4.75 mm	98.9%	NA	>4.75 mm	1.1%	2.68
B11-39A	2.66	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.66

<sup>1</sup>Based on the <4.75mm material

NA = Not Applicable since specified fraction is less than 5% of composite sample mass

NR = Test not Requested



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
B7A-0-20 (1+2)	13.7	1.83	---	---
B7A-40-60 (1+2)	15.0	1.76	---	---
B9-20-35 (1+2)	20.8	1.61	---	---
B10-10-25 (1+2)	13.8	1.85	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



### Summary of Pinhole Dispersion Testing

Sample Number	Percent Finer Than 5- $\mu$ m <sup>1</sup>	Plasticity Index <sup>1</sup>	Dispersion Classification
B5A-9A	22.2	0 (NP)	Not Classified <sup>2</sup>
B10-10-25 (1+2)	29.3	29	Non-Dispersive ND2
B11-39A	8.6	0 (NP)	Not Classified <sup>2</sup>

---

<sup>1</sup> This test method is applicable to soils that have a plasticity index greater than or equal to 4, and more than 12% of the soil fraction is finer than 5- $\mu$ m.

<sup>2</sup> Unable to apply a dispersive classification for this material following the pinhole dispersion method. The test results do not align with the specified classification criteria.

"NP" Non Plastic

## **Initial Properties**



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Dry Bulk Density (pcf)	Wet Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (pcf)	Calculated Porosity (%)
	As Received		Remolded						
	Gravimetric (% g/g)	Volumetric (% cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (% g/g)	Volumetric (% cm <sup>3</sup> /cm <sup>3</sup> )					
B5A-9A	7.5	9.9	---	---	1.31	81.8	1.41	88.0	50.1
B5A-9A (102.7 pcf)	NA	NA	10.6	17.4	1.65	102.7	1.82	113.6	37.3
B6A-19A	14.2	25.3	---	---	1.79	111.8	2.04	127.6	33.3
B6A-19A (90.8 pcf)	NA	NA	17.8	26.0	1.46	90.8	1.71	107.0	45.8
B7A-0-20 (1+2) (102.6 pcf)	NA	NA	11.2	18.4	1.64	102.6	1.83	114.1	38.4
B7A-40-60 (1+2) (98.3 pcf)	NA	NA	12.6	19.8	1.57	98.3	1.77	110.7	41.0
B9-20-35 (1+2) (90.3 pcf)	NA	NA	18.3	26.5	1.45	90.3	1.71	106.8	46.6
B10-39A (90.3 pcf)	NA	NA	18.3	26.5	1.45	90.3	1.71	106.9	45.9
B10-10-25 (1+2) (103.4 pcf)	NA	NA	11.6	19.2	1.66	103.4	1.85	115.4	38.0
B11-39A	9.5	14.4	---	---	1.51	94.5	1.66	103.5	42.9
B11-39 (104.2 pcf)	NA	NA	10.4	17.3	1.67	104.2	1.84	115.0	37.1

NA = Not analyzed

--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B5A-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	649.54	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	604.00	
<i>Sample volume (cm<sup>3</sup>):</i>	460.74	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.63	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	7.5	
<i>Volumetric Moisture Content (% vol):</i>	9.9	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.31	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.41	
<i>Calculated Porosity (% vol):</i>	50.1	
<i>Percent Saturation:</i>	19.7	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B5A-9A (102.7 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		359.15
<i>Tare weight, ring (g):</i>		70.10
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		261.46
<i>Sample volume (cm<sup>3</sup>):</i>		158.88
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.63
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		10.6
<i>Volumetric Moisture Content (% vol):</i>		17.4
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.65
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.82
<i>Calculated Porosity (% vol):</i>		37.3
<i>Percent Saturation:</i>		46.5
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B6A-19A  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-20.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	4-Jun-18	---
<i>Field weight* of sample (g):</i>	459.34	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	213.46	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	215.40	
<i>Sample volume (cm<sup>3</sup>):</i>	120.28	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.69	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	14.2	
<i>Volumetric Moisture Content (% vol):</i>	25.3	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.79	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	2.04	
<i>Calculated Porosity (% vol):</i>	33.3	
<i>Percent Saturation:</i>	76.0	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded





*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B6A-19A (90.8 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-20.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		360.38
<i>Tare weight, ring (g):</i>		73.64
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		243.34
<i>Sample volume (cm<sup>3</sup>):</i>		167.22
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.69
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		17.8
<i>Volumetric Moisture Content (% vol):</i>		26.0
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.46
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.71
<i>Calculated Porosity (% vol):</i>		45.8
<i>Percent Saturation:</i>		56.6
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-0-20 (1+2) (102.6 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 0'-20'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		540.84
<i>Tare weight, ring (g):</i>		137.16
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		363.11
<i>Sample volume (cm<sup>3</sup>):</i>		220.95
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.67
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		11.2
<i>Volumetric Moisture Content (% vol):</i>		18.4
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.64
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.83
<i>Calculated Porosity (% vol):</i>		38.4
<i>Percent Saturation:</i>		47.8
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-40-60 (1+2) (98.3 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-60'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		536.27
<i>Tare weight, ring (g):</i>		139.81
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		352.13
<i>Sample volume (cm<sup>3</sup>):</i>		223.58
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.67
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		12.6
<i>Volumetric Moisture Content (% vol):</i>		19.8
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.57
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.77
<i>Calculated Porosity (% vol):</i>		41.0
<i>Percent Saturation:</i>		48.4
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-20-35 (1+2) (90.3 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-35'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		512.42
<i>Tare weight, ring (g):</i>		127.42
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		325.36
<i>Sample volume (cm<sup>3</sup>):</i>		224.98
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.71
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		18.3
<i>Volumetric Moisture Content (% vol):</i>		26.5
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.45
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.71
<i>Calculated Porosity (% vol):</i>		46.6
<i>Percent Saturation:</i>		56.9
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-39A (90.3 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		515.29
<i>Tare weight, ring (g):</i>		133.57
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		322.67
<i>Sample volume (cm<sup>3</sup>):</i>		222.98
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.68
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		18.3
<i>Volumetric Moisture Content (% vol):</i>		26.5
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.45
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.71
<i>Calculated Porosity (% vol):</i>		45.9
<i>Percent Saturation:</i>		57.7
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-10-25 (1+2) (103.4 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-25'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		543.28
<i>Tare weight, ring (g):</i>		128.13
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		372.07
<i>Sample volume (cm<sup>3</sup>):</i>		224.65
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.67
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		11.6
<i>Volumetric Moisture Content (% vol):</i>		19.2
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.66
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.85
<i>Calculated Porosity (% vol):</i>		38.0
<i>Percent Saturation:</i>		50.4
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	5-Jun-18	---
<i>Field weight* of sample (g):</i>	761.72	
<i>Tare weight, ring (g):</i>	0.00	
<i>Tare weight, pan/plate (g):</i>	0.00	
<i>Tare weight, other (g):</i>	0.00	
<i>Dry weight of sample (g):</i>	695.51	
<i>Sample volume (cm<sup>3</sup>):</i>	459.51	
<i>Measured particle density (g/cm<sup>3</sup>):</i>	2.65	
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>	9.5	
<i>Volumetric Moisture Content (% vol):</i>	14.4	
<i>Dry bulk density (g/cm<sup>3</sup>):</i>	1.51	
<i>Wet bulk density (g/cm<sup>3</sup>):</i>	1.66	
<i>Calculated Porosity (% vol):</i>	42.9	
<i>Percent Saturation:</i>	33.6	

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines

*Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



*Daniel B. Stephens & Associates, Inc.*

### **Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-39 (104.2 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 0'-10'

	<u>As Received</u>	<u>Remolded</u>
<i>Test Date:</i>	NA	2-Aug-18
<i>Field weight* of sample (g):</i>		137.80
<i>Tare weight, ring (g):</i>		32.30
<i>Tare weight, pan/plate (g):</i>		0.00
<i>Tare weight, other (g):</i>		0.00
<i>Dry weight of sample (g):</i>		95.58
<i>Sample volume (cm<sup>3</sup>):</i>		57.29
<i>Measured particle density (g/cm<sup>3</sup>):</i>		2.65
<hr/>		
<i>Gravimetric Moisture Content (% g/g):</i>		10.4
<i>Volumetric Moisture Content (% vol):</i>		17.3
<i>Dry bulk density (g/cm<sup>3</sup>):</i>		1.67
<i>Wet bulk density (g/cm<sup>3</sup>):</i>		1.84
<i>Calculated Porosity (% vol):</i>		37.1
<i>Percent Saturation:</i>		46.7
<hr/>		
<i>Laboratory analysis by:</i>	D. O'Dowd	
<i>Data entered by:</i>	D. O'Dowd	
<i>Checked by:</i>	J. Hines	

#### *Comments:*

\* Weight including tares  
NA = Not analyzed  
--- = This sample was not remolded



## **Saturated Hydraulic Conductivity**



## Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K <sub>sat</sub> (cm/sec)	Oversize Corrected K <sub>sat</sub> (cm/sec)	Method of Analysis	
			Constant Head Rigid Wall	Falling Head Flexible Wall
B5A-9A (103.2 pcf)	9.2E-05	---		X
B6A-19A (90.5 pcf)	7.0E-05	---		X
B7A-0-20 (1+2) (102.8 pcf)	8.9E-05	---		X
B7A-40-60 (1+2) (98.7 pcf)	5.9E-04	---		X
B9-20-35 (1+2) (90.4 pcf)	4.1E-05	---		X
B10-39A (90.9 pcf)	5.5E-05	---		X
B10-10-25 (1+2) (103.6 pcf)	1.0E-04	---		X
B11-39 (104.2 pcf)	1.0E-03	---	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A (103.2 pcf)  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'

### Remolded or Initial Sample Properties

Initial Mass (g): 337.52  
Diameter (cm): 6.081  
Length (cm): 6.364  
Area (cm<sup>2</sup>): 29.04  
Volume (cm<sup>3</sup>): 184.83  
Dry Density (g/cm<sup>3</sup>): 1.65  
Dry Density (pcf): 103.2  
Water Content (% g/g): 10.4  
Water Content (% vol): 17.3  
Void Ratio (e): 0.59  
Porosity (% vol): 37.1  
Saturation (%): 46.5

### Post Permeation Sample Properties

Saturated Mass (g): 385.10  
Dry Mass (g): 305.62  
Diameter (cm): 6.172  
Length (cm): 6.367  
Deformation (%)\*\*: 0.05  
Area (cm<sup>2</sup>): 29.92  
Volume (cm<sup>3</sup>): 190.49  
Dry Density (g/cm<sup>3</sup>): 1.60  
Dry Density (pcf): 100.2  
Water Content (% g/g): 26.0  
Water Content (% vol): 41.7  
Void Ratio(e): 0.64  
Porosity (% vol): 39.0  
Saturation (%)\*: 107.0

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 0  
Particle Density(g/cm<sup>3</sup>): 2.63 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☐ A ☐ B ☒ C  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 840  
B-Value (% saturation) post to test: 0.99 8/13/18 1230

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



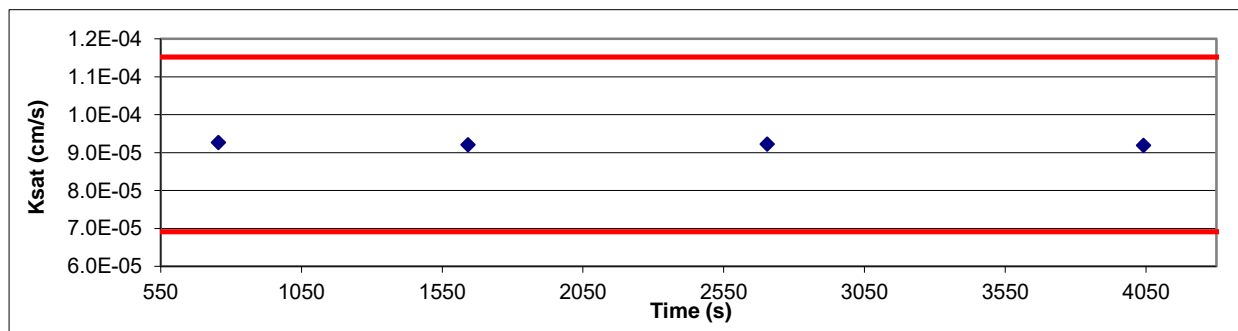
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## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A (103.2 pcf)  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:13:30	21.7	5.00	20.00	2.72	4.78	755	1.00	13%	9.65E-05	9.26E-05
13-Aug-18	08:26:05	21.7	6.00	19.00	2.36						
Test # 2:											
13-Aug-18	08:26:05	21.7	6.00	19.00	2.36	4.78	887	1.00	15%	9.58E-05	9.20E-05
13-Aug-18	08:40:52	21.7	7.00	18.00	1.99						
Test # 3:											
13-Aug-18	08:40:52	21.7	7.00	18.00	1.99	4.78	1063	1.00	18%	9.61E-05	9.22E-05
13-Aug-18	08:58:35	21.7	8.00	17.00	1.63						
Test # 4:											
13-Aug-18	08:58:35	21.7	8.00	17.00	1.63	4.78	1337	1.00	22%	9.57E-05	9.18E-05
13-Aug-18	09:20:52	21.7	9.00	16.00	1.27						

**Average Ksat (cm/sec): 9.22E-05**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 6.91E-05

Ksat (+25%) (cm/s): 1.15E-04



## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A (90.5 pcf)  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'

### Remolded or Initial Sample Properties

Initial Mass (g): 316.92  
Diameter (cm): 6.099  
Length (cm): 6.359  
Area (cm<sup>2</sup>): 29.22  
Volume (cm<sup>3</sup>): 185.78  
Dry Density (g/cm<sup>3</sup>): 1.45  
Dry Density (pcf): 90.5  
Water Content (% g/g): 17.6  
Water Content (% vol): 25.6  
Void Ratio (e): 0.85  
Porosity (% vol): 46.0  
Saturation (%): 55.6

### Post Permeation Sample Properties

Saturated Mass (g): 365.73  
Dry Mass (g): 269.4  
Diameter (cm): 6.169  
Length (cm): 6.361  
Deformation (%)\*\*: 0.03  
Area (cm<sup>2</sup>): 29.89  
Volume (cm<sup>3</sup>): 190.13  
Dry Density (g/cm<sup>3</sup>): 1.42  
Dry Density (pcf): 88.5  
Water Content (% g/g): 35.8  
Water Content (% vol): 50.7  
Void Ratio(e): 0.90  
Porosity (% vol): 47.3  
Saturation (%)\*: 107.2

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 0  
Particle Density(g/cm<sup>3</sup>): 2.69 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☒ A ☐ B ☐ C  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 844  
B-Value (% saturation) post to test: 0.99 8/13/18 1233

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



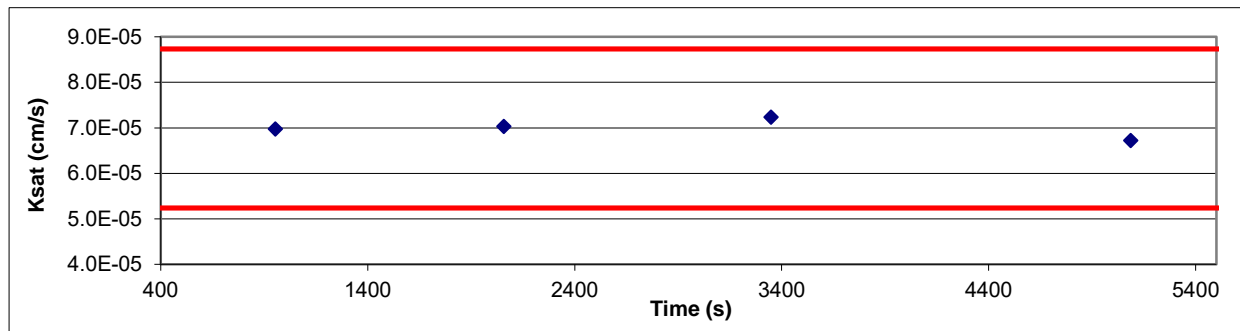
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## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A (90.5 pcf)  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:14:00	21.7	5.00	20.00	2.72	4.57	954	1.00	13%	7.26E-05	6.97E-05
13-Aug-18	08:29:54	21.7	6.00	19.00	2.36						
Test # 2:											
13-Aug-18	08:29:54	21.7	6.00	19.00	2.36	4.57	1105	1.00	15%	7.32E-05	7.03E-05
13-Aug-18	08:48:19	21.7	7.00	18.00	2.00						
Test # 3:											
13-Aug-18	08:48:19	21.7	7.00	18.00	2.00	4.57	1290	1.00	18%	7.53E-05	7.23E-05
13-Aug-18	09:09:49	21.7	8.00	17.00	1.63						
Test # 4:											
13-Aug-18	09:09:49	21.7	8.00	17.00	1.63	4.57	1738	1.00	22%	7.00E-05	6.72E-05
13-Aug-18	09:38:47	21.7	9.00	16.00	1.27						

**Average Ksat (cm/sec): 6.99E-05**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 5.24E-05

Ksat (+25%) (cm/s): 8.73E-05



## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2) (102.8 pcf)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

### Remolded or Initial Sample Properties

Initial Mass (g): 336.35  
Diameter (cm): 6.084  
Length (cm): 6.358  
Area (cm<sup>2</sup>): 29.07  
Volume (cm<sup>3</sup>): 184.84  
Dry Density (g/cm<sup>3</sup>): 1.65  
Dry Density (pcf): 102.8  
Water Content (% g/g): 10.5  
Water Content (% vol): 17.4  
Void Ratio (e): 0.62  
Porosity (% vol): 38.3  
Saturation (%): 45.4

### Post Permeation Sample Properties

Saturated Mass (g): 382.96  
Dry Mass (g): 304.26  
Diameter (cm): 6.136  
Length (cm): 6.357  
Deformation (%)\*\*: 0.02  
Area (cm<sup>2</sup>): 29.57  
Volume (cm<sup>3</sup>): 187.98  
Dry Density (g/cm<sup>3</sup>): 1.62  
Dry Density (pcf): 101.0  
Water Content (% g/g): 25.9  
Water Content (% vol): 41.9  
Void Ratio(e): 0.65  
Porosity (% vol): 39.3  
Saturation (%)\*: 106.5

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 0.7  
Particle Density(g/cm<sup>3</sup>): 2.67 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☐ A ☒ B ☐ C  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 846  
B-Value (% saturation) post to test: 0.99 8/13/18 1235

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines

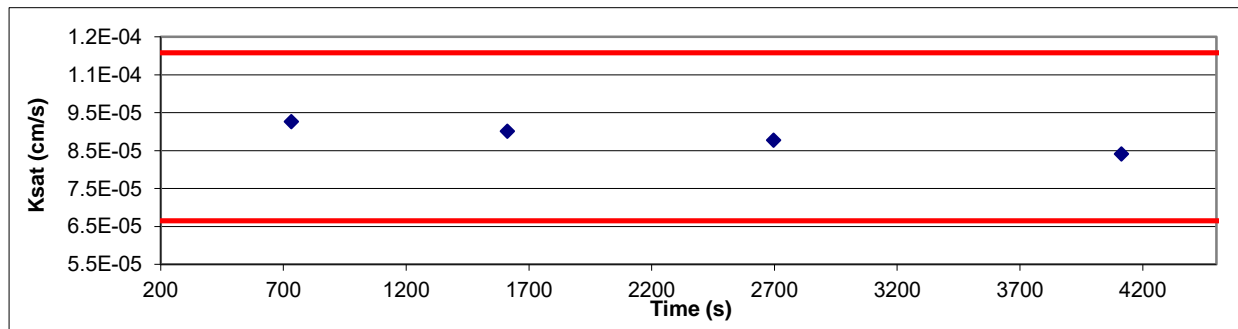


## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2) (102.8 pcf)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ( $\Delta H/\Delta L$ )	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:14:30	21.7	5.00	20.00	2.72	4.61	733	1.00	13%	9.64E-05	9.26E-05
13-Aug-18	08:26:43	21.7	6.00	19.00	2.36	4.61	733	1.00	13%	9.64E-05	9.26E-05
Test # 2:											
13-Aug-18	08:26:43	21.7	6.00	19.00	2.36	4.61	879	1.00	15%	9.39E-05	9.01E-05
13-Aug-18	08:41:22	21.7	7.00	18.00	2.00	4.61	879	1.00	15%	9.39E-05	9.01E-05
Test # 3:											
13-Aug-18	08:41:22	21.7	7.00	18.00	2.00	4.61	1085	1.00	18%	9.13E-05	8.77E-05
13-Aug-18	08:59:27	21.7	8.00	17.00	1.63	4.61	1085	1.00	18%	9.13E-05	8.77E-05
Test # 4:											
13-Aug-18	08:59:27	21.7	8.00	17.00	1.63	4.61	1417	1.00	22%	8.76E-05	8.41E-05
13-Aug-18	09:23:04	21.7	9.00	16.00	1.27	4.61	1417	1.00	22%	8.76E-05	8.41E-05

**Average Ksat (cm/sec): 8.86E-05**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 6.65E-05

Ksat (+25%) (cm/s): 1.11E-04





## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2) (98.7 pcf)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

### Remolded or Initial Sample Properties

Initial Mass (g): 328.19  
Diameter (cm): 6.085  
Length (cm): 6.358  
Area (cm<sup>2</sup>): 29.08  
Volume (cm<sup>3</sup>): 184.90  
Dry Density (g/cm<sup>3</sup>): 1.58  
Dry Density (pcf): 98.7  
Water Content (% g/g): 12.3  
Water Content (% vol): 19.4  
Void Ratio (e): 0.69  
Porosity (% vol): 40.8  
Saturation (%): 47.5

### Post Permeation Sample Properties

Saturated Mass (g): 379.07  
Dry Mass (g): 292.35  
Diameter (cm): 6.144  
Length (cm): 6.362  
Deformation (%)\*\*: 0.06  
Area (cm<sup>2</sup>): 29.65  
Volume (cm<sup>3</sup>): 188.62  
Dry Density (g/cm<sup>3</sup>): 1.55  
Dry Density (pcf): 96.8  
Water Content (% g/g): 29.7  
Water Content (% vol): 46.0  
Void Ratio(e): 0.72  
Porosity (% vol): 41.9  
Saturation (%)\*: 109.6

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 0.6  
Particle Density(g/cm<sup>3</sup>): 2.67 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☒ D ☐ E ☐ F  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 848  
B-Value (% saturation) post to test: 0.99 8/13/18 1238

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



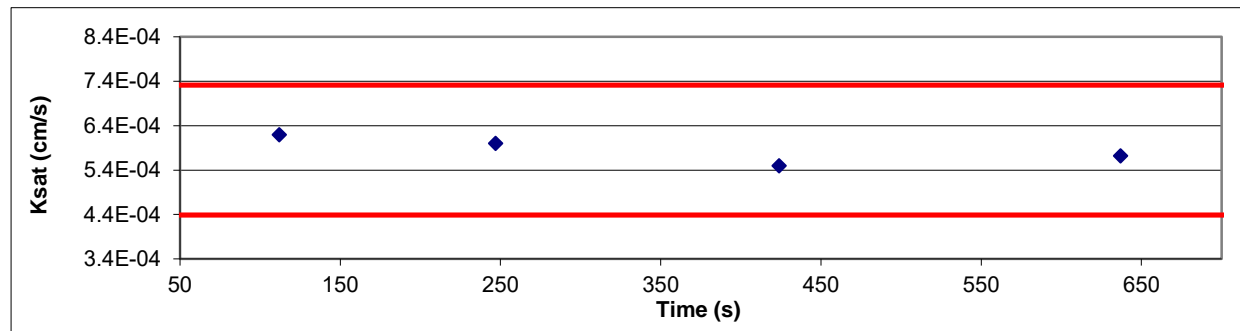
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## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2) (98.7 pcf)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:19:30	21.7	5.00	20.00	2.72	4.71	112	1.00	13%	6.45E-04	6.19E-04
13-Aug-18	08:21:22	21.7	6.00	19.00	2.36						
Test # 2:											
13-Aug-18	08:21:22	21.7	6.00	19.00	2.36	4.71	135	1.00	15%	6.25E-04	6.00E-04
13-Aug-18	08:23:37	21.7	7.00	18.00	2.00						
Test # 3:											
13-Aug-18	08:23:37	21.7	7.00	18.00	2.00	4.71	177	1.00	18%	5.72E-04	5.50E-04
13-Aug-18	08:26:34	21.7	8.00	17.00	1.63						
Test # 4:											
13-Aug-18	08:26:34	21.7	8.00	17.00	1.63	4.71	213	1.00	22%	5.96E-04	5.72E-04
13-Aug-18	08:30:07	21.7	9.00	16.00	1.27						

**Average Ksat (cm/sec): 5.85E-04**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 4.39E-04

Ksat (+25%) (cm/s): 7.31E-04



## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2) (90.4 pcf)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

### Remolded or Initial Sample Properties

Initial Mass (g): 316.70  
Diameter (cm): 6.088  
Length (cm): 6.362  
Area (cm<sup>2</sup>): 29.11  
Volume (cm<sup>3</sup>): 185.20  
Dry Density (g/cm<sup>3</sup>): 1.45  
Dry Density (pcf): 90.4  
Water Content (% g/g): 18.1  
Water Content (% vol): 26.3  
Void Ratio (e): 0.87  
Porosity (% vol): 46.6  
Saturation (%): 56.4

### Post Permeation Sample Properties

Saturated Mass (g): 371.32  
Dry Mass (g): 268.06  
Diameter (cm): 6.23  
Length (cm): 6.356  
Deformation (%)\*\*: 0.09  
Area (cm<sup>2</sup>): 30.48  
Volume (cm<sup>3</sup>): 193.75  
Dry Density (g/cm<sup>3</sup>): 1.38  
Dry Density (pcf): 86.4  
Water Content (% g/g): 38.5  
Water Content (% vol): 53.3  
Void Ratio(e): 0.96  
Porosity (% vol): 48.9  
Saturation (%)\*: 109.0

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 0.03  
Particle Density(g/cm<sup>3</sup>): 2.71 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☐ D ☒ E ☐ F  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 850  
B-Value (% saturation) post to test: 0.99 8/13/18 1241

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



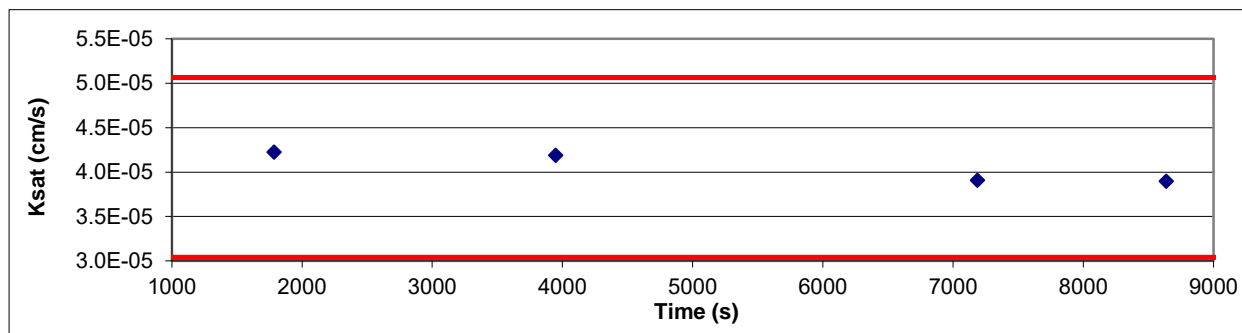
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## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2) (90.4 pcf)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ( $\Delta H/\Delta L$ )	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:32:36	21.7	6.00	19.00	2.36	4.52	1786	1.00	15%	4.40E-05	4.22E-05
13-Aug-18	09:02:22	21.7	7.00	18.00	2.00	4.52	1786	1.00	15%	4.40E-05	4.22E-05
Test # 2:											
13-Aug-18	09:02:22	21.7	7.00	18.00	2.00	4.52	2164	1.00	18%	4.36E-05	4.19E-05
13-Aug-18	09:38:26	21.7	8.00	17.00	1.64	4.52	2164	1.00	18%	4.36E-05	4.19E-05
Test # 3:											
13-Aug-18	09:38:26	21.7	8.00	17.00	1.64	4.97	3239	1.00	24%	4.07E-05	3.91E-05
13-Aug-18	10:32:25	21.7	9.10	15.90	1.24	4.97	3239	1.00	24%	4.07E-05	3.91E-05
Test # 4:											
13-Aug-18	10:32:25	21.7	9.10	15.90	1.24	1.81	1450	1.00	12%	4.06E-05	3.90E-05
13-Aug-18	10:56:35	21.7	9.50	15.50	1.09	1.81	1450	1.00	12%	4.06E-05	3.90E-05

**Average Ksat (cm/sec): 4.05E-05**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 3.04E-05

Ksat (+25%) (cm/s): 5.07E-05



## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A (90.9 pcf)  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

### Remolded or Initial Sample Properties

Initial Mass (g): 316.89  
Diameter (cm): 6.075  
Length (cm): 6.364  
Area (cm<sup>2</sup>): 28.99  
Volume (cm<sup>3</sup>): 184.46  
Dry Density (g/cm<sup>3</sup>): 1.46  
Dry Density (pcf): 90.9  
Water Content (% g/g): 18.0  
Water Content (% vol): 26.2  
Void Ratio (e): 0.84  
Porosity (% vol): 45.6  
Saturation (%): 57.5

### Post Permeation Sample Properties

Saturated Mass (g): 370.61  
Dry Mass (g): 268.53  
Diameter (cm): 6.205  
Length (cm): 6.362  
Deformation (%)\*\*: 0.03  
Area (cm<sup>2</sup>): 30.24  
Volume (cm<sup>3</sup>): 192.38  
Dry Density (g/cm<sup>3</sup>): 1.40  
Dry Density (pcf): 87.1  
Water Content (% g/g): 38.0  
Water Content (% vol): 53.1  
Void Ratio(e): 0.92  
Porosity (% vol): 47.8  
Saturation (%)\*: 110.9

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 0  
Particle Density(g/cm<sup>3</sup>): 2.68 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☐ D ☐ E ☒ F  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 852  
B-Value (% saturation) post to test: 0.99 8/13/18 1245

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



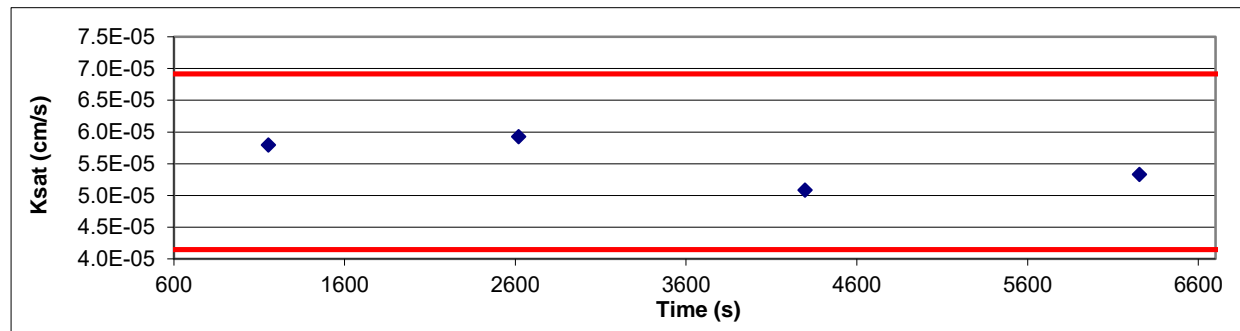
*Daniel B. Stephens & Associates, Inc.*

## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A (90.9 pcf)  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:16:00	21.7	5.00	20.00	2.72	4.64	1155	1.00	13%	6.04E-05	5.80E-05
13-Aug-18	08:35:15	21.7	6.00	19.00	2.36						
Test # 2:											
13-Aug-18	08:35:15	21.7	6.00	19.00	2.36	5.10	1464	1.00	17%	6.17E-05	5.92E-05
13-Aug-18	08:59:39	21.7	7.10	17.90	1.96						
Test # 3:											
13-Aug-18	08:59:39	21.7	7.10	17.90	1.96	4.17	1678	1.00	17%	5.29E-05	5.08E-05
13-Aug-18	09:27:37	21.7	8.00	17.00	1.63						
Test # 4:											
13-Aug-18	09:27:37	21.7	8.00	17.00	1.63	4.17	1958	1.00	20%	5.55E-05	5.33E-05
13-Aug-18	10:00:15	21.7	8.90	16.10	1.31						

**Average Ksat (cm/sec): 5.53E-05**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 4.15E-05

Ksat (+25%) (cm/s): 6.92E-05



## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2) (103.6 pcf)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

### Remolded or Initial Sample Properties

Initial Mass (g): 342.14  
Diameter (cm): 6.098  
Length (cm): 6.358  
Area (cm<sup>2</sup>): 29.21  
Volume (cm<sup>3</sup>): 185.69  
Dry Density (g/cm<sup>3</sup>): 1.66  
Dry Density (pcf): 103.6  
Water Content (% g/g): 11.1  
Water Content (% vol): 18.4  
Void Ratio (e): 0.61  
Porosity (% vol): 37.9  
Saturation (%): 48.4

### Post Permeation Sample Properties

Saturated Mass (g): 386.52  
Dry Mass (g): 308.03  
Diameter (cm): 6.137  
Length (cm): 6.359  
Deformation (%)\*\*: 0.02  
Area (cm<sup>2</sup>): 29.58  
Volume (cm<sup>3</sup>): 188.10  
Dry Density (g/cm<sup>3</sup>): 1.64  
Dry Density (pcf): 102.2  
Water Content (% g/g): 25.5  
Water Content (% vol): 41.7  
Void Ratio (e): 0.63  
Porosity (% vol): 38.7  
Saturation (%)\*: 107.7

### Test and Sample Conditions

Permeant liquid used: Tap Water  
Sample Preparation: ☐ In situ sample, extruded  
☒ Remolded Sample  
Number of Lifts: 3  
Split: #4  
Percent Coarse Material (%): 1.1  
Particle Density (g/cm<sup>3</sup>): 2.67 ☐ Assumed ☒ Measured  
Cell pressure (PSI): 81.0  
Influent pressure (PSI): 80.0  
Effluent pressure (PSI): 80.0  
Panel Used: ☒ O ☐ P ☐ Q  
Reading: ☒ Annulus ☒ Pipette  
Date/Time  
B-Value (% saturation) prior to test\*: 0.99 8/13/18 855  
B-Value (% saturation) post to test: 0.99 8/13/18 1247

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



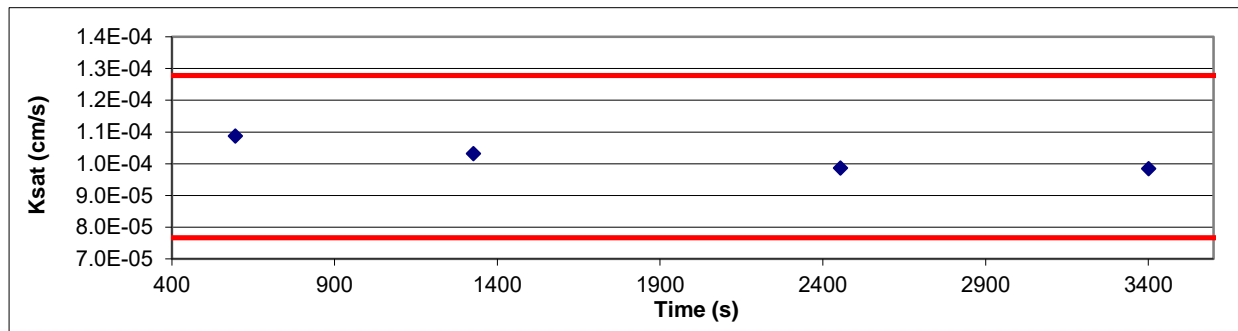
Daniel B. Stephens & Associates, Inc.

## Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2) (103.6 pcf)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ( $\Delta H/\Delta L$ )	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
13-Aug-18	08:16:30	21.7	5.00	20.00	2.72	4.38	595	1.00	13%	1.13E-04	1.09E-04
13-Aug-18	08:26:25	21.7	6.00	19.00	2.36	4.38	595	1.00	13%	1.13E-04	1.09E-04
Test # 2:											
13-Aug-18	08:26:25	21.7	6.00	19.00	2.36	4.38	732	1.00	15%	1.07E-04	1.03E-04
13-Aug-18	08:38:37	21.7	7.00	18.00	2.00	4.38	732	1.00	15%	1.07E-04	1.03E-04
Test # 3:											
13-Aug-18	08:38:37	21.7	7.00	18.00	2.00	5.26	1128	1.00	22%	1.03E-04	9.87E-05
13-Aug-18	08:57:25	21.7	8.20	16.80	1.56	5.26	1128	1.00	22%	1.03E-04	9.87E-05
Test # 4:											
13-Aug-18	08:57:25	21.7	8.20	16.80	1.56	3.51	946	1.00	19%	1.02E-04	9.84E-05
13-Aug-18	09:13:11	21.7	9.00	16.00	1.27	3.51	946	1.00	19%	1.02E-04	9.84E-05

**Average Ksat (cm/sec): 1.02E-04**  
Calculated Gravel Corrected Average Ksat (cm/sec): ---



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 7.67E-05

Ksat (+25%) (cm/s): 1.28E-04





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## Saturated Hydraulic Conductivity Constant Head Method

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39 (104.2 pcf)  
Project Name: NECR Jetty '18  
Depth: 0'-10'

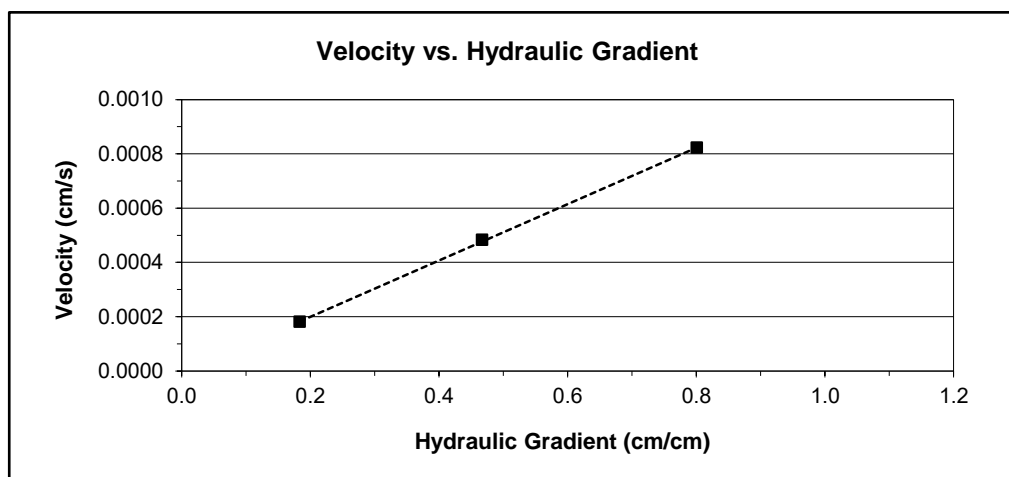
Type of water used: TAP  
Collection vessel tare (g): 11.03  
Sample length (cm): 3.00  
Sample diameter (cm): 4.94  
Sample x-sectional area (cm<sup>2</sup>): 19.13

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm <sup>3</sup> )	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
6-Aug-18	14:43:00	20.5	2.4	13.86	2.8	180	1.0E-03	1.0E-03
6-Aug-18	14:46:00							
Test # 2:								
6-Aug-18	14:56:00	20.5	1.4	12.69	1.7	180	1.0E-03	1.0E-03
6-Aug-18	14:59:00							
Test # 3:								
6-Aug-18	15:12:00	20.5	0.55	11.65	0.6	180	9.8E-04	9.7E-04
6-Aug-18	15:15:00							

Average Ksat (cm/sec): 1.0E-03  
Oversize Corrected Ksat (cm/sec): ---

### Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass



Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines

## **Moisture Retention Characteristics**



**Summary of Moisture Characteristics  
of the Initial Drainage Curve**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
B5A-9A (102.7 pcf)	0	38.2 #
	17	38.5 #
	54	38.3 #
	123	36.8 #
	337	26.5 #
	24373	11.6 #
	91578	8.2 #
	395580	5.7 #
	845560	4.6 #
B6A-19A (90.8 pcf)	0	44.8 #
	17	45.5 #
	54	45.4 #
	123	41.1 #
	337	37.8 #
	76485	14.1 #
	269737	9.6 #
	678881	7.0 #
	845560	6.5 #
B7A-0-20 (1+2) (102.6 pcf)	0	39.5 #
	17	39.6 #
	54	39.5 #
	123	36.1 #
	337	29.7 #
	16929	13.7 #
	75975	9.2 #
	273612	6.3 #
	845560	4.9 #

---

# Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics  
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
B7A-40-60 (1+2) (98.3 pcf)	0	41.4 #
	17	40.2 #
	54	35.3 #
	123	33.2 #
	337	30.7 #
	21008	15.6 #
	78423	10.7 #
	258009	6.9 #
	845560	5.2 #
B9-20-35 (1+2) (90.3 pcf)	0	45.9 #
	22	46.3 #
	75	45.2 #
	154	43.1 #
	337	41.2 #
	27229	20.1 #
	94433	14.7 #
	225580	12.0 #
	845560	7.4 #
B10-39A (90.3 pcf)	0	46.5 #
	17	47.2 #
	54	45.6 #
	123	42.2 #
	337	39.4 #
	22130	20.3 #
	86785	14.2 #
	258927	10.3 #
	845560	6.8 #

---

# Volume adjustments are applicable at this matric potential (see data sheet for this sample).



**Summary of Moisture Characteristics  
of the Initial Drainage Curve (Continued)**

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm <sup>3</sup> /cm <sup>3</sup> )
B10-10-25 (1+2) (103.4 pcf)	0	39.2 ‡
	17	39.3 ‡
	54	39.1 ‡
	123	33.7 ‡
	337	28.5 ‡
	21926	12.5 ‡
	73936	9.2 ‡
	187643	7.1 ‡
	845560	5.0 ‡
B11-39 (104.2 pcf)	0	38.7
	4	38.7
	19	38.2
	77	22.8
	337	15.0
	14073	7.8
	43036	5.7
	333169	3.3
	845560	2.5

---

‡ Volume adjustments are applicable at this matric potential (see data sheet for this sample).



## Summary of Calculated Unsaturated Hydraulic Properties

Sample Number	$\alpha$ (cm <sup>-1</sup> )	N (dimensionless)	$\theta_r$ (% vol)	$\theta_s$ (% vol)	Oversize Corrected	
					$\theta_r$ (% vol)	$\theta_s$ (% vol)
B5A-9A (102.7 pcf)	0.0072	1.3012	2.66	39.35	NA	NA
B6A-19A (90.8 pcf)	0.0049	1.2175	0.00	45.53	NA	NA
B7A-0-20 (1+2) (102.6 pcf)	0.0074	1.2353	0.00	40.29	---	---
B7A-40-60 (1+2) (98.3 pcf)	0.0153	1.1909	0.00	40.80	---	---
B9-20-35 (1+2) (90.3 pcf)	0.0023	1.2148	0.00	45.90	---	---
B10-39A (90.3 pcf)	0.0046	1.2040	0.00	46.70	---	---
B10-10-25 (1+2) (103.4 pcf)	0.0104	1.2238	0.00	40.09	---	---
B11-39 (104.2 pcf)	0.0315	1.5127	4.02	39.70	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B5A-9A (102.7 pcf)  
 Project Name: NECR Jetty '18  
 Depth: 10'-10.5'

Dry wt. of sample (g): 261.46  
 Tare wt., ring (g): 70.10  
 Tare wt., screen & clamp (g): 27.45  
 Initial sample volume (cm<sup>3</sup>): 158.88  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.65  
 Measured particle density (g/cm<sup>3</sup>): 2.63  
 Initial calculated total porosity (%): 37.32

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
<i>Hanging column:</i>	7-Aug-18	11:00	421.61	0	38.18	##
	14-Aug-18	10:50	422.15	17.0	38.51	##
	21-Aug-18	15:00	421.60	54.0	38.35	##
	28-Aug-18	15:20	418.73	123.0	36.77	##
<i>Pressure plate:</i>	7-Sep-18	10:40	401.95	337	26.53	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	163.98	+3.21%	1.59	39.27
	17.0	163.98	+3.21%	1.59	39.27
	54.0	163.22	+2.73%	1.60	38.99
	123.0	162.40	+2.22%	1.61	38.68
<i>Pressure plate:</i>	337	161.85	+1.87%	1.62	38.47

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by: D. O'Dowd*  
*Data entered by: C. Krous*  
*Checked by: J. Hines*



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B5A-9A (102.7 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.65

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 140.60

Tare weight, jar (g): 116.70

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	17-Aug-18	10:15	142.32	24373	11.62	##
	15-Aug-18	10:55	141.82	91578	8.23	##
	13-Aug-18	15:03	141.44	395580	5.65	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	24373	161.85	+1.87%	1.62	38.47
	91578	161.85	+1.87%	1.62	38.47
	395580	161.85	+1.87%	1.62	38.47

Dry weight\* of relative humidity box sample (g): 60.65

Tare weight (g): 42.91

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	61.16	845560	4.64	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	161.85	+1.87%	1.62	38.47

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd/M. Garcia

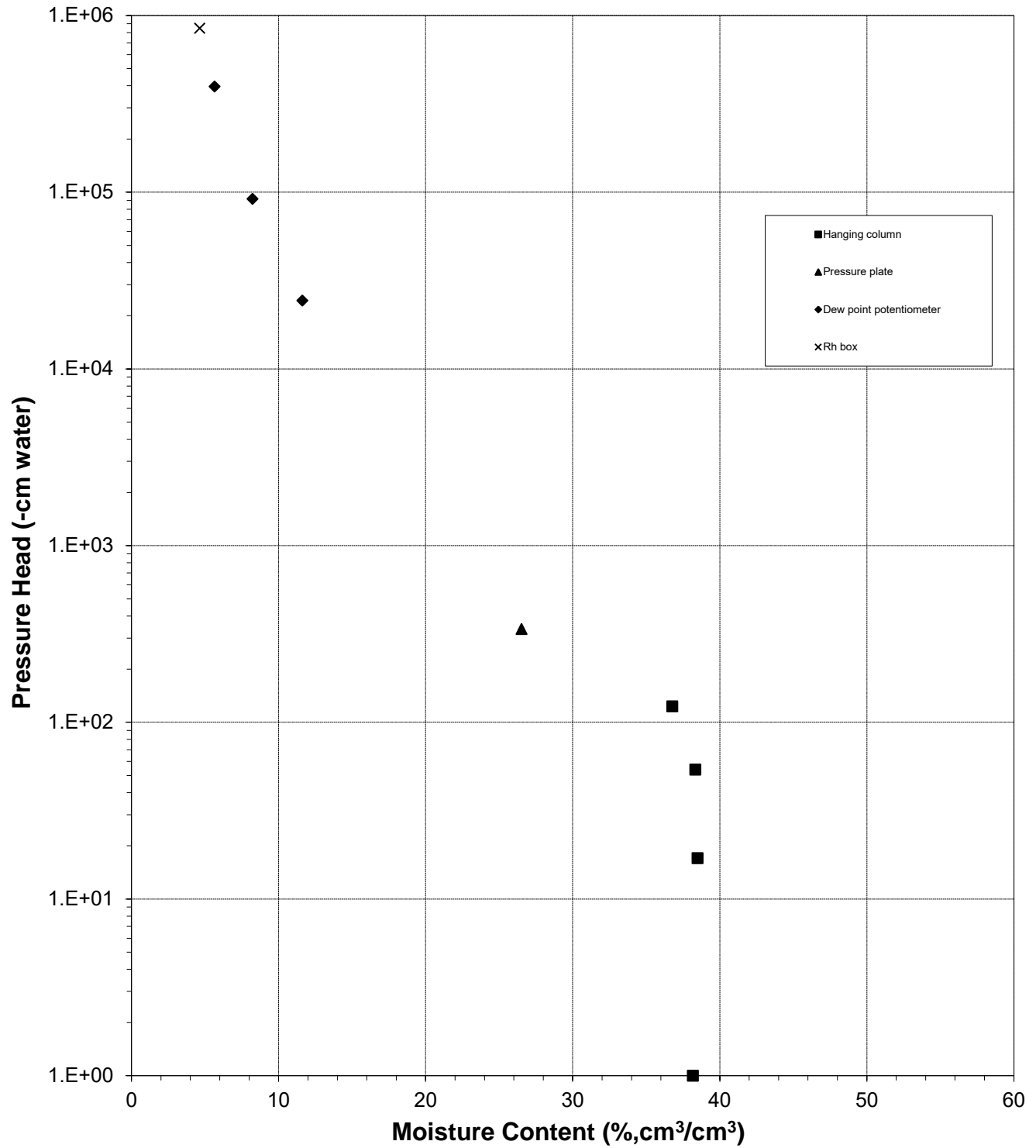
Data entered by: C. Krous

Checked by: J. Hines





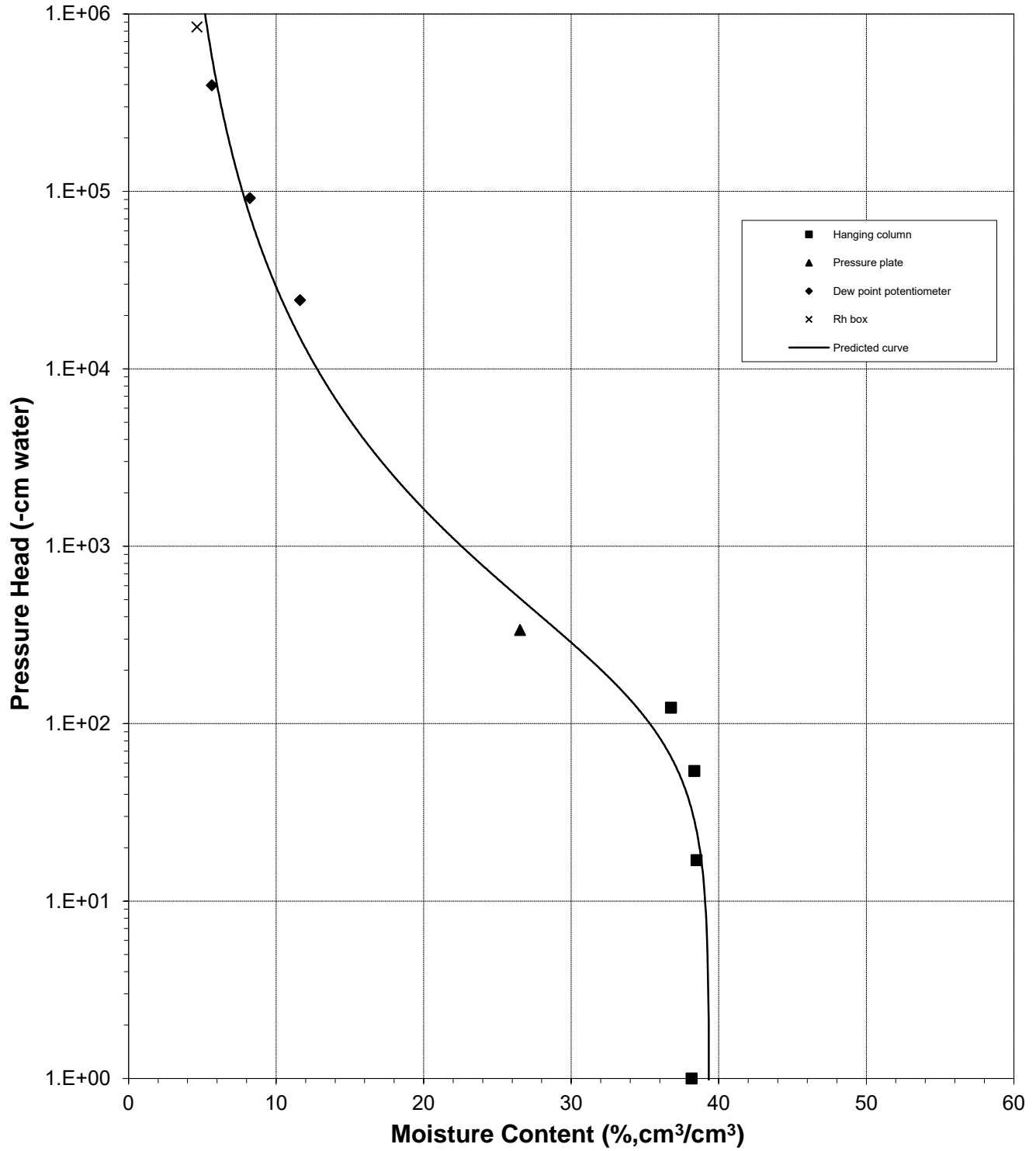
**Water Retention Data Points**  
Sample Number: B5A-9A (102.7 pcf)





### Predicted Water Retention Curve and Data Points

Sample Number: B5A-9A (102.7 pcf)

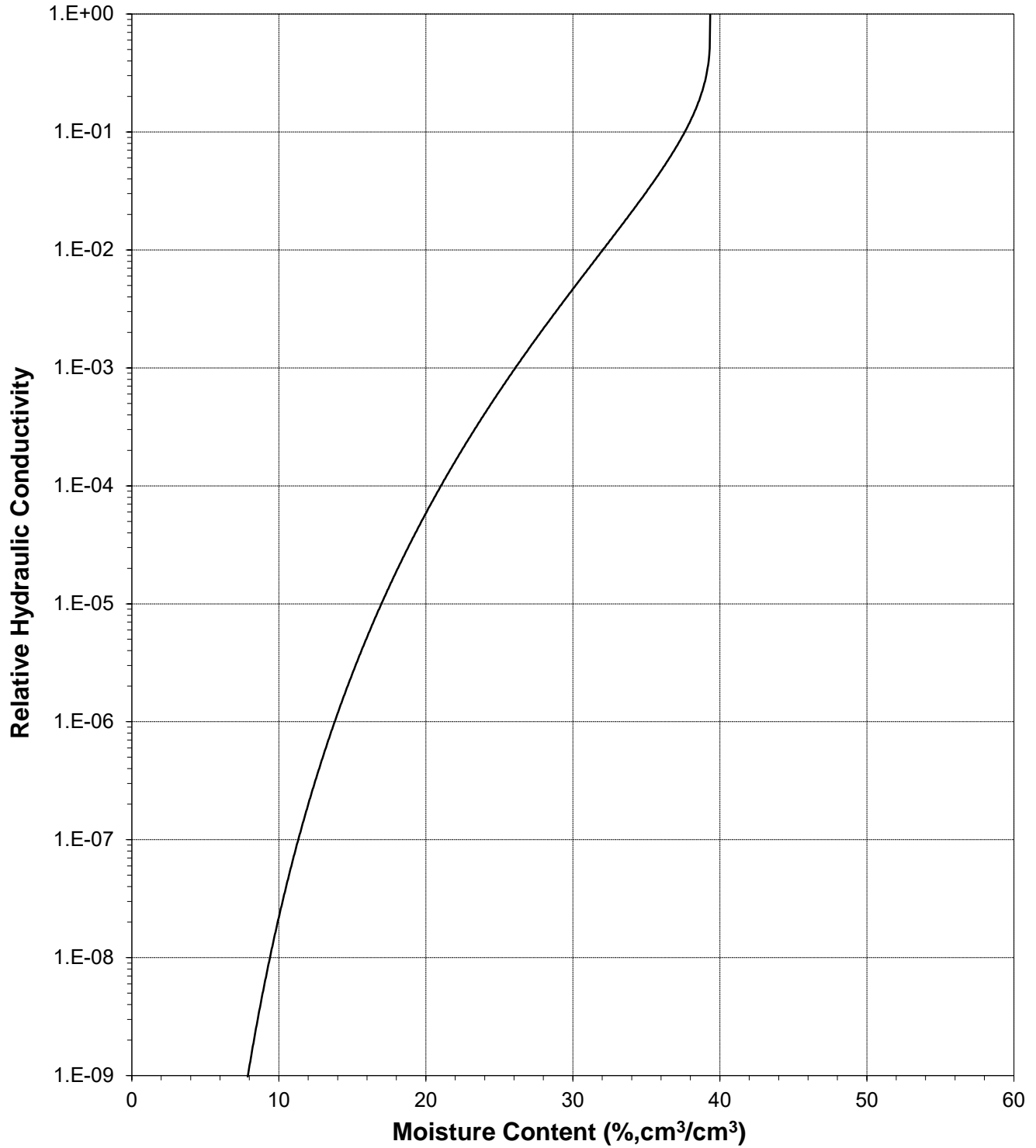




*Daniel B. Stephens & Associates, Inc.*

### Plot of Relative Hydraulic Conductivity vs Moisture Content

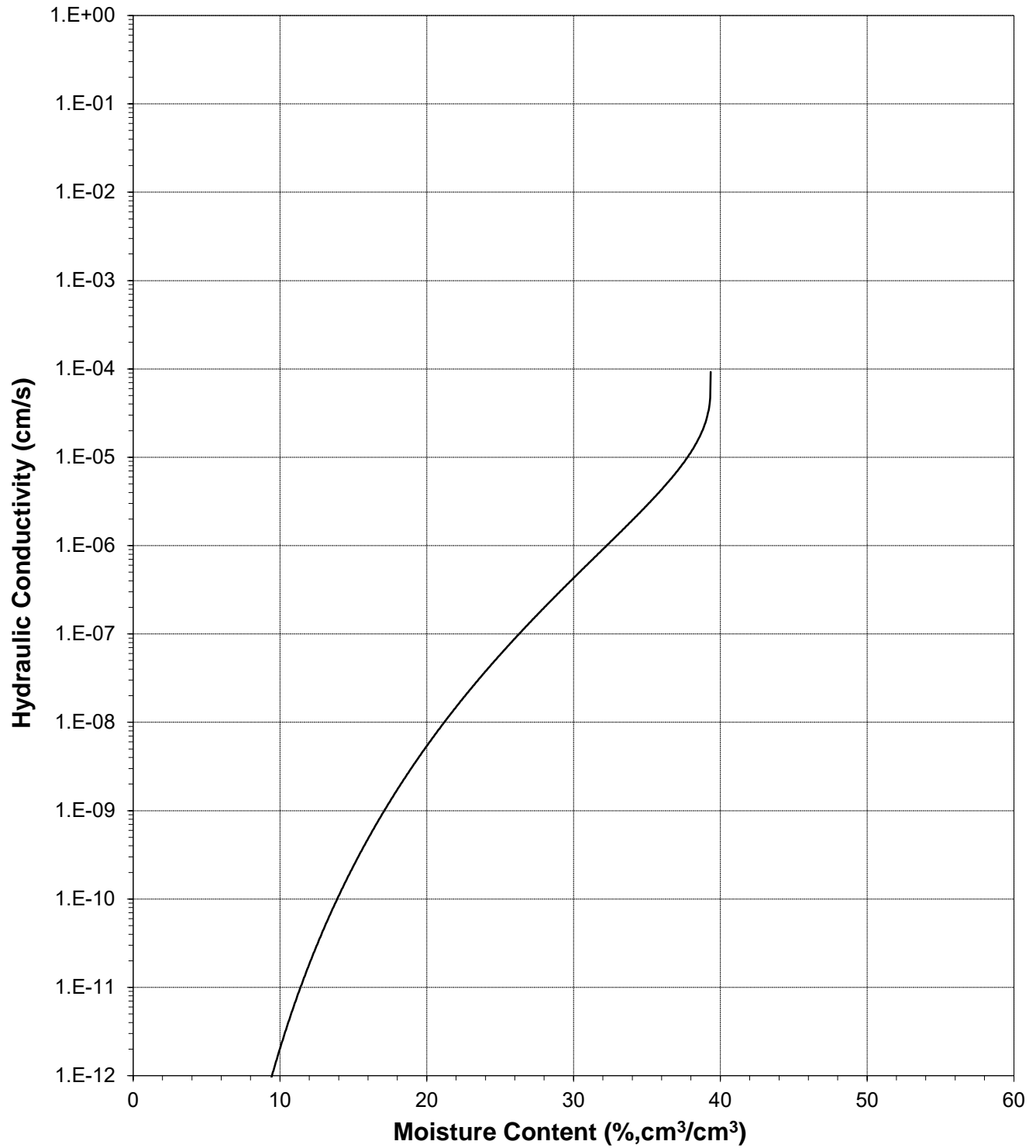
Sample Number: B5A-9A (102.7 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: B5A-9A (102.7 pcf)

