

Client

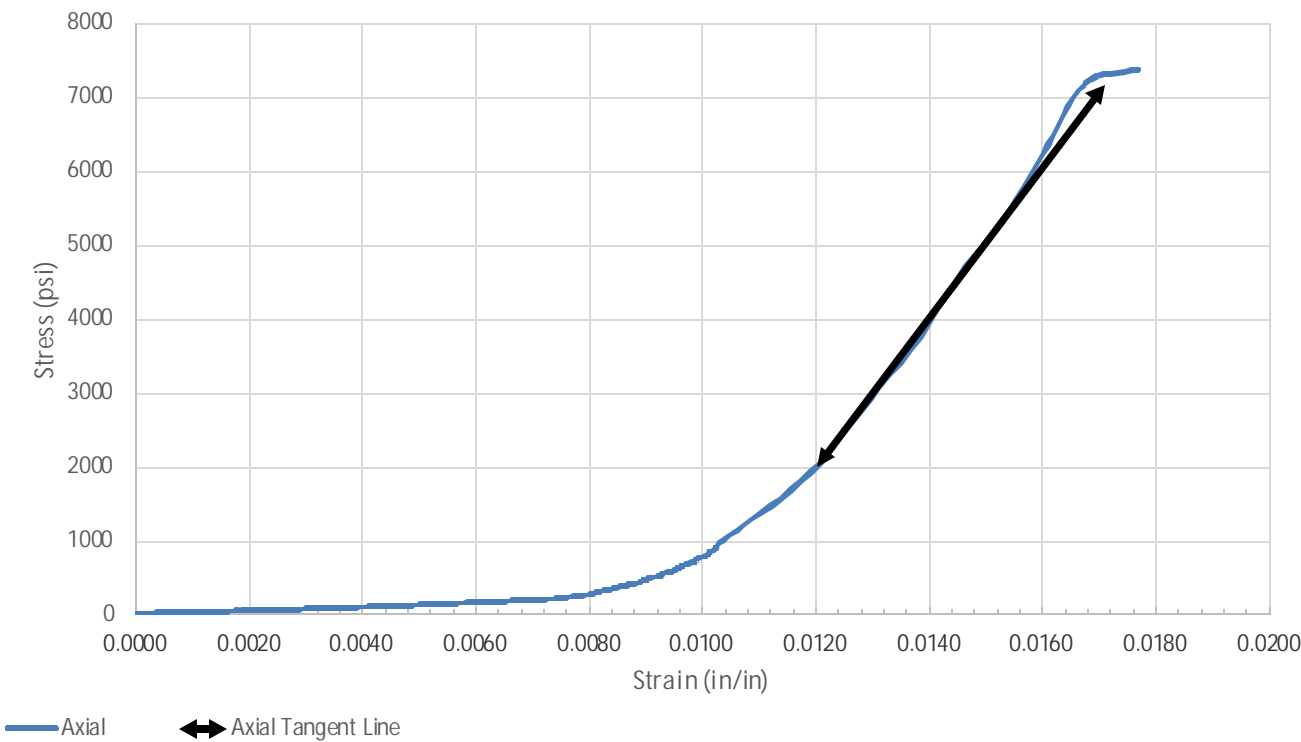
Kiewit Engineering (NY) Corp

Project

LAB Testing

Project No. JB215256H

ASTM D7012 Stress/ Strain Curve



SAMPLE LOCATION

Site:	LAB Testing		
Description:	Greywacke interbedded with Shale		
Boring:	KB-226.1	Depth (feet):	40.0-45.0

SPECIMEN INFORMATION

Sample No.:	RC2	Mass (g):	573.16
Length (in.):	4.18	Diameter (in.):	1.98
L/D Ratio:	2.11	Density (pcf):	169.65

TEST RESULTS

Failure Load (lbs):	22736
Failure Strain (in/in):	0.020
Unconfined Compressive Strength (psi):	7,384
Elastic Modulus, E, (ksi):	1016
Time of Failure (min):	02:32
Rate of Loading (in/sec):	0.04
Moisture Content Post-break:	0.09%

Rock Core D7012 Method C



Client	Project
Kiewit Engineering (NY) Corp	LAB Testing

Project No. JB215256H

Equipment:	TICCS ID:
Calipers	W-44049
Scale	B-71466
Dial Indicator	C-70608
Compression (spherically seated)	C-48999

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below:
Notes:

Per ASTM D4543, this specimen has not met the requirements for perpendicularity, by exceeding 0.250°.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
Per ASTM D4543, this specimen has not met the requirements for parallelism, by exceeding 0.25°.
Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.
Per ASTM D4543 and ASTM D7012, the desired specimen length to diameter are between 2.0:1 and 2.5:1.

According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

Client	Project
Kiewit Engineering (NY) Corp	LAB Testing

Project No. JB215256H

Splitting Tensile Strength of Intact Rock Core Specimens, ASTM D3967						
Boring	KB-226.1		Material Description		Greywacke	
Sample No	RC2		Equipment Used		Tinius Olsen (120,000lbs)	
Depth (ft)	40.0-45.0		TICCS ID/Serial No.		C-48999, 118285	
Lab No	8752		Calibration Date		11/2/2021	
		TENSILE STRENGTH				
Lab No.		1	2	3	4	5
Diameter (in)		1.97	1.98	1.97	1.97	1.98
Length (in)		0.6	0.64	0.58	0.69	0.58
Length Diameter Ratio		0.30	0.32	0.29	0.35	0.29
Rate of Loading		0.06	0.064	0.058	0.069	0.058
Moisture Condition		0.09%	0.09%	0.09%	0.09%	0.09%
Maximum Applied Load (lbf)		270	1372	1046	701	626
Splitting Tensile Strength (psi)		145.5	689.6	583.1	328.5	347.2
		TENSILE STRENGTH				
Lab No.		6	7	8	9	10
Diameter (in)		1.97	1.97	1.97	1.97	
Length (in)		0.62	0.58	0.58	0.51	
Length Diameter Ratio		0.31	0.29	0.29	0.26	
Rate of Loading		0.062	0.58	0.58	0.51	
Moisture Condition		0.09%	0.09%	0.09%	0.09%	
Maximum Applied Load (lbf)		2095	689	1804	534	
Splitting Tensile Strength (psi)		1092.5	384.1	1005.6	338.5	

**CERCHAR Abrasiveness
ASTM D7625**

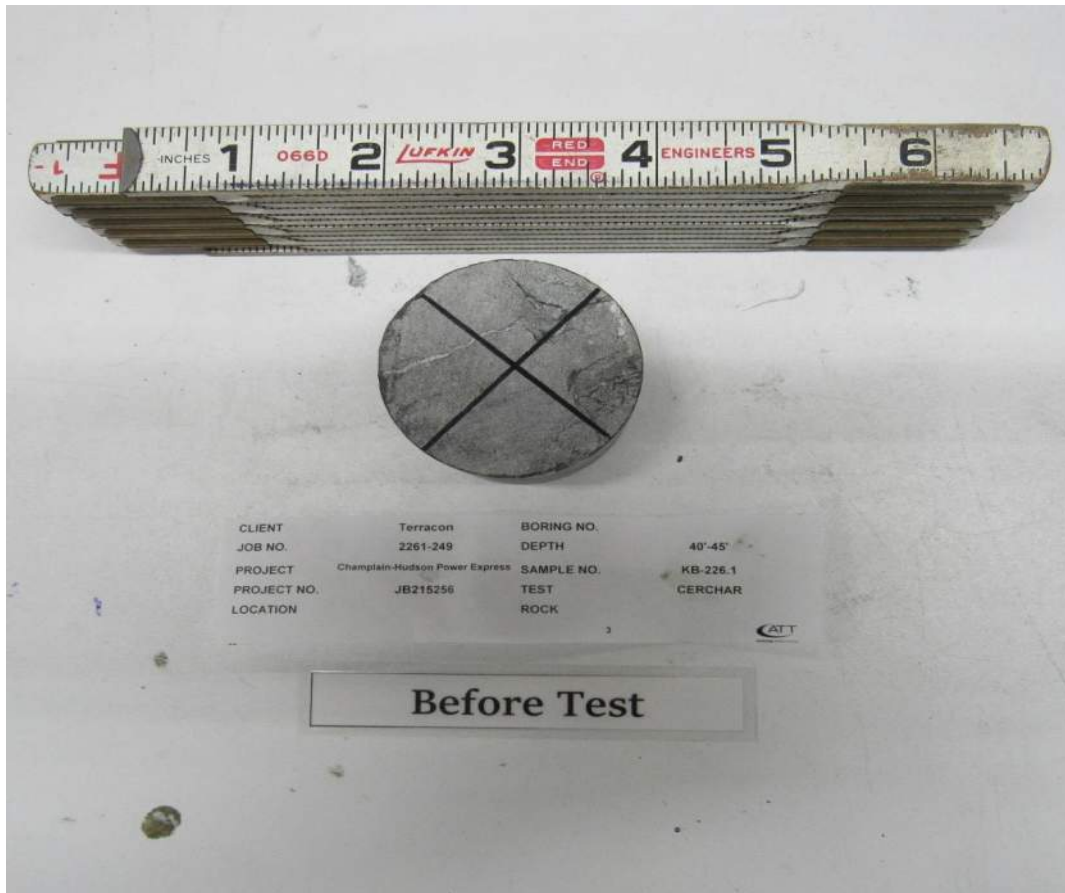
CLIENT	Terracon		JOB NO.	2261-249
PROJECT	Champlain-Hudson Power Express		LOCATION	--
PROJECT NO.	JB215256			
BORING NO.	KB-192.8A	KB-226.1		
DEPTH	54.5	40.0-45.0		
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	10/18/22	10/18/22		
TECHNICIAN	HN	HN		
ROCK TYPE				
Surface Type:	Natural	Saw Cut		
Moisture Condition	As Received	As Received		
Reading A.1 (in):	0.00920	0.00480		
Reading A.2 (in):	0.01350	0.00750		
Reading A.3 (in):	0.00380	0.00600		
Reading A.4 (in):	0.00890	0.00640		
Reading A.5 (in):	0.00830	0.00650		
Reading B.1 (in):	0.00790	0.00770		
Reading B.2 (in):	0.01620	0.00760		
Reading B.3 (in):	0.00540	0.00670		
Reading B.4 (in):	0.00790	0.00500		
Reading B.5 (in):	0.00850	0.00700		
Average Reading (in):	0.00896	0.00652		
Average Reading (mm):	0.2276	0.1656		
Uncorrected CAI or CAI _s :	2.28	1.66		
Corrected CAI:	--	2.12		
NOTES	<p>CAI_s is the CAI calculated on saw cut specimens.</p> <p>Corrected CAI for saw cut specimens based on R. Plinger and H. Kasling</p> <p>Suggested formula CAI = 0.99*CAI_s + 0.48.</p> <p>Applied pins had a Rockwell Hardness of 54-56.</p>			
Data entry by:	DL		Date:	10/19/22
Checked by:	HN		Date:	10/19/22
File name:	2261249_CERCHAR ASTM D7625_0.xlsm			

CHERCHAR Abrasiveness ASTM D7625

CLIENT Terracon
JOB NO. 2261-249
PROJECT Champlain-Hudson Power Express
PROJECT NO. JB215256
LOCATION --

BORING NO. KB-226.1
DEPTH 40.0-45.0
SAMPLE NO. --
DATE SAMPLED --
DATE TESTED 10/18/22
TECHNICIAN HN
ROCK TYPE --

Before Picture



NOTES

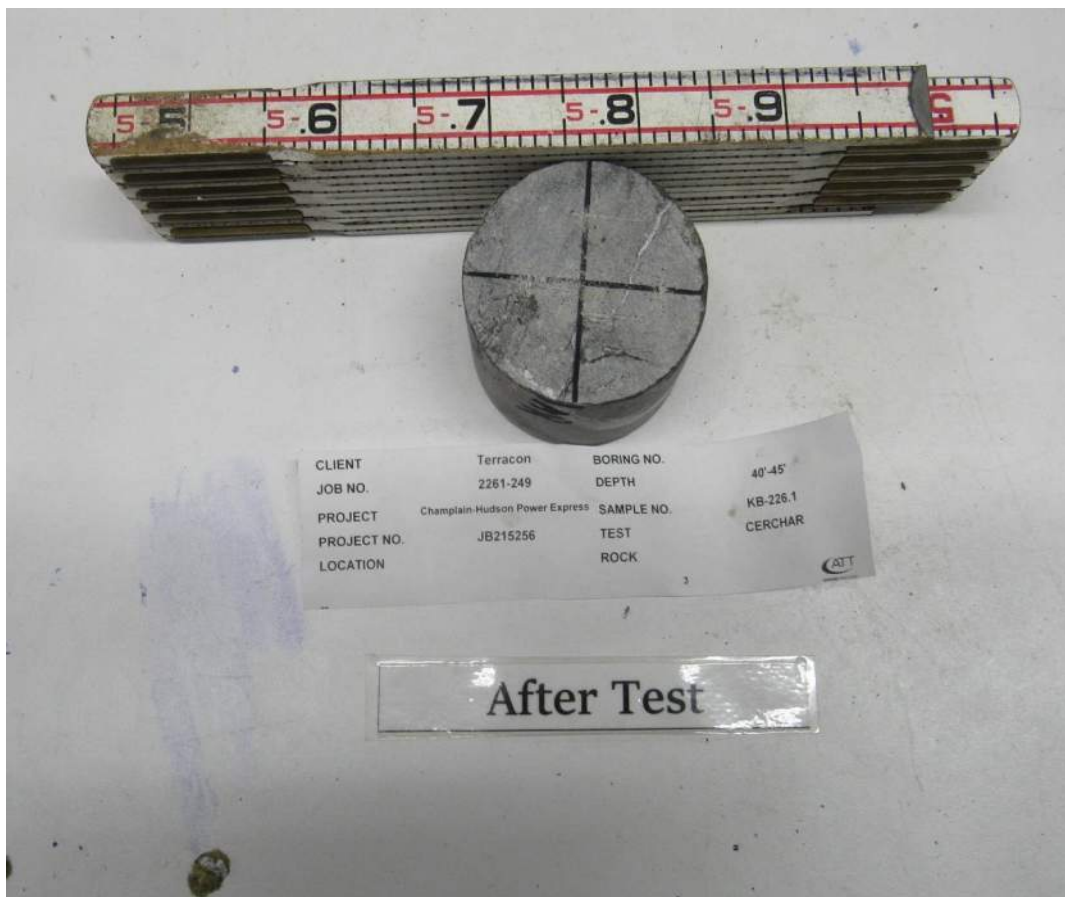
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CHERCHAR Abrasiveness ASTM D7625

CLIENT Terracon
JOB NO. 2261-249
PROJECT Champlain-Hudson Power Express
PROJECT NO. JB215256
LOCATION --

BORING NO. KB-226.1
DEPTH 40.0-45.0
SAMPLE NO. --
DATE SAMPLED --
DATE TESTED 10/18/22
TECHNICIAN HN
ROCK TYPE --

After Picture



NOTES

Picture File: 3a.JPG
File name: 2261249__CHERCHAR ASTM D7625_0.xlsm

DATE: December 16, 2022

TO: Zachary Bauer; Tetra Tech Rooney

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



SUBJECT: Geotechnical Data: Segment 11 – Package 7A – HDD Crossing 123 – Revision 1
Champlain Hudson Power Express Project
Catskill, 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 south of Catskill, New York. The approximate station for the start of HDD crossing number 123 is STA 70374+00 (42.1589° N, 73.9187° W).

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

- AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.
- TRC, Geotechnical Data Report, Champlain Hudson Power Express, Canadian Pacific Railway Borings MP 177.6-228.2, dated March 15, 2013.
- Kiewit Engineering (NY) Corp., Segment 11 Package 7A HDD Borings - Catskill, Champlain-Hudson Power Express, dated May 9, 2022.
- Kiewit Engineering (NY) Corp., Package 7A Phase 3 Borings, Champlain Hudson Power Express, New York, dated December 8, 2022.

Contact us if you have questions or require additional information.

HDD 123
Borings B226.6-1, CU-5A,
K-226.7, K-226.8, K-227.0,
KB-226.8A
Segment 11 - Design Package 7A

CHPE Segment 11 - Package 7A

HDD Soil Boring Coordinates and Elevations

Firm	Boring	Northing (feet)	Easting (feet)	Ground Surface Elevation (feet)
TRC*	B221.0-1	1237452.6	663787.2	99.6
	B221.2-1	1236173.4	663261.8	115.0
	B221.4-1	1235622.5	662622.3	22.4
	B221.5-1	1235006.9	662058.8	95.5
	B221.6-1	1234675.8	661633.8	98.3
	B221.8-1	1234265.3	661277.2	99.4
	B222.34-1	1232191.5	659098.9	133.5
	B222.6-1	1231252.6	658182.3	113.7
	B222.9-1	1229751.0	657274.3	121.4
	B225.8-1	1215861.0	650622.7	91.0
	B226.1-1	1214654.4	650328.3	105.9
	B226.2-1	1214120.5	650254.4	108.5
	B226.6-1	1211894.7	649689.7	112.1
AECOM**	CU-1	1237028.6	663123.9	19.7
	CU-2	1236042.7	662897.0	24.8
	CU-2A	1235325.9	662268.9	38.1
	CU-5A	1210523.7	649411.8	118.4
	SC-5	1239310.3	664321.6	110.2
	SC-6	1237781.0	663919.8	101.6

Notes:

- Northings and Eastings are provided in NAD83 New York State Plane East Zone.

- Elevations are referenced to the NAVD88 datum.

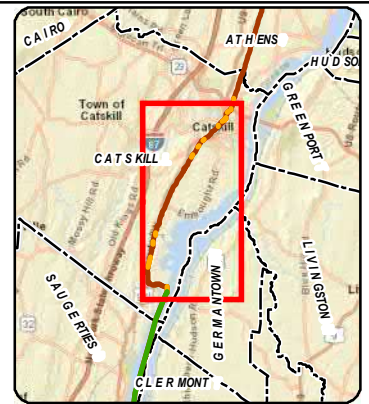
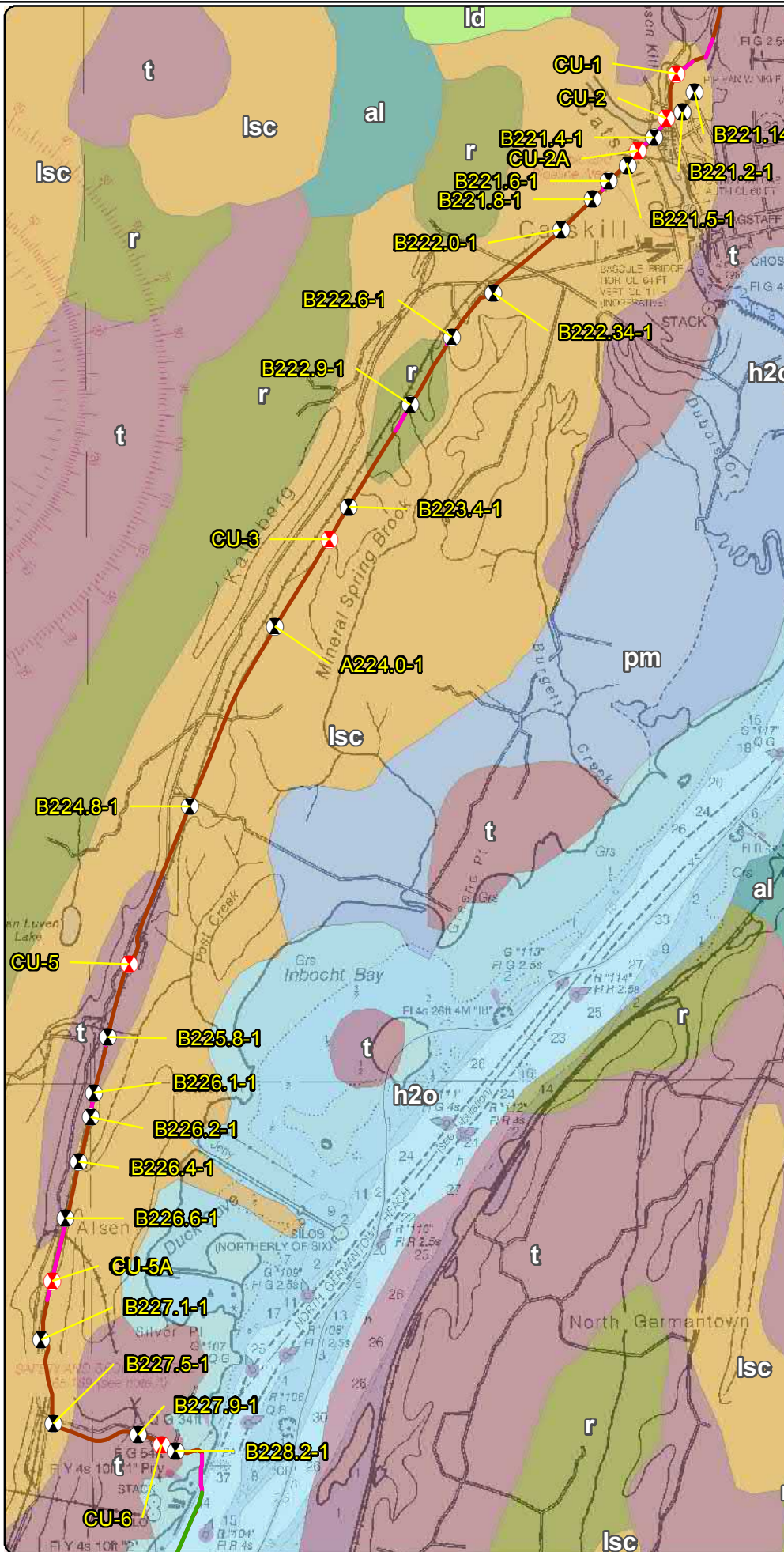
* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** Kiewit boring coordinates and elevations are noted on the boring logs.

Reference:

AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Surficial Geology

- al - Recent alluvium
- h2o - Water
- ld - Lacustrine delta
- lsc - Lacustrine silt and clay
- pm - Swamp deposits
- r - Bedrock
- t - Till



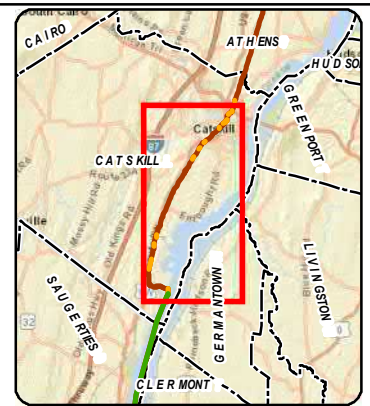
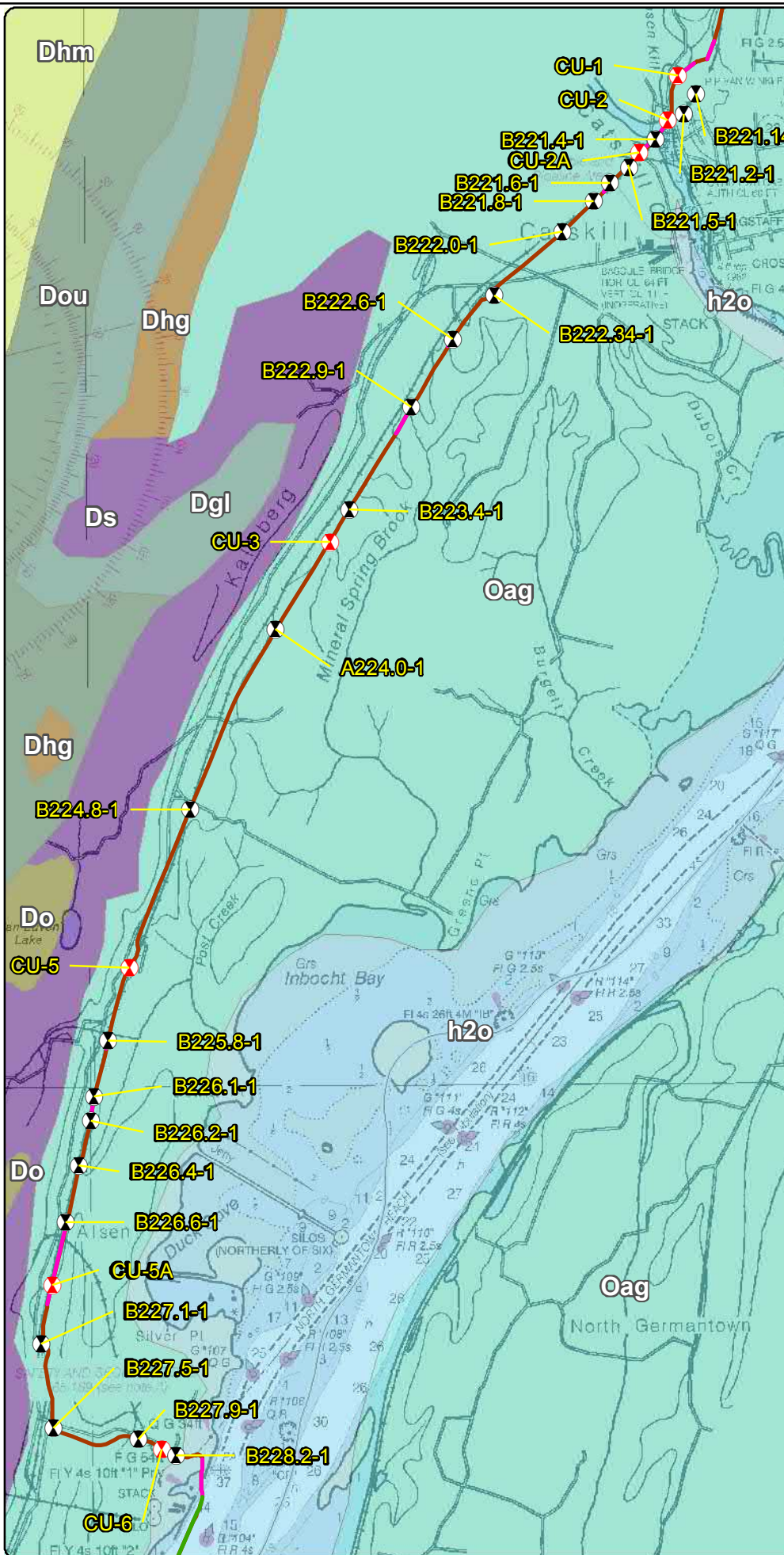
0.3 0.15 0 0.3 Miles



Champlain Hudson Power Express Project
Champlain Hudson Power Express Inc.

