Segment 12 Package 7B HDD Borings - Rockland

Champlain Hudson Power Express

New York

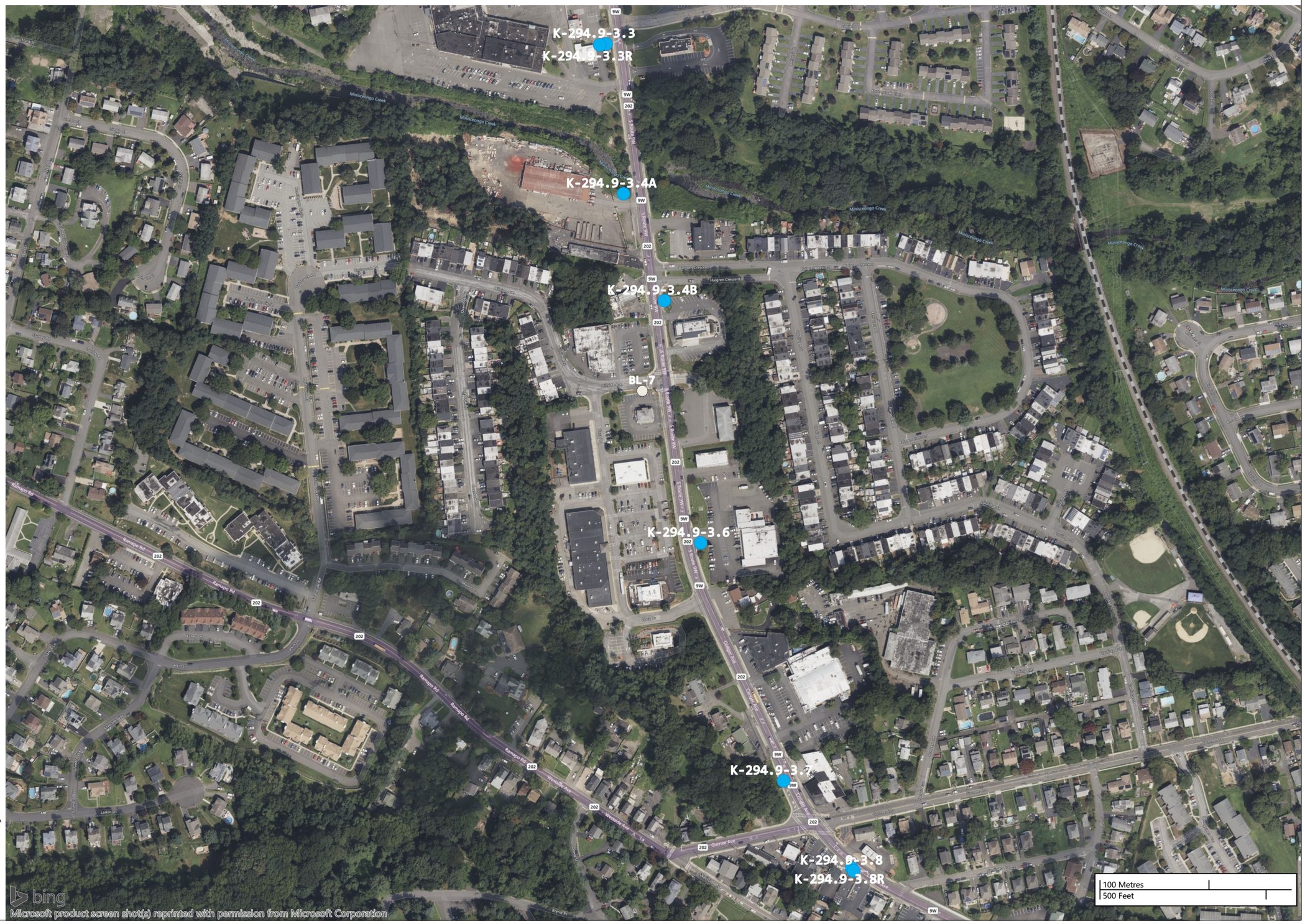
PROJECT NUMBER 20001480

CREATED BY Kiewit

DATE 07/05/2022

Legend Key

- Kiewit Borings (2022)
- Borings by Others



EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.6

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 862925.98 E 634278.00
START DATE	04/18/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	100.4 ft
FINISH DATE	04/18/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0	100.2	3" Topsoil Silty SAND (SM) (based on observations of excavated materials) 0 - 7.42 ft was excavated by air knife and vacuum truck						Boring advanced with 3.5" ID HSA
								Water added to hole
5								
	93.0	Silty SAND (SM), with gravel, trace clay, reddish brown, dense, dry to moist			50%		20-12-22-14 (34)	
10								
					0%		18-20-27-13 (47)	
15								
					0%		27-15-16-23 (31)	
20	80.4	Clayey SAND (SC), with gravel, grayish brown, very dense, moist			100%		100/3"	3-inch ring sampler
					0%		100/1"	
25	75.4	Siltstone, fresh, closely spaced fractures, fine grained, maroon, very strong			100% 67			
					89% 25			
30								

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.6

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 862925.98 E 634278.00
START DATE	04/18/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	100.4 ft
FINISH DATE	04/18/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
			Siltstone, fresh, closely spaced fractures, fine grained, maroon, very strong			100% 44			
35	65.4		Boring Terminated at 35 ft						
40									
45									
50									
55									
60									

Legend

- ▲ SPT N Value
- ● MC (%)
- — PL & LL (%)
- ⊠ Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.7

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 862210.06 E 634533.31
START DATE	04/14/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	124.7 ft
FINISH DATE	04/14/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0		18" Asphalt						Boring advanced with 3.25" ID HSA
	123.2	Silty SAND (SM) (based on observations of excavated materials) 0 - 7.5 ft was excavated by air knife and vacuum truck						
5								
	117.2	SAND with SILT (SP-SM), with gravel, reddish brown, loose to medium dense, dry to moist						Water added to hole
					38%		2-8-8-9 (16)	
10								
		Trace clay						
					58%		2-3-4-4 (7)	
15								
					54%		24-10-9-8 (19)	
20								
					0%		55-100/5"	3-inch ring sampler
25					100%		28-100/4"	
					100%		50/4"	
					100%		40-52-50/4"	
30								

Legend

▲ SPT N Value
● MC (%)
— PL & LL (%)
⊠ Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.7

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 862210.06 E 634533.31
START DATE	04/14/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	124.7 ft
FINISH DATE	04/14/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
35	89.7		Clay seams in soil Boring Terminated at 35 ft			84%		10-8-9-22 (17)	

Legend

▲ SPT N Value
● MC (%)
— PL & LL (%)
⊠ Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.8

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas	**COORDINATES**	N 861940.25 E 634747.10
START DATE	04/28/2022	**DRILLER/RIG**	Corey B. / CME 550	**GROUND ELEV.**	124.7 ft
FINISH DATE	04/28/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0	123.6	13" Asphalt						Boring advanced with 3.25" ID HSA
		Silty SAND (SM), with gravel and cobbles (based on observation of excavated soils) 0 - 7 ft was excavated using an air knife and vacuum truck						
5	117.7	Silty SAND (SM), with gravel, medium to coarse sand, coarse gravel, subangular, brown, dense, moist			42%		20-30-13-14 (43)	
10	111.7	SILT (ML), with gravel, fine to coarse, brown, hard, moist			67%		25-50/3"	
	110.7	Auger refusal at 14 ft, about 3.5 ft boulder, switched to NQ rock coring			40% 0			
15								
20		Could not progress further than 29 ft, boring would cave in to about 20 ft during extrusion of core barrel, with no recovery in any of the rock core runs			0% 0			
25					0% 0			
30	95.7	Boring Terminated at 29 ft						

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.8R

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 861948.90 E 634741.05
START DATE	05/02/2022	**DRILLER/RIG**	Corey / CME 550	**GROUND ELEV.**	124.7 ft
FINISH DATE	05/02/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0		18" Asphalt						Boring advanced with 3.5" ID HSA
	123.2	Silty SAND (SM) (based on observations of excavated materials) 0 - 6.67 ft was excavated by air knife and vacuum truck						
5								
	118.0	SAA, with conglomerate fragments, reddish brown to tan, medium dense to very dense						Boring advanced to 13 ft without sampling
10								
					100%		43-50/4"	
15								
		With little gravel			42%		19-10-11-12 (21)	
20								
					100%		50/1"	3-inch ring sampler
25					100%		43-50/4"	
					40%		32-50/4"	
30								

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-3.8R

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 861948.90 E 634741.05
START DATE	05/02/2022	**DRILLER/RIG**	Corey / CME 550	**GROUND ELEV.**	124.7 ft
FINISH DATE	05/02/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
	94.7		GRAVEL with SILT (GP-GM), with sand, reddish brown to tan, very dense			100%		50/3"	
35	89.7		Siltstone, fine grained, closely to very closely spaced fractures, red, strong to very strong			100% 80			
40						100% 97			
45						100% 81			
50	74.7		Boring Terminated at 50.2 ft						
55									
60									

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

SOIL LEGEND

Explanation of Symbols and Terms Used on Boring and Test Pit Logs for Sampling and Description of Soils

SAMPLE AND DRILL METHODS

☒	Standard Penetration Split-Spoon Sample
■	Undisturbed Sample
⊞	Piston Sampler
✋	Grab Sample
◇	Bulk Sample
▙	Auger Cuttings
▮	Rock Core
⧓	Modified California Sample

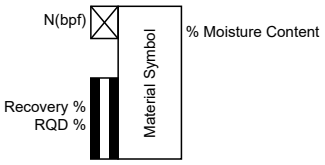
WATER LEVEL SYMBOLS

▽	Observation at time of drilling
▽	Observation after drilling
▼	Delayed observation
▽	Perched water observed at drilling
≋	Observed Seepage
▽	Cave-in Depth

COMMON ABBREVIATIONS AND ACRONYMS

MR	Mud Rotary
HSA	Hollow Stem Auger
SSA	Solid Stem Auger
SS	Split Spoon Sampler
UD	Undisturbed Sample
WOR	Weight of Rods
WOH	Weight of Hammer
SPT	Standard Penetration Test
REC	Recovery
RQD	Rock Quality Designation
MC	Moisture Content
PI	Plasticity Index
PL	Plastic Limit
LL	Liquid Limit
CPT	Cone Penetration Test
PP	Pocket Penetrometer
Bulk	Bulk Sample
EOB	End of Boring
AR	Auger Refusal
N-Value	Sum of blows for last two 6-in. increments of SPT
USCS	Unified Soil Classification System

CROSS SECTION LEGEND



RELATIVE DENSITY / CONSISTENCY

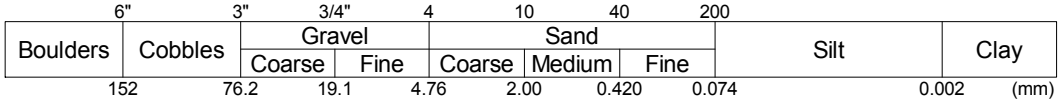
Coarse-grained Soils		Fine-grained Soils		
N-Value	Density	N-Value	Consistency	Pocket Pen (TSF)
0 - 4	Very Loose	0 - 1	Very Soft	0.0 - 0.25
5 - 10	Loose	2 - 4	Soft	0.25 - 0.50
11 - 30	Medium	5 - 8	Firm	0.51 - 1.00
31 - 50	Dense	9 - 15	Stiff	1.01 - 2.00
> 50	Very Dense	16 - 30	Very Stiff	2.01-4.00
		> 30	Hard	> 4.00

RELATIVE PROPORTIONS OF GRAVEL, SAND, AND FINES

Trace	> 5 %
Few	5 to 10 %
Little	15 to 25 %
Some	30 - 45 %
Mostly	50 to 100 %

SOIL GRAIN SIZE

U.S. Standard Sieve



CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible free water
Wet	Visible free water, typically soil is below water table

CRITERIA FOR DESCRIBING CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

CRITERIA FOR DESCRIBING STRUCTURE

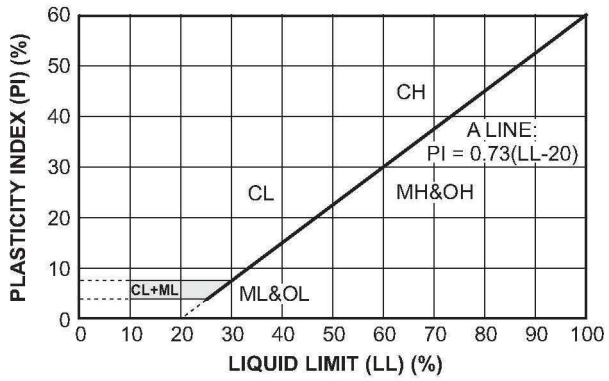
Description	Criteria
Stratified	Alternating layers of varying material or color with layers at least 1/4 in. thick; note thickness
Laminated	Alternating layers of varying material or color with the layers less than 1/4 in. thick; note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

SOIL SYMBOLS

USCS SOIL TYPES		
Symbol	Group	Description
	GW	Well-graded gravels, gravel sand mixtures with trace or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures with trace or no fines
	GW-GM	Well-graded gravels, gravel-sand mixtures with silt fines
	GW-GC	Well-graded gravels, gravel-sand mixtures with clay fines
	GP-GM	Poorly-graded gravels, gravel-sand mixtures with silt fines
	GP-GC	Poorly-graded gravels, gravel-sand mixtures with clay fines
	GM	Silty gravels, gravel-silt-sand mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	GC-GM	Clayey gravels, gravel-sand-clay-silt mixtures
	SW	Well-graded sands, sand-gravel mixtures with trace or no fines
	SP	Poorly-graded sands, sand-gravel mixtures with trace or no fines
	SW-SM	Well-graded sands, sand-gravel mixtures with silt fines
	SW-SC	Well-graded sands, sand-gravel mixtures with clayfines
	SP-SM	Poorly-graded sands, sand-gravel mixtures with silt fines
	SP-SC	Poorly-graded sands, sand-gravel mixtures with clay fines
	SM	Silty sands, sand-gravel-silt mixtures
	SC	Clayey sands, sand-gravel-clay mixtures
	SC-SM	Clayey sands, sand-gravel-clay-silt mixtures
	ML	Inorganic silts with low plasticity
	CL	Inorganic clays of low plasticity, gravelly or sandy clays, silty clays, lean clays
	CL-ML	Inorganic clay-silts of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
	MH	Inorganic silts of high plasticity, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays and organic silts of high plasticity
	PT	Peat, humus, swamp soils with high organic contents

OTHER MATERIALS	
Symbol	Description
	Asphalt
	Concrete
	Crushed Stone/Aggregate Base
	Fill

PLASTICITY CHART



ROCK LEGEND

Explanation of Symbols and Terms Used on Boring and Test Pit Logs for Sampling and Description of Rock

TERMS AND ABBREVIATIONS	
Fracture	Collective term for any seperation in a geologic formation
Joint (JT)	Natural break in a layer or body of rock that lacks visible offset
Bedding	Layers of sedimentary rocks that are distinctly different from overlying and underlying beds
Mechanical Break (MB)	Breaks due to drilling or handling in rock or sediment cores
RQD	Rock Quality Designation
REC	Percent Recovery
Shear (SH)	Surface of differential movement evident by presence of slickensides, striations, or polishing
Shear Zone (SZ)	Zone of gouge and rock fragments bounded by planar shear surfaces
Fault (FT)	Planar fracture with significant displacement

ROCK HARDNESS	
Very Soft	Can be deformed by hand (has a rock-like character but can be broken easily by hand)
Soft	Can be scratched by fingernail (cannot be crumbled between fingers but can be easily pitted with light blows of a geology hammer)
Moderately Hard	Can be scratched easily with a knife; cannot be scratched with a fingernail (can be pitted with moderate blows of a geology hammer)
Hard	Difficult to scratch with a knife (cannot be pitted with a geology hammer but can be chipped with moderate blows of the hammer)
Very Hard	Cannot be scratched with a knife (chips can be broken off only with heavy blows of the geology hammer)

BEDDING THICKNESS		
Laminated	< 0.04 in.	< 1 mm
Parting	0.04 - 1/4 in.	1 - 6 mm
Banded	1/4 - 1 in.	6 mm - 3 cm
Thin	1 - 4 in.	3 - 9.1 cm
Medium	4 in. - 1 ft.	9.1 - 30.5 cm
Thick	1 - 3 ft.	30.5 cm - 1 m
Massive	> 3 ft.	> 1 m

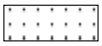
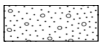
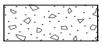
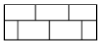
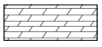
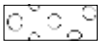
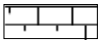
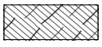
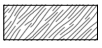
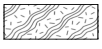
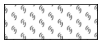
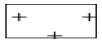
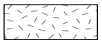
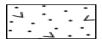
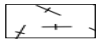
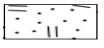
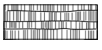
JOINT AND FRACTURE DENSITY		
Very Tight	< 2 in.	< 5.1 cm
Tight	2 in. - 1 ft.	5.1 - 30.5 cm
Moderately tight	1 - 3 ft.	30.5 - 91.4 cm
Wide	3 - 10 ft.	91.4 cm - 3 m

VOIDS	
Porous	Smaller than a pinhead. Their presence is indicated by the degree of absorbency.
Pitted	Pinhead size to a 1/4 in. If only thin walls separate the individual pits, the core may be described as honeycombed.
Vug	1/4 in. to the diameter of the core. The upper limit will vary with core size.
Cavity	Larger than the diameter of the core.

TEXTURE	
Aphanitic	Individual grains or crystals are too small to be seen with the naked eye.
Fine-grained, finely crystalline	Grain diameters between 0.1 and 1 mm; grains or crystals can be seen with naked eye.
Medium-grained, crystalline	Grain diameters between 1 and 5 mm.
Coarse-grained, coarsely crystalline	Grain diameters greater than 5 mm.

WEATHERING	
Unweathered	No evidence of any mechanical or chemical alteration.
Slightly	Superficial discoloration, alteration, and/or discoloration along discontinuities; less than 10% of the rock volume is altered; strength is essentially unaffected.
Moderately	Discoloration is evident; surface is pitted and altered, with alterations penetrating well below rock surfaces; 10 to 50% of the rock is altered; strength is noticeably less than unweathered rock.
Highly	Entire section is discolored; alteration is greater than 50%; some areas of slightly weathered rock are present; some minerals are leached away; retains only a fraction of its original strength (wet strength is usually lower than dry strength).
Decomposed	Saprolite; rock is essentially reduced to a soil with a relic rock texture; can be molded or crumbled by hand.

ROCK SYMBOLS

ROCK TYPES		
Sedimentary Rocks		Shale
		Siltstone
		Sandstone
		Conglomerate
		Breccia
		Limestone
		Dolomite
		Gypsum
		Coal
		Coral
		Chalk
Metamorphic Rocks		Slate
		Schist
		Gneiss
		Quartzite
		Serpentinite
		Greenstone
Igneous Rocks		Granite
		Tuff
		Rhyolite
		Dacite
		Andesite
		Basalt

OTHER MATERIALS		
Other		Asphalt
		Concrete
		Bedrock

ROCK QUALITY DESIGNATION (RQD) AND RECOVERY

% RQD	Quality
< 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

$$\text{Recovery (\%)} = \frac{\text{Length of Core Sample Recovered}}{\text{Length of the Core Run}} \times 100$$

$$\text{RQD (\%)} = \frac{\text{Sum of Lengths of Intact Rock Pieces of 4 in. and Longer}}{\text{Length of the Core Run}} \times 100$$

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/20/22
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

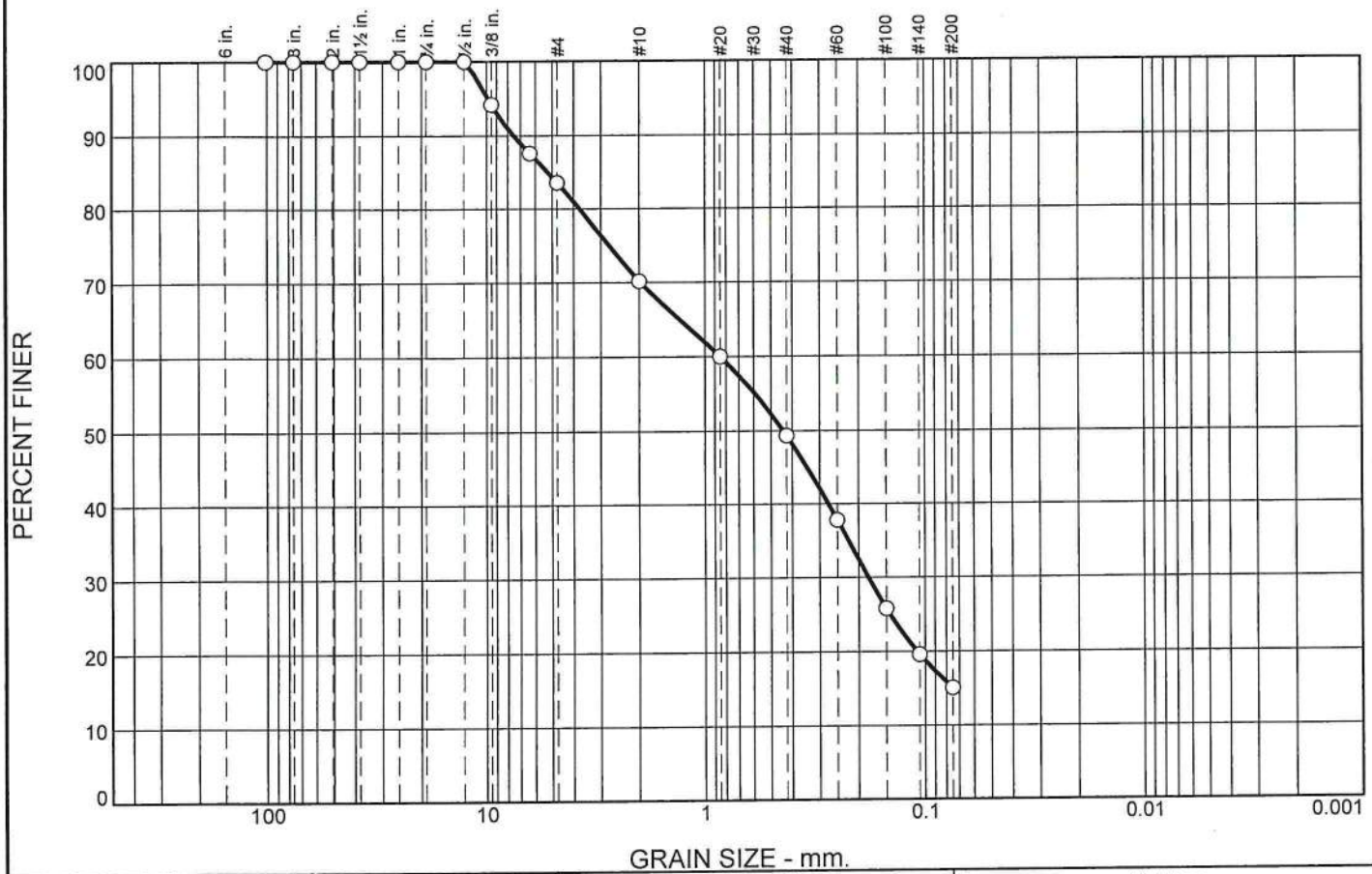
See attached reports for testing requested by the client as per attached submittals for locations K.294.9-3.6.

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.4	13.4	20.9	34.2	15.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	94.2		
1/4	87.6		
#4	83.6		
#10	70.2		
#20	60.0		
#40	49.3		
#60	37.8		
#100	25.8		
#140	19.6		
#200	15.1		

* (no specification provided)

Material Description

SS-1

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.5309 D_{85}= 5.2436 D_{60}= 0.8500
D_{50}= 0.4412 D_{30}= 0.1810 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913
Moisture Content- 11.9%

Source of Sample: 3.6 **Depth:** 8'-10'
Sample Number: 01-042022

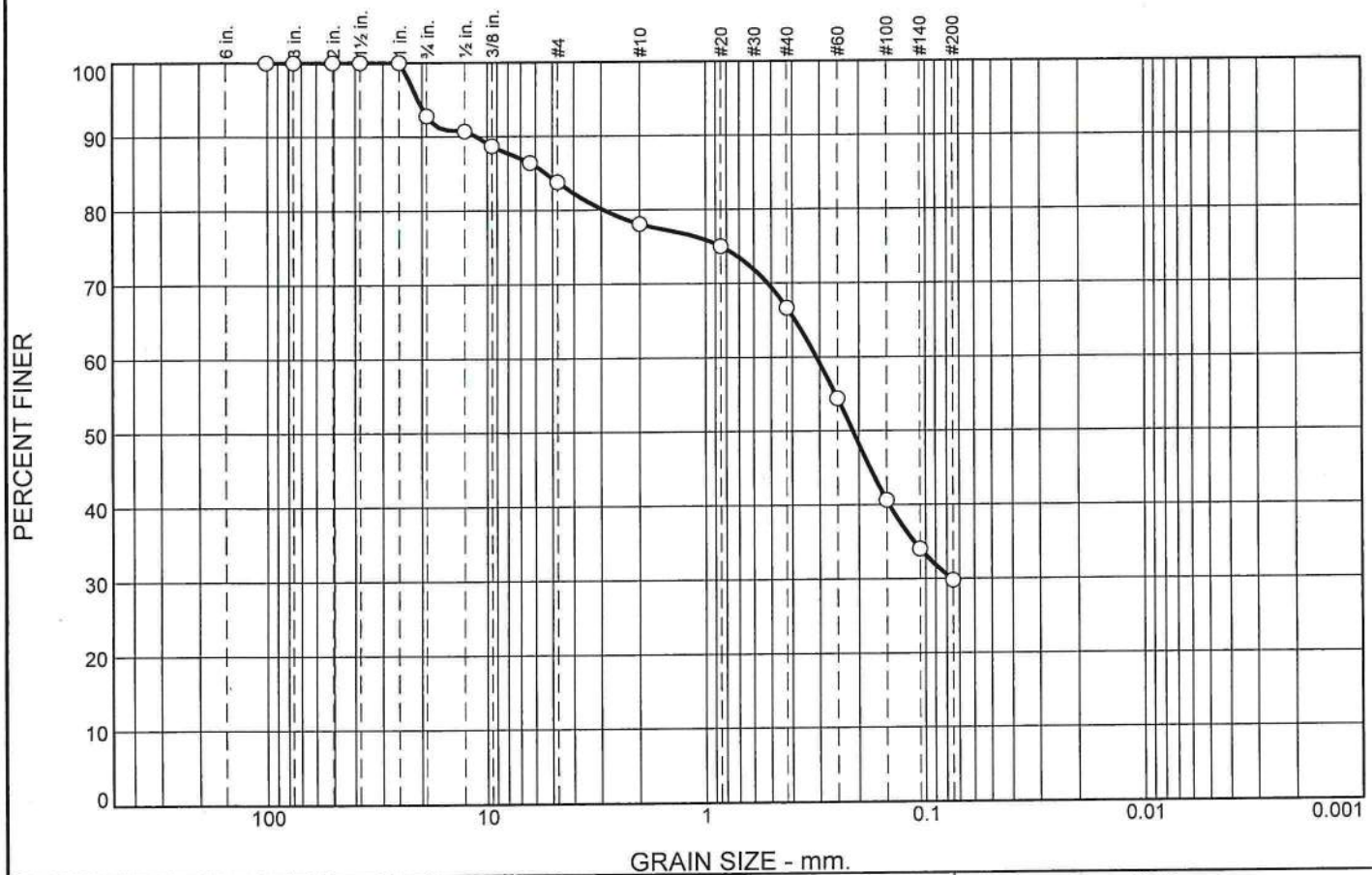
Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.2	9.0	5.7	11.4	36.9	29.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	92.8		
1/2	90.7		
3/8	88.7		
1/4	86.4		
#4	83.8		
#10	78.1		
#20	75.0		
#40	66.7		
#60	54.4		
#100	40.6		
#140	34.0		
#200	29.8		

* (no specification provided)

Material Description

MC-1

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 11.2207 D_{85}= 5.3859 D_{60}= 0.3107
D_{50}= 0.2135 D_{30}= 0.0764 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913
Moisture Content- 16.1%

Source of Sample: 3.6 **Depth:** 21'-23'
Sample Number: 02-042022

Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/20/22
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

See attached reports for testing requested by the client as per attached submittals for locations K.294.9- 3.7. Moisture content test results are listed below.