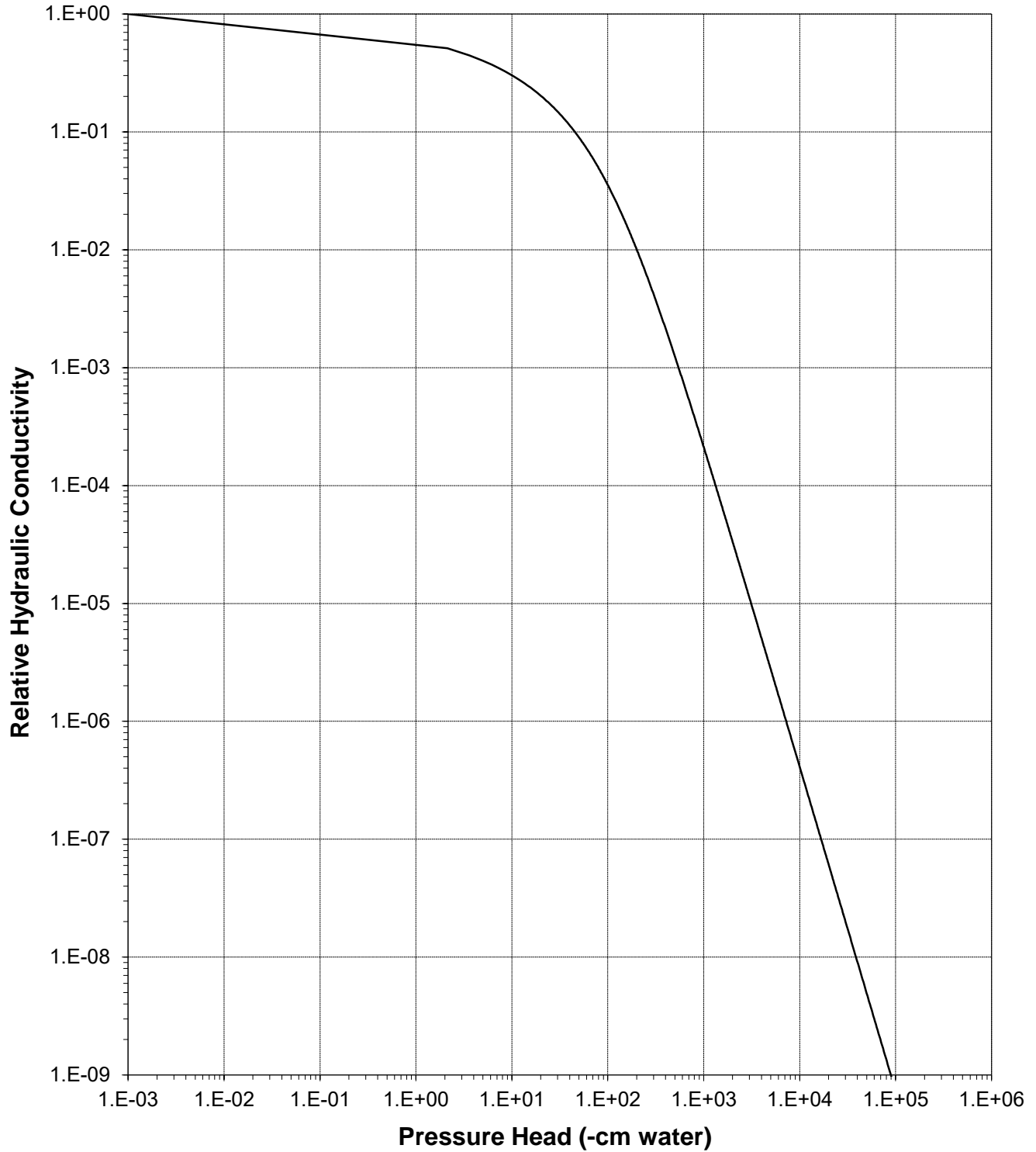




*Daniel B. Stephens & Associates, Inc.*

### Plot of Relative Hydraulic Conductivity vs Pressure Head

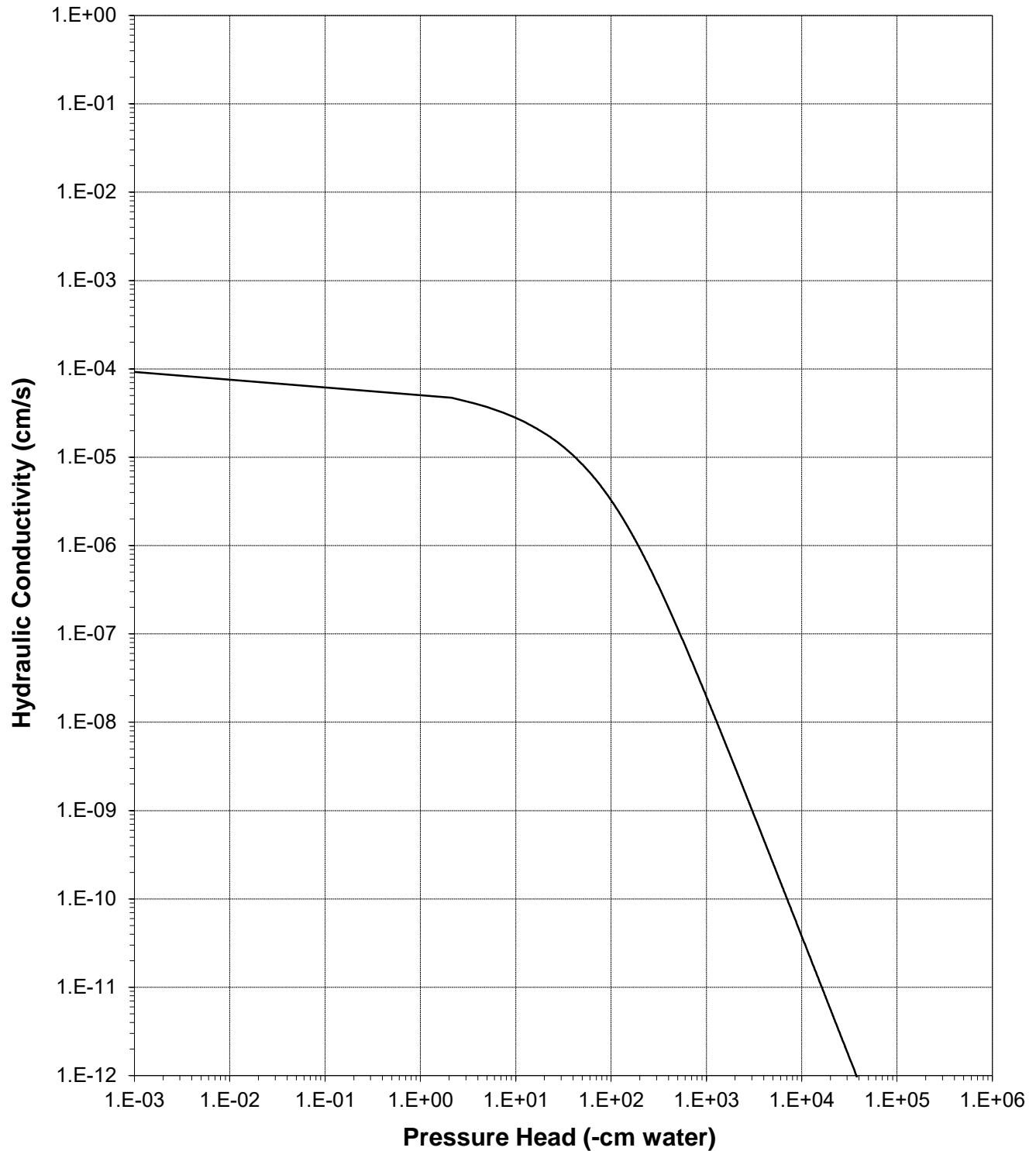
*Sample Number: B5A-9A (102.7 pcf)*





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B5A-9A (102.7 pcf)





*Daniel B. Stephens & Associates, Inc.*

**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B6A-19A (90.8 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-20.5'

*Dry wt. of sample (g):* 243.34  
*Tare wt., ring (g):* 73.64  
*Tare wt., screen & clamp (g):* 27.61  
*Initial sample volume (cm<sup>3</sup>):* 167.22  
*Initial dry bulk density (g/cm<sup>3</sup>):* 1.46  
*Measured particle density (g/cm<sup>3</sup>):* 2.69  
*Initial calculated total porosity (%):* 45.84

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
<i>Hanging column:</i>	7-Aug-18	11:00	423.13	0	44.78	##
	14-Aug-18	10:50	424.25	17.0	45.55	##
	21-Aug-18	14:45	423.70	54.0	45.37	##
	28-Aug-18	15:20	415.91	123.0	41.07	##
<i>Pressure plate:</i>	7-Sep-18	10:25	409.67	337	37.82	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	175.40	+4.89%	1.39	48.36
	17.0	174.89	+4.58%	1.39	48.21
	54.0	174.37	+4.27%	1.40	48.06
	123.0	173.64	+3.84%	1.40	47.84
<i>Pressure plate:</i>	337	172.06	+2.89%	1.41	47.36

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* C. Krous  
*Checked by:* J. Hines



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B6A-19A (90.8 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.46

Fraction of bulk sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 133.83

Tare weight, jar (g): 112.64

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	16-Aug-18	10:45	135.94	76485	14.10	##
	14-Aug-18	9:00	135.26	269737	9.56	##
	13-Aug-18	13:54	134.88	678881	7.01	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	76485	172.06	+2.89%	1.41	47.36
	269737	172.06	+2.89%	1.41	47.36
	678881	172.06	+2.89%	1.41	47.36

Dry weight\* of relative humidity box sample (g): 57.24

Tare weight (g): 39.42

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	58.06	845560	6.54	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	172.06	+2.89%	1.41	47.36

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

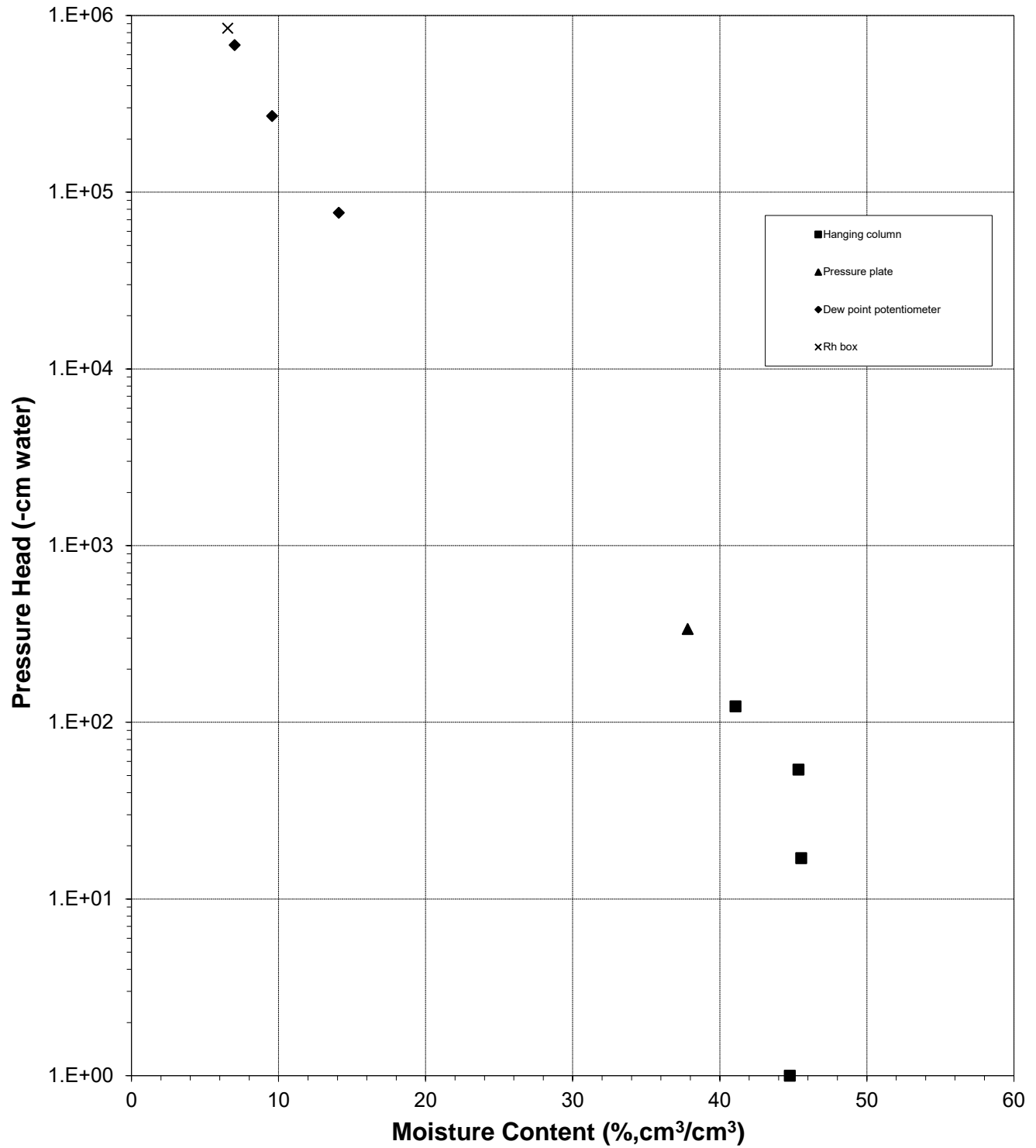
Data entered by: C. Krous

Checked by: J. Hines





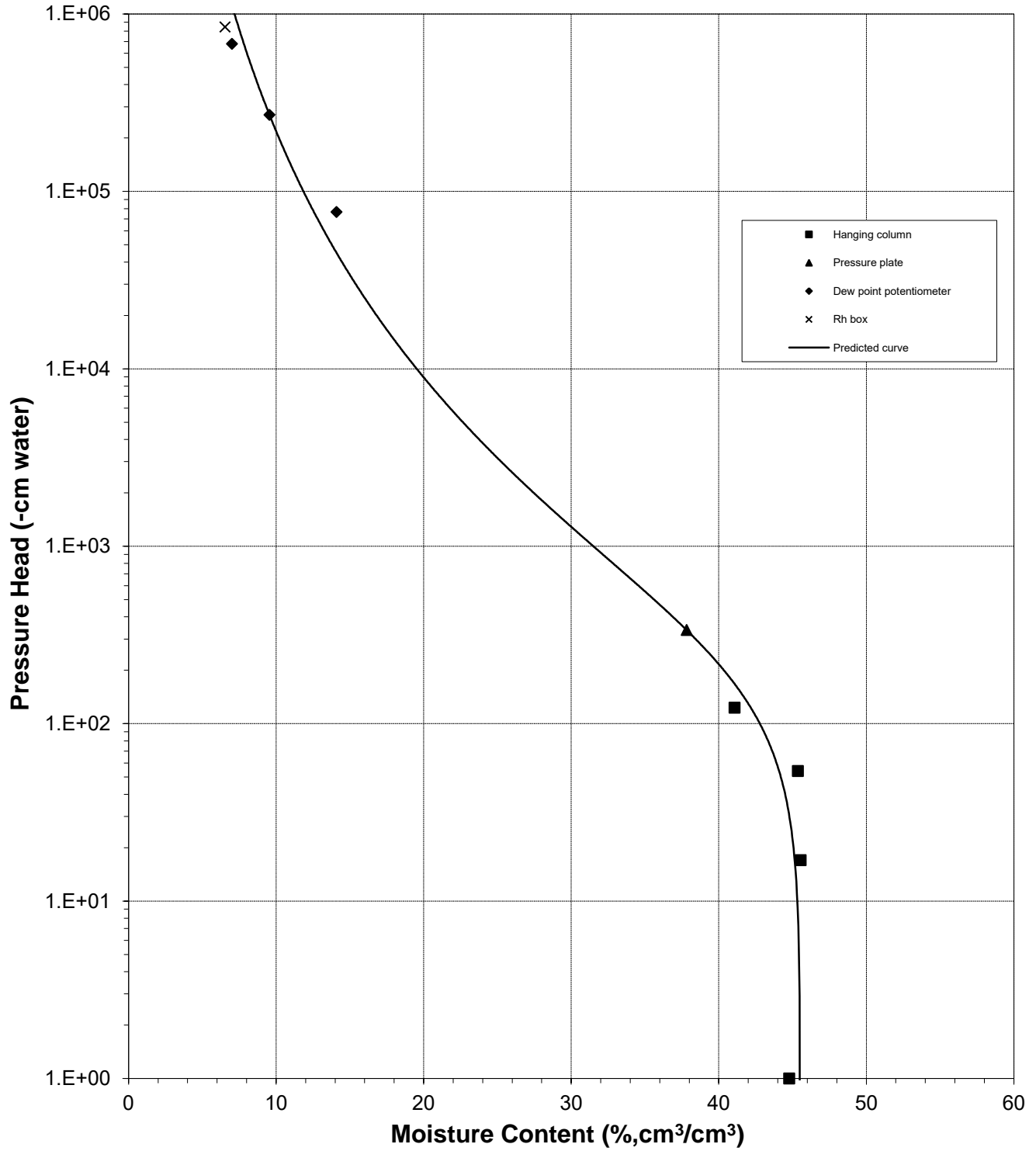
**Water Retention Data Points**  
Sample Number: B6A-19A (90.8 pcf)





### Predicted Water Retention Curve and Data Points

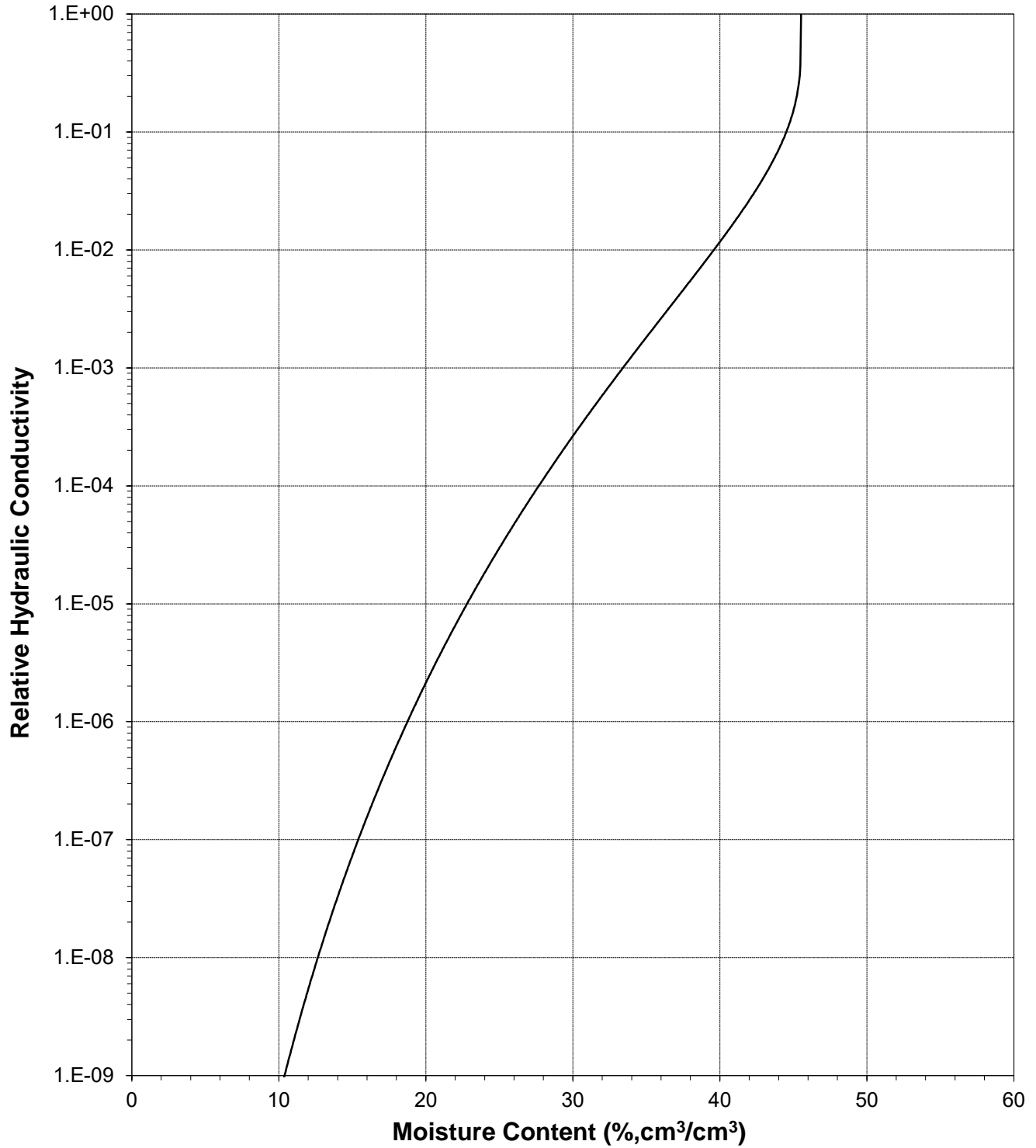
Sample Number: B6A-19A (90.8 pcf)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

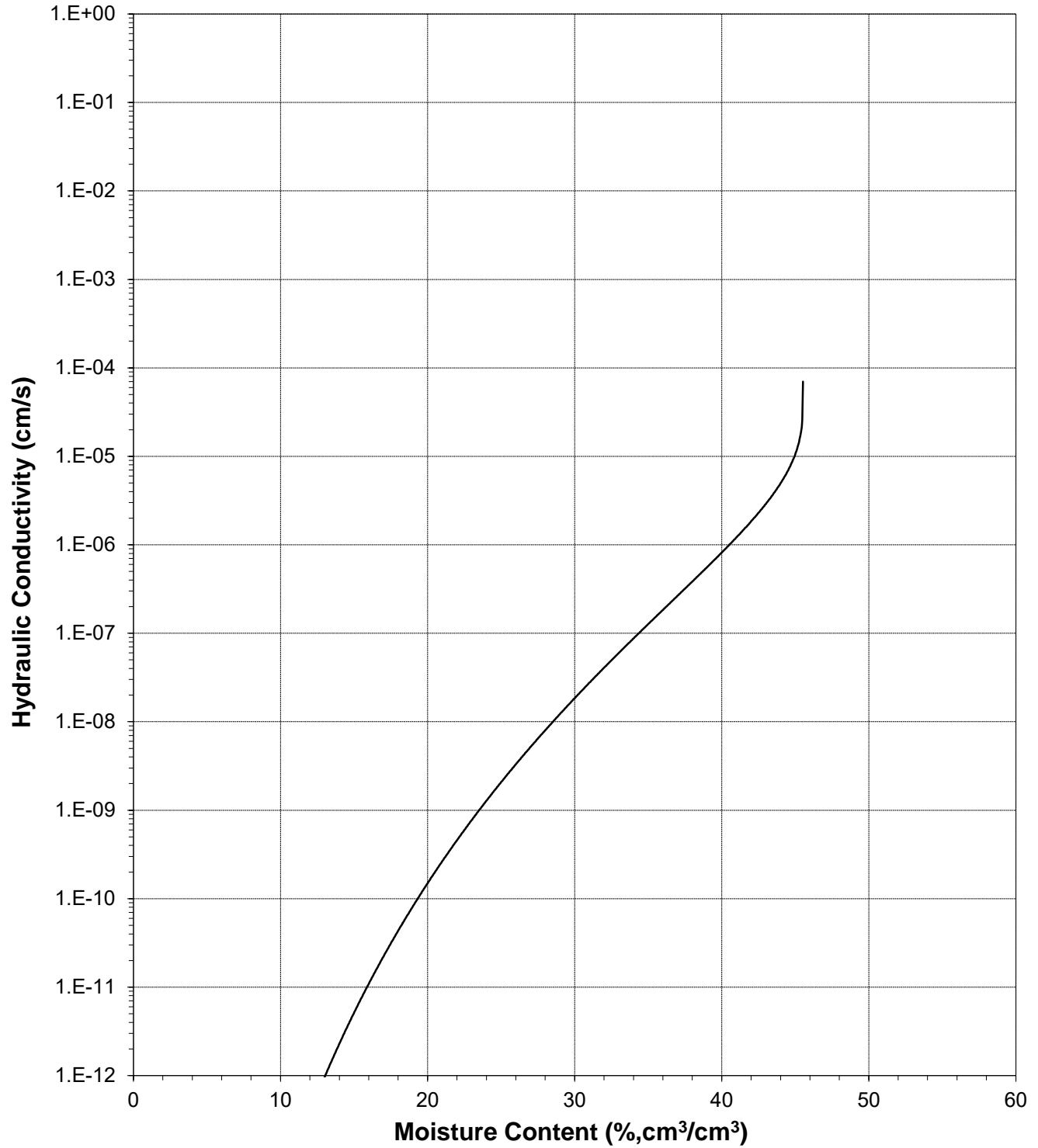
Sample Number: B6A-19A (90.8 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: B6A-19A (90.8 pcf)

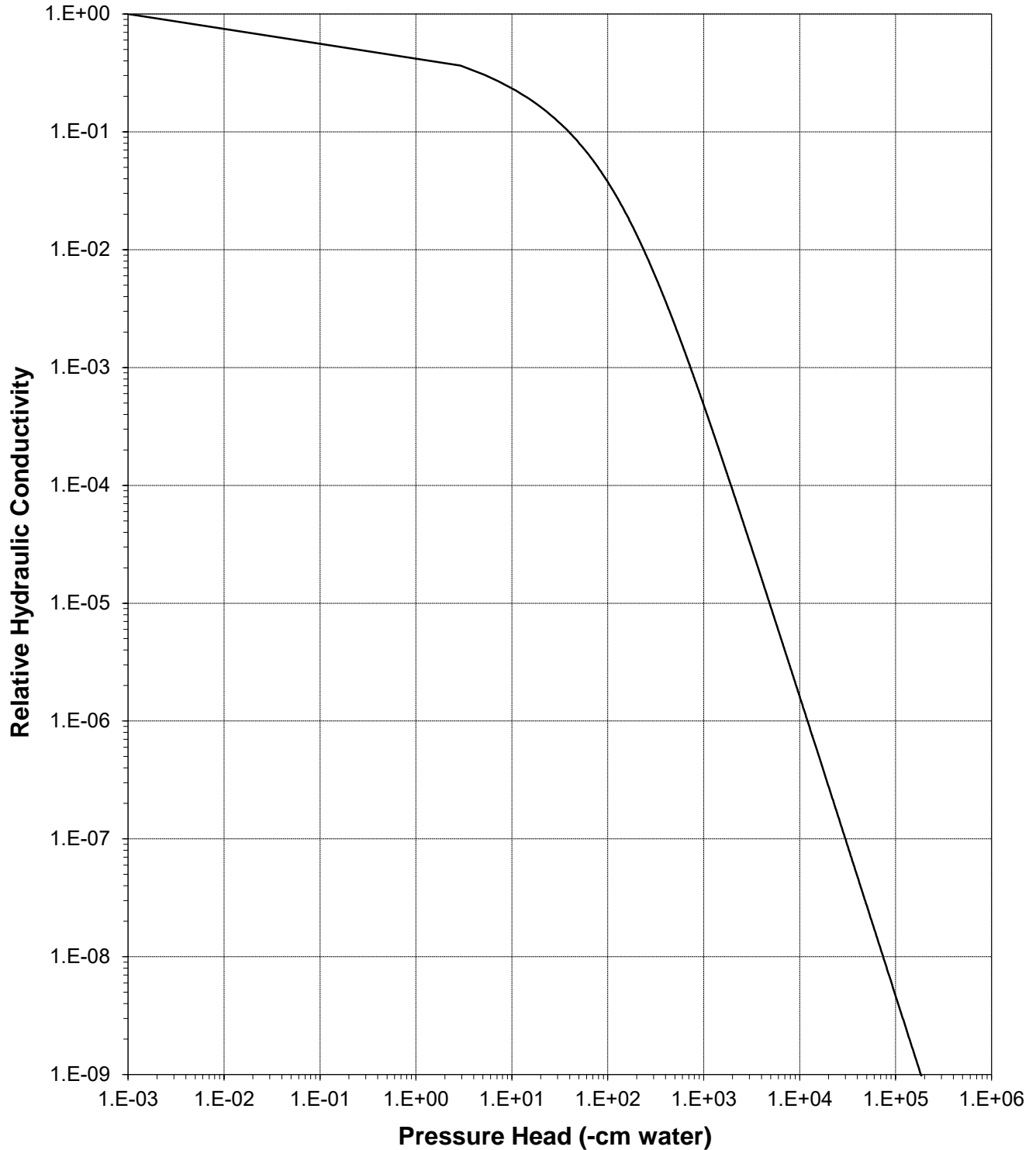




*Daniel B. Stephens & Associates, Inc.*

### Plot of Relative Hydraulic Conductivity vs Pressure Head

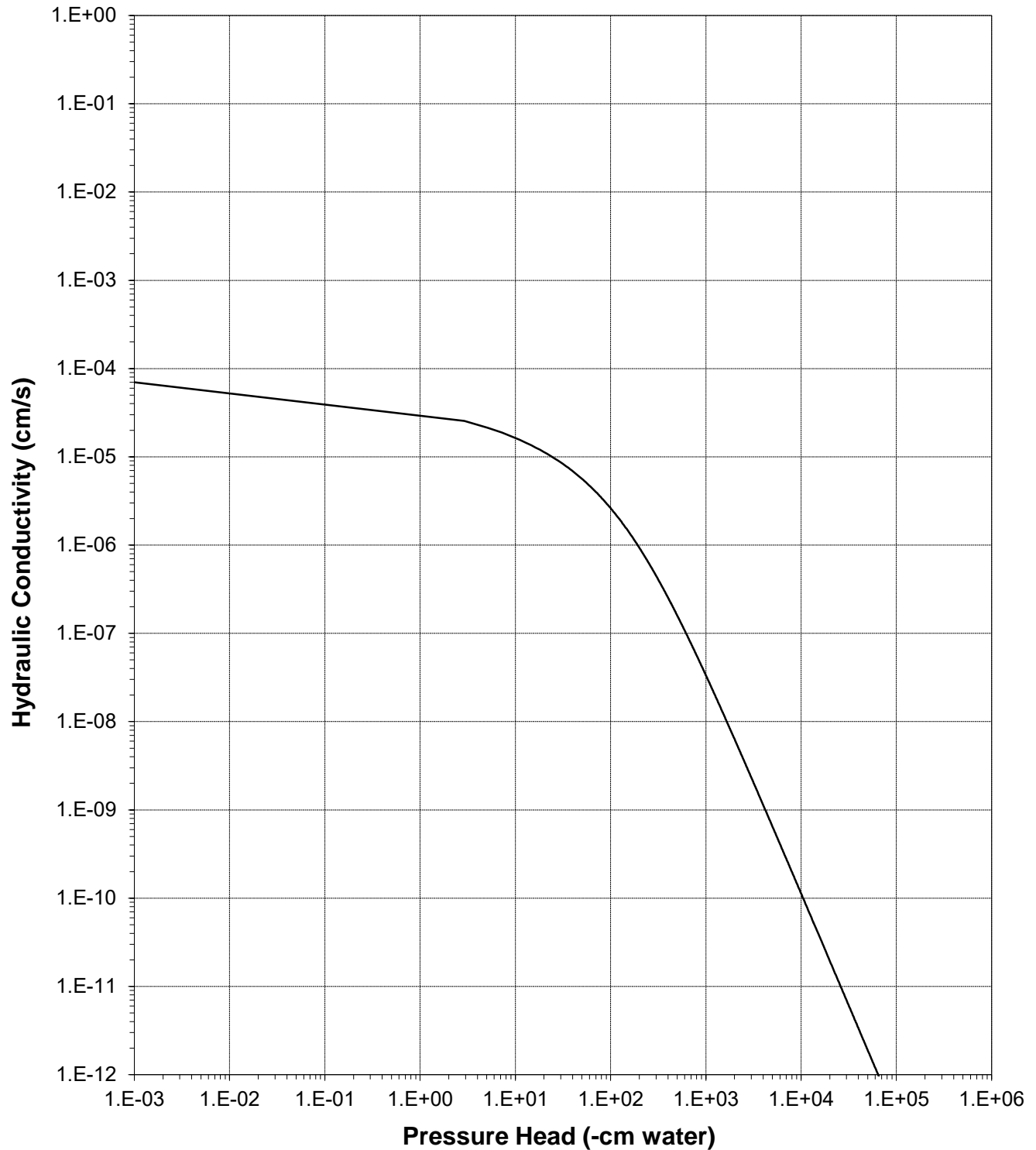
*Sample Number: B6A-19A (90.8 pcf)*





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B6A-19A (90.8 pcf)





Daniel B. Stephens & Associates, Inc.

### Moisture Retention Data Hanging Column / Pressure Plate (Soil-Water Characteristic Curve)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2) (102.6 pcf)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

Dry wt. of sample (g): 363.11  
Tare wt., ring (g): 137.16  
Tare wt., screen & clamp (g): 24.28  
Initial sample volume (cm<sup>3</sup>): 220.95  
Initial dry bulk density (g/cm<sup>3</sup>): 1.64  
Measured particle density (g/cm<sup>3</sup>): 2.67  
Initial calculated total porosity (%): 38.38

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Hanging column:	7-Aug-18	11:00	613.90	0	39.52	##
	14-Aug-18	10:50	614.06	17.0	39.59	##
	21-Aug-18	15:00	613.75	54.0	39.46	##
	28-Aug-18	15:20	605.73	123.0	36.09	##
Pressure plate:	7-Sep-18	10:35	591.46	337	29.74	##

#### Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
Hanging column:	0.0	226.07	+2.32%	1.61	39.77
	17.0	226.07	+2.32%	1.61	39.77
	54.0	226.07	+2.32%	1.61	39.77
	123.0	224.96	+1.81%	1.61	39.48
Pressure plate:	337	224.96	+1.81%	1.61	39.48

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "----" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '----' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

#### Technician Notes:

Laboratory analysis by: D. O'Dowd  
Data entered by: C. Krous  
Checked by: J. Hines



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B7A-0-20 (1+2) (102.6 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.64

Fraction of test sample used (<2.00mm fraction) (%): 99.74

Dry weight\* of dew point potentiometer sample (g): 146.47

Tare weight, jar (g): 113.46

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	20-Aug-18	8:37	149.27	16929	13.65	##
	16-Aug-18	10:50	148.35	75975	9.19	##
	14-Aug-18	9:05	147.77	273612	6.33	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16929	224.96	+1.81%	1.61	39.48
	75975	224.96	+1.81%	1.61	39.48
	273612	224.96	+1.81%	1.61	39.48

Dry weight\* of relative humidity box sample (g): 62.85

Tare weight (g): 41.90

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	63.49	845560	4.93	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	224.96	+1.81%	1.61	39.48

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

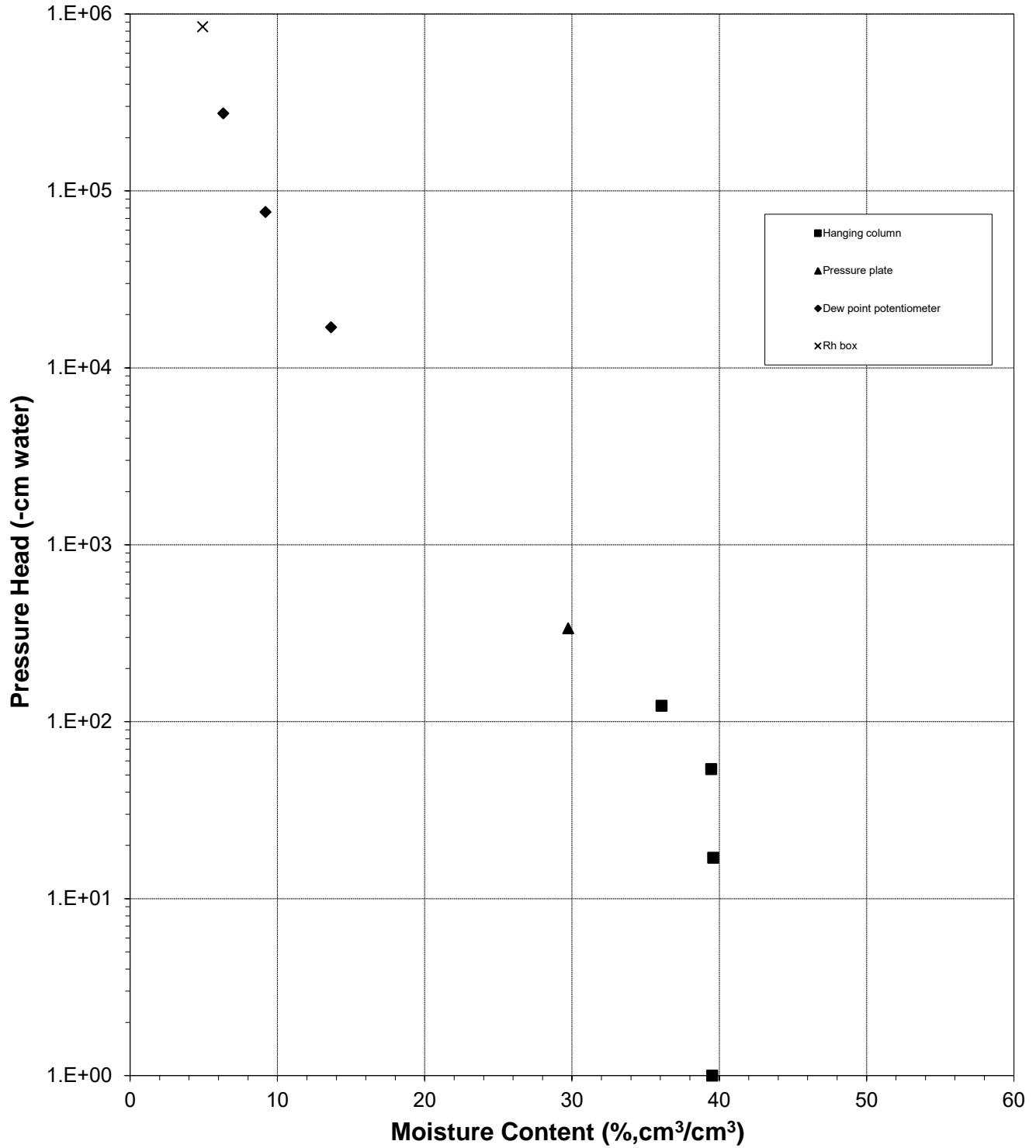
Data entered by: C. Krous

Checked by: J. Hines





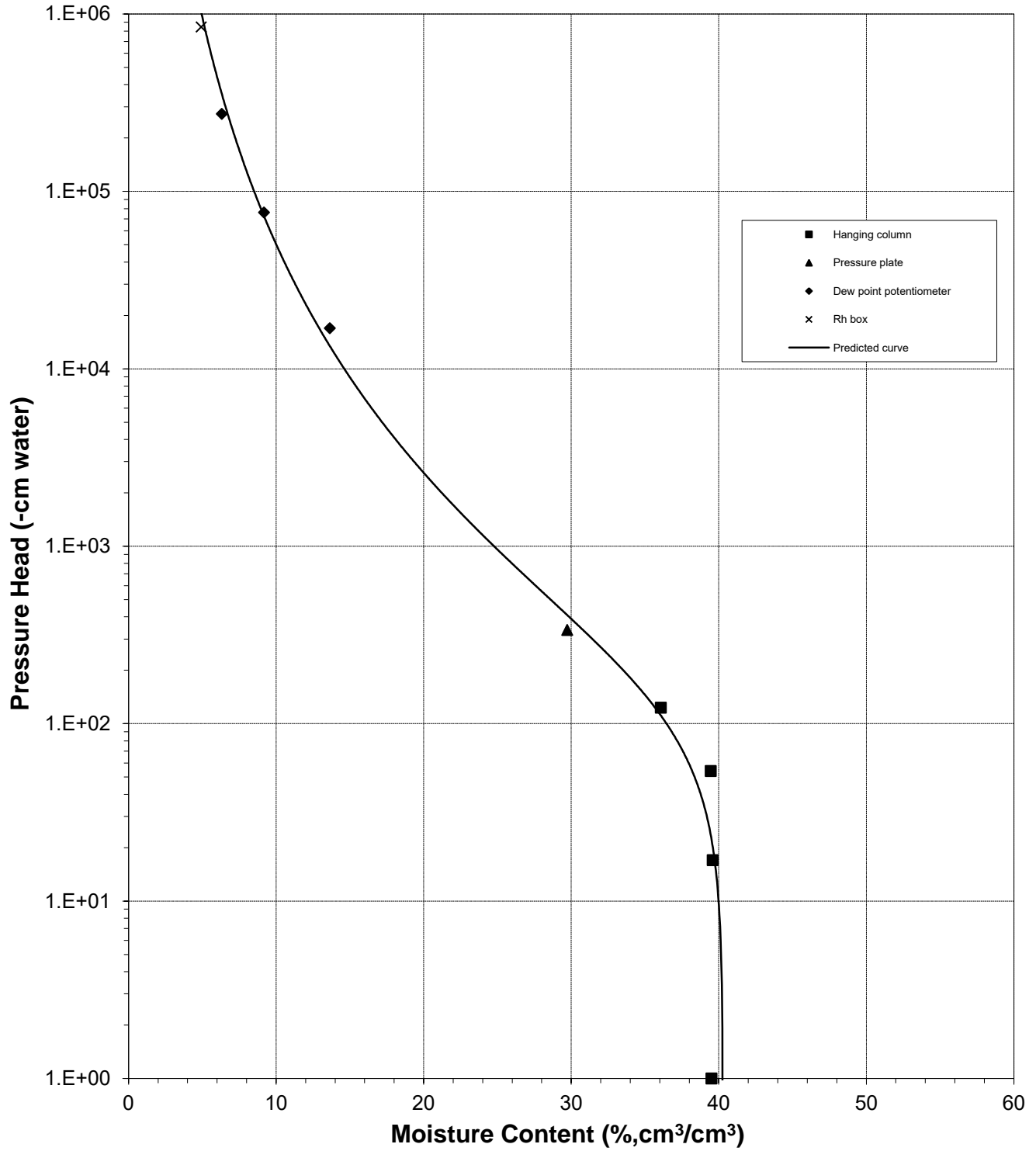
**Water Retention Data Points**  
Sample Number: B7A-0-20 (1+2) (102.6 pcf)





### Predicted Water Retention Curve and Data Points

Sample Number: B7A-0-20 (1+2) (102.6 pcf)

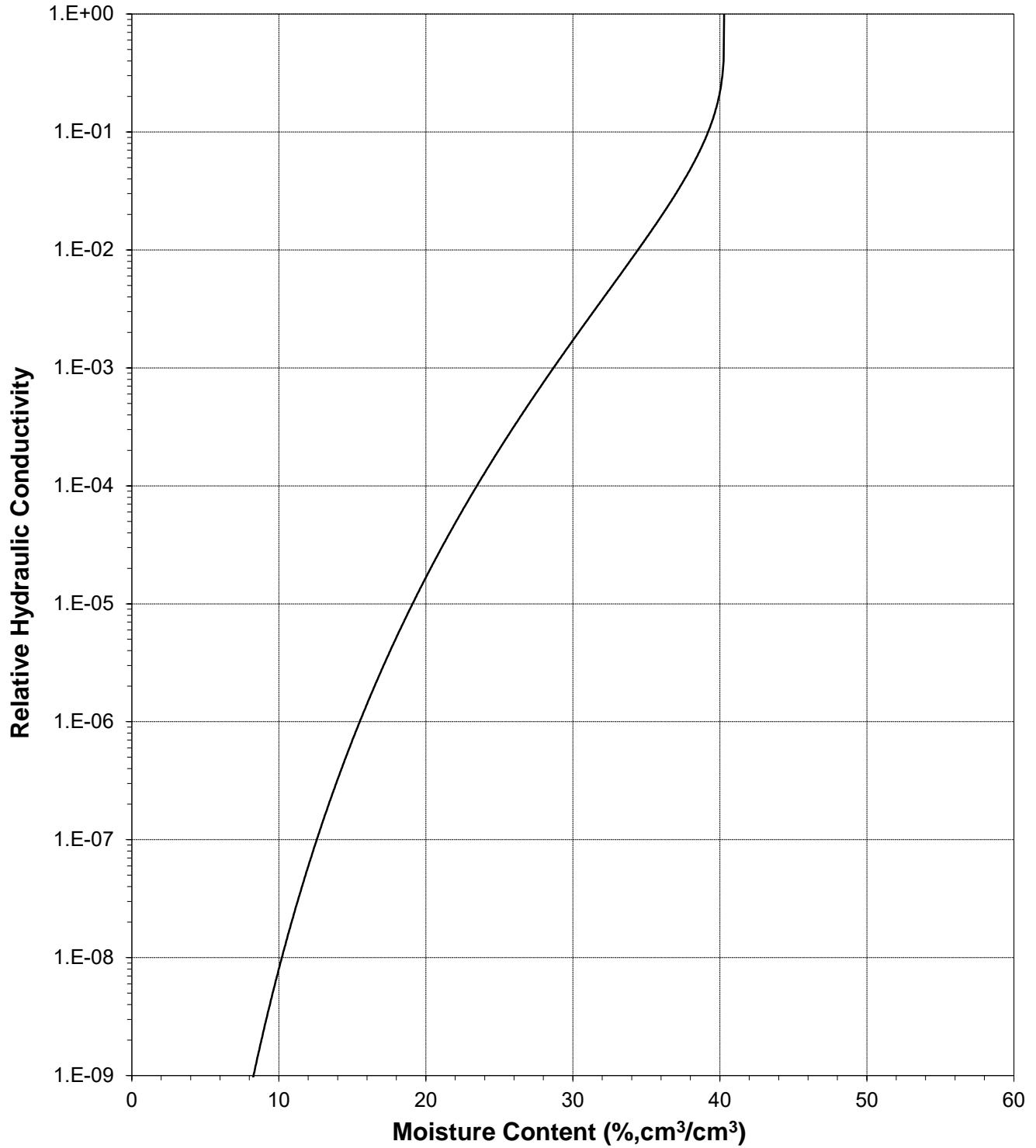




*Daniel B. Stephens & Associates, Inc.*

### Plot of Relative Hydraulic Conductivity vs Moisture Content

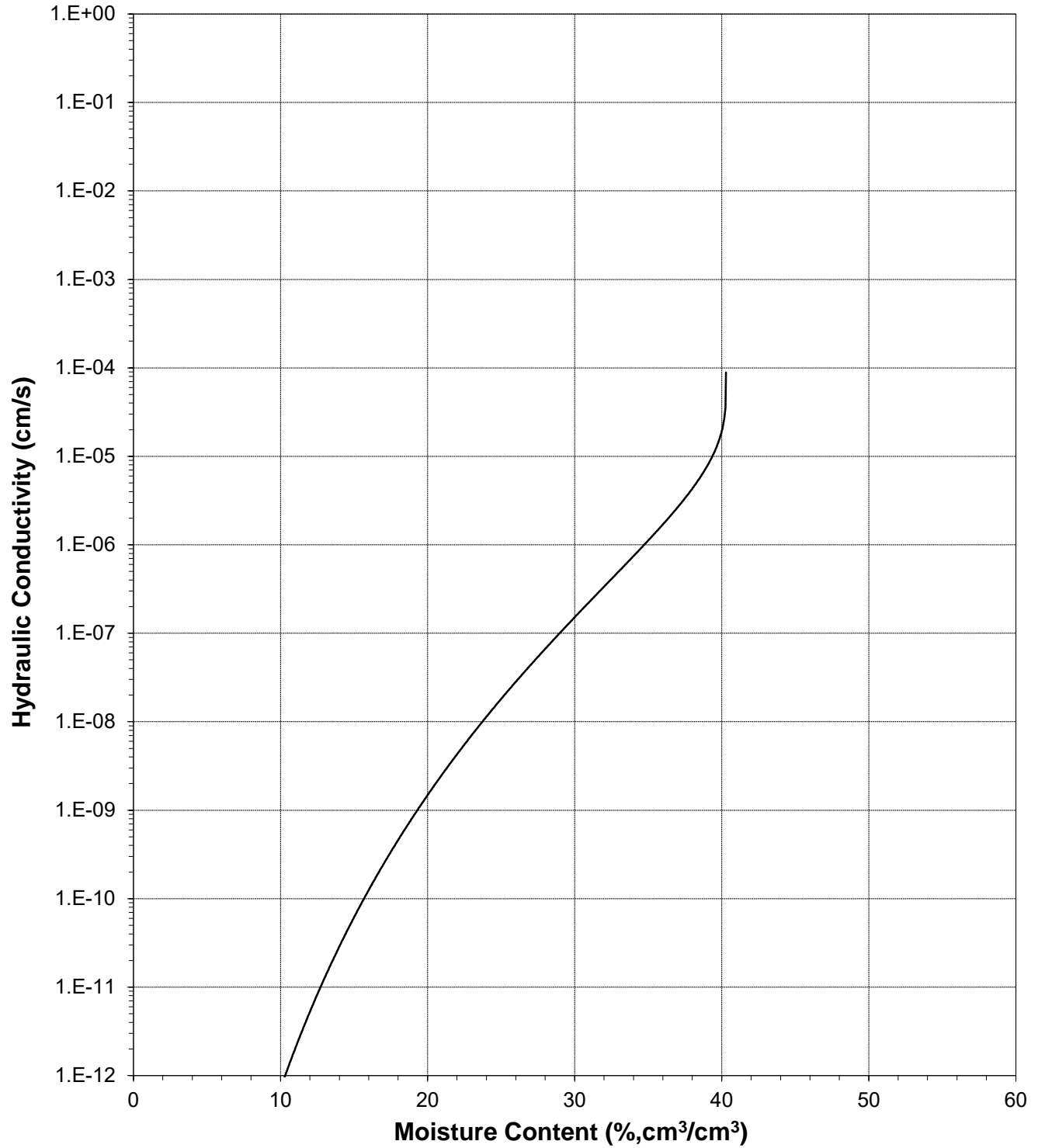
Sample Number: B7A-0-20 (1+2) (102.6 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: B7A-0-20 (1+2) (102.6 pcf)

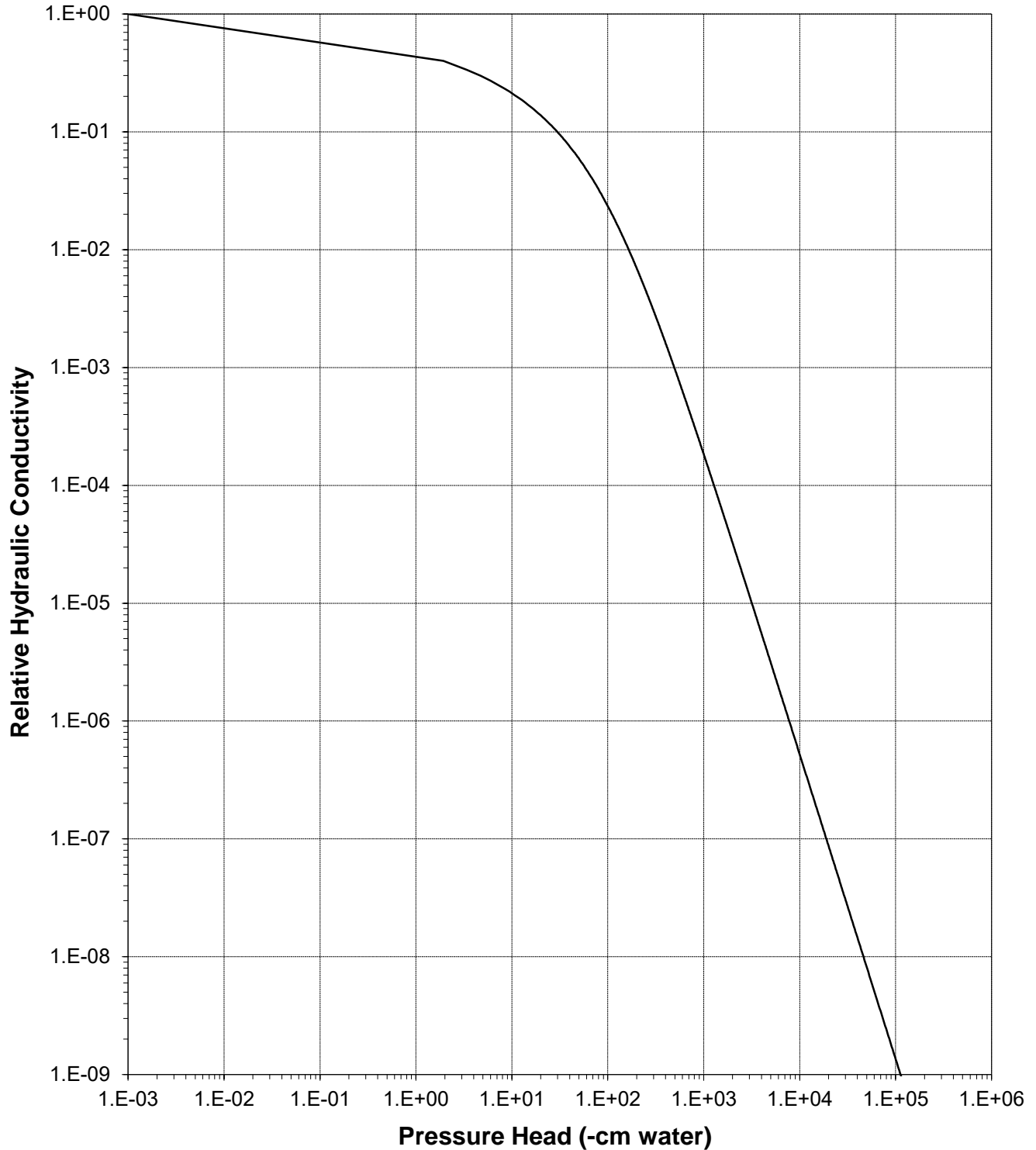




Daniel B. Stephens & Associates, Inc.

### Plot of Relative Hydraulic Conductivity vs Pressure Head

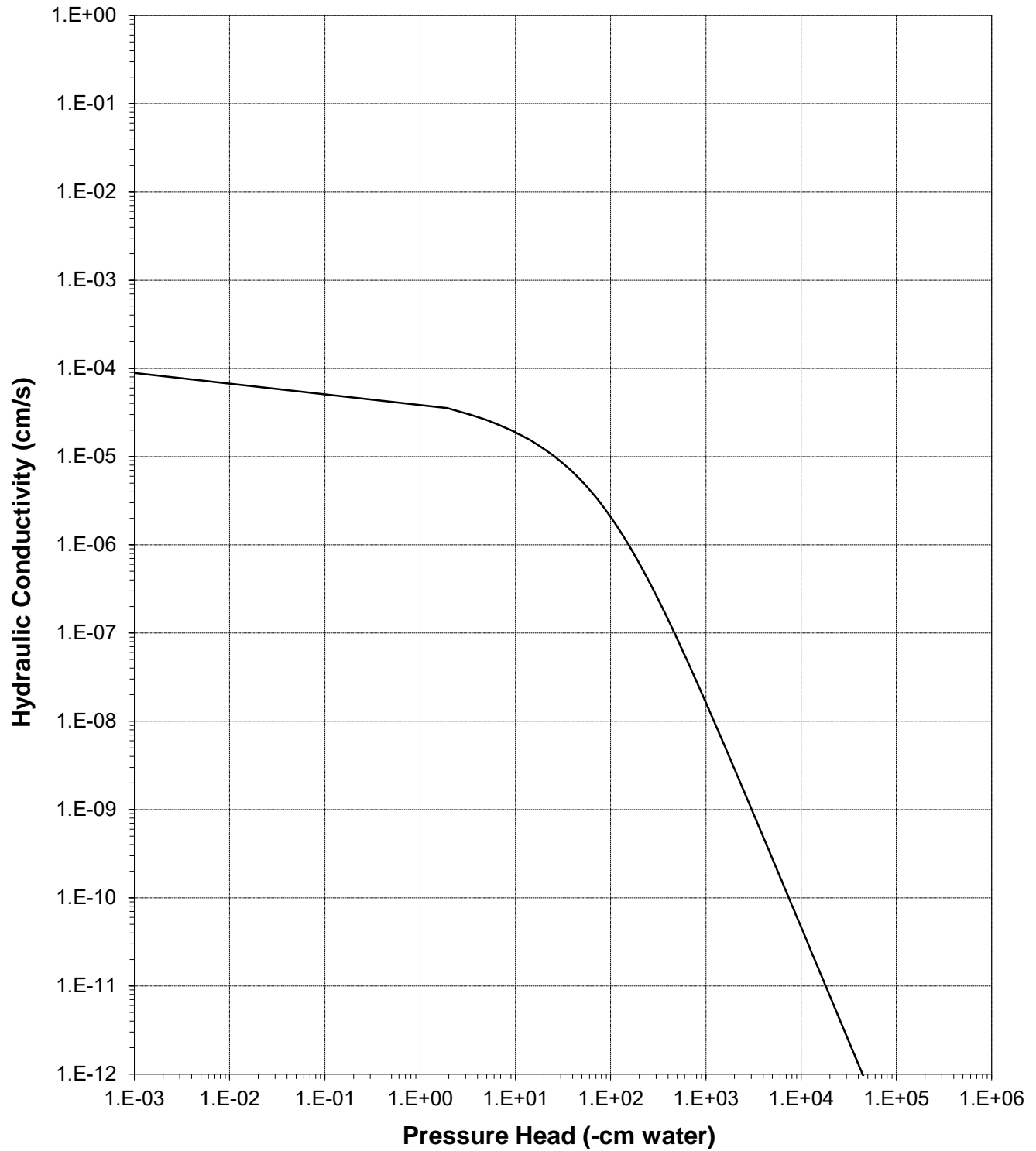
Sample Number: B7A-0-20 (1+2) (102.6 pcf)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B7A-0-20 (1+2) (102.6 pcf)





*Daniel B. Stephens & Associates, Inc.*

**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-40-60 (1+2) (98.3 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-60'

*Dry wt. of sample (g):* 352.13  
*Tare wt., ring (g):* 139.81  
*Tare wt., screen & clamp (g):* 27.19  
*Initial sample volume (cm<sup>3</sup>):* 223.58  
*Initial dry bulk density (g/cm<sup>3</sup>):* 1.57  
*Measured particle density (g/cm<sup>3</sup>):* 2.67  
*Initial calculated total porosity (%):* 41.01

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
<i>Hanging column:</i>	7-Aug-18	11:00	614.28	0	41.36	##
	14-Aug-18	10:50	611.54	17.0	40.17	##
	21-Aug-18	15:00	600.44	54.0	35.34	##
	28-Aug-18	15:20	595.30	123.0	33.21	##
<i>Pressure plate:</i>	8-Sep-18	10:40	589.29	337	30.69	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	230.05	+2.90%	1.53	42.67
	17.0	230.05	+2.90%	1.53	42.67
	54.0	230.05	+2.90%	1.53	42.67
	123.0	229.35	+2.58%	1.54	42.49
<i>Pressure plate:</i>	337	228.58	+2.24%	1.54	42.30

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-'-'-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* C. Krous  
*Checked by:* J. Hines



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B7A-40-60 (1+2) (98.3 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.57

Fraction of test sample used (<2.00mm fraction) (%): 99.98

Dry weight\* of dew point potentiometer sample (g): 153.34

Tare weight, jar (g): 112.70

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	20-Aug-18	8:47	157.45	21008	15.58	##
	16-Aug-18	11:10	156.17	78423	10.72	##
	14-Aug-18	9:20	155.16	258009	6.89	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	21008	228.58	+2.24%	1.54	42.30
	78423	228.58	+2.24%	1.54	42.30
	258009	228.58	+2.24%	1.54	42.30

Dry weight\* of relative humidity box sample (g): 61.07

Tare weight (g): 39.93

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	61.79	845560	5.25	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	228.58	+2.24%	1.54	42.30

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

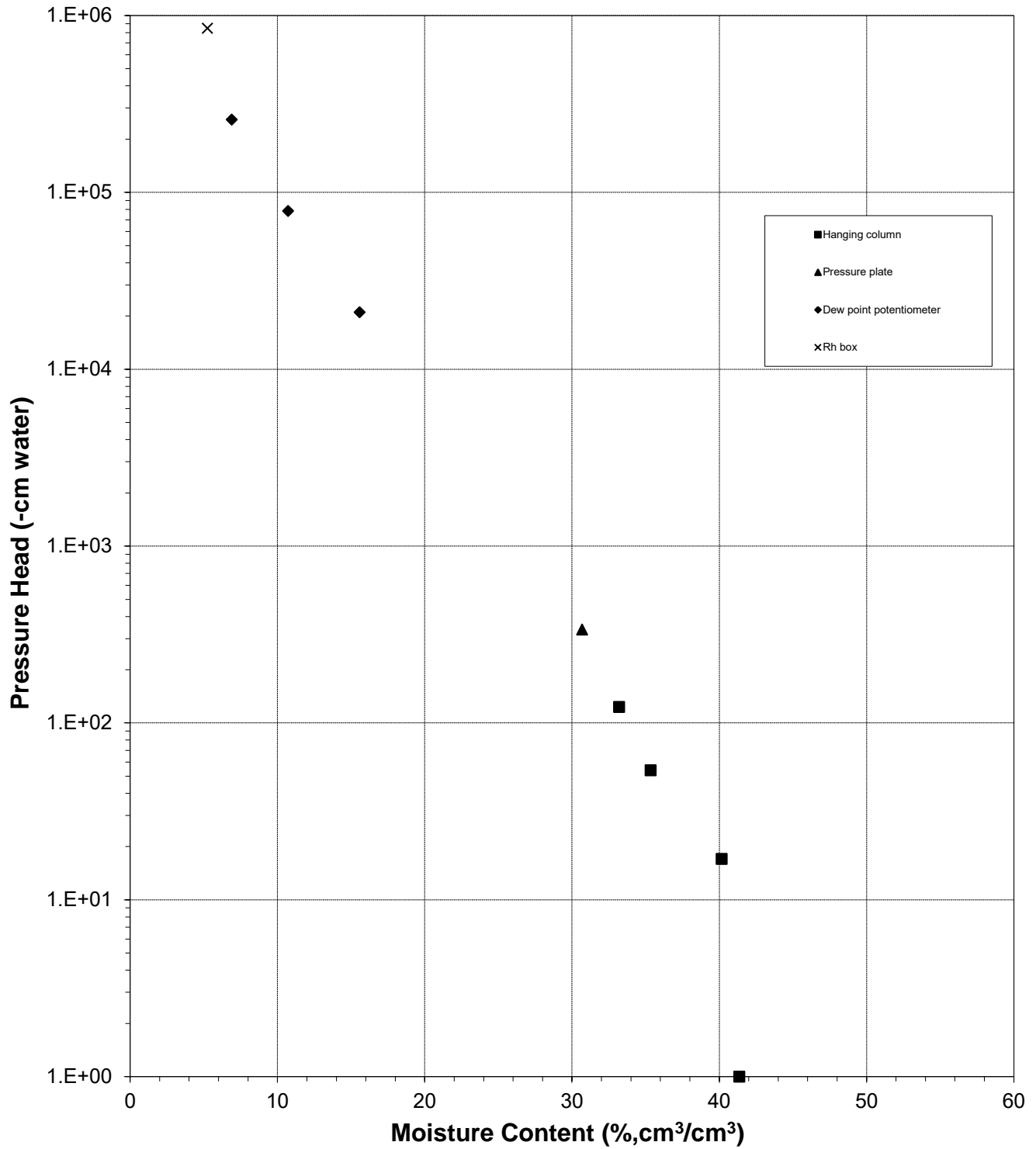
Data entered by: C. Krous

Checked by: J. Hines





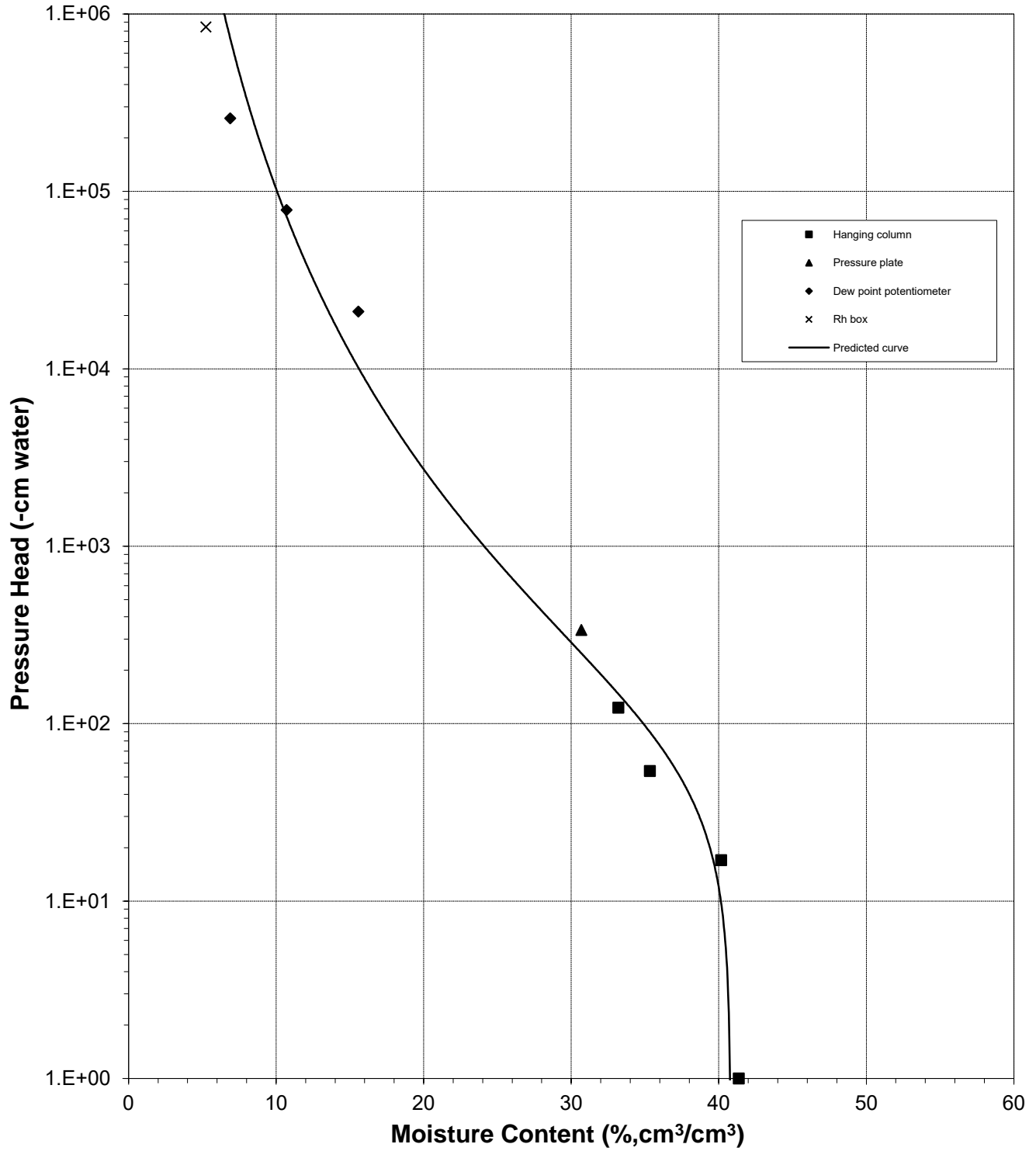
**Water Retention Data Points**  
Sample Number: B7A-40-60 (1+2) (98.3 pcf)