Surficial Geology and Geotechnical Borings Catskill to Upland Figure 3-11

Prepared on 5/3/2021
by: **AECOM**



LEGEND

- 2021 Boring Location
- Previous (2013) Boring Location
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- Town Boundary
- County Boundary

Bedrock Geology

- Dgl - Glenerie Formation
- Dhg - Port Ewen Formation
- Dhm - Undiff Lower Hamilton Group
- Do - Oriskany Sandstone
- Dou - Onondaga Limestone
- Ds - Cashaqua Shale
- Oag - Austin Glen Form (graywacke, shale)
- h2o - Water



0.3 0.15 0 0.3 Miles

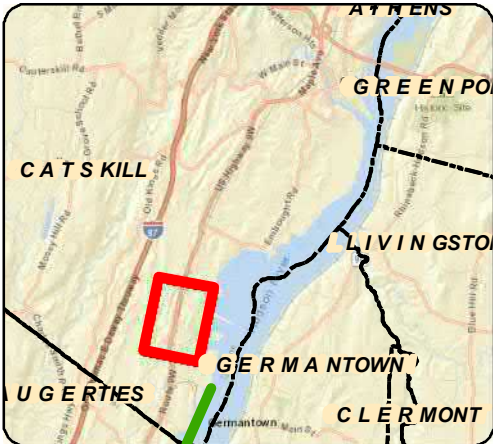
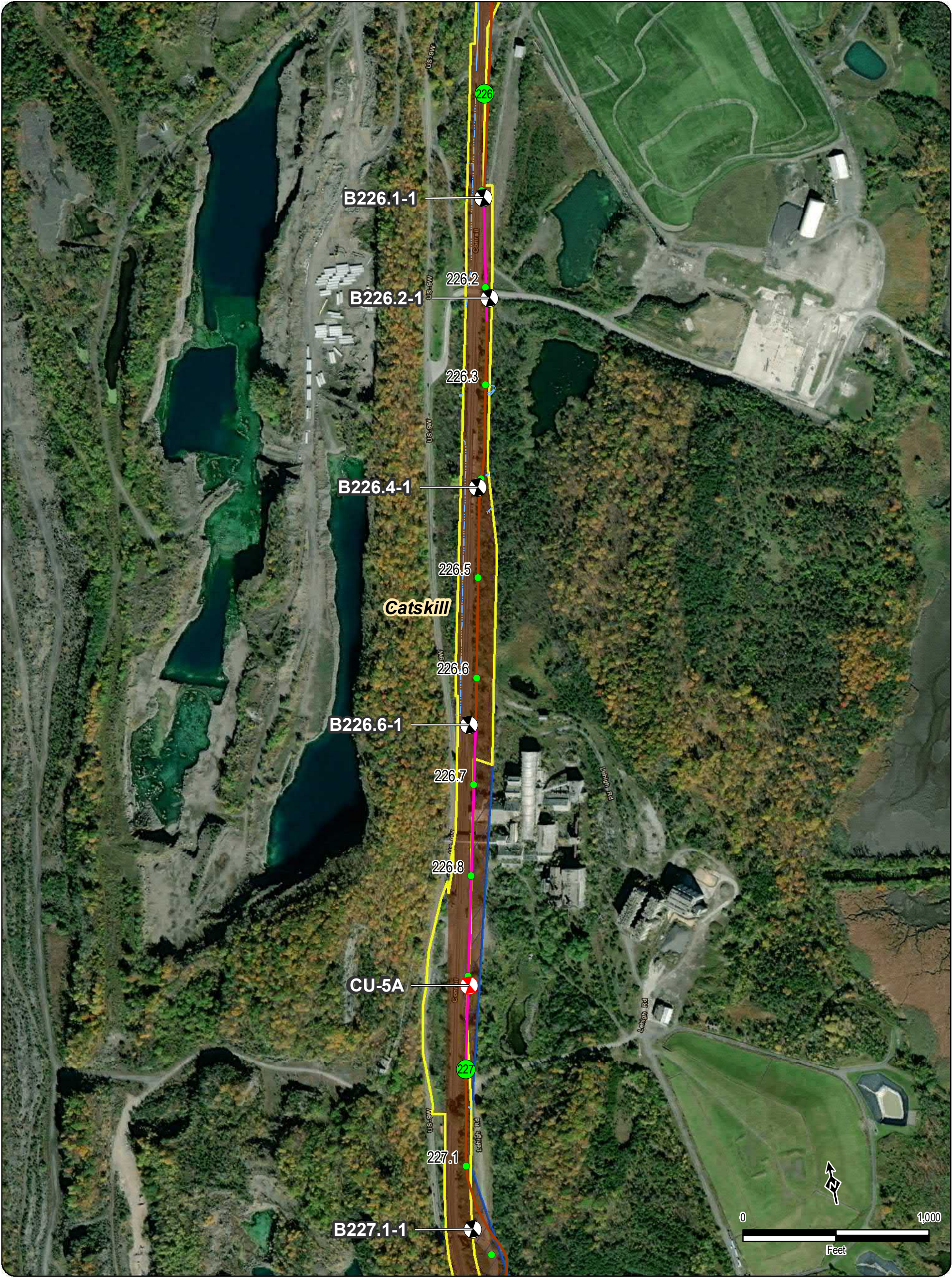


Champlain Hudson Power Express Project
Champlain Hudson Power Express Inc.

Bedrock Geology and Geotechnical Borings Catskill to Upland Figure 4-11

Prepared on 5/18/2021

by: **AECOM**



111.8

111.8

135

Terrestrial Route HVDC

Submarine Route HVDC

Terrestrial Route HVAC

Preliminary HDD Locations

Preliminary Pipe Bridge Location

2021 Boring Location

Previous (2013) Boring Location

Legend

Streams/Ditches

Railroad ROW

Deviation Zone

Deviation Zone Outside ROW

Preferred Alternative Deviation Zone

Preferred Alternative Deviation Zone Outside ROW

Town Boundary

Village Boundary

State Park (OPRHP)

Parcel Ownership

TOWN NAME

Road Name

Village Name

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Catskill to Upland

Figure A-11

Sheet 5 of 6

Prepared by:

5/20/2021



TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CSX RAILROAD ROW, NY

BORING B226.6-1

G.S. ELEV. N/A

FILE 195651

SHEET 1 OF 1

GROUNDWATER DATA

FIRST ENCOUNTERED NR

DEPTH	HOUR	DATE	ELAPSED TIME
18.7'	NR	12/1	0 HR

METHOD OF ADVANCING BOREHOLE

a	FROM	0.0'	TO	10.0'
d	FROM	10.0'	TO	25.0'

DRILLER R. CARUSO

HELPER C. SMART

INSPECTOR N/A


DATE STARTED 11/30/2012

DATE COMPLETED 12/01/2012

DEPTH	A	B	C	DESCRIPTION	Wn	REMARKS
				BLACK F/C GRAVEL-SIZED ROCK FRAGMENTS, SM M/C SAND, TR TO SM SILT (FILL)		
	S-1	7 10 8 5	2.0			
				LIGHT BROWN SILT, TR CLAY (POSSIBLE FILL)	29.5	
	S-2	4 8 11 12	4.0			
5	S-3	4 8 9 9				
	S-4	4 4 5 5		GRAY/BROWN CLAY, SM SILT	38.8	
10	S-5	7 9 9 9			40.7	
			13.5			
15	S-6	2 2 3				
				GRAY SILT, TR CLAY	53.7	
20	S-7	WOH 2				
25	S-8	WOR	25.0	END OF BORING AT 25'		
30						
35						

NEW PROJECTS TEST BORING LOG 195651_TDI_CSX.GPJ SITE BLAUVELT.GDT 3/12/13

DRN. TBT
CKD. PWK

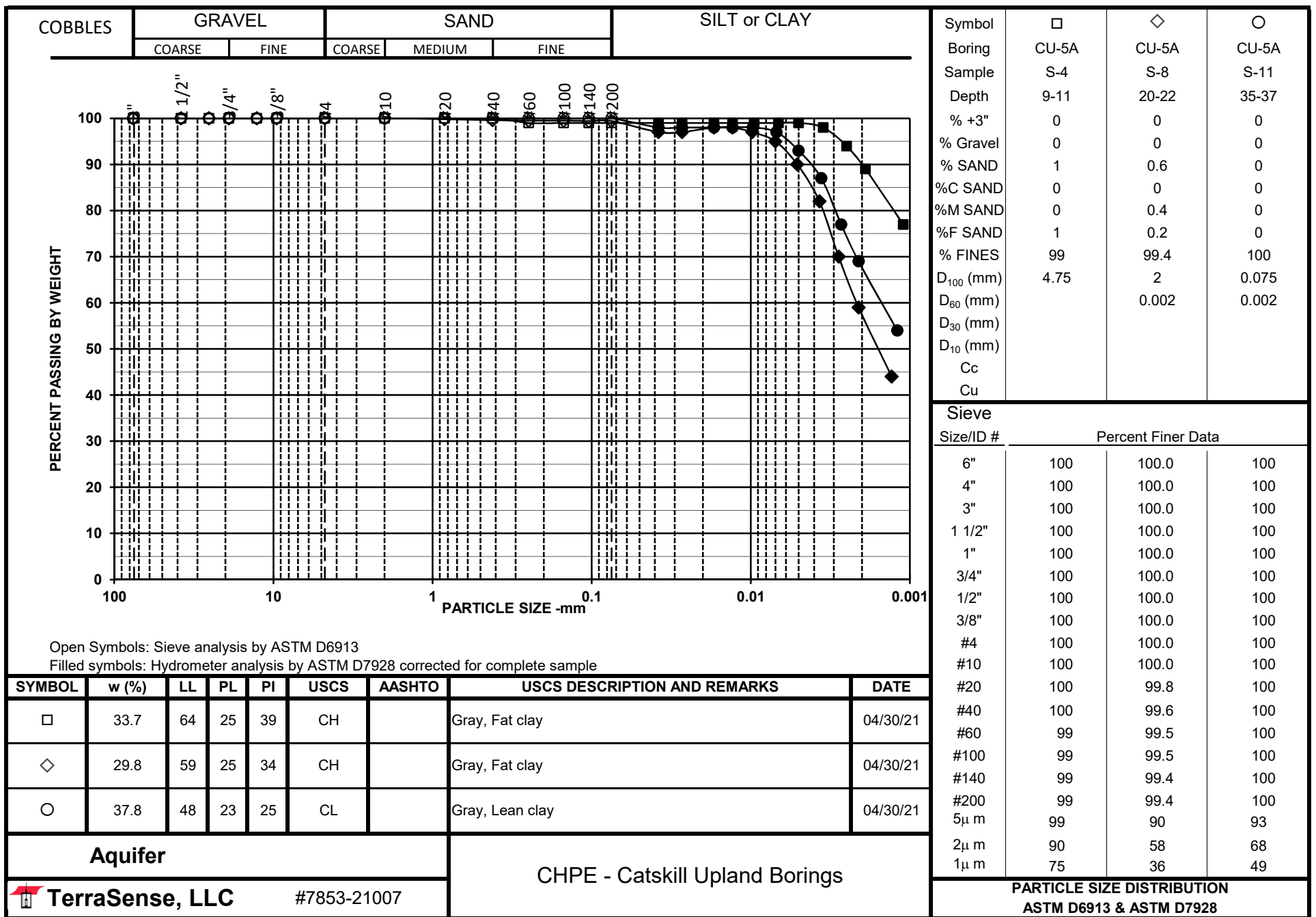
BORING CONTRACTOR: ADT												SHEET 1 OF 2		
DRILLER: Chris Chaillou												PROJECT NAME: CHPE -		
SOILS ENGINEER/GEOLOGIST: Chris French												PROJECT NO.: 60323056		
												HOLE NO.: CU-5A		
BORING LOG												START DATE: 2/4/21		
LOCATION: MP - 226.91 (CSX rail line)												FINISH DATE: 2/4/21		
GROUND WATER OBSERVATIONS												OFFSET: N/A		
Water at 25' (inferred)		TYPE		CASING		SAMPLER		DRILL BIT		CORE BARREL		DRILL RIG: CME LC-55		
		SIZE I.D.		Flush Joint Steel		California Modified		Tricone Roller Bit				BORING TYPE: SPT		
		SIZE O.D.		4"		2.5"		--				BORING O.D.: 4.5"		
		HAMMER WT.		140 lbs		140 lbs		3 7/8"				SURFACE ELEV.:		
		HAMMER FALL		30"		30"						LONGITUDE:		
												LATITUDE:		
D E P T H	CORING RATE MIN/FT	S A M P L E		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	
		DEPTHS FROM - TO (FEET)	TYPE AND NO.											
1.0		0'-5'				Hand Cleared						SAND & GRAVEL	Black fine-coarse SAND, little subrounded gravel, trace silt; loose, moist	
2.0														
3.0														
4.0		3'-5'	S-1									ML	SILT and CLAY	3.9'; Dark gray SILT and clay; medium stiff, moist TR-1; (3.0'-5.0') Brown SILT and clay; stiff, moist
5.0										12				
6.0		5'-7'	S-2	24"	15"	3	8	11	15					
7.0												ML	SILT and CLAY	Brown SILT and clay, trace fine-medium sand; very stiff, moist TR-2; (8.0'-8.5')
8.0		7'-9'	S-3	24"	24"	11	15	21	22	23				
9.0														
10.0		9'-11'	S-4	24"	17"	6	10	12	16	14		CL	Silty CLAY	Brown and gray CLAY and silt, trace fine sand; very stiff, moist
11.0														
12.0		11'-13'	S-5	24"	18"	9	13	14	15	18				
13.0												CL	Silty CLAY	Gray and brown CLAY and silt; stiff, moist TR-3; (12.0'-12.5') Gray silty CLAY; stiff, moist
14.0		13'-15'	S-6	24"	21"	4	7	10	11	11				
15.0														
16.0		15'-17'	S-7	24"	24"	13	15	15	16	20		CL	Silty CLAY	Gray silty CLAY; medium stiff, moist
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: $N_{corr} = N \cdot (2.0^2 - 1.375^2) \ln. / (3.0^2 - 2.4^2) \ln. = N \cdot 0.65$. Soil description represents a field identification after D.M. Burmister unless otherwise noted.												The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.		
SAMPLE TYPE:		S= SPLIT SPOON		U=SHELBY TUBE		R=ROCK CORE								
PROPORTIONS:		TRACE=1-10%		LITTLE=10-20%		SOME=20-35%		AND=35-50%						

BORING CONTRACTOR: ADT		<div>AECOM</div>										SHEET 2 OF 2	
DRILLER: Chris Chaillou												PROJECT NAME: CHPE -	
SOILS ENGINEER: Chris French												PROJECT NO.: 60323056	
												HOLE NO.: CU-5A	
LOCATION: MP - 226.91 (CSX rail line)										BORING LOG		START DATE: 2/4/21	
												FINISH DATE: 2/4/21	
												OFFSET: N/A	
DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
21.0		20'-22'	S-8	24"	24"	3	6	9	12	15	CL	Silty CLAY	Gray silty CLAY; medium stiff, moist
22.0													
23.0													
24.0													
25.0													
26.0		25'-27'	S-9	24"	24"	5	8	10	11	12	CL		SAA
27.0													TR-4; (26.0'-26.5')
28.0													
29.0													
30.0													
31.0		30'-32'	S-10	24"	24"	2	5	5	5	7	CH		Gray silty CLAY; soft, wet
32.0													
33.0													
34.0													
35.0													
36.0		35'-37'	S-11	24"	24"	WOH	WOH	2	5	1	CH		SAA
37.0													
38.0													
39.0		38'-40'	S-12	24"	24"	WOH	WOH	WOH	5		CH		Gray silty CLAY; very soft, wet
40.0													TR-5; (39.0'-39.5')
41.0												CU-5A terminated at 40', grouted to surface	
42.0													
43.0													
44.0													
45.0													
NOTES:												The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.	
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
CHPE - Catskill Upland 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 (%)	HYDROMETER % MINUS 2 μ m (%)	
CU-1	S-3	7-9	7.5				SM	33	9	
CU-1	S-6	13-15	9.0				SM	16	4	
CU-2	S-2	5-7	22.1				SM	14	3	
CU-2	S-6	13-15	20.6	34	20	14	SC	45	14	
CU-2	S-11	35-37	7.0				SM	23	5	
CU-2A	S-6	15-17	59.4	53	23	30	CH	99	87	
CU-2A	S-9	30-32	35.4	37	20	17	CL	99.6	46	
CU-2A	S-14	55-57	25.1	28	17	11	CL	85	28	
CU-4	S-2	5-7	28.9	60	26	34	CH	95.7	77	
CU-4	S-4	9-11	33.0				GC	31	22	
CU-5A	S-4	9-11	33.7	64	25	39	CH	99	90	
CU-5A	S-8	20-22	29.8	59	25	34	CH	99.4	58	
CU-5A	S-11	35-37	37.8	48	23	25	CL	100	68	
CU-6	S-2	5-5.5	9.4				SM	20	7	
CU-6	S-5	11-13	9.8				SM	15	4	

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



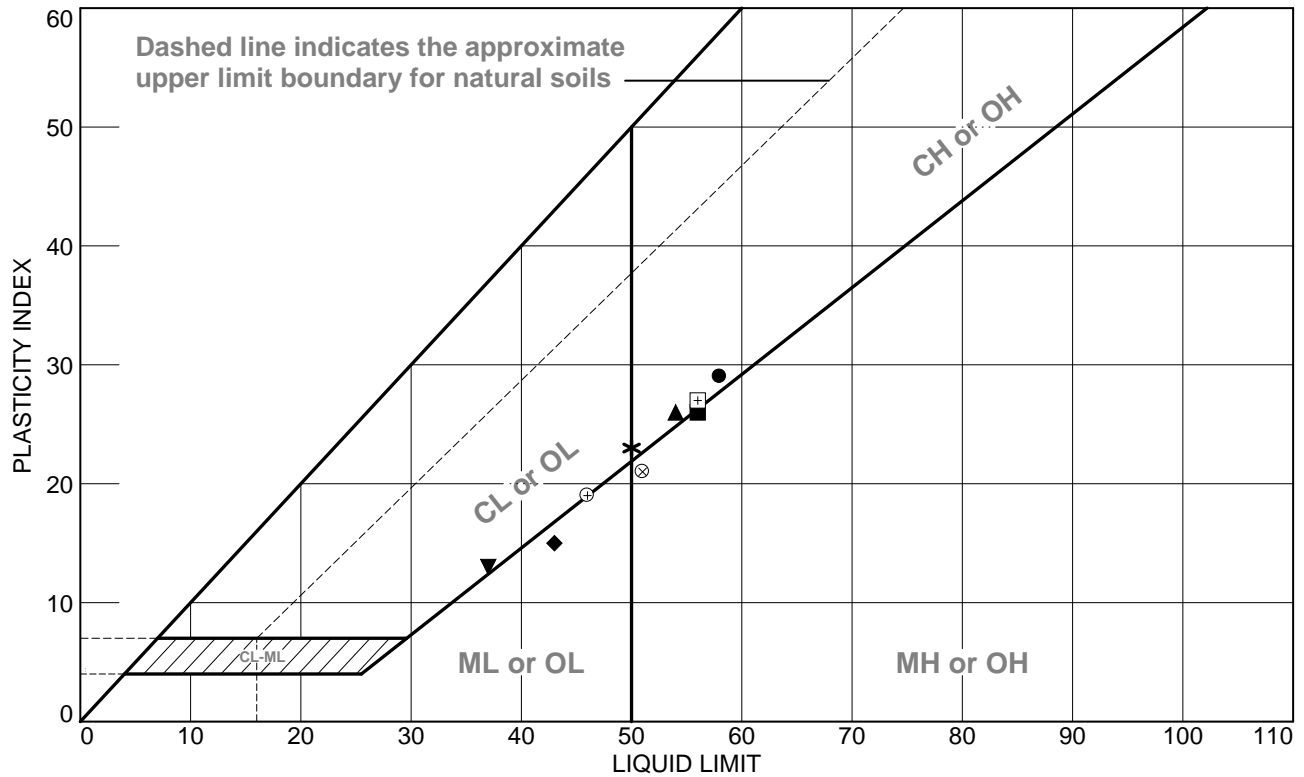


SUMMARY OF LABORATORY TEST DATA

Project Name: TDI Champlain Hudson Power Express – CSX
 Client Name: Transmission Developers, Inc.
 TRC Project #: 195651

SAMPLE IDENTIFICATION			Soil Group (USCS System)	GRAIN SIZE DISTRIBUTION				PLASTICITY				Specific Gravity	Moisture Content (%)	Unit Weight (pcf)	Compressive Strength (tsf)	Organic Content (%)
Boring #	Sample #	Depth (ft)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index					
	S-6	13.5-15.0	-	-	-	-	-	-	-	-	-	-	38.5	-	-	-
B226.6-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	29.5	-	-	-
	S-3	4.0-6.0	CH	-	-	-	-	56	29	27	0.3	-	38.8	-	-	-
	S-4	6.0-8.0		-	-	-	-	-	-	-	-	-	40.7	84.0		
	S-5	8.0-10.0	-	-	-	-	-	-	-	-	-	-	40.7	-	-	-
	S-6	13.5-15.0	MH	-	-	-	-	51	30	21	1.1	-	53.7	-	-	-
	S-7	18.5-20.0		-	-	-	-	-	-	-	-	-	53.7	-	-	-
B227.1-1	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	36.0	-	-	-
	S-4	6.0-8.0	CH	0.0	2.7	1.0	96.3	57	30	27	0.3	2.81	38.2	-	-	-
	S-5	8.0-10.0												84.6	-	-
	S-7	18.5-20.0	-	-	-	-	-	-	-	-	-	-	35.3	-	-	-

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	B222.34-1	S-4	6.0-8.0 FT	35.2	29	58	29	CH
■	B222.34-1	S-6	13.5-15.0 FT	34.8	30	56	26	CH/MH
▲	B222.9-1	S-5	8.0-10.0 FT	33.4	28	54	26	CH
◆	B223.4-1	S-7	18.5-20.0 FT	31.6	28	43	15	ML
▼	B224.8-1	S-8 & S-9	23.5-30.0 FT	33.3	24	37	13	CL
*	B226.1-1	S-6	13.5-15.0 FT	36.9	27	50	23	CH
⊕	B226.1-1	S-8	23.5-25.0 FT	39.0	27	46	19	CL
⊞	B226.6-1	S-3 & S-4	4.0-8.0 FT	38.8	29	56	27	CH
⊗	B226.6-1	S-6 & S-7	13.5-20.0 FT	53.7	30	51	21	MH

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: TRANSMISSION DEVELOPERS INC.
Project: TDI CHAMPLAIN HUDSON POWER EXPRESS - CSX

Project No.: 195651

Figure 9



Segment 11 Package 7A HDD Borings - Catskill
Champlain Hudson Power Express
New York

PROJECT NUMBER 20001480

CREATED BY Kiewit
DATE 05/09/2022

- Legend Key
- Kiewit Borings (2022)
 - Borings by Others





Kiewit

EXPLORATORY BORING LOG

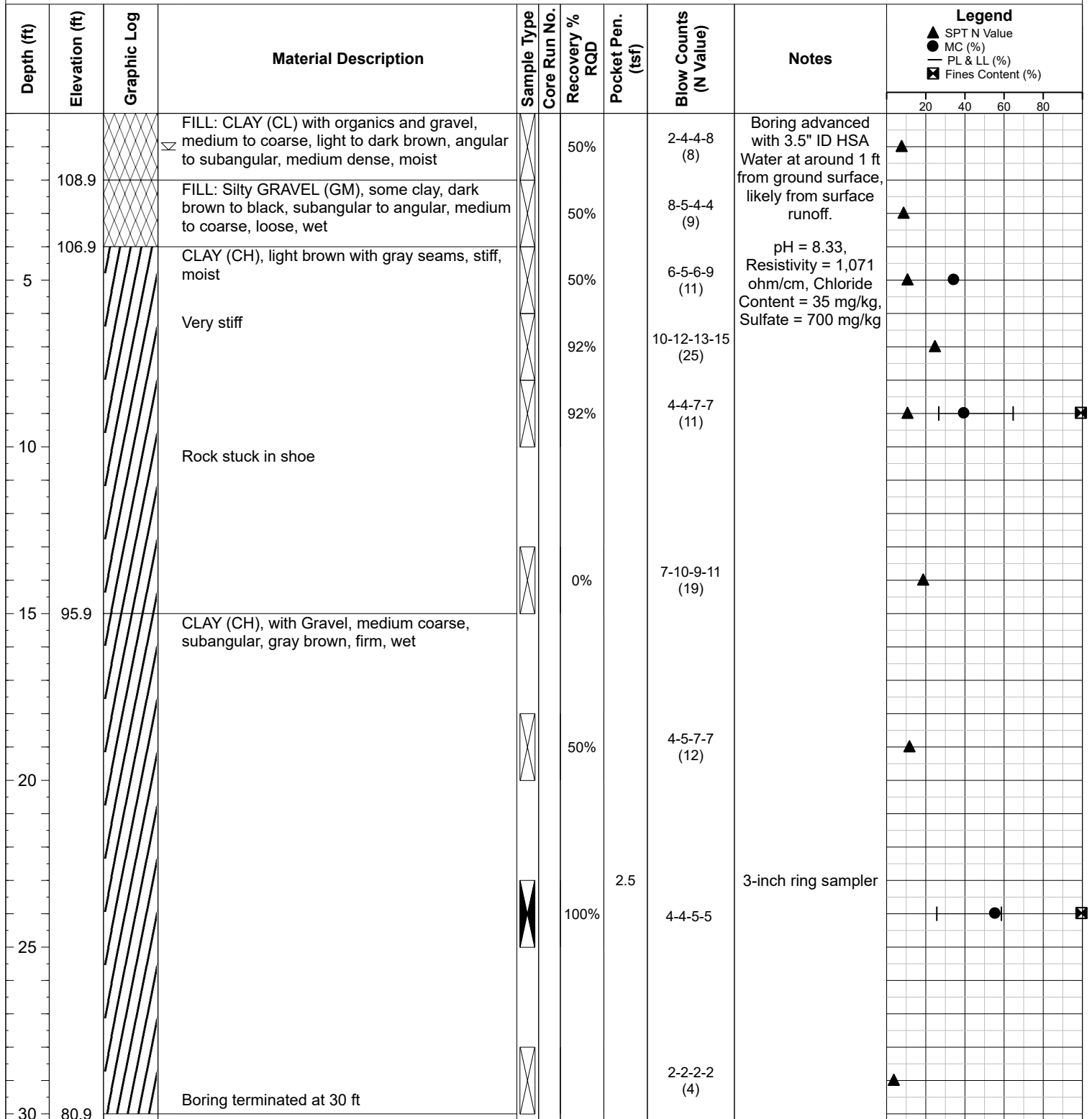
Champlain Hudson Power Express
New York

BORING NO: K-226.7

PROJECT NUMBER 20001480
START DATE 03/09/2022
FINISH DATE 03/09/2022

LOGGED BY Rafael Salas Jr
DRILLER/RIG Corey B. / Diedrich D-90
DRILL CONTRACTOR Parratt Wolff

