

**ATLANTIC COAST PIPELINE, LLC  
ATLANTIC COAST PIPELINE**

**and**

**DOMINION ENERGY TRANSMISSION, INC.  
SUPPLY HEADER PROJECT**

**Implementation Plan**

**EC51 Attachment 1**

**Geotechnical Investigation Reports**

26 May 2017  
TXG0007-012-6302

**VIA EMAIL**

Colin Olness, Contractor  
Atlantic Coast Pipeline  
99 Edmiston Way  
Buckhannon, WV 26201

**Subject: Geotechnical Investigation at Potential Slope Instability Site  
Supply Header Project (SHP) – Atlantic Coast Pipeline Project  
Route Revision 11B, Segment TL-635, MP 2.8  
Doddridge County, West Virginia**

Dear Mr. Olness:

This data summary report has been prepared by Geosyntec Consultants, Inc. (Geosyntec) for Dominion Transmission, Inc. (DTI) to present the geotechnical drilling investigation performed at a geohazard site located at Milepost (MP 2.8) along the Supply Header Project (SHP) TL-635 Segment of the Atlantic Coast Pipeline (ACP) Route Revision 11B (Project; Figure 1). The objective of this geotechnical drilling investigation was to characterize the subsurface conditions at the site and confirm or preclude suspected slope instability identified as part of our Phase 2 investigation [Geosyntec, 2016]<sup>1</sup>, so that if required, measures may be designed to mitigate the effects of potential ground movement on the pipeline. This report summarizes activities completed in the field, a description of the geologic conditions observed at the site, and provides the results of the geotechnical laboratory testing program.

## **GEOTECHNICAL INVESTIGATION**

This geotechnical drilling investigation included a site reconnaissance, access road improvements, geotechnical borings, instrumentation installation and monitoring, and geotechnical laboratory testing.

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<sup>1</sup> Geosyntec Consultants, 2016. "Geohazard Analysis Program Phase 2 Report, Atlantic Coast Pipeline and Supply Header Project", submitted to Dominion Transmission Inc. dated 29 July 2016.

## **Site Reconnaissance**

Our field reconnaissance performed on 24 August 2016 consisted of a site visit by a Principal Engineering Geologist from Geosyntec, two representatives from Horn and Associates (drilling subcontractor), and two representatives from the ACP to evaluate existing site conditions and access to the identified geohazard site location. The objective of the field reconnaissance was to familiarize the drilling contractor with the site conditions, identify potential access routes, evaluate the number and type of exploratory borings needed to adequately characterize the site, and select locations for the exploratory borings in the field.

## **Health and Safety**

Prior to conducting our field investigation, Geosyntec updated our existing site-specific Health and Safety Plan (HASP) in accordance with Occupational Safety & Health Administration (OSHA) requirements. The updated HASP addressed potential hazards at the two site locations, including requirements for worker protection based on the anticipated activities. Additionally, the HASP also included directions to nearest emergency medical facility. Prior to commencing work at the site, Geosyntec also delineated the locations of the individual explorations and notified Underground Service Alert (USA, Dig-Alert) to identify the locations of any existing underground utilities within the immediate vicinity.

## **Site Access and Improvements**

Access routes to the drilling locations at SHP MP 2.8 traversed Johnson Fork and followed pre-existing logging roads. Due to the remote locations of the investigation site, minor grading and road restoration activities were performed where no previous access existed. Road restoration and grading work was performed by Horn and Associates utilizing a John Deere 85D tracked excavator. Work consisted of trimming secondary vegetation growth, smoothing the ground surface, and localized widening and leveling where cross-slope conditions would not permit safe passage of a light weighted track mounted drill rig.

Where ground disturbance was required, erosion and sediment control Best Management Practices (BMPs) were implemented to minimize the potential for erosion and/or sediment transport to adjacent areas outside the limits of disturbance. BMPs consisted of 8-inch silt socks installed along the edge of the graded access roads and the drilling investigation pads. Upon completion of drilling activities, straw and seed were hand broadcasted along the surface of graded areas to help reduce erosion and sediment transport and promote vegetative growth. A photographic log documenting completed road improvement and site restoration activities is provided in Appendix A.

### Subsurface Explorations

This geotechnical investigation included drilling three exploratory borings at the SHP MP 2.8 geohazard site location along the northwestern facing slope (designated Borings B-1, B-2, and B-3; Figure 1). Borings were drilled between 25.5 and 34.1 feet below ground surface (ft bgs). Table 1 presents the coordinates, ground surface elevations, and termination depths of Borings B-1, B-2, and B-3.

**Table 1:** Coordinates of Boring Locations

Boring ID	Coordinates – UTM, Zone 17S, NAD83				Ground Surface Elev. WGS84 (MSL-ft)	Final Depth (ft)
	Proposed		As-Built			
	Latitude	Longitude	Latitude	Longitude		
B-1	39.200558	-80.590574	39.200598	-80.590640	1,236	25.5
B-2	39.200757	-80.590901	39.200751	-80.590948	1,213	32.3
B-3	39.201017	-80.591118	39.201056	-80.591168	1,148	34.1

The borings were advanced by Horn and Associates of Winchester, Kentucky utilizing a light-weight rubber track mounted Diedrich D-50 drill rig. Borings were drilled using a combination of 8-inch hollow-stem auger (HSA) and core drilling (NX) methods. During HSA drilling, drive samples were collected at approximately 30-inch intervals using a 2.5-inch diameter, 24-inch long Standard Penetration Test (SPT) sampler to facilitate lithologic logging and sample collection for geotechnical laboratory testing. SPT sampling was performed through the entire overburden material profile and into underlying bedrock, to the extent practical.

Following auger or SPT refusal, or upon encountering competent formation (bedrock) material, the investigations switched to core drilling methods until the borehole was advanced approximately 15 feet into bedrock. The core drilling process required circulation of water mixed with a naturally occurring bentonite based drilling fluid additive to regulate the temperature of the core bit, to carry cuttings to the surface, and to promote borehole stability. During the coring process, drilling fluid was pumped through the drill rods and past the bit before returning to the surface with cuttings through the annular space between the drill rods and the wall of the boring. At the surface, the fluid and cuttings were discharged into a baffled sump tank to allow the cuttings to fall out prior to recirculating the drilling fluid back down the borehole. Water required for this process was pumped from a nearby creek source located downslope along Johnson Fork.



The soil sample descriptions were logged by a Geosyntec Geologist in accordance with ASTM D2488. Additionally, recovered cores were logged to record structural orientation and discontinuities. Upon completion of logging, the cores were photographed (Appendix B) and retained in core boxes for subsequent sample selection and/or archiving. Table 2 summarizes the length of each boring, depth to top of bedrock, and the length of rock coring.

**Table 2:** Soil Thickness, Length of Rock Coring and Boring Penetration Depths

<b>Boring ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to top of Bedrock (ft)</b>	<b>Length of Rock Coring (ft)</b>
B-1 (SHP MP 2.8)	25.5	11.0	14.5
B-2 (SHP MP 2.8)	32.3	17.0	15.3
B-3 (SHP MP 2.8)	34.1	19.0	15.1

### **Geotechnical Instrumentation**

Following completion of the core drilling and evaluation of the subsurface conditions, boreholes were selected for instrumentation consisting of either a standpipe piezometer to monitor groundwater levels, or an inclinometer to record potential slope movement over time. Borings not selected for instrumentation were backfilled from the bottom up with a bentonite-cement grout using a tremie pipe.

#### **Piezometer**

One standpipe piezometer was installed in exploratory Boring B-3 at the SHP MP 2.8 investigation site. The piezometer consisted of a 2-inch diameter PVC pipe, installed after drilling and prior to auger withdrawal, with a 10 ft section of 0.010-inch slotted screen (screened interval) placed at the overburden material and bedrock interface. The annular space around the screened interval was backfilled with a permeable filter pack generally consisting of coarse-grained sand. A 2-foot bentonite seal was placed at the top of the filter pack, and the remainder of the annular space was backfilled with bentonite-cement grout to prevent conveyance of surface water into the ground. Standpipe piezometer construction logs for the piezometer installed at Boring B-3 are provided in Appendix C and summarized in Table 3a.

Depth to groundwater within the Boring B-3 temporary standpipe piezometer was measured at 21.89 ft bgs on 18 October 2016 approximately 96 hours after drilling. A subsequent groundwater level survey was performed on 13 December 2016 and depth to groundwater was recorded at 18.35 ft bgs. This subsequent measurement is considered to represent relatively stabilized levels, however, the subsurface materials at the site generally exhibits a relatively high percentage of silt and clay sized materials, which reduce permeability. It is possible that the observed groundwater levels in the temporary piezometers may not represent fully stabilized

groundwater conditions due to the time rate of travel of groundwater through these materials. The measurements indicate that depth to groundwater decreased approximately 3.54 ft between 18 October 2016 and 13 December 2016. A summary of the standpipe piezometer data is provided below in Table 3a and presented graphically in Figure 2.

**Table 3a:** Standpipe Piezometer Construction

<b>Piezometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Depth to Groundwater<sup>1</sup> (ft bgs)</b>	<b>Depth to Top of Screen (ft)</b>	<b>Screen Length (ft)</b>	<b>Depth to Bentonite Seal (ft)</b>
B-3 (SHP MP 2.8)	34.1	19.0	18.35	22.9	10	6

**Notes:**

1 - Depth to groundwater measured on 13 December 2016.

The surface completion for the piezometer included a locked surface monument to provide access for periodic groundwater level measurements, as well as to be used as a benchmark for subsequent level surveys. The temporary standpipe piezometer is anticipated to be monitored through pipeline construction, if deemed necessary. Upon completion of monitoring, the PVC piezometer should be cutoff below the ground surface and backfilled with bentonite-cement grout.

**Inclinometer**

One inclinometer was installed in exploratory Boring B-2 at the SHP MP 2.8 geohazard site to monitor the absence or the presence of progressive slope movement that may be imperceptible to the eye. Inclinometer casing consisted of 2.75-inch diameter acrylonitrile butadiene styrene (ABS) plastic. The bottom of the inclinometer casing was installed at 32.3 ft bgs. The annular space between the wall of the boring and the inclinometer casing was backfilled with a lean cement grout mixture from the bottom up using a tremmie pipe. Construction logs for the inclinometer installed at SHP MP 2.8 are provided in Appendix C and summarized in Table 3b.

Following instrumentation installation, an initial baseline survey (i.e., zero reading) was performed on 18 October 2016. The grouted-in inclinometer was allowed 5 days to set prior to conducting the baseline reading. A subsequent inclinometer survey was collected on 13 December 2016, 56 days following the zero reading. The inclinometer survey measurements indicate a cumulative deflection of less than 0.05 inches during the time between the zero reading and the subsequent inclinometer survey, and is considered negligible given the accuracy of the survey equipment. A summary of the inclinometer survey data is provided below in Table 3b and presented graphically in Figure 3.

**Table 3b:** Inclinometer Casing Construction

<b>Inclinometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth of Inclinometer Casing (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Length of Stickup above Ground Surface (ft)</b>
B-2 (SHP MP 2.8)	32.3	32.3	17	3.0

The surface completion for the inclinometer included a locked surface monument to provide access for periodic monitoring as well as to be used as a benchmark for subsequent level surveys. The inclinometer is expected to be monitored through construction, if deemed necessary. Upon completion of monitoring, the inclinometer casing should be cut off below the ground surface and backfilled with bentonite-cement grout.

**SITE CONDITIONS**

Knowledge of the site conditions was developed from a review of regional geologic conditions and our findings from explorations performed for this investigation.

**Geologic Setting**

The SHP MP 2.8 investigation site lies within the northeastern margin of the Appalachian Plateau Physiographic Province of West Virginia. The Appalachian Plateau is an uplifted tract of nearly horizontal or gently folded strata extending from the Adirondacks in northern New York, southwest through Pennsylvania, and terminating at the Coastal Plain in Alabama. The Appalachian Plateau feature is a southeast-facing escarpment bounded by the Central Lowland Province to the west and the Valley and Ridge Province to the east. The general site area is located within the Kanawha Physiographic Section. This section, also referred to as the Unglaciated Allegheny Mountains, exhibits high-elevation, low relief plateau-like morphology and is thoroughly dissected by streams with a dendritic drainage pattern and rugged topography.

The Doddridge County area is locally underlain by an approximately 1,100-ft thick sequence of Paleozoic sedimentary rocks of the Dunkard Group. The Dunkard Group is composed of Pennsylvanian-age non-marine cyclic sequences of lithic and micaceous sandstone, siltstone, red and gray shale, claystone and mudstone, limestone, and thin coal beds. During the Pennsylvanian, sedimentary rocks of the Dunkard Group were deposited within the Appalachian Basin following several major marine regressive cycles. Sedimentary rocks were deposited as a series of cyclothems representing landscape positions proximal to active streams. Deposition of sedimentary rocks ceased during early Permian age and were subsequently uplifted and faulted during the Appalachian Orogeny. Upper strata within the Dunkard Group are more resistant to weathering, resulting in decreased erosional processes.

## **Surface Conditions**

The SHP MP 2.8 investigation site is located off of Johnson Fork along the proposed SHP TL-635 Segment, where the alignment extends up a steep northwestern facing slope. The general site area currently consists of vegetated woodlands with localized residential development in close proximity, but outside the proposed pipeline corridor. The surface morphology along the proposed alignment is characterized by moderate to steep sloping terrain (30% to 58% inclination) with intermittent benches from previous logging activities which break up the steep slope faces. The natural hillsides along the proposed alignment are covered by moderate growth of low lying grasses, shrubs, and deciduous woodlands. An existing natural gas well pad is located outside the proposed pipeline corridor approximately 900 feet northeast of the boring locations on Johnson Fork. Additionally, several below ground gas lines were identified in the area by a Dominion utility locator crew, but do not traverse the geotechnical investigation site area.

The elevation at Boring B-3 is approximately 1,148 feet above mean sea level (ft msl) sloping upwards towards the southeast along the proposed pipeline alignment. The elevations at Borings B-1 and B-2 are approximately 1,236 and 1,213 ft msl, respectively, and sloping upwards towards an unnamed ridgeline at SHP MP 2.7 (southeast). The maximum elevation at SHP MP 2.7 along the proposed alignment is approximately 1,500 ft msl.

## **Subsurface Conditions**

The subsurface conditions at SHP MP 2.8 consist of surficial landslide deposits, generally comprised of reddish brown-to-brown, lean clay and silt with sand and gravel overlying bedrock of the Pennsylvanian-age Dunkard Group. Thickness of the landslide deposits observed in the borings at the SHP MP 2.8 geohazard site ranged from 11 ft (Boring B-1), 17 ft (Boring B-2), and 19 ft (Boring B-3). The identified landslide deposits were characterized by remolded and re-worked intervals observed in each of the three borings indicating evidence of a potential historical landslide.

Bedrock of the Pennsylvanian-age Dunkard Group observed in the borings at SHP MP 2.8 consist of dark greenish gray-to-gray interbedded micaceous shale and sandstone. Recovered rock cores were generally thinly bedded (10° to 30° bedding angles) and closely fractured (10° to 20° fracture angles). Recovered cores were also variably weathered consisting of iron oxidation infilling along the fracture planes. A generalized geologic cross section along the slope profile is presented in Figure 1. The rock quality designation (RQD) of the recovered cores was generally fair to excellent ranging from 71% to 78% (Boring B-1), 70% to 72% (Boring B-2), and 63% to 92% (Boring B-3). Detailed logs of the three borings advanced at the SHP MP 2.8 site, as well as a key sheet, are presented in Appendix D.

Conditions observed in the borings at the SHP MP 2.8 geohazard site along with the surface morphology features (i.e., moderate to steep sloping terrain and intermittent breaks in the slope faces) suggests the site experienced previous slope instability and subsequent episodic slope movement along the interface between the fine grained colluvial deposits and highly weathered bedrock. However, no evidence of recent active failure such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation.

## **LABORATORY TESTING**

### **Geotechnical Laboratory Testing Program**

Geosyntec contracted Geotechnics, Inc. (Geotechnics) of East Pittsburgh, Pennsylvania to conduct laboratory testing assigned by Geosyntec on selected soil samples and rock cores to evaluate the pertinent geotechnical index properties. The laboratory testing program, on soil samples, was primarily focused on soil classification and index testing. Testing on select rock cores focused on compressive and tensile strength. The laboratory testing program consisted of:

#### Soil Samples

- Water content tests per ASTM D2216;
- Atterberg limit tests per ASTM D4318;
- Sieve analysis tests per ASTM D6913; and
- Hydrometer tests per ASTM D7928.

#### Rock Cores

- Split tensile strength test per ASTM D3967; and
- Unconfined compression test per ASTM D7012-Method C.

Table 4 summarizes the number and types of laboratory testing conducted on soil and rock samples from the SHP MP 2.8 geohazard site.

**Table 4:** Number and Types of Laboratory Tests

Types of Laboratory Tests	Number of Laboratory Tests		
	Boring B-1	Boring B-2	Boring B-3
Water Content	3	3	3
Atterberg Limits	1	2	2
Sieve Analysis	1	2	2
Hydrometer Test	1	2	2
Rock Split Tensile Strength	3	0	3
Rock Uniaxial Compressive Strength	1	0	1

### Laboratory Test Results

The laboratory test results are also plotted in the corresponding boring logs (Appendix D), and the individual test results presented in detail in Appendix E.

### Soil Sample Testing

Given the granular nature of the soils from SHP MP 2.8, select samples were tested for grain-size distribution to quantify percentages of gravels, sands and fines. The results show that the soils consist of lean clay (CL) with sand and gravel, with the exception of one sample (B-2-6 at 14.8 ft bgs), which consists of clayey sand (SC) with gravel.

The laboratory soil testing performed for the SHP MP 2.8 borings included water content and Atterberg limits measured on selected lean clay and silt samples and grain-size analysis to quantify the percentages of gravel, sand and fines, particularly on samples containing coarser grained material. Table 5 presents a summary of the laboratory test results conducted on soil samples.

**Table 5:** Summary of Laboratory Test Results on Soil Samples

Boring ID	Sample ID	Depth (ft)	Water Content (%)	Percent of Gravel (1) (%)	Percent of Fines (2) (%)	Liquid Limit	Plastic Limit	Plasticity Index
B-1	B-1-1	2.3	15.3	-	-	-	-	-
B-1	B-1-3	7.0	15.8	0.0	94.7	42	23	19
B-1	B-1-4	8.8	7.8	-	-	-	-	-
B-2	B-2-1	2.5	21.8	0.21	76.1	39	21	18
B-2	B-2-3	7.5	17.3	-	-	-	-	-
B-2	B-2-6	14.8	4.6	21.0	45.0	30	19	11
B-3	B-3-1	3.0	13.8	18.9	56.7	35	20	15
B-3	B-3-3	7.7	9.4	-	-	-	-	-
B-3	B-3-6	15.5	11.4	4.3	60.3	33	19	14

**Notes:**

- 1 - Retained #4 sieve.
- 2 - Passing #200 sieve.
- “-“ Not analyzed

**Rock Core Testing**

A summary of laboratory test results conducted on rock samples is presented in Table 6.

**Table 6:** Summary of Laboratory Test Results on Rock Samples

Boring ID	Core ID	Sample Interval (ft)	Unit Weight (pcf)	Uniaxial Compres. Strength (psi)	Split Tensile Strength (psi)		
					Specimen 1	Specimen 2	Specimen 3
B-1	R-2	20.2-21.3	162.9	6,790	967.5	880.6	798.5
B-3	R-1	20.3-21.3	151.9	8,810	649.4	654.6	664.4

**Summary of Laboratory Testing**

The geotechnical laboratory test results indicate that water content of the landslide deposits varied between 8% and 16% (Boring B-1), 5% and 22% (Boring B-2), and 9% and 14% (Boring

B-3). The water content at the time of the field investigation showed a decreasing trend with depth. The sieve analyses indicate that the landslide deposits have approximately 45% to 95% fine-grained particles (particles smaller than 75 micrometers [ $\mu\text{m}$ ]) and approximately 10% to 41% clay particles (particles smaller than 5  $\mu\text{m}$ ). The Atterberg test results show that the landslide deposits contain a plasticity index (PI) of 8 to 11 and the soil unit is mainly within the low plasticity clay zone (i.e., CL). The PI is generally constant with depth within the low plasticity clay soil unit.

The split tensile strength of the recovered rock cores varied between 798.5 and 967.5 pounds per square inch (psi) for samples consisting of primarily shale material (core R-2) and between 649.4 and 664.4 psi for samples consisting of primarily sandstone (core R-1). The unconfined compression strength of the recovered rock core was 6,790 psi for shale material (core R-2) and 8,810 psi for sandstone material (core R-1).

## **SUMMARY OF FINDINGS**

Surficial morphologic features observed during our Phase 2 reconnaissance along with subsurface conditions recorded during the geotechnical drilling investigation at the SHP TL-635 MP 2.8 geohazard site suggest previous shallow seated slope movement occurred downslope along the proposed ACP alignment. The approximate extent of mapped instability is presented in Figure 1. Although no evidence of recent or active slope movement such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation, data collected during subsequent inclinometer monitoring events will be used to supplement and inform site-specific engineering evaluations, and recommendations for mitigation measures should future potential instability be identified. An addendum to this data summary report will be issued as subsequent monitoring data is collected.

As a consequence of these findings, and a subsequent engineering analysis of slope stability, reported separately, a site specific geotechnical hazard mitigation design has been developed for this slope which incorporates:

- restrictions on material stockpiling during construction grading;
- targeted drainage measures along the trench;
- use of deformable backfill around the installed pipeline; and,
- recommendations for post construction monitoring.



## CLOSING

Geosyntec appreciates the opportunity to provide Dominion Transmission, Inc. with this data summary report, and we look forward to working together on this important project. If you have any questions or require additional information, please contact Logan Brant ([lbrant@geosyntec.com](mailto:lbrant@geosyntec.com), 281.810.5056) or Jared Warner ([jwarner@geosyntec.com](mailto:jwarner@geosyntec.com), 858.716.2885).

Sincerely,

Geosyntec Consultants,



Logan Brant, Ph.D., P.E.  
Senior Geotechnical Engineer



Jared Warner, P.G.,  
Project Geologist

## Attachments:

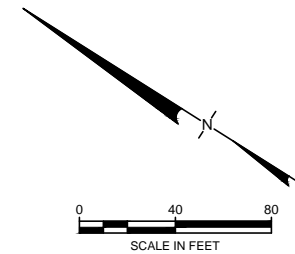
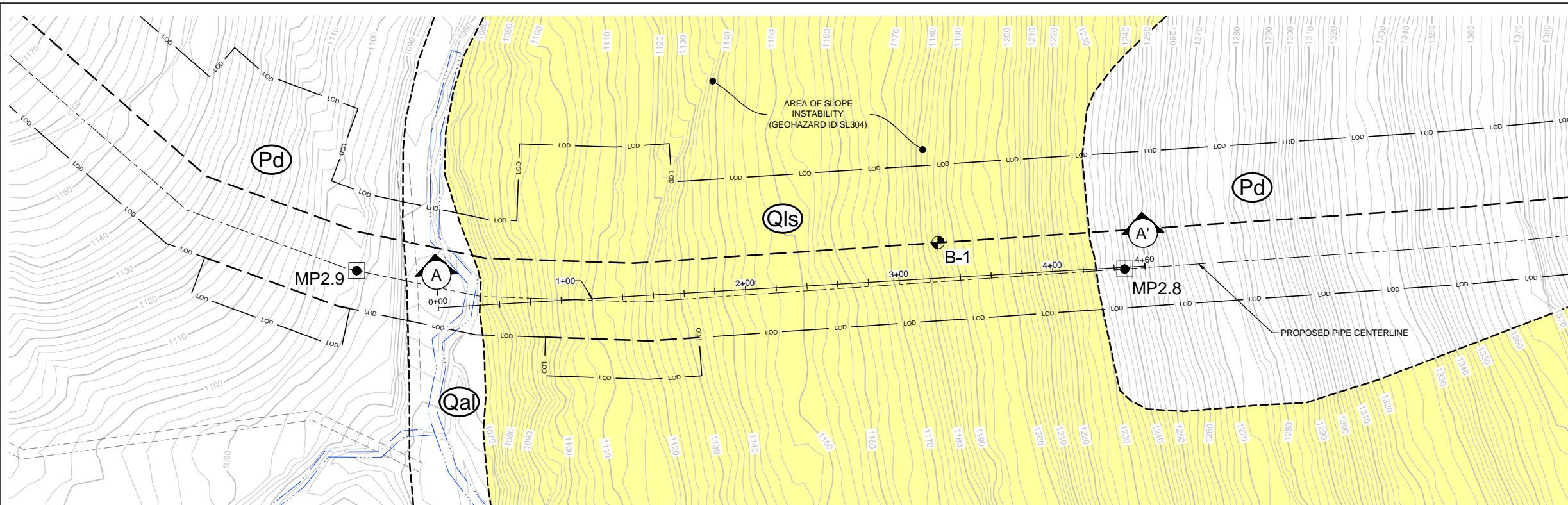
### Figures

- Figure 1 – Site Plan and Generalized Geologic Profile
- Figure 2 – Piezometer Survey Data
- Figure 3 – Inclinator Survey Data

### Appendices

- Appendix A – Photographic Log
- Appendix B – Core Photographs
- Appendix C – Piezometer and Inclinator Construction Logs
- Appendix D – Logs of Borings B-1, B-2, and B-3
- Appendix E – Laboratory Test Results

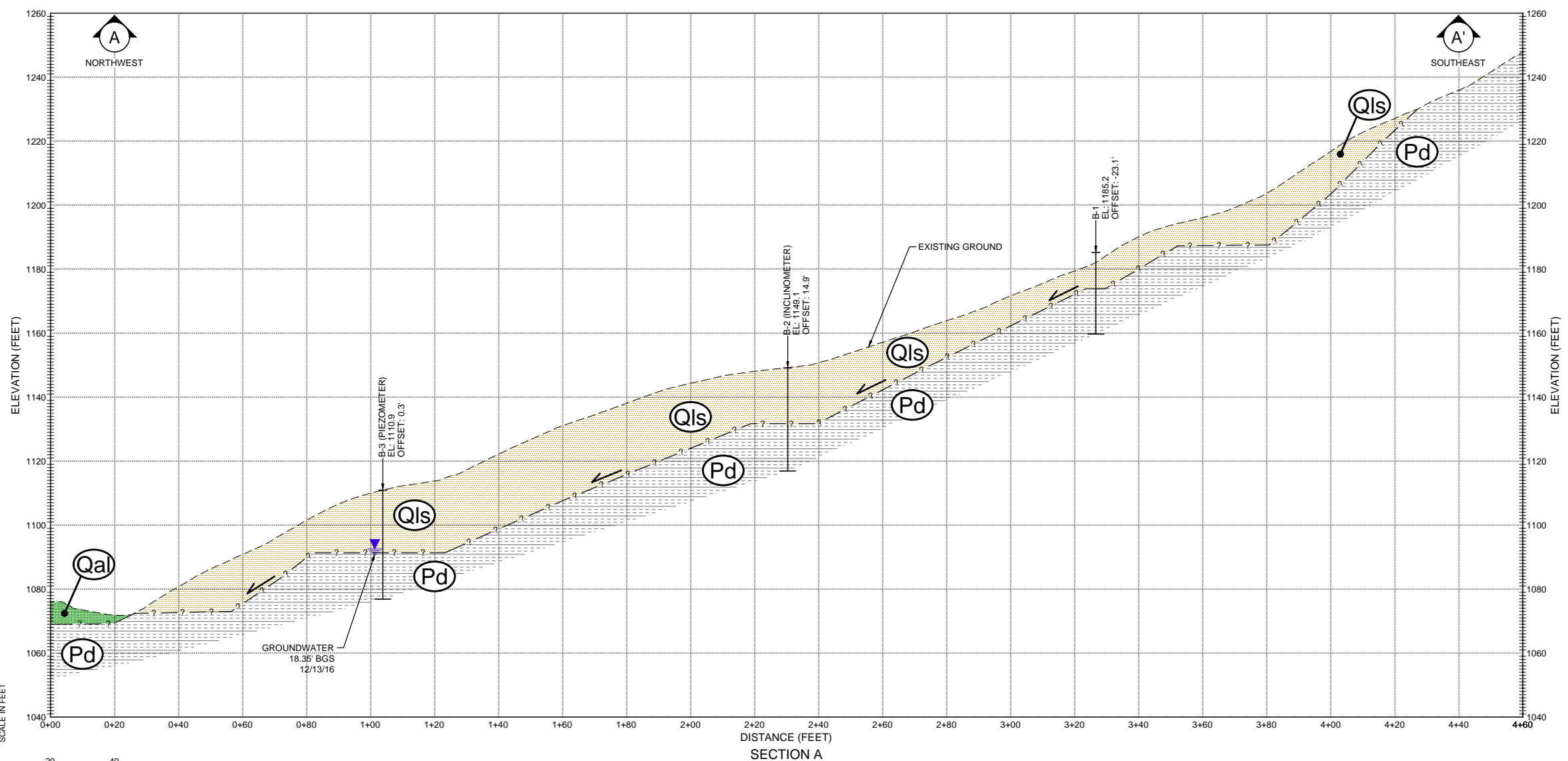
# **FIGURES**



**LEGEND**

	EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
	EXISTING STREAM LINE
	ACCESS ROAD
	LIMIT OF DISTURBANCE
	PERMANENT (ROW)
	PROPOSED PIPE CENTERLINE
	MILEPOST
	BORING LOCATION (GEOSYNTEC, 2017)
	AREA OF SLOPE INSTABILITY (GEOHAZARD ID SL304)
	LITHOLOGIC CONTACT

- NOTES:**
- MAPPING AND TOPOGRAPHY BASED ON UTM COORDINATE SYSTEM WITH NAD83 DATUM, ZONE 17, US SURVEY FOOT, CENTRAL MERIDIAN 81 W.
  - LIDAR ELEVATION DATA AND TOPOGRAPHIC FEATURES COLLECTED IN 2016 AND PROVIDED BY GAI AS 2-FOOT CONTOURS.
  - STREAM AND WETLAND DATA PROVIDED BY NRG/ERM.



**GEOLOGIC PROFILE LEGEND**

	EXISTING GROUND SURFACE
	LITHOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
	LANDSLIDE DEPOSITS
	DUNKARD GROUP
	ALLUVIUM
	APPROXIMATE DIRECTION OF LANDSLIDE
	WATER LEVEL 12/13/16

**SITE PLAN AND GENERALIZED GEOLOGIC PROFILE  
ACP SHP MP 2.8**



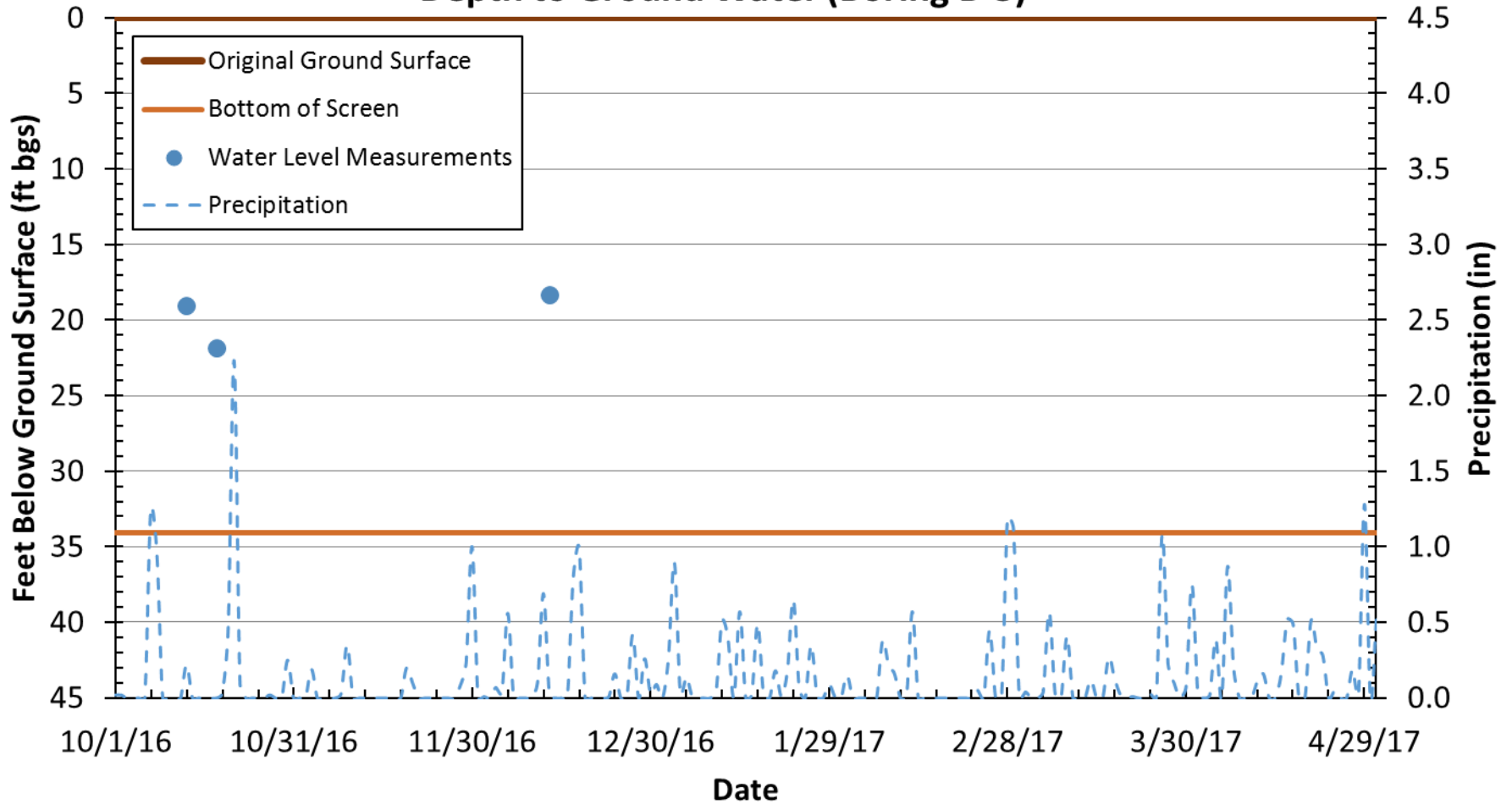
PROJECT NO: TXG0007

MAY 2017

**FIGURE  
1**

F:\CADD\PROJECTS\ATLANTIC COAST PIPELINE\GEOHAZARD ANALYSIS\INVESTIGATION DESIGN\ SERVICE SITE DESIGN\TXG0007\FIGURES\TXG0007\_01

### Depth to Ground Water (Boring B-3)



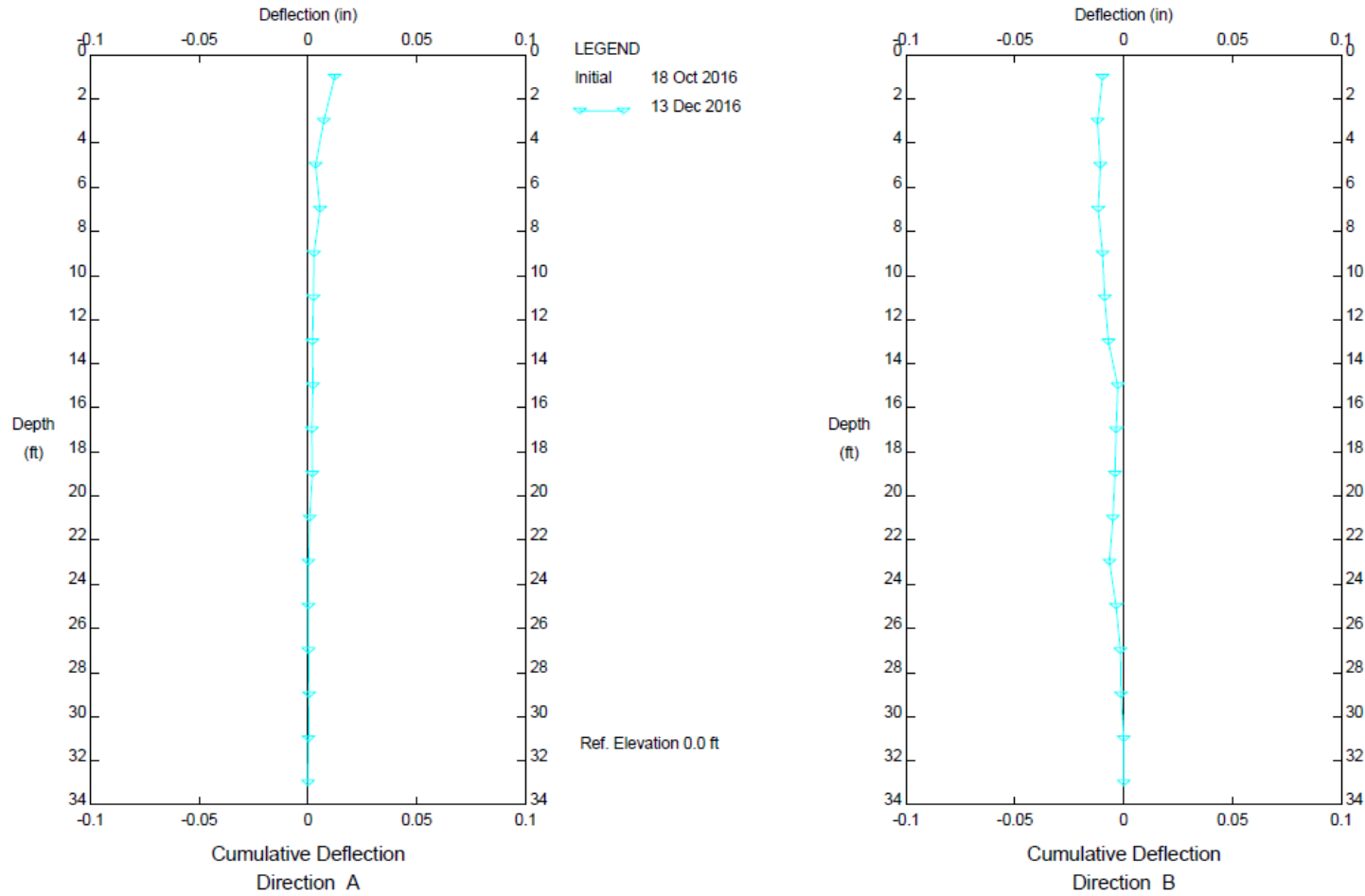
**Notes:** Precipitation data obtained from weather station located in Clarksburg, West Virginia.  
Reference: [www.wunderground.com](http://www.wunderground.com)

**Piezometer Survey Data (Boring B-3)**

Project: ACP SHP MP 2.8  
Location: Doddridge County, West Virginia  
Project Number: TXG0007-012-6302  
Client: Dominion Transmission, Inc.

**Figure 2**

Geosyntec Consultants - Houston TX



Mid Slope, Inclinometer B-2

Note: See inclinometer installation record for additional information.

**Inclinometer Survey Data (Boring B-2)**

Project: ACP SHP MP 2.8  
Location: Doddridge County, West Virginia  
Project Number: TXG0007-012-6302  
Client: Dominion Transmission, Inc.

**Figure 3**

**APPENDIX A**  
**PHOTOGRAPHIC LOG**



**APPENDIX A – PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP MP 2.8 Drill Site**  
**October 11 through 14 2016**



**Photograph 1 - (before work)**

**Location:** Abandoned Logging Trail  
(access to SHP MP 2.8)

View looking northwest. Photo shows pre-existing conditions along the existing abandoned logging trail.



**Photograph 2 - (during work)**

**Location:** Abandoned Logging Trail  
(access to SHP MP 2.8)

View looking northwest. Photo shows site conditions during temporary access route improvement activities along the existing abandoned logging trail.



**Photograph 3 - (after work)**

**Location:** Abandoned Logging Trail  
(access to SHP MP 2.8)

View looking northwest. Photo shows site conditions following drilling and restoration activities of temporary access route including casting seed in locations covered by locally sourced straw.



**APPENDIX A – PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP MP 2.8 Drill Site**  
**October 11 through 14 2016**



**Photograph 4 - (during work)**

**Location:** SHP MP 2.8 (Boring B-1)

View looking southwest. Photo shows site conditions during drilling activities at SHP MP 2.8 Boring B-1.



**Photograph 5 – (after work)**

**Location:** SHP MP 2.8 (Boring B-1)

View looking southwest. Photo shows site conditions at SHP MP 2.8 Boring B-1 following drilling activities. Restoration activities included casting of seed mix in locations covered by locally sourced straw.



**Photograph 6 – (during work)**

**Location:** SHP MP 2.8 (Boring B-2)

View looking southwest. Photo shows site conditions during drilling activities at SHP MP 2.8 Boring B-2.





**Photograph 7 - (after work)**

**Location:** SHP MP 2.8 (Boring B-2)

View looking southwest. Photo shows site conditions along with locked inclinometer cover at SHP MP 2.8 Boring B-2 following drilling activities. Restoration activities included casting of seed mix in locations covered by locally sourced straw.



**Photograph 8 – (during work)**

**Location:** SHP MP 2.8 (Boring B-3)

View looking northeast. Photo shows site conditions following drilling activities and standpipe piezometer construction at SHP MP 2.8 Boring B-3.



**Photograph 9 – (after work)**

**Location:** SHP MP 2.8 (Boring B-3)

View looking northeast. Photo shows site conditions at SHP MP 2.8 Boring B-3 following drilling activities. Restoration activities included casting of seed mix in locations covered by locally sourced straw. Photo was taken before the locked piezometer cover was installed.



**APPENDIX A – PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP MP 2.8 Drill Site**  
**October 11 through 14 2016**



**Photograph 10 – (during work)**

**Location:** Temporary access route (access to SHP MP 2.8)

Looking northwest. Photo shows site conditions during temporary access route improvement activities along the existing abandoned logging trail.



**Photograph 11 – (after work)**

**Location:** Temporary access route

View looking northwest. Photo shows site conditions following drilling and restoration activities of temporary access route including casting seed in locations covered by straw.



**Photograph 12 – (during work)**

**Location:** Abandoned Logging Trail (access to SHP MP 2.8)

View looking east. Photo shows site conditions during temporary access route improvement activities along the existing abandoned logging trail.



**APPENDIX A – PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP MP 2.8 Drill Site**  
**October 11 through 14 2016**



**Photograph 13 – (after work)**

**Location:** Abandoned Logging Trail (access to SHP MP 2.8)

View looking northwest. Photo shows site conditions following drilling and restoration activities of temporary access route including casting seed in locations covered by straw.



**Photograph 14 - (after work)**

**Location:** Johnson Fork service road (access to SHP MP 2.8)

View looking west. Photo shows site conditions following drilling activities restoration of temporary access route including casting of seed in locations covered by straw.

**APPENDIX B**  
**CORE PHOTOGRAPHS**

PROJECT NAME: ACP SHP MP 2.8

PROJECT NO.: TXG0007-012-6302

CLIENT: DOMINION TRANSMISSION, INC.

LOCATION: DODDRIDGE COUNTY, WEST VIRGINIA



SHP MP 2.8 Boring B-1: Box 1 of 1 (11.0 to 25.5 ft bgs)



SHP MP 2.8 Boring B-2: Box 1 of 1 (17 to 32 ft bgs)



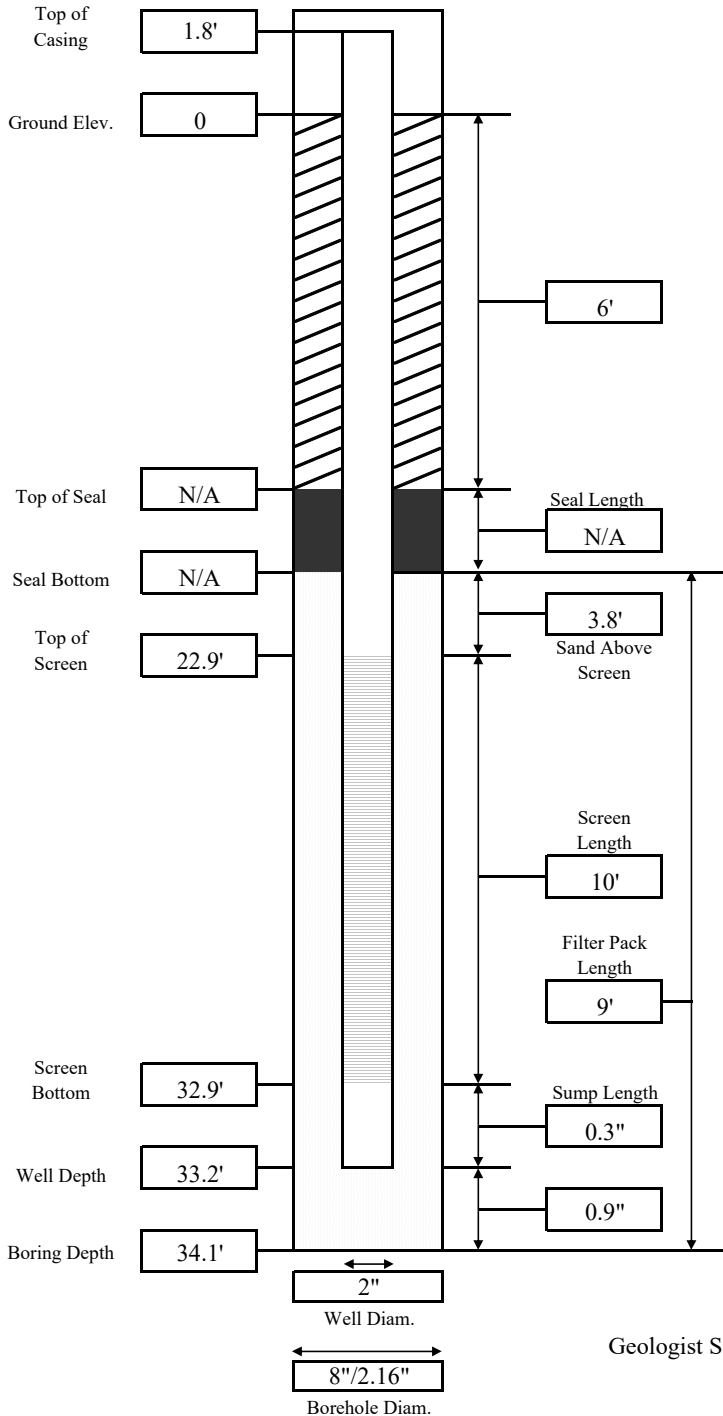
SHP MP 2.8 Boring B-3: Box 1 of 1 (19 to 34 ft bgs)

**APPENDIX C**  
**PIEZOMETER AND INCLINOMETER**  
**CONSTRUCTION LOGS**

**Appendix C - Piezometer Construction Log**

Site: Atlantic Coast Pipeline MP 2.8  
 Well ID: B-3  
 Drilling Company: Horn and Associates  
 Drillers: Steven Ison  
 Geologist: Jared Warner

Date: 12-Oct-16  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 34.1'  
 Boring Diameter: 8"/2.16"  
 Well Depth: 33.2'  
 Well Diameter: 2"



**Well Construction:**  
 Material: SCH 80 PVC  
 Inside Diameter: 2"  
 Screen Slot Size: 0.01"  
 Screen Beg.: 22.9' End: 32.9'  
 Sump **Y / N**  
 Type/Length: PVC End Cap (0.3")

**Filter Pack:**  
 Type/Brand: Global Drilling #5 Quartz Sand  
 Amount Used: 6.5 50lb bags  
 Placement Method: Tremie

**Seal:**  
 Type/Brand: N/A  
 Amount Used: N/A  
 Vol. Fluid Added: N/A  
 Set-up Time: N/A  
 Placement Method: N/A

**Grout:**  
 Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
 Amount Used: 1 94lb bag of Portland + 25lb bag bentonite  
 Vol. Fluid Added: ~30 gallons H<sub>2</sub>O  
 Placement Method: Tremie

**Well Completion:**  
**Above Grade / Below Grade**  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Protective Cover (4.5")

**Comments:** Hole collapsed from 19.1' to 15". Filter pack backfilled from 15' to 6'. Bentonite-grout backfilled from 6' to surface.

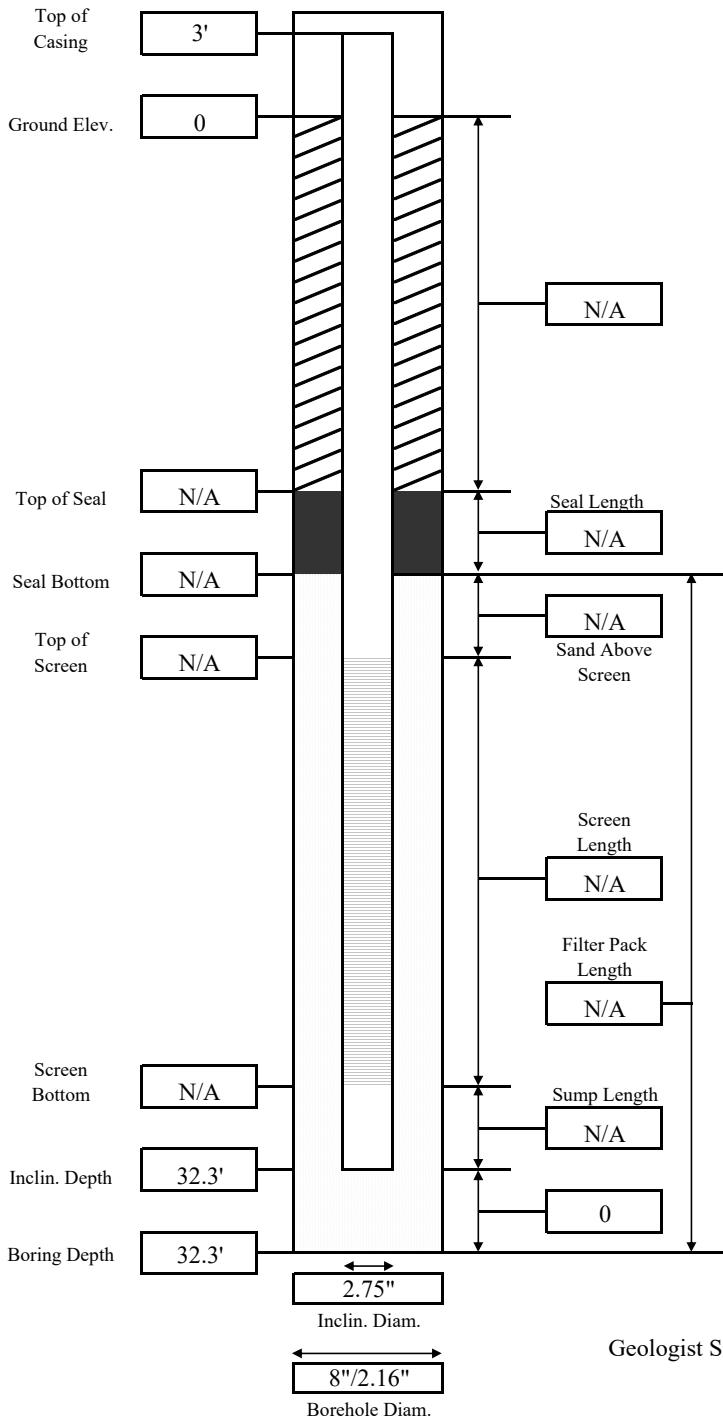
Geologist Signature: Jared Warner



## Appendix C - Inclinometer Construction Log

Site: Atlantic Coast Pipeline MP 2.8  
 Boring ID: B-2 (MP 2.8)  
 Drilling Company: Horn and Associates  
 Drillers: Steven Ison  
 Geologist: Jared Warner

Date: 13-Oct-16  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 32.3'  
 Boring Diameter: 8"/2.16"  
 Incl. Depth: 33.2'  
 Incl. Diameter: 2.75"



Well Construction:  
 Material: ABS Plastic (Quik Connect)  
 Inside Diameter: 2.32"  
 Screen Slot Size: N/A  
 Screen Beg.: N/A End: N/A  
 Sump Y / N  
 Type/Length: \_\_\_\_\_  
 Filter Pack:  
 Type/Brand: N/A  
 Amount Used: N/A  
 Placement Method: N/A  
 Seal:  
 Type/Brand: N/A  
 Amount Used: N/A  
 Vol. Fluid Added: N/A  
 Set-up Time: N/A  
 Placement Method: N/A  
 Grout:  
 Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
1 94lb bag of Portland + 25lb bag bentonite  
 Amount Used: \_\_\_\_\_  
 Vol. Fluid Added: ~30 gallons H<sub>2</sub>O  
 Placement Method: Tremie  
 Inclin. Completion:  
Above Grade / Below Grade  
 Guard Posts? Y / N  
 Pad Size: N/A  
 Cover Type/Size: Protective Cover (4.5")  
 Comments: Bottom of inclinometer casing placed at the boring depth (32.3') and grouted to surface.

Geologist Signature: Jared Warner



## **APPENDIX D**

### **LOG OF BORINGS B-1, B-2, and B-3**

**APPENDIX D - KEY SHEET: CLASSIFICATIONS AND SYMBOLS**

GS FORM:  
KEY 09/99

**EMPIRICAL CORRELATIONS WITH STANDARD PENETRATION RESISTANCE N VALUES \***

	N VALUE * (BLOWS/FT)	CONSISTENCY	UNDRAINED COMPRESSIVE STRENGTH (KSF)		N VALUE * (BLOWS/FT)	RELATIVE DENSITY
FINE GRAINED SOILS	0 - 2	VERY SOFT	<0.25	COARSE GRAINED SOILS	0 - 4	VERY LOOSE
	3 - 4	SOFT	0.25 - 0.50		5 - 10	LOOSE
	5 - 8	FIRM	0.50 - 1.00		11 - 30	MEDIUM DENSE
	9 - 15	STIFF	1.00 - 2.00		31 - 50	DENSE
	16 - 30	VERY STIFF	2.00 - 4.00		>50	VERY DENSE
	31 - 50	HARD	>4.00			
	>50	VERY HARD				

\* ASTM D 1586; NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 IN. O.D., 1.4 IN. I.D. SAMPLER ONE FOOT.

**UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART**

MAJOR DIVISIONS		SYMBOLS	DESCRIPTIONS	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		LITTLE OR NO FINES	GP POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES	GM SILTY GRAVELS, GRAVEL- SAND-SILT MIXTURES	
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO.4 SIEVE	APPRECIABLE AMOUNT OF FINES	GC CLAYEY GRAVELS, GRAVEL -SAND-CLAY MIXTURES	
		SAND AND SANDY SOILS	CLEAN SANDS	SW WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			LITTLE OR NO FINES	SP POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL COARSER THAN NO. 200 SIEVE SIZE	SANDS WITH FINES	APPRECIABLE AMOUNT OF FINES	SM SILTY SANDS, SAND-SILT MIXTURES	
		SC CLAYEY SANDS, SAND-CLAY MIXTURES		
FINE GRAINED SOILS	SILTS AND CLAYS	Liquid Limit Less Than 50	ML INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
		CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS		
		OL ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
	SILTS AND CLAYS	Liquid Limit Greater Than 50	MH INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT	
		CH INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
		OH ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS	PT PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT			

NOTE: DUAL SYMBOLS USED FOR BORDERLINE CLASSIFICATIONS

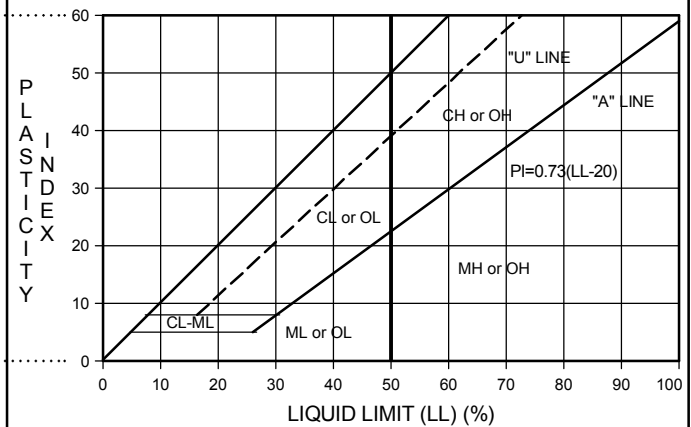
**PARTICLE SIZE IDENTIFICATION**

BOULDERS	>300 mm
COBBLES	75 - 300 mm
GRAVEL: COARSE	19.0 - 75 mm
GRAVEL: FINE	4.75 - 19 mm
SAND: COARSE	2.00 - 4.75 mm
SAND: MEDIUM	0.425 - 2.00 mm
SAND: FINE	0.075 - 0.425 mm
SILT	0.075 - 0.002 mm
CLAY	<0.002 mm

WELL GRADED - HAVING WIDE RANGE OF GRAIN SIZES AND APPRECIABLE AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES

POORLY GRADED - PREDOMINANTLY ONE GRAIN SIZE, OR HAVING A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING

**PLASTICITY CHART**



**OTHER MATERIAL SYMBOLS**

Siltstone	Sand
Sandstone	Silt
Siltstone/Claystone	Silty Sand
Claystone	Alluvium
Schist	Artificial Fill
Siltstone/Sandstone	Debris Fill
Conglomerate	Asphalt
Granitic	Metabasalt

**WELL SYMBOLS**

GRANULAR BENTONITE
BENTONITE CEMENT GROUT
FILTER PACK
CONCRETE
NATIVE/SLOUGH
CENTRAL-IZER

**SAMPLER AND OTHER SYMBOLS**

GRAB SAMPLE	Water Level at Time Drilling, or as Shown
SPLIT SPOON	Static Water Level
ROCK CORE	MSL: Mean Sea Level
SHELBY TUBE	MC: Moisture Content
CALIFORNIA SAMPLER	WA: #200 Wash
BULK SAMPLE	DD: Dry Density
	SA: Sieve Analysis
	PI: Plasticity Index
	PP: Pocket Pentrometer
	LL: Liquid Limit
	Su: Undrained Shear Strength
	K: Hydraulic Conductivity
	Phi: Friction Angle

KEY-GEOTECH - GEOSYNTec.GDT - 4/15/16 13:47 - P:\GINT\PROJECTS\BLUE RIDGE GEOTECHNICAL DRILLING\ACPHDD.GPJ



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 2.8 B-1**

**SHEET 1 OF 2**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/13/2016  
**FINISH DRILL DATE** 10/13/2016

**GROUND SURF.** 1236  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**Appendix D - Boring Log**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
1235		<b>FAT CLAY (CH)</b> , Light reddish brown to yellowish brown, Dry to moist, Medium stiff, High plasticity, Presence of Shale fragments (up to 0.5 inch).		B-1-1	2 3 3	6	83							15.3						
2		Becomes remolded dark reddish brown and olive brown, Dry to moist, Stiff, Presence of Shale fragments.		B-1-2	3 4 7	11	100													
4				B-1-3	3 6 7	13	67				92.8	7	0.2	15.8	42	23	19			
6	1230	<b>LEAN CLAY (CL)</b> , Olive brown, Dry to moist, Stiff, Presence of Shale fragments.		B-1-4	50/4	50	100							7.8						
8		Becomes platy, Hard.																		
10																				
12																				
14																				
16	1220																			
18																				
20																				
22	1215																			
24																				
26	1210																			
28																				
30																				

Rig chatter at 10.5 ft below ground surface (bgs).  
Auger refusal at 11 ft bgs.  
Switch to rock coring.

03-GEOTECH2 BORING LOG\_SHP SOIL.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.20060  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.59064  
**DRILL MTHD.** Hollow Stem Auger      **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner              **REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA							
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)
1235																		
5	1231																	
	1230																	
	1229																	
	1228																	
	1227																	
10	1226																	
	1225																	
	1224	<b>SANDSTONE</b> , Dark olive brown, Very thin bedding (10-30 degrees), Closely fractured (10-20 degrees) with FeOx along the fracture flaws, Fresh, Hard, Presence of microcrystalline Mica flakes.			R-1	4.5	3.8	84	71	4								
	1223																	
	1222	<b>SHALE</b> , Greenish gray to gray, Platy, Very closely to closely fractured (10 degrees), Slightly weathered, Low hardness.																
15	1221	No recovery.																
	1220	No recovery.			R-2	10	9.3	93	78	10								
	1219	Becomes dark reddish brown, Platy, Very closely to closely fractured (10 degrees), Hard.																
	1218																	
20	1217																	
	1216	Becomes greenish gray to dark gray, Closely to medium fractured.																
	1215																	
	1214																	
	1213																	
	1212																	
25	1211	Fractures becomes nearly vertical (70 degrees) with FeOx infilling.																
	1210																	
	1209																	
	1208																	
	1207																	
30	1206																	

Termination depth at 25.5 ft bgs. Backfill to surface using bentonite grout.

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

<b>CONTRACTOR</b>	Horn & Associates	<b>LATITUDE:</b>	39.20060
<b>EQUIPMENT</b>	Diedrich D-50	<b>LONGITUDE:</b>	-80.59064
<b>DRILL MTHD.</b>	Rock Coring	<b>COORDINATE SYSTEM:</b>	
<b>DIAMETER</b>	8 inches		
<b>LOGGER</b>	Jared Warner	<b>REVIEWER</b>	Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 2.8 B-2**

**SHEET 1 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/12/2016  
**FINISH DRILL DATE** 10/13/2016

**GROUND SURF.** 1213  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**Appendix D - Boring Log**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	1210	<b>LEAN CLAY WITH SAND (CL)</b> , Dark reddish brown, Moist, Medium stiff, Presence of fine sand and black lenses with Shale fragments.	[Hatched pattern]	B-2-1	2 3 4	7	67				73.1	24.7	2.2	21.8	39	21	18			
4		Becomes stiff, Increase in Shale Fragments.	[Hatched pattern]	B-2-2	2 5 6	11	33													
6		Decrease in moisture content, Dry to moist, Presence of Sandstone fragments (<0.25 inch), Crumbles.	[Hatched pattern]	B-2-3	3 6 7	13	67						17.3							
8	1205	Becomes dry, Hard, Blocky to platy.	[Hatched pattern]	B-2-4	15 50/3	50	100													
10			[Hatched pattern]	B-2-5	50/3	50	0													
12	1200	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , Light olive brown, Dry, Hard, Presence of platy Shale fragments (up to 1 inch).	[Cross-hatched pattern]	B-2-6	30 50/3	80	100						4.6							
14			[Cross-hatched pattern]																	
16			[Cross-hatched pattern]																	
18	1195		[Cross-hatched pattern]																	
20			[Cross-hatched pattern]																	
22	1190		[Cross-hatched pattern]																	
24			[Cross-hatched pattern]																	
26			[Cross-hatched pattern]																	
28	1185		[Cross-hatched pattern]																	
30			[Cross-hatched pattern]																	
										Auger refusal at 17 ft bgs. Switch to rock coring.										

03-GEOTECH2 BORING LOG\_SHP\_SOIL.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates  
**EQUIPMENT** Diedrich D-50  
**DRILL MTHD.** Hollow Stem Auger  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner

**LATITUDE:** 39.20075  
**LONGITUDE:** -80.59095  
**COORDINATE SYSTEM:**

**REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 2.8 B-2**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/12/2016  
**FINISH DRILL DATE** 10/13/2016

**GROUND SURF.** 1213  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA													
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)						
1212																								
5																								
1208																								
1207																								
1206																								
1205																								
10																								
1203																								
1202																								
1201																								
1200																								
15																								
1198																								
1197																								
1196		<b>SANDSTONE</b> , Olive brown to dark olive brown, Black cross beddings (10-20 degrees), Closely fractured (10-20 degrees), Fresh, Hard.			R-1	5	2.4	48		7														
1195																								
1194		No recovery.																						
20																								
1193																								
1192																								
1191		<b>SHALE</b> , Dark reddish brown, Closely fractured (10-20 degrees) with FeOx along fracture planes, Slightly weathered, Low hardness.			R-2	4	3.5	87.5		70														
1190		Becomes olive brown, Fresh, Hard.																						
1189		Becomes dark reddish brown, Slightly weathered, Medium hardness.																						
25		Becomes dark gray.																						
1188		No recovery.																						
1187																								
1186		Becomes dark gray, Interbedded, Presence of Fat clay, Heavily weathered, Soft.			R-3	6	5.6	93		72														
1185		Becomes dark reddish brown, 30 to 40 degrees fractures, Slightly weathered, Hard, Presence of Fat clay seams between 27.2 to 28.3 ft bgs.																						
1184																								
30																								
1183																								

<b>CONTRACTOR</b>	Horn & Associates	<b>LATITUDE:</b>	39.20075
<b>EQUIPMENT</b>	Diedrich D-50	<b>LONGITUDE:</b>	-80.59095
<b>DRILL MTHD.</b>	Rock Coring	<b>COORDINATE SYSTEM:</b>	
<b>DIAMETER</b>	8 inches		
<b>LOGGER</b>	Jared Warner	<b>REVIEWER</b>	Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 2.8 B-2**

**SHEET 3 OF 3**

**PROJECT** ACP SHP TL-635

**NUMBER** TXG0007

**LOCATION** Doddridge County, WV

**START DRILL DATE** 10/12/2016

**FINISH DRILL DATE** 10/13/2016

**GROUND SURF.** 1213

**TOP OF CASING**

**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION		GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA													
						RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)						
1182		1) Formation, Member 2) Rock Name 3) Color 4) Grain Size/Percentage 5) Bedding	6) Weathering 7) Hardness 8) Cementation 9) Moisture 10) Other (Mineralization, Discoloration, Odor, etc.)																						
1181																									
1180																									
1179																									
35 1178																									
1177																									
1176																									
1175																									
1174																									
40 1173																									
1172																									
1171																									
1170																									
1169																									
45 1168																									
1167																									
1166																									
1165																									
1164																									
50 1163																									
1162																									
1161																									
1160																									
1159																									
55 1158																									
1157																									
1156																									
1155																									
1154																									
60 1153																									

Termination depth at 32.3 ft bgs.

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.20075  
**EQUIPMENT** Diedrich D-50            **LONGITUDE:** -80.59095  
**DRILL MTHD.** Rock Coring            **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner                **REVIEWER** Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GS FORM:  
SOIL-5910

## Appendix D - Boring Log

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	1145	<b>SANDY LEAN CLAY WITH GRAVEL (CL)</b> , Yellowish and reddish brown, Dry to moist, Medium plasticity, Very stiff, Presence of sporadic Sandstone fragments (up to 0.5 inch).		B-3-1	3 8	16	100				54.3	21.6	24.1	13.8	35	20	15			
4		Becomes dark reddish brown, Blocky to platy, lensed with black Shale.		B-3-2	12 21 38	59	100													
6		Becomes light olive brown, Dry, Hard, Presence of localized black organics with FeOx staining.		B-3-3	16 32 36	68	83						9.4							
8	1140	Becomes light olive brown and reddish brown.		B-3-4	9 24 31	55	100													
12	1135	<b>SILT (ML)</b> , Dark reddish brown, Dry, Hard, Non-plastic, Blocky, Crumbles.		B-3-5	13 21 27	48	100													
14		<b>SANDY LEAN CLAY WITH GRAVEL (CL)</b> , Dark brown to olive brown, Very stiff, Low plasticity.		B-3-6	15 13 16	29	100				58.6	30.2	11.2	11.4	33	19	14			
16		Becomes light olive brown, Hard, Platy, Presence of Shale fragments.		B-3-7	35 50/1	50	39													
18	1130																			
20																				
22	1125																			
24																				
26																				
28	1120																			
30																				

Rig chatter at 18 ft bgs.  
Auger refusal at 19 ft bgs.  
Switch to rock coring.

03-GEOTECH2 BORING LOG\_SHP SOIL.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates  
**EQUIPMENT** Diedrich D-50  
**DRILL MTHD.** Hollow Stem Auger  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner

**LATITUDE:** 39.20106  
**LONGITUDE:** -80.59117  
**COORDINATE SYSTEM:**

**REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS





11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 2.8 B-3**

SHEET 2 OF 3

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/12/2016  
**FINISH DRILL DATE** 10/12/2016

**GROUND SURF.** 1148  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE				COMMENTS	DISCONTINUITY DATA													
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)		RQD	RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)					
1147																							
5	1143																						
10	1138																						
15	1133																						
20	1129	<b>SANDSTONE</b> , Dark greenish gray to gray, Medium dark grey cross bedding, 10 to 20 degrees fracture sets, Fresh, Hard. Presence of slightly weathered, very soft, gray lean clay seam between 21.2 to 21.5 ft bgs.			R-1	2.5	2.5	100	92	3													
	1128																						
	1127																						
	1126	<b>SHALE</b> , Dark gray to gray, 10 to 20 degrees dark grey cross bedding, Fresh, Hard.			R-2	3.5	3.5	100	63	3													
	1125	<b>SANDSTONE</b> , Dark gray to gray, Fresh, Hard.																					
	1124	<b>SHALE</b> , Dark gray to gray, Fresh, Hard.																					
	1123	<b>SANDSTONE</b> , Dark gray to gray, Fresh, Hard.																					
25	1123	<b>SHALE</b> , Dark gray to gray, Slightly weathered, Medium Hard.			R-3	8	8.9	99	89	9													
	1122	<b>SANDSTONE</b> , Dark gray to gray, Fresh, Hard.																					
	1121																						
	1120																						
	1119																						
30	1118																						

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.20106  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.59117  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 2.8 B-3**

**SHEET 3 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/12/2016  
**FINISH DRILL DATE** 10/12/2016

**GROUND SURF.** 1148  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION		GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA							
						RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)
1117		1) Formation, Member	6) Weathering	[Symbol]							Termination depth at 34.1 ft bgs.								
1116		2) Rock Name	7) Hardness																
1115		3) Color	8) Cementation																
1114		4) Grain Size/Percentage	9) Moisture																
35 1113		5) Bedding	10) Other (Mineralization, Discoloration, Odor, etc.)																
1112																			
1111																			
1110																			
1109																			
40 1108																			
1107																			
1106																			
1105																			
1104																			
45 1103																			
1102																			
1101																			
1100																			
1099																			
50 1098																			
1097																			
1096																			
1095																			
1094																			
55 1093																			
1092																			
1091																			
1090																			
1089																			
60 1088																			

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.20106  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.59117  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner              **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

**APPENDIX E**  
**LABORATORY TEST RESULTS**



November 30, 2016

Project No. 2016-527-001

Mustafa Erten  
Geosyntec Consultants, Inc.  
11490 Westheimer Rd., Suite 150  
Houston, TX 77077

**Transmittal**  
**Laboratory Test Results**  
**ACP TXG0007**

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens that were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,  
**Geotechnics, Inc.**

David R. Backstrom  
Laboratory Director

***We understand that you have a choice in your laboratory services  
and we thank you for choosing Geotechnics.***

## MOISTURE CONTENT

ASTM D 2216-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001

Lab ID:	017	018	019	020	021
Boring No.:	B-1(MP2.8)	B-1(MP2.8)	B-1(MP2.8)	B-2(MP2.8)	B-2(MP2.8)
Depth (ft):	2.3	7.0	8.8	2.5	7.5
Sample No.:	B-1-1	B-1-3	B-1-4	B-2-1	B-2-3
Tare Number	18	19	20	21	10
Wt. of Tare & Wet Sample (g)	72.28	66.24	65.72	67.33	73.02
Wt. of Tare & Dry Sample (g)	63.62	58.13	61.47	56.52	63.24
Weight of Tare (g)	6.94	6.91	7.00	6.91	6.82
Weight of Water (g)	8.66	8.11	4.25	10.81	9.78
Weight of Dry Sample (g)	56.68	51.22	54.47	49.61	56.42
<b>Water Content (%)</b>	<b>15.3</b>	<b>15.8</b>	<b>7.8</b>	<b>21.8</b>	<b>17.3</b>

Lab ID	022	023	024	025	026
Boring No.	B-2(MP2.8)	B-3(MP2.8)	B-3(MP2.8)	B-3(MP2.8)	B-1(MP9.3)
Depth (ft)	14.8	3.0	7.7	15.5	1.8
Sample No.	B-2-6	B-3-1	B-3-3	B-3-6	B-1-1
Tare Number	11	30	12	29	13
Wt. of Tare & Wet Sample (g)	59.77	61.97	75.65	70.16	56.19
Wt. of Tare & Dry Sample (g)	57.42	55.29	69.73	63.69	49.45
Weight of Tare (g)	6.86	6.82	6.92	6.82	6.96
Weight of Water (g)	2.35	6.68	5.92	6.47	6.74
Weight of Dry Sample (g)	50.56	48.47	62.81	56.87	42.49
<b>Water Content (%)</b>	<b>4.6</b>	<b>13.8</b>	<b>9.4</b>	<b>11.4</b>	<b>15.9</b>

Notes :

*Tested By*    *PC*                      *Date*    11/10/16    *Checked By*    *TMP*                      *Date*    11/11/16



## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C (Modified to report Unit Weight)

This method does not report strain rate or deformation

Sample Prep and Conformance Verification: ASTM D4543-08

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID No.: 2016-527-001-001

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 20.2-21.3  
 Sample ID: R-2  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 467.30**

SPECIMEN LENGTH (in)

Reading 1: 4.00  
 Reading 2: 4.00  
 Reading 3: 4.00  
**Average: 4.00**

SPECIMEN DIAMETER (in):

Reading 1: 1.85  
 Reading 2: 1.85  
 Average: **1.85**  
 Area (in<sup>2</sup>): 2.70  
 L/D: 2.16

MOISTURE CONTENT

Tare Number: 874  
 Wt. of Tare & Wet Sample (g): 573.13  
 Wt. of Tare & Dry Sample (g): 567.38  
 Weight of Tare (g): 110.37  
 Weight of Wet Sample (g): 462.76  
 Sample Volume (cm<sup>3</sup>): 176.75  
 Moisture Content (%): 1.26  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.644  
 Unit Wet Weight (pcf): 165.0  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.611**  
**Unit Dry Weight (pcf): 162.9**

Total Load (lb): 18,310  
**Uniaxial Compressive Strength (psi): 6,790**

Fracture Type: **Shear**

Rate of Loading (lb/sec): 136  
 Time to Break (min:sec): 2:14.35  
 Deviation From Straightness<sup>2</sup>: > 0.02

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:    Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are:    As Received-Unpreserved
- 2) Deviation from straightness, Procedure A of ASTM D 4543-08  
     Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 3) Temperature is laboratory room temperature.
- 4) Geotechnics Equipment Used: G788 Compression Tester,  
 G1122 Digital Calipers, G1380 Dial Guage,  
 G1557 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By:            AJD                      Date:    11/16/16                      Checked By:            CLK                      Date: 11/17/16

**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-002

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 20.2-21.3  
 Sample No.: R2 Test 1  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.305	Top Diam (in):	1.850
Length (in):	1.305	Mid Diam (in):	1.850
Length (in):	1.306	Bot Diam (in):	1.850
Avg. Length (in):	1.305	Avg. Diam (in):	1.850
		Area (in <sup>2</sup> ):	2.688

MOISTURE CONTENT	
Tare No.:	3055
Weight Tare & Wet Sample (g):	157.36
Weight of Tare & Dry Sample (g):	155.75
Weight of Tare (g):	6.77
Moisture (%):	1.1

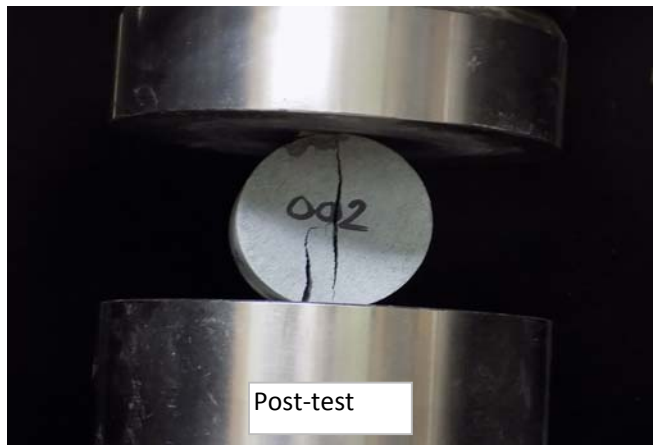
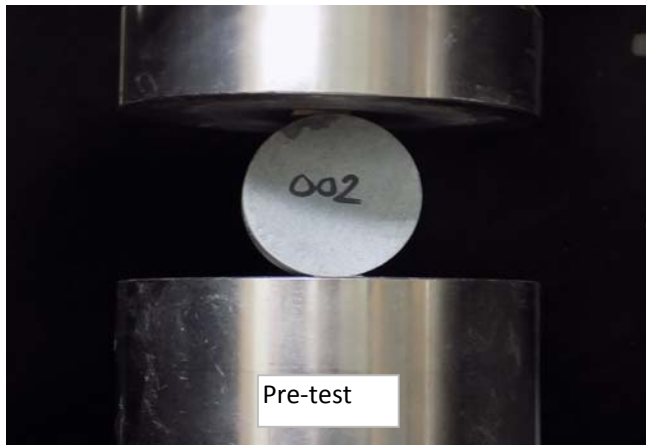
Thickness to Diameter Ratio: 0.71 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 150.6

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 98.0  
 Rate of Loading (lb/min): 5880  
 Time to Break (min:sec): 0:37.44

LOAD (lb)	Splitting Tensile Strength (psi)
3670	967.50



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16  
 page 1 of 1 DCN: CT-S68Concrete Date: 8/30/12 Revision: 0

**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-003

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 20.2-21.3  
 Sample No.: R2 Test 2  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.323	Top Diam (in):	1.847
Length (in):	1.323	Mid Diam (in):	1.847
Length (in):	1.321	Bot Diam (in):	1.850
Avg. Length (in):	1.322	Avg. Diam (in):	1.848
		Area (in <sup>2</sup> ):	2.682

MOISTURE CONTENT	
Tare No.:	3175
Weight Tare & Wet Sample (g):	158.72
Weight of Tare & Dry Sample (g):	157.21
Weight of Tare (g):	6.76
Moisture (%):	1.0

Thickness to Diameter Ratio: 0.72 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 152.2

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 94.0  
 Rate of Loading (lb/min): 5640  
 Time to Break (min:sec): 0:35.87

<i>LOAD (lb)</i>	<i>Splitting Tensile Strength (psi)</i>
3380	880.55



**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-004

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 20.2-21.3  
 Sample No.: R2 Test 3  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.286	Top Diam (in):	1.833
Length (in):	1.287	Mid Diam (in):	1.823
Length (in):	1.285	Bot Diam (in):	1.831
Avg. Length (in):	1.286	Avg. Diam (in):	1.829
		Area (in <sup>2</sup> ):	2.627

MOISTURE CONTENT	
Tare No.:	2982
Weight Tare & Wet Sample (g):	154.09
Weight of Tare & Dry Sample (g):	152.70
Weight of Tare (g):	6.77
Moisture (%):	1.0

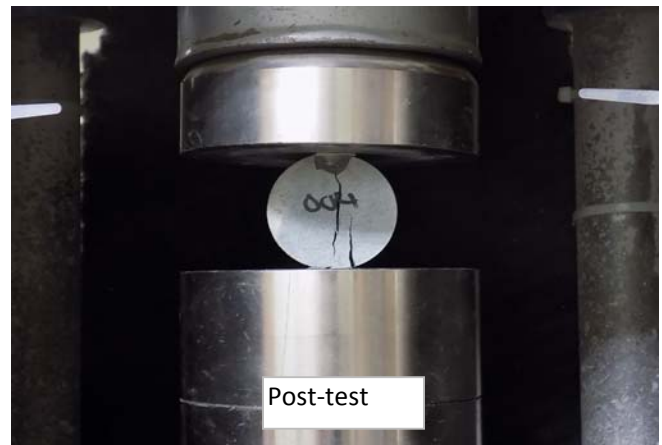
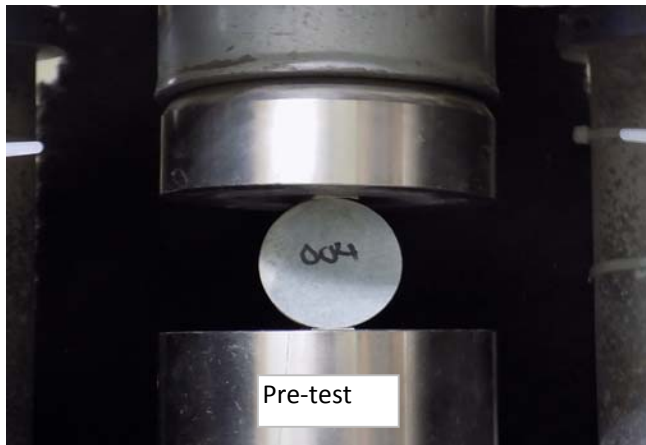
Thickness to Diameter Ratio: 0.70 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 147.9

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 71.0  
 Rate of Loading (lb/min): 4260  
 Time to Break (min:sec): 0:41.6

LOAD (lb)	Splitting Tensile Strength (psi)
2950	798.45



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C (Modified to report Unit Weight)

This method does not report strain rate or deformation

Sample Prep and Conformance Verification: ASTM D4543-08

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID No.: 2016-527-001-005

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 20.3-21.3  
 Sample ID: R-1  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 433.80**

SPECIMEN LENGTH (in)

Reading 1: 3.99  
 Reading 2: 3.99  
 Reading 3: 3.99  
**Average: 3.99**

SPECIMEN DIAMETER (in):

Reading 1: 1.86  
 Reading 2: 1.86  
 Average: **1.86**  
 Area (in<sup>2</sup>): 2.72  
 L/D: 2.14

MOISTURE CONTENT

Tare Number: 907  
 Wt. of Tare & Wet Sample (g): 533.54  
 Wt. of Tare & Dry Sample (g): 532.76  
 Weight of Tare (g): 110.40  
 Weight of Wet Sample (g): 423.14  
 Sample Volume (cm<sup>3</sup>): 177.89  
 Moisture Content (%): 0.18  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.439  
 Unit Wet Weight (pcf): 152.2  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.434**  
**Unit Dry Weight (pcf): 151.9**

Total Load (lb): 23,980  
**Uniaxial Compressive Strength (psi): 8,810**

Fracture Type: **Cone Split**

Rate of Loading (lb/sec): 123  
 Time to Break (min:sec): 3:15.53  
 Deviation From Straightness<sup>2</sup>: >0.02