### Predicted Water Retention Curve and Data Points

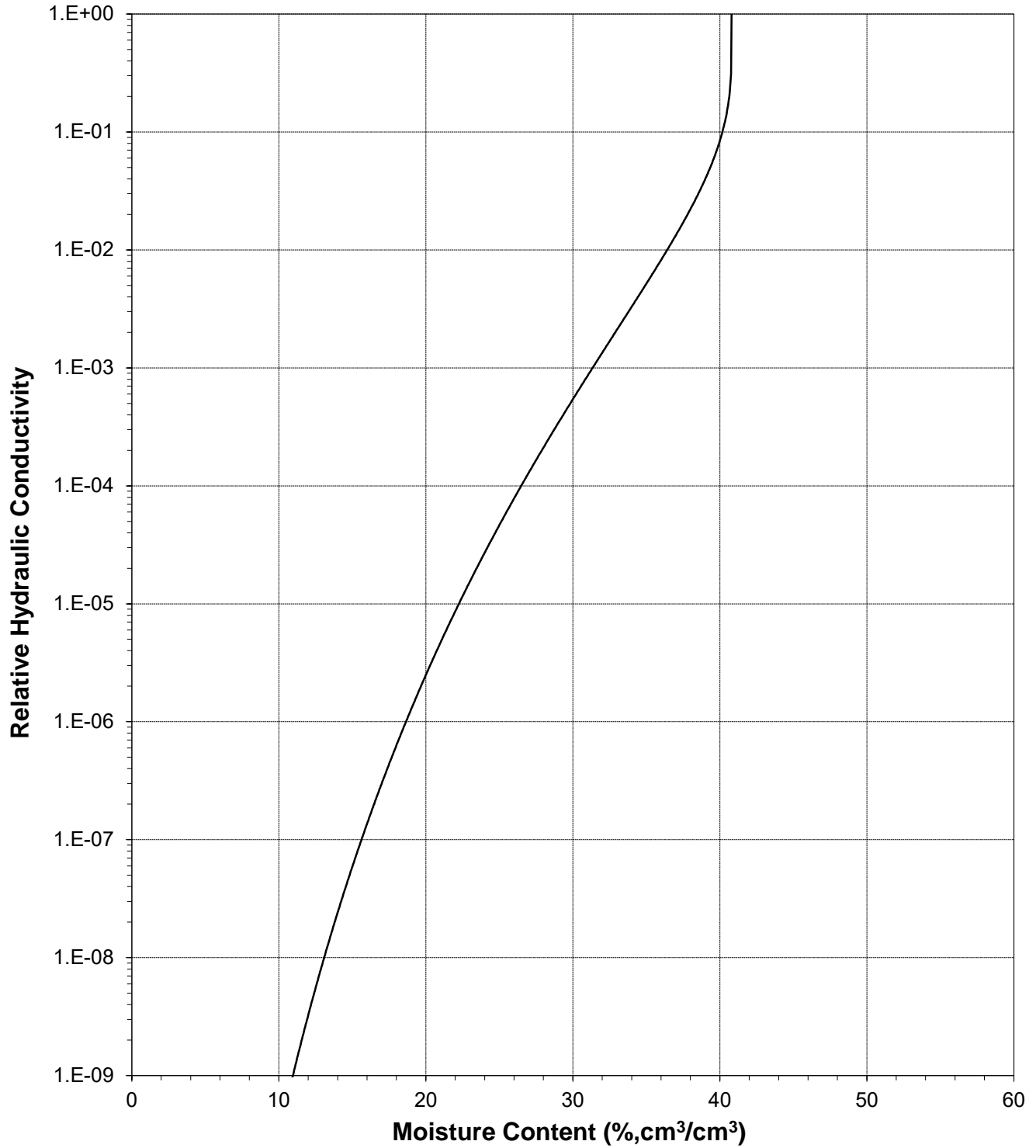
Sample Number: B7A-40-60 (1+2) (98.3 pcf)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

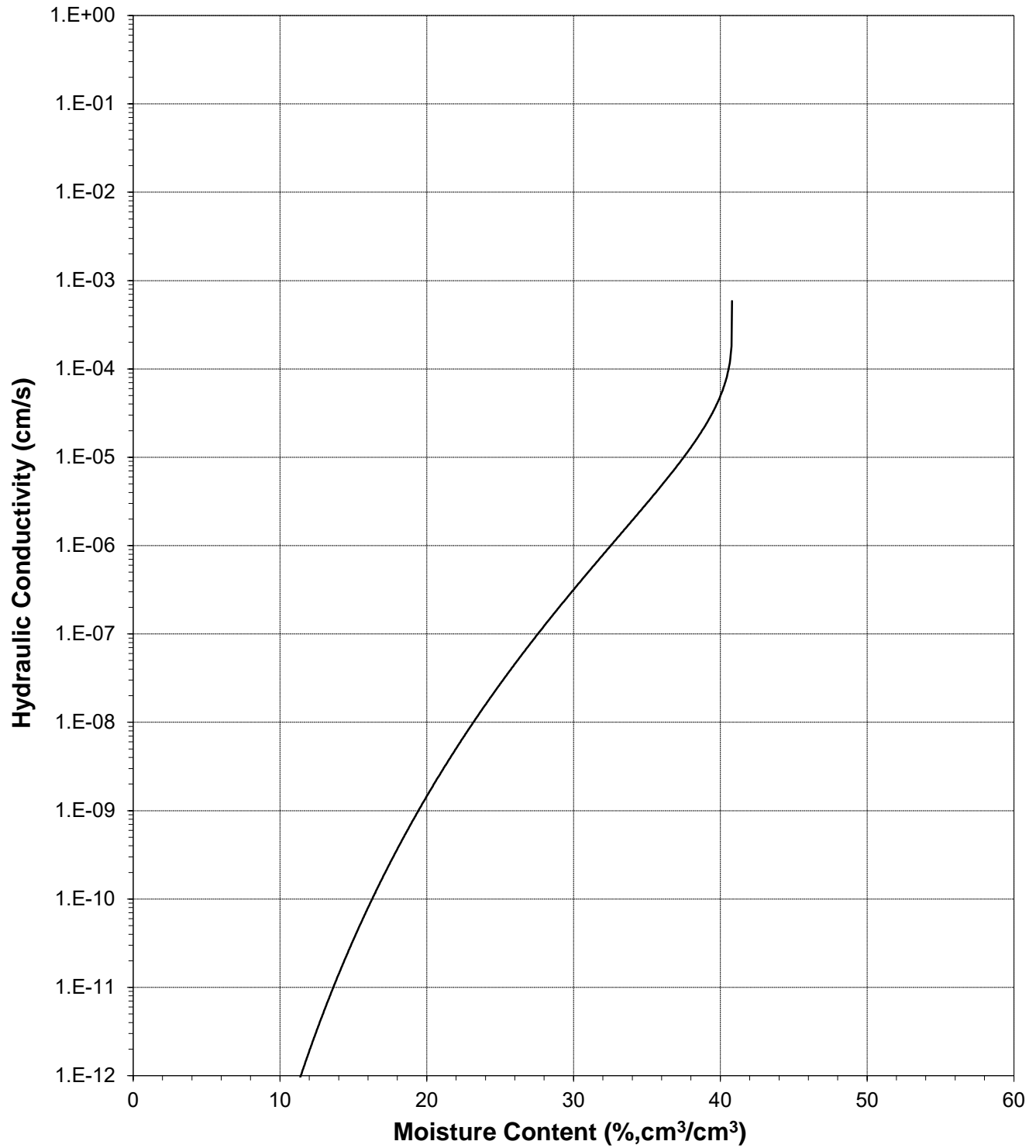
Sample Number: B7A-40-60 (1+2) (98.3 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

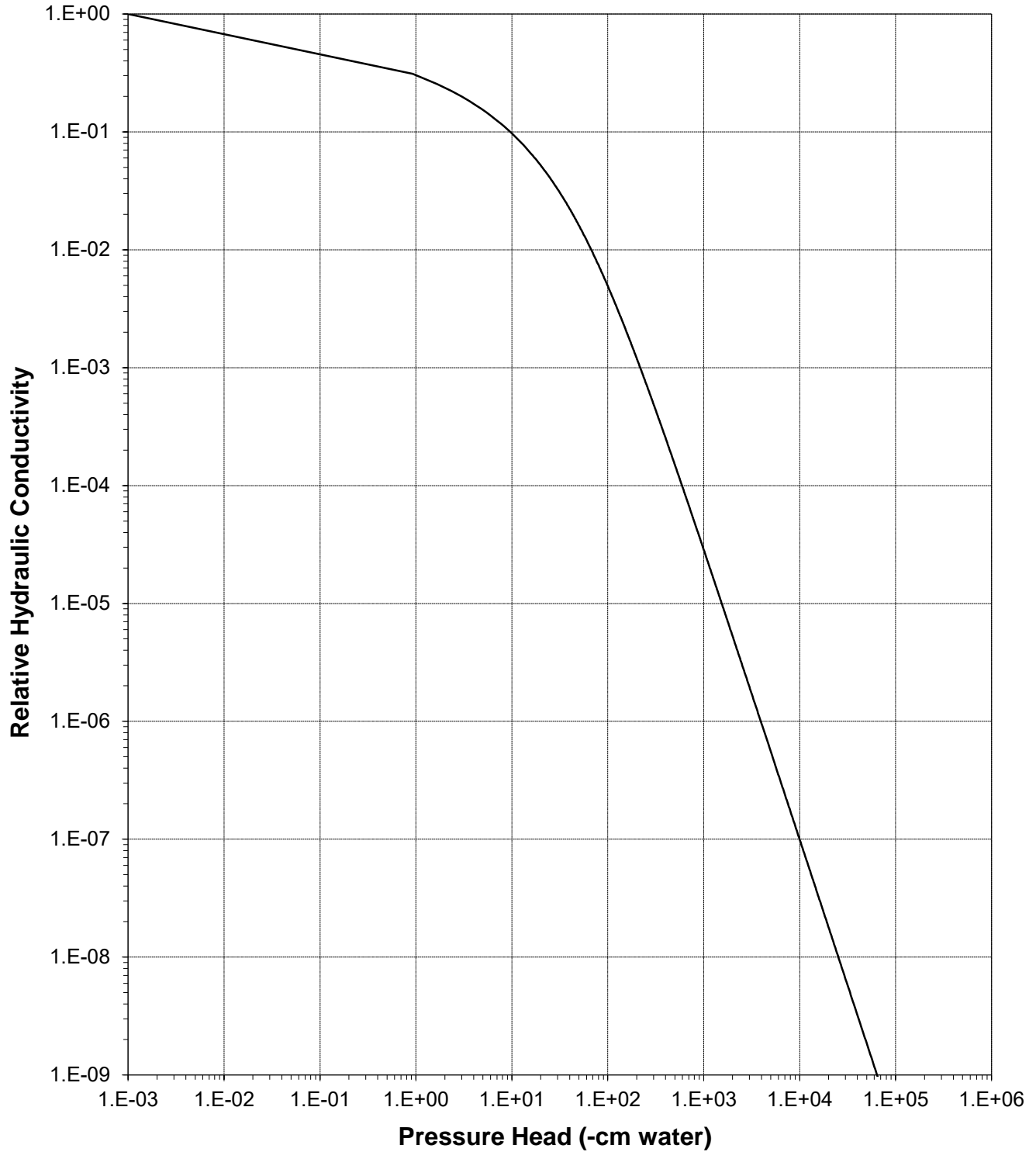
Sample Number: B7A-40-60 (1+2) (98.3 pcf)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

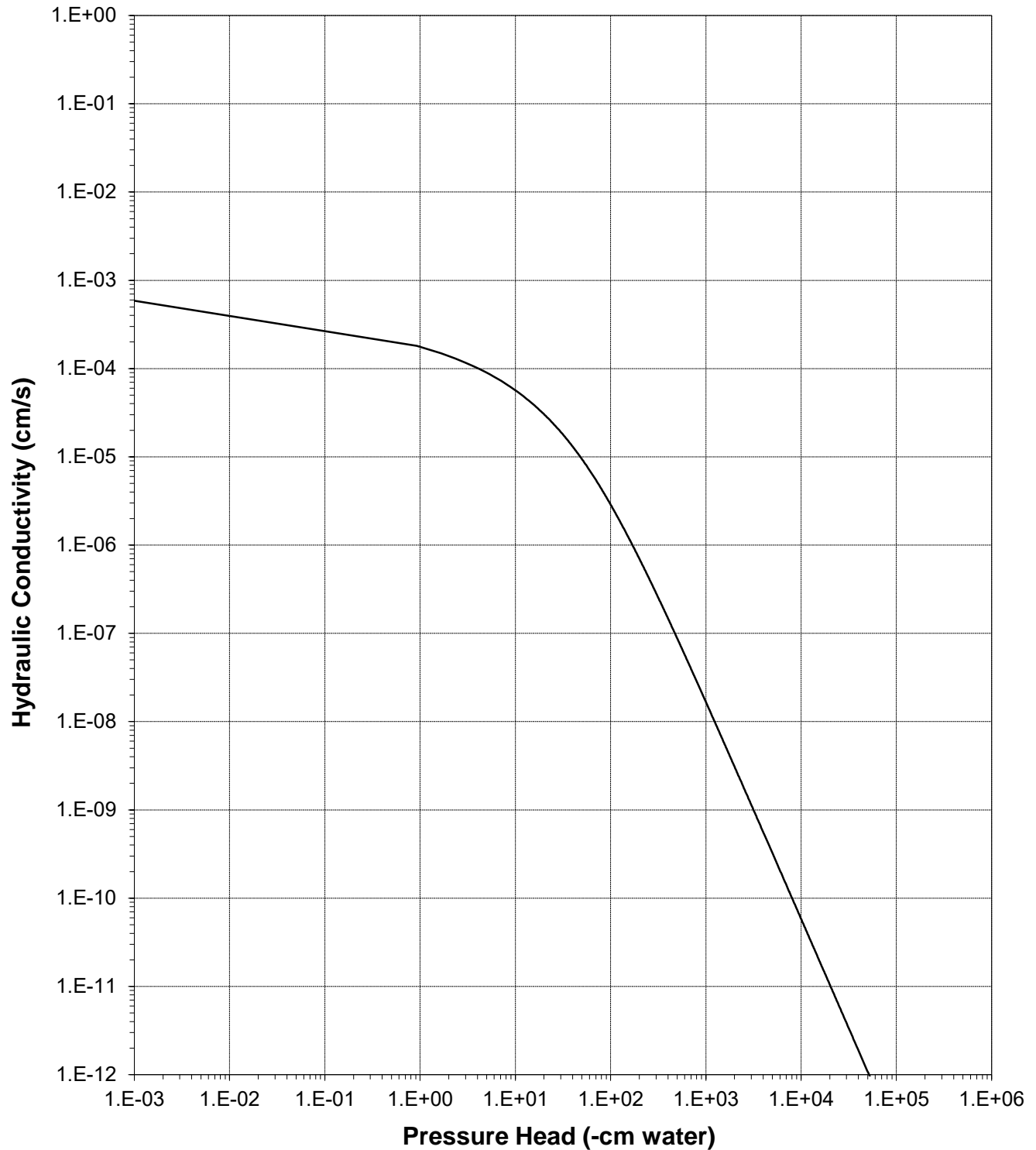
Sample Number: B7A-40-60 (1+2) (98.3 pcf)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B7A-40-60 (1+2) (98.3 pcf)





*Daniel B. Stephens & Associates, Inc.*

**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B9-20-35 (1+2) (90.3 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-35'

*Dry wt. of sample (g):* 325.36  
*Tare wt., ring (g):* 127.42  
*Tare wt., screen & clamp (g):* 24.16  
*Initial sample volume (cm<sup>3</sup>):* 224.98  
*Initial dry bulk density (g/cm<sup>3</sup>):* 1.45  
*Measured particle density (g/cm<sup>3</sup>):* 2.71  
*Initial calculated total porosity (%):* 46.60

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
<i>Hanging column:</i>	7-Aug-18	11:00	585.09	0	45.95	##
	14-Aug-18	10:55	586.59	22.0	46.28	##
	21-Aug-18	15:00	583.94	75.0	45.18	##
	28-Aug-18	15:35	578.72	154.0	43.10	##
<i>Pressure plate:</i>	7-Sep-18	10:30	573.97	337	41.25	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	235.37	+4.62%	1.38	48.96
	22.0	236.94	+5.32%	1.37	49.30
	75.0	236.85	+5.28%	1.37	49.28
	154.0	236.14	+4.96%	1.38	49.13
<i>Pressure plate:</i>	337	235.25	+4.57%	1.38	48.93

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-'-'-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* C. Krous  
*Checked by:* J. Hines



### Moisture Retention Data

#### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B9-20-35 (1+2) (90.3 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.45

Fraction of test sample used (<2.00mm fraction) (%): 99.99

Dry weight\* of dew point potentiometer sample (g): 149.70

Tare weight, jar (g): 114.93

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	20-Aug-18	9:00	154.75	27229	20.09	##
	16-Aug-18	11:20	153.39	94433	14.68	##
	14-Aug-18	9:40	152.71	225580	11.97	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	27229	235.25	+4.57%	1.38	48.93
	94433	235.25	+4.57%	1.38	48.93
	225580	235.25	+4.57%	1.38	48.93

Dry weight\* of relative humidity box sample (g): 64.35

Tare weight (g): 47.61

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	65.25	845560	7.43	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	235.25	+4.57%	1.38	48.93

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

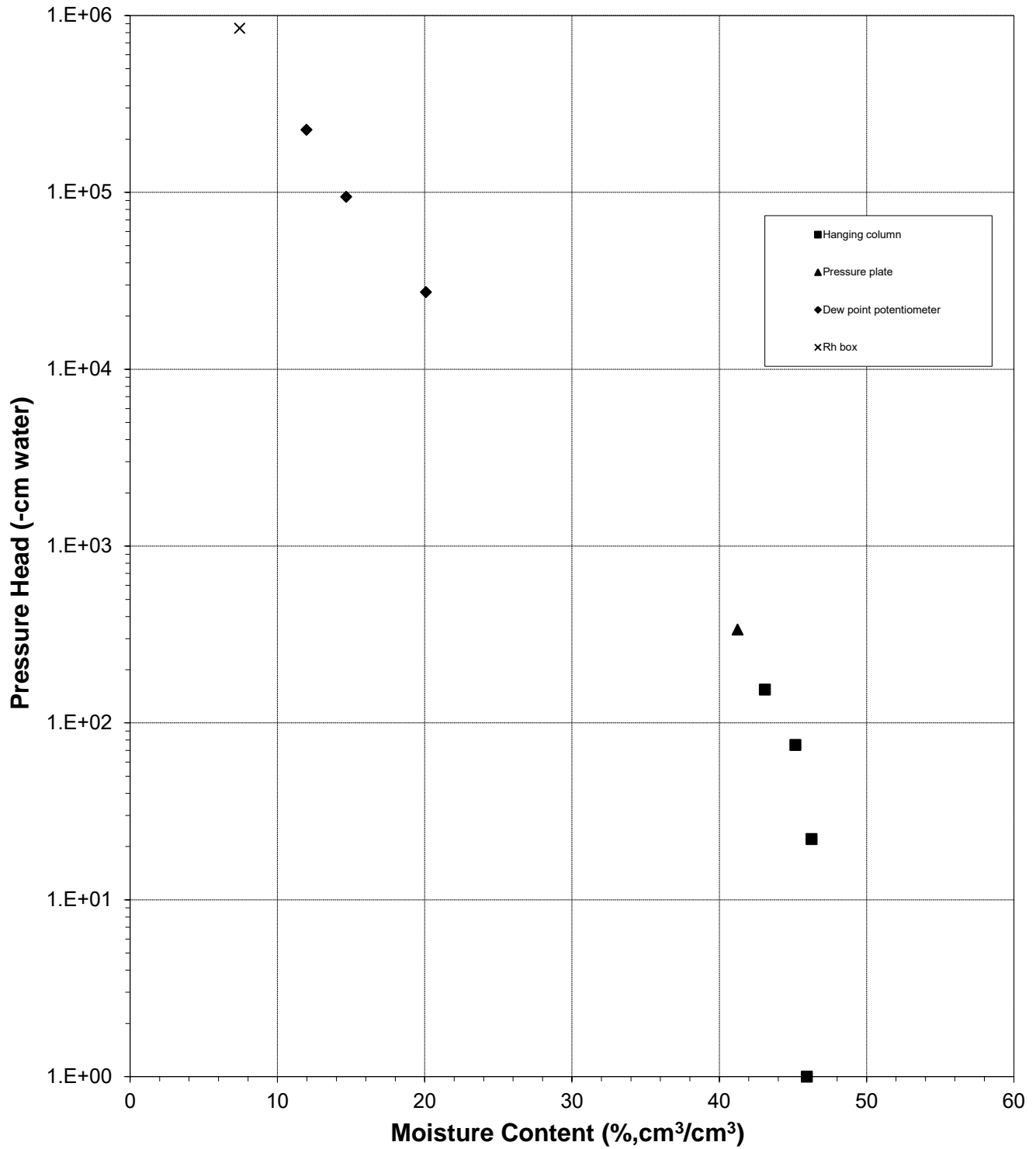
Checked by: J. Hines





### Water Retention Data Points

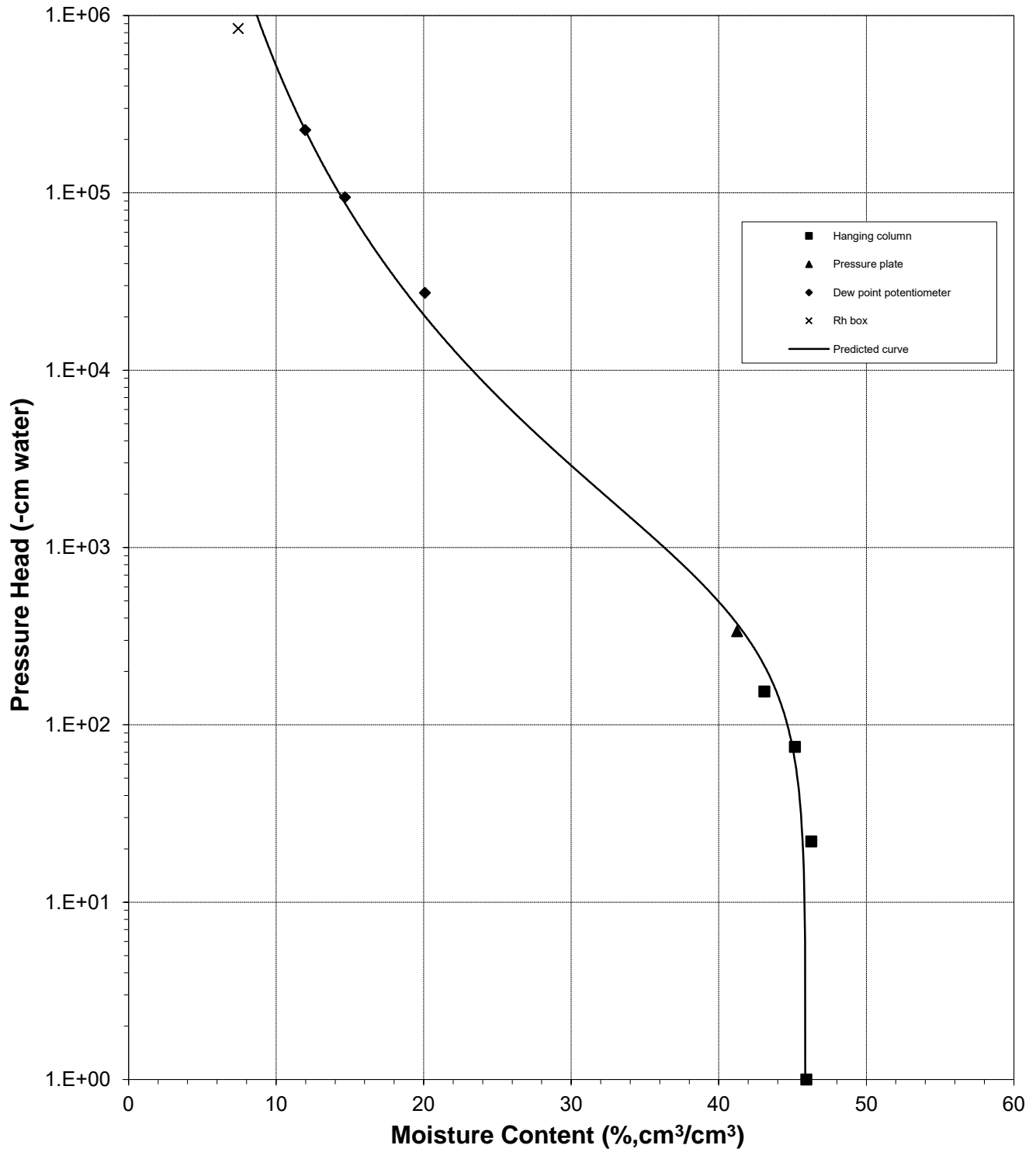
Sample Number: B9-20-35 (1+2) (90.3 pcf)





### Predicted Water Retention Curve and Data Points

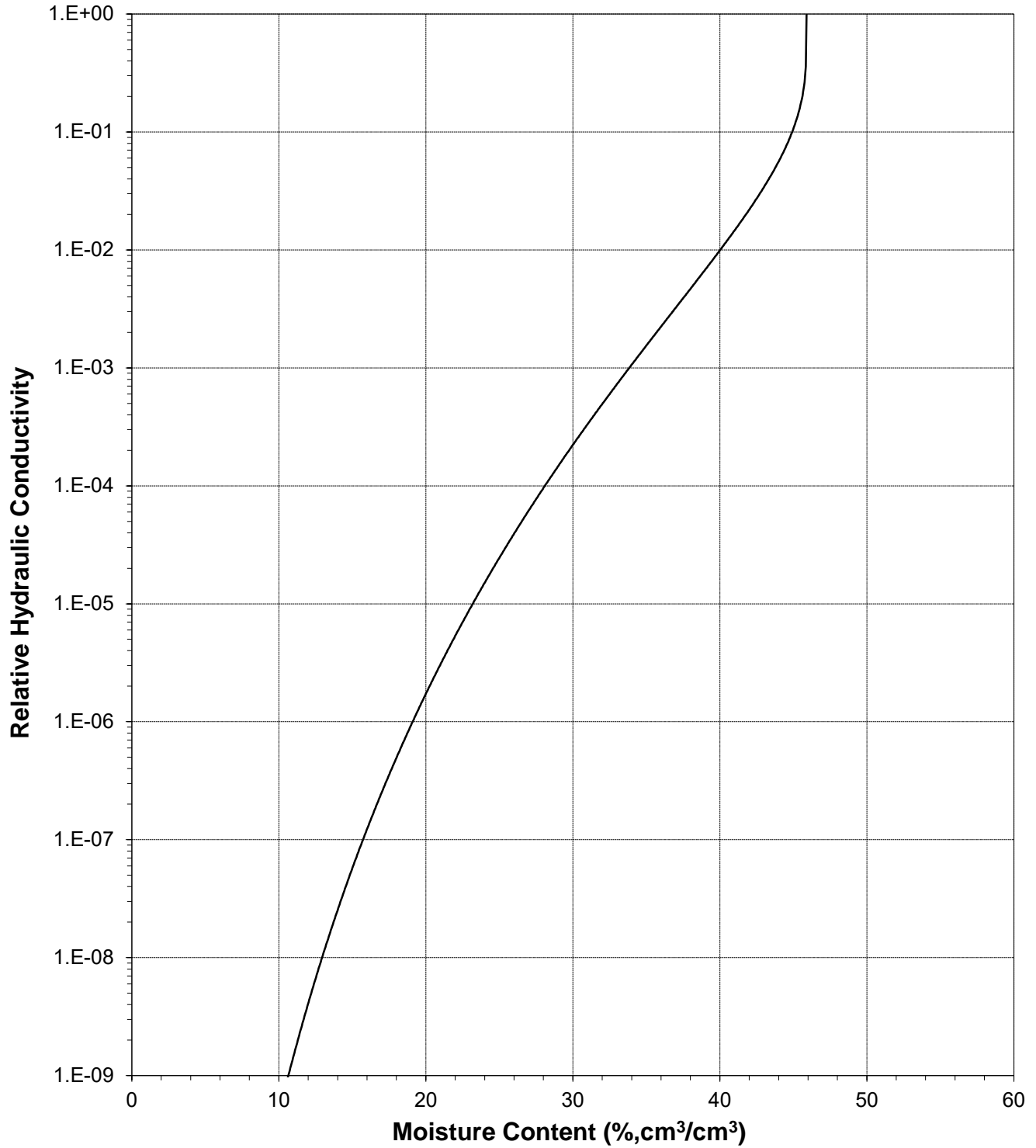
Sample Number: B9-20-35 (1+2) (90.3 pcf)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

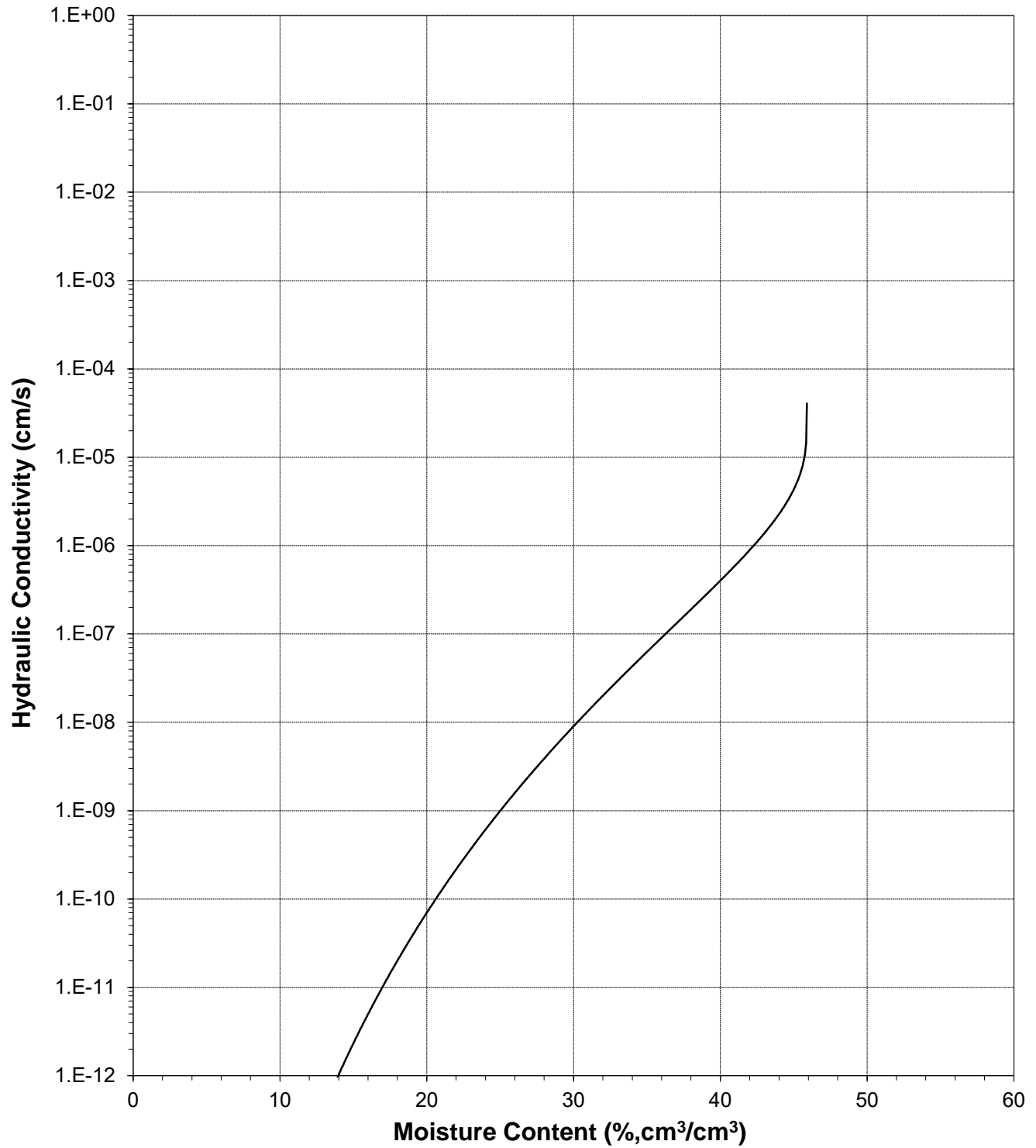
Sample Number: B9-20-35 (1+2) (90.3 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

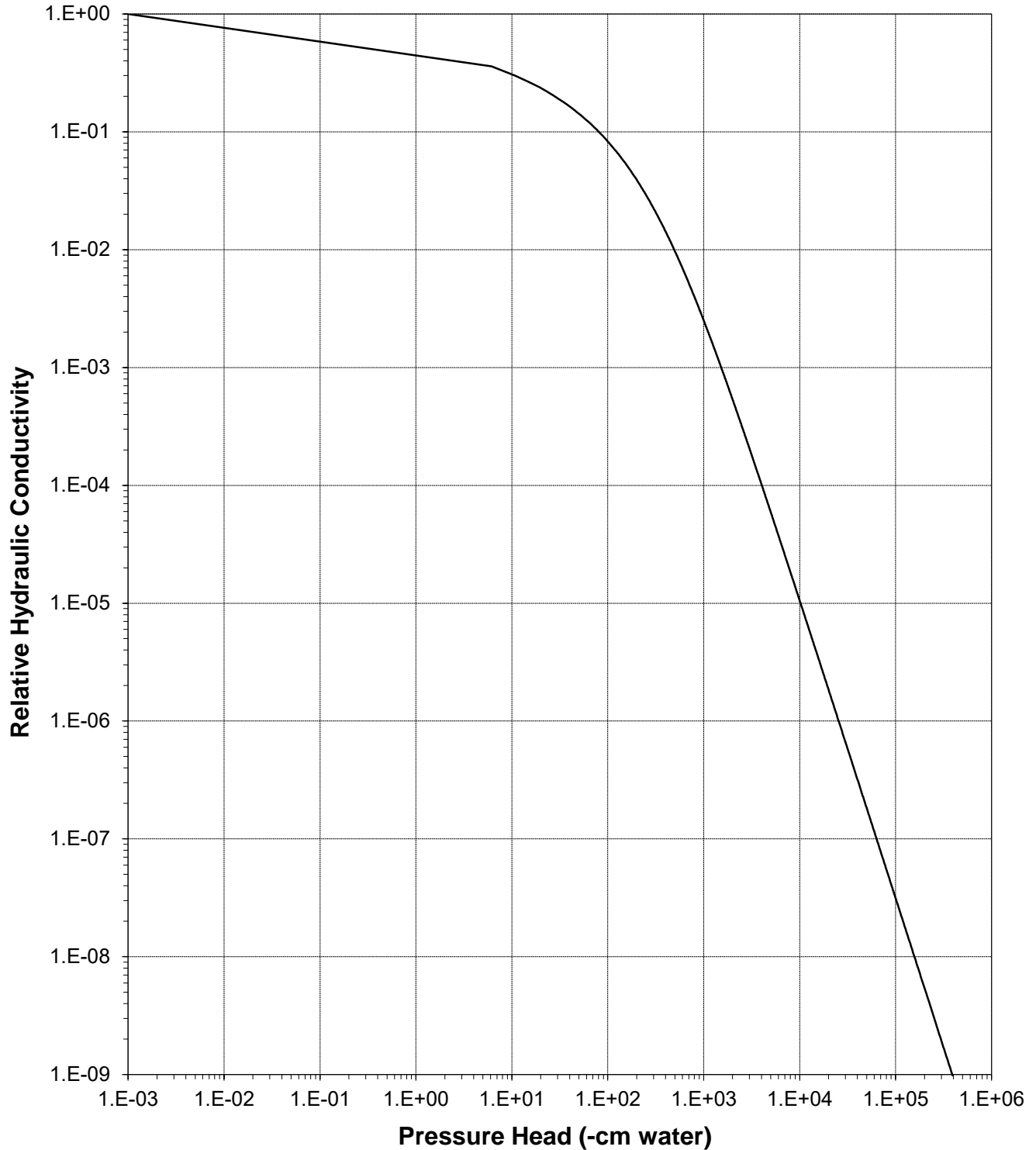
Sample Number: B9-20-35 (1+2) (90.3 pcf)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

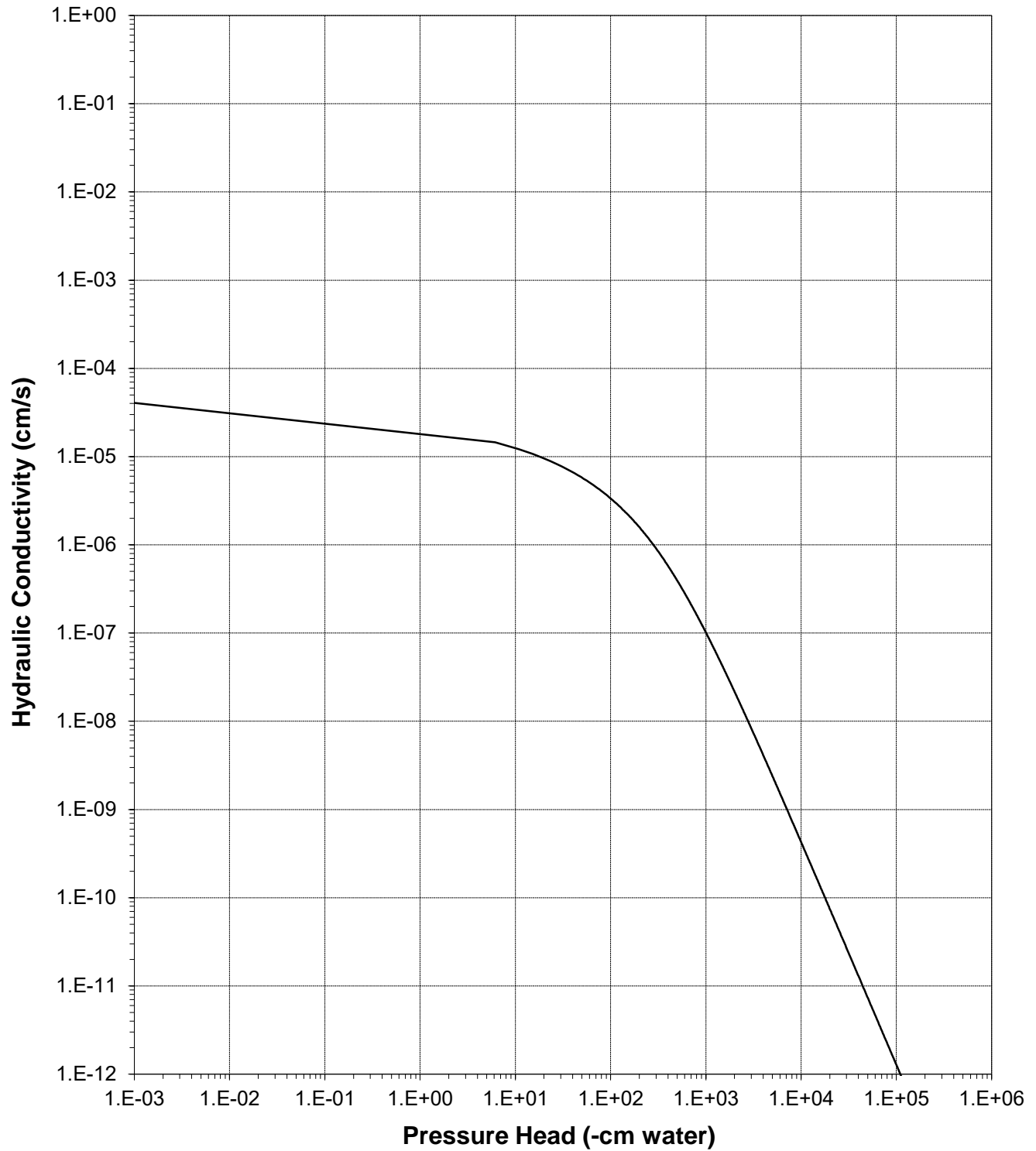
Sample Number: B9-20-35 (1+2) (90.3 pcf)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B9-20-35 (1+2) (90.3 pcf)





*Daniel B. Stephens & Associates, Inc.*

**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-39A (90.3 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

*Dry wt. of sample (g):* 322.67  
*Tare wt., ring (g):* 133.57  
*Tare wt., screen & clamp (g):* 26.32  
*Initial sample volume (cm<sup>3</sup>):* 222.98  
*Initial dry bulk density (g/cm<sup>3</sup>):* 1.45  
*Measured particle density (g/cm<sup>3</sup>):* 2.68  
*Initial calculated total porosity (%):* 45.93

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
<i>Hanging column:</i>	7-Aug-18	11:00	589.64	0	46.55	##
	14-Aug-18	10:50	591.58	17.0	47.21	##
	21-Aug-18	15:00	587.91	54.0	45.63	##
	28-Aug-18	15:20	579.76	123.0	42.24	##
<i>Pressure plate:</i>	7-Sep-18	10:25	572.99	337	39.43	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	230.05	+3.17%	1.40	47.59
	17.0	230.90	+3.55%	1.40	47.78
	54.0	230.90	+3.55%	1.40	47.78
	123.0	230.11	+3.20%	1.40	47.60
<i>Pressure plate:</i>	337	229.32	+2.84%	1.41	47.42

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* C. Krous  
*Checked by:* J. Hines



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B10-39A (90.3 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.45

Fraction of test sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 135.37

Tare weight, jar (g): 113.23

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	20-Aug-18	9:03	138.56	22130	20.26	##
	16-Aug-18	11:55	137.60	86785	14.15	##
	14-Aug-18	9:45	136.99	258927	10.28	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	22130	229.32	+2.84%	1.41	47.42
	86785	229.32	+2.84%	1.41	47.42
	258927	229.32	+2.84%	1.41	47.42

Dry weight\* of relative humidity box sample (g): 54.53

Tare weight (g): 38.03

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	55.33	845560	6.85	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	229.32	+2.84%	1.41	47.42

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

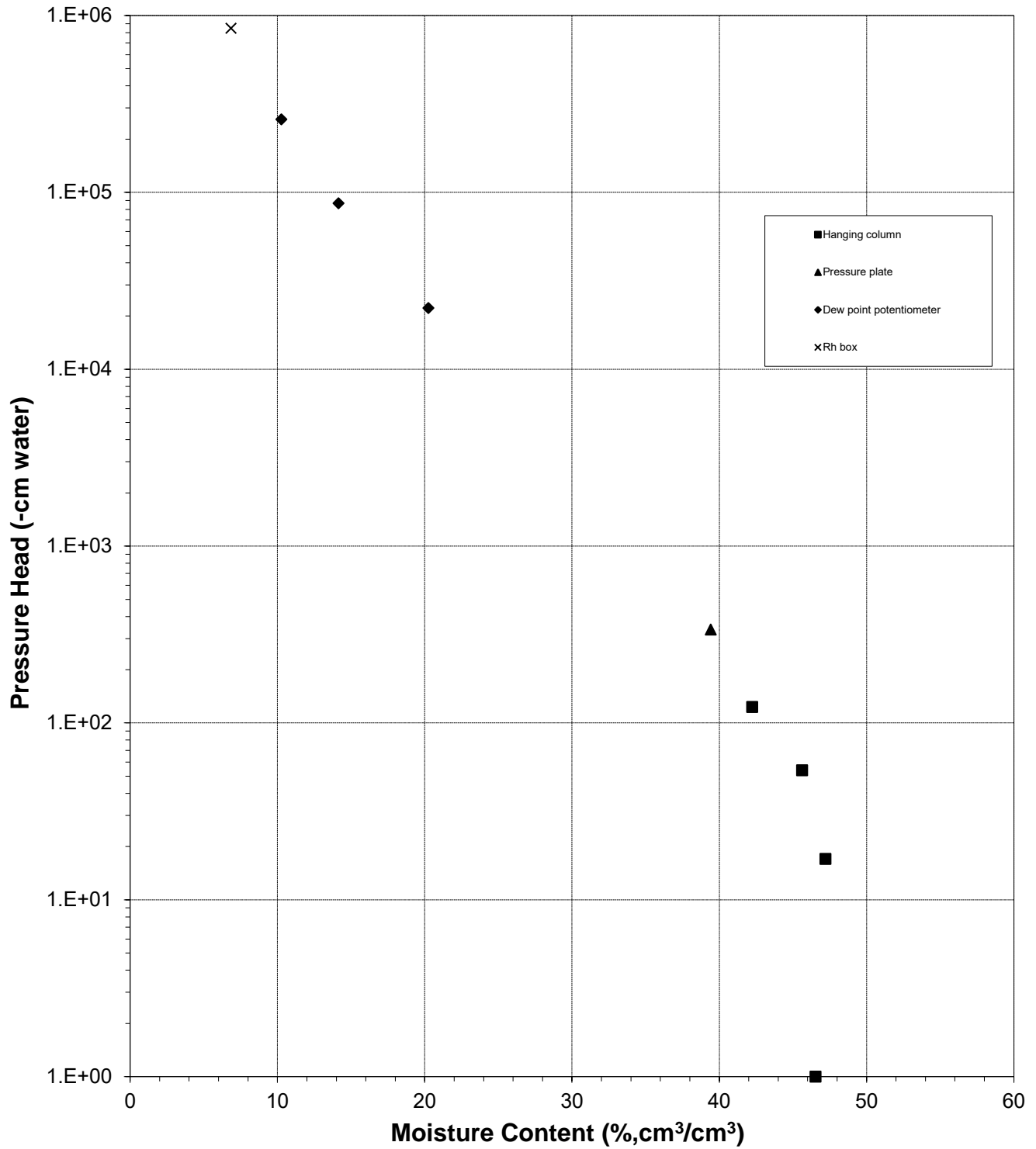
Data entered by: C. Krous

Checked by: J. Hines





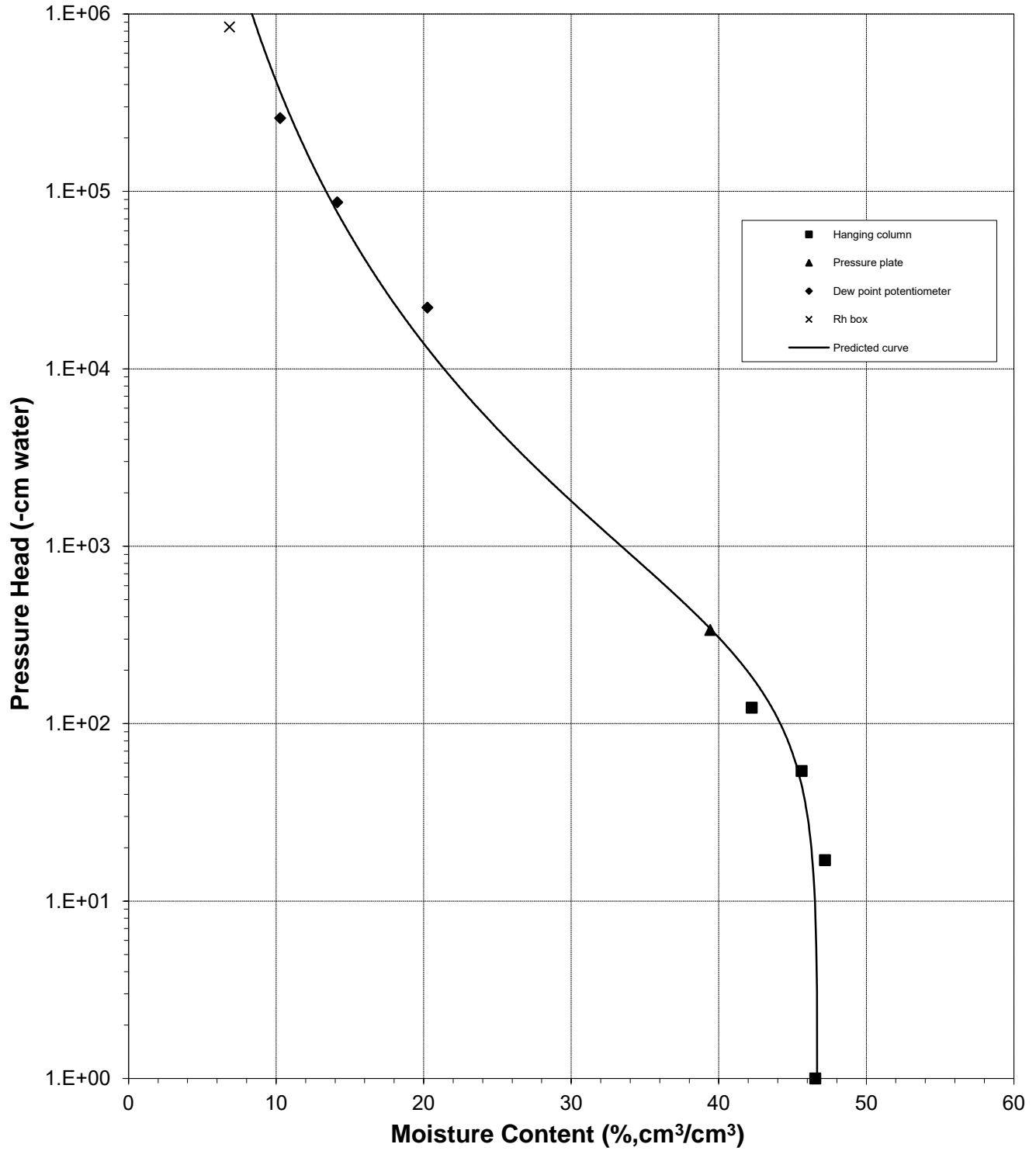
**Water Retention Data Points**  
Sample Number: B10-39A (90.3 pcf)





### Predicted Water Retention Curve and Data Points

Sample Number: B10-39A (90.3 pcf)

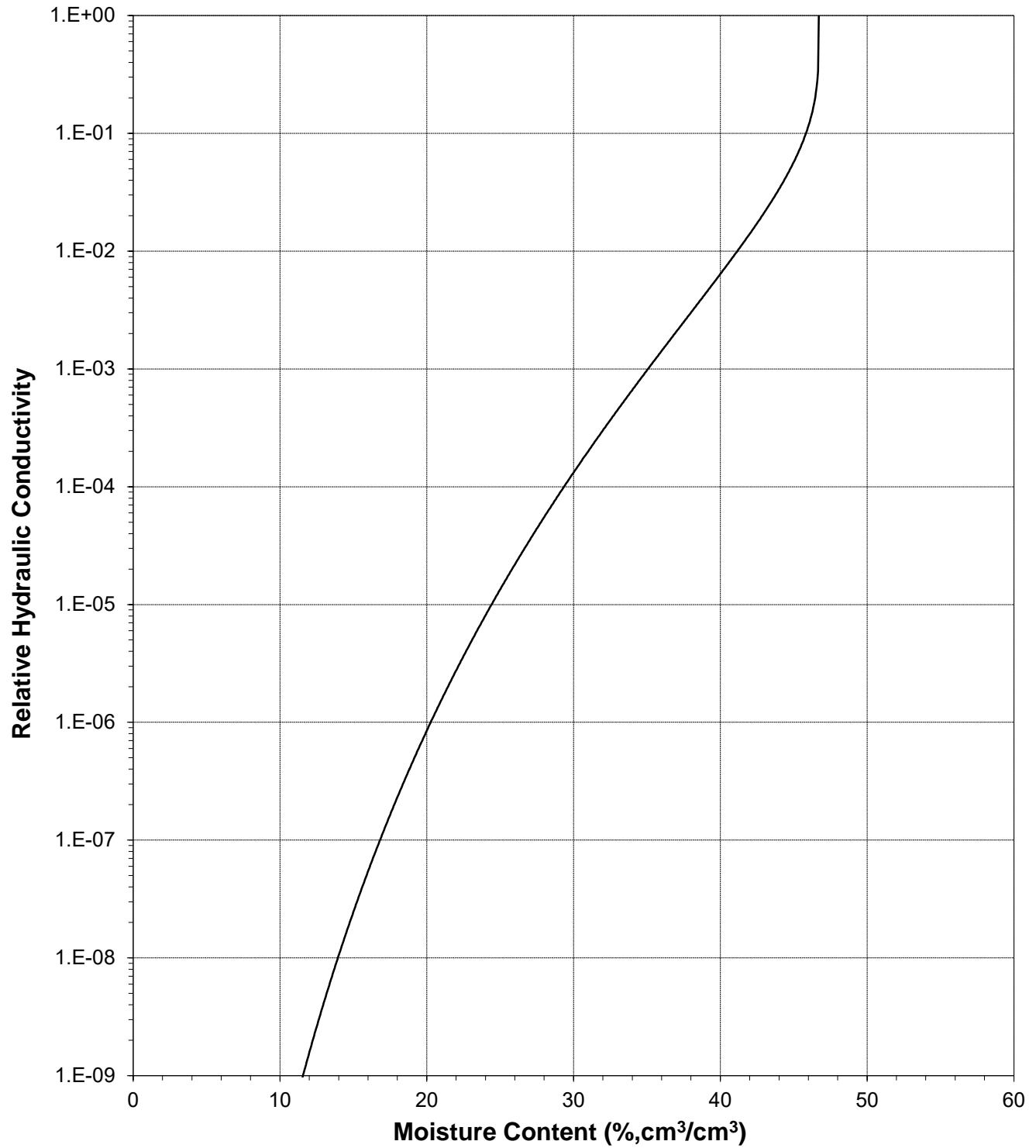




*Daniel B. Stephens & Associates, Inc.*

### Plot of Relative Hydraulic Conductivity vs Moisture Content

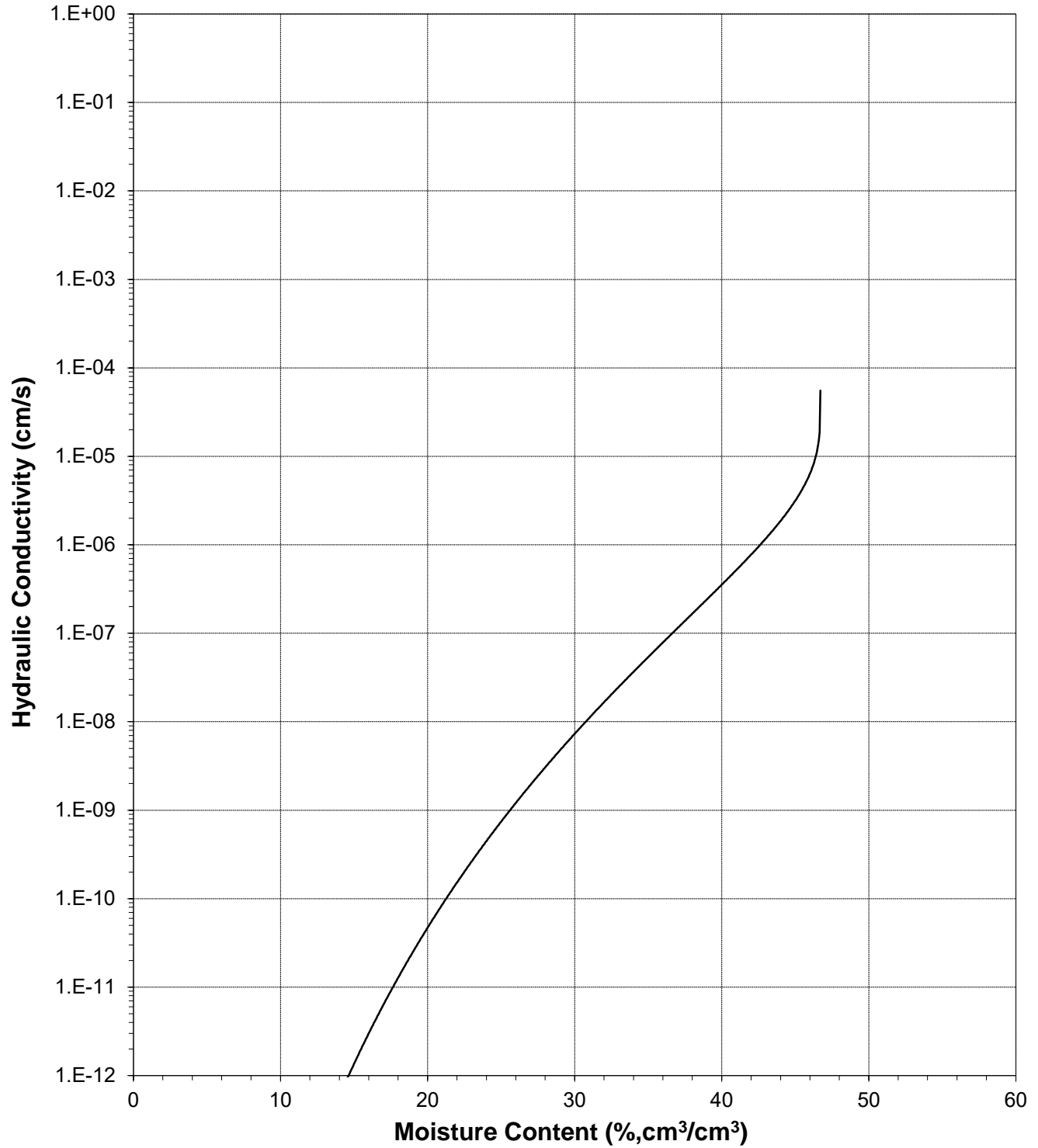
*Sample Number: B10-39A (90.3 pcf)*





### Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: B10-39A (90.3 pcf)

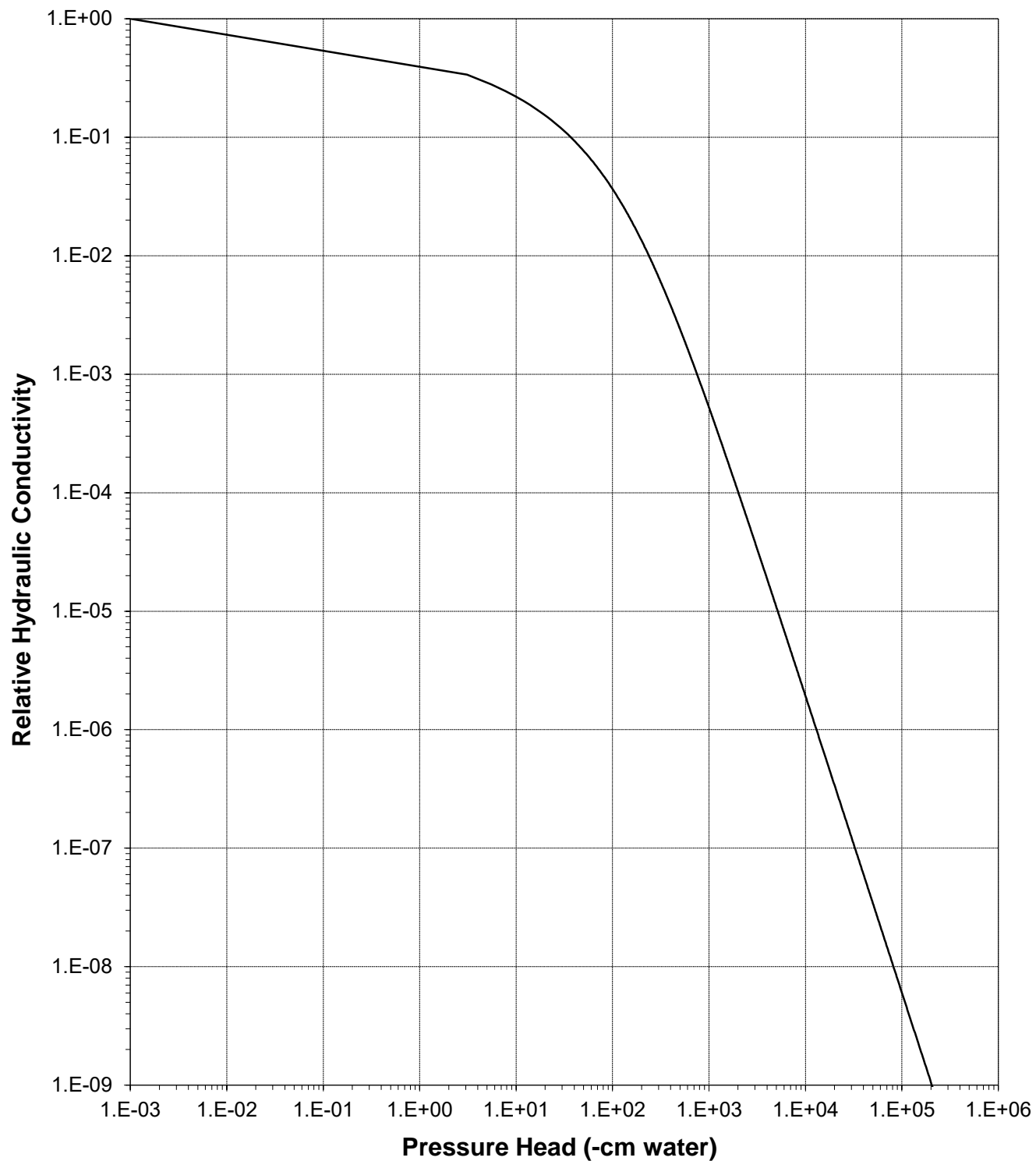




*Daniel B. Stephens & Associates, Inc.*

### Plot of Relative Hydraulic Conductivity vs Pressure Head

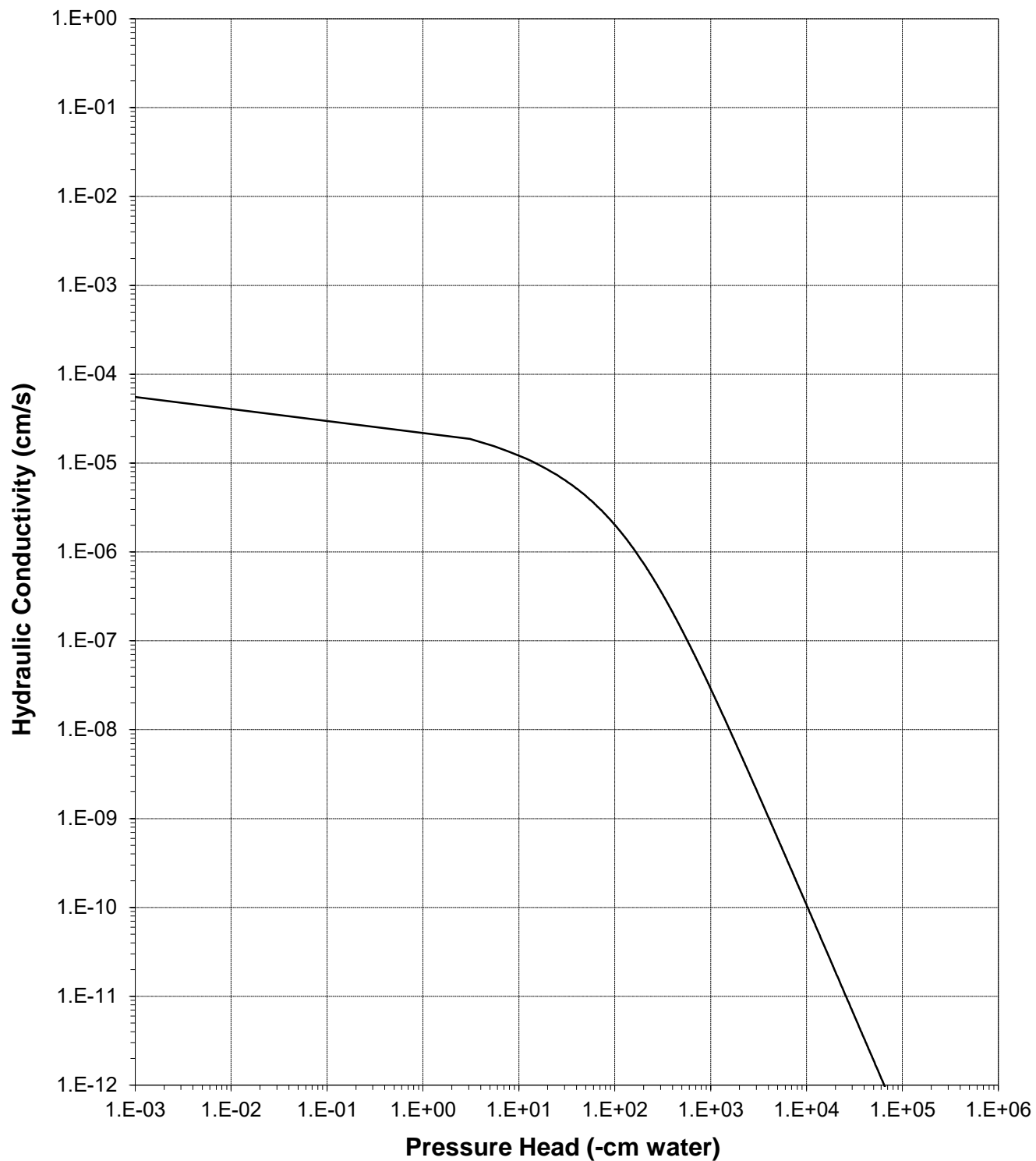
*Sample Number: B10-39A (90.3 pcf)*





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B10-39A (90.3 pcf)