COORDINATES N 1211665.80
E 649663.36
GROUND ELEV. 110.9 ft
HAMMER TYPE/EFF. Manual - Safety





Kiewit

EXPLORATORY BORING LOG

Champlain Hudson Power Express
New York

BORING NO: K-226.8

PROJECT NUMBER 20001480
START DATE 03/08/2022
FINISH DATE 03/08/2022

LOGGED BY Rafael Salas Jr
DRILLER/RIG Corey B. / Diedrich D-90
DRILL CONTRACTOR Parratt Wolff

COORDINATES N 1210977.45
E 649510.63
GROUND ELEV. 108.5 ft
HAMMER TYPE/EFF. Manual - Safety

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery %	RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes	Legend
											▲ SPT N Value ● MC (%) — PL & LL (%) ☒ Fines Content (%)
	106.5		FILL: SAND (SM) with Gravel, fine to medium coarse sand, coarse gravel, subangular to angular, dark brown to black, loose, wet			62%			5-4-3-3 (7)	Boring advanced with 3.5" ID HSA	▲
	104.5		FILL: Silty GRAVEL (GM), black to dark brown, medium to coarse, angular to subangular, loose, moist			66%			2-4-4-6 (8)	Water present in upper 2 ft, no water beyond.	▲
5			CLAY (CH) with Gravel, light gray brown, subangular to angular, coarse gravel, loose to medium dense, moist			71%			2-2-7-7 (9)		▲
			with some gray sand, stiff, moist to dry			0%			6-8-13-14 (21)		▲
10	98.5		CLAY (CH), light brown to gray, firm to soft, moist to wet			92%			2-5-9-8 (14)		▲ ●
15						71%			6-4-4-10 (8)		▲
20						100%			3-2-2-3 (4)		▲
25						100%		0.0	4-3-5-8	3-inch ring sampler	▲ ● ☒
30	78.5		Boring terminated at 30 ft			100%			1-2-3-4 (5)		▲



Kiewit

EXPLORATORY BORING LOG

Champlain Hudson Power Express
New York

BORING NO: K-227.0

PROJECT NUMBER 20001480
START DATE 03/08/2022
FINISH DATE 03/08/2022

LOGGED BY Rafael Salas Jr
DRILLER/RIG Corey B. / Diedrich D-90
DRILL CONTRACTOR Parratt Wolff

COORDINATES N 1210143.14
E 649327.25
GROUND ELEV. 95.5 ft
HAMMER TYPE/EFF. Manual - Safety

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery %	RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes	Legend
											▲ SPT N Value ● MC (%) — PL & LL (%) ☒ Fines Content (%)
	93.5		FILL: Sandy CLAY (CL), with silt, dark brown to brown, firm, moist			58%			5-5-1-2 (6)	Boring advanced with 3.5" ID HSA	▲
	91.5		FILL: SILT (ML), with gravel and brick fragments, light brown and gray with red, 6 inches of brick, medium dense, dry			50%			11-6-6-6 (12)		▲
5	89.5		FILL: Sandy CLAY (CL), brown, 4 inches of red brick, very stiff, dry			46%			8-11-15-7 (26)		●
	89.5		CLAY (CH), light brown with gray seams, organics, some gravel, coarse, subangular, stiff, dry			50%			6-11-7-7 (18)		▲
			Some silt and gravel, dark brown			62%			2-3-7-3 (10)		▲ ● ☒
10	85.5		CLAY (CH), olive brown to light brown, stiff, dry								
						75%			2-5-8-9 (13)		▲
15			Blueish gray to light brown, firm								
						84%			2-3-4-5 (7)		▲
20			Very stiff								
						100%			8-9-10-10	3-inch ring sampler	☒
25	70.5		CLAY (CH), gray, firm, moist								
30	65.5		Boring terminated at 30 ft						2-3-3-2 (6)		▲



ATLANTIC TESTING LABORATORIES

WBE certified company

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS

ASTM D 2216

Page 1 of 1

PROJECT INFORMATION

Client: Kiewit Infrastructure Co.
Project: Champlain Hudson Power Express
United Cable Installation
Various Locations, New York

ATL Report No.: CD10279E-08-03-22

Report Date: March 28, 2022

Date Received: March 18, 2022

TEST DATA

Boring No.	Sample No.	Depth (ft)	Moisture Content (%)
K-225.9	S-6	13-15	43.0
	S-9/10	28-30	48.0
K-226.2A	S-4	6-8	36.0
	S-6	13-15	33.8
	S-9/10	28-30	38.1
K-226.2B	S-5 ¹	8-10	7.7
	S-8/9	21-23	37.6
	S-12	33-35	37.8
K-226.7	S-5/6	4-6	34.5
	S-9/10	8-10	39.7
	S-15/16	23-25	55.6
K-226.8	S-7/8	8-10	36.2
	S-13/14	23-25	54.7
K-227.0	S-5/6 ¹	4-6	23.5
	S-9/10	8-10	33.3
	S-15/16	23-25	40.6

Remarks

1. Sample mass was less than the minimum mass outlined in the referenced test method.

Reviewed By:

Date: 03/28/22



ATLANTIC TESTING LABORATORIES

WBE certified company

AMOUNT OF MATERIAL IN SOILS FINER THAN THE NO. 200 SIEVE ASTM D 1140

PROJECT INFORMATION

Client: Kiewit Infrastructure Co.
Project: Champlain Hudson Power Express
United Cable Installation
Various Locations, New York

ATL Report No.: CD10279E-08-03-22
Report Date: March 28, 2022
Test Date: March 18, 2022
Performed By: M. White

TEST DATA

Boring No.	Sample No.	Depth (ft)	Method (A or B)	Soak Time (min)	Initial Dry Weight (g)	% Finer than #200
K-225.9	S-6	13-15	A	10	48.43	97.9
K-225.9	S-9/10	28-30	A	10	100.48	99.9
K-226.2A	S-6	13-15	A	10	62.57	98.3
K-226.2A	S-9/10	28-30	A	10	74.20	96.7
K-226.2B	S-8/9	21-23	A	10	95.42	99.9
K-226.2B	S-12	33-35	A	10	144.57	98.3
K-226.7	S-9/10	8-10	A	10	87.63	99.6
K-226.7	S-15/16	23-25	A	10	52.32	99.9
K-226.8	S-7/8	8-10	A	10	92.92	100.0
K-226.8	S-13/14	23-25	A	10	59.61	100.0
K-227.0	S-9/10	8-10	A	10	180.64	54.8
K-227.0	S-15/16	23-25	A	10	87.65	99.8

Reviewed By: 

Date: 03/28/22



ATLANTIC TESTING LABORATORIES

WBE certified company

Page 1 of 2

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOIL ASTM D 4318

PROJECT INFORMATION

Client: Kiewit Infrastructure Co.
Project: Champlain Hudson Power Express
United Cable Installation
Various Locations, New York

ATL Report No.: CD10279E-08-03-22
Report Date: March 28, 2022
Date Received: March 18, 2022

TEST DATA

Boring No.	Sample No.	LL	PL	PI
K-225.9	S-6	58	24	34
K-225.9	S-9/10	37	21	16
K-226.2A	S-6	61	25	36
K-226.2A	S-9/10	61	26	35
K-226.2B	S-8/9	62	26	36
K-226.2B	S-12	50	24	26
K-226.7	S-9/10	65	27	38
K-226.7	S-15/16	59	26	33
K-226.8	S-7/8	63	26	37
K-226.8	S-13/14	52	23	29
K-227.0	S-9/10	54	26	28
K-227.0	S-15/16	57	24	33

SAMPLE INFORMATION

Boring No.	Sample No.	Maximum Grain Size (mm)	Estimated Amount of Sample Retained on No. 40 Sieve (%)	As Received Moisture Content (%)
K-225.9	S-6	0.074	0	43.0
K-225.9	S-9/10	0.050	0	48.0
K-226.2A	S-6	0.074	0	33.8
K-226.2A	S-9/10	0.074	0	38.1
K-226.2B	S-8/9	0.050	0	37.6
K-226.2B	S-12	0.074	0	37.8
K-226.7	S-9/10	0.050	0	39.7
K-226.7	S-15/16	0.050	0	55.6
K-226.8	S-7/8	0.050	0	36.2
K-226.8	S-13/14	0.050	0	54.7
K-227.0	S-9/10	4.76	6	33.3
K-227.0	S-15/16	0.050	0	40.6

Client: Kiewit Infrastructure Co.
Project: Champlain Hudson Power Express

ATL Report No. CD10279E-08-03-22

Date: March 28, 2022

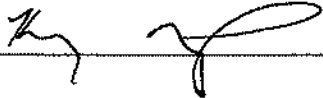
Page 2 of 2

PREPARATION INFORMATION

Boring No.	Sample No.	Preparation	Method of Removing Oversized Material
K-225.9	S-6	Air Dry	Not Necessary
K-225.9	S-9/10	Air Dry	Not Necessary
K-226.2A	S-6	Air Dry	Not Necessary
K-226.2A	S-9/10	Air Dry	Not Necessary
K-226.2B	S-8/9	Air Dry	Not Necessary
K-226.2B	S-12	Air Dry	Not Necessary
K-226.7	S-9/10	Air Dry	Not Necessary
K-226.7	S-15/16	Air Dry	Not Necessary
K-226.8	S-7/8	Air Dry	Not Necessary
K-226.8	S-13/14	Air Dry	Not Necessary
K-227.0	S-9/10	Air Dry	Pulverizing and Screening
K-227.0	S-15/16	Air Dry	Not Necessary

EQUIPMENT INFORMATION

Liquid Limit Procedure:	Multipoint - Method A	<input checked="" type="checkbox"/>	Single Point - Method B	<input type="checkbox"/>
Liquid Limit Apparatus:	Manual	<input checked="" type="checkbox"/>	Motor Driven	<input type="checkbox"/>
Liquid Limit Grooving Tool Material:	Plastic	<input checked="" type="checkbox"/>	Metal	<input type="checkbox"/>
Liquid Limit Grooving Tool Shape:	Flat	<input checked="" type="checkbox"/>	Curved (AASHTO Only)	<input type="checkbox"/>
Plastic Limit:	Hand Rolled	<input checked="" type="checkbox"/>	Mechanical Rolling Device	<input type="checkbox"/>

Reviewed By: 

Date: 03/28/22



ATLANTIC TESTING LABORATORIES

CORROSION ANALYSIS SUITE

Client: Kiewit Infrastructure Co.
Project: Champlain Hudson Power Express
United Cable Installation
Location: Various Locations, New York

ATL Report No. CD10279E-08-03-22
Report Date: March 28, 2022
Date Received: March 18, 2022

Sample: K-226.7, S-5/6

Depth (ft): 4-6

MEASURING pH OF SOIL FOR USE IN CORROSION TESTING ASTM G 51

Type of Test	Soil Temperature (°C)	pH Readings			Average
Laboratory	20.0	8.37	8.32	8.31	8.33

pH of calibration standards used: 7.00

MEASUREMENT OF SOIL RESISTIVITY USING THE TWO-ELECTRODE SOIL BOX METHOD ASTM G 187 (LABORATORY)

Test Date: 03/22/22
Meter Used: Miller 400A

Performed by: E. Hannon
Soil Box Factor: 1.29

Date Collected	Temperature at Collection (°C)	Measured Resistance (Ω)	Calculated Resistivity (Ω/cm)
10/19/2021	Not Provided	830	1,071

WATER-SOLUBLE CHLORIDE ION CONTENT IN SOIL AASHTO T 291, Method A

Chloride by Mass of Soil (mg/kg)
35

WATER-SOLUBLE SULFATE IN SOIL ASTM C 1580

Sulfate by Mass of Sample (%)	Sulfate by Mass of Sample (mg/kg)
0.07	700

Reviewed By:

Date: 03/28/22



Package 7A Phase 3 Borings

Champlain Hudson Power Express
New York

PROJECT NUMBER 20001480

CREATED BY	Kiewit
DATE	12/08/2022

Legend Key

● Kiewit Borings (Phase 3)





Kiewit

EXPLORATORY BORING LOG

Champlain Hudson Power Express
New York

BORING NO: KB-226.8A

PROJECT NUMBER	20001480	LOGGED BY	Rafael Salas	COORDINATES	N 1211213.00 E 649563.70
START DATE	08/31/2022	DRILLER/RIG	C. Brown / CME-850	GROUND ELEV.	108.9 ft
FINISH DATE	08/31/2022	DRILL CONTRACTOR	Parratt Wolff	HAMMER TYPE/EFF.	Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery %	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes	Legend
										▲ SPT N Value ● MC (%) — PL & LL (%) ☒ Fines Content (%)
										20 40 60 80
			FILL: Silty GRAVEL with railroad ballast (GM), dark gray, loose, fine to coarse, moist, subangular to subrounded			46%		1-2-3-4 (5)	Boring advanced with 3.25" ID HSA	▲
	105.9					50%		5-3-3-3 (6)		▲
	104.9		Silty CLAY (CL-ML), light gray, firm, moist							
5			SILT (MH), olive brown and gray, very stiff to firm, high plasticity, moist			50%		2-4-7-6 (11)		▲ ● ☒
						100%		7-9-7-10 (16)		▲
						100%		3-5-6-9 (11)		▲
10						100%		2-3-4-4 (7)		▲
			2" gravel seam, fine to medium grained, subangular to subrounded, at 11.0- 11.2 ft							
15	93.9		CLAY (CH), medium to high plasticity, dark gray, stiff, moist			100%		4-4-5-6 (9)		▲
20			Firm below 20 ft			100%		3-2-3-3 (5)		▲ ● ☒
25	83.9		SILT (MH), dark gray, very soft, moist			100%		0-0-1-2 (1)		▲
30						100%		0-0-0-1 (0)		▲
35										



Kiewit

EXPLORATORY BORING LOG

Champlain Hudson Power Express
New York

BORING NO: KB-226.8A

PROJECT NUMBER 20001480
START DATE 08/31/2022
FINISH DATE 08/31/2022

LOGGED BY Rafael Salas
DRILLER/RIG C. Brown / CME-850
DRILL CONTRACTOR Parratt Wolff

COORDINATES N 1211213.00
E 649563.70
GROUND ELEV. 108.9 ft
HAMMER TYPE/EFF. Automatic

Depth (ft)	Elevation (ft)	Graphic Log	Material Description	Sample Type	Core Run No.	Recovery %	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes	Legend			
										▲	●	—	■
										SPT N Value	MC (%)	PL & LL (%)	Fines Content (%)
			SILT (MH), dark gray, very soft, moist										
						100%		0-0-0-2 (0)					
40						100%		0-0-0-1 (0)					
45						100%		4-4-4-5	3-inch ring sampler				
50						100%		0-0-0-0 (0)	WOH				
55						100%		0-0-0-0 (0)	WOH				
60	48.9		Boring Terminated at 60 ft			100%		0-0-0-3 (0)					
65													
70													

Summary of Laboratory Results

Sheet 2 of 2

BORING ID	Depth (Ft.)	Water Content (%)
KB-222.6A	15-17	1.2
KB-222.6A	35-37	35.8
KB-222.6A	50-52	41.7
KB-222.6A	65-67	38.4
KB-223.1A	6-8	31.3
KB-223.1A	25-27	39.6
KB-223.1A	45-47	22.0
KB-226.1	6-8	33.3
KB-226.1	20-22	37.7
KB-226.8A	4-6	35.5
KB-226.8A	20-22	37.4
KB-226.8A	38-40	46.7

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express



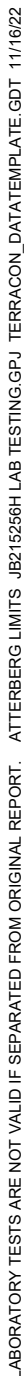
PROJECT NUMBER: JB215256H

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

EXHIBIT: B-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SMART LAB SUMMARY-PORTRAIT JB215256H LAB TESTING.GPJ TERRACON_DATA\TEMPLATE.GDT 11/16/22

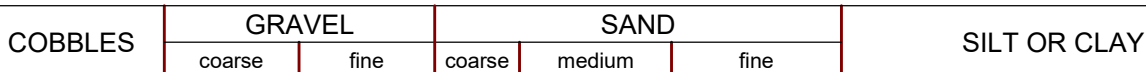
ASTM D4318



LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS JB215256H LAB TESTING.GPJ TERRACON_DATATEMPLATE.GDT 11/16/22

EXHIBIT: B-3

ASTM D422 / ASTM C136



Boring ID		Depth (Ft)	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	KB-226.1	20 - 22	FAT CLAY with SAND (CH)	37.7	66	31	35		
☒	KB-226.8A	4 - 6	ELASTIC SILT (MH)	35.5	62	33	29		
▲	KB-226.8A	20 - 22	FAT CLAY (CH)	37.4	50	27	23		
★	KB-226.8A	38 - 40	ELASTIC SILT (MH)	46.7	50	32	18		

[illegible]

PROJECT: LAB Testing

SITE: Champlain- Hudson Power Express



PROJECT NUMBER: JB215256H

CLIENT: Kiewit Engineering (NY) Corp
Lone Tree, CO

EXHIBIT: B-11

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 JB215256H LAB TESTING.GPJ TERRACON DATATEMPLATE.GDT 11/16/22

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: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 111.B
DWG C-311.B

Input Summary

Start Coordinate	(0.00, 0.00, 112.32) ft
End Coordinate	(765.00, 0.00, 120.00) ft
Project Length	765.00 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: 3

Soil Layer #1 USCS, Sand (S), SM

Depth: 4.00 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, Gravel (G), GM

Depth: 11.00 ft

Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

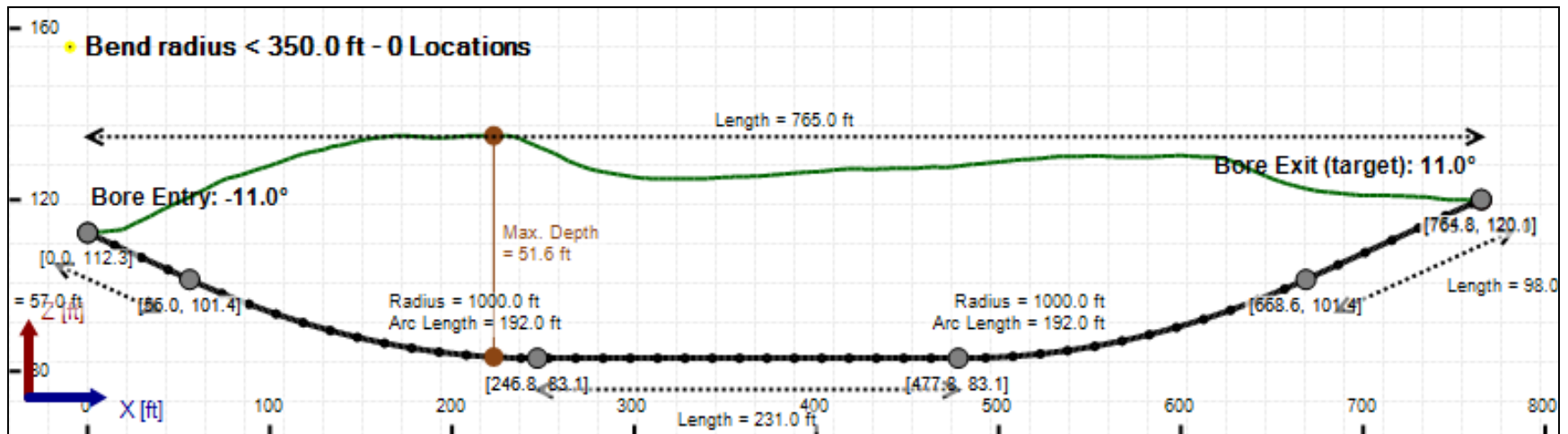
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks

Depth: 65.00 ft

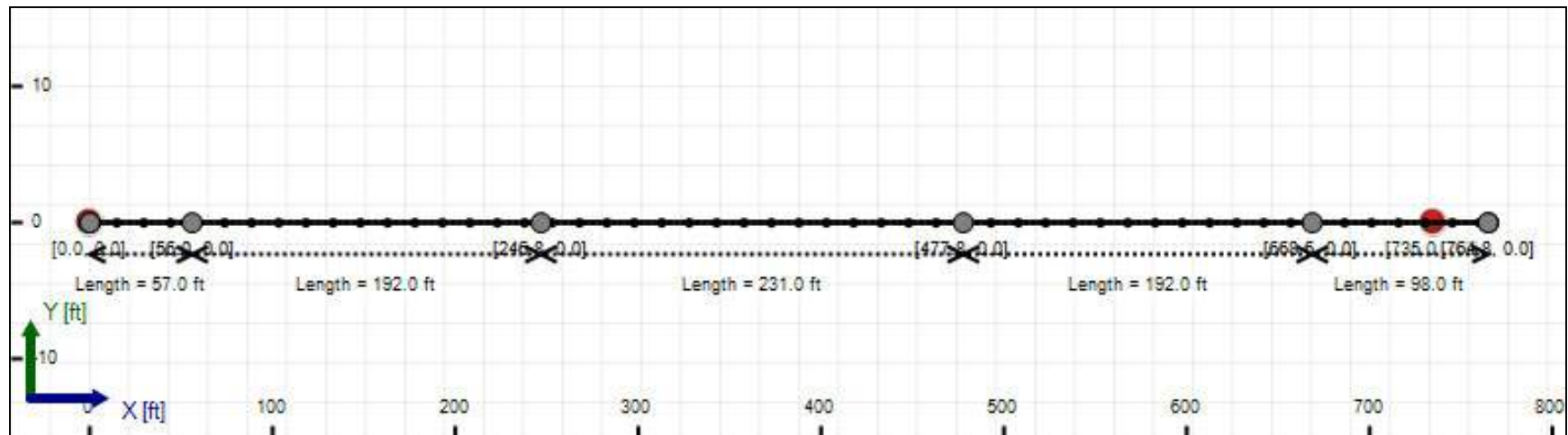
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 780.00 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	6.2	41.9
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	6.2	41.9
Deflection		
Earth Load Deflection	1.701	11.401
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.833	11.533
Compressive Stress [psi]		
Compressive Wall Stress	28.1	188.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	13656.8	13656.8
Pullback Stress [psi]	380.9	380.9
Pullback Strain	6.624E-3	6.624E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	380.9	406.2
Tensile Strain	6.624E-3	7.512E-3

Net External Pressure = 21.9 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.833	7.5	4.1	OK
Unconstrained Collapse [psi]	25.4	117.3	4.6	OK
Compressive Wall Stress [psi]	28.1	1150.0	40.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.3	233.1	6.6	OK
Tensile Stress [psi]	406.2	1200.0	3.0	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	8.75 in	591.142 psi	1337.413 psi
1	8.75 in	12.00 in	591.064 psi	1337.294 psi
2	12.00 in	16.13 in	590.930 psi	1337.088 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