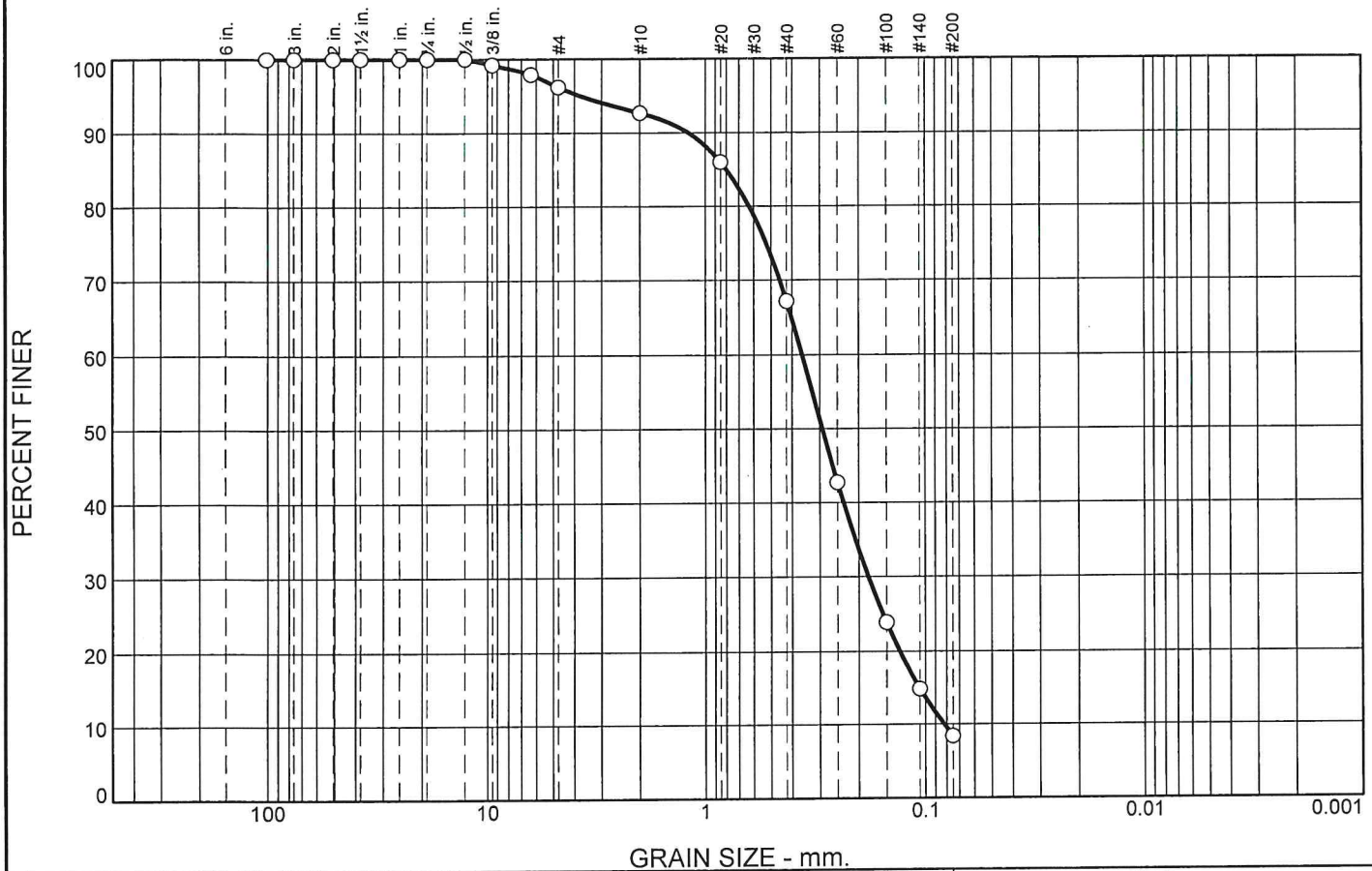
Sample ID (sample depth, ft.)	Moisture Content
SS-2 (8'- 10')	7.0%
SS-4 (13'-15')	19.1%

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.8	3.5	25.5	58.8	8.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	100.0		
3/8	99.2		
1/4	97.9		
#4	96.2		
#10	92.7		
#20	86.0		
#40	67.2		
#60	42.7		
#100	23.9		
#140	14.9		
#200	8.4		

* (no specification provided)

Material Description

MC-1

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.1975 D_{85}= 0.7999 D_{60}= 0.3609
D_{50}= 0.2926 D_{30}= 0.1811 D_{15}= 0.1065
D_{10}= 0.0822 C_u= 4.39 C_c= 1.11

Classification

USCS= AASHTO=

Remarks

ASTM D6913
Moisture Content- 15.1%

Source of Sample: 3.7 **Depth:** 25'-27'
Sample Number: 02-042022

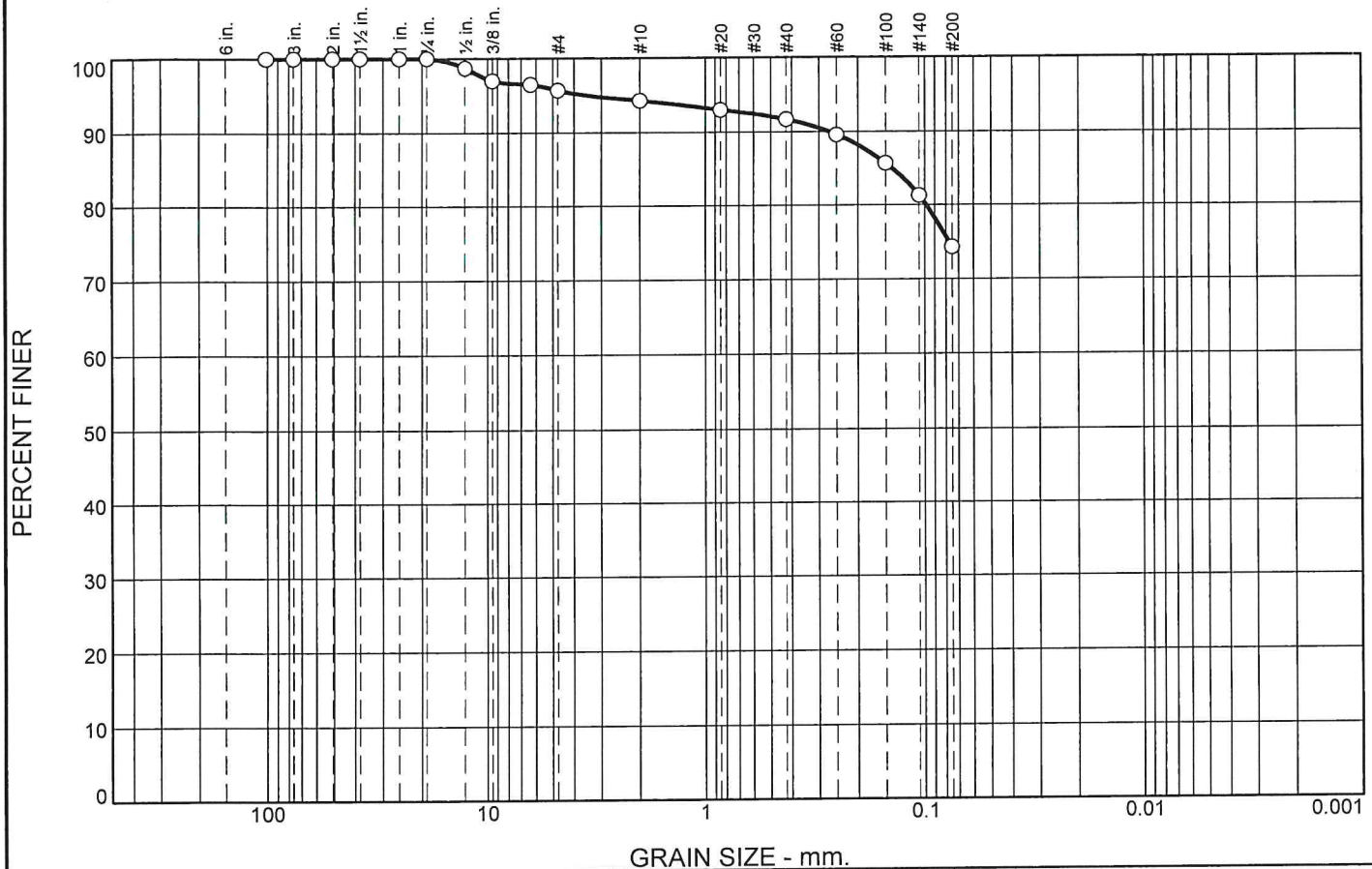
Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.3	1.4	2.6	17.4	74.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	98.7		
3/8	97.0		
1/4	96.5		
#4	95.7		
#10	94.3		
#20	93.0		
#40	91.7		
#60	89.6		
#100	85.7		
#140	81.3		
#200	74.3		

* (no specification provided)

Material Description

SS-8

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.2695 D_{85}= 0.1401 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913
Moisture Content- 20.2%

Source of Sample: 3.7 **Depth:** 33'-35'
Sample Number: 01-042022

Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/24/2022
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

See attached reports for testing requested by the client as per attached submittals for locations K.294.9-3.8. Test results are listed on attached reports.

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.0	24.5	9.3	23.4	19.8	12.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	89.0		
1/2	74.6		
3/8	71.2		
1/4	67.9		
#4	64.5		
#10	55.2		
#20	44.0		
#40	31.8		
#60	24.7		
#100	18.7		
#140	15.1		
#200	12.0		

* (no specification provided)

Material Description

SS-1

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.4759 D_{85}= 17.3856 D_{60}= 3.1672
D_{50}= 1.2809 D_{30}= 0.3771 D_{15}= 0.1049
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913, D2216
Moisture Content- 9.7%

Source of Sample: 3.8 **Depth:** 8'-10'
Sample Number: 01-050422

Date: 05-04-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/24/2022
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

See attached reports for testing requested by the client as per attached submittals for locations K.294.9-3.8R. Moisture content test results are listed below.

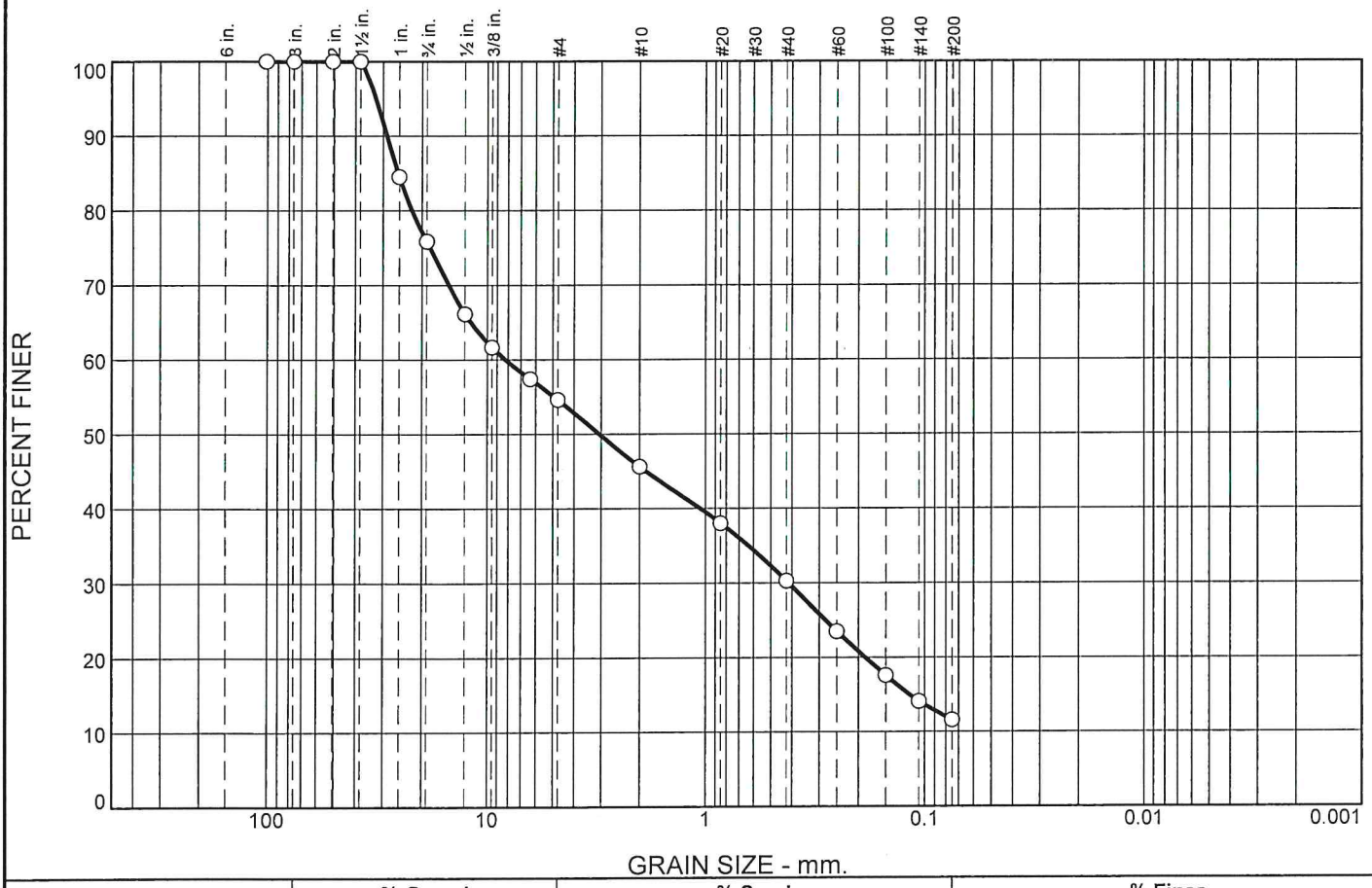
Sample ID (sample depth, ft.)	Moisture Content
MC-2 (25'-27')	9.0%

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	24.1	21.3	9.0	15.3	18.7	11.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	84.5		
3/4	75.9		
1/2	66.2		
3/8	61.7		
1/4	57.4		
#4	54.6		
#10	45.6		
#20	38.0		
#40	30.3		
#60	23.5		
#100	17.6		
#140	14.1		
#200	11.6		

* (no specification provided)

Material Description

MC-4

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 28.8588 D_{85}= 25.7233 D_{60}= 8.2348
D_{50}= 3.0663 D_{30}= 0.4150 D_{15}= 0.1170
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913, D2216
Moisture Content- 7.0%

Source of Sample: 3.8R **Depth:** 33'-35'
Sample Number: 02-050422

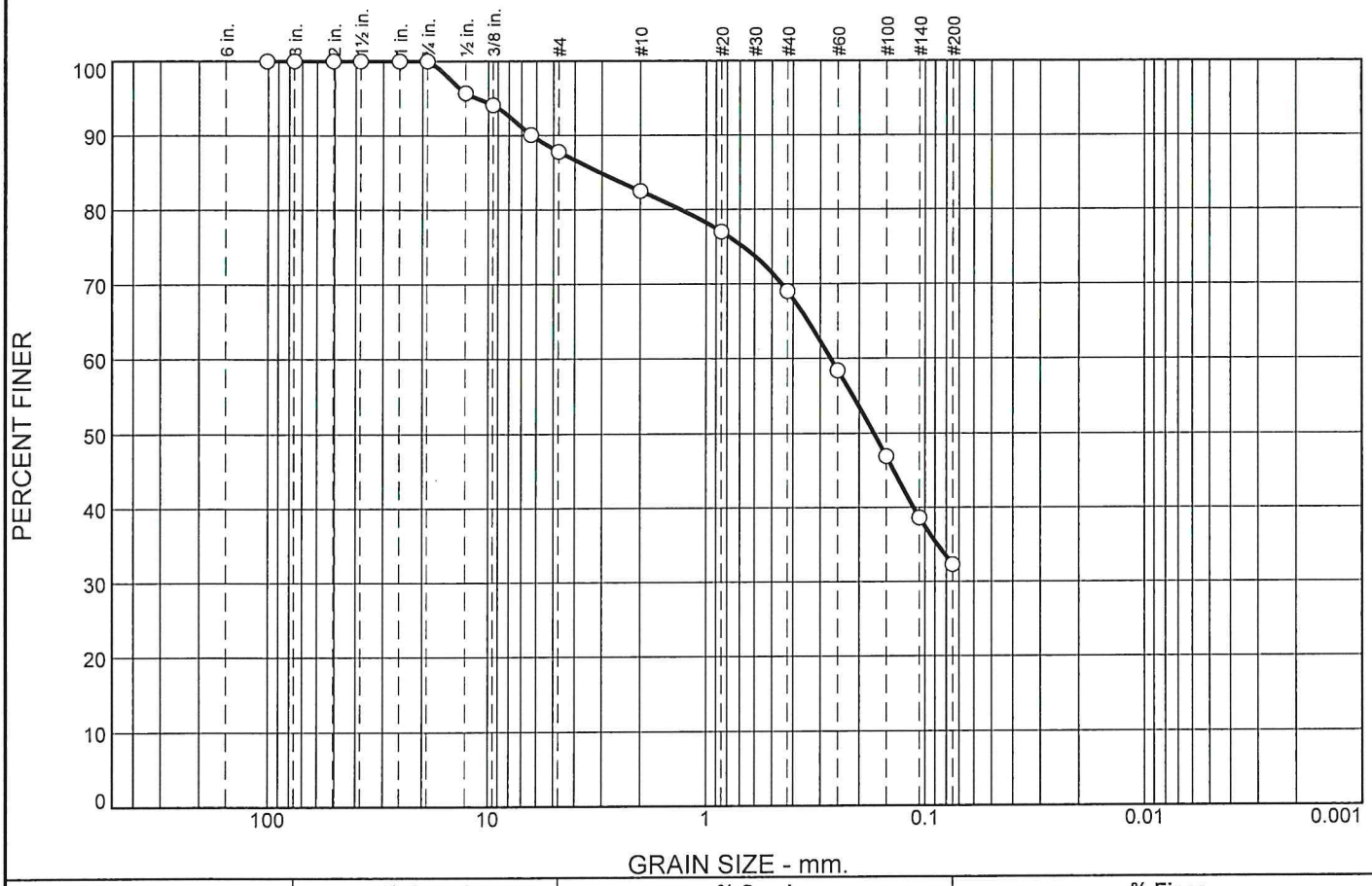
Date: 05-04-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.2	5.3	13.5	36.7	32.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	95.7		
3/8	94.1		
1/4	90.1		
#4	87.8		
#10	82.5		
#20	77.0		
#40	69.0		
#60	58.4		
#100	46.9		
#140	38.6		
#200	32.3		

* (no specification provided)

Material Description

SS-3

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 6.2846 D_{85}= 3.0687 D_{60}= 0.2692
D_{50}= 0.1710 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913, D2216
Moisture Content- 14.6%

Source of Sample: 3.8R **Depth:** 18'-20'
Sample Number: 01-050422

Date: 05-04-22

FAIRWAY TESTING CO., INC.

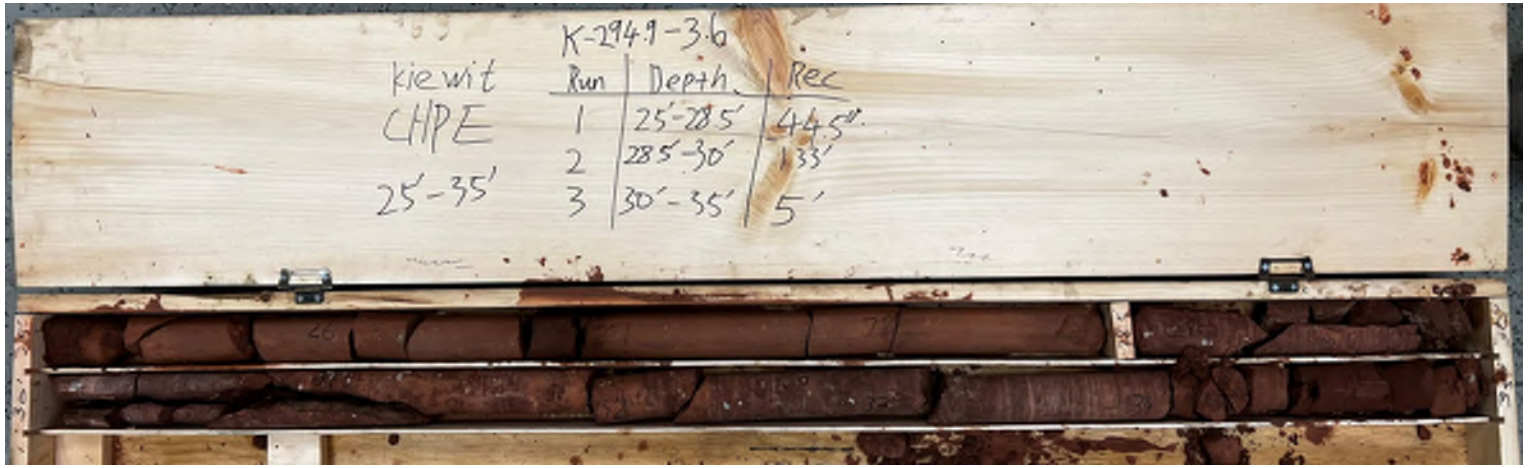
Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

K-294.9-3.4B - Runs 1 and 2

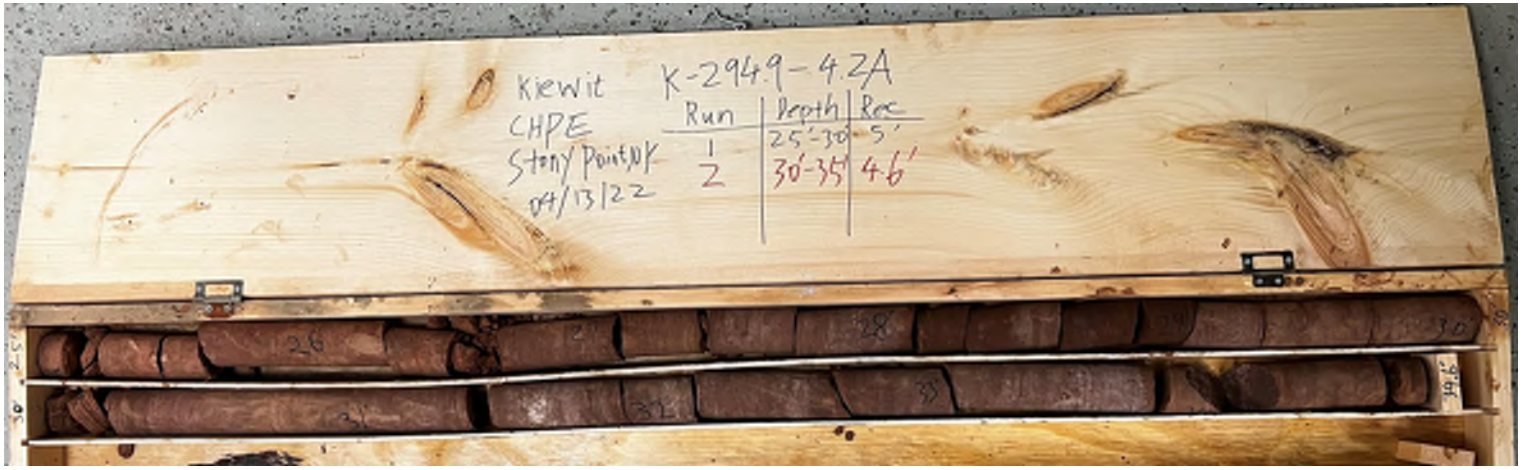
K-294.9-3.6 - Runs 1 through 3



Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

K-294.9-3.8R - Runs 1 through 3

K-294.9-4.2A - Runs 1 and 2



ADVANCED TERRA TESTING

CERCHAR Abrasiveness
ASTM D7625

CLIENT	Fairway Testing Company	JOB NO.	3151-001
PROJECT	Champlain Hudson Power Express	LOCATION	New York
PROJECT NO.	K-294.9		

BORING NO.	RC2	RC2	RC2	RC1
DEPTH	55.0-60.0	28.5-30.0	75.0-80.0	25.0-30.0
SAMPLE NO.	3.3R	3.6	3.4B	4.2A
DATE SAMPLED				
DATE TESTED	06/16/22	06/16/22	06/16/22	06/16/22
TECHNICIAN	HN	HN	HN	HN
ROCK TYPE				
Surface Type:	Saw Cut	Saw Cut	Saw Cut	Saw Cut
Moisture Condition	As Received	As Received	As Received	As Received
Reading A.1 (in):	0.00360	0.00330	0.00300	0.00330
Reading A.2 (in):	0.00380	0.00430	0.00380	0.00350
Reading A.3 (in):	0.00360	0.00540	0.00220	0.00420
Reading A.4 (in):	0.00510	0.00360	0.00260	0.00300
Reading A.5 (in):	0.00490	0.00370	0.00260	0.00430
Reading B.1 (in):	0.00310	0.00320	0.00260	0.00370
Reading B.2 (in):	0.00300	0.00420	0.00380	0.00350
Reading B.3 (in):	0.00390	0.00460	0.00300	0.00320
Reading B.4 (in):	0.00480	0.00380	0.00220	0.00500
Reading B.5 (in):	0.00550	0.00380	0.00330	0.00420
Average Reading (in):	0.00413	0.00399	0.00291	0.00379
Average Reading (mm):	0.1049	0.1013	0.0739	0.0963
Uncorrected CAI or CAI_s:	**1.05**	**1.01**	**0.74**	**0.96**
Corrected CAI:	**1.52**	**1.48**	**1.21**	**1.43**

NOTES

CAI_s is the CAI calculated on saw cut specimens.
Corrected CAI for saw cut specimens based on R. Plinger and H. Kasling
Suggested formula CAI = 0.99*CAIs + 0.48.
Applied pins had a Rockwell Hardness of 54-56.