**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B10-10-25 (1+2) (103.4 pcf)  
 Project Name: NECR Jetty '18  
 Depth: 10'-25'

Dry wt. of sample (g): 372.07  
 Tare wt., ring (g): 128.13  
 Tare wt., screen & clamp (g): 27.30  
 Initial sample volume (cm<sup>3</sup>): 224.65  
 Initial dry bulk density (g/cm<sup>3</sup>): 1.66  
 Measured particle density (g/cm<sup>3</sup>): 2.67  
 Initial calculated total porosity (%): 38.03

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
<i>Hanging column:</i>	7-Aug-18	11:00	617.74	0	39.22	##
	14-Aug-18	10:50	617.89	17.0	39.29	##
	21-Aug-18	15:00	617.36	54.0	39.07	##
	28-Aug-18	15:20	604.85	123.0	33.73	##
<i>Pressure plate:</i>	7-Sep-18	10:30	592.45	337	28.46	##

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	230.06	+2.41%	1.62	39.49
	17.0	230.06	+2.41%	1.62	39.49
	54.0	230.00	+2.38%	1.62	39.48
	123.0	229.32	+2.08%	1.62	39.30
<i>Pressure plate:</i>	337	228.20	+1.58%	1.63	39.00

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by: D. O'Dowd*  
*Data entered by: C. Krous*  
*Checked by: J. Hines*



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B10-10-25 (1+2) (103.4 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.66

Fraction of test sample used (<2.00mm fraction) (%): 99.91

Dry weight\* of dew point potentiometer sample (g): 156.36

Tare weight, jar (g): 117.64

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Dew point potentiometer:	17-Aug-18	10:13	159.34	21926	12.52	##
	15-Aug-18	10:50	158.54	73936	9.19	##
	14-Aug-18	9:20	158.04	187643	7.08	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	21926	228.20	+1.58%	1.63	39.00
	73936	228.20	+1.58%	1.63	39.00
	187643	228.20	+1.58%	1.63	39.00

Dry weight\* of relative humidity box sample (g): 64.66

Tare weight (g): 38.34

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)	
Relative humidity box:	8-Aug-18	8:10	65.47	845560	5.03	##

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	228.20	+1.58%	1.63	39.00

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

## Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

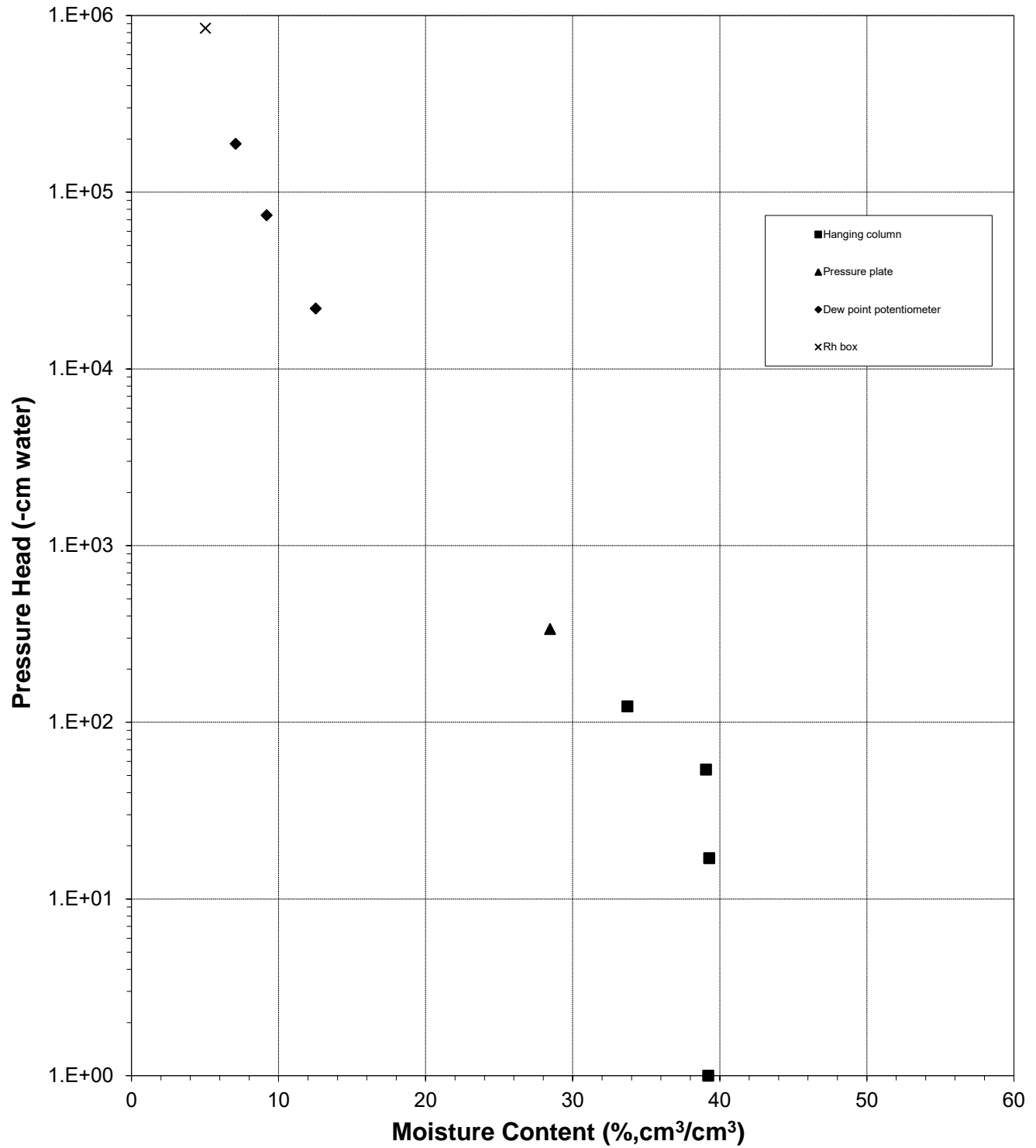
Data entered by: C. Krous

Checked by: J. Hines





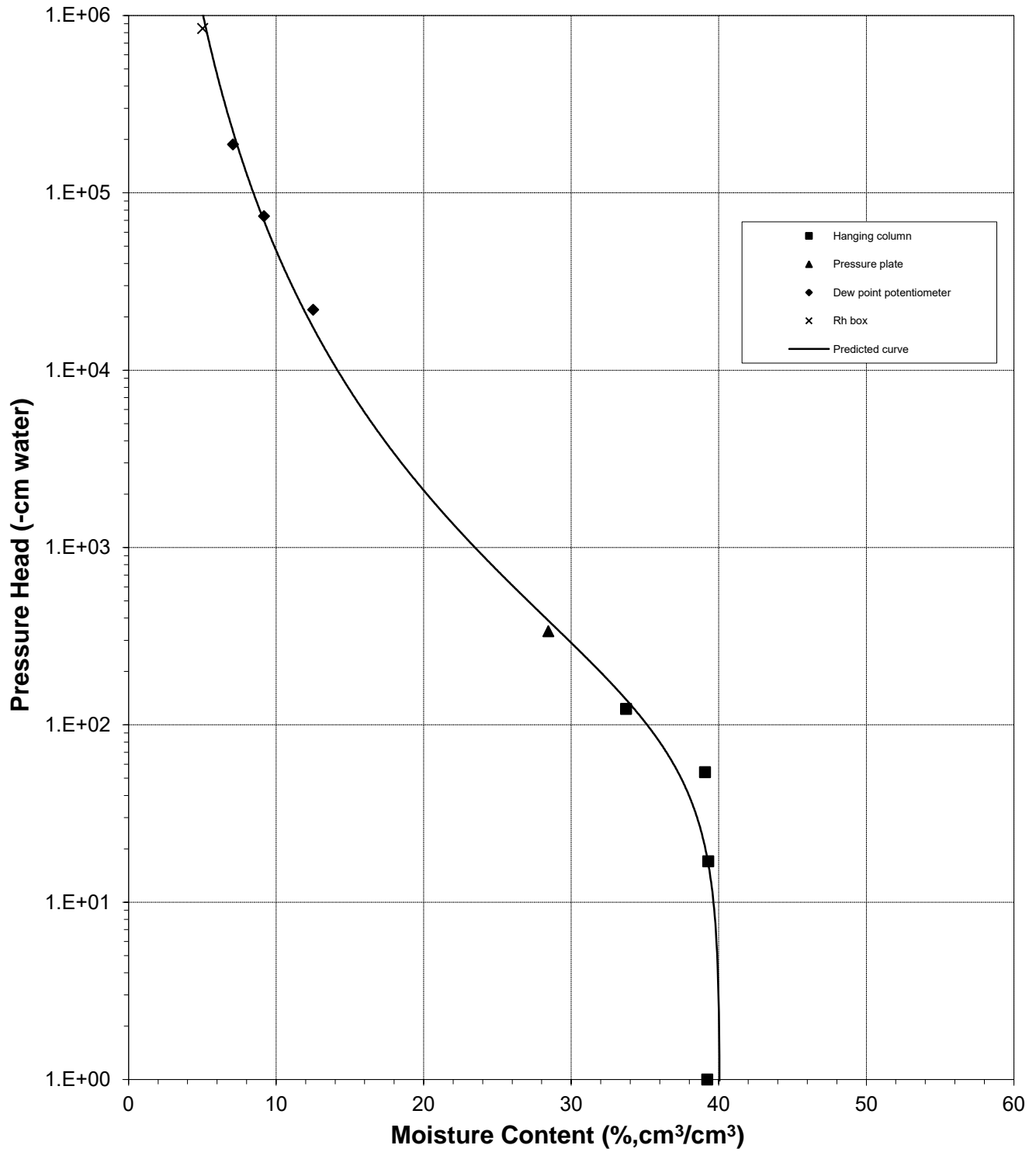
**Water Retention Data Points**  
Sample Number: B10-10-25 (1+2) (103.4 pcf)





### Predicted Water Retention Curve and Data Points

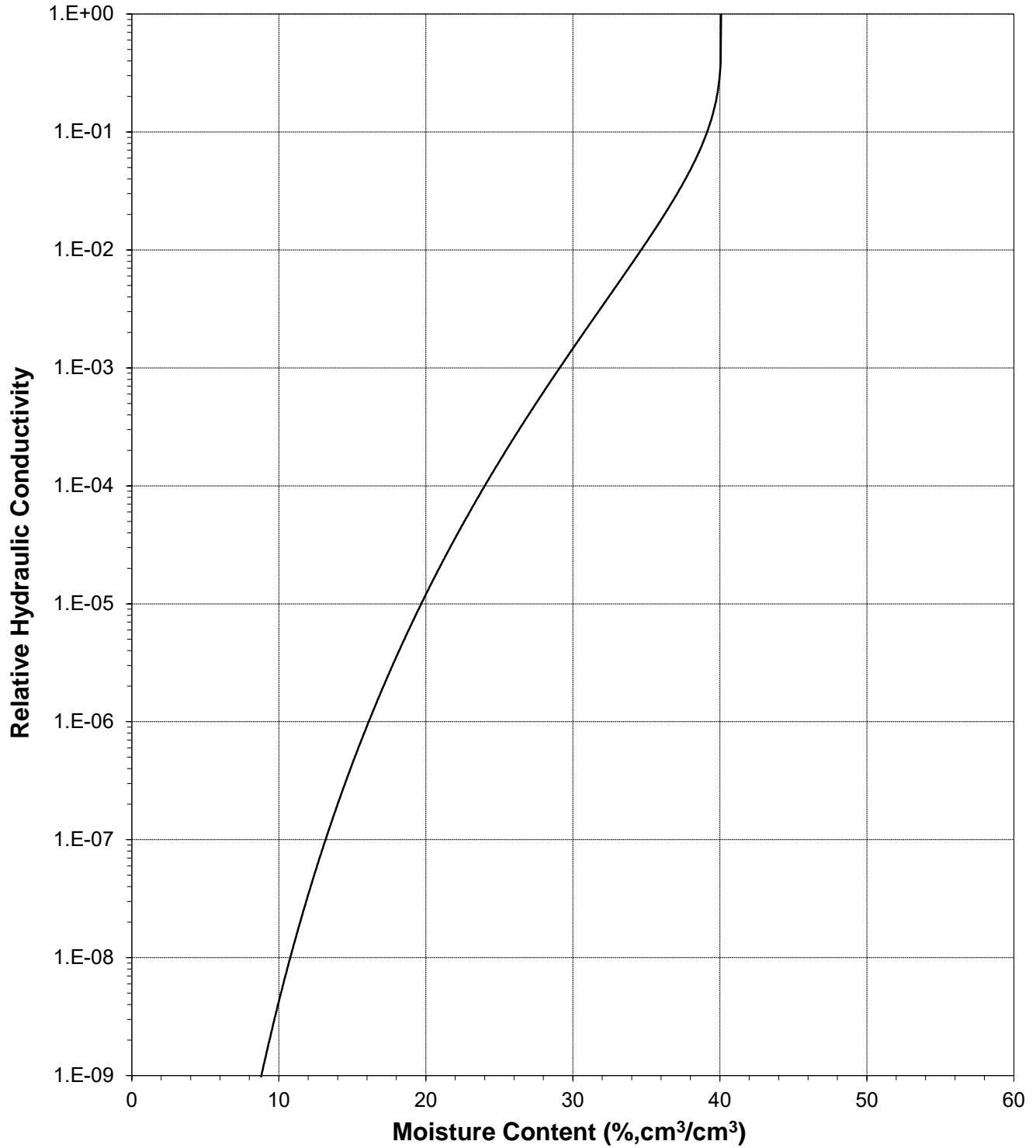
Sample Number: B10-10-25 (1+2) (103.4 pcf)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

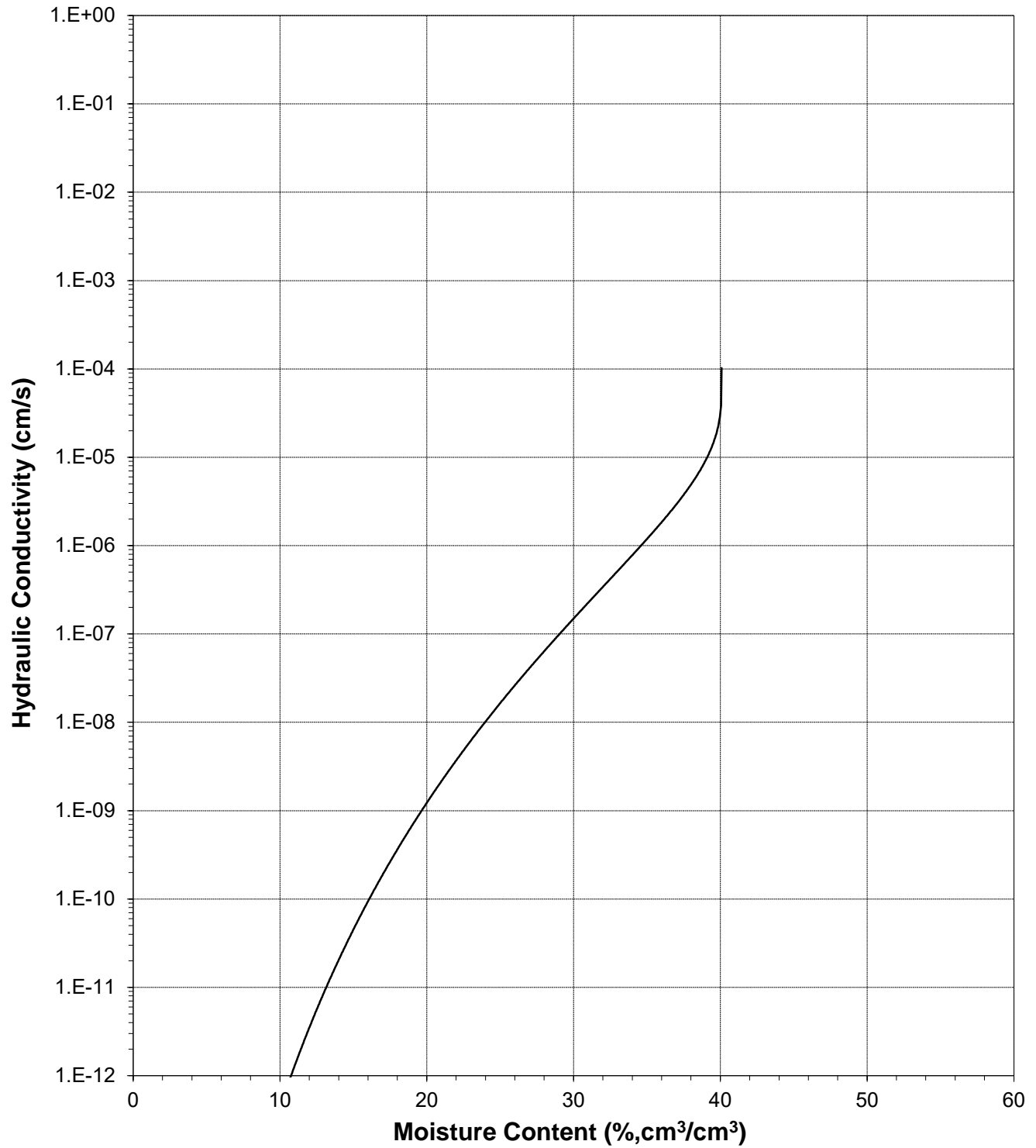
Sample Number: B10-10-25 (1+2) (103.4 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

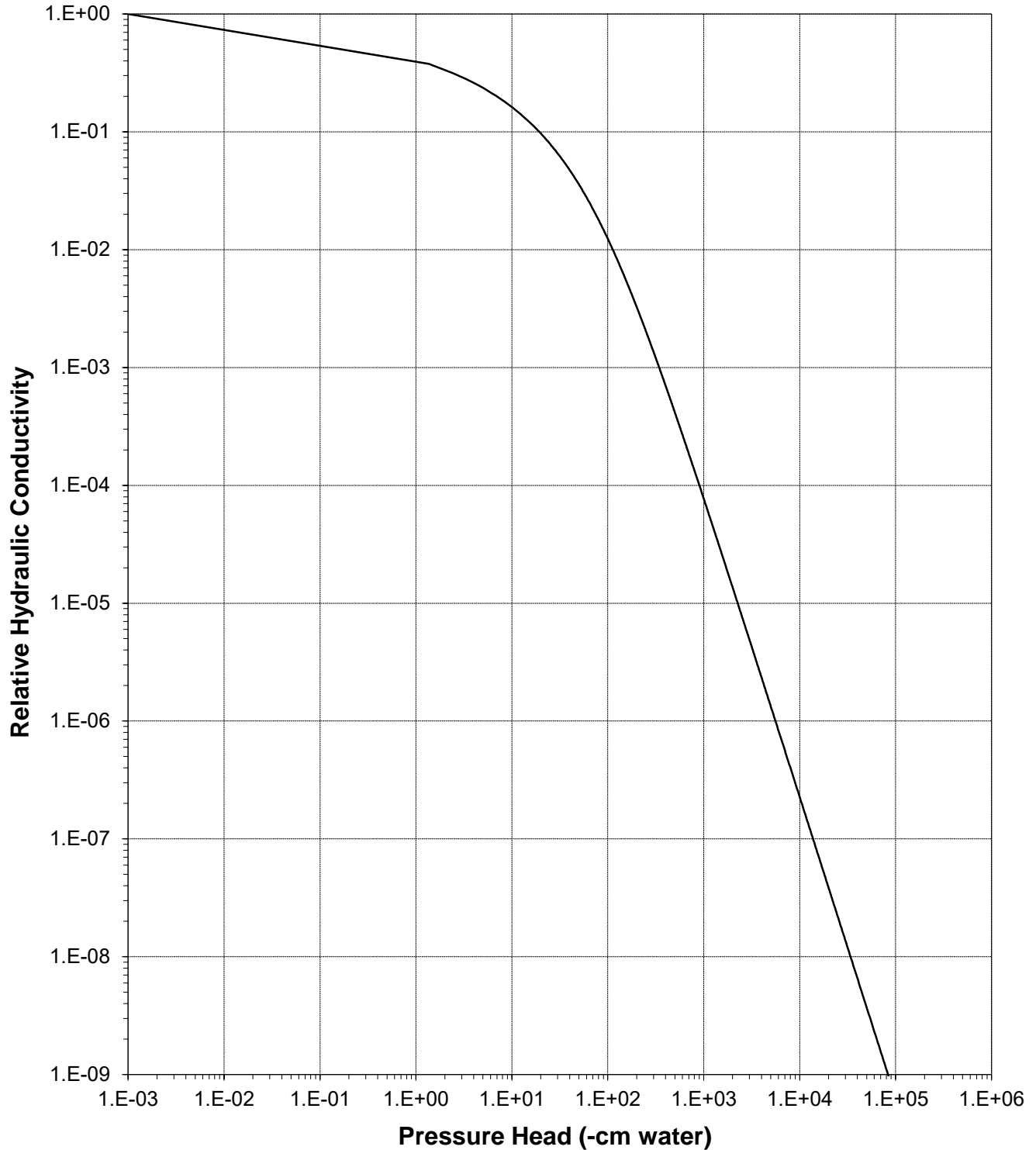
Sample Number: B10-10-25 (1+2) (103.4 pcf)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

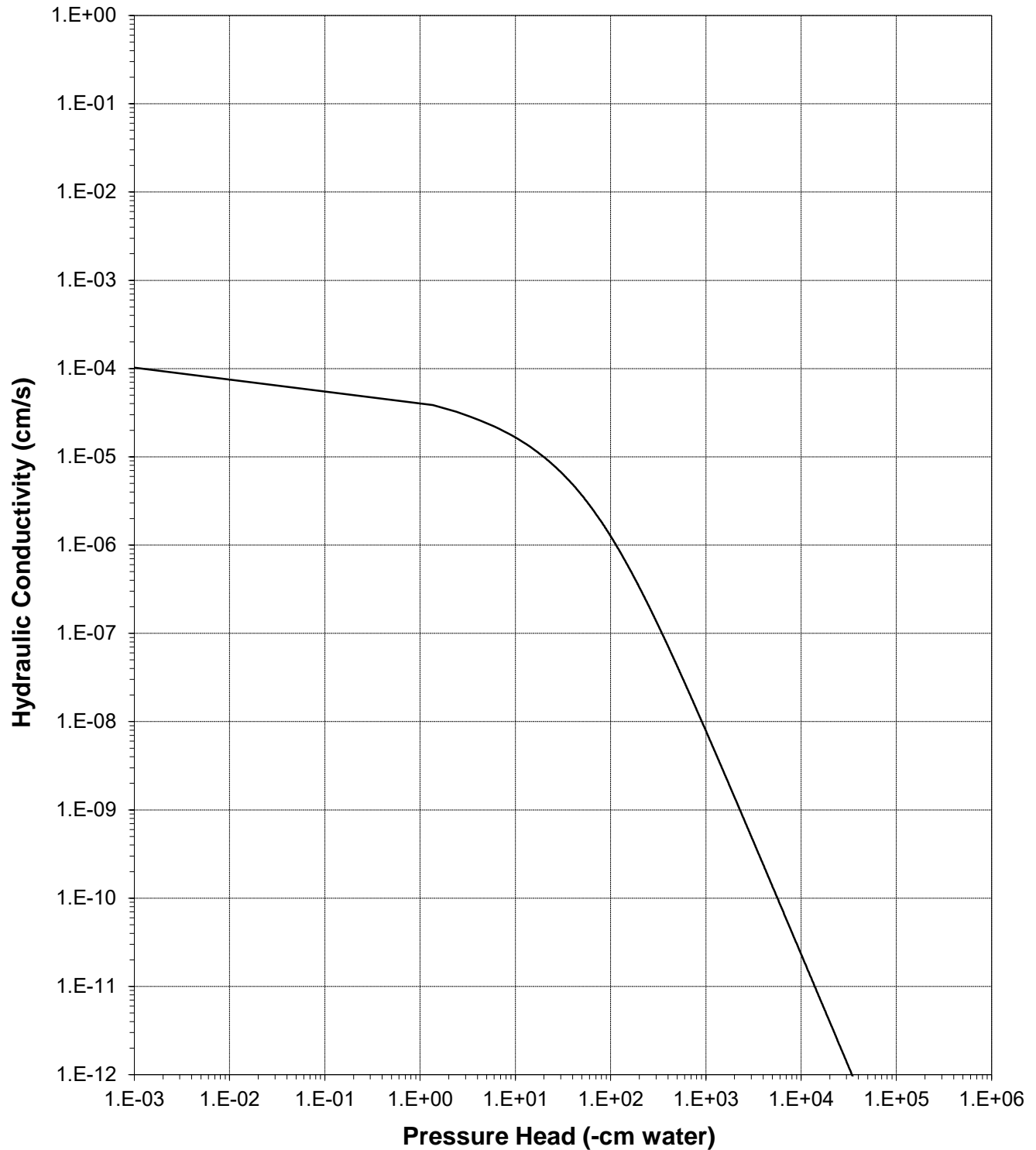
Sample Number: B10-10-25 (1+2) (103.4 pcf)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B10-10-25 (1+2) (103.4 pcf)





*Daniel B. Stephens & Associates, Inc.*

**Moisture Retention Data**  
**Hanging Column / Pressure Plate**  
 (Soil-Water Characteristic Curve)

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-39 (104.2 pcf)  
*Project Name:* NECR Jetty '18  
*Depth:* 0'-10'

*Dry wt. of sample (g):* 95.58  
*Tare wt., ring (g):* 32.30  
*Tare wt., screen & clamp (g):* 25.32  
*Initial sample volume (cm<sup>3</sup>):* 57.29  
*Initial dry bulk density (g/cm<sup>3</sup>):* 1.67  
*Measured particle density (g/cm<sup>3</sup>):* 2.65  
*Initial calculated total porosity (%):* 37.10

	Date	Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
<i>Hanging column:</i>	7-Aug-18	11:00	175.39	0	38.73
	14-Aug-18	10:36	175.37	4.0	38.70
	21-Aug-18	13:15	175.09	19.0	38.21
	28-Aug-18	15:15	166.29	77.0	22.85
<i>Pressure plate:</i>	7-Sep-18	10:30	161.80	337	15.01

Volume Adjusted Data<sup>1</sup>

	Matric Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calculated Porosity (%)
<i>Hanging column:</i>	0.0	---	---	---	---
	4.0	---	---	---	---
	19.0	---	---	---	---
	77.0	---	---	---	---
<i>Pressure plate:</i>	337	---	---	---	---

**Comments:**

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent each of the volume change measurements obtained after saturated hydraulic conductivity testing and throughout hanging column/pressure plate testing. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Assumed density of water is 1.0 g/cm<sup>3</sup>

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

**Technician Notes:**

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* C. Krous  
*Checked by:* J. Hines



## Moisture Retention Data

### Dew Point Potentiometer / Relative Humidity Box (Soil-Water Characteristic Curve)

Sample Number: B11-39 (104.2 pcf)

Initial sample bulk density (g/cm<sup>3</sup>): 1.67

Fraction of test sample used (<2.00mm fraction) (%): 100.00

Dry weight\* of dew point potentiometer sample (g): 153.18

Tare weight, jar (g): 115.15

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Dew point potentiometer:	17-Aug-18	10:35	154.96	14073	7.80
	15-Aug-18	10:10	154.48	43036	5.71
	13-Aug-18	13:45	153.94	333169	3.32

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14073	---	---	---	---
	43036	---	---	---	---
	333169	---	---	---	---

Dry weight\* of relative humidity box sample (g): 57.15

Tare weight (g): 39.51

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content <sup>†</sup> (% vol)
Relative humidity box:	8-Aug-18	8:10	57.42	845560	2.54

#### Volume Adjusted Data<sup>1</sup>

	Water Potential (-cm water)	Adjusted Volume (cm <sup>3</sup> )	% Volume Change <sup>2</sup> (%)	Adjusted Density (g/cm <sup>3</sup> )	Adjusted Calc. Porosity (%)
Relative humidity box:	845560	---	---	---	---

#### Comments:

<sup>1</sup> Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the last hanging column or pressure plate point. "---" indicates no volume changes occurred.

<sup>2</sup> Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '-' denotes no volume change occurred.

\* Weight including tares

<sup>†</sup> Adjusted for >2.00mm (#10 sieve) material not used in DPP/RH testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm<sup>3</sup>.

<sup>‡</sup> Volume adjustments are applicable at this matric potential (see comment #1). Changes in volume, if applicable, are estimated based on obtainable measurements of changes in sample length and diameter.

Laboratory analysis by: D. O'Dowd

Data entered by: C. Krous

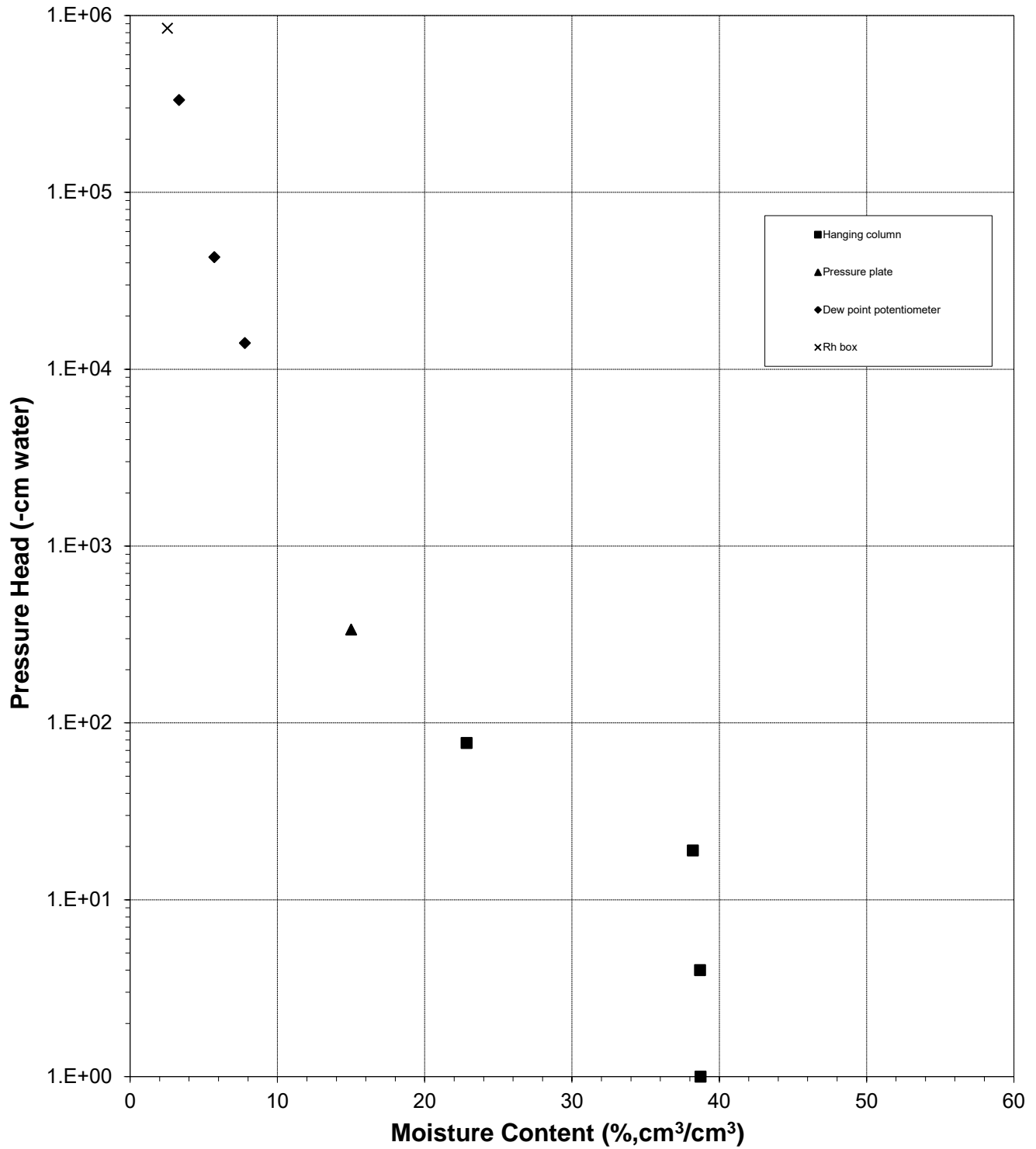
Checked by: J. Hines





### Water Retention Data Points

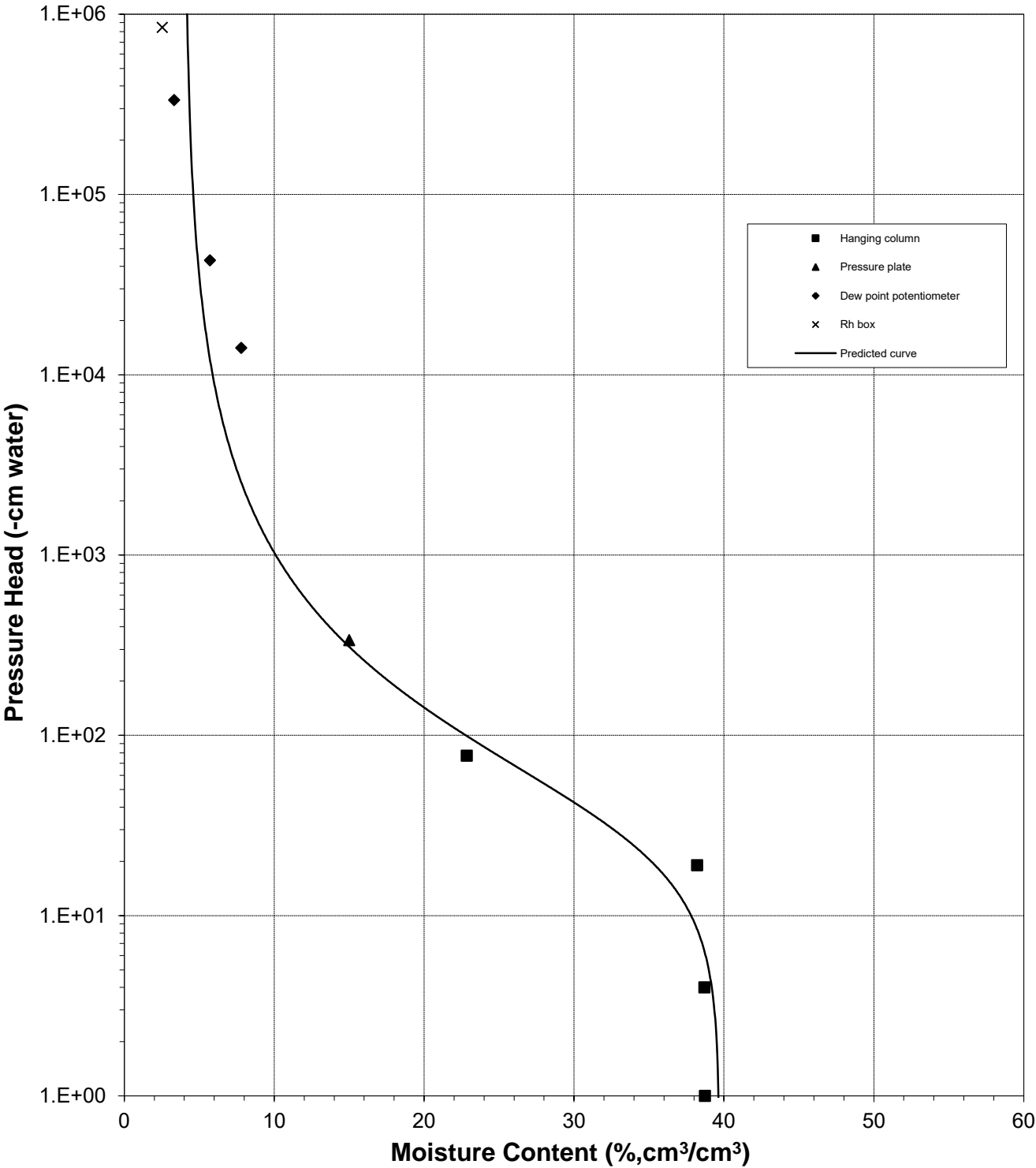
Sample Number: B11-39 (104.2 pcf)





Predicted Water Retention Curve and Data Points

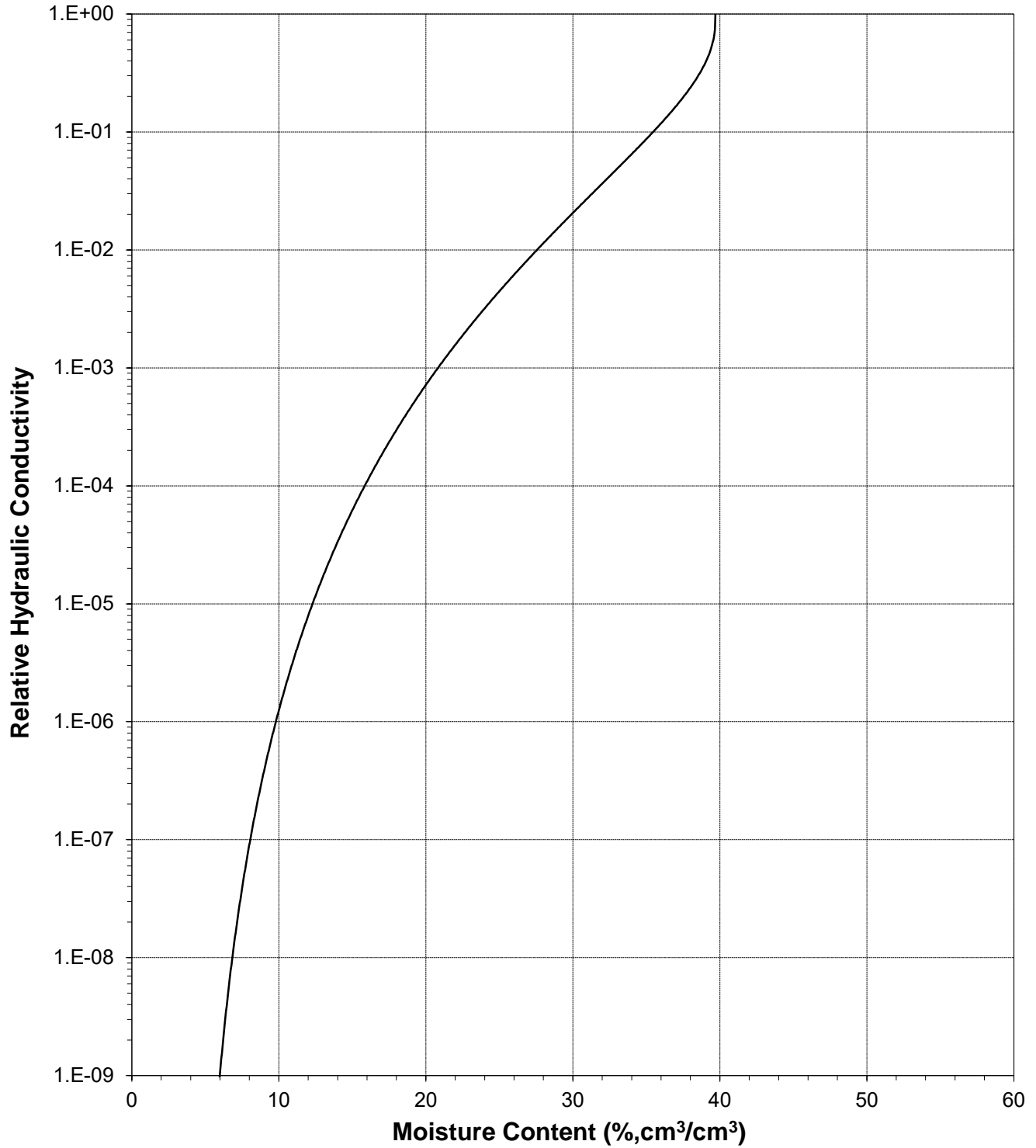
Sample Number: B11-39 (104.2 pcf)





### Plot of Relative Hydraulic Conductivity vs Moisture Content

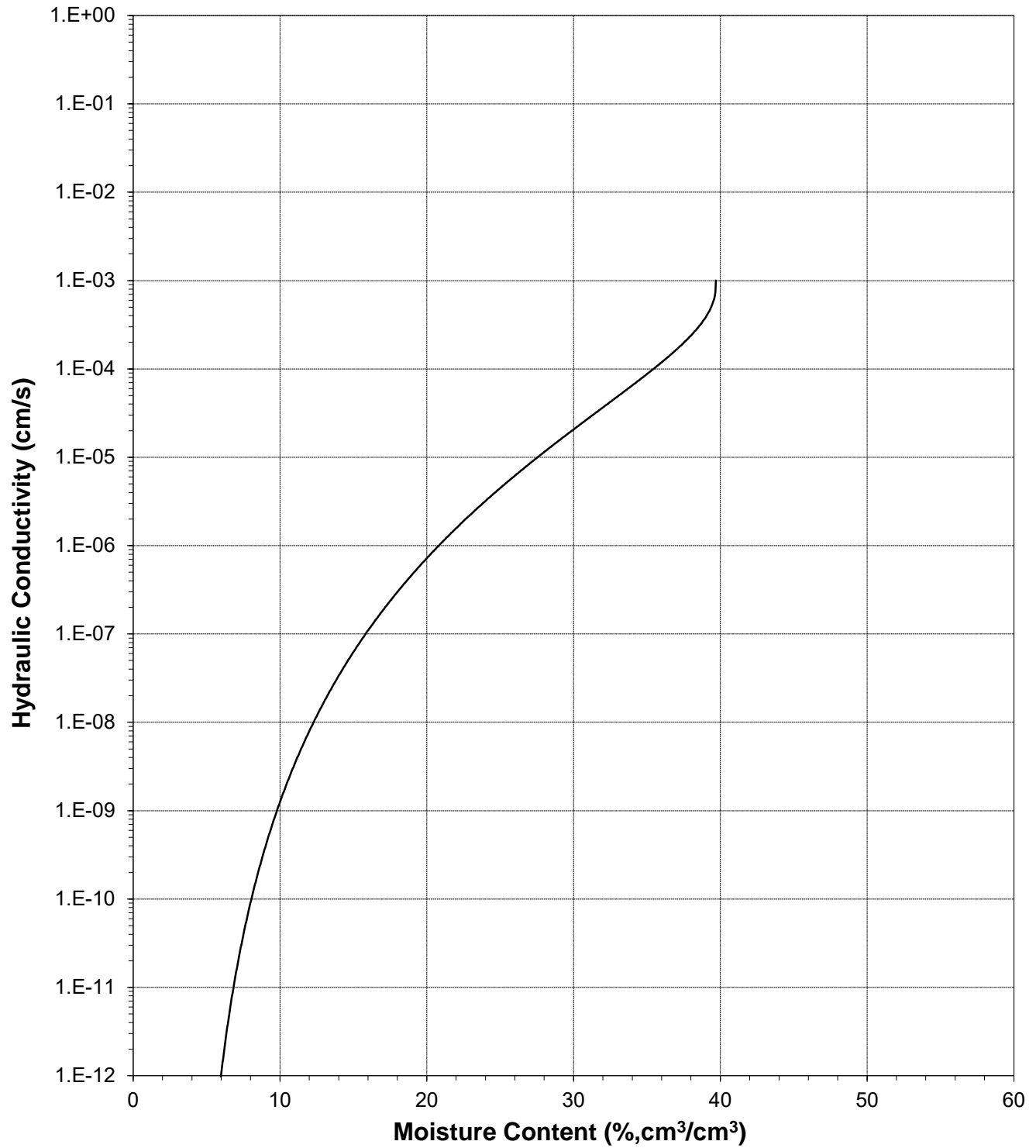
Sample Number: B11-39 (104.2 pcf)





### Plot of Hydraulic Conductivity vs Moisture Content

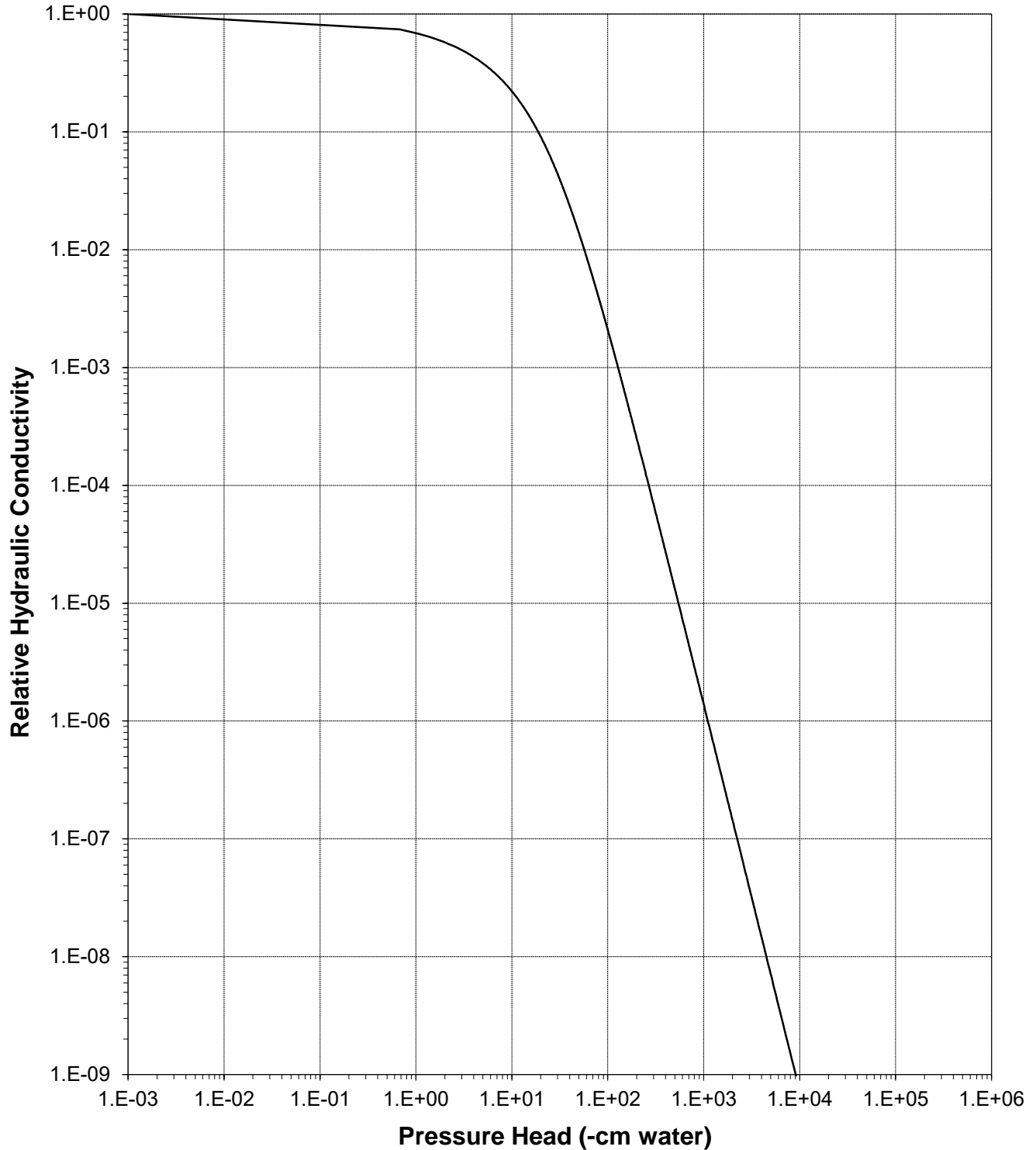
Sample Number: B11-39 (104.2 pcf)





### Plot of Relative Hydraulic Conductivity vs Pressure Head

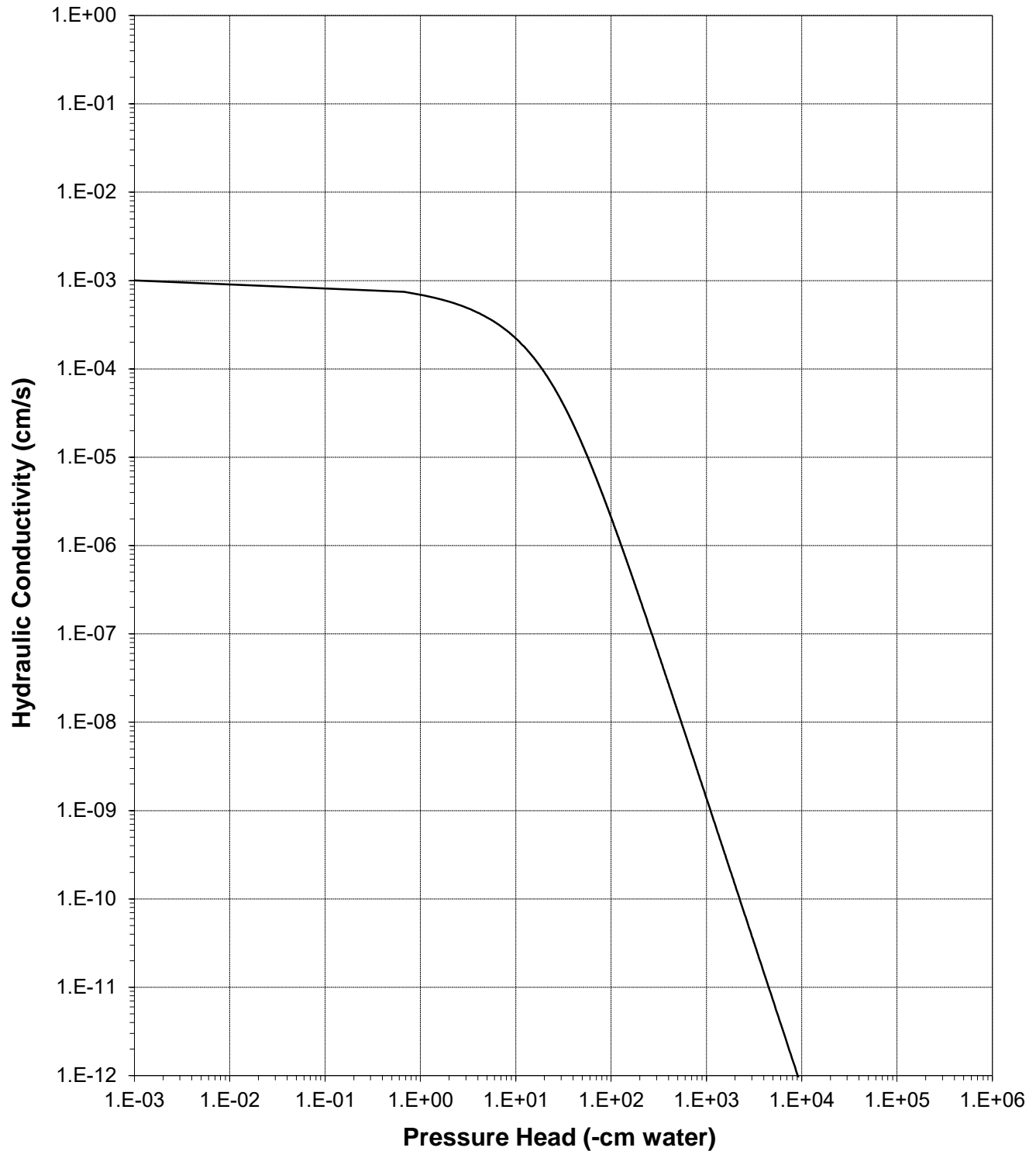
Sample Number: B11-39 (104.2 pcf)





### Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: B11-39 (104.2 pcf)



## **Particle Size Analysis**



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
B5A-9A	0.00030	0.059	0.078	260	21	WS/H	Sandy silt s(ML)	Sandy Loam	(Est)
B6A-19A	5.5E-05	0.0035	0.0080	145	0.57	WS/H	Fat clay (CH)	Clay	(Est)
B7A-0-20 (1+2)	4.1E-05	0.045	0.068	1659	15	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B7A-40-60 (1+2)	4.6E-05	0.018	0.046	1000	1.5	WS/H	Lean clay with sand (CL)s	Clay Loam	(Est)
B9-20-35 (1+2)	6.3E-05	0.0015	0.0028	44	0.51	WS/H	Fat clay (CH)	Clay	(Est)
B10-39A	6.1E-05	0.0044	0.0086	141	1.0	WS/H	Fat clay (CH)	Silty Clay Loam	(Est)
B10-10-25 (1+2)	2.4E-05	0.046	0.073	3042	17	WS/H	Sandy lean clay s(CL)	Loam	(Est)
B11-39A	0.0062	0.11	0.13	21	5.2	WS/H	Silty sand (SM)	Loamy Sand	

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material





**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
B5A-9A	0.0	41.9	39.8	18.3
B6A-19A	0.0	13.3	44.2	42.5
B7A-0-20 (1+2)	0.7	37.1	41.1	21.1
B7A-40-60 (1+2)	0.6	28.3	40.6	30.5
B9-20-35 (1+2)	0.0	3.5	42.6	53.9
B10-39A	0.0	5.4	56.5	38.1
B10-10-25 (1+2)	1.1	38.3	38.0	22.5
B11-39A	0.0	64.6	29.1	6.3

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 207.02  
Weight Passing #10 (g): 207.02  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 64.50  
Calculated Weight of Sieve Sample (g): 64.50

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	207.02	100.00
	2"	50	0.00	0.00	207.02	100.00
	1.5"	38.1	0.00	0.00	207.02	100.00
	1"	25	0.00	0.00	207.02	100.00
	3/4"	19.0	0.00	0.00	207.02	100.00
	3/8"	9.5	0.00	0.00	207.02	100.00
	4	4.75	0.00	0.00	207.02	100.00
	10	2.00	0.00	0.00	207.02	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	64.50	100.00
	40	0.425	0.01	0.01	64.49	99.98
	60	0.250	0.16	0.17	64.33	99.74
	140	0.106	16.85	17.02	47.48	73.61
	200	0.075	10.01	27.03	37.47	58.09
	dry pan		1.21	28.24	36.26	
	wet pan			36.26	0.00	

d<sub>10</sub> (mm): 0.00030      d<sub>50</sub> (mm): 0.059  
d<sub>16</sub> (mm): 0.0012      d<sub>60</sub> (mm): 0.078  
d<sub>30</sub> (mm): 0.022      d<sub>84</sub> (mm): 0.15

Median Particle Diameter--d<sub>50</sub> (mm): 0.059  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 260  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 21  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.070

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines (visual method): ML

ASTM Soil Classification: Sandy silt s(ML)  
USDA Soil Classification: Sandy Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'

Test Date: 7-Jun-18  
Start Time: 9:12

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.63

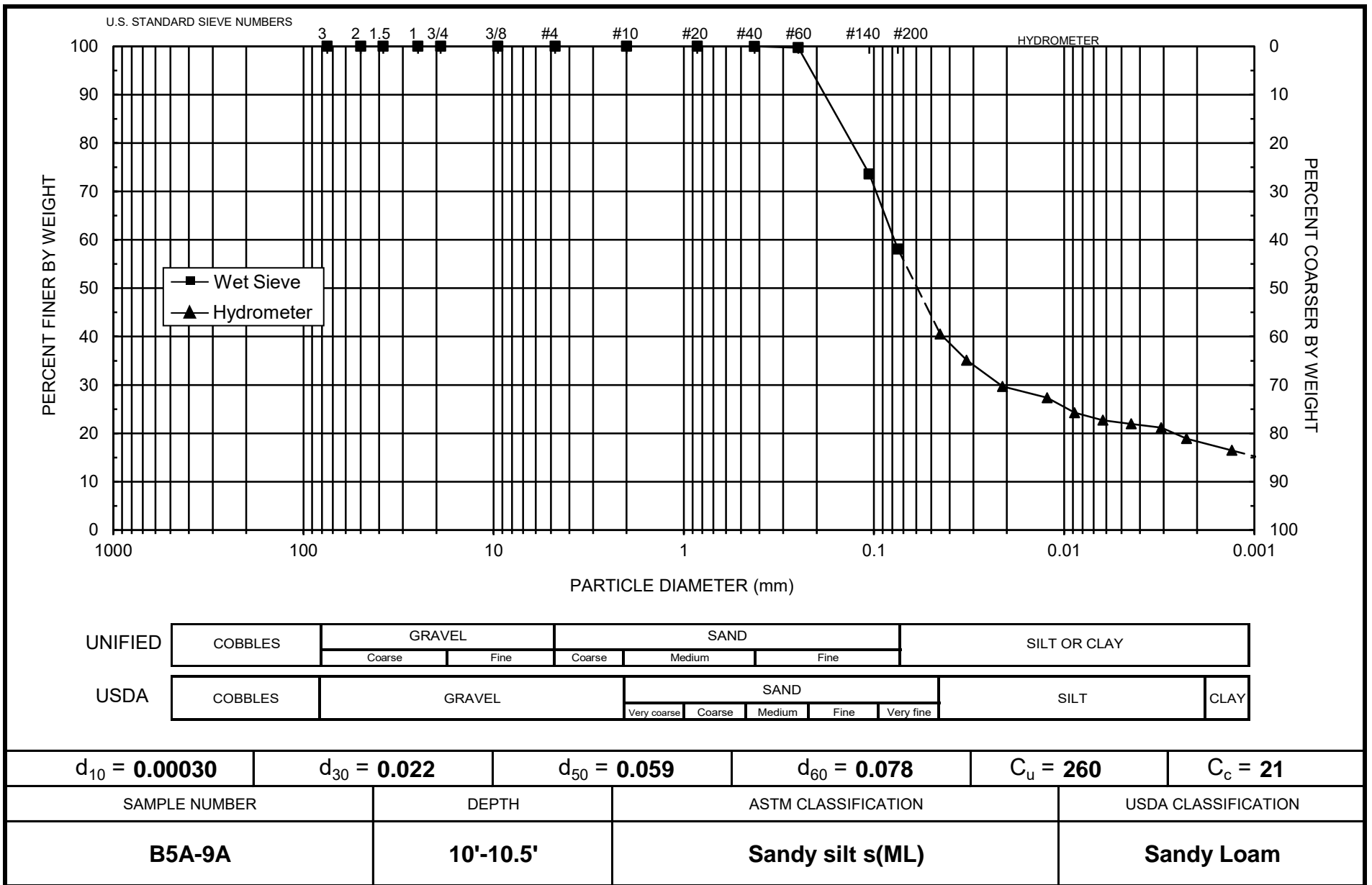
Initial Wt. (g): 64.50  
Total Sample Wt. (g): 207.02  
Wt. Passing #10 (g): 207.02

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	31.5	5.4	26.1	11.1	0.04487	40.5	40.5
	2	21.7	28.0	5.4	22.6	11.7	0.03255	35.1	35.1
	5	21.7	24.5	5.4	19.1	12.3	0.02109	29.7	29.7
	15	21.7	23.0	5.4	17.6	12.5	0.01229	27.3	27.3
	30	21.7	21.0	5.4	15.6	12.9	0.00880	24.2	24.2
	60	21.8	20.0	5.4	14.7	13.0	0.00626	22.7	22.7
	120	21.8	19.5	5.4	14.2	13.1	0.00444	21.9	21.9
	250	21.8	19.0	5.4	13.7	13.2	0.00308	21.2	21.2
	462	22.5	17.5	5.3	12.2	13.4	0.00227	18.9	18.9
8-Jun-18	1443	21.5	16.0	5.4	10.6	13.7	0.00131	16.5	16.5

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'  
Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 215.40  
Weight Passing #10 (g): 215.40  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 61.90  
Calculated Weight of Sieve Sample (g): 61.90

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	215.40	100.00
	2"	50	0.00	0.00	215.40	100.00
	1.5"	38.1	0.00	0.00	215.40	100.00
	1"	25	0.00	0.00	215.40	100.00
	3/4"	19.0	0.00	0.00	215.40	100.00
	3/8"	9.5	0.00	0.00	215.40	100.00
	4	4.75	0.00	0.00	215.40	100.00
	10	2.00	0.00	0.00	215.40	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.04	0.04	61.86	99.94
	40	0.425	0.07	0.11	61.79	99.82
	60	0.250	0.35	0.46	61.44	99.26
	140	0.106	4.52	4.98	56.92	91.95
	200	0.075	3.26	8.24	53.66	86.69
	dry pan		0.37	8.61	53.29	
	wet pan			53.29	0.00	

d<sub>10</sub> (mm): 5.5E-05      d<sub>50</sub> (mm): 0.0035  
d<sub>16</sub> (mm): 0.00011      d<sub>60</sub> (mm): 0.0080  
d<sub>30</sub> (mm): 0.00050      d<sub>84</sub> (mm): 0.062

Median Particle Diameter--d<sub>50</sub> (mm): 0.0035  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 145  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.57  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.022

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'  
Test Date: 7-Jun-18  
Start Time: 9:18