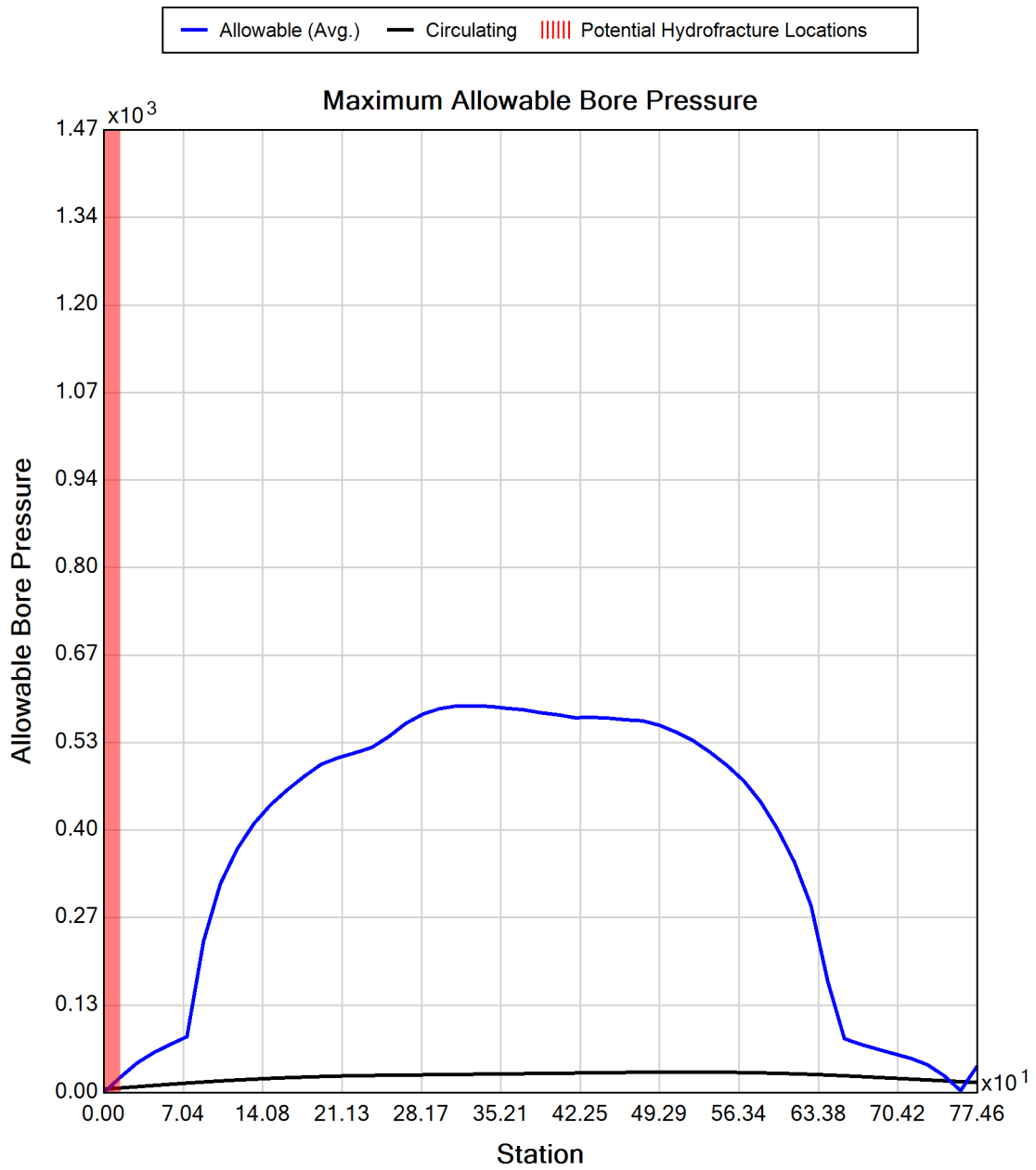
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 HDD 111.B DWG C-311.B.2

Input Summary

Start Coordinate	(0.00, 0.00, 113.48) ft
End Coordinate	(765.00, 0.00, 120.84) ft
Project Length	765.00 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: 3

Soil Layer #1 USCS, Sand (S), SM

Depth: 4.00 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, Gravel (G), GM

Depth: 11.00 ft

Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

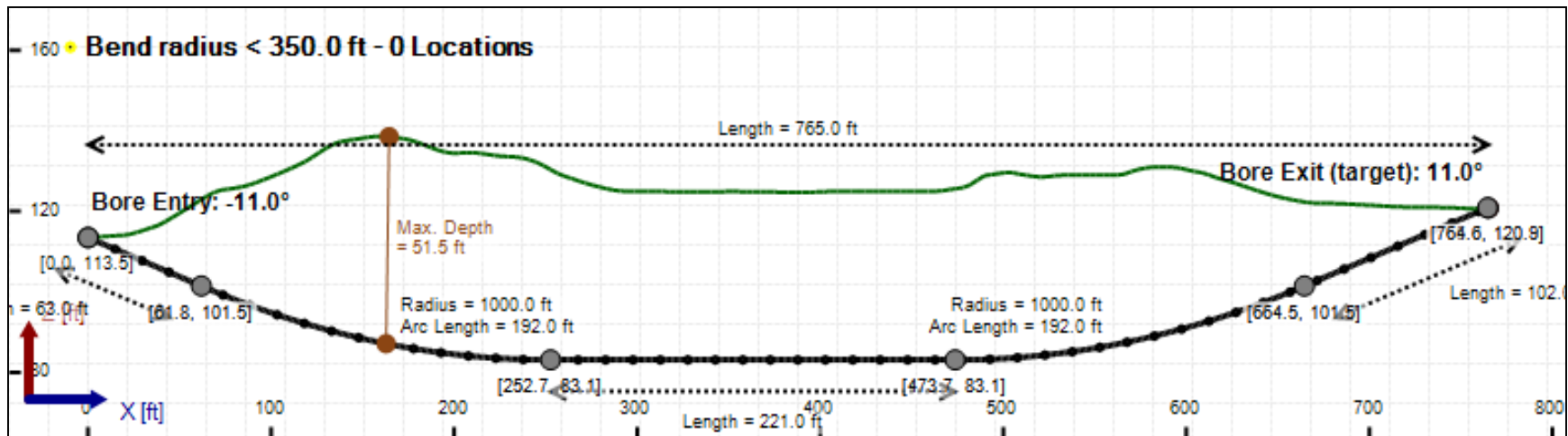
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks

Depth: 65.00 ft

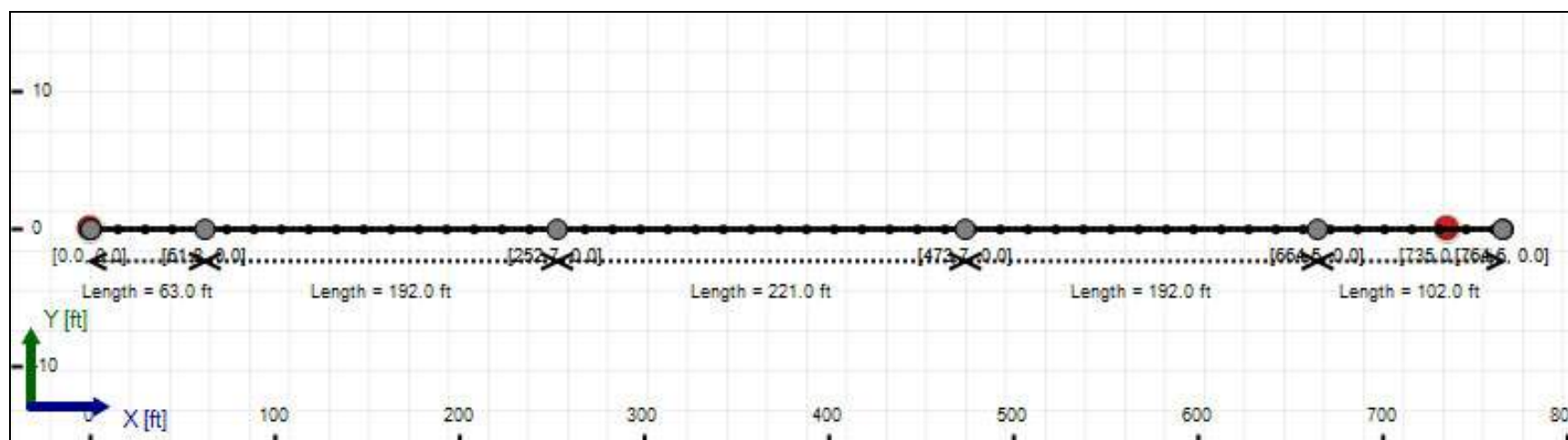
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 780.00 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	6.2	42.0
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	6.2	42.0
Deflection		
Earth Load Deflection	1.699	11.425
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.831	11.557
Compressive Stress [psi]		
Compressive Wall Stress	28.1	188.8

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	13674.3	13674.3
Pullback Stress [psi]	381.4	381.4
Pullback Strain	6.632E-3	6.632E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	381.4	405.6
Tensile Strain	6.632E-3	7.502E-3

Net External Pressure = 23.5 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.831	7.5	4.1	OK
Unconstrained Collapse [psi]	25.8	117.4	4.5	OK
Compressive Wall Stress [psi]	28.1	1150.0	41.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.8	232.9	6.5	OK
Tensile Stress [psi]	405.6	1200.0	3.0	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	8.75 in	624.836 psi	1337.485 psi
1	8.75 in	12.00 in	624.753 psi	1337.366 psi
2	12.00 in	16.13 in	624.609 psi	1337.161 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 inadvertent 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

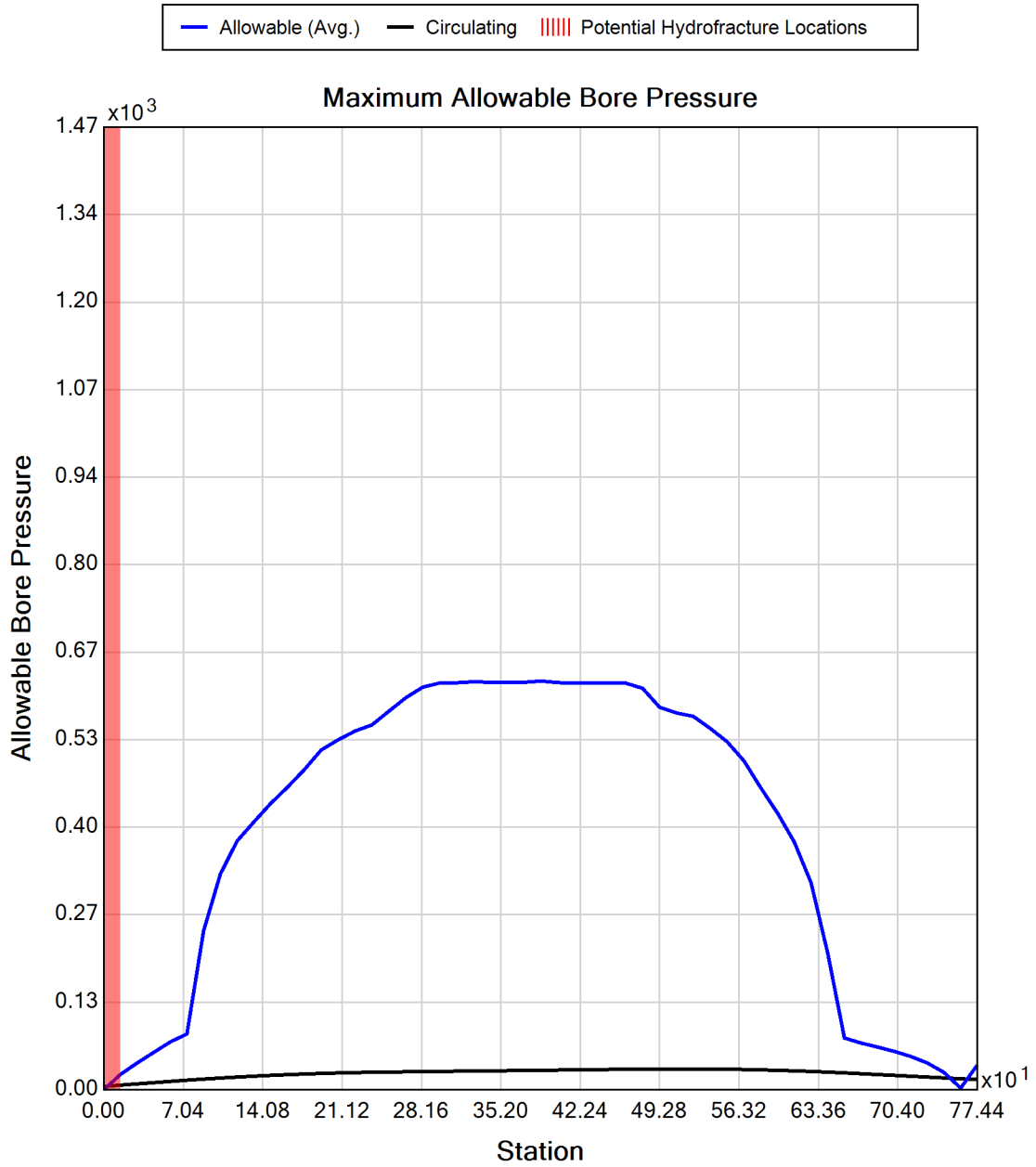
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 111.B
DWG C-311.B.2

Input Summary

Start Coordinate	(0.00, 0.00, 113.48) ft
End Coordinate	(765.00, 0.00, 120.84) ft
Project Length	765.00 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: 3

Soil Layer #1 USCS, Sand (S), SM

Depth: 4.00 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, Gravel (G), GM

Depth: 11.00 ft

Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

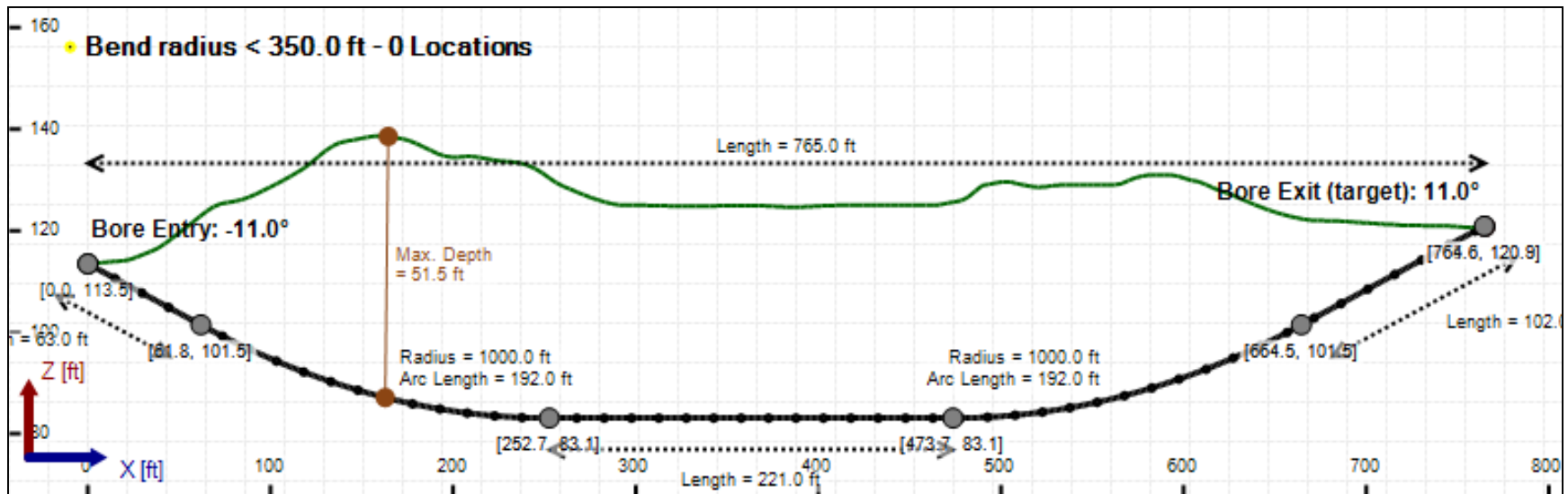
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks

Depth: 65.00 ft

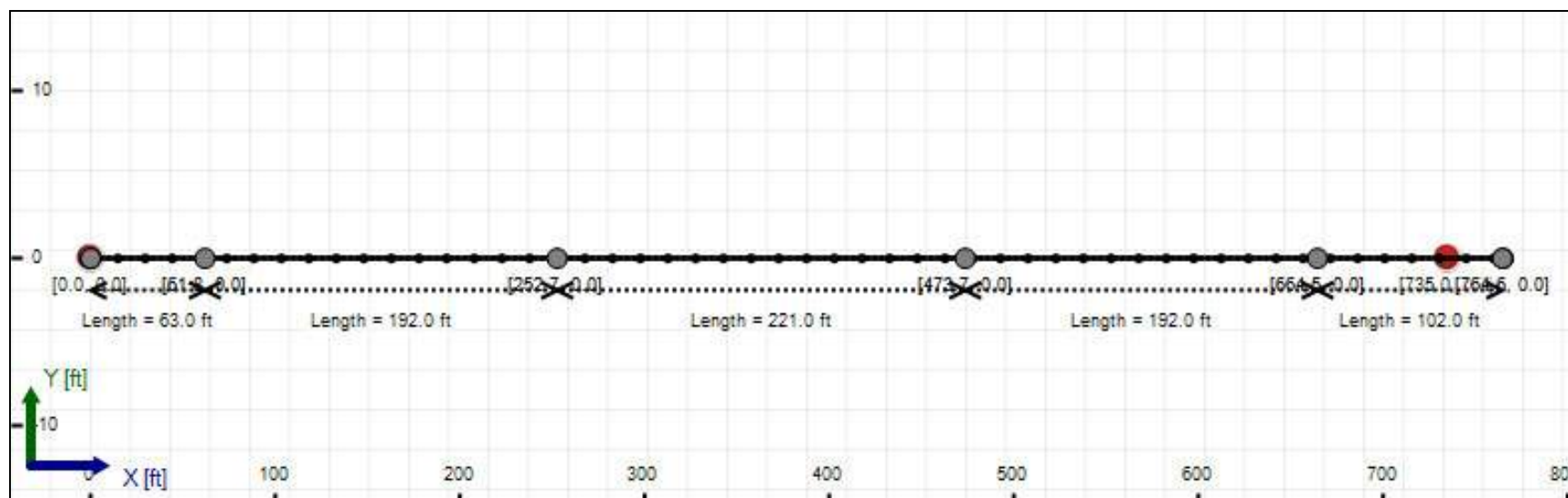
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 780.00 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	3.0	42.0
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	3.0	42.0
Deflection		
Earth Load Deflection	0.810	11.425
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	0.853	11.468
Compressive Stress [psi]		
Compressive Wall Stress	13.4	188.8

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	1562.1	1562.1
Pullback Stress [psi]	411.0	411.0
Pullback Strain	7.148E-3	7.148E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	411.0	417.9
Tensile Strain	7.148E-3	7.413E-3

Net External Pressure = 23.5 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.853	7.5	8.8	OK
Unconstrained Collapse [psi]	25.8	128.2	5.0	OK
Compressive Wall Stress [psi]	13.4	1150.0	86.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	35.8	233.0	6.5	OK
Tensile Stress [psi]	417.9	1200.0	2.9	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	8.75 in	624.836 psi	1337.485 psi
1	8.75 in	12.00 in	624.753 psi	1337.366 psi
2	12.00 in	16.13 in	624.609 psi	1337.161 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

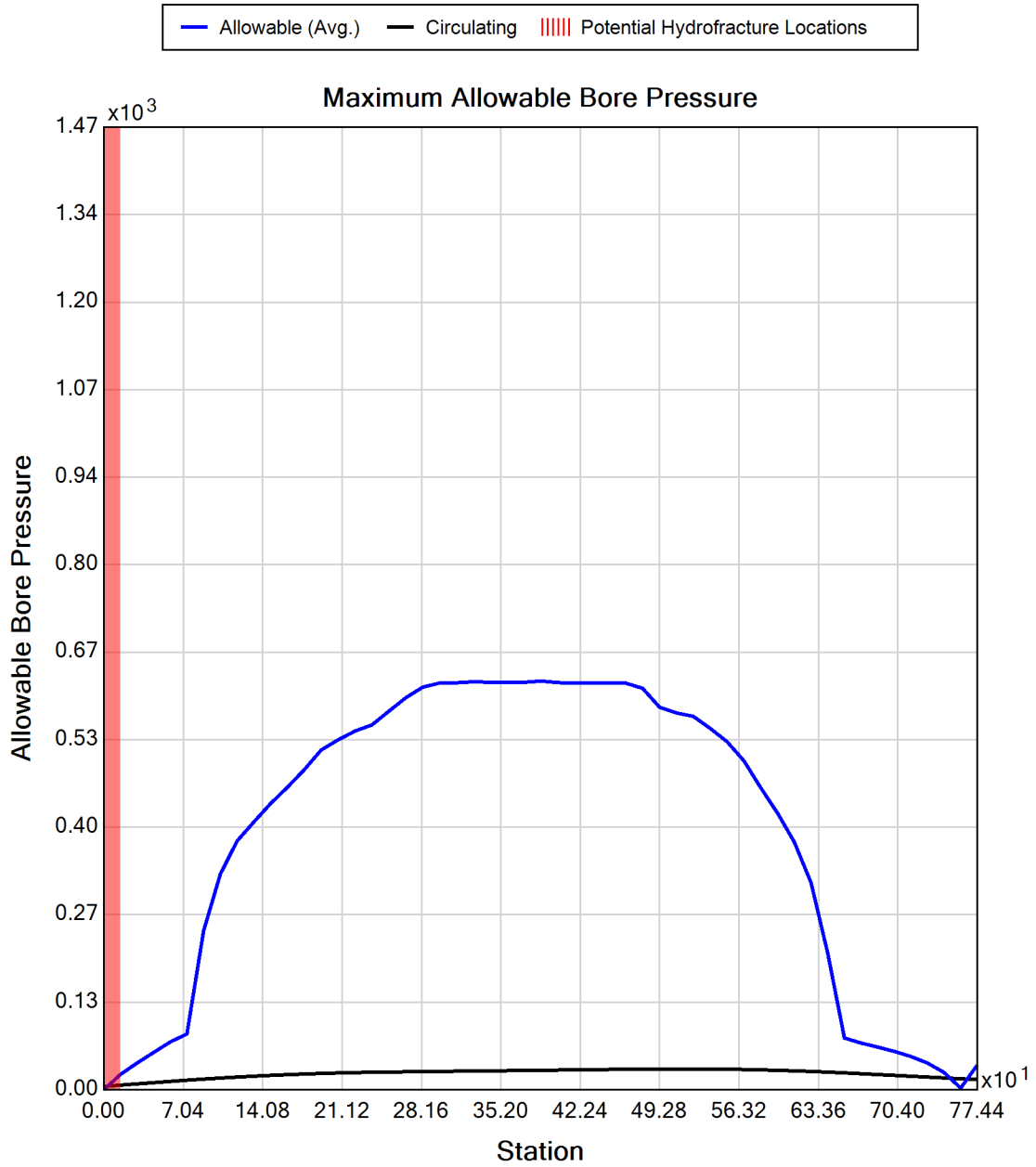
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 & 3 Equivalent Pipe Bundle HDD 111.B DWG C-311.B.2

Input Summary

Start Coordinate	(0.00, 0.00, 113.48) ft
End Coordinate	(765.00, 0.00, 120.84) ft
Project Length	765.00 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: 780.00 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	8.0	42.0
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	8.0	42.0
Deflection		
Earth Load Deflection	10.061	52.497
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	10.751	53.186
Compressive Stress [psi]		
Compressive Wall Stress	57.5	299.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	11427.6	11427.6
Pullback Stress [psi]	285.3	285.3
Pullback Strain	4.962E-3	4.962E-3
Bending Stress [psi]	33.5	33.5
Bending Strain	5.833E-4	5.833E-4
Tensile Stress [psi]	318.9	318.9
Tensile Strain	6.129E-3	6.129E-3

Net External Pressure = 15.1 [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]	18.6	50.4	2.7	OK
Tensile Stress [psi]	318.9	1200.0	3.8	OK



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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 1 HDD 112 DWG C-312

Input Summary

Start Coordinate	(0.00, 0.00, 110.55) ft
End Coordinate	(960.00, 0.00, 131.68) ft
Project Length	960.00 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: 7

Soil Layer #1 USCS, Sand (S), SP

Depth: 5.00 ft

Unit Weight: 14.6454 (dry), 16.9323 (sat) [lb/US (liquid) gallon]

Phi: 30.00, 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 USCS, Sand (S), SM

Depth: 4.00 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: 3.00 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 #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 9.00 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 #6 USCS, Gravel (G), GM

Depth: 7.00 ft

Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

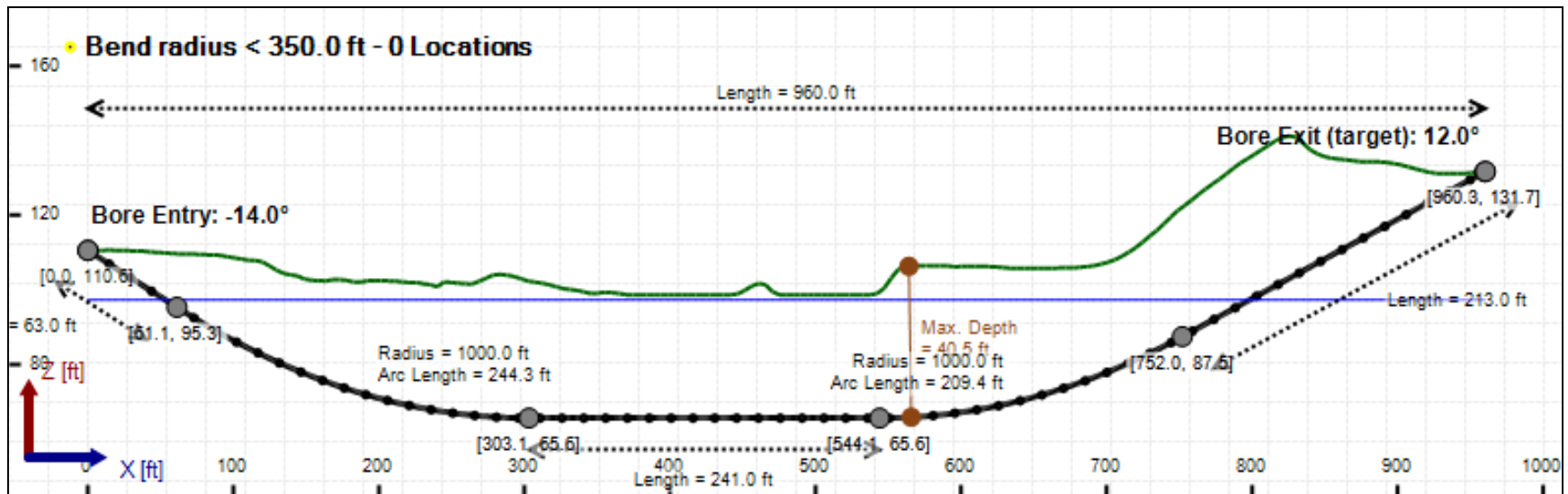
Soil Layer #7 Rock, Geological Classification, Sedimentary Rocks