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:    Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are:    As Received-Unpreserved
- 2) Deviation from straightness, Procedure A of ASTM D 4543-08  
     Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 3) Temperature is laboratory room temperature.
- 4) Geotechnics Equipment Used: G788 Compression Tester,  
 G1122 Digital Calipers, G1380 Dial Guage,  
 G1557 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By: AJD                      Date: 11/16/16                      Checked By: CLK                      Date: 11/17/16



**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-006

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 20.3-21.3  
 Sample No.: R1 Test 1  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.269	Top Diam (in):	1.860
Length (in):	1.270	Mid Diam (in):	1.860
Length (in):	1.270	Bot Diam (in):	1.862
Avg. Length (in):	1.270	Avg. Diam (in):	1.861
		Area (in <sup>2</sup> ):	2.719

MOISTURE CONTENT	
Tare No.:	3127
Weight Tare & Wet Sample (g):	144.33
Weight of Tare & Dry Sample (g):	143.86
Weight of Tare (g):	6.77
Moisture (%):	0.3

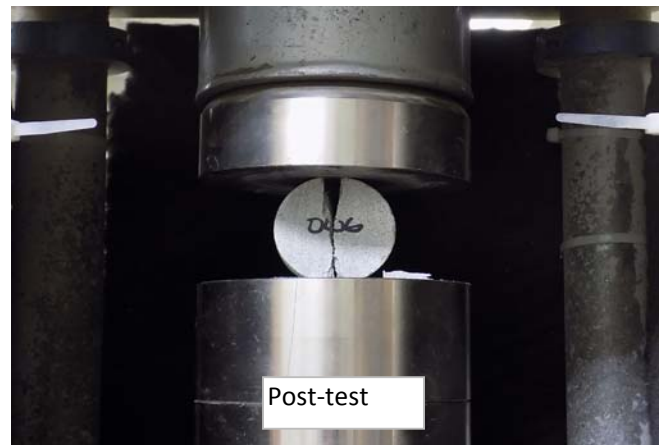
Thickness to Diameter Ratio: 0.68 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 139.8

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 77.0  
 Rate of Loading (lb/min): 4620  
 Time to Break (min:sec): 0:31.41

<i>LOAD (lb)</i>	<i>Splitting Tensile Strength (psi)</i>
2410	649.44



**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-007

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 20.3-21.3  
 Sample No.: R1 Test 2  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.287	Top Diam (in):	1.860
Length (in):	1.286	Mid Diam (in):	1.861
Length (in):	1.284	Bot Diam (in):	1.862
Avg. Length (in):	1.286	Avg. Diam (in):	1.861
		Area (in <sup>2</sup> ):	2.720

MOISTURE CONTENT	
Tare No.:	3220
Weight Tare & Wet Sample (g):	146.65
Weight of Tare & Dry Sample (g):	146.14
Weight of Tare (g):	6.53
Moisture (%):	0.4

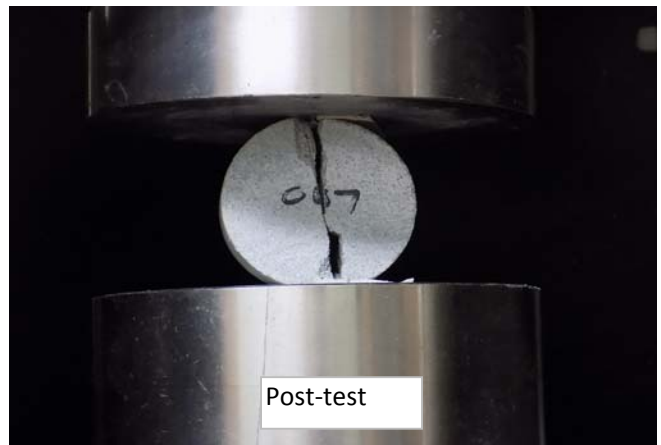
Thickness to Diameter Ratio: 0.69 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 141.8

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 70.0  
 Rate of Loading (lb/min): 4200  
 Time to Break (min:sec): 0:35.37

LOAD (lb)	Splitting Tensile Strength (psi)
2460	654.55



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16

**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-008

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 20.3-21.3  
 Sample No.: R1 Test 3  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.243	Top Diam (in):	1.860
Length (in):	1.244	Mid Diam (in):	1.862
Length (in):	1.238	Bot Diam (in):	1.857
Avg. Length (in):	1.242	Avg. Diam (in):	1.860
		Area (in <sup>2</sup> ):	2.716

MOISTURE CONTENT	
Tare No.:	3021
Weight Tare & Wet Sample (g):	139.94
Weight of Tare & Dry Sample (g):	139.35
Weight of Tare (g):	6.79
Moisture (%):	0.4

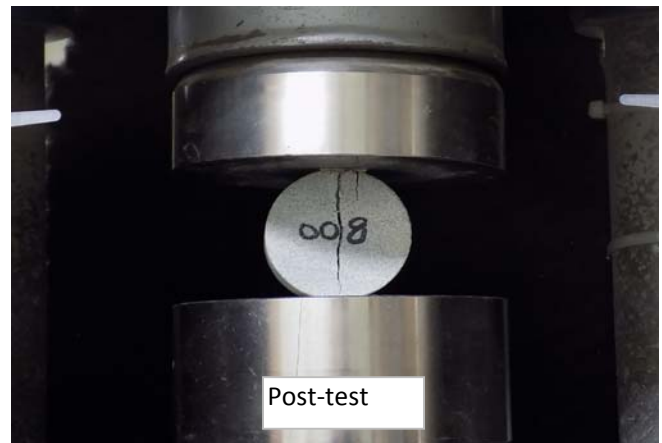
Thickness to Diameter Ratio: 0.67 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 133.5

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 49.0  
 Rate of Loading (lb/min): 2940  
 Time to Break (min:sec): 0:49.53

<i>LOAD (lb)</i>	<i>Splitting Tensile Strength (psi)</i>
2410	664.44



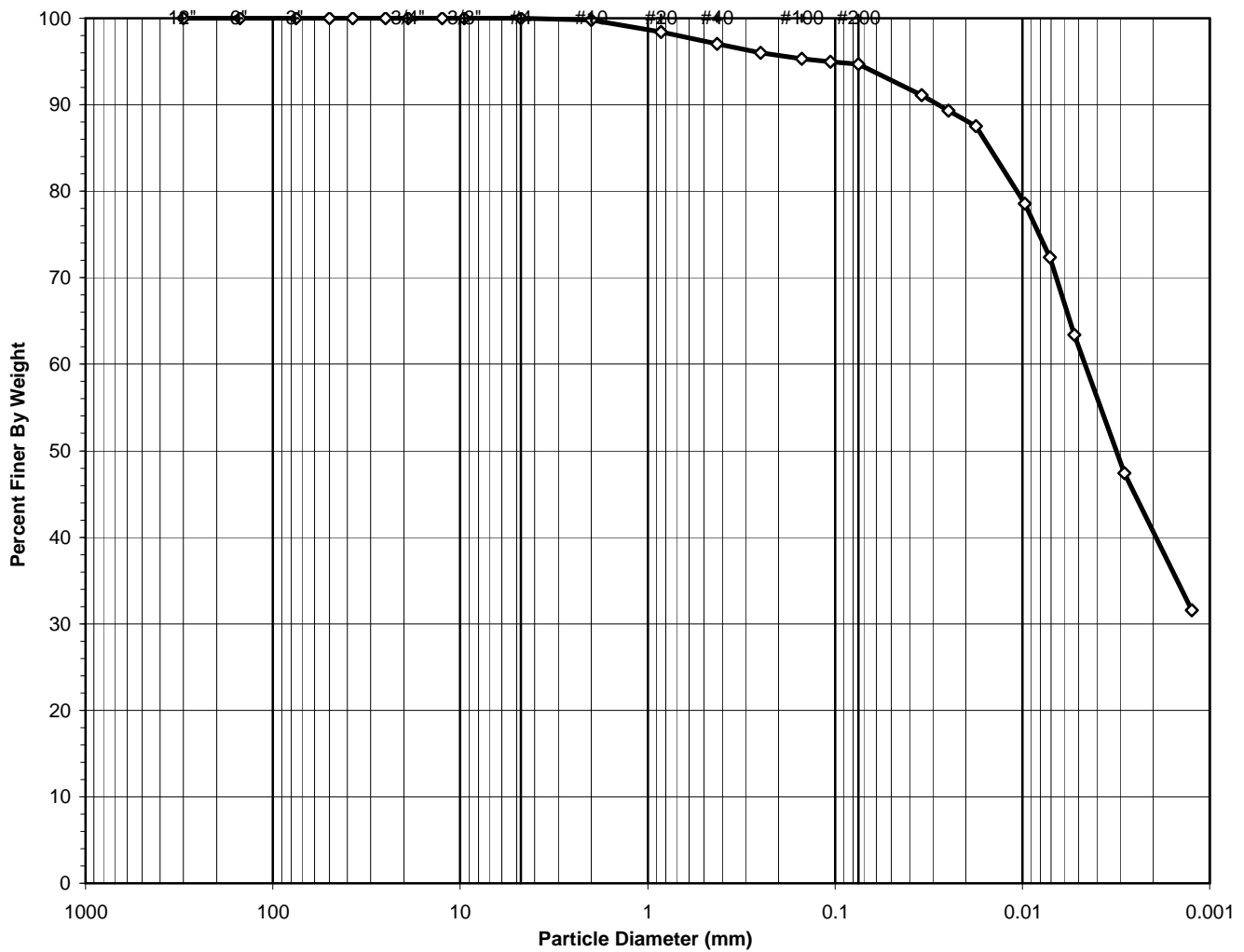
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-018

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 7.0  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

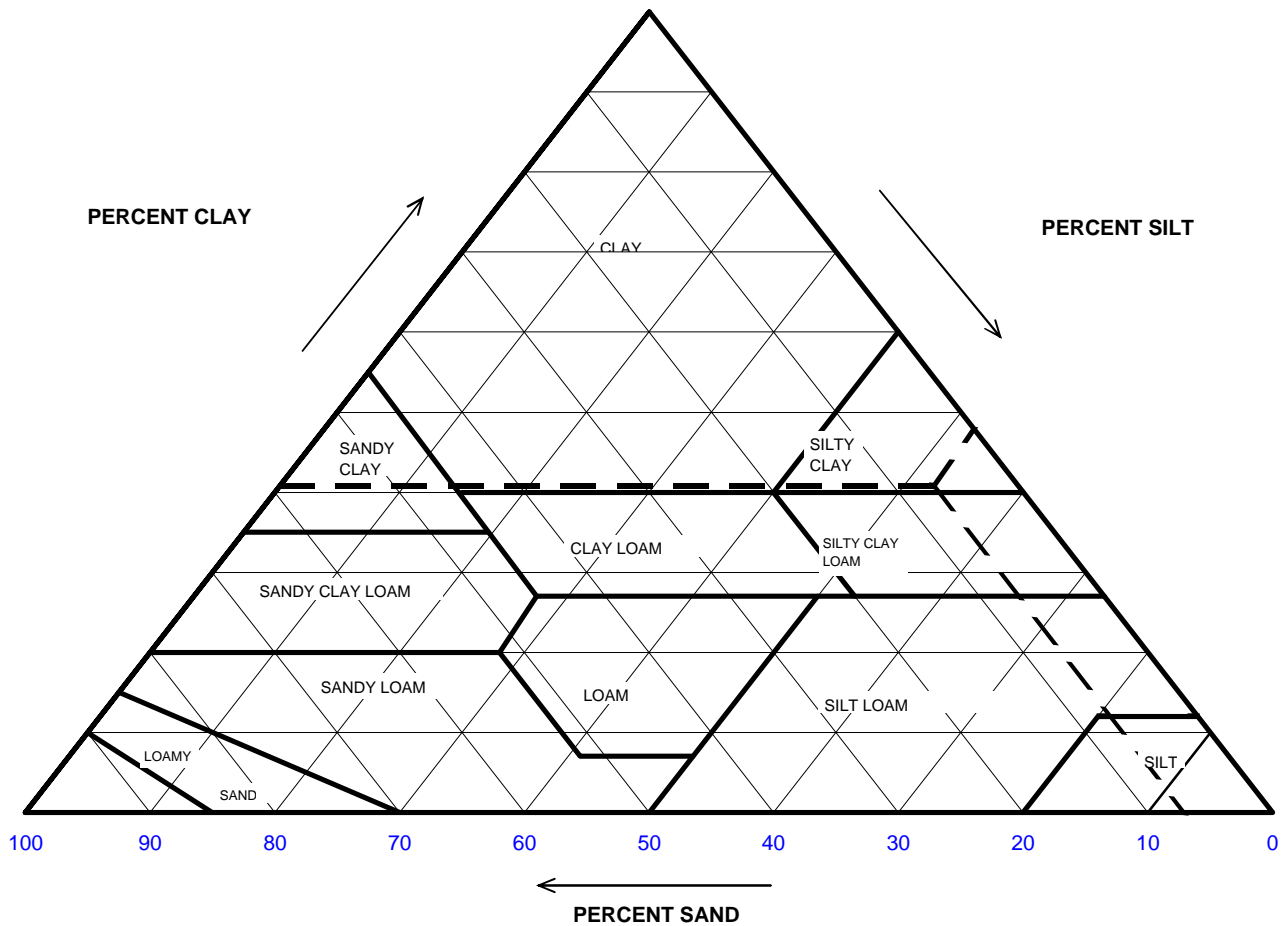
**USCS Classification:**  
**LEAN CLAY**

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-018

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 7.0  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	0.24
2	99.76	Sand	6.98
0.05	92.80	Silt	52.28
0.002	40.64	Clay	40.74

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-018

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 7.0  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1541	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	396.35	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	396.35	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	146.94	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	249.41	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	249.41
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	236.11
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	13.30
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00		0.00	100.00	100.0
1"	25	0.00		0.00	100.00	100.0
3/4"	19	0.00		0.00	100.00	100.0
1/2"	12.5	0.00		0.00	100.00	100.0
3/8"	9.5	0.00		0.00	100.00	100.0
#4	4.75	0.00		0.00	100.00	100.0
#10	2	0.60		0.24	99.76	99.8
#20	0.85	3.39	(**)	1.36	98.40	98.4
#40	0.425	3.45		1.38	97.02	97.0
#60	0.25	2.45		0.98	96.03	96.0
#100	0.15	1.74		0.70	95.34	95.3
#140	0.106	0.87		0.35	94.99	95.0
#200	0.075	0.80		0.32	94.67	94.7
Pan	-	236.11		94.67	100.00	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
 (\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16



## HYDROMETER ANALYSIS

ASTM D7928-16

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-018

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 7.0  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	57.0	22.3	5.97	6.8	0.0345	96.2	91.1
2	56.0	22.3	5.97	7.0	0.0247	94.3	89.3
4	55.0	22.3	5.97	7.2	0.0177	92.4	87.5
15	50.0	22.3	5.97	8.1	0.0097	83.0	78.6
30	46.5	22.3	5.97	8.7	0.0071	76.4	72.3
60	41.5	22.3	5.97	9.6	0.0053	67.0	63.4
240	32.5	22.4	5.93	11.2	0.0029	50.1	47.4
1440	23.5	22.7	5.82	12.8	0.0012	33.3	31.6

### Soil Specimen Data

Tare No.:	961	Percent Finer than # 200:	94.67
Wt. of Tare & Dry Material (g):	158.28		
Weight of Tare (g):	100.83	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	52.45		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 358
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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### ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-018

Boring No.: B-1 (MP 2.8)  
 Depth (ft): 7.0  
 Sample No.: B-1-3  
 Soil Description: REDDISH BROWN LEAN CLAY  
 (Minus No. 40 sieve material, Air dried)

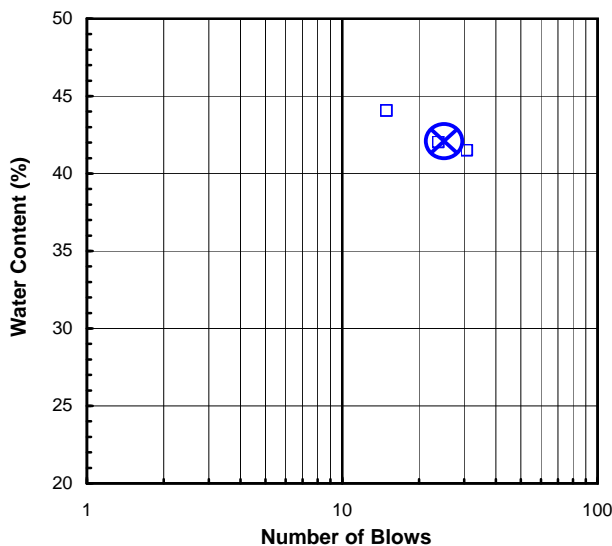
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10		Liquid Limit Test			
		1	2	3	M
Tare Number:	19	115	316	394	U
Wt. of Tare & Wet Sample (g):	66.24	38.92	39.00	34.74	L
Wt. of Tare & Dry Sample (g):	58.13	32.72	32.89	28.68	T
Weight of Tare (g):	6.91	18.63	18.34	14.06	I
Weight of Water (g):	8.1	6.2	6.1	6.1	P
Weight of Dry Sample (g):	51.2	14.1	14.6	14.6	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>15.8</b>	<b>44.0</b>	<b>42.0</b>	<b>41.5</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>24</b>	<b>31</b>	<b>T</b>

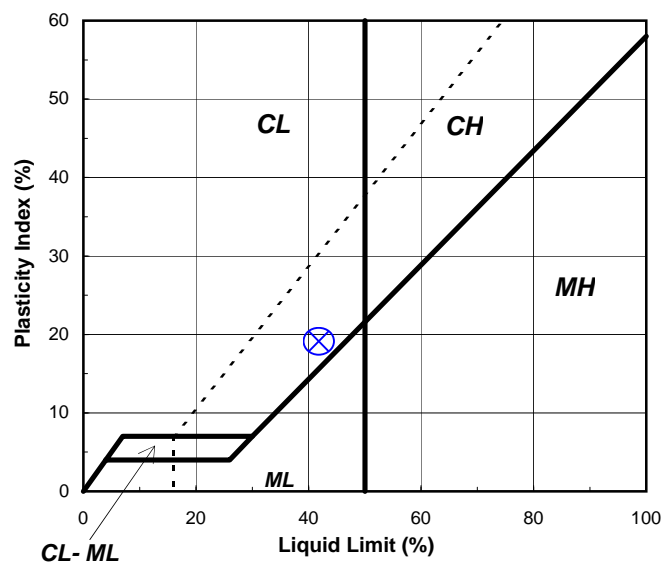
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	183	131		Liquid Limit (%):	42
Wt. of Tare & Wet Sample (g):	25.64	26.06		Plastic Limit (%):	23
Wt. of Tare & Dry Sample (g):	24.45	24.88		Plasticity Index (%):	19
Weight of Tare (g):	19.30	19.70		USCS Symbol:	CL
Weight of Water (g):	1.2	1.2			
Weight of Dry Sample (g):	5.2	5.2			
<b>Moisture Content (%):</b>	<b>23.1</b>	<b>22.8</b>	<b>0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



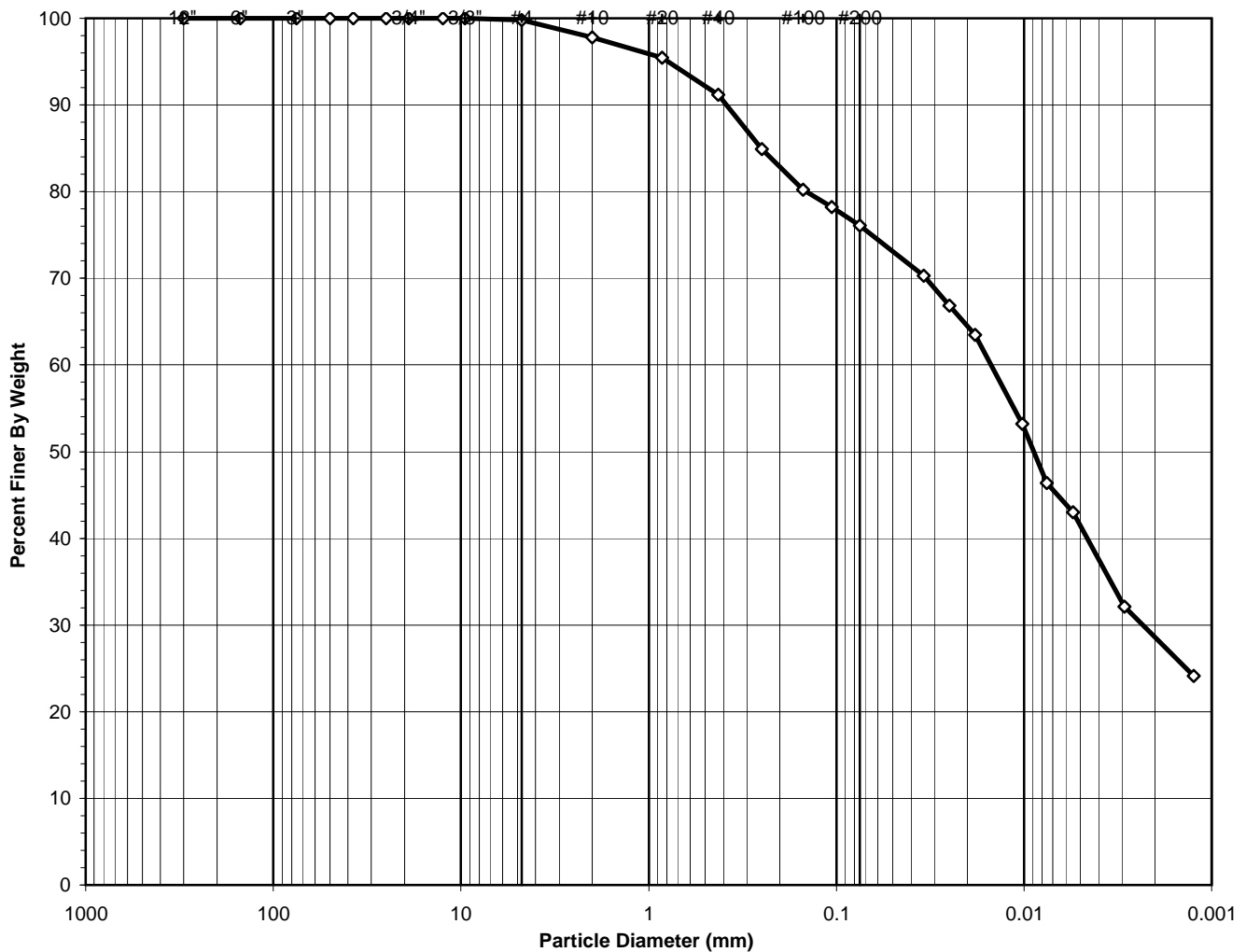
Tested By RAL Date 11/14/16 Checked By TMP Date 11/15/16

## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	Geosyntec Consultants, Inc.	Boring No.: B-2 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft): 2.5
Project No.:	2016-527-001	Sample No.: B-2-1
Lab ID:	2016-527-001-020	Soil Color: Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

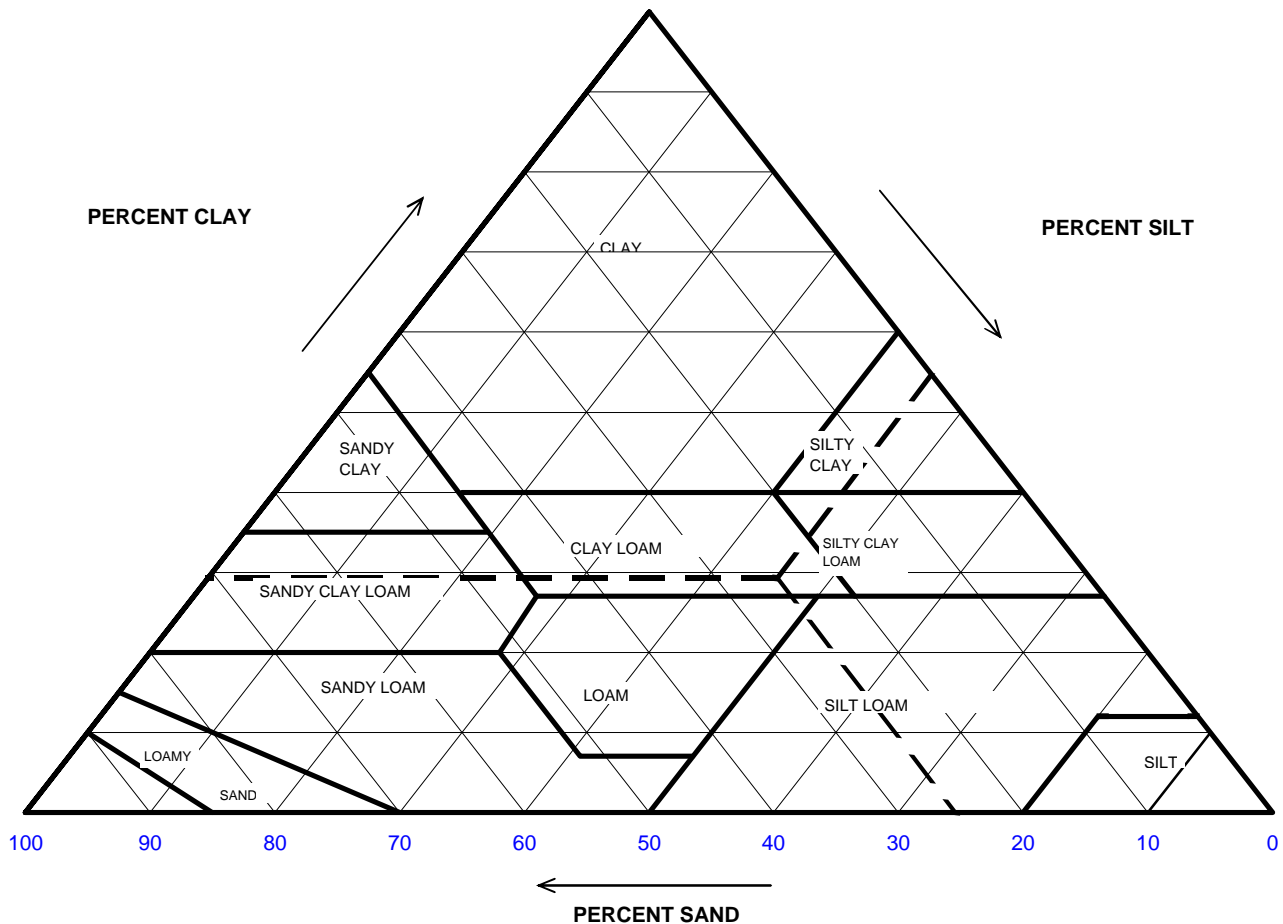
**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-020

Boring No.: B-2 (MP 2.8)  
 Depth (ft): 2.5  
 Sample No.: B-2-1  
 Soil Color: Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	2.19
2	97.81	Sand	25.30
0.05	73.07	Silt	45.48
0.002	28.58	Clay	29.22

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	2.5
Project No.:	2016-527-001	Sample No.:	B-2-1
Lab ID:	2016-527-001-020	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1472	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	417.01	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	368.19	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	144.05	Weight of Tare (g):	0.00
Weight of Water (g):	48.82	Weight of Water (g):	0.00
Weight of Dry Soil (g):	224.14	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>21.8</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	224.14
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	170.47
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	53.67
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.0
1"	25	0.00	0.00	0.00	100.00	100.0
3/4"	19	0.00	0.00	0.00	100.00	100.0
1/2"	12.5	0.00	0.00	0.00	100.00	100.0
3/8"	9.5	0.00	0.00	0.00	100.00	100.0
#4	4.75	0.48	0.21	0.21	99.79	99.8
#10	2	4.43	1.98	2.19	97.81	97.8
#20	0.85	5.28	(**)	4.55	95.45	95.5
#40	0.425	9.60	4.28	8.83	91.17	91.2
#60	0.25	14.07	6.28	15.11	84.89	84.9
#100	0.15	10.49	4.68	19.79	80.21	80.2
#140	0.106	4.44	1.98	21.77	78.23	78.2
#200	0.075	4.88	2.18	23.94	76.06	76.1
Pan	-	170.47	76.06	100.00	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample

(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16

## HYDROMETER ANALYSIS

ASTM D7928-16

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-020

Boring No.: B-2 (MP 2.8)  
 Depth (ft): 2.5  
 Sample No.: B-2-1  
 Soil Color: Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	57.5	22.3	5.97	6.7	0.0342	92.4	70.3
2	55.0	22.3	5.97	7.2	0.0250	87.9	66.9
4	52.5	22.3	5.97	7.6	0.0182	83.4	63.5
15	45.0	22.3	5.97	9.0	0.0102	70.0	53.2
30	40.0	22.3	5.97	9.9	0.0076	61.0	46.4
60	37.5	22.3	5.97	10.3	0.0055	56.5	43.0
240	29.5	22.4	5.93	11.7	0.0029	42.3	32.1
1440	23.5	22.7	5.82	12.8	0.0012	31.7	24.1

### Soil Specimen Data

Tare No.:	967	Percent Finer than # 200:	76.06
Wt. of Tare & Dry Material (g):	160.21		
Weight of Tare (g):	100.06	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	55.15		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 353
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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0

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## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-020

Boring No.: B-2 (MP 2.8)  
 Depth (ft): 2.5  
 Sample No.: B-2-1  
 Soil Description: BROWN LEAN CLAY

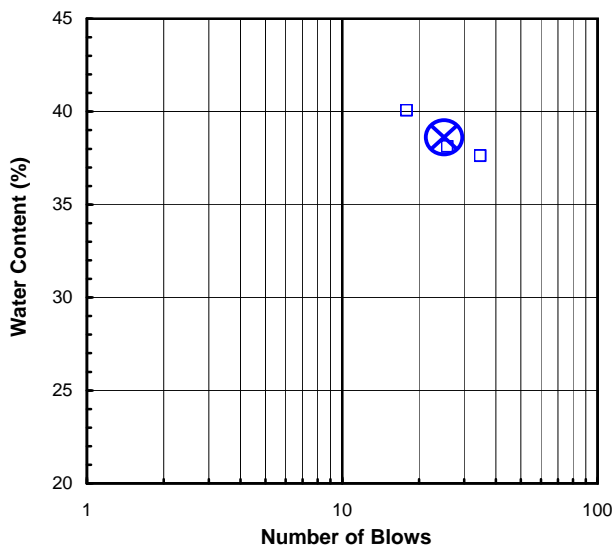
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10		Liquid Limit Test			
		1	2	3	M
Tare Number:	21	250	162	246	U
Wt. of Tare & Wet Sample (g):	67.33	38.15	37.84	36.08	L
Wt. of Tare & Dry Sample (g):	56.52	32.25	32.23	30.91	T
Weight of Tare (g):	6.91	17.51	17.50	17.15	I
Weight of Water (g):	10.8	5.9	5.6	5.2	P
Weight of Dry Sample (g):	49.6	14.7	14.7	13.8	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>21.8</b>	<b>40.0</b>	<b>38.1</b>	<b>37.6</b>	<b>N</b>
<b>Number of Blows:</b>		<b>18</b>	<b>26</b>	<b>35</b>	<b>T</b>

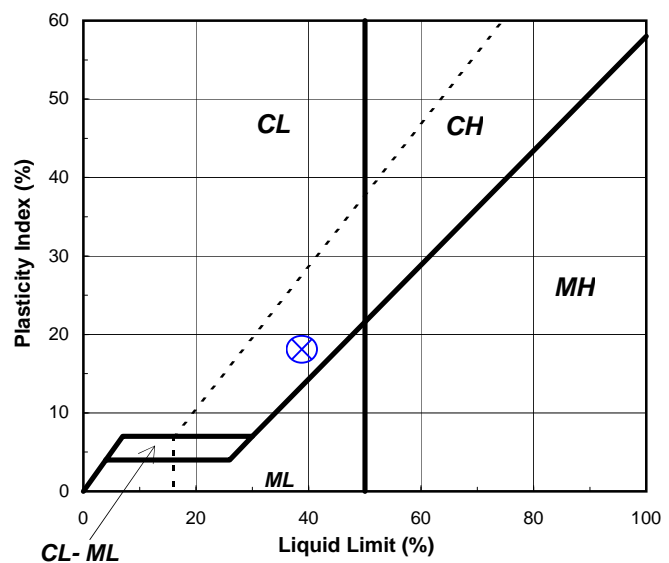
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	1106	25		<b>Liquid Limit (%):</b>	<b>39</b>
Wt. of Tare & Wet Sample (g):	23.98	25.05		<b>Plastic Limit (%):</b>	<b>21</b>
Wt. of Tare & Dry Sample (g):	22.90	23.96		<b>Plasticity Index (%):</b>	<b>18</b>
Weight of Tare (g):	17.82	18.91		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.1	1.1			
Weight of Dry Sample (g):	5.1	5.1			
<b>Moisture Content (%):</b>	<b>21.3</b>	<b>21.6</b>	<b>-0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



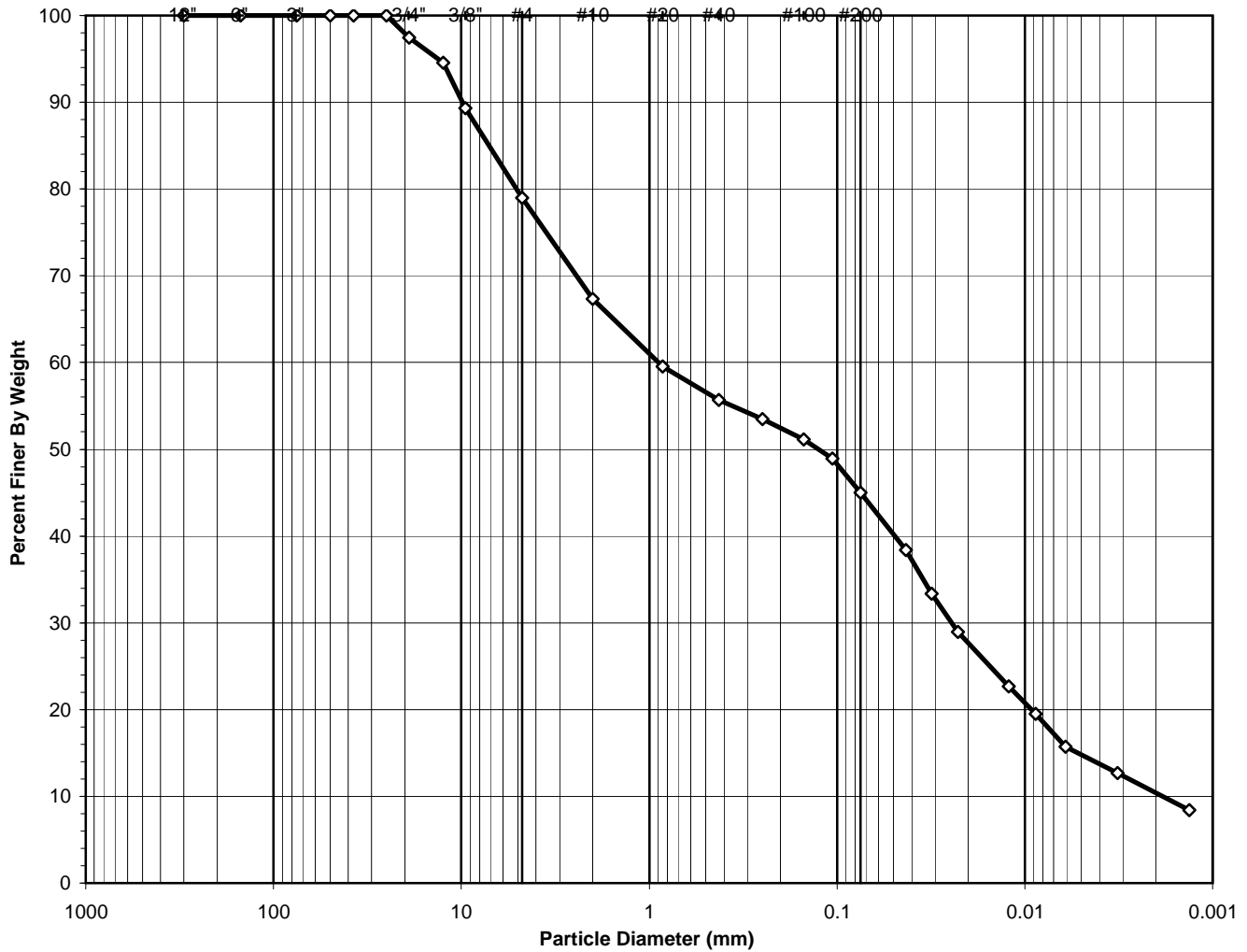
Tested By RAL Date 11/16/16 Checked By TMP Date 11/17/16

## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	14.8
Project No.:	2016-527-001	Sample No.:	B-2-6
Lab ID:	2016-527-001-022	Soil Color:	Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
SC, TESTED

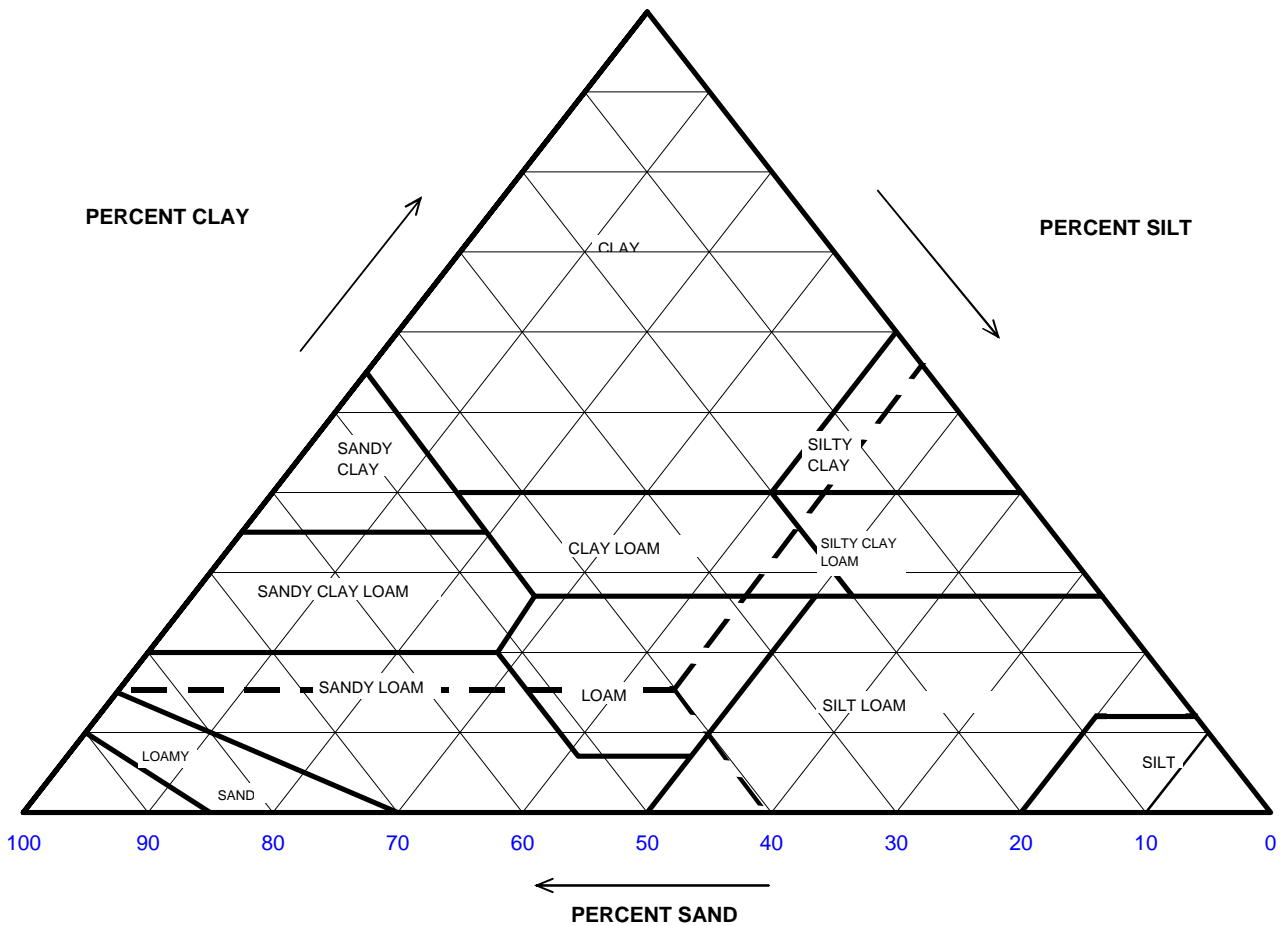
**USCS Classification:**  
CLAYEY SAND WITH GRAVEL

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-022

Boring No.: B-2 (MP 2.8)  
 Depth (ft): 14.8  
 Sample No.: B-2-6  
 Soil Color: Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification

		<b>Gravel</b>	<b>32.64</b>	
<b>2</b>	<b>67.36</b>	<b>Sand</b>	<b>27.16</b>	<b>40.32</b>
<b>0.05</b>	<b>40.20</b>	<b>Silt</b>	<b>29.85</b>	<b>44.31</b>
<b>0.002</b>	<b>10.36</b>	<b>Clay</b>	<b>10.36</b>	<b>15.37</b>

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	14.8
Project No.:	2016-527-001	Sample No.:	B-2-6
Lab ID:	2016-527-001-022	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1424	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	406.24	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	406.24	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	145.76	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	260.48	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	260.48
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	123.87
Wet Weight of +3/4" Sample (g):	6.59	Weight of plus #200 Material (g):	136.61
Dry Weight of + 3/4" Sample (g):	6.59		
Total Dry Weight of Sample (g):	6.6	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.0</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.0</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.0</b>
2"	50	0.00	(*)	0.00	100.00	<b>100.0</b>
1 1/2"	37.5	0.00		0.00	100.00	<b>100.0</b>
1"	25	0.00		0.00	100.00	<b>100.0</b>
3/4"	19	6.59	2.53	2.53	97.47	<b>97.5</b>
1/2"	12.5	7.52	2.89	5.42	94.58	<b>94.6</b>
3/8"	9.5	13.69	5.26	10.67	89.33	<b>89.3</b>
#4	4.75	27.02	10.37	21.05	78.95	<b>79.0</b>
#10	2	30.19	11.59	32.64	67.36	<b>67.4</b>
#20	0.85	20.32	(**)	40.44	59.56	<b>59.6</b>
#40	0.425	10.07	3.87	44.30	55.70	<b>55.7</b>
#60	0.25	5.77	2.22	46.52	53.48	<b>53.5</b>
#100	0.15	6.09	2.34	48.86	51.14	<b>51.1</b>
#140	0.106	5.85	2.25	51.10	48.90	<b>48.9</b>
#200	0.075	10.09	3.87	54.98	45.02	<b>45.0</b>
Pan	-	123.87	47.55	102.53	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
 (\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By **SG** Date **11/17/16** Checked By **KC** Date **11/21/16**

## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	14.8
Project No.:	2016-527-001	Sample No.:	B-2-6
Lab ID:	2016-527-001-022	Soil Color:	Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	36.5	22.3	5.97	10.5	0.0428	85.2	38.4
2	32.5	22.3	5.97	11.2	0.0313	74.0	33.3
4	29.0	22.3	5.97	11.8	0.0227	64.3	28.9
15	24.0	22.3	5.97	12.7	0.0122	50.3	22.7
30	21.5	22.3	5.97	13.2	0.0088	43.3	19.5
65	18.5	22.3	5.97	13.7	0.0061	35.0	15.7
240	16.0	22.4	5.93	14.2	0.0032	28.1	12.6
1440	12.5	22.7	5.82	14.8	0.0013	18.6	8.4

### Soil Specimen Data

Tare No.:	947	Percent Finer than # 200:	45.02
Wt. of Tare & Dry Material (g):	140.04	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	99.60		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	35.44		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 199
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-022

Boring No.: B-2 (MP 2.8)  
 Depth (ft): 14.8  
 Sample No.: B-2-6  
 Soil Description: BROWN LEAN CLAY

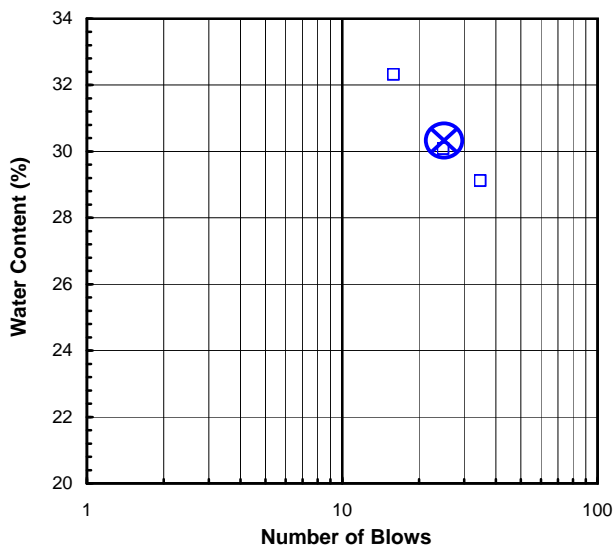
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	11	200	1101	150	U
Wt. of Tare & Wet Sample (g):	59.77	33.74	33.96	35.30	L
Wt. of Tare & Dry Sample (g):	57.42	30.03	30.32	31.80	T
Weight of Tare (g):	6.86	18.54	18.21	19.77	I
Weight of Water (g):	2.4	3.7	3.6	3.5	P
Weight of Dry Sample (g):	50.6	11.5	12.1	12.0	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>4.6</b>	<b>32.3</b>	<b>30.1</b>	<b>29.1</b>	<b>N</b>
<b>Number of Blows:</b>		<b>16</b>	<b>25</b>	<b>35</b>	<b>T</b>

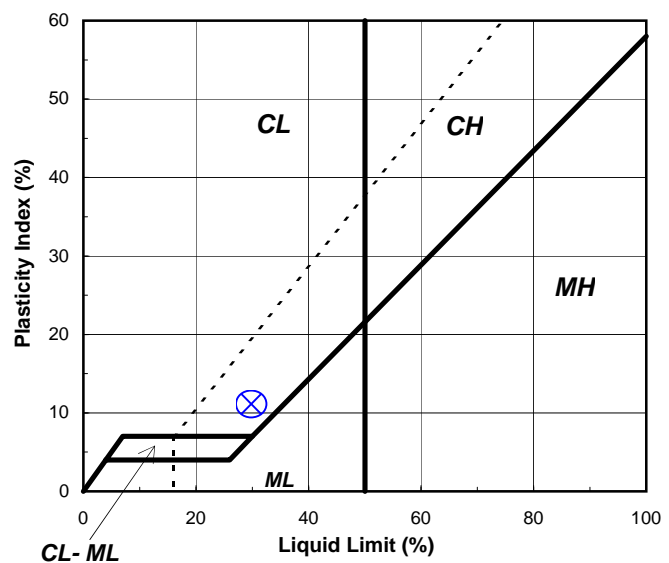
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	176	236		<b>Liquid Limit (%):</b>	<b>30</b>
Wt. of Tare & Wet Sample (g):	25.87	24.64		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	24.86	23.66		<b>Plasticity Index (%):</b>	<b>11</b>
Weight of Tare (g):	19.42	18.51		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.0	1.0			
Weight of Dry Sample (g):	5.4	5.2			
<b>Moisture Content (%):</b>	<b>18.6</b>	<b>19.0</b>	<b>-0.5</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

**Flow Curve**



**Plasticity Chart**



Tested By RAL Date 11/14/16 Checked By TMP Date 11/15/16



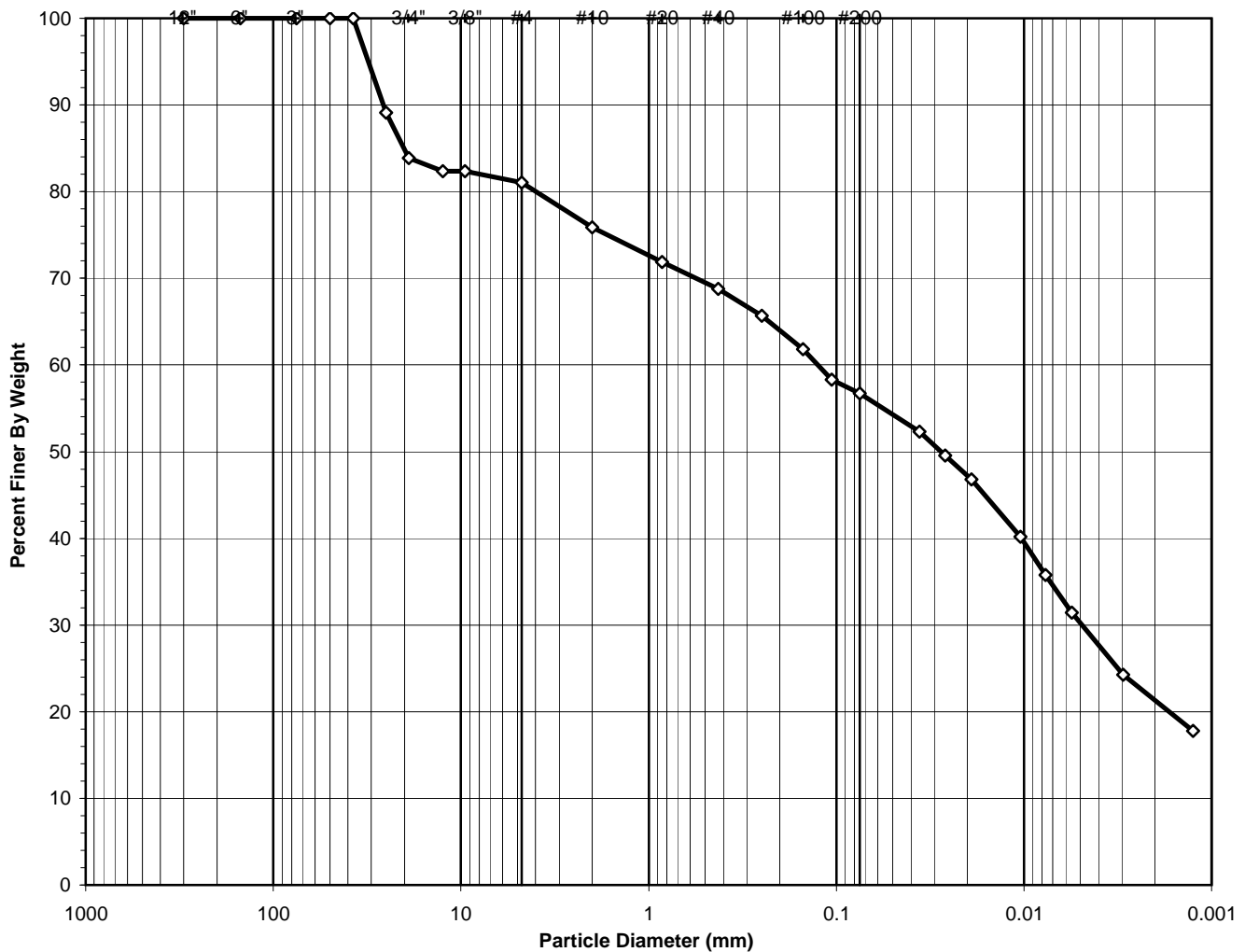
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-023

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 3.0  
 Sample No.: B-3-1  
 Soil Color: Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

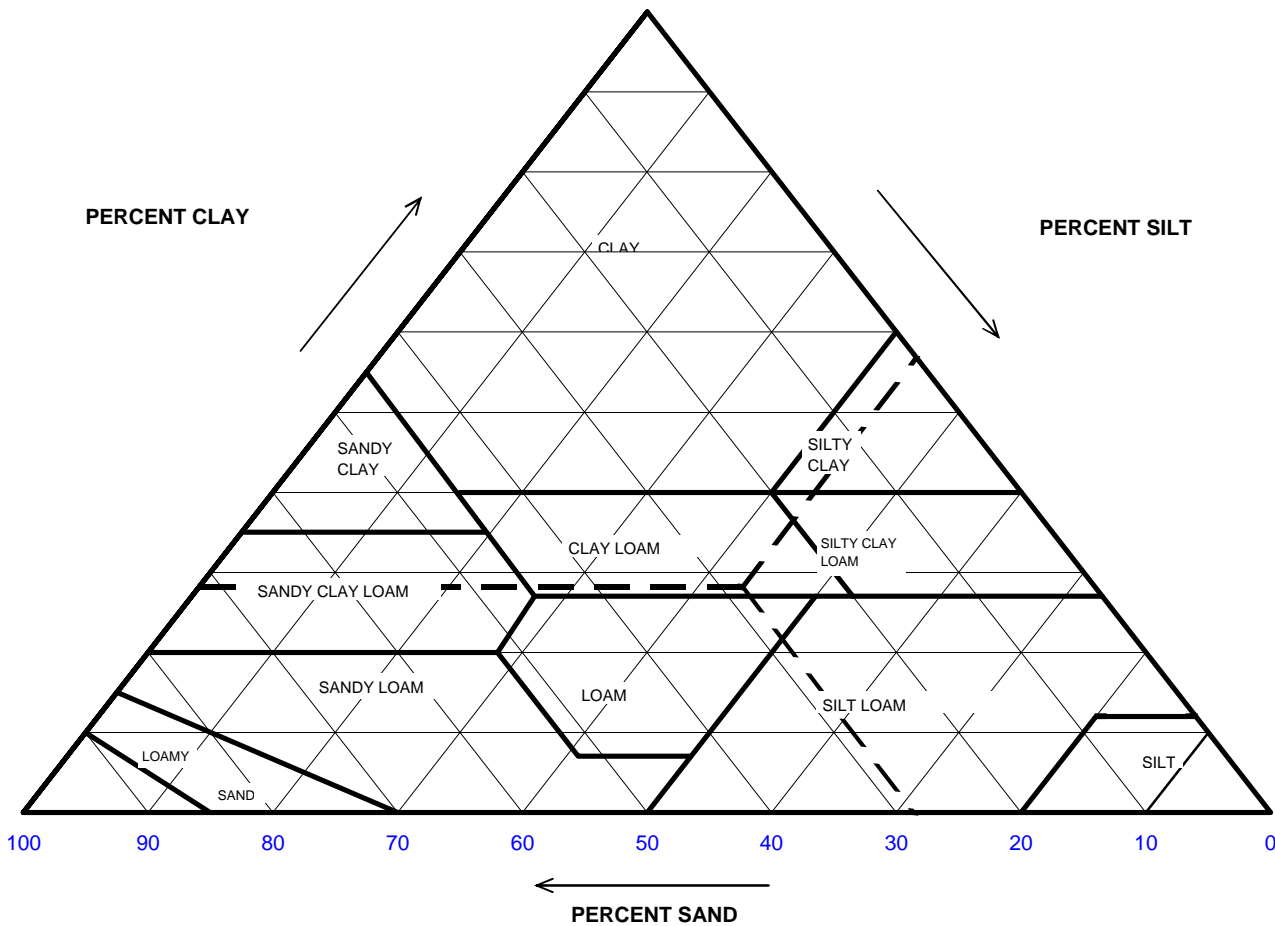
**USCS Classification:**  
**SANDY LEAN CLAY WITH GRAVEL**

Tested By **SG** Date **11/17/16** Checked By **KC** Date **11/21/16**

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-023

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 3.0  
 Sample No.: B-3-1  
 Soil Color: Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification

		<b>Gravel</b>	<b>24.11</b>	
<b>2</b>	<b>75.89</b>	<b>Sand</b>	<b>21.62</b>	<b>28.49</b>
<b>0.05</b>	<b>54.27</b>	<b>Silt</b>	<b>32.93</b>	<b>43.40</b>
<b>0.002</b>	<b>21.33</b>	<b>Clay</b>	<b>21.33</b>	<b>28.11</b>

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	3.0
Project No.:	2016-527-001	Sample No.:	B-3-1
Lab ID:	2016-527-001-023	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1511	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	468.94	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	468.94	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	147.52	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	321.42	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	321.42
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	234.08
Wet Weight of +3/4" Sample (g):	51.87	Weight of plus #200 Material (g):	87.34
Dry Weight of + 3/4" Sample (g):	51.87		
Total Dry Weight of Sample (g):	51.9	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.0</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.0</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.0</b>
2"	50	0.00	(*)	0.00	100.00	<b>100.0</b>
1 1/2"	37.5	0.00		0.00	100.00	<b>100.0</b>
1"	25	35.09	10.92	10.92	89.08	<b>89.1</b>
3/4"	19	16.78	5.22	16.14	83.86	<b>83.9</b>
1/2"	12.5	4.77	1.48	17.62	82.38	<b>82.4</b>
3/8"	9.5	0.00	0.00	17.62	82.38	<b>82.4</b>
#4	4.75	4.29	1.33	18.96	81.04	<b>81.0</b>
#10	2	16.57	5.16	24.11	75.89	<b>75.9</b>
#20	0.85	12.77	(**)	28.08	71.92	<b>71.9</b>
#40	0.425	10.00	3.11	31.20	68.80	<b>68.8</b>
#60	0.25	10.13	3.15	34.35	65.65	<b>65.7</b>
#100	0.15	12.38	3.85	38.20	61.80	<b>61.8</b>
#140	0.106	11.16	3.47	41.67	58.33	<b>58.3</b>
#200	0.075	5.27	1.64	43.31	56.69	<b>56.7</b>
Pan	-	234.08	72.83	116.14	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By **SG** Date **11/17/16** Checked By **KC** Date **11/21/16**

## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	3.0
Project No.:	2016-527-001	Sample No.:	B-3-1
Lab ID:	2016-527-001-023	Soil Color:	Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	53.5	22.3	5.97	7.4	0.0360	92.3	52.3
2	51.0	22.3	5.97	7.9	0.0262	87.4	49.6
4	48.5	22.3	5.97	8.3	0.0191	82.6	46.8
15	42.5	22.3	5.97	9.4	0.0105	70.9	40.2
30	38.5	22.3	5.97	10.1	0.0077	63.1	35.8
61	34.5	22.3	5.97	10.8	0.0056	55.4	31.4
240	28.0	22.4	5.93	12.0	0.0030	42.8	24.3
1440	22.0	22.7	5.82	13.1	0.0013	31.4	17.8

### Soil Specimen Data

Tare No.:	1092	Percent Finer than # 200:	56.69
Wt. of Tare & Dry Material (g):	154.80	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	98.86		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	50.94		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 209
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-023

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 3.0  
 Sample No.: B-3-1  
 Soil Description: BROWN LEAN CLAY

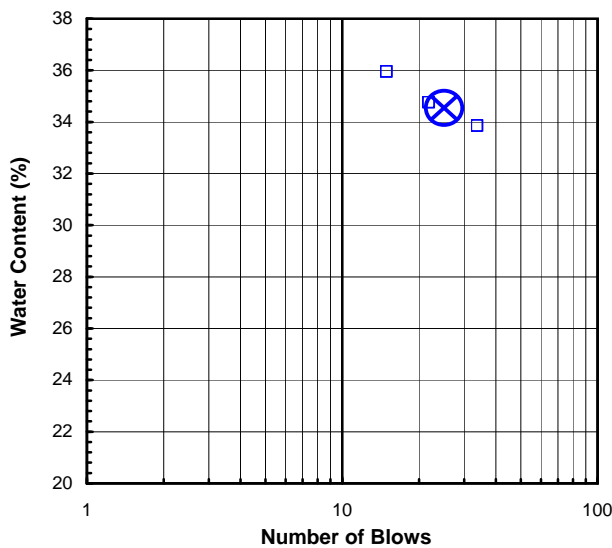
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	30	161	101	195	U
Wt. of Tare & Wet Sample (g):	61.97	38.35	38.41	37.52	L
Wt. of Tare & Dry Sample (g):	55.29	32.93	33.17	32.40	T
Weight of Tare (g):	6.82	17.84	18.08	17.26	I
Weight of Water (g):	6.7	5.4	5.2	5.1	P
Weight of Dry Sample (g):	48.5	15.1	15.1	15.1	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>13.8</b>	<b>35.9</b>	<b>34.7</b>	<b>33.8</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>22</b>	<b>34</b>	<b>T</b>

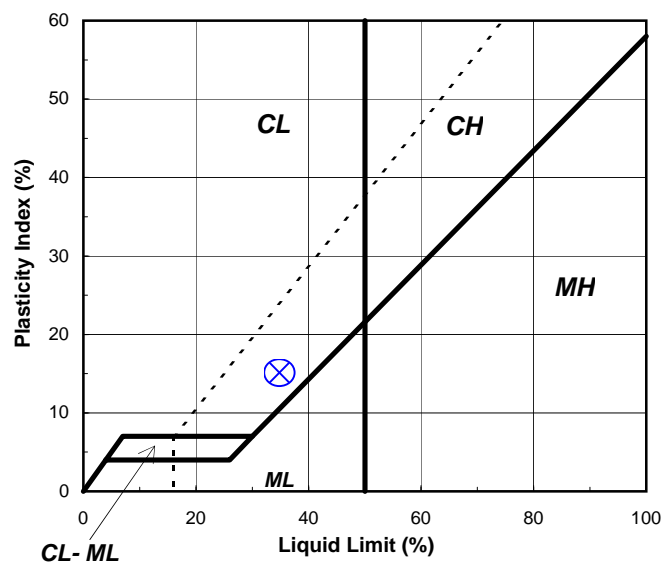
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	3	220		Liquid Limit (%):	<b>35</b>
Wt. of Tare & Wet Sample (g):	25.27	25.69		Plastic Limit (%):	<b>20</b>
Wt. of Tare & Dry Sample (g):	24.20	24.61		Plasticity Index (%):	<b>15</b>
Weight of Tare (g):	18.89	19.27		USCS Symbol:	<b>CL</b>
Weight of Water (g):	1.1	1.1			
Weight of Dry Sample (g):	5.3	5.3			
<b>Moisture Content (%):</b>	<b>20.2</b>	<b>20.2</b>	<b>-0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



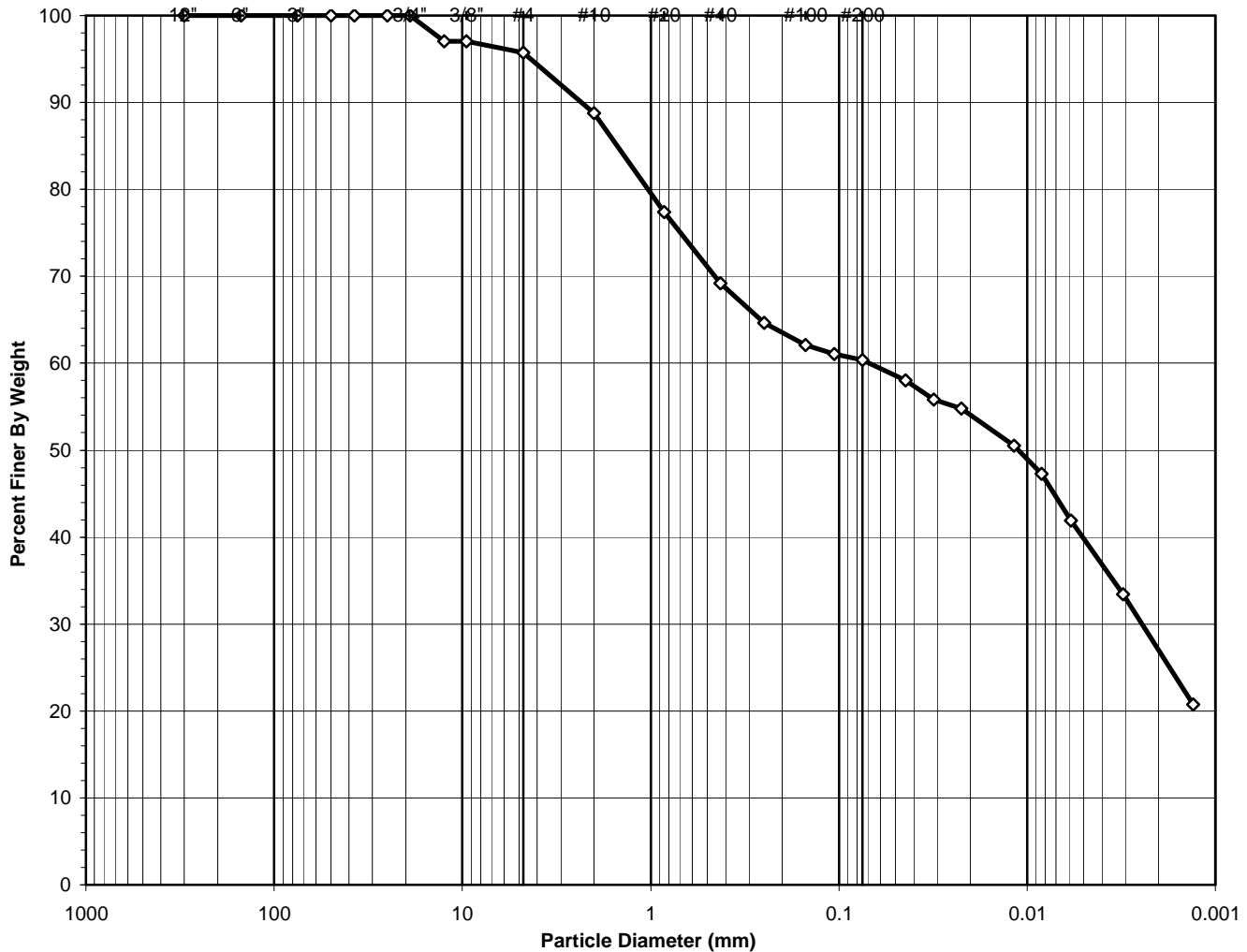
Tested By RAL Date 11/14/16 Checked By TMP Date 11/15/16

## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	15.5
Project No.:	2016-527-001	Sample No.:	B-3-6
Lab ID:	2016-527-001-025	Soil Color:	Dark Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**SANDY LEAN CLAY**

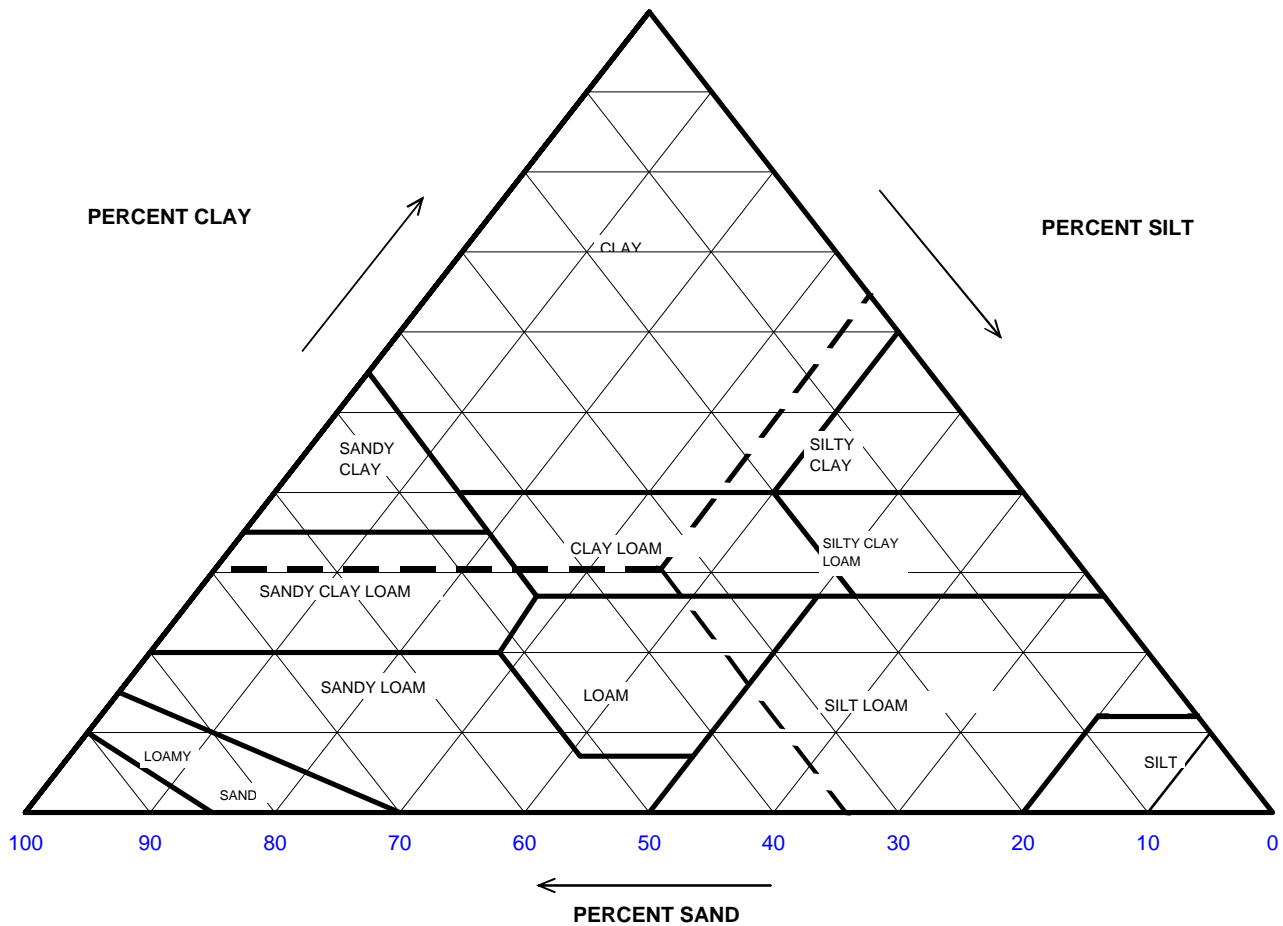
Tested By HL Date 11/14/16 Checked By KC Date 11/21/16



## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-025

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 15.5  
 Sample No.: B-3-6  
 Soil Color: Dark Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer		Corrected % of Minus 2.0 mm material for USDA Classification
		<b>Gravel</b>	<b>11.21</b>
<b>2</b>	<b>88.79</b>	<b>Sand</b>	<b>34.06</b>
<b>0.05</b>	<b>58.55</b>	<b>Silt</b>	<b>35.55</b>
<b>0.002</b>	<b>26.99</b>	<b>Clay</b>	<b>30.40</b>

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	15.5
Project No.:	2016-527-001	Sample No.:	B-3-6
Lab ID:	2016-527-001-025	Soil Color:	Dark Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1480	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	464.34	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	430.12	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	147.84	Weight of Tare (g):	0.00
Weight of Water (g):	34.22	Weight of Water (g):	0.00
Weight of Dry Soil (g):	282.28	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>12.1</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	282.28
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	170.33
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	111.95
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.0</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.0</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.0</b>
2"	50	0.00	(*)	0.00	100.00	<b>100.0</b>
1 1/2"	37.5	0.00		0.00	100.00	<b>100.0</b>
1"	25	0.00		0.00	100.00	<b>100.0</b>
3/4"	19	0.00		0.00	100.00	<b>100.0</b>
1/2"	12.5	8.30		2.94	97.06	<b>97.1</b>
3/8"	9.5	0.00		2.94	97.06	<b>97.1</b>
#4	4.75	3.76		4.27	95.73	<b>95.7</b>
#10	2	19.57		11.21	88.79	<b>88.8</b>
#20	0.85	32.27	(**)	22.64	77.36	<b>77.4</b>
#40	0.425	23.14		30.83	69.17	<b>69.2</b>
#60	0.25	12.83		35.38	64.62	<b>64.6</b>
#100	0.15	7.09		37.89	62.11	<b>62.1</b>
#140	0.106	3.03		38.96	61.04	<b>61.0</b>
#200	0.075	1.96		39.66	60.34	<b>60.3</b>
Pan	-	170.33		100.00	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By HL Date 11/14/16 Checked By KC Date 11/21/16

## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 2.8)
Client Reference:	ACP TXG0007	Depth (ft):	15.5
Project No.:	2016-527-001	Sample No.:	B-3-6
Lab ID:	2016-527-001-025	Soil Color:	Dark Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	33.0	22.3	5.97	11.1	0.0441	96.1	58.0
2	32.0	22.3	5.97	11.3	0.0314	92.6	55.9
4	31.5	22.3	5.97	11.4	0.0223	90.8	54.8
15	29.5	22.3	5.97	11.7	0.0117	83.7	50.5
30	28.0	22.3	5.97	12.0	0.0084	78.3	47.3
64	25.5	22.3	5.97	12.5	0.0058	69.4	41.9
240	21.5	22.4	5.93	13.2	0.0031	55.4	33.4
1440	15.5	22.7	5.82	14.3	0.0013	34.4	20.8

### Soil Specimen Data

Tare No.:	1466	Percent Finer than # 200:	60.34
Wt. of Tare & Dry Material (g):	142.40	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	109.59		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	27.81		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 771
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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0

0

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-025

Boring No.: B-3 (MP 2.8)  
 Depth (ft): 15.5  
 Sample No.: B-3-6  
 Soil Description: DARK BROWN LEAN CLAY

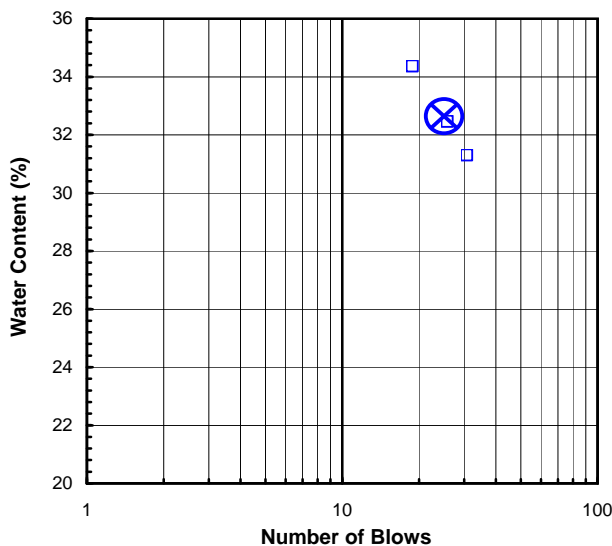
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**  
 (Minus No. 40 sieve material, Air dried)

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	29	117	213	2101	U
Wt. of Tare & Wet Sample (g):	70.16	42.51	39.96	41.61	L
Wt. of Tare & Dry Sample (g):	63.69	37.19	34.72	35.69	T
Weight of Tare (g):	6.82	20.18	18.56	18.45	I
Weight of Water (g):	6.5	5.3	5.2	5.9	P
Weight of Dry Sample (g):	56.9	17.0	16.2	17.2	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>11.4</b>	<b>31.3</b>	<b>32.4</b>	<b>34.3</b>	<b>N</b>
<b>Number of Blows:</b>		<b>31</b>	<b>26</b>	<b>19</b>	<b>T</b>

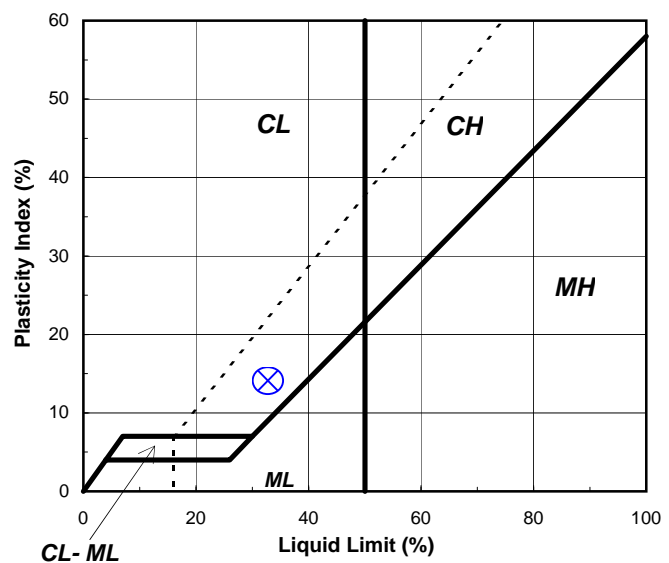
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	100	198		<b>Liquid Limit (%):</b>	<b>33</b>
Wt. of Tare & Wet Sample (g):	26.85	22.99		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	25.85	22.01		<b>Plasticity Index (%):</b>	<b>14</b>
Weight of Tare (g):	20.73	16.94		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.0	1.0			
Weight of Dry Sample (g):	5.1	5.1			
<b>Moisture Content (%):</b>	<b>19.5</b>	<b>19.3</b>	<b>0.2</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



Tested By TO Date 11/14/16 Checked By TMP Date 11/16/16

26 May 2017  
TXG0007-012-6302

**VIA EMAIL**

Colin Olness, Contractor  
Atlantic Coast Pipeline  
99 Edmiston Way  
Buckhannon, WV 26201

**Subject: Geotechnical Investigation at Potential Slope Instability Site  
Supply Header Project (SHP) – Atlantic Coast Pipeline Project  
Route Revision 11B, Segment TL-635, MP 9.3  
Doddridge County, West Virginia**

Dear Mr. Olness:

This data summary report has been prepared by Geosyntec Consultants, Inc. (Geosyntec) for Dominion Transmission, Inc. (DTI) to present the geotechnical drilling investigation performed at a geohazard site located at Milepost (MP 9.3) along the Supply Header Project (SHP) TL-635 Segment of the Atlantic Coast Pipeline (ACP) Route Revision 11B (Project; Figure 1). The objective of this geotechnical drilling investigation was to characterize the subsurface conditions at the site and confirm or preclude suspected slope instability identified as part of our Phase 2 investigation [Geosyntec, 2016]<sup>1</sup>, so that if required, measures may be designed to mitigate the effects of potential ground movement on the pipeline. This report summarizes activities completed in the field, a description of the geologic conditions observed at the site, and provides the results of the geotechnical laboratory testing program.

## **GEOTECHNICAL INVESTIGATION**

This geotechnical drilling investigation included a site reconnaissance, access road improvements, geotechnical borings, instrumentation installation and monitoring, and geotechnical laboratory testing.

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<sup>1</sup> Geosyntec Consultants, 2016. "Geohazard Analysis Program Phase 2 Report, Atlantic Coast Pipeline and Supply Header Project", submitted to Dominion Transmission Inc. dated 29 July 2016.

## **Site Reconnaissance**

Our field reconnaissance performed on 24 August 2016 consisted of a site visit by a Principal Engineering Geologist from Geosyntec, two representatives from Horn and Associates (drilling subcontractor), and two representatives from the ACP to evaluate existing site conditions and access to the identified geohazard site location. The objective of the field reconnaissance was to familiarize the drilling contractor with the site conditions, identify potential access routes, evaluate the number and type of exploratory borings needed to adequately characterize the site, and select locations for the exploratory borings in the field.

## **Health and Safety**

Prior to conducting our field investigation, Geosyntec updated our existing site-specific Health and Safety Plan (HASP) in accordance with Occupational Safety & Health Administration (OSHA) requirements. The updated HASP addressed potential hazards at the site locations, including requirements for worker protection based on the anticipated activities. Additionally, the HASP also included directions to nearest emergency medical facility. Prior to commencing work at the site, Geosyntec also delineated the locations of the individual explorations and notified Underground Service Alert (USA, Dig-Alert) to identify the locations of any existing underground utilities within the immediate vicinity.

## **Site Access and Improvements**

Drilling locations at SHP MP 9.3 were accessed using a private gated road off of Long Run Road and followed pre-existing logging roads. Due to the remote locations of the investigation site, minor grading and road restoration activities were performed where no previous access existed. Road restoration and grading work was performed by Horn and Associates utilizing a John Deere 85D tracked excavator. Work consisted of trimming secondary vegetation growth, smoothing the ground surface, and localized widening and leveling where cross-slope conditions would not permit safe passage of a light weighted track mounted drill rig.

Where ground disturbance was required, erosion and sediment control Best Management Practices (BMPs) were implemented to minimize the potential for erosion and/or sediment transport to adjacent areas outside the limits of disturbance. BMPs consisted of 8-inch silt socks installed along the edge of the graded access roads and the drilling investigation pads. Upon completion of drilling activities, straw and seed were hand broadcasted along the surface of graded areas to help reduce erosion and sediment transport and promote vegetative growth. A photographic log documenting completed road improvement and site restoration activities is provided in Appendix A.

### Subsurface Explorations

This geotechnical investigation included drilling three exploratory borings at the SHP MP 9.3 geohazard site location along the northeastern facing slope (designated Borings B-1, B-2, and B-3; Figure 1). Borings were drilled between 50.0 and 50.5 feet below ground surface (ft bgs). Table 1 presents the coordinates, ground surface elevations, and termination depths of Borings B-1, B-2, and B-3.

**Table 1 – Coordinates of Boring Locations**

Boring ID	Coordinates – UTM, Zone 17S, NAD83				Ground Surface Elev. WGS84 (MSL-ft)	Final Depth (ft)
	Proposed		As-Built			
	Latitude	Longitude	Latitude	Longitude		
B-1	39.275308	-80.634097	39.275313	-80.634053	1,150	50.4
B-2	39.275757	-80.633648	39.275871	-80.633730	1,095	50.0
B-3	39.275952	-80.633808	39.275975	-80.633790	955	50.5

The borings were advanced by Horn and Associates of Winchester, Kentucky utilizing a light-weight rubber track mounted Diedrich D-50 drill rig. Borings were drilled using a combination of 8-inch hollow-stem auger (HSA) and core drilling (NX) methods. During HSA drilling, drive samples were collected at approximately 30-inch intervals using a 2.5-inch diameter, 24-inch long Standard Penetration Test (SPT) sampler to facilitate lithologic logging and sample collection for geotechnical laboratory testing. SPT sampling was performed through the entire overburden material profile and into underlying bedrock, to the extent practical.

Following auger or SPT refusal, or upon encountering competent formation (bedrock) material, the investigations switched to core drilling methods until the borehole was advanced at least 15 feet into intact bedrock. The core drilling process required circulation of water mixed with a naturally occurring bentonite based drilling fluid additive to regulate the temperature of the core bit, to carry cuttings to the surface, and to promote borehole stability. During the coring process, drilling fluid was pumped through the drill rods and past the bit before returning to the surface with cuttings through the annular space between the drill rods and the wall of the boring. At the surface, the fluid and cuttings were discharged into a baffled sump tank to allow the cuttings to fall out prior to recirculating the drilling fluid back down the borehole. Water required for this process was pumped from a nearby creek source located downslope along Long Run Road.