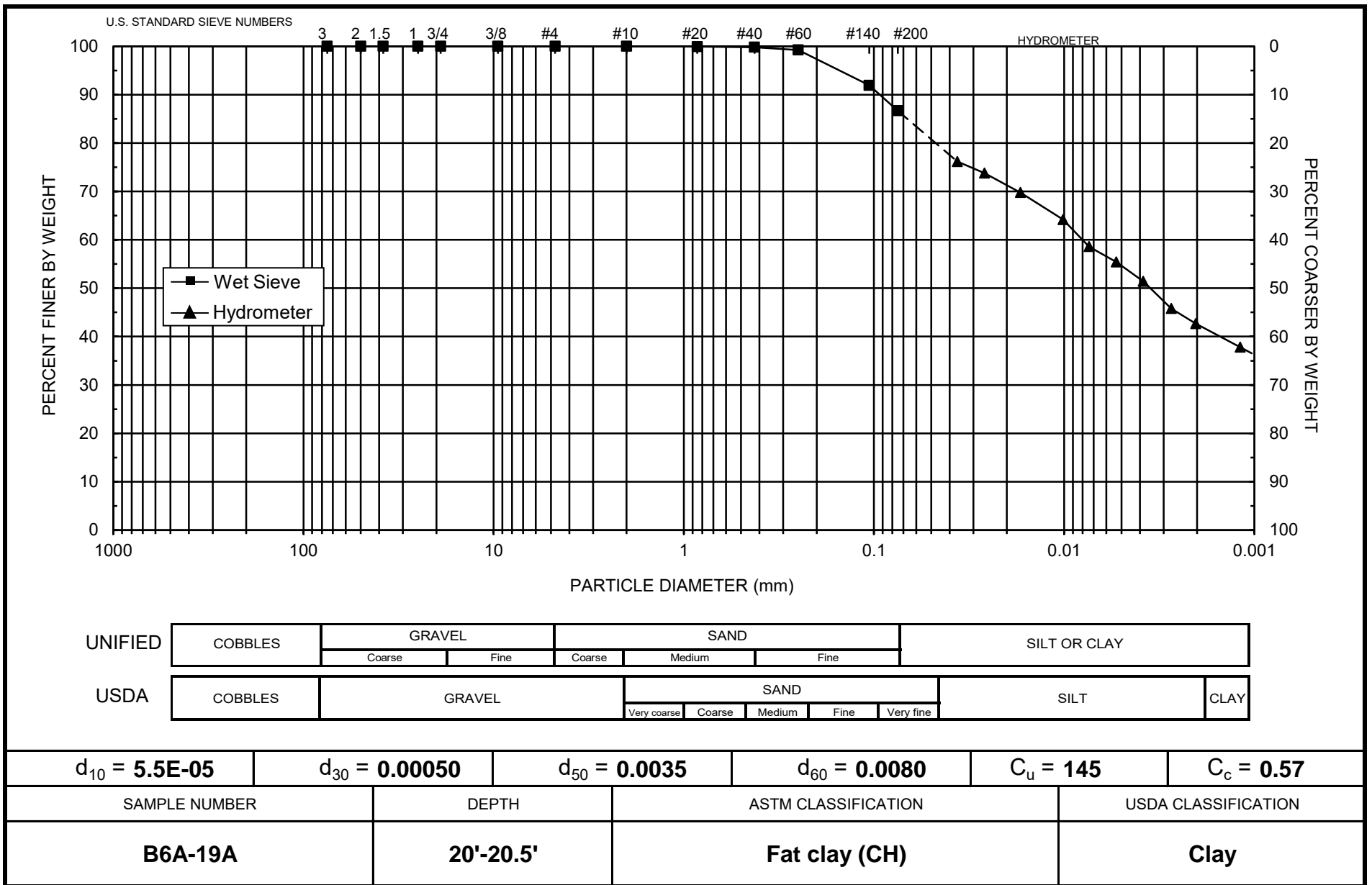
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.69  
Initial Wt. (g): 61.90  
Total Sample Wt. (g): 215.40  
Wt. Passing #10 (g): 215.40

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	53.0	5.4	47.6	7.6	0.03644	76.2	76.2
	2	21.7	51.5	5.4	46.1	7.9	0.02618	73.8	73.8
	5	21.7	49.0	5.4	43.6	8.3	0.01697	69.8	69.8
	15	21.7	45.5	5.4	40.1	8.8	0.01013	64.2	64.2
	30	21.7	42.0	5.4	36.6	9.4	0.00739	58.6	58.6
	60	21.8	40.0	5.4	34.7	9.7	0.00531	55.4	55.4
	120	21.8	37.5	5.4	32.2	10.2	0.00384	51.4	51.4
	250	21.8	34.0	5.4	28.6	10.7	0.00273	45.8	45.8
	457	22.5	32.0	5.3	26.7	11.1	0.00203	42.7	42.7
8-Jun-18	1438	21.5	29.0	5.4	23.6	11.5	0.00119	37.8	37.8

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 43348.48  
Weight Passing #10 (g): 42914.02  
Weight Retained #10 (g): 434.46  
Weight of Hydrometer Sample (g): 51.68  
Calculated Weight of Sieve Sample (g): 52.20

Shape: Angular  
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	43348.48	100.00
	2"	50	0.00	0.00	43348.48	100.00
	1.5"	38.1	0.00	0.00	43348.48	100.00
	1"	25	0.00	0.00	43348.48	100.00
	3/4"	19.0	9.44	9.44	43339.04	99.98
	3/8"	9.5	98.42	107.86	43240.62	99.75
	4	4.75	214.77	322.63	43025.85	99.26
	10	2.00	111.83	434.46	42914.02	99.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.23	0.75	51.45	98.56
	40	0.425	0.18	0.93	51.27	98.21
	60	0.250	0.49	1.42	50.78	97.27
	140	0.106	12.35	13.77	38.43	73.62
	200	0.075	5.96	19.73	32.47	62.20
	dry pan		0.51	20.24	31.96	
	wet pan			31.96	0.00	

$d_{10}$  (mm): 4.1E-05       $d_{50}$  (mm): 0.045  
 $d_{16}$  (mm): 0.00034       $d_{60}$  (mm): 0.068  
 $d_{30}$  (mm): 0.0065       $d_{84}$  (mm): 0.15

Median Particle Diameter-- $d_{50}$  (mm): 0.045  
Uniformity Coefficient,  $C_u$ -- $[d_{60}/d_{10}]$  (mm): 1659  
Coefficient of Curvature,  $C_c$ -- $[(d_{30})^2/(d_{10} \cdot d_{60})]$  (mm): 15  
Mean Particle Diameter-- $[(d_{16}+d_{50}+d_{84})/3]$  (mm): 0.065

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and soil classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)  
USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines





*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-0-20 (1+2)  
*Project Name:* NECR Jetty '18  
*Depth:* 0'-20'

*Test Date:* 12-Jun-18  
*Start Time:* 9:18

*Type of Water Used:* DISTILLED  
*Reaction with H<sub>2</sub>O<sub>2</sub>:* NA  
*Dispersant\*:* (NaPO<sub>3</sub>)<sub>6</sub>  
*Measured particle density:* 2.67

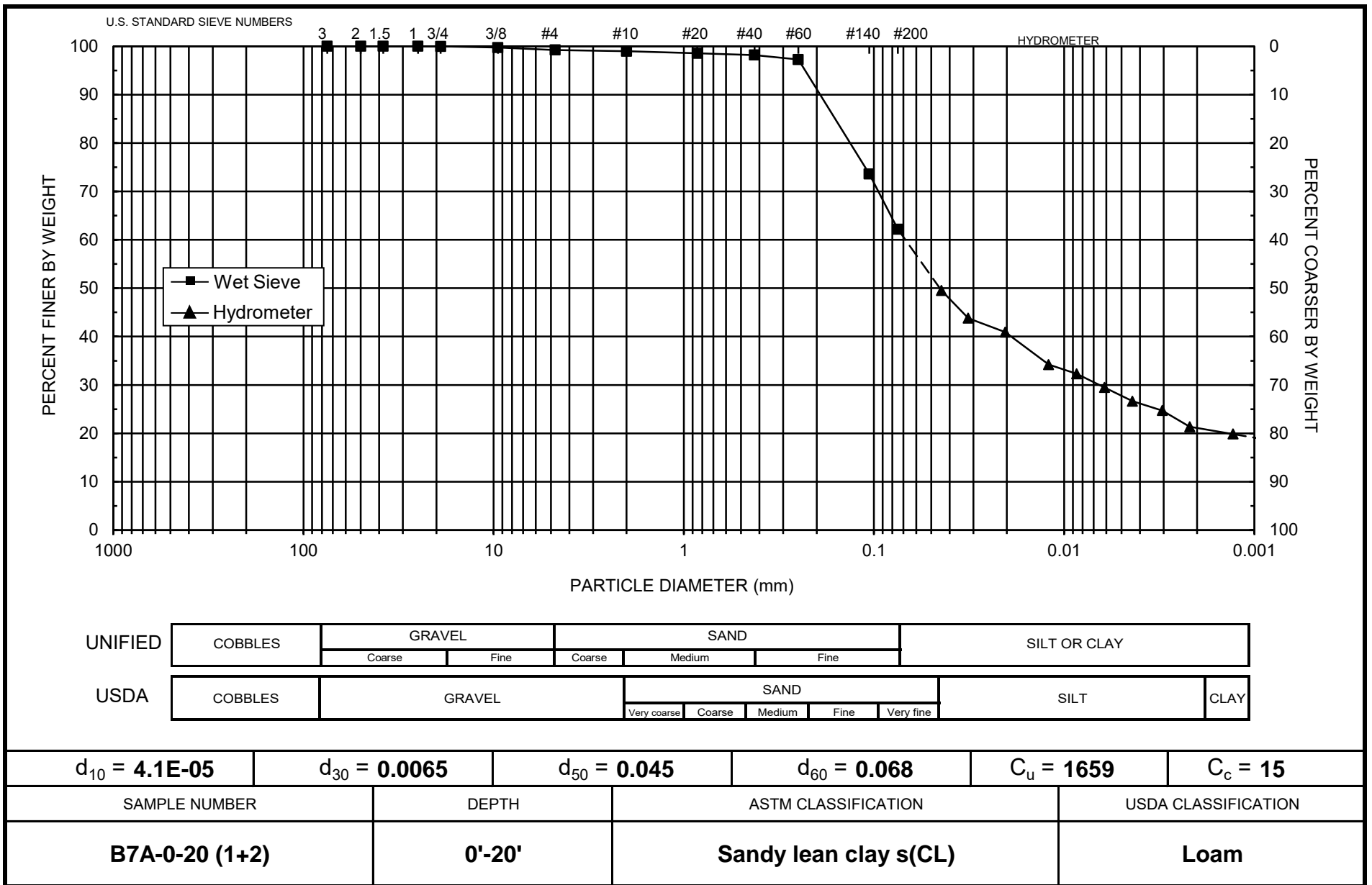
*Initial Wt. (g):* 51.68  
*Total Sample Wt. (g):* 43348.48  
*Wt. Passing #10 (g):* 42914.02

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	32.0	6.1	25.9	11.1	0.04420	50.0	49.5
	2	21.6	29.0	6.1	22.9	11.5	0.03194	44.2	43.8
	5	21.6	27.5	6.1	21.4	11.8	0.02041	41.3	40.9
	15	21.6	24.0	6.1	17.9	12.4	0.01207	34.6	34.2
	30	21.6	23.0	6.1	16.9	12.5	0.00859	32.6	32.3
	60	21.7	21.5	6.1	15.4	12.8	0.00613	29.8	29.5
	120	21.8	20.0	6.1	13.9	13.0	0.00437	26.9	26.6
	250	21.8	19.0	6.1	12.9	13.2	0.00305	25.0	24.7
	485	22.9	17.0	5.9	11.1	13.5	0.00219	21.6	21.3
13-Jun-18	1433	21.6	16.5	6.1	10.4	13.6	0.00129	20.0	19.8

*Comments:*

\* Dispersion device: mechanically operated stirring device

*Laboratory analysis by:* M. Garcia  
*Data entered by:* M. Garcia  
*Checked by:* J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

Test Date: 18-Jun-18

Initial Dry Weight of Sample (g): 34688.11  
Weight Passing #10 (g): 34472.55  
Weight Retained #10 (g): 215.56  
Weight of Hydrometer Sample (g): 56.27  
Calculated Weight of Sieve Sample (g): 56.62

Shape: Rounded  
Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	34688.11	100.00
	2"	50	0.00	0.00	34688.11	100.00
	1.5"	38.1	0.00	0.00	34688.11	100.00
	1"	25	0.00	0.00	34688.11	100.00
	3/4"	19.0	0.00	0.00	34688.11	100.00
	3/8"	9.5	83.77	83.77	34604.34	99.76
	4	4.75	124.81	208.58	34479.53	99.40
	10	2.00	6.98	215.56	34472.55	99.38
-10	(Based on calculated sieve wt.)					
	20	0.85	0.21	0.56	56.06	99.01
	40	0.425	0.17	0.73	55.89	98.71
	60	0.250	0.47	1.20	55.42	97.88
	140	0.106	9.74	10.94	45.68	80.68
	200	0.075	5.40	16.34	40.28	71.14
	dry pan		0.87	17.21	39.41	
	wet pan			39.41	0.00	

d<sub>10</sub> (mm): 4.6E-05      d<sub>50</sub> (mm): 0.018  
d<sub>16</sub> (mm): 0.00014      d<sub>60</sub> (mm): 0.046  
d<sub>30</sub> (mm): 0.0018      d<sub>84</sub> (mm): 0.13

Median Particle Diameter--d<sub>50</sub> (mm): 0.018  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 1000  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.5  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.049

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Lean clay with sand (CL)s  
USDA Soil Classification: Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

Test Date: 14-Jun-18  
Start Time: 9:00

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67

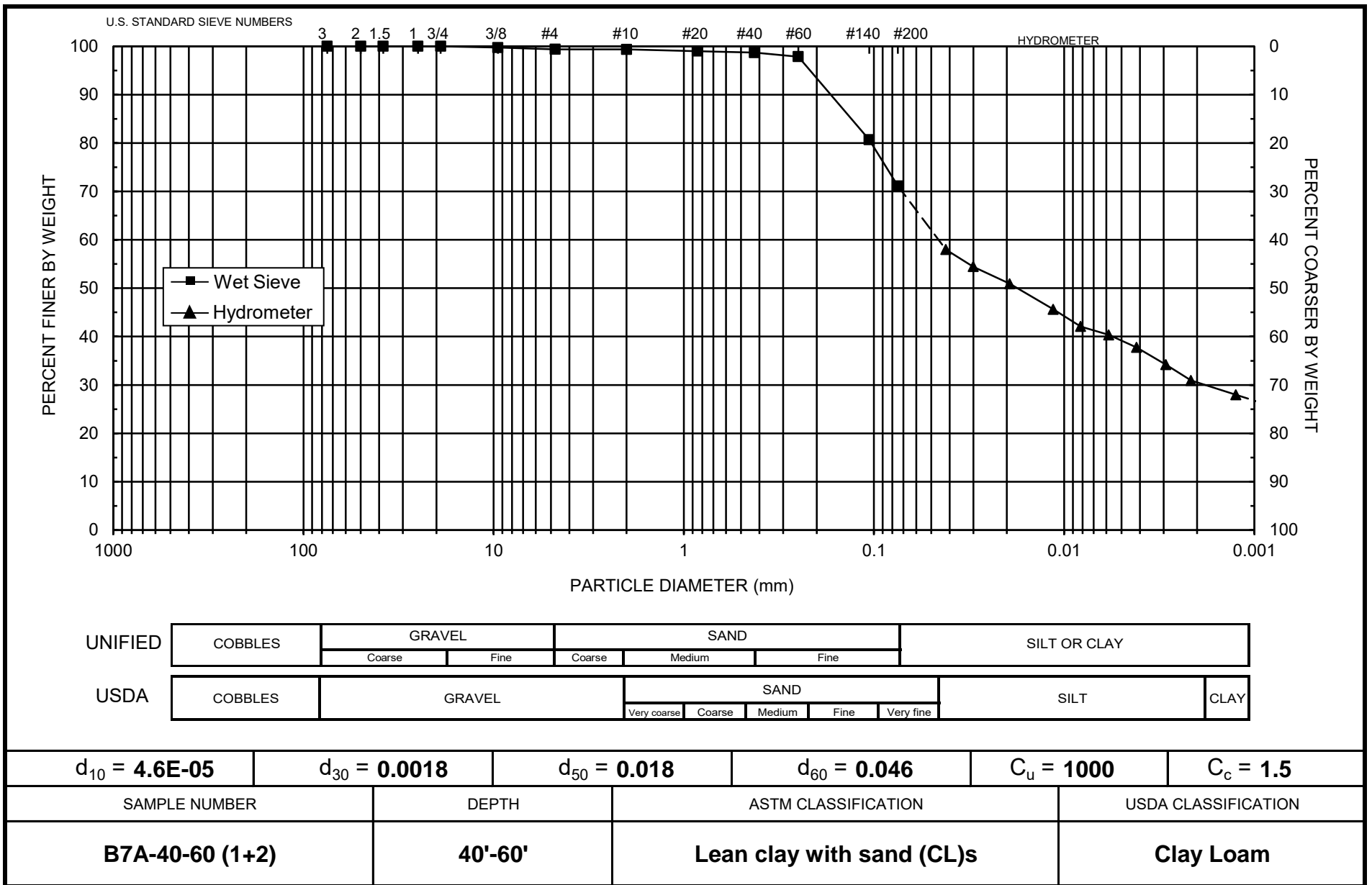
Initial Wt. (g): 56.27  
Total Sample Wt. (g): 34688.11  
Wt. Passing #10 (g): 34472.55

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
14-Jun-18	1	21.5	39.0	6.2	32.8	9.9	0.04185	58.3	58.0
	2	21.5	37.0	6.2	30.8	10.2	0.03008	54.8	54.4
	5	21.5	35.0	6.2	28.8	10.6	0.01933	51.2	50.9
	15	21.5	32.0	6.2	25.8	11.1	0.01142	45.9	45.6
	30	21.5	30.0	6.2	23.8	11.4	0.00819	42.3	42.1
	60	21.6	29.0	6.2	22.8	11.5	0.00583	40.6	40.3
	120	21.7	27.5	6.1	21.4	11.8	0.00416	38.0	37.8
	250	21.7	25.5	6.1	19.4	12.1	0.00292	34.4	34.2
	466	22.3	23.5	6.0	17.5	12.4	0.00215	31.1	30.9
	1433	21.6	22.0	6.2	15.8	12.7	0.00125	28.1	28.0
15-Jun-18	1433	21.6	22.0	6.2	15.8	12.7	0.00125	28.1	28.0

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 39884.70  
Weight Passing #10 (g): 39868.26  
Weight Retained #10 (g): 16.43  
Weight of Hydrometer Sample (g): 58.46  
Calculated Weight of Sieve Sample (g): 58.48

Shape: Rounded  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	39884.70	100.00
	2"	50	0.00	0.00	39884.70	100.00
	1.5"	38.1	0.00	0.00	39884.70	100.00
	1"	25	0.00	0.00	39884.70	100.00
	3/4"	19.0	0.00	0.00	39884.70	100.00
	3/8"	9.5	1.44	1.44	39883.26	100.00
	4	4.75	12.19	13.63	39871.07	99.97
	10	2.00	2.80	16.43	39868.26	99.96
-10	(Based on calculated sieve wt.)					
	20	0.85	0.02	0.04	58.44	99.92
	40	0.425	0.01	0.05	58.43	99.91
	60	0.250	0.07	0.12	58.36	99.79
	140	0.106	1.20	1.32	57.16	97.74
	200	0.075	0.76	2.08	56.40	96.44
	dry pan		0.10	2.18	56.30	
	wet pan			56.30	0.00	

d<sub>10</sub> (mm): 6.3E-05      d<sub>50</sub> (mm): 0.0015  
d<sub>16</sub> (mm): 0.00010      d<sub>60</sub> (mm): 0.0028  
d<sub>30</sub> (mm): 0.00030      d<sub>84</sub> (mm): 0.018

Median Particle Diameter--d<sub>50</sub> (mm): 0.0015  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 44  
Coefficient of Curvature, Cc--[d<sub>30</sub><sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 0.51  
Mean Particle Diameter--[d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>]/3] (mm): 0.0065

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)

USDA Soil Classification: Clay

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

Test Date: 7-Jun-18  
Start Time: 9:36

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.71

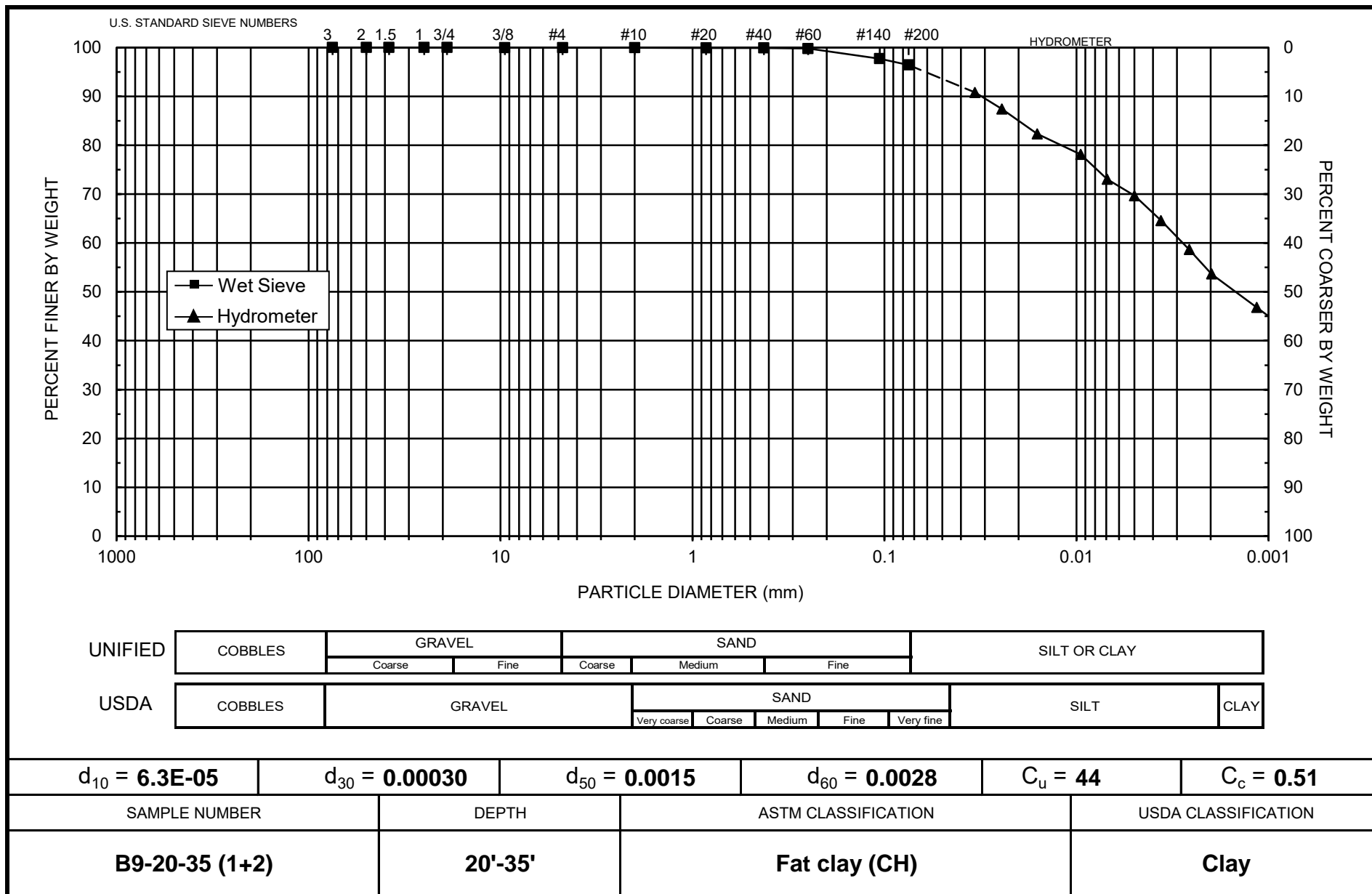
Initial Wt. (g): 58.46  
Total Sample Wt. (g): 39884.70  
Wt. Passing #10 (g): 39868.26

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	59.0	5.4	53.6	6.6	0.03377	90.8	90.8
	2	21.7	57.0	5.4	51.6	7.0	0.02446	87.5	87.4
	5	21.7	54.0	5.4	48.6	7.4	0.01601	82.4	82.3
	15	21.7	51.5	5.4	46.1	7.9	0.00949	78.1	78.1
	30	21.8	48.5	5.4	43.2	8.3	0.00691	73.1	73.0
	60	21.8	46.5	5.4	41.2	8.7	0.00498	69.7	69.7
	120	21.7	43.5	5.4	38.1	9.2	0.00363	64.6	64.6
	250	21.9	40.0	5.4	34.7	9.7	0.00258	58.7	58.7
	442	22.5	37.0	5.3	31.7	10.2	0.00198	53.7	53.6
8-Jun-18	1423	21.6	33.0	5.4	27.6	10.9	0.00115	46.8	46.8

*Comments:*

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*







Daniel B. Stephens & Associates, Inc.

## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 14-Jun-18

Initial Dry Weight of Sample (g): 151.12  
Weight Passing #10 (g): 151.12  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 41.33  
Calculated Weight of Sieve Sample (g): 41.33

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	151.12	100.00
	2"	50	0.00	0.00	151.12	100.00
	1.5"	38.1	0.00	0.00	151.12	100.00
	1"	25	0.00	0.00	151.12	100.00
	3/4"	19.0	0.00	0.00	151.12	100.00
	3/8"	9.5	0.00	0.00	151.12	100.00
	4	4.75	0.00	0.00	151.12	100.00
	10	2.00	0.00	0.00	151.12	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	41.33	100.00
	40	0.425	0.00	0.00	41.33	100.00
	60	0.250	0.02	0.02	41.31	99.95
	140	0.106	1.45	1.47	39.86	96.44
	200	0.075	0.78	2.25	39.08	94.56
	dry pan		0.13	2.38	38.95	
	wet pan			38.95	0.00	

d<sub>10</sub> (mm): 6.1E-05      d<sub>50</sub> (mm): 0.0044  
d<sub>16</sub> (mm): 0.00013      d<sub>60</sub> (mm): 0.0086  
d<sub>30</sub> (mm): 0.00073      d<sub>84</sub> (mm): 0.052

Median Particle Diameter--d<sub>50</sub> (mm): 0.0044  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 141  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 1.0  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.019

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CH

ASTM Soil Classification: Fat clay (CH)  
USDA Soil Classification: Silty Clay Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 12-Jun-18  
Start Time: 9:42

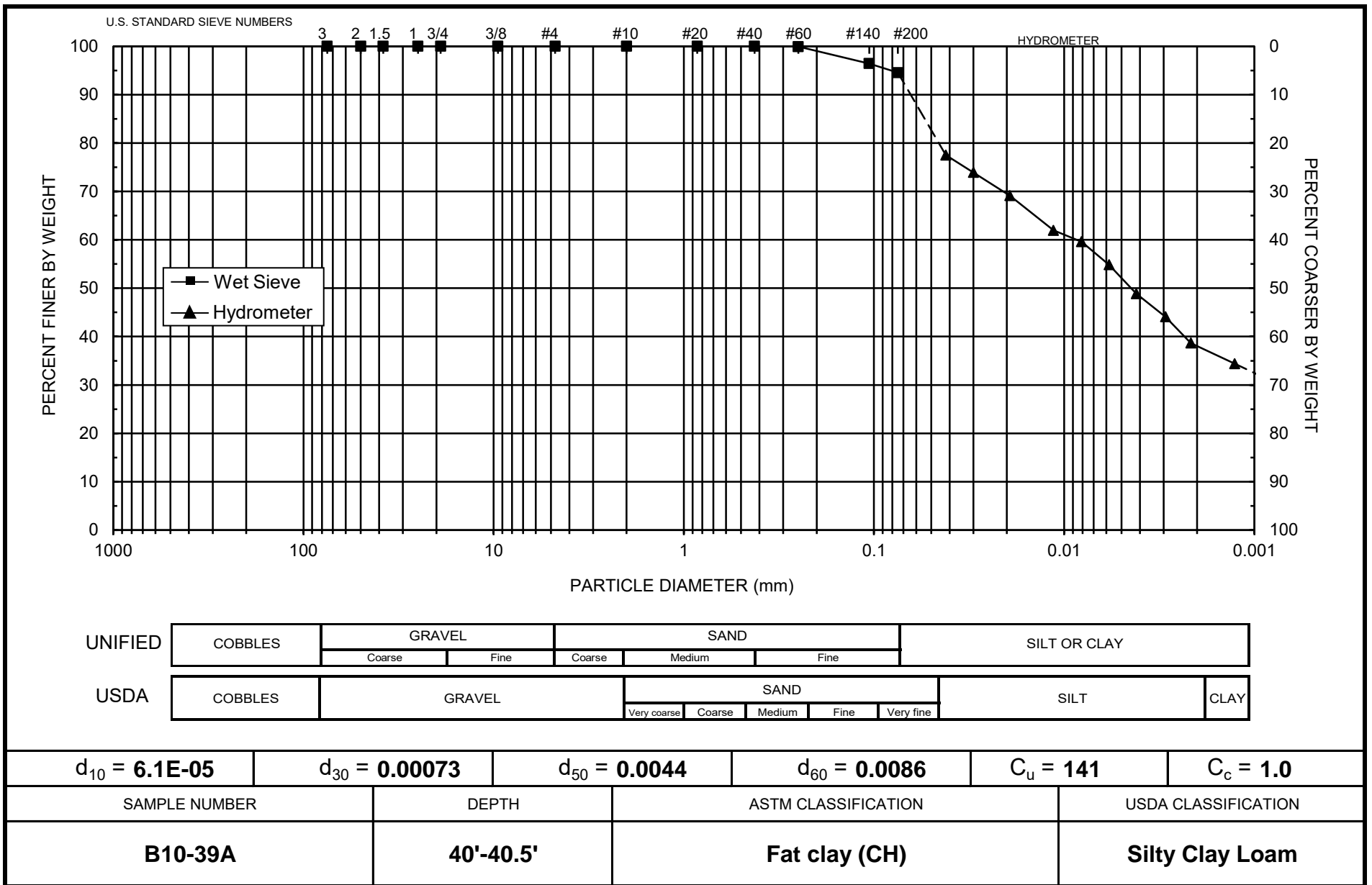
Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.68  
Initial Wt. (g): 41.33  
Total Sample Wt. (g): 151.12  
Wt. Passing #10 (g): 151.12

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
12-Jun-18	1	21.6	38.5	6.1	32.4	10.0	0.04189	77.5	77.5
	2	21.6	37.0	6.1	30.9	10.2	0.02999	73.9	73.9
	5	21.6	35.0	6.1	28.9	10.6	0.01927	69.1	69.1
	15	21.6	32.0	6.1	25.9	11.1	0.01138	61.9	61.9
	30	21.7	31.0	6.1	24.9	11.2	0.00810	59.6	59.6
	60	21.8	29.0	6.1	22.9	11.5	0.00580	54.8	54.8
	120	21.8	26.5	6.1	20.4	12.0	0.00417	48.9	48.9
	250	21.8	24.5	6.1	18.4	12.3	0.00293	44.1	44.1
	465	22.9	22.0	5.9	16.1	12.7	0.00216	38.7	38.7
13-Jun-18	1413	21.6	20.5	6.1	14.4	12.9	0.00127	34.4	34.4

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

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## Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

Test Date: 13-Jun-18

Initial Dry Weight of Sample (g): 38094.17  
Weight Passing #10 (g): 37631.25  
Weight Retained #10 (g): 462.92  
Weight of Hydrometer Sample (g): 63.31  
Calculated Weight of Sieve Sample (g): 64.09

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	38094.17	100.00
	2"	50	0.00	0.00	38094.17	100.00
	1.5"	38.1	0.00	0.00	38094.17	100.00
	1"	25	0.00	0.00	38094.17	100.00
	3/4"	19.0	13.52	13.52	38080.65	99.96
	3/8"	9.5	140.65	154.17	37940.00	99.60
	4	4.75	274.69	428.86	37665.31	98.87
	10	2.00	34.06	462.92	37631.25	98.78
-10	(Based on calculated sieve wt.)					
	20	0.85	0.41	1.19	62.90	98.15
	40	0.425	0.40	1.59	62.50	97.52
	60	0.250	0.68	2.27	61.82	96.46
	140	0.106	15.21	17.48	46.61	72.73
	200	0.075	7.81	25.29	38.80	60.54
	dry pan		0.83	26.12	37.97	
	wet pan			37.97	0.00	

d<sub>10</sub> (mm): 2.4E-05      d<sub>50</sub> (mm): 0.046  
d<sub>16</sub> (mm): 0.00020      d<sub>60</sub> (mm): 0.073  
d<sub>30</sub> (mm): 0.0054      d<sub>84</sub> (mm): 0.16

Median Particle Diameter--d<sub>50</sub> (mm): 0.046  
Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 3042  
Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 17  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.069

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: CL

ASTM Soil Classification: Sandy lean clay s(CL)

USDA Soil Classification: Loam

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

Test Date: 7-Jun-18  
Start Time: 9:48

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.67

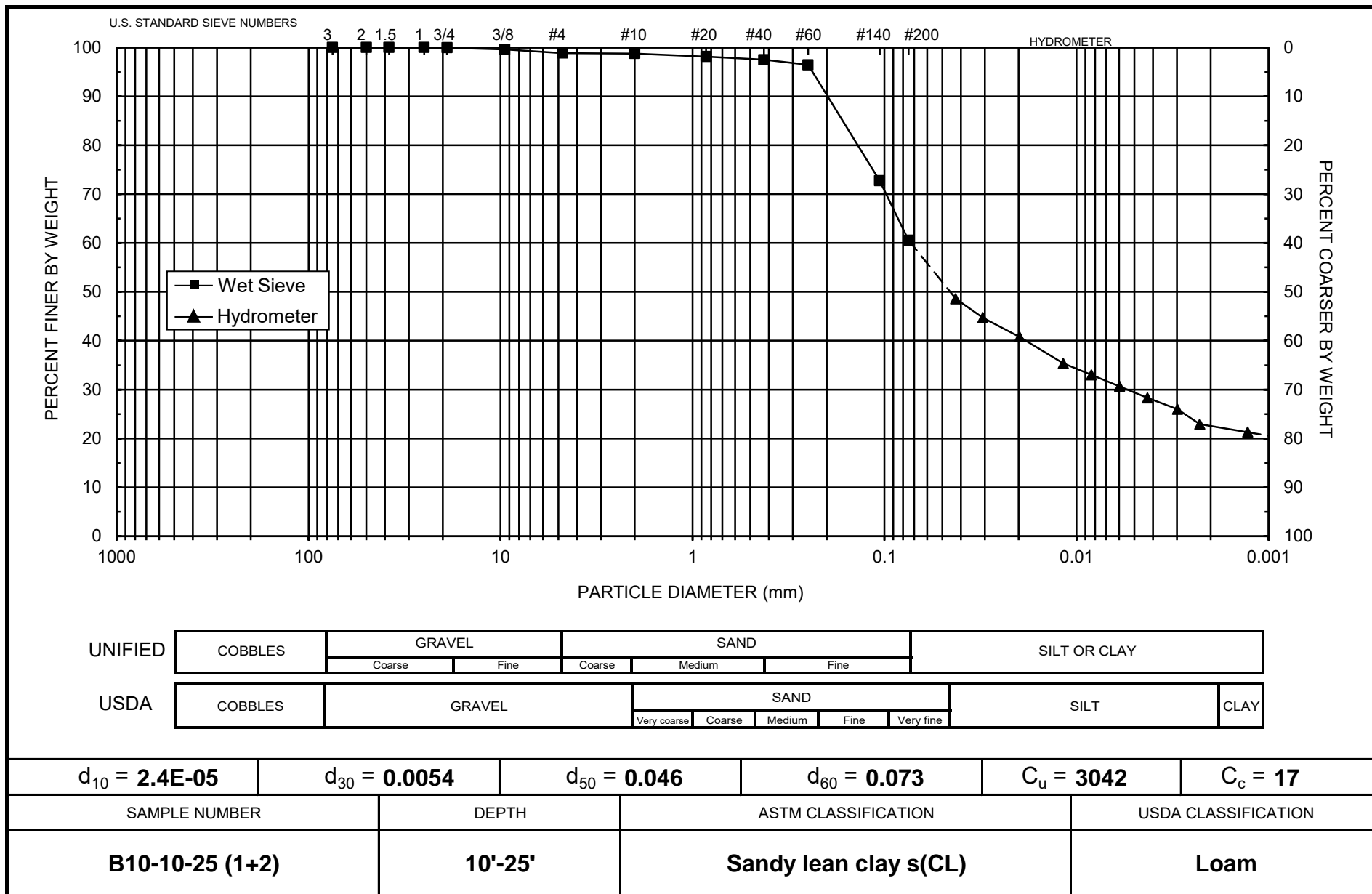
Initial Wt. (g): 63.31  
Total Sample Wt. (g): 38094.17  
Wt. Passing #10 (g): 37631.25

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
7-Jun-18	1	21.7	36.5	5.4	31.1	10.3	0.04257	49.2	48.6
	2	21.7	34.0	5.4	28.6	10.7	0.03069	45.2	44.7
	5	21.7	31.5	5.4	26.1	11.1	0.01978	41.3	40.8
	15	21.8	28.0	5.4	22.7	11.7	0.01170	35.8	35.3
	30	21.8	26.5	5.4	21.2	12.0	0.00836	33.4	33.0
	60	21.8	25.0	5.4	19.7	12.2	0.00597	31.0	30.7
	120	21.7	23.5	5.4	18.1	12.4	0.00427	28.7	28.3
	250	21.9	22.0	5.4	16.7	12.7	0.00298	26.3	26.0
	432	22.5	20.0	5.3	14.7	13.0	0.00228	23.2	22.9
8-Jun-18	1413	21.6	19.0	5.4	13.6	13.2	0.00128	21.5	21.3

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter

*Daniel B. Stephens & Associates, Inc.*





*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Wet Sieve Data (#10 Split)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 18-Jun-18

Initial Dry Weight of Sample (g): 271.00  
Weight Passing #10 (g): 271.00  
Weight Retained #10 (g): 0.00  
Weight of Hydrometer Sample (g): 46.83  
Calculated Weight of Sieve Sample (g): 46.83

Shape: Angular  
Hardness: Soft

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	271.00	100.00
	2"	50	0.00	0.00	271.00	100.00
	1.5"	38.1	0.00	0.00	271.00	100.00
	1"	25	0.00	0.00	271.00	100.00
	3/4"	19.0	0.00	0.00	271.00	100.00
	3/8"	9.5	0.00	0.00	271.00	100.00
	4	4.75	0.00	0.00	271.00	100.00
	10	2.00	0.00	0.00	271.00	100.00
-10	(Based on calculated sieve wt.)					
	20	0.85	0.00	0.00	46.83	100.00
	40	0.425	0.03	0.03	46.80	99.94
	60	0.250	1.93	1.96	44.87	95.81
	140	0.106	22.69	24.65	22.18	47.36
	200	0.075	5.60	30.25	16.58	35.40
	dry pan		0.85	31.10	15.73	
	wet pan			15.73	0.00	

d<sub>10</sub> (mm): 0.0062      d<sub>50</sub> (mm): 0.11  
d<sub>16</sub> (mm): 0.033      d<sub>60</sub> (mm): 0.13  
d<sub>30</sub> (mm): 0.065      d<sub>84</sub> (mm): 0.20

Median Particle Diameter--d<sub>50</sub> (mm): 0.11  
Uniformity Coefficient, Cu--[d<sub>60</sub>/d<sub>10</sub>] (mm): 21  
Coefficient of Curvature, Cc--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 5.2  
Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.11

Classification of fines (visual method): ML

ASTM Soil Classification: Silty sand (SM)  
USDA Soil Classification: Loamy Sand

Laboratory analysis by: Z. Calhoun  
Data entered by: M. Garcia  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 14-Jun-18  
Start Time: 9:18

Type of Water Used: DISTILLED  
Reaction with  $H_2O_2$ : NA  
Dispersant\*:  $(NaPO_3)_6$   
Measured particle density: 2.65  
Initial Wt. (g): 46.83  
Total Sample Wt. (g): 271.00  
Wt. Passing #10 (g): 271.00

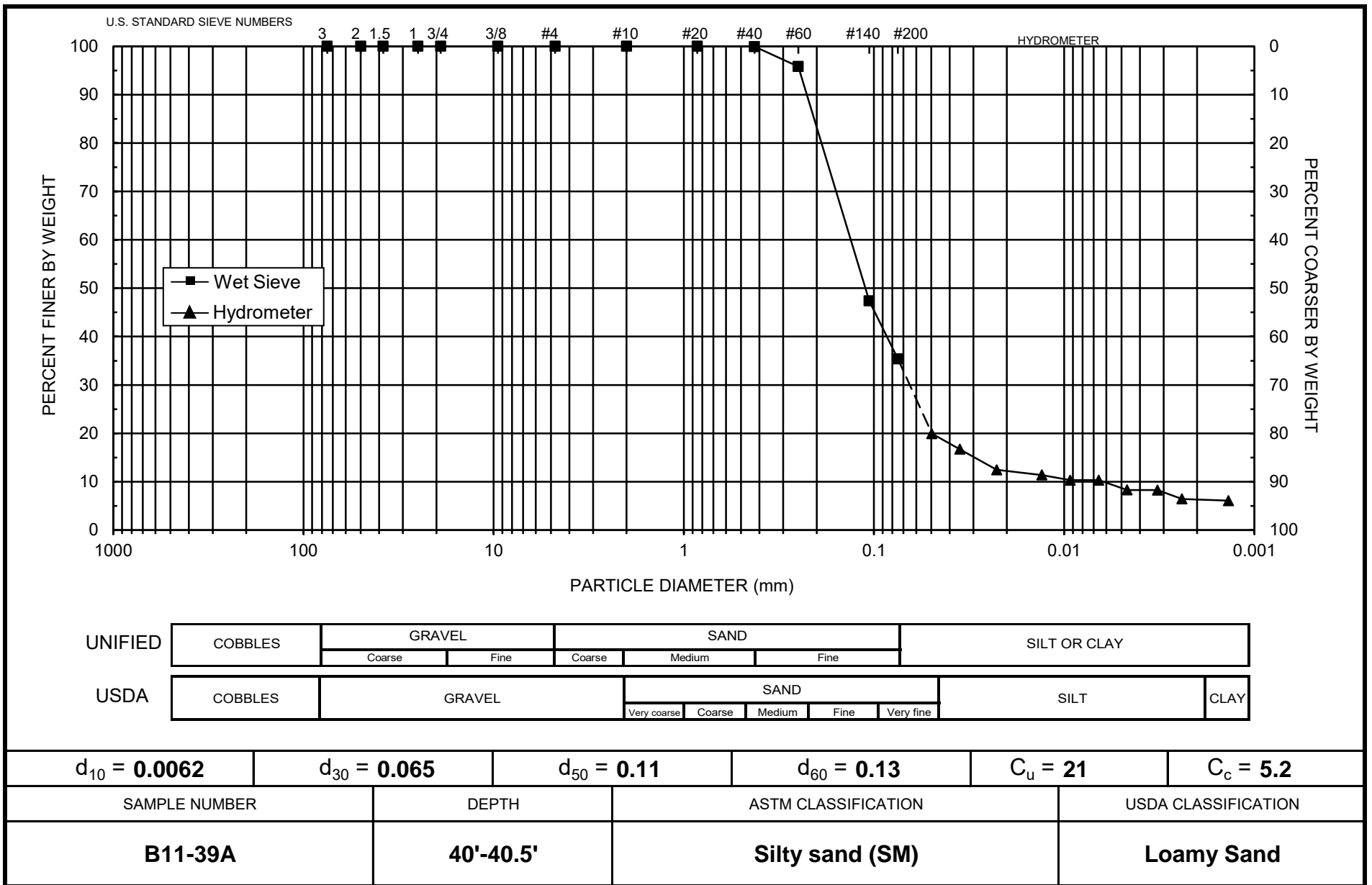
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
14-Jun-18	1	21.5	15.5	6.2	9.3	13.8	0.04958	19.9	19.9
	2	21.5	14.0	6.2	7.8	14.0	0.03537	16.7	16.7
	5	21.5	12.0	6.2	5.8	14.3	0.02263	12.4	12.4
	15	21.5	11.5	6.2	5.3	14.4	0.01310	11.4	11.4
	30	21.5	11.0	6.2	4.8	14.5	0.00929	10.3	10.3
	60	21.6	11.0	6.2	4.8	14.5	0.00657	10.3	10.3
	120	21.7	10.0	6.1	3.9	14.7	0.00466	8.3	8.3
	250	21.7	10.0	6.1	3.9	14.7	0.00323	8.3	8.3
	451	22.3	9.0	6.0	3.0	14.8	0.00240	6.4	6.4
	1418	21.6	9.0	6.2	2.8	14.8	0.00137	6.1	6.1
15-Jun-18	1418	21.6	9.0	6.2	2.8	14.8	0.00137	6.1	6.1

### Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: M. Garcia  
Data entered by: M. Garcia  
Checked by: J. Hines





Daniel B. Stephens & Associates, Inc.

## **Double Hydrometer**



### Summary of Percent Dispersion by Double Hydrometer

Sample Number	Percent Finer Than 2- $\mu$ m, Not Dispersed	Percent Finer Than 2- $\mu$ m, Dispersed <sup>1</sup>	Percent Dispersion	Plasticity Index versus Liquid Limit Plot Falls on or Above the "A" Line <sup>1</sup>	Dispersiveness Classification
B5A-9A	3	18	16	No	Nondispersive
B6A-19A	4	42	9	Yes	Nondispersive
B7A-0-20 (1+2)	4	21	17	Yes	Nondispersive
B7A-40-60 (1+2)	4	30	12	Yes	Nondispersive
B9-20-35 (1+2)	3	54	5	Yes	Nondispersive
B10-39A	6	38	15	Yes	Nondispersive
B10-10-25 (1+2)	0	22	0	Yes	Nondispersive
B11-39A	0	6	0	No	Nondispersive

<sup>1</sup> This test method is applicable to soils where the position of the plasticity index versus liquid limit plot falls on or above the "A" line, and more than 12% of the soil fraction is finer than 2- $\mu$ m when dispersant is used.



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'

Test Date: 9-Aug-18  
Start Time: 9:00

Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.63

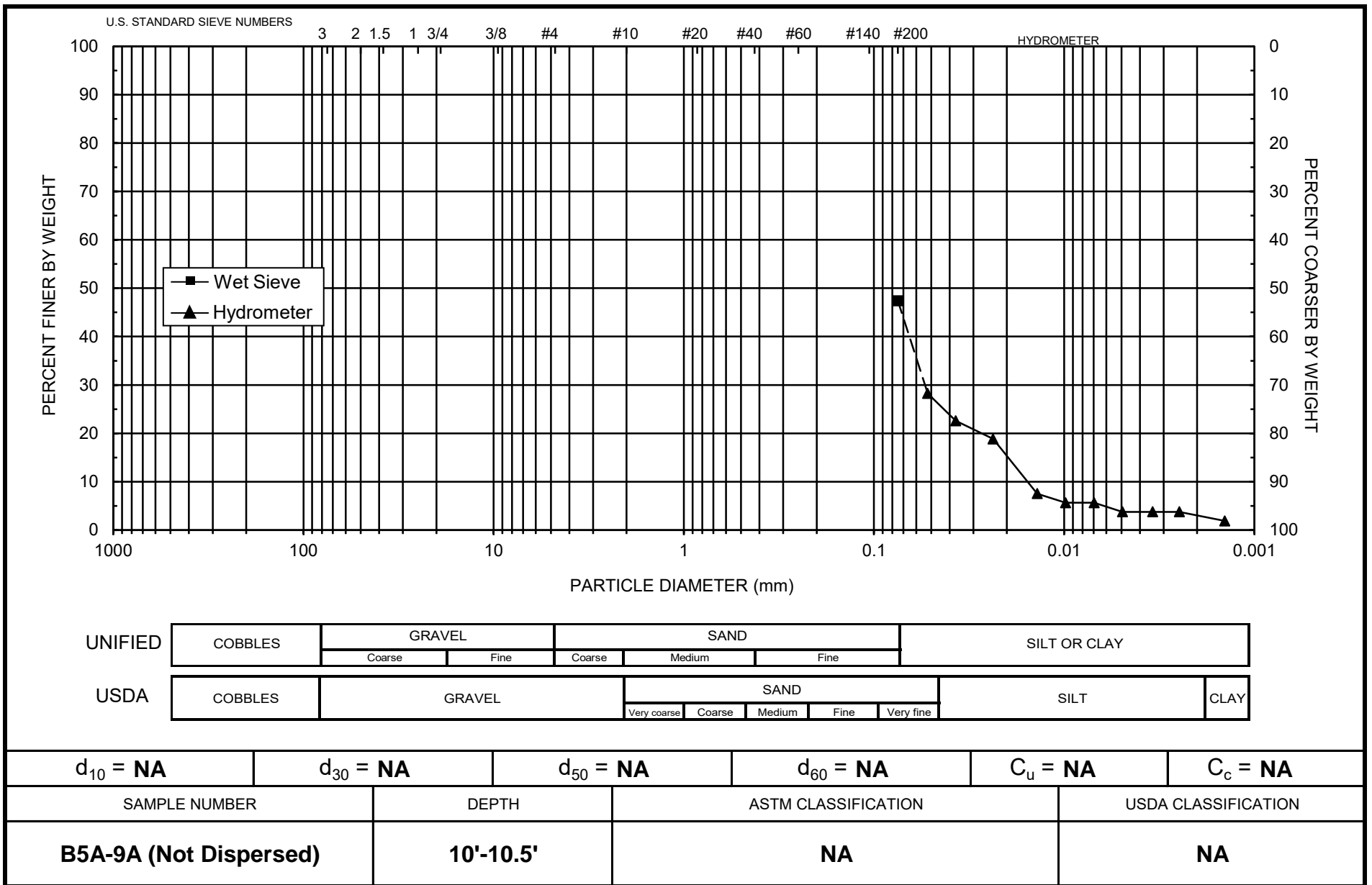
Initial Wt. (g): 26.56  
Total Sample Wt. (g): 207.02  
Wt. Passing #10 (g): 207.02

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
9-Aug-18	1	21.8	7.5	0.0	7.5	15.1	0.05213	28.2	28.2
	2	21.8	6.0	0.0	6.0	15.3	0.03716	22.6	22.6
	5	21.8	5.0	0.0	5.0	15.5	0.02363	18.8	18.8
	15	21.8	2.0	0.0	2.0	16.0	0.01386	7.5	7.5
	30	21.8	1.5	0.0	1.5	16.1	0.00982	5.6	5.6
	60	21.7	1.5	0.0	1.5	16.1	0.00695	5.6	5.6
	120	21.6	1.0	0.0	1.0	16.1	0.00494	3.8	3.8
	250	21.6	1.0	0.0	1.0	16.1	0.00342	3.8	3.8
	471	22.0	1.0	0.0	1.0	16.1	0.00248	3.8	3.8
10-Aug-18	1433	21.7	0.5	0.0	0.5	16.2	0.00143	1.9	1.9

*Comments:*

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: A. Bland  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B6A-19A (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 20'-20.5'

Test Date: 9-Aug-18  
Start Time: 9:06

Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.69

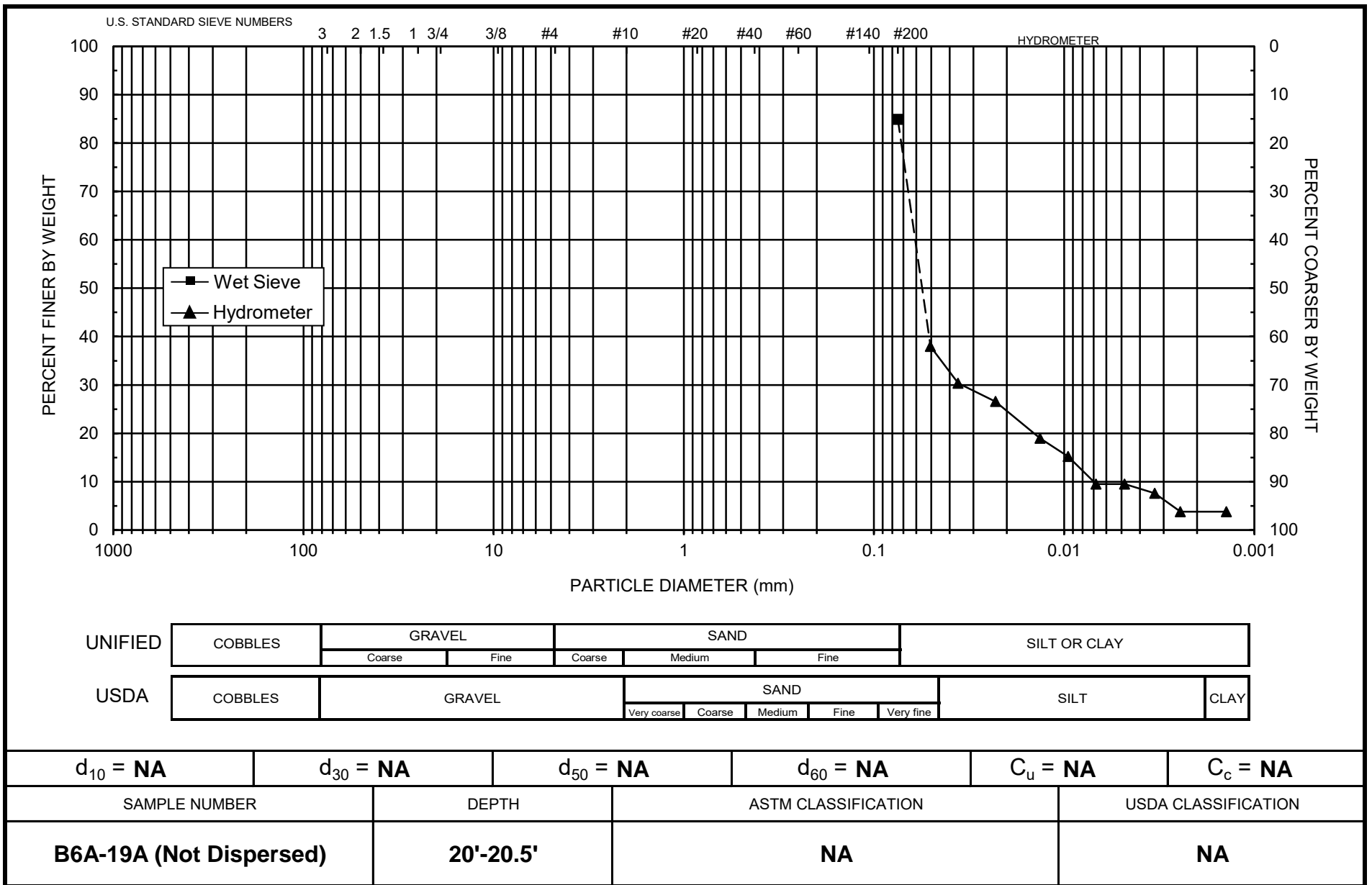
Initial Wt. (g): 26.09  
Total Sample Wt. (g): 215.40  
Wt. Passing #10 (g): 215.40

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
9-Aug-18	1	21.8	10.0	0.0	10.0	14.7	0.05048	37.9	37.9
	2	21.8	8.0	0.0	8.0	15.0	0.03609	30.4	30.4
	5	21.8	7.0	0.0	7.0	15.2	0.02295	26.6	26.6
	15	21.8	5.0	0.0	5.0	15.5	0.01339	19.0	19.0
	30	21.8	4.0	0.0	4.0	15.6	0.00952	15.2	15.2
	60	21.7	2.5	0.0	2.5	15.9	0.00679	9.5	9.5
	120	21.6	2.5	0.0	2.5	15.9	0.00481	9.5	9.5
	250	21.6	2.0	0.0	2.0	16.0	0.00334	7.6	7.6
	466	22.0	1.0	0.0	1.0	16.1	0.00245	3.8	3.8
10-Aug-18	1428	21.7	1.0	0.0	1.0	16.1	0.00140	3.8	3.8

*Comments:*

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: A. Bland  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2) (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

Test Date: 9-Aug-18  
Start Time: 9:12

Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.67

Initial Wt. (g): 26.97  
Total Sample Wt. (g): 43348.48  
Wt. Passing #10 (g): 42914.02

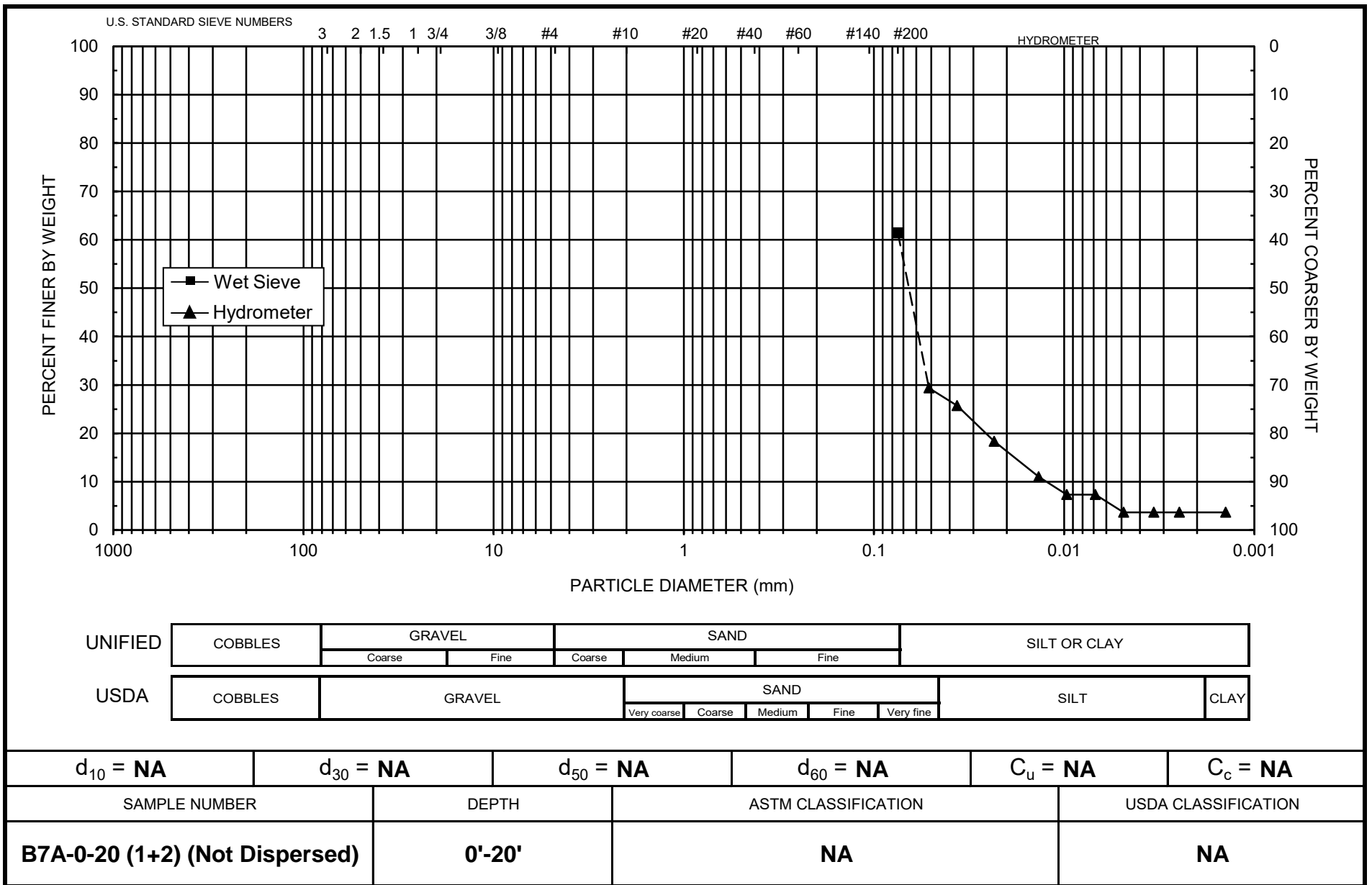
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
9-Aug-18	1	21.8	8.0	0.0	8.0	15.0	0.05134	29.7	29.4
	2	21.8	7.0	0.0	7.0	15.2	0.03650	26.0	25.7
	5	21.8	5.0	0.0	5.0	15.5	0.02333	18.5	18.4
	15	21.8	3.0	0.0	3.0	15.8	0.01361	11.1	11.0
	30	21.7	2.0	0.0	2.0	16.0	0.00969	7.4	7.3
	60	21.7	2.0	0.0	2.0	16.0	0.00685	7.4	7.3
	120	21.7	1.0	0.0	1.0	16.1	0.00487	3.7	3.7
	250	21.6	1.0	0.0	1.0	16.1	0.00338	3.7	3.7
	461	22.0	1.0	0.0	1.0	16.1	0.00248	3.7	3.7
10-Aug-18	1423	21.7	1.0	0.0	1.0	16.1	0.00141	3.7	3.7

### Comments:

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: A. Bland  
Checked by: J. Hines





Daniel B. Stephens & Associates, Inc.