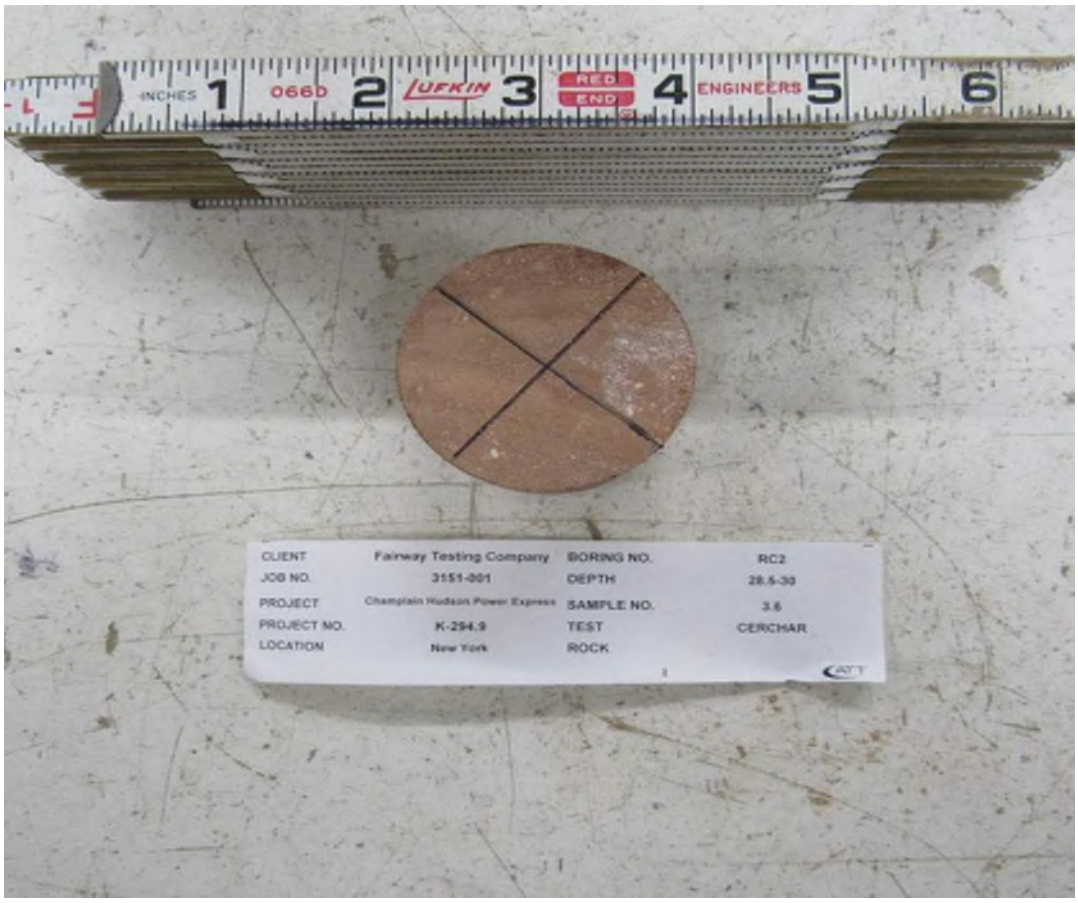
Data entry by:	HN	Date:	06/17/22
Checked by:	DL	Date:	06/17/22
File name:	3151001__CHERCHAR ASTM D7625_0.xlsm		

ADVANCED TERRA TESTING

CHERCHAR Abrasiveness
ASTM D7625

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30.0
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	--
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	HN
		ROCK TYPE	--

Before Picture



NOTES

Picture File: 2.JPG
File name: 3151001__CHERCHAR ASTM D7625_0.xlsm

ADVANCED TERRA TESTING

CHERCHAR Abrasiveness
ASTM D7625

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30.0
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	--
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	HN
		ROCK TYPE	--

After Picture

NOTES

Picture File: 2a.JPG
File name: 3151001__CHERCHAR ASTM D7625_0.xlsm

ADVANCED TERRA TESTING

Splitting Tensile Strength
ASTM D3967

CLIENT	Fairway Testing Company	JOB NO.	3151-001
PROJECT	Champlain Hudson Power Express	LOCATION	New York
PROJECT NO.	K-294.9		

BORING NO.	RC2	RC2	RC2	RC1	RC3
DEPTH	55-60	28.5-30	75-80	25-30	21-26
SAMPLE NO.	3.3R	3.6	3.4B	4.2A	0.7
DATE SAMPLED					
DATE TESTED	06/16/22	06/16/22	06/16/22	06/16/22	06/16/22
TECHNICIAN	DL	DL	DL	DL	DL
ROCK TYPE					
Diameter (in):	1.971	1.982	1.979	1.966	1.989
Height (in):	0.999	1.018	1.084	1.093	1.036
Mass of Wet Rock (g):	127.50	131.70	134.40	137.10	138.20
Wet Density (lbs/ft³):	159.4	159.7	153.6	157.4	163.6
Wet Density (g/cm³):	2.553	2.559	2.460	2.522	2.620
Peak Load (lbs):	3099	1286	1128	2924	4536
Splitting Tensile Strength (psi):	1002	406	335	866	1401
Splitting Tensile Strength (kPa):	6907	2799	2307	5972	9662
Failure Type:	Single Plane	Single Plane	Multiple Plane	Single Plane	Single Plane

BORING NO.	
DEPTH	
SAMPLE NO.	
DATE SAMPLED	
DATE TESTED	
TECHNICIAN	
ROCK TYPE	
Diameter (in):	
Height (in):	
Mass of Wet Rock (g):	
Wet Density (lbs/ft³):	
Wet Density (g/cm³):	
Peak Load (lbs):	
Splitting Tensile Strength (psi):	
Splitting Tensile Strength (kPa):	
Failure Type:	

NOTES

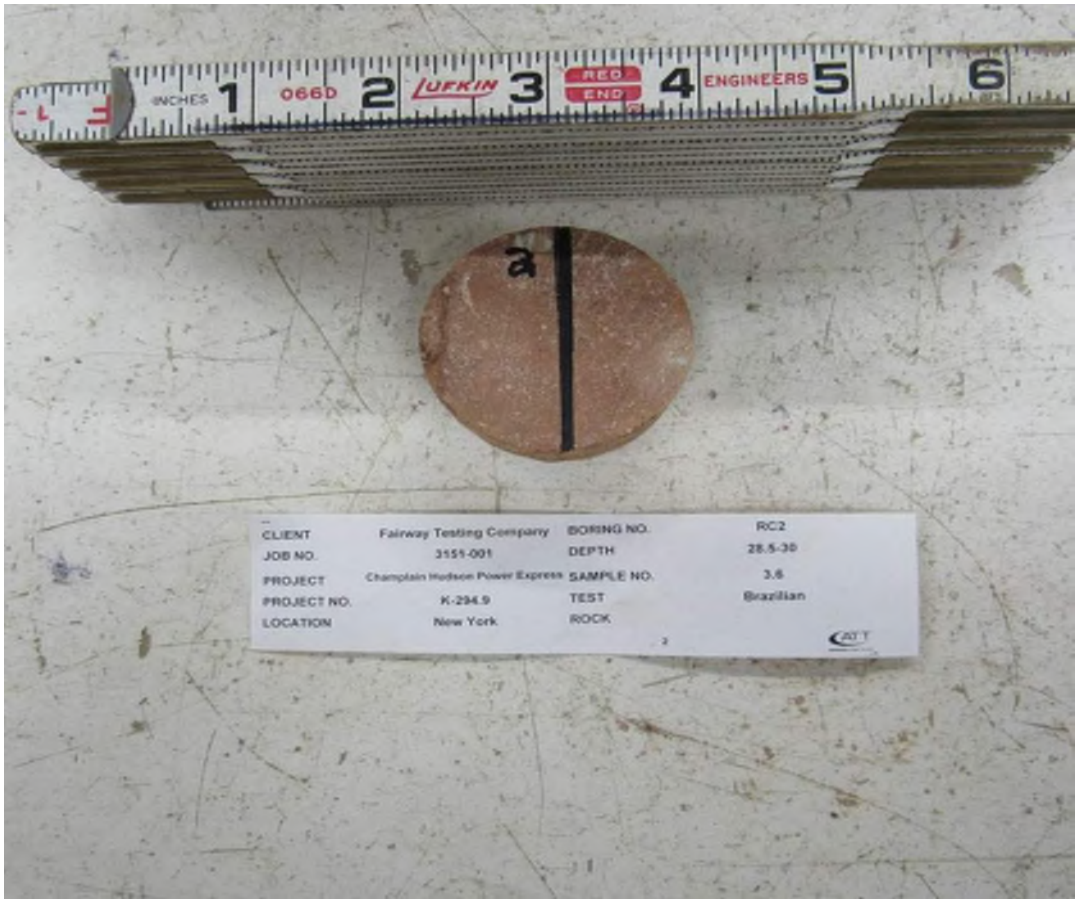
Data entry by:	DL	Date: 06/16/22
Checked by:	HN	Date: 06/17/22
File name:	3151001__Brazilian ASTM D3967_0.xlsm	

ADVANCED TERRA TESTING

Splitting Tensile
ASTM D3967

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	DL
		ROCK TYPE	

Before Picture



NOTES

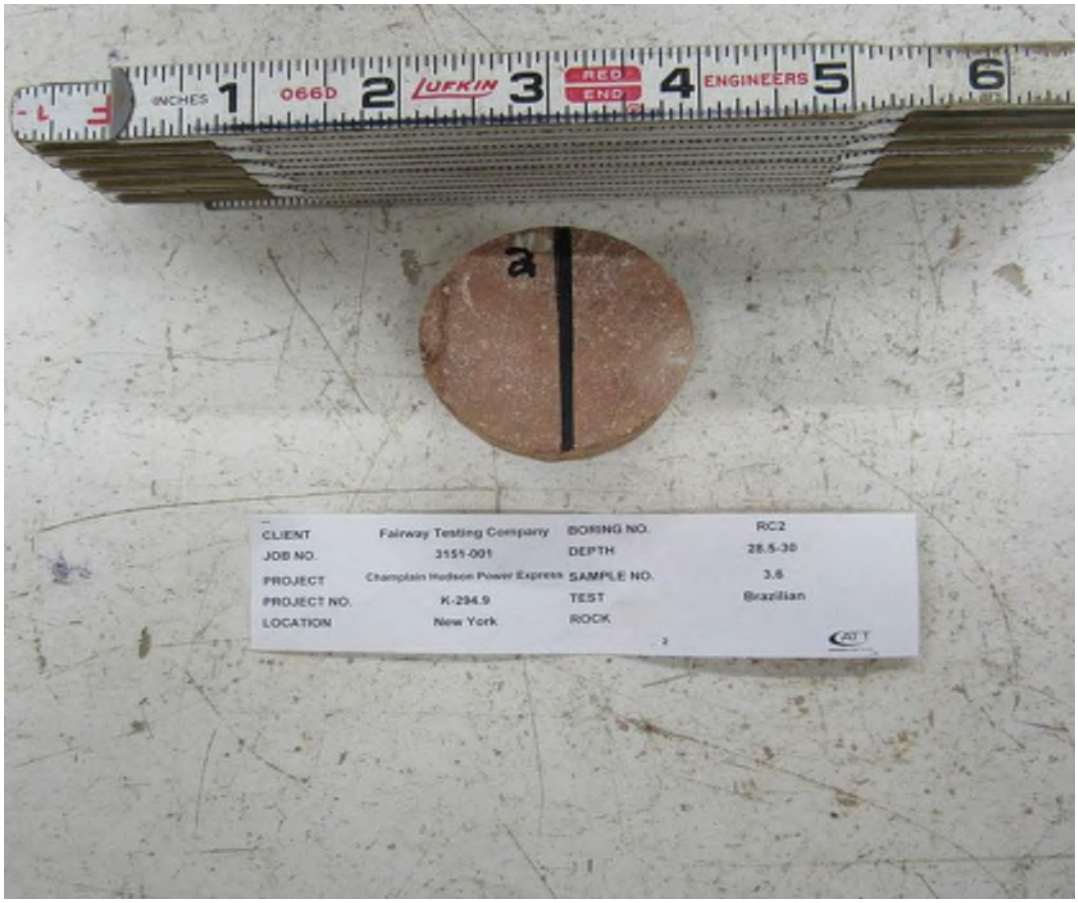
Picture File: 2.JPG
File name: 3151001__Brazilian ASTM D3967_0.xlsm

ADVANCED TERRA TESTING

Splitting Tensile
ASTM D3967

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	DL
		ROCK TYPE	

Before Picture



NOTES

Picture File: 2.JPG
File name: 3151001__Brazilian ASTM D3967_0.xlsm

ADVANCED TERRA TESTING

Splitting Tensile
ASTM D3967

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	DL
		ROCK TYPE	

After Picture

NOTES

Picture File: 2a.JPG
File name: 3151001__Brazilian ASTM D3967_0.xlsm

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Fairway Testing Company	JOB NO.	3151-001
PROJECT	Champlain Hudson Power Express	LOCATION	New York
PROJECT NO.	K-294.9		

BORING NO.	RC2	RC2	RC2	RC1	RC3
DEPTH	55-60	28.5-30	75-80	25-30	21-26
SAMPLE NO.	3.3R	3.6	3.4B	4.2A	0.7
DATE SAMPLED					
DATE TESTED	06/17/22	06/17/22	06/17/22	06/17/22	06/17/22
TECHNICIAN	DL	DL	DL	DL	DL
ROCK TYPE					
Diameter (in):	1.975	1.975	1.973	1.974	1.982
Height (in):	4.194	3.954	4.075	4.321	3.977
Mass of Wet Rock (g):	527.20	511.20	525.10	550.40	542.30
Wet Density (lbs/ft³):	156.3	160.8	160.6	158.6	168.4
Wet Density (g/cm³):	2.50	2.58	2.57	2.54	2.70
Peak Load (lbs):	38252	19993	14999	28736	28043
Compressive Strength (psi)	12486	6526	4906	9389	9089
Compressive Strength (MPa)	86	45	34	65	63
Failure Type:	Shear / Fracture	Fracture / Void	Shear	Fracture / Bedding	Fracture / Bedding

BORING NO.	
DEPTH	
SAMPLE NO.	
DATE SAMPLED	
DATE TESTED	
TECHNICIAN	
ROCK TYPE	
Diameter (in):	
Height (in):	
Mass of Wet Rock (g):	
Wet Density (lbs/ft³):	
Wet Density (g/cm³):	
Peak Load (lbs):	
Compressive Strength (psi)	
Compressive Strength (MPa)	
Failure Type:	
NOTES	

Data entry by:	DL	Date: 06/17/22
Checked by:	HN	Date: 06/17/22
File name:	3151001__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm	

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/17/22
		TECHNICIAN	DL
		ROCK TYPE	

Before Picture

NOTES

Picture File: 2.JPG
File name: 3151001__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Fairway Testing Company	BORING NO.	RC2
JOB NO.	3151-001	DEPTH	28.5-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	3.6
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/17/22
		TECHNICIAN	DL
		ROCK TYPE	

After Picture

NOTES

Picture File: 2a.JPG
File name: 3151001__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm

Kiewit

MEMORANDUM

DATE: July 14, 2022

TO: Zachary Bauer; Tetra Tech Rooney

FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp. MKH
Jaren Knighton; Kiewit Engineering (NY) Corp.

SUBJECT: Geotechnical Data: Segment 12 - Package 7B - HDD Crossing 132/133
Champlain Hudson Power Express Project
Haverstraw, New York

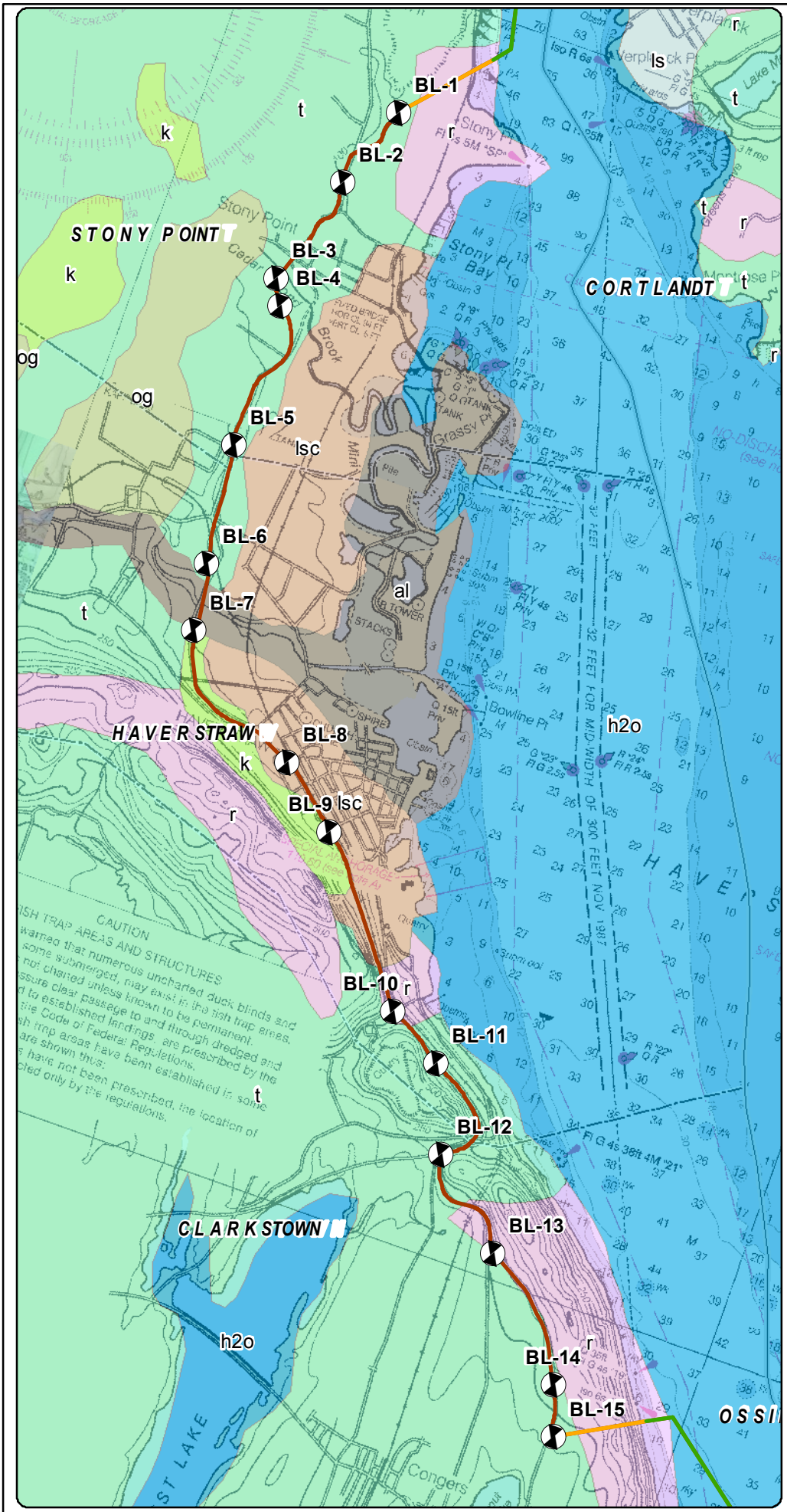
Kiewit Engineering is providing the attached geotechnical data for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located in Haverstraw, New York. The approximate station for the start of HDD crossing number 132/133 is STA 72678+50 (41.19736° N, 73.9776° W).

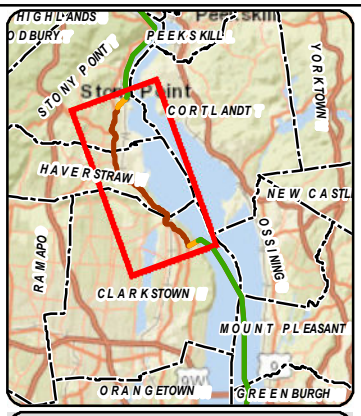
The geotechnical data at this HDD crossing is attached. The available data is taken from the previous investigation by AECOM and data from a recent investigation by Kiewit, referenced below.

- AECOM, Geotechnical Data Report, Upland Segment, Rockland County, NY, Champlain Hudson Power Express, dated September 18, 2020.
- Kiewit Engineering (NY) Corp., Segment 12 Package 7B HDD Borings - Rockland, Champlain-Hudson Power Express, dated July 5, 2022.

Contact us if you have questions or require additional information.

HDD 132/133
Borings K-294.9-4.1, K-294.9-4.2A, K-294.9-4.2B, BL-8
Segment 12 - Design Package 7B





LEGEND

Approximate Boring Locations

- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location

Surficial Geology

- af- Artificial fill
- al- Recent alluvium, fine sand to gravel
- alf- Alluvial fan
- b- Beach, sand and gravel deposit at marine shorelines
- bi- Barier island, sand and gravel deposit as barrier islands
- h2o- Water
- k- Kame deposits, coarse to fine gravel and/or sand
- km- Kame moraine, variable texture from boulders to sand
- ld- Lacustrine delta, coarse to fine gravel and sand
- ls- Lacustrine sand, generally quartz sand, well sorted, stratified
- lsc, Lacustrine silt and clay, generally laminated silt and clay
- og- Outwash sand and gravel, coarse to fine gravel with sand
- pm- Swamp deposits, peat-muck, organic silt and sand in poorly drained area
- r- Bedrock, exposed or generally within 1 meter of surface
- t- Till, variable texture (boulders to silt)
- tm-Till moraine, variable texture (size and sorting)

Town Boundary

County Boundary

N

0.35 0.175 0 0.35 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

FIGURE 3

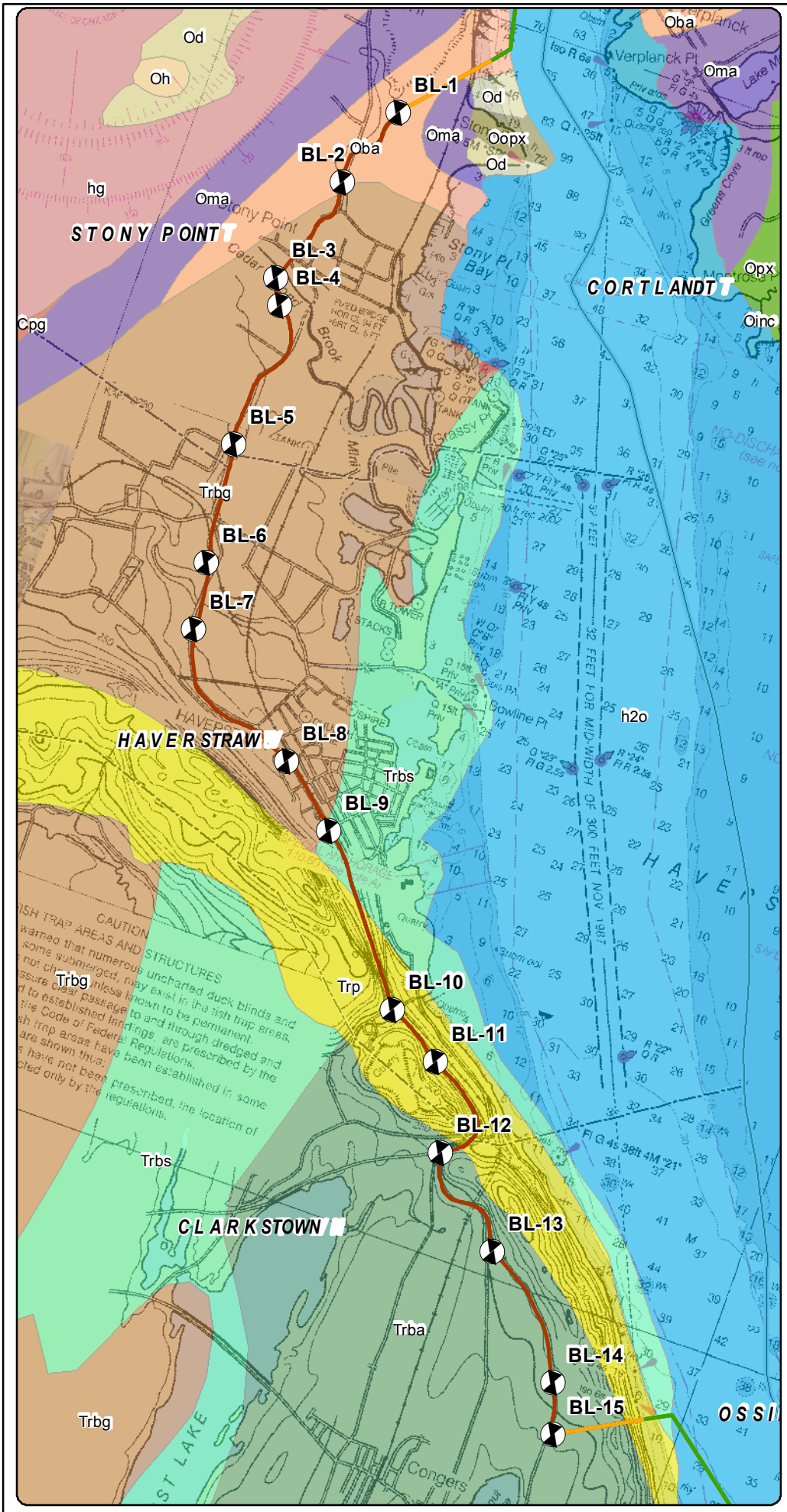
Surficial Geology and Geotechnical Borings