The soil sample descriptions were logged by a Geosyntec geologist in accordance with ASTM International D2488. Additionally, recovered cores were logged to record structural orientation and discontinuities. Upon completion of logging, the cores were photographed (Appendix B) and retained in core boxes for subsequent sample selection and/or archiving. Table 2 summarizes the length of each boring, depth to top of bedrock, and the length of rock coring.

**Table 2:** Soil Thickness, Length of Rock Cores and Boring Penetration Depths

<b>Boring ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to top of Bedrock (ft)</b>	<b>Length of Rock Coring (ft)</b>
B-1 (SHP MP 9.3)	50.4	10.4	40.0
B-2 (SHP MP 9.3)	50.0	15.0	35.0
B-3 (SHP MP 9.3)	50.5	19.0	31.5

## **Geotechnical Instrumentation**

Following completion of the core drilling and evaluation of the subsurface conditions, boreholes were selected for instrumentation consisting of either a standpipe piezometer to monitor groundwater levels, or an inclinometer to record potential slope movement over time. Borings not selected for instrumentation were backfilled from the bottom up with a bentonite-cement grout using a tremie pipe.

### **Piezometer**

One temporary standpipe piezometer was installed in exploratory Boring B-3 at the SHP MP 9.3 investigation site. The piezometer consisted of a 2-inch diameter PVC pipe, installed after drilling and prior to auger withdrawal, with a 20 ft section of 0.010-inch slotted screen (screened interval) placed at the overburden material and bedrock interface. The annular space around the screened interval was backfilled with a permeable filter pack generally consisting of coarse-grained sand. A 2-foot bentonite seal was placed at the top of the filter pack, and the remainder of the annular space was backfilled with bentonite-cement grout to prevent conveyance of surface water into the ground. Standpipe piezometer construction logs for the piezometer installed at Boring B-3 are provided in Appendix C and summarized in Table 3a.

Depth to groundwater within the Boring B-3 temporary standpipe piezometer was measured at 30.60 ft bgs on 18 October 2016 approximately 72 hours after drilling. A subsequent groundwater level survey was performed on 13 December 2016 and depth to groundwater was recorded at 29.81 ft bgs. This subsequent measurement is considered to represent relatively stabilized levels, however, the subsurface materials at the site generally exhibits a relatively high percentage of silt and clay sized materials, which reduce permeability. It is possible that the observed groundwater levels in the temporary piezometers may not represent fully stabilized

groundwater conditions due to the time rate of travel of groundwater through these materials. The measurements indicate depth to groundwater decreased 0.79 ft between 18 October 2016 and 13 December 2016. A summary of the standpipe piezometer data is provided below in Table 3a and presented graphically in Figure 2.

**Table 3a: Standpipe Piezometer Construction**

<b>Piezometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Depth to Groundwater<sup>1</sup> (ft bgs)</b>	<b>Depth to Top of Screen (ft)</b>	<b>Screen Length (ft)</b>	<b>Depth to Bentonite Seal (ft bgs)</b>
B-3 (SHP MP 9.3)	50.5	19.0	29.81	8.8	20	6.8

**Notes:**

1 - Depth to groundwater measured on 13 December 2016.

The surface completion for the piezometer included a locked surface monument to provide access for periodic groundwater level measurements, as well as to be used as a benchmark for subsequent level surveys. The temporary standpipe piezometer is anticipated to be monitored through pipeline construction, if deemed necessary. Upon completion of monitoring, the PVC piezometer should be cutoff below the ground surface and backfilled with bentonite-cement grout.

**Inclinometer**

One inclinometer was installed in exploratory Boring B-2 at the SHP MP 9.3 geohazard site to monitor the absence or the presence of progressive slope movement that may be imperceptible to the eye. Inclinometer casing consisted of 2.75-inch diameter acrylonitrile butadiene styrene (ABS) plastic. The bottom of the inclinometer casing was installed at 50.0 ft bgs. The annular space between the wall of the boring and the inclinometer casing was backfilled with a lean cement grout mixture from the bottom up using a tremmie pipe. Construction logs for the inclinometer installed at SHP MP 9.3 are provided in Appendix C and summarized in Table 3b.

Following instrumentation installation, an initial baseline survey (i.e., zero reading) was performed on 18 October 2016. The grouted-in inclinometer was allowed approximately 2 days to set prior to conducting the baseline reading. A subsequent inclinometer survey was collected on 13 December 2016, 56 days following the zero reading. The survey measurements indicate a cumulative deflection of less than 0.05 inches during the time between the zero reading and the subsequent inclinometer survey, and is considered negligible given the accuracy of the survey equipment. A summary of the inclinometer survey data is provided below in Table 3b and presented graphically in Figure 3.

**Table 3b: Inclinometer Casing Construction**

<b>Inclinometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth of Inclinometer Casing (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Length of Stickup above Ground Surface (ft)</b>
B-2 (SHP MP 9.3)	50.0	50.0	15.0	1.8

The surface completion for the inclinometer included a locked surface monument to provide access for periodic monitoring as well as to be used as a benchmark for subsequent level surveys. The inclinometer is expected to be monitored through construction if deemed necessary. Upon completion of monitoring, the inclinometer casing should be cut off below the ground surface and backfilled with bentonite-cement grout.

**SITE CONDITIONS**

Knowledge of the site conditions was developed from a review of regional geologic conditions and our findings from explorations performed for this investigation.

**Geologic Setting**

The SHP MP 9.3 investigation site lies within the northeastern margin of the Appalachian Plateau Physiographic Province of West Virginia. The Appalachian Plateau is an uplifted tract of nearly horizontal or gently folded strata extending from the Adirondacks in northern New York, southwest through Pennsylvania, and terminating at the Coastal Plain in Alabama. The Appalachian Plateau feature is a southeast-facing escarpment bounded by the Central Lowland Province to the west and the Valley and Ridge Province to the east. The general site area is located within the Kanawha Physiographic Section. This section, also referred to as the Unglaciaded Allegheny Mountains, exhibits high-elevation, low relief plateau-like morphology and is thoroughly dissected by streams with a dendritic drainage pattern and rugged topography.

The Doddridge County area is locally underlain by an approximately 1,100-ft thick sequence of Paleozoic sedimentary rocks of the Dunkard Group. The Dunkard Group is composed of Pennsylvanian-age non-marine cyclic sequences of lithic and micaceous sandstone, siltstone, red and gray shale, claystone and mudstone, limestone, and thin coal beds. During the Pennsylvanian, sedimentary rocks of the Dunkard Group were deposited within the Appalachian Basin following several major marine regressive cycles. Sedimentary rocks were deposited as a series of cyclothems representing landscape positions proximal to active streams. Deposition of sedimentary rocks ceased during early Permian age and were subsequently uplifted and faulted during the Appalachian Orogeny. Upper strata within the Dunkard Group are more resistant to weathering, resulting in decreased erosional processes.

## **Surface Conditions**

The SHP MP 9.3 investigation site is located off of Long Run Road along the proposed SHP TL-635 Segment, where the alignment extends down a steep northeastern facing slope. The site is located upslope of the North Bend Rail-Trail, a multi-use recreational path operated by the West Virginia State Parks. The general site area currently consists of vegetated woodlands with localized residential development in close proximity, but outside the proposed pipeline corridor. The surface morphology along the proposed alignment is characterized by moderate to steep sloping terrain (30% to >58% inclination) with intermittent benches from previous logging activities which break up the steep slope faces. The natural hillsides along the proposed alignment are covered by moderate growth of low lying grasses, shrubs, and deciduous woodlands. An existing underground utility line was observed within the proposed pipeline corridor during the geotechnical drilling investigation located approximately 60 feet west of the boring locations. The underground utility line extends down the northeastern facing slope at MP 9.3 towards Long Run Road, but does not traverse the geotechnical investigation site area.

The elevation at Boring B-3 is approximately 955 feet above mean sea level (ft msl) sloping upwards towards the southwest along the proposed pipeline alignment. The elevation at Borings B-1 and B-2 are approximately 1,150 and 1,095 ft msl, respectively, and sloping upwards towards SHP MP 9.2 (southeast).

## **Subsurface Conditions**

The subsurface conditions at SHP MP 9.3 consist of surficial landslide deposits generally comprised of reddish brown-to-brown, lean clay and silt overlying bedrock of the Pennsylvanian-age Dunkard Group. Thickness of the landslide deposits observed in the borings at the SHP MP 9.3 geohazard site ranged from 10.4 ft (Boring B-1), 15 ft (Boring B-2), and 19 ft (Boring B-3). The identified landslide deposits were characterized by remolded and re-worked intervals observed in each of the three borings indicating evidence of a potential historical landslide

Bedrock of the Pennsylvanian-age Dunkard Group observed in the borings at SHP MP 9.3 consist of dark greenish gray-to-gray and olive brown interbedded micaceous shale and sandstone. Recovered rock cores were generally thinly bedded (10° to 30° bedding angles) and closely fractured (10° to 30° fracture angles). Recovered cores were also variably weathered consisting of iron oxidation infilling along the fracture planes. A generalized geologic cross section along the slope profile is presented in Figure 1. The rock quality designation (RQD) of the recovered cores was generally very poor to excellent ranging from 40% to 98% (Boring B-1), 60% to 90% (Boring B-2), and 40% to 98% (Boring B-3). Detailed logs of the three borings advanced at the MP 9.3 site as well, as a key sheet, are presented in Appendix D.

Conditions observed in the borings at the SHP MP 9.3 geohazard site along the with the surface morphology features (i.e., moderate to steep sloping terrain and intermittent breaks in the slope

faces) suggests the site experienced previous slope instability and subsequent episodic slope movement along the interface between the fine grained the colluvial deposits and highly weathered bedrock. However, no evidence of recent active failure such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation.

## LABORATORY TESTING

### Geotechnical Laboratory Testing Program

Geosyntec contracted Geotechnics, Inc. (Geotechnics) of East Pittsburgh, Pennsylvania to conduct laboratory testing assigned by Geosyntec on selected soil samples and rock cores to evaluate the pertinent geotechnical index properties. The laboratory testing program, on soil samples, was primarily focused on soil classification and index testing. Testing on select rock cores focused on compressive and tensile strength. The laboratory testing program consisted of:

#### Soil Samples

- Water content tests per ASTM D2216;
- Atterberg limit tests per ASTM D4318;
- Sieve analysis tests per ASTM D6913; and
- Hydrometer tests per ASTM D7928.

#### Rock Cores

- Split tensile strength test per ASTM D3967; and
- Unconfined compression test per ASTM D7012-Method C.

Table 4 summarizes the number and types of laboratory testing conducted on soil and rock samples from the SHP MP 9.3 geohazard site.

**Table 4 – Number and Types of Laboratory Tests**

Types of Laboratory Tests	Number of Laboratory Tests		
	Boring B-1	Boring B-2	Boring B-3
Water Content	3	4	4
Atterberg Limits	2	2	3
Sieve Analysis	2	2	3
Hydrometer Test	2	2	3
Rock Split Tensile Strength	3	3	0
Rock Uniaxial Compressive Strength	1	1	1

## Laboratory Test Results

The laboratory test results are also plotted in the corresponding boring logs (Appendix D), and the individual test results are presented in detail in Appendix E.

## Soil Sample Testing

Given the granular nature of the soils from SHP MP 9.3, select samples were tested for grain-size distribution to quantify percentages of gravels, sands and fines. The results show that the soils consist of lean clay (CL), with the exception of one sample (B-2-5 at 11.2 ft bgs), which consists of silt (ML).

The laboratory soil testing performed for the SHP MP 9.3 borings included water content and Atterberg limits measured on selected lean clay and silt samples and grain-size analysis to quantify the percentages of gravel, sand and fines, particularly on samples containing coarser grained material. Table 5 presents a summary of the laboratory test results conducted on soil samples.

**Table 5:** Summary of Laboratory Test Results on Soil Samples

Boring ID	Sample ID	Depth (ft)	Water Content (%)	Percent of Gravel <sup>(1)</sup> (%)	Percent of Fines <sup>(2)</sup> (%)	Liquid Limit	Plastic Limit	Plasticity Index
B-1	B-1-1	1.8	15.9	-	-	-	-	-
B-1	B-1-3	7.5	12.1	0.63	94.31	38	21	17
B-1	B-1-4	9.6	7.0	0.22	82.16	36	19	17
B-2	B-2-1	1.5	16.8	1.24	52.72	37	22	15
B-2	B-2-2	5.0	14.1	-	-	-	-	-
B-2	B-2-4	9.5	9.6	-	-	-	-	-
B-2	B-2-5	11.2	5.2	0.51	93.43	33	18	15
B-3	B-3-1	2.5	18.8	2.96	77.55	41	24	17
B-3	B-3-3	7.5	14.3	-	-	-	-	-
B-3	B-3-5	13.0	10.4	0.81	71.95	32	21	11
B-3	B-3-6	14.9	5.3	18.24	21.73	31	20	11

**Notes:**

- 1 - Retained #4 sieve.
- 2 - Passing #200 sieve.
- “-“ Not analyzed

## Rock Core Testing

A summary of laboratory test results conducted on rock samples is presented in Table 6.

**Table 6:** Summary of Laboratory Test Results on Rock Samples

Boring ID	Core ID	Sample Interval (ft)	Unit Weight (pcf)	Uniaxial Compress. Strength (psi)	Split Tensile Strength (psi)		
					Specimen 1	Specimen 2	Specimen 3
B-1	R-4	31.7-32.7	162.9	8,940	997.3	840.3	632.3
B-2	R-1	17.1-18.1	154.3	9,900	748.2	833.0	835.1

## Summary of Laboratory Testing

The geotechnical laboratory test results indicate that water content of landslide deposits varied between 7% and 16% (Boring B-1), 5% and 17% (Boring B-2), and 5% and 19% (Boring B-3). The moisture content at the time of the field investigation showed a decreasing trend with depth. The sieve analyses indicate that the landslide deposits have approximately 22% to 94% fine-grained particles (particles smaller than 75 micrometers [ $\mu\text{m}$ ]) and approximately 7% to 34% clay particles (particles smaller than 5  $\mu\text{m}$ ). The Atterberg test results show that the landslide deposits contain a plasticity index (PI) of 11 to 17 and the soil unit is mainly within the low plasticity clay zone (i.e., CL). The PI is generally constant with depth within the low plasticity clay soil unit.

The split tensile strength of the recovered rock cores varied between 632.3 and 997.3 pounds per square inch (psi) for samples consisting of primarily shale material (core R-4) and between 748.2 and 835.1 psi for samples consisting of primarily sandstone (core R-1). The unconfined compression strength of the recovered rock core was 8,940 psi for shale material (core R-4) and 9,900 psi for sandstone material (core R-1).

## SUMMARY OF FINDINGS

Surficial morphologic features observed during our Phase 2 reconnaissance along with subsurface conditions recorded during the geotechnical drilling investigation at the SHP TL-635 MP 9.3 geohazard site suggest previous shallow seated slope movement occurred downslope along the proposed ACP alignment. The approximate extent of mapped instability is presented in Figure 1. Although no evidence of recent or active slope movement such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation, data collected during subsequent inclinometer monitoring events will be used to supplement and inform site-specific



engineering evaluations, and recommendations for mitigation measures should future potential instability be identified. An addendum to this data summary report will be issued as subsequent monitoring data is collected.

As a consequence of these findings, and a subsequent engineering analysis of slope stability, reported separately, a site specific geotechnical hazard mitigation design has been developed for this slope which incorporates:

- restrictions on material stockpiling during construction grading;
- targeted drainage measures along the trench;
- use of deformable backfill around the installed pipeline; and,
- recommendations for post construction monitoring.

## CLOSING

Geosyntec appreciates the opportunity to provide Dominion Transmission, Inc. with this data summary report, and we look forward to working together on this important project. If you have any questions or require additional information, please contact Logan Brant ([lbrant@geosyntec.com](mailto:lbrant@geosyntec.com), 281.810.5056) or Jared Warner ([jwarner@geosyntec.com](mailto:jwarner@geosyntec.com), 858.716.2885).

Sincerely,

Geosyntec Consultants,



Logan Brant, Ph.D., P.E.  
Senior Geotechnical Engineer



Jared Warner, P.G.  
Project Geologist

Attachments:

Figures

Figure 1 – Site Plan and Generalized Geologic Profile

Figure 2 – Piezometer Survey Data

Figure 3 – Inclinator Survey Data

Appendices

Appendix A – Photographic Log

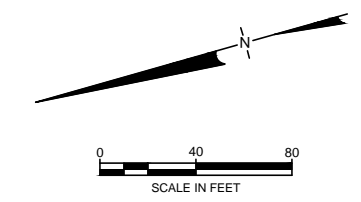
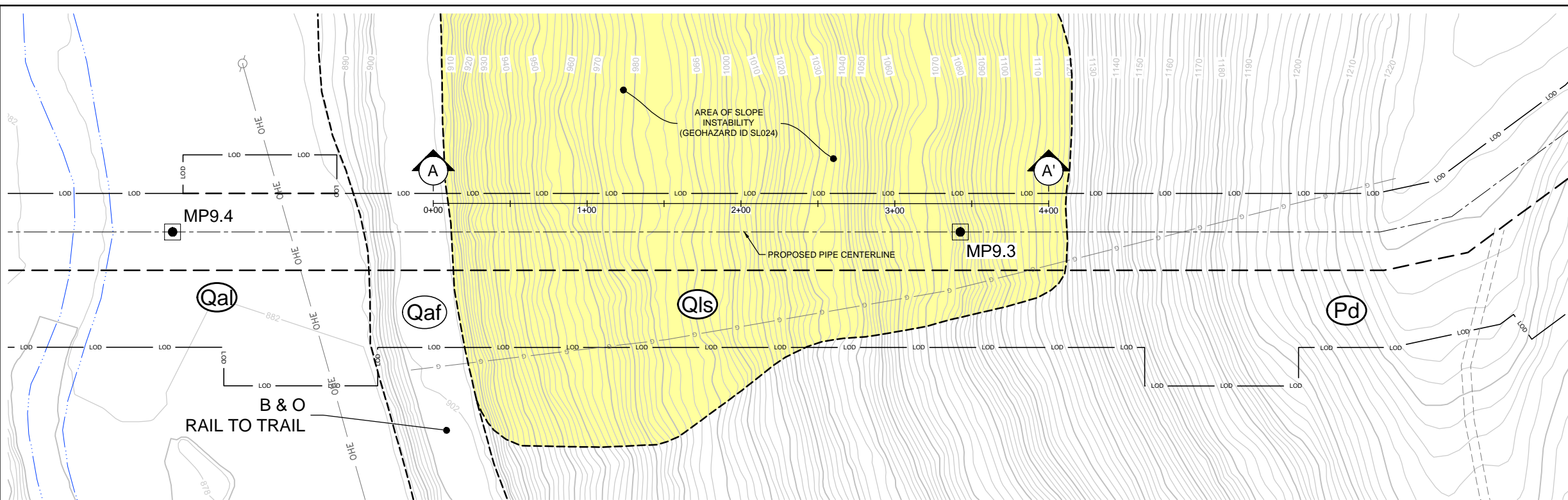
Appendix B – Core Photographs

Appendix C – Piezometer and Inclinator Construction Logs

Appendix D – Logs of Borings B-1, B-2, and B-3

Appendix E – Laboratory Test Results

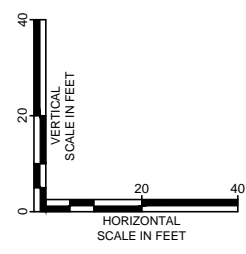
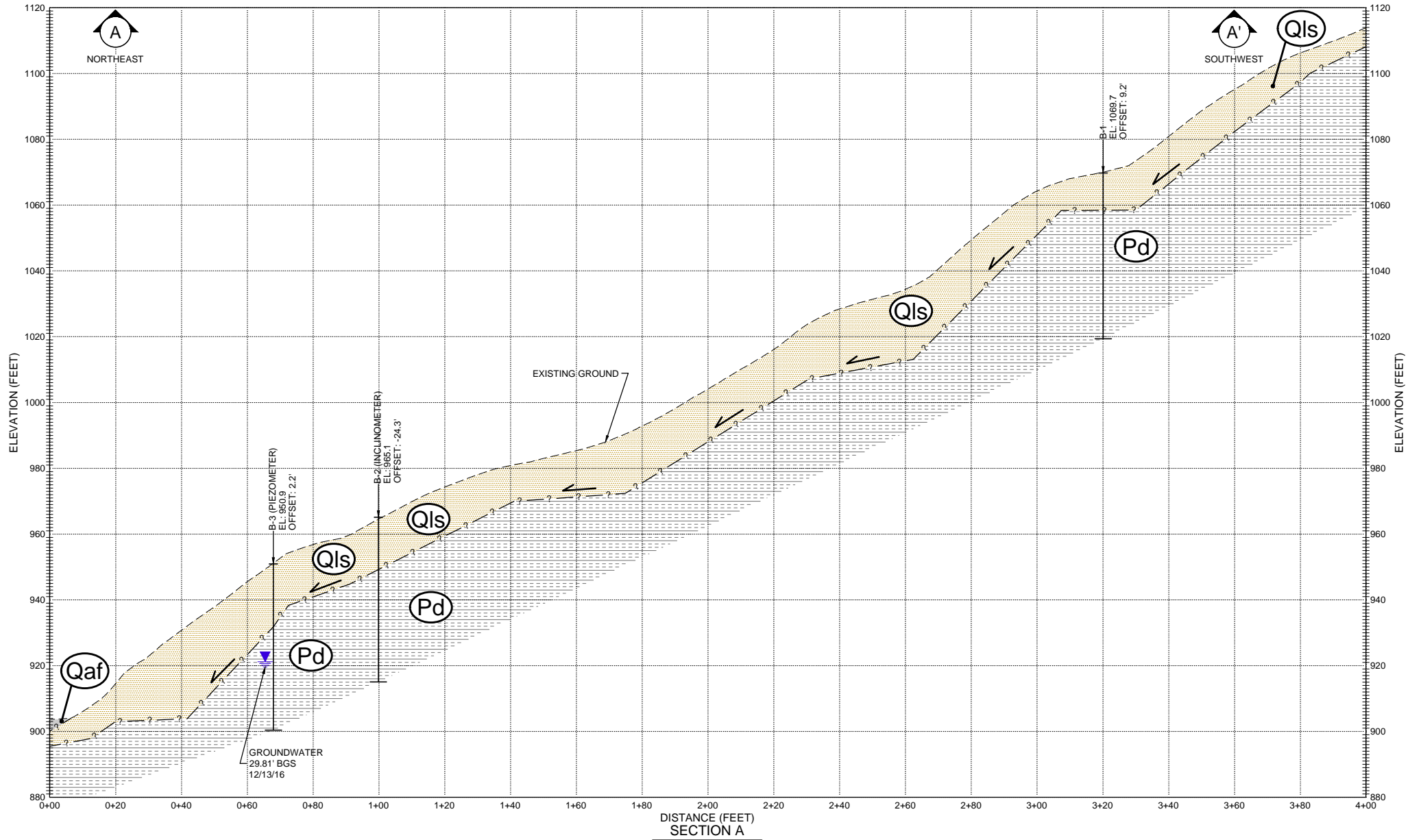
# **FIGURES**



**LEGEND**

1220	EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
1222	EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
---	EXISTING STREAM LINE
OHE	EXISTING OVERHEAD ELECTRIC LINE
G	EXISTING GAS LINE
---	ACCESS ROAD
---	LIMIT OF DISTURBANCE
---	PERMANENT (ROW)
---	PROPOSED PIPE CENTERLINE
MP9.3	MILEPOST
+	BORING LOCATION (GEOSYNTEC, 2017)
■	AREA OF SLOPE INSTABILITY (GEOHAZARD ID SL024)
---	LITHOLOGIC CONTACT

- NOTES:
- MAPPING AND TOPOGRAPHY BASED ON UTM COORDINATE SYSTEM WITH NAD83 DATUM, ZONE 17, US SURVEY FOOT, CENTRAL MERIDIAN 81 W.
  - LIDAR ELEVATION DATA AND TOPOGRAPHIC FEATURES COLLECTED IN 2016 AND PROVIDED BY GAI AS 2-FOOT CONTOURS.
  - STREAM AND WETLAND DATA PROVIDED BY NRG/ERM.



**GEOLOGIC PROFILE LEGEND**

---	EXISTING GROUND SURFACE
---	LITHOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
Qls	LANDSLIDE DEPOSITS
Pd	DUNKARD GROUP
Qaf	ARTIFICIAL FILL
Qal	ALLUVIUM
←	APPROXIMATE DIRECTION OF LANDSLIDE
▽	WATER LEVEL 12/13/16

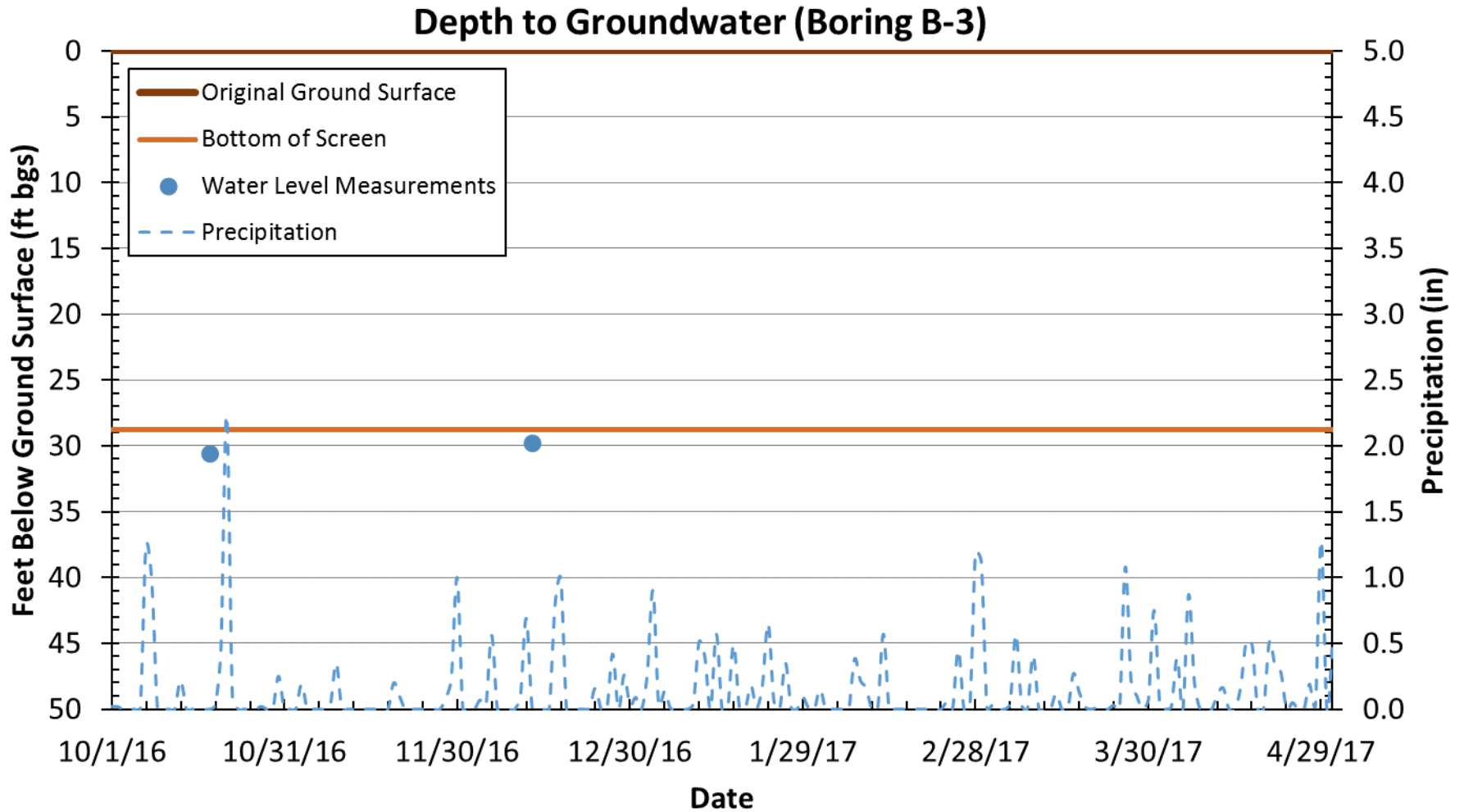
**SITE PLAN AND GENERALIZED GEOLOGIC PROFILE**  
ACP SHP MP 9.3

**Geosyntec**  
consultants

PROJECT NO: TXG0007      MAY 2017

**FIGURE 1**

F:\CADD\PROJECTS\ATLANTIC COAST PIPELINE\GEOHAZARD ANALYSIS\INVESTIGATION DESIGN\ SERVICE SITE DESIGN\TXG0007\FIGURES\TXG0007\_102



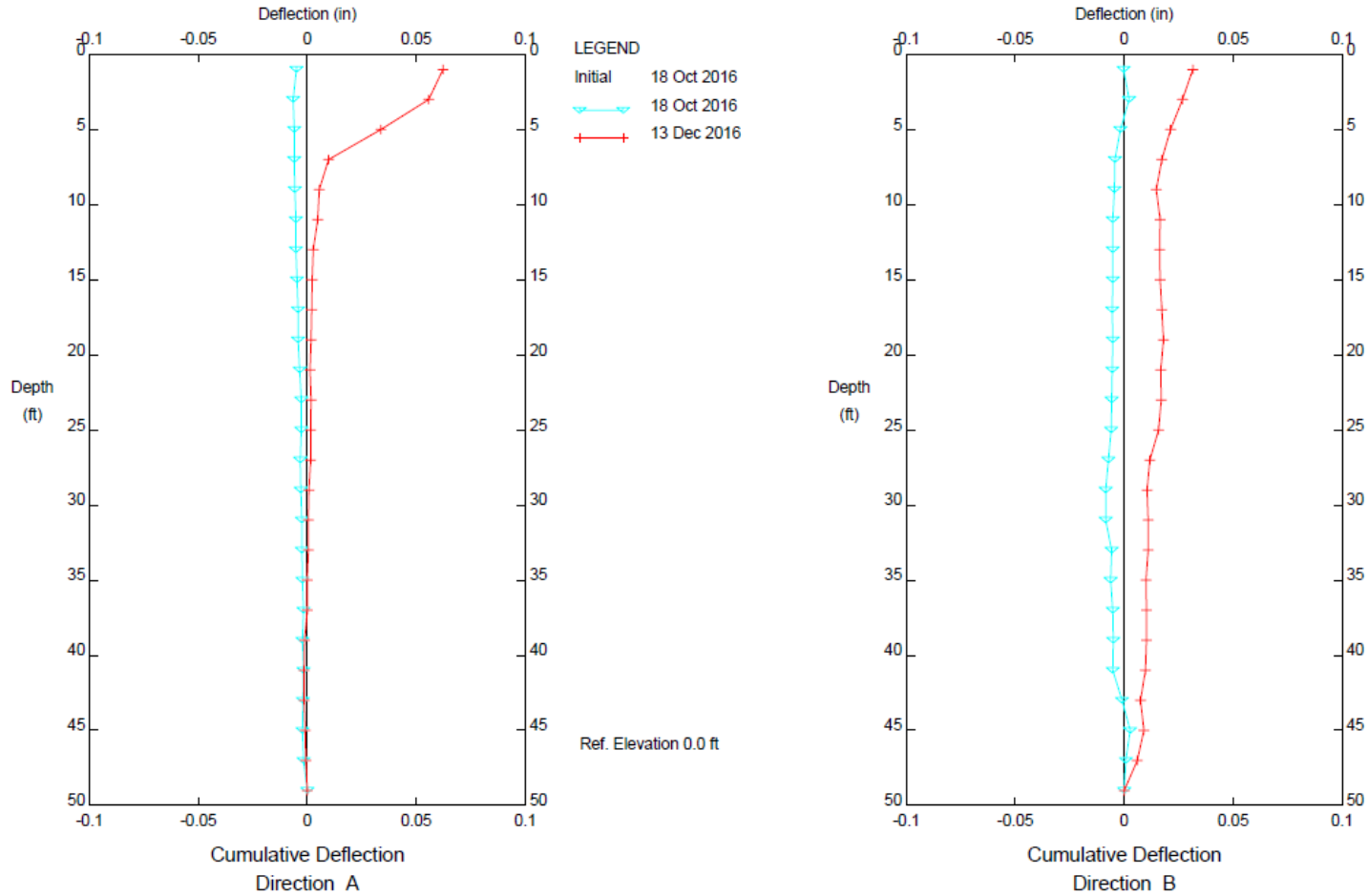
**Notes:** Precipitation data obtained from weather station located in Clarksburg, West Virginia. Reference: [www.wunderground.com](http://www.wunderground.com)

**Piezometer Survey Data (Boring B-3)**

Project: ACP SHP MP 9.3  
 Location: Doddridge County, West Virginia  
 Project Number: TXG0007-012-6302  
 Client: Dominion Transmission, Inc.

**Figure 2**

Geosyntec Consultants - Houston TX



Mid Slope, Inclinator B-2

Note: See inclinometer installation record for additional information.

**Inclinometer Survey Data (Boring B-2)**

Project: ACP SHP MP 9.3  
Location: Doddridge County, West Virginia  
Project Number: TXG0007-012-6302  
Client: Dominion Transmission, Inc.

**Figure 3**

**APPENDIX A**  
**PHOTOGRAPHIC LOG**



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP Drilling Site MP 9.3**  
**October 14 through 17 2016**



**Photograph 1 - (before work)**

**Location:** Long Run Road (access to SHP MP 9.3)

View looking northeast. Photo shows pre-existing conditions along Long Run road and existing gated access road (right).



**Photograph 2 - (after work)**

**Location:** Long Run Road (access to SHP MP 9.3)

View looking northeast. Photo shows site conditions along Long Run road and the existing gated access road (right) following work activities at SHP MP 9.3.



**Photograph 3 - (during work)**

**Location:** Gated access road (access to SHP MP 9.3)

View looking southeast. Photo shows site conditions and pre-existing straw along the gated access road during work activities at SHP MP 9.3.



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP Drilling Site MP 9.3**  
**October 14 through 17 2016**



**Photograph 4 - (after work)**

**Location:** Gated access road (access to to SHP MP 9.3)

View looking southeast. Photo shows site conditions along the existing access road following drilling and restoration activities including casting of seed in locations covered by locally sourced straw.



**Photograph 5 – (during work)**

**Location:** Existing logging trail (access to SHP MP 9.3)

View looking northwest. Photo shows site conditions along the temporary access route during road improvement activities.



**Photograph 6 – (after work)**

**Location:** Temporary access route (access to SHP MP 9.3)

View looking northwest. Photo shows site conditions along the temporary access route following drilling and restoration activities including casting of seed in locations covered by locally sourced straw.



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP Drilling Site MP 9.3**  
**October 14 through 17 2016**



**Photograph 7 - (during work)**

**Location:** Gated access road (access to to SHP MP 9.3)

View looking north. Photo shows site conditions and pre-existing shed along the gated access road during work activities at SHP MP 9.3.



**Photograph 8 – (after work)**

**Location:** Gated access road (access to to SHP MP 9.3)

View looking north. Photo shows site conditions and pre-existing shed along the gated access road following drilling and restoration activities including casting of seed in locations covered by locally sourced straw.



**Photograph 9 – (during work)**

**Location:** Northeast facing slope along SHP MP 9.3

Photo shows exposed unmarked utility extending down the northeast facing slope at SHP MP 9.3. Utility was observed approx. 60 feet west of the boring locations. Note the utility line did not traverse the geotechnical investigation area.



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP Drilling Site MP 9.3**  
**October 14 through 17 2016**



**Photograph 10 – (before work)**

**Location:** SHP MP 9.3 (Boring B-1)

View looking west. Photo shows pre-existing site conditions at location of SHP MP 9.3 Boring B-1 (center).



**Photograph 11 – (during work)**

**Location:** SHP MP 9.3 (Boring B-1)

View looking west. Photo shows site conditions during drilling activities at SHP MP 9.3 Boring B-1.



**Photograph 12 – (after work)**

**Location:** SHP MP 9.3 (Boring B-1)

View looking west. Photo shows site conditions at location of SHP MP 9.3 Boring B-1 (center) following completion of drilling and restoration activities including casting of seed mix in locations covered by locally sourced straw.



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP Drilling Site MP 9.3**  
**October 14 through 17 2016**



**Photograph 13 – (before work)**

**Location:** SHP MP 9.3 (Boring B-2)

View looking east. Photo shows pre-existing site conditions at location of SHP MP 9.3 Boring B-2 (center).



**Photograph 14 - (during work)**

**Location:** SHP MP 9.3 (Boring B-2)

View looking west. Photo shows site conditions during drilling activities at SHP MP 9.3 Boring B-2.



**Photograph 15 – (after work)**

**Location:** SHP MP 9.3 (Boring B-2)

View looking west. Photo shows site conditions along with locked inclinometer cover at SHP MP 9.3 Boring B-2 following drilling activities. Restoration activities included casting of seed mix in locations covered by locally sourced straw.



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**SHP Drilling Site MP 9.3**  
**October 14 through 17 2016**



**Photograph 16 – (during work)**

**Location:** SHP MP 9.3 (Boring B-3)

View looking southwest. Photo shows site conditions during drilling activities at MP 120.3 Boring B-2.



**Photograph 17 – (after work)**

**Location:** SHP MP 9.3 (Boring B-3)

View looking west. Photo shows site conditions along with locked piezometer cover at SHP MP 9.3 Boring B-3 following drilling and restoration activities. Restoration included casting of seed mix in locations covered by locally sourced straw.

**APPENDIX B**  
**CORE PHOTOGRAPHS**



PROJECT NAME: ACP SHP MP 9.3

PROJECT NO.: TXG0007-012-6302

CLIENT: DOMINION TRANSMISSION, INC.

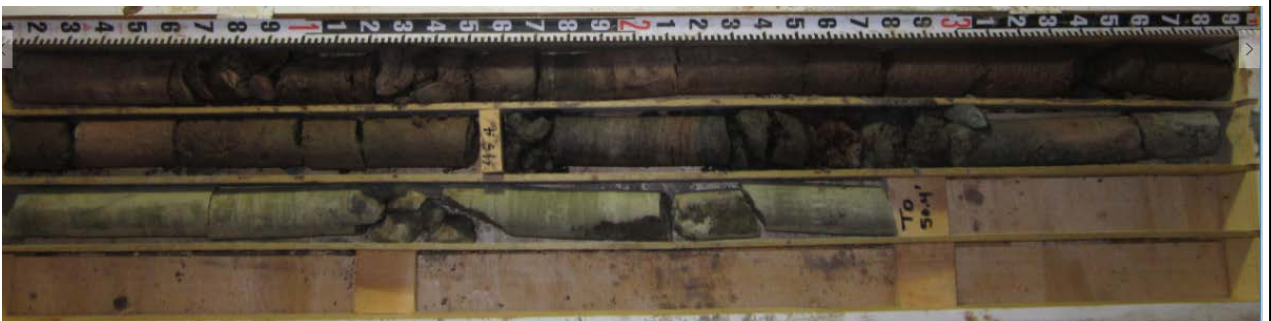
LOCATION: DODDRIDGE COUNTY, WEST VIRGINIA



SHP MP 9.3 Boring B-1: Box 1 of 3 (10.4 to 25.4 ft bgs)



SHP MP 9.3 Boring B-1: Box 2 of 3 (25.4 to 40.2 feet)



SHP MP 9.3 Boring B-1: Box 3 of 3 (40.2 to 50.4 ft bgs)

PROJECT NAME: ACP SHP MP 9.3

PROJECT NO.: TXG0007-012-6302

CLIENT: DOMINION TRANSMISSION, INC.

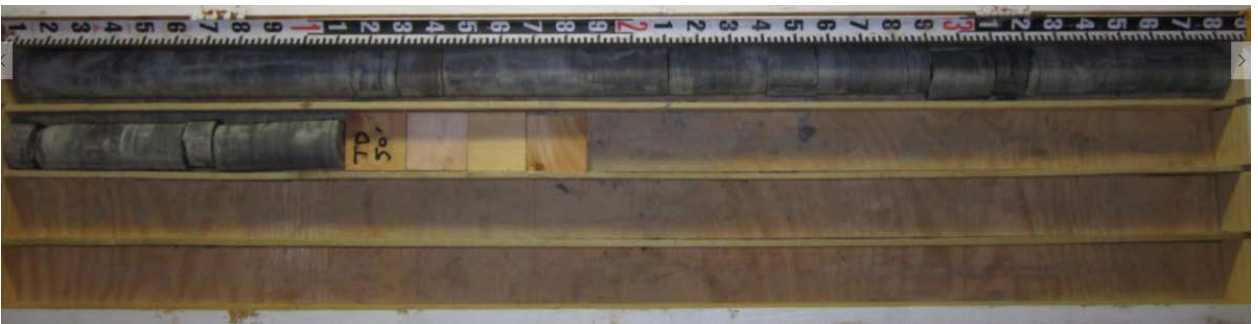
LOCATION: DODDRIDGE COUNTY, WEST VIRGINIA



SHP MP 9.3 Boring B-2: Box 1 of 3 (15.0 to 30.0 ft bgs)



SHP MP 9.3 Boring B-2: Box 2 of 3 (30.0 to 45.0 ft bgs)



SHP MP 9.3 Boring B-2: Box 3 of 3 (45.0 to 50.0 ft bgs)



PROJECT NAME: ACP SHP MP 9.3

PROJECT NO.: TXG0007-012-6302

CLIENT: DOMINION TRANSMISSION, INC.

LOCATION: DODDRIDGE COUNTY, WEST VIRGINIA



SHP MP 9.3 Boring B-3: Box 1 of 3 (19.0 to 34.3 ft bgs)



SHP MP 9.3 Boring B-3: Box 2 of 3 (34.3 to 49.2 ft bgs)



SHP MP 9.3 Boring B-3: Box 3 of 3 (49.2 to 50.5 ft bgs)

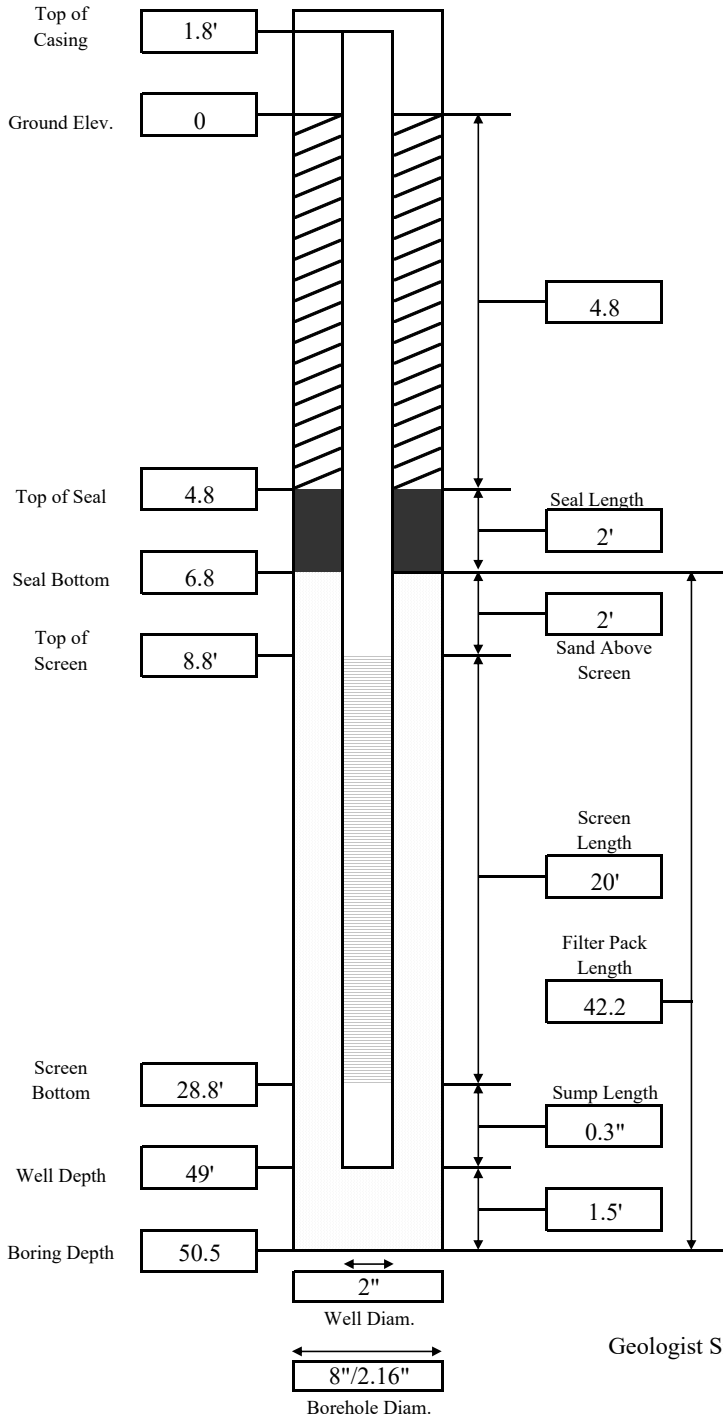
**APPENDIX C**

**PIEZOMETER AND INCLINOMETER  
CONSTRUCTION LOGS**

**Appendix C - Piezometer Construction Log**

Site: Atlantic Coast Pipeline MP 9.3  
 Well ID: B-3 (MP 9.3)  
 Drilling Company: Horn and Associates  
 Drillers: Steven Ison  
 Geologist: Jared Warner

Date: 16-Oct-16  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 50.5'  
 Boring Diameter: 8"/2.16"  
 Well Depth: 49'  
 Well Diameter: 2"



**Well Construction:**  
 Material: SCH 80 PVC  
 Inside Diameter: 2"  
 Screen Slot Size: 0.01"  
 Screen Beg.: 8.8' End: 28.8'  
 Sump **Y / N**  
 Type/Length: PVC End Cap (0.3")

**Filter Pack:**  
 Type/Brand: Global Drilling #5 Quartz Sand  
 Amount Used: 6.5 50lb bags  
 Placement Method: Tremie

**Seal:**  
 Type/Brand: Pure Gold Gel Bentonite  
 Amount Used: 1/2 50lb bag  
 Vol. Fluid Added: NA  
 Set-up Time: Overnight  
 Placement Method: Poured

**Grout:**  
 Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
2 94lb bag of Portland + 50lb bag bentonite  
 Amount Used: bentonite  
 Vol. Fluid Added: ~60 gallons H<sub>2</sub>O  
 Placement Method: Tremie

**Well Completion:**  
**Above Grade / Below Grade**  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Protective Cover (4.5")

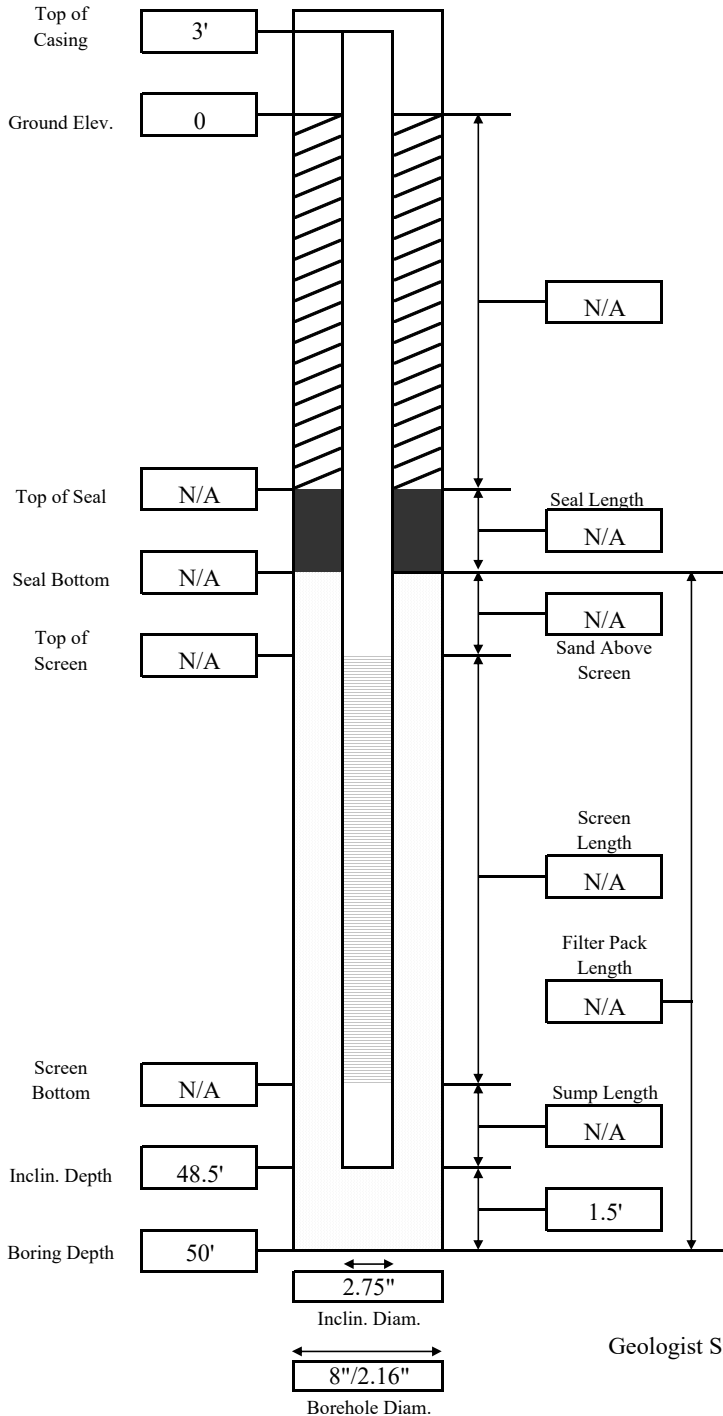
Comments: \_\_\_\_\_

Geologist Signature: Jared Warner

**Appendix C - Inclinometer Construction Log**

Site: Atlantic Coast Pipeline MP 9.3  
 Boring ID: B-2 (MP 9.3)  
 Drilling Company: Horn and Associates  
 Drillers: Steven Ison  
 Geologist: Jared Warner

Date: 16-Oct-16  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 50.0'  
 Boring Diameter: 8"/2.16"  
 Incl. Depth: 48.5'  
 Incl. Diameter: 2.75"



**Well Construction:**  
 Material: ABS Plastic (Quick Connect)  
 Inside Diameter: 2.32"  
 Screen Slot Size: N/A  
 Screen Beg.: N/A End: N/A  
 Sump **Y / N**  
 Type/Length: \_\_\_\_\_  
**Filter Pack:**  
 Type/Brand: N/A  
 Amount Used: N/A  
 Placement Method: N/A  
**Seal:**  
 Type/Brand: N/A  
 Amount Used: N/A  
 Vol. Fluid Added: N/A  
 Set-up Time: N/A  
 Placement Method: N/A  
**Grout:**  
 Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
1 94lb bag of Portland + 25lb bag bentonite  
 Amount Used: \_\_\_\_\_  
 Vol. Fluid Added: ~30 gallons H<sub>2</sub>O  
 Placement Method: Tremie  
**Inclin. Completion:**  
**Above Grade / Below Grade**  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Protective Cover (4.5")  
 Comments: Bottom of inclinometer casing placed at 48.5' following hole collapse from 50' to 48.5' and backfilled with grout to surface.

Geologist Signature: Jared Warner

## **APPENDIX D**

### **LOG OF BORINGS B-1, B-2, and B-3**



**APPENDIX D - KEY SHEET: CLASSIFICATIONS AND SYMBOLS**

GS FORM:  
KEY 09/99

**EMPIRICAL CORRELATIONS WITH STANDARD PENETRATION RESISTANCE N VALUES \***

	N VALUE * (BLOWS/FT)	CONSISTENCY	UNDRAINED COMPRESSIVE STRENGTH (KSF)		N VALUE * (BLOWS/FT)	RELATIVE DENSITY
FINE GRAINED SOILS	0 - 2	VERY SOFT	<0.25	COARSE GRAINED SOILS	0 - 4	VERY LOOSE
	3 - 4	SOFT	0.25 - 0.50		5 - 10	LOOSE
	5 - 8	FIRM	0.50 - 1.00		11 - 30	MEDIUM DENSE
	9 - 15	STIFF	1.00 - 2.00		31 - 50	DENSE
	16 - 30	VERY STIFF	2.00 - 4.00		>50	VERY DENSE
	31 - 50	HARD	>4.00			
	>50	VERY HARD				

\* ASTM D 1586; NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 IN. O.D., 1.4 IN. I.D. SAMPLER ONE FOOT.

**UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART**

MAJOR DIVISIONS		SYMBOLS	DESCRIPTIONS	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		LITTLE OR NO FINES	GP POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES	GM SILTY GRAVELS, GRAVEL- SAND-SILT MIXTURES	
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO.4 SIEVE	APPRECIABLE AMOUNT OF FINES	GC CLAYEY GRAVELS, GRAVEL -SAND-CLAY MIXTURES	
		SAND AND SANDY SOILS	CLEAN SANDS	SW WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			LITTLE OR NO FINES	SP POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL COARSER THAN NO. 200 SIEVE SIZE	SANDS WITH FINES	APPRECIABLE AMOUNT OF FINES	SM SILTY SANDS, SAND-SILT MIXTURES	
		SC CLAYEY SANDS, SAND-CLAY MIXTURES		
FINE GRAINED SOILS	SILTS AND CLAYS	Liquid Limit Less Than 50	ML INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
			CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
			OL ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
	MORE THAN 50% OF MATERIAL FINER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	Liquid Limit Greater Than 50	MH INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT
				CH INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS		PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	

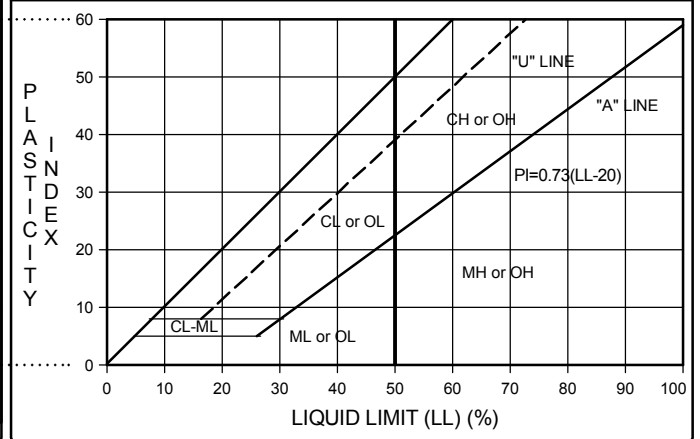
NOTE: DUAL SYMBOLS USED FOR BORDERLINE CLASSIFICATIONS

**PARTICLE SIZE IDENTIFICATION**

BOULDERS	>300 mm
COBBLES	75 - 300 mm
GRAVEL: COARSE	19.0 - 75 mm
GRAVEL: FINE	4.75 - 19 mm
SAND: COARSE	2.00 - 4.75 mm
SAND: MEDIUM	0.425 - 2.00 mm
SAND: FINE	0.075 - 0.425 mm
SILT	0.075 - 0.002 mm
CLAY	<0.002 mm

WELL GRADED - HAVING WIDE RANGE OF GRAIN SIZES AND APPRECIABLE AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES  
POORLY GRADED - PREDOMINANTLY ONE GRAIN SIZE, OR HAVING A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING

**PLASTICITY CHART**



**OTHER MATERIAL SYMBOLS**

Siltstone	Sand
Sandstone	Silt
Siltstone/Claystone	Silty Sand
Claystone	Alluvium
Schist	Artificial Fill
Siltstone/Sandstone	Debris Fill
Conglomerate	Asphalt
Granitic	Metabasalt

**WELL SYMBOLS**

GRANULAR BENTONITE
BENTONITE CEMENT GROUT
FILTER PACK
CONCRETE
NATIVE/SLOUGH
CENTRAL-IZER

**SAMPLER AND OTHER SYMBOLS**

GRAB SAMPLE	Water Level at Time Drilling, or as Shown
SPLIT SPOON	Static Water Level
ROCK CORE	MSL: Mean Sea Level
SHELBY TUBE	MC: Moisture Content
CALIFORNIA SAMPLER	WA: #200 Wash
BULK SAMPLE	DD: Dry Density
	SA: Sieve Analysis
	PI: Plasticity Index
	PP: Pocket Pentrometer
	LL: Liquid Limit
	Su: Undrained Shear Strength
	K: Hydraulic Conductivity
	Phi: Friction Angle

KEY-GEOTECH - GEOSNTEC.GDT - 4/5/16 13:47 - P:\GINT\PROJECTS\BLUE RIDGE GEOTECHNICAL DRILLING\ACPHDD.GPJ



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-1**

**SHEET 1 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/15/2016  
**FINISH DRILL DATE** 10/15/2016

**GROUND SURF.** 1150  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**Appendix D - Boring Log**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2		<b>FAT CLAY (CH)</b> , Light reddish brown, Moist, Medium stiff, High plasticity, Presence of olive brown Sandstone fragments (up to 0.5 inch).		B-1-1	3 3 4	7	22							15.9						
4	1145	Becomes yellowish brown and reddish brown with localized FeOx staining. Dry to moist, Medium stiff to stiff.		B-1-2	2 3 5	8	67													
8		<b>LEAN CLAY (CL)</b> , Dark reddish brown with grayish brown seams (<0.1 inch), Dry to moist, Hard.		B-1-3	5 15 20	35	67				91.6	4.5	3.9	12.1	38	21	17			
10	1140	<b>LEAN CLAY WITH SAND (CL)</b> , Dark reddish brown, Dry, Hard, Platy, Presence of trace fine sand and olive brown Sandstone fragments.		B-1-4	27 50/1	50	100				80	10.5	9.5	7.0	36	19	17			
10.4		Auger refusal at 10.4 ft bgs. Switch to rock coring.																		

03-GEOTECH2 BORING LOG\_SHP\_SOIL.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.27531  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.63405  
**DRILL MTHD.** Hollow Stem Auger      **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner              **REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-1**

SHEET 2 OF 3

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/15/2016  
**FINISH DRILL DATE** 10/15/2016

**GROUND SURF.** 1150  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA															
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)								
1149																										
5																										
1139		<b>SHALE</b> , Olive brown to black, Thin and wavy bedding (10 degrees), Near vertical very closely fractured with Quartz infilling, Moderately weathered, Hard, Presence of FeOx along fracture planes.  Becomes dark brown, Low hardness. Becomes hard. Becomes slightly weathered.  Fractures becomes 30 to 40 degrees.			R-1	5	5	100	40	5																
15																										
1132						R-2	10	8.7	87	43	14															
20																										
25		<b>SANDSTONE</b> , Dark greenish gray, Interbedded Shale, Closely to medium fractured, Slightly weathered, Hard.  Bedding becomes wavy (30 degrees), 30 degrees fracture, Fresh, Hard.			R-3	5	5	100	92	5																
30																										

<b>CONTRACTOR</b>	Horn & Associates	<b>LATITUDE:</b>	39.27531
<b>EQUIPMENT</b>	Diedrich D-50	<b>LONGITUDE:</b>	-80.63405
<b>DRILL MTHD.</b>	Rock Coring	<b>COORDINATE SYSTEM:</b>	
<b>DIAMETER</b>	8 inches		
<b>LOGGER</b>	Jared Warner	<b>REVIEWER</b>	Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-1**

**SHEET 3 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/15/2016  
**FINISH DRILL DATE** 10/15/2016

**GROUND SURF.** 1150  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA							
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)
1119		<b>SHALE</b> , Dark gray to reddish brown, 30 degrees fractures with FeOx infilling, Fresh, Hard.			R-4	5	5	100	98	5								
1118		Becomes stratified dark gray to dark reddish brown.																
1117																		
1116		Becomes gray to dark gray, Moderately fractured (70 degrees), Moderately weathered, Weak.																
35 1115		Becomes very closely fractured, Slightly weathered to fresh, Hard.			R-5	10	10	100	60	10								
1114																		
1113																		
1112																		
1111		Becomes moderately weathered, Weak.																
40 1110		Becomes dark reddish brown, Intensely fractured with interbedded Fat clay seams between (41.5 to 41.9 ft bgs) and (42.7 to 44.3 ft bgs).																
1109																		
1108																		
1107																		
1106																		
45 1105		Becomes dark greenish gray.																
1104		Becomes dark gray, Moderately weathered, Weak, Presence of clay seam between 46.2 and 47 ft bgs.			R-6	10	10	100	72	6								
1103																		
1102		<b>SANDSTONE</b> , Dark olive brown, 30 to 40 degrees wavy bedding, Near vertical close fractures throughout, Fresh, Hard.																
1101																		
50 1100																		
1099																		
1098																		
1097																		
1096																		
55 1095																		
1094																		
1093																		
1092																		
1091																		
60 1090																		

Termination depth at 50.4 ft bgs.

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

<b>CONTRACTOR</b>	Horn & Associates	<b>LATITUDE:</b>	39.27531
<b>EQUIPMENT</b>	Diedrich D-50	<b>LONGITUDE:</b>	-80.63405
<b>DRILL MTHD.</b>	Rock Coring	<b>COORDINATE SYSTEM:</b>	
<b>DIAMETER</b>	8 inches		
<b>LOGGER</b>	Jared Warner	<b>REVIEWER</b>	Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-2**

**SHEET 1 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/16/2016  
**FINISH DRILL DATE** 10/16/2016

**GROUND SURF.** 1098  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**Appendix D - Boring Log**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	1095	<b>GRAVELLY LEAN CLAY WITH SAND (CL)</b> , Brown and greenish brown, Moist, Stiff, Presence of dark gray to black Shale fragments	[Hatched pattern]	B-2-1	3 5 4	9	33				50.9	16.6	32.5		37	22	15			
4		Becomes dark reddish brown, Moist to dry, Very stiff, Blocky and crumbles, Presence of Shale fragments (<0.25 inch).	[Hatched pattern]	B-2-2	3 8 9	17	100													
6		Becomes hard, Presence of white to gray Shale intervals.	[Hatched pattern]	B-2-3	11 30 37	67	67													
8	1090		[Hatched pattern]	B-2-4	7 15 17	32	67													
12	1085	<b>SILT (ML)</b> , Dark reddish brown, Moist to Dry, Hard, Platy, Presence of fine sand.	[Vertical lines]	B-2-5	50/3	50	100				90.1	9	0.9		33	18	15			
14		Becomes tan, Presence of Sandstone fragments.	[Vertical lines]																	
16																				
18	1080																			
20																				
22	1075																			
24																				
26																				
28	1070																			
30																				
										Auger refusal at 15 ft bgs. Switch to rock coring.										

03-GEOTECH2 BORING LOG\_SHP SOIL.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.27587  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.63373  
**DRILL MTHD.** Hollow Stem Auger      **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-2**

**SHEET 2 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/16/2016  
**FINISH DRILL DATE** 10/16/2016

**GROUND SURF.** 1098  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA												
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)					
1097																							
5																							
1093																							
1092																							
1091																							
1090																							
1089																							
10																							
1088																							
1087																							
1086																							
1085																							
1084																							
15																							
1083		<b>SANDSTONE</b> , Olive brown, Massive bedding, 10 degrees fracture sets, 70 degrees near vertical fracture with gypsum infilling between 15 ft to 15.7 ft bgs and at 18 ft bgs.			R-1	10	9.7	97	80	10													
1082																							
1081																							
1080																							
1079																							
20																							
1078																							
1077																							
1076		<b>SHALE</b> , Reddish brown, Platy, Closely fractured, Presence of 1.5 inches Fat clay seam at 23.6 ft bgs.																					
1075																							
1074																							
25																							
1073		<b>SANDSTONE</b> , Reddish brown, Closely fractured.																					
1072		<b>SHALE</b> , Reddish brown, Platy, Interbedded Sandstones, Close to medium fractures (10 degrees).			R-2	5	5.3	106	70	5													
1071																							
1070																							
1069		<b>SANDSTONE</b> , Reddish brown, Wavy bedding, Closely fractured with FeOx along fracture planes.																					
30																							
1068																							

**CONTRACTOR** Horn & Associates **LATITUDE:** 39.27587  
**EQUIPMENT** Diedrich D-50 **LONGITUDE:** -80.63373  
**DRILL MTHD.** Rock Coring **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner **REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-2**

**SHEET 3 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/16/2016  
**FINISH DRILL DATE** 10/16/2016

**GROUND SURF.** 1098  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA										
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)			
1067		SHALE, Olive brown, Interbedded Sandstone, Closely fractured (10 to 20 degrees) with FeOx along fracture planes.			R-3	5	4.8	96	60	6											
1066																					
1065		Becomes dark gray to greenish gray, Near vertical fractures (70 to 100 degrees) with yellowish brown clay infilling along fracture planes.																			
1064																					
35	1063	Fractures become 30 degrees.			R-4	10	10	100	71	13											
1062																					
1061																					
1060																					
1059		Becomes intensely fractured and clayey between 39 to 40 ft bgs.																			
40	1058																				
1057																					
1056																					
1055		Becomes dark gray.																			
1054																					
45	1053	Beddings become wavy (10 to 20 degrees), 10 degrees close to medium fractures.			R-5	5	5	100	90	5											
1052																					
1051																					
1050																					
1049																					
50	1048																				
1047																					
1046																					
1045																					
1044																					
55	1043																				
1042																					
1041																					
1040																					
1039																					
60	1038																				

Termination depth at 50 ft bgs.

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.27587  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.63373  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS





11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-3**

**SHEET 1 OF 3**

**PROJECT** ACP SHP TL-635  
**NUMBER** TXG0007  
**LOCATION** Doddridge County, WV  
**START DRILL DATE** 10/15/2016  
**FINISH DRILL DATE** 10/16/2016

**GROUND SURF.** 955  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**Appendix D - Boring Log**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2		<b>LEAN CLAY WITH SAND (CL)</b> , Mottled yellowish to reddish brown, Dry, Medium stiff, Presence of Shale and Sandstone fragments (up to 0.5 inch).		B-3-1	2 4 4	8	67				74.3	13.5	12.2	18.8	41	24	17			
4	950	Increase in Olive brown Sandstone fragments (up to 1 inch).		B-3-2	2 4 4	8	67													
6		Becomes very stiff, Blocky and crumbles, Decrease in Sandstone fragments.		B-3-3	5 9 7	16	67							14.3						
8		Becomes dark reddish brown, Dry, Medium plasticity, Hard, Blocky and crumbles. Presence of light gray Shale fragments.		B-3-4	18 37 50/2	87	100													
10	945	Becomes dark reddish brown and olive brown, Presence of Shale fragments (up to 0.5 inch).		B-3-5	24 25 38	63	100				70.0	23.9	6.1	10.4	32	21	11			
12		<b>SILT WITH GRAVEL AND SAND (ML)</b> , Olive brown to tan, Dry, Hard, Presence of fine to coarse sand and fine to coarse Shale and Sandstone fragments.		B-3-6	19 50/4	50	100				19.9	29.4	50.7	5.3	31	20	11			
14	940																			
16																				
18																				
20	935																			
22																				
24																				
26	930																			
28																				
30	925																			
										Auger refusal at 19 ft bgs. Switch to rock coring.										

03-GEOTECH2 BORING LOG\_SHP SOIL.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.27598  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.63379  
**DRILL MTHD.** Hollow Stem Auger      **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-3**

**SHEET 2 OF 3**

**PROJECT** ACP SHP TL-635

**NUMBER** TXG0007

**LOCATION** Doddridge County, WV

**START DRILL DATE** 10/15/2016

**FINISH DRILL DATE** 10/16/2016

**GROUND SURF.** 955

**TOP OF CASING**

**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA										
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)			
954																					
953																					
952																					
951																					
5																					
950																					
949																					
948																					
947																					
946																					
10																					
945																					
944																					
943																					
942																					
941																					
940																					
15																					
939																					
938																					
937																					
936																					
20		<b>SHALE</b> , Dark to greenish gray, Very thin interbedded Sandstones (10 degrees), 10 degrees close fracture sets with localized FeOx in the fracture planes.			R-1	6.5	6.5	100	49	7											
935																					
934																					
933																					
932		Becomes dark olive brown, Presence of 1-inch thick dark brown clay seam at 23.5 ft bgs.																			
931		Becomes dark gray to gray, 40 degree fracture sets.																			
25																					
930																					
929		Fracture sets become 10 to 20 degrees.			R-2	5	5	100	66	7											
928		Becomes reddish brown due to the presence of FeOx.																			
927																					
926																					
925																					
30																					

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

<b>CONTRACTOR</b>	Horn & Associates	<b>LATITUDE:</b>	39.27598
<b>EQUIPMENT</b>	Diedrich D-50	<b>LONGITUDE:</b>	-80.63379
<b>DRILL MTHD.</b>	Rock Coring	<b>COORDINATE SYSTEM:</b>	
<b>DIAMETER</b>	8 inches		
<b>LOGGER</b>	Jared Warner	<b>REVIEWER</b>	Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING SHP MP 9.3 B-3**

**SHEET 3 OF 3**

**PROJECT** ACP SHP TL-635

**NUMBER** TXG0007

**LOCATION** Doddridge County, WV

**START DRILL DATE** 10/15/2016

**FINISH DRILL DATE** 10/16/2016

**GROUND SURF.** 955

**TOP OF CASING**

**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**Appendix D - Boring Log**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA									
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)		
924		Bedding planes become 10 to 20 degrees, Platy, Intensely fractured.			R-3	5	5	100	40	4										
923																				
922		Becomes dark gray, Closely fractured.																		
921																				
35	920	<b>SANDSTONE</b> , Greenish gray, Wavy bedding, Presence of Shale between 35 to 35.3 ft bgs and 38.7 and 39.0 ft bgs, Presence of sporadic Shale clasts and seams (up to 2-inches).			R-4	10	10	100	79	10										
919																				
918																				
917																				
916		Becomes dark gray to gray, 20 degrees wavy bedding, Black coal seams along fracture planes.																		
40	915																			
914		<b>SHALE</b> , Dark gray to black, 10 degree thin bedding with interbedded Sandstone, Closely fractured (10 degrees).																		
913																				
912																				
911																				
45	910																			
909					R-5	10	10	100	98	4										
908																				
907																				
906		Decrease in interbedded Sandstone.																		
50	905																			
904																				
903																				
902																				
901																				
55	900																			
899																				
898																				
897																				
896																				
60	895																			

05-CONT CORE BORING LOG SHP ROCK.GPJ GEOSNTEC.GDT 4/25/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 39.27598  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -80.63379  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner              **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

**APPENDIX E**  
**LABORATORY TEST RESULTS**



November 30, 2016

Project No. 2016-527-001

Mustafa Erten  
Geosyntec Consultants, Inc.  
11490 Westheimer Rd., Suite 150  
Houston, TX 77077

**Transmittal**  
**Laboratory Test Results**  
**ACP TXG0007**

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens that were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,  
**Geotechnics, Inc.**

David R. Backstrom  
Laboratory Director

***We understand that you have a choice in your laboratory services  
and we thank you for choosing Geotechnics.***

## MOISTURE CONTENT

ASTM D 2216-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001

Lab ID:	027	028	029	030	031
Boring No.:	B-1(MP9.3)	B-1(MP9.3)	B-2(MP9.3)	B-2(MP9.3)	B-2(MP9.3)
Depth (ft):	7.5	9.6	1.5	5.0	9.5
Sample No.:	B-1-3	B-1-4	B-2-1	B-2-2	B-2-4
Tare Number	28	14	15	1	27
Wt. of Tare & Wet Sample (g)	61.33	46.84	43.04	63.25	74.25
Wt. of Tare & Dry Sample (g)	55.43	44.24	37.86	56.29	68.32
Weight of Tare (g)	6.85	6.93	6.95	6.82	6.86
Weight of Water (g)	5.90	2.60	5.18	6.96	5.93
Weight of Dry Sample (g)	48.58	37.31	30.91	49.47	61.46
<b>Water Content (%)</b>	<b>12.1</b>	<b>7.0</b>	<b>16.8</b>	<b>14.1</b>	<b>9.6</b>

Lab ID	032	033	034	035	036
Boring No.	B-2(MP9.3)	B-3(MP9.3)	B-3(MP9.3)	B-3(MP9.3)	B-3(MP9.3)
Depth (ft)	11.2	2.5	7.5	13.0	14.9
Sample No.	B-2-5	B-3-1	B-3-3	B-3-5	B-3-6
Tare Number	26	25	24	16	17
Wt. of Tare & Wet Sample (g)	40.55	50.79	70.46	67.56	52.06
Wt. of Tare & Dry Sample (g)	38.89	43.85	62.51	61.84	49.78
Weight of Tare (g)	6.85	6.84	6.85	6.90	6.97
Weight of Water (g)	1.66	6.94	7.95	5.72	2.28
Weight of Dry Sample (g)	32.04	37.01	55.66	54.94	42.81
<b>Water Content (%)</b>	<b>5.2</b>	<b>18.8</b>	<b>14.3</b>	<b>10.4</b>	<b>5.3</b>

Notes :

Tested By PC Date 11/10/16 Checked By TMP Date 11/11/16

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C (Modified to report Unit Weight)

This method does not report strain rate or deformation

Sample Prep and Conformance Verification: ASTM D4543-08

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID No.: 2016-527-001-009

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 31.7-32.7  
 Sample ID: R-4  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 459.30**

SPECIMEN LENGTH (in)

Reading 1: 4.02  
 Reading 2: 4.03  
 Reading 3: 4.02  
**Average: 4.02**

SPECIMEN DIAMETER (in):

Reading 1: 1.83  
 Reading 2: 1.83  
 Average: **1.83**  
 Area (in<sup>2</sup>): 2.64  
 L/D: 2.19

MOISTURE CONTENT

Tare Number: 1692  
 Wt. of Tare & Wet Sample (g): 534.61  
 Wt. of Tare & Dry Sample (g): 529.89  
 Weight of Tare (g): 82.61  
 Weight of Wet Sample (g): 452.00  
 Sample Volume (cm<sup>3</sup>): 174.09  
 Moisture Content (%): 1.06  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.638  
 Unit Wet Weight (pcf): 164.6  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.611**  
**Unit Dry Weight (pcf): 162.9**

Total Load (lb): 23,610  
**Uniaxial Compressive Strength (psi): 8,940**

Fracture Type: **Shear**

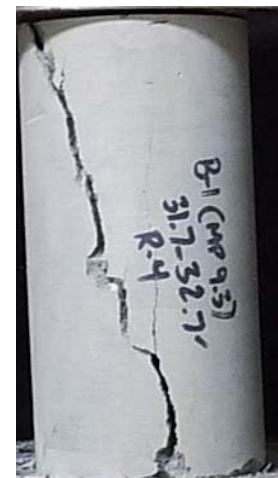
Rate of Loading (lb/sec): 168  
 Time to Break (min:sec): 2:20.25  
 Deviation From Straightness<sup>2</sup>: < 0.02

AXIAL: *Pass*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:    Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are:    As Received-Unpreserved
- 2) Deviation from straightness, Procedure A of ASTM D 4543-08  
     Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 3) Temperature is laboratory room temperature.
- 4) Geotechnics Equipment Used: G788 Compression Tester,  
 G1122 Digital Calipers, G1380 Dial Guage,  
 G1557 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



**Tested By:**            AJD                      **Date:**    11/16/16                      **Checked By:**        CLK                      **Date:** 11/17/16



**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-010

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 31.7-32.7  
 Sample No.: R4 Test 1  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.270	Top Diam (in):	1.837
Length (in):	1.274	Mid Diam (in):	1.840
Length (in):	1.266	Bot Diam (in):	1.842
Avg. Length (in):	1.270	Avg. Diam (in):	1.840
		Area (in <sup>2</sup> ):	2.658

MOISTURE CONTENT	
Tare No.:	3219
Weight Tare & Wet Sample (g):	152.01
Weight of Tare & Dry Sample (g):	150.33
Weight of Tare (g):	6.78
Moisture (%):	1.2

Thickness to Diameter Ratio: 0.69 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 145.4

Rate of Loading (lb/sec): 91.0

Rate of Loading (lb/min): 5460

Location/Type of Failure: Center / Split

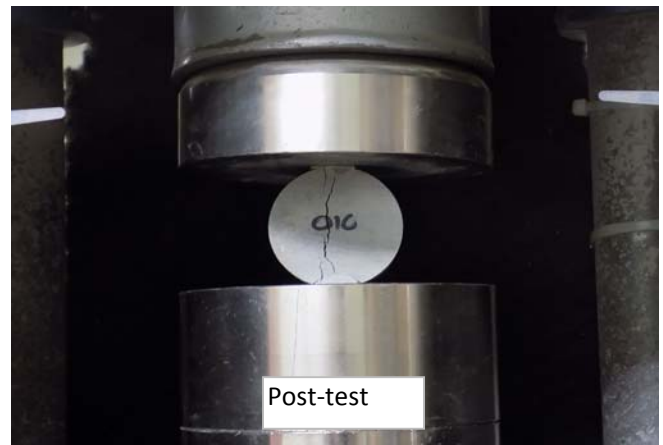
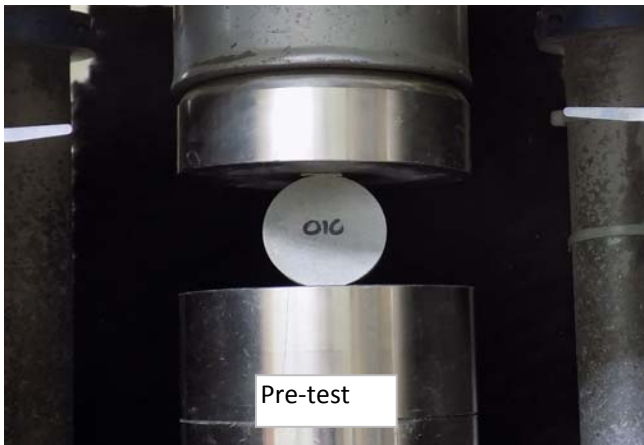
Time to Break (min:sec): 0:40.28

**LOAD (lb)**

**Splitting Tensile Strength (psi)**

3660

997.28



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16

**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-011

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 31.7-32.7  
 Sample No.: R4 Test 2  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.264	Top Diam (in):	1.837
Length (in):	1.258	Mid Diam (in):	1.838
Length (in):	1.260	Bot Diam (in):	1.842
Avg. Length (in):	1.261	Avg. Diam (in):	1.839
		Area (in <sup>2</sup> ):	2.656

MOISTURE CONTENT	
Tare No.:	3051
Weight Tare & Wet Sample (g):	152.65
Weight of Tare & Dry Sample (g):	150.35
Weight of Tare (g):	6.46
Moisture (%):	1.6

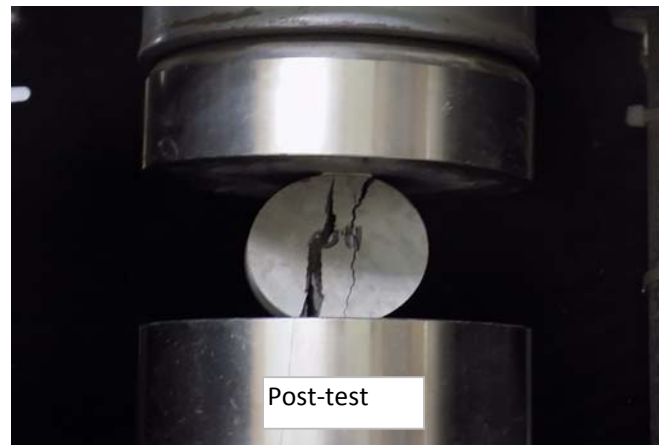
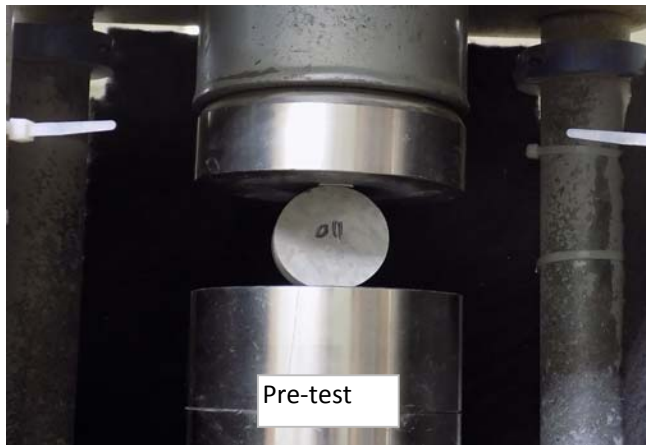
Thickness to Diameter Ratio: 0.69 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 146.3

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 97.0  
 Rate of Loading (lb/min): 5820  
 Time to Break (min:sec): 0:31.68

<i>LOAD (lb)</i>	<i>Splitting Tensile Strength (psi)</i>
3060	840.27



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16

**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-012

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 31.7-32.7  
 Sample No.: R4 Test 3  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.307	Top Diam (in):	1.844
Length (in):	1.310	Mid Diam (in):	1.845
Length (in):	1.312	Bot Diam (in):	1.846
Avg. Length (in):	1.310	Avg. Diam (in):	1.845
		Area (in <sup>2</sup> ):	2.674

MOISTURE CONTENT	
Tare No.:	3177
Weight Tare & Wet Sample (g):	157.73
Weight of Tare & Dry Sample (g):	155.39
Weight of Tare (g):	6.87
Moisture (%):	1.6

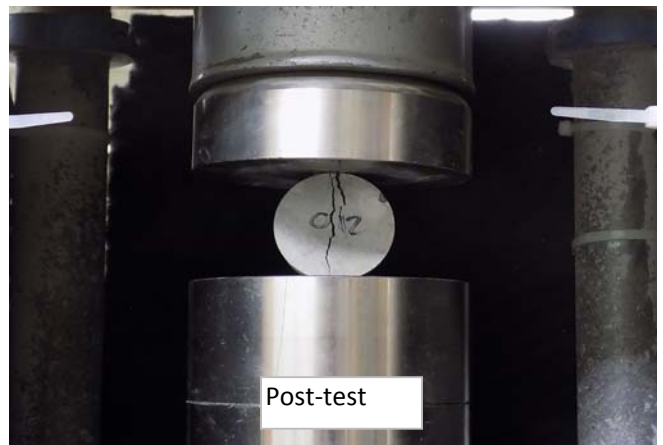
Thickness to Diameter Ratio: 0.71 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 150.9