*Daniel B. Stephens & Associates, Inc.*

### Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2) (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

Test Date: 9-Aug-18  
Start Time: 9:18

Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.67

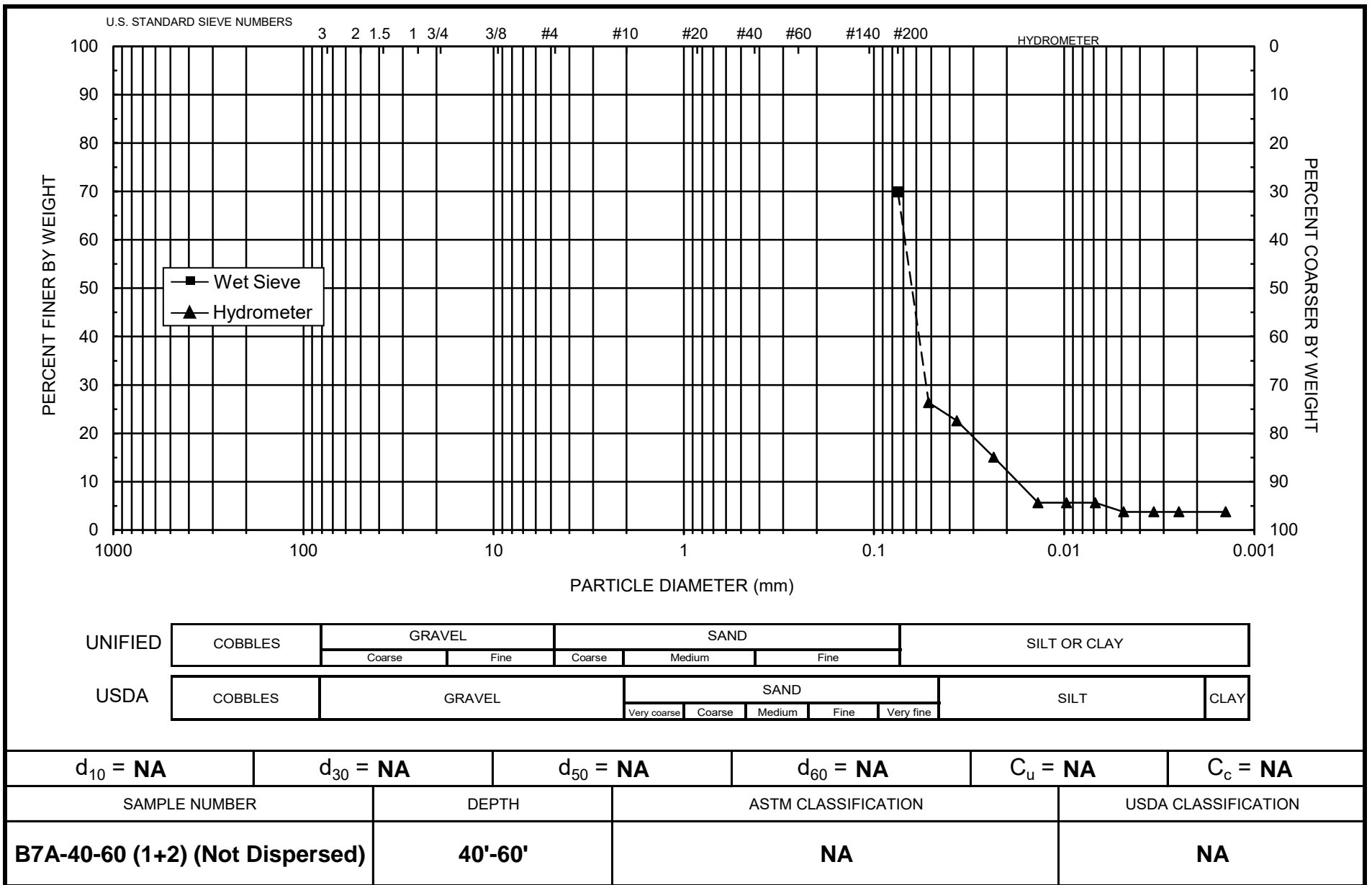
Initial Wt. (g): 26.41  
Total Sample Wt. (g): 34688.11  
Wt. Passing #10 (g): 34472.55

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
9-Aug-18	1	21.8	7.0	0.0	7.0	15.2	0.05158	26.5	26.3
	2	21.8	6.0	0.0	6.0	15.3	0.03667	22.7	22.6
	5	21.8	4.0	0.0	4.0	15.6	0.02344	15.1	15.1
	15	21.8	1.5	0.0	1.5	16.1	0.01371	5.7	5.6
	30	21.7	1.5	0.0	1.5	16.1	0.00970	5.7	5.6
	60	21.7	1.5	0.0	1.5	16.1	0.00686	5.7	5.6
	120	21.7	1.0	0.0	1.0	16.1	0.00486	3.8	3.8
	250	21.6	1.0	0.0	1.0	16.1	0.00337	3.8	3.8
	455	22.0	1.0	0.0	1.0	16.1	0.00249	3.8	3.8
	1418	21.7	1.0	0.0	1.0	16.1	0.00142	3.8	3.8
10-Aug-18	1418	21.7	1.0	0.0	1.0	16.1	0.00142	3.8	3.8

*Comments:*

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: A. Bland  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2) (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 20'-35'

Test Date: 9-Aug-18  
Start Time: 9:24

Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.71

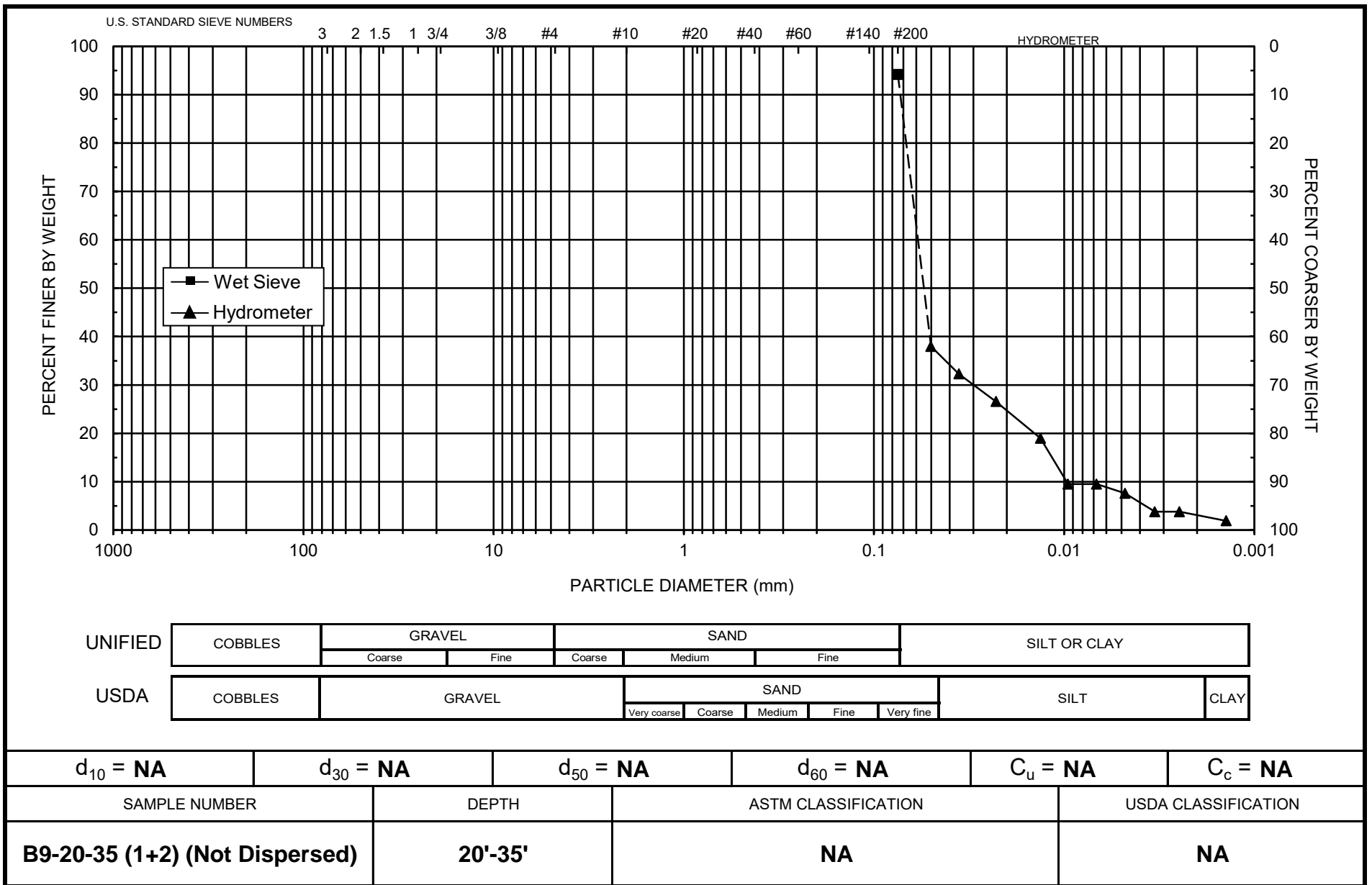
Initial Wt. (g): 26.07  
Total Sample Wt. (g): 39884.70  
Wt. Passing #10 (g): 39868.26

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
9-Aug-18	1	21.8	10.0	0.0	10.0	14.7	0.05016	38.0	38.0
	2	21.8	8.5	0.0	8.5	14.9	0.03576	32.3	32.3
	5	21.8	7.0	0.0	7.0	15.2	0.02280	26.6	26.6
	15	21.7	5.0	0.0	5.0	15.5	0.01332	19.0	19.0
	30	21.7	2.5	0.0	2.5	15.9	0.00955	9.5	9.5
	60	21.7	2.5	0.0	2.5	15.9	0.00675	9.5	9.5
	120	21.7	2.0	0.0	2.0	16.0	0.00478	7.6	7.6
	250	21.6	1.0	0.0	1.0	16.1	0.00334	3.8	3.8
	450	22.0	1.0	0.0	1.0	16.1	0.00247	3.8	3.8
	1412	21.7	0.5	0.0	0.5	16.2	0.00141	1.9	1.9
10-Aug-18	1412	21.7	0.5	0.0	0.5	16.2	0.00141	1.9	1.9

### Comments:

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: A. Bland  
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-39A (Not Dispersed)  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'

*Test Date:* 9-Aug-18  
*Start Time:* 9:30

*Type of Water Used:* DISTILLED  
*Reaction with H<sub>2</sub>O<sub>2</sub>:* NA  
*Dispersant\*:* Distilled Water  
*Measured particle density:* 2.68

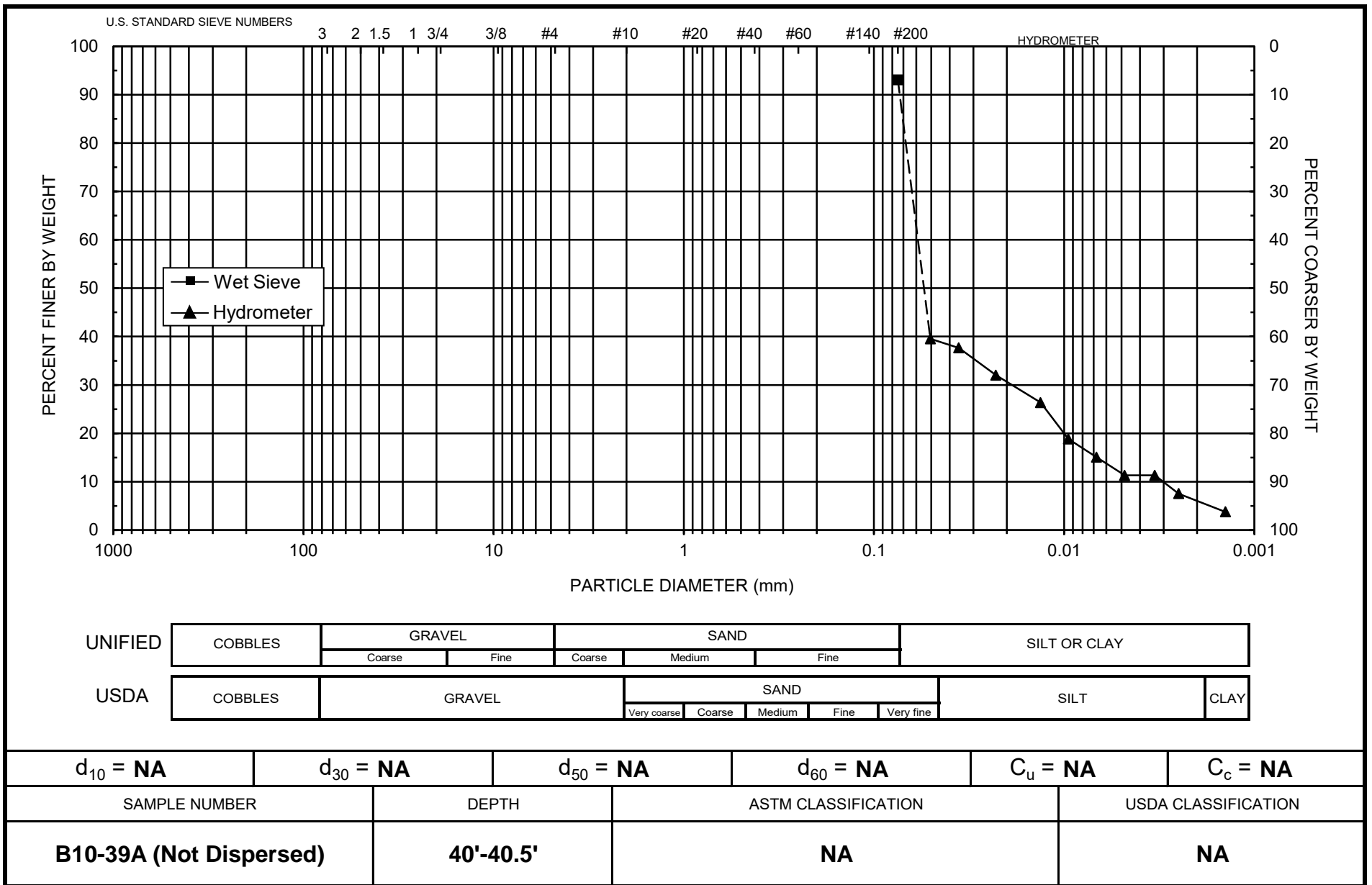
*Initial Wt. (g):* 26.29  
*Total Sample Wt. (g):* 151.12  
*Wt. Passing #10 (g):* 151.12

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
9-Aug-18	1	21.8	10.5	0.0	10.5	14.6	0.05049	39.5	39.5
	2	21.8	10.0	0.0	10.0	14.7	0.03580	37.7	37.7
	5	21.8	8.5	0.0	8.5	14.9	0.02283	32.0	32.0
	15	21.7	7.0	0.0	7.0	15.2	0.01331	26.4	26.4
	30	21.7	5.0	0.0	5.0	15.5	0.00951	18.8	18.8
	60	21.7	4.0	0.0	4.0	15.6	0.00676	15.1	15.1
	120	21.7	3.0	0.0	3.0	15.8	0.00481	11.3	11.3
	250	21.6	3.0	0.0	3.0	15.8	0.00333	11.3	11.3
	445	22.0	2.0	0.0	2.0	16.0	0.00250	7.5	7.5
10-Aug-18	1407	21.7	1.0	0.0	1.0	16.1	0.00142	3.8	3.8

*Comments:*

\* Not Mechanically or Chemically Dispersed

*Laboratory analysis by:* A. Bland  
*Data entered by:* A. Bland  
*Checked by:* J. Hines



*Daniel B. Stephens & Associates, Inc.*



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2) (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

Test Date: 11-Sep-18  
Start Time: 9:00

Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.67

Initial Wt. (g): 25.48  
Total Sample Wt. (g): 38094.17  
Wt. Passing #10 (g): 37631.25

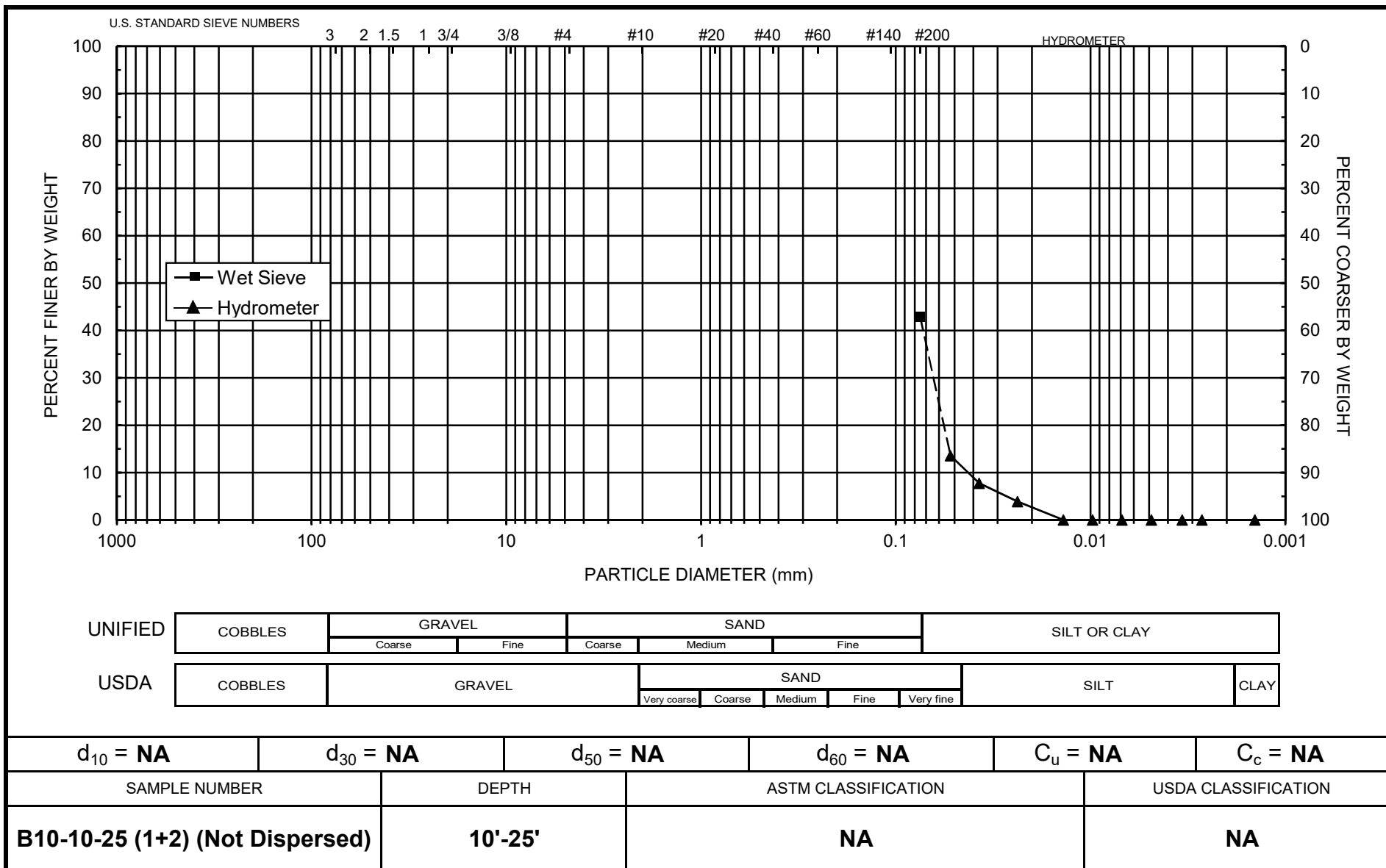
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
11-Sep-18	1	22.0	3.5	0.0	3.5	15.7	0.05237	13.7	13.6
	2	22.0	2.0	0.0	2.0	16.0	0.03732	7.8	7.8
	5	22.0	1.0	0.0	1.0	16.1	0.02373	3.9	3.9
	15	21.9	0.0	0.0	0.0	16.3	0.01378	0.0	0.0
	30	21.8	0.0	0.0	0.0	16.3	0.00976	0.0	0.0
	60	21.8	0.0	0.0	0.0	16.3	0.00690	0.0	0.0
	120	21.9	0.0	0.0	0.0	16.3	0.00487	0.0	0.0
	250	21.6	0.0	0.0	0.0	16.3	0.00339	0.0	0.0
	395	22.1	0.0	0.0	0.0	16.3	0.00268	0.0	0.0
12-Sep-18	1398	21.7	0.0	0.0	0.0	16.3	0.00143	0.0	0.0

Comments:

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: C. Krous  
Checked by: J. Hines





*Daniel B. Stephens & Associates, Inc.*



*Daniel B. Stephens & Associates, Inc.*

## Particle Size Analysis Hydrometer Data

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A (Not Dispersed)  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

Test Date: 11-Sep-18  
Start Time: 9:06

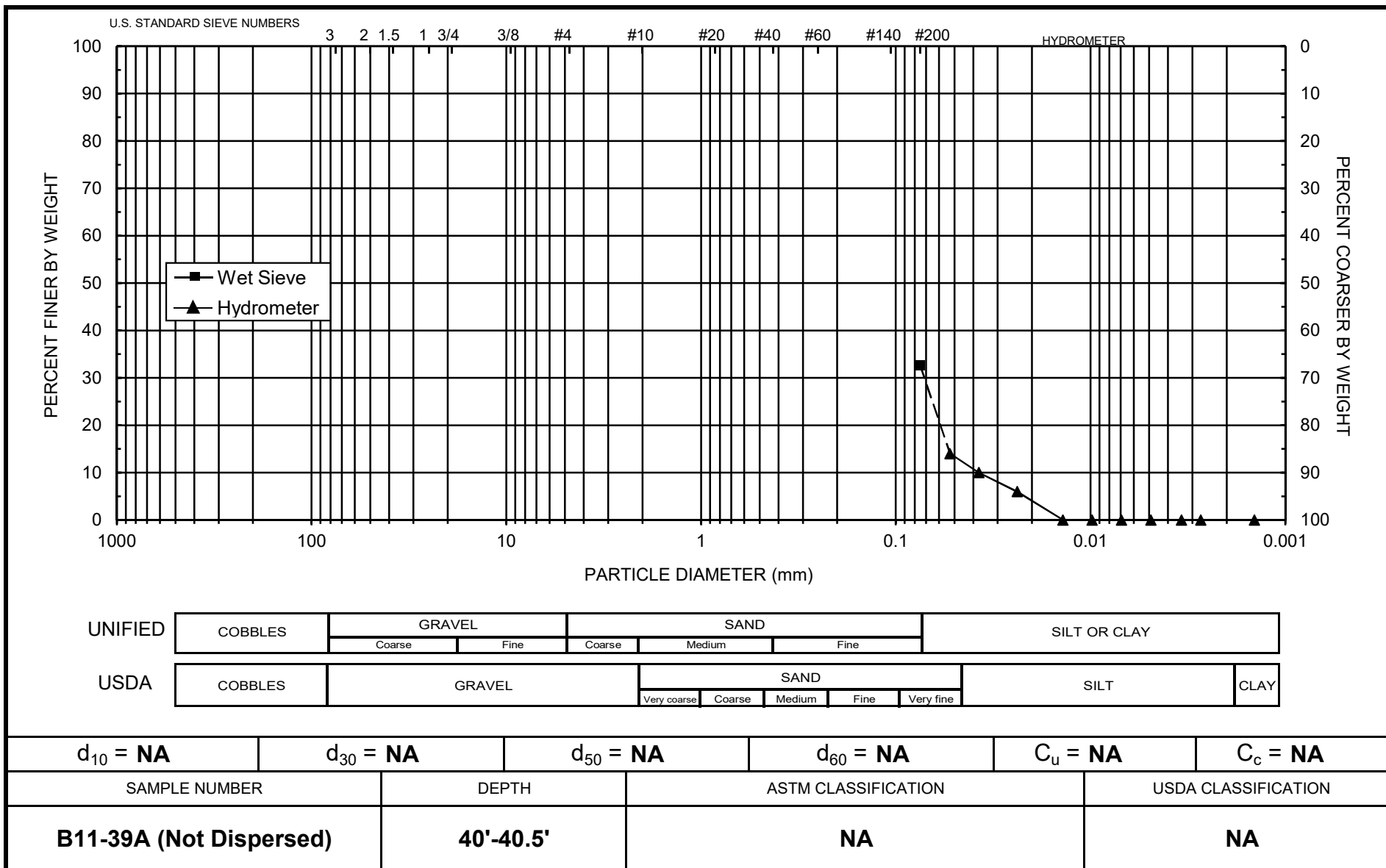
Type of Water Used: DISTILLED  
Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
Dispersant\*: Distilled Water  
Measured particle density: 2.65  
Initial Wt. (g): 24.99  
Total Sample Wt. (g): 271.00  
Wt. Passing #10 (g): 271.00

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
11-Sep-18	1	22.0	3.5	0.0	3.5	15.7	0.05270	14.0	14.0
	2	22.0	2.5	0.0	2.5	15.9	0.03746	10.0	10.0
	5	22.0	1.5	0.0	1.5	16.1	0.02381	6.0	6.0
	15	21.9	0.0	0.0	0.0	16.3	0.01387	0.0	0.0
	30	21.8	0.0	0.0	0.0	16.3	0.00982	0.0	0.0
	60	21.8	0.0	0.0	0.0	16.3	0.00694	0.0	0.0
	120	21.9	0.0	0.0	0.0	16.3	0.00490	0.0	0.0
	250	21.6	0.0	0.0	0.0	16.3	0.00341	0.0	0.0
	390	22.1	0.0	0.0	0.0	16.3	0.00271	0.0	0.0
12-Sep-18	1393	21.7	0.0	0.0	0.0	16.3	0.00144	0.0	0.0

Comments:

\* Not Mechanically or Chemically Dispersed

Laboratory analysis by: A. Bland  
Data entered by: C. Krous  
Checked by: J. Hines



Daniel B. Stephens & Associates, Inc.

## **Atterberg Limits/ Identification of Fines**



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
B5A-9A	---	---	---	ML
B6A-19A	51	22	29	CH
B7A-0-20 (1+2)	29	15	14	CL
B7A-40-60 (1+2)	37	16	21	CL
B9-20-35 (1+2)	55	21	34	CH
B10-39A	56	21	35	CH
B10-10-25 (1+2)	45	16	29	CL
B11-39A	---	---	---	ML

---

--- = Soil requires visual-manual classification due to non-plasticity



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B5A-9A  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-10.5'  
*Test Date:* 7-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Olive Brown (2.5Y 3/3)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

**Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



*Daniel B. Stephens & Associates, Inc.*

### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B6A-19A  
*Project Name:* NECR Jetty '18  
*Depth:* 20'-20.5'  
*Test Date:* 8-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	25	18
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	124.91	123.71	124.76
<i>Weight of pan plus dry soil (g)</i>	120.98	120.20	120.76
<i>Weight of pan (g):</i>	112.97	113.35	113.37
<i>Gravimetric moisture content (% g/g):</i>	49.06	51.24	54.13
<i>Liquid Limit:</i>	51		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	124.81	128.06
<i>Weight of pan plus dry soil (g)</i>	123.21	126.17
<i>Weight of pan (g):</i>	116.09	117.65
<i>Gravimetric moisture content (% g/g):</i>	22.47	22.18
<i>Plastic Limit:</i>	22	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 51  
*Plastic Limit:* 22  
*Plasticity Index:* 29  
*Classification:* CH

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines





## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'  
Test Date: 7-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	27	20
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	126.30	128.60	129.26
Weight of pan plus dry soil (g)	123.03	125.44	125.82
Weight of pan (g):	110.57	114.24	114.49
Gravimetric moisture content (% g/g):	26.24	28.21	30.36
Liquid Limit:	29		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	121.72	125.62
Weight of pan plus dry soil (g)	120.54	124.14
Weight of pan (g):	112.52	113.98
Gravimetric moisture content (% g/g):	14.71	14.57
Plastic Limit:	15	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 29  
Plastic Limit: 15  
Plasticity Index: 14  
Classification: CL

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



*Daniel B. Stephens & Associates, Inc.*

### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B7A-40-60 (1+2)  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-60'  
*Test Date:* 11-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	33	25	18
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	122.53	126.19	132.85
<i>Weight of pan plus dry soil (g):</i>	119.39	122.98	127.78
<i>Weight of pan (g):</i>	110.57	114.24	114.49
<i>Gravimetric moisture content (% g/g):</i>	35.60	36.73	38.15
<i>Liquid Limit:</i>	37		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	120.95	123.87
<i>Weight of pan plus dry soil (g):</i>	119.77	122.49
<i>Weight of pan (g):</i>	112.52	113.98
<i>Gravimetric moisture content (% g/g):</i>	16.28	16.22
<i>Plastic Limit:</i>	16	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 37  
*Plastic Limit:* 16  
*Plasticity Index:* 21  
*Classification:* CL

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



### Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B9-20-35 (1+2)  
Project Name: NECR Jetty '18  
Depth: 20'-35'  
Test Date: 8-Jun-18

#### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	32	26	19
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	128.01	126.70	124.24
Weight of pan plus dry soil (g)	124.38	122.98	119.90
Weight of pan (g):	117.59	116.23	112.26
Gravimetric moisture content (% g/g):	53.46	55.11	56.81
Liquid Limit:	55		

#### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	125.00	125.83
Weight of pan plus dry soil (g)	123.49	124.21
Weight of pan (g):	116.39	116.57
Gravimetric moisture content (% g/g):	21.27	21.20
Plastic Limit:	21	

#### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: 55  
Plastic Limit: 21  
Plasticity Index: 34  
Classification: CH

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



### **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 11-Jun-18

#### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	27	21
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	126.92	124.52	125.51
<i>Weight of pan plus dry soil (g)</i>	122.10	122.07	121.01
<i>Weight of pan (g):</i>	113.14	117.65	113.15
<i>Gravimetric moisture content (% g/g):</i>	53.79	55.43	57.25
<i>Liquid Limit:</i>	56		

#### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	121.43	125.24
<i>Weight of pan plus dry soil (g)</i>	119.89	123.88
<i>Weight of pan (g):</i>	112.63	117.42
<i>Gravimetric moisture content (% g/g):</i>	21.21	21.05
<i>Plastic Limit:</i>	21	

#### **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 56  
*Plastic Limit:* 21  
*Plasticity Index:* 35  
*Classification:* CH

#### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## **Atterberg Limits**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-10-25 (1+2)  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-25'  
*Test Date:* 7-Jun-18

### **Liquid Limit**

	<b>Trial 1</b>	<b>Trial 2</b>	<b>Trial 3</b>
<i>Number of drops:</i>	34	24	15
<i>Pan number:</i>	LL1	LL2	LL3
<i>Weight of pan plus moist soil (g):</i>	131.38	128.69	131.93
<i>Weight of pan plus dry soil (g):</i>	126.91	124.86	127.66
<i>Weight of pan (g):</i>	116.79	116.44	118.65
<i>Gravimetric moisture content (% g/g):</i>	44.17	45.49	47.39
<i>Liquid Limit:</i>	45		

### **Plastic Limit**

	<b>Trial 1</b>	<b>Trial 2</b>
<i>Pan number:</i>	PL1	PL2
<i>Weight of pan plus moist soil (g):</i>	121.91	124.01
<i>Weight of pan plus dry soil (g):</i>	120.81	123.06
<i>Weight of pan (g):</i>	114.08	117.13
<i>Gravimetric moisture content (% g/g):</i>	16.34	16.02
<i>Plastic Limit:</i>	16	

## **Results**

*Percent of Sample Retained on #40 Sieve:* See Sieve

*Liquid Limit:* 45  
*Plastic Limit:* 16  
*Plasticity Index:* 29  
*Classification:* CL

### **Comments:**

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Atterberg Limits

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'  
Test Date: 8-Jun-18

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:			
Pan number:			
Weight of pan plus moist soil (g):			
Weight of pan plus dry soil (g)			
Weight of pan (g):			
Gravimetric moisture content (% g/g):	---	---	---
Liquid Limit:	---		

### Plastic Limit

	Trial 1	Trial 2
Pan number:		
Weight of pan plus moist soil (g):		
Weight of pan plus dry soil (g)		
Weight of pan (g):		
Gravimetric moisture content (% g/g):	---	---
Plastic Limit:	---	

### Results

Percent of Sample Retained on #40 Sieve: See Sieve

Liquid Limit: ---  
Plastic Limit: ---  
Plasticity Index: ---  
Classification (Visual Method): ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



**Data for Description and Identification of Fines  
(Visual-Manual Procedure)**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B11-39A  
*Project Name:* NECR Jetty '18  
*Depth:* 40'-40.5'  
*Test Date:* 8-Jun-18

Visual-manual classification of material passing the #40 sieve in lieu of  
Atterberg analysis due to non-plasticity:

**Descriptive Information:**

Color of Moist Sample: Dark Grayish Brown (2.5Y 4/2)  
Odor: None  
Moisture Condition: Moist  
HCl Reaction: Strong

**Preliminary Identification:**

Dry Strength: None  
Dilatency: Rapid  
Toughness: Low  
Plasticity: Non-plastic

**Identification of Inorganic Fine Grained Soils:**

Silt (ML)

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines

## **Specific Gravity**





### Summary of Specific Gravity Tests

Sample Number	<4.75 mm Fraction			>4.75 mm Fraction			Bulk Sample
	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity	Particle Size	% of Bulk Sample	Specific Gravity <sup>1</sup>
B5A-9A	2.63	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.63
B6A-19A	2.69	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.69
B7A-0-20 (1+2)	2.67	<4.75 mm	99.3%	NA	>4.75 mm	0.7%	2.67
B7A-40-60 (1+2)	2.67	<4.75 mm	99.4%	NA	>4.75 mm	0.6%	2.67
B9-20-35 (1+2)	2.71	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.71
B10-39A	2.68	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.68
B10-10-25 (1+2)	2.68	<4.75 mm	98.9%	NA	>4.75 mm	1.1%	2.68
B11-39A	2.66	<4.75 mm	100.0%	NA	>4.75 mm	0.0%	2.66

<sup>1</sup>Based on the <4.75mm material

NA = Not Applicable since specified fraction is less than 5% of composite sample mass

NR = Test not Requested



## Data for Specific Gravity of Sample: B5A-9A

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B5A-9A  
 Project Name: NECR Jetty '18  
 Depth: 10'-10.5'

### ASTM D854 (<4.75mm Fraction)

	Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0		
Percent of Bulk Sample (% g/g):	100.0		
	Trial 1	Trial 2	
Weight of pycnometer filled w/air (g):	90.93	88.30	
Weight of pycnometer filled w/soil (g):	141.96	138.83	
Weight of pycnometer filled w/soil & water (g):	371.83	368.96	
Weight of pycnometer filled w/water (g):	340.21	337.61	
Specific Gravity (g/g):	2.63	2.63	
Observed temperature (°C):	22.90	22.90	
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976	
Correction factor, K:	0.9994	0.9994	
Specific Gravity at 20°C (g/g):	2.63	2.63	
Average Specific Gravity (g/g):	2.63		
Average Particle Density (g/cm <sup>3</sup> ):	2.63		

### ASTM C127 (>4.75mm) Fraction

	Test Date:	NA	Test unnecessary since
Percent of Test Sample (% g/g):	0.0		fraction is less than 5% of
Percent of Bulk Sample (% g/g):	0.0		bulk sample mass
Tare Weight (g):	---		
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---		
Saturated Apparent mass in Water & Tare (g):	---		
Oven Dry (OD) mass in Air & Tare (g):	---		
SSD Specific Gravity (g/g):	---		
Apparent Specific Gravity (g/g):	---		
OD Specific Gravity (g/g):	---		
Percent Absorption (%):	---		
Observed Temperature (°C):	---		
Density of water at observed temperature (g/m <sup>3</sup> ):	---		
Correction Factor, K:	---		
Specific Gravity (Apparent), Corrected to 20° C:	---		
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---		

**Specific Gravity (Apparent) of Sample\*: 2.63**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.63**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



## Data for Specific Gravity of Sample: B6A-19A

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B6A-19A  
 Project Name: NECR Jetty '18  
 Depth: 20'-20.5'

### ASTM D854 (<4.75mm Fraction)

Test Date:	22-Jun-18	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	92.38	89.53
Weight of pycnometer filled w/soil (g):	142.42	139.90
Weight of pycnometer filled w/soil & water (g):	373.09	370.49
Weight of pycnometer filled w/water (g):	341.60	338.85
Specific Gravity (g/g):	2.70	2.69
Observed temperature (°C):	22.45	22.05
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9977	0.9978
Correction factor, K:	0.9995	0.9996
Specific Gravity at 20°C (g/g):	2.70	2.69
Average Specific Gravity (g/g):	2.69	
Average Particle Density (g/cm <sup>3</sup> ):	2.69	

### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.69**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.69**

\* Based on <4.75mm Fraction

Laboratory analysis by: D. O'Dowd  
 Data entered by: M. Garica  
 Checked by: J. Hines



### Data for Specific Gravity of Sample: B7A-0-20 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-0-20 (1+2)  
Project Name: NECR Jetty '18  
Depth: 0'-20'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	99.3	
Percent of Bulk Sample (% g/g):	99.3	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	89.25	90.51
Weight of pycnometer filled w/soil (g):	137.24	139.46
Weight of pycnometer filled w/soil & water (g):	368.47	370.45
Weight of pycnometer filled w/water (g):	338.43	339.81
Specific Gravity (g/g):	2.67	2.67
Observed temperature (°C):	23.00	23.00
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9975	0.9975
Correction factor, K:	0.9993	0.9993
Specific Gravity at 20°C (g/g):	2.67	2.67
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.7	
Percent of Bulk Sample (% g/g):	0.7	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.67</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.67	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B7A-40-60 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B7A-40-60 (1+2)  
Project Name: NECR Jetty '18  
Depth: 40'-60'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	99.4	
Percent of Bulk Sample (% g/g):	99.4	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.68	92.07
Weight of pycnometer filled w/soil (g):	139.38	138.19
Weight of pycnometer filled w/soil & water (g):	371.53	370.23
Weight of pycnometer filled w/water (g):	342.94	341.32
Specific Gravity (g/g):	2.67	2.68
Observed temperature (°C):	22.75	22.65
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.67	2.68
Average Specific Gravity (g/g):	2.67	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.6	
Percent of Bulk Sample (% g/g):	0.6	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.67</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.67	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B9-20-35 (1+2)

Job Name: Stantec Consulting Services Inc.  
 Job Number: DB18.1176.00  
 Sample Number: B9-20-35 (1+2)  
 Project Name: NECR Jetty '18  
 Depth: 20'-35'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	91.50	93.69
Weight of pycnometer filled w/soil (g):	141.16	147.42
Weight of pycnometer filled w/soil & water (g):	372.01	376.81
Weight of pycnometer filled w/water (g):	340.62	342.89
Specific Gravity (g/g):	2.72	2.71
Observed temperature (°C):	22.95	22.25
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9977
Correction factor, K:	0.9993	0.9995
Specific Gravity at 20°C (g/g):	2.72	2.71
Average Specific Gravity (g/g):	2.71	
Average Particle Density (g/cm <sup>3</sup> ):	2.71	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.71**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.71**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
 Data entered by: M. Garica  
 Checked by: J. Hines



### Data for Specific Gravity of Sample: B10-39A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	92.37	92.44
Weight of pycnometer filled w/soil (g):	138.65	141.42
Weight of pycnometer filled w/soil & water (g):	370.54	372.46
Weight of pycnometer filled w/water (g):	341.50	341.75
Specific Gravity (g/g):	2.68	2.68
Observed temperature (°C):	22.90	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.68	2.68
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm <sup>3</sup> ):	2.68	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	

**Specific Gravity (Apparent) of Sample\*: 2.68**  
**Particle Density (Apparent) of Sample (g/cm<sup>3</sup>)\*: 2.68**

\* Based on <4.75mm Fraction

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines



### Data for Specific Gravity of Sample: B10-10-25 (1+2)

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B10-10-25 (1+2)  
Project Name: NECR Jetty '18  
Depth: 10'-25'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	12-Jun-18	
Percent of Test Sample (% g/g):	98.9	
Percent of Bulk Sample (% g/g):	98.9	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	94.22	93.97
Weight of pycnometer filled w/soil (g):	145.98	143.85
Weight of pycnometer filled w/soil & water (g):	375.86	374.41
Weight of pycnometer filled w/water (g):	343.40	343.16
Specific Gravity (g/g):	2.68	2.68
Observed temperature (°C):	22.70	22.90
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.68	2.68
Average Specific Gravity (g/g):	2.68	
Average Particle Density (g/cm <sup>3</sup> ):	2.67	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	1.1	
Percent of Bulk Sample (% g/g):	1.1	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.68</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.67	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines





### Data for Specific Gravity of Sample: B11-39A

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

#### ASTM D854 (<4.75mm Fraction)

Test Date:	11-Jun-18	
Percent of Test Sample (% g/g):	100.0	
Percent of Bulk Sample (% g/g):	100.0	
	<i>Trial 1</i>	<i>Trial 2</i>
Weight of pycnometer filled w/air (g):	93.56	92.20
Weight of pycnometer filled w/soil (g):	144.25	142.49
Weight of pycnometer filled w/soil & water (g):	374.36	372.76
Weight of pycnometer filled w/water (g):	342.71	341.41
Specific Gravity (g/g):	2.66	2.66
Observed temperature (°C):	22.85	22.60
Density of water at observed temperature (g/cm <sup>3</sup> ):	0.9976	0.9976
Correction factor, K:	0.9994	0.9994
Specific Gravity at 20°C (g/g):	2.66	2.65
Average Specific Gravity (g/g):	2.66	
Average Particle Density (g/cm <sup>3</sup> ):	2.65	

#### ASTM C127 (>4.75mm) Fraction

Test Date:	NA	Test unnecessary since fraction is less than 5% of bulk sample mass
Percent of Test Sample (% g/g):	0.0	
Percent of Bulk Sample (% g/g):	0.0	
Tare Weight (g):	---	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m <sup>3</sup> ):	---	
Correction Factor, K:	---	
Specific Gravity (Apparent), Corrected to 20° C:	---	
Particle Density (Apparent), Corrected to 20° C (g/cm <sup>3</sup> ):	---	
<b>Specific Gravity (Apparent) of Sample*:</b>	<b>2.66</b>	* Based on <4.75mm Fraction
Particle Density (Apparent) of Sample (g/cm <sup>3</sup> ):	2.65	

Laboratory analysis by: C. Krous/M. Garcia  
Data entered by: M. Garica  
Checked by: J. Hines

## **Proctor Compaction**



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
B7A-0-20 (1+2)	13.7	1.83	---	---
B7A-40-60 (1+2)	15.0	1.76	---	---
B9-20-35 (1+2)	20.8	1.61	---	---
B10-10-25 (1+2)	13.8	1.85	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 322.63
Sample Number: B7A-0-20 (1+2)	Mass of fines material (g): 43025.85
Project Name: NECR Jetty '18	Mold weight (g): 4226
Depth: 0'-20'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 11-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5980	1169.70	1096.92	288.45	1.71	9.00
2	6060	1150.34	1066.77	294.38	1.76	10.82
3	6168	1009.96	925.40	267.81	1.83	12.86
4	6197	1003.64	908.75	267.60	1.82	14.80
5	6135	980.40	877.20	284.08	1.73	17.40

Soil Fractions  
 Coarse Fraction (% g/g): 0.7  
 Fines Fraction (% g/g): 99.3

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



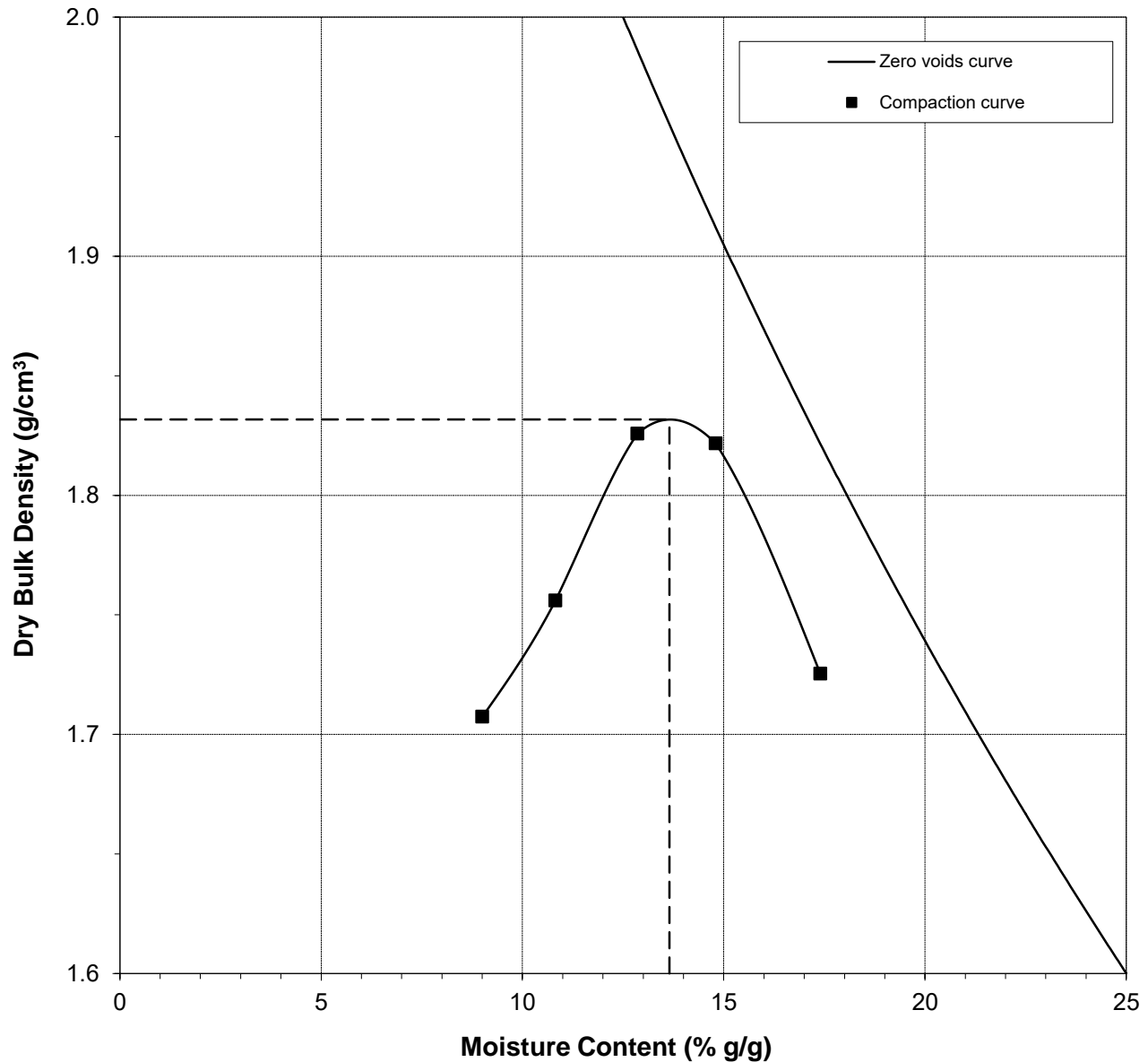
Daniel B. Stephens & Associates, Inc.

### Proctor Compaction Data Points with Fitted Curve

Sample Number: B7A-0-20 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.7	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.83	---

Test Date: 11-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 208.58
Sample Number: B7A-40-60 (1+2)	Mass of fines material (g): 34479.53
Project Name: NECR Jetty '18	Mold weight (g): 4226
Depth: 40'-60'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 12-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5891	1019.73	953.54	296.02	1.61	10.07
2	5975	1003.78	927.55	286.62	1.66	11.89
3	6109	953.82	872.92	301.49	1.75	14.16
4	6135	1033.05	924.64	286.96	1.73	17.00
5	6106	1066.29	943.86	293.34	1.68	18.82

Soil Fractions  
 Coarse Fraction (% g/g): 0.6  
 Fines Fraction (% g/g): 99.4

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



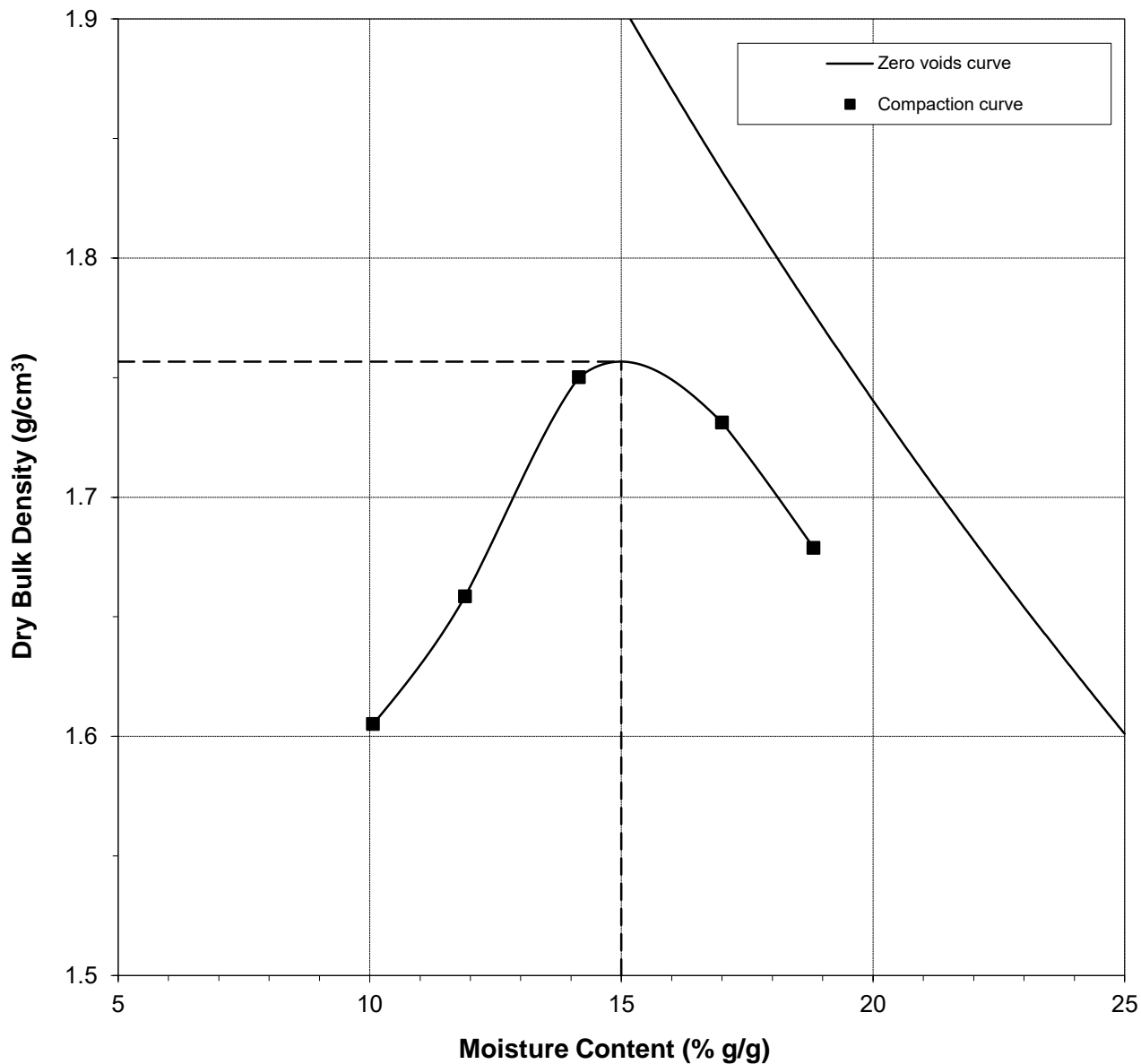
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B7A-40-60 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	15.0	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.76	---

Test Date: 12-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 13.63
Sample Number: B9-20-35 (1+2)	Mass of fines material (g): 39871.07
Project Name: NECR Jetty '18	Mold weight (g): 4227
Depth: 20'-35'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 8-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	5914	1000.49	902.36	269.60	1.55	15.51
2	5972	918.60	822.86	293.44	1.57	18.08
3	6064	957.65	839.32	271.83	1.61	20.85
4	6042	1017.16	879.83	269.87	1.57	22.51
5	6025	947.73	813.10	270.66	1.53	24.82

Soil Fractions  
 Coarse Fraction (% g/g): 0.0  
 Fines Fraction (% g/g): 100.0

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines





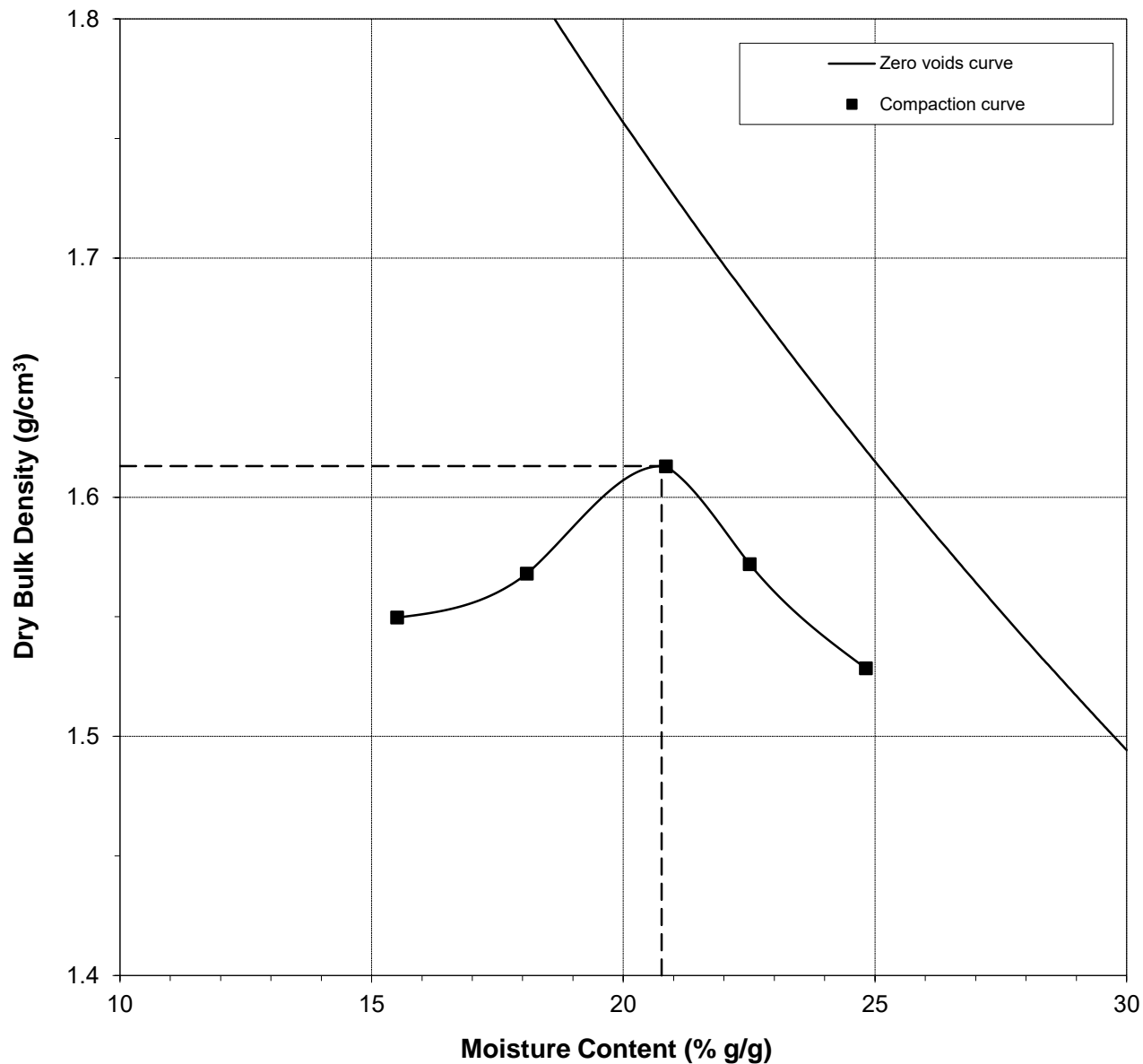
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B9-20-35 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	20.8	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.61	---

Test Date: 8-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines



## Proctor Compaction Data

Job Name: Stantec Consulting Services Inc.	Split (3/4", 3/8", #4): #4
Job Number: DB18.1176.00	Mass of coarse material (g): 428.86
Sample Number: B10-10-25 (1+2)	Mass of fines material (g): 37665.31
Project Name: NECR Jetty '18	Mold weight (g): 4227
Depth: 10'-25'	Mold volume (cm <sup>3</sup> ): 942.46
Test Date: 8-Jun-18	Compaction Method: Standard A
	Preparation Method: Dry
As Received Moisture Content (% g/g): NA	Type of Rammer: Mechanical

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6023	1029.32	959.97	283.81	1.73	10.26
2	6148	1123.31	1031.12	284.66	1.81	12.35
3	6212	1055.01	959.91	269.95	1.85	13.78
4	6207	1067.64	965.23	282.61	1.83	15.00
5	6084	948.77	838.53	268.35	1.65	19.33

Soil Fractions  
 Coarse Fraction (% g/g): 1.1  
 Fines Fraction (% g/g): 98.9

Properties of Coarse Material  
 Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

### Override Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	---	---
2	---	---
3	---	---
4	---	---
5	---	---

--- = Override correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



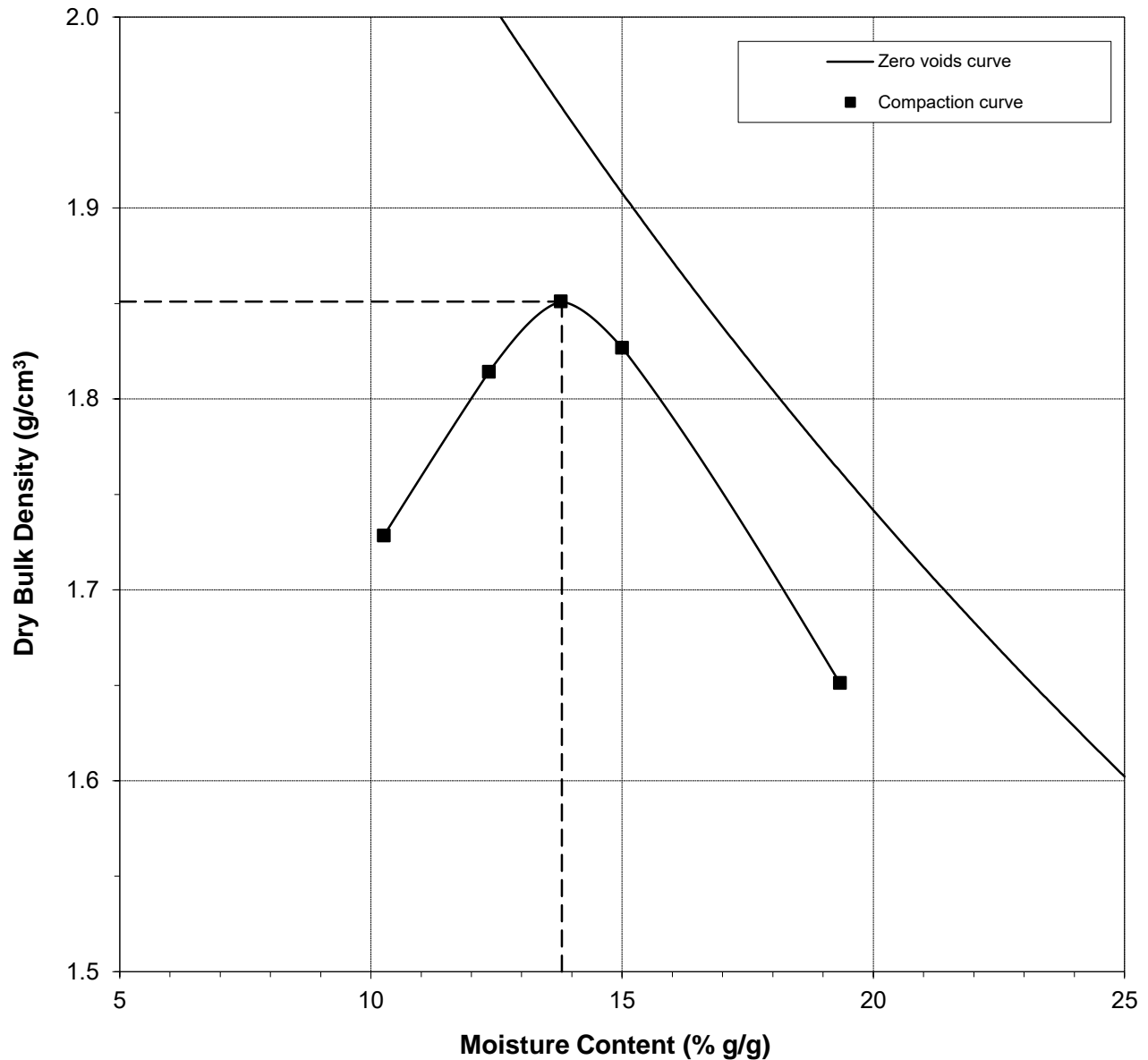
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### Proctor Compaction Data Points with Fitted Curve

Sample Number: B10-10-25 (1+2)

	Measured	Corrected
Optimum Moisture Content (% g/g):	13.8	---
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.85	---

Test Date: 8-Jun-18



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: D. O'Dowd

Data entered by: D. O'Dowd

Checked by: J. Hines

## **Pinhole Dispersion**



### Summary of Pinhole Dispersion Testing

Sample Number	Percent Finer Than 5- $\mu$ m <sup>1</sup>	Plasticity Index <sup>1</sup>	Dispersion Classification
B5A-9A	22.2	0 (NP)	Not Classified <sup>2</sup>
B10-10-25 (1+2)	29.3	29	Non-Dispersive ND2
B11-39A	8.6	0 (NP)	Not Classified <sup>2</sup>

---

<sup>1</sup> This test method is applicable to soils that have a plasticity index greater than or equal to 4, and more than 12% of the soil fraction is finer than 5- $\mu$ m.

<sup>2</sup> Unable to apply a dispersive classification for this material following the pinhole dispersion method. The test results do not align with the specified classification criteria.