Depth: 25.00 ft

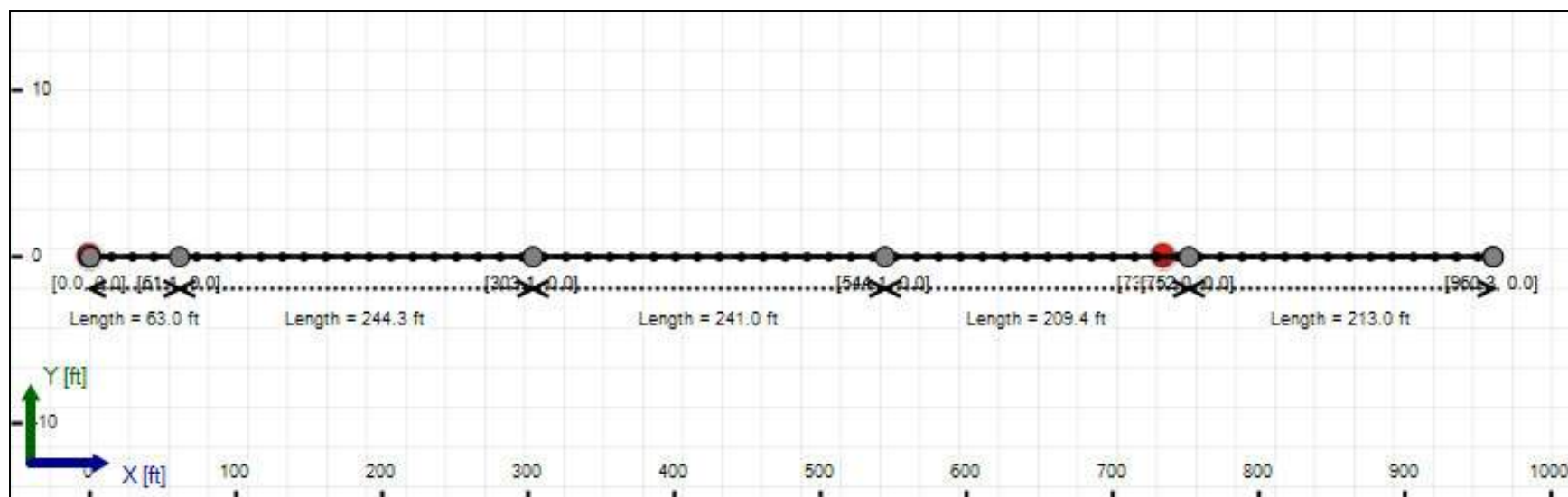
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 975.00 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	5.4	29.4
Water Pressure	13.7	13.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.2	43.0
Deflection		
Earth Load Deflection	1.541	8.025
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.673	8.157
Compressive Stress [psi]		
Compressive Wall Stress	86.2	193.5

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	18384.6	18384.6
Pullback Stress [psi]	512.7	512.7
Pullback Strain	8.917E-3	8.917E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	512.7	536.9
Tensile Strain	8.917E-3	9.785E-3

Net External Pressure = 33.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.673	7.5	4.5	OK
Unconstrained Collapse [psi]	43.6	119.5	2.7	OK
Compressive Wall Stress [psi]	86.2	1150.0	13.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	53.6	225.5	4.2	OK
Tensile Stress [psi]	536.9	1200.0	2.2	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	8.75 in	942.479 psi	1340.560 psi
1	8.75 in	12.00 in	942.273 psi	1340.367 psi
2	12.00 in	16.13 in	941.918 psi	1340.033 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

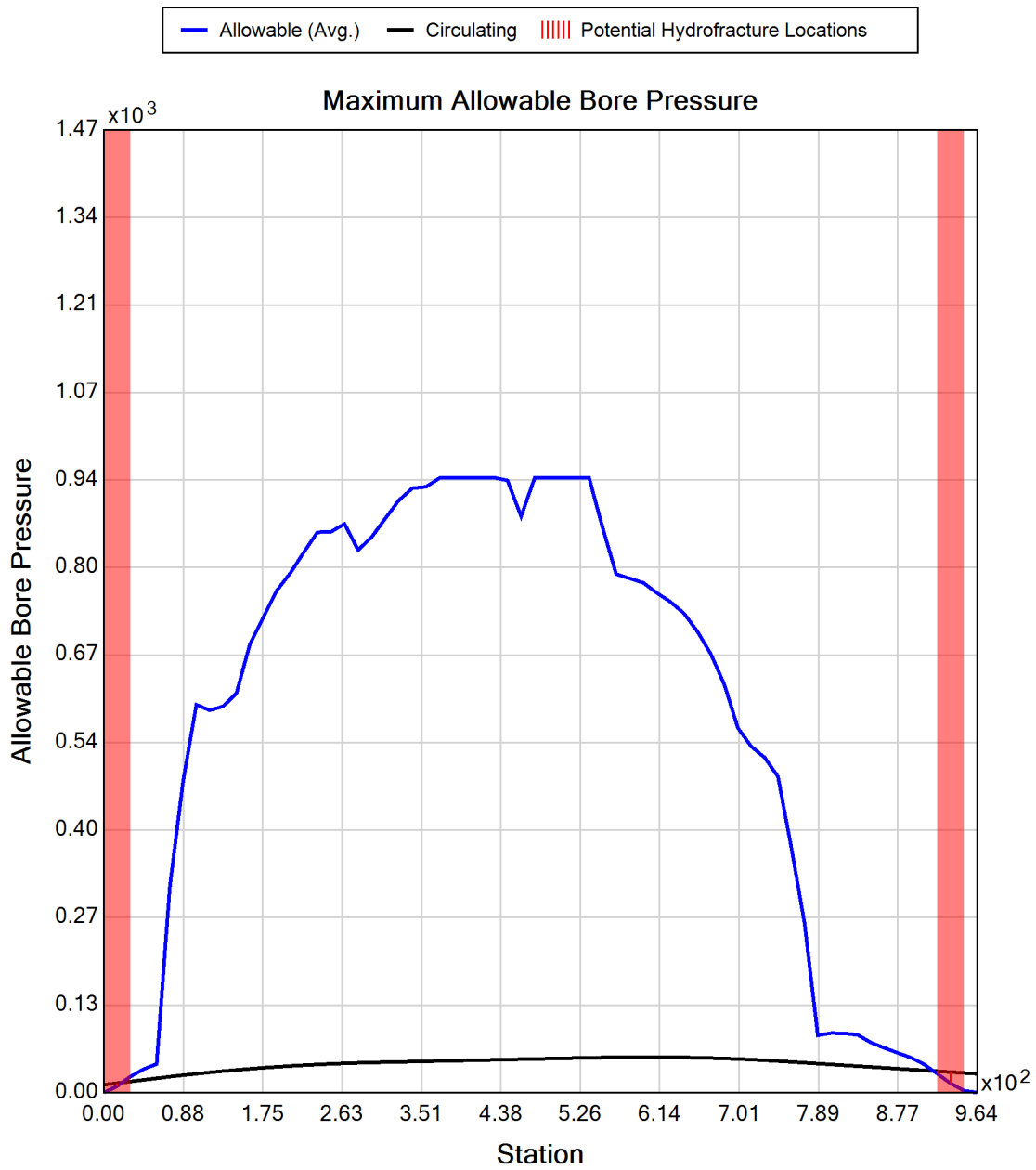
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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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: 06-19-2023

Designer:

Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description:

Segment 11 (Package 7A)
Conduit 2
HDD 112
DWG C-312.2

Input Summary

Start Coordinate	(0.00, 0.00, 110.99) ft
End Coordinate	(960.00, 0.00, 129.86) ft
Project Length	960.00 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: 7

Soil Layer #1 USCS, Sand (S), SP

Depth: 5.00 ft

Unit Weight: 14.6454 (dry), 16.9323 (sat) [lb/US (liquid) gallon]

Phi: 30.00, 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 USCS, Sand (S), SM

Depth: 4.00 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: 3.00 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 #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 9.00 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 #6 USCS, Gravel (G), GM

Depth: 7.00 ft

Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

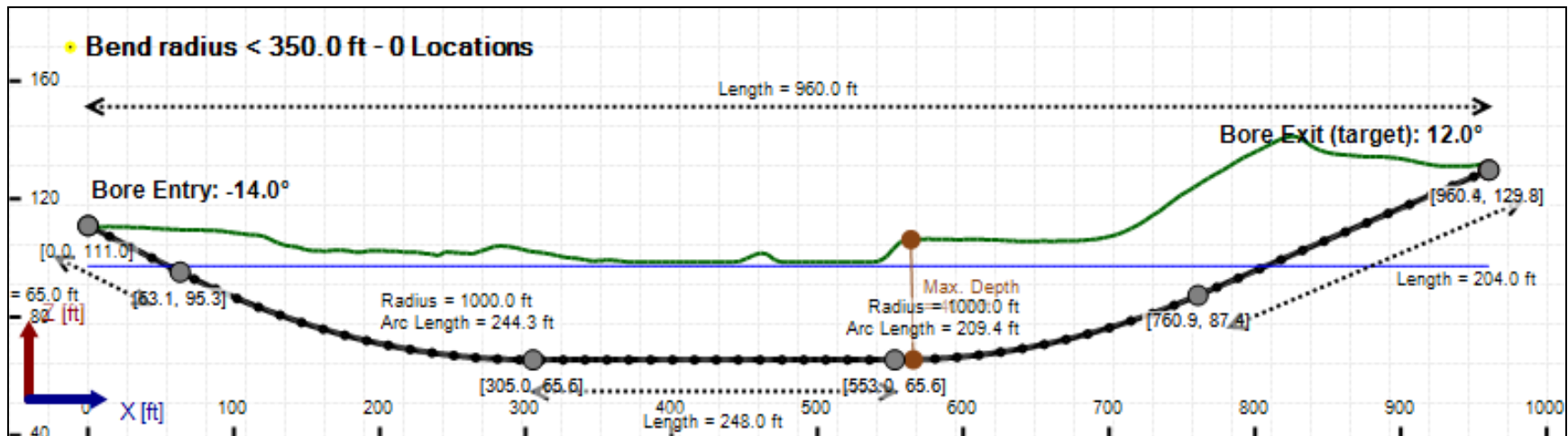
Soil Layer #7 Rock, Geological Classification, Sedimentary Rocks

Depth: 25.00 ft

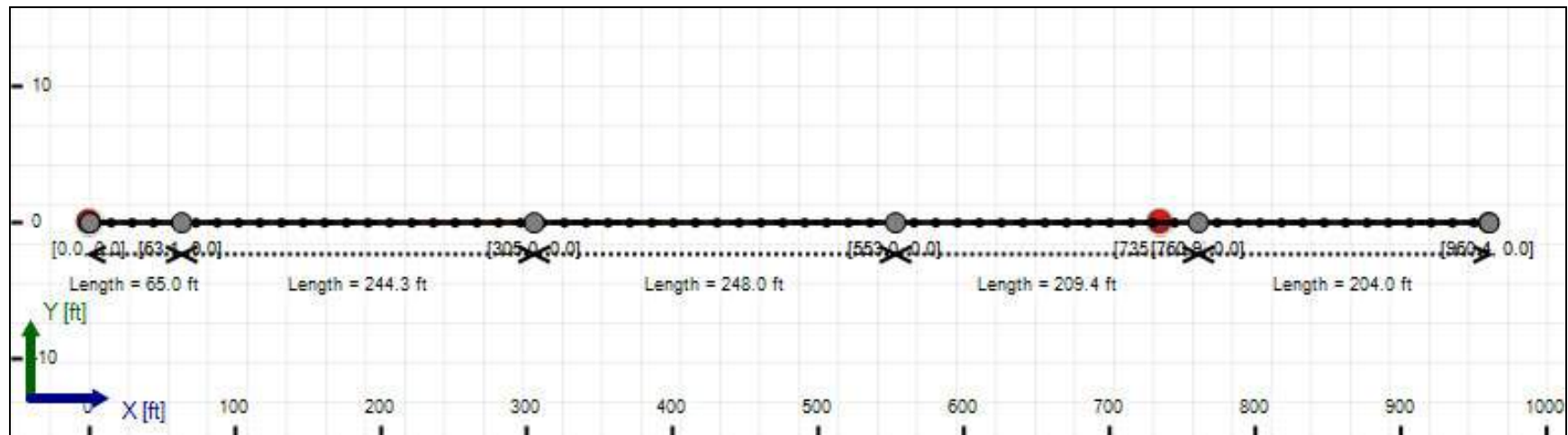
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 975.00 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	5.5	29.7
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.2	43.4
Deflection		
Earth Load Deflection	1.541	8.460
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.673	8.592
Compressive Stress [psi]		
Compressive Wall Stress	86.5	195.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	18257.6	18257.6
Pullback Stress [psi]	509.2	509.2
Pullback Strain	8.855E-3	8.855E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	509.2	533.6
Tensile Strain	8.855E-3	9.727E-3

Net External Pressure = 32.3 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.673	7.5	4.5	OK
Unconstrained Collapse [psi]	42.4	119.4	2.8	OK
Compressive Wall Stress [psi]	86.5	1150.0	13.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	52.3	225.7	4.3	OK
Tensile Stress [psi]	533.6	1200.0	2.2	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	8.75 in	957.767 psi	1340.904 psi
1	8.75 in	12.00 in	957.558 psi	1340.712 psi
2	12.00 in	16.13 in	957.198 psi	1340.381 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

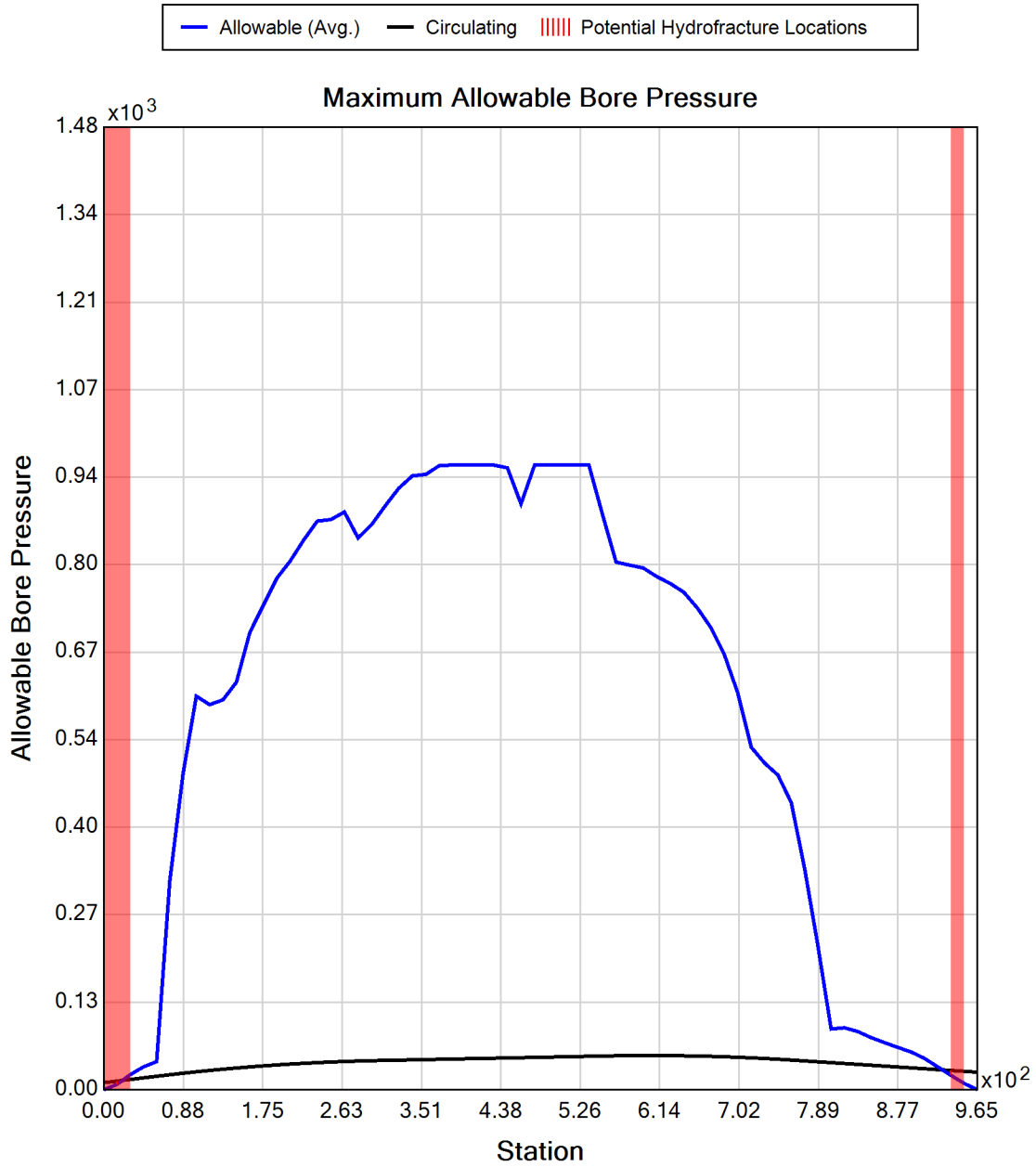
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 112
DWG C-312.2

Input Summary

Start Coordinate	(0.00, 0.00, 110.99) ft
End Coordinate	(960.00, 0.00, 129.86) ft
Project Length	960.00 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: 7

Soil Layer #1 USCS, Sand (S), SP

Depth: 5.00 ft

Unit Weight: 14.6454 (dry), 16.9323 (sat) [lb/US (liquid) gallon]

Phi: 30.00, 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 USCS, Sand (S), SM

Depth: 4.00 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: 3.00 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 #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 9.00 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 #6 USCS, Gravel (G), GM

Depth: 7.00 ft

Unit Weight: 16.9785 (dry), 18.6879 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

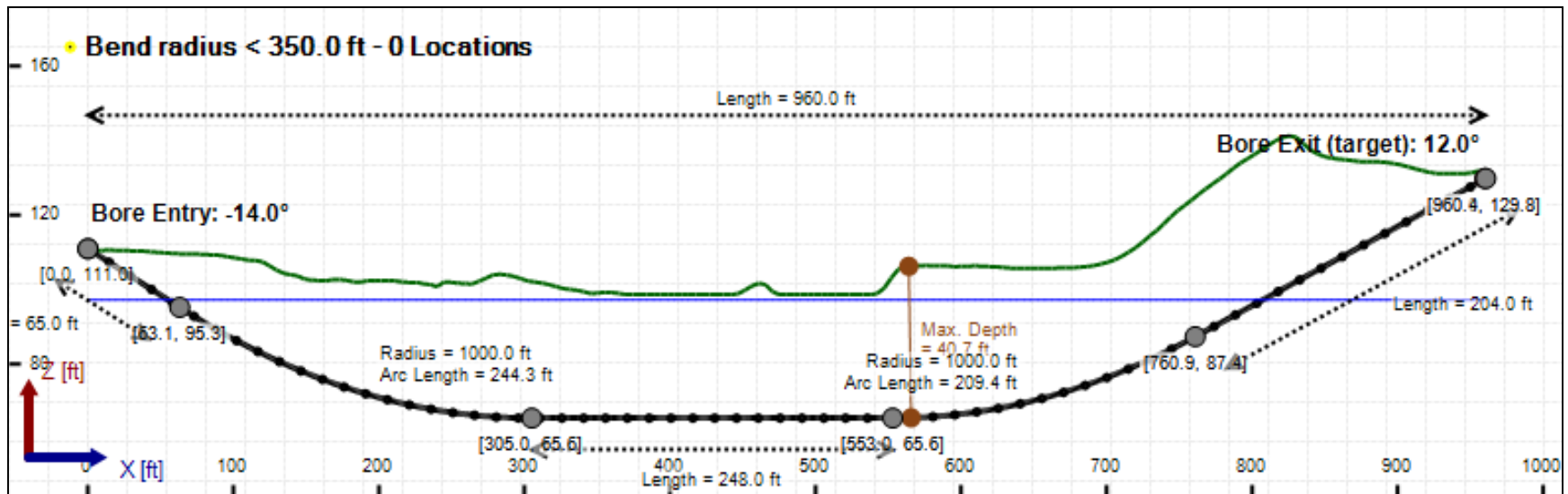
Soil Layer #7 Rock, Geological Classification, Sedimentary Rocks

Depth: 25.00 ft

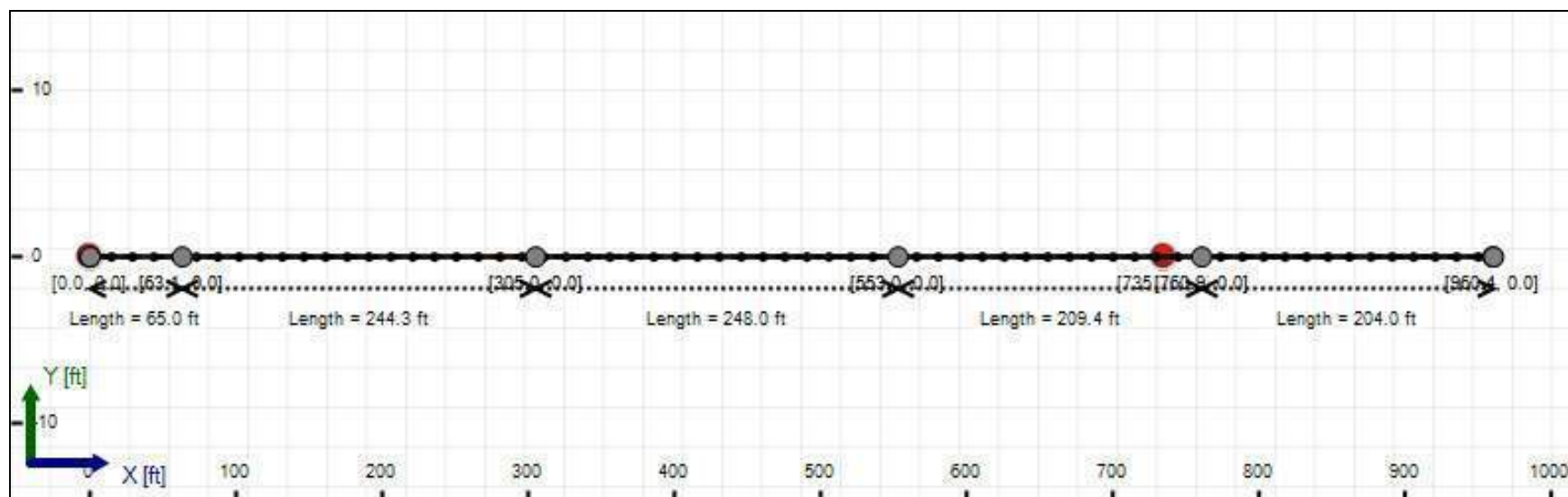
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 975.00 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	2.6	29.7
Water Pressure	13.7	13.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.3	43.4
Deflection		
Earth Load Deflection	0.750	8.460
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	0.793	8.503
Compressive Stress [psi]		
Compressive Wall Stress	73.4	195.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	2048.0	2048.0
Pullback Stress [psi]	538.8	538.8
Pullback Strain	9.371E-3	9.371E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	538.8	545.8
Tensile Strain	9.371E-3	9.639E-3

Net External Pressure = 32.3 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.793	7.5	9.5	OK
Unconstrained Collapse [psi]	42.4	129.2	3.1	OK
Compressive Wall Stress [psi]	73.4	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	52.3	225.7	4.3	OK
Tensile Stress [psi]	545.8	1200.0	2.2	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	8.75 in	957.767 psi	1340.904 psi
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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

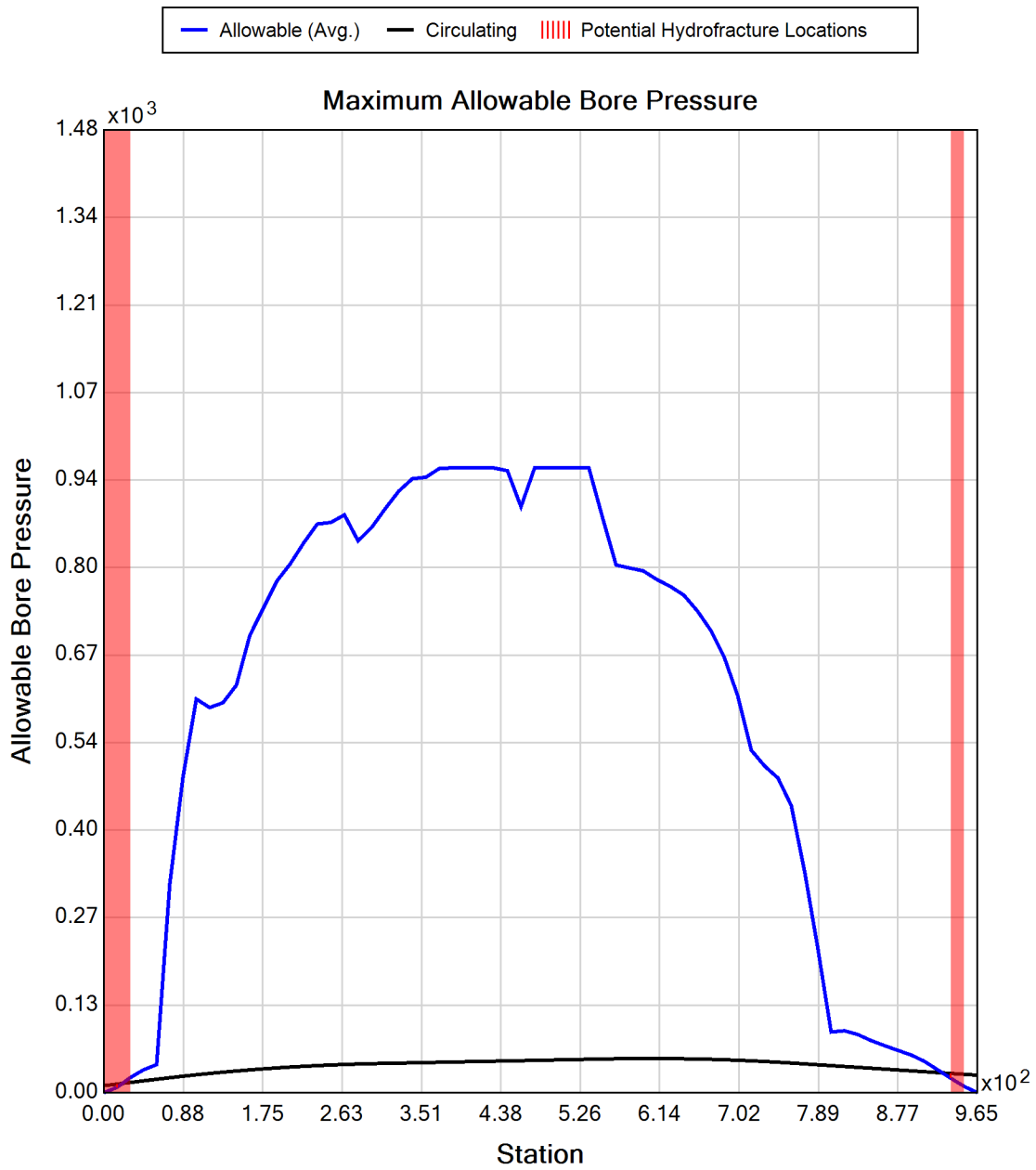
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