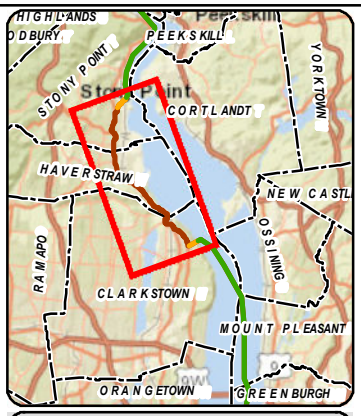
Prepared on 8/25/2020

by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

Y:\Projects\CHPE\Rockland_Co_Geology_Figures\Boring_location_Map_082520.mxd





LEGEND

- Approximate Boring Locations
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location

Bedrock Geology

- Other
- Cg- Germantown Formation
- Cpg- Poughquag Quartzite
- Oba- Balville Limestone
- Ocs- Cambrian thru Middle Ordovician carbonate rock
- Od- Diorite with hornblend and/or biotite
- Oh- Hornblende norite
- Oma- Manhattan Formation (A Member)
- Oopx- Olivine pyroxenite
- Trb-Brunswick Formation, undivided
- Trba- Brunswick Formation
- Trbg- Groveton Member of the Bull Run Formation
- Trbs- Triassic Brunswick Formation
- Trl- Ladentown diabase & baslatic lava
- Trp- Palisade Diabase
- Trs- Stockton Formation
- h2o- Water
- hg- Hornblende granite and granite gneiss
- Town Boundary
- County Boundary

N

0.35 0.175 0 0.35 Miles

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

FIGURE 4

Bedrock Geology and Geotechnical Borings

Prepared on 8/26/2020
by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

Y:\Projects\CHPE\Rockland_Co_Geology_Figures\Boring_location_Bedrock_Map_082520.mxd

BORING CONTRACTOR: ADT	AECOM		SHEET 1 OF 1
DRILLER: Chris Chaillou			PROJECT NAME: CHPE - Rockland Co. Borings
SOILS ENGINEER: Roberto Lucidi			PROJECT NO.: 60323056
			HOLE NO.: BL-8
	BORING LOG		START DATE: 7/9/2020
LOCATION: Route 9W in front of cemetery, Haverstraw, NY			FINISH DATE: 7/9/2020
			OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	
Not Encountered	TYPE	Flush joint Steel	SPLIT SPOON[1]	-	-	DRILL RIG: Geoprobe
	SIZE I.D.	4.0"	2.4"	-	-	BORING TYPE: SPT
	SIZE O.D.	4.5"	3.0"	-	-	BORING O.D.: 4.5"
	HAMMER WT.	140 lb (AUTO)	140 lb	-	-	SURFACE ELEV.: 113.886
	HAMMER FALL	30"	30"	-	-	NORTHING 861016.248
						EASTING 637485.511

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	SAMPLE TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.[2]	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
1.0												Silty Clay	Grass Area
		Hand Cleared									CL		Gray-brown, silty CLAY, trace fine sand, moist
2.0		0.0 - 6.0											
3.0													TR[3]-1 (3.0'-6.0')
4.0													
5.0													
6.0													
7.0		6.0 - 8.0	S-1	24.0	24.0	9	13	19	22	21	CL		S-1: Brown-yellow, silty CLAY, some fine sand, some fine gravel, moist, very stiff
8.0													TR-2 (7.0'-7.5')
9.0		8.0 - 10.0	S-2	24.0	17.0	78	60	73	68	86	ML	Decomposed siltstone-sandstone	S-2: Red-brown, SILT, and fine sand, dry, very dense
10.0													
11.0		10.0 - 12.0	S-3	24.0	22.0	53	25	22	20	31	SM		S-3: Red-brown, f-m SAND, some silt, trace fine gravel, dry, dense
12.0													TR-3 (11.0'-11.5')
13.0													End of boring at 12.0' below grade
													Borehole grouted
14.0													
15.0													
16.0													
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

(3) TR = sample for thermal resistivity testing.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

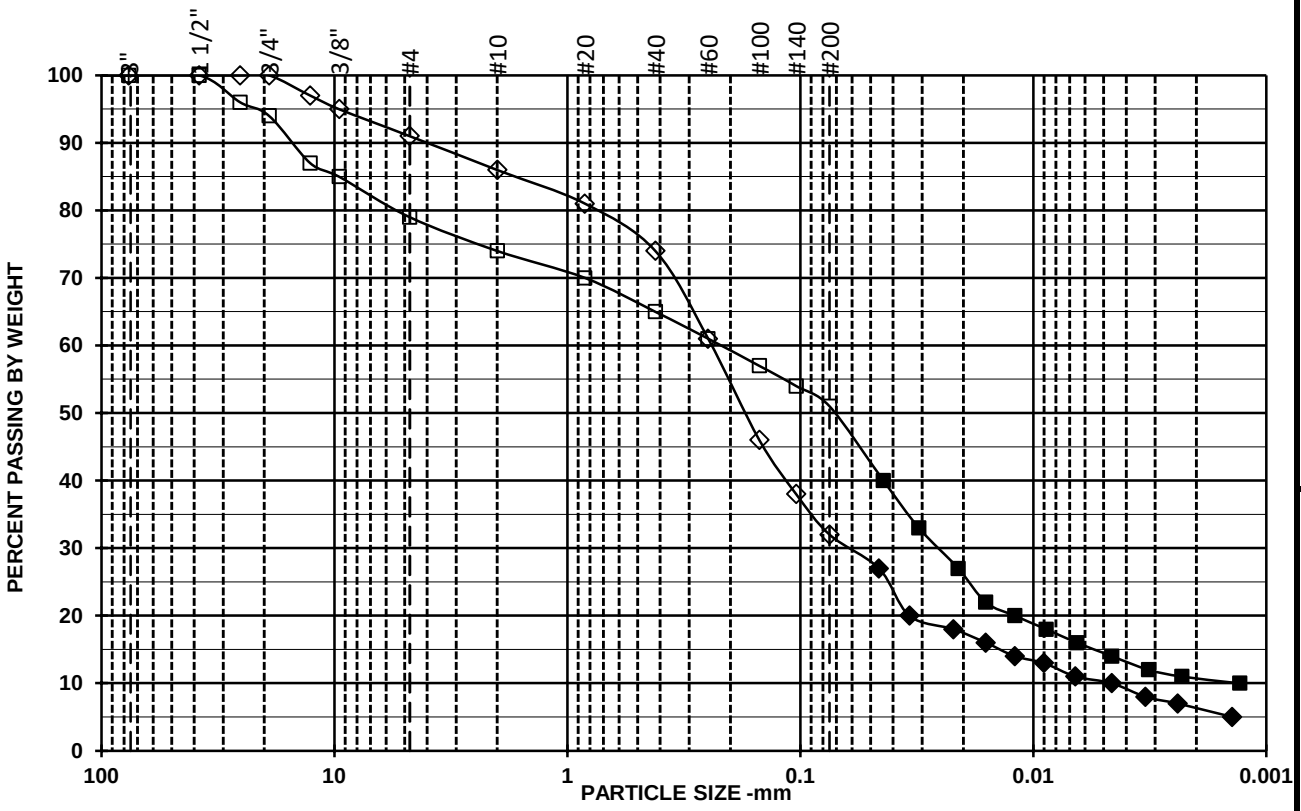
SAMPLE TYPE: S= SPLIT SPOON U=SHELBY TUBE R=ROCK CORE

PROPORTIONS: TRACE=1-10% LITTLE=10-20% SOME=20-35% AND=35-50%

Aquifer / AECOM #60323056
CHPE - Rockland County Borings
LABORATORY SOIL TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS								REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	SPECIFIC GRAVITY (-)	
BL-2	S-1b	7.2-8.0	22.1	28	19	9	CL	86	17		
BL-2	S-2	8-10	18.6	27	19	8	CL	75	13		
BL-3	S-1	6-8	12.5				ML	96.1	20		
BL-3	S-2	8-10	16.3				ML	93	14		
BL-3	S-3	10-10.7	12.4				ML	66	14		
BL-5	S-1	5-7	10.6				SM	40	8		
BL-5	S-3	9-11	7.0				SM	23	4	2.728	
BL-5	S-4	11-13	8.6				SM	24	4		
BL-5	S-6	15-17	8.2				SM	22	3		
BL-6	S-1	4-6	4.1				GW-GM	7	2		
BL-7	S-1	5-7	5.1				SP-SM	8	2		
BL-7	S-3	9-11	5.3				GW-GM	10	2		
BL-7	S-4	11-13	7.5				SM	25	4		
BL-7	S-6	15-17	6.0				SM	14	2		
BL-8	S-1	6-8	17.9	35	20	15	CL	51	11		
BL-8	S-3	10-12	10.2				SM	32	6		
BL-9	S-1	6-8	10.0				SP-SM	9	2		
BL-9	S-3	10-12	7.0				SM	14	3		
BL-9	S-5	14-16	4.9				SW-SM	11	3		
BL-11	S-4	11-13	10.1				SM	24	5		
BL-12	S-1	6-8	8.9				SM	24	6		
BL-13	S-1	4.5-6.5	9.3				SM	15	4	2.722	
BL-13	S-3	8.5-10.5	6.6				SM	13	3		
BL-13	S-4	10.5-12.5	9.9				SM	19	5		
BL-14	S-1	6-8	10.0				SM	27	6		
BL-14	S-2	8-10	8.1				SM	24	5		
BL-15	S-3	9-11	9.5				SM	32	8		
BL-15	S-9	21-23	7.9				SM	26	4		
BL-15	S-14	31-33	6.1				SM	33	4		
BL-15	S-17	45-47	11.9				SM	20	3		
BL-15	S-21	65-67	8.2				SP-SM	10	1		

Note: (1) USCS symbol based on visual observation and Sieve and Atterberg limits reported.



Open Symbols: Sieve analysis by ASTM D6913

Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	17.9	35	20	15	CL		Brown, Sandy lean clay	08/04/20
◇	10.2				SM		Brown, Silty sand	08/04/20
○								

Symbol	□	◇	○
Boring	BL-8	BL-8	
Sample	S-1	S-3	
Depth	6-8	10-12	
% +3"	0	0	
% Gravel	21	9	
% SAND	28	59	
%C SAND	5	5	
%M SAND	9	12	
%F SAND	14	42	
% FINES	51	32	
D_{100} (mm)	38.1	19.1	
D_{60} (mm)	0.219	0.241	
D_{30} (mm)	0.026	0.062	
D_{10} (mm)	0.001	0.005	
Cc	2.4	3.5	
Cu	168.5	52.4	

Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	96	100	
3/4"	94	100	
1/2"	87	97	
3/8"	85	95	
#4	79	91	
#10	74	86	
#20	70	81	
#40	65	74	
#60	61	61	
#100	57	46	
#140	54	38	
#200	51	32	
5μ m	14	10	
2μ m	11	6	
1μ m	10	4	

Aquifer / AECOM #60323056

TerraSense, LLC #7853-20003

CHPE - Rockland County Borings

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

Segment 12 Package 7B HDD Borings - Rockland

Champlain Hudson Power Express

New York

PROJECT NUMBER 20001480

CREATED BY Kiewit

DATE 07/05/2022

Legend Key

- Kiewit Borings (2022)
- Borings by Others

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-4.1

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas	**COORDINATES**	N 861506.83 E 636176.23
START DATE	04/13/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	109.3 ft
FINISH DATE	04/13/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0		Silty GRAVEL (GM), with sand (based on observations of excavated materials) 0 - 7.0 ft was excavated by air knife and vacuum truck						Boring advanced with 3.5" ID HSA
5	102.3	SAND with SILT (SP-SM), with gravel, fine grained gravel, red, medium to coarse sand, with 3" layer of red slightly cemented silt, medium dense			38%		11-9-4-4 (13)	
10	96.3	Clayey and Silty SAND (SC-SM), with gravel increasing with depth, red, medium dense to very dense, dry			62%		4-5-6-6 (11)	
15								3-inch ring sampler
20					100%		17-41-71-72	
					60%		20-80/4"	
25					86%		54-50/1"	
30					100%		100/4"	

Legend

▲ SPT N Value
● MC (%)
— PL & LL (%)
⊠ Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-4.1

PROJECT NUMBER	20001480	**LOGGED BY**	Rafael Salas	**COORDINATES**	N 861506.83 E 636176.23
START DATE	04/13/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	109.3 ft
FINISH DATE	04/13/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
			Clayey and Silty SAND (SC-SM), with gravel increasing with depth, red, medium dense to very dense, dry						
	76.3		SILT (ML), with sand, little gravel, red, hard, moist	⊠		99%		70/4"	
35	74.3		Boring Terminated at 35 ft						
40									
45									
50									
55									
60									

Legend

▲ SPT N Value
● MC (%)
— PL & LL (%)
⊠ Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-4.2A

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 861435.89 E 636669.20
START DATE	04/13/2022	**DRILLER/RIG**	Corey Brown / CME 550	**GROUND ELEV.**	111.1 ft
FINISH DATE	04/13/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0		18" Asphalt						Boring advanced with 3.5" ID HSA
	109.6	Silty SAND (SM), with gravel (based on observations of excavated materials) 0 - 7.2 ft was excavated by air knife and vacuum truck						
5								
	103.9	Clayey SAND (SC), reddish brown, loose to medium dense						
10					85%		7-9-8-7 (17)	
					35%		3-5-5-6 (10)	
15								
	93.1	Clayey and Silty SAND (SC-SM), red, medium dense to very dense, dry			83%		4-4-12-13 (16)	
20								
		Siltstone fragments			100%		49-50/2"	
25	86.1	Siltstone/Sandstone, fresh, closely spaced fractures, fine grained, reddish brown, very strong			100% 52			
30								

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-4.2A

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 861435.89 E 636669.20
START DATE	04/13/2022	**DRILLER/RIG**	Corey Brown / CME 550	**GROUND ELEV.**	111.1 ft
FINISH DATE	04/13/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
			Siltstone/Sandstone, fresh, closely spaced fractures, fine grained, reddish brown, very strong			92% 74			
35	76.1		Boring Terminated at 35 ft						
40									
45									
50									
55									
60									

Legend

- ▲ SPT N Value
- ● MC (%)
- — PL & LL (%)
- ⊠ Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-4.2B

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 861296.79 E 636935.05
START DATE	04/20/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	115.1 ft
FINISH DATE	04/21/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
0			18" Asphalt						Boring advanced with 3.5" ID HSA
	113.6		SILT (ML), with sand, gravel and cobbles (based on observation of excavated materials) 0 - 7 ft was excavated by air knife and vacuum truck						
5									
	107.1		Silty SAND (SM), with gravel, fine to coarse subangular to angular gravel and siltstone fragments, red, medium dense to very dense, dry			50%		6-11-12-11 (23)	
10									
						0%		50/4"	
15									
						47%		44-50-50/4"	
20									
						73%		22-50/5"	
25			Moist at 25 ft						
						100%		50/1"	
30									

Legend

- SPT N Value
- MC (%)
- PL & LL (%)
- Fines Content (%)

20 40 60 80

EXPLORATORY BORING LOG

Champlain Hudson Power Express

New York

BORING NO: K-294.9-4.2B

PROJECT NUMBER	20001480	**LOGGED BY**	Jialin Li	**COORDINATES**	N 861296.79 E 636935.05
START DATE	04/20/2022	**DRILLER/RIG**	Rick / Diedrich D-90	**GROUND ELEV.**	115.1 ft
FINISH DATE	04/21/2022	**DRILL CONTRACTOR**	Parratt Wolff	**HAMMER TYPE/EFF.**	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes
	85.1		Siltstone, fresh, closely spaced to very closely spaced fractures, fine grained, red, strong to very strong		1	92% 82			
35					2	88% 38			
40					3	100% 97			
45	70.1		Boring Terminated at 45 ft						
50									
55									
60									

Legend

▲ SPT N Value
● MC (%)
— PL & LL (%)
⊠ Fines Content (%)

20 40 60 80

SOIL LEGEND

Explanation of Symbols and Terms Used on Boring and Test Pit Logs for Sampling and Description of Soils

SAMPLE AND DRILL METHODS

☒	Standard Penetration Split-Spoon Sample
■	Undisturbed Sample
⊞	Piston Sampler
✋	Grab Sample
◇	Bulk Sample
▙	Auger Cuttings
▮	Rock Core
⧓	Modified California Sample

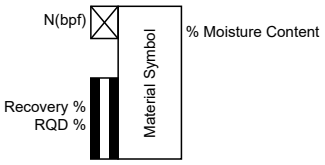
WATER LEVEL SYMBOLS

▽	Observation at time of drilling
▽	Observation after drilling
▼	Delayed observation
▽	Perched water observed at drilling
≋	Observed Seepage
▽	Cave-in Depth

COMMON ABBREVIATIONS AND ACRONYMS

MR	Mud Rotary
HSA	Hollow Stem Auger
SSA	Solid Stem Auger
SS	Split Spoon Sampler
UD	Undisturbed Sample
WOR	Weight of Rods
WOH	Weight of Hammer
SPT	Standard Penetration Test
REC	Recovery
RQD	Rock Quality Designation
MC	Moisture Content
PI	Plasticity Index
PL	Plastic Limit
LL	Liquid Limit
CPT	Cone Penetration Test
PP	Pocket Penetrometer
Bulk	Bulk Sample
EOB	End of Boring
AR	Auger Refusal
N-Value	Sum of blows for last two 6-in. increments of SPT
USCS	Unified Soil Classification System

CROSS SECTION LEGEND



RELATIVE DENSITY / CONSISTENCY

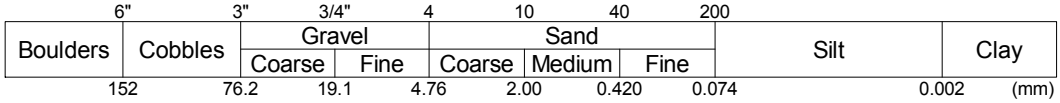
Coarse-grained Soils		Fine-grained Soils		
N-Value	Density	N-Value	Consistency	Pocket Pen (TSF)
0 - 4	Very Loose	0 - 1	Very Soft	0.0 - 0.25
5 - 10	Loose	2 - 4	Soft	0.25 - 0.50
11 - 30	Medium	5 - 8	Firm	0.51 - 1.00
31 - 50	Dense	9 - 15	Stiff	1.01 - 2.00
> 50	Very Dense	16 - 30	Very Stiff	2.01-4.00
		> 30	Hard	> 4.00

RELATIVE PROPORTIONS OF GRAVEL, SAND, AND FINES

Trace	> 5 %
Few	5 to 10 %
Little	15 to 25 %
Some	30 - 45 %
Mostly	50 to 100 %

SOIL GRAIN SIZE

U.S. Standard Sieve



CRITERIA FOR DESCRIBING MOISTURE CONDITION

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible free water
Wet	Visible free water, typically soil is below water table

CRITERIA FOR DESCRIBING CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

CRITERIA FOR DESCRIBING STRUCTURE

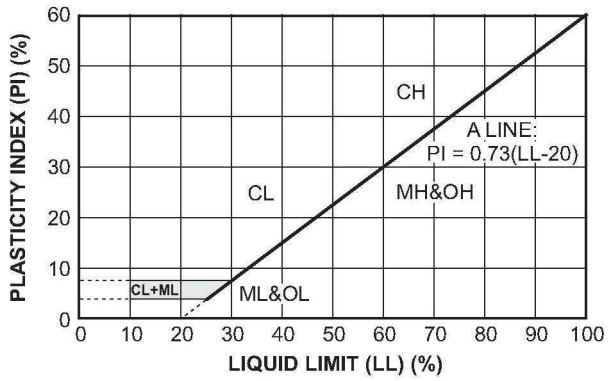
Description	Criteria
Stratified	Alternating layers of varying material or color with layers at least 1/4 in. thick; note thickness
Laminated	Alternating layers of varying material or color with the layers less than 1/4 in. thick; note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

SOIL SYMBOLS

USCS SOIL TYPES		
Symbol	Group	Description
	GW	Well-graded gravels, gravel sand mixtures with trace or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures with trace or no fines
	GW-GM	Well-graded gravels, gravel-sand mixtures with silt fines
	GW-GC	Well-graded gravels, gravel-sand mixtures with clay fines
	GP-GM	Poorly-graded gravels, gravel-sand mixtures with silt fines
	GP-GC	Poorly-graded gravels, gravel-sand mixtures with clay fines
	GM	Silty gravels, gravel-silt-sand mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	GC-GM	Clayey gravels, gravel-sand-clay-silt mixtures
	SW	Well-graded sands, sand-gravel mixtures with trace or no fines
	SP	Poorly-graded sands, sand-gravel mixtures with trace or no fines
	SW-SM	Well-graded sands, sand-gravel mixtures with silt fines
	SW-SC	Well-graded sands, sand-gravel mixtures with clayfines
	SP-SM	Poorly-graded sands, sand-gravel mixtures with silt fines
	SP-SC	Poorly-graded sands, sand-gravel mixtures with clay fines
	SM	Silty sands, sand-gravel-silt mixtures
	SC	Clayey sands, sand-gravel-clay mixtures
	SC-SM	Clayey sands, sand-gravel-clay-silt mixtures
	ML	Inorganic silts with low plasticity
	CL	Inorganic clays of low plasticity, gravelly or sandy clays, silty clays, lean clays
	CL-ML	Inorganic clay-silts of low plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
	MH	Inorganic silts of high plasticity, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays and organic silts of high plasticity
	PT	Peat, humus, swamp soils with high organic contents

OTHER MATERIALS	
Symbol	Description
	Asphalt
	Concrete
	Crushed Stone/Aggregate Base
	Fill

PLASTICITY CHART



ROCK LEGEND

Explanation of Symbols and Terms Used on Boring and Test Pit Logs for Sampling and Description of Rock

TERMS AND ABBREVIATIONS	
Fracture	Collective term for any seperation in a geologic formation
Joint (JT)	Natural break in a layer or body of rock that lacks visible offset
Bedding	Layers of sedimentary rocks that are distinctly different from overlying and underlying beds
Mechanical Break (MB)	Breaks due to drilling or handling in rock or sediment cores
RQD	Rock Quality Designation
REC	Percent Recovery
Shear (SH)	Surface of differential movement evident by presence of slickensides, striations, or polishing
Shear Zone (SZ)	Zone of gouge and rock fragments bounded by planar shear surfaces
Fault (FT)	Planar fracture with significant displacement

ROCK HARDNESS	
Very Soft	Can be deformed by hand (has a rock-like character but can be broken easily by hand)
Soft	Can be scratched by fingernail (cannot be crumbled between fingers but can be easily pitted with light blows of a geology hammer)
Moderately Hard	Can be scratched easily with a knife; cannot be scratched with a fingernail (can be pitted with moderate blows of a geology hammer)
Hard	Difficult to scratch with a knife (cannot be pitted with a geology hammer but can be chipped with moderate blows of the hammer)
Very Hard	Cannot be scratched with a knife (chips can be broken off only with heavy blows of the geology hammer)

BEDDING THICKNESS		
Laminated	< 0.04 in.	< 1 mm
Parting	0.04 - 1/4 in.	1 - 6 mm
Banded	1/4 - 1 in.	6 mm - 3 cm
Thin	1 - 4 in.	3 - 9.1 cm
Medium	4 in. - 1 ft.	9.1 - 30.5 cm
Thick	1 - 3 ft.	30.5 cm - 1 m
Massive	> 3 ft.	> 1 m

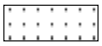
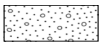
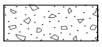
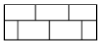
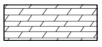
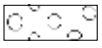
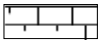
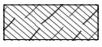
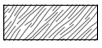
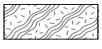
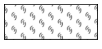
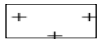
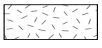
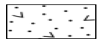
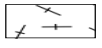
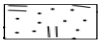
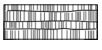
JOINT AND FRACTURE DENSITY		
Very Tight	< 2 in.	< 5.1 cm
Tight	2 in. - 1 ft.	5.1 - 30.5 cm
Moderately tight	1 - 3 ft.	30.5 - 91.4 cm
Wide	3 - 10 ft.	91.4 cm - 3 m

VOIDS	
Porous	Smaller than a pinhead. Their presence is indicated by the degree of absorbency.
Pitted	Pinhead size to a 1/4 in. If only thin walls separate the individual pits, the core may be described as honeycombed.
Vug	1/4 in. to the diameter of the core. The upper limit will vary with core size.
Cavity	Larger than the diameter of the core.

TEXTURE	
Aphanitic	Individual grains or crystals are too small to be seen with the naked eye.
Fine-grained, finely crystalline	Grain diameters between 0.1 and 1 mm; grains or crystals can be seen with naked eye.
Medium-grained, crystalline	Grain diameters between 1 and 5 mm.
Coarse-grained, coarsely crystalline	Grain diameters greater than 5 mm.

WEATHERING	
Unweathered	No evidence of any mechanical or chemical alteration.
Slightly	Superficial discoloration, alteration, and/or discoloration along discontinuities; less than 10% of the rock volume is altered; strength is essentially unaffected.
Moderately	Discoloration is evident; surface is pitted and altered, with alterations penetrating well below rock surfaces; 10 to 50% of the rock is altered; strength is noticeably less than unweathered rock.
Highly	Entire section is discolored; alteration is greater than 50%; some areas of slightly weathered rock are present; some minerals are leached away; retains only a fraction of its original strength (wet strength is usually lower than dry strength).
Decomposed	Saprolite; rock is essentially reduced to a soil with a relic rock texture; can be molded or crumbled by hand.