"NP" Non Plastic



## Pinhole Dispersion Test Data ASTM D4647

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B5A-9A  
Project Name: NECR Jetty '18  
Depth: 10'-10.5'

### Sample Properties

Sample Type: Disturbed Remolded  
USCS Classification: Sandy silt s(ML)  
Plastic Limit: Non Plastic  
Liquid Limit: Non Plastic  
Classification of Fines: ML  
Percent Coarse Material (+2mm) (%): 0  
As Received Water Content (% g/g): 7.5  
Target Relative Compaction (%): NA  
Target Remold Density (g/cm<sup>3</sup>): 1.65  
Target Remold Density (pcf): 102.9  
Target Remold Water Content (% g/g): 10.7  
Test Sample Density (g/cm<sup>3</sup>): 1.65  
Test Sample Density (pcf): 102.9  
Test Sample Water Content (% g/g): 10.7

### Test Conditions

Test Date: 16-Aug-18  
Curing Time (Hours): 24  
Test Method: A  
Water Type: Distilled

### Test Data

Hydraulic Head		Test Time (min:sec)	Flow Rate (ml/sec)	Cloudiness of Flow at End of Test	Hole Diameter After
(inches)	(mm)				Test (mm)
2	51	10:00	0.47	Barely Visible	---
7	178	05:00	1.12	Moderately Dark	---
15	381	05:00	1.65	Moderately Dark	1.32 to 7.14
40	1,016	NA	NA	NA	

### Dispersive Classification: Not Classified

#### Comments:

Unable to apply a dispersive classification for this material following the pinhole dispersion method. The test results do not align with the specified classification criteria.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## **Pinhole Dispersion Test Data ASTM D4647**

*Job Name:* Stantec Consulting Services Inc.  
*Job Number:* DB18.1176.00  
*Sample Number:* B10-10-25 (1+2)  
*Project Name:* NECR Jetty '18  
*Depth:* 10'-25'

### **Sample Properties**

*Sample Type:* Disturbed Remolded  
*USCS Classification:* Sandy lean clay s(CL)  
*Plastic Limit:* 16  
*Liquid Limit:* 45  
*Classification of Fines:* CL  
*Percent Coarse Material (+2mm) (%):* 1.1  
*As Received Water Content (% g/g):* ---  
*Target Relative Compaction (%):* NA  
*Target Remold Density (g/cm<sup>3</sup>):* 1.67  
*Target Remold Density (pcf):* 104.0  
*Target Remold Water Content (% g/g):* 10.8  
*Test Sample Density (g/cm<sup>3</sup>):* 1.67  
*Test Sample Density (pcf):* 104.0  
*Test Sample Water Content (% g/g):* 10.8

### **Test Conditions**

*Test Date:* 16-Aug-18  
*Curing Time (Hours):* 24  
*Test Method:* A  
*Water Type:* Distilled

### **Test Data**

Hydraulic Head		Test Time (min:sec)	Flow Rate (ml/sec)	Cloudiness of Flow at End of Test	Hole Diameter After
(inches)	(mm)				Test (mm)
2	51	10:00	0.40	Completely Clear	---
7	178	05:00	1.00	Completely Clear	---
15	381	05:00	1.79	Completely Clear	---
40	1,016	04:00	3.36	Completely Clear	1.01

***Dispersive Classification: Non-Dispersive ND2***

*Comments:*

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



## Pinhole Dispersion Test Data ASTM D4647

Job Name: Stantec Consulting Services Inc.  
Job Number: DB18.1176.00  
Sample Number: B11-39A  
Project Name: NECR Jetty '18  
Depth: 40'-40.5'

### Sample Properties

Sample Type: Disturbed Remolded  
USCS Classification: Silty sand (SM)  
Plastic Limit: Non Plastic  
Liquid Limit: Non Plastic  
Classification of Fines: ML  
Percent Coarse Material (+2mm) (%): 0  
As Received Water Content (% g/g): 9.5  
Target Relative Compaction (%): NA  
Target Remold Density (g/cm<sup>3</sup>): 1.69  
Target Remold Density (pcf): 105.6  
Target Remold Water Content (% g/g): 9.7  
Test Sample Density (g/cm<sup>3</sup>): 1.69  
Test Sample Density (pcf): 105.6  
Test Sample Water Content (% g/g): 9.7

### Test Conditions

Test Date: 16-Aug-18  
Curing Time (Hours): 24  
Test Method: A  
Water Type: Distilled

### Test Data

Hydraulic Head		Test Time (min:sec)	Flow Rate (ml/sec)	Cloudiness of Flow at End of Test	Hole Diameter After
(inches)	(mm)				Test (mm)
2	51	10:00	1.11	Barely Visible	>1.5
7	178	NA	NA	NA	
15	381	NA	NA	NA	
40	1,016	NA	NA	NA	

### Dispersive Classification: Not Classified

#### Comments:

Test halted, flow rate not between 0.4 and 0.8 after 10 minutes under 2" head.  
Unable to apply a dispersive classification for this material following the pinhole dispersion method. The test results do not align with the specified classification criteria.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



## **Laboratory Tests and Methods**



## Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 5856 (modified apparatus)
Falling Head Rising Tail: (Flexible Wall)	ASTM D5084
Hanging Column Method:	ASTM D6836 (modified apparatus)
Pressure Plate Method:	ASTM D6836 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Relative Humidity (Box) Method:	Campbell, G. and G. Gee. 1986. Water Potential: Miscellaneous Methods. Chp. 25, pp. 631-632, in A. Klute (ed.), Methods of Soil Analysis. Part 1. American Society of Agronomy, Madison, WI; Karathanasis & Hajek. 1982. Quantitative Evaluation of Water Adsorption on Soil Clays. SSA Journal 46:1321-1325
Moisture Retention Characteristics & Calculated Unsaturated Hydraulic Conductivity:	ASTM D6836; van Genuchten, M.T. 1980. A closed-form equation for predicting the hydraulic conductivity of unsaturated soils. SSSAJ 44:892-898; van Genuchten, M.T., F.J. Leij, and S.R. Yates. 1991. The RETC code for quantifying the hydraulic functions of unsaturated soils. Robert S. Kerr Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Ada, Oklahoma. EPA/600/2091/065. December 1991
Specific Gravity Fine:	ASTM D854
Particle Size Analysis:	ASTM D7928, ASTM D6913
USCS (ASTM) Classification:	ASTM D7928, ASTM D6913, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Visual-Manual Description:	ASTM D2488
Standard Proctor Compaction:	ASTM D698
Identification and Classification of Dispersive Clay Soils by the Pinhole Test:	ASTM D4647
Dispersive Characteristics of Clay Soil by Double Hydrometer:	ASTM D4221

**GEOTECHNICAL DATA REPORT  
CHURCH ROCK MILL SITE JETTY**

Appendix D Technical Memorandum: NECR 2018 Jetty Investigation Borehole Soil Sample Screening for Ra-226

July 31, 2019

**APPENDIX D      TECHNICAL      MEMORANDUM: NECR 2018  
JETTY      INVESTIGATION      BOREHOLE      SOIL      SAMPLE  
SCREENING FOR RA-226**

**July 19 2018**

**AVM Environmental Services, Inc.**

**Technical Memorandum Report**

**NECR 2018 Jetty Investigation Borehole Soil Sample Screening for Ra-226**

On-site ex-situ gamma radiation soil screening was performed for the NECR Jetty investigation borehole soil samples from April 30, 2018 to May 4, 2018 to determine if the soil is below or above the 6.0 pCi/g soil screening level (SSL). Since the Jetty area is within the boundaries of the Church Rock Mill Site tailings facility, the 10CFR40 Ra-226 soil criterion of 5.0 pCi/g above the 1.0 pCi/g NECR Mill Site background was used to establish the SSL. The ex-situ soil screening of borehole samples was performed using SOP-4 (Field Soil Gamma Radiation Screening Procedure) included in the *Work Plan for Additional Soil Characterization at Proposed Jetty Improvements* (Work Plan) dated March 30, 2018.

This field soil screening procedure for Ra-226 consisted of measuring 609 KeV gamma radiations of Bi-214, a decay product of Ra-226 through Rn-222. The 609 KeV gamma radiation counts of the sample soil were compared to a reference soil from the North East Church Rock Mine Site (Site) with a known Ra-226 concentration for field screening. The heavily shielded gamma soil screening counting chamber lowers the background counts without lowering the counting efficiency for that geometry and sample size, thus lowering the detectable concentration. A reference soil at 5.5 pCi/g, slightly lower than the 6.0 pCi/g SSL, was prepared (see Attachment A to this report) as a conservative approach. The soil sample was placed in a plastic liner around the detector in the lead shielded counting chamber, and 609 KeV gamma radiation counts were obtained and compared to the reference soil counts for field screening.

The ex-situ gamma soil screening system was located in a pickup truck in a low gamma radiation level area near the boreholes to keep background counts as low as possible in order to maintain low Minimum Detectable Concentration (MDC). The borehole soil samples were placed in one-gallon Ziploc® bags and labeled with the sample ID, date and time collected. The samples were homogenized in a stainless-steel bowl and 3,000 grams of sample was weighed for field soil screening. The gamma soil screening was performed consistent with the SOP-4. The soil screening information was recorded in field soil screening logs (included in Attachment B). The gamma soil screening instrument system calibration and daily function checks are shown in Attachment C of this Report. Based on the system daily background counts and the detector response factor of 0.010 pCi/g determined from reference soil counts, the MDCs for soil screening are calculated to be less than 1 pCi/g. The soil screening results are summarized in Table 1. A total of 84 soil samples from eight boreholes were screened from April 30, 2018 thru May 3, 2018. The primary purpose of the gamma soil screening was to identify soil samples above or below the Ra-226 SSL of 6.0 pCi/g. As shown in Table 1, the gamma soil screening showed only three borehole soil samples above the SSL of 6.0 pCi/g as follows:

- 0 to 4.0' from Borehole B5A
- 6.0' to 8.0' from Borehole B5A
- the 4.5' to 6.0' from Borehole B6A.

Although the primary objective of the ex-situ gamma radiation soil screening was to determine the Ra-226 concentrations at above or below the 6.0 pCi/g SSL, Ra-226 concentrations were estimated in all 84 borehole soil samples screened. Prior to mobilizing the soil screening system in the field, a correlation of the screening system was performed using the 5.5 pCi/g reference soil, 2.0 pCi/g and

100 pCi/g reference soils prepared previously for the 2013 Pre-Design Studies soil screening along with the Site background soil. This correlation is included in Attachment D. The estimated Ra-226 concentration in the borehole samples determined using the correlation are included in Table 1.

For this Jetty investigation, 69 samples out of a total of 84 borehole samples were sent to an off-site vendor laboratory (ALS in Fort Collins, CO) for Ra-226 analysis using EPA method 901.1 (modified for soil) for confirmation. Also, seven field QA/QC duplicates (10%) were sent to the laboratory. The laboratory result reports are included in Attachment E. The laboratory Ra-226 results are also summarized in Table 1. As shown in Table 1, the estimated Ra-226 levels by on-site ex-situ soil screening are comparable and consistent with the laboratory Ra-226 results (i.e., above or below the SSL), except for one sample. The 0 to 4.0' interval sample from Borehole B5A was screened as above 5.5 pCi/g at approximately 8.2 pCi/g by the on-site ex-situ screening while the laboratory results indicated that sample at 1.36 pCi/g, below the SSL. The samples from adjacent intervals (6.0' to 8.0') from the borehole were determined to be just above the SSL by both the onsite ex-situ screening and the laboratory sample results. Therefore, the upper interval (0 to 4.0,) sample is unlikely to be at 1.36 pCi/g.

In addition to Ra-226, total uranium was analyzed on all samples by the laboratory. The U-238 isotopic activities were calculated from total uranium results (1 mg/kg U-nat contains 0.331 pCi/g U-238) for three samples, which were screened above the Ra-226 SSL as shown in Table 2. The Ra-226 and the U-238 activity ratio was used to estimate if the borehole samples may contain material from mill tailings or from mine ore waste. Generally, the Ra-226/U-238 ratio from unprocessed uranium ore would be near one (unity) since U-238 and Ra-226 would be in a secular equilibrium. A Ra-226/U-238 ratio of material from the sulfuric acid leach mill tailings would be much higher since the uranium is extracted and Ra-226 remains in mill tailings. As shown in Table 2, the Ra-226/U-238 ratio ranges from 4 to 20 in the three samples, indicating that these sample may contain mill tailings material.

## Tables

**Table 1**  
**NECR Jetty Borehole Soil Sample Field Gamma Radiation Screening Summary**

Sample Data		Field Soil Screening Data					Laboratory Data				
Soil Sample ID	Sample Date	Date	5.5 pCi/g SSL Reference Soil CPM	Soil Sample CPM	Comments	Estimated Ra-226 pCi/g	Sample Sent to Lab	Ra-226 pCi/g	Error Estimate pCi/g	MDC pCi/g	Comments
B5A 0-4.0'	4/30/2018	4/30/2018	573	821	>5.5 pCi/g SSL	8.2	Y	1.36	0.36	0.50	
B5A 6.0-8.0'	4/30/2018	4/30/2018		697	>5.5 pCi/g SSL	6.7	Y	5.73	0.58	0.50	
B5A 6.0-8.0' QA/QC Dup		-		-			Y	5.60	0.80	0.60	
B5A 12.5-14.0'	4/30/2018	4/30/2018		420	<5.5 pCi/g SSL	3.3	Y	1.91	0.56	0.50	
B5A 17.5-19.0'	4/30/2018	4/30/2018		357	<5.5 pCi/g SSL	2.5	Y	1.62	0.46	0.50	
B5A 22.5-24.0'	4/30/2018	4/30/2018		343	<5.5 pCi/g SSL	2.3	Y	1.79	0.59	0.50	
B5A 27.5-29.0'	4/30/2018	4/30/2018		321	<5.5 pCi/g SSL	2.1	Y	1.36	0.62	0.50	
B5A 30.0-31.5'	4/30/2018	4/30/2018		426	<5.5 pCi/g SSL	3.3	Y	2.16	0.58	0.50	
B5A 36.0-37.5'	4/30/2018	4/30/2018		272	<5.5 pCi/g SSL	1.5	Y	0.95	0.28	0.49	
B5A 42.5-44.0'	4/30/2018	4/30/2018		317	<5.5 pCi/g SSL	2.0	Y	1.25	0.25	0.41	
B5A 47.5-49.0'	4/30/2018	4/30/2018		300	<5.5 pCi/g SSL	1.8	Y	1.50	0.33	0.54	
B5A 52.5-54.0'	4/30/2018	4/30/2018		270	<5.5 pCi/g SSL	1.4	Y	1.06	0.47	0.50	
B5A 57.5-59.0'	4/30/2018	4/30/2018		236	<5.5 pCi/g SSL	1.0	Y	0.90	0.21	0.26	
B5A 62.5-64.0'	4/30/2018	4/30/2018		221	<5.5 pCi/g SSL	0.8	Y	0.66	0.21	0.37	
B5A 67.5-69.0'	4/30/2018	4/30/2018		270	<5.5 pCi/g SSL	1.4	Y	1.04	0.27	0.42	
B4A 0-4.0'	4/30/2018	4/30/2018	573	395	<5.5 pCi/g SSL	3.0	Y	1.44	0.30	0.43	
B4A 7.5-9.0'	4/30/2018	4/30/2018		353	<5.5 pCi/g SSL	2.5	Y	1.49	0.34	0.53	
B4A 12.5-14.0'	4/30/2018	4/30/2018		347	<5.5 pCi/g SSL	2.4	Y	1.61	0.38	0.64	
B4A 17.5-19.0'	4/30/2018	4/30/2018		427	<5.5 pCi/g SSL	3.4	Y	1.96	0.37	0.41	
B4A 22.5-24.0'	4/30/2018	4/30/2018		323	<5.5 pCi/g SSL	2.1	Y	1.58	0.33	0.44	
B4A 27.5-29.0'	4/30/2018	4/30/2018		321	<5.5 pCi/g SSL	2.1	Y	1.47	0.32	0.46	
B4A 32.5-34.0'	4/30/2018	4/30/2018		320	<5.5 pCi/g SSL	2.0	Y	1.59	0.27	0.37	
B4A 37.5-39.0'	4/30/2018	5/1/2018	555	241	<5.5 pCi/g SSL	1.1	Y	1.29	0.30	0.42	
B4A 42.5-44.0'	4/30/2018	5/1/2018		267	<5.5 pCi/g SSL	1.4	Y	1.24	0.31	0.52	
B4A 42.5-44.0' QA/QC Dup		-		-			Y	1.50	0.32	0.46	
B4A 47.5-49.0'	4/30/2018	5/1/2018		262	<5.5 pCi/g SSL	1.3	Y	1.43	0.33	0.55	
B4A 52.5-54.0'	5/1/2018	5/1/2018		322	<5.5 pCi/g SSL	2.1	Y	1.80	0.32	0.38	

**Table 1**  
**NECR Jetty Borehole Soil Sample Field Gamma Radiation Screening Summary**

Sample Data		Field Soil Screening Data					Laboratory Data				
Soil Sample ID	Sample Date	Date	5.5 pCi/g SSL Reference Soil CPM	Soil Sample CPM	Comments	Estimated Ra-226 pCi/g	Sample Sent to Lab	Ra-226 pCi/g	Error Estimate pCi/g	MDC pCi/g	Comments
B11 1.5-3.0'	5/1/2018	5/1/2018	555	269	<5.5 pCi/g SSL	1.4	N				
B11 12.5-14.0'	5/1/2018	5/1/2018		301	<5.5 pCi/g SSL	1.8	Y	1.08	0.26	0.42	
B11 22.5-24.0'	5/1/2018	5/1/2018		292	<5.5 pCi/g SSL	1.7	N				
B11 32.5-34.0'	5/1/2018	5/1/2018		279	<5.5 pCi/g SSL	1.5	N				
B11 42.5-44.0'	5/1/2018	5/1/2018		282	<5.5 pCi/g SSL	1.6	Y	1.07	0.26	0.42	
B11 47.5-49.0'	5/1/2018	5/1/2018		340	<5.5 pCi/g SSL	2.3	N				
B10 2.5-4.0'	5/1/2018	5/1/2018	555	268	<5.5 pCi/g SSL	1.4	N				
B10 12.5-14.0'	5/1/2018	5/1/2018		267	<5.5 pCi/g SSL	1.4	Y	1.10	0.30	0.51	
B10 22.5-24.0'	5/1/2018	5/1/2018		275	<5.5 pCi/g SSL	1.5	N				
B10 32.5-34.0'	5/1/2018	5/1/2018		284	<5.5 pCi/g SSL	1.6	N				
B10 42.5-44.0'	5/1/2018	5/1/2018		271	<5.5 pCi/g SSL	1.4	N				
B10 47.5-49.0'	5/1/2018	5/1/2018		306	<5.5 pCi/g SSL	1.9	Y	1.63	0.36	0.55	
B10 47.5-49.0' QA/QC Dup		-		-			Y	1.54	0.29	0.44	
B9 2.5-4.0'	5/1/2018	5/1/2018	555	282	<5.5 pCi/g SSL	1.6	N				
B9 4.5-6.0'	5/1/2018	5/1/2018		320	<5.5 pCi/g SSL	2.0	Y	1.41	0.32	0.51	
B9 17.5-19.0'	5/1/2018	5/1/2018		352	<5.5 pCi/g SSL	2.4	N				
B9 27.5-29.0'	5/1/2018	5/1/2018		330	<5.5 pCi/g SSL	2.2	N				
B9 37.5-39.0'	5/1/2018	5/1/2018		297	<5.5 pCi/g SSL	1.8	Y	1.33	0.37	0.50	
B9 47.5-49.0'	5/2/2018	5/2/2018	545	245	<5.5 pCi/g SSL	1.1	N				
B8 2.5-4.0'	5/2/2018	5/2/2018	545	285	<5.5 pCi/g SSL	1.6	N				
B8 12.5-14.0'	5/2/2018	5/2/2018		347	<5.5 pCi/g SSL	2.4	Y	1.49	0.31	0.44	
B8 22.5-24.0'	5/2/2018	5/2/2018		290	<5.5 pCi/g SSL	1.7	N				
B8 32.5-34.0'	5/2/2018	5/2/2018		283	<5.5 pCi/g SSL	1.6	N				
B8 37.5-39.0'	5/2/2018	5/2/2018		274	<5.5 pCi/g SSL	1.5	Y	1.56	0.35	0.48	



**Table 1**  
**NECR Jetty Borehole Soil Sample Field Gamma Radiation Screening Summary**

Sample Data		Field Soil Screening Data					Laboratory Data				
Soil Sample ID	Sample Date	Date	5.5 pCi/g SSL Reference Soil CPM	Soil Sample CPM	Comments	Estimated Ra-226 pCi/g	Sample Sent to Lab	Ra-226 pCi/g	Error Estimate pCi/g	MDC pCi/g	Comments
B7A 2.5-4.0'	5/2/2018	5/2/2018	545	276	<5.5 pCi/g SSL	1.5	Y	1.13	0.28	0.48	
B7A 7.5-9.0'	5/2/2018	5/2/2018		251	<5.5 pCi/g SSL	1.2	Y	1.01	0.21	0.37	
B7A 11.5-13.0'	5/2/2018	5/2/2018		273	<5.5 pCi/g SSL	1.5	Y	1.15	0.29	0.50	
B7A 17.5-19.0'	5/2/2018	5/2/2018		273	<5.5 pCi/g SSL	1.5	Y	1.30	0.27	0.40	
B7A 22.5-24.0'	5/2/2018	5/2/2018		267	<5.5 pCi/g SSL	1.4	Y	1.24	0.26	0.36	
B7A 27.5-29.0'	5/2/2018	5/2/2018		283	<5.5 pCi/g SSL	1.6	Y	1.35	0.30	0.46	
B7A 27.5-29.0' QA/QC Dup		-		-			Y	1.30	0.30	0.41	
B7A 32.5-34.0'	5/2/2018	5/2/2018		282	<5.5 pCi/g SSL	1.6	Y	1.59	0.38	0.63	
B7A 37.5-39.0'	5/2/2018	5/2/2018		246	<5.5 pCi/g SSL	1.1	Y	1.53	0.28	0.30	
B7A 42.5-44.0'	5/2/2018	5/2/2018		229	<5.5 pCi/g SSL	0.9	Y	1.12	0.25	0.50	
B7A 47.5-49.0'	5/2/2018	5/2/2018		261	<5.5 pCi/g SSL	1.3	Y	1.29	0.32	0.54	
B7A 52.5-54.0'	5/2/2018	5/2/2018		289	<5.5 pCi/g SSL	1.7	Y	1.49	0.50	0.50	
B7A 57.5-59.0'	5/2/2018	5/2/2018		416	<5.5 pCi/g SSL	3.2	Y	4.57	0.53	0.50	
B7A 62.5-64.0'	5/2/2018	5/2/2018		262	<5.5 pCi/g SSL	1.3	Y	1.87	0.38	0.50	
B7A 67.5-69.0'	5/2/2018	5/2/2018		307	<5.5 pCi/g SSL	1.9	Y	1.65	0.30	0.35	
B7A 72.5-74.0'	5/2/2018	5/3/2018	540	264	<5.5 pCi/g SSL	1.4	Y	2.00	0.54	0.50	Wet
B7A 72.5-74.0' QA/QC Dup		-		-			Y	1.57	0.33	0.43	
B7A 77.5-79.0'	5/3/2018	5/3/2018		216	<5.5 pCi/g SSL	0.8	Y	0.81	0.23	0.37	Wet
B7A 82.5-84.0'	5/3/2018	5/3/2018		290	<5.5 pCi/g SSL	1.7	Y	1.75	0.34	0.43	Moist
B7A 87.5-89.0'	5/3/2018	5/3/2018		277	<5.5 pCi/g SSL	1.5	Y	1.46	0.29	0.36	Wet
B7A 92.5-94.0'	5/3/2018	5/3/2018		193	<5.5 pCi/g SSL	0.5	Y	0.83	0.24	0.40	Wet

**Table 1**  
**NECR Jetty Borehole Soil Sample Field Gamma Radiation Screening Summary**

Sample Data		Field Soil Screening Data					Laboratory Data				
Soil Sample ID	Sample Date	Date	5.5 pCi/g SSL Reference Soil CPM	Soil Sample CPM	Comments	Estimated Ra-226 pCi/g	Sample Sent to Lab	Ra-226 pCi/g	Error Estimate pCi/g	MDC pCi/g	Comments
B6A 2.5-4.0'	5/3/2018	5/3/2018	540	400	<5.5 pCi/g SSL	3.0	Y	1.50	0.29	0.43	
B6A 4.5-6.0'	5/3/2018	5/3/2018		6820	>5.5 pCi/g SSL	82.0	Y	78.50	9.30	0.90	
B6A 7.5-9.0'	5/3/2018	5/3/2018		468	<5.5 pCi/g SSL	3.9	Y	2.40	0.35	0.36	
B6A 12.5-14.0'	5/3/2018	5/3/2018		364	<5.5 pCi/g SSL	2.6	Y	1.48	0.36	0.61	
B6A 17.5-19.0'	5/3/2018	5/3/2018		339	<5.5 pCi/g SSL	2.3	Y	1.69	0.35	0.50	
B6A 22.5-24.0'	5/3/2018	5/3/2018		332	<5.5 pCi/g SSL	2.2	Y	1.27	0.32	0.53	
B6A 22.5-24.0' QA/QC Dup		-		-			Y	1.68	0.39	0.61	
B6A 27.5-29.0'	5/3/2018	5/3/2018		344	<5.5 pCi/g SSL	2.3	Y	1.75	0.35	0.48	
B6A 32.5-34.0'	5/3/2018	5/3/2018		277	<5.5 pCi/g SSL	1.5	Y	1.16	0.28	0.39	
B6A 37.5-39.0'	5/3/2018	5/3/2018		278	<5.5 pCi/g SSL	1.5	Y	1.50	0.37	0.59	
B6A 42.5-44.0'	5/3/2018	5/3/2018		260	<5.5 pCi/g SSL	1.3	Y	1.18	0.43	0.50	
B6A 47.5-49.0'	5/3/2018	5/3/2018		393	<5.5 pCi/g SSL	2.9	Y	0.99	0.38	0.50	
B6A 52.5-54.0'	5/3/2018	5/3/2018		271	<5.5 pCi/g SSL	1.4	Y	1.27	0.50	0.50	
B6A 57.5-59.0'	5/3/2018	5/3/2018		249	<5.5 pCi/g SSL	1.2	Y	1.04	0.26	0.44	
B6A 62.5-64.0'	5/3/2018	5/3/2018		201	<5.5 pCi/g SSL	0.6	Y	0.75	0.22	0.41	
B6A 67.5-69.0'	5/3/2018	5/3/2018		227	<5.5 pCi/g SSL	0.9	Y	0.90	0.29	0.51	
B6A 72.5-74.0'	5/3/2018	5/3/2018		280	<5.5 pCi/g SSL	1.6	Y	1.99	0.41	0.53	
B6A 72.5-74.0' QA/QC Dup		-		-			Y	1.67	0.34	0.49	
B6A 77.5-79.0'	5/3/2018	5/3/2018		276	<5.5 pCi/g SSL	1.5	Y	1.37	0.32	0.53	

**Table 2**  
**Borehole Soil Sample Ra-226 to U-238 Ratio**

Borehole Soil Sample ID	Total Uranium (U-nat) mg/Kg	U-238 pCi/g	Ra-226 pCi/g	Ra-226/U-238 Ratio
B5A 0-4.0'	1.1	0.36	1.36	4
B5A 6.0-8.0'	2.0	0.66	5.73	9
B6A 4.5-6.0'	12.0	3.97	78.5	20

## **Attachment A**

### **AVM Environmental Services, Inc. Ra-226 Reference Soil Preparation for NECR Soil Screening**

The Ra-226 reference soil was prepared by blending local matrix soil and 200 pCi/g PTW reference soil previously prepared for NECR PDS in 2013 using the Department of Energy's New Brunswick Laboratory (NBL) CRM 3-B (3.90%  $U_3O_8$  with Ra to U weight ratio of  $3.38E-07$ ). The reference soil was prepared to calibrate the gamma radiation soil screening system for NECR Jetty drilling borehole samples. The gamma soil screening system will be utilized to determine if the soil sample is above or below the screening level (5.0 pCi/g plus the background (1.0 pCi/g)). The matrix soil blending provides additional compensation for local background. The 200 pCi/g reference soil was diluted and mixed with the local matrix soil to bring the reference soil concentrations to 5.5 pCi/gm of Ra-226, slightly less than 6.0 pCi/g screening level to be conservative in soil screening.

115 grams of 200 pCi/g Reference Soil	= 23,000 pCi
<u>5,000 grams of Matrix Soil (@1.0 pCi/g)</u>	<u>= 5,000 pCi</u>
5,115 grams Total	= 28,000 pCi

**Reference Soil Ra-226 concentration = 5.5 pCi/g (April 14, 2018)**

The reference and matrix soils were weighed using the Ohaus LS2000 electronic balance.

## **Attachment B**

### **Ex-Situ Soil Screening Field Forms**

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
UNC NECR

Instrumentation : Scaler/Ratemeter L2221/229801, Detector L44-20  
Instrument Calibration Date: 8-1-17, Instrument Function Check Performed: ✓  
Survey Area/Unit Description NECR Jetty

Date/Time	Soil Sample ID	Sample Weight Grams	609 (559-669) Kev Gross Counts, CPSM	Weight Corrected Counts	CPM	5.5 pCi/g Ref Soil Comparison	Comments
4-30-18	Blank	-	319		64		~ 18 uR/hr around truck
4-30-18	5.5 pCi/g Ref Soil	3000	2866		573		
4-30-18	B5A - 0'-4' @ 1045	1558	2138 4105 net	4105	821	>	1
4-30-18	B5A 6'-8' @ 1100	3000	3485		697	>	
4-30-18	B5A 12.5'-14.0' @ 1120	2780	1963	2100	420	<	
4-30-18	B5A 17.5'-19.0' @ 1135	3000	1784		357	<	
4-30-18	B5A 22.5'-24.0' @ 1148	3000	1715		343	<	
4-30-18	B5A 27.5'-29.0' @ 1200	3000	1604		321	<	
4-30-18	B5A 30'-31.5' @ 1256	3000	2132		426	<	
4-30-18	B5A 36'-37.5' @ 1307	2902	1322	1362	272	<	
4-30-18	B5A 42.5'-44.0' @ 1318	3000	1584		317	<	
4-30-18	B5A - 47.5'-49.0' @ 1331	3000	1499		300	<	
4-30-18	B5A - 52.5'-54.0' @ 1345	3000	1352		270	<	
4-30-18	B5A - 57.5'-59.0' @ 1357	3000	1181		236	<	
4-30-18	B5A 62.5'-64' @ 1409	3000	1105		221	<	

Technician Signature [Signature], Reviewed by [Signature] P-1

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
UNC NECR

Instrumentation: Scaler/Ratemeter L22218290801, Detector L44-20  
Instrument Calibration Date: 8-1-17, Instrument Function Check Performed: ☒  
Survey Area/Unit Description NECR Jeff

Date/Time	Soil Sample ID	Sample Weight Grams	609 (559-669) Kev Gross Counts, CPM	Weight Corrected Counts	CPM	5.5 pCi/g Ref Soil Comparison	Comments
4-30-18	B5A 67.5-69.0' @ 1428	3000	1351		270	<	
4-30-18	B4A 0.4' @ 1540	1970	1300	1976	395	<	labcat
4-30-18	B4A 7.5-9.0' @ 1551	2734	1619	1765	353	<	labcat
4-30-18	B4A 12.5-14.0' @ 1558	2844	1653	1736	347	<	labcat
4-30-18	B4A 17.5-19' @ 1605	2176	1548	2134	427	<	labcat
4-30-18	B4A 22.5-24' @ 1612	3000	1613		323	<	labcat
4-30-18	B4A 27.5-29.0' @ 1620	3000	1605		321	<	labcat
4-30-18	B4A 32.5-34.0' @ 1628	3000	1600		320	<	labcat
5-1-18	Blank	-	301		60	/	
5-1-18	5.5 pCi/g Ref Soil	3000	2777		555		
5-1-18	B4A 37.5-39.0' @ 1640 4-30-18	3000	1207		241	<	labcat
5-1-18	B4A 42.5-44' @ 1647 4-30-18	3000	1337		267	<	labcat
5-1-18	B4A 47.5-49.0' @ 1659 4-30-18	3000	1311		262	<	labcat
5-1-18	B4A 52.5-54' @ 845 5-1-18	3000	1609		322	<	labcat

Technician Signature [Signature] Reviewed by [Signature]

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
UNC NECR

Instrumentation : Scaler/Ratemeter L22215#290806 Detector L44-20  
Instrument Calibration Date: 8-1-17 Instrument Function Check Performed: ✓  
Survey Area/Unit Description NECR Jetty

Date/Time	Soil Sample ID	Sample Weight Grams	609 (559-669) Kev Gross Counts, CPSM	Weight Corrected Counts	CPM	5.5 pCi/g Ref Soil Comparison	Comments
5-1-18	B11 15'-30' 5-1-18 @ 1000	3000	1345		269	<	
5-1-18	B11 12.5-14' 5-1-18 @ 1010	3000	1506		301	<	
5-1-18	B11 22.5-24' 5-1-18 @ 1025	3000	1459		292	<	
5-1-18	B11 32.5-34' 5-1-18 @ 1057	3000	1394		279	<	
5-1-18	<sup>VP</sup> B11 32.5-42.5-44' 5-1-18 @ 1126	3000	1410		282	<	
5-1-18	B11 47.5-49' 5-1-18 @ 1145	3000	1701		340	<	
5-1-18	B10 2.5-4.0' 5-1-18 @ 1315	3000	1341		268	<	
5-1-18	B10 12.5-14' 5-1-18 @ 1325	3000	1333		267	<	
5-1-18	B10 22.5-24' 5-1-18 @ 1350	3000	1377		275	<	
5-1-18	B10 32.5-34' 5-1-18 @ 1421	3000	1420		284	<	
5-1-18	B10 42.5-44' 5-1-18 @ 1444	3000	1357		271	<	
5-1-18	B10 47.5-49' 5-1-18 @ 1500	3000	1530		306	<	
5-1-18	B9 2.5-4.0' 5-1-18 @ 1540	3000	1411		282	<	
5-1-18	B9 4.5-6.0' 5-1-18 @ 1546	3000	1602		320	<	
5-1-18	B9 17.5-19' 5-1-18 @ 1604	3000	1761		352	<	

Technician Signature [Signature] Reviewed by [Signature]



AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
UNC NECR

Instrumentation : Scaler/Ratemeter L2221SA29030i Detector L44-20  
Instrument Calibration Date: 8-7-17 Instrument Function Check Performed: ☒  
Survey Area/Unit Description NECR Jetty

Date/Time	Soil Sample ID	Sample Weight Grams	609 (559-669) Kev Gross Counts, CPSM	Weight Corrected Counts	CPM	5.5 pCi/g Ref Soil Comparison	Comments
5-1-18	B9 27.5-29.0' 5-1-18 @ 1625	3000	1649		330	<	
5-1-18	B9 37.5-39' 5-1-18 @ 1643	2872	1429	1486	297	<	
5-2-18	Blank	-	355		71		10-12 uR/hr around truck
5-2-18	5.5 pCi/g Ref Soil	3000	2724		545		
5-2-18	B9 47.5-49' 5-2-18 @ 841	3000	1174		245	<	
5-2-18	B8 2.5'-4.0' 5-2-18 @ 930	3000	1425		285	<	
5-2-18	B8 12.5'-14.0' 5-2-18 @ 955	2336	1352	1736	347	<	
5-2-18	B8 22.5'-24' 5-2-18 @ 1010	2864	1382	1448	290	<	
5-2-18	B8 32.5'-34' 5-2-18 @ 1035	2940	1389	1417	283	<	
5-2-18	B8 37.5'-39' 5-2-18 @ 1045	3000	1372		274	<	
5-2-18	B7A 2.5'-4' 5-2-18 @ 1130	3000	1381		276	<	Lab cut
5-2-18	B7A 7.5'-9.0' 5-2-18 @ 1136	3000	1256		251	<	Lab cut
5-2-18	B7A 11.5'-13' 5-2-18 @ 1153	3000	1367		273	<	Lab cut
5-2-18	B7A 17.5'-19' 5-2-18 @ 1245	3000	1364		273	<	Lab Cut
5-2-18	B7A 22.5'-24' 5-2-18 @ 1300	3000	1348		267	<	Lab Cut

Technician Signature \_\_\_\_\_ Reviewed by [Signature]

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
UNC NECR

Instrumentation: Scaler/Ratemeter L222154290801, Detector L44-20  
Instrument Calibration Date: 8-1-17, Instrument Function Check Performed: ☒  
Survey Area/Unit Description NECR Jetty

Date/Time	Soil Sample ID	Sample Weight Grams	609 (59-669) Key Gross Counts, CFSM	Weight Corrected Counts	CPM	5.5 pCi/g Ref Soil Comparison	Comments
5-2-18	B7A 27.5-29' 5-2-18 @ 1305	3000	1415		283	<	lab cut
5-2-18	B7A 32.5-34' 5-2-18 @ 1320	3000	1410		282	<	lab cut
5-2-18	B7A 37.5-39' 5-2-18 @ 1335	3000	1230		246	<	lab cut
5-2-18	B7A 42.5-44' 5-2-18 @ 1345	3000	1144		229	<	lab cut
5-2-18	B7A 47.5-49' 5-2-18 @ 1400	3000	1303		261	<	lab cut
5-2-18	B7A 52.5-54' 5-2-18 @ 1420	3000	1444		289	<	lab cut
5-2-18	B7A 57.5-59' 5-2-18 @ 1435	3000	2082		416	<	lab cut
5-2-18	B7A 62.5-64' 5-2-18 @ 1450	3000	1308		262	<	lab cut
5-2-18	B7A 67.5-69' 5-2-18 @ 1520	3000	1533		307	<	lab cut
5-3-18	Blank	-	321		64		
5-3-18	5.5 pCi/g Ref Soil	3000	2702		540		
5-3-18	B7A 72.5-74' 5-2-18 @ 1535	3000	1322		264	<	lab cut
5-3-18	B7A 79-79' 5-2-18 @ 835	3000	1078		216	<	lab cut Very Wet
5-3-18	B7A 82.5-84' 5-3-18 @ 900	3000	1490		290	<	lab cut
5-3-18	B7A 87.5-89' 5-3-18 @ 910	3000	1384		277	<	lab cut very wet

Technician Signature [Signature] Reviewed by [Signature] P.5

AVM Environmental Services, Inc.  
Field Soil Sample Gamma Radiation Screening Form  
UNC NECR

Instrumentation: Scaler/Ratemeter L2221 5#290301, Detector L44-20  
Instrument Calibration Date: 8-1-17, Instrument Function Check Performed: ☒  
Survey Area/Unit Description: NECR Jc Hy

Date/Time	Soil Sample ID	Sample Weight Grams	609 (559-669) Key Gross Counts, CPSM	Weight Corrected Counts	CPM	5.5 pCi/g Ref Soil Comparison	Comments
5-3-18	B6A 92.5-94' @ 1140	3000	966		193	<	labent very wet
5-3-18	B6A 2.5-4' @ 1140	3000	1999		400	<	labent
5-3-18	B6A 4.5-6.0' @ 1155	3000	34099		6820	>	labent
5-3-18	B6A 7.5-9' @ 1200	3000	2338		468	<	labent
5-3-18	B6A 12.5-14' @ 1235	3000	1822		364	<	labent
5-3-18	B6A 17.5-19' @ 1245	2676	1510	1693	<del>339</del> 302	<	labent
5-3-18	B6A 22.5-24' @ 1250	3000	1659		332	<	labent
5-3-18	B6A 27.5-29' @ 1300	3000	1719		344	<	labent
5-3-18	B6A 32.5-34' @ 1310	3000	1385		277	<	labent
5-3-18	B6A 37.5-39' @ 1320	3000	1388		<del>278</del> 294	<	labent
5-3-18	B6A 42.5-44' @ 1335	3000	1300		260	<	labent
5-3-18	B6A 47.5-49' @ 1340	2938	1154	1178	393	<	labent
5-3-18	B6A 52.5-54' @ 1355	3000	1357		271	<	labent
5-3-18	B6A 57.5-59' @ 1405	3000	1243		249	<	labent
5-3-18	B6A 62.5-64' @ 1435	3000	1065		201	<	labent

Technician Signature [Signature] Reviewed by [Signature] p.6

**AVM Environmental Services, Inc.**

# Field Soil Sample Gamma Radiation Screening Form

**UNC NECR**

Instrumentation : Scaler/Ratemeter L2221 S# 290801 Detector LY4-20  
Instrument Calibration Date: 8-1-17 Instrument Function Check Performed: ✓  
Survey Area/Unit Description NECR Jct #5

[illegible]

Technician Signature [Signature], Reviewed by [Signature]

AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/ preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B5A 0-4.0'	4-30-18 @ 1045		Borehole 1 gal plastic bag No preservative	Per 226	Subsurface 0.0-4.0'	Lab Cut	NP
B5A 6.0-8.0'	@ 1100		"	"		706 OK 10C DUP B5D 40-50 4-30-18 @ 0900	NP
B5A 12.5-14.0'	@ 1120		"	"		Lab Cut	NP
B5A 17.5-19.0'	@ 1135		"	"		Lab Cut	NP
B5A 22.5-24.0'	@ 1148		"	"		Lab Cut	NP
B5A 27.5-29.0'	@ 1200		"	"		Lab Cut	NP
B5A 30.0-31.5'	@ 1256		"	"		Lab Cut	NP
B5A 36.0-37.5'	@ 1307		"	"		Lab Cut	NP
B5A 42.5-44.0'	@ 1318		"	"		Lab Cut	NP
B5A 47.5-49.0'	@ 1331		"	"		Lab Cut	NP
B5A 52.5-54.0'	@ 1345		"	"		Lab Cut	NP
B5A 57.5-59.0'	@ 1357		"	"		Lab Cut	NP

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

4

A graph on a grid with 10 vertical and 10 horizontal lines. A curve is plotted, starting near the bottom left and rising steeply towards the top right. The curve passes through approximately the following points: (2, 1), (4, 4), (6, 7), and (8, 9). The curve is concave down, indicating a decreasing rate of growth.

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B4A 0-40'	4-30-18 @ 1540		Borehole, 150L Plastic Bag No Preservative	Ra-226	Subsurface 0'-40'	Lab cut	ND
B4A 7.5'-90'	4-30-18 @ 1551		"	Ra-226	Subsurface soil 7.5'-90'	Lab cut	ND
B4A 12.5'-140'	4-30-18 @ 1558		"	Ra-226	Subsurface Soil 12.5'-140'	Lab cut	ND
B4A 17.5'-190'	4-30-18 @ 1605		"		Subsurface Soil	Lab cut	ND
B4A 22.5'-240'	4-30-18 @ 1612		"		Subsurface Soil	Lab cut	ND
B4A 27.5'-290'	4-30-18 @ 1620		"			Lab cut	ND
B4A 32.5'-340'	4-30-18 @ 1628		"			Lab cut	ND
B4A 37.5'-390'	4-30-18 @ 1640		"			Lab cut	ND
B4A 42.5'-440'	4-30-18 @ 1647		"			Field QA/QC Duplicate B4D-41.0-420 4/30/18 @ 1700	ND
B4A 47.5'-490'	4-30-18 @ 1659		"			Lab cut	ND
B4A 52.5'-540'	5-1-18 @ 0845		"			Lab cut	ND

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B11 15'-30'	5-1-18 @ 1000		Borehole plastic bag No preservative	RA-226	Subsurface 15-30'		VP
B11 12.5'-14'	5-1-18 @ 1010		"	"	Subsurface 12.5'-14'	Lab cut	VP
B11 22.5-24'	5-1-18 @ 1025		"	"	Subsurface 22.5-24'		VP
B11 32.5-34'	5-1-18 @ 1051		"	"	Subsurface 32.5'-34'		VP
B11 42.5-44'	5-1-18 @ 1126		"	"	Subsurface 42.5-44'	Lab cut	VP
B11 47.5-49'	5-1-18 @ 1145		"	"	Subsurface 47.5-49'		VP
B10 2.5'-4.0	5-1-18 @ 1315		"	"	Subsurface 2.5-4.0'		VP
B10 12.5-14'	5-1-18 @ 1335		"	"	Subsurface 12.5-14'	Lab cut	VP
B10 22.5-24'	5-1-18 @ 1350		"	"	Subsurface 22.5-24'		VP
B10 32.5-34'	5-1-18 @ 1421		"	"	Subsurface 32.5-34'		VP
B10 42.5-44'	5-1-18 @ 1444		"	"	Subsurface 42.5-44'		VP
B10 47.5-49'	5-1-18 @ 1500		"	"	Subsurface 47.5-49'	Field photo B10D 46.0-47.0' 5-1-18 @ 1520 Lab cut	VP

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes



AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B9 2.5'-4.0'	5-1-18 @ 1540		Borehole / Plastic bag No Preservative	Ro-226	Subsurface 2.5'-4.0'		VP
B9 4.5'-6.0'	5-1-18 @ 1546		"	"	Subsurface 4.5'-6.0'	Lab cut	VP
B9 17.5'-19.0'	5-1-18 @ 1604		"	"	Subsurface 17.5'-19.0'		VP
B9 27.5'-29'	5-1-18 @ 1625		"	"	Subsurface 27.5'-29'		VP
B9 37.5'-39'	5-1-18 @ 1643		"	"	Subsurface 37.5'-39'	Lab cut	VP
B9 47.5'-49'	5-2-18 @ 841		"	"	Subsurface 47.5'-49'		VP
B8 2.5'-4.0'	5-2-18 @ 930		"	"	Subsurface 2.5'-4.0'		VP
B8 12.5'-14.0'	5-2-18 @ 955		"	"	Subsurface 12.5'-14.0'	Lab cut	VP
B8 22.5'-24'	5-2-18 @ 1010		"	"	Subsurface 22.5'-24'		VP
B8 32.5'-34'	5-2-18 @ 1035		"	"	Subsurface 32.5'-34'		VP
B8 37.5'-39'	5-2-18 @ 1042		"	"	Subsurface 37.5'-39'	Lab cut	VP
B7A 2.5'-4'	5-2-18 @ 1130		"	"	Subsurface 2.5'-4'	Lab cut	VP

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B7A 7.5-9.0'	5-2-18 @ 1136		Borehole Plastic Box No preservative	Ra-226	Subsurface 7.5-9.0'	lob cut	NP
B7A 11.5-13'	5-2-18 @ 1153		"	"	Subsurface 11.5-13'	lob cut	NP
B7A 17.5-19'	5-2-18 @ 1245		"	"	Subsurface 17.5-19'	lob cut	NP
B7A 22.5-24'	5-2-18 @ 1300		"	"	Subsurface 22.5-24'	lob cut	NP
B7A 27.5-29'	5-2-18 @ 1305		"	"	Subsurface 27.5-29'	lob cut	NP
B7A 32.5-34'	5-2-18 @ 1320		"	"	Subsurface 32.5-34'	lob cut	NP
B7A 37.5-39'	5-2-18 @ 1335		"	"	Subsurface 37.5-39'	lob cut	NP
B7A 42.5-44'	5-2-18 @ 1345		"	"	Subsurface 42.5-44'	lob cut	NP
B7A 47.5-49'	5-2-18 @ 1400		"	"	Subsurface 47.5-49'	lob cut	NP
B7A 52.5-54'	5-2-18 @ 1420		"	"	Subsurface 52.5-54'	lob cut	NP
B7A 57.5-59'	5-2-18 @ 1435		"	"	Subsurface 57.5-59'	lob cut	NP
B7A 62.5-64'	5-2-18 @ 1450		"	"	Subsurface 62.5-64'	lob cut	NP

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B7A 67.5-69'	5-2-18 @ 1520		Borehole plastic bag No preservative	Ra-226	Subsurface 67.5-69'	16 cent	VP
B7A 72.5-74'	5-2-18 @ 1535		"	"	Subsurface 72.5-74'	Field dn/qc Duplicate 16 cent 870 71-72 5-2-18 @ 1530	VP
B7A 77.5-79'	5-3-18 @ 835		"	"	Subsurface 77.5-79'	16 cent very wet	VP
B7A 82.5-74'	5-3-18 @ 805		"	"	Subsurface 82.5-74'	16 cent	VP
B7A 87.5-89'	5-3-18 @ 910		"	"	Subsurface 87.5-89'	16 cent	VP
B7A 92.5-94'	5-3-18 @ 920		"	"	Subsurface 92.5-94'	16 cent	VP
B6A 2.5-4.0'	5-3-18 @ 1140		"	"	Subsurface 2.5-4.0'	16 cent	VP
B6A 4.5-6.0'	5-3-18 @ 1155		"	"	Subsurface 4.5-6.0'	16 cent	VP
B6A 7.5-9.0'	5-3-18 @ 1200		"	"	Subsurface 7.5-9.0'	16 cent	VP
B6A 12.5-14'	5-3-18 @ 1225		"	"	Subsurface 12.5-14'	16 cent	VP
B6A 17.5-19'	5-3-18 @ 1245		"	"	Subsurface 17.5-19'	16 cent	VP
B6A 22.5-24'	5-3-18 @ 1245		"	"	Subsurface 22.5-24'	Field dn/qc Dup. B6D 21-22' 5-3-18 @ 1250	VP

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

AVM Environmental Services, Inc.  
Field Soil Sample Log Form  
NECR Jetty Borehole

Sample ID	Sample Date and Time	Sample Location (Coordinates)	Sample collection method/container/preservative	Analysis	Sample Type/Description	Comments/Notes	Sample Tech
B6A 27.5-29	5-3-18 @ 1300		Borehole plastic bag Also preservative	RA226	Subsurface 27.5-29'	1.6 cut	NP
B6A 32.5-34	5-3-18 @ 1310		"	"	Subsurface 32.5-34'	1.6 cut	NP
B6A 37.5-39	5-3-18 @ 1320		"	"	Subsurface 37.5-39'	1.6 cut	NP
B6A 42.5-44	5-3-18 @ 1335		"	"	Subsurface 42.5-44'	1.6 cut	NP
B6A 47.5-49	5-3-18 @ 1340		"	"	Subsurface 47.5-49'	1.6 cut	NP
B6A 52.5-54	5-3-18 @ 1355		"	"	Subsurface 52.5-54'	1.6 cut	NP
B6A 57.5-59	5-3-18 @ 1405		"	"	Subsurface 57.5-59'	1.6 cut	NP
B6A 62.5-64	5-3-18 @ 1425		"	"	Subsurface 62.5-64'	1.6 cut	NP
B6A 67.5-69	5-3-18 @ 1445		"	"	Subsurface 67.5-69'	1.6 cut	NP
B6A 72.5-74	5-3-18 @ 1500		"	"	Subsurface 72.5-74'	Field over Dip B6D 71.5-72' 5-3-18 @ 1505	NP
B6A 77.5-79	5-3-18 @ 1510		"	"	Subsurface 77.5-79'	1.6 cut	NP

Please include other applicable information, such as sampling activity/event, COC#, sampling depth, soil description, sample sub-location, etc in sample description or comments/notes

**Attachment C**  
**Instrument Calibration and Operational Function Checks**



# CERTIFICATE OF CALIBRATION

**LUDLUM MEASUREMENTS, INC.**  
501 Oak Street  
325-235-5494  
Sweetwater, TX 79556, U.S.A.  
**CERT # 4084.01**

Model No. / Serial No. 500 / 114513

Customer AVM ENVIRONMENTAL SERVICES

ORDER NO. 20314713/451652

Date 5-Jul-17 Cal Due Date 5-Jul-18 Cal. Interval 1 Year Procedure M500, Rev. 5

☐ New Instrument ☒ Instrument Received ☒ Within Tolerance ☐ Out of Tol. ☐ Requiring Repair ☒ Other-See Comments

T. 72 °F RH 49 % Alt 707.0 mm Hg ☒ Meter Zeroed ☒ Mechanical Check

CUSTOMER PO N/A

PULSE WIDTH			
	As Found	As Left	Acceptable Range (µs) ± 10%
NEG PULSE	<u>1.7</u>	<u>1.7</u>	1.5 - 1.9
POS PULSE	<u>1.6</u>	<u>1.6</u>	< 2.25

PULSE AMPLITUDE							
Reference Amplitude	As Found Amplitude Reading	As Left Amplitude Reading	Acceptable Range ± 10%	Reference Amplitude	As Found Amplitude Reading	As Left Amplitude Reading	Acceptable Range ± 10%
1 V	<u>1 V</u>	<u>1 V</u>	0.9 - 1.1	4 V	<u>4.2 V</u>	<u>4.2 V</u>	3.6 - 4.4
100 mV	<u>100 mV</u>	<u>100 mV</u>	90 - 110	400 mV	<u>420 mV</u>	<u>420 mV</u>	360 - 440
10 mV	<u>10 mV</u>	<u>10 mV</u>	9 - 11	40 mV	<u>42 mV</u>	<u>42 mV</u>	36 - 44
1 mV	<u>1 mV</u>	<u>1 mV</u>	0.9 - 1.1	4 mV	<u>4.2 mV</u>	<u>4.2 mV</u>	3.6 - 4.4

PULSE FREQUENCY (PERIOD)			
Pulser Range	As Found Period	As Left Period	Acceptable Range ± 2%
x 10K	<u>66.674</u>	<u>66.674</u>	6.534 - 6.8
x 1K	<u>66.74</u>	<u>66.74</u>	65.34 - 68
x 100	<u>667.4</u>	<u>667.4</u>	653.4 - 680
x 10	<u>6674</u>	<u>6674</u>	6534 - 6800
x 1	<u>66.75</u>	<u>66.75</u>	65.34 - 68
x 0.1	<u>90</u>	<u>90</u>	88.2 - 91.8 Counts

Reference Voltage	As Found Voltage Reading	As Left Voltage Reading	Acceptable Range ± 5%
500 V	<u>500</u>	<u>500</u>	475 - 525
2000 V	<u>1990</u>	<u>1990</u>	1900 - 2100

CPM Reading	As Found cpm Reading	As Left cpm Reading	Acceptable Range ± 10%
MAX	<u>992</u>	<u>992</u>	981 - 999
MIN	<u>0-1</u>	<u>0-1</u>	0 - 1*

\* READING OF 0-99 IS ACCEPTABLE FOR INSTRUMENTS WITH A S/N 100000 AND BELOW AND MAIN BOARD = 5208-066

## COMMENTS:

Cal'd w/ 39" cable.

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology. The calibration system conforms to the requirements of ANSI/NCCL Z540-1-1994 and ANSI N323-1978. ISO/IE 17025:2005(E)

## Reference Instruments:

Frequency Counter Model 1856 D S/N 1856412450626063 Cal Date 3-Nov-2016  
Oscilloscope Model GOS-6103 S/N EP832241 Cal Date 2-Feb-2017  
Voltmeter Model Fluke 83V S/N 94000441 Cal Date 3-May-2017

Calibrator William Tinsley Title Calibrator Date 5-July-2017

QC'd By [Signature] Title Service Dept QC Date 5-Jul-17

# AVM Environmental Services Inc.

## Scaler/Ratemeter Calibration Form

Model : L2221

S/N: 68782

Reference Instrument/Source: Ludlum Pulser 500, S/N:114513

### HV Calibration

HV Readout (2 points): Ref/Inst 600 / 600

Ref/Inst 990 / 1000

### Ratemeter Calibration

Instrument Threshold @ 100 (10 mV), WIN: Out, HV 900VDC; Pulser Threshold @ 200 (20mV)

Range/Mode	Range Multiplier	Calibration Point (Pulser Setting) cpm x multiplier	Target CPM (±5%)	As Found Reading	Left or Set Reading
Ratemeter	x1	40x1	38-42	<u>38-41</u>	<u>38-41</u>
	x1	40x10	380-420	<u>400</u>	<u>400</u>
	x10	40x100	3800-4200	<u>4000</u>	<u>4000</u>
	x100	40x1K	38K-42K	<u>40000</u>	<u>40000</u>
	x1K	40x10K	380K-420K	<u>400000</u>	<u>400000</u>
Digital Ratemeter	-	40x1	38-42	<u>38-41</u>	<u>38-41</u>
	-	40x10	380-420	<u>394-400</u>	<u>394-400</u>
	-	40x100	3800-4200	<u>3964-4000</u>	<u>3964-4000</u>
	-	40x1K	38K-42K	<u>39k-40k</u>	<u>39k-40k</u>
	-	40x10K	380K-420K	<u>397k-400k</u>	<u>397k-400k</u>

### Threshold/Gain Calibration

WIN OUT

Pulser Amplitude (mV)	Pulser CPM	L2221 Theshold (mv)	Target CPM	L2221 CPM Found	L2221 CPM Left or Set @
10.0	40000	100 (10 mV)	27K -33K	<u>30706</u>	<u>30706</u>
20.0	40000	200 (20 mV)	27K -33K	<u>32190</u>	<u>32190</u>
30.0	40000	300 (30 mV)	27K -33K	<u>31635</u>	<u>31635</u>
40.0	40000	400 (40 mV)	27K -33K	<u>30918</u>	<u>30918</u>
50.0	40000	500 (50 mV)	27K -33K	<u>31244</u>	<u>31244</u>

Note: Use R174 Gain Control on Power Supply Board to adjust L2221 CPM @75% for Threshold/Gain Calibration

### Window Cut-off Points Check

L2221 Threshold set @100 (10.0 mv)

WIN @ 100 (10.0 mV)

WIN @ 200 (20.0 mV)

✓  
✓

WIN @ 400 (40.0 mV)

WIN @ 500 (50.0 mV)

✓  
✓

Date 8-1-17

Calibrated By [Signature]

AVM Environmental Services Inc.  
L2221 SCA/L44-20 Energy Calibration Form

SCA: L2221, SR #68782

Detector: Ludlum 44-20 (3x3 NaI Scintillator)

Calibration Source: Cs-137 Check Source, 5 uCi (August 2008) For 662 KeV Peak Cal

Threshold (input sensitivity) 652

Window, In/Out IN Window 20

HV Initial 100, At Peak 589

Maximum CPM: 187,148 Background CPM: 6

HV Set @ 589 VDC

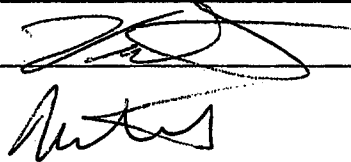
For Bi-214 609.2 KeV Peak (559 - 659 KeV ROI), Set Threshold @ 559, Window @ 100

Calibration Check w 1% U3O8 Ore Check Source: 15176 CPM

Blank 62 CPM

Date 04-29-2018

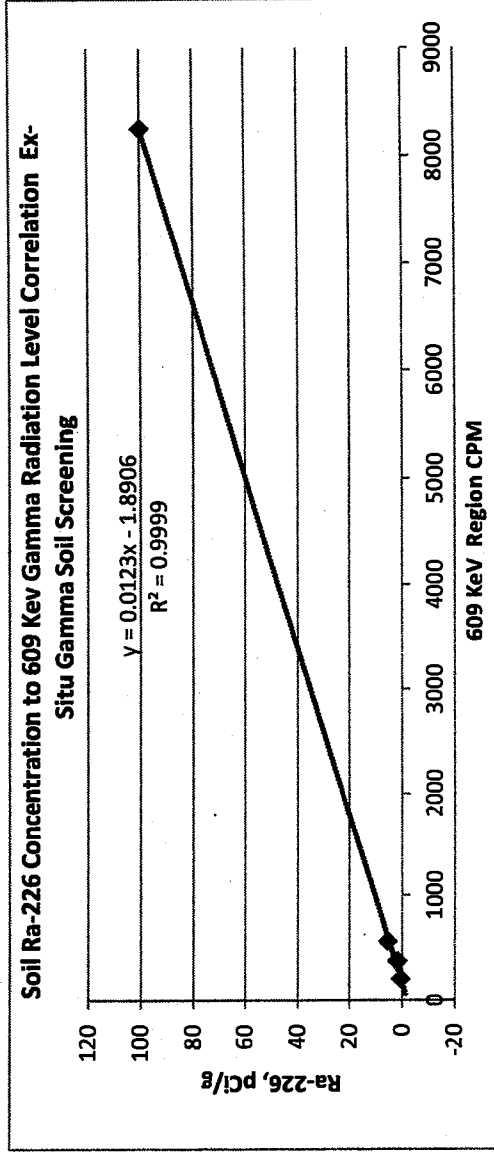
Calibrated By





**AVM Environmental Services**  
**Ex-Situ Soil Screening Gamma Radiation Level to Ra-226 Correlation**  
**NECR 2018 Jetty Investigation**

Reference Soil ID	Date	Ra-226 pCi/g	Wt gms	609 KeV CPSMin Gross (3x3 NaI Detector)	CPM
Blank	4/29/2018			301	60
BKG Soil	4/29/2018	0.7	3000	998	200
NECR 2.0 pCi/g Ref Soil	4/29/2018	2.0	3000	1851	370
NECR 5.5 pCi/g Ref Soil	4/29/2018	5.5	3000	2766	553
NECR PTW Ref Soil	4/29/2018	100	3000	41278	8256



Regression Statistics	
Multiple R	0.999944197
R Square	0.99988396
Adjusted R Square	0.999832595
Standard Error	0.629789797
Observations	4

ANOVA				
	df	SS	MS	F
Regression	1	7107.13673	7107.13673	17918.57337
Residual	2	0.793270377	0.396635189	
Total	3	7107.93		

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-1.890589655	0.381970196	-4.949573744	0.038478599	-3.534074763	-0.247104547	-3.534074763	-0.247104547
X Variable 1	0.012343245	9.22099E-05	133.8602756	5.58033E-05	0.011946498	0.012739992	0.011946498	0.012739992

**AVM Environmental Services, Inc.**

L222 | s# 29080 | Detector L 44-20

1

AVM office

[illegible]

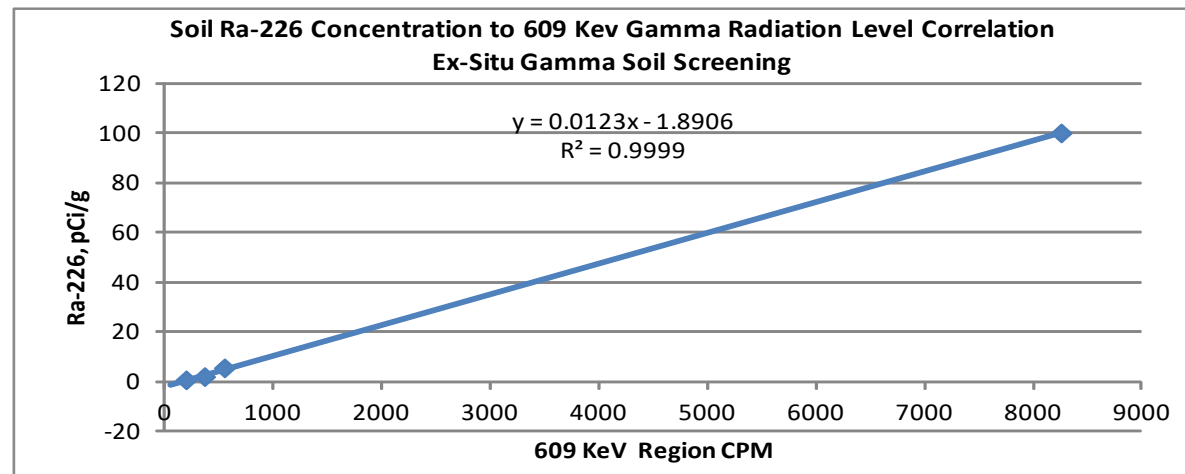
Reviewed by:

**Note: (1) Battery Voltage for Ludlum 2221 must be >5.3 volts; (2) Threshold must be at 220 mV; (3) Window @ 440, must be IN**

**Attachment D**  
**AVM Environmental Services**  
**Ex-Situ Soil Screening Gamma Radiation Level to Ra-226 Correlation**  
**NECR 2018 Jetty Investigation**

Reference Soil ID	Date	Ra-226 pCi/g	Wt gms	609 KeV CP5Min Gross (3x3 NaI Detector)	CPM
Blank	4/29/2018		-	301	60
BKG Soil	4/29/2018	0.7	3000	998	200
NECR 2.0 pCi/g Ref Soil	4/29/2018	2.0	3000	1851	370
NECR 5.5 pCi/g Ref Soil	4/29/2018	5.5	3000	2766	553
NECR PTW Ref Soil	4/29/2018	100	3000	41278	8256

Regression Statistics	
Multiple R	0.999944197
R Square	0.999888396
Adjusted R Square	0.999832595
Standard Error	0.629789797
Observations	4



ANOVA

	df	SS	MS	F	Significance F
Regression	1	7107.13673	7107.13673	17918.57337	5.58033E-05
Residual	2	0.793270377	0.396635189		
Total	3	7107.93			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-1.89058966	0.381970196	-4.94957374	0.038478599	-3.53407476	-0.24710455	-3.53407476	-0.24710455
X Variable 1	0.012343245	9.22099E-05	133.8602756	5.58033E-05	0.011946498	0.012739992	0.011946498	0.012739992

**Attachment E**  
**Laboratory Ra-226 Analytical Results Reports**



# Gamma Spectroscopy Case Narrative

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## Stantec Consulting Services

NECR Jetty 2018 – 233001048

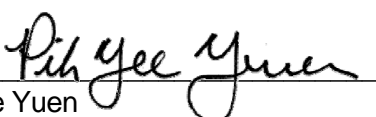
Work Order Number: 1805159

1. The following report consists of analytical results and supporting documentation for 13 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/17/2018 and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis on 06/07/2018 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/07/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

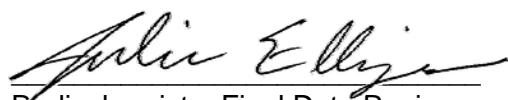


7. Activity concentrations above the calculated MDC are reported in some instances where minimum nuclide identification criteria are not met. Such tentative identifications result when the software attempts to calculate net activity concentrations for analytes where either one or both of the following criteria are not satisfied: the 'diagnostic' peak for a nuclide must be identified above the critical level, or the minimum library peak abundance must be attained. Nuclides not meeting these requirements have been flagged with a "T1" qualifier.
8. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of +/- 15% of the density of the calibration standard are flagged with a 'G', denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.
9. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
10. The requested detection limit was not met for samples 1805159-1, -3DUP, -7, -8, -9, -10, and -12. The reported activity exceeds the achieved MDC. Results are submitted without further qualification. The results are flagged with an "M3" qualifier on the final reports.
11. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Pik Yee Yuen  
Radiochemistry Primary Data Reviewer

6/8/18  
Date

  
Radiochemistry Final Data Reviewer

6/15/18  
Date

## Section 1

# CHAIN OF CUSTODY



# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

---

**OrderNum:** 1805159

**Client Name:** Stantec Consulting Services

**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

---

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B9 4.5-6	1805159-1		SOIL	01-May-18	15:46
B11 12.5-14	1805159-2		SOIL	01-May-18	10:10
B8 12.5-14	1805159-3		SOIL	02-May-18	9:55
B9 37.5-39	1805159-4		SOIL	01-May-18	16:43
B11 42.5-44	1805159-5		SOIL	01-May-18	11:26
B8 37.5-39	1805159-6		SOIL	02-May-18	10:42
B6A 67.5-69	1805159-7		SOIL	03-May-18	14:45
B10 12.5-14	1805159-8		SOIL	01-May-18	13:35
B6A 77.5-79	1805159-9		SOIL	03-May-18	15:10
B6A 72.5-74	1805159-10		SOIL	03-May-18	15:00
B6D 71-72	1805159-11		SOIL	03-May-18	15:05
B10 47.5-49	1805159-12		SOIL	01-May-18	15:00
B10D 46-47	1805159-13		SOIL	01-May-18	15:20

1805159

STANTEC  
COC Number: 1000-6314-D  
CHAIN OF CUSTODY RECORD  
Stantec CONTACT PERSON: Jason Cumbers  
LAB: ALS  
COOLER # 3  
LAB: ALS, 225 Commerce Drive, Fort Collins, Colorado 80524  
Page 1 of 1  
Phone: 970-212-2755

SAMPLER(S) PRINTED NAME AND SIGNATURE  
Matt Kapp

ANALYSIS REQUEST

PROJECT NAME: NECR Jetty 2018  
TASK ORDER: 233001048  
PROJECT NUMBER: 233001048  
Program: Borrow Soil Characterization

SAMPLE ID	LOC ID	SBD	SED	DATE	TIME	MC*	Re-226 (EPA 901.1 soils, pCi/g)	Total Uranium (EPA 6020, mg/kg)	Comments	SM*
B9 4.5-6	B9	4.5	6	5/1/2018	1546	SO	X	X		H
B11 12.5-14	B11	12.5	14	5/1/2018	1010	SO	X	X		H
B8 12.5-14	B8	12.5	14	5/2/2018	955	SO	X	X		H
B9 37.5-39	B9	37.5	39	5/1/2018	1643	SO	X	X		H
B11 42.5-44	B11	42.5	44	5/1/2018	1126	SO	X	X		H
B8 37.5-39	B8	37.5	39	5/2/2018	1042	SO	X	X		H
B6A 67.5-69	B6A	67.5	69	5/3/2018	1445	SO	X	X		H
B10 12.5-14	B10	12.5	14	5/1/2018	1335	SO	X	X		H
B6A 77.5-79	B6A	77.5	79	5/3/2018	1510	SO	X	X		H
B6A 72.5-74	B6A	72.5	74	5/3/2018	1500	SO	X	X		H
B6D 71-72	B6A	71	72	5/3/2018	1505	SO	X	X		H
B10 47.5-49	B10	47.5	49	5/1/2018	1500	SO	X	X		H
B10D 46-47	B10	46	47	5/1/2018	1520	SO	X	X		H

Comments/Instructions  
Turn-around time is 30 calendar days for rad analyses and 14 calendar days for all other analyses.  
Level IV data package unless otherwise specified

Signature: Matt Kapp  
Print Name: MATT KAPP  
Company Name/Title: STANTEC  
Date: 5/4/18  
Time: 1200  
RECEIVED BY: KELLI-JEAN SMITH  
ALS FC  
5-8-18  
1212

For Lab Use Only: Sample Condition Upon Receipt:  
Legend  
SBD: Sample Beginning Depth  
SED: Sample Ending Depth (0 for gw)  
LOC ID: Unique XY locator  
ORIGINAL: Send with sample (sign only in blue or black ink)  
COPIES: Retained by Sampler, Sent to Office



**ALS Environmental - Fort Collins**  
**CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: STANTEC

Workorder No: 1805159

Project Manager: URS

Initials: K Date: 3/8/18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<u>NO</u>
2. Are custody seals on shipping containers intact?	<u>NONE</u>	YES	NO
3. Are Custody seals on sample containers intact?	<u>NONE</u>	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<u>YES</u>	NO
5. Are the COC and bottle labels complete and legible?		<u>YES</u>	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<u>YES</u>	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<u>YES</u>	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<u>N/A</u>	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<u>N/A</u>	YES	NO
10. Is there sufficient sample for the requested analyses?		<u>YES</u>	NO
11. Were all samples placed in the proper containers for the requested analyses?		<u>YES</u>	NO
12. Are all samples within holding times for the requested analyses?		<u>YES</u>	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<u>YES</u>	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	<u>N/A</u>	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ____ dusting ____ moderate ____ heavy	Amount <u>N/A</u>	YES	NO
16. Were the samples shipped on ice?		YES	<u>NO</u>
17. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #1 #3 #4	RAD ONLY	YES
Cooler #: <u>1</u>			
Temperature (°C): <u>4.1</u>			
No. of custody seals on cooler: <u>9</u>			
External µR/hr reading: <u>94</u>			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <u>YES</u> / NO / NA (If no, see Form 008.)			