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Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2 & 3 Equivalent Pipe Bundle
HDD 112
DWG C-312.2

Input Summary

Start Coordinate	(0.00, 0.00, 110.99) ft
End Coordinate	(960.00, 0.00, 129.86) ft
Project Length	960.00 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: 975.00 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	29.7
Water Pressure	13.7	13.7
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	20.7	43.4
Deflection		
Earth Load Deflection	9.120	38.875
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	9.810	39.565
Compressive Stress [psi]		
Compressive Wall Stress	148.4	310.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15033.1	15033.1
Pullback Stress [psi]	375.4	375.4
Pullback Strain	6.528E-3	6.528E-3
Bending Stress [psi]	33.5	33.5
Bending Strain	5.833E-4	5.833E-4
Tensile Stress [psi]	408.9	408.9
Tensile Strain	7.695E-3	7.695E-3

Net External Pressure = 18.2 [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]	24.1	49.3	2.0	OK
Tensile Stress [psi]	408.9	1200.0	2.9	OK



Generated Output



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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: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 113
DWG C-313

Input Summary

Start Coordinate	(0.00, 0.00, 96.49) ft
End Coordinate	(610.00, 0.00, 110.20) ft
Project Length	610.00 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, Sand (S), SM

Depth: 2.00 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, Clay (C), CH

Depth: 18.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 25.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

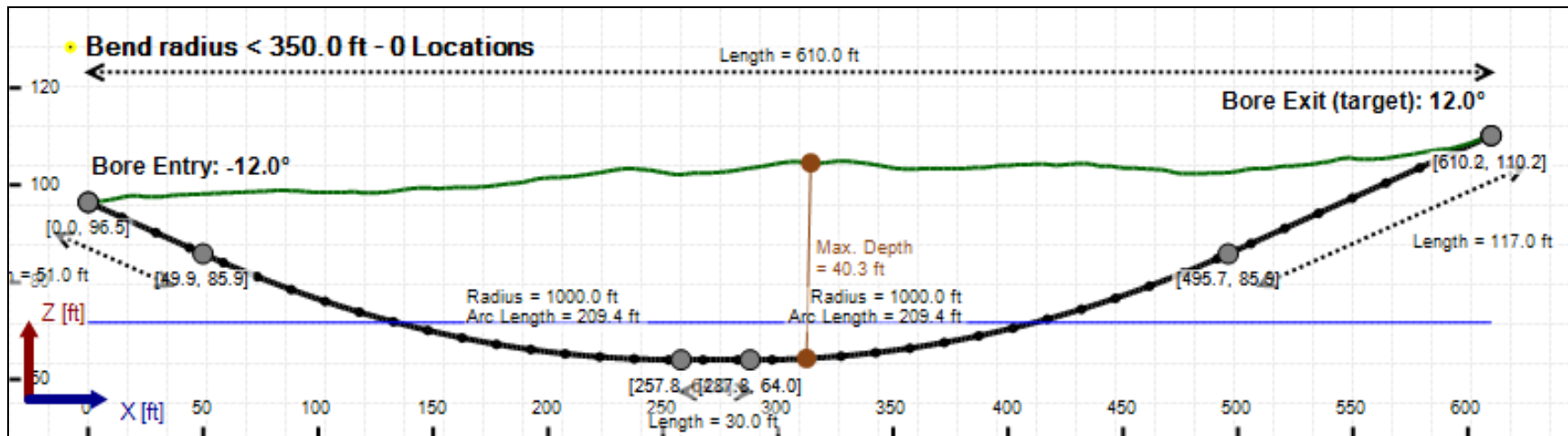
Soil Layer #4 USCS, Silt (M), ML

Depth: 12.00 ft

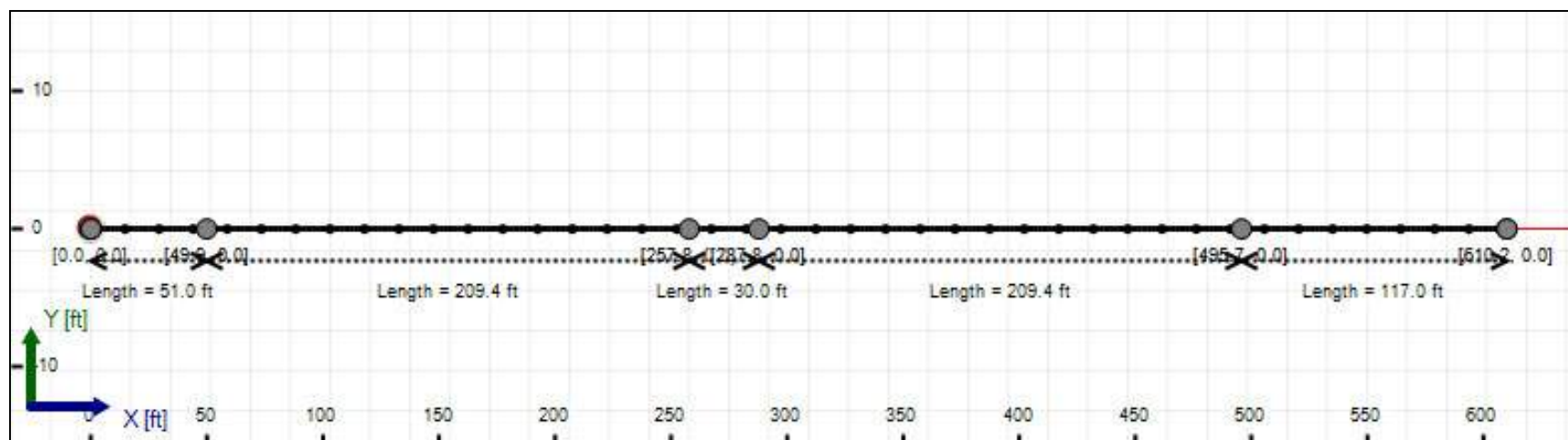
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

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: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 630.00 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	9.1	26.3
Water Pressure	3.3	3.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.4	29.5
Deflection		
Earth Load Deflection	2.696	7.176
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.828	7.308
Compressive Stress [psi]		
Compressive Wall Stress	55.7	132.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	11975.3	11975.3
Pullback Stress [psi]	334.0	334.0
Pullback Strain	5.808E-3	5.808E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	334.0	359.3
Tensile Strain	5.808E-3	6.696E-3

Net External Pressure = 26.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.828	7.5	2.7	OK
Unconstrained Collapse [psi]	31.8	109.4	3.4	OK
Compressive Wall Stress [psi]	55.7	1150.0	20.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	41.8	235.9	5.6	OK
Tensile Stress [psi]	359.3	1200.0	3.3	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	8.75 in	77.451 psi	58.806 psi
1	8.75 in	12.00 in	77.384 psi	58.562 psi
2	12.00 in	16.13 in	77.269 psi	58.157 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 inadvertent 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): 70.00 US (liquid) gallon/min

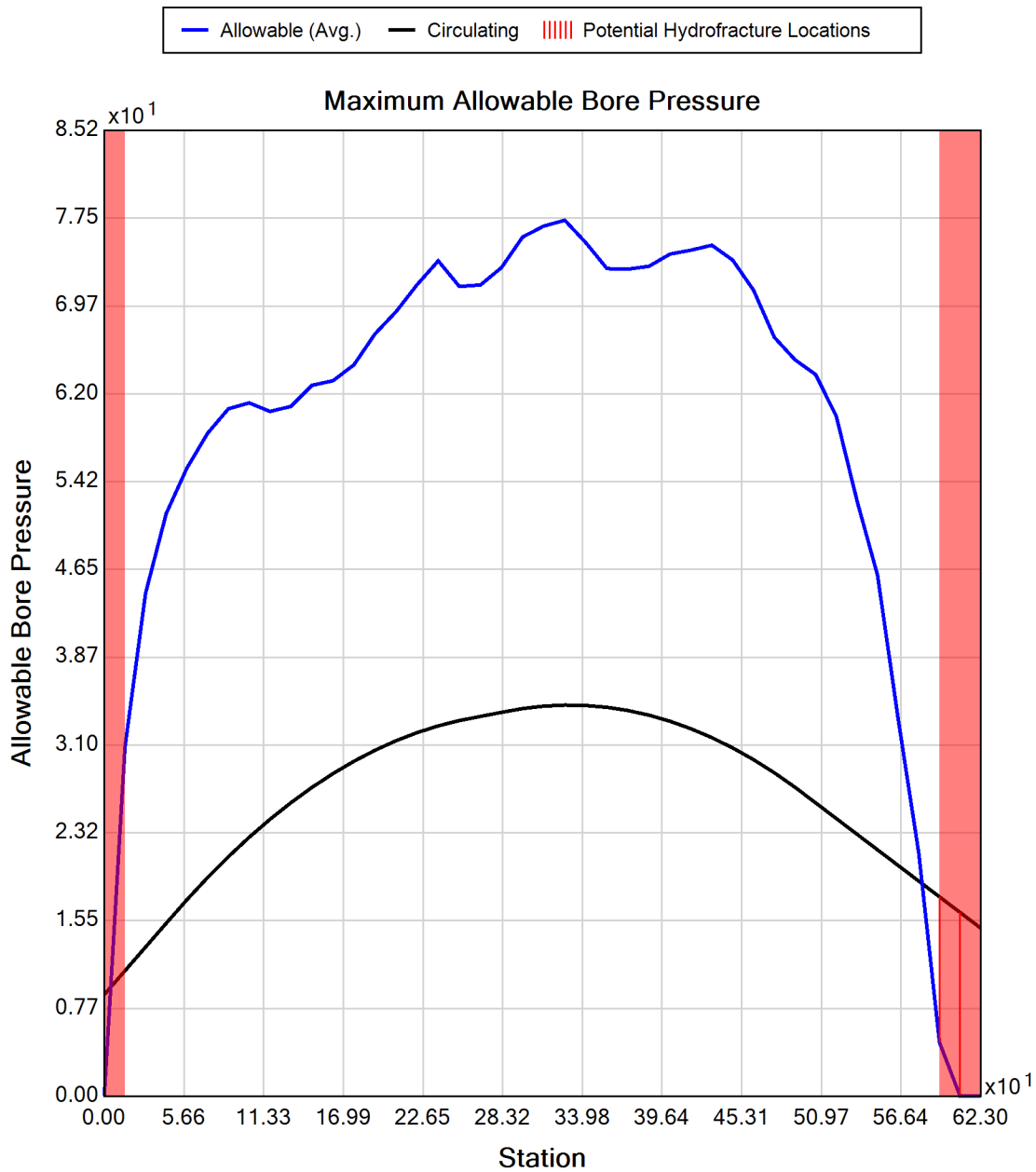
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 113
DWG C-313.2

Input Summary

Start Coordinate	(0.00, 0.00, 96.49) ft
End Coordinate	(610.00, 0.00, 109.16) ft
Project Length	610.00 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, Sand (S), SM

Depth: 2.00 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, Clay (C), CH

Depth: 18.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 25.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

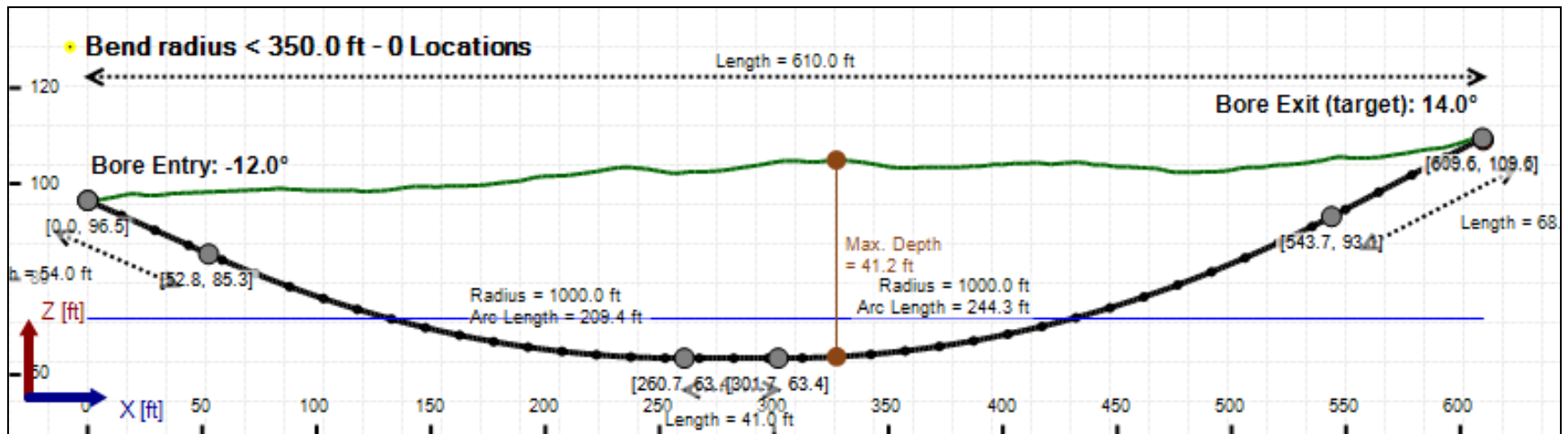
Soil Layer #4 USCS, Silt (M), ML

Depth: 12.00 ft

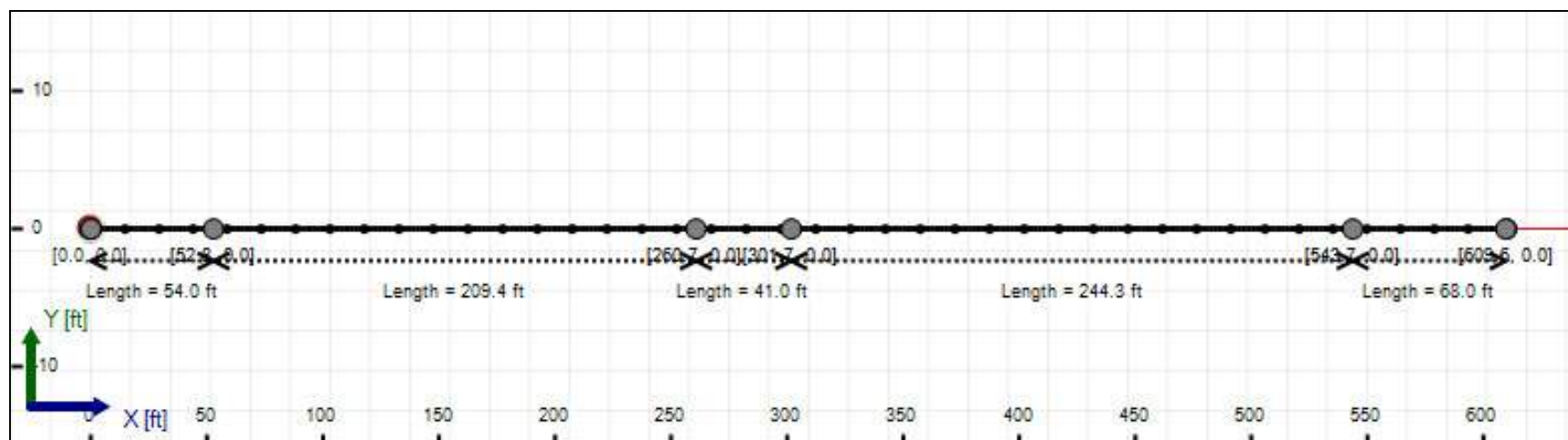
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

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: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 630.00 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	9.1	26.7
Water Pressure	3.6	3.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.7	30.3
Deflection		
Earth Load Deflection	2.713	7.307
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.845	7.439
Compressive Stress [psi]		
Compressive Wall Stress	57.2	136.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	12100.8	12100.8
Pullback Stress [psi]	337.5	337.5
Pullback Strain	5.869E-3	5.869E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	337.5	363.2
Tensile Strain	5.869E-3	6.764E-3

Net External Pressure = 26.7 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.845	7.5	2.6	OK
Unconstrained Collapse [psi]	32.1	109.3	3.4	OK
Compressive Wall Stress [psi]	57.2	1150.0	20.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	42.1	235.5	5.6	OK
Tensile Stress [psi]	363.2	1200.0	3.3	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	8.75 in	77.756 psi	56.297 psi
1	8.75 in	12.00 in	77.694 psi	55.980 psi
2	12.00 in	16.13 in	77.587 psi	55.463 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): 70.00 US (liquid) gallon/min

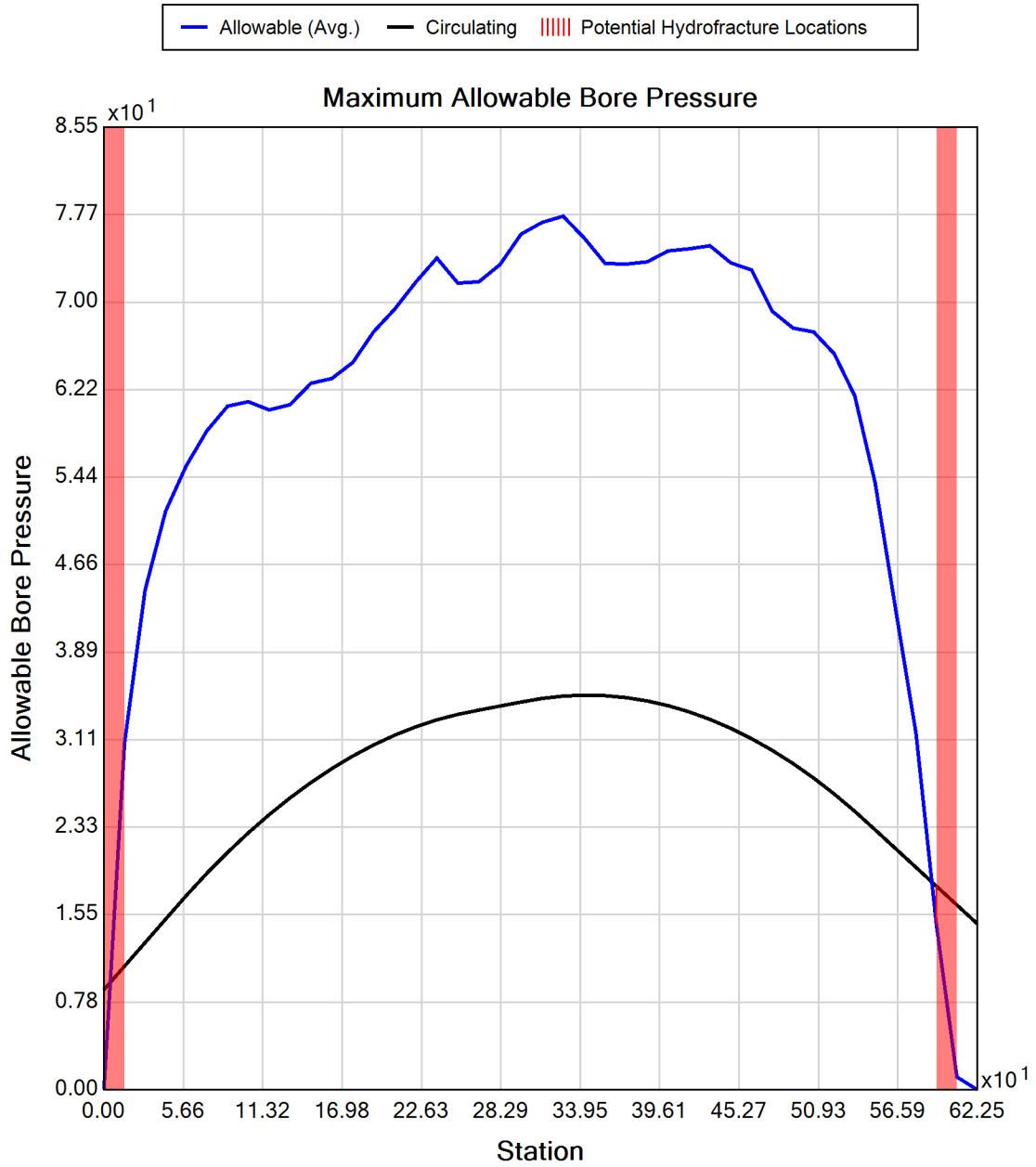
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 3 HDD 113 DWG C-313.2

Input Summary

Start Coordinate	(0.00, 0.00, 96.49) ft
End Coordinate	(610.00, 0.00, 109.16) ft
Project Length	610.00 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, Sand (S), SM

Depth: 2.00 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, Clay (C), CH

Depth: 18.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 25.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

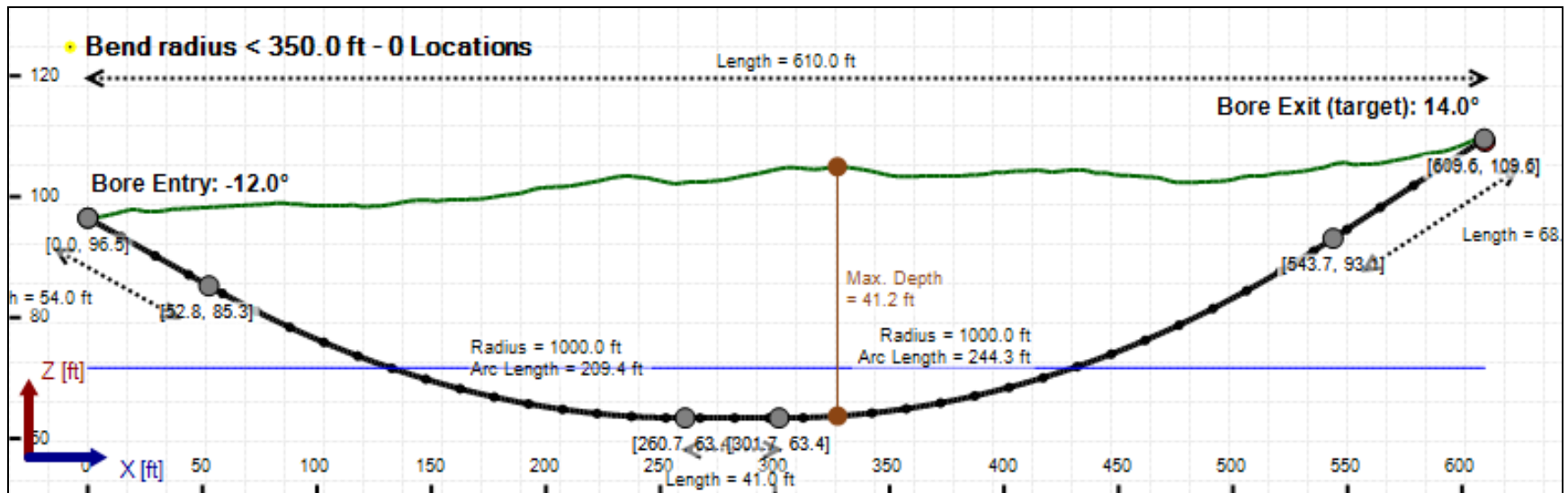
Soil Layer #4 USCS, Silt (M), ML

Depth: 12.00 ft

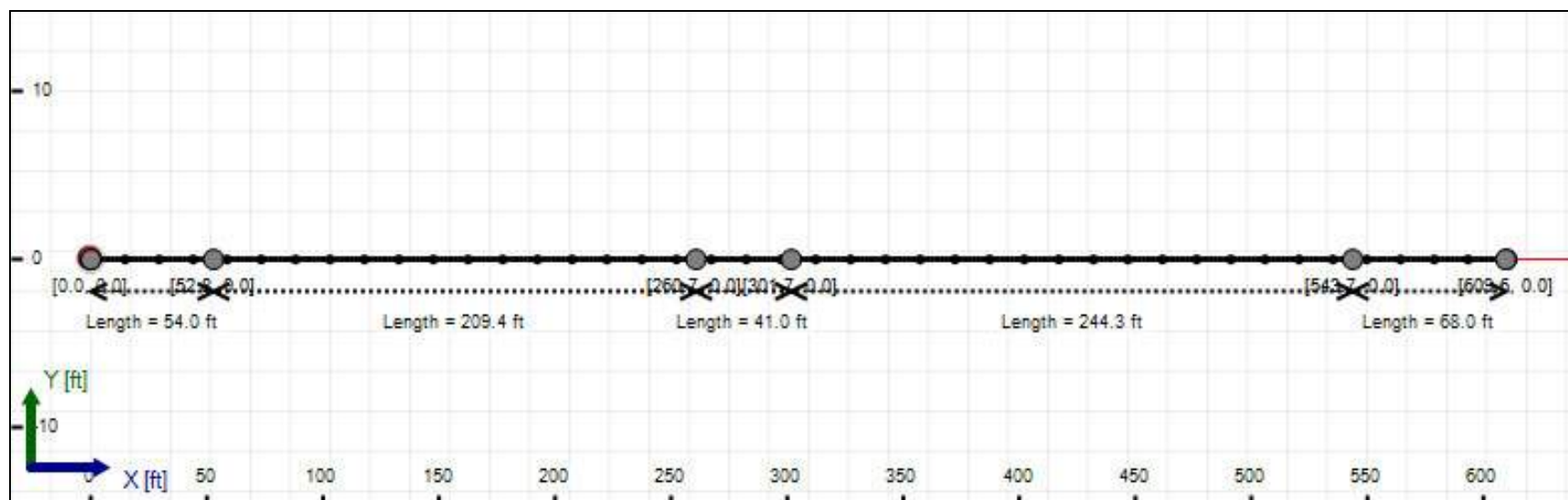
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