ROCK SYMBOLS

ROCK TYPES		
Sedimentary Rocks		Shale
		Siltstone
		Sandstone
		Conglomerate
		Breccia
		Limestone
		Dolomite
		Gypsum
		Coal
		Coral
		Chalk
Metamorphic Rocks		Slate
		Schist
		Gneiss
		Quartzite
		Serpentinite
		Greenstone
Igneous Rocks		Granite
		Tuff
		Rhyolite
		Dacite
		Andesite
		Basalt

OTHER MATERIALS		
Other		Asphalt
		Concrete
		Bedrock

ROCK QUALITY DESIGNATION (RQD) AND RECOVERY

% RQD	Quality
< 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

$$\text{Recovery (\%)} = \frac{\text{Length of Core Sample Recovered}}{\text{Length of the Core Run}} \times 100$$

$$\text{RQD (\%)} = \frac{\text{Sum of Lengths of Intact Rock Pieces of 4 in. and Longer}}{\text{Length of the Core Run}} \times 100$$

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/8/2022
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

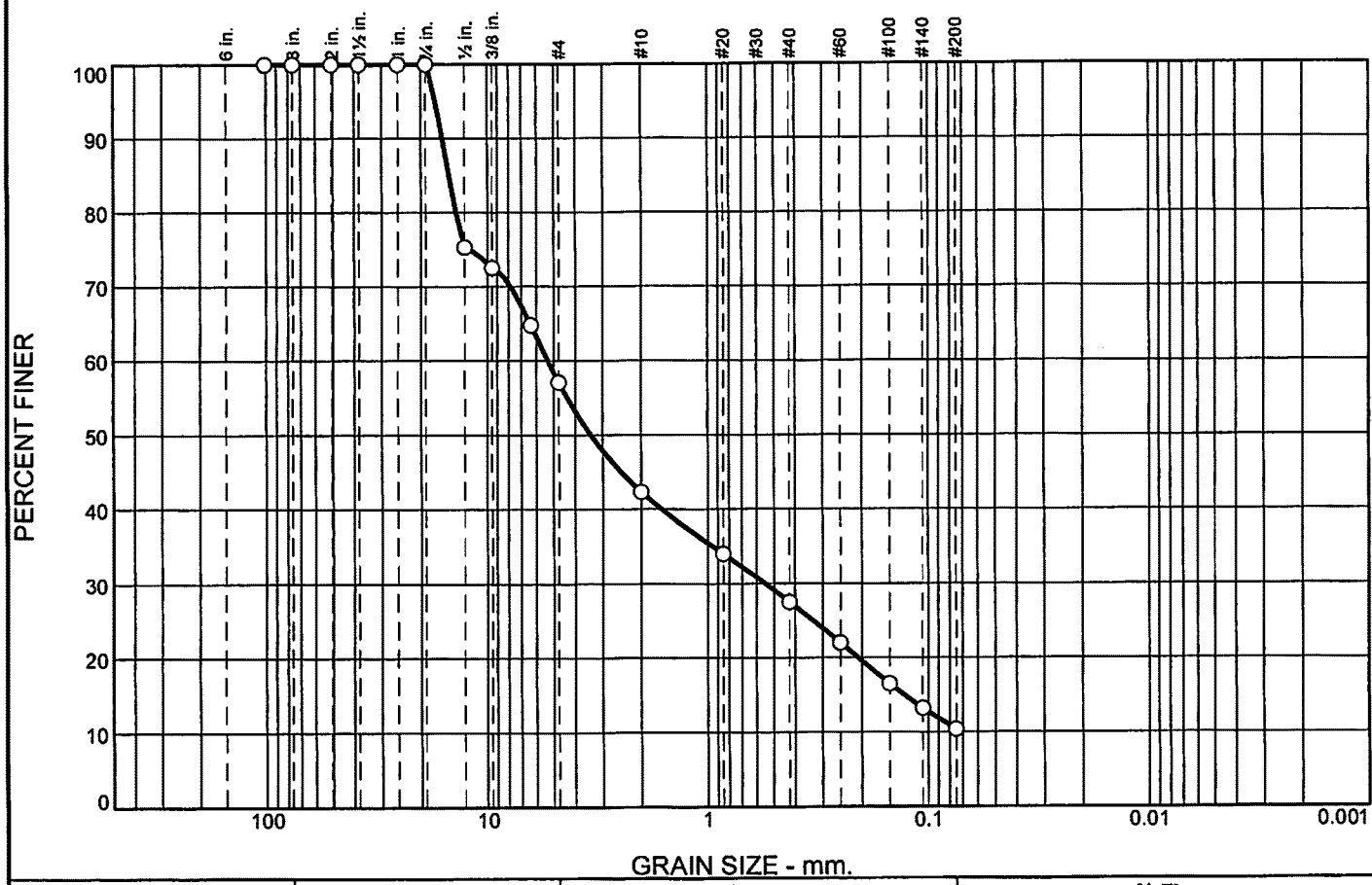
See attached reports for testing requested by the client as per attached submittals for locations K.294.9-4.1. Moisture content test results are listed below.

Sample ID (sample depth, ft.)	Moisture Content
SS-8 (28'-30')	10.0%

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	42.9	14.8	14.8	17.1	10.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	75.3		
3/8	72.5		
1/4	64.8		
#4	57.1		
#10	42.3		
#20	34.0		
#40	27.5		
#60	22.0		
#100	16.5		
#140	13.2		
#200	10.4		

* (no specification provided)

Material Description

SS-2
poorly graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 15.9983 D_{85}= 14.9420 D_{60}= 5.3188
D_{50}= 3.3979 D_{30}= 0.5500 D_{15}= 0.1290
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-1-a

Remarks

ASTM D6913, D1140, D4318
Moisture Content- 5.4%

Source of Sample: 4.1 **Depth:** 8'-10'
Sample Number: 01-042022

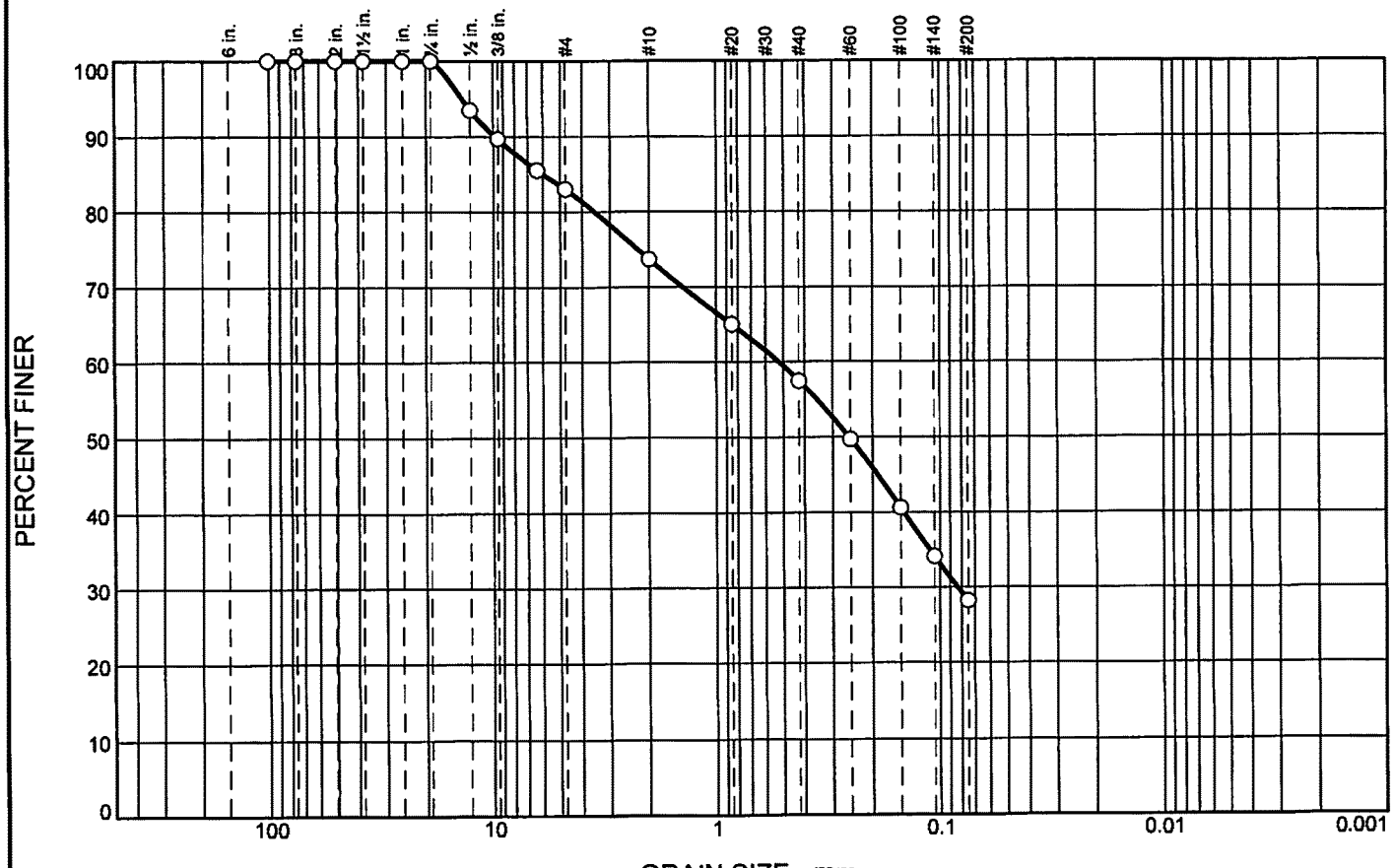
Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	17.0	9.3	16.2	29.3	28.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	93.5		
3/8	89.7		
1/4	85.5		
#4	83.0		
#10	73.7		
#20	65.0		
#40	57.5		
#60	49.7		
#100	40.6		
#140	34.1		
#200	28.2		

* (no specification provided)

Material Description

MC-5
silty, clayey sand with gravel

Atterberg Limits

PL= 7 LL= 14 PI= 7

Coefficients

D_{90}= 9.7815 D_{85}= 6.0010 D_{60}= 0.5238
D_{50}= 0.2546 D_{30}= 0.0836 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

ASTM D6913, D1140, D4318
Moisture Content- 10.0%

Source of Sample: 4.1 **Depth:** 18'-20'
Sample Number: 02-042022

Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/20/22
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

See attached reports for testing requested by the client as per attached submittals for locations K.294.9- 4.2A. Moisture content test results are listed below.

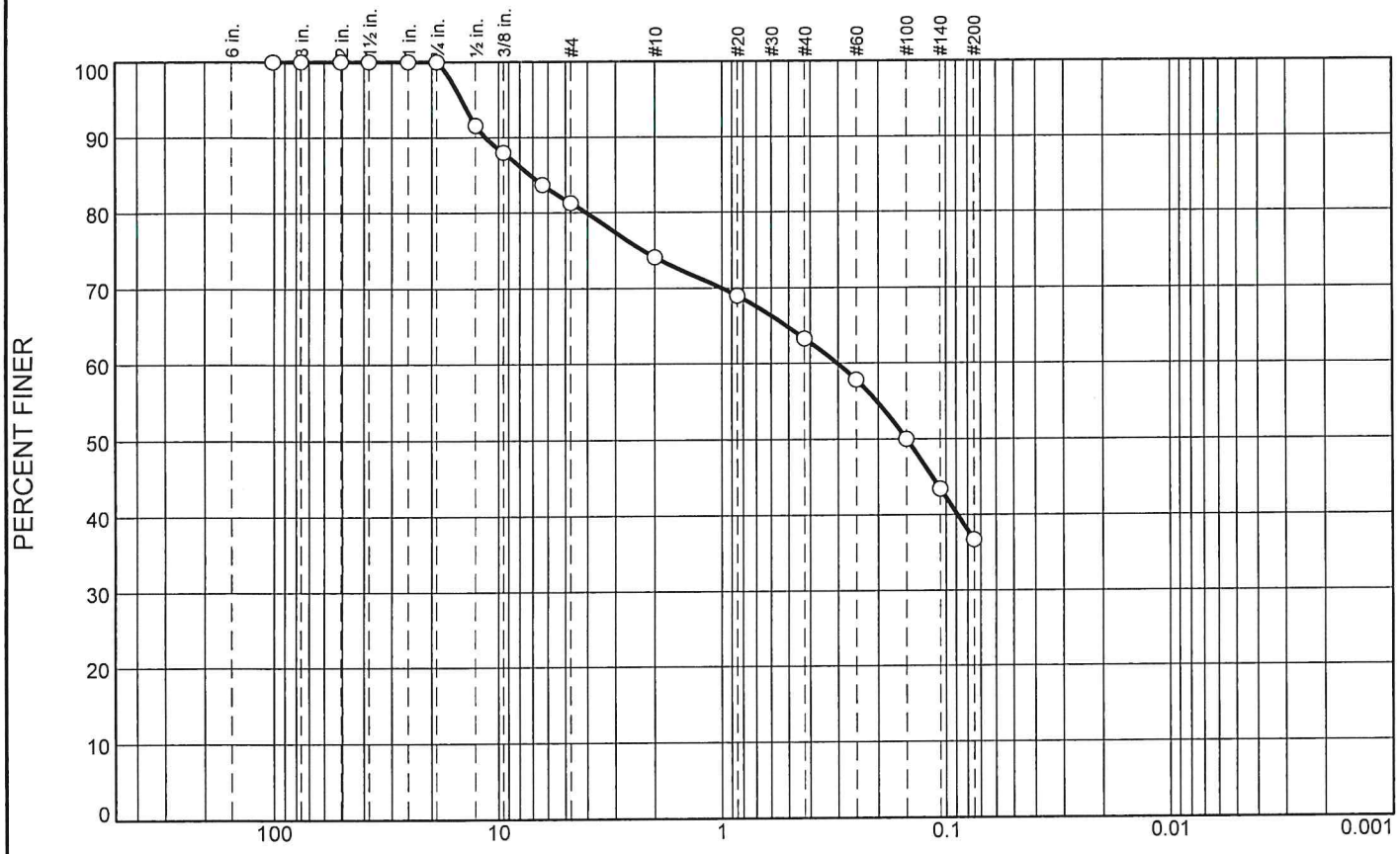
Sample ID (sample depth, ft.)	Moisture Content
S-1 (8'- 10')	16.8%
S-7 (23'-25')	8.7%

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	18.7	7.2	10.8	26.6	36.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	91.6		
3/8	88.0		
1/4	83.7		
#4	81.3		
#10	74.1		
#20	69.0		
#40	63.3		
#60	57.8		
#100	50.0		
#140	43.4		
#200	36.7		

* (no specification provided)

Material Description

SS-4
clayey sand with gravel

Atterberg Limits

PL= 10 LL= 18 PI= 8

Coefficients

D_{90}= 11.4710 D_{85}= 7.2170 D_{60}= 0.3027
D_{50}= 0.1500 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(0)

Remarks

ASTM D6913, D4318
Moisture Content- 10.8%

Source of Sample: 4.2A **Depth:** 13'-15'
Sample Number: 01-042022

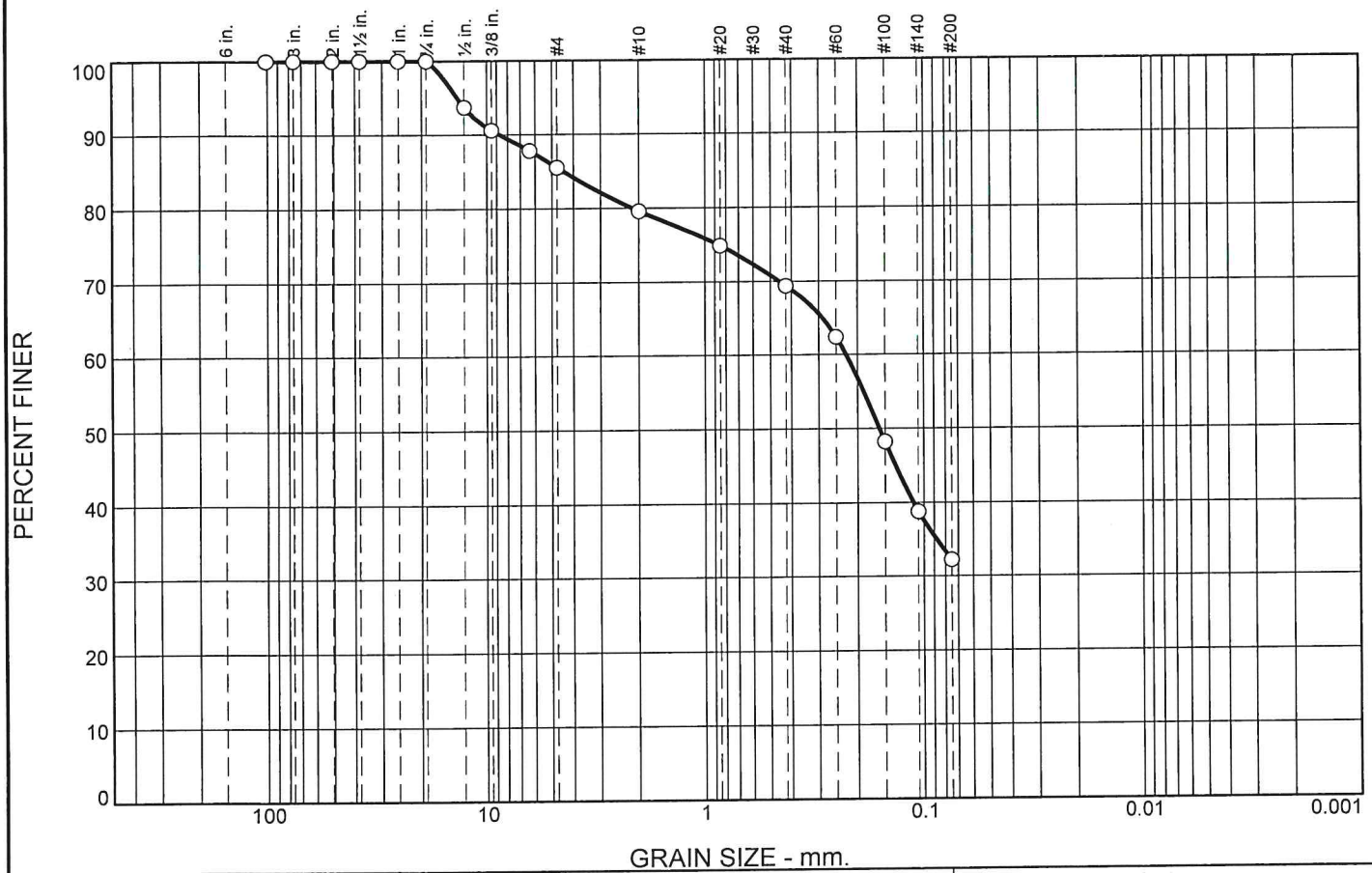
Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.5	5.9	10.2	37.2	32.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	93.7		
3/8	90.6		
1/4	87.8		
#4	85.5		
#10	79.6		
#20	74.9		
#40	69.4		
#60	62.4		
#100	48.2		
#140	38.8		
#200	32.2		

* (no specification provided)

Material Description

SS-6
silty, clayey sand

Atterberg Limits

PL= 8 LL= 15 PI= 7

Coefficients

D_{90}= 8.7810 D_{85}= 4.4604 D_{60}= 0.2254
D_{50}= 0.1592 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

ASTM D6913, D4318
Moisture Content- 11.1%

Source of Sample: 4.2A **Depth:** 18'-20'
Sample Number: 02-042022

Date: 04-20-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

f.t.
FAIRWAY TESTING

22 North Liberty Drive
P.O. Box 578
Stony Point, NY 10980
Telephone 845.942.2088
Fax 845.942.0995

Report Date: 6/22/22
Project: Champlain Hudson Power Express

Client: Kiewit Engineering (NY) Corp.
REPORT: Soil Analysis

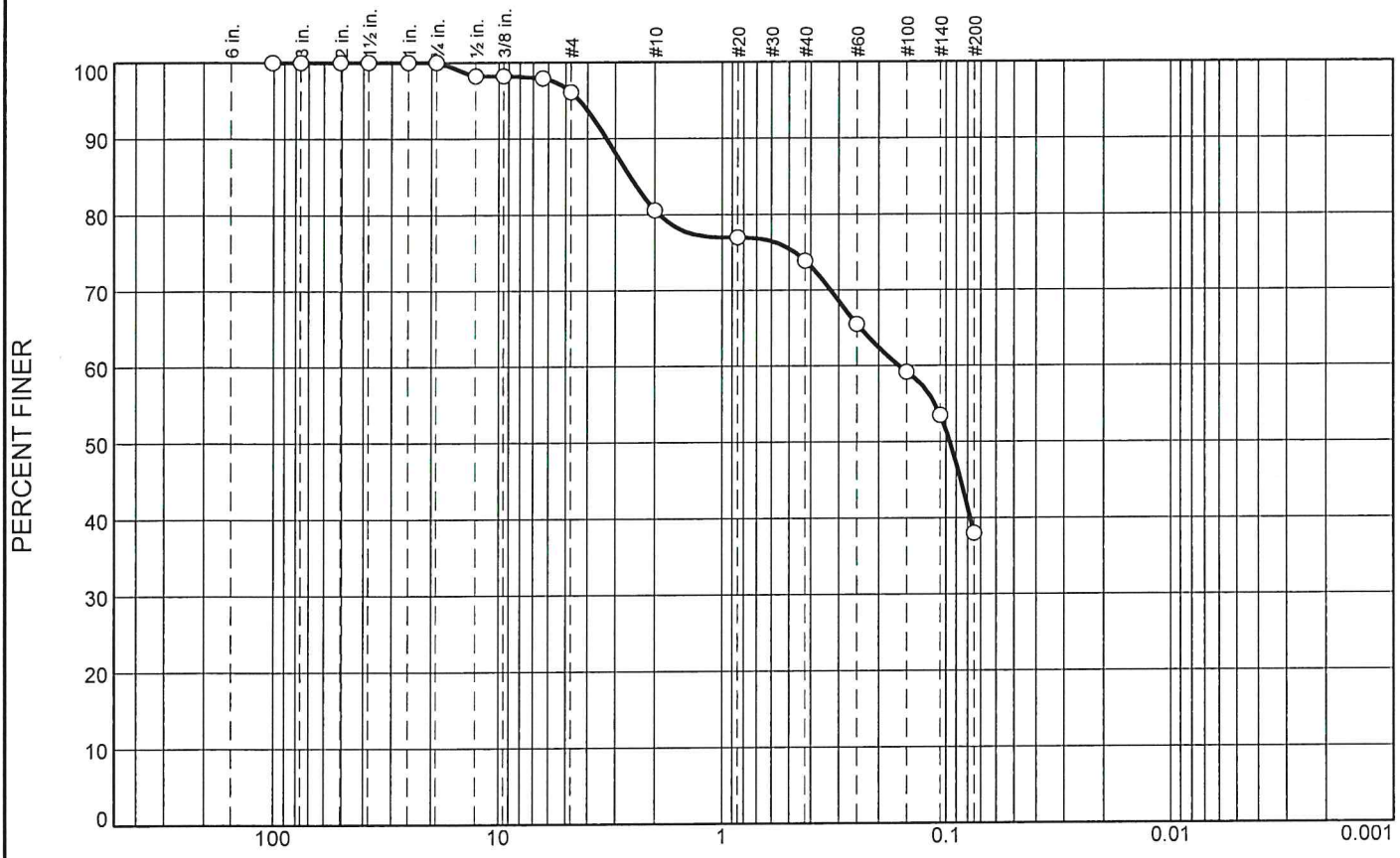
See attached reports for testing requested by the client as per attached submittals for locations K.294.9- 4.2B. Moisture content test results are listed below.

Sample ID (sample depth, ft.)	Moisture Content
SS-4 (18'- 20')	4.1%

Respectfully Submitted,
Fairway Testing

Gabriel J. O'Connell, P.E.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	15.5	6.7	35.9	38.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	98.2		
3/8	98.2		
1/4	97.9		
#4	96.1		
#10	80.6		
#20	77.0		
#40	73.9		
#60	65.5		
#100	59.2		
#140	53.5		
#200	38.0		

* (no specification provided)

Material Description

SS-1

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 3.2898 D_{85}= 2.5787 D_{60}= 0.1623
D_{50}= 0.0962 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

ASTM D6913, D2216
Moisture Content- 10.1%

Source of Sample: 4.2B **Depth:** 8'-10'
Sample Number: 01-042622

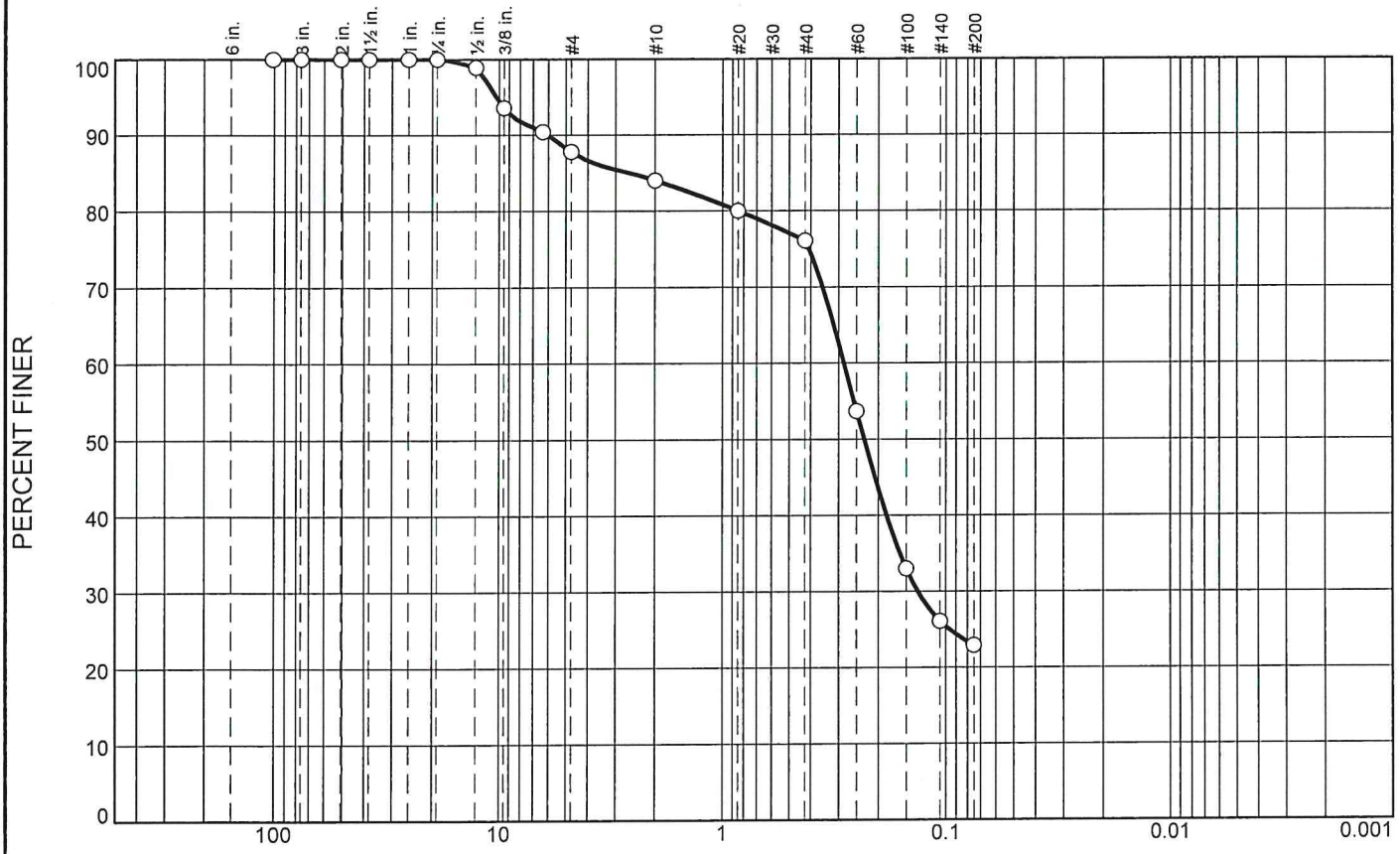
Date: 04-26-22

FAIRWAY TESTING CO., INC.

Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.2	3.8	7.9	53.2	22.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
4	100.0		
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
3/4	100.0		
1/2	98.9		
3/8	93.6		
1/4	90.4		
#4	87.8		
#10	84.0		
#20	80.0		
#40	76.1		
#60	53.7		
#100	33.0		
#140	26.1		
#200	22.9		

* (no specification provided)

Material Description

SS-6
silty sand

Atterberg Limits

PL= NP LL= 12 PI= NV

Coefficients

D_{90}= 6.0296 D_{85}= 2.6185 D_{60}= 0.2845
D_{50}= 0.2313 D_{30}= 0.1332 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

ASTM D6913, D4318, D2216
Moisture Content- 14.4%

Source of Sample: 4.2B **Depth:** 23'-25'
Sample Number: 02-042622

Date: 04-26-22

FAIRWAY TESTING CO., INC.

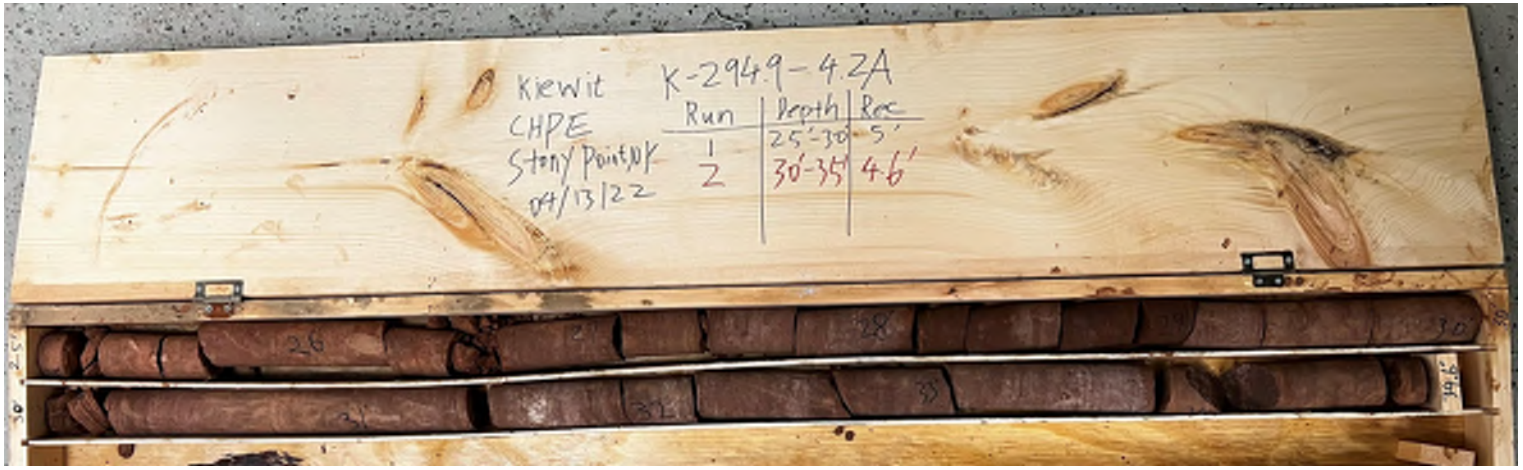
Client: Kiewit Engineering (NY) Corp.
Project: Champlain Hudson Power Express

Project No: K-294.9 **Figure**

Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

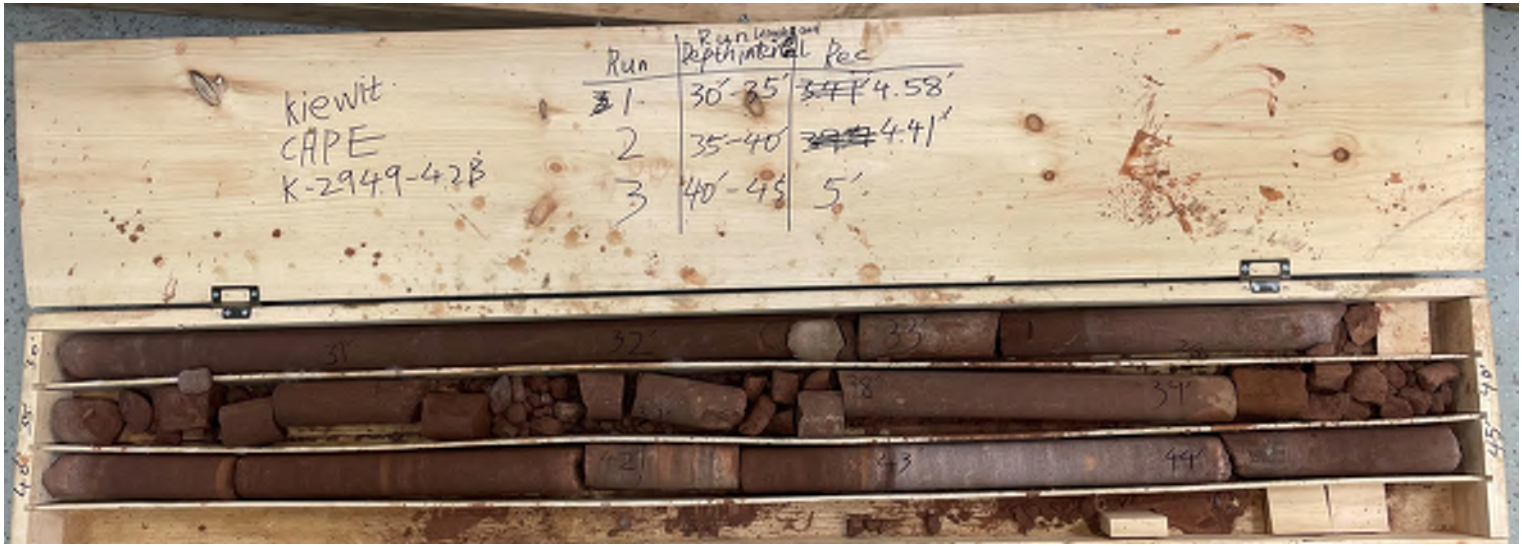
K-294.9-3.8R - Runs 1 through 3

K-294.9-4.2A - Runs 1 and 2



Champlain Hudson Power Express
Kiewit Engineering (NY) Corp.

K-294.9-4.2B - Runs 1 through 3



ADVANCED TERRA TESTING

CERCHAR Abrasiveness
ASTM D7625

CLIENT	Fairway Testing Company	JOB NO.	3151-001
PROJECT	Champlain Hudson Power Express	LOCATION	New York
PROJECT NO.	K-294.9		

BORING NO.	RC2	RC2	RC2	RC1
DEPTH	55.0-60.0	28.5-30.0	75.0-80.0	25.0-30.0
SAMPLE NO.	3.3R	3.6	3.4B	4.2A
DATE SAMPLED				
DATE TESTED	06/16/22	06/16/22	06/16/22	06/16/22
TECHNICIAN	HN	HN	HN	HN
ROCK TYPE				
Surface Type:	Saw Cut	Saw Cut	Saw Cut	Saw Cut
Moisture Condition	As Received	As Received	As Received	As Received
Reading A.1 (in):	0.00360	0.00330	0.00300	0.00330
Reading A.2 (in):	0.00380	0.00430	0.00380	0.00350
Reading A.3 (in):	0.00360	0.00540	0.00220	0.00420
Reading A.4 (in):	0.00510	0.00360	0.00260	0.00300
Reading A.5 (in):	0.00490	0.00370	0.00260	0.00430
Reading B.1 (in):	0.00310	0.00320	0.00260	0.00370
Reading B.2 (in):	0.00300	0.00420	0.00380	0.00350
Reading B.3 (in):	0.00390	0.00460	0.00300	0.00320
Reading B.4 (in):	0.00480	0.00380	0.00220	0.00500
Reading B.5 (in):	0.00550	0.00380	0.00330	0.00420
Average Reading (in):	0.00413	0.00399	0.00291	0.00379
Average Reading (mm):	0.1049	0.1013	0.0739	0.0963
Uncorrected CAI or CAI_s:	**1.05**	**1.01**	**0.74**	**0.96**
Corrected CAI:	**1.52**	**1.48**	**1.21**	**1.43**

NOTES

CAI_s is the CAI calculated on saw cut specimens.
Corrected CAI for saw cut specimens based on R. Plinger and H. Kasling
Suggested formula CAI = 0.99*CAIs + 0.48.
Applied pins had a Rockwell Hardness of 54-56.

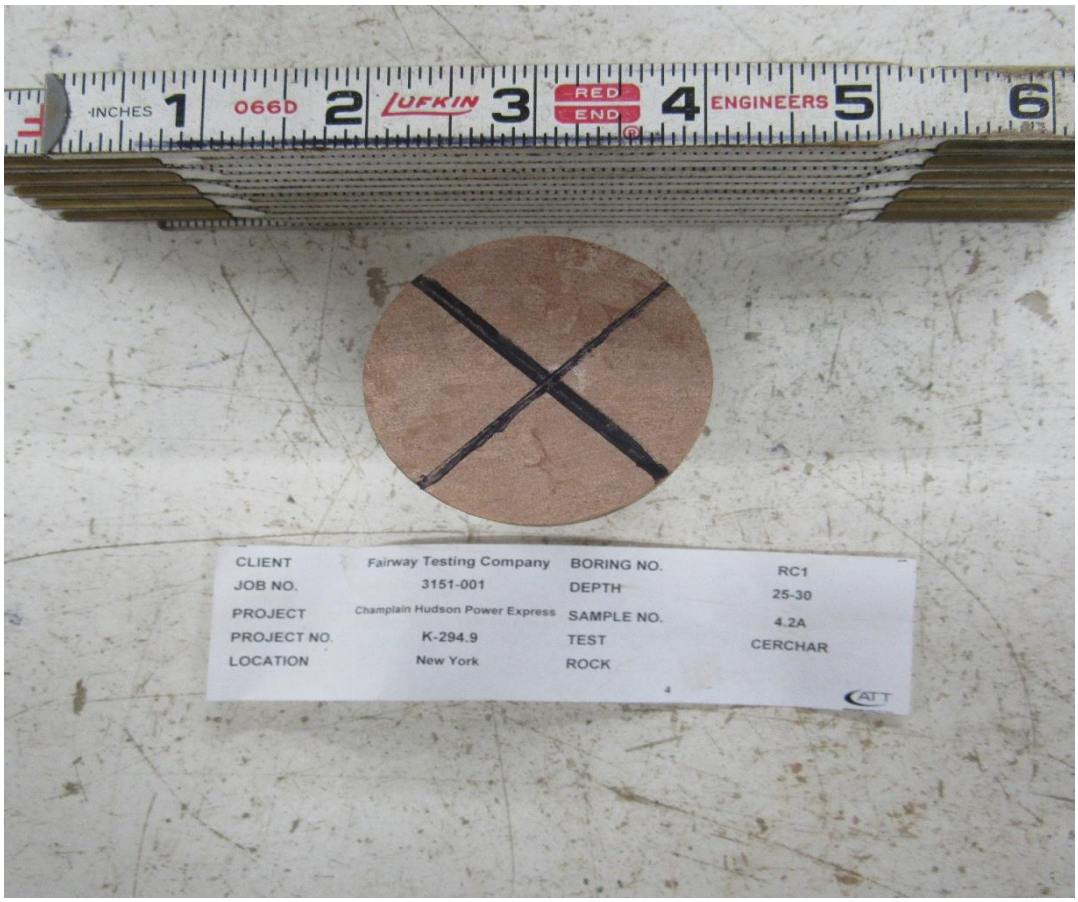
Data entry by:	HN	Date:	06/17/22
Checked by:	DL	Date:	06/17/22
File name:	3151001__CHERCHAR ASTM D7625_0.xlsm		

ADVANCED TERRA TESTING

CHERCHAR Abrasiveness
ASTM D7625

CLIENT	Fairway Testing Company	BORING NO.	RC1
JOB NO.	3151-001	DEPTH	25.0-30.0
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	4.2A
PROJECT NO.	K-294.9	DATE SAMPLED	--
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	HN
		ROCK TYPE	--

Before Picture



NOTES

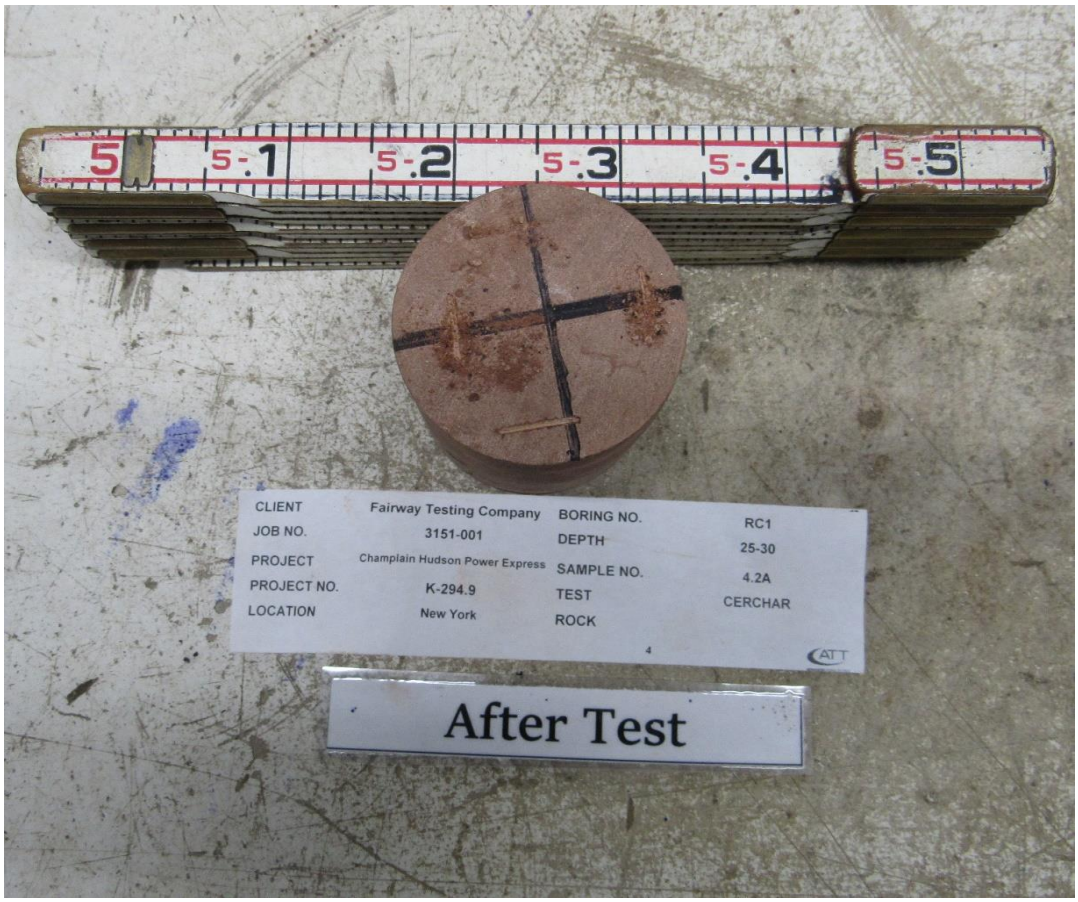
Picture File: 4.JPG
File name: 3151001__CHERCHAR ASTM D7625_0.xlsm

ADVANCED TERRA TESTING

CHERCHAR Abrasiveness
ASTM D7625

CLIENT	Fairway Testing Company	BORING NO.	RC1
JOB NO.	3151-001	DEPTH	25.0-30.0
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	4.2A
PROJECT NO.	K-294.9	DATE SAMPLED	--
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	HN
		ROCK TYPE	--

After Picture



NOTES

Picture File: 4a.JPG
File name: 3151001__CHERCHAR ASTM D7625_0.xlsm

ADVANCED TERRA TESTING

Splitting Tensile Strength
ASTM D3967

CLIENT	Fairway Testing Company	JOB NO.	3151-001
PROJECT	Champlain Hudson Power Express	LOCATION	New York
PROJECT NO.	K-294.9		

BORING NO.	RC2	RC2	RC2	RC1	RC3
DEPTH	55-60	28.5-30	75-80	25-30	21-26
SAMPLE NO.	3.3R	3.6	3.4B	4.2A	0.7
DATE SAMPLED					
DATE TESTED	06/16/22	06/16/22	06/16/22	06/16/22	06/16/22
TECHNICIAN	DL	DL	DL	DL	DL
ROCK TYPE					
Diameter (in):	1.971	1.982	1.979	1.966	1.989
Height (in):	0.999	1.018	1.084	1.093	1.036
Mass of Wet Rock (g):	127.50	131.70	134.40	137.10	138.20
Wet Density (lbs/ft³):	159.4	159.7	153.6	157.4	163.6
Wet Density (g/cm³):	2.553	2.559	2.460	2.522	2.620
Peak Load (lbs):	3099	1286	1128	2924	4536
Splitting Tensile Strength (psi):	1002	406	335	866	1401
Splitting Tensile Strength (kPa):	6907	2799	2307	5972	9662
Failure Type:	Single Plane	Single Plane	Multiple Plane	Single Plane	Single Plane

BORING NO.	
DEPTH	
SAMPLE NO.	
DATE SAMPLED	
DATE TESTED	
TECHNICIAN	
ROCK TYPE	
Diameter (in):	
Height (in):	
Mass of Wet Rock (g):	
Wet Density (lbs/ft³):	
Wet Density (g/cm³):	
Peak Load (lbs):	
Splitting Tensile Strength (psi):	
Splitting Tensile Strength (kPa):	
Failure Type:	

NOTES	

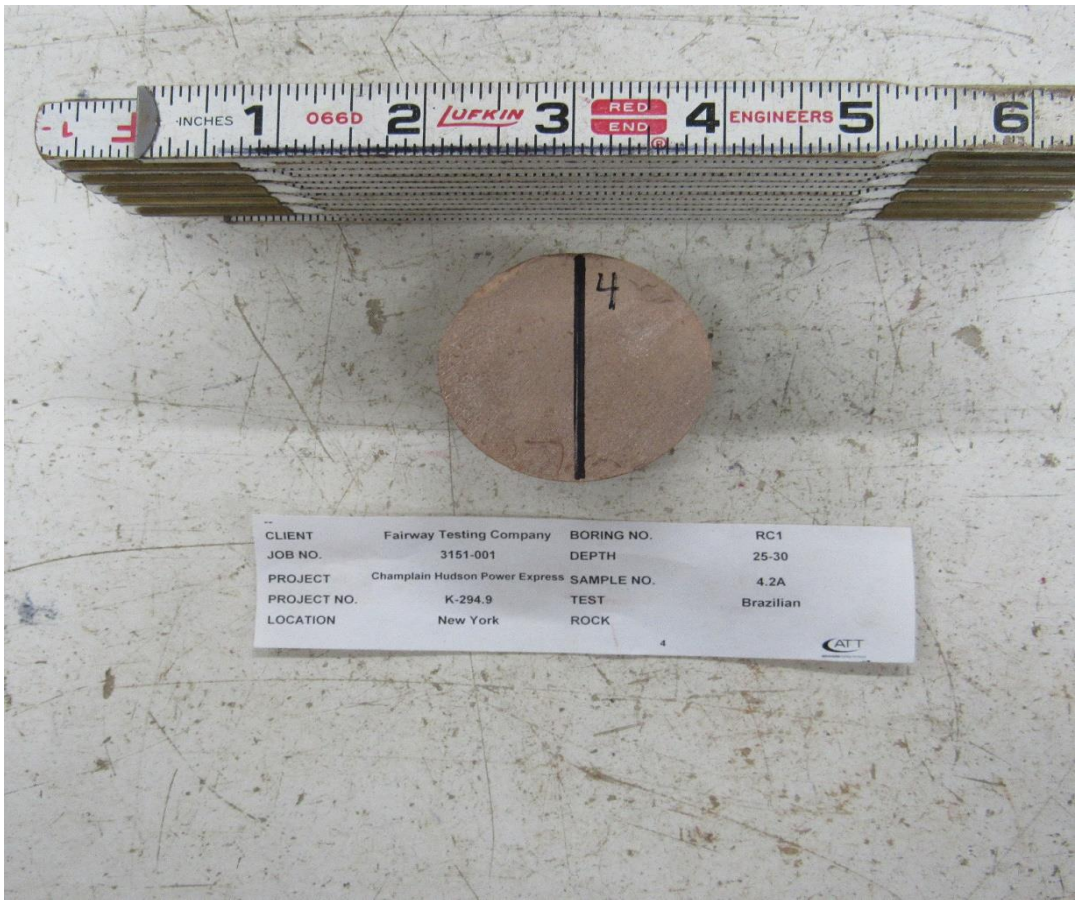
Data entry by:	DL		Date: 06/16/22
Checked by:	HN		Date: 06/17/22
File name:	3151001__Brazilian ASTM D3967_0.xlsm		

ADVANCED TERRA TESTING

Splitting Tensile
ASTM D3967

CLIENT	Fairway Testing Company	BORING NO.	RC1
JOB NO.	3151-001	DEPTH	25-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	4.2A
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	DL
		ROCK TYPE	

Before Picture



NOTES

Picture File: 4.JPG
File name: 3151001__Brazilian ASTM D3967_0.xlsm

ADVANCED TERRA TESTING

Splitting Tensile
ASTM D3967

CLIENT	Fairway Testing Company	BORING NO.	RC1
JOB NO.	3151-001	DEPTH	25-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	4.2A
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/16/22
		TECHNICIAN	DL
		ROCK TYPE	

After Picture

NOTES

Picture File: 4a.JPG
File name: 3151001__Brazilian ASTM D3967_0.xlsm

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Fairway Testing Company	JOB NO.	3151-001
PROJECT	Champlain Hudson Power Express	LOCATION	New York
PROJECT NO.	K-294.9		

BORING NO.	RC2	RC2	RC2	RC1	RC3
DEPTH	55-60	28.5-30	75-80	25-30	21-26
SAMPLE NO.	3.3R	3.6	3.4B	4.2A	0.7
DATE SAMPLED					
DATE TESTED	06/17/22	06/17/22	06/17/22	06/17/22	06/17/22
TECHNICIAN	DL	DL	DL	DL	DL
ROCK TYPE					
Diameter (in):	1.975	1.975	1.973	1.974	1.982
Height (in):	4.194	3.954	4.075	4.321	3.977
Mass of Wet Rock (g):	527.20	511.20	525.10	550.40	542.30
Wet Density (lbs/ft³):	156.3	160.8	160.6	158.6	168.4
Wet Density (g/cm³):	2.50	2.58	2.57	2.54	2.70
Peak Load (lbs):	38252	19993	14999	28736	28043
Compressive Strength (psi)	12486	6526	4906	9389	9089
Compressive Strength (MPa)	86	45	34	65	63
Failure Type:	Shear / Fracture	Fracture / Void	Shear	Fracture / Bedding	Fracture / Bedding

BORING NO.	
DEPTH	
SAMPLE NO.	
DATE SAMPLED	
DATE TESTED	
TECHNICIAN	
ROCK TYPE	
Diameter (in):	
Height (in):	
Mass of Wet Rock (g):	
Wet Density (lbs/ft³):	
Wet Density (g/cm³):	
Peak Load (lbs):	
Compressive Strength (psi)	
Compressive Strength (MPa)	
Failure Type:	
NOTES	

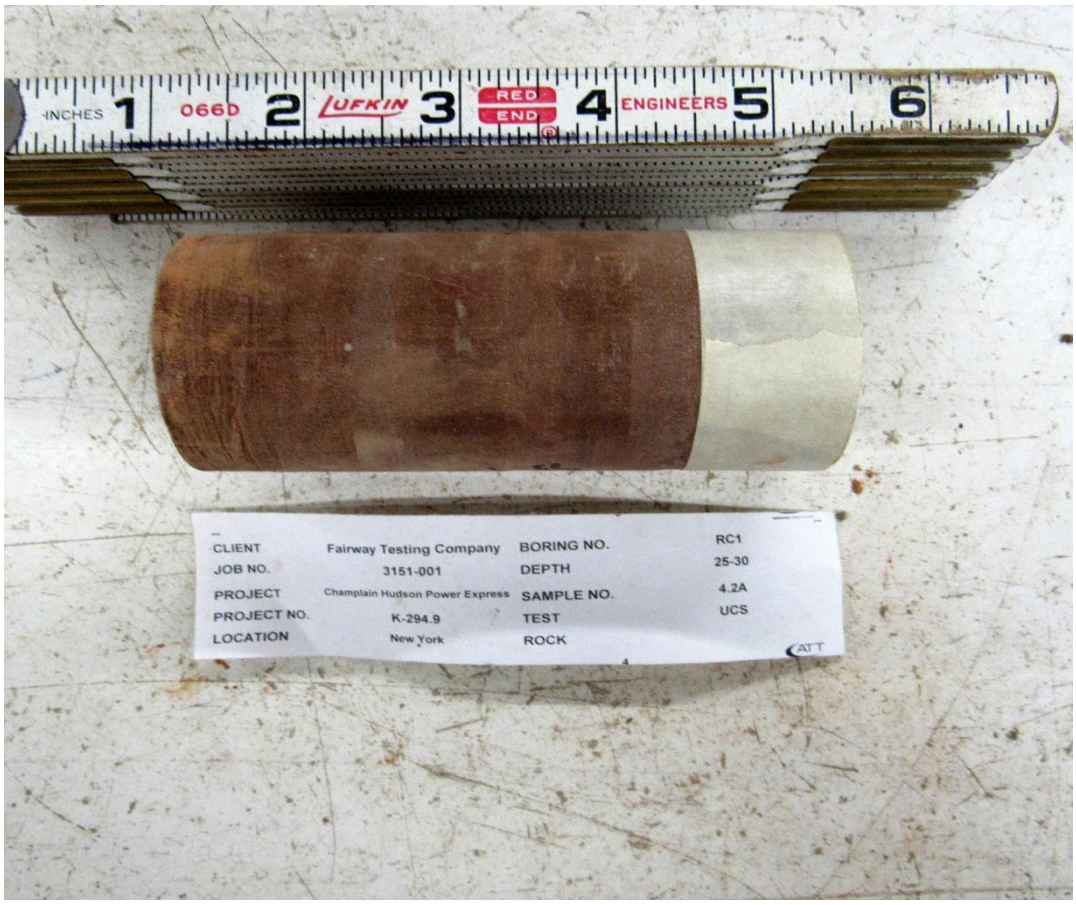
Data entry by:	DL	Date: 06/17/22
Checked by:	HN	Date: 06/17/22
File name:	3151001__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm	