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

If applicable, was the client contacted? YES / NO / NA Contact: [Signature] Date/Time: 5/8/18

Project Manager Signature / Date: [Signature] 5/8/18

FROM: BOWLING SHIPPIING (505) 863-3366  
REF: Bowling's Shipping Center  
102 S First Street  
CULLUP NM 87301  
US

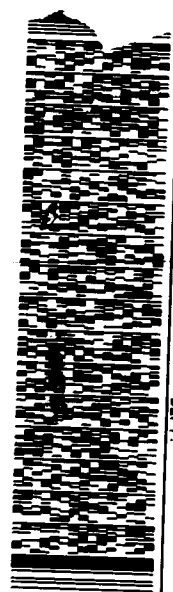
SHIP DATE: 04MAY18  
ACTWT: 37.35 LB  
CNO: 112065956/MSX13300  
DIMED: 15 X 12 X 12 IN  
BILL SENDER

ALS  
225 COMMERCE DR

140

FORT COLLINS CO 80524  
(800) 443-1511  
REF: MATT KAPP  
PNO: PKG ID: 58639  
DEPT:

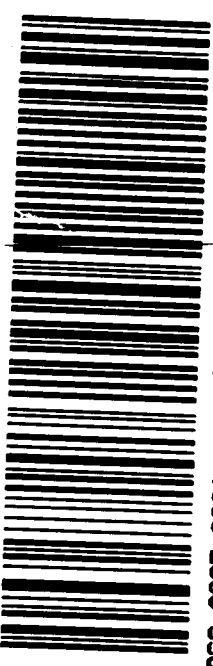
(USE)



TRK# 7808 2509 3569

80524

9622 0019 0 (000 000 0000) 0 00 7808 2509 3569



6515081

## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180518-2MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180699d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	-0.13 +/- 0.19	0.38	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805159-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180518-2LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180786d07

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	464 +/- 54	3	468.3	99.1	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B8 12.5-14

Lab ID: 1805159-3DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 194 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180997d03

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
13982-63-3	Ra-226	1.49 +/- 0.31		0.44		1.62 +/- 0.35		0.51	M3	0.293	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B9 4.5-6

Lab ID: 1805159-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 179 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180783d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.41 +/- 0.32	0.51	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B11 12.5-14

Lab ID: 1805159-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 219 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180683d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.08 +/- 0.26	0.42	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B8 12.5-14

Lab ID: 1805159-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 188 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180778d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.49 +/- 0.31	0.44	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B8 12.5-14

Lab ID: 1805159-3DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 194 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180997d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.62 +/- 0.35	0.51	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805159-1

Date Printed:

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# Gamma Spectroscopy Results

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## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B9 37.5-39

Lab ID: 1805159-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 194 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180641d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.33 +/- 0.28	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B11 42.5-44

Lab ID: 1805159-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 199 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180697d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.07 +/- 0.26	0.42	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B8 37.5-39

Lab ID: 1805159-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 173 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180784d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.56 +/- 0.35	0.48	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

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# Gamma Spectroscopy Results

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## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 67.5-69

Lab ID: 1805159-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 196 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180684d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.90 +/- 0.29	0.51	0.5	NA	M3,TI

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B10 12.5-14

Lab ID: 1805159-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 182 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180803d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.10 +/- 0.30	0.51	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 77.5-79

Lab ID: 1805159-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 179 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180779d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.37 +/- 0.32	0.53	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 72.5-74

Lab ID: 1805159-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 178 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180998d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.99 +/- 0.41	0.53	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6D 71-72

Lab ID: 1805159-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 167 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180642d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.67 +/- 0.34	0.49	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B10 47.5-49

Lab ID: 1805159-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 166 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180698d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.63 +/- 0.36	0.55	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805159

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B10D 46-47

Lab ID: 1805159-13

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 165 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180698d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.54 +/- 0.29	0.44	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805159-1



# Gamma Spectroscopy Case Narrative

---

## Stantec Consulting Services

NECR Jetty 2018 – 233001048

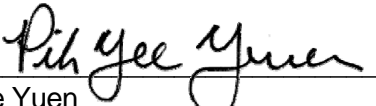
Work Order Number: 1805162

1. The following report consists of analytical results and supporting documentation for 15 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/17/2018 and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis on 06/17/2018 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/08/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

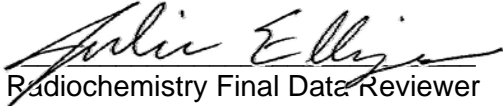


7. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of  $\pm 15\%$  of the density of the calibration standard are flagged with a 'G', denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.
8. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
9. The requested MDC was not met for samples 1805161-2, -3, -5, -6, -7, -10, and -15. The reported activity exceeds the achieved MDC. Results are submitted without further qualification. The results are flagged with an "M3" flag on the final report.
10. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Pik Yee Yuen  
Radiochemistry Primary Data Reviewer

6/11/18  
Date

  
Radiochemistry Final Data Reviewer

6/15/18  
Date

## Section 1

# CHAIN OF CUSTODY

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

---

**OrderNum:** 1805161

**Client Name:** Stantec Consulting Services

**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

---

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B5A 0-4	1805161-1		SOIL	30-Apr-18	10:45
B5A 6-8	1805161-2		SOIL	30-Apr-18	11:00
B5A 12.5-14	1805161-3		SOIL	30-Apr-18	11:20
B5A 17.5-19	1805161-4		SOIL	30-Apr-18	11:35
B5A 22.5-24	1805161-5		SOIL	30-Apr-18	11:48
B5A 27.5-29	1805161-6		SOIL	30-Apr-18	12:00
B5A 30-31.5	1805161-7		SOIL	30-Apr-18	12:56
B5A 36-37.5	1805161-8		SOIL	30-Apr-18	13:07
B5A 42.5-44	1805161-9		SOIL	30-Apr-18	13:18
B5A 47.5-49	1805161-10		SOIL	30-Apr-18	13:31
B5A 52.5-54	1805161-11		SOIL	30-Apr-18	13:45
B5A 57.5-59	1805161-12		SOIL	30-Apr-18	13:57
B5A 62.5-64	1805161-13		SOIL	30-Apr-18	14:09
B5A 67.5-69	1805161-14		SOIL	30-Apr-18	14:28
B5D 40-50	1805161-15		SOIL	30-Apr-18	9:00

1805161

STANTEC  
FED EX #: 1000-6314-D  
CHAIN OF CUSTODY RECORD  
COOLER # 2  
LAB: ALS  
LAB:ALS, 225 Commerce Drive, Fort Collins, Colorado 80524  
Phone: 970-212-2755  
Page 1 of 1

SAMPLER(S) PRINTED NAME AND SIGNATURE

Matt Kapp

PROJECT NAME: NECR Jetty 2018

TASK ORDER:

PROJECT NUMBER: 13300/048

Program: Borrow Soil Characterization

ANALYSIS REQUEST

SAMPLE ID	LOC ID	SBD	SED	DATE	TIME	MC*	Ra-226 (EPA 901.1 soils, pCi/g)	Total Uranium (EPA 6020, mg/kg)	Comments	SM*
B5A 0-4	B5A	0	4	4/30/2018	1045	SO	X	X		H
B5A 6-8	B5A	6	8	4/30/2018	1100	SO	X	X		H
B5A 12.5-14	B5A	12.5	14	4/30/2018	1120	SO	X	X		H
B5A 17.5-19	B5A	17.5	19	4/30/2018	1135	SO	X	X		H
B5A 22.5-24	B5A	22.5	24	4/30/2018	1148	SO	X	X		H
B5A 27.5-29	B5A	27.5	29	4/30/2018	1200	SO	X	X		H
B5A 30-31.5	B5A	30	31.5	4/30/2018	1256	SO	X	X		H
B5A 36-37.5	B5A	36	37.5	4/30/2018	1307	SO	X	X		H
B5A 42.5-44	B5A	42.5	44	4/30/2018	1318	SO	X	X		H
B5A 47.5-49	B5A	47.5	49	4/30/2018	1331	SO	X	X		H
B5A 52.5-54	B5A	52.5	54	4/30/2018	1345	SO	X	X		H
B5A 57.5-59	B5A	57.5	59	4/30/2018	1357	SO	X	X		H
B5A 62.5-64	B5A	62.5	64	4/30/2018	1409	SO	X	X		H
B5A 67.5-69	B5A	67.5	69	4/30/2018	1428	SO	X	X		H

Comments/Instructions

Turn-around time is 30 calendar days for rad analyses and 14 calendar days for all other analyses.

Level IV data package unless otherwise specified

RELINQUISHED BY:	Matt Kapp	Signature:	MATT KAPP	Company Name/Title:	STANTEC	Date:	5/4/18	Time:	1200
RECEIVED BY:			KELI-JEAN SMITH		ALSFC		5-8-18		1212
RELINQUISHED BY:									
RECEIVED BY:									

For Lab Use Only: Sample Condition Upon Receipt:

Legend

SBD: Sample Beginning Depth

SED: Sample Ending Depth (0 for gw)

LOC ID: Unique XY locator

\* Sampling Matrix Code (MC): SO=soil, WG=gw, WS=surface water, WO=water QC, GS=soil gas/vapor

b Sampling Method Code (SM): HA=Hand Auger, H=Hollow Stem Auger, EC=Encore Soil Sampler, SS=Split Spoon, G=Grab, B=Bailer, SA=Summa Passivated Air Canister  
(for Equip.Blanks enter SM of associated samples, for Trip Blank enter "G")  
C=Composite

ORIGINAL: Send with sample (sign only in blue or black ink)

COPIES: Retained by Sampler, Sent to Office





**ALS Environmental - Fort Collins**  
**CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: STANTEC

Workorder No: 1805141

Project Manager: URS

Initials: Kg Date: 5/8/18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<u>NO</u>
2. Are custody seals on shipping containers intact?	<u>NONE</u>	YES	NO
3. Are Custody seals on sample containers intact?	<u>NONE</u>	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<u>YES</u>	NO
5. Are the COC and bottle labels complete and legible?		<u>YES</u>	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<u>YES</u>	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<u>YES</u>	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<u>N/A</u>	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<u>N/A</u>	YES	NO
10. Is there sufficient sample for the requested analyses?		<u>YES</u>	NO
11. Were all samples placed in the proper containers for the requested analyses?		<u>YES</u>	NO
12. Are all samples within holding times for the requested analyses?		<u>YES</u>	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<u>YES</u>	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	<u>N/A</u>	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ____ dusting ____ moderate ____ heavy	Amount <u>N/A</u>	YES	NO
16. Were the samples shipped on ice?		YES	<u>NO</u>
17. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #1 #3 #4 RAD ONLY	YES	<u>NO</u>

Cooler #: 1

Temperature (°C): Amb

No. of custody seals on cooler: 0

External µR/hr reading: 14

Background µR/hr reading: 12

Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

- sample B5D 40-50 4-30-18 @ 0900 in cooler but not on coc

- COC for sample -15 arrived after log in

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

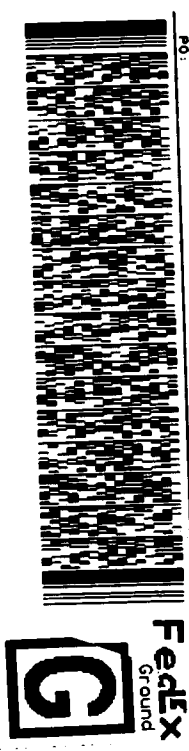
Project Manager Signature / Date: [Signature] 5/10/18



FROM: BOWLING SHIPING (505) 963-3366  
REF: Bowling's Shipping Center  
102 S First Street  
GALLUP NM 87301  
SHIP DATE: 04MAY18  
ACTWT: 40.15 LB  
CAD: 112065956/MSX13300  
DIMED: 15 X 12 X 12 IN  
BILL SENDER

TO  
ALS  
225 COMMERCE DR  
14-0  
(US)

FORT COLLINS CO 80524  
(800) 443-1511  
REF: MATT KAPP  
INV: PKG ID: 59637  
DEPT:

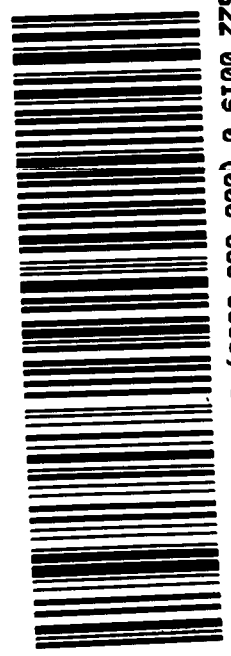


1805161

TRK# 7808 2504 0999

80524

9622 0019 0 (000 000 0000) 0 00 7808 2504 0999



## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180518-2MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180699d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	-0.13 +/- 0.19	0.38	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180519-1MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 181003d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.02 +/- 0.19	0.35	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180518-2LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180786d07

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	464 +/- 54	3	468.3	99.1	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180519-1LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 181006d03

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	449 +/- 53	3	468.3	95.8	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805161-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 36-37.5

Lab ID: 1805161-8DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 201 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180805d01

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
13982-63-3	Ra-226	0.95 +/- 0.28		0.49		0.93 +/- 0.27		0.45		0.0487	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 0-4

Lab ID: 1805161-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 211 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180785d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.36 +/- 0.28	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 6-8

Lab ID: 1805161-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 198 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180685d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	5.73 +/- 0.82	0.58	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 12.5-14

Lab ID: 1805161-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 176 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180804d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.91 +/- 0.40	0.56	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 17.5-19

Lab ID: 1805161-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 161 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180700d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.62 +/- 0.30	0.46	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 22.5-24

Lab ID: 1805161-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 157 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180780d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.79 +/- 0.39	0.59	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 27.5-29

Lab ID: 1805161-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 157 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180999d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.36 +/- 0.37	0.62	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 30-31.5

Lab ID: 1805161-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180518-2

QCBatchID: GS180518-2-1

Run ID: GS180518-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 149 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180643d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	2.16 +/- 0.43	0.58	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 36-37.5

Lab ID: 1805161-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 202 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180686d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.95 +/- 0.28	0.49	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1

Date Printed: Monday, June 11, 2018

ALS -- Fort Collins

LIMS Version: 6.864

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# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 36-37.5

Lab ID: 1805161-8DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 201 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180805d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.93 +/- 0.27	0.45	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1

Date Printed:

Monday, June 11, 2018

ALS -- Fort Collins

LIMS Version: 6.864

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# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 42.5-44

Lab ID: 1805161-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 181 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180701d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.25 +/- 0.25	0.41	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 47.5-49

Lab ID: 1805161-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 180 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180781d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.50 +/- 0.33	0.54	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 52.5-54

Lab ID: 1805161-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 191 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181000d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.06 +/- 0.29	0.47	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 57.5-59

Lab ID: 1805161-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 220 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180644d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.90 +/- 0.21	0.26	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 62.5-64

Lab ID: 1805161-13

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 213 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180700d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.66 +/- 0.21	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805161-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5A 67.5-69

Lab ID: 1805161-14

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 204 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180787d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.04 +/- 0.27	0.42	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805161

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B5D 40-50

Lab ID: 1805161-15

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 212 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180687d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	5.60 +/- 0.80	0.62	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805161-1



# Gamma Spectroscopy Case Narrative

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## Stantec Consulting Services

NECR Jetty 2018 – 233001048

Work Order Number: 1805162

1. The following report consists of analytical results and supporting documentation for 12 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/17/2018 and stored for at least 21 or 22 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis for samples stored for 21 days is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%. The degree of ingrowth achieved prior to analysis for samples stored for 22 days is at least 98.15%, and the effective radon progeny ingrowth for these samples would be greater than 99.07%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/08/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

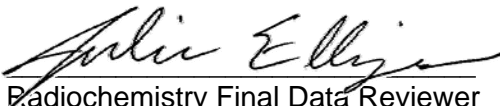


7. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of  $\pm 15\%$  of the density of the calibration standard are flagged with a 'G', denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.
8. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
9. The requested MDC was not met for samples 1805162-3, -5, -7, -8, -9, and -11. The reported activity exceeds the achieved MDC. Results are submitted without further qualification. The results are flagged with an "M3" flag on the final report.
10. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Pik Yee Yuen  
Radiochemistry Primary Data Reviewer

6/11/18  
Date

  
Radiochemistry Final Data Reviewer

6/15/18  
Date

## Section 1

# CHAIN OF CUSTODY

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

---

**OrderNum:** 1805162

**Client Name:** Stantec Consulting Services

**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

---


Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B6A 42.5-44	1805162-1		SOIL	03-May-18	13:35
B6A 47.5-49	1805162-2		SOIL	03-May-18	13:40
B6A 52.5-54	1805162-3		SOIL	03-May-18	13:55
B7A 27.5-29	1805162-4		SOIL	02-May-18	13:05
B7A 32.5-34	1805162-5		SOIL	02-May-18	13:20
B7A 42.5-44	1805162-6		SOIL	02-May-18	13:45
B7A 47.5-49	1805162-7		SOIL	02-May-18	14:00
B7A 52.5-54	1805162-8		SOIL	02-May-18	14:20
B7A 57.5-59	1805162-9		SOIL	02-May-18	14:35
B7A 62.5-64	1805162-10		SOIL	02-May-18	14:50
B7A 72.5-74	1805162-11		SOIL	02-May-18	15:35
B7A 77.5-79	1805162-12		SOIL	03-May-18	8:35

1805162

STANTEC  
FED EX #:  
COC Number:  
1000-6314-D

CHAIN OF CUSTODY RECORD  
Stantec CONTACT PERSON Jason Cumbers  
LAB: ALS  
COOLER # 5



LAB:ALS, 225 Commerce Drive, Fort Collins, Colorado 80524  
Phone: 970-212-2755  
Page 1 of 1

SAMPLER(S) PRINTED NAME AND SIGNATURE  
Matt Kapp  


PROJECT NAME: NECR Jetty 2018  
TASK ORDER:  
PROJECT NUMBER: 233001048  
Program: Borrow Soil Characterization

SAMPLE ID	LOC ID	SBD	SED	DATE	TIME	MC*	Ra-226 (EPA 901.1 soils, pCi/g)	Total Uranium (EPA 6020, mg/kg)	Comments	Surf
B6A 42.5-44	B6A	42.5	44	5/3/2018	1335	SO	X	X		H
B6A 47.5-49	B6A	47.5	49	5/3/2018	1340	SO	X	X		H
B6A 52.5-54	B6A	52.5	54	5/3/2018	1355	SO	X	X		H
B7A 27.5-29	B7A	27.5	29	5/2/2018	1305	SO	X	X		H
B7A 32.5-34	B7A	32.5	34	5/2/2018	1320	SO	X	X		H
B7A 42.5-44	B7A	42.5	44	5/2/2018	1345	SO	X	X		H
B7A 47.5-49	B7A	47.5	49	5/2/2018	1400	SO	X	X		H
B7A 52.5-54	B7A	52.5	54	5/2/2018	1420	SO	X	X		H
B7A 57.5-59	B7A	57.5	59	5/2/2018	1435	SO	X	X		H
B7A 62.5-64	B7A	62.5	64	5/2/2018	1450	SO	X	X		H
B7A 72.5-74	B7A	72.5	74	5/2/2018	1535	SO	X	X		H
B7A 77.5-79	B7A	77.5	79	5/3/2018	835	SO	X	X		H

Comments/Instructions  
Turn-around time is 30 calendar days for rad analyses and 14 calendar days for all other analyses.  
Level IV data package unless otherwise specified

Signature:   
RELINQUISHED BY:  
Signature:   
RECEIVED BY:

Print Name: MATT KAPP  
NICK JOSTES

Company Name/Title: STANTEC  
ALS

Date: 5/4/18  
5/8/18

Time: 12:00  
12:12

For Lab Use Only: Sample Condition Upon Receipt:  
Legend  
SBD: Sample Beginning Depth  
SED: Sample Ending Depth (0 for gw)  
LOC ID: Unique XY locator  
ORIGINAL: Send with sample (sign only in blue or black ink)

For Lab Use Only: Sample Condition Upon Receipt:  
\* Sampling Matrix Code (MC): SO=soil, WG=gw, WS=surface water, WO=water QC, GS=soil gas/vapor  
\* Sampling Method Code (SM): HA=Hand Auger, H=Hollow Stem Auger, EC=Encore Soil Sampler, SS=Split Spoon, G=Grab, B=Bailer, SA=Summa Passivated Air Canister  
(for Equip.Blanks enter SM of associated samples, for Trip Blank enter "G")  
C=Composite  
COPIES: Retained by Sampler, Sent to Office



ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: STANTEC  
Project Manager: URS

Workorder No: 1905162  
Initials: K Date: 5/8/18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	NO
2. Are custody seals on shipping containers intact?	NONE	YES	NO
3. Are Custody seals on sample containers intact?	NONE	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		YES	NO
5. Are the COC and bottle labels complete and legible?		YES	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		YES	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	YES	NO
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	N/A	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	N/A	YES	NO
10. Is there sufficient sample for the requested analyses?		YES	NO
11. Were all samples placed in the proper containers for the requested analyses?		YES	NO
12. Are all samples within holding times for the requested analyses?		YES	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		YES	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	N/A	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ____ dusting ____ moderate ____ heavy	Amount N/A	YES	NO
16. Were the samples shipped on ice?		YES	NO
17. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #1 #3 #4 RAD ONLY		YES	NO
Cooler #: <u>1</u>			
Temperature (°C): <u>4.1</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>13</u>			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? YES / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

- Airbill tore during removal

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 5/10/18



1805162

SHIP DATE: 04MAY18  
ACTWGT: 38.70 LB  
CAD: 112065956/MSX13300  
DIMMED: 15 X 12 X 12 IN  
BILL SENDER

ALS  
225 COMMERCE DR

13-0

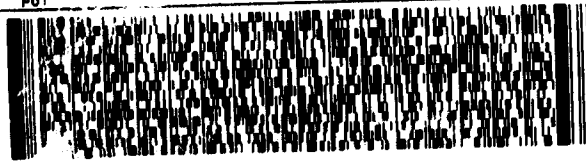
FORT COLLINS CO 80524

(US)

(800) 443-1111  
INV: PKG ID: 8964  
PO:

REF: TATT KAPP

DEPT:



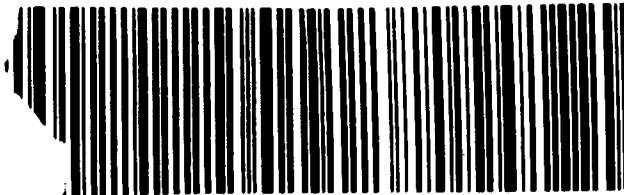
FedEx  
Ground



RK# 78008 2516 8332

80524

0019 0 (000 000 0000) 0 00 7808 2516 8332



## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180519-1MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 181003d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.02 +/- 0.19	0.35	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180519-1LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 181006d03

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	449 +/- 53	3	468.3	95.8	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805162-1

## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 42.5-44

Lab ID: 1805162-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 196 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180806d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.18 +/- 0.30	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 47.5-49

Lab ID: 1805162-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 196 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180702d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.99 +/- 0.22	0.38	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 52.5-54

Lab ID: 1805162-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 187 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180807d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.27 +/- 0.32	0.50	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 27.5-29

Lab ID: 1805162-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 183 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180782d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.35 +/- 0.30	0.46	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 32.5-34

Lab ID: 1805162-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 172 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181001d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.59 +/- 0.38	0.63	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 42.5-44

Lab ID: 1805162-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 188 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180645d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.12 +/- 0.25	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 47.5-49

Lab ID: 1805162-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 180 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180788d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.29 +/- 0.32	0.54	0.5	NA	M3,G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 52.5-54

Lab ID: 1805162-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 184 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180701d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.49 +/- 0.32	0.50	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 57.5-59

Lab ID: 1805162-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 193 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180688d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	4.57 +/- 0.68	0.53	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 62.5-64

Lab ID: 1805162-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 194 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180703d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.87 +/- 0.31	0.38	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 72.5-74

Lab ID: 1805162-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 17-May-18

Date Analyzed: 07-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 183 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181002d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	2.00 +/- 0.42	0.54	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805162-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805162

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 77.5-79

Lab ID: 1805162-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 17-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180519-1

QCBatchID: GS180519-1-1

Run ID: GS180519-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 216 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180810d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.81 +/- 0.23	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805162-1



# Gamma Spectroscopy Case Narrative

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## Stantec Consulting Services

NECR Jetty 2018 – 233001048

Work Order Number: 1805163

1. The following report consists of analytical results and supporting documentation for 12 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/18/2018 and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis on 06/08/2018 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/08/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. Sample volumes were insufficient to allow preparation of a duplicate. A duplicate analysis of sample 1805163-8 was performed in lieu of a prepared duplicate.
6. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
7. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

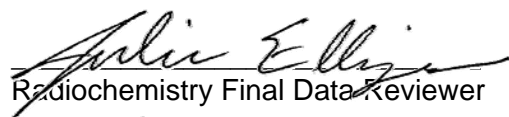


8. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
9. The requested MDC for Ra-226 was not met for sample 1805163-9. The reported activity for this sample exceeds the achieved MDC. Results are submitted without further qualification. The results are identified with an "M3" flag on the final report.
10. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Jean Anderson  
Radiochemistry Primary Data Reviewer

6/12/18  
Date

  
Radiochemistry Final Data Reviewer

6/15/18  
Date

## Section 1

# CHAIN OF CUSTODY

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

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**OrderNum:** 1805163

**Client Name:** Stantec Consulting Services


**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

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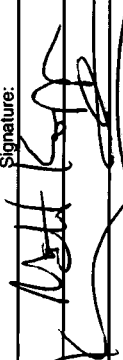
Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B7A 22.5-24	1805163-1		SOIL	03-May-18	13:00
B7A 87.5-89	1805163-2		SOIL	03-May-18	9:10
B7A 92.5-94	1805163-3		SOIL	03-May-18	9:25
B7A 37.5-39	1805163-4		SOIL	03-May-18	13:35
B7A 2.5-4	1805163-5		SOIL	02-May-18	11:30
B7D 25-26	1805163-6		SOIL	02-May-18	13:10
B7A 17.5-19	1805163-7		SOIL	02-May-18	12:45
B7A 7.5-9	1805163-8		SOIL	02-May-18	11:36
B7A 11.5-13	1805163-9		SOIL	02-May-18	11:53
B7A 67.5-69	1805163-10		SOIL	02-May-18	15:20
B7D 71-72	1805163-11		SOIL	02-May-18	15:30
B7A 82.5-84	1805163-12		SOIL	02-May-18	9:05

SAMPLER(S) PRINTED NAME AND SIGNATURE  
Matt Kapp  


PROJECT NAME: NECR Jetty 2018  
TASK ORDER:  
PROJECT NUMBER: 233001048  
Program: Borrow Soil Characterization

ANALYSIS REQUEST										Comments	SM*
SAMPLE ID	LOC ID	SBD	SED	DATE	TIME	MC*	Ra-226 (EPA 901.1 soils, pCi/g)		Total Uranium (EPA 6020, mg/kg)		
B7A 22.5-24	B7A	22.5	24	5/3/2018	1300	SO	X	X	X		H
B7A 87.5-89	B7A	87.5	89	5/3/2018	910	SO	X	X	X		H
B7A 92.5-94	B7A	92.5	94	5/3/2018	925	SO	X	X	X		H
B7A 37.5-39	B7A	37.5	39	5/3/2018	1335	SO	X	X	X		H
B7A 2.5-4	B7A	2.5	4	5/2/2018	1130	SO	X	X	X		H
B7D 25-26	B7A	25	26	5/2/2018	1310	SO	X	X	X		H
B7A 17.5-19	B7A	17.5	19	5/2/2018	1245	SO	X	X	X		H
B7A 7.5-9	B7A	7.5	9	5/2/2018	1136	SO	X	X	X		H
B7A 11.5-13	B7A	11.5	13	5/2/2018	1153	SO	X	X	X		H
B7A 67.5-69	B7A	67.5	69	5/2/2018	1520	SO	X	X	X		H
B7D 71-72	B7A	71	72	5/2/2018	1530	SO	X	X	X		H
B7A 82.5-84	B7A	82.5	84	5/2/2018	905	SO	X	X	X		H

Comments/Instructions  
Turn-around time is 30 calendar days for rad analyses and 14 calendar days for all other analyses.  
Level IV data package unless otherwise specified

RELINQUISHED BY:  MATT KAPP  
RECEIVED BY: KELLI-JEAN SMITH  
Signature: Date: 5/4/18 Time: 1200  
ALS FC 5818 1212

RELINQUISHED BY:  
RECEIVED BY:





ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: STANTEC  
Project Manager: URS

Workorder No: 1805143  
Initials: K Date: 5/8/18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<u>NO</u>
2. Are custody seals on shipping containers intact?	<u>NONE</u>	YES	NO
3. Are Custody seals on sample containers intact?	<u>NONE</u>	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<u>YES</u>	NO
5. Are the COC and bottle labels complete and legible?		<u>YES</u>	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<u>YES</u>	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<u>YES</u>	<u>NO</u>
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<u>N/A</u>	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<u>N/A</u>	YES	NO
10. Is there sufficient sample for the requested analyses?		<u>YES</u>	NO
11. Were all samples placed in the proper containers for the requested analyses?		<u>YES</u>	NO
12. Are all samples within holding times for the requested analyses?		<u>YES</u>	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<u>YES</u>	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	<u>N/A</u>	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ____ dusting ____ moderate ____ heavy	Amount <u>N/A</u>	YES	NO
16. Were the samples shipped on ice?		YES	<u>NO</u>
17. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #1 #3 #4 RAD ONLY	YES	<u>NO</u>
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>75</u>			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <u>YES</u> / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

7) The airbill ripped while removing. I was able to retrieve a small sticker with the airbill number on it.

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 5/10/18

1805/43

15-0

0005 T 128 03 35 IC-1D 2889525  
ALS  
225 COMMENCE DR  
FORT COLLINS CO 80524-2762-25

G

128-4072

ETP-7  
780825058394  
PD:SP:100-Y

Qairbidit #

## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180524-1MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 18-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180692d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	-0.01 +/- 0.23	0.44	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180524-1LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 18-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180708d10

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	467 +/- 55	2	468.3	99.7	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 7.5-9

Lab ID: 1805163-8DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 227 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181008d03

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
13982-63-3	Ra-226	1.01 +/- 0.21		0.37		1.12 +/- 0.28		0.48		0.311	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1



## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 22.5-24

Lab ID: 1805163-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 218 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180785d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.24 +/- 0.26	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 87.5-89

Lab ID: 1805163-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 215 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180705d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.46 +/- 0.29	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 92.5-94

Lab ID: 1805163-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 221 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180691d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.83 +/- 0.24	0.40	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 37.5-39

Lab ID: 1805163-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 221 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180648d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.53 +/- 0.28	0.30	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 2.5-4

Lab ID: 1805163-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 237 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181007d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.13 +/- 0.28	0.48	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7D 25-26

Lab ID: 1805163-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 204 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180811d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.30 +/- 0.30	0.41	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 17.5-19

Lab ID: 1805163-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 212 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180786d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.30 +/- 0.27	0.40	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 7.5-9

Lab ID: 1805163-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 227 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180707d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.01 +/- 0.21	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 7.5-9

Lab ID: 1805163-8DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 227 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181008d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.12 +/- 0.28	0.48	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805163-1

Date Printed:

Tuesday, June 12, 2018

ALS -- Fort Collins

LIMS Version: 6.864

Page 1 of 1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 11.5-13

Lab ID: 1805163-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 220 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181250d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.15 +/- 0.29	0.50	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 67.5-69

Lab ID: 1805163-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 212 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180649d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.65 +/- 0.30	0.35	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7D 71-72

Lab ID: 1805163-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 202 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180792d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.57 +/- 0.33	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 82.5-84

Lab ID: 1805163-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 198 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180706d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.75 +/- 0.34	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1



# Gamma Spectroscopy Case Narrative

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## Stantec Consulting Services

NECR Jetty 2018 – 233001048

Work Order Number: 1805163

1. The following report consists of analytical results and supporting documentation for 12 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/18/2018 and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis on 06/08/2018 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/08/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. Sample volumes were insufficient to allow preparation of a duplicate. A duplicate analysis of sample 1805163-8 was performed in lieu of a prepared duplicate.
6. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
7. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

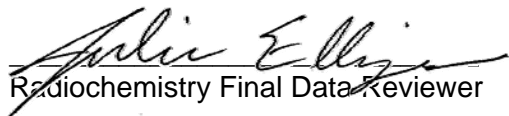


8. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
9. The requested MDC for Ra-226 was not met for sample 1805163-9. The reported activity for this sample exceeds the achieved MDC. Results are submitted without further qualification. The results are identified with an "M3" flag on the final report.
10. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Jean Anderson  
Radiochemistry Primary Data Reviewer

6/12/18  
Date

  
Radiochemistry Final Data Reviewer

6/15/18  
Date



## Section 1

# CHAIN OF CUSTODY

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

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**OrderNum:** 1805163

**Client Name:** Stantec Consulting Services


**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

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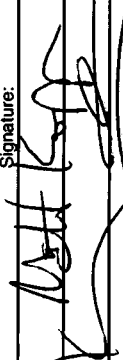
Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B7A 22.5-24	1805163-1		SOIL	03-May-18	13:00
B7A 87.5-89	1805163-2		SOIL	03-May-18	9:10
B7A 92.5-94	1805163-3		SOIL	03-May-18	9:25
B7A 37.5-39	1805163-4		SOIL	03-May-18	13:35
B7A 2.5-4	1805163-5		SOIL	02-May-18	11:30
B7D 25-26	1805163-6		SOIL	02-May-18	13:10
B7A 17.5-19	1805163-7		SOIL	02-May-18	12:45
B7A 7.5-9	1805163-8		SOIL	02-May-18	11:36
B7A 11.5-13	1805163-9		SOIL	02-May-18	11:53
B7A 67.5-69	1805163-10		SOIL	02-May-18	15:20
B7D 71-72	1805163-11		SOIL	02-May-18	15:30
B7A 82.5-84	1805163-12		SOIL	02-May-18	9:05

SAMPLER(S) PRINTED NAME AND SIGNATURE  
Matt Kapp  


PROJECT NAME: NECR Jetty 2018  
TASK ORDER:  
PROJECT NUMBER: 233001048  
Program: Borrow Soil Characterization

ANALYSIS REQUEST										Comments	SM*
SAMPLE ID	LOC ID	SBD	SED	DATE	TIME	MC*	Ra-226 (EPA 901.1 soils, pCi/g)	Total Uranium (EPA 6020, mg/kg)			
B7A 22.5-24	B7A	22.5	24	5/3/2018	1300	SO	X	X			H
B7A 87.5-89	B7A	87.5	89	5/3/2018	910	SO	X	X			H
B7A 92.5-94	B7A	92.5	94	5/3/2018	925	SO	X	X			H
B7A 37.5-39	B7A	37.5	39	5/3/2018	1335	SO	X	X			H
B7A 2.5-4	B7A	2.5	4	5/2/2018	1130	SO	X	X			H
B7D 25-26	B7A	25	26	5/2/2018	1310	SO	X	X			H
B7A 17.5-19	B7A	17.5	19	5/2/2018	1245	SO	X	X			H
B7A 7.5-9	B7A	7.5	9	5/2/2018	1136	SO	X	X			H
B7A 11.5-13	B7A	11.5	13	5/2/2018	1153	SO	X	X			H
B7A 67.5-69	B7A	67.5	69	5/2/2018	1520	SO	X	X			H
B7D 71-72	B7A	71	72	5/2/2018	1530	SO	X	X			H
B7A 82.5-84	B7A	82.5	84	5/2/2018	905	SO	X	X			H

Comments/Instructions  
Turn-around time is 30 calendar days for rad analyses and 14 calendar days for all other analyses.  
Level IV data package unless otherwise specified

RELINQUISHED BY:  MATT KAPP  
RECEIVED BY: KELLI-JEAN SMITH  
Signature: Date: 5/4/18 Time: 1200  
ALS FC 5818 1212

RELINQUISHED BY:  
RECEIVED BY:



ALS Environmental - Fort Collins  
CONDITION OF SAMPLE UPON RECEIPT FORM

Client: STANTEC  
Project Manager: URS

Workorder No: 1805143  
Initials: K Date: 5/8/18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<u>NO</u>
2. Are custody seals on shipping containers intact?	<u>NONE</u>	YES	NO
3. Are Custody seals on sample containers intact?	<u>NONE</u>	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<u>YES</u>	NO
5. Are the COC and bottle labels complete and legible?		<u>YES</u>	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<u>YES</u>	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<u>YES</u>	<u>NO</u>
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<u>N/A</u>	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<u>N/A</u>	YES	NO
10. Is there sufficient sample for the requested analyses?		<u>YES</u>	NO
11. Were all samples placed in the proper containers for the requested analyses?		<u>YES</u>	NO
12. Are all samples within holding times for the requested analyses?		<u>YES</u>	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<u>YES</u>	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	<u>N/A</u>	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ____ dusting ____ moderate ____ heavy	Amount <u>N/A</u>	YES	NO
16. Were the samples shipped on ice?		YES	<u>NO</u>
17. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #1 #3 #4 RAD ONLY	YES	<u>NO</u>
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: <u>75</u>			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <u>YES</u> / NO / NA (If no, see Form 008.)			

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

7) The airbill ripped while removing. I was able to retrieve a small sticker with the airbill number on it.

If applicable, was the client contacted? YES / NO / NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 5/10/18

1805/43

15-0

0005 T 128 03 35 IC-1D 2889525  
ALS COMMENCE DR  
225 COLLINS CO  
FORT COLLINS CO 80524-2762-25

G

128-4072

ETP-7  
780825058394  
PD:SP:100Y  
Givbdl #

## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180524-1MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 18-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180692d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	-0.01 +/- 0.23	0.44	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180524-1LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 18-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180708d10

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	467 +/- 55	2	468.3	99.7	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 7.5-9

Lab ID: 1805163-8DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 227 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181008d03

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
13982-63-3	Ra-226	1.01 +/- 0.21		0.37		1.12 +/- 0.28		0.48		0.311	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 22.5-24

Lab ID: 1805163-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 218 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180785d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.24 +/- 0.26	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 87.5-89

Lab ID: 1805163-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 215 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180705d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.46 +/- 0.29	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 92.5-94

Lab ID: 1805163-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 221 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180691d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.83 +/- 0.24	0.40	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 37.5-39

Lab ID: 1805163-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 221 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180648d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.53 +/- 0.28	0.30	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 2.5-4

Lab ID: 1805163-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 237 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181007d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.13 +/- 0.28	0.48	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7D 25-26

Lab ID: 1805163-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 204 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180811d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.30 +/- 0.30	0.41	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 17.5-19

Lab ID: 1805163-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 212 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180786d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.30 +/- 0.27	0.40	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 7.5-9

Lab ID: 1805163-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 227 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180707d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.01 +/- 0.21	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 7.5-9

Lab ID: 1805163-8DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 227 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181008d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.12 +/- 0.28	0.48	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805163-1

Date Printed:

Tuesday, June 12, 2018

ALS -- Fort Collins

LIMS Version: 6.864

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# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 11.5-13

Lab ID: 1805163-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 220 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181250d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.15 +/- 0.29	0.50	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

Date Printed: Tuesday, June 12, 2018

ALS -- Fort Collins

LIMS Version: 6.864

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# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 67.5-69

Lab ID: 1805163-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 212 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180649d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.65 +/- 0.30	0.35	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7D 71-72

Lab ID: 1805163-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 202 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180792d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.57 +/- 0.33	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805163

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B7A 82.5-84

Lab ID: 1805163-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 02-May-18

Date Prepared: 18-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-1

QCBatchID: GS180524-1-1

Run ID: GS180624-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 198 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180706d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.75 +/- 0.34	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805163-1



# Gamma Spectroscopy Case Narrative

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## Stantec Consulting Services

NECR Jetty 2018 – 233001048

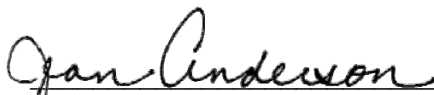
Work Order Number: 1805165

1. The following report consists of analytical results and supporting documentation for 12 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/21/2018 and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis on 06/11/2018 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/11/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.

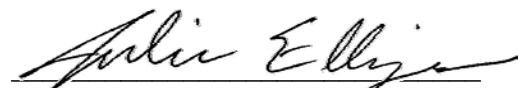


7. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
8. The requested MDC for Ra-226 was not met for samples 1805165-2, -3, -9, and -10. The reported activity for these samples exceeds the achieved MDC. Results are submitted without further qualification. The results are identified with an "M3" flag on the final report.
9. There are cases where the magnitude of negative activity is greater than the  $2\sigma$  TPU. Under typical conditions, where background data is normally distributed and analyzed by paired observations, this event is likely to occur at least 2.5% of the time. Review of the data does not indicate a problem with the instrument or reporting systems and results are reported without further qualification.
10. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

  
Jean Anderson  
Radiochemistry Primary Data Reviewer

6/12/18  
Date

  
Radiochemistry Final Data Reviewer

6/15/18  
Date

## Section 1

# CHAIN OF CUSTODY

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

---

**OrderNum:** 1805165

**Client Name:** Stantec Consulting Services

**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

---

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B4A 0-4	1805165-1		SOIL	30-Apr-18	15:40
B4A 7.5-9	1805165-2		SOIL	30-Apr-18	15:51
B4A 12.5-14	1805165-3		SOIL	30-Apr-18	15:58
B4A 17.5-19	1805165-4		SOIL	30-Apr-18	16:05
B4A 22.5-24	1805165-5		SOIL	30-Apr-18	16:12
B4A 27.5-29	1805165-6		SOIL	30-Apr-18	16:20
B4A 32.5-34	1805165-7		SOIL	30-Apr-18	16:28
B4A 37.5-39	1805165-8		SOIL	30-Apr-18	16:40
B4A 42.5-44	1805165-9		SOIL	30-Apr-18	16:47
B4A 47.5-49	1805165-10		SOIL	30-Apr-18	16:59
B4A 52.5-54	1805165-11		SOIL	01-May-18	8:45
B4D 41-42.0	1805165-12		SOIL	30-Apr-18	17:00





1805165

66

SHIP DATE: 04MAY18  
ACTWGT: 35.80 LB  
CAD: 112085956/WSX13300  
DIMMED: 15 X 12 X 12 IN  
BILL SENDER

UB05 1 128 03:37 PR-1D 2307478  
ALS  
225 COMMENCE DR  
FORT COLLINS CO  
80524-2762-25

G

128-4072

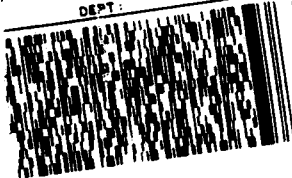
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780825122319

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J3)

80524

SF: MATT KAPP  
DEPT:



FedEx  
Ground

G

TRK# 7808 2512 2319

80524

00) 0 00 7808 2512 2319





## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180522-1MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180699d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	-0.23 +/- 0.19	0.42	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180522-1LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 17-May-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180714d10

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	464 +/- 54	2	468.3	99.0	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 0-4

Lab ID: 1805165-1DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 234 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180792d02

CASNO	Analyte	Sample				Duplicate				DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC	Flags		
13982-63-3	Ra-226	1.44 +/- 0.30		0.43		1.77 +/- 0.31		0.36		0.755	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halflives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 0-4

Lab ID: 1805165-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 226 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180818d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.44 +/- 0.30	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 0-4

Lab ID: 1805165-1DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 234 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180792d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.77 +/- 0.31	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805165-1

Date Printed:

Tuesday, June 12, 2018

ALS -- Fort Collins

LIMS Version: 6.864

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# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 7.5-9

Lab ID: 1805165-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 214 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181015d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.49 +/- 0.34	0.53	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 12.5-14

Lab ID: 1805165-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 192 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181257d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.61 +/- 0.38	0.64	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 17.5-19

Lab ID: 1805165-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 198 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180798d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.96 +/- 0.37	0.41	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 22.5-24

Lab ID: 1805165-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 188 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180711d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.58 +/- 0.33	0.44	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 27.5-29

Lab ID: 1805165-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 202 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180698d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.47 +/- 0.32	0.46	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 32.5-34

Lab ID: 1805165-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 197 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180713d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.59 +/- 0.27	0.37	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 37.5-39

Lab ID: 1805165-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 209 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180819d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.29 +/- 0.30	0.42	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805165-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 42.5-44

Lab ID: 1805165-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 194 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180793d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.24 +/- 0.31	0.52	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 47.5-49

Lab ID: 1805165-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 218 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181016d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.43 +/- 0.33	0.55	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4A 52.5-54

Lab ID: 1805165-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 01-May-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 225 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180799d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.80 +/- 0.32	0.38	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805165

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B4D 41-42.0

Lab ID: 1805165-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 30-Apr-18

Date Prepared: 17-May-18

Date Analyzed: 11-Jun-18

Prep Batch: GS180522-1

QCBatchID: GS180522-1-1

Run ID: GS180522-1A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 189 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180712d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.50 +/- 0.32	0.46	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805165-1



# Gamma Spectroscopy Case Narrative

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## Stantec Consulting Services

NECR Jetty 2018 – 233001048

Work Order Number: 1805166

1. The following report consists of analytical results and supporting documentation for 12 soil samples received by ALS on 05/08/2018.
2. These samples were prepared according to the current revision of SOP 739. The samples were sealed in steel cans on 05/18/2018 and stored for at least 21 days to allow  $^{222}\text{Rn}$  to approach secular equilibrium with its parent,  $^{226}\text{Ra}$ . The degree of ingrowth achieved prior to analysis on 06/08/2018 is at least 97.8%. Conservatively assuming a radon emanation efficiency of approximately 50%, the effective radon progeny ingrowth for these samples would be greater than 98.9%.
3. The samples were analyzed for the presence of gamma emitting radionuclides according to the current revision of SOP 713. The analyses were completed on 06/08/2018.
4. The results for these samples are reported on a “Dry Weight” basis in units of pCi/gram.
5. ALS has observed a reproducible low bias in  $^{226}\text{Ra}$  results (about -30% for the geometry in question) when using a mixed gamma source for the calibration of HPGe detectors for solid samples. This bias is eliminated by calibration using a NIST traceable  $^{226}\text{Ra}$  source in the same geometry and configuration as the samples.
6. The library used for calibration and analysis employs multiple peaks for the  $^{226}\text{Ra}$  progeny,  $^{214}\text{Pb}$  (352 and 295 keV) and  $^{214}\text{Bi}$  (609 and 1120 keV). Using these peaks avoids the use of the problematic  $^{226}\text{Ra}$  photopeak at 186 keV, which suffers from poorly resolvable interference from  $^{235}\text{U}$  at the same energy. Final activity results for  $^{226}\text{Ra}$  are calculated, using the uncertainty-weighted mean of the activities for the four photopeaks, by the Seeker gamma spectroscopy software assuming secular equilibrium.



7. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
8. There are cases where the sample density is less than the associated calibration standard density. Cases that exceed the limit of  $\pm 15\%$  of the density of the calibration standard are flagged with a 'G', denoting a significant density difference between the sample and calibration standard. Consequently, the results may be biased high for the flagged results in this work order. If requested, ALS can perform a transmission spike in order to estimate a magnitude of this bias. The results are reported without further qualification.
9. The requested MDC for Ra-226 was not met for samples 1805166-3, -4, -5, -5DUP, -11, and -12.. The reported activity for these samples exceeds the achieved MDC. Results are submitted without further qualification. The results are identified with an "M3" flag on the final report.
10. No further problems were encountered with either the client samples or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.

Jean Anderson  
Radiochemistry Primary Data Reviewer

6/12/18  
Date

Radiochemistry Final Data Reviewer

6/15/18  
Date

## Section 1

# CHAIN OF CUSTODY

# ALS -- Fort Collins

## Sample Number(s) Cross-Reference Table

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**OrderNum:** 1805166

**Client Name:** Stantec Consulting Services

**Client Project Name:** NECR Jetty 2018

**Client Project Number:** 233001048

**Client PO Number:** 233001048

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Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
B6A 17.5-19	1805166-1		SOIL	03-May-18	12:45
B6A 2.5-4	1805166-2		SOIL	03-May-18	11:40
B6A 22.5-24	1805166-3		SOIL	03-May-18	12:50
B6D 21-22	1805166-4		SOIL	03-May-18	12:55
B6A 4.5-6	1805166-5		SOIL	03-May-18	11:55
B6A 27.5-29	1805166-6		SOIL	03-May-18	13:00
B6A 62.5-64	1805166-7		SOIL	03-May-18	14:35
B6A 7.5-9	1805166-8		SOIL	03-May-18	12:00
B6A 32.5-34	1805166-9		SOIL	03-May-18	13:10
B6A 57.5.59	1805166-10		SOIL	03-May-18	14:05
B6A 12.5-14	1805166-11		SOIL	03-May-18	12:35
B6A 37.5-39	1805166-12		SOIL	03-May-18	13:20



18051660

STANTEC  
FED EX #: 1000-6314-D  
COC Number: 1000-6314-D  
COOLER # 4  
LAB: ALS  
LAB: ALS, 225 Commerce Drive, Fort Collins, Colorado 80524  
Phone: 970-212-2755  
Page 1 of 1

SAMPLER(S) PRINTED NAME AND SIGNATURE

Matt Kapp

Matt Kapp

PROJECT NAME: NECR Jetty 2018

TASK ORDER:

PROJECT NUMBER: 23801048

Program: Borrow Soil Characterization

ANALYSIS REQUEST

SAMPLE ID	LOC ID	SBD	SED	DATE	TIME	MC*	Ra-226 (EPA 901.1 soils, pCi/g)	Total Uranium (EPA 6020, mg/kg)	Comments	SM*
B6A 17.5-19	B6A	17.5	19	5/3/2018	1245	SO	X	X		H
B6A 2.5-4	B6A	2.5	4	5/3/2018	1140	SO	X	X		H
B6A 22.5-24	B6A	22.5	24	5/3/2018	1250	SO	X	X		H
B6D 21-22	B6A	21	22	5/3/2018	1255	SO	X	X		H
B6A 4.5-6	B6A	4.5	6	5/3/2018	1155	SO	X	X		H
B6A 27.5-29	B6A	27.5	29	5/3/2018	1300	SO	X	X		H
B6A 62.5-64	B6A	62.5	64	5/3/2018	1435	SO	X	X		H
B6A 7.5-9	B6A	7.5	9	5/3/2018	1200	SO	X	X		H
B6A 32.5-34	B6A	32.5	34	5/3/2018	1310	SO	X	X		H
B6A 57.5-59	B6A	57.5	59	5/3/2018	1405	SO	X	X		H
B6A 12.5-14	B6A	12.5	14	5/3/2018	1235	SO	X	X		H
B6A 37.5-39	B6A	37.5	39	5/3/2018	1320	SO	X	X		H

Comments/Instructions

Turn-around time is 30 calendar days for rad analyses and 14 calendar days for all other analyses.

Level IV data package unless otherwise specified

RELINQUISHED BY:	Signature: Matt Kapp	Print Name: MATT KAPP	Company Name/Title: STANTEC	Date: 5/4/18	Time: 1200
RECEIVED BY:			KELI-JEAN SMITH	5.8.18	1212
RELINQUISHED BY:					
RECEIVED BY:					

For Lab Use Only: Sample Condition Upon Receipt:

Legend

SBD: Sample Beginning Depth

SED: Sample Ending Depth (0 for gw)

LOC ID: Unique XY locator

\* Sampling Matrix Code (MC): SO=soil, WG=gw, WS=surface water, WQ=water QC, GS=soil gas/vapor

\* Sampling Method Code (SM): HA=Hand Auger, H=Hollow Stem Auger, EC=Encore Soil Sampler, SS=Split Spoon, G=Grab, B=Bailer, SA=Summa Passivated Air Canister

(for Equip. Blanks enter SM of associated samples, for Trip Blank enter "G") C=Composite

ORIGINAL: Send with sample (sign only in blue or black ink)

COPIES: Retained by Sampler, Sent to Office



**ALS Environmental - Fort Collins**  
**CONDITION OF SAMPLE UPON RECEIPT FORM**

Client: STANTEC  
Project Manager: URS

Workorder No: 1805146  
Initials: K Date: 5/8/18

1. Does this project require any special handling in addition to standard ALS procedures?		YES	<u>NO</u>
2. Are custody seals on shipping containers intact?	<u>NONE</u>	YES	NO
3. Are Custody seals on sample containers intact?	<u>NONE</u>	YES	NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<u>YES</u>	NO
5. Are the COC and bottle labels complete and legible?		<u>YES</u>	NO
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)		<u>YES</u>	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<u>YES</u>	<u>NO</u>
8. Are all aqueous samples requiring preservation preserved correctly? (excluding volatiles)	<u>N/A</u>	YES	NO
9. Are all aqueous non-preserved samples pH 4-9?	<u>N/A</u>	YES	NO
10. Is there sufficient sample for the requested analyses?		<u>YES</u>	NO
11. Were all samples placed in the proper containers for the requested analyses?		<u>YES</u>	NO
12. Are all samples within holding times for the requested analyses?		<u>YES</u>	NO
13. Were all sample containers received intact? (not broken or leaking, etc.)		<u>YES</u>	NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: ____ < green pea ____ > green pea	<u>N/A</u>	YES	NO
15. Do any water samples contain sediment? Amount of sediment: ____ dusting ____ moderate ____ heavy	Amount <u>N/A</u>	YES	NO
16. Were the samples shipped on ice?		YES	<u>NO</u>
17. Were cooler temperatures measured at 0.1-6.0°C?	IR gun used*: #1 #3 #4	RAD ONLY	YES <u>NO</u>
Cooler #: <u>1</u>			
Temperature (°C): <u>Amb</u>			
No. of custody seals on cooler: <u>0</u>			
External µR/hr reading: _____			
Background µR/hr reading: <u>12</u>			
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <u>YES</u> / NO / NA (If no, see Form 008.)			

**Additional Information:** PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

7) airbill not removable without ripping; was able to retrieve small sticker with the airbill number on it.

If applicable, was the client contacted? YES / NO NA Contact: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Project Manager Signature / Date: [Signature] 5/10/18

1805104

16-0

0805 T 128 03 17 IC-1D 2889525  
ALS  
225 COMMERCE DR  
FORT COLLINS CO

G

80524-2762-25

128-4072

ETP:7 PD:SP:100:Y  
780825148580

→ Airbill number

## Section 2



# **SAMPLE RESULTS SUMMARY**

**Due to the nature of gamma spectroscopy data, a summary report is not provided.**

**Please refer to the individual sample results in Section 4.**

## Section 3

# QC RESULTS SUMMARY

3

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Method Blank Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180524-2MB

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 24-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180651d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	-0.01 +/- 0.15	0.29	0.5	NA	U

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

DL - Decision Level

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Laboratory Control Sample(s)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Lab ID: GS180524-2LCS

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 24-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Final Aliquot: 215 g

Result Units: pCi/g

File Name: 180794d07

CASNO	Target Nuclide	Results +/- 2s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
13982-63-3	Ra-226	456 +/- 53	3	468.3	97.4	85 - 115	P,M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Minimum Detectable Concentration

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS1805166-1



# Gamma Spectroscopy Results

PAI 713 Rev 14

## Duplicate Sample Results (DER)

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 4.5-6

Lab ID: 1805166-5DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 243 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180793d07

CASNO	Analyte	Sample				Duplicate			DER	DER Lim
		Result +/-	2 s TPU	MDC	Flags	Result +/-	2 s TPU	MDC		
13982-63-3	Ra-226	78.5 +/-	9.3	0.9	M3	93 +/-	11	1	1.03	2.13

### Comments:

#### Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

#### Abbreviations:

TPU - Total Propagated Uncertainty

DER - Duplicate Error Ratio

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

Date Printed: Tuesday, June 12, 2018

ALS -- Fort Collins

LIMS Version: 6.864

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## Section 4

# INDIVIDUAL SAMPLE RESULTS

4

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 17.5-19

Lab ID: 1805166-1

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 206 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180812d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.69 +/- 0.35	0.50	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 2.5-4

Lab ID: 1805166-2

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 232 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180787d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.50 +/- 0.29	0.43	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 22.5-24

Lab ID: 1805166-3

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 189 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181009d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.27 +/- 0.32	0.53	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

Date Printed: Tuesday, June 12, 2018

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# Gamma Spectroscopy Results

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## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6D 21-22

Lab ID: 1805166-4

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 204 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181251d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.68 +/- 0.39	0.61	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 4.5-6

Lab ID: 1805166-5

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 247 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180650d05

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	78.5 +/- 9.3	0.9	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Duplicate Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 4.5-6

Lab ID: 1805166-5DUP

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 243 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180793d07

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	93 +/- 11	1	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805166-1

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# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 27.5-29

Lab ID: 1805166-6

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 180 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180707d08

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.75 +/- 0.35	0.48	0.5	NA	G

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 62.5-64

Lab ID: 1805166-7

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 242 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180693d09

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	0.75 +/- 0.22	0.41	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 7.5-9

Lab ID: 1805166-8

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 224 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180709d10

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	2.40 +/- 0.35	0.36	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 32.5-34

Lab ID: 1805166-9

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 206 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180813d01

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.16 +/- 0.28	0.39	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 57.5.59

Lab ID: 1805166-10

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 195 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 180788d02

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.04 +/- 0.26	0.44	0.5	NA	

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP  
Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.  
Y2 - Chemical Yield outside default limits.  
LT - Result is less than Requested MDC, greater than sample specific MDC.  
M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.  
M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty  
MDC - Sample specific Minimum Detectable Concentration  
BDL - Below Detection Limit  
DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 12.5-14

Lab ID: 1805166-11

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 185 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181010d03

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.48 +/- 0.36	0.61	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1

# Gamma Spectroscopy Results

PAI 713 Rev 14

## Sample Results

Lab Name: ALS -- Fort Collins

Work Order Number: 1805166

Client Name: Stantec Consulting Services

ClientProject ID: NECR Jetty 2018 233001048

Field ID: B6A 37.5-39

Lab ID: 1805166-12

Library: RA226.LIB

Sample Matrix: SOIL

Prep SOP: PAI 739 Rev 12

Date Collected: 03-May-18

Date Prepared: 24-May-18

Date Analyzed: 08-Jun-18

Prep Batch: GS180524-2

QCBatchID: GS180524-2-1

Run ID: GS180524-2A

Count Time: 30 minutes

Report Basis: Dry Weight

Final Aliquot: 189 g

Prep Basis: Dry Weight

Moisture(%): NA

Result Units: pCi/g

File Name: 181252d04

CASNO	Target Nuclide	Result +/- 2 s TPU	MDC	Requested MDC	DL	Lab Qualifier
13982-63-3	Ra-226	1.50 +/- 0.37	0.59	0.5	NA	M3

### Comments:

#### Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TP

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

#### Abbreviations:

TPU - Total Propagated Uncertainty

MDC - Sample specific Minimum Detectable Concentration

BDL - Below Detection Limit

DL - Decision Level

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS1805166-1