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 97.0  
 Rate of Loading (lb/min): 5820  
 Time to Break (min:sec): 0:24.78

LOAD (lb)	Splitting Tensile Strength (psi)
2400	632.32



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16

page 1 of 1 DCN: CT-S68Concrete Date: 8/30/12 Revision: 0

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C (Modified to report Unit Weight)

This method does not report strain rate or deformation

Sample Prep and Conformance Verification: ASTM D4543-08

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID No.: 2016-527-001-013

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 17.1-18.1  
 Sample ID: R-1  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 442.20**

SPECIMEN LENGTH (in)

Reading 1: 3.96  
 Reading 2: 3.96  
 Reading 3: 3.96  
**Average: 3.96**

SPECIMEN DIAMETER (in):

Reading 1: 1.87  
 Reading 2: 1.87  
 Average: **1.87**  
 Area (in<sup>2</sup>): 2.73  
 L/D: 2.12

MOISTURE CONTENT

Tare Number: 875  
 Wt. of Tare & Wet Sample (g): 549.55  
 Wt. of Tare & Dry Sample (g): 545.76  
 Weight of Tare (g): 110.43  
 Weight of Wet Sample (g): 439.12  
 Sample Volume (cm<sup>3</sup>): 177.23  
 Moisture Content (%): 0.87  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.495  
 Unit Wet Weight (pcf): 155.7  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.473**  
**Unit Dry Weight (pcf): 154.3**

Total Load (lb): 27,060  
**Uniaxial Compressive Strength (psi): 9,900**

Fracture Type: **Cone split**

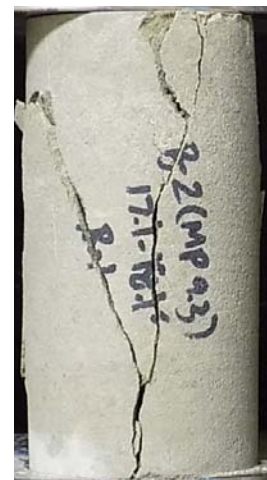
Rate of Loading (lb/sec): 137  
 Time to Break (min:sec): 3:17.40  
 Deviation From Straightness<sup>2</sup>: > 0.02

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:    Gray Rock Core

Notes:

- 1) Moisture conditions at time of the test are:    As Received-Unpreserved
- 2) Deviation from straightness, Procedure A of ASTM D 4543-08  
     Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 3) Temperature is laboratory room temperature.
- 4) Geotechnics Equipment Used: G788 Compression Tester,  
 G1122 Digital Calipers, G1380 Dial Guage,  
 G1557 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By:     AJD                          Date:     11/16/16                          Checked By:     CLK                          Date:     11/17/16

**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-014

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 17.1-18.1  
 Sample No.: R1 Test 1  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.294	Top Diam (in):	1.863
Length (in):	1.295	Mid Diam (in):	1.862
Length (in):	1.290	Bot Diam (in):	1.862
Avg. Length (in):	1.293	Avg. Diam (in):	1.862
		Area (in <sup>2</sup> ):	2.724

MOISTURE CONTENT	
Tare No.:	3012
Weight Tare & Wet Sample (g):	150.10
Weight of Tare & Dry Sample (g):	148.89
Weight of Tare (g):	6.63
Moisture (%):	0.9

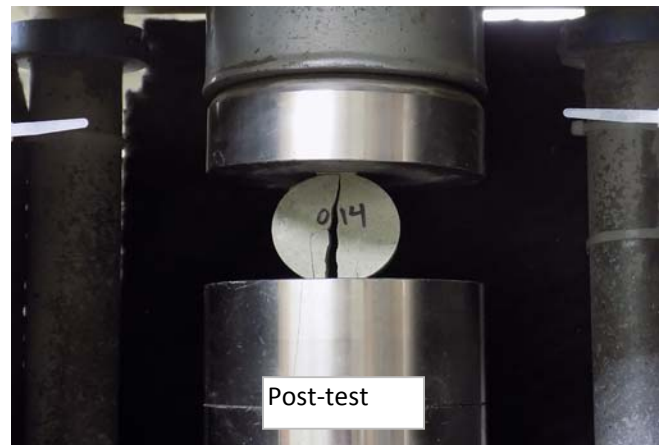
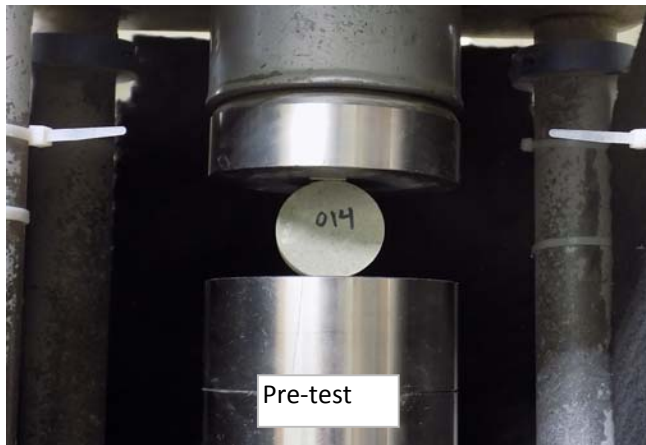
Thickness to Diameter Ratio: 0.69 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 143.7

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 99.0  
 Rate of Loading (lb/min): 5940  
 Time to Break (min:sec): 0:28.5

LOAD (lb)	Splitting Tensile Strength (psi)
2830	748.19



Tested By AJD Date 11/16/16 Input Checked By CLK Date 11/17/16



**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-015

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 17.1-18.1  
 Sample No.: R1 Test 2  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.336	Top Diam (in):	1.862
Length (in):	1.334	Mid Diam (in):	1.861
Length (in):	1.331	Bot Diam (in):	1.864
Avg. Length (in):	1.334	Avg. Diam (in):	1.862
		Area (in <sup>2</sup> ):	2.724

MOISTURE CONTENT	
Tare No.:	3057
Weight Tare & Wet Sample (g):	154.99
Weight of Tare & Dry Sample (g):	153.75
Weight of Tare (g):	6.49
Moisture (%):	0.8

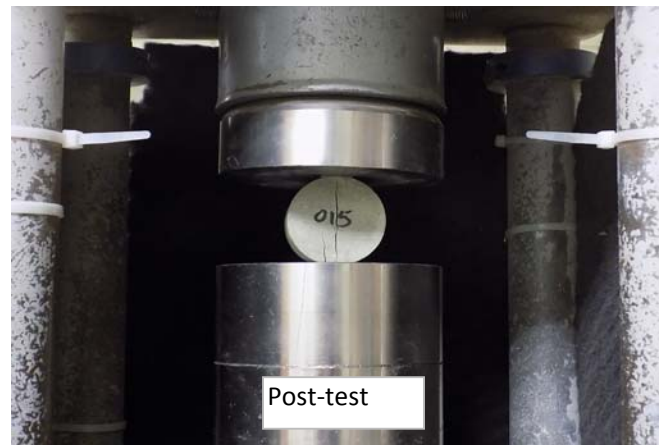
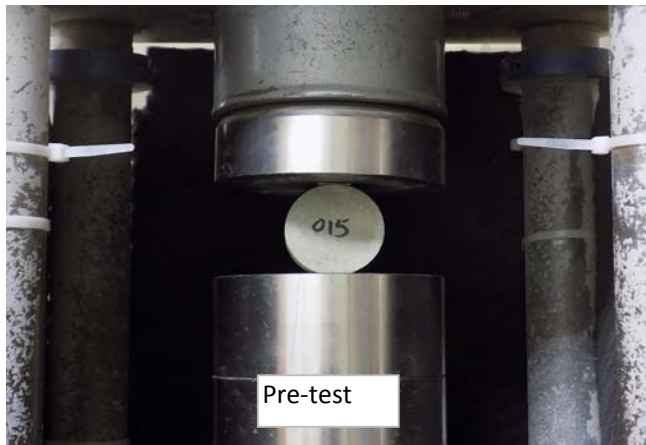
Thickness to Diameter Ratio: 0.72 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 148.6

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 128.0  
 Rate of Loading (lb/min): 7680  
 Time to Break (min:sec): 0:25.3

LOAD (lb)	Splitting Tensile Strength (psi)
3250	833.03





**SPLITTING TENSILE STRENGTH OF INTACT ROCK CORE SPECIMENS**  
ASTM D3967-08

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-016

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 17.1-18.1  
 Sample No.: R1 Test 3  
 Visual Description: Rock Core  
 Moisture Condition: AS RECEIVED-UNPRESERVED

INITIAL SAMPLE DIMENSIONS			
Length (in):	1.266	Top Diam (in):	1.864
Length (in):	1.269	Mid Diam (in):	1.862
Length (in):	1.271	Bot Diam (in):	1.862
Avg. Length (in):	1.269	Avg. Diam (in):	1.863
		Area (in <sup>2</sup> ):	2.725

MOISTURE CONTENT	
Tare No.:	3178
Weight Tare & Wet Sample (g):	149.83
Weight of Tare & Dry Sample (g):	148.31
Weight of Tare (g):	6.84
Moisture (%):	1.1

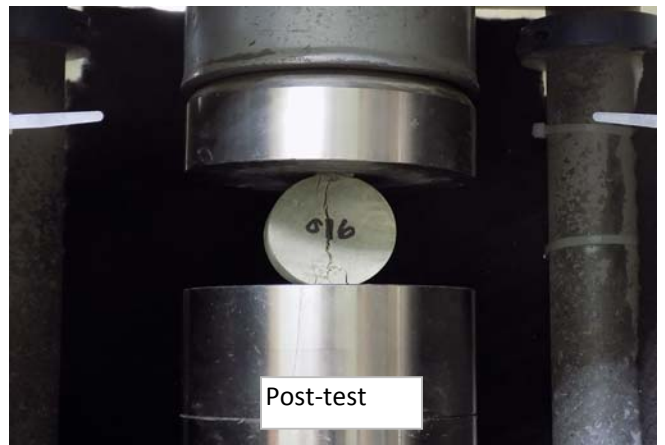
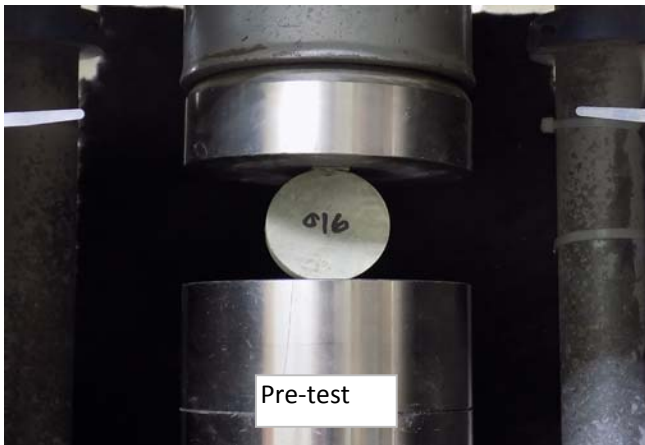
Thickness to Diameter Ratio: 0.68 **Shall be approximately 0.2 - 0.75**

Weight of Prepared Cylinder (g): 143.0

Location/Type of Failure: Center / Split

Rate of Loading (lb/sec): 122.0  
 Rate of Loading (lb/min): 7320  
 Time to Break (min:sec): 0:25.45

<i>LOAD (lb)</i>	<i>Splitting Tensile Strength (psi)</i>
3100	835.14



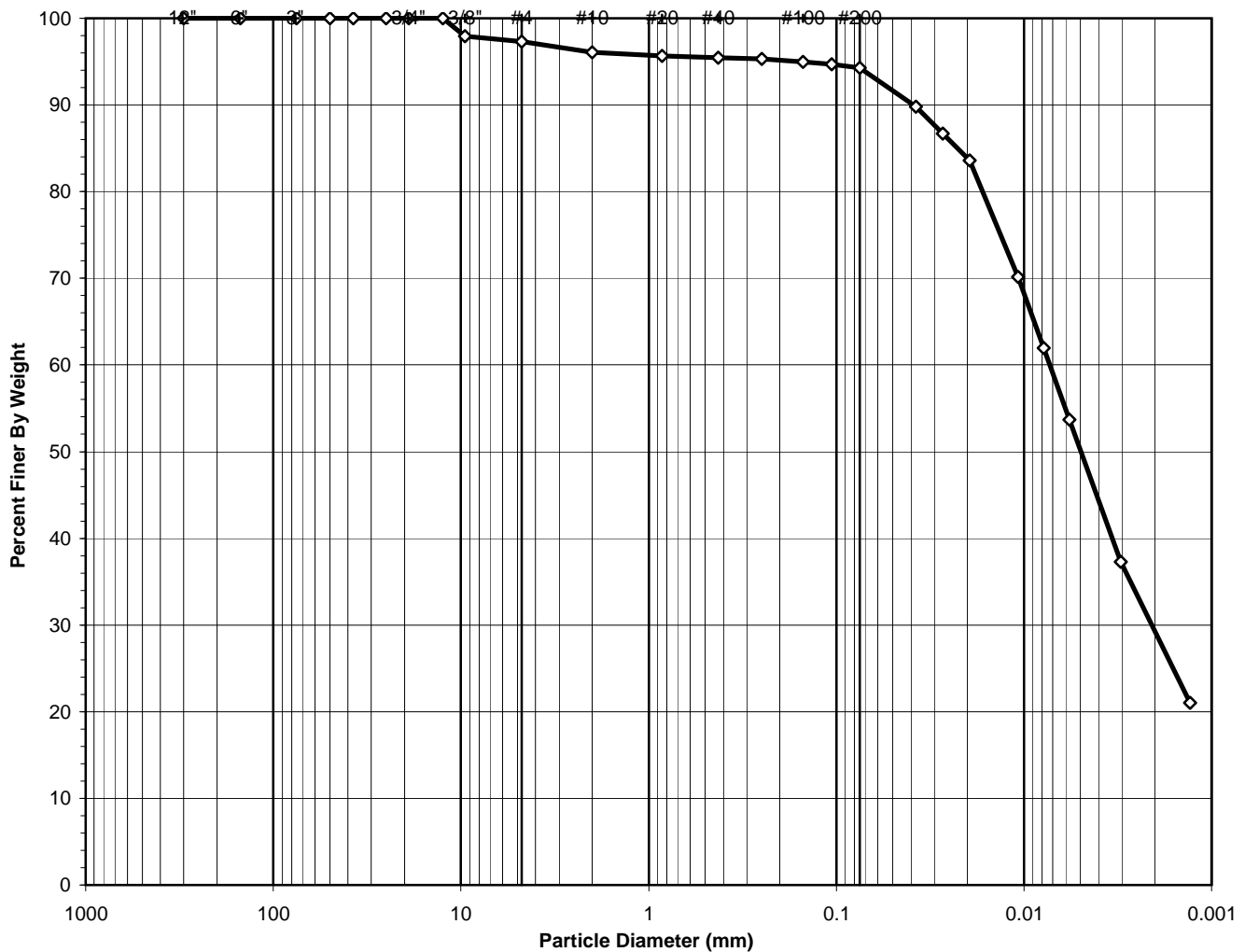
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-027

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 7.5  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

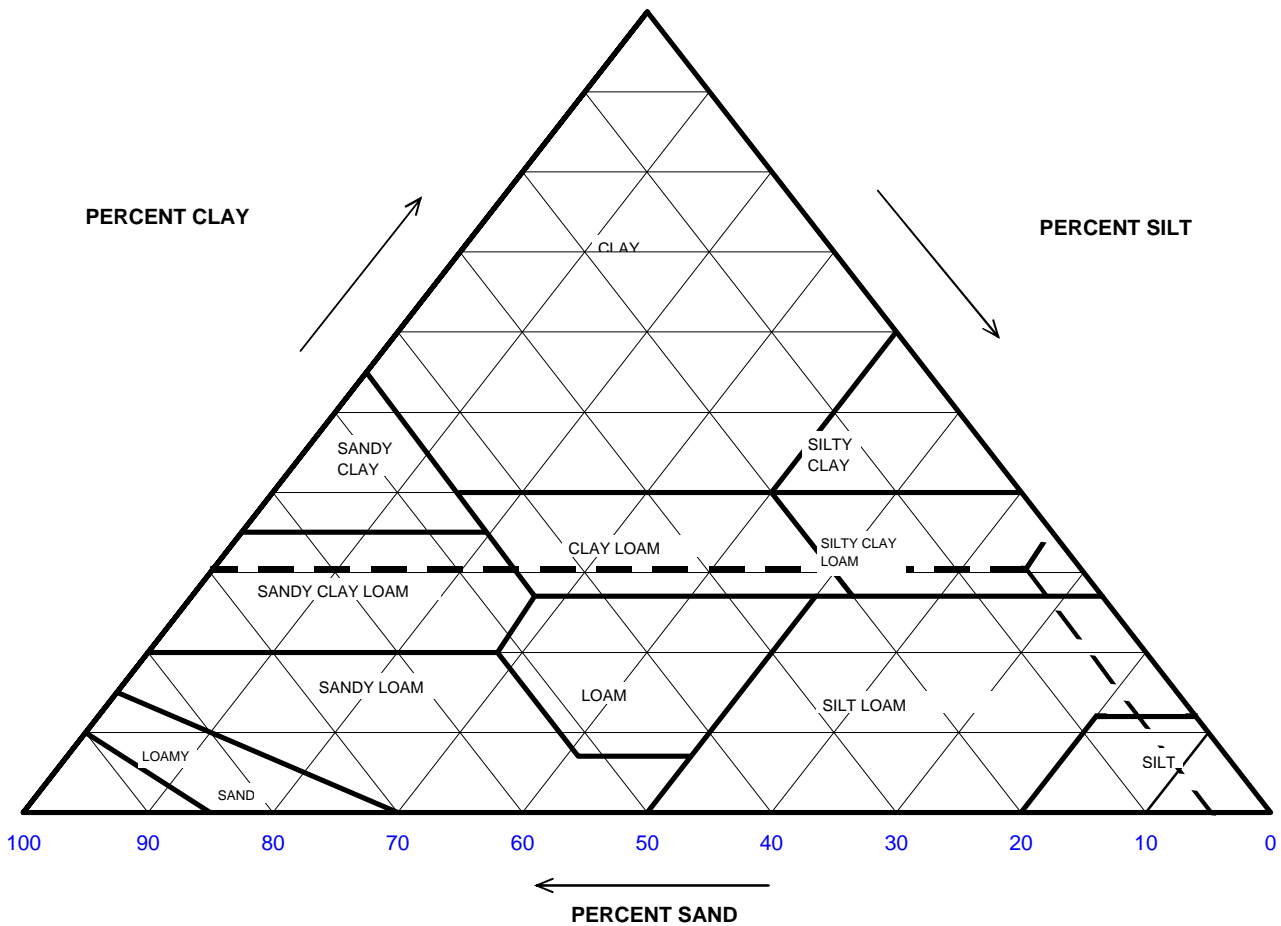
**USCS Classification:**  
**LEAN CLAY**

Tested By HL Date 11/14/16 Checked By KC Date 11/21/16

# USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-027

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 7.5  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer		Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	3.92
2	96.08	Sand	4.44
0.05	91.63	Silt	62.43
0.002	29.20	Clay	29.20

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-027

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 7.5  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1555	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	406.96	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	378.18	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	147.30	Weight of Tare (g):	0.00
Weight of Water (g):	28.78	Weight of Water (g):	0.00
Weight of Dry Soil (g):	230.88	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>12.5</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	230.88
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	217.74
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	13.14
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.0
1"	25	0.00	0.00	0.00	100.00	100.0
3/4"	19	0.00	0.00	0.00	100.00	100.0
1/2"	12.5	0.00	0.00	0.00	100.00	100.0
3/8"	9.5	4.83	2.09	2.09	97.91	97.9
#4	4.75	1.45	0.63	2.72	97.28	97.3
#10	2	2.78	1.20	3.92	96.08	96.1
#20	0.85	0.96	(**)	4.34	95.66	95.7
#40	0.425	0.43	0.19	4.53	95.47	95.5
#60	0.25	0.37	0.16	4.69	95.31	95.3
#100	0.15	0.75	0.32	5.01	94.99	95.0
#140	0.106	0.76	0.33	5.34	94.66	94.7
#200	0.075	0.81	0.35	5.69	94.31	94.3
Pan	-	217.74	94.31	100.00	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample

(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By HL Date 11/14/16 Checked By KC Date 11/21/16

## HYDROMETER ANALYSIS

ASTM D7928-16

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-027

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 7.5  
 Sample No.: B-1-3  
 Soil Color: Reddish Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	49.5	22.3	5.97	8.1	0.0377	95.2	89.8
2	48.0	22.3	5.97	8.4	0.0271	91.9	86.7
4	46.5	22.3	5.97	8.7	0.0195	88.6	83.6
15	40.0	22.3	5.97	9.9	0.0107	74.4	70.2
30	36.0	22.3	5.97	10.6	0.0078	65.7	61.9
60	32.0	22.3	5.97	11.3	0.0057	56.9	53.7
240	24.0	22.4	5.93	12.7	0.0030	39.5	37.3
1440	16.0	22.7	5.82	14.2	0.0013	22.3	21.0

### Soil Specimen Data

Tare No.:	970	Percent Finer than # 200:	94.31
Wt. of Tare & Dry Material (g):	150.23		
Weight of Tare (g):	100.01	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	45.22		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 375
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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0

0

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-027

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 7.5  
 Sample No.: B-1-3  
 Soil Description: REDDISH BROWN LEAN CLAY  
 (Minus No. 40 sieve material, Air dried)

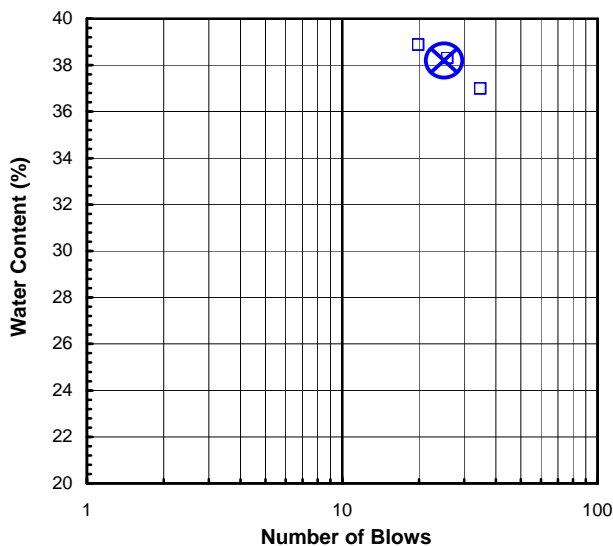
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	28	158	44	191	U
Wt. of Tare & Wet Sample (g):	61.33	37.65	37.56	37.58	L
Wt. of Tare & Dry Sample (g):	55.43	32.01	31.99	32.18	T
Weight of Tare (g):	6.85	17.49	17.44	17.57	I
Weight of Water (g):	5.9	5.6	5.6	5.4	P
Weight of Dry Sample (g):	48.6	14.5	14.6	14.6	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>12.1</b>	<b>38.8</b>	<b>38.3</b>	<b>37.0</b>	<b>N</b>
<b>Number of Blows:</b>		<b>20</b>	<b>26</b>	<b>35</b>	<b>T</b>

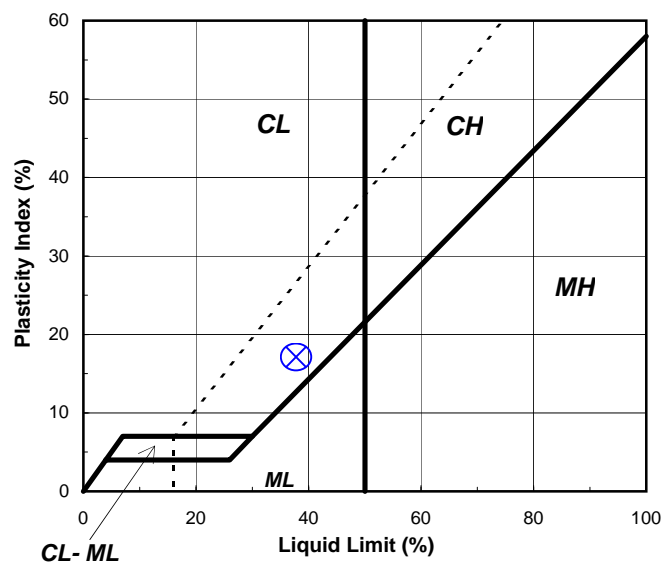
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	226	234		<b>Liquid Limit (%):</b>	<b>38</b>
Wt. of Tare & Wet Sample (g):	25.64	26.23		<b>Plastic Limit (%):</b>	<b>21</b>
Wt. of Tare & Dry Sample (g):	24.54	25.11		<b>Plasticity Index (%):</b>	<b>17</b>
Weight of Tare (g):	19.33	19.87		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.1	1.1			
Weight of Dry Sample (g):	5.2	5.2			
<b>Moisture Content (%):</b>	<b>21.1</b>	<b>21.4</b>	<b>-0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



Tested By RAL Date 11/16/16 Checked By TMP Date 11/17/16



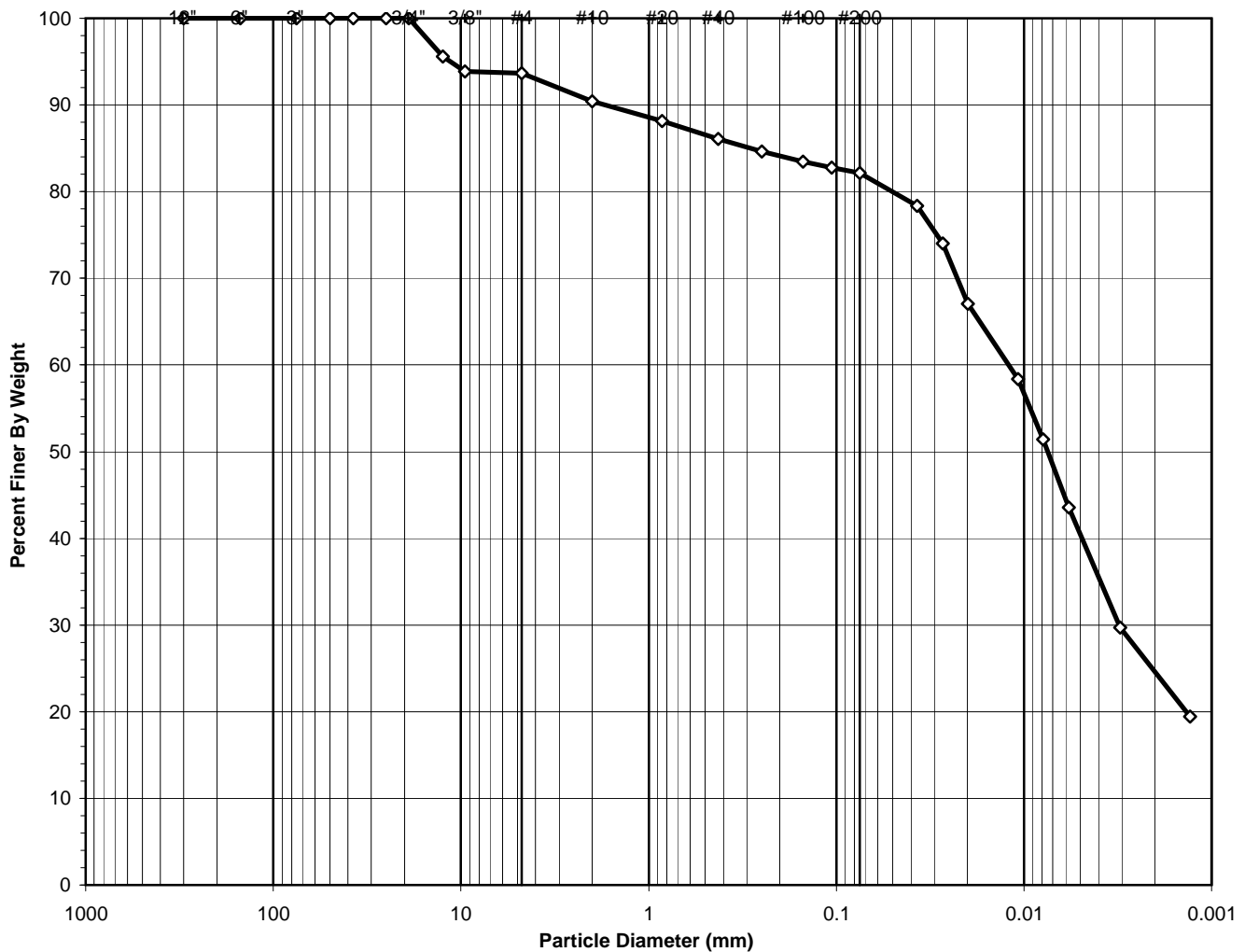
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-028

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 9.6  
 Sample No.: B-1-4  
 Soil Color: Reddish Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

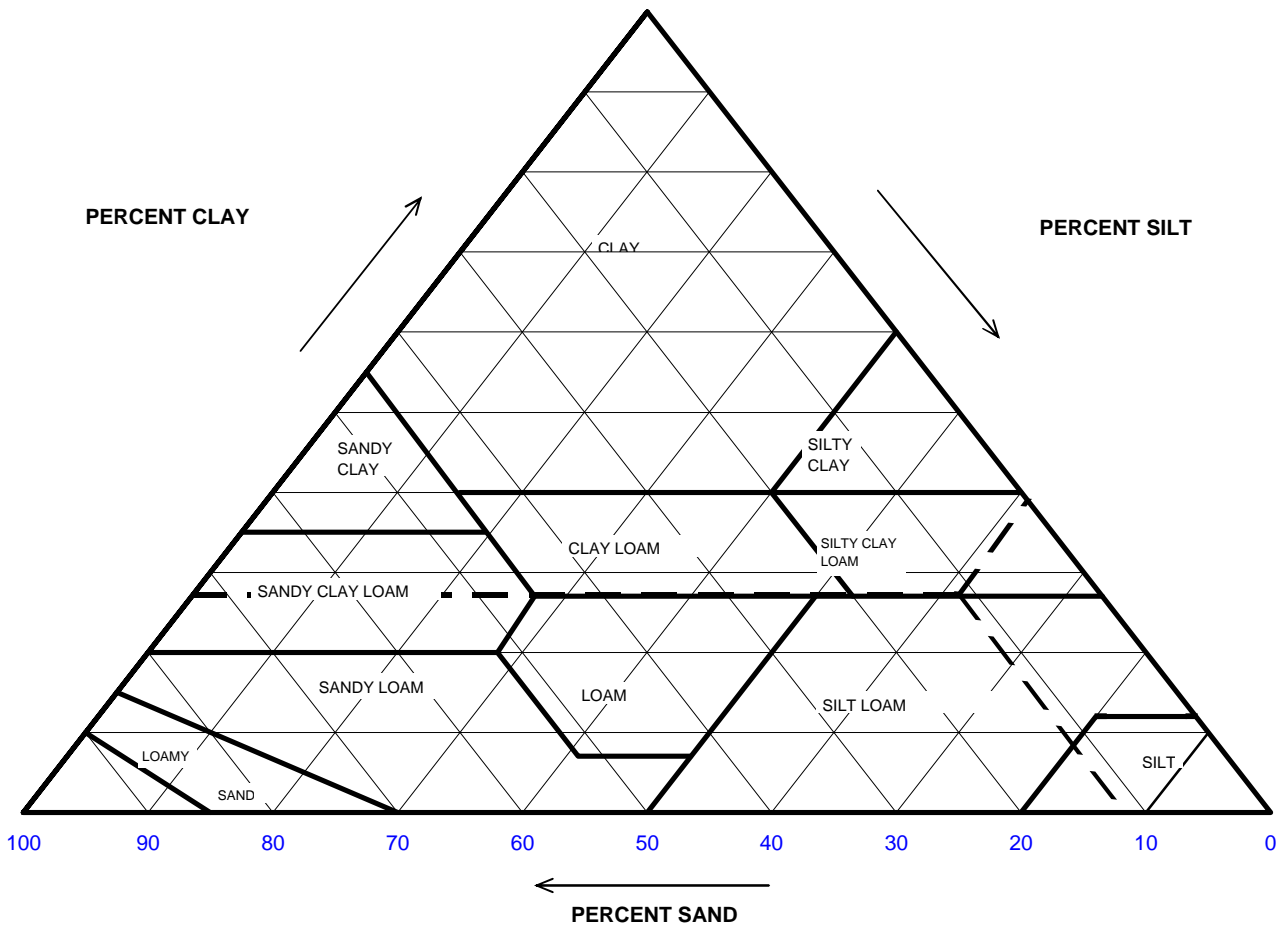
**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By HL Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-028

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 9.6  
 Sample No.: B-1-4  
 Soil Color: Reddish Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	9.56
2	90.44	Sand	11.58
0.05	79.97	Silt	61.20
0.002	24.62	Clay	27.22

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-028

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 9.6  
 Sample No.: B-1-4  
 Soil Color: Reddish Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1487	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	358.71	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	358.71	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	147.15	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	211.56	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	211.56
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	173.81
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	37.75
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.0
1"	25	0.00	0.00	0.00	100.00	100.0
3/4"	19	0.00	0.00	0.00	100.00	100.0
1/2"	12.5	9.39	4.44	4.44	95.56	95.6
3/8"	9.5	3.62	1.71	6.15	93.85	93.9
#4	4.75	0.46	0.22	6.37	93.63	93.6
#10	2	6.75	3.19	9.56	90.44	90.4
#20	0.85	4.85	(**)	11.85	88.15	88.1
#40	0.425	4.45	2.10	13.95	86.05	86.0
#60	0.25	2.97	1.40	15.36	84.64	84.6
#100	0.15	2.55	1.21	16.56	83.44	83.4
#140	0.106	1.38	0.65	17.21	82.79	82.8
#200	0.075	1.33	0.63	17.84	82.16	82.2
Pan	-	173.81	82.16	100.00	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample

(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By HL Date 11/17/16 Checked By KC Date 11/21/16

## HYDROMETER ANALYSIS

ASTM D7928-16

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-028

Boring No.: B-1 (MP 9.3)  
 Depth (ft): 9.6  
 Sample No.: B-1-4  
 Soil Color: Reddish Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	51.0	22.3	5.97	7.9	0.0371	95.4	78.4
2	48.5	22.3	5.97	8.3	0.0270	90.1	74.0
4	44.5	22.3	5.97	9.0	0.0199	81.6	67.0
15	39.5	22.3	5.97	9.9	0.0108	71.0	58.3
30	35.5	22.3	5.97	10.7	0.0079	62.5	51.4
60	31.0	22.3	5.97	11.5	0.0058	53.0	43.6
240	23.0	22.4	5.93	12.9	0.0031	36.1	29.7
1440	17.0	22.7	5.82	14.0	0.0013	23.7	19.5

### Soil Specimen Data

Tare No.:	2331	Percent Finer than # 200:	82.16
Wt. of Tare & Dry Material (g):	144.99	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	93.30		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	46.69		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 206
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.	Boring No.: B-1 (MP 9.3)
Client Reference: ACP TXG0007	Depth (ft): 9.6
Project No.: 2016-527-001	Sample No.: B-1-4
Lab ID: 2016-527-001-028	Soil Description: REDDISH BROWN LEAN CLAY

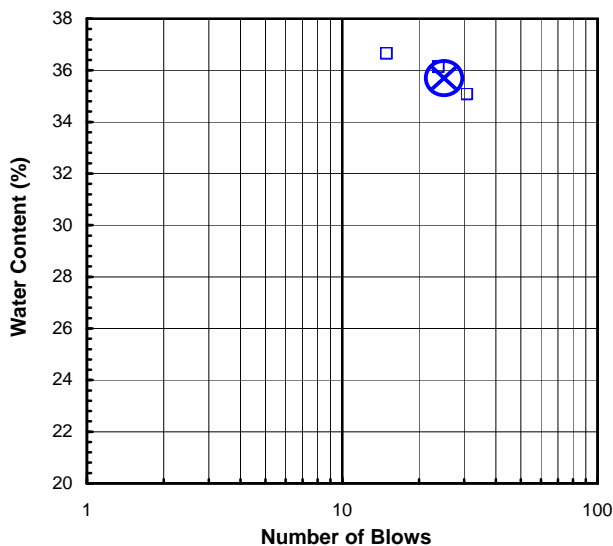
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	14	207	164	246	U
Wt. of Tare & Wet Sample (g):	46.84	38.89	37.54	37.66	L
Wt. of Tare & Dry Sample (g):	44.24	33.39	32.20	32.43	T
Weight of Tare (g):	6.93	18.37	17.41	17.51	I
Weight of Water (g):	2.6	5.5	5.3	5.2	P
Weight of Dry Sample (g):	37.3	15.0	14.8	14.9	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>7.0</b>	<b>36.6</b>	<b>36.1</b>	<b>35.1</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>24</b>	<b>31</b>	<b>T</b>

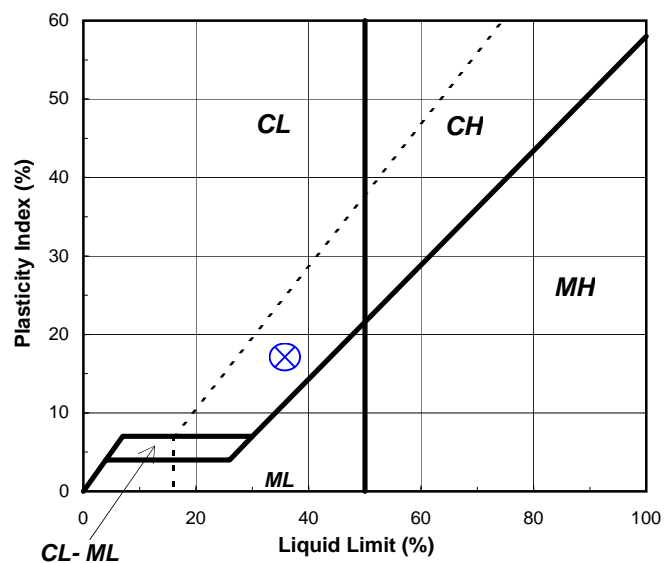
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	224	2		<b>Liquid Limit (%):</b>	<b>36</b>
Wt. of Tare & Wet Sample (g):	26.08	25.54		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	25.09	24.59		<b>Plasticity Index (%):</b>	<b>17</b>
Weight of Tare (g):	19.77	19.47		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.0	0.9			
Weight of Dry Sample (g):	5.3	5.1			
<b>Moisture Content (%):</b>	<b>18.6</b>	<b>18.6</b>	<b>0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

**Flow Curve**



**Plasticity Chart**



Tested By RAL Date 11/14/16 Checked By TMP Date 11/15/16

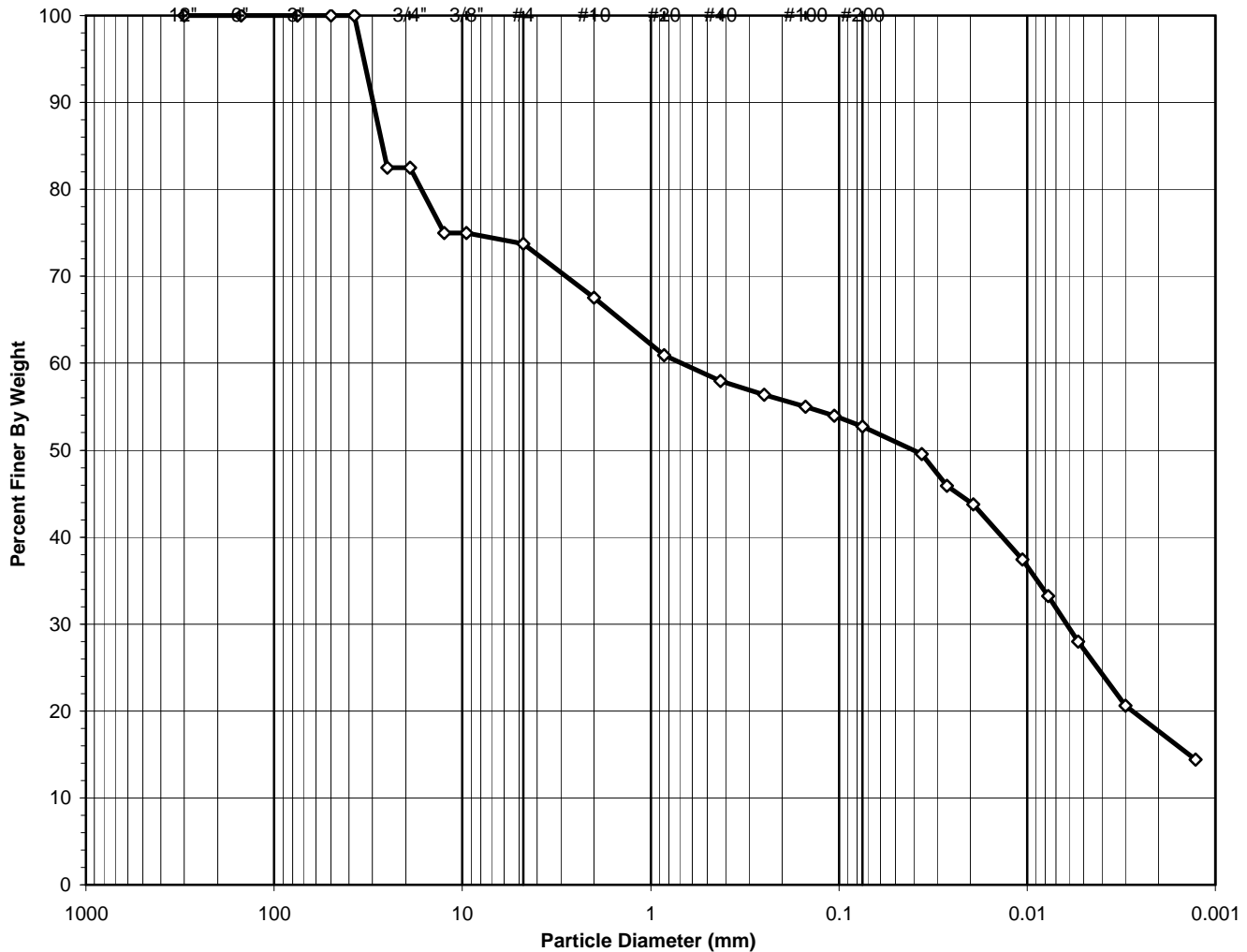
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-029

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 1.5  
 Sample No.: B-2-1  
 Soil Color: Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**GRAVELLY LEAN CLAY WITH SAND**

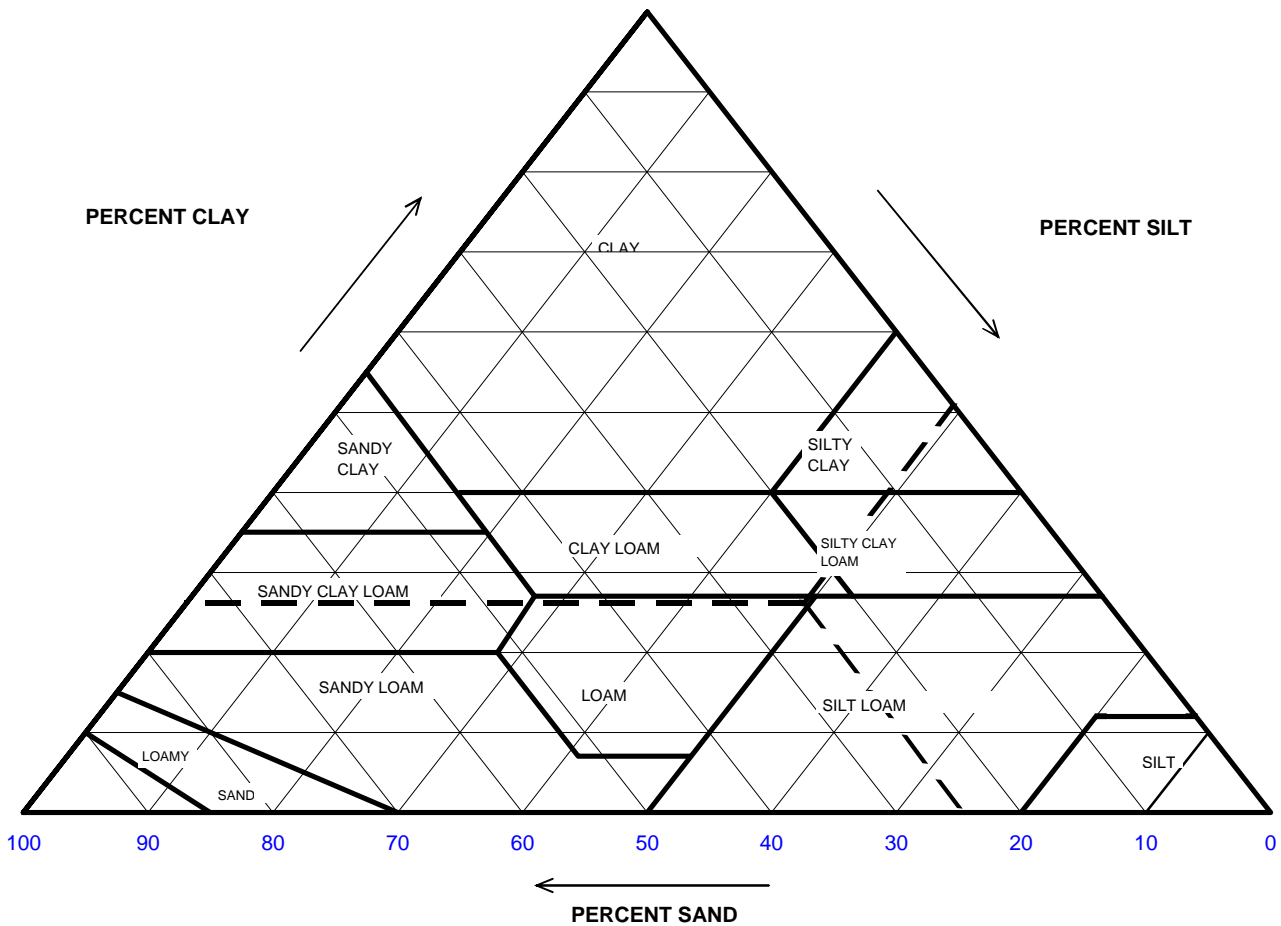
Tested By SG Date 11/17/16 Checked By KC Date 11/21/16



## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-029

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 1.5  
 Sample No.: B-2-1  
 Soil Color: Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	32.47
2	67.53	Sand	24.52
0.05	50.97	Silt	49.31
0.002	17.67	Clay	26.17

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	1.5
Project No.:	2016-527-001	Sample No.:	B-2-1
Lab ID:	2016-527-001-029	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1414	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	292.63	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	292.63	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	145.22	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	147.41	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	147.41
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	103.56
Wet Weight of +3/4" Sample (g):	25.84	Weight of plus #200 Material (g):	43.85
Dry Weight of + 3/4" Sample (g):	25.84		
Total Dry Weight of Sample (g):	25.8	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.0</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.0</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.0</b>
2"	50	0.00	(*)	0.00	100.00	<b>100.0</b>
1 1/2"	37.5	0.00		0.00	100.00	<b>100.0</b>
1"	25	25.84	17.53	17.53	82.47	<b>82.5</b>
3/4"	19	0.00	0.00	17.53	82.47	<b>82.5</b>
1/2"	12.5	11.07	7.51	25.04	74.96	<b>75.0</b>
3/8"	9.5	0.00	0.00	25.04	74.96	<b>75.0</b>
#4	4.75	1.83	1.24	26.28	73.72	<b>73.7</b>
#10	2	9.13	6.19	32.47	67.53	<b>67.5</b>
#20	0.85	9.77	(**)	39.10	60.90	<b>60.9</b>
#40	0.425	4.30	2.92	42.02	57.98	<b>58.0</b>
#60	0.25	2.41	1.63	43.65	56.35	<b>56.3</b>
#100	0.15	1.99	1.35	45.00	55.00	<b>55.0</b>
#140	0.106	1.51	1.02	46.03	53.97	<b>54.0</b>
#200	0.075	1.84	1.25	47.28	52.72	<b>52.7</b>
Pan	-	103.56	70.25	117.53	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By **SG** Date **11/17/16** Checked By **KC** Date **11/21/16**

## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	1.5
Project No.:	2016-527-001	Sample No.:	B-2-1
Lab ID:	2016-527-001-029	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	53.0	22.3	5.97	7.5	0.0362	94.0	49.6
2	49.5	22.3	5.97	8.1	0.0267	87.0	45.9
4	47.5	22.3	5.97	8.5	0.0193	83.0	43.8
15	41.5	22.3	5.97	9.6	0.0106	71.0	37.5
30	37.5	22.3	5.97	10.3	0.0077	63.0	33.2
68	32.5	22.3	5.97	11.2	0.0054	53.0	28.0
240	25.5	22.4	5.93	12.5	0.0030	39.1	20.6
1440	19.5	22.7	5.82	13.5	0.0013	27.3	14.4

### Soil Specimen Data

Tare No.:	975	Percent Finer than # 200:	52.72
Wt. of Tare & Dry Material (g):	150.32	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	95.86		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	49.46		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 355
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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### ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-029

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 1.5  
 Sample No.: B-2-1  
 Soil Description: BROWN LEAN CLAY

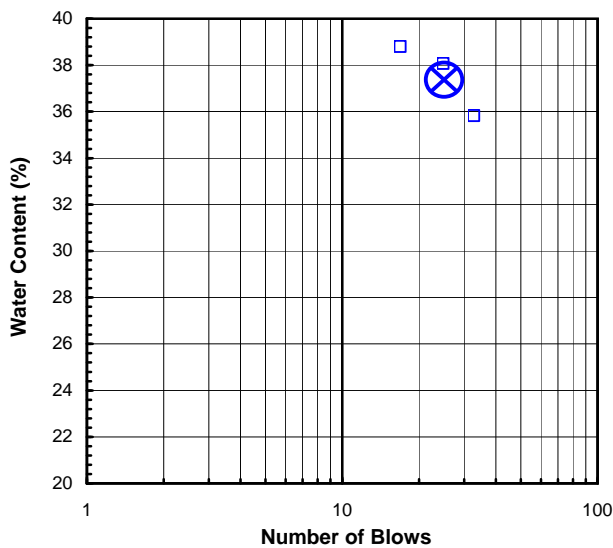
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10		Liquid Limit Test			
		1	2	3	M
Tare Number:	15	166	241	160	U
Wt. of Tare & Wet Sample (g):	43.04	28.44	28.61	28.90	L
Wt. of Tare & Dry Sample (g):	37.86	25.63	25.83	26.17	T
Weight of Tare (g):	6.95	18.38	18.52	18.54	I
Weight of Water (g):	5.2	2.8	2.8	2.7	P
Weight of Dry Sample (g):	30.9	7.3	7.3	7.6	O
Was As Received MC Preserved:	Yes				I
<b>Moisture Content (%):</b>	<b>16.8</b>	<b>38.8</b>	<b>38.0</b>	<b>35.8</b>	<b>N</b>
<b>Number of Blows:</b>		<b>17</b>	<b>25</b>	<b>33</b>	<b>T</b>

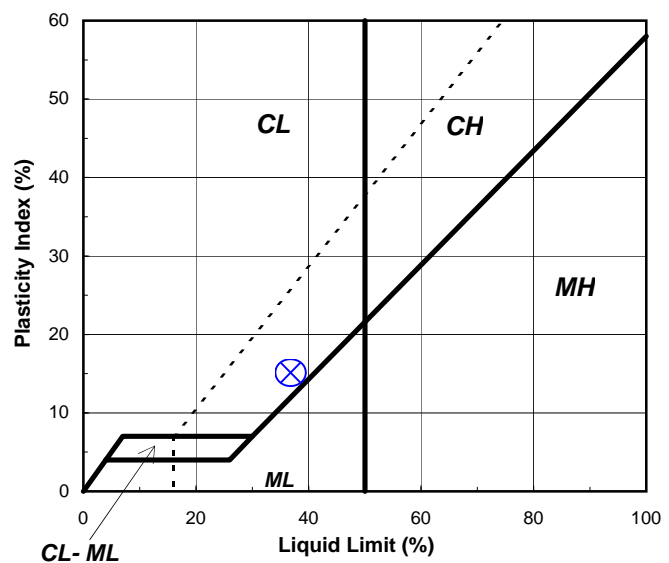
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	122	12		Liquid Limit (%):	37
Wt. of Tare & Wet Sample (g):	25.08	25.83		Plastic Limit (%):	22
Wt. of Tare & Dry Sample (g):	23.92	24.70		Plasticity Index (%):	15
Weight of Tare (g):	18.67	19.73		USCS Symbol:	CL
Weight of Water (g):	1.2	1.1			
Weight of Dry Sample (g):	5.3	5.0			
<b>Moisture Content (%):</b>	<b>22.1</b>	<b>22.7</b>	<b>-0.6</b>		

Note: The acceptable range of the two Moisture contents is  $\pm 2.6$

Flow Curve



Plasticity Chart



Tested By RAL Date 11/15/16 Checked By TMP Date 11/16/16

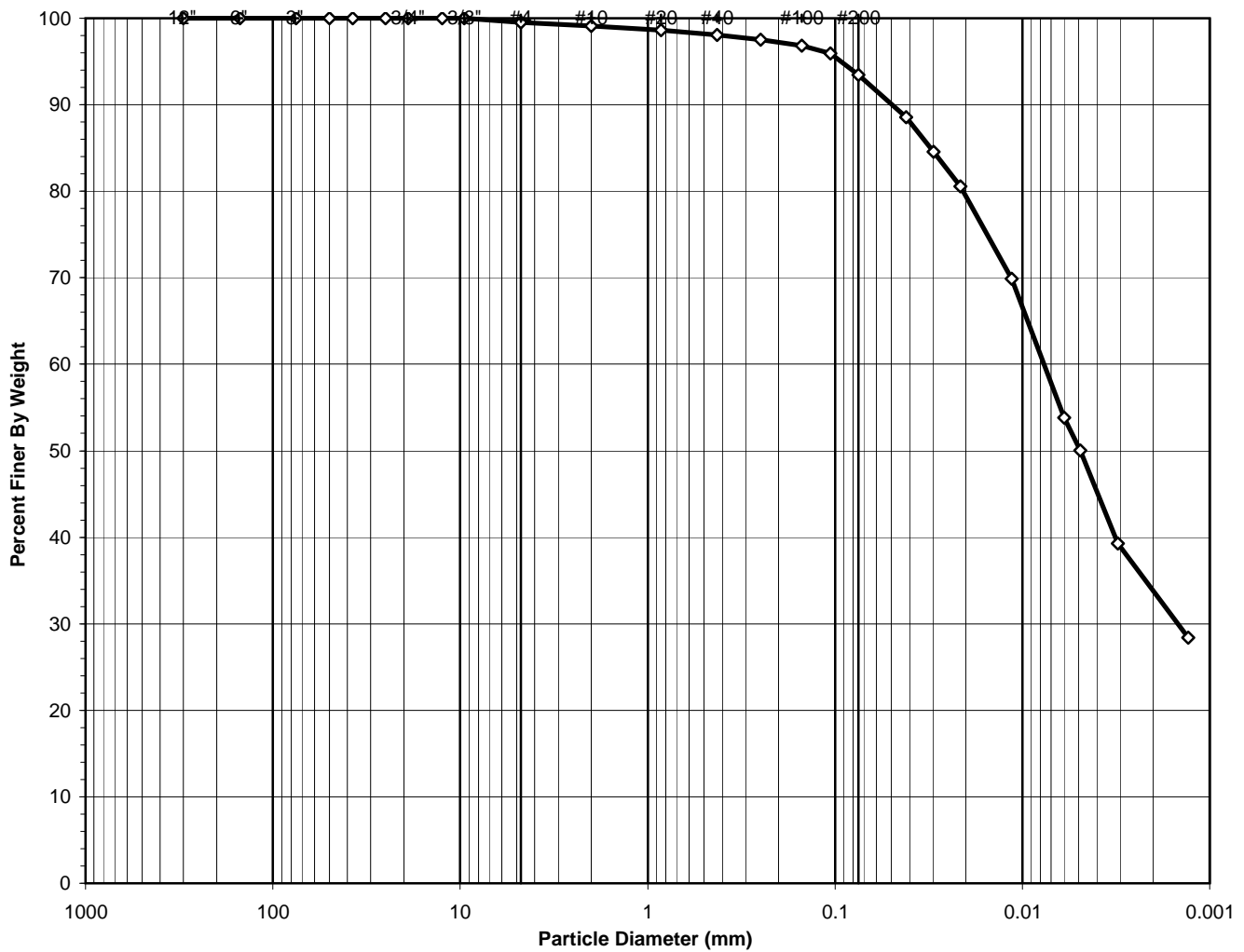
# SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-032

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 11.2  
 Sample No.: B-2-5  
 Soil Color: Reddish Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
**ML, TESTED**

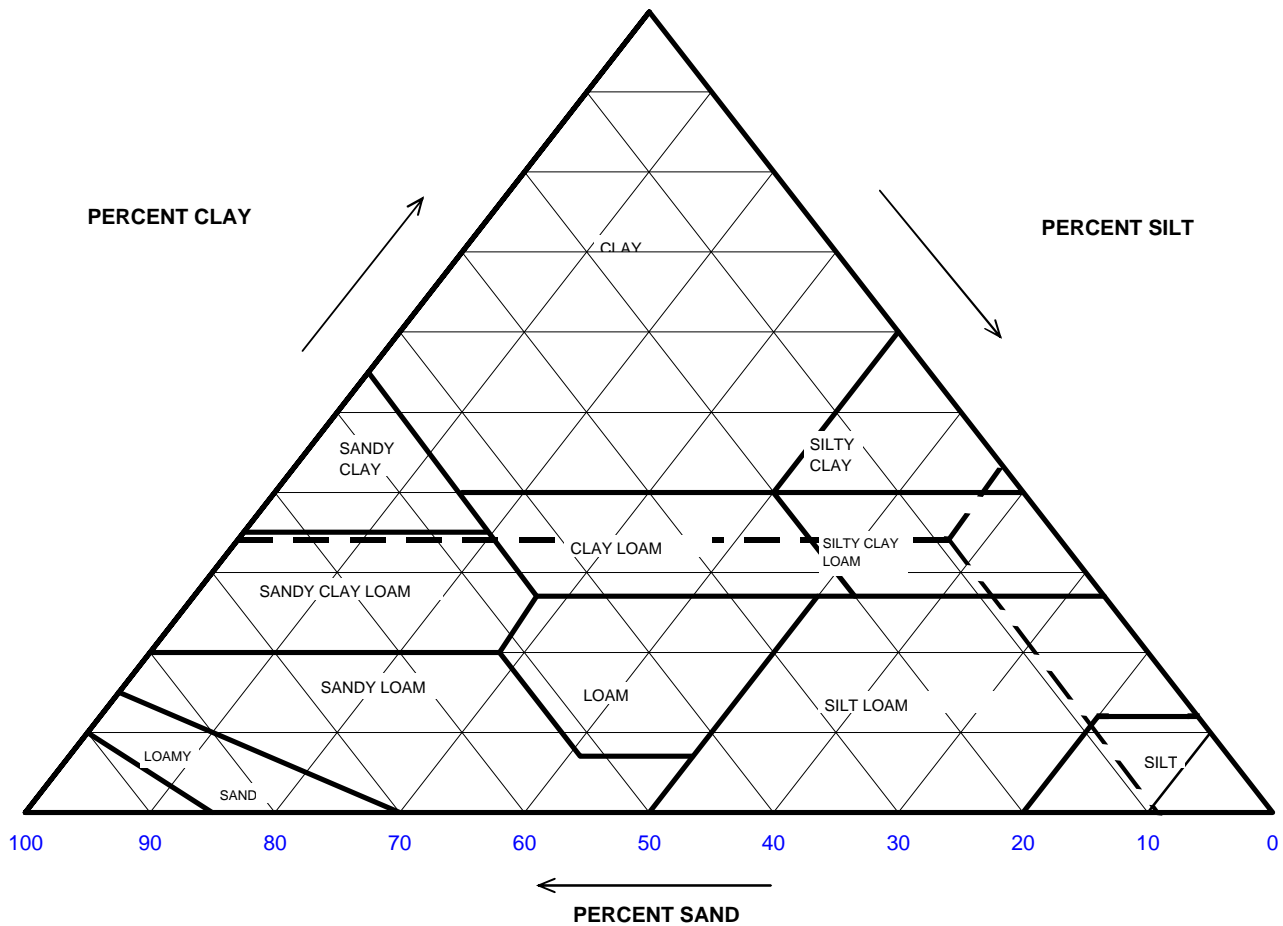
**USCS Classification:**  
**SILT**

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-032

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 11.2  
 Sample No.: B-2-5  
 Soil Color: Reddish Brown



USDA SUMMARY				
Particle Size (mm)	Percent Finer		Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		<b>Gravel</b>	<b>0.92</b>	
<b>2</b>	<b>99.08</b>	<b>Sand</b>	<b>9.02</b>	<b>9.10</b>
<b>0.05</b>	<b>90.06</b>	<b>Silt</b>	<b>56.29</b>	<b>56.81</b>
<b>0.002</b>	<b>33.78</b>	<b>Clay</b>	<b>33.78</b>	<b>34.09</b>

**USDA Classification: LOAMY SAND**



## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-032

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 11.2  
 Sample No.: B-2-5  
 Soil Color: Reddish Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1460	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	298.43	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	298.43	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	142.63	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	155.80	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	155.80
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	145.57
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	10.23
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00		0.00	100.00	100.0
1"	25	0.00		0.00	100.00	100.0
3/4"	19	0.00		0.00	100.00	100.0
1/2"	12.5	0.00		0.00	100.00	100.0
3/8"	9.5	0.00		0.00	100.00	100.0
#4	4.75	0.79		0.51	99.49	99.5
#10	2	0.64		0.41	99.08	99.1
#20	0.85	0.73	(**)	0.47	98.61	98.6
#40	0.425	0.82		0.53	98.09	98.1
#60	0.25	0.90		0.58	97.51	97.5
#100	0.15	1.04		0.67	96.84	96.8
#140	0.106	1.44		0.92	95.92	95.9
#200	0.075	3.87		2.48	93.43	93.4
Pan	-	145.57		93.43	100.00	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
 (\*\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By **SG** Date **11/17/16** Checked By **KC** Date **11/21/16**

## HYDROMETER ANALYSIS

ASTM D7928-16

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-032

Boring No.: B-2 (MP 9.3)  
 Depth (ft): 11.2  
 Sample No.: B-2-5  
 Soil Color: Reddish Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	39.0	22.7	5.82	10.0	0.0417	94.8	88.5
2	37.5	22.7	5.82	10.3	0.0299	90.5	84.5
4	36.0	22.7	5.82	10.6	0.0214	86.2	80.5
15	32.0	22.7	5.82	11.3	0.0114	74.8	69.9
60	26.0	22.7	5.82	12.4	0.0060	57.6	53.9
90	24.5	22.9	5.75	12.6	0.0049	53.6	50.1
240	20.5	22.8	5.78	13.4	0.0031	42.0	39.3
1440	16.5	22.6	5.86	14.1	0.0013	30.4	28.4

### Soil Specimen Data

Tare No.:	706	Percent Finer than # 200:	93.43
Wt. of Tare & Dry Material (g):	137.99		
Weight of Tare (g):	98.37	Specific Gravity:	2.70 Assumed
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	34.62		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 368
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/17/16	Checked By	KC	Date	11/21/16
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## ONE POINT ATTERBERG LIMIT

ASTM D 4318-10 (SOP - S4)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	11.2
Project No.:	2016-527-001	Sample No.:	B-2-5
Lab ID:	2016-527-001-032	Soil Description:	REDDISH BROWN SILT

( Minus No. 40 sieve material, Airdried)

Liquid Limit Test	1	2	Blows	K-factor
Tare Number:	194	151	20	0.974
Weight of Tare & Wet Sample (g):	25.59	26.79	21	0.979
Weight of Tare & Dry Sample (g):	24.03	24.84	22	0.985
Weight of Tare (g):	19.29	18.86	23	0.990
Weight of Water (g):	1.56	1.95	24	0.995
Weight of Dry Sample (g):	4.74	5.98	25	1.000
<b>Moisture Content (%):</b>	<b>32.9</b>	<b>32.6</b>	26	1.005
<b>Number of Blows:</b>	<b>24</b>	<b>25</b>	27	1.009
			28	1.014
			29	1.018
			30	1.022

Plastic Limit Test	1	2	Range	Liquid Limit Test Results
Tare Number:	1269	1273		<b>Test 1</b>
Weight of Tare & Wet Sample (g):	21.69	28.96		LL = <b>32.9</b>
Weight of Tare & Dry Sample (g):	20.71	27.85		LL <sup>CORR</sup> = <b>33</b>
Weight of Tare (g):	15.36	21.88		<b>Test 2</b>
Weight of Water (g):	0.98	1.11		LL = <b>32.6</b>
Weight of Dry Sample (g):	5.35	5.97		LL <sup>CORR</sup> = <b>33</b>
<b>Moisture Content (%):</b>	<b>18.3</b>	<b>18.6</b>	<b>-0.3</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Summary		As Received Moisture Content	
		ASTM D2216-10	
<b>Liquid Limit (%):</b>	<b>33</b>	Tare Number:	26
<b>Plastic Limit (%):</b>	<b>18</b>	Wt. of Tare & Wet Sample (g):	40.55
<b>Plasticity Index (%):</b>	<b>15</b>	Wt. of Tare & Dry Sample (g):	38.89
<b>USCS Symbol:</b>	<b>ML</b>	Weight of Tare (g):	6.85
		Weight of Water (g):	1.7
		Weight of Dry Sample (g):	32.0
		Was As Received MC Preserved:	<b>Yes</b>
		<b>Moisture Content (%):</b>	<b>5.2</b>

Tested By TO Date 11/14/16 Checked By TMP Date 11/16/16

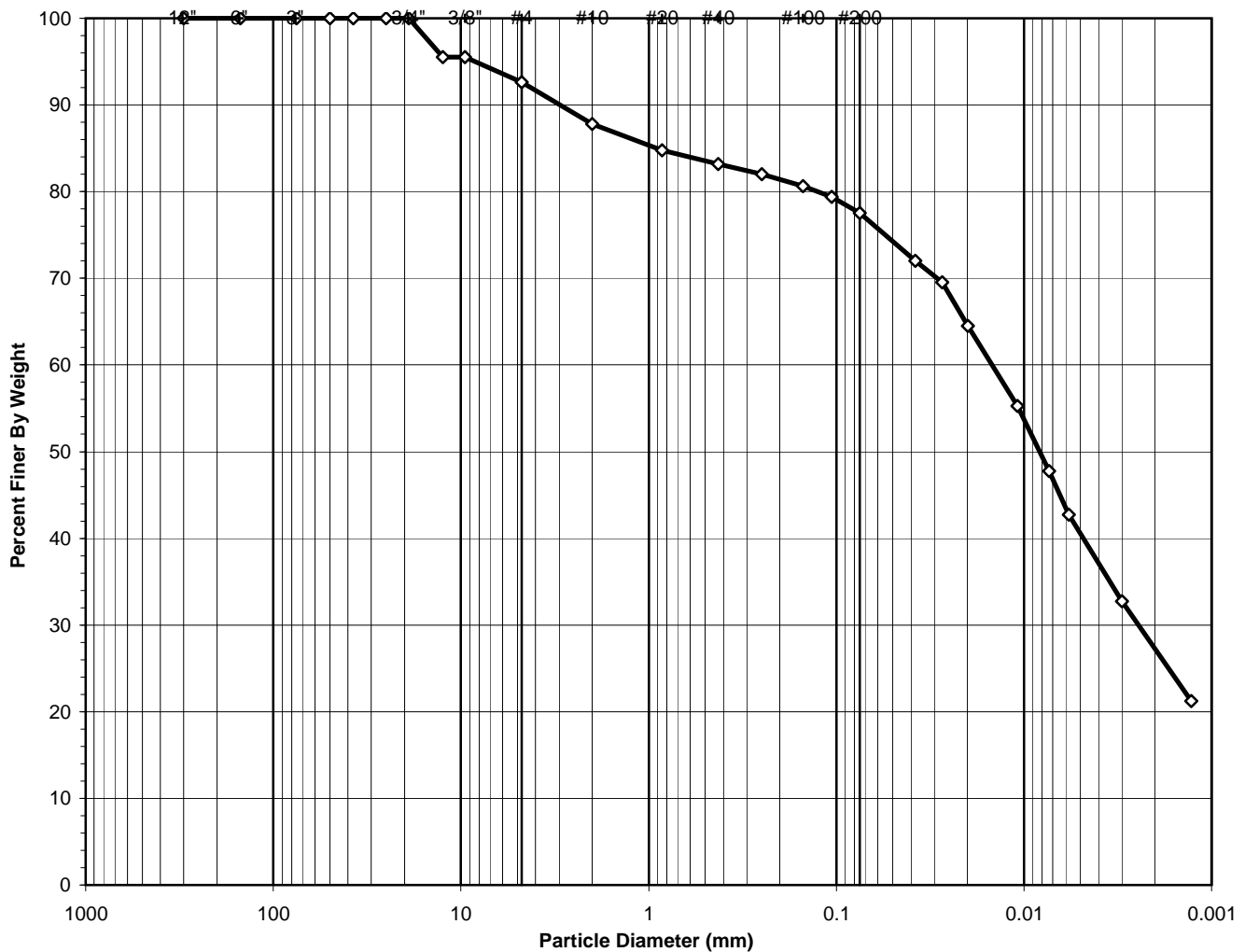
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-033

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 2.5  
 Sample No.: B-3-1  
 Soil Color: Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

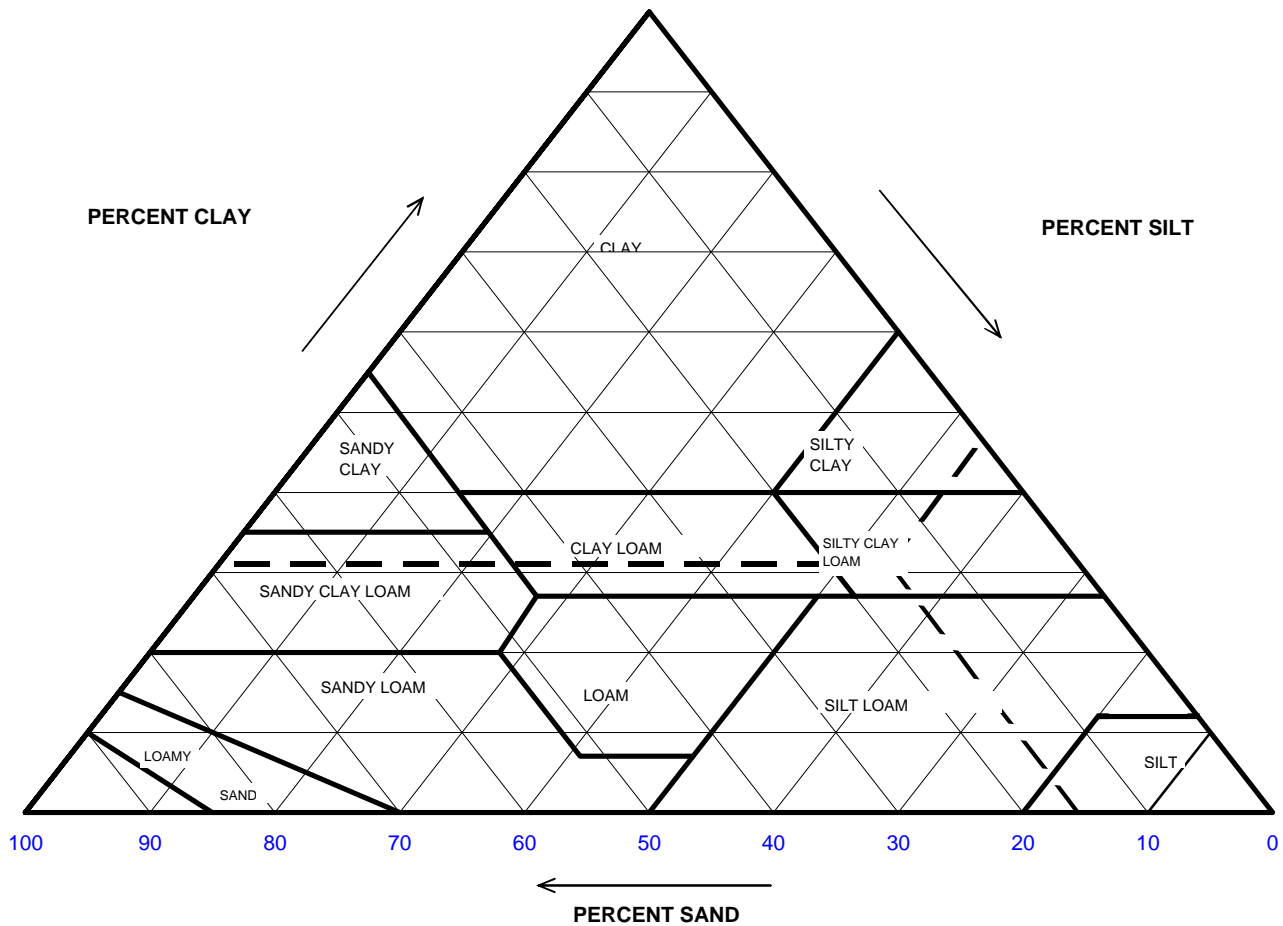
**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By HL Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-033

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 2.5  
 Sample No.: B-3-1  
 Soil Color: Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification

		<b>Gravel</b>	12.19	
2	87.81	<b>Sand</b>	13.54	15.42
0.05	74.26	<b>Silt</b>	47.05	53.58
0.002	27.22	<b>Clay</b>	27.22	31.00

**USDA Classification: LOAMY SAND**

### WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	2.5
Project No.:	2016-527-001	Sample No.:	B-3-1
Lab ID:	2016-527-001-033	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1452	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	352.04	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	318.51	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	145.16	Weight of Tare (g):	0.00
Weight of Water (g):	33.53	Weight of Water (g):	0.00
Weight of Dry Soil (g):	173.35	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>19.3</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	173.35
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	134.44
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	38.91
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00	0.00	0.00	100.00	100.0
1"	25	0.00	0.00	0.00	100.00	100.0
3/4"	19	0.00	0.00	0.00	100.00	100.0
1/2"	12.5	7.71	4.45	4.45	95.55	95.6
3/8"	9.5	0.00	0.00	4.45	95.55	95.6
#4	4.75	5.13	2.96	7.41	92.59	92.6
#10	2	8.30	4.79	12.19	87.81	87.8
#20	0.85	5.29	(**)	15.25	84.75	84.8
#40	0.425	2.78	1.60	16.85	83.15	83.1
#60	0.25	1.93	1.11	17.96	82.04	82.0
#100	0.15	2.38	1.37	19.34	80.66	80.7
#140	0.106	2.17	1.25	20.59	79.41	79.4
#200	0.075	3.22	1.86	22.45	77.55	77.6
Pan	-	134.44	77.55	100.00	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample

(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By HL Date 11/17/16 Checked By KC Date 11/21/16



## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	2.5
Project No.:	2016-527-001	Sample No.:	B-3-1
Lab ID:	2016-527-001-033	Soil Color:	Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	49.0	22.3	5.97	8.2	0.0379	92.9	72.0
2	47.5	22.3	5.97	8.5	0.0273	89.6	69.5
4	44.5	22.3	5.97	9.0	0.0199	83.2	64.5
15	39.0	22.3	5.97	10.0	0.0108	71.3	55.3
35	34.5	22.3	5.97	10.8	0.0074	61.6	47.8
60	31.5	22.3	5.97	11.4	0.0058	55.1	42.7
240	25.5	22.4	5.93	12.5	0.0030	42.2	32.8
1440	18.5	22.7	5.82	13.7	0.0013	27.4	21.2

### Soil Specimen Data

Tare No.:	2324	Percent Finer than # 200:	77.55
Wt. of Tare & Dry Material (g):	148.15	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	97.33		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	45.82		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 781
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-033

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 2.5  
 Sample No.: B-3-1  
 Soil Description: BROWN LEAN CLAY

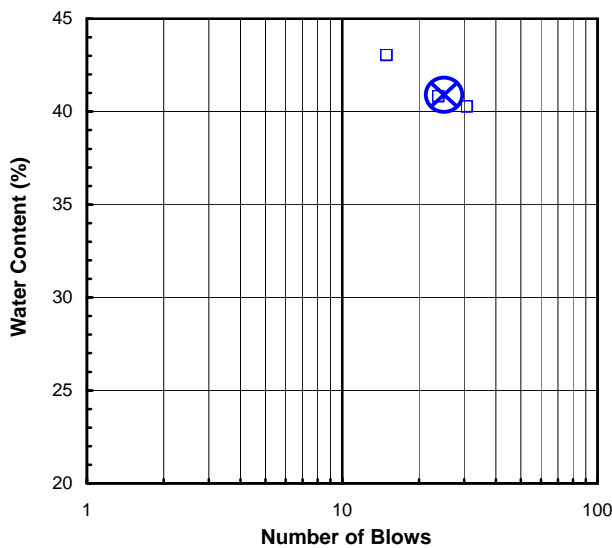
**Note: The USCS symbol used with this test refers only to the minus No. 40 (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	25	202	247	243	U
Wt. of Tare & Wet Sample (g):	50.79	37.65	39.69	38.92	L
Wt. of Tare & Dry Sample (g):	43.85	31.53	33.74	33.17	T
Weight of Tare (g):	6.84	17.30	19.15	18.88	I
Weight of Water (g):	6.9	6.1	6.0	5.8	P
Weight of Dry Sample (g):	37.0	14.2	14.6	14.3	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>18.8</b>	<b>43.0</b>	<b>40.8</b>	<b>40.2</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>24</b>	<b>31</b>	<b>T</b>

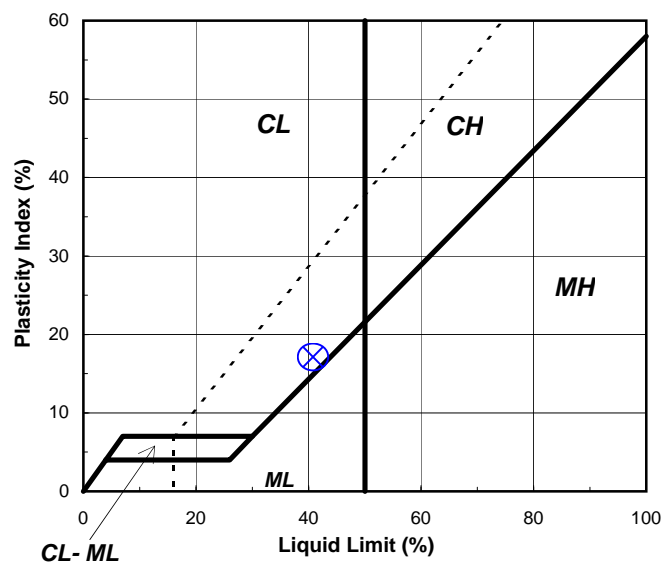
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	226	124		<b>Liquid Limit (%):</b>	<b>41</b>
Wt. of Tare & Wet Sample (g):	25.89	24.96		<b>Plastic Limit (%):</b>	<b>24</b>
Wt. of Tare & Dry Sample (g):	24.60	23.71		<b>Plasticity Index (%):</b>	<b>17</b>
Weight of Tare (g):	19.36	18.51		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.3	1.3			
Weight of Dry Sample (g):	5.2	5.2			
<b>Moisture Content (%):</b>	<b>24.6</b>	<b>24.0</b>	<b>0.6</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



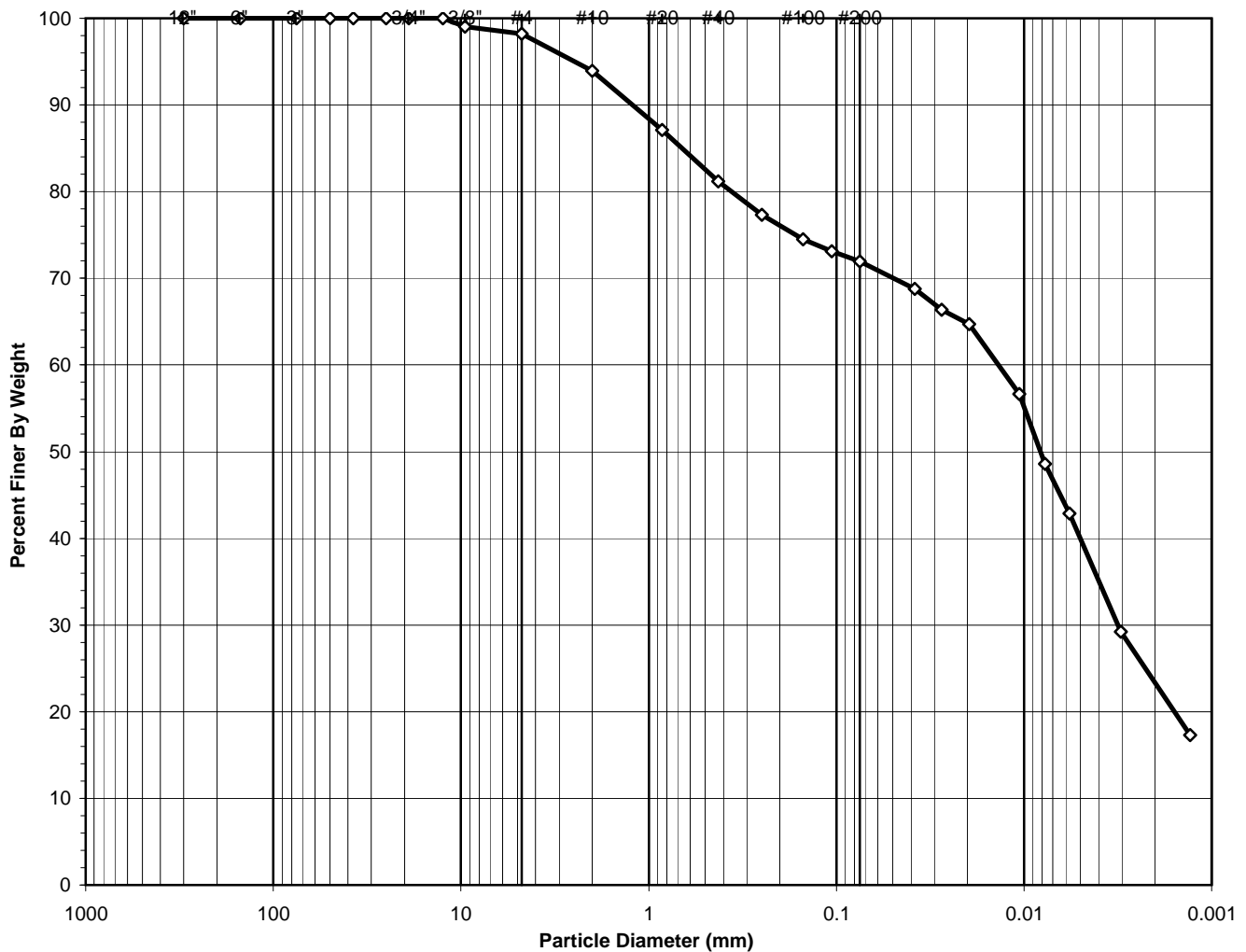
Tested By RAL Date 11/15/16 Checked By TMP Date 11/16/16

## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client:	Geosyntec Consultants, Inc.	Boring No.: B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft): 13.0
Project No.:	2016-527-001	Sample No.: B-3-5
Lab ID:	2016-527-001-035	Soil Color: Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

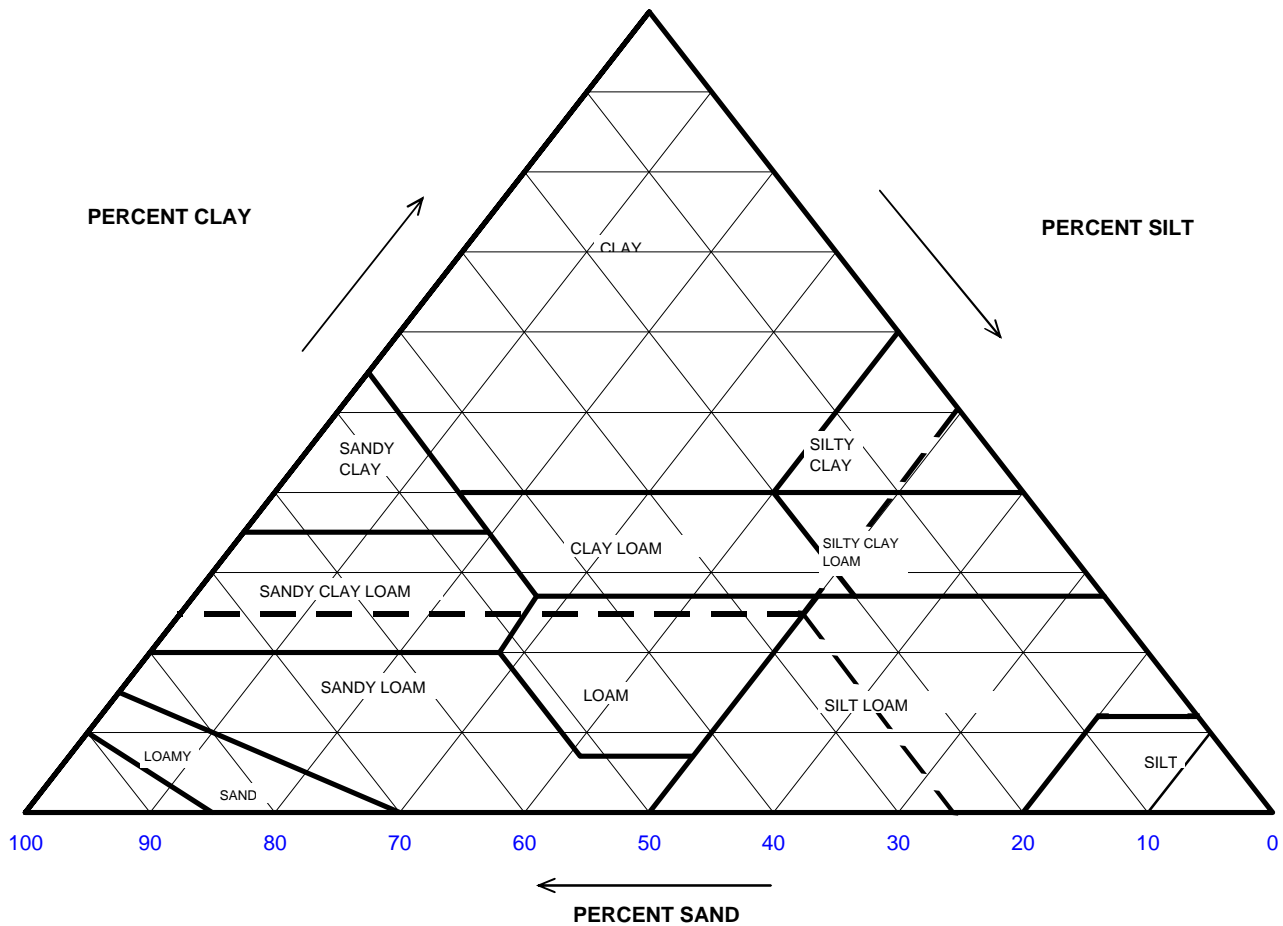
**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By HL Date 11/14/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-035

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 13.0  
 Sample No.: B-3-5  
 Soil Color: Brown



USDA SUMMARY			
Particle Size (mm)	Percent Finer	Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		Gravel	6.04
2	93.96	Sand	25.45
0.05	70.04	Silt	49.74
0.002	23.31	Clay	24.81

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	13.0
Project No.:	2016-527-001	Sample No.:	B-3-5
Lab ID:	2016-527-001-035	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1510	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	487.80	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	457.30	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	147.60	Weight of Tare (g):	0.00
Weight of Water (g):	30.50	Weight of Water (g):	0.00
Weight of Dry Soil (g):	309.70	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>9.8</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	309.70
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	222.83
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	86.87
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	100.0
6"	150	0.00	0.00	0.00	100.00	100.0
3"	75	0.00	0.00	0.00	100.00	100.0
2"	50	0.00	(*)	0.00	100.00	100.0
1 1/2"	37.5	0.00		0.00	100.00	100.0
1"	25	0.00		0.00	100.00	100.0
3/4"	19	0.00		0.00	100.00	100.0
1/2"	12.5	0.00		0.00	100.00	100.0
3/8"	9.5	2.96		0.96	99.04	99.0
#4	4.75	2.51		0.81	98.23	98.2
#10	2	13.24		4.28	93.96	94.0
#20	0.85	21.15	(**)	6.83	87.13	87.1
#40	0.425	18.49		5.97	81.16	81.2
#60	0.25	11.93		3.85	77.31	77.3
#100	0.15	8.68		2.80	74.50	74.5
#140	0.106	4.21		1.36	73.14	73.1
#200	0.075	3.70		1.19	71.95	72.0
Pan	-	222.83		71.95	100.00	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By HL Date 11/14/16 Checked By KC Date 11/21/16

## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	13.0
Project No.:	2016-527-001	Sample No.:	B-3-5
Lab ID:	2016-527-001-035	Soil Color:	Brown

Elapsed Time (min)	Reading rm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	48.5	22.3	5.97	8.3	0.0382	95.6	68.8
2	47.0	22.3	5.97	8.6	0.0274	92.2	66.3
4	46.0	22.3	5.97	8.8	0.0196	90.0	64.7
15	41.0	22.3	5.97	9.7	0.0106	78.7	56.6
31	36.0	22.3	5.97	10.6	0.0077	67.5	48.6
60	32.5	22.3	5.97	11.2	0.0057	59.6	42.9
240	24.0	22.4	5.93	12.7	0.0030	40.6	29.2
1440	16.5	22.7	5.82	14.1	0.0013	24.0	17.3

### Soil Specimen Data

Tare No.:	976	Percent Finer than # 200:	71.95
Wt. of Tare & Dry Material (g):	148.74	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	99.74		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	44.00		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 773
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-035

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 13.0  
 Sample No.: B-3-5  
 Soil Description: BROWN LEAN CLAY

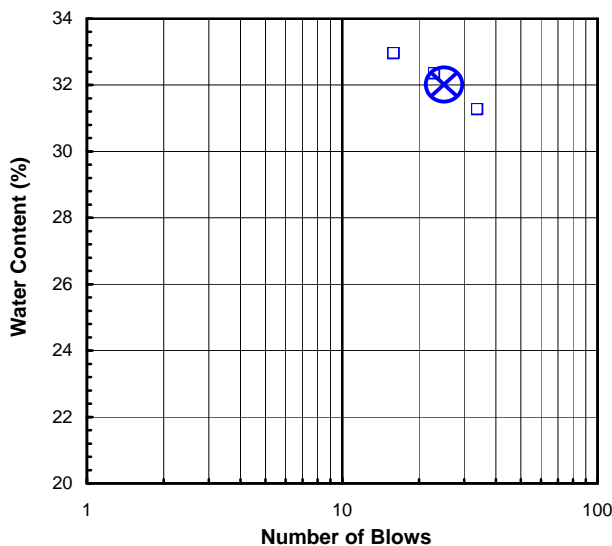
**Note: The USCS symbol used with this test refers only to the minus No. 40 (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	16	209	355	144	U
Wt. of Tare & Wet Sample (g):	67.56	39.69	38.52	38.19	L
Wt. of Tare & Dry Sample (g):	61.84	34.64	33.55	33.38	T
Weight of Tare (g):	6.90	19.31	18.18	17.99	I
Weight of Water (g):	5.7	5.1	5.0	4.8	P
Weight of Dry Sample (g):	54.9	15.3	15.4	15.4	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>10.4</b>	<b>32.9</b>	<b>32.3</b>	<b>31.3</b>	<b>N</b>
<b>Number of Blows:</b>		<b>16</b>	<b>23</b>	<b>34</b>	<b>T</b>

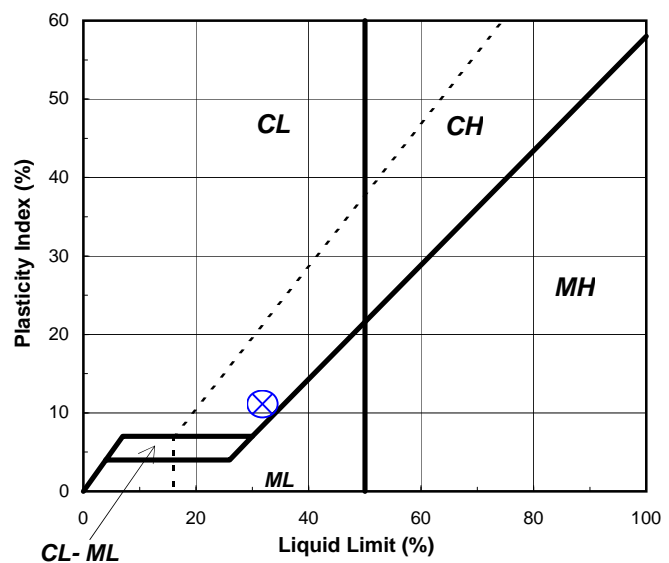
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	192	121		<b>Liquid Limit (%):</b>	<b>32</b>
Wt. of Tare & Wet Sample (g):	25.35	25.54		<b>Plastic Limit (%):</b>	<b>21</b>
Wt. of Tare & Dry Sample (g):	24.25	24.50		<b>Plasticity Index (%):</b>	<b>11</b>
Weight of Tare (g):	18.93	19.44		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.1	1.0			
Weight of Dry Sample (g):	5.3	5.1			
<b>Moisture Content (%):</b>	<b>20.7</b>	<b>20.6</b>	<b>0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

Flow Curve



Plasticity Chart



Tested By RAL Date 11/15/16 Checked By TMP Date 11/16/16

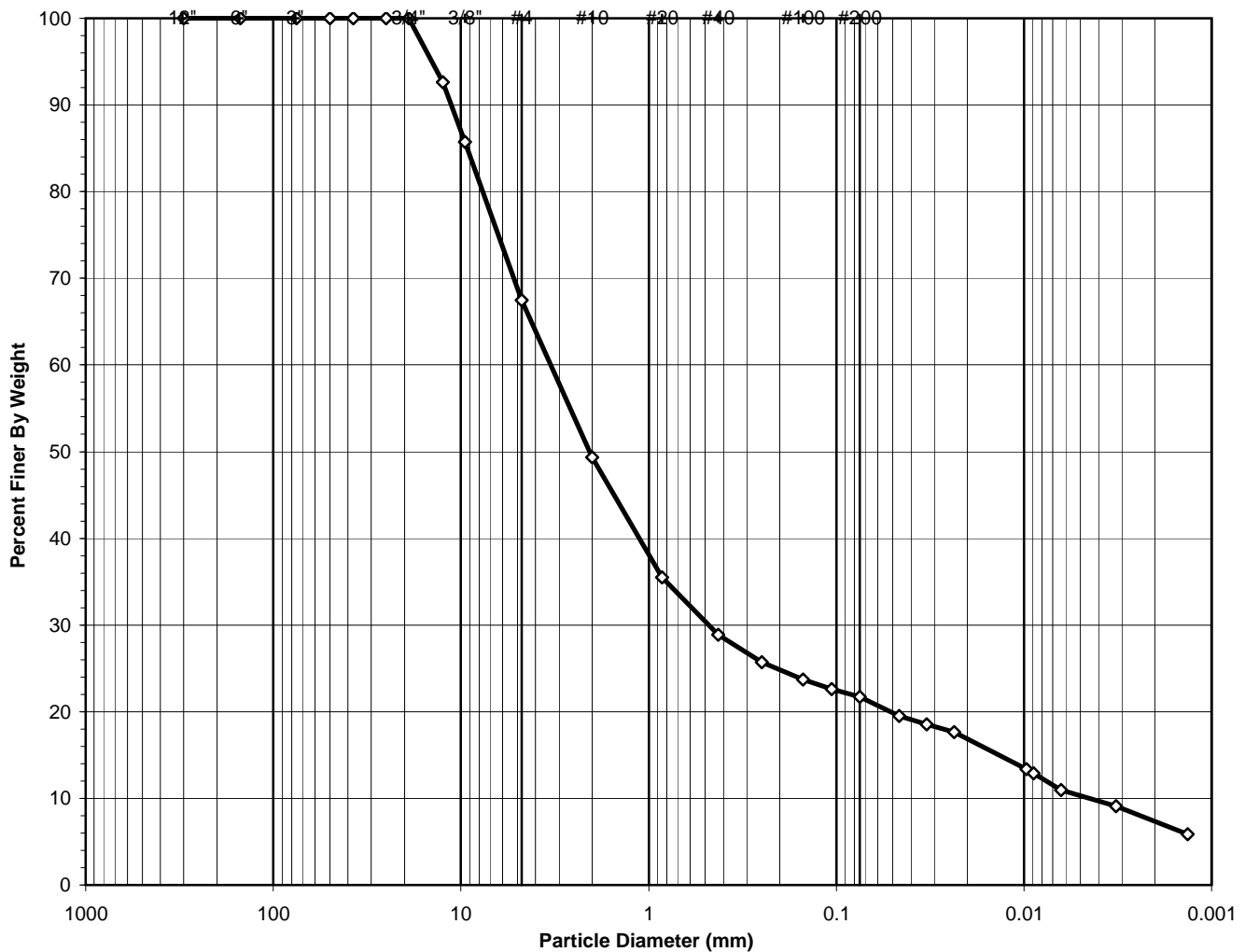
## SIEVE AND HYDROMETER ANALYSIS

ASTM D6913 / D7928

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-036

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 14.9  
 Sample No.: B-3-6  
 Soil Color: Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**SC, TESTED**

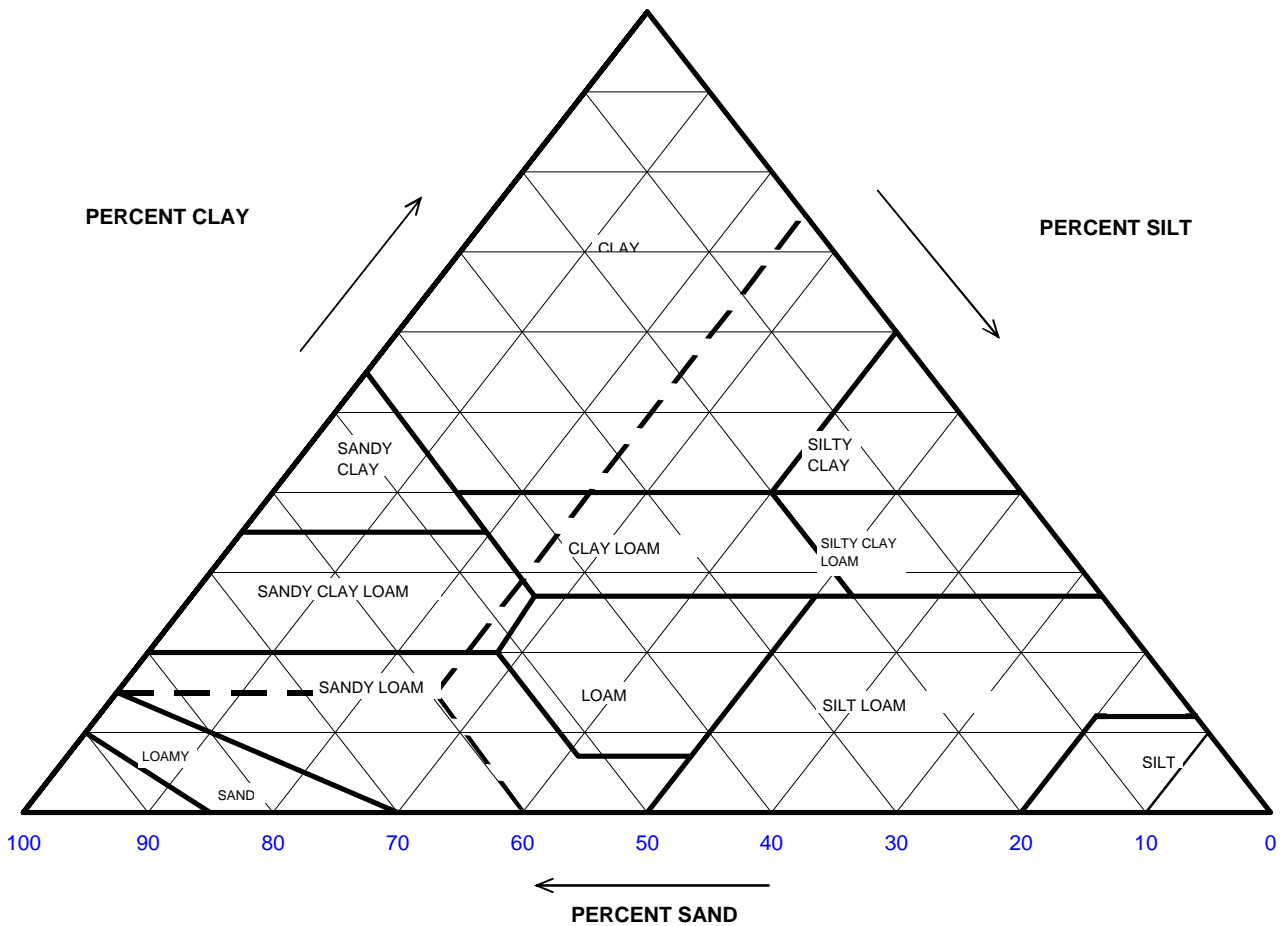
**USCS Classification:**  
**CLAYEY SAND WITH GRAVEL**

Tested By SG Date 11/17/16 Checked By KC Date 11/21/16

## USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-036

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 14.9  
 Sample No.: B-3-6  
 Soil Color: Brown



USDA SUMMARY				
Particle Size (mm)	Percent Finer		Actual Percentage	Corrected % of Minus 2.0 mm material for USDA Classification
		<b>Gravel</b>	<b>50.67</b>	
<b>2</b>	<b>49.33</b>	<b>Sand</b>	<b>29.46</b>	<b>59.72</b>
<b>0.05</b>	<b>19.87</b>	<b>Silt</b>	<b>12.52</b>	<b>25.38</b>
<b>0.002</b>	<b>7.35</b>	<b>Clay</b>	<b>7.35</b>	<b>14.90</b>

**USDA Classification: LOAMY SAND**

## WASH SIEVE ANALYSIS

ASTM D6913-04 (2009)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	14.9
Project No.:	2016-527-001	Sample No.:	B-3-6
Lab ID:	2016-527-001-036	Soil Color:	Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.:	1477	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	436.62	Weight of Tare & Wet Sample (g):	0.00
Wt. of Tare & Dry Sample (g):	436.62	Weight of Tare & Dry Sample (g):	0.00
Weight of Tare (g):	144.08	Weight of Tare (g):	0.00
Weight of Water (g):	0.00	Weight of Water (g):	0.00
Weight of Dry Soil (g):	292.54	Weight of Dry Soil (g):	0.00
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>0.0</b>

Wet Weight of -3/4" Sample (g):	0	Weight of the Dry Sample (g):	292.54
Dry Weight of - 3/4" Sample (g):	0.0	Weight of minus #200 Material (g):	63.57
Wet Weight of +3/4" Sample (g):	0.00	Weight of plus #200 Material (g):	228.97
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	0.0	<b>J - Factor (Percent Finer than 3/4"):</b>	<b>NA</b>

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.0</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.0</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.0</b>
2"	50	0.00	(*)	0.00	100.00	<b>100.0</b>
1 1/2"	37.5	0.00		0.00	100.00	<b>100.0</b>
1"	25	0.00		0.00	100.00	<b>100.0</b>
3/4"	19	0.00		0.00	100.00	<b>100.0</b>
1/2"	12.5	21.55	7.37	7.37	92.63	<b>92.6</b>
3/8"	9.5	20.22	6.91	14.28	85.72	<b>85.7</b>
#4	4.75	53.35	18.24	32.52	67.48	<b>67.5</b>
#10	2	53.11	18.15	50.67	49.33	<b>49.3</b>
#20	0.85	40.53	(**)	64.52	35.48	<b>35.5</b>
#40	0.425	19.24	6.58	71.10	28.90	<b>28.9</b>
#60	0.25	9.32	3.19	74.29	25.71	<b>25.7</b>
#100	0.15	5.92	2.02	76.31	23.69	<b>23.7</b>
#140	0.106	3.10	1.06	77.37	22.63	<b>22.6</b>
#200	0.075	2.63	0.90	78.27	21.73	<b>21.7</b>
Pan	-	63.57	21.73	100.00	-	-

**Notes :** (\*) The + 3/4" sieve analysis is based on the Total Dry Weight of the Sample  
(\*\*) The - 3/4" sieve analysis is based on the Weight of the Dry Specimen

Tested By **SG** Date **11/17/16** Checked By **KC** Date **11/21/16**

## HYDROMETER ANALYSIS

ASTM D7928-16

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-3 (MP 9.3)
Client Reference:	ACP TXG0007	Depth (ft):	14.9
Project No.:	2016-527-001	Sample No.:	B-3-6
Lab ID:	2016-527-001-036	Soil Color:	Brown

Elapsed Time (min)	Reading mm	Temp. (Co)	Offset rd,m	Effective Depth, Hm (cm)	D (mm)	Mass Percent (%) Finer, Nm	Mass Percent (%) Finer, Nm'
0	NA	NA	NA	NA	NA	NA	NA
1	26.5	22.3	5.97	12.3	0.0463	89.8	19.5
2	25.5	22.3	5.97	12.5	0.0330	85.5	18.6
4	24.5	22.3	5.97	12.6	0.0235	81.1	17.6
25	20.0	22.3	5.97	13.5	0.0097	61.4	13.3
30	19.5	22.3	5.97	13.5	0.0089	59.2	12.9
60	17.5	22.3	5.97	13.9	0.0064	50.5	11.0
240	15.5	22.4	5.93	14.3	0.0032	41.9	9.1
1440	12.0	22.7	5.82	14.9	0.0013	27.0	5.9

### Soil Specimen Data

Tare No.:	301	Percent Finer than # 200:	21.73
Wt. of Tare & Dry Material (g):	133.26	Specific Gravity:	2.70 Assumed
Weight of Tare (g):	105.66		
Weight of Deflocculant (g):	5.0		
Weight of Dry Material (g):	22.60		

**Notes:** Hydrometer test is performed on - # 200 sieve material.

Hydrometer - 152H	G- 1159
Cylinder	G- 772
Thermometer	G- 1505
Balance	G- 1057
#200 Sieve	G- 1718
Foam Inhibitor Used	No

Tested By	TO	Date	11/16/16	Checked By	KC	Date	11/21/16
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0

0

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2016-527-001  
 Lab ID: 2016-527-001-036

Boring No.: B-3 (MP 9.3)  
 Depth (ft): 14.9  
 Sample No.: B-3-6  
 Soil Description: BROWN LEAN CLAY

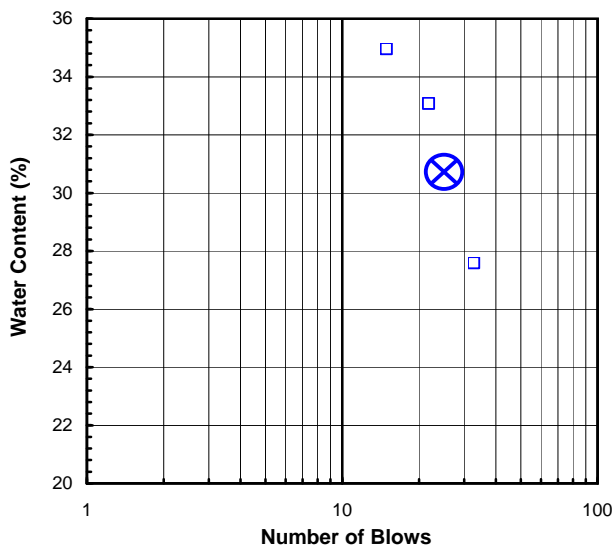
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.** (Minus No. 40 sieve material, Air dried)

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	17	167	454	196	U
Wt. of Tare & Wet Sample (g):	52.06	28.76	25.85	29.79	L
Wt. of Tare & Dry Sample (g):	49.78	25.99	23.12	27.18	T
Weight of Tare (g):	6.97	18.06	14.86	17.71	I
Weight of Water (g):	2.3	2.8	2.7	2.6	P
Weight of Dry Sample (g):	42.8	7.9	8.3	9.5	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>5.3</b>	<b>34.9</b>	<b>33.1</b>	<b>27.6</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>22</b>	<b>33</b>	<b>T</b>

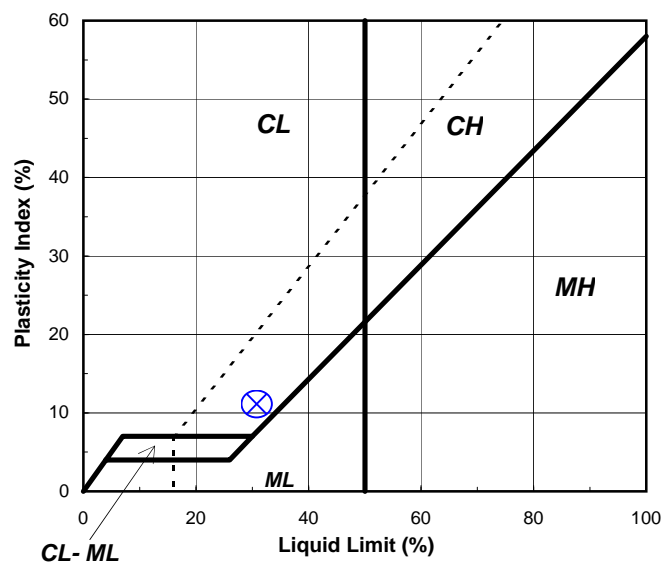
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	226	234		<b>Liquid Limit (%):</b>	<b>31</b>
Wt. of Tare & Wet Sample (g):	25.60	25.90		<b>Plastic Limit (%):</b>	<b>20</b>
Wt. of Tare & Dry Sample (g):	24.56	24.89		<b>Plasticity Index (%):</b>	<b>11</b>
Weight of Tare (g):	19.35	19.89		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.0	1.0			
Weight of Dry Sample (g):	5.2	5.0			
<b>Moisture Content (%):</b>	<b>20.0</b>	<b>20.2</b>	<b>-0.2</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 2.6$*

**Flow Curve**



**Plasticity Chart**



Tested By RAL Date 11/14/16 Checked By TMP Date 11/15/16



30 May 2017  
TXG0007-012-6303

**VIA EMAIL**

Colin Olness, Contractor  
Atlantic Coast Pipeline  
99 Edmiston Way  
Buckhannon, WV 26201

**Subject: Geotechnical Investigation at Potential Slope Instability Site  
George Washington National Forest (GWNF)  
Atlantic Coast Pipeline (ACP) Project  
Route Revision 11B, Segment AP-1, MP 120.3  
Augusta County, Virginia**

Dear Mr. Olness:

This data summary report has been prepared by Geosyntec Consultants, Inc. (Geosyntec) for Dominion Transmission, Inc. (DTI) to present the geotechnical drilling investigation performed at a geohazard site located within the George Washington National Forest (GWNF) at Milepost (MP 120.3) along Segment AP-1 of the Atlantic Coast Pipeline (ACP) Route Revision 11B (Project; Figure 1). The objective of this geotechnical drilling investigation was to characterize the subsurface conditions at the site and confirm or preclude suspected slope instability identified as part of our Phase 2 investigation [Geosyntec, 2016a]<sup>1</sup>, so that if required, measures may be designed to mitigate the effects of potential ground movement on the pipeline. This geotechnical investigation was performed in accordance with requirements of the United States Forest Service (USFS) Special Use Permit (authorization I.D. No. GWP433202T), dated 11 April 2016 and the completed work plan [Geosyntec, 2016b]<sup>2</sup>. This report summarizes activities completed in the

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<sup>1</sup> Geosyntec Consultants, 2016a. "Geohazard Analysis Program Phase 2 Report, Atlantic Coast Pipeline and Supply Header Project", submitted to Dominion Transmission, Inc., dated 29 July 2016.

<sup>2</sup> Geosyntec Consultants, 2016b. "Work Plan for Geotechnical Investigations at Potential Slope Instability Sites, George Washington National Forest (GWNF), Atlantic Coast Pipeline Project, Route Revision 11a Segment AP-1 MP 120.3 and MP 123.1, Highland County, Virginia", submitted to Dominion Transmission, Inc., dated 26 September 2016.

field, a description of the geologic conditions observed at the site, and provides the results of the geotechnical laboratory testing program.

## **GEOTECHNICAL INVESTIGATION**

This geotechnical drilling investigation included a site reconnaissance, access road improvements, geotechnical borings, instrumentation installation and monitoring, and geotechnical laboratory testing.

### **Site Reconnaissance**

Our field reconnaissance performed on 25 August 2016 consisted of a site visit by a Principal Engineering Geologist from Geosyntec, two representatives from Horn and Associates (drilling subcontractor), and two representatives from the ACP to evaluate existing site conditions and access to the identified geohazard site location. The objective of the field reconnaissance was to familiarize the drilling contractor with the site conditions, identify potential access routes, evaluate the number and type of exploratory borings needed to adequately characterize the site, and select locations for the exploratory borings in the field.

### **Health and Safety**

Prior to conducting our field investigation, Geosyntec updated our existing site-specific Health and Safety Plan (HASP) in accordance with Occupational Safety & Health Administration (OSHA) requirements. The updated HASP addressed potential hazards at the two site locations, including requirements for worker protection based on the anticipated activities. Additionally, the HASP also included directions to nearest emergency medical facility. Prior to commencing work at the site, Geosyntec also delineated the locations of the individual explorations and notified Underground Service Alert (USA, Dig-Alert) to identify the locations of any existing underground utilities within the immediate vicinity.

### **Site Access and Improvements**

Drilling locations at GWNF MP 120.3 were accessed using the existing USFS Buckhorn Creek service road and abandoned logging trails. Due to the remote locations of the investigation site, minor grading and road restoration activities were performed where no previous access existed. Road restoration and grading work was performed by Horn and Associates utilizing a John Deere 85D tracked excavator. Work consisted of trimming secondary vegetation growth, smoothing the ground surface, and localized widening and leveling where cross-slope conditions would not permit safe passage of a light weighted track mounted drill rig. Drilling locations and temporary access routes at GWNF MP 120.3 were selected to minimize grading and to minimize removal of timber greater than 4-inch diameter-breast-height (DBH), to the extent practical.

Where ground disturbance was required, erosion and sediment control Best Management Practices (BMPs) were implemented to minimize the potential for erosion and/or sediment transport to adjacent areas outside the limits of disturbance. BMPs consisted of 8-inch silt socks installed along the edge of the graded access roads and the drilling investigation pads. Upon completion of drilling activities, excess cuttings from the borings were thinly spread within the limits of disturbance and the ground surface was re-contoured to match that of pre-existing conditions to the extent feasible. Locally sourced straw and an approved seed mix specified by the USFS were hand broadcasted along the surface of graded areas to help reduce erosion and sediment transport and promote vegetative growth. Silt socks were slit and spread at the surface.

Following completion of drilling activities at MP 120.3, pre-existing water bars (berms) located along the abandoned logging trails were reinstalled to promote positive flow off the logging trails. Restoration activities included casting of approved seed mix and covered by straw. Restoration activities were also completed at the logging trail access point off of Buckhorn Creek Road where wet road conditions resulting in tire rutting. A photographic log documenting completed road improvement and site restoration activities is provided in Appendix A.

### Subsurface Explorations

This geotechnical investigation included drilling two exploratory borings at the GWNF MP 120.3 geohazard site location along the east facing slope (designated Borings B-1 and B-2; Figure 1). Borings were drilled between 54.3 and 60.0 feet below ground surface (ft bgs). Table 1 presents the coordinates, ground surface elevations, and termination depths of Borings B-1 and B-2.

**Table 1 – Coordinates of Boring Locations**

Boring ID	Coordinates – UTM, Zone 17S, NAD83				Ground Surface Elev. WGS84 (MSL-ft)	Final Depth (ft)
	Proposed		As-Built			
	Latitude	Longitude	Latitude	Longitude		
B-1 (MP 120.3)	38.291879	-79.235864	38.29187	-79.23584	1,892	60.0
B-2 (MP 120.3)	38.291940	-79.235626	38.29196	-79.23562	1,884	54.3

The borings were advanced by Horn and Associates of Winchester, Kentucky utilizing a light-weight rubber track mounted Diedrich D-50 drill rig. Borings were drilled using a combination of 8-inch hollow-stem auger (HSA) and core drilling (NX) methods. During HSA drilling, drive samples were collected at approximately 30-inch intervals using a 2.5-inch diameter, 24-inch long Standard Penetration Test (SPT) sampler to facilitate lithologic logging and sample

collection for geotechnical laboratory testing. SPT sampling was performed through the entire overburden material profile and into underlying bedrock, to the extent practical.

Following auger or SPT refusal, or upon encountering competent formation (bedrock) material, the investigations switched to core drilling methods until the borehole was advanced at least 15 feet into intact bedrock. The core drilling process required circulation of water mixed with a naturally occurring bentonite based drilling fluid additive to regulate the temperature of the core bit, to carry cuttings to the surface, and to promote borehole stability. During the coring process, drilling fluid was pumped through the drill rods and past the bit before returning to the surface with cuttings through the annular space between the drill rods and the wall of the boring. At the surface, the fluid and cuttings were discharged into a baffled sump tank to allow the cuttings to fall out prior to recirculating the drilling fluid back down the borehole. Water required for this process was purchased from the City of Staunton, Virginia and hauled to the drilling sites and stored in 1,000 gallon tanks staged at the drilling locations.

The soil sample descriptions were logged by a Geosyntec Geologist in accordance with ASTM D2488. Additionally, recovered cores were logged to record structural orientation and discontinuities. Upon completion of logging, the cores were photographed (Appendix B) and retained in core boxes for subsequent sample selection and/or archiving. Table 2 summarizes the length of each boring, depth to top of bedrock, and the length of rock coring.

**Table 2:** Soil Thickness, Length of Rock Coring and Boring Penetration Depths

<b>Boring ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to top of Bedrock (ft)</b>	<b>Length of Rock Coring (ft)</b>
B-1 (MP 120.3)	60.0	17.0	43.0
B-2 (MP 120.3)	54.3	19.0	35.3

## **Geotechnical Instrumentation**

Following completion of the core drilling and evaluation of the subsurface conditions, boreholes were selected for instrumentation consisting of either a standpipe piezometer to monitor groundwater levels or an inclinometer to record potential slope movement over time.

### **Piezometer**

One temporary standpipe piezometer was installed in exploratory Boring B-2 at the GWNF MP 120.3 investigation site. The piezometer consisted of a 2-inch diameter PVC pipe, installed after drilling and prior to auger withdrawal, with a 10 ft section of 0.010-inch slotted screen (screened interval) placed at the overburden material and bedrock interface. The annular space around the screened interval was backfilled with a permeable filter pack generally consisting of coarse-

grained sand. A 2-foot bentonite seal was placed at the top of the filter pack, and the remainder of the annular space was backfilled with bentonite-cement grout to prevent conveyance of surface water into the ground. Standpipe piezometer construction logs for the piezometer installed at Boring B-2 are provided in Appendix C and summarized in Table 3a.

Depth to groundwater within the Boring B-2 temporary standpipe piezometer was measured at 27.50 ft bgs on 2 April 2017 approximately 24 hours after drilling. A subsequent groundwater level survey was performed on 20 April 2017 and depth to groundwater was recorded at 28.40 ft bgs. This subsequent measurement is considered to represent relatively stabilized levels, however, the subsurface materials at the site generally exhibits a relatively high percentage of silt and clay sized materials, which reduce permeability. It is possible that the observed groundwater levels in the temporary piezometers may not represent fully stabilized groundwater conditions due to the time rate of travel of groundwater through these materials. The measurements indicate that depth to groundwater increased approximately 0.90 ft between 2 April 2017 and 20 April 2017. A summary of the standpipe piezometer data is provided below in Table 3a and presented graphically in Figure 2.

**Table 3a:** Standpipe Piezometer Construction

<b>Piezometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Depth to Groundwater<sup>1</sup> (ft bgs)</b>	<b>Depth to Top of Screen (ft)</b>	<b>Screen Length (ft)</b>	<b>Depth to Bentonite Seal (ft)</b>
B-2 (MP 120.3)	54.3	19.0	28.40	19.7	10	15.1

**Notes:**

1 - Depth to groundwater measured on 20 April 2017.

The surface completion for the piezometer included a locked surface monument to provide access for periodic groundwater level measurements, as well as to be used as a benchmark for subsequent level surveys. The temporary standpipe piezometer is anticipated to be monitored through pipeline construction if deemed necessary. Upon completion of monitoring, the PVC piezometer should be cutoff below the ground surface and backfilled with bentonite-cement grout.

**Inclinometer**

One inclinometer was installed in exploratory Boring B-1 at the GWNF MP 120.3 geohazard site to monitor the absence or the presence of progressive slope movement that may be imperceptible to the eye. Inclinometer casing consisted of 2.75-inch diameter acrylonitrile butadiene styrene

(ABS) plastic. The bottom of the inclinometer casing was installed at 35.5 ft bgs due to borehole collapse after drilling activities were completed. The annular space between the wall of the boring and the inclinometer casing was backfilled with a lean cement grout mixture from the bottom up using a tremmie pipe. Construction logs for the inclinometer installed at GWNF MP 120.3 are provided in Appendix C and summarized in Table 3b.

Following instrumentation installation, an initial baseline survey (i.e., zero reading) was performed on 20 April 2017. The grouted-in inclinometer was allowed 21 days to set prior to conducting the baseline reading. A summary of the inclinometer survey data is described below in Table 3b and presented graphically in Figure 3.

**Table 3b:** Installation depth of inclinometer

<b>Inclinometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth of Inclinometer Casing<sup>1</sup> (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Length of Stickup above Ground Surface (ft)</b>
B-1 (MP 120.3)	60.0	35.5	17.0	3.5

**Notes:**

1 – Borehole collapsed to 35.5 ft bgs prior to constructing inclinometer casing.

The surface completion for the inclinometer included a locked surface monument to provide access for periodic monitoring as well as to be used as a benchmark for subsequent level surveys. The inclinometer is expected to be monitored through construction if deemed necessary. Upon completion of monitoring, the inclinometer casing should be cut off below the ground surface and backfilled with bentonite-cement grout.

## **SITE CONDITIONS**

Knowledge of the site conditions was developed from a review of regional geologic conditions and our findings from explorations performed for this investigation.

### **Geologic Setting**

The GWNF MP 120.3 investigation site lies within the central Valley and Ridge physiographic province of northwestern Virginia. The Valley and Ridge province is characterized by linear, northeast-southwest trending ridges and valleys resulting from differential erosion of Paleozoic continental shelf and platform strata that has been deformed into a series of elongate macroscale folds and imbricate southeast-dipping thrust faults. Deformation disrupts strata as young as Late Carboniferous, and is the product of the Carboniferous-Permian Alleghanian orogeny, which was



the result of the collision between Africa and North America during the formation of the supercontinent Pangea.

### **Surface Conditions**

The GWNF MP 120.3 investigation site is located approximately 0.6 miles north of Hanky Mountain Highway (Highway 250) and was accessed along the USFS Buckhorn Creek service road and abandoned logging trails along the proposed AP-1 Segment, where the alignment extends up an east-facing slope. The surface morphology along the proposed alignment is characterized by moderately sloping terrain (30% to 40% inclination) across a natural bench with minor tree growth distortion. The natural hillsides along the proposed alignment are covered by moderate growth of low lying grasses, shrubs, and deciduous woodlands. Additionally, several below ground utility lines were identified along Hanky Mountain Highway (Highway 250), but do not traverse the geotechnical investigation site area.

The elevation at Boring B-2 is approximately 1,884 feet above mean sea level (ft msl), sloping upwards towards the southwest along the proposed pipeline alignment. The elevation at Boring B-1 is approximately 1,892 ft msl, also sloping upwards towards the southwest along the proposed pipeline alignment. The latitude and longitude of the GWNF MP 120.3 borings were acquired during the drilling investigation using a hand-held global positioning (GPS) device. Boring elevations were obtained by plotting those coordinates on a topographical map for the area.

### **Subsurface Conditions**

The subsurface conditions at GWNF MP 120.3 consist of colluvial and talus deposits (fining upwards) generally comprised of light yellowish brown to reddish brown lean clay with silt and sand and sporadic sandstone gravels, cobbles, and boulders overlying bedrock of the Devonian-age Chemung Formation. Thickness of the colluvial/talus deposits observed in the borings at the GWNF MP 120.3 site ranged from 17.0 ft (Boring B-1) and 19.0 ft (Boring B-2).

Bedrock of the Devonian-age Chemung Formation observed in each of the two borings at GWNF MP 120.3 consist of olive brown to dark gray interbedded shale and sandstone. Recovered rock cores were generally massively bedded and highly fractured (50° to 70° fracture angles). Recovered cores were also variably weathered consisting of iron oxidation infilling along the fracture planes. A generalized geologic cross section along the slope profile is presented in Figure 1. Due to the high angle bedding at this location and localized fracture frequency, several sections of the recovered cores exhibited abnormally high fracture intensity as a result of the coring process and the rock quality designation (RQD) could not be accurately determined. Where the RQD could be determined in less fractured material, the RQD was generally very poor

to fair ranging from 38% to 55% (B-1) and 33% to 71% (B-2). Detailed logs of the two borings advanced at the GWNF MP 120.3 site, as well as a key sheet, are presented in Appendix D.

On 1 December 2016, Draper Aden Associates (Draper) conducted a seismic refraction study<sup>3</sup> at the GWNF MP 120.3 investigation site (Appendix E). The objective of the survey was to determine depth to bedrock at soil test pits excavated during the completion of an Order 1 Soil Survey where bedrock was not encountered within the protocol depth of 50-inches below ground surface. Data from the seismic refraction profile conducted at the GWNF MP 120.3 investigation site (test pit ID GWNF-P279B-161201) suggest depth to weathered bedrock and bedrock is at 7.3 ft bgs and 9.0 ft bgs, respectively. The shallower depths to weathered bedrock and bedrock suggested by the seismic refraction study likely represent the talus material shed from the adjacent ridge and is generally consistent with the conditions encountered during this geotechnical drilling investigation. The approximate location of the three seismic refraction surveys performed near the GWNF MP 120.3 investigation site is presented on Figure 1.

Subsurface conditions observed in the borings at the GWNF MP 120.3 geohazard site did not substantiate that the surface morphology features initially identified in the Phase 2 reconnaissance (i.e., scarp and bench morphology, moderately steep sloping terrain, and minor tree growth distortion) were a result of previous slope failure or slope instability. The lack of subsurface evidence to support slope instability based on explorations performed suggest that the site morphology is likely a result of a relict fluvial cut terrace given the proximity of the existing creek downslope from the site and is further substantiated by the presence of basal gravels, cobbles and boulder talus material documented along the erosional contact with the underlying formational material. Additionally, no evidence of recent active failure such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation.

## **LABORATORY TESTING**

### **Geotechnical Laboratory Testing Program**

Geosyntec contracted Geotechnics, Inc. (Geotechnics) of East Pittsburgh, Pennsylvania to conduct laboratory testing assigned by Geosyntec on selected soil samples and rock cores to evaluate the pertinent geotechnical index properties. The laboratory testing program, on soil samples, was primarily focused on soil classification and index testing. Testing on select rock cores focused on compressive strength. The laboratory testing program consisted of:

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<sup>3</sup> Draper Arden Associates, 2017. "Atlantic Coast Pipeline – Seismic Refraction Study, George Washington National Forest and Monongahela Nation Forest, Virginia and West Virginia", submitted to Geosyntec Consultants dated 10 March 2017.

#### Soil Samples

- Water content tests per ASTM D2216;
- Atterberg limit tests per ASTM D4318;
- Sieve analysis tests per ASTM D422; and
- Hydrometer tests per ASTM D422.

#### Rock Cores

- Unconfined compressive strength test per ASTM D7012-Method C.

Table 4 summarizes the number and types of laboratory testing conducted on soil and rock samples from the GWNF MP 120.3 geohazard site.

**Table 4:** Number and Types of Laboratory Tests

Types of Laboratory Tests	Number of Tests	
	B-1 (MP 120.3)	B-2 (MP 120.3)
Water Content	8	5
Atterberg Limits	4	3
Sieve Analysis	4	3
Hydrometer Test	0	0
Rock Unconfined Compressive Strength	3	1

#### Laboratory Test Results

The laboratory test results are also plotted in the corresponding boring logs (Appendix D), and the individual test results presented in detail in Appendix E.

#### Soil Testing

Given the granular nature of the soils from GWNF MP 120.3, select samples were tested for grain-size distribution to quantify percentages of gravels, sands and fines. The results show that the soils generally consist of lean clay (CL) with silt, sand, and gravel and coarsen with depth consisting of clayey sand (SC) with silt and gravel, and silty sand (SM) with gravel.

The laboratory soil testing performed for the GWNF MP 120.3 borings included water content and Atterberg limits measured on selected lean clay and silt samples and grain-size analysis to quantify the percentages of gravel, sand and fines, particularly on samples containing coarser

grained material. Table 5 presents a summary of the laboratory test results conducted on soil samples.

**Table 5: Summary of Laboratory Test Results on Soil Samples**

Boring ID	Sample ID	Depth (ft)	Water Content (%)	Percent of Gravel (1) (%)	Percent of Fines (2) (%)	Liquid Limit	Plastic Limit	Plasticity Index
B-1	B-1-1	0.9	20.1	-	-	-	-	-
B-1	B-1-2	4.0	16.5	11.7	71.7	31	18	13
B-1	B-1-3	6.5	18.1	-	-	-	-	-
B-1	B-1-4	9.0	14.6	9.4	62.8	31	18	13
B-1	B-1-5	11.3	14.6	-	-	-	-	-
B-1	B-1-6	13.4	15.5	-	-	-	-	-
B-1	B-1-7	16.5	16.1	2.8	63.4	35	20	15
B-1	B-1-8	18.7	12.6	22.0	37.2	29	19	10
B-2	B-2-1	1.2	21.9	-	-	-	-	-
B-2	B-2-2	3.5	19.2	6.9	73.6	42	21	21
B-2	B-2-3	5.8	9.6	19.5	30.6	0	0	0
B-2	B-2-4	18.0	23.0	5.7	25.4	24	19	5
B-2	B-2-6	23.2	11.9	-	-	-	-	-

**Notes:**

- 1 - Retained #4 sieve.
- 2 - Passing #200 sieve.
- “-“ Not analyzed

**Rock Core Testing**

A summary of laboratory test results conducted on rock samples is presented in Table 6.

**Table 6:** Summary of Laboratory Test Results on Rock Samples

<b>Boring ID</b>	<b>Core ID</b>	<b>Sample Interval (ft)</b>	<b>Unit Weight (pcf)</b>	<b>Uniaxial Compres. Strength (psi)</b>
B-1	R-5	46.2-47.1	163.7	2,470
B-1	R-6	51.8-52.3	164.5	3,920
B-1	R-7	55.2-55.8	151.1	13,470
B-2	R-5	33.3-33.6	160.4	3,610

### Summary of Laboratory Testing

The geotechnical laboratory test results indicate that water content of colluvial/talus deposits varied between 12.6% and 20.1% (Boring B-1) and 9.6% and 23.0% (Boring B-2), and showed a decreasing trend with depth. The Atterberg test results show that the colluvial/talus deposits contain a plasticity index (PI) of 0 (non-plastic) to 21 and the soil unit is mainly within the low plasticity clay zone (i.e., CL). The PI generally decreases with depth within the low plasticity clay soil unit.

The unconfined compressive strength of the recovered rock cores varied between 2,470 psi (Core R-5 of Boring B-1) and 13,470 psi (Core R-7 of Boring B-1).

### SUMMARY OF FINDINGS

Subsurface conditions recorded during the geotechnical drilling investigation at the GWNF AP-1 MP 120.3 geohazard site suggest previous shallow seated slope movement did not occur along the proposed ACP alignment. The suspect site morphology initially identified as a landslide, is likely a result of a relict fluvial cut terrace, given the proximity of the existing creek downslope from the site. This interpretation is further substantiated by the presence of basal gravels, cobbles and boulder talus material along the erosional contact with the underlying formational material as documented in the subsurface explorations.

As a consequence of these findings, the BIC typical scenario for this site was reclassified from B2(E) to A2(E), a change which allowed the removal of some BIC incremental controls for geohazard mitigation, which were no longer consider necessary.

Although no evidence of recent or active slope movement, such as ground cracks, recent scarps, or exposed earth, was observed at the time of our investigation, data collected during subsequent inclinometer monitoring events will be used to validate the current interpretation and inform site-

specific engineering evaluations. An addendum to this data summary report will be issued as subsequent monitoring data is collected.

## CLOSING

Geosyntec appreciates the opportunity to provide Dominion Transmission, Inc. with this data summary report, and we look forward to working together on this important project. If you have any questions or require additional information, please contact Logan Brant ([lbrant@geosyntec.com](mailto:lbrant@geosyntec.com), 281.810.5056) or Jared Warner ([jwarner@geosyntec.com](mailto:jwarner@geosyntec.com), 858.716.2885).

Sincerely,

Geosyntec Consultants,



Logan Brant, Ph.D., P.E. (VA)  
Senior Geotechnical Engineer



Jared Warner, P.G.  
Project Geologist

## Attachments:

### Figures

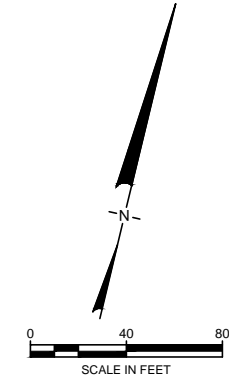
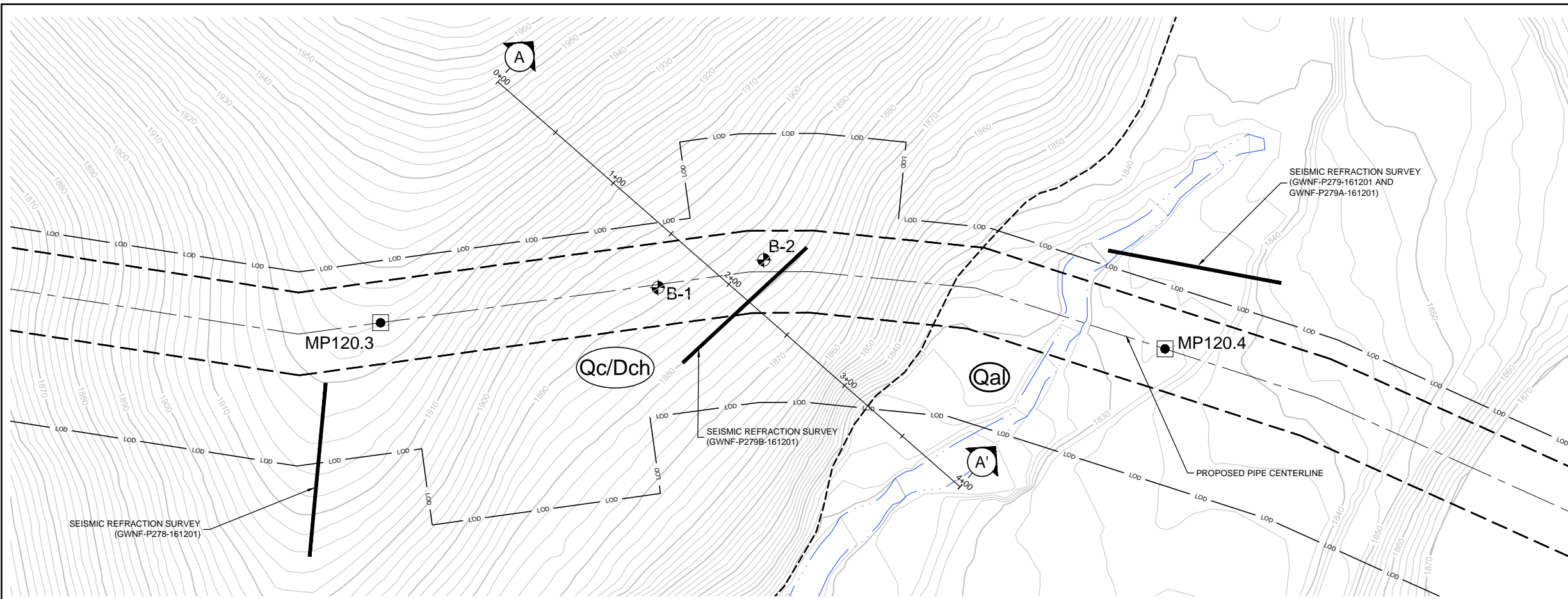
- Figure 1 – Site Plan and Generalized Geologic Profile
- Figure 2 – Piezometer Survey Data
- Figure 3 – Inclinator Survey Data

### Appendices

- Appendix A – Photographic Log
- Appendix B – Core Photographs
- Appendix C – Piezometer and Inclinator Construction Logs
- Appendix D – Logs of Borings B-1 and B-2
- Appendix E – Laboratory Test Results

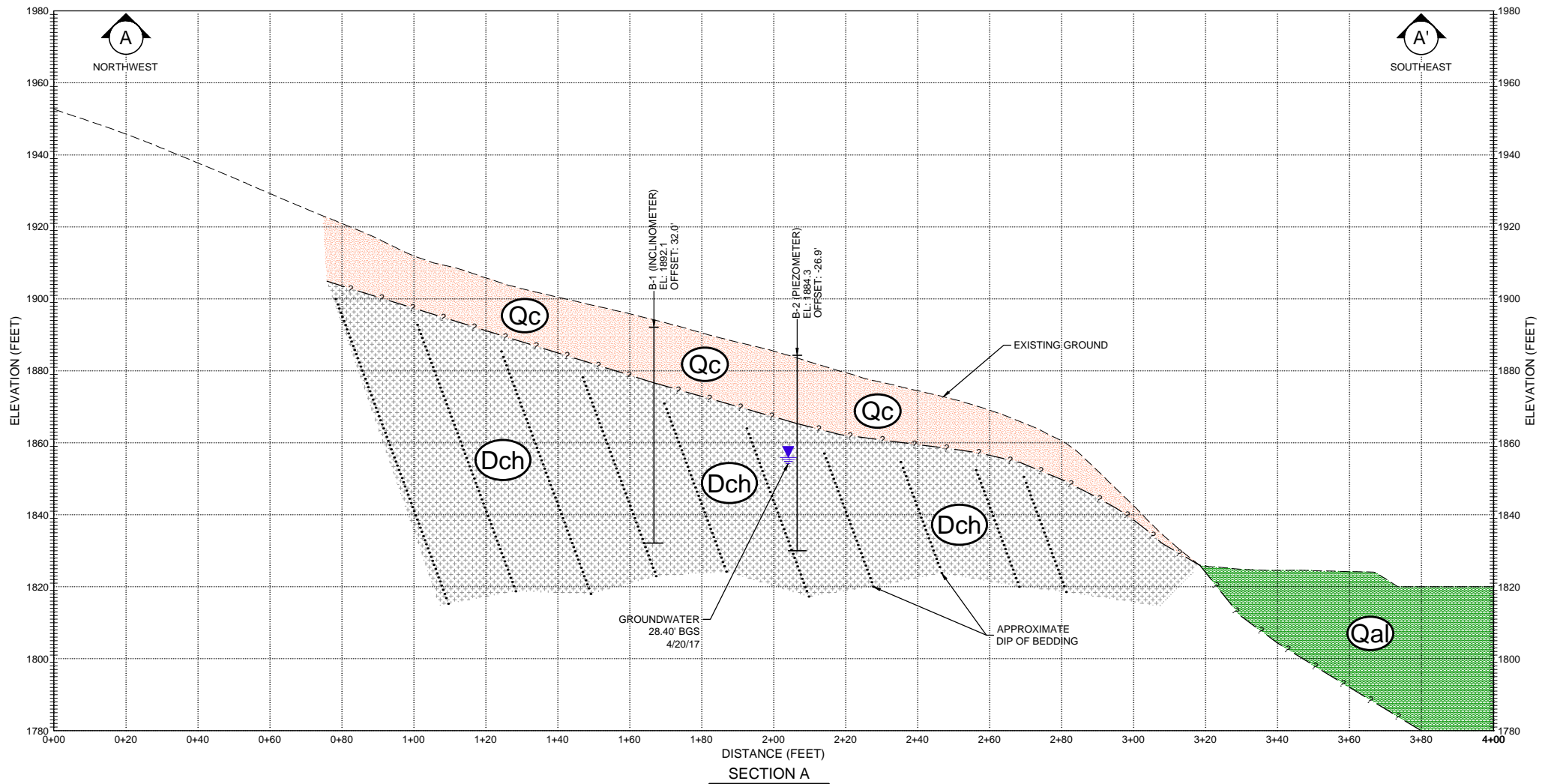


# **FIGURES**



**LEGEND**

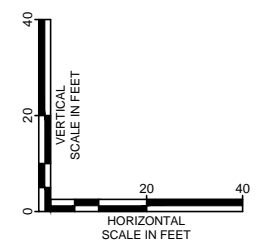
1850	EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
1852	EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
---	EXISTING STREAM LINE
---	LIMIT OF DISTURBANCE
---	PERMANENT (ROW)
---	PROPOSED PIPE CENTERLINE
●	MILEPOST
⊕	BORING LOCATION (GEOSYNTEC, 2017)
---	LITHOLOGIC CONTACT
---	SEISMIC REFRACTION SURVEY (DRAPER, 2016)



- NOTES:**
- MAPPING AND TOPOGRAPHY BASED ON UTM COORDINATE SYSTEM WITH NAD83 DATUM, ZONE 17, US SURVEY FOOT, CENTRAL MERIDIAN 81° W.
  - LIDAR ELEVATION DATA AND TOPOGRAPHIC FEATURES COLLECTED IN 2016 AND PROVIDED BY GAI AS 2-FOOT CONTOURS.
  - STREAM AND WETLAND DATA PROVIDED BY NRG/ERM.

**GEOLOGIC PROFILE LEGEND**

---	EXISTING GROUND SURFACE
---	LITHOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
---	APPROXIMATE DIP OF BEDDING
Qc	COLLUVIUM / TALUS DEPOSITS (FINES UPWARD)
Dch	CHEMUNG FORMATION
Qal	ALLUVIUM
▼	WATER LEVEL 4/20/17



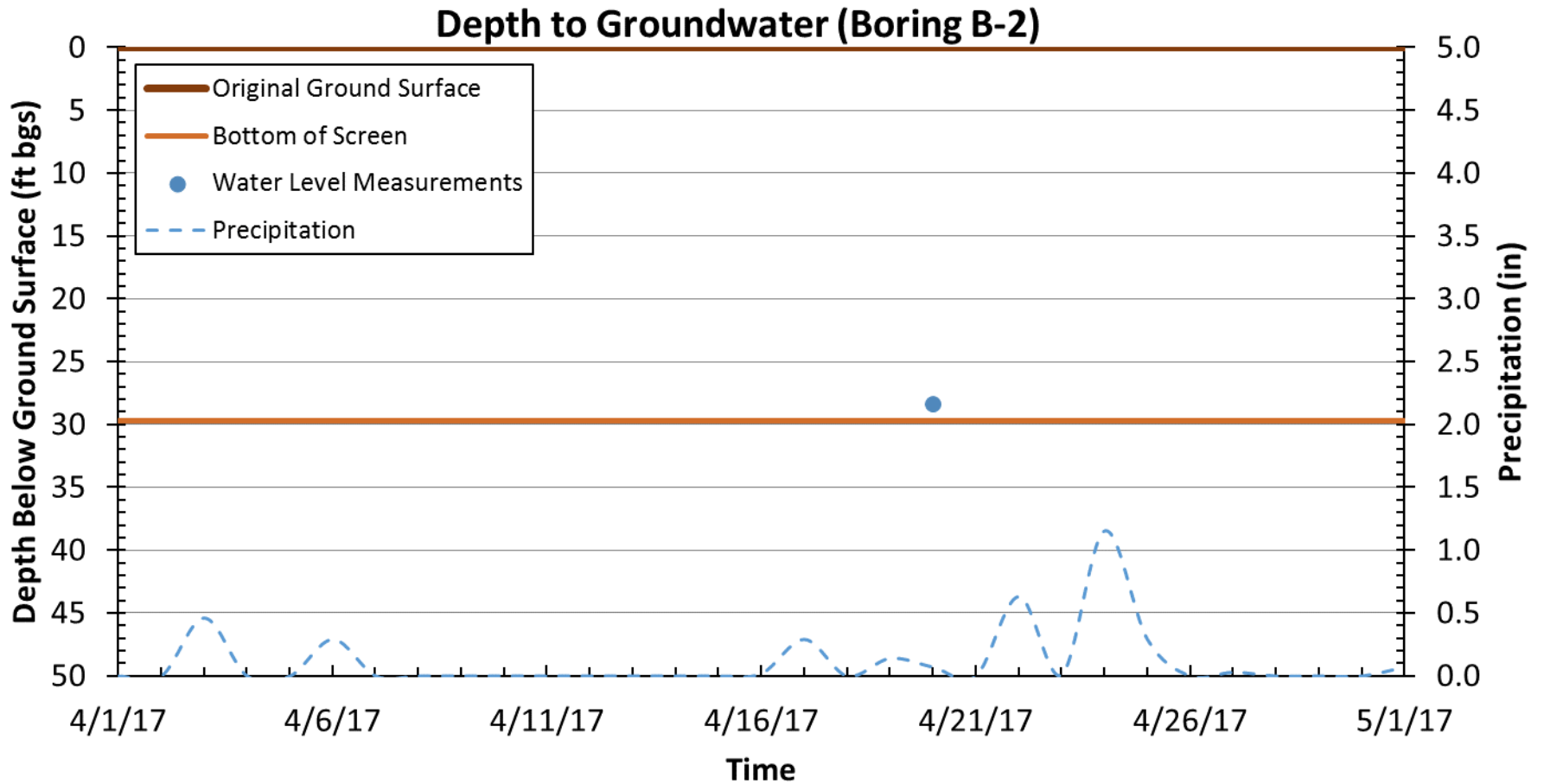
**SITE PLAN AND GENERALIZED GEOLOGIC PROFILE  
ACP GWNF MP 120.3**

**Geosyntec**  
consultants

PROJECT NO: TXG0007      MAY 2017

**FIGURE 1**

F:\GDD\PROJECTS\ATLANTIC COAST PIPELINE\GEOHAZARD ANALYSIS\FIGURE 1\FIGURES\TXG0007\_103



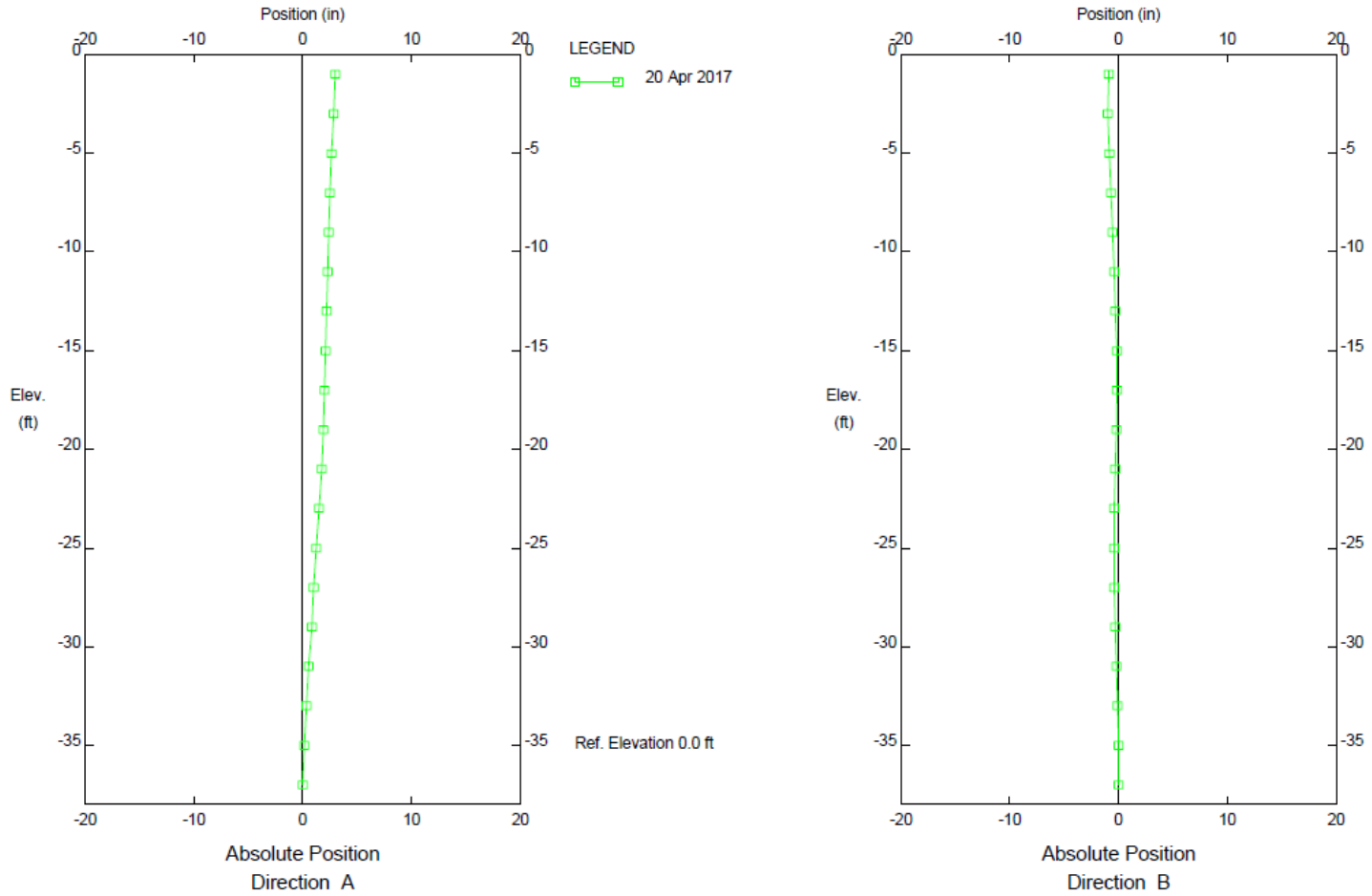
**Notes:** Precipitation data obtained from weather station located in Staunton, Virginia. Reference: [www.wunderground.com](http://www.wunderground.com)

**Piezometer Survey Data (Boring B-2)**

Project: ACP GWNF MP 120.3  
 Location: Augusta County, Virginia  
 Project Number: TXG0007-012-6303  
 Client: Dominion Transmission, Inc.

**Figure 2**

Geosyntec Consultants - Houston TX



Mp120-3-B1-2, Inclinometer Mp120-3-B1-2

**Inclinometer Survey Data (Boring B-1)**

Project: ACP GWNF MP 120.3  
Location: Augusta County, Virginia  
Project Number: TXG0007-012-6303  
Client: Dominion Transmission, Inc.

**Figure 3**

**APPENDIX A**  
**PHOTOGRAPHIC LOG**



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**GWNF MP 120.3 Drilling Site**  
**30 March through 4 April 2017**



**Photograph 1 - (before work)**

**Location:** Buckhorn Creek Forest Service Road (access to MP 120.3)

View looking south. Photo shows pre-existing conditions along Buckhorn Creek Forest Service road and existing logging trail (right).



**Photograph 2 - (during work)**

**Location:** Buckhorn Creek Forest Service Road (access to MP 120.3)

View looking south. Photo shows site conditions during temporary access route improvement activities along the existing logging trail (right).



**Photograph 3 - (after work)**

**Location:** Buckhorn Creek Forest Service Road (access to MP 120.3)

View looking south. Photo shows site conditions following drilling and restoration activities of temporary access route including casting of approved seed mix in locations covered by straw.





**Photograph 4 - (before work)**

**Location:** Existing logging trail (access to MP 120.3)

View looking southwest. Photo shows pre-existing conditions of the existing logging trail.



**Photograph 5 - (during work)**

**Location:** Existing logging trail (access to MP 120.3)

View looking southwest. Photo shows site conditions along the existing logging trail during temporary access route improvement activities.



**Photograph 6 - (after work)**

**Location:** Existing logging trail (access to MP 120.3)

View looking southwest. Photo shows site conditions along the existing logging trail following drilling and restoration activities of temporary access route including casting of approved seed mix in locations covered by locally sourced straw.





**Photograph 7 - (before work)**

**Location:** Existing logging trail (access to MP 120.3)

View looking southwest. Photo shows pre-existing conditions of the existing logging trail including a water bar (center).



**Photograph 8 - (during work)**

**Location:** Existing logging trail (access to MP 120.3)

View looking southwest. Photo shows conditions of the existing logging trail during temporary access route improvement activities. Existing water bar located in the center of the photograph.



**Photograph 9 - (after work)**

**Location:** Existing logging trail (access to MP 120.3)

View looking southwest. Photo shows site conditions along the existing logging trail following drilling and restoration activities of temporary access route including casting of approved seed mix in locations covered by locally sourced straw near MP 120.3. Note reinstallation of the existing water bar (center) to allow for positive flow off logging trail





**Photograph 10 – (before work)**

**Location:** Temporary access route  
(access to MP 120.3)

Looking southeast. Photo shows pre-existing site conditions along the logging trail prior to work activities.



**Photograph 11 – (during work)**

**Location:** Temporary access route  
(access to MP 120.3)

View looking northeast. Photo shows site conditions along the temporary access route during work activities. Note placement of silt sock BMP to prevent migration of sediment down slope.



**Photograph 12 – (after work)**

**Location:** Temporary access route  
(access to MP 120.3)

View looking northeast. Photo shows conditions along the temporary access route following completion of drilling and restoration activities including casting of approved seed mix in locations covered by locally sourced straw.





**Photograph 13 – (before work)**

**Location:** MP 120.3 (Boring B-1)

View looking west. Photo shows pre-existing site conditions at location of MP 120.3 Boring B-1 (center).



**Photograph 14 - (during work)**

**Location:** MP 120.3 (Boring B-1)

View looking west. Photo shows site conditions during drilling activities at MP120.3 Boring B-1.



**Photograph 15 – (after work)**

**Location:** MP 120.3 (Boring B-1)

View looking west. Photo shows site conditions along with locked inclinometer cover at MP 120.3 Boring B-1 following drilling activities. Restoration activities included casting of approved seed mix in locations covered by locally sourced straw.





**Photograph 16 – (before work)**

**Location:** MP 120.3 (Boring B-2)

View looking northeast. Photo shows pre-existing site conditions at location of MP 120.3 Boring B-2 (center).



**Photograph 17 – (during work)**

**Location:** MP 120.3 (Boring B-2)

View looking southwest. Photo shows site conditions during drilling activities at MP 120.3 Boring B-2.



**Photograph 18 – (after work)**

**Location:** MP 120.3 (Boring B-2)

View looking northeast. Photo shows site conditions along with locked piezometer cover at MP 120.3 Boring B-2 following drilling activities. Restoration activities included casting of approved seed mix in locations covered by locally sourced straw.

**APPENDIX B**  
**CORE PHOTOGRAPHS**



PROJECT NAME: ACP GWNF MP 120.3

PROJECT NO.: TXG0007-012-6303

CLIENT: DOMINION TRANSMISSION, INC.

LOCATION: AUGUSTA COUNTY, VIRGINIA



GWNF MP 120.3 Boring B-1: Box 1 of 2 (25.0 to 55.0 ft bgs)



GWNF MP 120.3 Boring B-1: Box 2 of 2 (55.0 to 60.0 ft bgs)

PROJECT NAME: ACP GWNF MP 120.3

PROJECT NO.: TXG0007-012-6303

CLIENT: DOMINION TRANSMISSION, INC.

LOCATION: AUGUSTA COUNTY, VIRGINIA



GWNF MP 120.3 Boring B-2: Box 1 of 2 (5.5 to 16.5 ft bgs and 24.7 to 44.7 ft bgs)



GWNF MP 120.3 Boring B-2: Box 2 of 2 (44.7 to 54.3 ft bgs)

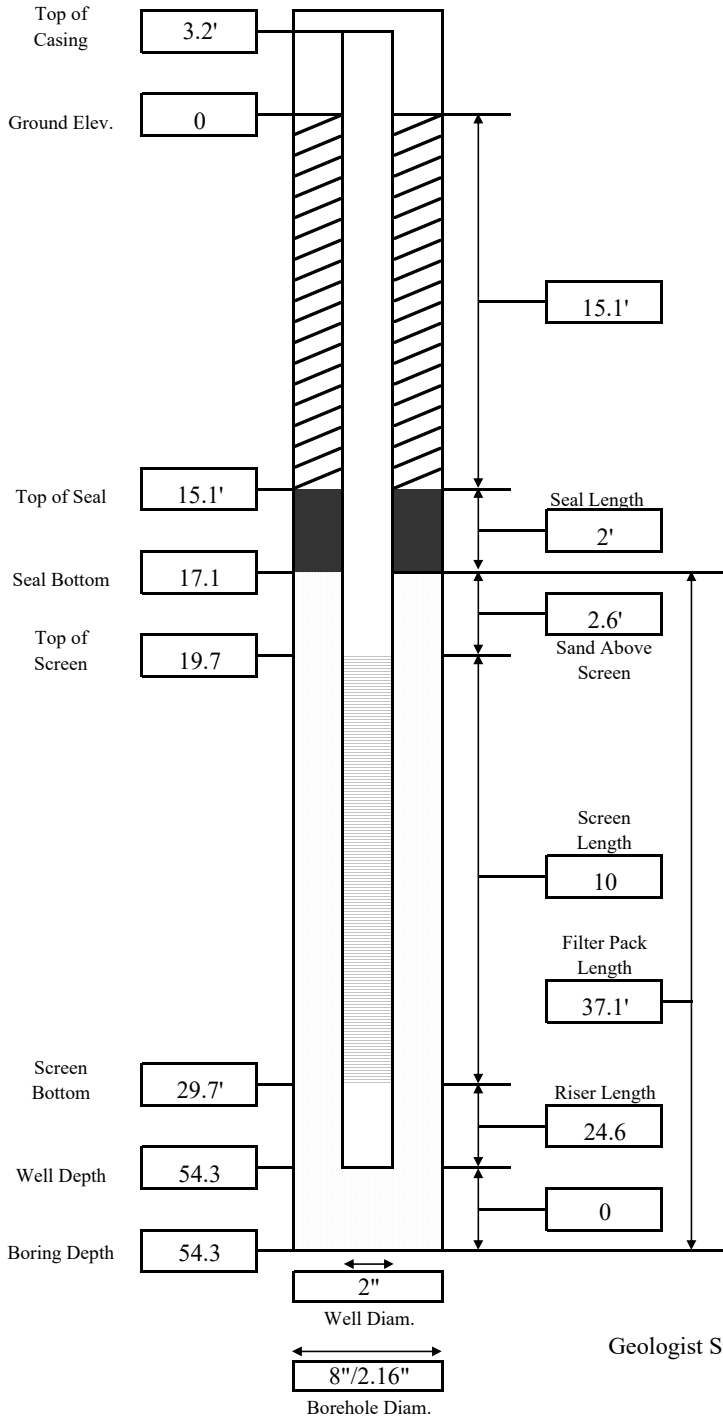
**APPENDIX C**

**PIEZOMETER AND INCLINOMETER  
CONSTRUCTION LOGS**

**Appendix C - Piezometer Construction Log**

Site: Atlantic Coast Pipeline  
 Well ID: B-2 (MP 120.3)  
 Drilling Company: Horn and Associates  
 Drillers: Tim Jenkins  
 Geologist: Jared Warner

Date: 1-Apr-17  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 54.3  
 Boring Diameter: 8"/2.16"  
 Well Depth: 54.3'  
 Well Diameter: 2"



**Well Construction:**

Material: SCH 80 PVC  
 Inside Diameter: 2"  
 Screen Slot Size: 0.01"  
 Screen Beg.: 19.7' End: 29.7'  
 Sump **Y / N**  
 Type/Length: PVC End Cap (0.3")

**Filter Pack:**

Type/Brand: Global Drilling #5 Quartz Sand  
 Amount Used: 6.5 50lb bags  
 Placement Method: Tremie

**Seal:**

Type/Brand: Pure Gold Gel Bentonite  
 Amount Used: 1/2 50lb bag  
 Vol. Fluid Added: NA  
 Set-up Time: Overnight  
 Placement Method: Poured

**Grout:**

Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
2 94lb bag of Portland + 50lb bag bentonite  
 Amount Used: bentonite  
 Vol. Fluid Added: ~60 gallons H<sub>2</sub>O  
 Placement Method: Tremie

**Well Completion:**

**Above Grade / Below Grade**  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Protective Cover (4.5")

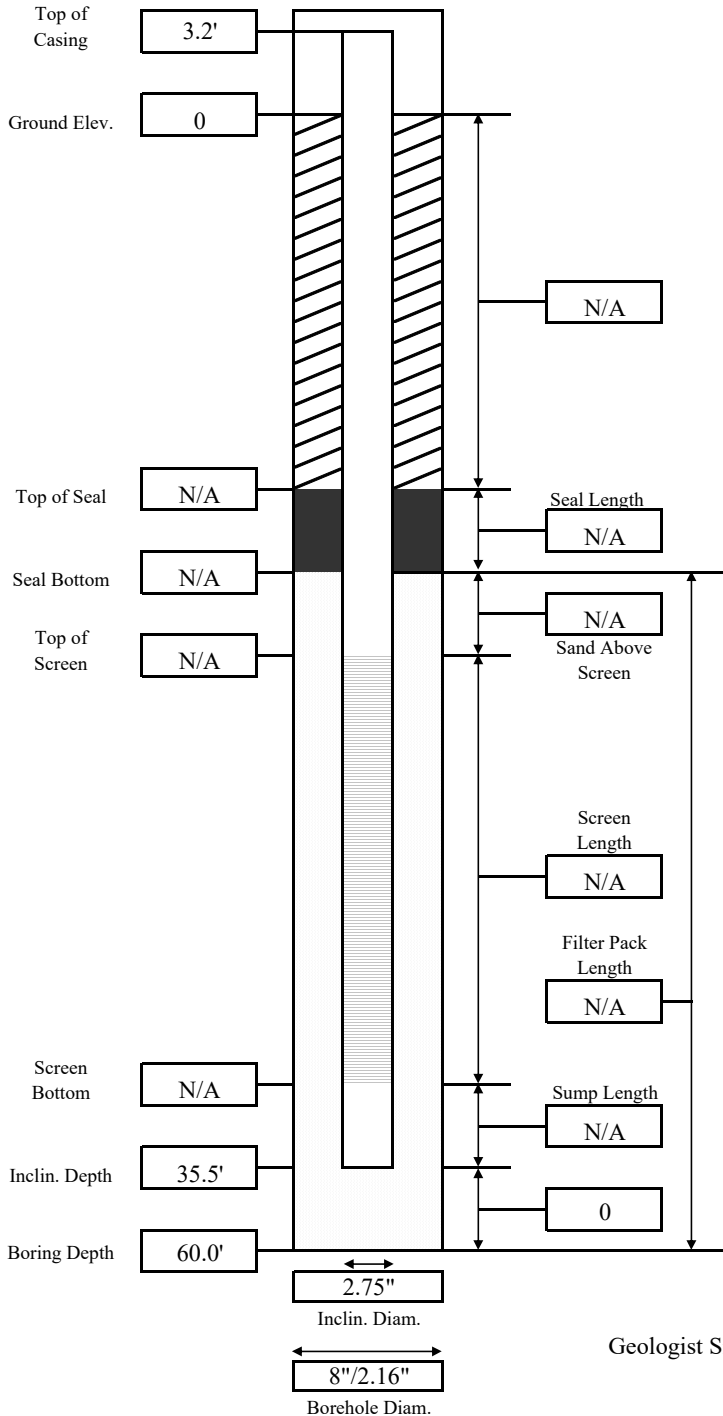
Comments: \_\_\_\_\_

Geologist Signature: Jared Warner

**Inclinometer Construction Log**

Site: Atlantic Coast Pipeline GWNF MP 120.3  
 Boring ID: B-1  
 Drilling Company: Horn and Associates  
 Drillers: Tim Jenkins  
 Geologist: Jared Warner

Date: 2-Apr-17  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 60.0'  
 Boring Diameter: 8"/2.16"  
 Incl. Depth: 35.5'  
 Incl. Diameter: 2.75"



**Well Construction:**

Material: ABS Plastic (Quick Connect)  
 Inside Diameter: 2.32"  
 Screen Slot Size: N/A  
 Screen Beg.: N/A End: N/A  
 Sump **Y / N**  
 Type/Length: \_\_\_\_\_

**Filter Pack:**

Type/Brand: N/A  
 Amount Used: N/A  
 Placement Method: N/A

**Seal:**

Type/Brand: N/A  
 Amount Used: N/A  
 Vol. Fluid Added: N/A  
 Set-up Time: N/A  
 Placement Method: N/A

**Grout:**

Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
1 94lb bag of Portland + 25lb bag bentonite  
 Amount Used: \_\_\_\_\_  
 Vol. Fluid Added: ~30 gallons H<sub>2</sub>O  
 Placement Method: Tremie

**Inclin. Completion:**

**Above Grade** / Below Grade  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Locked Cover (4.5')

Comments: Bottom of inclinometer casing placed at 35.5' due to borehole collapse. Grouted to surface.