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Fairway Testing Company	BORING NO.	RC1
JOB NO.	3151-001	DEPTH	25-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	4.2A
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/17/22
		TECHNICIAN	DL
		ROCK TYPE	

Before Picture



NOTES

Picture File: 4.JPG
File name: 3151001__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm

ADVANCED TERRA TESTING

Unconfined Compressive Strength
ASTM D7012 Method C

CLIENT	Fairway Testing Company	BORING NO.	RC1
JOB NO.	3151-001	DEPTH	25-30
PROJECT	Champlain Hudson Power Express	SAMPLE NO.	4.2A
PROJECT NO.	K-294.9	DATE SAMPLED	
LOCATION	New York	DATE TESTED	06/17/22
		TECHNICIAN	DL
		ROCK TYPE	

After Picture

NOTES

Picture File: 4a.JPG
File name: 3151001__Rock UCS-TCS ASTM D7012 Method A and C_0.xlsm

Appendix C

BoreAid HDD Simulation Output

Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	Kiewit CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 04-14-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetratech.com
Description:	Segment 12 (Package 7B) Conduit 1 HDD 124 DWG C-324

Input Summary

Start Coordinate	(0.00, 0.00, 25.48) ft
End Coordinate	(647.00, 0.00, 16.80) ft
Project Length	647.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

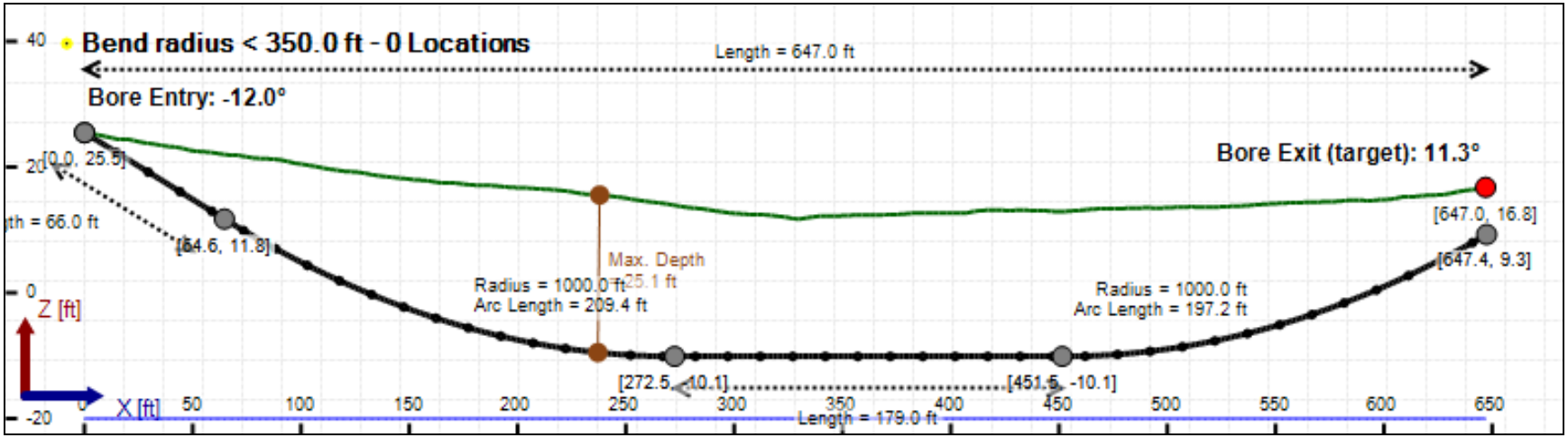
Soil Layer #1 USCS, Gravel (G), GM
Depth: 8.00 ft
Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), ML
Depth: 4.00 ft
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

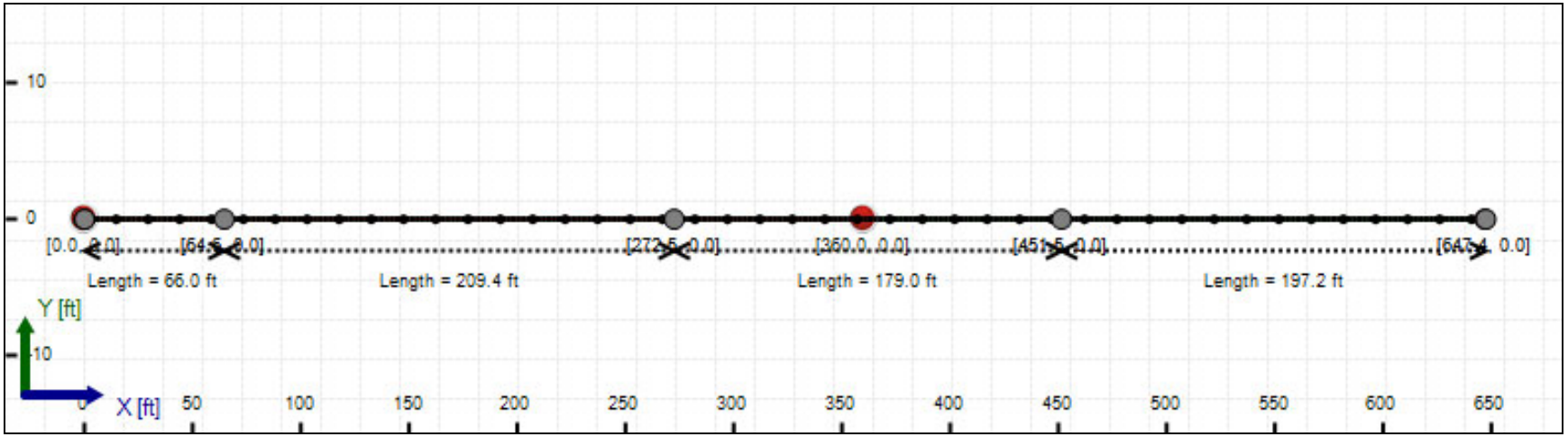
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
Depth: 18.00 ft
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks
Depth: 35.00 ft
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: HDPE

Classification: IPS

Pipe OD: 10" (10.75")

Pipe DR: 9

Pipe Length: 660.00 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.34400002161662 ft

Silo Width: 1.34400002161662 ft

Surface Surcharge: 0 psi

Short Term Modulus: 57500 psi

Long Term Modulus: 28200 psi

Short Term Poisson Ratio: 0.35

Long Term Poisson Ratio: 0.45

Pipe Unit Weight: 7.92790 lb/US (liquid) gallon

Allowable Tensile Stress (Short Term): 1200 psi

Allowable Tensile Stress (Long Term): 1100 psi

Allowable Compressive Stress (Short Term): 1150 psi

Allowable Compressive Stress (Long Term): 1150 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 12.51801 lb/US (liquid) gallon

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.6	18.8
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	5.6	18.8
Deflection		
Earth Load Deflection	1.524	5.112
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.656	5.244
Compressive Stress [psi]		
Compressive Wall Stress	25.2	84.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10615.5	10615.5
Pullback Stress [psi]	296.1	296.1
Pullback Strain	5.149E-3	5.149E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	296.1	321.6
Tensile Strain	5.149E-3	6.041E-3

Net External Pressure = 18.1 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.656	7.5	4.5	OK
Unconstrained Collapse [psi]	23.1	119.1	5.1	OK
Compressive Wall Stress [psi]	25.2	1150.0	45.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	33.1	238.0	7.2	OK
Tensile Stress [psi]	321.6	1200.0	3.7	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	6.00 in	1316.898 psi	1318.040 psi
1	6.00 in	12.00 in	1315.959 psi	1317.229 psi
2	12.00 in	16.13 in	1314.950 psi	1316.358 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 200.00 US (liquid) gallon/min

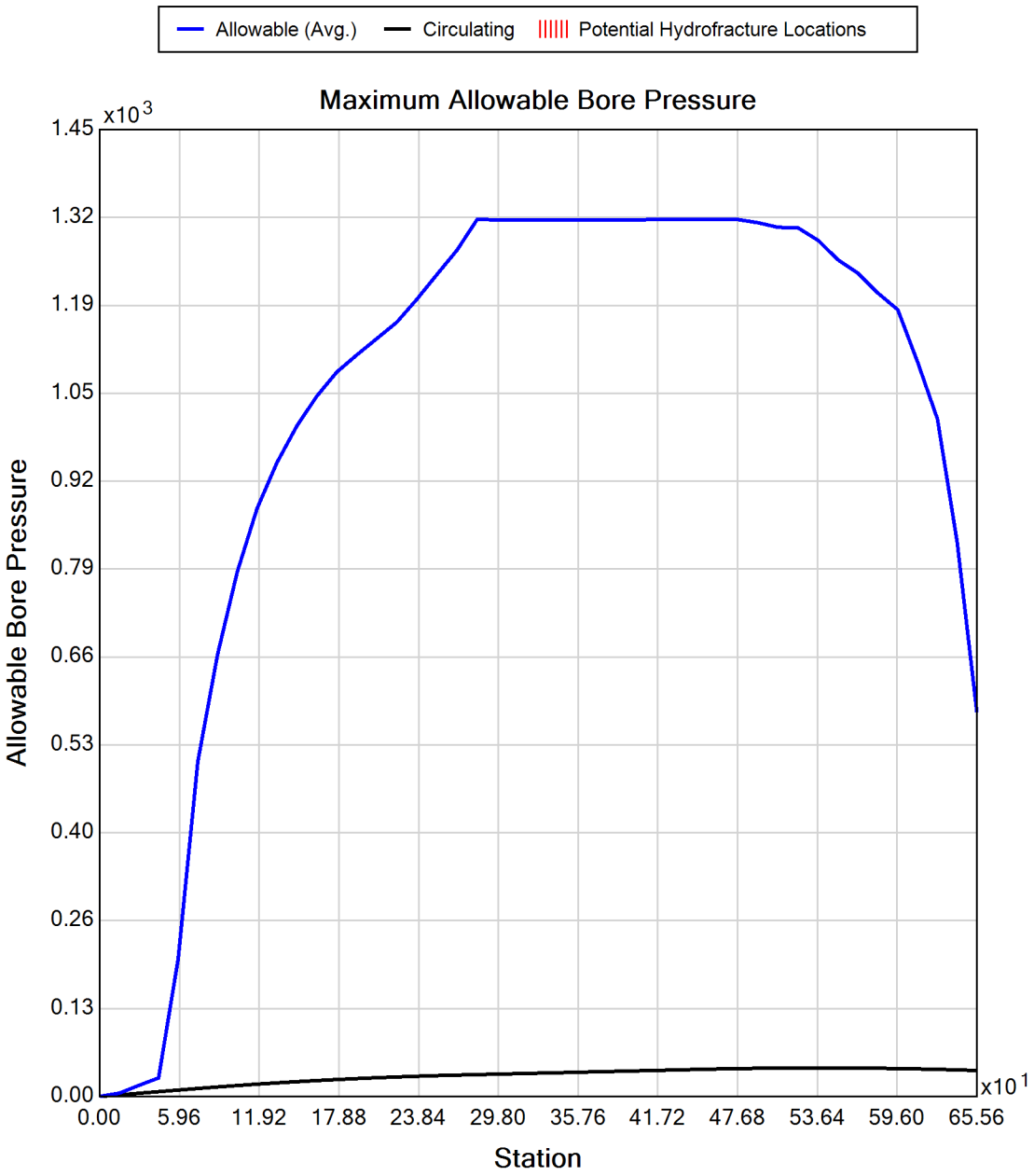
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 85.5



Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	Kiewit CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 04-14-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetratech.com
Description:	Segment 12 (Package 7B) Conduit 2 HDD 124 DWG C-324.2

Input Summary

Start Coordinate	(0.00, 0.00, 27.94) ft
End Coordinate	(738.00, 0.00, 22.54) ft
Project Length	738.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

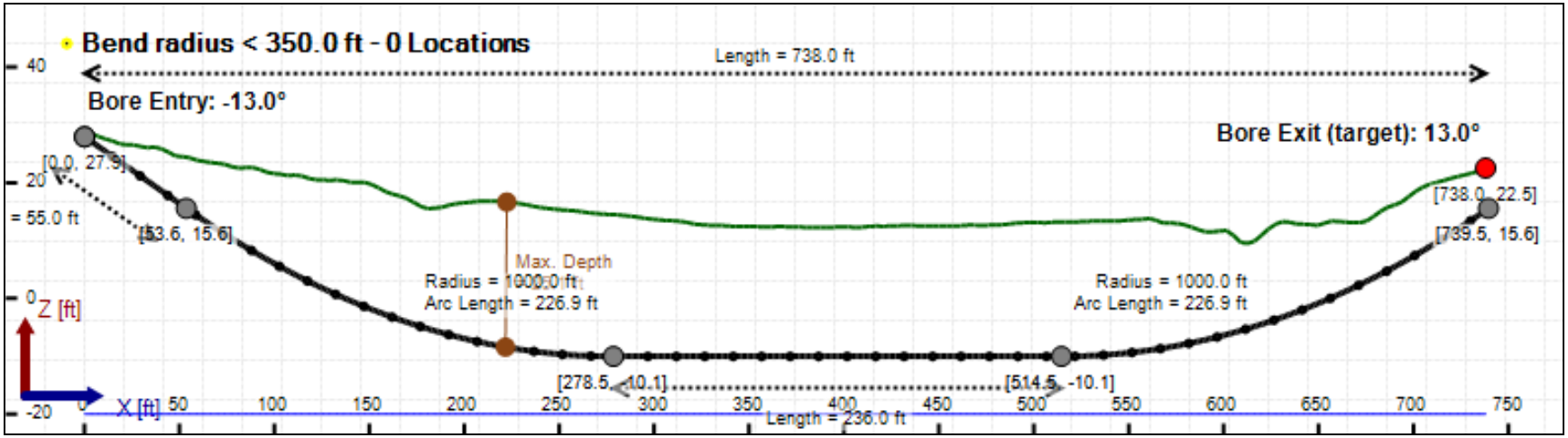
Soil Layer #1 USCS, Gravel (G), GM
Depth: 8.00 ft
Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), ML
Depth: 4.00 ft
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

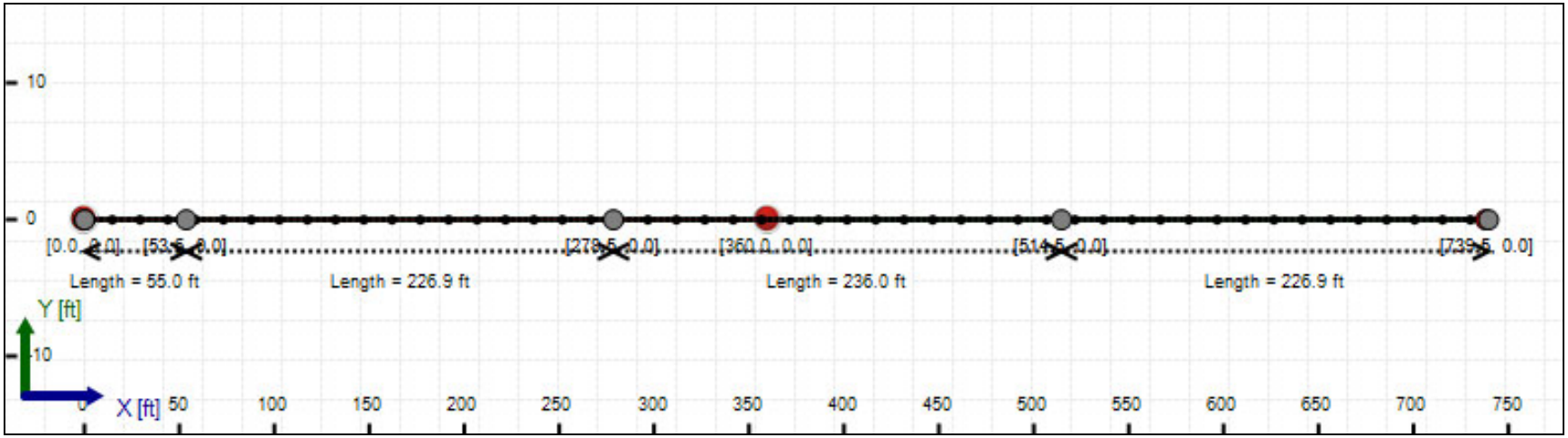
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
Depth: 18.00 ft
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks
Depth: 35.00 ft
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: HDPE

Classification: IPS

Pipe OD: 10" (10.75")

Pipe DR: 9

Pipe Length: 750.00 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.34400002161662 ft

Silo Width: 1.34400002161662 ft

Surface Surcharge: 0 psi

Short Term Modulus: 57500 psi

Long Term Modulus: 28200 psi

Short Term Poisson Ratio: 0.35

Long Term Poisson Ratio: 0.45

Pipe Unit Weight: 7.92790 lb/US (liquid) gallon

Allowable Tensile Stress (Short Term): 1200 psi

Allowable Tensile Stress (Long Term): 1100 psi

Allowable Compressive Stress (Short Term): 1150 psi

Allowable Compressive Stress (Long Term): 1150 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 12.51801 lb/US (liquid) gallon

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.6	18.8
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	5.6	18.8
Deflection		
Earth Load Deflection	1.537	5.121
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.669	5.253
Compressive Stress [psi]		
Compressive Wall Stress	25.4	84.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	12446.2	12446.2
Pullback Stress [psi]	347.1	347.1
Pullback Strain	6.037E-3	6.037E-3
Bending Stress [psi]	25.8	25.8
Bending Strain	4.479E-4	4.479E-4
Tensile Stress [psi]	372.9	372.9
Tensile Strain	6.932E-3	6.932E-3

Net External Pressure = 18.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.669	7.5	4.5	OK
Unconstrained Collapse [psi]	24.7	119.0	4.8	OK
Compressive Wall Stress [psi]	25.4	1150.0	45.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	34.7	235.0	6.8	OK
Tensile Stress [psi]	372.9	1200.0	3.2	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	6.00 in	1317.983 psi	1318.068 psi
1	6.00 in	12.00 in	1317.166 psi	1317.259 psi
2	12.00 in	16.13 in	1316.288 psi	1316.390 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 200.00 US (liquid) gallon/min

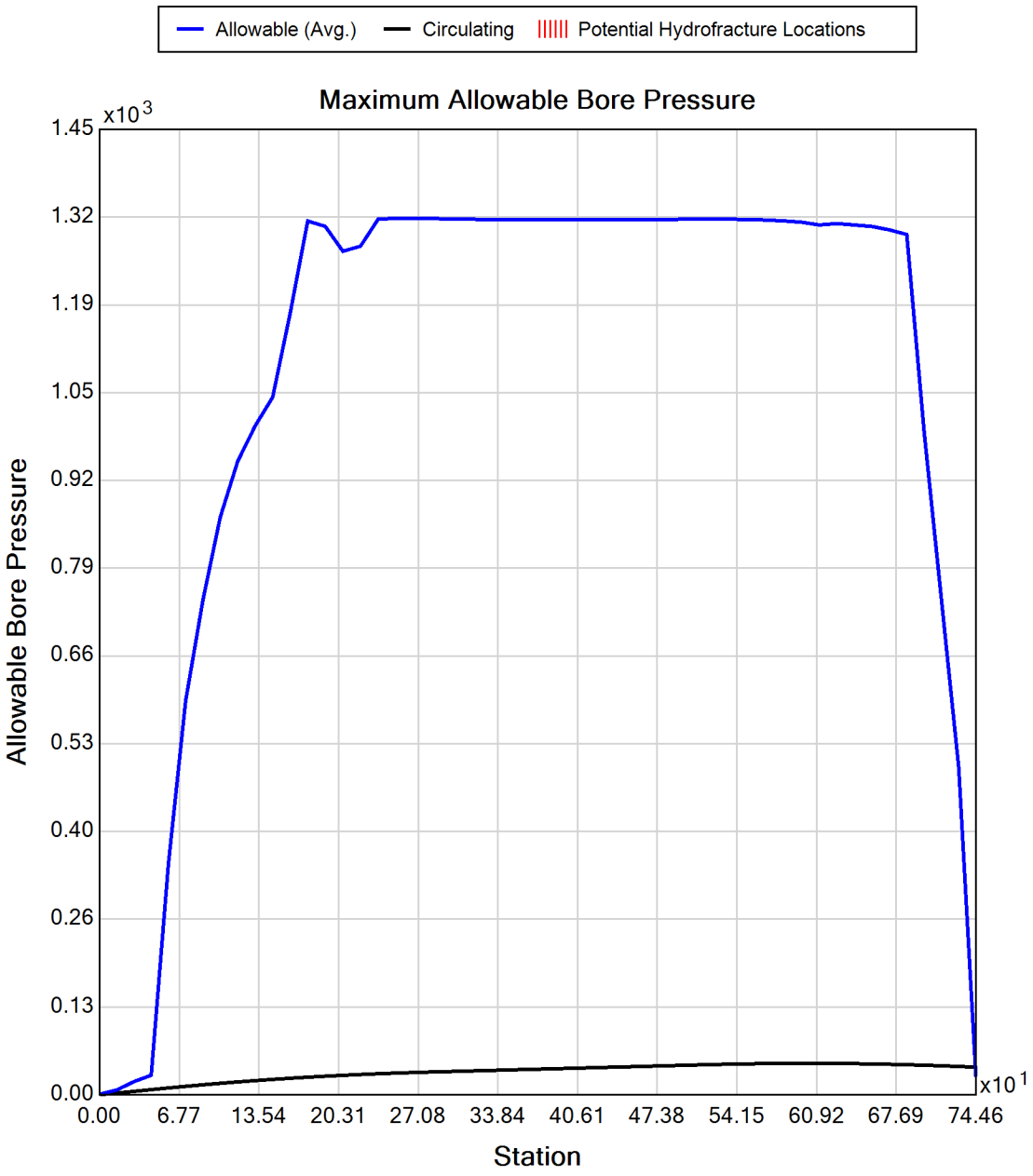
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 85.5



Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	Kiewit CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 04-14-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetratech.com
Description:	Segment 12 (Package 7B) Conduit 3 HDD 124 DWG C-324.2

Input Summary

Start Coordinate	(0.00, 0.00, 27.94) ft
End Coordinate	(738.00, 0.00, 22.54) ft
Project Length	738.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	9.0
Pipe Thickness	0.39 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

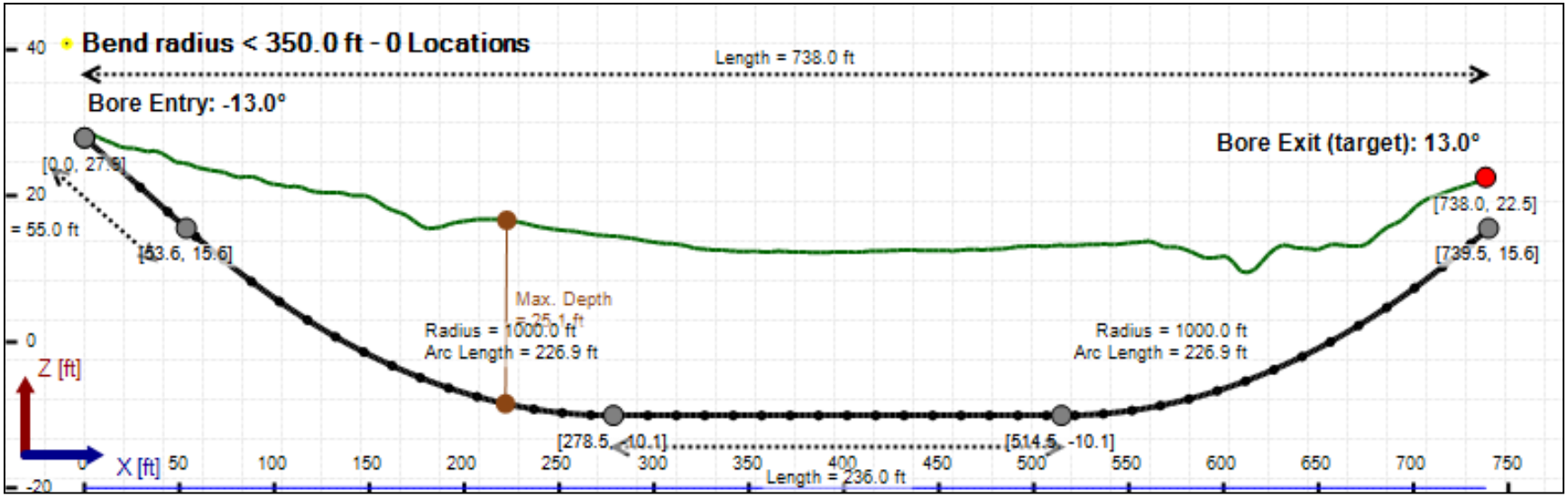
Soil Layer #1 USCS, Gravel (G), GM
Depth: 8.00 ft
Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), ML
Depth: 4.00 ft
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

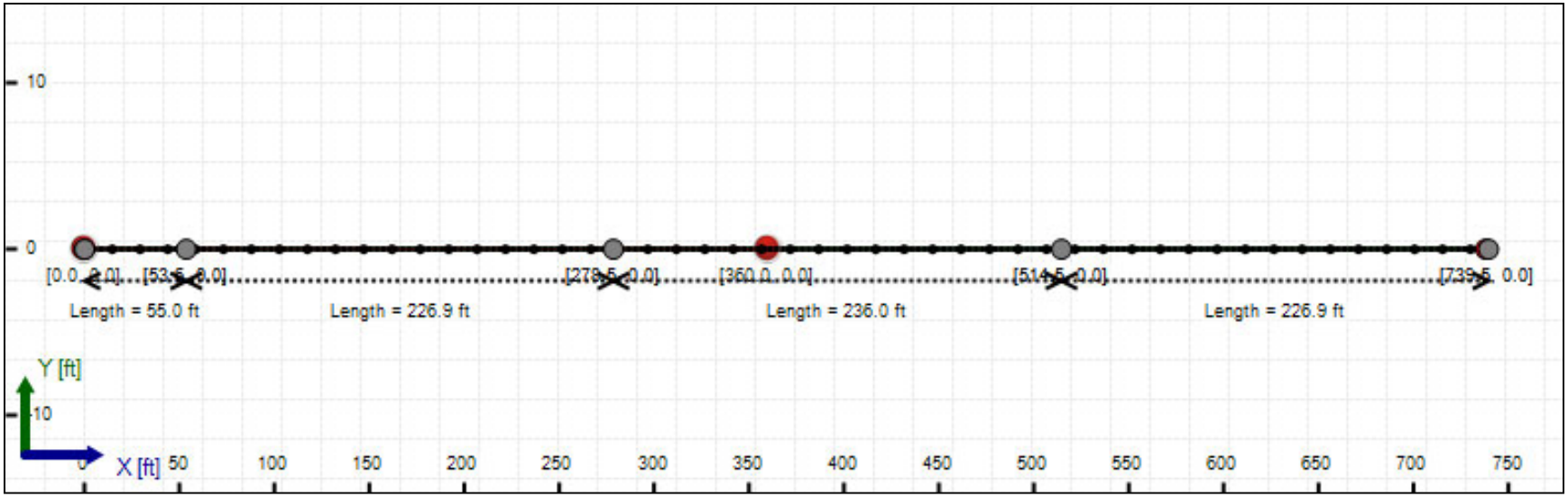
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
Depth: 18.00 ft
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks
Depth: 35.00 ft
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]
Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: HDPE