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: HDPE
Classification: IPS
Pipe OD: 3" (3.5")
Pipe DR: 9
Pipe Length: 630.00 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	4.6	26.7
Water Pressure	3.6	3.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	8.2	30.3
Deflection		
Earth Load Deflection	1.562	7.307
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	1.605	7.350
Compressive Stress [psi]		
Compressive Wall Stress	36.9	136.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	1395.3	1395.3
Pullback Stress [psi]	367.1	367.1
Pullback Strain	6.384E-3	6.384E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	367.1	375.4
Tensile Strain	6.384E-3	6.675E-3

Net External Pressure = 26.7 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.605	7.5	4.7	OK
Unconstrained Collapse [psi]	32.1	123.0	3.8	OK
Compressive Wall Stress [psi]	36.9	1150.0	31.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	42.1	235.7	5.6	OK
Tensile Stress [psi]	375.4	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	8.75 in	77.756 psi	56.297 psi
1	8.75 in	12.00 in	77.694 psi	55.980 psi
2	12.00 in	16.13 in	77.587 psi	55.463 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): 70.00 US (liquid) gallon/min

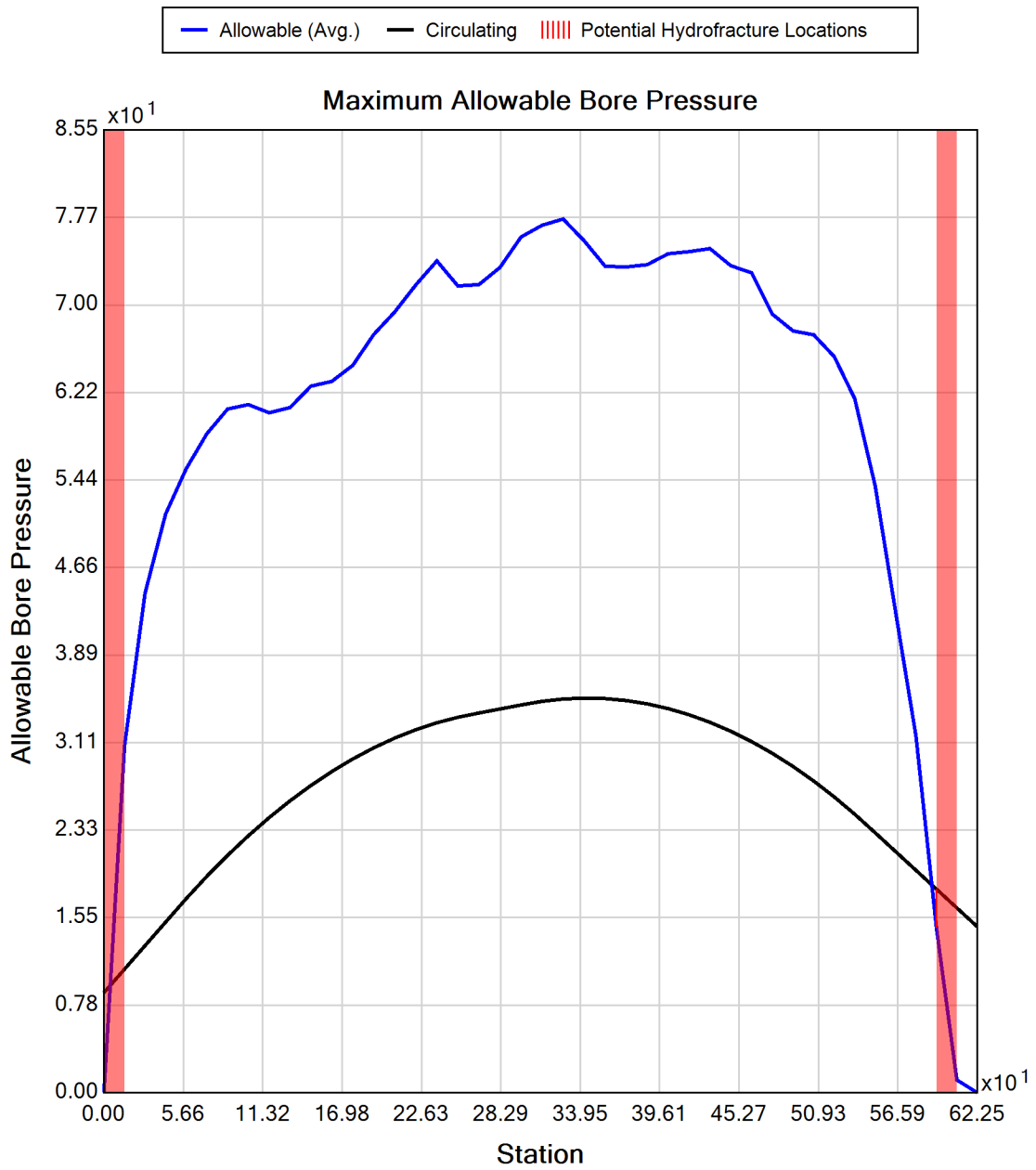
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





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General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2 & 3 Equivalent Pipe Bundle
HDD 113
DWG C-313.2

Input Summary

Start Coordinate	(0.00, 0.00, 96.49) ft
End Coordinate	(610.00, 0.00, 109.16) ft
Project Length	610.00 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: 630.00 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	11.0	26.7
Water Pressure	3.6	3.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.6	30.3
Deflection		
Earth Load Deflection	14.503	33.574
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	15.192	34.263
Compressive Stress [psi]		
Compressive Wall Stress	104.7	216.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10257.0	10257.0
Pullback Stress [psi]	256.1	256.1
Pullback Strain	4.454E-3	4.454E-3
Bending Stress [psi]	33.5	33.5
Bending Strain	5.833E-4	5.833E-4
Tensile Stress [psi]	289.7	289.7
Tensile Strain	5.621E-3	5.621E-3

Net External Pressure = 18.0 [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]	20.7	50.7	2.5	OK
Tensile Stress [psi]	289.7	1200.0	4.1	OK



Generated Output



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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: 06-19-2023
Designer:	Aaron Coady TetraTech Rooney 115 Inverness Drive, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 1 HDD 115 DWG C-315

Input Summary

Start Coordinate	(0.00, 0.00, 34.11) ft
End Coordinate	(1337.80, 0.00, 51.18) ft
Project Length	1337.80 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: 5

Soil Layer #1 USCS, Gravel (G), GC

Depth: 2.00 ft

Unit Weight: 16.3086 (dry), 18.2028 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 4.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 7.30 [psi]

Soil Layer #3 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]

Soil Layer #4 USCS, Gravel (G), GC

Depth: 8.00 ft

Unit Weight: 16.3086 (dry), 18.2028 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

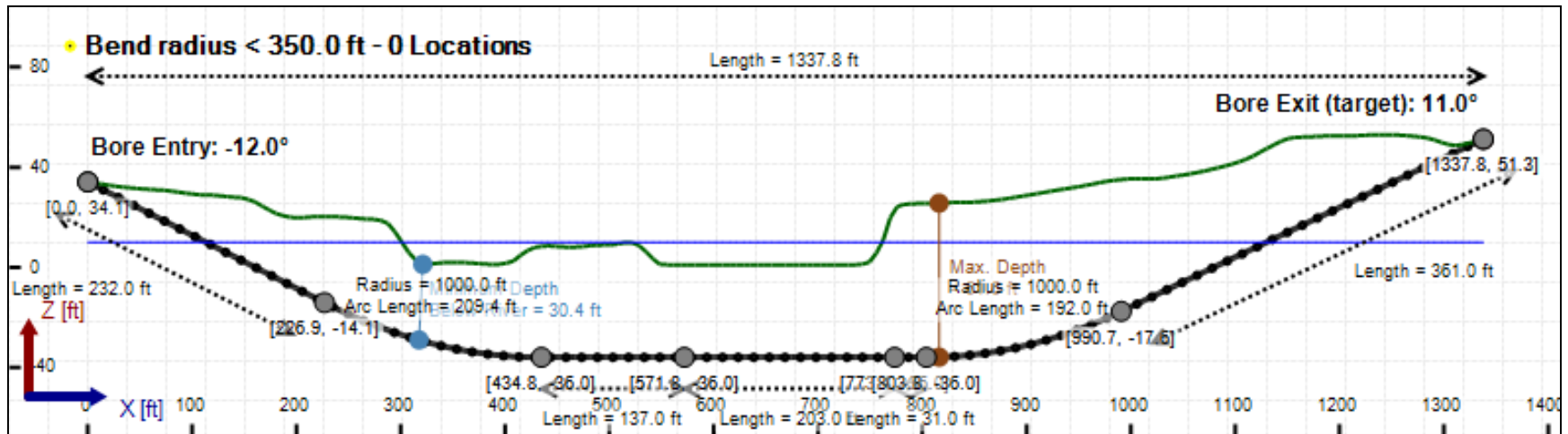
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 94.00 ft

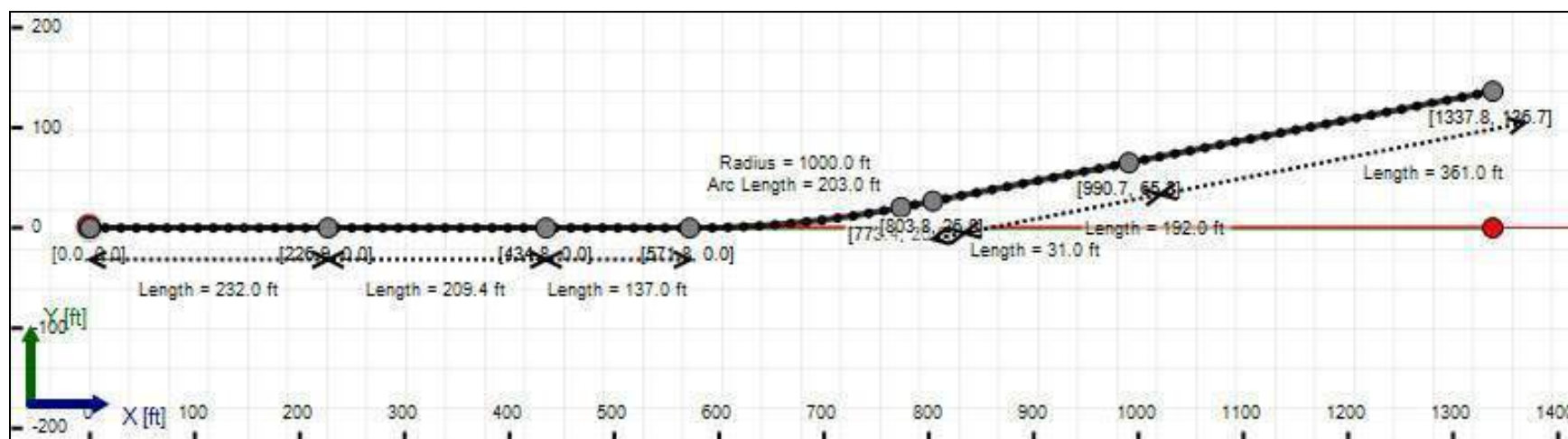
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: PVC
Classification: IPS
Pipe OD: 8" (8.625")
Pipe DR: 18
Pipe Length: 1379.99 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	5.0	49.2
Water Pressure	19.9	20.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	25.0	69.1
Deflection		
Earth Load Deflection	0.929	9.063
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	0.989	9.123
Compressive Stress [psi]		
Compressive Wall Stress	224.9	622.2

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	17818.3	17818.3
Pullback Stress [psi]	1453.1	1453.1
Pullback Strain	3.633E-3	3.633E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	1453.1	1588.1
Tensile Strain	3.633E-3	4.330E-3

Net External Pressure = 53.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.989	7.5	7.6	OK
Unconstrained Collapse [psi]	58.5	174.1	3.0	OK
Compressive Wall Stress [psi]	224.9	3200.0	14.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	68.4	160.8	2.4	OK
Tensile Stress [psi]	1588.1	2800.0	1.8	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	8.75 in	1353.006 psi	1363.489 psi
1	8.75 in	12.00 in	1352.855 psi	1363.405 psi
2	12.00 in	12.94 in	1352.802 psi	1363.376 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 inadvertent 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

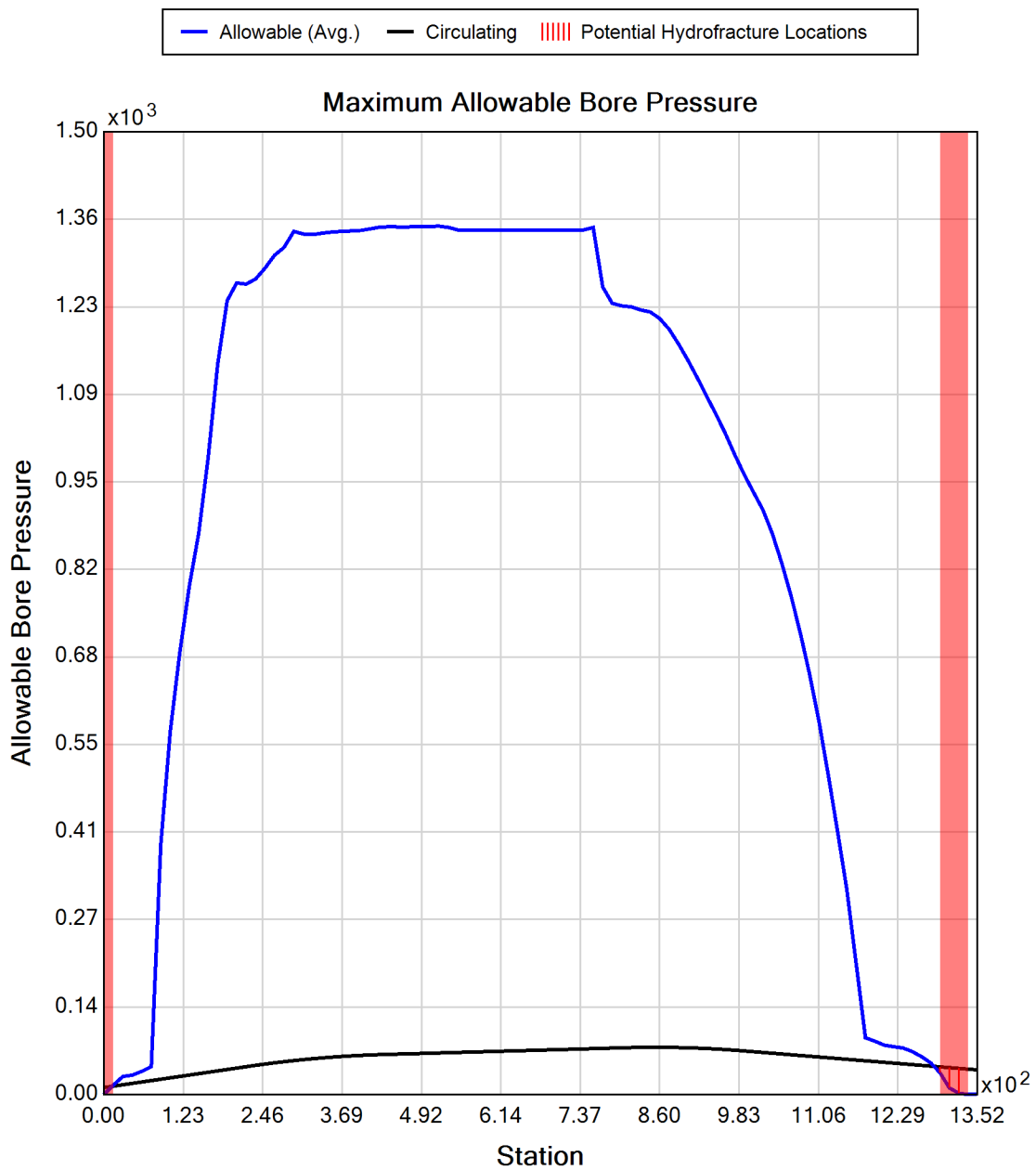
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General: Kiewit CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 115
DWG C-315.2

Input Summary

Start Coordinate	(0.00, 0.00, 33.87) ft
End Coordinate	(1349.00, 0.00, 54.01) ft
Project Length	1349.00 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: 5

Soil Layer #1 USCS, Gravel (G), GC

Depth: 2.00 ft

Unit Weight: 16.3086 (dry), 18.2028 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 4.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 7.30 [psi]

Soil Layer #3 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]

Soil Layer #4 USCS, Gravel (G), GC

Depth: 8.00 ft

Unit Weight: 16.3086 (dry), 18.2028 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

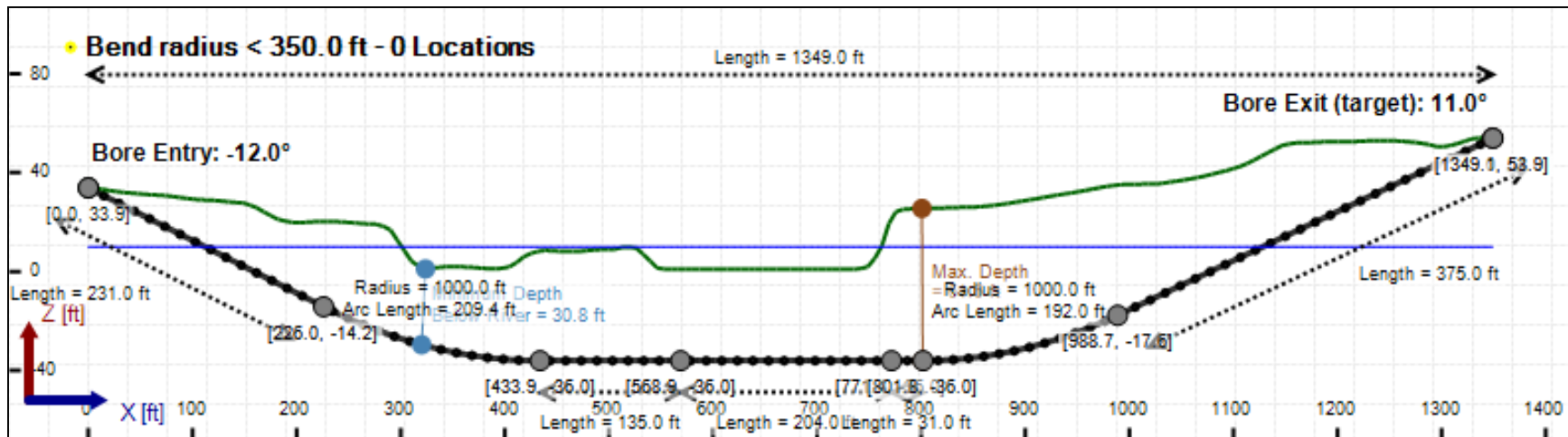
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 94.00 ft

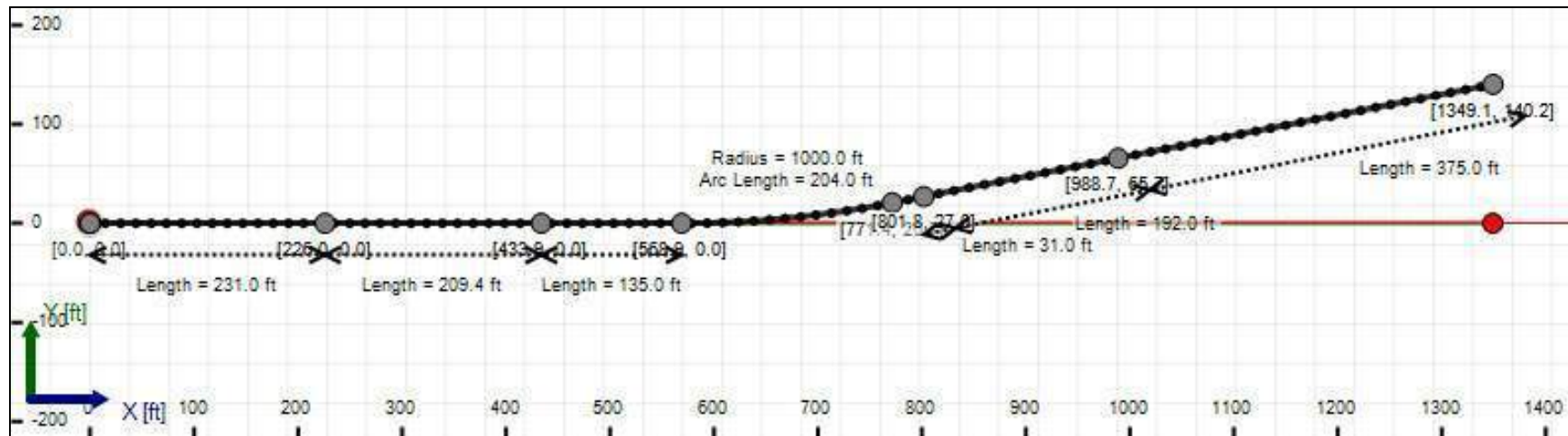
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: PVC
Classification: IPS
Pipe OD: 8" (8.625")
Pipe DR: 18
Pipe Length: 1379.99 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	5.0	49.2
Water Pressure	20.0	20.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	25.0	69.2
Deflection		
Earth Load Deflection	0.935	9.070
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	0.995	9.129
Compressive Stress [psi]		
Compressive Wall Stress	225.1	622.7

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	17844.6	17844.6
Pullback Stress [psi]	1455.2	1455.2
Pullback Strain	3.638E-3	3.638E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	1455.2	1589.8
Tensile Strain	3.638E-3	4.334E-3

Net External Pressure = 53.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.995	7.5	7.5	OK
Unconstrained Collapse [psi]	58.8	174.1	3.0	OK
Compressive Wall Stress [psi]	225.1	3200.0	14.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	68.7	160.7	2.3	OK
Tensile Stress [psi]	1589.8	2800.0	1.8	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	8.75 in	1353.042 psi	1363.545 psi
1	8.75 in	12.00 in	1352.891 psi	1363.461 psi
2	12.00 in	12.94 in	1352.838 psi	1363.432 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

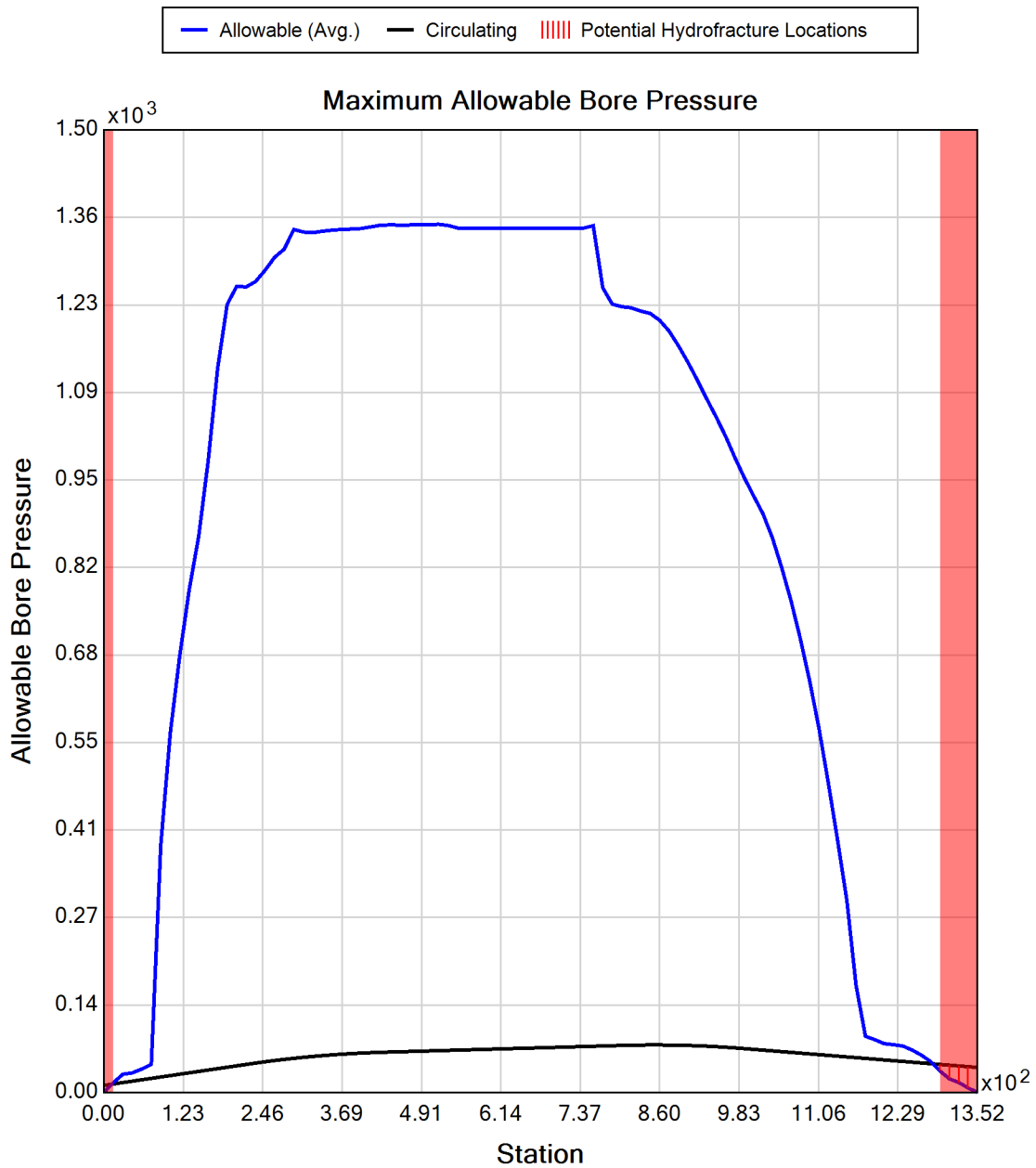
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