Geologist Signature: Jared Warner

**APPENDIX D**  
**LOG OF BORINGS B-1 AND B-2**



**APPENDIX D - KEY SHEET: CLASSIFICATIONS AND SYMBOLS**

GS FORM:  
KEY 09/99

**EMPIRICAL CORRELATIONS WITH STANDARD PENETRATION RESISTANCE N VALUES \***

	N VALUE * (BLOWS/FT)	CONSISTENCY	UNDRAINED COMPRESSIVE STRENGTH (KSF)		N VALUE * (BLOWS/FT)	RELATIVE DENSITY
FINE GRAINED SOILS	0 - 2	VERY SOFT	<0.25	COARSE GRAINED SOILS	0 - 4	VERY LOOSE
	3 - 4	SOFT	0.25 - 0.50		5 - 10	LOOSE
	5 - 8	FIRM	0.50 - 1.00		11 - 30	MEDIUM DENSE
	9 - 15	STIFF	1.00 - 2.00		31 - 50	DENSE
	16 - 30	VERY STIFF	2.00 - 4.00		>50	VERY DENSE
	31 - 50	HARD	>4.00			
	>50	VERY HARD				

\* ASTM D 1586; NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 IN. O.D., 1.4 IN. I.D. SAMPLER ONE FOOT.

**UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART**

MAJOR DIVISIONS		SYMBOLS	DESCRIPTIONS	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		LITTLE OR NO FINES	GP POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES	GM SILTY GRAVELS, GRAVEL- SAND-SILT MIXTURES	
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO.4 SIEVE	APPRECIABLE AMOUNT OF FINES	GC CLAYEY GRAVELS, GRAVEL -SAND-CLAY MIXTURES	
		SAND AND SANDY SOILS	CLEAN SANDS	SW WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			LITTLE OR NO FINES	SP POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL COARSER THAN NO. 200 SIEVE SIZE	SANDS WITH FINES	APPRECIABLE AMOUNT OF FINES	SM SILTY SANDS, SAND-SILT MIXTURES	
		SC CLAYEY SANDS, SAND-CLAY MIXTURES		
FINE GRAINED SOILS	SILTS AND CLAYS	Liquid Limit Less Than 50	ML INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
		CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS		
		OL ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
	SILTS AND CLAYS	Liquid Limit Greater Than 50	MH INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT	
		CH INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
		OH ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
HIGHLY ORGANIC SOILS	PT PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT			

NOTE: DUAL SYMBOLS USED FOR BORDERLINE CLASSIFICATIONS

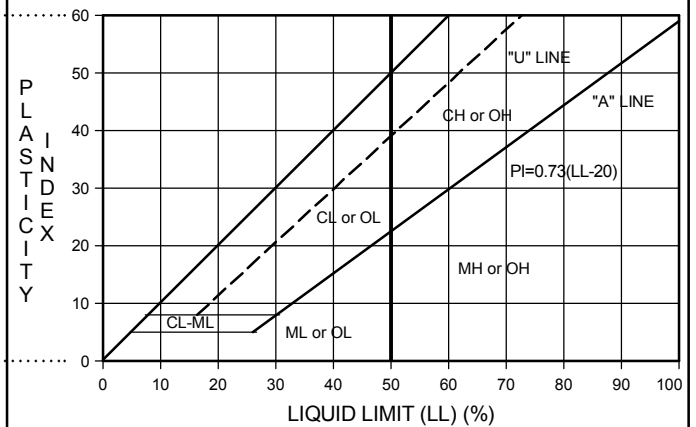
**PARTICLE SIZE IDENTIFICATION**

BOULDERS	>300 mm
COBBLES	75 - 300 mm
GRAVEL: COARSE	19.0 - 75 mm
GRAVEL: FINE	4.75 - 19 mm
SAND: COARSE	2.00 - 4.75 mm
SAND: MEDIUM	0.425 - 2.00 mm
SAND: FINE	0.075 - 0.425 mm
SILT	0.075 - 0.002 mm
CLAY	<0.002 mm

WELL GRADED - HAVING WIDE RANGE OF GRAIN SIZES AND APPRECIABLE AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES

POORLY GRADED - PREDOMINANTLY ONE GRAIN SIZE, OR HAVING A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING

**PLASTICITY CHART**



**OTHER MATERIAL SYMBOLS**

Siltstone	Sand
Sandstone	Silt
Siltstone/Claystone	Silty Sand
Claystone	Alluvium
Schist	Artificial Fill
Siltstone/Sandstone	Debris Fill
Conglomerate	Asphalt
Granitic	Metabasalt

**WELL SYMBOLS**

GRANULAR BENTONITE
BENTONITE CEMENT GROUT
FILTER PACK
CONCRETE
NATIVE/SLOUGH
CENTRAL-IZER

**SAMPLER AND OTHER SYMBOLS**

GRAB SAMPLE	Water Level at Time Drilling, or as Shown
SPLIT SPOON	Static Water Level
ROCK CORE	MSL: Mean Sea Level
SHELBY TUBE	MC: Moisture Content
CALIFORNIA SAMPLER	WA: #200 Wash
BULK SAMPLE	DD: Dry Density
	SA: Sieve Analysis
	PI: Plasticity Index
	PP: Pocket Pentrometer
	LL: Liquid Limit
	Su: Undrained Shear Strength
	K: Hydraulic Conductivity
	Phi: Friction Angle

KEY-GEOTECH - GEOSYNTEC.GDT - 4/15/16 13:47 - P:\GINT\PROJECTS\BLUE RIDGE GEOTECHNICAL DRILLING\ACPHDD.GPJ

GS FORM:  
SOIL-5910

## APPENDIX D - BORING LOG

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	1890	<b>COLLUVIUM: LEAN CLAY WITH SAND (CL)</b> , light to dark yellowish brown, moist, soft, presence of trace coarse sand, fine sandstone gravel, and plant debris.		B-1-1	1 2 2	4	50	0.75 to 1.2						20.1						
4		Becomes mottled light yellowish brown and dark reddish brown, hard, increase in fine sandstone gravel.		B-1-2	6 9 12	21	100	3.2 to >4.5		71.6				16.5	31	18	13			
6		Becomes mottled reddish brown and tan to light yellowish brown, dry to moist, increase in fine weathered sandstone gravel.		B-1-3	5 8 13	21	100	3.0 to 4.0						18.1						
8		Becomes sandy lean clay with trace coarse sandstone gravel (up to 1.5 inches).		B-1-4	8 11 14	25	100			62.7				14.6	31	18	13			
10		Becomes fine with slight increase in coarse sandstone gravel (up to 1.5 inches).		B-1-5	10 9 9	18	89	2.3 to 2.5						14.6						
12	1880	Becomes reddish brown, slight increase in fine sands and decrease in coarse weathered sandstone gravel.		B-1-6	5 9 9	18	61	2.5 to 2.7						15.5						
14		Same as above with trace rootlets.		B-1-7	6 7 10	17	100	2.6 to 3.0		63.4				16.1	35	20	15			
18	1875	<b>CLAYEY SAND WITH GRAVEL (SC)</b> , dark reddish brown, dry to moist, dense, fine sand, with fine sandstone gravel. Becomes brown to reddish brown weathered sandstone at 18 ft bgs.		B-1-8	9 9 22	31	78			37.2				12.6	29	19	10			
20		<b>CHEMUNG FORMATION: WEATHERED SHALE</b> , light brown, highly weathered, highly fractured, hard, crumbles, FeOx staining, possible boulder.		B-1-9	50/1	50	0													
22	1870			B-1-10	29 50/2	50	100													
24																				
26																				
28	1865	Refer to MP 120.3 B-1 Page 2.																		

03-GEOTECH2\_SHP\_MP120.3 AND MP123.1 SOIL LOG.GPJ\_GEOSNTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates  
**EQUIPMENT** Diedrich D-50  
**DRILL MTHD.** Hollow Stem Auger  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner

**LATITUDE:** 38.29187  
**LONGITUDE:** -79.23584  
**COORDINATE SYSTEM:**

**REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING MP 120.3 B-1**  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 4/2/2017  
**FINISH DRILL DATE** 4/2/2017

**SHEET 2 OF 3**

**GROUND SURF.** 1892.1  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**APPENDIX D - BORING LOG**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA												
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)					
		1) Formation, Member 2) Rock Name 3) Color 4) Grain Size/Percentage 5) Bedding 6) Weathering 7) Hardness 8) Cementation 9) Moisture 10) Other (Mineralization, Discoloration, Odor, etc.)																					
		Refer to 120.3 B-1 page 1.																					
1891																							
1890																							
1889																							
1888																							
5 1887																							
1886																							
1885																							
1884																							
10 1883																							
1882																							
1881																							
1880																							
1879																							
1878																							
15 1877																							
1876																							
1875																							
1874																							
1873																							
20 1872		<b>CHEMUNG FORMATION: WEATHERED SHALE</b> , light brown, highly weathered, highly fractured, hard, crumbles, FeOx staining, possible boulder or talus material.																					
1871																							
1870																							
1869																							
1868																							
25 1867		Becomes moderately weathered and highly fractured (40 to 50 degrees), FeOx along fractured planes.			R-1	5	1.5	30		7													
1866																							
1865		No recovery from 26.5 to 30 ft bgs.																					
1864																							
1863																							
30 1862																							

05-CONT. CORE SHP MP120.3 AND MP123.1 ROCK LOG.GPJ GEOSINTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 38.29187  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -79.23584  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** NX  
**LOGGER** Jared Warner              **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

**APPENDIX D - BORING LOG**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA										
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)			
1861		Same as above with high angle fracture sets (50 degrees).			R-2	5	3.1	62		11											
1860		<b>SANDSTONE</b> , gray, moderately weathered, highly fractuere, moderate to strong, high angle fractures (50 to 60 degrees).																			
1859		No recovery from 33.1 to 35 ft bgs.																			
35	1857	No recovery from 35 to 40 ft bgs.			R-3	5	3	60		10	Lost water at 36.0 ft bgs.										
40	1852	<b>SHALE</b> , olive brown to brown, moderately weathered, near vertical bedding (0.1 to 0.2 inch thick), near vertical fractures (50 to 70 degrees), FeOx infilled fractures (0.1 to 0.2 inch thick).			R-4	5	2.6	52		13											
1849		Becomes light to dark gray.																			
1848		No recovery from 42.6 to 45 ft bgs.																			
45	1847	Becomes dark gray, high angle fractures (50 to 60 degrees), FeOx infilled fractures (0.1 to 0.2 inch).			R-5	5	4.2	84		20											
1845		Becomes slightly fractured, near vertical fractures between 46.3 to 46.6 and 47.5 to 48.3 ft bgs.																			
1843		No recovery.																			
50	1842	Becomes olive brown to brown, highly fractured, moderately weathered.			R-6	5	2.8	56		17											
1841		Becomes dark gray.																			
1840		High angle fractures (50 to 60 degrees).																			
55	1837	High angle fractures (70 to 80 degrees) with FeOx infilling.			R-7	5	2.9	58		17											
1836																					
1835																					
1834																					
1833																					
60	1832	Becomes olive brown at 60 ft bgs.									Termination depth at 60 ft bgs. Borehole collapsed at 35.5 ft bgs prior to setting inclinometer casing.										

**CONTRACTOR** Horn & Associates  
**EQUIPMENT** Diedrich D-50  
**DRILL MTHD.** Rock Coring  
**DIAMETER** NX  
**LOGGER** Jared Warner

**LATITUDE:** 38.29187  
**LONGITUDE:** -79.23584  
**COORDINATE SYSTEM:**  
**REVIEWER** Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GS FORM:  
SOIL-5910

## APPENDIX D - BORING LOG

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	1880	<b>COLLUVIUM: LEAN CLAY WITH SAND (CL)</b> , brown to light yellowish brown with reddish brown intervals, moist, very soft, presence trace coarse sand, sandstone gravel, and plant debris.		B-2-1	1 2 4	6	78	0.3 to 0.5					21.9							
4	1880	Becomes firm, increase in coarse sand and gravel, light yellowish brown sandstone fragments at 3.5 ft bgs.		B-2-2	4 6 7	13	100	3.5 to 4.0			73.6		19.2	42	21	21				
6		<b>SILTY SAND WITH GRAVEL (SM)</b> , reddish brown with resistant yellowish brown to tan weathered sandstone intervals, moist, fine sand, very hard, non-plastic.		B-2-3	15 24 45	69	89				30.6		9.6	0	0	0				
10	1875	Refer to MP 120.3 B-2 page 2.																		
18	1870	<b>SILTY, CLAYEY SAND (SC-SM)</b> , reddish brown to yellowish brown, wet (due to rock coring), medium dense, coarse sand, trace coarse gravel.		B-2-4	2 4 11	15	100				25.4		23	24	19	5				
20	1865			B-2-5	50	50	100													
22		Same as above, trace coarse sandstone gravel (up to 1 inch).		B-2-6	33 36 50	86	100						11.9							
24	1860	Refer to MP 120.3 B-2 page 2.		B-2-7	50/2	50	0													
26																				
28	1855																			
30																				

03-GEOTECH2\_SHP\_MP120.3 AND MP123.1 SOIL LOG.GPJ\_GEOSNTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 38.29196  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -79.23562  
**DRILL MTHD.** Hollow Stem Auger      **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner                      **REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING MP 120.3 B-2**  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 4/1/2017  
**FINISH DRILL DATE** 4/1/2017

**SHEET 2 OF 3**

**GROUND SURF.** 1884.3  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**APPENDIX D - BORING LOG**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE				COMMENTS	DISCONTINUITY DATA										
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)		RQD	RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)		
		1) Formation, Member 2) Rock Name 3) Color 4) Grain Size/Percentage 5) Bedding 6) Weathering 7) Hardness 8) Cementation 9) Moisture 10) Other (Mineralization, Discoloration, Odor, etc.)																		
		Refer to MP 120.3 B-2 page 1.																		
1883																				
1882																				
1881																				
1880																				
5 1879																				
1878		No recovery, possible boulder or talus material.			R-1	5	1.1	22		8										
1877																				
1876																				
1875																				
10 1874		<b>CHEMUNG FORMATION: WEATHERED SANDSTONE</b> , dark reddish brown to black, highly weathered, highly fractured, strong, FeOx staining, possible boulder or talus material.			R-2	5	2	40		10										
1873																				
1872		Same as above.																		
1871																				
1870		Becomes dark greenish gray.																		
15 1869																				
1868		No recovery.			R-3	1	0.1	10		3										
1867		Refer to MP 120.3 B-2 page 1.																		
1866																				
1865																				
20 1864																				
1863																				
1862																				
1861																				
1860																				
25 1859		<b>CHEMUNG FORMATION: SHALE</b> , olive brown, slightly weathered, highly fractured, high fracture angles (50 to 60 degrees), moderate to strong, FeOx along fracture planes.			R-4	5	3.5	70		11										
1858																				
1857																				
1856		No recovery.																		
1855		Becomes olive brown, highly fractured with FeOx staining along fracture planes, slightly fractured, moderate to strong.																		
30 1854					R-5	5	3.2	64		11										

05-CONT. CORE SHP MP120.3 AND MP123.1 ROCK LOG.GPJ GEOSINTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 38.29196  
**EQUIPMENT** Diedrich D-50      **LONGITUDE:** -79.23562  
**DRILL MTHD.** Rock Coring      **COORDINATE SYSTEM:**  
**DIAMETER** NX  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS





11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING** MP 120.3 B-2  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 4/1/2017  
**FINISH DRILL DATE** 4/1/2017

SHEET 3 OF 3

**GROUND SURF.** 1884.3  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**APPENDIX D - BORING LOG**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA								
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)	
1853		Same as above.																	
1852																			
1851		No recovery.																	
1850																			
35	1849	Same as above.			R-6	5	2.6	52		9									
1848																			
1847																			
1846		No recovery.																	
1845																			
40	1844	Same as above.			R-7	5	3.2	64		9									
1843																			
1842																			
1841		No recovery.																	
1840																			
45	1839	Same as above.			R-8	5	5	100		11									
1838																			
1837		Becomes dark gray, moderately fractured.																	
1836																			
1835																			
50	1834				R-9	4.3	4.2	98		9									
1833																			
1832																			
1831																			
1830																			
55	1829																		
1828																			
1827																			
1826																			
1825																			
60	1824																		

Termination depth at 54.3 ft bgs.

05-CONT CORE SHP MP120.3 AND MP123.1 ROCK LOG.GPJ GEOSNTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates **LATITUDE:** 38.29196  
**EQUIPMENT** Diedrich D-50 **LONGITUDE:** -79.23562  
**DRILL MTHD.** Rock Coring **COORDINATE SYSTEM:**  
**DIAMETER** NX  
**LOGGER** Jared Warner **REVIEWER** Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

**APPENDIX E**  
**LABORATORY TEST RESULTS**



May 17, 2017

Project No. 2017-241-001

Logan Brant  
Geosyntec Consultants, Inc.  
11490 Westheimer Rd., Suite 150  
Houston, TX 77077

**Transmittal**  
**Laboratory Test Results**  
**ACP TXG0007**

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens that were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,  
**Geotechnics, Inc.**

David R. Backstrom  
Laboratory Director

***We understand that you have a choice in your laboratory services  
and we thank you for choosing Geotechnics.***

Summary Table for ACP TXG0007



LAB ID	Boring	Depth	Sample Number	Water Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	USCS Symbol (Limits)	Passing #200%	Passing 0.002 mm %	USCS Symbol (Grain Size)	USCS Classification	UC Rock Peak Strength (psi)
2017-241-001-001	B-1 (MP120.3)	0.9	B-1-1	20.1	-	-	-	-	-	-	-	-	-
2017-241-001-002	B-1 (MP120.3)	4	B-1-2	16.5	31	18	13	CL	71.67	-	CL	LEAN CLAY WITH SAND	-
2017-241-001-003	B-1 (MP120.3)	6.5	B-1-3	18.1	-	-	-	-	-	-	-	-	-
2017-241-001-004	B-1 (MP120.3)	9	B-1-4	14.6	31	18	13	CL	62.75	NA	CL	SANDY LEAN CLAY	-
2017-241-001-005	B-1 (MP120.3)	11.3	B-1-5	14.6	-	-	-	-	-	-	-	-	-
2017-241-001-006	B-1 (MP120.3)	13.4	B-1-6	15.5	-	-	-	-	-	-	-	-	-
2017-241-001-007	B-1 (MP120.3)	16.5	B-1-7	16.1	35	20	15	CL	63.41	NA	CL	SANDY LEAN CLAY	-
2017-241-001-008	B-1 (MP120.3)	18.7	B-1-8	12.6	29	19	10	CL	37.24	NA	SC	CLAYEY SAND WITH GRAVEL	-
2017-241-001-009	B-1 (MP120.3)	46.2-47.1	R5	-	-	-	-	-	-	-	-	-	2,470
2017-241-001-010	B-1 (MP120.3)	51.8-52.3	R6	-	-	-	-	-	-	-	-	-	3,920
2017-241-001-011	B-1 (MP120.3)	55.2-55.8	R7	-	-	-	-	-	-	-	-	-	13,470
2017-241-001-012	B-2 (MP120.3)	1.2	B-2-1	21.9	-	-	-	-	-	-	-	-	-
2017-241-001-013	B-2 (MP120.3)	3.5	B-2-2	19.2	42	21	21	CL	73.59	NA	CL	LEAN CLAY WITH SAND	-
2017-241-001-014	B-2 (MP120.3)	5.8	B-2-3	9.6	0	0	0	Non-Plastic	30.61	NA	SM	SILTY SAND WITH GRAVEL	-
2017-241-001-015	B-2 (MP120.3)	18	B-2-4	23	24	19	5	CL-ML	25.43	-	SC-SM	SILTY, CLAYEY SAND	-
2017-241-001-016	B-2 (MP120.3)	23.2	B-2-6	11.9	-	-	-	-	-	-	-	-	-
2017-241-001-017	B-2 (MP120.3)	33.3-33.6	R5	-	-	-	-	-	-	-	-	-	3,610

## MOISTURE CONTENT

ASTM D 2216-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001

Lab ID:	001	002	003	004	005
Boring No.:	B-1(MP120.3)	B-1(MP120.3)	B-1(MP120.3)	B-1(MP120.3)	B-1(MP120.3)
Depth (ft):	0.9	4.0	6.5	9.0	11.3
Sample No.:	B-1-1	B-1-2	B-1-3	B-1-4	B-1-5
Tare Number	3102	2672	3243	3009	3136
Wt. of Tare & Wet Sample (g)	127.06	90.45	97.14	103.17	130.74
Wt. of Tare & Dry Sample (g)	106.94	78.61	83.29	90.93	114.92
Weight of Tare (g)	6.86	6.69	6.85	6.85	6.70
Weight of Water (g)	20.12	11.84	13.85	12.24	15.82
Weight of Dry Sample (g)	100.08	71.92	76.44	84.08	108.22
<b>Water Content (%)</b>	<b>20.1</b>	<b>16.5</b>	<b>18.1</b>	<b>14.6</b>	<b>14.6</b>

Lab ID	006	007	008	012	013
Boring No.	B-1(MP120.3)	B-1(MP120.3)	B-1(MP120.3)	B-2(MP120.3)	B-2(MP120.3)
Depth (ft)	13.4	16.5	18.7	1.2	3.5
Sample No.	B-1-6	B-1-7	B-1-8	B-2-1	B-2-2
Tare Number	3197	3208	2986	3112	3204
Wt. of Tare & Wet Sample (g)	90.47	76.20	81.73	139.66	95.01
Wt. of Tare & Dry Sample (g)	79.25	66.59	73.28	115.74	80.78
Weight of Tare (g)	6.76	6.74	6.34	6.76	6.77
Weight of Water (g)	11.22	9.61	8.45	23.92	14.23
Weight of Dry Sample (g)	72.49	59.85	66.94	108.98	74.01
<b>Water Content (%)</b>	<b>15.5</b>	<b>16.1</b>	<b>12.6</b>	<b>21.9</b>	<b>19.2</b>

Notes :

*Tested By*    *PC*                      *Date*            *5/8/17*            *Checked By*    *TMP*                      *Date*            *5/9/17*

## MOISTURE CONTENT

ASTM D 2216-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001

Lab ID:	014	016
Boring No.:	B-2(MP120.3)	B-2(MP120.3)
Depth (ft):	5.8	23.2
Sample No.:	B-2-3	B-2-6
Tare Number	3241	2936
Wt. of Tare & Wet Sample (g)	94.85	128.42
Wt. of Tare & Dry Sample (g)	87.15	115.51
Weight of Tare (g)	6.80	6.63
Weight of Water (g)	7.70	12.91
Weight of Dry Sample (g)	80.35	108.88
<b>Water Content (%)</b>	<b>9.6</b>	<b>11.9</b>

Notes :

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<i>Tested By</i>	<i>PC</i>	<i>Date</i>	<i>5/8/17</i>	<i>Checked By</i>	<i>TMP</i>	<i>Date</i>	<i>5/9/17</i>
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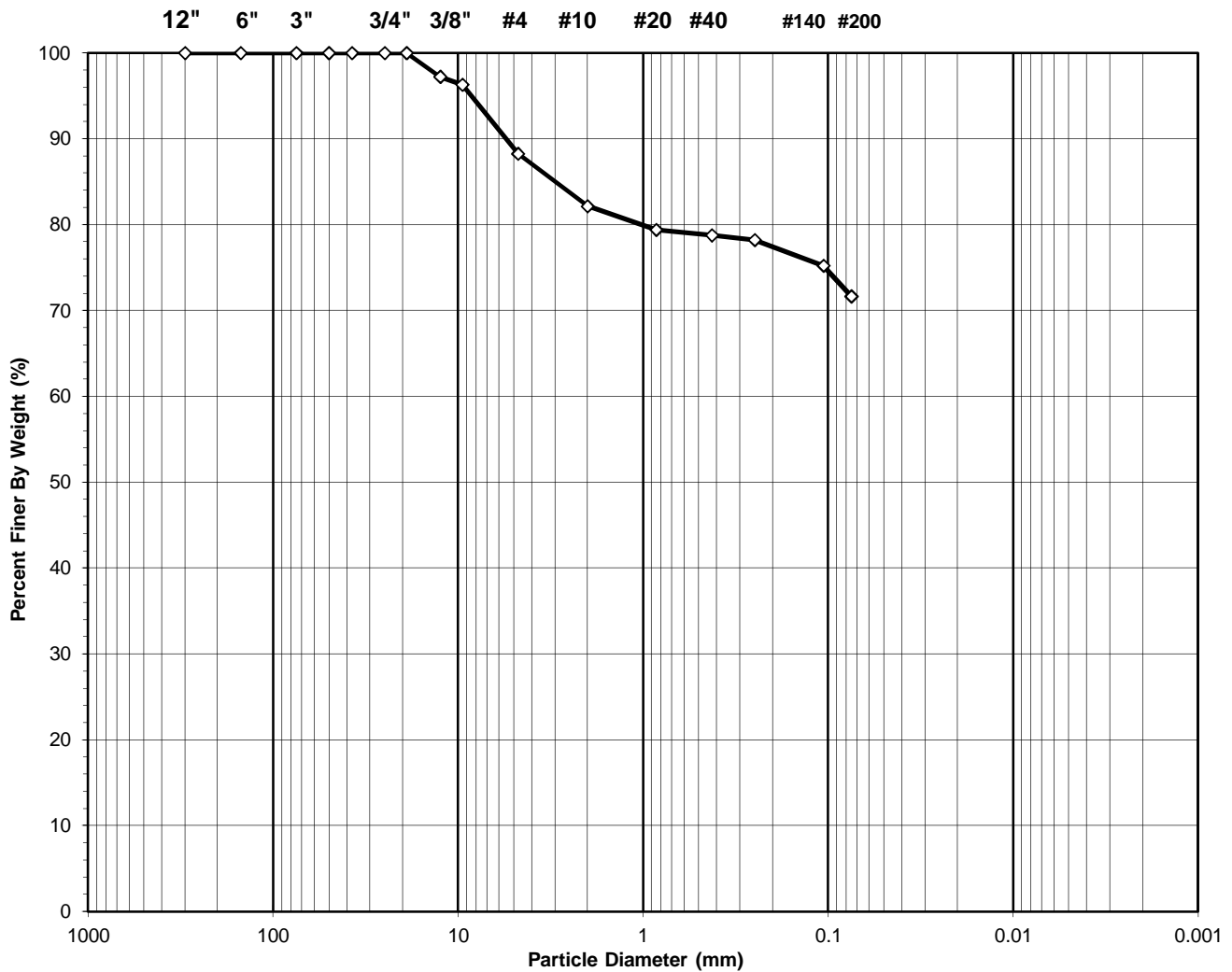
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**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-1(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft):	4.0
Project No.:	2017-241-001	Sample No.:	B-1-2
Lab ID:	2017-241-001-002	Soil Color:	Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By HL Date 5/10/17 Checked By TMP Date 5/17/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.: B-1(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft): 4.0
Project No.:	2017-241-001	Sample No.: B-1-2
Lab ID:	2017-241-001-002	Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1516	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	486.60	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	436.79	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	142.91	Weight of Tare (g):	NA
Weight of Water (g):	49.81	Weight of Water (g):	NA
Weight of Dry Sample (g):	293.88	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>16.9</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	293.88
Dry Weight of - 3/4" Sample (g):	83.3	Weight of - #200 Material (g):	210.61
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	83.27
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	8.12	2.76	2.76	97.24	<b>97.24</b>
3/8"	9.50	2.73	0.93	3.69	96.31	<b>96.31</b>
#4	4.75	23.64	8.04	11.74	88.26	<b>88.26</b>
#10	2.00	17.97	6.11	17.85	82.15	<b>82.15</b>
#20	0.850	8.06	2.74	20.59	79.41	<b>79.41</b>
#40	0.425	1.88	0.64	21.23	78.77	<b>78.77</b>
#60	0.250	1.57	0.53	21.77	78.23	<b>78.23</b>
#140	0.106	8.80	2.99	24.76	75.24	<b>75.24</b>
#200	0.075	10.50	3.57	28.33	71.67	<b>71.67</b>
Pan	-	210.61	71.67	100.00	-	-

Tested By **HL**      Date **5/10/17**      Checked By **TMP**      Date **5/17/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-002

Boring No.: B-1(MP120.3)  
 Depth (ft): 4.0  
 Sample No.: B-1-2  
 Soil Description: BROWN LEAN CLAY

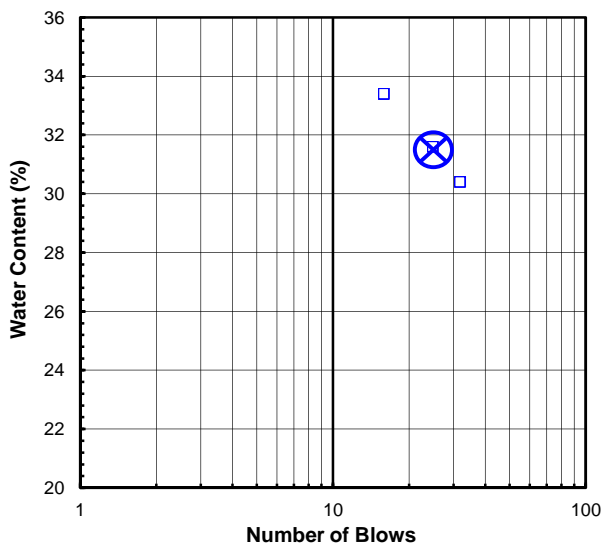
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	2672	237	144	208	U
Wt. of Tare & Wet Sample (g):	90.45	37.45	38.40	39.22	L
Wt. of Tare & Dry Sample (g):	78.61	32.44	33.50	34.53	T
Weight of Tare (g):	6.69	17.43	17.98	19.09	I
Weight of Water (g):	11.8	5.0	4.9	4.7	P
Weight of Dry Sample (g):	71.9	15.0	15.5	15.4	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>16.5</b>	<b>33.4</b>	<b>31.6</b>	<b>30.4</b>	<b>N</b>
<b>Number of Blows:</b>		<b>16</b>	<b>25</b>	<b>32</b>	<b>T</b>

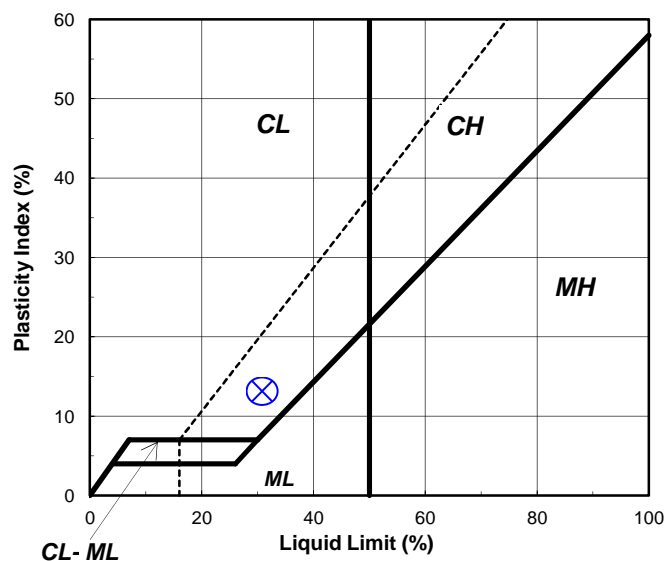
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	114	217		<b>Liquid Limit (%):</b>	<b>31</b>
Wt. of Tare & Wet Sample (g):	24.63	24.85		<b>Plastic Limit (%):</b>	<b>18</b>
Wt. of Tare & Dry Sample (g):	23.68	23.89		<b>Plasticity Index (%):</b>	<b>13</b>
Weight of Tare (g):	18.42	18.66		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	0.9	1.0			
Weight of Dry Sample (g):	5.3	5.2			
<b>Moisture Content (%):</b>	<b>18.1</b>	<b>18.4</b>	<b>-0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



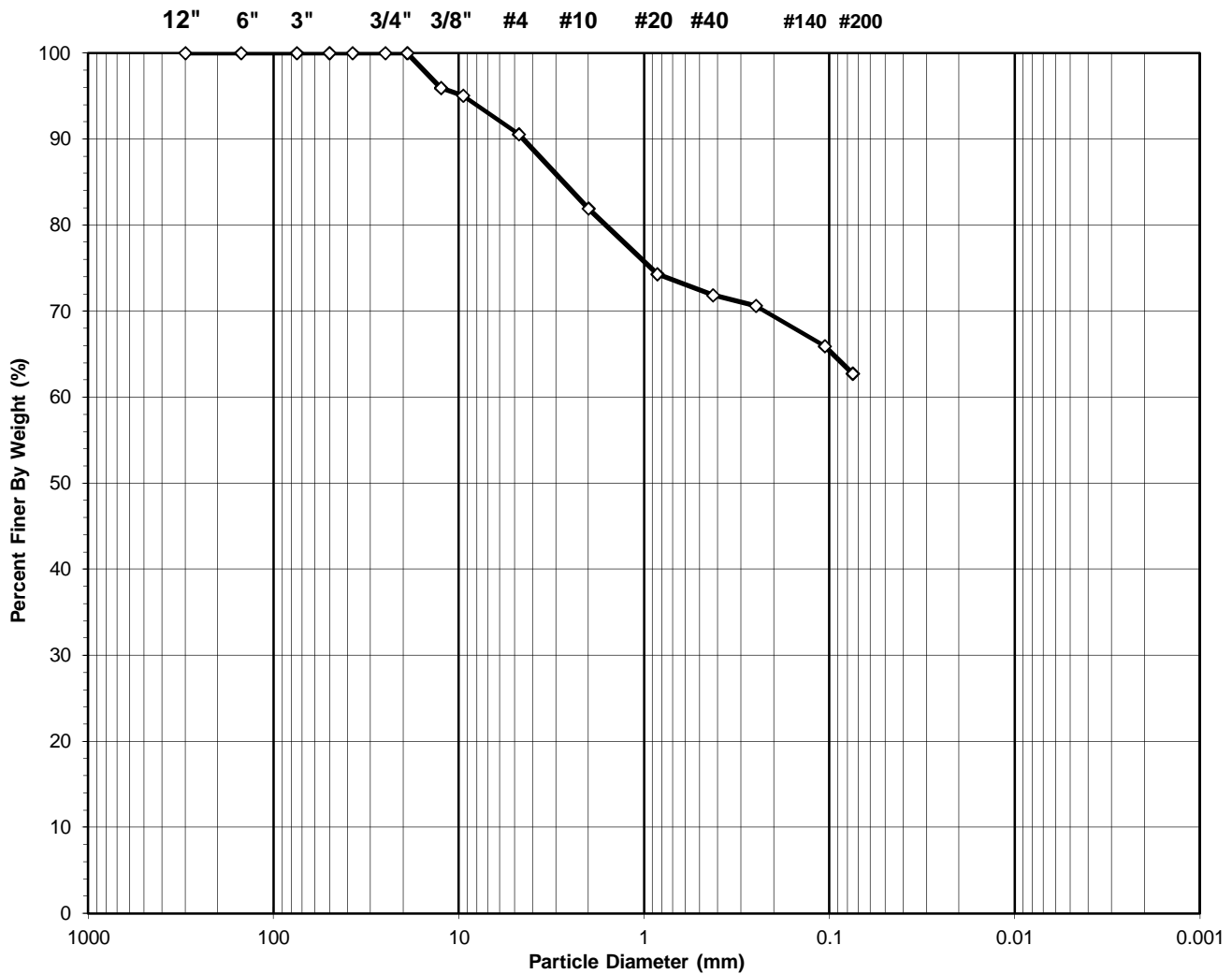
Tested By RAL Date 5/15/17 Checked By KC Date 5/16/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-004

Boring No.: B-1(MP120.3)  
 Depth (ft): 9.0  
 Sample No.: B-1-4  
 Soil Color: Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**SANDY LEAN CLAY**

Tested By HL Date 5/10/17 Checked By TMP Date 5/12/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-004

Boring No.: B-1(MP120.3)  
 Depth (ft): 9.0  
 Sample No.: B-1-4  
 Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1511	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	487.07	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	444.19	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	147.50	Weight of Tare (g):	NA
Weight of Water (g):	42.88	Weight of Water (g):	NA
Weight of Dry Sample (g):	296.69	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>14.5</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	296.69
Dry Weight of - 3/4" Sample (g):	110.5	Weight of - #200 Material (g):	186.16
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	110.53
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	12.01	4.05	4.05	95.95	<b>95.95</b>
3/8"	9.50	2.64	0.89	4.94	95.06	<b>95.06</b>
#4	4.75	13.36	4.50	9.44	90.56	<b>90.56</b>
#10	2.00	25.61	8.63	18.07	81.93	<b>81.93</b>
#20	0.850	22.62	7.62	25.70	74.30	<b>74.30</b>
#40	0.425	7.29	2.46	28.15	71.85	<b>71.85</b>
#60	0.250	3.59	1.21	29.36	70.64	<b>70.64</b>
#140	0.106	13.94	4.70	34.06	65.94	<b>65.94</b>
#200	0.075	9.47	3.19	37.25	62.75	<b>62.75</b>
Pan	-	186.16	62.75	100.00	-	-

Tested By **HL**      Date **5/10/17**      Checked By **TMP**      Date **5/12/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-004

Boring No.: B-1(MP120.3)  
 Depth (ft): 9.0  
 Sample No.: B-1-4  
 Soil Description: BROWN LEAN CLAY

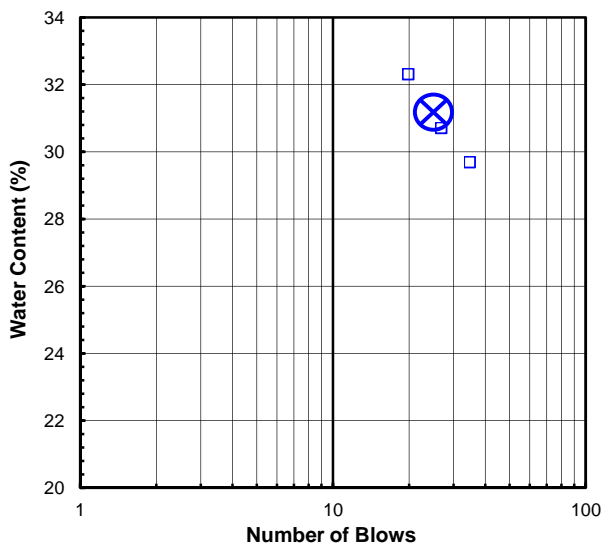
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	3009	162	196	1101	U
Wt. of Tare & Wet Sample (g):	103.17	41.54	40.24	39.67	L
Wt. of Tare & Dry Sample (g):	90.93	36.04	34.95	34.43	T
Weight of Tare (g):	6.85	17.50	17.71	18.20	I
Weight of Water (g):	12.2	5.5	5.3	5.2	P
Weight of Dry Sample (g):	84.1	18.5	17.2	16.2	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>14.6</b>	<b>29.7</b>	<b>30.7</b>	<b>32.3</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>27</b>	<b>20</b>	<b>T</b>

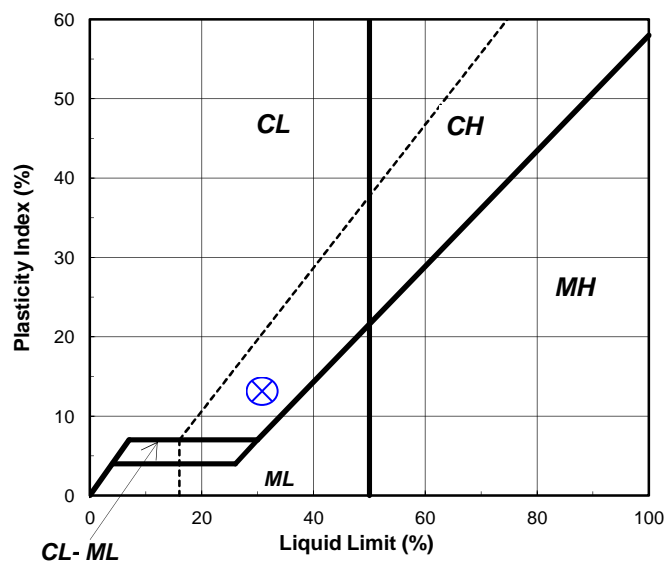
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	217	122		Liquid Limit (%):	<b>31</b>
Wt. of Tare & Wet Sample (g):	25.71	24.81		Plastic Limit (%):	<b>18</b>
Wt. of Tare & Dry Sample (g):	24.61	23.85		Plasticity Index (%):	<b>13</b>
Weight of Tare (g):	18.65	18.67		USCS Symbol:	<b>CL</b>
Weight of Water (g):	1.1	1.0			
Weight of Dry Sample (g):	6.0	5.2			
<b>Moisture Content (%):</b>	<b>18.5</b>	<b>18.5</b>	<b>-0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By BS Date 5/11/17 Checked By TMP Date 5/12/17

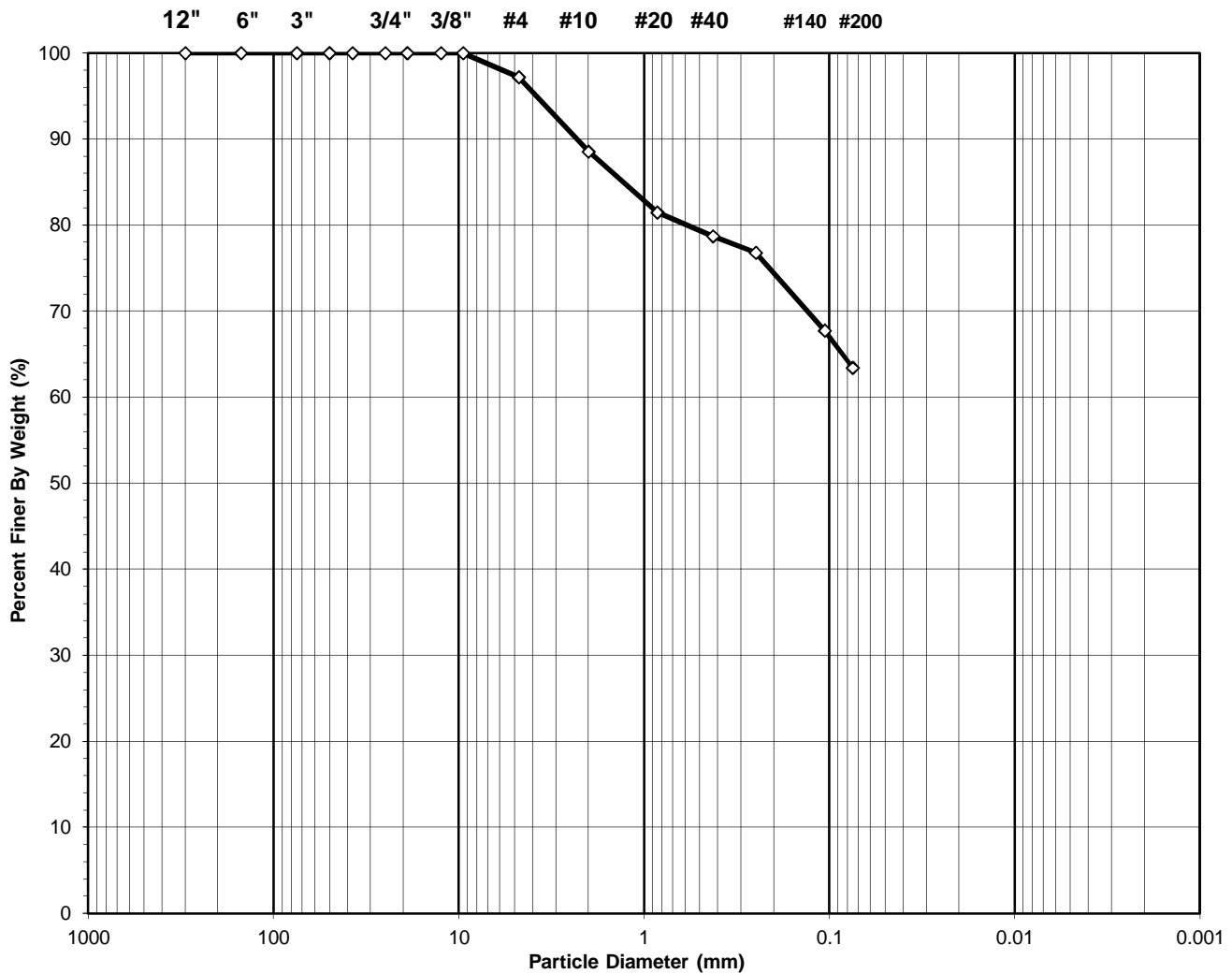


**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-007

Boring No.: B-1(MP120.3)  
 Depth (ft): 16.5  
 Sample No.: B-1-7  
 Soil Color: Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**SANDY LEAN CLAY**

Tested By HL Date 5/10/17 Checked By TMP Date 5/12/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-007

Boring No.: B-1(MP120.3)  
 Depth (ft): 16.5  
 Sample No.: B-1-7  
 Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1465	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	434.67	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	392.55	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	145.65	Weight of Tare (g):	NA
Weight of Water (g):	42.12	Weight of Water (g):	NA
Weight of Dry Sample (g):	246.90	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>17.1</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	246.90
Dry Weight of - 3/4" Sample (g):	90.3	Weight of - #200 Material (g):	156.57
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	90.33
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	0.00	0.00	0.00	100.00	<b>100.00</b>
#4	4.75	6.90	2.79	2.79	97.21	<b>97.21</b>
#10	2.00	21.38	8.66	11.45	88.55	<b>88.55</b>
#20	0.850	17.46	7.07	18.53	81.47	<b>81.47</b>
#40	0.425	6.80	2.75	21.28	78.72	<b>78.72</b>
#60	0.250	4.77	1.93	23.21	76.79	<b>76.79</b>
#140	0.106	22.31	9.04	32.25	67.75	<b>67.75</b>
#200	0.075	10.71	4.34	36.59	63.41	<b>63.41</b>
Pan	-	156.57	63.41	100.00	-	-

Tested By **HL**      Date **5/10/17**      Checked By **TMP**      Date **5/12/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-007

Boring No.: B-1(MP120.3)  
 Depth (ft): 16.5  
 Sample No.: B-1-7  
 Soil Description: BROWN LEAN CLAY

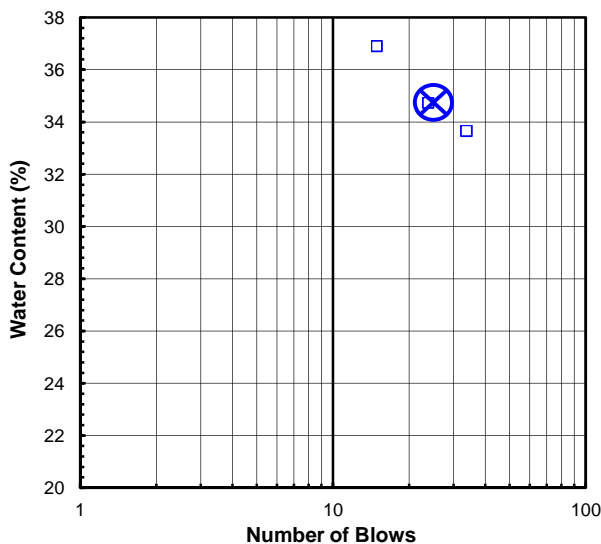
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	3208	3	114	135	U
Wt. of Tare & Wet Sample (g):	76.20	39.91	40.48	39.79	L
Wt. of Tare & Dry Sample (g):	66.59	34.62	34.80	34.30	T
Weight of Tare (g):	6.74	18.89	18.43	19.41	I
Weight of Water (g):	9.6	5.3	5.7	5.5	P
Weight of Dry Sample (g):	59.9	15.7	16.4	14.9	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>16.1</b>	<b>33.6</b>	<b>34.7</b>	<b>36.9</b>	<b>N</b>
<b>Number of Blows:</b>		<b>34</b>	<b>24</b>	<b>15</b>	<b>T</b>

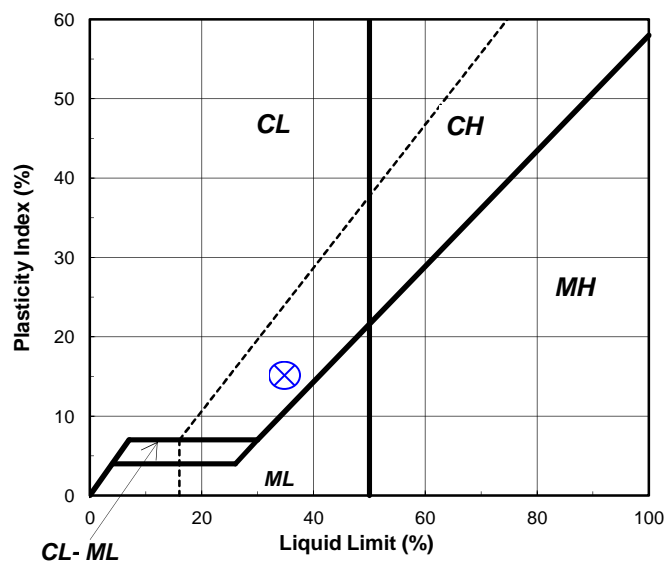
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	179	183		Liquid Limit (%):	<b>35</b>
Wt. of Tare & Wet Sample (g):	25.96	25.49		Plastic Limit (%):	<b>20</b>
Wt. of Tare & Dry Sample (g):	24.68	24.43		Plasticity Index (%):	<b>15</b>
Weight of Tare (g):	18.33	19.29		USCS Symbol:	<b>CL</b>
Weight of Water (g):	1.3	1.1			
Weight of Dry Sample (g):	6.4	5.1			
<b>Moisture Content (%):</b>	<b>20.2</b>	<b>20.6</b>	<b>-0.5</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart

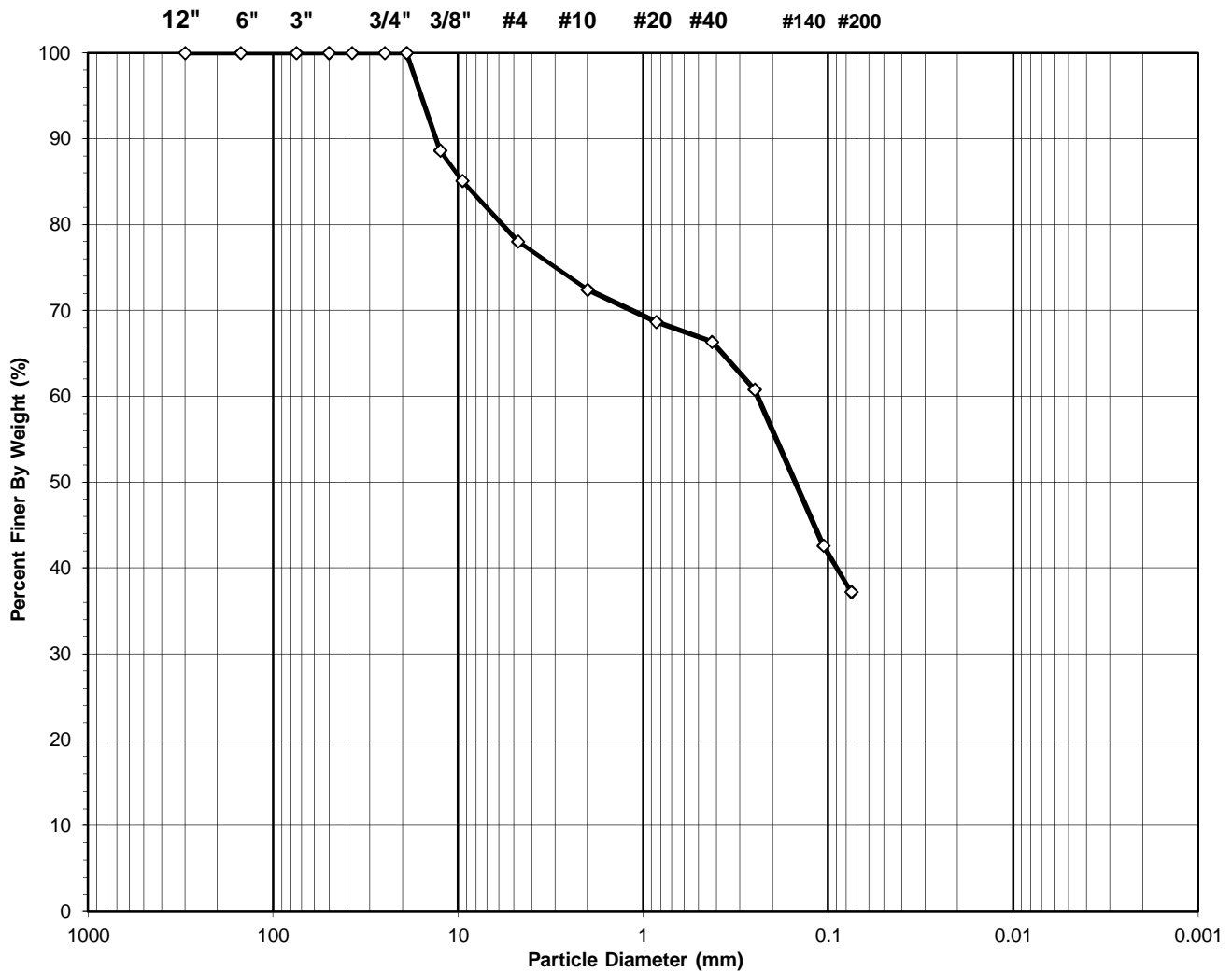


Tested By BS Date 5/11/17 Checked By TMP Date 5/12/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-1(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft):	18.7
Project No.:	2017-241-001	Sample No.:	B-1-8
Lab ID:	2017-241-001-008	Soil Color:	Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**SC, TESTED**

**USCS Classification:**  
**CLAYEY SAND WITH GRAVEL**

Tested By HL Date 5/10/17 Checked By TMP Date 5/12/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-008

Boring No.: B-1(MP120.3)  
 Depth (ft): 18.7  
 Sample No.: B-1-8  
 Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1485	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	453.31	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	421.67	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	147.71	Weight of Tare (g):	NA
Weight of Water (g):	31.64	Weight of Water (g):	NA
Weight of Dry Sample (g):	273.96	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>11.5</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	273.96
Dry Weight of - 3/4" Sample (g):	172.0	Weight of - #200 Material (g):	102.01
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	171.95
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	31.12	11.36	11.36	88.64	<b>88.64</b>
3/8"	9.50	9.64	3.52	14.88	85.12	<b>85.12</b>
#4	4.75	19.38	7.07	21.95	78.05	<b>78.05</b>
#10	2.00	15.39	5.62	27.57	72.43	<b>72.43</b>
#20	0.850	10.27	3.75	31.32	68.68	<b>68.68</b>
#40	0.425	6.41	2.34	33.66	66.34	<b>66.34</b>
#60	0.250	15.19	5.54	39.20	60.80	<b>60.80</b>
#140	0.106	49.79	18.17	57.38	42.62	<b>42.62</b>
#200	0.075	14.76	5.39	62.76	37.24	<b>37.24</b>
Pan	-	102.01	37.24	100.00	-	-

Tested By **HL**      Date **5/10/17**      Checked By **TMP**      Date **5/12/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-008

Boring No.: B-1(MP120.3)  
 Depth (ft): 18.7  
 Sample No.: B-1-8  
 Soil Description: BROWN LEAN CLAY

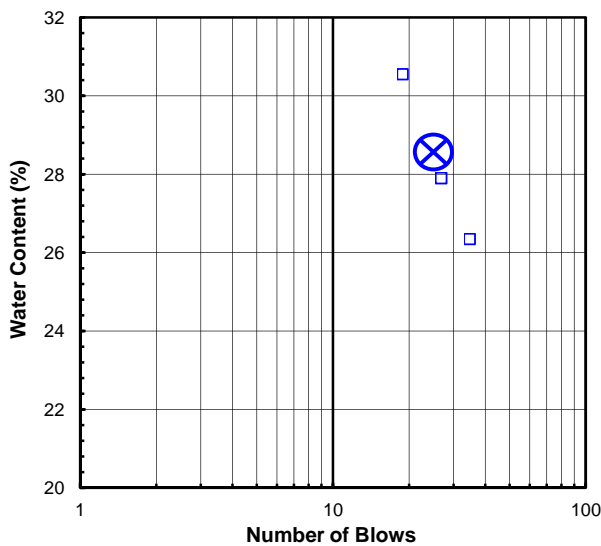
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	2986	4	139	167	U
Wt. of Tare & Wet Sample (g):	81.73	41.14	41.54	41.51	L
Wt. of Tare & Dry Sample (g):	73.28	36.51	36.77	36.11	T
Weight of Tare (g):	6.34	18.92	19.66	18.42	I
Weight of Water (g):	8.5	4.6	4.8	5.4	P
Weight of Dry Sample (g):	66.9	17.6	17.1	17.7	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>12.6</b>	<b>26.3</b>	<b>27.9</b>	<b>30.5</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>27</b>	<b>19</b>	<b>T</b>

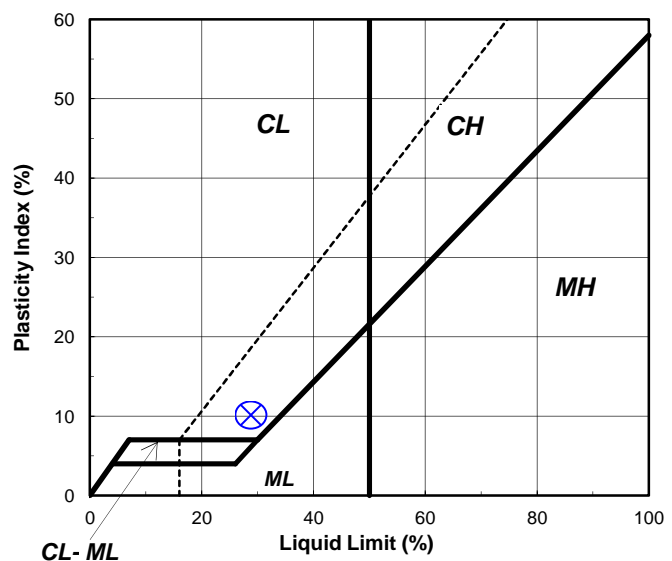
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	231	224		<b>Liquid Limit (%):</b>	<b>29</b>
Wt. of Tare & Wet Sample (g):	25.74	26.67		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	24.78	25.58		<b>Plasticity Index (%):</b>	<b>10</b>
Weight of Tare (g):	19.67	19.76		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.0	1.1			
Weight of Dry Sample (g):	5.1	5.8			
<b>Moisture Content (%):</b>	<b>18.8</b>	<b>18.7</b>	<b>0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By BS Date 5/11/17 Checked By TMP Date 5/12/17



## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID No.: 2017-241-001-009

Boring No.: B-1 (MP120.3)  
 Depth (ft): 46.2-47.1  
 Sample ID: R-5  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 458.47**

SPECIMEN LENGTH (in)

Reading 1: 3.99  
 Reading 2: 3.99  
 Reading 3: 3.99  
**Average: 3.99**

SPECIMEN DIAMETER (in):

Reading 1: 1.84  
 Reading 2: 1.84  
 Average: **1.84**  
 Area (in<sup>2</sup>): 2.65  
 L/D: 2.17

MOISTURE CONTENT

Tare Number: 3059  
 Wt. of Tare & Wet Sample (g): 454.61  
 Wt. of Tare & Dry Sample (g): 451.33  
 Weight of Tare (g): 6.71  
 Weight of Wet Sample (g): 447.90  
 Sample Volume (cm<sup>3</sup>): 173.53  
 Moisture Content (%): 0.74  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.642  
 Unit Wet Weight (pcf): 164.9  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.623**  
**Unit Dry Weight (pcf): 163.7**

Total Load (lb): 6,560  
**Uniaxial Compressive Strength (psi): 2,470**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 48  
 Time to Break (min:sec): 2:16.50  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID No.: 2017-241-001-010

Boring No.: B-1 (MP120.3)  
 Depth (ft): 51.8-52.3  
 Sample ID: R-6  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 467.89**

SPECIMEN LENGTH (in)

Reading 1: 3.99  
 Reading 2: 3.99  
 Reading 3: 3.99  
**Average: 3.99**

SPECIMEN DIAMETER (in):

Reading 1: 1.85  
 Reading 2: 1.85  
 Average: **1.85**  
 Area (in<sup>2</sup>): 2.69  
 L/D: 2.15

MOISTURE CONTENT

Tare Number: 2988  
 Wt. of Tare & Wet Sample (g): 472.30  
 Wt. of Tare & Dry Sample (g): 468.60  
 Weight of Tare (g): 6.70  
 Weight of Wet Sample (g): 465.60  
 Sample Volume (cm<sup>3</sup>): 176.05  
 Moisture Content (%): 0.80  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.658  
 Unit Wet Weight (pcf): 165.8  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.637**  
**Unit Dry Weight (pcf): 164.5**

Total Load (lb): 10,570  
**Uniaxial Compressive Strength (psi): 3,920**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 66  
 Time to Break (min:sec): 2:39.66  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Pass*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID No.: 2017-241-001-011

Boring No.: B-1 (MP120.3)  
 Depth (ft): 55.2-55.8  
 Sample ID: R-7  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 483.60**

SPECIMEN LENGTH (in)

Reading 1: 3.98  
 Reading 2: 3.98  
 Reading 3: 3.98  
**Average: 3.98**

SPECIMEN DIAMETER (in):

Reading 1: 1.97  
 Reading 2: 1.97  
 Average: **1.97**  
 Area (in<sup>2</sup>): 3.05  
 L/D: 2.02

MOISTURE CONTENT

Tare Number: 3007  
 Wt. of Tare & Wet Sample (g): 485.81  
 Wt. of Tare & Dry Sample (g): 484.85  
 Weight of Tare (g): 6.75  
 Weight of Wet Sample (g): 479.06  
 Sample Volume (cm<sup>3</sup>): 199.28  
 Moisture Content (%): 0.20  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.427  
 Unit Wet Weight (pcf): 151.4  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.422**  
**Unit Dry Weight (pcf): 151.1**

Total Load (lb): 41,150  
**Uniaxial Compressive Strength (psi): 13,470**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 144  
 Time to Break (min:sec): 4:46.66  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Pass*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.

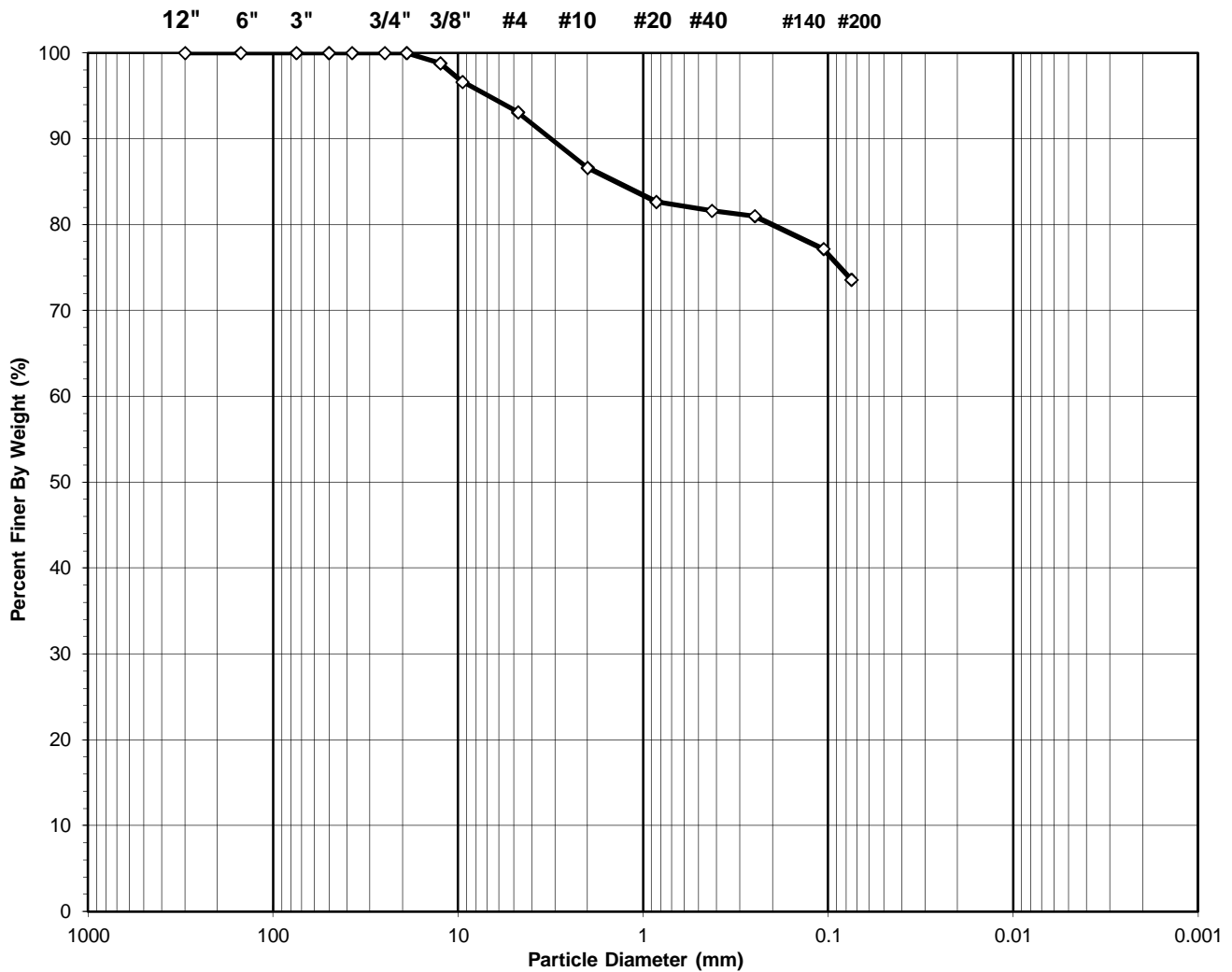


Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft):	3.5
Project No.:	2017-241-001	Sample No.:	B-2-2
Lab ID:	2017-241-001-013	Soil Color:	Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**LEAN CLAY WITH SAND**

Tested By HL Date 5/10/17 Checked By TMP Date 5/12/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.: B-2(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft): 3.5
Project No.:	2017-241-001	Sample No.: B-2-2
Lab ID:	2017-241-001-013	Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1489	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	476.85	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	421.10	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	146.65	Weight of Tare (g):	NA
Weight of Water (g):	55.75	Weight of Water (g):	NA
Weight of Dry Sample (g):	274.45	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>20.3</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	274.45
Dry Weight of - 3/4" Sample (g):	72.5	Weight of - #200 Material (g):	201.96
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	72.49
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	3.29	1.20	1.20	98.80	<b>98.80</b>
3/8"	9.50	5.95	2.17	3.37	96.63	<b>96.63</b>
#4	4.75	9.70	3.53	6.90	93.10	<b>93.10</b>
#10	2.00	17.79	6.48	13.38	86.62	<b>86.62</b>
#20	0.850	10.89	3.97	17.35	82.65	<b>82.65</b>
#40	0.425	2.79	1.02	18.37	81.63	<b>81.63</b>
#60	0.250	1.69	0.62	18.98	81.02	<b>81.02</b>
#140	0.106	10.50	3.83	22.81	77.19	<b>77.19</b>
#200	0.075	9.89	3.60	26.41	73.59	<b>73.59</b>
Pan	-	201.96	73.59	100.00	-	-

Tested By **HL**      Date **5/10/17**      Checked By **TMP**      Date **5/12/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-013

Boring No.: B-2(MP120.3)  
 Depth (ft): 3.5  
 Sample No.: B-2-2  
 Soil Description: BROWN LEAN CLAY

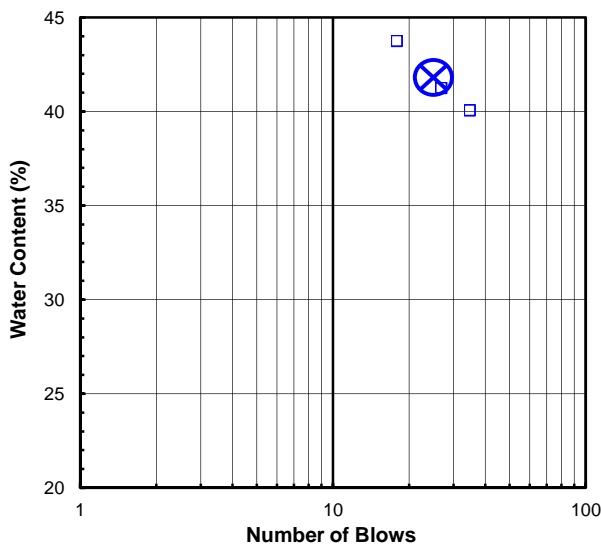
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	3204	17	150	191	U
Wt. of Tare & Wet Sample (g):	95.01	38.16	39.92	39.61	L
Wt. of Tare & Dry Sample (g):	80.78	32.33	34.04	32.91	T
Weight of Tare (g):	6.77	17.76	19.77	17.58	I
Weight of Water (g):	14.2	5.8	5.9	6.7	P
Weight of Dry Sample (g):	74.0	14.6	14.3	15.3	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>19.2</b>	<b>40.0</b>	<b>41.2</b>	<b>43.7</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>27</b>	<b>18</b>	<b>T</b>

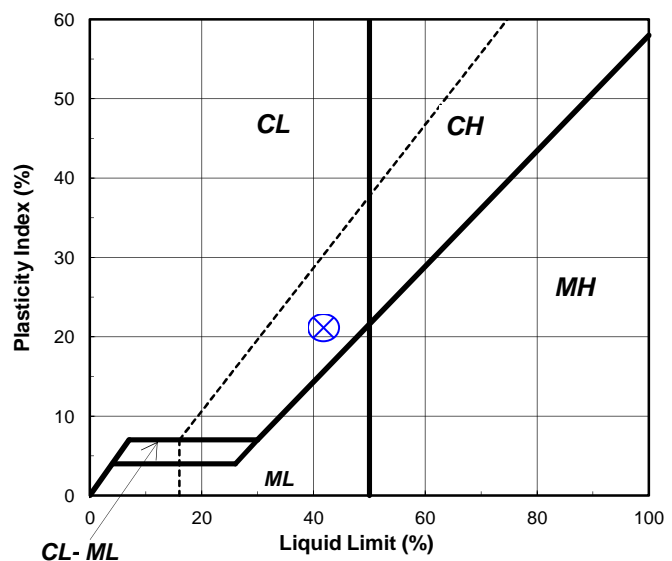
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	250	241		Liquid Limit (%):	42
Wt. of Tare & Wet Sample (g):	24.54	26.22		Plastic Limit (%):	21
Wt. of Tare & Dry Sample (g):	23.28	24.89		Plasticity Index (%):	21
Weight of Tare (g):	17.50	18.52		USCS Symbol:	CL
Weight of Water (g):	1.3	1.3			
Weight of Dry Sample (g):	5.8	6.4			
<b>Moisture Content (%):</b>	<b>21.8</b>	<b>20.9</b>	<b>0.9</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



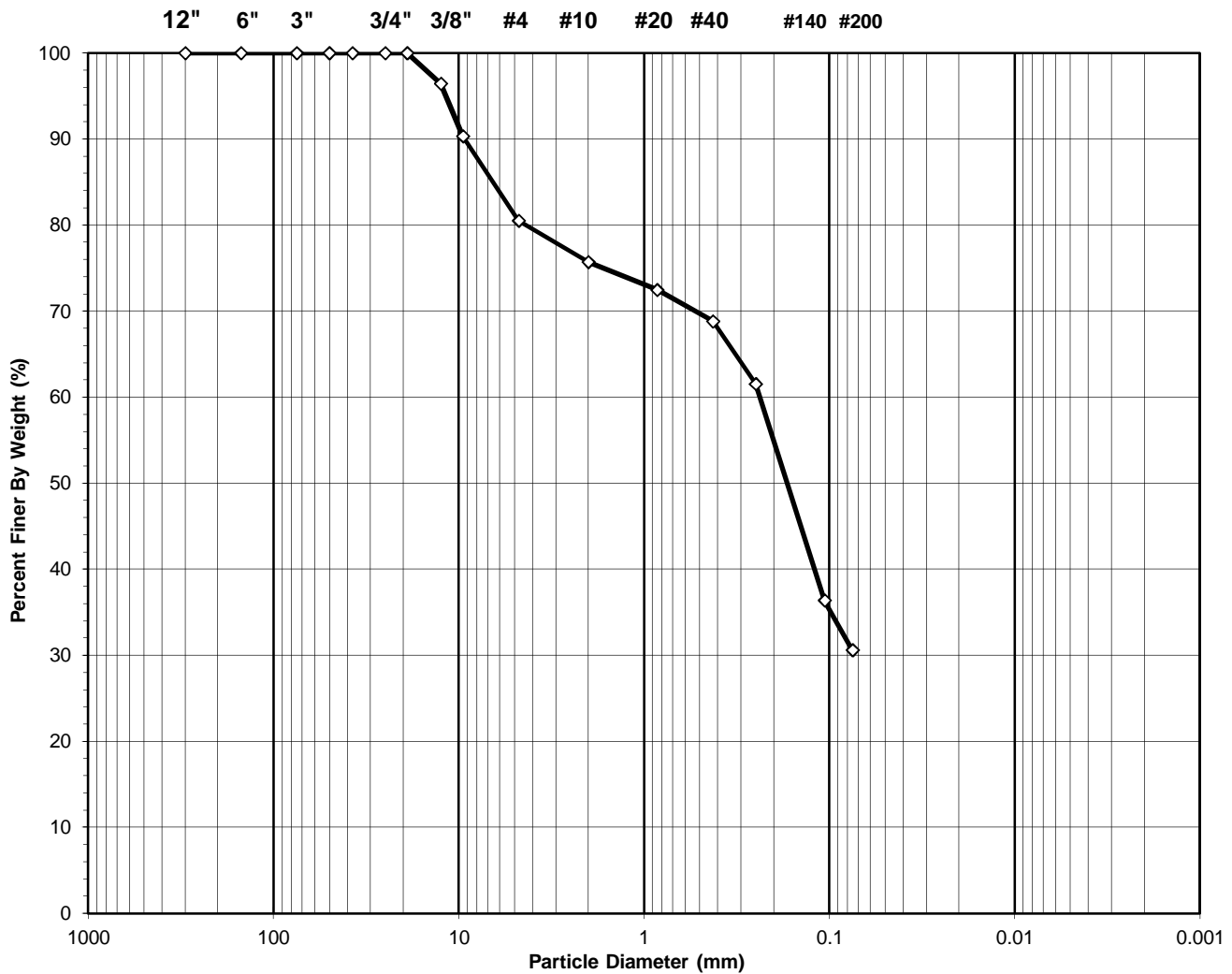
Tested By BS Date 5/11/17 Checked By TMP Date 5/12/17



**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft):	5.8
Project No.:	2017-241-001	Sample No.:	B-2-3
Lab ID:	2017-241-001-014	Soil Color:	Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**SM, TESTED**

**USCS Classification:**  
**SILTY SAND WITH GRAVEL**  
**(NON-PLASTIC FINES)**

Tested By HL Date 5/10/17 Checked By TMP Date 5/12/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.: B-(MP120.3)
Client Reference:	ACP TXG0007	Depth (ft): 5.8
Project No.:	2017-241-001	Sample No.: B-2-3
Lab ID:	2017-241-001-014	Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1513	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	471.98	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	445.52	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	148.54	Weight of Tare (g):	NA
Weight of Water (g):	26.46	Weight of Water (g):	NA
Weight of Dry Sample (g):	296.98	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>8.9</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	296.98
Dry Weight of - 3/4" Sample (g):	206.1	Weight of - #200 Material (g):	90.90
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	206.08
Dry Weight of + 3/4" Sample (g):	0.00		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.50	10.54	3.55	3.55	96.45	<b>96.45</b>
3/8"	9.50	18.16	6.11	9.66	90.34	<b>90.34</b>
#4	4.75	29.12	9.81	19.47	80.53	<b>80.53</b>
#10	2.00	14.26	4.80	24.27	75.73	<b>75.73</b>
#20	0.850	9.68	3.26	27.53	72.47	<b>72.47</b>
#40	0.425	10.82	3.64	31.17	68.83	<b>68.83</b>
#60	0.250	21.64	7.29	38.46	61.54	<b>61.54</b>
#140	0.106	74.70	25.15	63.61	36.39	<b>36.39</b>
#200	0.075	17.16	5.78	69.39	30.61	<b>30.61</b>
Pan	-	90.90	30.61	100.00	-	-

Tested By **HL**      Date **5/10/17**      Checked By **TMP**      Date **5/12/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
Client Reference: ACP TXG0007  
Project No.: 2017-241-001  
Lab ID: 2017-241-001-014

Boring No.: B-2(MP120.3)  
Depth (ft): 5.8  
Sample No.: B-2-3  
Color: Brown  
( Minus No. 40 sieve material)

### As Received Water Content

Tare Number	3241
Wt. of Tare & Wet Sample (g)	94.85
Wt. of Tare & Dry Sample (g)	87.15
Weight of Tare (g)	6.80
Weight of Water (g)	7.70
Weight of Dry Sample (g)	80.35

**Water Content (%)**                      **9.6**

# NON - PLASTIC MATERIAL

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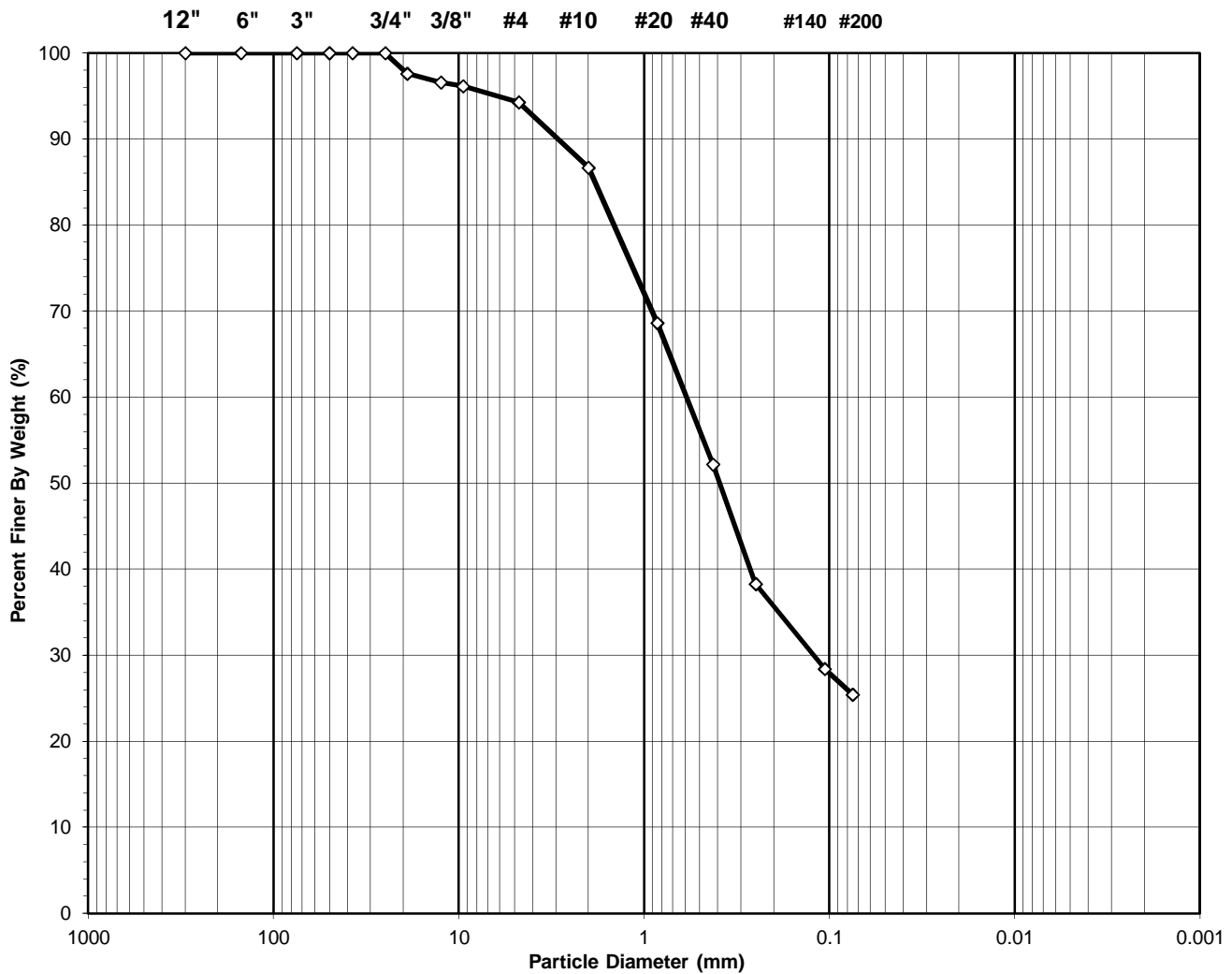
*Tested By*    *BS*            *Date*    *5/11/17*            *Checked By*            *TMP*            *Date*    *5/12/17*

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-015

Boring No.: B-2(MP120.3)  
 Depth (ft): 18.0  
 Sample No.: B-2-4  
 Soil Color: Brown

USCS	SIEVE ANALYSIS		HYDROMETER
	gravel	sand	silt and clay



**USCS Symbol:**  
**SC-SM, TESTED**

**USCS Classification:**  
**SILTY, CLAYEY SAND**

Tested By HL Date 5/10/17 Checked By TMP Date 5/17/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-015

Boring No.: B-2(MP120.3)  
 Depth (ft): 18.0  
 Sample No.: B-2-4  
 Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1424	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	602.53	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	514.12	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	145.81	Weight of Tare (g):	NA
Weight of Water (g):	88.41	Weight of Water (g):	NA
Weight of Dry Sample (g):	368.31	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>24.0</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	368.31
Dry Weight of - 3/4" Sample (g):	265.8	Weight of - #200 Material (g):	93.66
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	274.65
Dry Weight of + 3/4" Sample (g):	8.88		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	8.88	2.41	2.41	97.59	<b>97.59</b>
1/2"	12.50	3.65	0.99	3.40	96.60	<b>96.60</b>
3/8"	9.50	1.68	0.46	3.86	96.14	<b>96.14</b>
#4	4.75	6.88	1.87	5.73	94.27	<b>94.27</b>
#10	2.00	27.98	7.60	13.32	86.68	<b>86.68</b>
#20	0.850	66.49	18.05	31.38	68.62	<b>68.62</b>
#40	0.425	60.54	16.44	47.81	52.19	<b>52.19</b>
#60	0.250	51.21	13.90	61.72	38.28	<b>38.28</b>
#140	0.106	36.37	9.87	71.59	28.41	<b>28.41</b>
#200	0.075	10.97	2.98	74.57	25.43	<b>25.43</b>
Pan	-	93.66	25.43	100.00	-	-

Tested By HL Date 5/10/17 Checked By TMP Date 5/17/17

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID: 2017-241-001-015

Boring No.: B-2(MP120.3)  
 Depth (ft): 18.0  
 Sample No.: B-2-4  
 Soil Description: BROWN SILTY CLAY

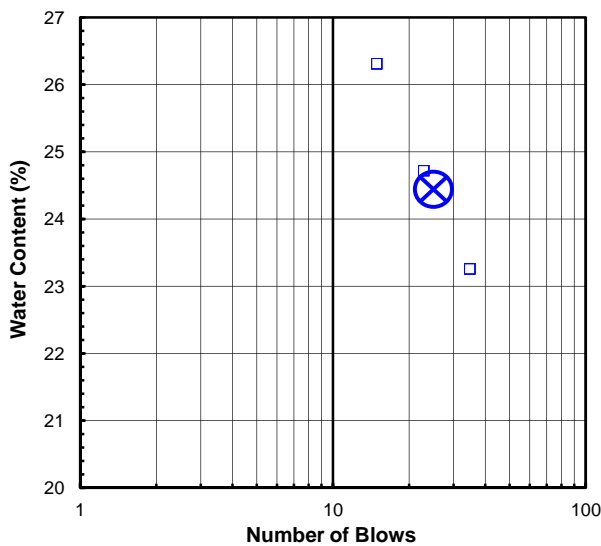
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	3216	207	1101	438	U
Wt. of Tare & Wet Sample (g):	130.72	38.76	38.34	37.37	L
Wt. of Tare & Dry Sample (g):	107.51	34.51	34.35	33.56	T
Weight of Tare (g):	6.76	18.35	18.20	17.17	I
Weight of Water (g):	23.2	4.3	4.0	3.8	P
Weight of Dry Sample (g):	100.8	16.2	16.2	16.4	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>23.0</b>	<b>26.3</b>	<b>24.7</b>	<b>23.2</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>23</b>	<b>35</b>	<b>T</b>

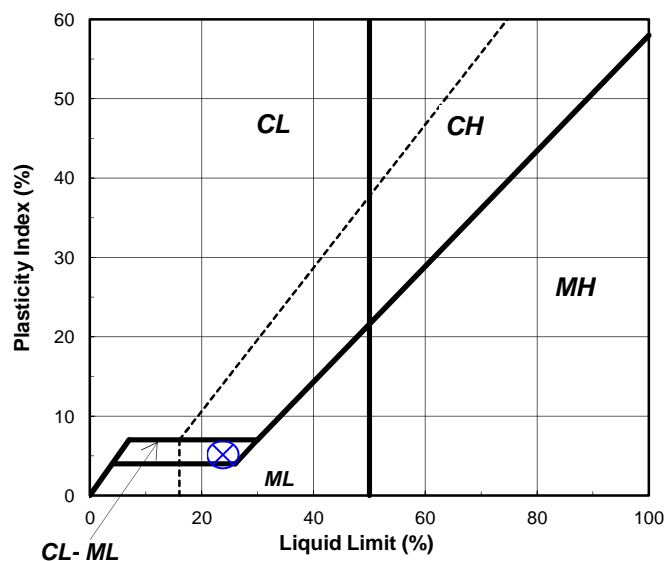
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	175	135		<b>Liquid Limit (%):</b>	<b>24</b>
Wt. of Tare & Wet Sample (g):	26.15	25.49		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	25.13	24.52		<b>Plasticity Index (%):</b>	<b>5</b>
Weight of Tare (g):	19.67	19.40		<b>USCS Symbol:</b>	<b>CL-ML</b>
Weight of Water (g):	1.0	1.0			
Weight of Dry Sample (g):	5.5	5.1			
<b>Moisture Content (%):</b>	<b>18.7</b>	<b>18.9</b>	<b>-0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By RAL Date 5/15/17 Checked By TMP Date 5/16/17



## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-001  
 Lab ID No.: 2017-241-001-017

Boring No.: B-2 (MP120.3)  
 Depth (ft): 33.3-33.6  
 Sample ID: R-5  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 398.78**

SPECIMEN LENGTH (in)

Reading 1: 3.47  
 Reading 2: 3.47  
 Reading 3: 3.47  
**Average: 3.47**

SPECIMEN DIAMETER (in):

Reading 1: 1.84  
 Reading 2: 1.84  
 Average: **1.84**  
 Area (in<sup>2</sup>): 2.66  
 L/D: 1.88

MOISTURE CONTENT

Tare Number: 2661  
 Wt. of Tare & Wet Sample (g): 405.44  
 Wt. of Tare & Dry Sample (g): 395.38  
 Weight of Tare (g): 6.90  
 Weight of Wet Sample (g): 398.54  
 Sample Volume (cm<sup>3</sup>): 151.25  
 Moisture Content (%): 2.59  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.637  
 Unit Wet Weight (pcf): 164.5  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.570**  
**Unit Dry Weight (pcf): 160.4**

Total Load (lb): 9,620  
**Uniaxial Compressive Strength (psi): 3,610**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 70  
 Time to Break (min:sec): 2:17.31  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Pass*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.
- 6) Sample short of L/D parameters.



Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17

30 May 2017  
TXG0007-012-6303

**VIA EMAIL**

Colin Olness, Contractor  
Atlantic Coast Pipeline  
99 Edmiston Way  
Buckhannon, WV 26201

**Subject: Geotechnical Investigation at Potential Slope Instability Site  
George Washington National Forest (GWNF)  
Atlantic Coast Pipeline (ACP) Project  
Route Revision 11B, Segment AP-1, MP 123.1  
Augusta County, Virginia**

Dear Mr. Olness:

This data summary report has been prepared by Geosyntec Consultants, Inc. (Geosyntec) for Dominion Transmission, Inc. (DTI) to present the geotechnical drilling investigation performed at a geohazard site located within the George Washington National Forest (GWNF) at Milepost (MP 123.1) along Segment AP-1 of the Atlantic Coast Pipeline (ACP) Route Revision 11B (Project; Figure 1). The objective of this geotechnical drilling investigation was to characterize the subsurface conditions at the site and confirm or preclude suspected slope instability identified as part of our Phase 2 investigation [Geosyntec, 2016a]<sup>1</sup>, so that if required, measures may be designed to mitigate the effects of potential ground movement on the pipeline. This geotechnical investigation was performed in accordance with requirements of the United States Forest Service (USFS) Special Use Permit (authorization I.D. No. GWP433202T), dated 11 April 2016 and the completed work plan [Geosyntec, 2016b]<sup>2</sup>. This report summarizes activities completed in the

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<sup>1</sup> Geosyntec Consultants, 2016a. "Geohazard Analysis Program Phase 2 Report, Atlantic Coast Pipeline and Supply Header Project", submitted to Dominion Transmission, Inc., dated 29 July 2016.

<sup>2</sup> Geosyntec Consultants, 2016b. "Work Plan for Geotechnical Investigations at Potential Slope Instability Sites, George Washington National Forest (GWNF), Atlantic Coast Pipeline Project, Route Revision 11a Segment AP-1 MP 120.3 and MP 123.1, Highland County, Virginia", submitted to Dominion Transmission, Inc., dated 26 September 2016.

field, a description of the geologic conditions observed at the site, and provides the results of the geotechnical laboratory testing program.

## **GEOTECHNICAL INVESTIGATION**

This geotechnical drilling investigation included a site reconnaissance, access road improvements, geotechnical borings, instrumentation installation and monitoring, and geotechnical laboratory testing.

### **Site Reconnaissance**

Our field reconnaissance performed on 25 August 2016 consisted of a site visit by a Principal Engineering Geologist from Geosyntec, two representatives from Horn and Associates (drilling subcontractor), and two representatives from the ACP to evaluate existing site conditions and access to the identified geohazard site location. The objective of the field reconnaissance was to familiarize the drilling contractor with the site conditions, identify potential access routes, evaluate the number and type of exploratory borings needed to adequately characterize the site, and select locations for the exploratory borings in the field.

### **Health and Safety**

Prior to conducting our field investigation, Geosyntec updated our existing site-specific Health and Safety Plan (HASP) in accordance with Occupational Safety & Health Administration (OSHA) requirements. The updated HASP addressed potential hazards at the two site locations, including requirements for worker protection based on the anticipated activities. Additionally, the HASP also included directions to nearest emergency medical facility. Prior to commencing work at the site, Geosyntec also delineated the locations of the individual explorations and notified Underground Service Alert (USA, Dig-Alert) to identify the locations of any existing underground utilities within the immediate vicinity.

### **Site Access and Improvements**

Drilling locations at GWNF MP 123.1 were accessed using existing USFS roads and both active and abandoned logging roads. Due to the remote locations of the investigation site, minor grading and road restoration activities were performed where no previous access existed. Road restoration and grading work was performed by Horn and Associates utilizing a John Deere 85D tracked excavator. Work consisted of trimming secondary vegetation growth, smoothing the ground surface, and localized widening and leveling where cross-slope conditions would not permit safe passage of a light weighted track mounted drill rig. Drilling locations and temporary access routes at GWNF MP 123.1 were selected to minimize grading and to minimize removal of timber greater than 4-inch diameter-breast-height (DBH), to the extent practical.

Where ground disturbance was required, erosion and sediment control Best Management Practices (BMPs) were implemented to minimize the potential for erosion and/or sediment transport to adjacent areas outside the limits of disturbance. BMPs consisted of 8-inch silt socks installed along the edge of the graded access roads and the drilling investigation pads. Upon completion of drilling activities, excess cuttings from the borings were thinly spread within the limits of disturbance and the ground surface was re-contoured to match that of pre-existing conditions to the extent feasible. Locally sourced straw and an approved seed mix specified by the USFS were hand broadcasted along the surface of graded areas to help reduce erosion and sediment transport and promote vegetative growth. Silt socks were slit and spread at the surface.

Following completion of drilling activities at MP 123.1 and equipment demobilization, the pre-existing dirt berm barrier (tank trap) located at the start of the recently constructed logging road was reinstalled and restored. Restoration activities included casting of approved seed mix and covered by straw. Restoration activities were also completed at select areas along the USFS road and active/abandoned logging roads where wet road conditions resulting in tire rutting. A photographic log documenting completed road improvement and site restoration activities is provided in Appendix A.

### Subsurface Explorations

This geotechnical investigation included drilling two exploratory borings at the GWNF MP 123.1 geohazard site location along the northwestern facing slope (designated Borings B-1 and B-2; Figure 1). Borings were drilled between 30.0 and 53.7 feet below ground surface (ft bgs). Table 1 presents the coordinates, elevation and termination depths of Borings B-1 and B-2.

**Table 1:** Coordinates of Boring Locations

Boring ID	Coordinates – UTM, Zone 17S, NAD83				Ground Surface Elev. WGS84 (MSL-ft)	Final Depth (ft)
	Proposed		As-Built			
	Latitude	Longitude	Latitude	Longitude		
B-1 (MP 123.1)	38.28891103	-79.18890255	38.28885	-79.18895	2,023	30.0
B-2 (MP 123.1)	38.28914881	-79.18969272	38.28911	-79.18964	1,966	53.7

The borings were advanced by Horn and Associates of Winchester, Kentucky utilizing a light-weight rubber track mounted Diedrich D-50 drill rig. Borings were drilled using a combination of 8-inch hollow-stem auger (HSA) and core drilling (NX) methods. During HSA drilling, drive samples were collected at approximately 30-inch intervals using a 2.5-inch diameter, 24-inch

long Standard Penetration Test (SPT) sampler to facilitate lithologic logging and sample collection for geotechnical laboratory testing. SPT sampling was performed through the entire overburden material profile and into underlying bedrock, to the extent practical.

Following auger or SPT refusal, or upon encountering competent formation (bedrock) material, the investigations switched to core drilling methods until the borehole was advanced approximately 15 feet into bedrock. The core drilling process required circulation of water mixed with a naturally occurring bentonite based drilling fluid additive to regulate the temperature of the core bit, to carry cuttings to the surface, and to promote borehole stability. During the coring process, drilling fluid was pumped through the drill rods and past the bit before returning to the surface with cuttings through the annular space between the drill rods and the wall of the boring. At the surface, the fluid and cuttings were discharged into a baffled sump tank to allow the cuttings to fall out prior to recirculating the drilling fluid back down the borehole. Water required for this process was purchased from the City of Staunton, Virginia and hauled to the drilling sites and stored in 1,000 gallon tanks staged at the drilling locations.

The soil sample descriptions were logged by a Geosyntec Geologist in accordance with ASTM D2488. Additionally, recovered cores were logged to record structural orientation and discontinuities. Upon completion of logging, the cores were photographed (Appendix B) and retained in core boxes for subsequent sample selection and/or archiving. Table 2 summarizes the length of each boring, depth to top of bedrock, and the length of rock coring.

**Table 2:** Soil Thickness, Length of Rock Coring and Boring Penetration Depths

<b>Boring ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to top of Weathered Bedrock (ft)</b>	<b>Depth to top of Bedrock (ft)</b>	<b>Length of Rock Coring (ft)</b>
B-1 (MP 123.1)	30.0	12.0	15.0	15.0
B-2 (MP 123.1)	53.7	17.0	38.7	15.0

### **Geotechnical Instrumentation**

Following completion of the core drilling and evaluation of the subsurface conditions, boreholes were selected for instrumentation consisting of either a standpipe piezometer to monitor groundwater levels, or an inclinometer to record potential slope movement over time.

#### **Piezometer**

One temporary standpipe piezometer was installed in exploratory Boring B-2 at the GWNF MP 123.1 investigation site. The piezometer consisted of a 2-inch diameter PVC pipe, installed after

drilling and prior to auger withdrawal, with a 10 ft section of 0.010-inch slotted screen (screened interval) placed at the overburden material and bedrock interface. The annular space around the screened interval was backfilled with a permeable filter pack generally consisting of coarse-grained sand. A 2-foot bentonite seal was placed at the top of the filter pack, and the remainder of the annular space was backfilled with bentonite-cement grout to prevent conveyance of surface water into the ground. Standpipe piezometer construction logs for the piezometer installed at Boring B-2 are provided in Appendix C and summarized in Table 3a.

Depth to groundwater within the Boring B-2 temporary standpipe piezometer was measured at 13.6 ft bgs on 2 April 2017 approximately 96 hours after drilling. A subsequent groundwater level survey was performed on 20 April 2017 and depth to groundwater was recorded at 12.78 ft bgs. This subsequent measurement is considered to represent relatively stabilized levels, however, the subsurface materials at the site generally exhibits a relatively high percentage of silt and clay sized materials, which reduce permeability. It is possible that the observed groundwater levels in the temporary piezometers may not represent fully stabilized groundwater conditions due to the time rate of travel of groundwater through these materials. A summary of the standpipe piezometer data is provided below in Table 3a and presented graphically in Figure 2.

**Table 3a: Standpipe Piezometer Construction**

<b>Piezometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth to top of Bedrock (ft)</b>	<b>Depth to Groundwater<sup>1</sup> (ft bgs)</b>	<b>Depth to Top of Screen (ft)</b>	<b>Screen Length (ft)</b>	<b>Depth to Bentonite Seal (ft)</b>
B-2 (MP 123.1)	53.7	38.7	12.78	33.7	10	4.0

**Notes:**

1 - Depth to groundwater measured on 20 April 2017.

The surface completion for the piezometer included a locked surface monument to provide access for periodic groundwater level measurements, as well as to be used as a benchmark for subsequent level surveys. The temporary standpipe piezometer is anticipated to be monitored through pipeline construction, if deemed necessary. Upon completion of monitoring, the PVC piezometer should be cutoff below the ground surface and backfilled with bentonite-cement grout.

**Inclinometer**

One inclinometer was installed in exploratory Boring B-1 at the GWNF MP 123.1 geohazard site to monitor the absence or the presence of progressive slope movement that may be imperceptible



to the eye. Inclinometer casing consisted of 2.75-inch diameter acrylonitrile butadiene styrene (ABS) plastic. The bottom of the inclinometer casing was installed at 30.0 ft bgs. The annular space between the wall of the boring and the inclinometer casing was backfilled with a lean cement grout mixture from the bottom up using a tremmie pipe. Construction logs for the inclinometer installed at GWNF MP 123.1 are provided in Appendix C and summarized in Table 3b.

Following instrumentation installation, an initial baseline survey (i.e., zero reading) was performed on 20 April 2017. The grouted-in inclinometer was allowed 21 days to set prior to conducting the baseline reading. A summary of the inclinometer survey data is described below in Table 3b and presented in graphically in Figure 3.

**Table 3b:** Installation Depth of Inclinometer

<b>Inclinometer ID</b>	<b>Boring Depth (ft)</b>	<b>Depth of Inclinometer Casing (ft)</b>	<b>Depth to Top of Bedrock (ft)</b>	<b>Length of Stickup above Ground Surface (ft)</b>
B-1 (GWMF MP 123.1)	30.0	30.0	15.0	3.8

The surface completion for the inclinometer included a locked surface monument to provide access for periodic monitoring as well as to be used as a benchmark for subsequent level surveys. The inclinometer is expected to be monitored through construction if deemed necessary. Upon completion of monitoring, the inclinometer casing will be cut off below the ground surface and will be backfilled with bentonite-cement grout.

## **SITE CONDITIONS**

Knowledge of the site conditions was developed from a review of regional geologic conditions and our findings from explorations performed for this investigation.

### **Geologic Setting**

The GWNF MP 123.1 geohazard site lies within the central Valley and Ridge physiographic province of northwestern Virginia. The Valley and Ridge province is characterized by linear northeast-southwest trending ridges and valleys resulting from differential erosion of Paleozoic continental shelf and platform strata that has been deformed into a series of elongate macroscale folds and imbricate southeast-dipping thrust faults. Deformation disrupts strata as young as Late Carboniferous, and is the product of the Carboniferous-Permian Alleghanian orogeny, which was the result of the collision between Africa and North America during the formation of the supercontinent Pangea.

## **Surface Conditions**

The GWNF MP 123.1 site is located approximately 2.3 miles east of Stover Shop Road (Route 728) and was accessed along an existing USFS logging road along the proposed AP-1 Segment, where the alignment extends up a steep northwestern facing slope towards Little North Mountain. The surface morphology along the proposed alignment is characterized by moderate to steep sloping terrain (30% to 58% inclination) with hummocky unconsolidated materials and moderate tree growth distortion observed at the surface. Hummocky topography observed at the site consisted of an assemblage of irregular mounds of limestone talus derived from a resistant cliff band upslope of the site, and colluvial hollows that were rounded or irregular in cross-profile. The natural hillsides along the proposed alignment are covered by moderate growth of low lying grasses, shrubs, and deciduous woodlands. Additionally, several below ground utility lines were identified along Hanky Mountain Highway (Highway 250), but do not traverse the geotechnical investigation site area.

The elevation at Boring B-2 is approximately 1,966 feet above mean sea level (ft msl) sloping upwards towards the southeast along the proposed pipeline alignment. The elevation at Boring B-1 is approximately 2,023 ft msl, also sloping upwards towards Little North Mountain at MP 123.2 (southeast). The maximum elevation of Little North Mountain along the proposed alignment is approximately 2,345 ft msl. The latitude and longitude of the GWNF MP 123.1 borings were acquired during the drilling investigation using a hand-held global positioning (GPS) device. Boring elevations were obtained by plotting those coordinates on a topographical map for the areas.

## **Subsurface Conditions**

The subsurface conditions at MP 123.1 consist of surficial colluvium/talus and landslide deposits generally comprised of yellowish brown-to-brown, lean clay and silt with sporadic limestone and sandstone gravels, cobbles, and boulders overlying bedrock of the Devonian to Silurian-age Formations (undivided). Thickness of the colluvium/talus and landslide deposits observed in the borings at the GWNF MP 123.1 site ranged from 12.0 ft (Boring B-1) and 17.0 ft (Boring B-2), increasing in thickness downslope. The identified colluvium/talus and landslide deposits were characterized by the surficial hummocks and boulders observed in each of the two borings indicating evidence of a potential historical slope failure and episodic debris flows.

Bedrock of the Devonian to Silurian-age Formations (undivided) observed in the borings at GWNF MP 123.1 consist of dark gray-to-gray and black shale. Recovered rock cores were generally massively bedded and closely fractured (30° to 70° fracture angles). Recovered cores were also variably weathered consisting of iron oxidation infilling along the fracture planes. A generalized geologic cross section along the slope profile is presented in Figure 1. Due to the high angle bedding at this location and localized fracture frequency, several sections of the

recovered cores exhibited abnormally high fracture intensity as a result of the coring process and the rock quality designation (RQD) could not be accurately determined. Where the RQD could be determined in less fractured material, the RQD was generally poor to good ranging from 71% to 88% (B-1) and 28% to 43% (B-2). Detailed logs of the two borings advanced at the GWNF MP 123.1 site, as well as a key sheet, are presented in Appendix D.

On 1 December 2016, Draper Aden Associates (Draper) conducted a seismic refraction study<sup>3</sup> at the GWNF MP 123.1 investigation site (Appendix E). The objective of the survey was to determine depth to bedrock at soil test pits excavated during the completion of an Order 1 Soil Survey where bedrock was not encountered within the protocol depth of 50-inches below ground surface. Data from the seismic refraction profile conducted at the GWNF MP 123.1 investigation site (test pit ID GWNF-R012-161201) suggest depth to weathered bedrock and bedrock is at 8.3 ft bgs and 8.1 ft bgs, respectively. The shallower depths to weathered bedrock and bedrock suggested by the seismic refraction study likely represent the talus material shed from the adjacent ridge and is generally consistent with the conditions encountered during this geotechnical drilling investigation. The approximate location of the three seismic refraction surveys performed near the GWNF MP 123.1 investigation site is presented on Figure 1.

Subsurface conditions observed in the borings at the GWNF MP 123.1 geohazard site along with the surface morphology features (i.e., moderate to steep sloping terrain, tree growth distortion, and surficial hummocks) suggest the site experienced previous slope failure and subsequent episodic slope instability within the colluvial/talus deposits and highly weathered bedrock material. However, no evidence of recent active failure such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation.

## **LABORATORY TESTING**

### **Geotechnical Laboratory Testing Program**

Geosyntec contracted Geotechnics, Inc. (Geotechnics) of East Pittsburgh, Pennsylvania to conduct laboratory testing assigned by Geosyntec on selected soil samples and rock cores to evaluate the pertinent geotechnical index properties. The laboratory testing program, on soil samples, was primarily focused on soil classification and index testing. Testing on select rock cores was focused compressive strength. The laboratory testing program consisted of:

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<sup>3</sup> Draper Arden Associates, 2017. “Atlantic Coast Pipeline – Seismic Refraction Study, George Washington National Forest and Monongahela Nation Forest, Virginia and West Virginia”, submitted to Geosyntec Consultants dated 10 March 2017.

#### Soil Samples

- Water content tests per ASTM D2216;
- Atterberg limit tests per ASTM D4318;
- Sieve analysis tests per ASTM D422; and
- Hydrometer tests per ASTM D422.

#### Rock Cores

- Unconfined compressive strength test per ASTM D7012-Method C.

Table 4 summarizes the number and types of laboratory testing conducted on soil and rock samples from the GWNF MP 123.1 geohazard site.

**Table 4:** Number and Types of Laboratory Tests

Types of Laboratory Tests	Number of Tests	
	B-1 (MP 123.1)	B-2 (MP 123.1)
Water Content	6	12
Atterberg Limits	1	5
Sieve Analysis	2	4
Hydrometer Test	0	2
Rock Unconfined Compressive Strength	2	2

#### Laboratory Test Results

The laboratory test results are also plotted in the corresponding boring logs (Appendix D), and the individual test results are presented in detail in Appendix E.

#### Soil Testing

Given the granular nature of the soils from GWNF MP 123.1, select samples were tested for grain-size distribution to quantify gravels, sands and fines. The results show that the soils consist of poorly graded gravel with silt and sand (GP-GM) and clayey sand with gravel (SC), and fines downward consisting of silt with sand (ML) and sandy lean clay (CL) with gravel.

The laboratory soil testing performed for the GWNF MP 123.1 borings included water content and Atterberg limits measured on selected lean clay and silt samples and grain-size analysis to quantify the percentages of gravel, sand and fines, particularly on samples containing coarser

grained material. Table 5 presents a summary of the laboratory test results conducted on soil samples.

**Table 5: Summary of Laboratory Test Results on Soil Samples**

<b>Boring ID</b>	<b>Sample ID</b>	<b>Depth (ft)</b>	<b>Water Content (%)</b>	<b>Percent of Gravel (1) (%)</b>	<b>Percent of Fines (2) (%)</b>	<b>Liquid Limit (%)</b>	<b>Plastic Limit (%)</b>	<b>Plasticity Index (%)</b>
B-1	B-1-1	0.4	7.3	-	-	-	-	-
B-1	B-1-2	2.9	6.5	63.1	10.14	-	-	-
B-1	B-1-3	5.6	8.6	-	-	-	-	-
B-1	B-1-4	8.2	28.0	-	-	-	-	-
B-1	B-1-5	11.2	28.7	10.3	77.8	35	26	9
B-1	B-1-6	14.0	30.1	-	-	-	-	-
B-2	B-2-1	1.0	18.3	-	-	-	-	-
B-2	B-2-2	3.0	12.0	-	-	-	-	-
B-2	B-2-3	5.5	12.8	-	-	-	-	-
B-2	B-2-4	8.2	9.6	26.9	39.0	29	18	11
B-2	B-2-5	10.8	12.4	15.0	57.8	28	19	9
B-2	B-2-6	13.1	7.4	-	-	-	-	-
B-2	B-2-7	16.0	8.4	-	-	-	-	-
B-2	B-2-8	22.0	20.2	-	-	35	19	16
B-2	B-2-9	23.8	10.8	-	-	-	-	-
B-2	B-2-10	27.5	19.1	4.8	66.4	37	21	16
B-2	B-2-11	31.8	16.8	12.4	45.9	37	20	17
B-2	B-2-12	34.3	18.5	-	-	-	-	-

**Notes:**

- 1 - Retained #4 sieve.
- 2 - Passing #200 sieve.
- “-“ Not analyzed

**Rock Core Testing**

A summary of laboratory test results conducted on rock samples is presented in Table 6.

**Table 6:** Summary of Laboratory Test Results on Rock Samples

<b>Boring ID</b>	<b>Core ID</b>	<b>Sample Interval (ft)</b>	<b>Unit Weight (pcf)</b>	<b>Uniaxial Compres. Strength (psi)</b>
B-1	R-1	15.7-16.5	160.6	4,320
B-1	R-3	25.3-26.0	161.6	5,890
B-2	R-1	41.6-42.2	145.8	620
B-2	R-3	49.2-50.0	148.4	940

### Summary of Laboratory Testing

The geotechnical laboratory test results indicate that water content of colluvial/talus deposits varied between 6.5% to 30.1% (Boring B-1) and 7.4% to 20.2% (Boring B-2), and showed a decreasing trend with depth. The Atterberg test results show that the colluvial/talus deposits contain a plasticity index (PI) of 9 to 17 and the soil unit is mainly within the low plasticity clay zone (i.e., CL). The PI is generally constant with depth within the low plasticity clay soil unit.

The unconfined compressive strength of the recovered rock cores ranged from 4,320 to 5,890 pounds per square inch (psi) in cores from Boring B-1, and 620 to 940 psi in cores from Boring B-2.

### SUMMARY OF FINDINGS

Surficial morphologic features observed during our Phase 2 reconnaissance along with subsurface conditions recorded during the geotechnical drilling investigation at the GWNF AP-1 MP 123.1 geohazard site suggest the site has experienced previous shallow seated slope movement in the form of episodic colluvial and talus debris migration downslope along the proposed ACP alignment. The approximate limit of mapped instability is presented in Figure 1. Although no evidence of recent or active slope movement such as ground cracks, recent scarps, or exposed earth was observed at the time of our investigation, data collected during subsequent inclinometer monitoring events will be used to supplement and inform site-specific engineering evaluations, and recommendations for mitigation measures should future potential instability be identified. An addendum to this data summary report will be issued as subsequent monitoring data is collected.

As a consequence of these findings, and a subsequent engineering analysis of slope stability, reported separately, a site-specific geotechnical hazard mitigation design has been developed for this slope which incorporates:



- restrictions on material stockpiling during construction grading;
- targeted drainage measures along the trench;
- use of deformable backfill around the installed pipeline; and,
- recommendations for post construction monitoring.

## CLOSING

Geosyntec appreciates the opportunity to provide Dominion Transmission, Inc. with this data summary report, and we look forward to working together on this important project. If you have any questions or require additional information, please contact Logan Brant ([lbrant@geosyntec.com](mailto:lbrant@geosyntec.com), 281.810.5056) or Jared Warner ([jwarner@geosyntec.com](mailto:jwarner@geosyntec.com), 858.716.2885)

Sincerely,

Geosyntec Consultants,



Logan Brant, Ph.D., P.E. (VA)  
Senior Geotechnical Engineer



Jared Warner, P.G.  
Project Geologist

## Attachments:

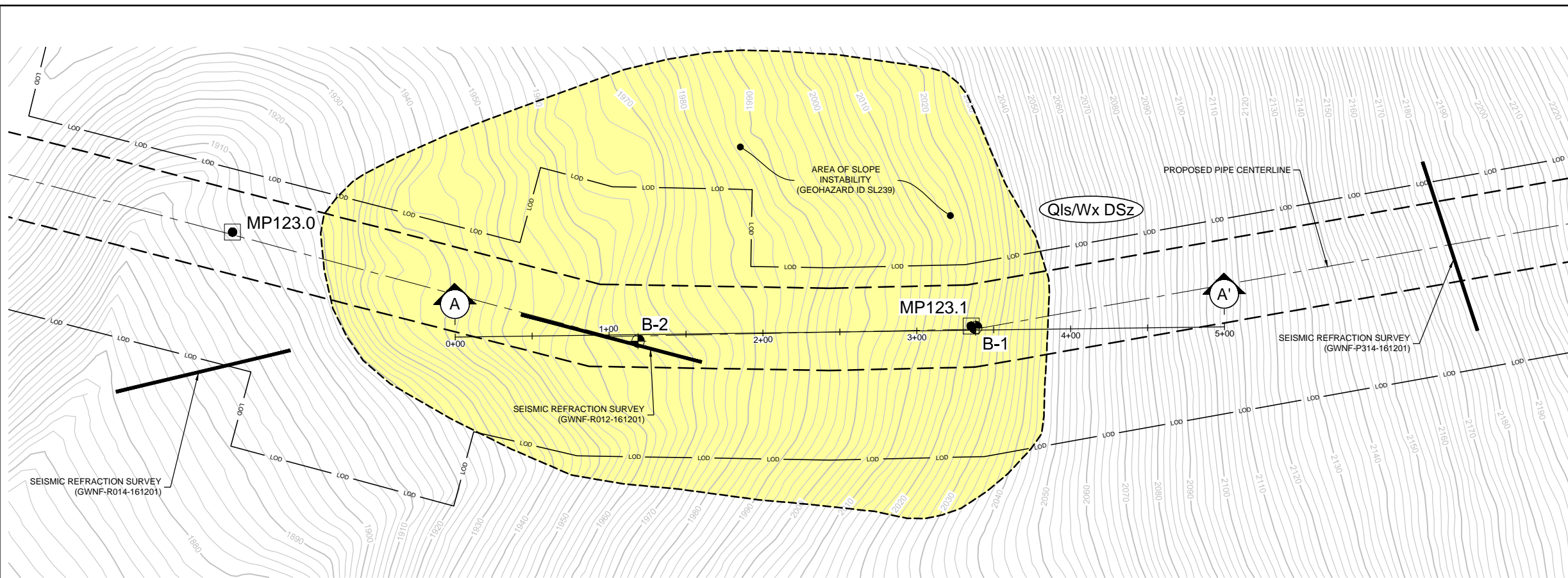
### Figures

- Figure 1 – Site Plan and Generalized Geologic Profile
- Figure 2 – Piezometer Survey Data
- Figure 3 – Inclinator Survey Data

### Appendices

- Appendix A – Photographic Log
- Appendix B – Core Photographs
- Appendix C – Piezometer and Inclinator Construction Logs
- Appendix D – Logs of Borings B-1 and B-2
- Appendix E – Laboratory Test Results

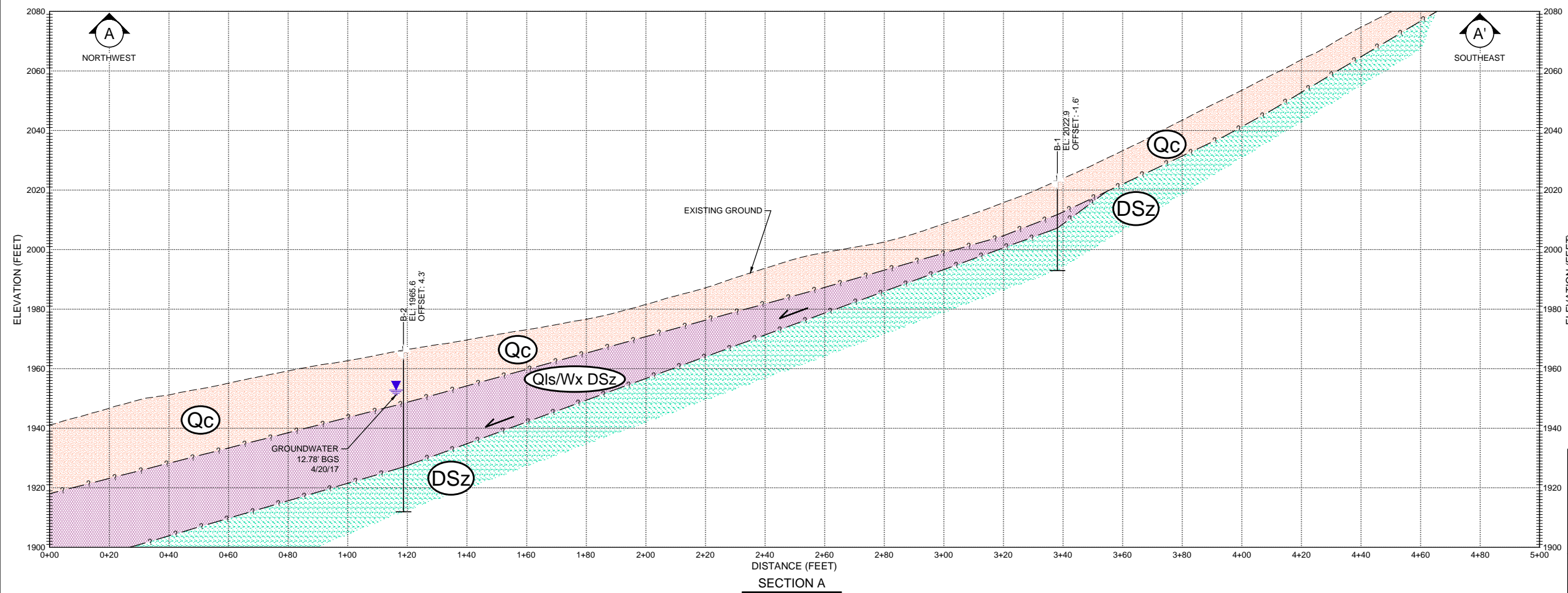
# **FIGURES**



**LEGEND**

- 2180 EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
- 2182 EXISTING GROUND ELEVATION CONTOUR (FT, MSL)
- L00 LIMIT OF DISTURBANCE
- PERMANENT (ROW)
- PROPOSED PIPE CENTERLINE
- MP123.1 MILEPOST
- BORING LOCATION (GEOSYNTEC, 2017)
- LITHOLOGIC CONTACT
- AREA OF SLOPE INSTABILITY (GEOHAZARD ID SL239)
- SEISMIC REFRACTION SURVEY (DRAPER, 2016)

- NOTES:**
- MAPPING AND TOPOGRAPHY BASED ON UTM COORDINATE SYSTEM WITH NAD83 DATUM, ZONE 17, US SURVEY FOOT, CENTRAL MERIDIAN 81 W.
  - LIDAR ELEVATION DATA AND TOPOGRAPHIC FEATURES COLLECTED IN 2016 AND PROVIDED BY GAI AS 2-FOOT CONTOURS.
  - STREAM AND WETLAND DATA PROVIDED BY NRG/ERM.



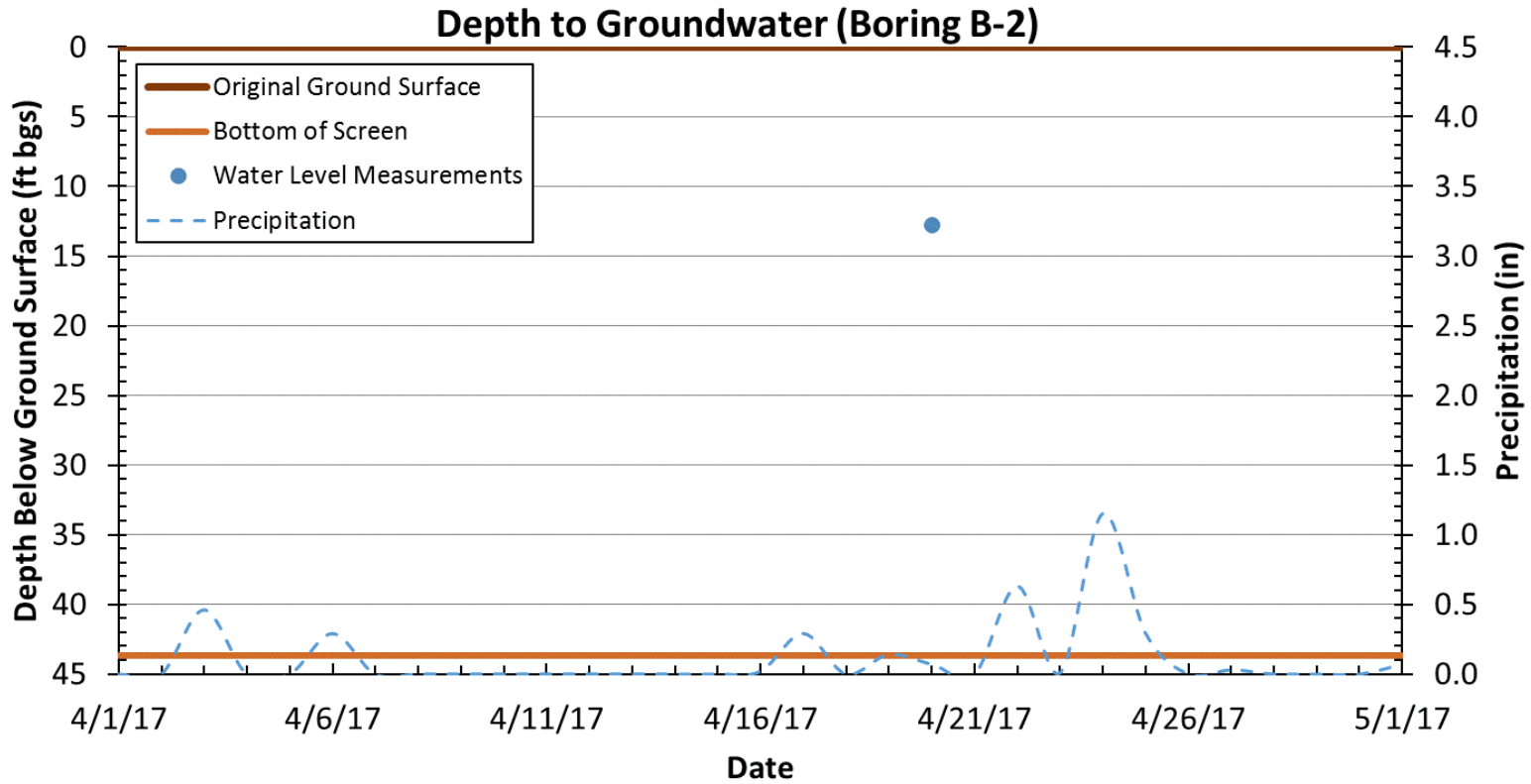
**GEOLOGIC PROFILE LEGEND**

- EXISTING GROUND SURFACE
- LITHOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
- Qc COLLUVIUM / TALUS DEPOSITS
- DSz LOWER DEVONIAN AND SILURIAN FORMATIONS (UNDIVIDED), SHALE AND SILTSTONE
- Qls/Wx DSz HIGHLY WEATHERED SHALE AND SILTSTONE / POTENTIAL OLD LANDSLIDE DEPOSITS
- WATER LEVEL 4/20/17
- APPROXIMATE DIRECTION OF EPISODE CREEP IN COLLUVIAL DEPOSITS

**SITE PLAN AND GENERALIZED GEOLOGIC PROFILE  
ACP GWNF MP 123.1**



F:\GDD\PROJECTS\ATLANTIC COAST PIPELINE\GEOHAZARD ANALYSIS\GEOHAZARD SERVICE SITE DESIGN\FIG0007\FIGURES\FIG0007\_104



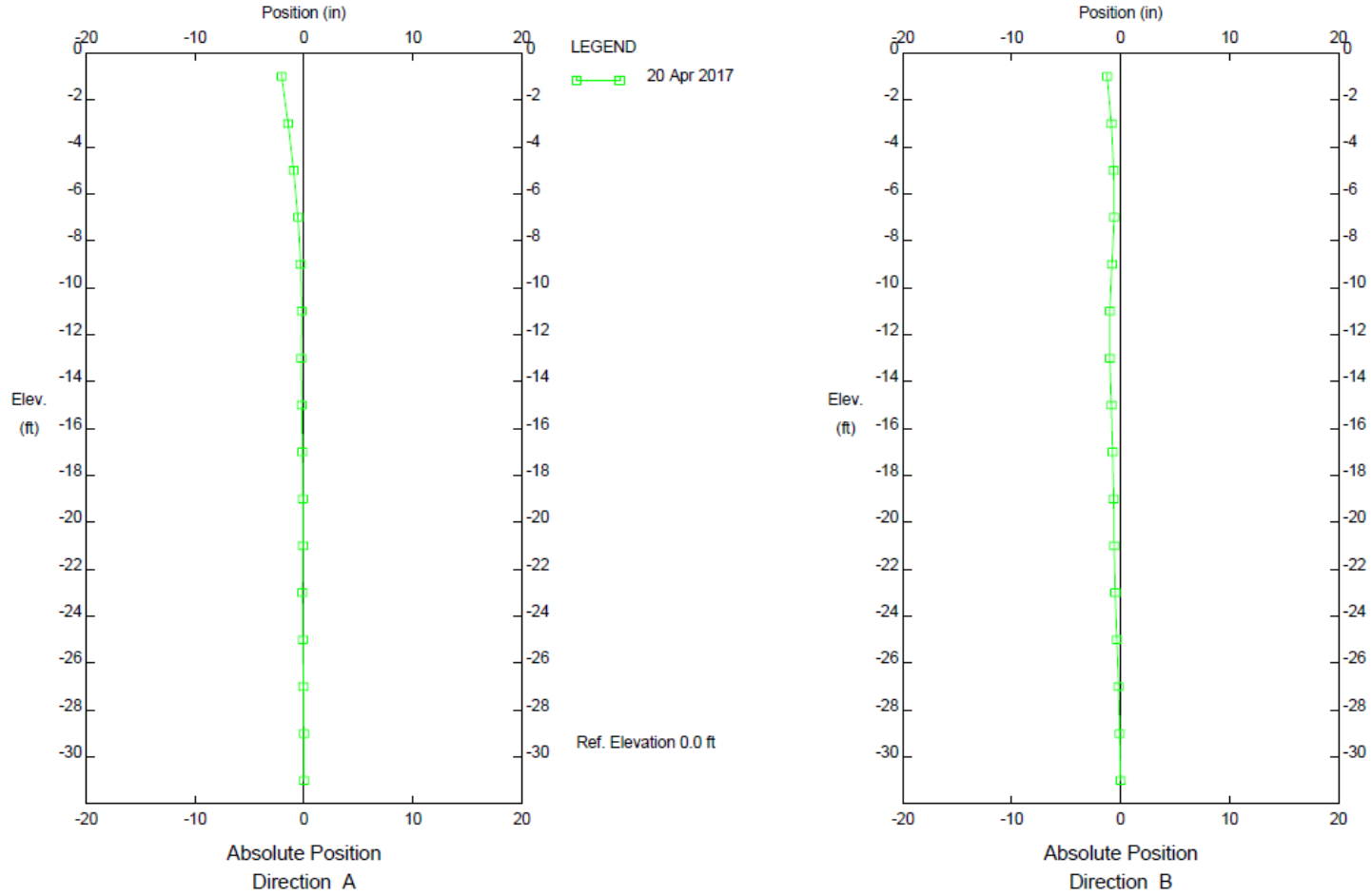
**Notes:** Precipitation data obtained from weather station located in Staunton, Virginia. Reference: [www.wunderground.com](http://www.wunderground.com)

**Piezometer Survey Data (Boring B-2)**

Project: ACP GWNF MP 123.1  
 Location: Augusta County, Virginia  
 Project Number: TXG0007-012-6303  
 Client: Dominion Transmission, Inc.

**Figure 2**

Geosyntec Consultants - Houston TX



Mp123-1-B1-3, Inclinometer Mp123-1-B1-3

**Inclinometer Survey Data (Boring B-1)**

Project: ACP GWNF MP 123.1  
 Location: Augusta County, Virginia  
 Project Number: TXG0007-012-6303  
 Client: Dominion Transmission, Inc.

**Figure 3**

**APPENDIX A**  
**PHOTOGRAPHIC LOG**



**APPENDIX A - PHOTOGRAPHIC LOG**  
**ACP Geotechnical Investigation**  
**GWNF MP 123.1 Drilling Site**  
**27 March through 4 April 2017**



**Photograph 1 – (before work)**

**Location:** Gated entrance to Jennings Branch Forest Service Road (access to MP 123.1)

View looking west. Photo shows conditions of the access road area inside the gated entrance during work activities at MP 123.1. Stover Shop Road located in the background.



**Photograph 2 – (after work)**

**Location:** Gated entrance to Jennings Branch Forest Service Road (access to MP 123.1). View looking west. Photo shows conditions of the access road area inside the gated entrance following work activities at MP 123.1 and casting of approved seed mix in locations covered by locally sourced straw. Stover Shop Road located in the background.



**Photograph 3 - (after work)**

**Location:** Stover Shop Road (access to MP 123.1)

View looking northeast. Photo shows site conditions along Stover Shop Road following work activities at MP 123.1. Gated entrance to Jennings Branch Forest Service Road located in the background.





**Photograph 4 – (before work)**

**Location:** Recently Constructed Logging Road (access to MP 123.1)

View looking southeast. Photo shows pre-existing conditions of the dirt berm barrier (tank trap) at the start of the recently constructed logging road.



**Photograph 5 – (during work)**

**Location:** Recently Constructed Logging Road (access to MP 123.1)

View looking southeast. Photo shows conditions of the dirt berm barrier (tank trap) during work activities at MP 123.1.



**Photograph 6 – (after work)**

**Location:** Recently Constructed Logging Road (access to MP 123.1)

View looking southeast. Photo shows conditions of the reconstructed dirt berm barrier (tank trap) following work activities at MP 123.1. Restoration activities included casting of approved seed mix in locations covered by locally sourced straw.





**Photograph 7 – (before work)**

**Location:** Recently Constructed Logging Road (access to MP 123.1)

View looking south-southeast. Photo shows pre-existing conditions of a water crossing along the recently constructed logging road. Water crossing is located up the road from the dirt berm barrier (tank trap).



**Photograph 8 – (during work)**

**Location:** Recently Constructed Logging Road (access to MP 123.1)

View looking south-southeast. Photo shows conditions of the water crossing during work activities.



**Photograph 9 – (after work)**

**Location:** Recently Constructed Logging Road (access to MP 123.1)

View looking south-southeast. Photo shows conditions of the water crossing along the recently constructed logging road following drilling and restoration activities including casting of approved seed mix in locations covered by locally sourced straw at MP 123.1.





**Photograph 10 – (before work)**

**Location:** MP 123.1

Looking southeast. Photo shows pre-existing site conditions in direction of proposed temporary access route above the recently constructed logging road prior to work activities.



**Photograph 11 – (during work)**

**Location:** MP123.1

View looking southeast. Photo shows constructed temporary access route. Silt sock BMP installed downslope of ground disturbance to prevent migration of sediment downslope.



**Photograph 12 – (after work)**

**Location:** MP 123.1

View looking southeast. Photo shows temporary access route following completion of drilling and restoration activities including casting of approved seed mix in locations covered by locally sourced straw. Note, silt sock BMP was left at transition from temporary access route onto recently constructed logging road to prevent migration of sediment downslope.





**Photograph 13 – (before work)**

**Location:** MP 123.1 (Boring B-1)

View looking northeast. Photo shows pre-existing site conditions at MP123.1 Boring B-1.



**Photograph 14 – (during work)**

**Location:** MP123.1 (Boring B-1)

View looking northeast. Photo shows site conditions at MP 123.1 Boring B-1 during work activities. Photo was taken prior to installation of silt sock BMP.



**Photograph 15 – (after work)**

**Location:** MP 123.1 (Boring B-1)

View looking northeast. Photo shows site conditions at MP 123.1 Boring B-1 following drilling and restoration activities including casting of approved seed mix in locations covered by locally sourced straw. Inclinometer with locked cover shown in distance.





**Photograph 16 – (before work)**

**Location:** MP 123.1 (Boring B-2)

View looking west. Photo shows pre-existing site conditions at MP 123.1 Boring B-2.



**Photograph 17 – (during work)**

**Location:** MP 123.1 (Boring B-1)

View looking west. Photo shows site conditions at MP 123.1 Boring B-2 during work activities. Temporary piezometer with locked well cover located on the right.



**Photograph 18 – (after work)**

**Location:** MP 123.1 (Boring B-2)

View looking southeast. Photo shows site conditions at Boring B-2 following drilling and restoration activities including casting of approved seed mix in locations covered by locally sourced straw. Temporary piezometer with locked cover located in the center of photograph.



**APPENDIX B**  
**CORE PHOTOGRAPHS**

PROJECT NAME: ACP GWNF MP 123.1

PROJECT NO.: TXG0007-012-6303

CLIENT: DOMINION TRANSMISSION, INC.

LOCATION: AUGUSTA COUNTY, VIRGINIA



GWNF MP 123.1 Boring B-1: Box 1 of 1 (15.0 to 30.0 ft bgs)



GWNF MP 123.1 Boring B-2: Box 1 of 1 (38.7 to 53.7 ft bgs)

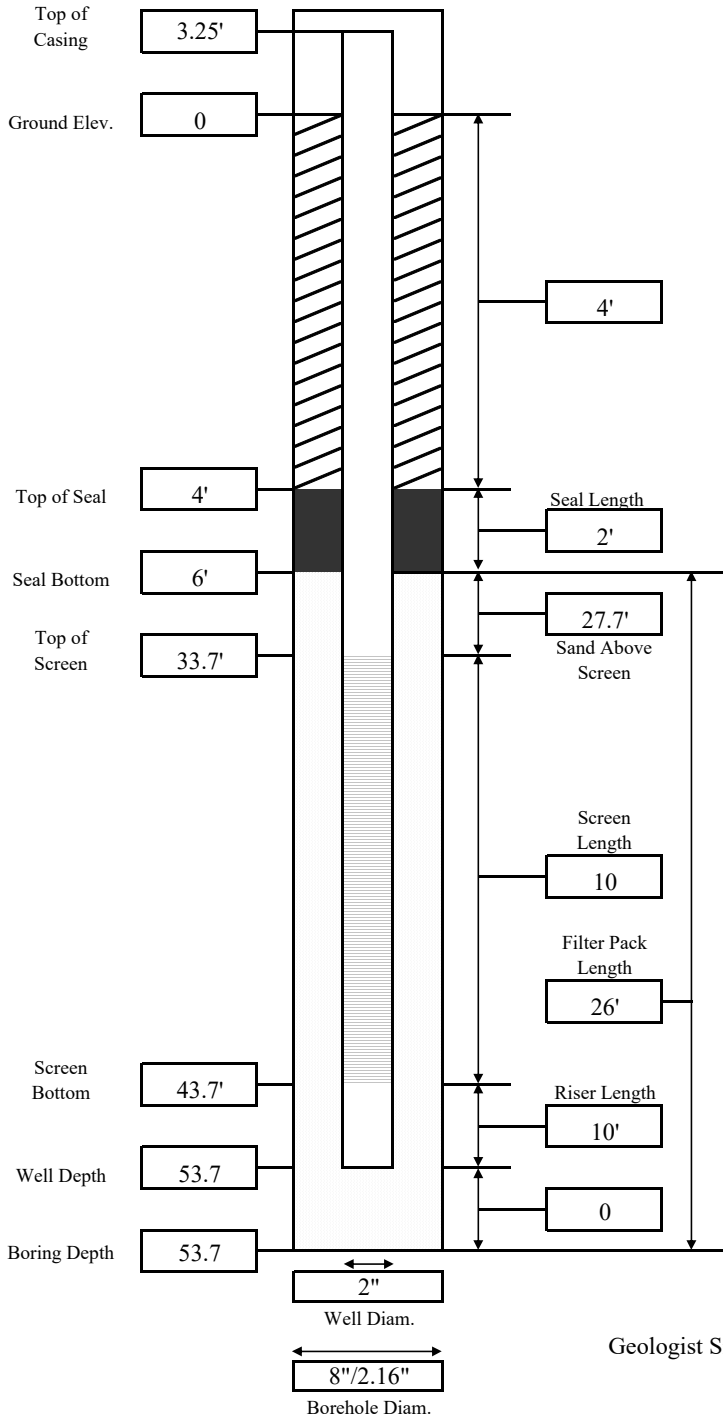
**APPENDIX C**

**PIEZOMETER AND INCLINOMETER  
CONSTRUCTION LOGS**

**Appendix C - Piezometer Construction Log**

Site: Atlantic Coast Pipeline  
 Well ID: B-2 (MP 123.1)  
 Drilling Company: Horn and Associates  
 Drillers: Tim Jenkins  
 Geologist: Jared Warner

Date: 30-Mar-17  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 54.3  
 Boring Diameter: 8"/2.16"  
 Well Depth: 53.7'  
 Well Diameter: 2"



**Well Construction:**  
 Material: SCH 80 PVC  
 Inside Diameter: 2"  
 Screen Slot Size: 0.01"  
 Screen Beg.: 19.7' End: 29.7'  
 Sump **Y / N**  
 Type/Length: PVC End Cap (0.3")

**Filter Pack:**  
 Type/Brand: Global Drilling #5 Quartz Sand  
 Amount Used: 1 50lb bag  
 Placement Method: Tremie

**Seal:**  
 Type/Brand: Cetco 1/4" Bentonite Pellets  
 Amount Used: 1 50lb bucket  
 Vol. Fluid Added: NA  
 Set-up Time: Overnight  
 Placement Method: Poured

**Grout:**  
 Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
 Amount Used: 1 94lb bag of Portland + 50lb bag bentonite  
 Vol. Fluid Added: ~60 gallons H<sub>2</sub>O  
 Placement Method: Tremie

**Well Completion:**  
**Above Grade** / Below Grade  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Protective Cover (4.5")

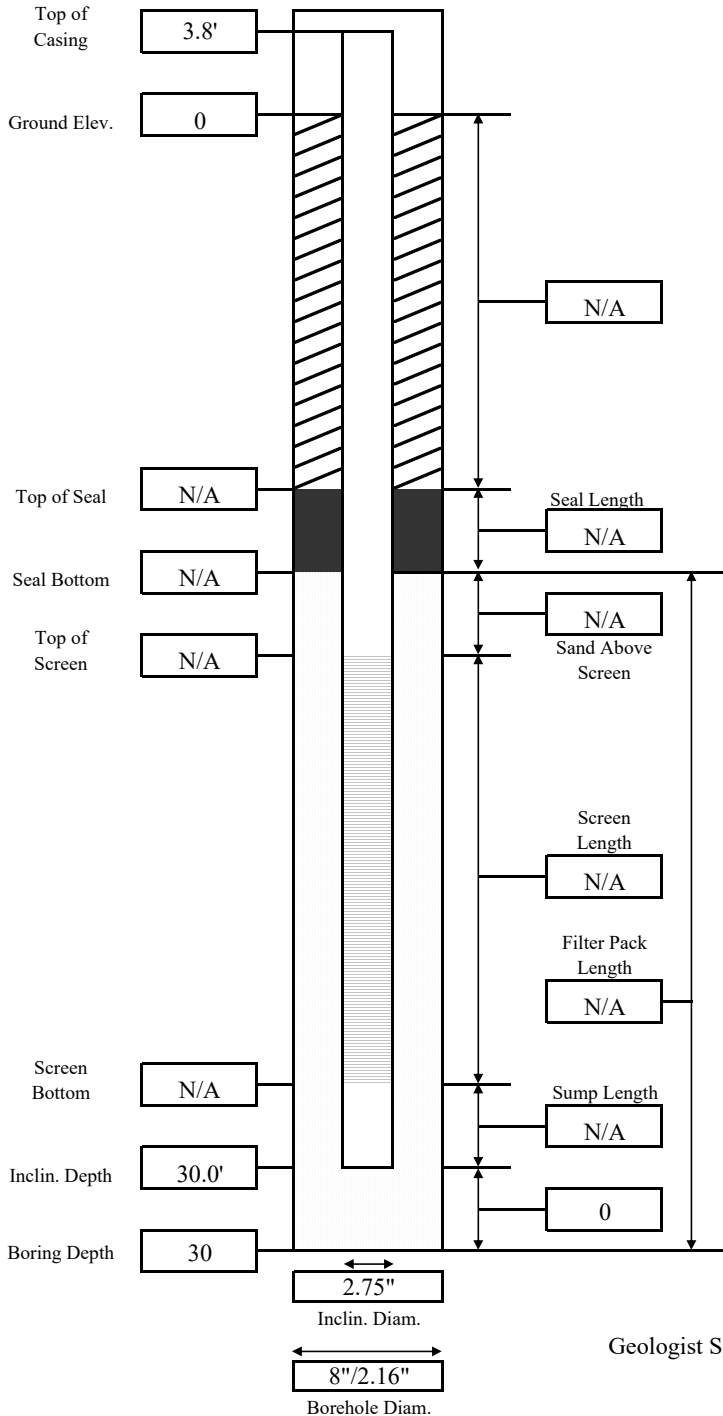
Comments: \_\_\_\_\_

Geologist Signature: Jared Warner

## Inclinometer Construction Log

Site: Atlantic Coast Pipeline  
 Boring ID: B-1 (MP 123.1)  
 Drilling Company: Horn and Associates  
 Drillers: Tim Jenkins  
 Geologist: Jared Warner

Date: 30-Mar-17  
 Drilling Method: Hollow-Stem Auger (8")/Rock Core (2.16")  
 Boring Depth: 30.0'  
 Boring Diameter: 8"/2.16"  
 Incl. Depth: 30.0'  
 Incl. Diameter: 2.75"



**Well Construction:**

Material: ABS Plastic (Quick Connect)  
 Inside Diameter: 2.32"  
 Screen Slot Size: N/A  
 Screen Beg.: N/A End: N/A  
 Sump **Y / N**  
 Type/Length: \_\_\_\_\_

**Filter Pack:**

Type/Brand: N/A  
 Amount Used: N/A  
 Placement Method: N/A

**Seal:**

Type/Brand: N/A  
 Amount Used: N/A  
 Vol. Fluid Added: N/A  
 Set-up Time: N/A  
 Placement Method: N/A

**Grout:**

Type/Brand: Type I/II Portland Cement/PureGold Gel Bentonite  
1 94lb bag of Portland + 25lb bag bentonite  
 Amount Used: \_\_\_\_\_  
 Vol. Fluid Added: ~30 gallons H<sub>2</sub>O  
 Placement Method: Tremie

**Inclin. Completion:**

**Above Grade / Below Grade**  
 Guard Posts? **Y / N**  
 Pad Size: N/A  
 Cover Type/Size: Locked Cover (4.5')

Comments: Inclinometer casing set at 30.0 ft bgs and grouted to surface.

Geologist Signature: Jared Warner

**APPENDIX D**  
**LOG OF BORINGS B-1 AND B-2**



**APPENDIX D - KEY SHEET: CLASSIFICATIONS AND SYMBOLS**

GS FORM:  
KEY 09/99

**EMPIRICAL CORRELATIONS WITH STANDARD PENETRATION RESISTANCE N VALUES \***

	N VALUE * (BLOWS/FT)	CONSISTENCY	UNDRAINED COMPRESSIVE STRENGTH (KSF)		N VALUE * (BLOWS/FT)	RELATIVE DENSITY
FINE GRAINED SOILS	0 - 2	VERY SOFT	<0.25	COARSE GRAINED SOILS	0 - 4	VERY LOOSE
	3 - 4	SOFT	0.25 - 0.50		5 - 10	LOOSE
	5 - 8	FIRM	0.50 - 1.00		11 - 30	MEDIUM DENSE
	9 - 15	STIFF	1.00 - 2.00		31 - 50	DENSE
	16 - 30	VERY STIFF	2.00 - 4.00		>50	VERY DENSE
	31 - 50	HARD	>4.00			
	>50	VERY HARD				

\* ASTM D 1586; NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 IN. O.D., 1.4 IN. I.D. SAMPLER ONE FOOT.

**UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART**

MAJOR DIVISIONS		SYMBOLS	DESCRIPTIONS	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		LITTLE OR NO FINES	GP POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	
		GRAVELS WITH FINES	GM SILTY GRAVELS, GRAVEL- SAND-SILT MIXTURES	
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO.4 SIEVE	APPRECIABLE AMOUNT OF FINES	GC CLAYEY GRAVELS, GRAVEL -SAND-CLAY MIXTURES	
		SAND AND SANDY SOILS	CLEAN SANDS	SW WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			LITTLE OR NO FINES	SP POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL COARSER THAN NO. 200 SIEVE SIZE	SANDS WITH FINES	APPRECIABLE AMOUNT OF FINES	SM SILTY SANDS, SAND-SILT MIXTURES	
		SC CLAYEY SANDS, SAND-CLAY MIXTURES		
FINE GRAINED SOILS	SILTS AND CLAYS	Liquid Limit Less Than 50	ML INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	
		CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS		
		OL ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
	MORE THAN 50% OF MATERIAL FINER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	Liquid Limit Greater Than 50	MH INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILT
			CH INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
			OH ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
HIGHLY ORGANIC SOILS	PT PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT			

NOTE: DUAL SYMBOLS USED FOR BORDERLINE CLASSIFICATIONS

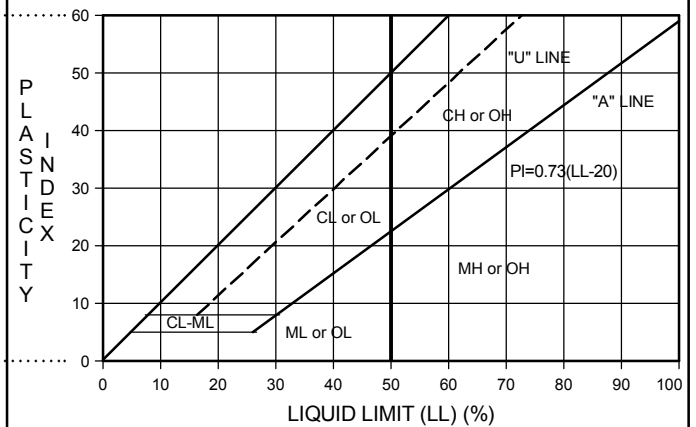
**PARTICLE SIZE IDENTIFICATION**

BOULDERS	>300 mm
COBBLES	75 - 300 mm
GRAVEL: COARSE	19.0 - 75 mm
GRAVEL: FINE	4.75 - 19 mm
SAND: COARSE	2.00 - 4.75 mm
SAND: MEDIUM	0.425 - 2.00 mm
SAND: FINE	0.075 - 0.425 mm
SILT	0.075 - 0.002 mm
CLAY	<0.002 mm

WELL GRADED - HAVING WIDE RANGE OF GRAIN SIZES AND APPRECIABLE AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES

POORLY GRADED - PREDOMINANTLY ONE GRAIN SIZE, OR HAVING A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING

**PLASTICITY CHART**



**OTHER MATERIAL SYMBOLS**

Siltstone	Sand
Sandstone	Silt
Siltstone/Claystone	Silty Sand
Claystone	Alluvium
Schist	Artificial Fill
Siltstone/Sandstone	Debris Fill
Conglomerate	Asphalt
Granitic	Metabasalt

**WELL SYMBOLS**

GRANULAR BENTONITE
BENTONITE CEMENT GROUT
FILTER PACK
CONCRETE
NATIVE/SLOUGH
CENTRAL-IZER

**SAMPLER AND OTHER SYMBOLS**

GRAB SAMPLE	Water Level at Time Drilling, or as Shown
SPLIT SPOON	Static Water Level
ROCK CORE	MSL: Mean Sea Level
SHELBY TUBE	MC: Moisture Content
CALIFORNIA SAMPLER	WA: #200 Wash
BULK SAMPLE	DD: Dry Density
	SA: Sieve Analysis
	PI: Plasticity Index
	PP: Pocket Pentrometer
	LL: Liquid Limit
	Su: Undrained Shear Strength
	K: Hydraulic Conductivity
	Phi: Friction Angle

KEY-GEOTECH - GEOSYNTec.GDT - 4/15/16 13:47 - P:\GINT\PROJECTS\BLUE RIDGE GEOTECHNICAL DRILLING\ACPHDD.GPJ



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING MP 123.1 B-1**  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 3/30/2017  
**FINISH DRILL DATE** 3/30/2017

**SHEET 1 OF 2**

**GROUND SURF.** 2022.9  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**APPENDIX D - BORING LOG**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	2020	<b>COLLUVIUM: POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)</b> , dark yellowish brown, moist, medium stiff, fine to medium sand, fine to coarse limestone and sandstone gravel (up to 1 inch), rootlets.  Becomes stiff, slight increase in medium to coarse sand and coarse sandstone gravel, trace clay.  Becomes mottled dark brown and yellowish brown, very stiff, slight increase in clay content.		B-1-1	2 3 3	5	28							7.3						
4				B-1-2	3 6 7	13	28				10.1				6.5					
6				B-1-3	4 4 15	19	39									8.6				
8	2015	<b>SILT WITH SAND (ML)</b> , very dark brown, moist, very stiff, low plasticity.		B-1-4	9 7 9	16	78	2.5 to 2.75						28						
10		Slight increase in trace weathered shale gravel (up to 1 inch), gray clay lense (0.5 inch thick) at 10.7 ft bgs.		B-1-5	7 7 9	16	78	2.25 to 2.75			77.8			28.7	35	26	9			
12	2010	Same as above, becomes mottled very dark brown and yellowish brown.		B-1-6	3 7 14	21	100	1.5 to 2.5							30.1					
14				B-1-7	50/1	50	0													
16	2005																			
18																				
20																				
22	2000	Refer to MP 123.1 B-1 page 2.																		
24																				
26																				
28	1995																			
30																				

Termination depth at 30 ft

**CONTRACTOR** Horn & Associates  
**EQUIPMENT** Diedrich D-50  
**DRILL MTHD.** Hollow Stem Auger  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner  
**LATITUDE:** 38.28885  
**LONGITUDE:** -79.18895  
**COORDINATE SYSTEM:**  
**REVIEWER** Jared Warner

**NOTES:**  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

03-GEOTECH2\_SHP\_MP120.3\_AND\_MP123.1\_SOIL\_LOG.GPJ\_GEOSNTEC.GDT\_5/28/17



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING MP 123.1 B-1**  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 3/30/2017  
**FINISH DRILL DATE** 3/30/2017

**SHEET 2 OF 2**

**GROUND SURF.** 2022.9  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**APPENDIX D - BORING LOG**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA								
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)	
2021		Refer to MP 123.1 B-1 page 1.  <b>LOWER DEVONIAN AND SILURIAN FORMATIONS (UNDIVIDED): SHALE</b> , very dark gray to black, massive, slightly fractured (40 to 50 degrees fracture sets), slightly weathered, FeOx infilled fractures (0.1 to 0.3 inch).  No recovery. Same as above.  No recovery. Same as above.																	
2017	5																		
2007	15						R-1	5	4.2	84	71	10	Begin rock coring at 15.0 ft bgs.						
2002	20						R-2	5	4.6	92	86	10							
1997	25						R-3	5	5	100	88	8							
1992	30												Termination depth at 30 ft bgs.						

05-CONT. CORE SHP MP120.3 AND MP123.1 ROCK LOG.GPJ GEOSINTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 38.28885  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -79.18895  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** NX  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS

GS FORM:  
SOIL-5910

## APPENDIX D - BORING LOG

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
2	1960	<b>COLLUVIUM: CLAYEY SAND WITH GRAVEL (SC)</b> , light brown, moist, medium stiff, presence of fine to coarse limestone and sandstone gravel (up to 1 inch). Becomes stiff, increase in gravel and fine and medium sand.		B-2-1	3 3 5	8	67	1.0 to 1.5					18.3							
4		Becomes very stiff, increase in gravelly silt, light brown with FeOx staining.		B-2-2	6 8 7	15	67	1.0 to 2.0					12							
6		Becomes mottled light brown and yellowish brown with light gray limestone gravel (up to 2 inches), possible boulder.		B-2-3	4 7 11	18	67	1.0 to 2.5					12.8							
8				B-2-4	8 8 22	30	78				39.0		9.6	29	18	11				
10	1955	<b>SANDY LEAN CLAY WITH GRAVEL (CL)</b> , dark reddish brown sandstone gravel (up to 0.5 inches), hard.		B-2-5	14 22 25	47	83				57.8		12.4	28	19	9				
12		Same as above with white to light gray limestone gravel (up to 1.5 inches), possible boulder at 12.5 ft bgs.		B-2-6	23 31 50	81	88						7.4							
14				B-2-7	23 24 38	62	100						8.4							
16		Possible limestone or sandstone boulder (2.5 feet), no recovery.																		
18																				
20	1945	<b>LEAN CLAY WITH GRAVEL (CL)</b> , yellowish brown to light brown, moist, very stiff, fine to coarse gravel, low to medium plasticity,		B-2-8	9 9 12	21	67						20.2	35	19	16				
22				B-2-9	13 24 20	44	22						10.8							
24		Same as above, increase in coarse limestone gravels (up to 2 inches).																		
26	1940	<b>SANDY LEAN CLAY (CL)</b> , Light gray to yellowish brown with FeOx staining, moist, medium plasticity, weathered siltstone and sandstone fragments.		B-2-10	6 9 12	21	1.5	1.75 to 2.5			66.4		19.1	37	21	16				
28																				
30	1935	Possible sandstone boulder (approx. 2.5 inches thick), dark reddish brown, no recovery.																		

03-GEOTECH2\_SHP\_MP120.3\_AND\_MP123.1\_SOIL\_LOG.GPJ\_GEOSNTEC.GDT\_5/28/17

**CONTRACTOR** Horn & Associates  
**EQUIPMENT** Diedrich D-50  
**DRILL MTHD.** Hollow Stem Auger  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner

**LATITUDE:** 38.28911  
**LONGITUDE:** -79.18964  
**COORDINATE SYSTEM:**

**REVIEWER** Jared Warner

**NOTES:**

SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING MP 123.1 B-2**  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 3/28/2017  
**FINISH DRILL DATE** 3/29/2017

**SHEET 2 OF 3**

**GROUND SURF.** 1965.6  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
SOIL-5910

**APPENDIX D - BORING LOG**

DEPTH BGS (ft)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	SAMPLE						COMMENTS	LABORATORY RESULTS									
				SAMPLE NO.	TYPE	BLOWS PER 6"	N VALUE	RECOVERY (%)	POCKET PEN (tsf)		TORVANE (tsf)	DRY UNIT WEIGHT (pcf)	MOIST UNIT WEIGHT (pcf)	PERCENT FINES (%)	PERCENT SAND (%)	PERCENT GRAVEL (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS		
																		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
32		<b>CLAYEY SAND (SC)</b> , mottled brown and yellowish brown with FeOx staining, moist, very stiff, high plasticity, fine to coarse sandstone and limestone gravel (up to 1 inch).		B-2-11	6 7 8	15	55				45.9		16.8	37	20	17				
34	1930	Becomes dark gray to black, slight increase in gravel, sandstone and limestone gravel (up to 1 inch), possible boulder at 35 ft bgs.		B-2-12	5 6 11	17	55	2.0 to 2.5		Hard drilling.			18.5							
36		No recovery.		B-2-13	5 3 4	7	0			Sample fell out of spoon sampler. No recovery.										
38		No recovery. Dark gray shale fragments observed in the spoon.		B-2-14	50/2	50	0			Sampler refusal. Switch to rock core at 38.7 ft bgs.										
40	1925																			
42																				
44	1920																			
46		Refer to MP 123.1 B-2 page 3.																		
48																				
50	1915																			
52																				
54	1910																			
56																				
58																				
60	1905																			

03-GEOTECH2\_SHP\_MP120.3\_AND\_MP123.1\_SOIL\_LOG.GPJ\_GEOSNTEC.GDT\_5/28/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 38.28911  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -79.18964  
**DRILL MTHD.** Hollow Stem Auger      **COORDINATE SYSTEM:**  
**DIAMETER** 8 inches  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



11490 Westheimer Road  
Houston Texas 77077  
Tel: (281) 920-4601

**BORING MP 123.1 B-2**  
**PROJECT** Atlantic Coast Pipeline  
**NUMBER** TXG0007  
**LOCATION** Augusta County, VA  
**START DRILL DATE** 3/28/2017  
**FINISH DRILL DATE** 3/29/2017

**GROUND SURF.** 1965.6  
**TOP OF CASING**  
**DATUM** Ft above MSL

GS FORM:  
ROCK-5910

**APPENDIX D - BORING LOG**

DEPTH (ft-bgs)	ELEVATION (ft)	DESCRIPTION	GRAPHIC LOG	WELL LOG	SAMPLE					COMMENTS	DISCONTINUITY DATA											
					RUN NUMBER	LENGTH (ft)	RECOVERY (ft)	RECOVERY (%)	RQD		RUN TIME (min.)	TYPE	FRACTURE DENSITY	APERTURE	FRACTURE FILLING	MINERAL TYPE	PLANARITY	DIP (degrees)				
1934																						
1933																						
1932																						
1931																						
35		Refer to MP 123.1 B-2 page 2.																				
1930																						
1929																						
1928																						
1927																						
1926		<b>LOWER DEVONIAN AND SILURIAN FORMATIONS</b>																				
40		<b>(UNDIVIDED): SHALE,</b> very dark gray to black, thinly bedded, intensely fractured, moderate to strong, fresh.			R-1	5	3.5	70	40	8	Begin rock coring at 38.7 ft bgs.											
1925																						
1924		Becomes slightly fractured at 40.6 ft bgs (30 degree fractures) at 0.5 to 0.9 inch spacing, 70 degree clay infilled fracture, soft/smooth.																				
1923																						
1922		No recovery.																				
1921		Same as above.			R-2	5	3.6	72	43	13												
45																						
1920																						
1919		30 degrees fractures with 2 to 3 inches spacing, soft/smooth.																				
1918		No recovery																				
1917																						
1916		Becomes slightly fractured at 40.6 ft bgs (30 degree fractures) at 0.5 to 0.9 inch spacing, presence of 70 degree clay infilled fracture, soft/smooth.			R-3	5	4.4	88	28	13												
50																						
1915																						
1914		High angle fractures (50 to 60 degrees).																				
1913																						
1912																						
1911																						
55																						
1910											Termination depth at 53.7 ft bgs.											
1909																						
1908																						
1907																						
1906																						
60																						

05-CONT. CORE SHP MP120.3 AND MP123.1 ROCK LOG.GPJ GEOSINTEC.GDT 5/28/17

**CONTRACTOR** Horn & Associates      **LATITUDE:** 38.28911  
**EQUIPMENT** Diedrich D-50              **LONGITUDE:** -79.18964  
**DRILL MTHD.** Rock Coring              **COORDINATE SYSTEM:**  
**DIAMETER** NX  
**LOGGER** Jared Warner      **REVIEWER** Jared Warner

**NOTES:**  
  
SEE KEY SHEET FOR SYMBOLS AND ABBREVIATIONS



**APPENDIX E**  
**LABORATORY TEST RESULTS**



May 17, 2017

Project No. 2017-241-002

Logan Brant  
Geosyntec Consultants, Inc.  
11490 Westheimer Rd., Suite 150  
Houston, TX 77077

**Transmittal**  
**Laboratory Test Results**  
**ACP TXG0007**

Please find attached the laboratory test results for the above referenced project. The tests were outlined on the Project Verification Form that was transmitted to your firm prior to the testing. The testing was performed in general accordance with the methods listed on the enclosed data sheets. The test results are believed to be representative of the samples that were submitted for testing and are indicative only of the specimens that were evaluated. We have no direct knowledge of the origin of the samples and imply no position with regard to the nature of the test results, i.e. pass/fail and no claims as to the suitability of the material for its intended use.

The test data and all associated project information provided shall be held in strict confidence and disclosed to other parties only with authorization by our Client. The test data submitted herein is considered integral with this report and is not to be reproduced except in whole and only with the authorization of the Client and Geotechnics. The remaining sample materials for this project will be retained for a minimum of 90 days as directed by the Geotechnics' Quality Program.

We are pleased to provide these testing services. Should you have any questions or if we may be of further assistance, please contact our office.