Classification: IPS

Pipe OD: 3" (3.5")

Pipe DR: 9

Pipe Length: 750.00 ft

Internal Pressure: 0 psi

Borehole Diameter: 0.625 ft

Silo Width: 0.625 ft

Surface Surcharge: 0 psi

Short Term Modulus: 57500 psi

Long Term Modulus: 28200 psi

Short Term Poisson Ratio: 0.35

Long Term Poisson Ratio: 0.45

Pipe Unit Weight: 7.92790 lb/US (liquid) gallon

Allowable Tensile Stress (Short Term): 1200 psi

Allowable Tensile Stress (Long Term): 1100 psi

Allowable Compressive Stress (Short Term): 1150 psi

Allowable Compressive Stress (Long Term): 1150 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 12.51801 lb/US (liquid) gallon

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.7	18.8
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	2.7	18.8
Deflection		
Earth Load Deflection	0.745	5.121
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	0.788	5.164
Compressive Stress [psi]		
Compressive Wall Stress	12.3	84.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1431.9	1431.9
Pullback Stress [psi]	376.7	376.7
Pullback Strain	6.552E-3	6.552E-3
Bending Stress [psi]	8.4	8.4
Bending Strain	1.458E-4	1.458E-4
Tensile Stress [psi]	385.1	385.1
Tensile Strain	6.844E-3	6.844E-3

Net External Pressure = 18.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.788	7.5	9.5	OK
Unconstrained Collapse [psi]	24.7	128.7	5.2	OK
Compressive Wall Stress [psi]	12.3	1150.0	93.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	34.7	235.1	6.8	OK
Tensile Stress [psi]	385.1	1200.0	3.1	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	6.00 in	1317.983 psi	1318.068 psi
1	6.00 in	7.50 in	1317.830 psi	1317.916 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 200.00 US (liquid) gallon/min

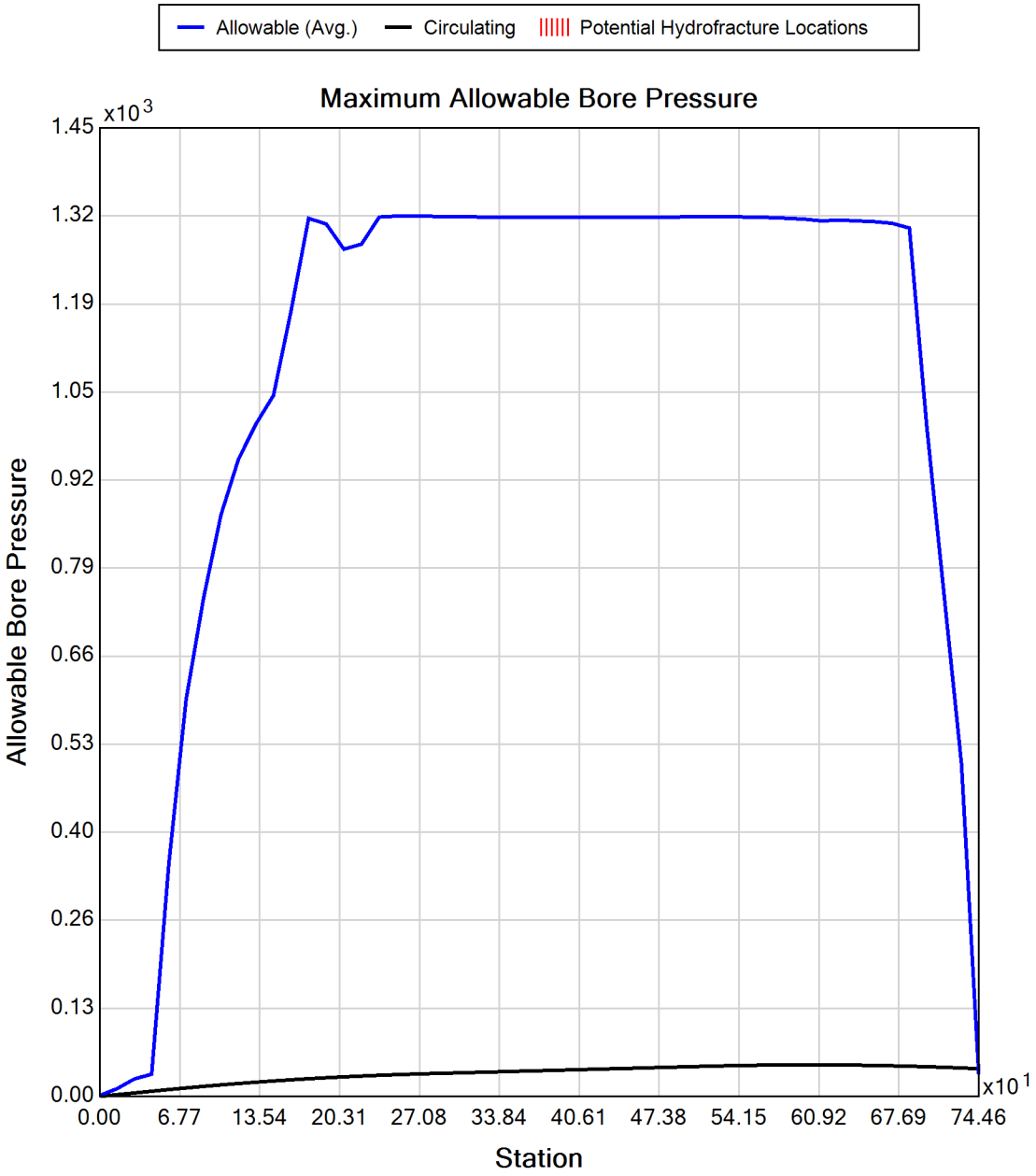
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 85.5



Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	Kiewit CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 04-14-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetratech.com
Description:	Segment 12 (Package 7B) Conduit 2 & 3 Equivalent Pipe Bundle HDD 124 DWG C-324.2

Input Summary

Start Coordinate	(0.00, 0.00, 27.94) ft
End Coordinate	(738.00, 0.00, 22.54) ft
Project Length	738.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	14.000 in
Pipe DR	14.3
Pipe Thickness	0.98 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 14" (14")
Pipe DR: 14.3
Pipe Length: 750.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.75 ft
Silo Width: 1.75 ft
Surface Surcharge: 0 psi
Short Term Modulus: 57500 psi
Long Term Modulus: 28200 psi
Short Term Poisson Ratio: 0.35
Long Term Poisson Ratio: 0.45
Pipe Unit Weight: 7.92790 lb/US (liquid) gallon
Allowable Tensile Stress (Short Term): 1200 psi
Allowable Tensile Stress (Long Term): 1100 psi
Allowable Compressive Stress (Short Term): 1150 psi
Allowable Compressive Stress (Long Term): 1150 psi
Surface-pipe friction coefficient at entrance: 0.5
Surface-pipe friction coefficient in borehole: 0.3
Pipe-soil friction angle: 30
Slurry Unit Weight: 12.51801 lb/US (liquid) gallon
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	7.0	18.8
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	7.0	18.8
Deflection		
Earth Load Deflection	8.765	23.531
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	9.455	24.221
Compressive Stress [psi]		
Compressive Wall Stress	50.1	134.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10582.8	10582.8
Pullback Stress [psi]	264.3	264.3
Pullback Strain	4.596E-3	4.596E-3
Bending Stress [psi]	33.5	33.5
Bending Strain	5.833E-4	5.833E-4
Tensile Stress [psi]	297.8	297.8
Tensile Strain	5.762E-3	5.762E-3

Net External Pressure = 15.4 [psi]

Buoyant Deflection = 0.3

Hydrokinetic Force = 962.1 lb

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.338	7.5	22.2	OK
Unconstrained Collapse [psi]	18.2	50.6	2.8	OK
Tensile Stress [psi]	297.8	1200.0	4.0	OK

Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 04-14-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetratech.com
Description:	Segment 12 (Package 7B) Conduit 1 HDD 126 DWG C-326

Input Summary

Start Coordinate	(0.00, 0.00, 101.13) ft
End Coordinate	(1613.00, 0.00, 103.51) ft
Project Length	1613.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	8.625 in
Pipe DR	18.0
Pipe Thickness	0.48 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

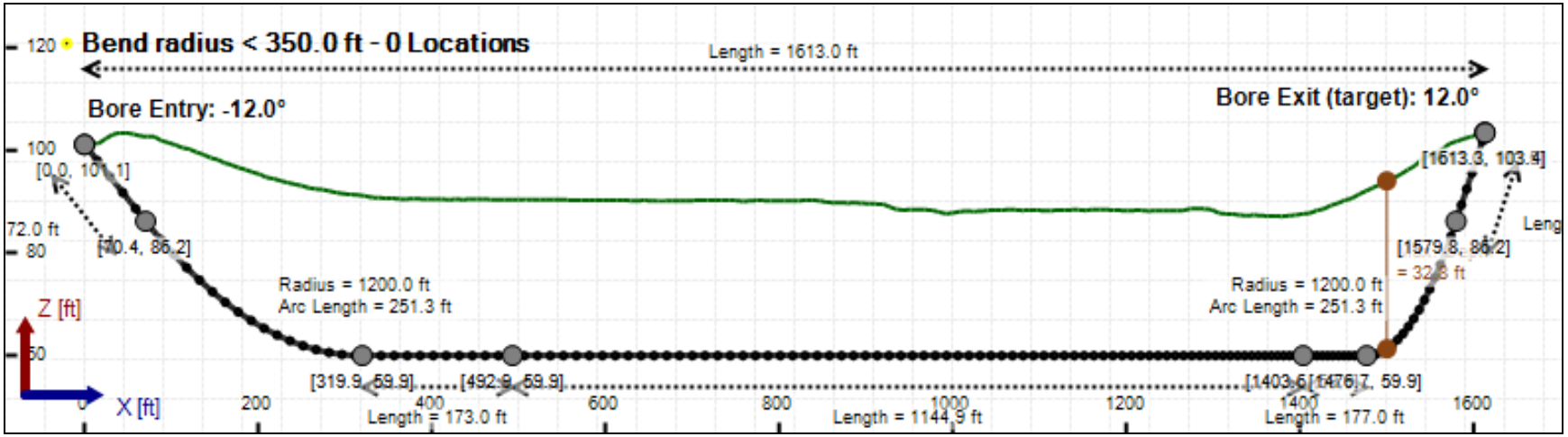
Soil Layer #1 USCS, Sand (S), SM
Depth: 7.00 ft
Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]
Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Sand (S), SM
Depth: 16.00 ft
Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]
Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

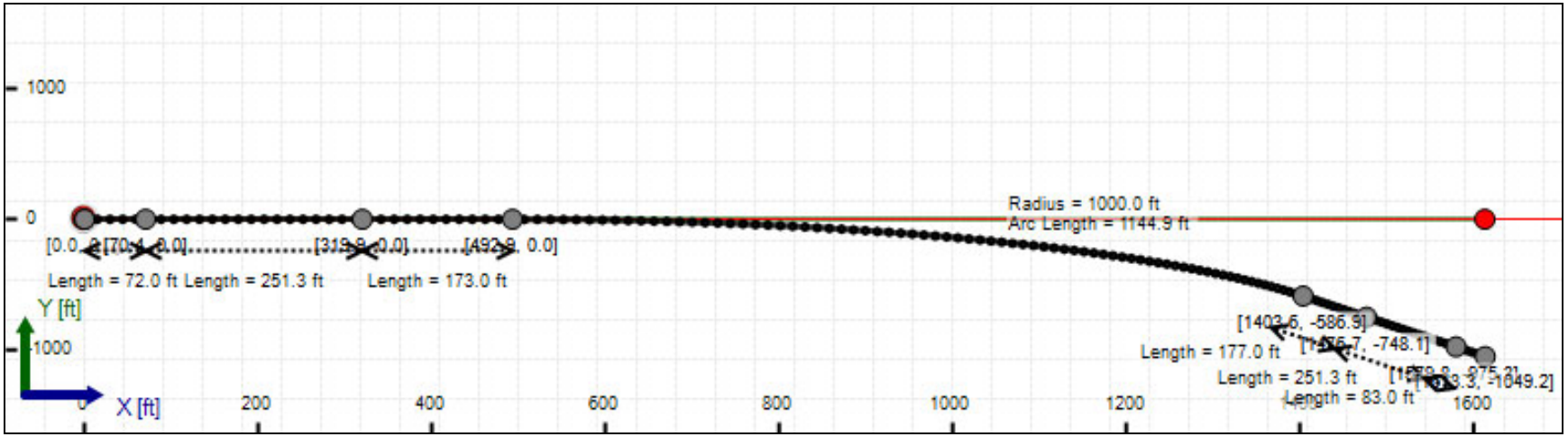
Soil Layer #3 USCS, Sand (S), SM
Depth: 22.00 ft
Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]
Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #4 USCS, Silt (M), ML
Depth: 2.00 ft
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: PVC

Classification: IPS

Pipe OD: 8" (8.625")

Pipe DR: 18

Pipe Length: 2159.99 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.07799990971883 ft

Silo Width: 1.07799990971883 ft

Surface Surcharge: 0 psi

Short Term Modulus: 400000 psi

Long Term Modulus: 400000 psi

Short Term Poisson Ratio: 0.38

Long Term Poisson Ratio: 0.38

Pipe Unit Weight: 11.68400 lb/US (liquid) gallon

Allowable Tensile Stress (Short Term): 7000 psi

Allowable Tensile Stress (Long Term): 7000 psi

Allowable Compressive Stress (Short Term): 3200 psi

Allowable Compressive Stress (Long Term): 3200 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 12.51801 lb/US (liquid) gallon

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	4.9	26.7
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	4.9	26.7
Deflection		
Earth Load Deflection	0.901	4.920
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	0.960	4.980
Compressive Stress [psi]		
Compressive Wall Stress	44.0	240.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	32730.5	32730.5
Pullback Stress [psi]	2669.2	2669.2
Pullback Strain	6.673E-3	6.673E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	2669.2	2780.2
Tensile Strain	6.673E-3	7.250E-3

Net External Pressure = 20.6 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.960	7.5	7.8	OK
Unconstrained Collapse [psi]	29.3	174.6	6.0	OK
Compressive Wall Stress [psi]	44.0	3200.0	72.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	39.3	170.5	4.3	OK
Tensile Stress [psi]	2780.2	7000.0	2.5	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	175.497 psi	175.497 psi
1	8.00 in	14.00 in	175.482 psi	175.482 psi
2	14.00 in	19.13 in	175.463 psi	175.463 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 120.00 US (liquid) gallon/min

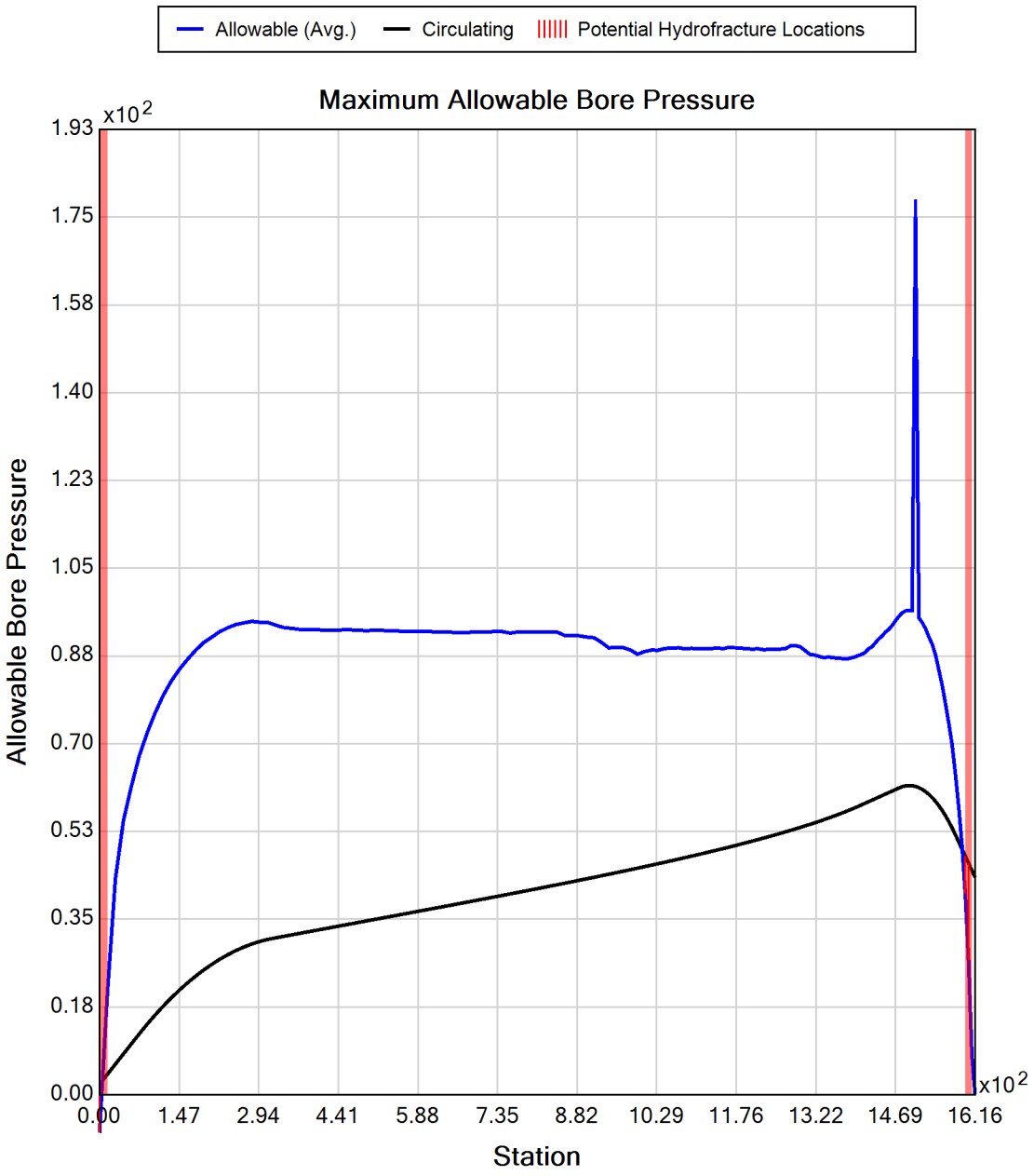
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 417.7



Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 04-14-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetratech.com
Description:	Segment 12 (Package 7B) Conduit 2 HDD 126 DWG C-326.2

Input Summary

Start Coordinate	(0.00, 0.00, 100.31) ft
End Coordinate	(1630.00, 0.00, 103.46) ft
Project Length	1630.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	8.625 in
Pipe DR	18.0
Pipe Thickness	0.48 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

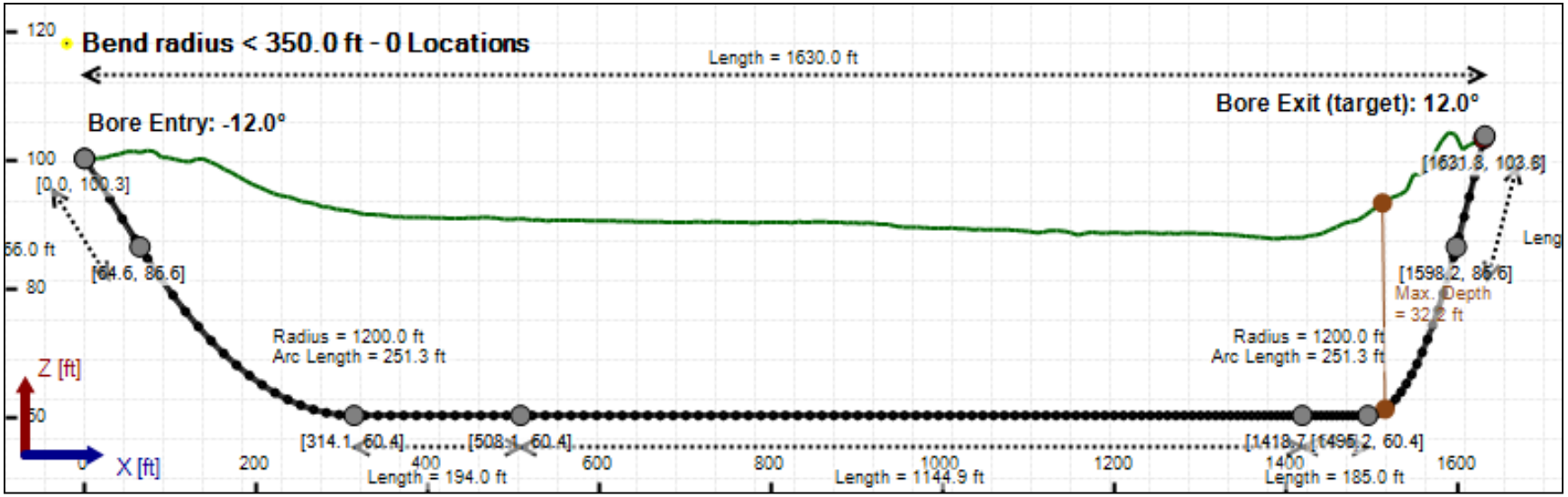
Soil Layer #1 USCS, Sand (S), SM
Depth: 7.00 ft
Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]
Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Sand (S), SM
Depth: 16.00 ft
Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]
Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

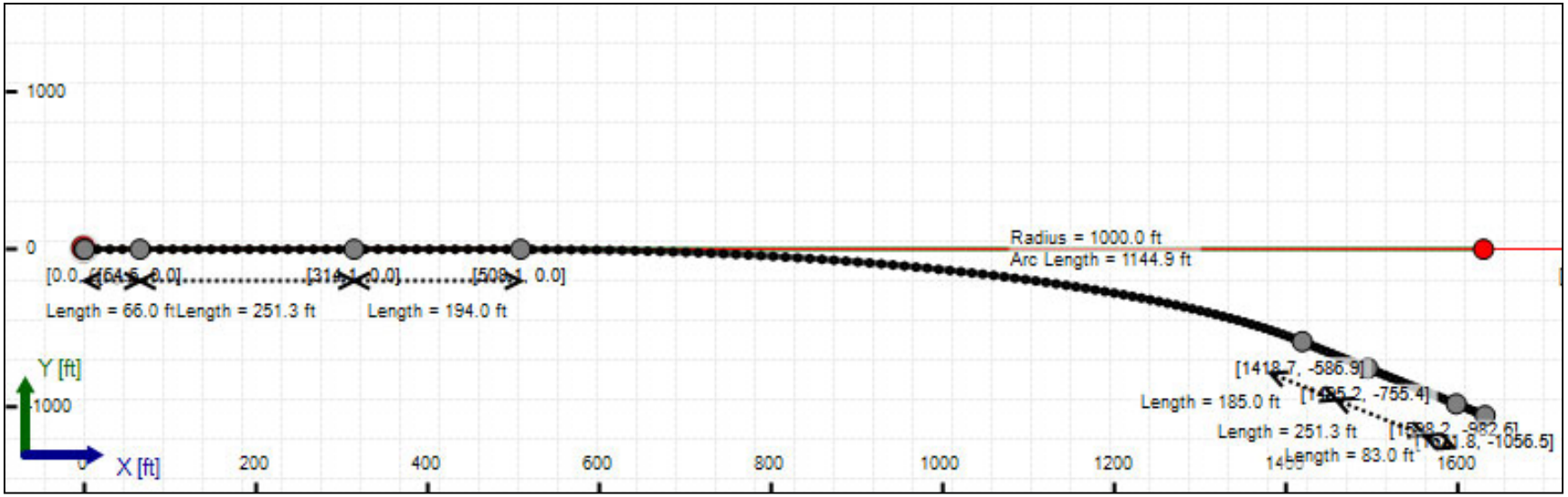
Soil Layer #3 USCS, Sand (S), SM
Depth: 22.00 ft
Unit Weight: 15.6618 (dry), 17.7639 (sat) [lb/US (liquid) gallon]
Phi: 30.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #4 USCS, Silt (M), ML
Depth: 2.00 ft
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]
Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: PVC

Classification: IPS

Pipe OD: 8" (8.625")

Pipe DR: 18

Pipe Length: 2189.99 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.07799990971883 ft

Silo Width: 1.07799990971883 ft

Surface Surcharge: 0 psi

Short Term Modulus: 400000 psi

Long Term Modulus: 400000 psi

Short Term Poisson Ratio: 0.38

Long Term Poisson Ratio: 0.38

Pipe Unit Weight: 11.68400 lb/US (liquid) gallon

Allowable Tensile Stress (Short Term): 7000 psi

Allowable Tensile Stress (Long Term): 7000 psi

Allowable Compressive Stress (Short Term): 3200 psi

Allowable Compressive Stress (Long Term): 3200 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 12.51801 lb/US (liquid) gallon

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 8.34534 lb/US (liquid) gallon

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	4.9	26.3
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	4.9	26.3
Deflection		
Earth Load Deflection	0.900	4.845
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	0.960	4.905
Compressive Stress [psi]		
Compressive Wall Stress	44.0	236.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	33302.7	33302.7
Pullback Stress [psi]	2715.9	2715.9
Pullback Strain	6.790E-3	6.790E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	2715.9	2821.8
Tensile Strain	6.790E-3	7.354E-3

Net External Pressure = 22.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.960	7.5	7.8	OK
Unconstrained Collapse [psi]	30.2	174.6	5.8	OK
Compressive Wall Stress [psi]	44.0	3200.0	72.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	40.2	170.1	4.2	OK
Tensile Stress [psi]	2821.8	7000.0	2.5	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	96.344 psi	96.344 psi
1	8.00 in	14.00 in	96.198 psi	96.198 psi
2	14.00 in	19.13 in	96.012 psi	96.012 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 120.00 US (liquid) gallon/min

Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 417.7