Respectively submitted,  
**Geotechnics, Inc.**

David R. Backstrom  
Laboratory Director

***We understand that you have a choice in your laboratory services  
and we thank you for choosing Geotechnics.***

**Summary Table for ACP TXG0007**

LAB ID	Boring	Depth	Sample Number	Water Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	USCS Symbol (Limits)	Passing #200%	Passing 0.002 mm %	USCS Symbol (Grain Size)	USCS Classification	UC Rock Peak Strength (psi)
2017-241-002-001	B-1(MP123.1)	0.4	B-1-1	7.3	-	-	-	-	-	-	-	-	-
2017-241-002-002	B-1(MP123.1)	2.9	B-1-2	6.5	-	-	-	-	10.14	-	gp-gm, assumed	POORLY GRADED GRAVEL WITH SILT AND SAND	-
2017-241-002-003	B-1(MP123.1)	5.6	B-1-3	8.6	-	-	-	-	-	-	-	-	-
2017-241-002-004	B-1(MP123.1)	8.2	B-1-4	28	-	-	-	-	-	-	-	-	-
2017-241-002-005	B-1(MP123.1)	11.2	B-1-5	28.7	35	26	9	ML	77.84	-	ML	SILT WITH SAND	-
2017-241-002-006	B-1(MP123.1)	14	B-1-6	30.1	-	-	-	-	-	-	-	-	-
2017-241-002-007	B-1(MP123.1)	15.7-16.5	R1	-	-	-	-	-	-	-	-	-	4,320
2017-241-002-008	B-1(MP123.1)	25.3-26.0	R3	-	-	-	-	-	-	-	-	-	5,890
2017-241-002-009	B-2(MP123.1)	1	B-2-1	18.3	-	-	-	-	-	-	-	-	-
2017-241-002-010	B-2(MP123.1)	3	B-2-2	12	-	-	-	-	-	-	-	-	-
2017-241-002-011	B-2(MP123.1)	5.5	B-2-3	12.8	-	-	-	-	-	-	-	-	-
2017-241-002-012	B-2(MP123.1)	8.2	B-2-4	9.6	29	18	11	CL	39.03	-	SC	CLAYEY SAND WITH GRAVEL	-
2017-241-002-013	B-2(MP123.1)	10.8	B-2-5	12.4	28	19	9	CL	57.81	-	CL	SANDY LEAN CLAY WITH GRAVEL	-
2017-241-002-014	B-2(MP123.1)	13.1	B-2-6	7.4	-	-	-	-	-	-	-	-	-
2017-241-002-015	B-2(MP123.1)	16	B-2-7	8.4	-	-	-	-	-	-	-	-	-
2017-241-002-016	B-2(MP123.1)	22	B-2-8	20.2	35	19	16	CL	-	-	-	-	-
2017-241-002-017	B-2(MP123.1)	23.8	B-2-9	10.8	-	-	-	-	-	-	-	-	-
2017-241-002-018	B-2(MP123.1)	27.5	B-2-10	19.1	37	21	16	CL	66.4	32.32	CL	SANDY LEAN CLAY	-



## MOISTURE CONTENT

ASTM D 2216-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002

Lab ID:	001	002	003	004	005
Boring No.:	B-1(MP123.1)	B-1(MP123.1)	B-1(MP123.1)	B-1(MP123.1)	B-1(MP123.1)
Depth (ft):	0.4	2.9	5.6	8.2	11.2
Sample No.:	B-1-1	B-1-2	B-1-3	B-1-4	B-1-5
Tare Number	48	1423	31	18	16
Wt. of Tare & Wet Sample (g)	181.40	395.94	109.25	83.61	76.65
Wt. of Tare & Dry Sample (g)	169.53	380.57	101.11	66.85	61.12
Weight of Tare (g)	6.81	143.44	6.90	6.97	6.98
Weight of Water (g)	11.87	15.37	8.14	16.76	15.53
Weight of Dry Sample (g)	162.72	237.13	94.21	59.88	54.14
<b>Water Content (%)</b>	<b>7.3</b>	<b>6.5</b>	<b>8.6</b>	<b>28.0</b>	<b>28.7</b>

Lab ID	006	009	010	011	012
Boring No.	B-1(MP123.1)	B-2(MP123.1)	B-2(MP123.1)	B-2(MP123.1)	B-2(MP123.1)
Depth (ft)	14.0	1.0	3.0	5.5	8.0
Sample No.	B-1-6	B-2-1	B-2-2	B-2-3	B-2-4
Tare Number	14	41	28	6	22
Wt. of Tare & Wet Sample (g)	102.05	96.74	106.22	129.31	89.69
Wt. of Tare & Dry Sample (g)	80.04	82.85	95.57	115.46	82.43
Weight of Tare (g)	7.00	6.89	6.84	6.93	7.00
Weight of Water (g)	22.01	13.89	10.65	13.85	7.26
Weight of Dry Sample (g)	73.04	75.96	88.73	108.53	75.43
<b>Water Content (%)</b>	<b>30.1</b>	<b>18.3</b>	<b>12.0</b>	<b>12.8</b>	<b>9.6</b>

Notes :

Tested By PC Date 5/9/17 Checked By TMP Date 5/10/17

## MOISTURE CONTENT

ASTM D 2216-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002

Lab ID:	013	014	015	016	017
Boring No.:	B-2(MP123.1)	B-2(MP123.1)	B-2(MP123.1)	B-2(MP123.1)	B-2(MP123.1)
Depth (ft):	9.5-11.0	13.1	16.0	22.0	23.5-25.0
Sample No.:	B-2-5	B-2-6	B-2-7	B-2-8	B-2-9
Tare Number	37	33	23	11	26
Wt. of Tare & Wet Sample (g)	68.06	117.28	107.80	69.49	153.42
Wt. of Tare & Dry Sample (g)	61.34	109.69	100.02	58.97	139.18
Weight of Tare (g)	6.97	6.83	6.85	6.92	6.91
Weight of Water (g)	6.72	7.59	7.78	10.52	14.24
Weight of Dry Sample (g)	54.37	102.86	93.17	52.05	132.27
<b>Water Content (%)</b>	<b>12.4</b>	<b>7.4</b>	<b>8.4</b>	<b>20.2</b>	<b>10.8</b>

Lab ID	018	019	020
Boring No.	B-2(MP123.1)	B-2(MP123.1)	B-2(MP123.1)
Depth (ft)	27.5	31.8	34.3
Sample No.	B-2-10	B-2-11	B-2-12
Tare Number	39	8	45
Wt. of Tare & Wet Sample (g)	78.60	63.91	124.75
Wt. of Tare & Dry Sample (g)	67.08	55.72	106.37
Weight of Tare (g)	6.87	6.96	7.08
Weight of Water (g)	11.52	8.19	18.38
Weight of Dry Sample (g)	60.21	48.76	99.29
<b>Water Content (%)</b>	<b>19.1</b>	<b>16.8</b>	<b>18.5</b>

Notes :

Tested By PC Date 5/9/17 Checked By TMP Date 5/10/17

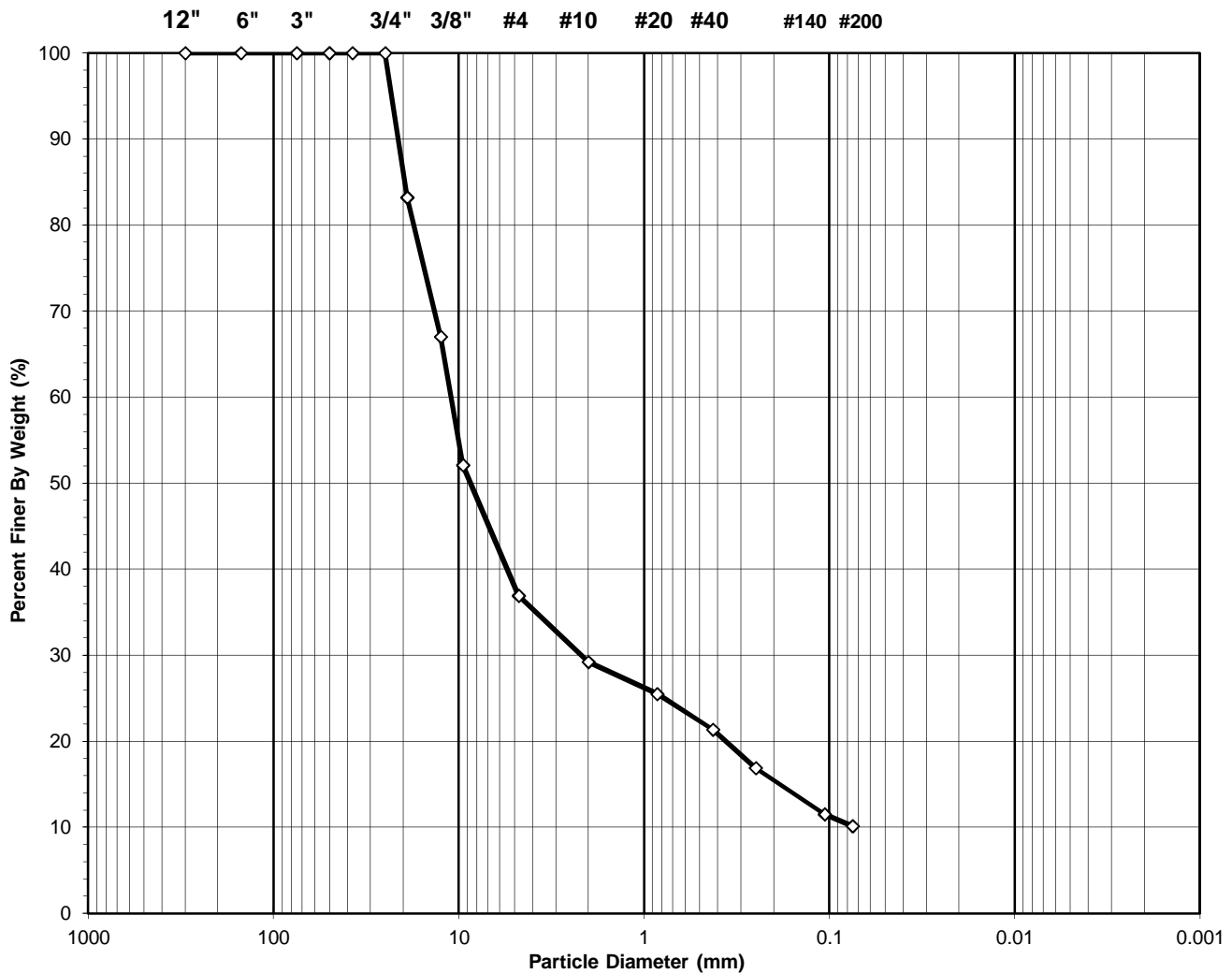


**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
Client Reference: ACP TXG0007  
Project No.: 2017-241-002  
Lab ID: 2017-241-002-002

Boring No.: B-1(MP123.1)  
Depth (ft): 2.9  
Sample No.: B-1-2  
Soil Color: Dark Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**gp-gm, ASSUMED**

**D60 = 10.99      CC = 5.98**

**USCS Classification:**  
**POORLY GRADED GRAVEL WITH SILT AND SAND**

**D30 = 2.18      CU = 151.81**

**D10 = 0.07**

Tested By HL Date 5/11/17

Checked By TMP Date 5/11/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-002

Boring No.: B-1(MP123.1)  
 Depth (ft): 2.9  
 Sample No.: B-1-2  
 Soil Color: Dark Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1423	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	395.94	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	380.57	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	143.44	Weight of Tare (g):	NA
Weight of Water (g):	15.37	Weight of Water (g):	NA
Weight of Dry Sample (g):	237.13	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>6.5</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	237.13
Dry Weight of - 3/4" Sample (g):	173.3	Weight of - #200 Material (g):	24.05
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	213.08
Dry Weight of + 3/4" Sample (g):	39.82		
Total Dry Weight of Sample (g):	NA		

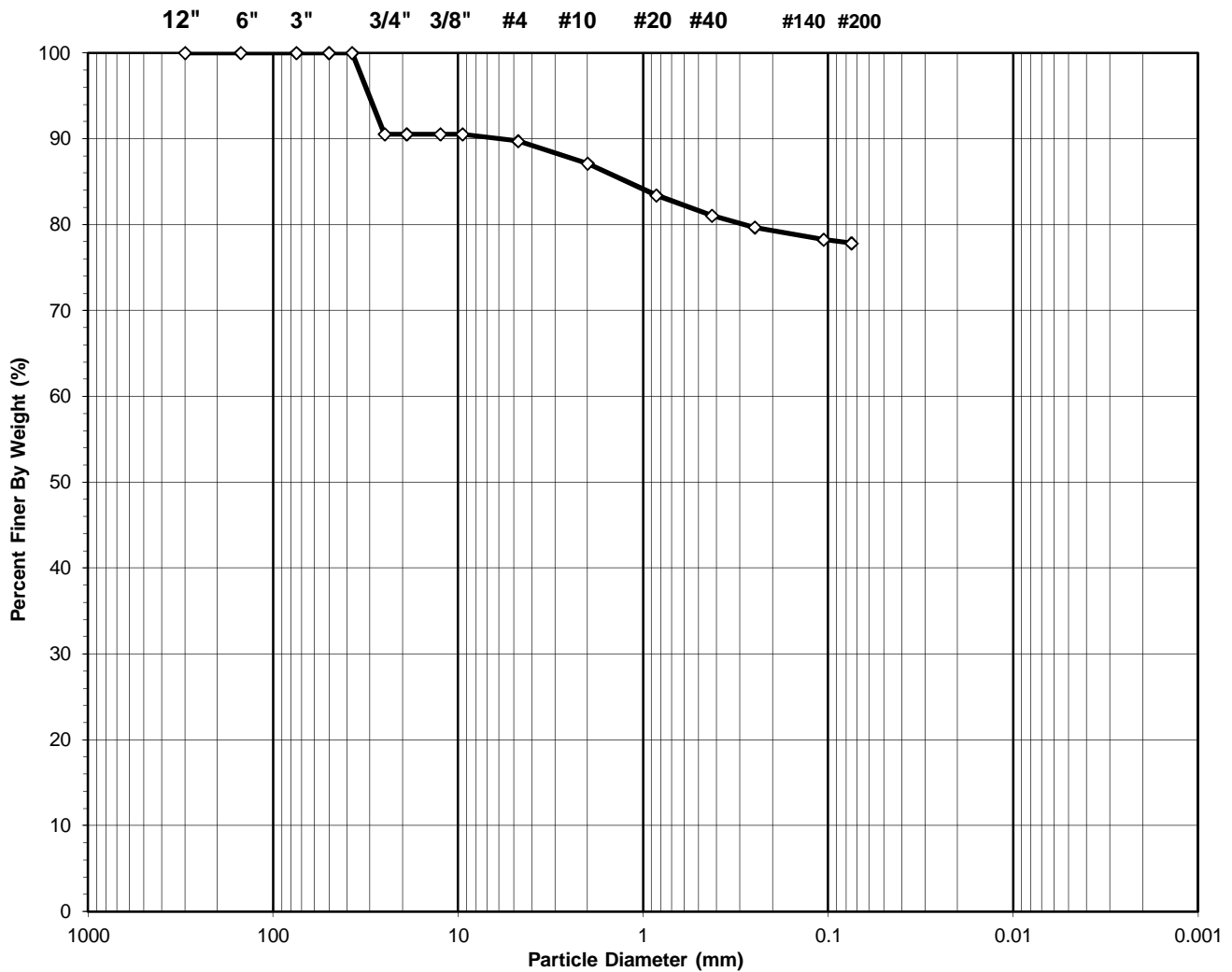
Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	39.82	16.79	16.79	83.21	<b>83.21</b>
1/2"	12.50	38.38	16.19	32.98	67.02	<b>67.02</b>
3/8"	9.50	35.39	14.92	47.90	52.10	<b>52.10</b>
#4	4.75	35.99	15.18	63.08	36.92	<b>36.92</b>
#10	2.00	18.23	7.69	70.77	29.23	<b>29.23</b>
#20	0.850	8.87	3.74	74.51	25.49	<b>25.49</b>
#40	0.425	9.80	4.13	78.64	21.36	<b>21.36</b>
#60	0.250	10.57	4.46	83.10	16.90	<b>16.90</b>
#140	0.106	12.77	5.39	88.48	11.52	<b>11.52</b>
#200	0.075	3.26	1.37	89.86	10.14	<b>10.14</b>
Pan	-	24.05	10.14	100.00	-	-

Tested By **HL**      Date **5/11/17**      Checked By **TMP**      Date **5/11/17**

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-1(MP123.1)
Client Reference:	ACP TXG0007	Depth (ft):	11.2
Project No.:	2017-241-002	Sample No.:	B-1-5
Lab ID:	2017-241-002-005	Soil Color:	Dark Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**ML, TESTED**

**USCS Classification:**  
**SILT WITH SAND**

Tested By HL Date 5/11/17 Checked By TMP Date 5/16/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.: B-1(MP123.1)
Client Reference:	ACP TXG0007	Depth (ft): 11.2
Project No.:	2017-241-002	Sample No.: B-1-5
Lab ID:	2017-241-002-005	Soil Color: Dark Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1549	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	594.92	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	497.70	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	142.95	Weight of Tare (g):	NA
Weight of Water (g):	97.22	Weight of Water (g):	NA
Weight of Dry Sample (g):	354.75	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>27.4</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	354.75
Dry Weight of - 3/4" Sample (g):	45.1	Weight of - #200 Material (g):	276.12
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	78.63
Dry Weight of + 3/4" Sample (g):	33.56		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	33.56	9.46	9.46	90.54	<b>90.54</b>
3/4"	19.0	0.00	0.00	9.46	90.54	<b>90.54</b>
1/2"	12.50	0.00	0.00	9.46	90.54	<b>90.54</b>
3/8"	9.50	0.00	0.00	9.46	90.54	<b>90.54</b>
#4	4.75	2.88	0.81	10.27	89.73	<b>89.73</b>
#10	2.00	9.21	2.60	12.87	87.13	<b>87.13</b>
#20	0.850	13.22	3.73	16.59	83.41	<b>83.41</b>
#40	0.425	8.38	2.36	18.96	81.04	<b>81.04</b>
#60	0.250	4.79	1.35	20.31	79.69	<b>79.69</b>
#140	0.106	5.11	1.44	21.75	78.25	<b>78.25</b>
#200	0.075	1.48	0.42	22.16	77.84	<b>77.84</b>
Pan	-	276.12	77.84	100.00	-	-

Tested By **HL**      Date **5/11/17**      Checked By **TMP**      Date **5/16/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.	Boring No.: B-1(MP123.1)
Client Reference: ACP TXG0007	Depth (ft): 11.2
Project No.: 2017-241-002	Sample No.: B-1-5
Lab ID: 2017-241-002-005	Soil Description: DARK BROWN SILT

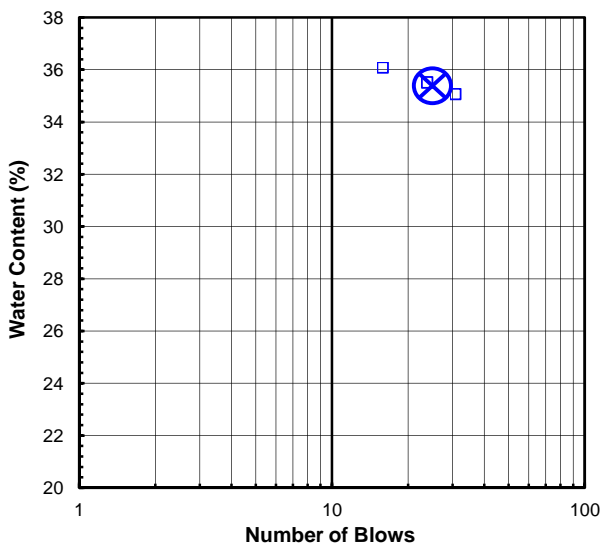
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content ASTM D2216-10	Liquid Limit Test				
	1	2	3	M	
Tare Number:	16	246	212	243	U
Wt. of Tare & Wet Sample (g):	76.65	38.09	39.72	39.28	L
Wt. of Tare & Dry Sample (g):	61.12	32.64	34.37	33.99	T
Weight of Tare (g):	6.98	17.52	19.29	18.89	I
Weight of Water (g):	15.5	5.5	5.4	5.3	P
Weight of Dry Sample (g):	54.1	15.1	15.1	15.1	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>28.7</b>	<b>36.0</b>	<b>35.5</b>	<b>35.0</b>	<b>N</b>
<b>Number of Blows:</b>	<b>16</b>	<b>24</b>	<b>31</b>		<b>T</b>

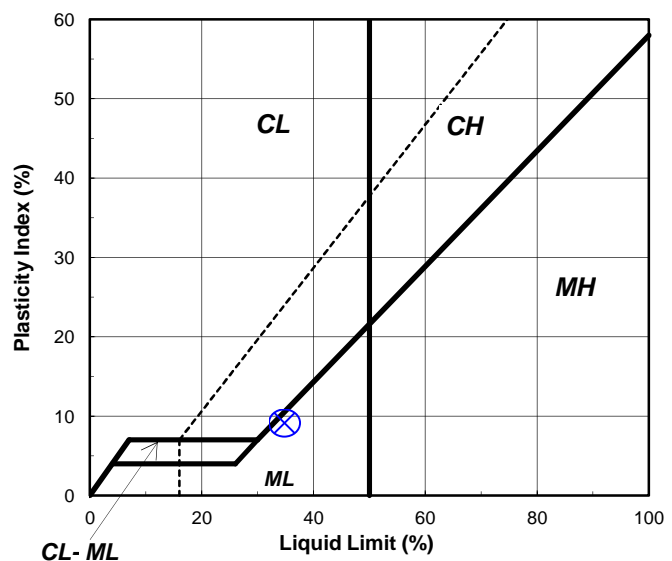
Plastic Limit Test	1	2	Range	Test Results
Tare Number:	171	1339		<b>Liquid Limit (%):</b> <b>35</b>
Wt. of Tare & Wet Sample (g):	25.66	24.72		<b>Plastic Limit (%):</b> <b>26</b>
Wt. of Tare & Dry Sample (g):	24.28	23.45		<b>Plasticity Index (%):</b> <b>9</b>
Weight of Tare (g):	19.11	18.54		<b>USCS Symbol:</b> <b>ML</b>
Weight of Water (g):	1.4	1.3		
Weight of Dry Sample (g):	5.2	4.9		
<b>Moisture Content (%):</b>	<b>26.7</b>	<b>25.9</b>	<b>0.8</b>	

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**



Tested By RAL Date 5/15/17 Checked By KC Date 5/16/17

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID No.: 2017-241-002-007

Boring No.: B-1 (MP123.1)  
 Depth (ft): 15.7-16.5  
 Sample ID: R-1  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 467.70**

SPECIMEN LENGTH (in)

Reading 1: 4.02  
 Reading 2: 4.02  
 Reading 3: 4.02  
**Average: 4.02**

SPECIMEN DIAMETER (in):

Reading 1: 1.87  
 Reading 2: 1.87  
 Average: **1.87**  
 Area (in<sup>2</sup>): 2.75  
 L/D: 2.15

MOISTURE CONTENT

Tare Number: 3084  
 Wt. of Tare & Wet Sample (g): 468.64  
 Wt. of Tare & Dry Sample (g): 466.01  
 Weight of Tare (g): 6.71  
 Weight of Wet Sample (g): 461.93  
 Sample Volume (cm<sup>3</sup>): 180.72  
 Moisture Content (%): 0.57  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.588  
 Unit Wet Weight (pcf): 161.5  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.573**  
**Unit Dry Weight (pcf): 160.6**

Total Load (lb): 11,860  
**Uniaxial Compressive Strength (psi): 4,320**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 60  
 Time to Break (min:sec): 3:17.94  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17



## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID No.: 2017-241-002-008

Boring No.: B-1 (MP123.1)  
 Depth (ft): 25.3-26.0  
 Sample ID: R-3  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 473.30**

SPECIMEN LENGTH (in)

Reading 1: 4.03  
 Reading 2: 4.03  
 Reading 3: 4.03  
**Average: 4.03**

SPECIMEN DIAMETER (in):

Reading 1: 1.87  
 Reading 2: 1.87  
 Average: **1.87**  
 Area (in<sup>2</sup>): 2.75  
 L/D: 2.15

MOISTURE CONTENT

Tare Number: 3172  
 Wt. of Tare & Wet Sample (g): 475.53  
 Wt. of Tare & Dry Sample (g): 473.45  
 Weight of Tare (g): 6.84  
 Weight of Wet Sample (g): 468.69  
 Sample Volume (cm<sup>3</sup>): 181.97  
 Moisture Content (%): 0.45  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.601  
 Unit Wet Weight (pcf): 162.3  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.589**  
**Unit Dry Weight (pcf): 161.6**

Total Load (lb): 16,220  
**Uniaxial Compressive Strength (psi): 5,890**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 71  
 Time to Break (min:sec): 3:47.91  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Pass*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.

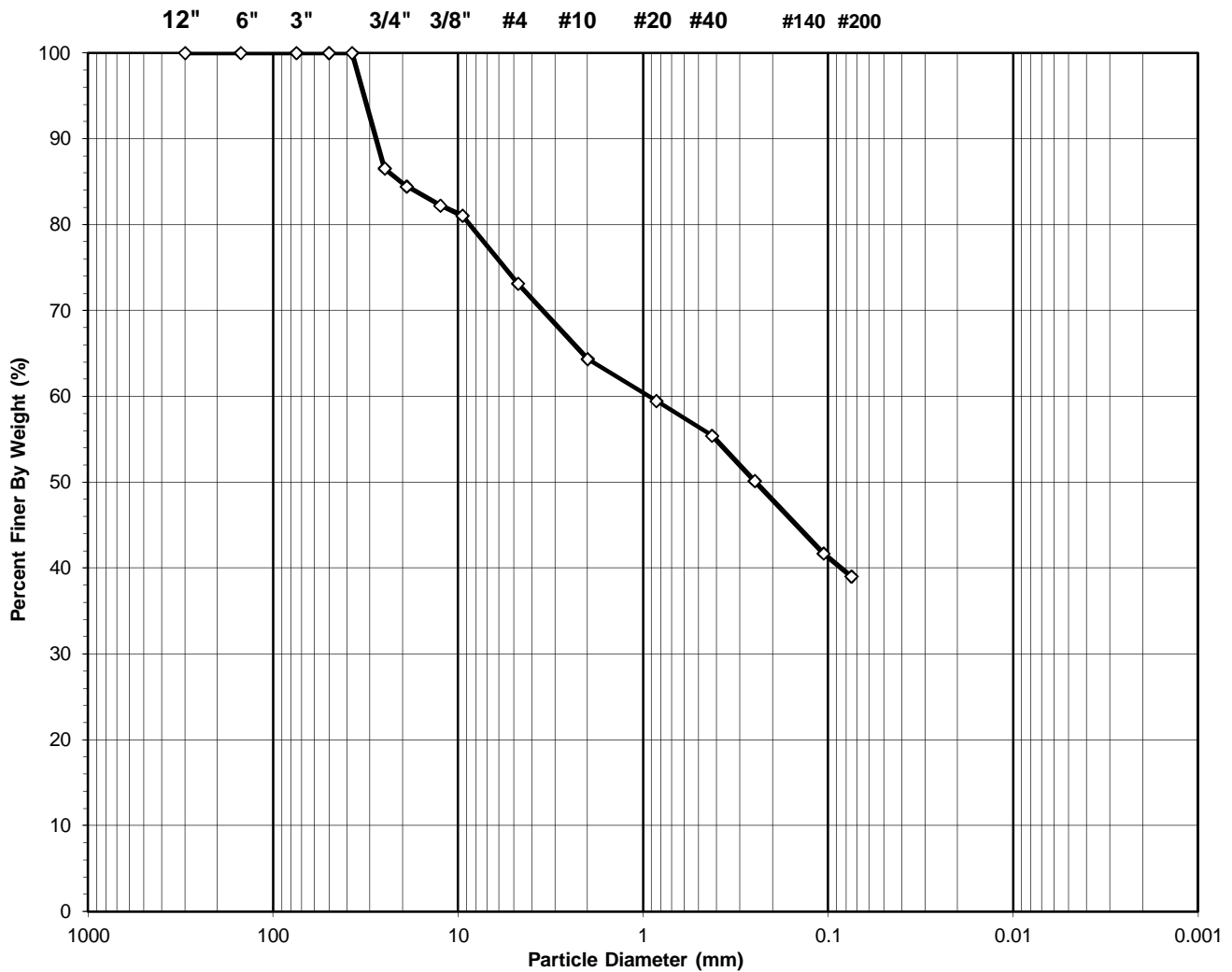


Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2(MP123.1)
Client Reference:	ACP TXG0007	Depth (ft):	8.2
Project No.:	2017-241-002	Sample No.:	B-2-4
Lab ID:	2017-241-002-012	Soil Color:	Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**SC, TESTED**

**USCS Classification:**  
**CLAYEY SAND WITH GRAVEL**

Tested By HL Date 5/15/17 Checked By TMP Date 5/16/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.: B-2(MP123.1)
Client Reference:	ACP TXG0007	Depth (ft): 8.2
Project No.:	2017-241-002	Sample No.: B-2-4
Lab ID:	2017-241-002-012	Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1437	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	691.83	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	691.83	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	144.15	Weight of Tare (g):	NA
Weight of Water (g):	0.00	Weight of Water (g):	NA
Weight of Dry Sample (g):	547.68	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>0.0</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	547.68
Dry Weight of - 3/4" Sample (g):	248.7	Weight of - #200 Material (g):	213.75
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	333.93
Dry Weight of + 3/4" Sample (g):	85.20		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	73.68	13.45	13.45	86.55	<b>86.55</b>
3/4"	19.0	11.52	2.10	15.56	84.44	<b>84.44</b>
1/2"	12.50	12.14	2.22	17.77	82.23	<b>82.23</b>
3/8"	9.50	6.45	1.18	18.95	81.05	<b>81.05</b>
#4	4.75	43.35	7.92	26.87	73.13	<b>73.13</b>
#10	2.00	48.09	8.78	35.65	64.35	<b>64.35</b>
#20	0.850	26.74	4.88	40.53	59.47	<b>59.47</b>
#40	0.425	22.23	4.06	44.59	55.41	<b>55.41</b>
#60	0.250	28.79	5.26	49.84	50.16	<b>50.16</b>
#140	0.106	46.30	8.45	58.30	41.70	<b>41.70</b>
#200	0.075	14.64	2.67	60.97	39.03	<b>39.03</b>
Pan	-	213.75	39.03	100.00	-	-

Tested By **HL**      Date **5/15/17**      Checked By **TMP**      Date **5/16/17**

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-012

Boring No.: B-2(MP123.1)  
 Depth (ft): 8.2  
 Sample No.: B-2-4  
 Soil Description: BROWN LEAN CLAY

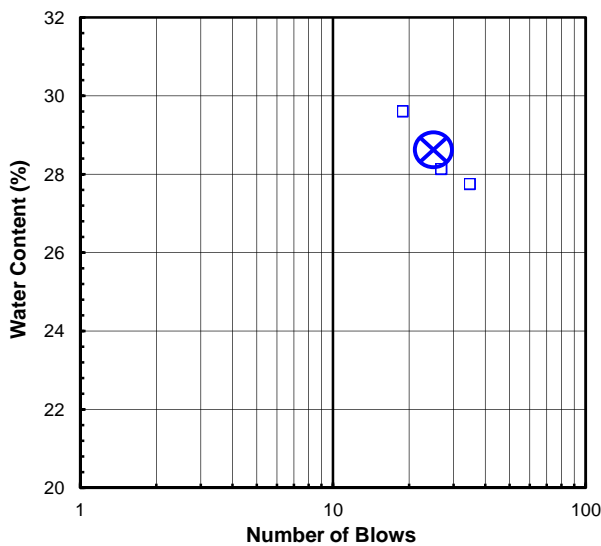
**Note: The USCS symbol used with this test refers only to the minus No. 40** (Minus No. 40 sieve material, Air dried)  
**sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	22	115	144	158	U
Wt. of Tare & Wet Sample (g):	89.69	44.70	38.35	37.64	L
Wt. of Tare & Dry Sample (g):	82.43	39.04	33.88	33.04	T
Weight of Tare (g):	7.00	18.63	17.98	17.49	I
Weight of Water (g):	7.3	5.7	4.5	4.6	P
Weight of Dry Sample (g):	75.4	20.4	15.9	15.6	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>9.6</b>	<b>27.7</b>	<b>28.1</b>	<b>29.6</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>27</b>	<b>19</b>	<b>T</b>

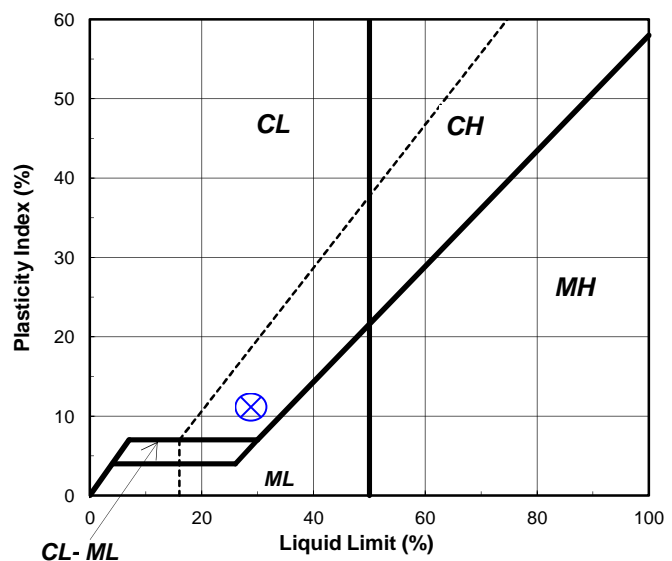
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	203	315		<b>Liquid Limit (%):</b>	<b>29</b>
Wt. of Tare & Wet Sample (g):	25.57	24.66		<b>Plastic Limit (%):</b>	<b>18</b>
Wt. of Tare & Dry Sample (g):	24.63	23.74		<b>Plasticity Index (%):</b>	<b>11</b>
Weight of Tare (g):	19.34	18.59		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	0.9	0.9			
Weight of Dry Sample (g):	5.3	5.2			
<b>Moisture Content (%):</b>	<b>17.8</b>	<b>17.9</b>	<b>-0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

**Flow Curve**



**Plasticity Chart**

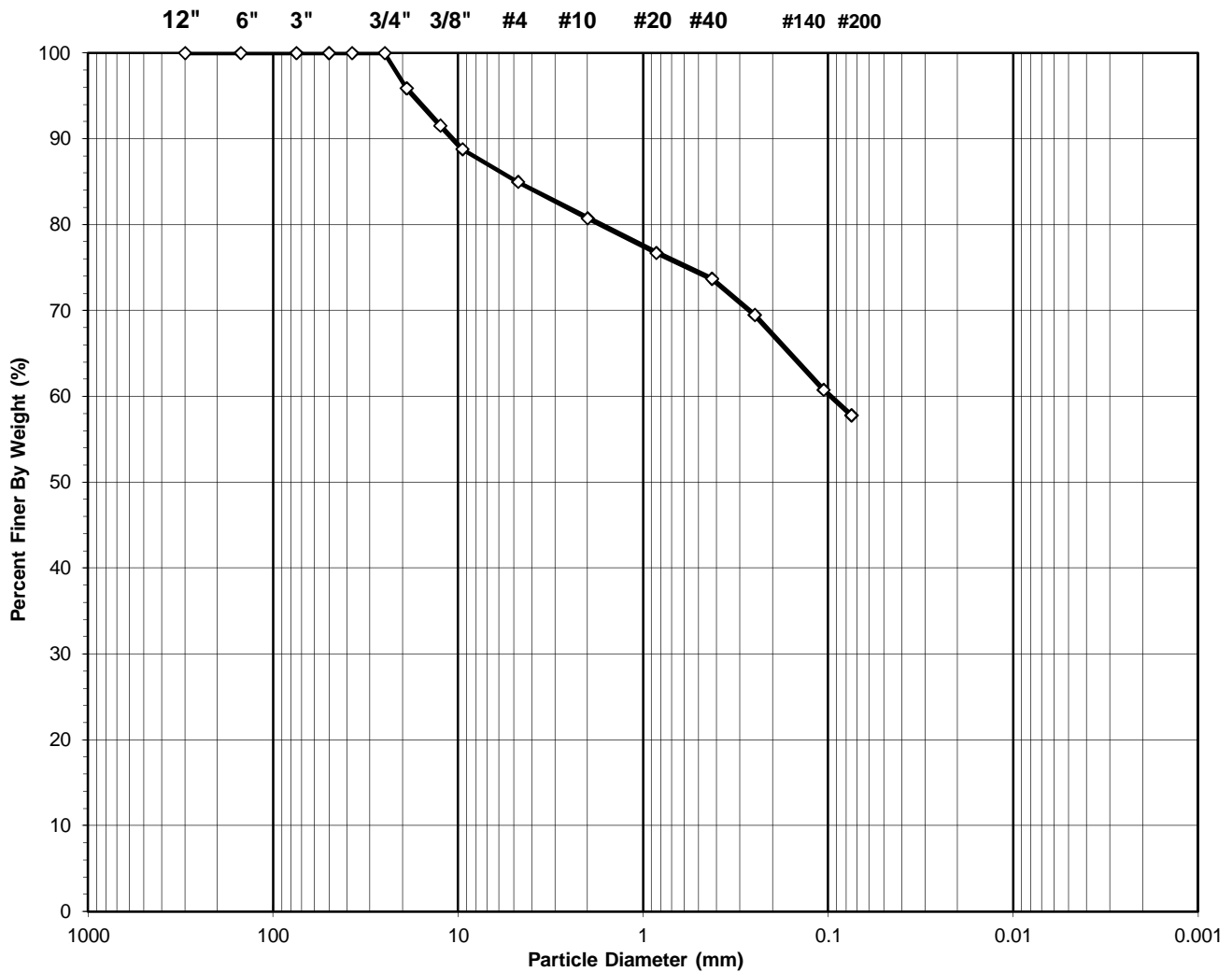


Tested By BS Date 5/11/17 Checked By TMP Date 5/12/17

**SIEVE ANALYSIS**  
ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.:	B-2(MP123.1)
Client Reference:	ACP TXG0007	Depth (ft):	10.8
Project No.:	2017-241-002	Sample No.:	B-2-5
Lab ID:	2017-241-002-013	Soil Color:	Brown

<b>USCS</b>	<b>SIEVE ANALYSIS</b>		<b>HYDROMETER</b>
	gravel	sand	silt and clay



**USCS Symbol:**  
**CL, TESTED**

**USCS Classification:**  
**SANDY LEAN CLAY WITH GRAVEL**

Tested By HL Date 5/11/17 Checked By TMP Date 5/16/17

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client:	Geosyntec Consultants, Inc.	Boring No.: B-2(MP123.1)
Client Reference:	ACP TXG0007	Depth (ft): 10.8
Project No.:	2017-241-002	Sample No.: B-2-5
Lab ID:	2017-241-002-013	Soil Color: Brown

Moisture Content of Passing 3/4" Sample		Water Content of Retained 3/4" Sample	
Tare No.:	1477	Tare No.:	NA
Wt. of Tare & Wet Sample (g):	484.12	Weight of Tare & Wet Sample (g):	NA
Wt. of Tare & Dry Sample (g):	450.30	Weight of Tare & Dry Sample (g):	NA
Weight of Tare (g):	144.11	Weight of Tare (g):	NA
Weight of Water (g):	33.82	Weight of Water (g):	NA
Weight of Dry Sample (g):	306.19	Weight of Dry Sample (g):	NA
<b>Moisture Content (%):</b>	<b>11.0</b>	<b>Moisture Content (%):</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g):	NA	Weight of the Dry Sample (g):	306.19
Dry Weight of - 3/4" Sample (g):	116.6	Weight of - #200 Material (g):	177.02
Wet Weight of +3/4" Sample (g):	NA	Weight of + #200 Material (g):	129.17
Dry Weight of + 3/4" Sample (g):	12.55		
Total Dry Weight of Sample (g):	NA		

Sieve Size	Sieve Opening (mm)	Weight of Soil Retained (g)	Percent Retained (%)	Accumulated Percent Retained (%)	Percent Finer (%)	Accumulated Percent Finer (%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	12.55	4.10	4.10	95.90	<b>95.90</b>
1/2"	12.50	13.30	4.34	8.44	91.56	<b>91.56</b>
3/8"	9.50	8.41	2.75	11.19	88.81	<b>88.81</b>
#4	4.75	11.70	3.82	15.01	84.99	<b>84.99</b>
#10	2.00	12.97	4.24	19.25	80.75	<b>80.75</b>
#20	0.850	12.36	4.04	23.28	76.72	<b>76.72</b>
#40	0.425	9.20	3.00	26.29	73.71	<b>73.71</b>
#60	0.250	12.89	4.21	30.50	69.50	<b>69.50</b>
#140	0.106	26.74	8.73	39.23	60.77	<b>60.77</b>
#200	0.075	9.05	2.96	42.19	57.81	<b>57.81</b>
Pan	-	177.02	57.81	100.00	-	-

Tested By **HL**      Date **5/11/17**      Checked By **TMP**      Date **5/16/17**



## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-013

Boring No.: B-2(MP123.1)  
 Depth (ft): 10.8  
 Sample No.: B-2-5  
 Soil Description: BROWN LEAN CLAY

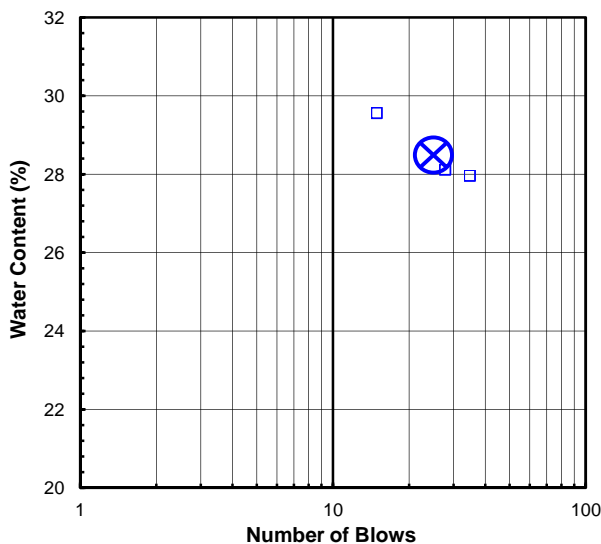
**Note: The USCS symbol used with this test refers only to the minus No. 40 (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	37	201	17	313	U
Wt. of Tare & Wet Sample (g):	68.06	37.97	38.14	38.73	L
Wt. of Tare & Dry Sample (g):	61.34	33.25	33.67	34.29	T
Weight of Tare (g):	6.97	17.27	17.76	18.40	I
Weight of Water (g):	6.7	4.7	4.5	4.4	P
Weight of Dry Sample (g):	54.4	16.0	15.9	15.9	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>12.4</b>	<b>29.5</b>	<b>28.1</b>	<b>27.9</b>	<b>N</b>
<b>Number of Blows:</b>		<b>15</b>	<b>28</b>	<b>35</b>	<b>T</b>

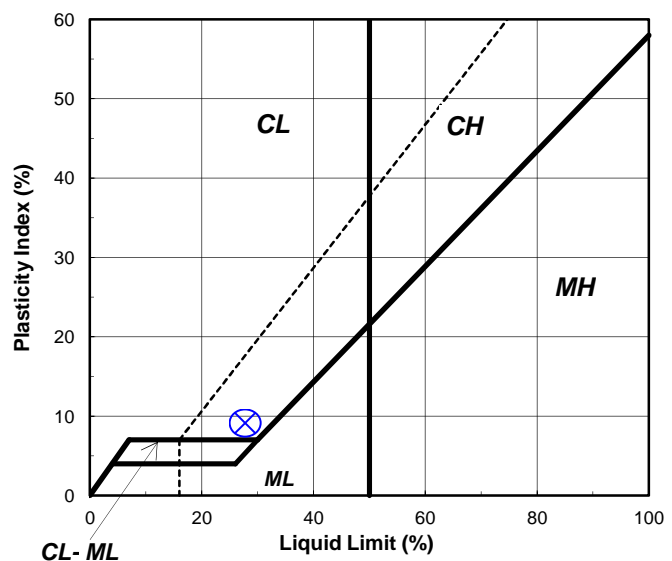
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	231	122		<b>Liquid Limit (%):</b>	<b>28</b>
Wt. of Tare & Wet Sample (g):	25.94	24.97		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	24.95	23.97		<b>Plasticity Index (%):</b>	<b>9</b>
Weight of Tare (g):	19.67	18.66		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.0	1.0			
Weight of Dry Sample (g):	5.3	5.3			
<b>Moisture Content (%):</b>	<b>18.8</b>	<b>18.8</b>	<b>-0.1</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By RAL Date 5/15/17 Checked By TMP Date 5/16/17

## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-016

Boring No.: B-2(MP123.1)  
 Depth (ft): 22.0  
 Sample No.: B-2-8  
 Soil Description: BROWN LEAN CLAY

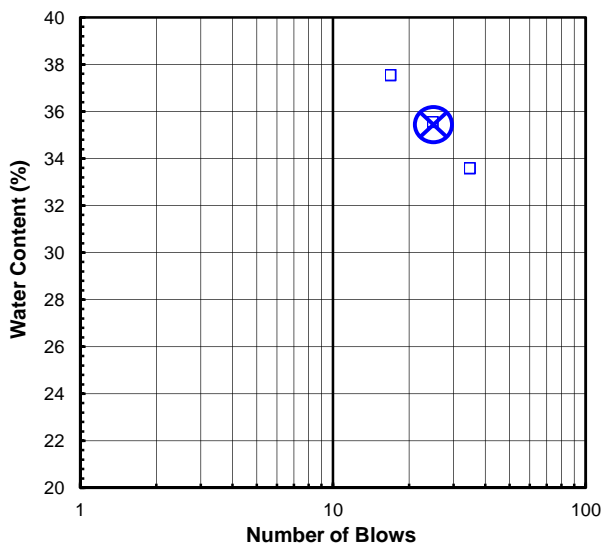
**Note: The USCS symbol used with this test refers only to the minus No. 40 (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	11	161	202	355	U
Wt. of Tare & Wet Sample (g):	69.49	38.14	37.55	38.79	L
Wt. of Tare & Dry Sample (g):	58.97	32.60	32.24	33.61	T
Weight of Tare (g):	6.92	17.83	17.29	18.17	I
Weight of Water (g):	10.5	5.5	5.3	5.2	P
Weight of Dry Sample (g):	52.1	14.8	15.0	15.4	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>20.2</b>	<b>37.5</b>	<b>35.5</b>	<b>33.5</b>	<b>N</b>
<b>Number of Blows:</b>		<b>17</b>	<b>25</b>	<b>35</b>	<b>T</b>

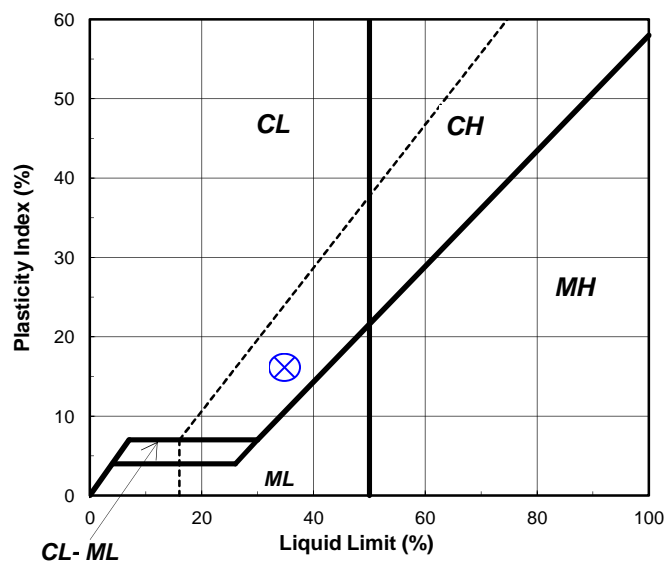
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	145	220		<b>Liquid Limit (%):</b>	<b>35</b>
Wt. of Tare & Wet Sample (g):	23.80	25.43		<b>Plastic Limit (%):</b>	<b>19</b>
Wt. of Tare & Dry Sample (g):	22.74	24.45		<b>Plasticity Index (%):</b>	<b>16</b>
Weight of Tare (g):	17.34	19.26		<b>USCS Symbol:</b>	<b>CL</b>
Weight of Water (g):	1.1	1.0			
Weight of Dry Sample (g):	5.4	5.2			
<b>Moisture Content (%):</b>	<b>19.6</b>	<b>18.9</b>	<b>0.7</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By RAL Date 5/15/17 Checked By TMP Date 5/16/17

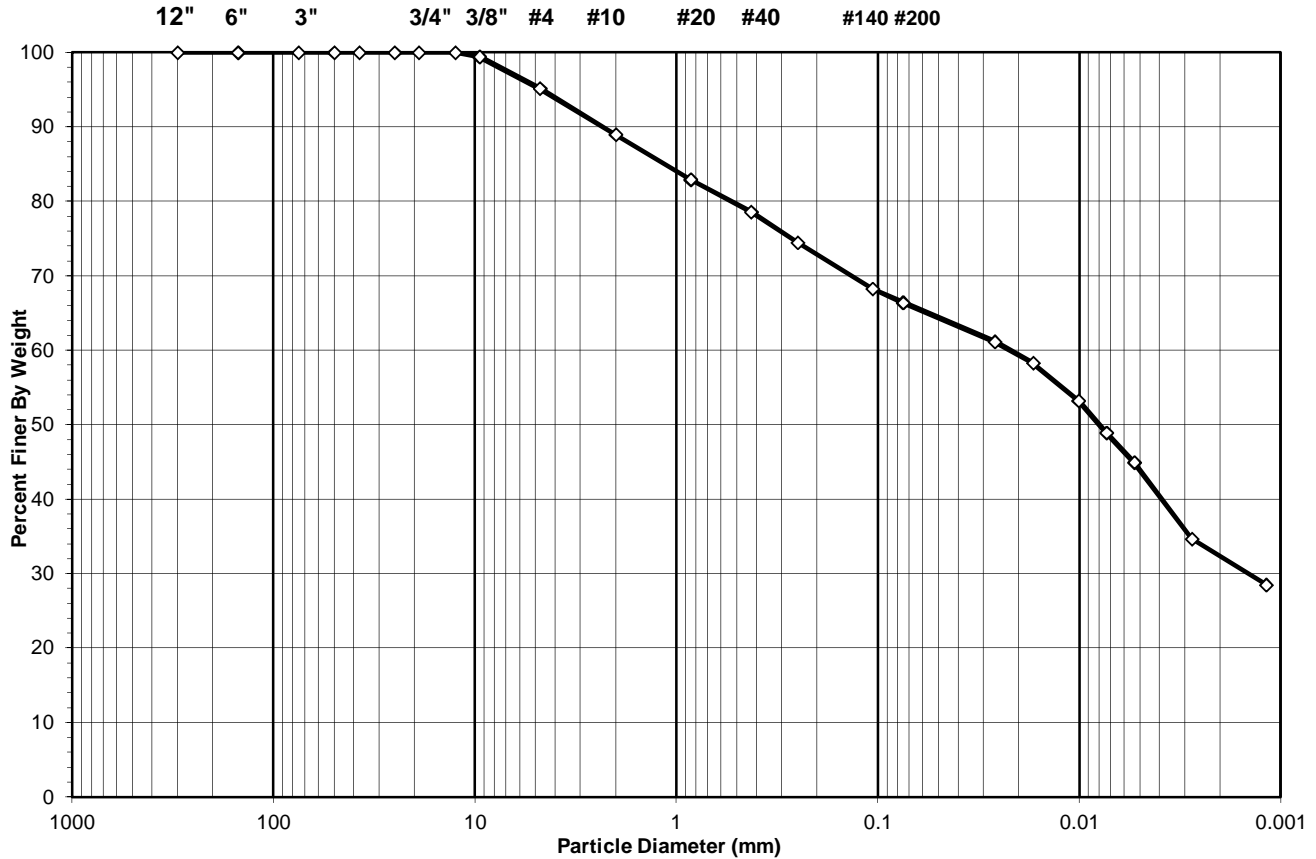
## SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-018

Boring No.: B-2(MP123.1)  
 Depth (ft): 27.5  
 Sample No.: B-2-10  
 Soil Color: Brown

USCS USDA	SIEVE ANALYSIS						HYDROMETER	
	cobble	gravel		sand		silt and clay fraction		
	cobble	gravel		sand		silt	clay	

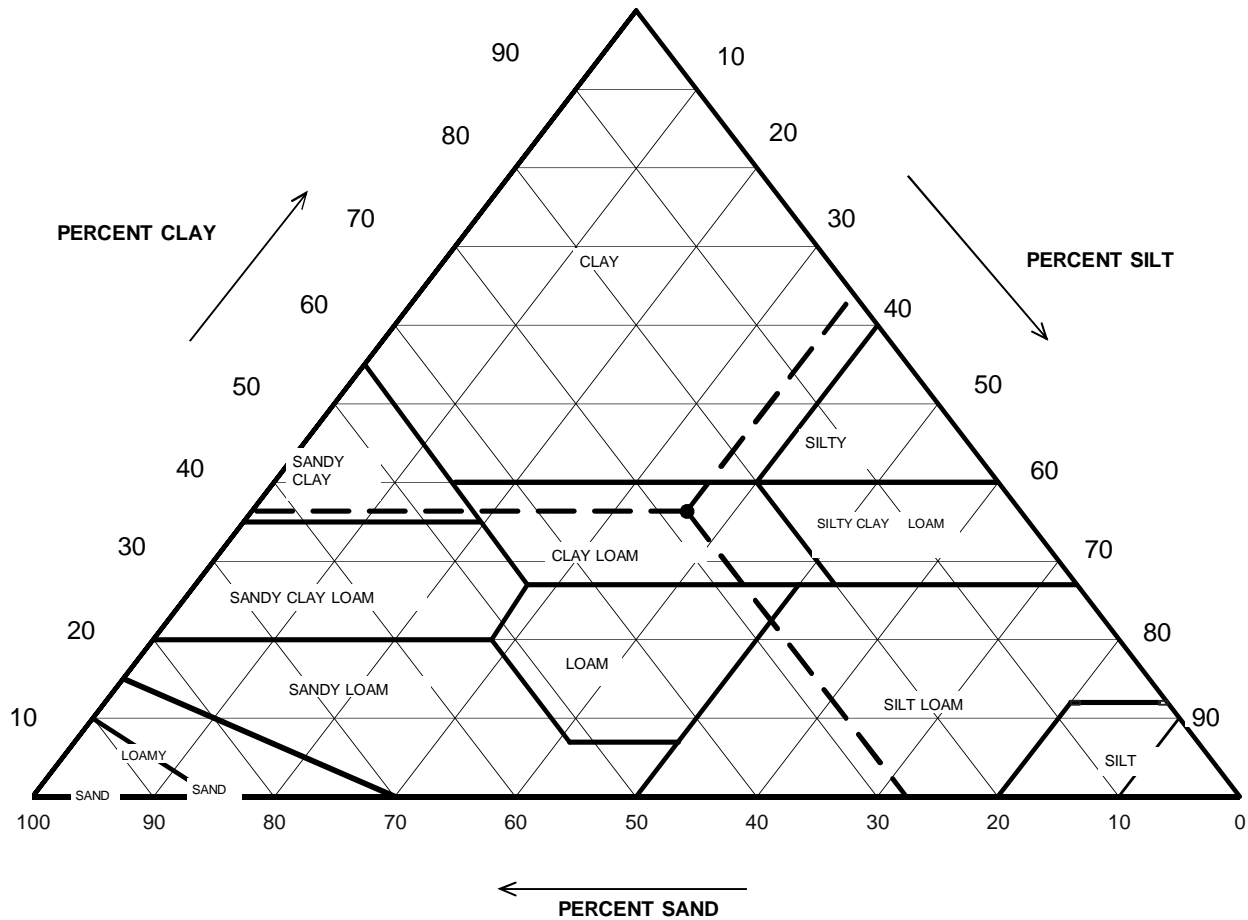


USCS Summary		
Sieve Sizes (mm)		Percentage
Greater Than #4	<i>Gravel</i>	4.84
#4 To #200	<i>Sand</i>	28.75
Finer Than #200	<i>Silt &amp; Clay</i>	66.40
<b>USCS Symbol:</b> <i>CL, TESTED</i>		
<b>USCS Classification:</b> <i>SANDY LEAN CLAY</i>		

### USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-018

Boring No.: B-2(MP123.1)  
 Depth (ft): 27.5  
 Sample No.: B-2-10  
 Soil Color: Brown



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
2	88.96	Gravel	11.04	0.00
0.05	64.38	Sand	24.59	27.64
0.002	32.32	Silt	32.05	36.03
		Clay	32.32	36.33
		<b>USDA Classification:</b>	<b>CLAY LOAM</b>	

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-018

Boring No.: B-2(MP123.1)  
 Depth (ft): 27.5  
 Sample No.: B-2-10  
 Soil Color: Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1468	Tare No.	NA
Weight of Tare & Wet Sample (g)	447.73	Weight of Tare & Wet Sample (g)	NA
Weight of Tare & Dry Sample (g)	392.76	Weight of Tare & Dry Sample (g)	NA
Weight of Tare (g)	147.19	Weight of Tare (g)	NA
Weight of Water (g)	54.97	Weight of Water (g)	NA
Weight of Dry Sample (g)	245.57	Weight of Dry Sample (g)	NA
<b>Moisture Content (%)</b>	<b>22.4</b>	<b>Moisture Content (%)</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Sample (g)	245.57
Dry Weight of -3/4" Sample (g)	82.50	Weight of - #200 Material (g)	163.07
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 Material (g)	82.50
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained	Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)	(%)	(%)
12"	300	0.00	0.00	0.00	100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00	100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00	100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00	100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00	100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00	100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00	100.00	<b>100.00</b>
1/2"	12.5	0.00	0.00	0.00	100.00	<b>100.00</b>
3/8"	9.50	1.42	0.58	0.58	99.42	<b>99.42</b>
#4	4.75	10.47	4.26	4.84	95.16	<b>95.16</b>
#10	2.00	15.22	6.20	11.04	88.96	<b>88.96</b>
#20	0.85	14.83	6.04	17.08	82.92	<b>82.92</b>
#40	0.425	10.69	4.35	21.43	78.57	<b>78.57</b>
#60	0.250	10.05	4.09	25.52	74.48	<b>74.48</b>
#140	0.106	15.32	6.24	31.76	68.24	<b>68.24</b>
#200	0.075	4.50	1.83	33.60	66.40	<b>66.40</b>
Pan	-	163.07	66.40	100.00	-	-

Tested By **HL**      Date **5/11/17**      Checked By **TMP**      Date **5/16/17**

## HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-018

Boring No.: B-2(MP123.1)  
 Depth (ft): 27.5  
 Sample No.: B-2-10  
 Soil Color: Brown

Elapsed Time	R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)		(°C)			(%)		(mm)	(%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	48.0	24.1	5.61	42.4	92.1	0.01281	0.0263	<b>61.2</b>
5	46.0	24.1	5.61	40.4	87.8	0.01281	0.0169	<b>58.3</b>
15	42.5	24.1	5.61	36.9	80.1	0.01281	0.0101	<b>53.2</b>
30	39.5	24.1	5.61	33.9	73.6	0.01281	0.0073	<b>48.9</b>
60	37.0	23.4	5.86	31.1	67.7	0.01291	0.0053	<b>44.9</b>
250	30.0	23.1	5.97	24.0	52.2	0.01296	0.0028	<b>34.7</b>
1440	25.5	23.7	5.75	19.7	42.9	0.01287	0.0012	<b>28.5</b>

Soil Specimen Data	Other Corrections
Tare No. 923	
Weight of Tare & Dry Material (g) 149.49	a - Factor 0.99
Weight of Tare (g) 98.92	
Weight of Deflocculant (g) 5.0	Percent Finer than # 200 66.40
Weight of Dry Material (g) 45.6	Specific Gravity 2.7 Assumed

**Note:** Hydrometer test is performed on - # 200 sieve material.



## ATTERBERG LIMITS

ASTM D 4318-10

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-018

Boring No.: B-2(MP123.1)  
 Depth (ft): 27.5  
 Sample No.: B-2-10  
 Soil Description: BROWN LEAN CLAY

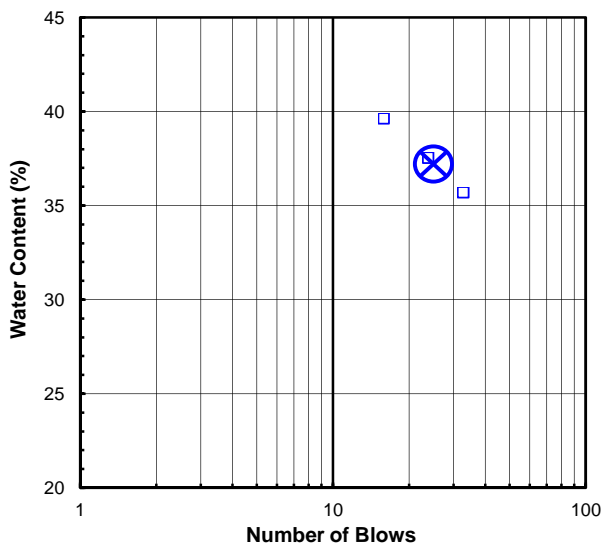
**Note: The USCS symbol used with this test refers only to the minus No. 40 sieve material. (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	39	146	158	196	U
Wt. of Tare & Wet Sample (g):	78.60	39.26	37.73	37.75	L
Wt. of Tare & Dry Sample (g):	67.08	33.50	32.21	32.48	T
Weight of Tare (g):	6.87	18.95	17.49	17.70	I
Weight of Water (g):	11.5	5.8	5.5	5.3	P
Weight of Dry Sample (g):	60.2	14.6	14.7	14.8	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>19.1</b>	<b>39.6</b>	<b>37.5</b>	<b>35.7</b>	<b>N</b>
<b>Number of Blows:</b>		<b>16</b>	<b>24</b>	<b>33</b>	<b>T</b>

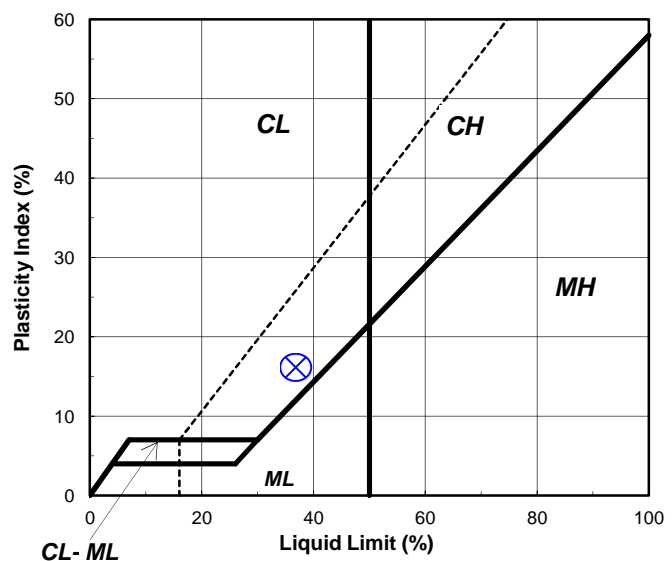
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	3	236		Liquid Limit (%):	<b>37</b>
Wt. of Tare & Wet Sample (g):	25.23	24.55		Plastic Limit (%):	<b>21</b>
Wt. of Tare & Dry Sample (g):	24.13	23.51		Plasticity Index (%):	<b>16</b>
Weight of Tare (g):	18.89	18.49		USCS Symbol:	<b>CL</b>
Weight of Water (g):	1.1	1.0			
Weight of Dry Sample (g):	5.2	5.0			
<b>Moisture Content (%):</b>	<b>21.0</b>	<b>20.7</b>	<b>0.3</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By RAL Date 5/15/17 Checked By TMP Date 5/16/17

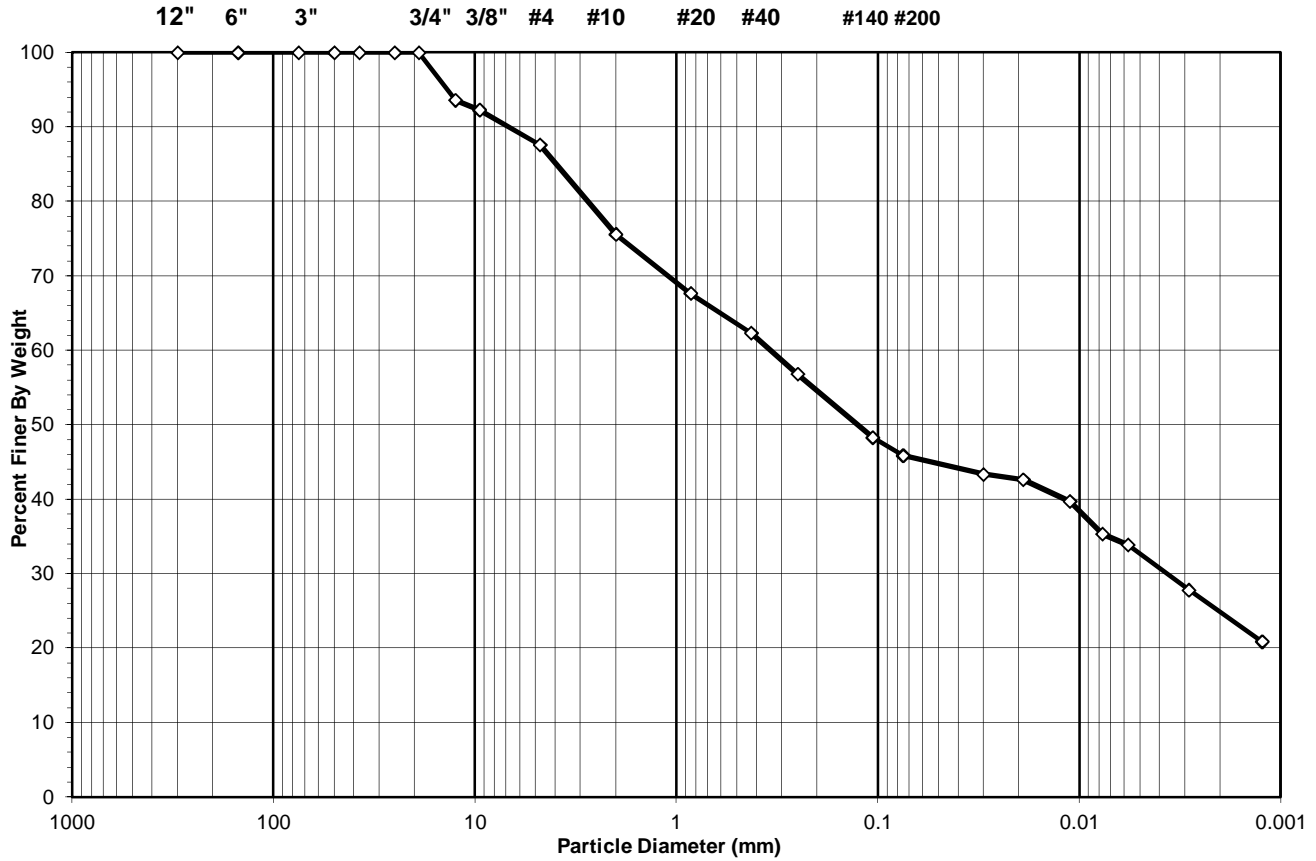
## SIEVE AND HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-019

Boring No.: B-2(MP123.1)  
 Depth (ft): 31.8  
 Sample No.: B-2-11  
 Soil Color: Brown

USCS USDA	SIEVE ANALYSIS						HYDROMETER		
	cobble		gravel		sand		silt and clay fraction		
	cobble	gravel	sand		silt	clay			

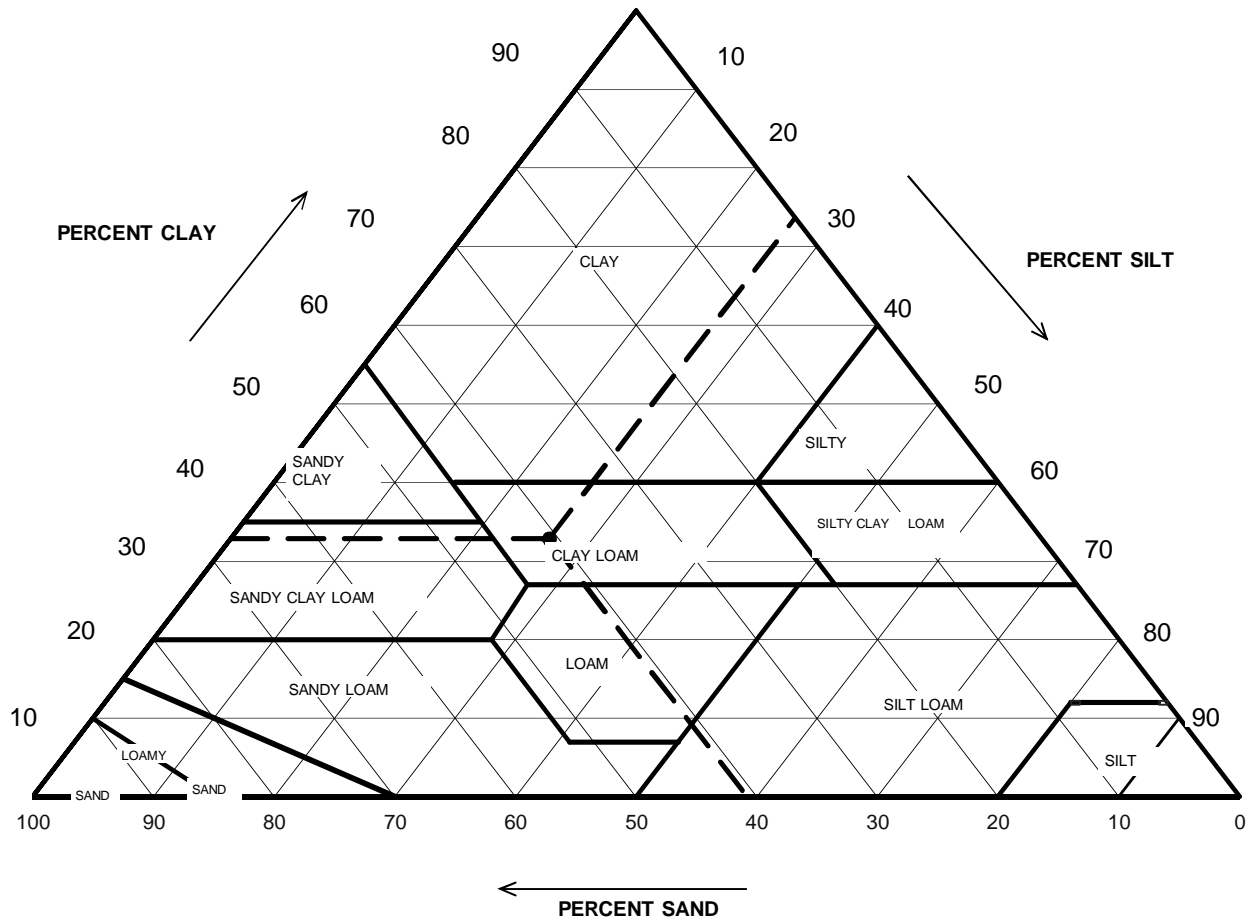


USCS Summary		
Sieve Sizes (mm)		Percentage
Greater Than #4	<i>Gravel</i>	12.40
#4 To #200	<i>Sand</i>	41.74
Finer Than #200	<i>Silt &amp; Clay</i>	45.86
<b>USCS Symbol:</b> <i>SC, TESTED</i>		
<b>USCS Classification:</b> <i>CLAYEY SAND</i>		

### USDA CLASSIFICATION CHART

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-019

Boring No.: B-2(MP123.1)  
 Depth (ft): 31.8  
 Sample No.: B-2-11  
 Soil Color: Brown



Particle Size (mm)	Percent Finer (%)	USDA SUMMARY	Actual Percentage (%)	Corrected % of Minus 2.0 mm material for USDA Classificat. (%)
2	75.60	Gravel	24.40	0.00
0.05	44.76	Sand	30.84	40.80
0.002	24.84	Silt	19.92	26.35
		Clay	24.84	32.85
		<b>USDA Classification:</b>	<b>CLAY LOAM</b>	

## WASH SIEVE ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-019

Boring No.: B-2(MP123.1)  
 Depth (ft): 31.8  
 Sample No.: B-2-11  
 Soil Color: Brown

Moisture Content of Passing 3/4" Material		Water Content of Retained 3/4" Material	
Tare No.	1453	Tare No.	NA
Weight of Tare & Wet Sample (g)	494.69	Weight of Tare & Wet Sample (g)	NA
Weight of Tare & Dry Sample (g)	494.69	Weight of Tare & Dry Sample (g)	NA
Weight of Tare (g)	137.35	Weight of Tare (g)	NA
Weight of Water (g)	0.00	Weight of Water (g)	NA
Weight of Dry Sample (g)	357.34	Weight of Dry Sample (g)	NA
<b>Moisture Content (%)</b>	<b>0.0</b>	<b>Moisture Content (%)</b>	<b>NA</b>

Wet Weight of -3/4" Sample (g)	NA	Weight of the Dry Sample (g)	357.34
Dry Weight of -3/4" Sample (g)	193.45	Weight of - #200 Material (g)	163.89
Wet Weight of +3/4" Sample (g)	NA	Weight of + #200 Material (g)	193.45
Dry Weight of +3/4" Sample (g)	0.00		
Total Dry Weight of Sample (g)	NA		

Sieve Size	Sieve Opening	Weight of Soil Retained	Percent Retained	Accumulated Percent Retained		Percent Finer	Accumulated Percent Finer
	(mm)	(g)	(%)	(%)		(%)	(%)
12"	300	0.00	0.00	0.00		100.00	<b>100.00</b>
6"	150	0.00	0.00	0.00		100.00	<b>100.00</b>
3"	75	0.00	0.00	0.00		100.00	<b>100.00</b>
2"	50	0.00	0.00	0.00		100.00	<b>100.00</b>
1 1/2"	37.5	0.00	0.00	0.00		100.00	<b>100.00</b>
1"	25.0	0.00	0.00	0.00		100.00	<b>100.00</b>
3/4"	19.0	0.00	0.00	0.00		100.00	<b>100.00</b>
1/2"	12.5	22.92	6.41	6.41		93.59	<b>93.59</b>
3/8"	9.50	4.64	1.30	7.71		92.29	<b>92.29</b>
#4	4.75	16.74	4.68	12.40		87.60	<b>87.60</b>
#10	2.00	42.90	12.01	24.40		75.60	<b>75.60</b>
#20	0.85	28.41	7.95	32.35		67.65	<b>67.65</b>
#40	0.425	19.07	5.34	37.69		62.31	<b>62.31</b>
#60	0.250	19.68	5.51	43.20		56.80	<b>56.80</b>
#140	0.106	30.46	8.52	51.72		48.28	<b>48.28</b>
#200	0.075	8.63	2.42	54.14		45.86	<b>45.86</b>
Pan	-	163.89	45.86	100.00		-	-

Tested By **HL**      Date **5/15/17**      Checked By **TMP**      Date **5/17/17**

## HYDROMETER ANALYSIS

ASTM D 422-63 (2007)

Client: Geosyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-019

Boring No.: B-2(MP123.1)  
 Depth (ft): 31.8  
 Sample No.: B-2-11  
 Soil Color: Brown

Elapsed Time	R Measured	Temp.	Composite Correction	R Corrected	N	K Factor	Diameter	N'
(min)		(°C)			(%)		(mm)	(%)
0	NA	NA	NA	NA	NA	NA	NA	NA
2	36.0	22.1	6.33	29.7	94.5	0.01311	0.0299	<b>43.4</b>
5	35.5	22.1	6.33	29.2	92.9	0.01311	0.0190	<b>42.6</b>
15	33.5	22.1	6.33	27.2	86.6	0.01311	0.0111	<b>39.7</b>
33	30.5	22.1	6.33	24.2	77.0	0.01311	0.0077	<b>35.3</b>
60	29.5	22.1	6.33	23.2	73.8	0.01311	0.0057	<b>33.9</b>
250	25.0	23.1	5.97	19.0	60.6	0.01296	0.0029	<b>27.8</b>
1440	20.5	22.4	6.22	14.3	45.5	0.01307	0.0012	<b>20.9</b>

Soil Specimen Data	Other Corrections
Tare No. 520	
Weight of Tare & Dry Material (g) 126.38	a - Factor 0.99
Weight of Tare (g) 90.30	
Weight of Deflocculant (g) 5.0	Percent Finer than # 200 45.86
Weight of Dry Material (g) 31.1	Specific Gravity 2.7 Assumed

**Note:** Hydrometer test is performed on - # 200 sieve material.

Tested By TO Date 5/15/17 Checked By TMP Date 5/17/17

## ATTERBERG LIMITS

ASTM D 4318-10

Client: GeoSyntec Consultants, Inc.  
 Client Reference: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID: 2017-241-002-019

Boring No.: B-2(MP123.1)  
 Depth (ft): 31.8  
 Sample No.: B-2-11  
 Soil Description: BROWN LEAN CLAY

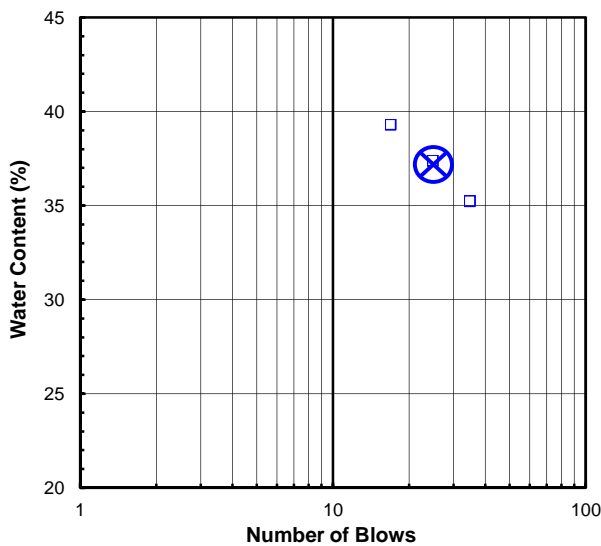
**Note: The USCS symbol used with this test refers only to the minus No. 40 (Minus No. 40 sieve material, Air dried) sieve material. See the "Sieve and Hydrometer Analysis" graph page for the complete material description.**

As Received Moisture Content		Liquid Limit Test			
ASTM D2216-10		1	2	3	M
Tare Number:	8	319	405	396	U
Wt. of Tare & Wet Sample (g):	63.91	41.01	39.91	42.38	L
Wt. of Tare & Dry Sample (g):	55.72	35.10	33.80	35.42	T
Weight of Tare (g):	6.96	18.31	17.44	17.69	I
Weight of Water (g):	8.2	5.9	6.1	7.0	P
Weight of Dry Sample (g):	48.8	16.8	16.4	17.7	O
Was As Received MC Preserved:	<b>Yes</b>				I
<b>Moisture Content (%):</b>	<b>16.8</b>	<b>35.2</b>	<b>37.3</b>	<b>39.3</b>	<b>N</b>
<b>Number of Blows:</b>		<b>35</b>	<b>25</b>	<b>17</b>	<b>T</b>

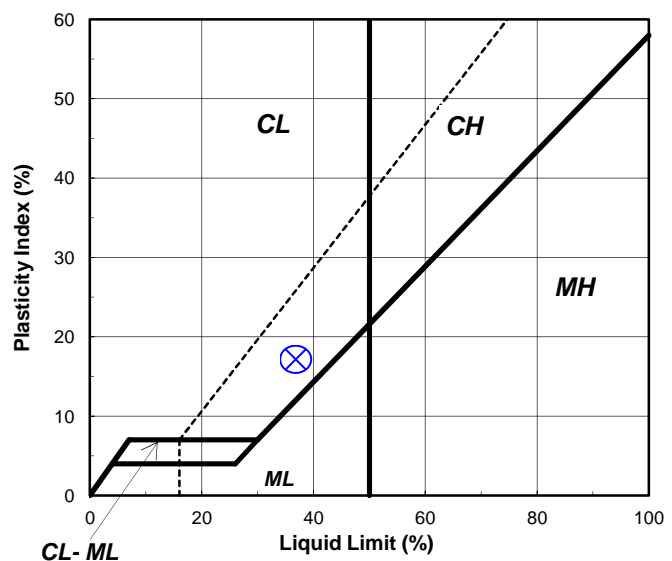
Plastic Limit Test	1	2	Range	Test Results	
Tare Number:	1251	1287		Liquid Limit (%):	<b>37</b>
Wt. of Tare & Wet Sample (g):	21.02	22.25		Plastic Limit (%):	<b>20</b>
Wt. of Tare & Dry Sample (g):	20.00	21.20		Plasticity Index (%):	<b>17</b>
Weight of Tare (g):	14.95	16.00		USCS Symbol:	<b>CL</b>
Weight of Water (g):	1.0	1.1			
Weight of Dry Sample (g):	5.1	5.2			
<b>Moisture Content (%):</b>	<b>20.2</b>	<b>20.2</b>	<b>0.0</b>		

*Note: The acceptable range of the two Moisture contents is  $\pm 1.4$*

Flow Curve



Plasticity Chart



Tested By TO Date 5/12/17 Checked By TMP Date 5/12/17



## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID No.: 2017-241-002-021

Boring No.: B-2 (MP123.1)  
 Depth (ft): 41.6-42.2  
 Sample ID: R-1  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 473.35**

SPECIMEN LENGTH (in)

Reading 1: 4.00  
 Reading 2: 4.00  
 Reading 3: 4.00  
**Average: 4.00**

SPECIMEN DIAMETER (in):

Reading 1: 1.97  
 Reading 2: 1.98  
 Average: **1.97**  
 Area (in<sup>2</sup>): 3.06  
 L/D: 2.03

MOISTURE CONTENT

Tare Number: 3061  
 Wt. of Tare & Wet Sample (g): 479.32  
 Wt. of Tare & Dry Sample (g): 475.00  
 Weight of Tare (g): 6.88  
 Weight of Wet Sample (g): 472.44  
 Sample Volume (cm<sup>3</sup>): 200.71  
 Moisture Content (%): 0.92  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.358  
 Unit Wet Weight (pcf): 147.2  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.337**  
**Unit Dry Weight (pcf): 145.8**

Total Load (lb): 1,900  
**Uniaxial Compressive Strength (psi): 620**

Fracture Type: **Shear**

Rate of Loading (lb/sec): 32  
 Time to Break (min:sec): 0:58.53  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17

## UNCONFINED COMPRESSIVE STRENGTH of INTACT ROCK CORE SPECIMENS

ASTM D 7012-14 Method C

This method does not report strain rate or deformation

Client: Geosyntec Consultants, Inc.  
 Client Project: ACP TXG0007  
 Project No.: 2017-241-002  
 Lab ID No.: 2017-241-002-022

Boring No.: B-2 (MP123.1)  
 Depth (ft): 49.2-50.0  
 Sample ID: R-3  
 Moisture Condition: As Received-Unpreserved

**Specimen Weight (g): 481.24**

SPECIMEN LENGTH (in)

Reading 1: 4.00  
 Reading 2: 4.00  
 Reading 3: 4.00  
**Average: 4.00**

SPECIMEN DIAMETER (in):

Reading 1: 1.97  
 Reading 2: 1.98  
 Average: **1.98**  
 Area (in<sup>2</sup>): 3.06  
 L/D: 2.02

MOISTURE CONTENT

Tare Number: 3247  
 Wt. of Tare & Wet Sample (g): 472.92  
 Wt. of Tare & Dry Sample (g): 468.82  
 Weight of Tare (g): 6.74  
 Weight of Wet Sample (g): 466.18  
 Sample Volume (cm<sup>3</sup>): 200.58  
 Moisture Content (%): 0.89  
 Unit Wet Weight (g/cm<sup>3</sup>): 2.399  
 Unit Wet Weight (pcf): 149.7  
**Unit Dry Weight (g/cm<sup>3</sup>): 2.378**  
**Unit Dry Weight (pcf): 148.4**

Total Load (lb): 2,890  
**Uniaxial Compressive Strength (psi): 940**

Fracture Type: **Cone & Split**

Rate of Loading (lb/sec): 29  
 Time to Break (min:sec): 1:38.15  
 Deviation From Straightness<sup>2</sup>:

AXIAL: *Fail*                      TOP: *Pass*                      BOTTOM: *Pass*

Physical Description:                      Rock Core

Notes:

- 1) Moisture conditions at time of the test are: As Received-Unpreserved
- 2) Sample prep conforms to ASTM D4543-08 "best effort" if applicable
- 3) Deviation from straightness, Procedure A of ASTM D 4543-08  
 Pass/Fail criteria: gap < 0.02 = Pass, gap > 0.02 = Fail
- 4) Temperature is laboratory room temperature.
- 5) D4543 Prep and D7012 Testing Equipment Used:  
 G788 Compression Machine,  
 G1661 Digital Calipers, G1380 Dial Gauge,  
 G1616 Straight Edge, G1571 Feeler Gauge,  
 G1633 V-Block, G1634 Rock Saw, G1635 Grinder.



Tested By: JAC                      Date: 5/13/17                      Checked By: KC                      Date: 5/17/17