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Ref: New York
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Start Date: 04-29-2022
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Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 115
DWG C-315.2

Input Summary

Start Coordinate	(0.00, 0.00, 33.87) ft
End Coordinate	(1349.00, 0.00, 54.01) ft
Project Length	1349.00 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: 5

Soil Layer #1 USCS, Gravel (G), GC

Depth: 2.00 ft

Unit Weight: 16.3086 (dry), 18.2028 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 4.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 7.30 [psi]

Soil Layer #3 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]

Soil Layer #4 USCS, Gravel (G), GC

Depth: 8.00 ft

Unit Weight: 16.3086 (dry), 18.2028 (sat) [lb/US (liquid) gallon]

Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

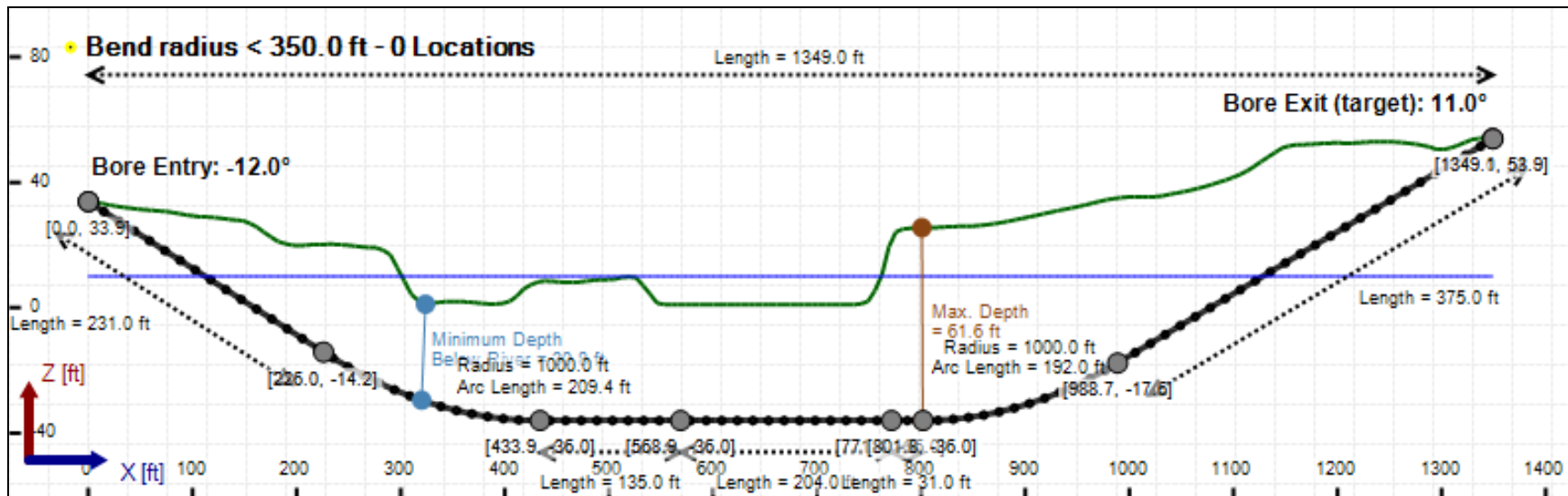
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 94.00 ft

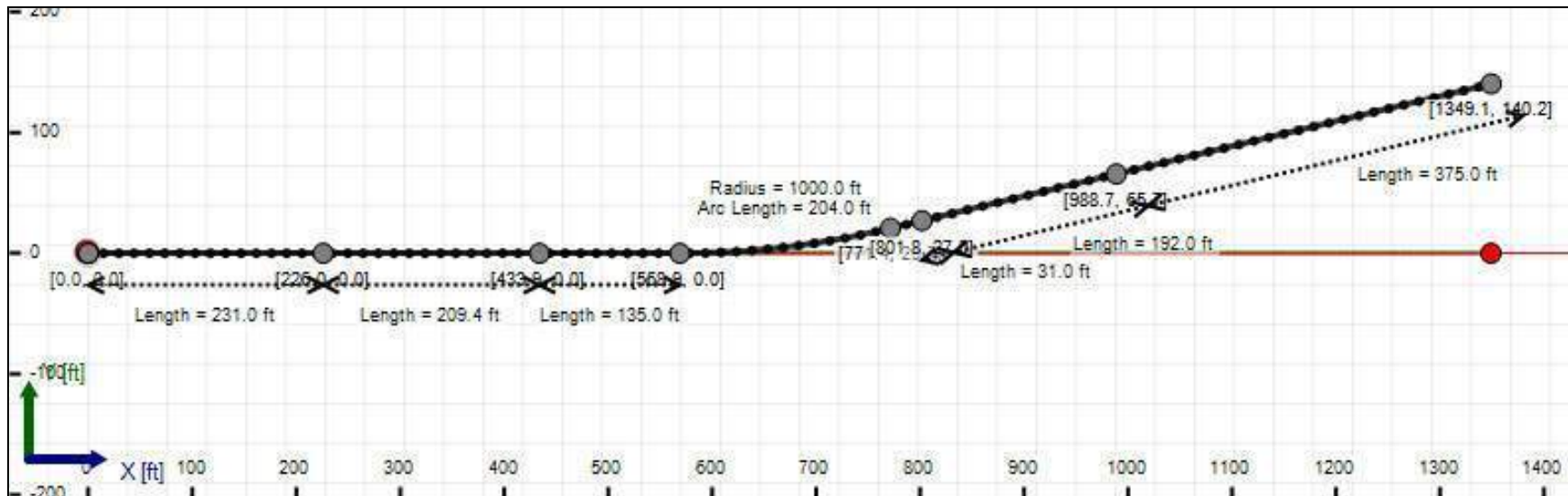
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 1379.99 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	2.9	49.2
Water Pressure	20.0	20.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	22.9	69.2
Deflection		
Earth Load Deflection	0.926	13.407
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	0.969	13.450
Compressive Stress [psi]		
Compressive Wall Stress	103.0	311.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	2945.2	2945.2
Pullback Stress [psi]	774.9	774.9
Pullback Strain	1.348E-2	1.348E-2
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	774.9	779.6
Tensile Strain	1.348E-2	1.370E-2

Net External Pressure = 53.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.969	7.5	7.7	OK
Unconstrained Collapse [psi]	58.8	128.1	2.2	OK
Compressive Wall Stress [psi]	103.0	1150.0	11.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	68.7	209.6	3.1	OK
Tensile Stress [psi]	779.6	1200.0	1.5	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	8.75 in	1353.042 psi	1363.545 psi
1	8.75 in	12.00 in	1352.891 psi	1363.461 psi
2	12.00 in	12.94 in	1352.838 psi	1363.432 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 inadvertent 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

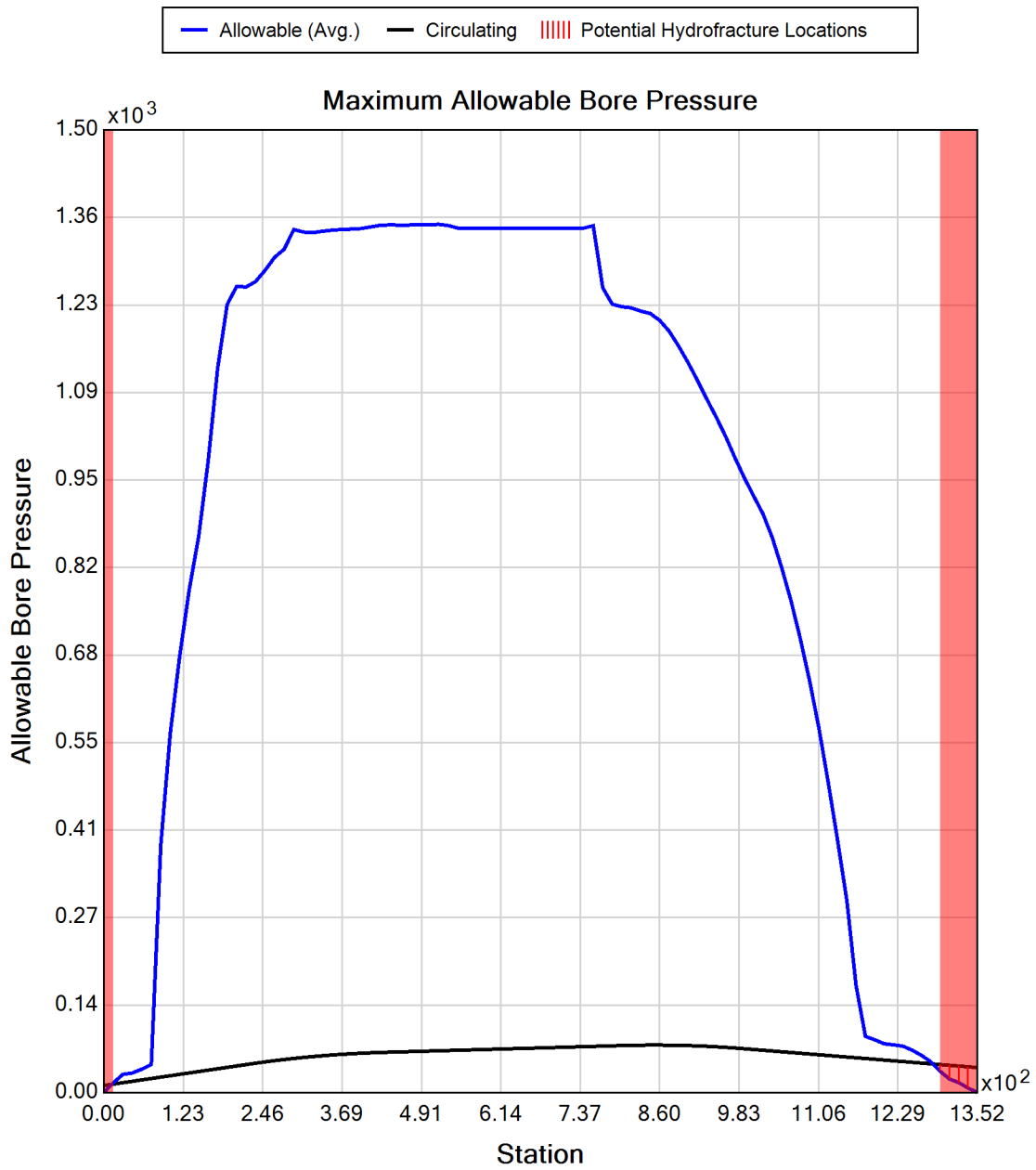
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General:	Kiewit CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 & 3 Equivalent Pipe Bundle HDD 115 DWG C-315.2

Input Summary

Start Coordinate	(0.00, 0.00, 33.87) ft
End Coordinate	(1349.00, 0.00, 54.01) ft
Project Length	1349.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	12.750 in
Pipe DR	25.0
Pipe Thickness	0.51 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: PVC
Classification: IPS
Pipe OD: 12" (12.75")
Pipe DR: 25
Pipe Length: 1379.99 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.59400002161662 ft
Silo Width: 1.59400002161662 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	7.4	49.2
Water Pressure	20.0	20.0
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	27.4	69.2
Deflection		
Earth Load Deflection	3.855	25.520
Buoyant Deflection	0.237	0.237
Reissner Effect	0	0
Net Deflection	4.092	25.757
Compressive Stress [psi]		
Compressive Wall Stress	342.5	864.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15944.7	15944.7
Pullback Stress [psi]	813.0	813.0
Pullback Strain	2.033E-3	2.033E-3
Bending Stress [psi]	0.0	212.5
Bending Strain	0	5.313E-4
Tensile Stress [psi]	813.0	1023.4
Tensile Strain	2.033E-3	3.090E-3

Net External Pressure = 24.6 [psi]

Buoyant Deflection = 0.2

Hydrokinetic Force = 798.4 lb

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.237	7.5	31.7	OK
Unconstrained Collapse [psi]	29.6	59.9	2.0	OK
Tensile Stress [psi]	1023.4	2800.0	2.7	OK



Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 Package 7A
Conduit 1
HDD 117
DWG C-317

Input Summary

Start Coordinate	(0.00, 0.00, 100.79) ft
End Coordinate	(735.00, 0.00, 101.29) ft
Project Length	735.00 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: 6

Soil Layer #1 USCS, Sand (S), SP

Depth: 2.00 ft

Unit Weight: 14.6454 (dry), 16.9323 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #3 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]

Soil Layer #4 USCS, Silt (M), ML

Depth: 29.00 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 #5 USCS, Silt (M), MH

Depth: 10.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #6 USCS, Silt (M), ML

Depth: 37.00 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 profile for the 1000 ft bore

Length = 735.0 ft

Bore Entry: -12.0°

Bore Exit (target): 10.0°

Max. Depth = 46.5 ft

Radius = 1000.0 ft
Arc Length = 209.4 ft

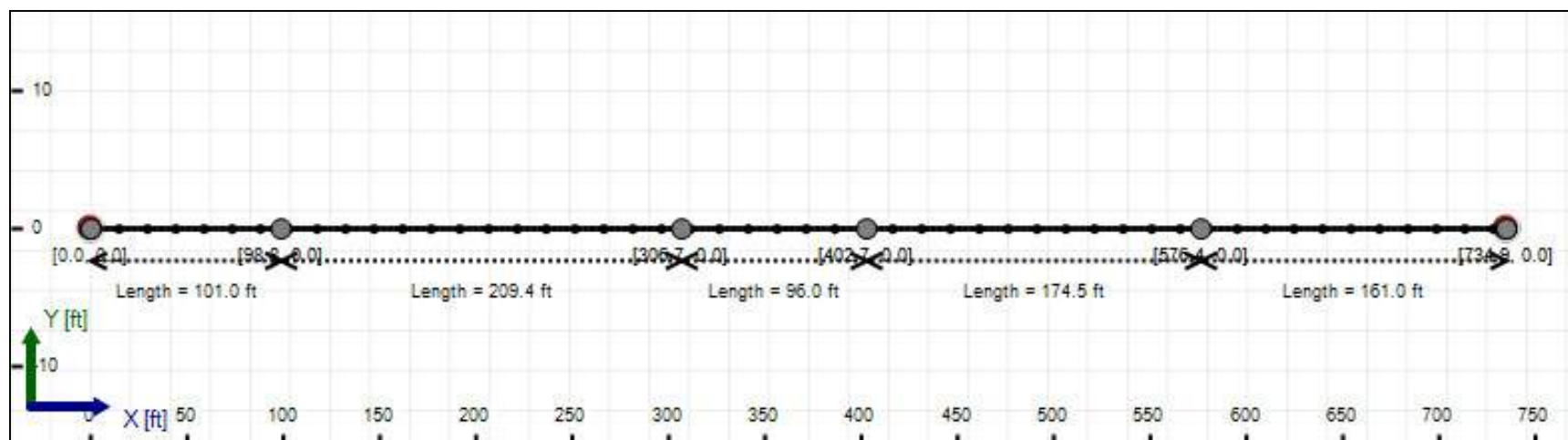
Radius = 1000.0 ft
Arc Length = 174.5 ft

Length = 161.0 ft

Length = 96.0 ft

Coordinate system: Z [ft] (vertical), X [ft] (horizontal)

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	20.0	26.3
Water Pressure	13.1	11.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	33.1	37.9
Deflection		
Earth Load Deflection	5.440	7.163
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.572	7.295
Compressive Stress [psi]		
Compressive Wall Stress	149.0	170.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	13164.4	13164.4
Pullback Stress [psi]	367.1	367.1
Pullback Strain	6.385E-3	6.385E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	367.1	392.7
Tensile Strain	6.385E-3	7.277E-3

Net External Pressure = 23.3 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.572	7.5	1.3	OK
Unconstrained Collapse [psi]	33.1	84.0	2.5	OK
Compressive Wall Stress [psi]	149.0	1150.0	7.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	38.9	234.0	6.0	OK
Tensile Stress [psi]	392.7	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	8.75 in	68.226 psi	57.625 psi
1	8.75 in	12.00 in	68.201 psi	57.594 psi
2	12.00 in	16.13 in	68.157 psi	57.541 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): 70.00 US (liquid) gallon/min

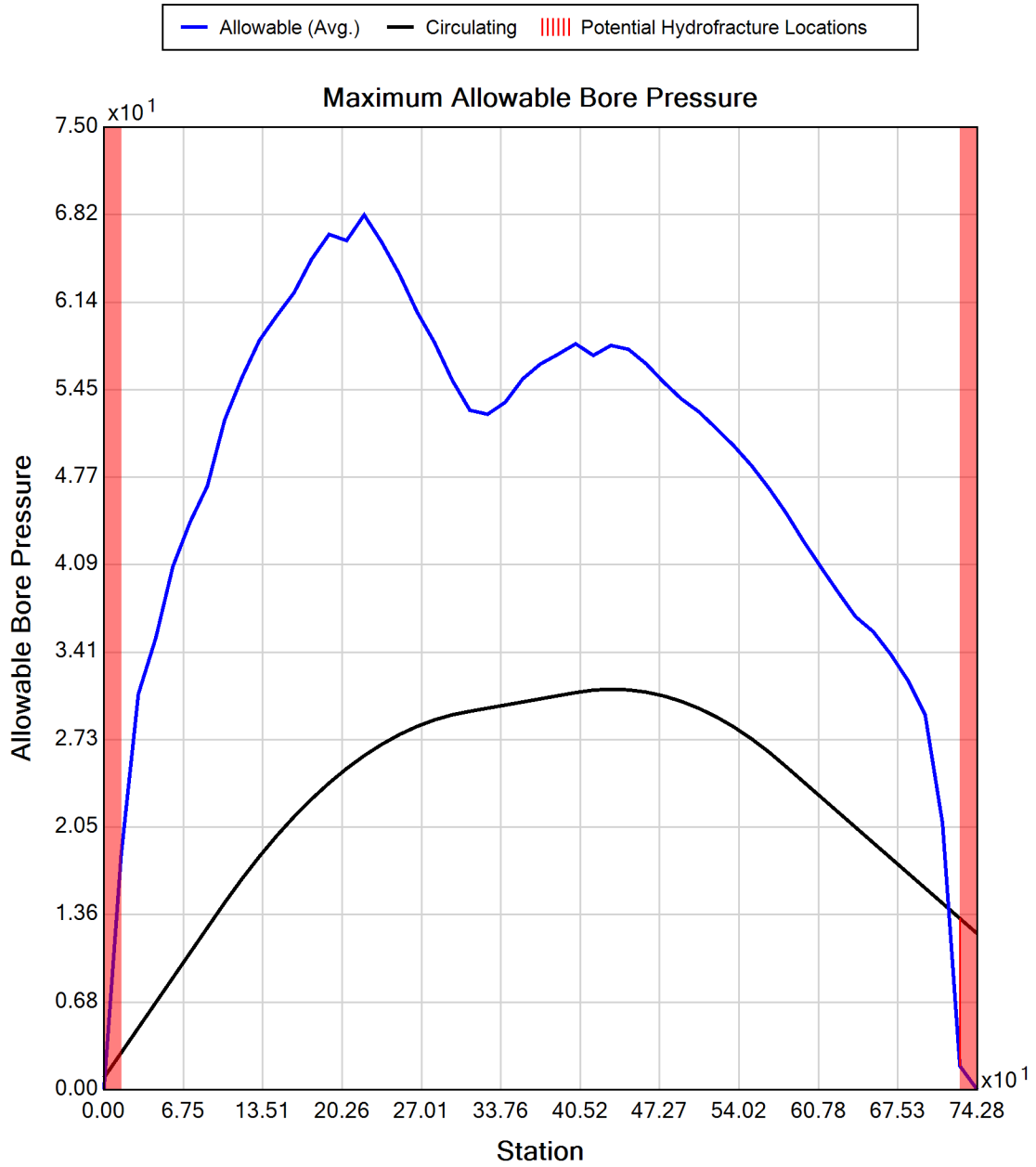
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 117
DWG C-317.2

Input Summary

Start Coordinate	(0.00, 0.00, 105.20) ft
End Coordinate	(790.00, 0.00, 101.50) ft
Project Length	790.00 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: 6

Soil Layer #1 USCS, Sand (S), SP

Depth: 2.00 ft

Unit Weight: 14.6454 (dry), 16.9323 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #3 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]

Soil Layer #4 USCS, Silt (M), ML

Depth: 29.00 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 #5 USCS, Silt (M), MH

Depth: 10.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

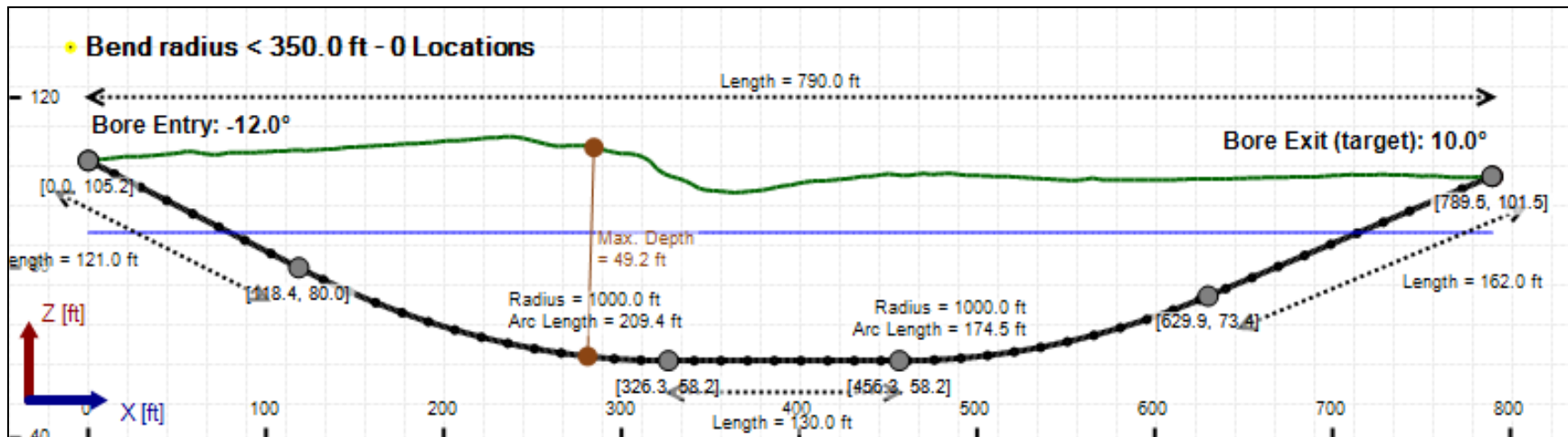
Soil Layer #6 USCS, Silt (M), ML

Depth: 37.00 ft

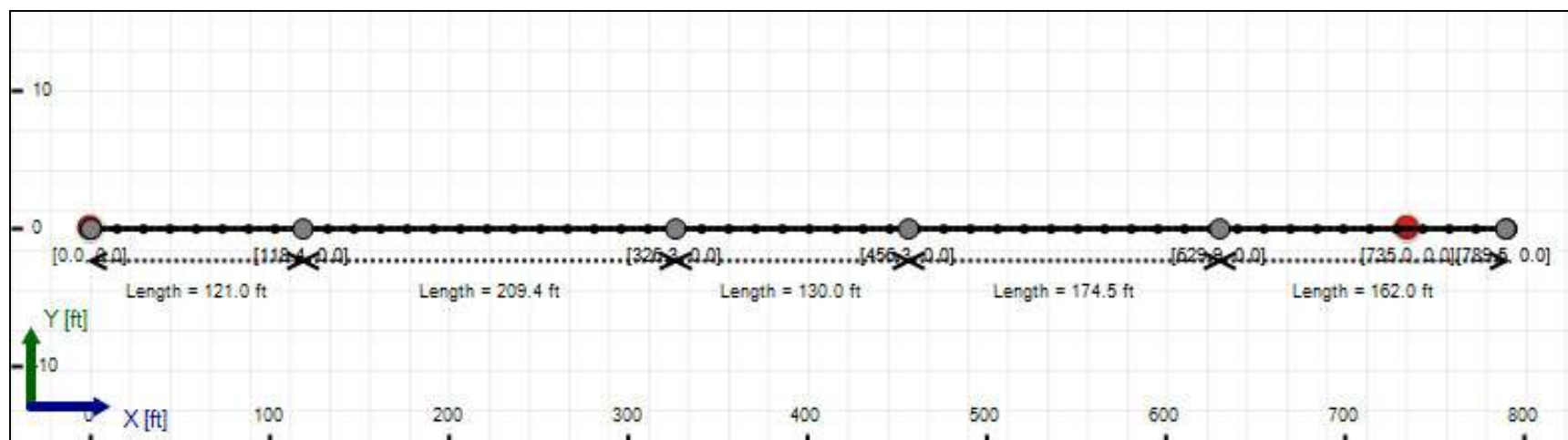
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

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: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 810.00 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	22.2	26.9
Water Pressure	13.0	12.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	35.3	39.5
Deflection		
Earth Load Deflection	6.056	7.481
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	6.188	7.613
Compressive Stress [psi]		
Compressive Wall Stress	158.7	177.7

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	14050.5	14050.5
Pullback Stress [psi]	391.8	391.8
Pullback Strain	6.815E-3	6.815E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	391.8	416.2
Tensile Strain	6.815E-3	7.686E-3

Net External Pressure = 26.2 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.188	7.5	1.2	OK
Unconstrained Collapse [psi]	35.3	79.5	2.3	OK
Compressive Wall Stress [psi]	158.7	1150.0	7.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	40.6	232.7	5.7	OK
Tensile Stress [psi]	416.2	1200.0	2.9	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	8.75 in	67.239 psi	59.266 psi
1	8.75 in	12.00 in	67.217 psi	59.239 psi
2	12.00 in	16.13 in	67.179 psi	59.192 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): 70.00 US (liquid) gallon/min

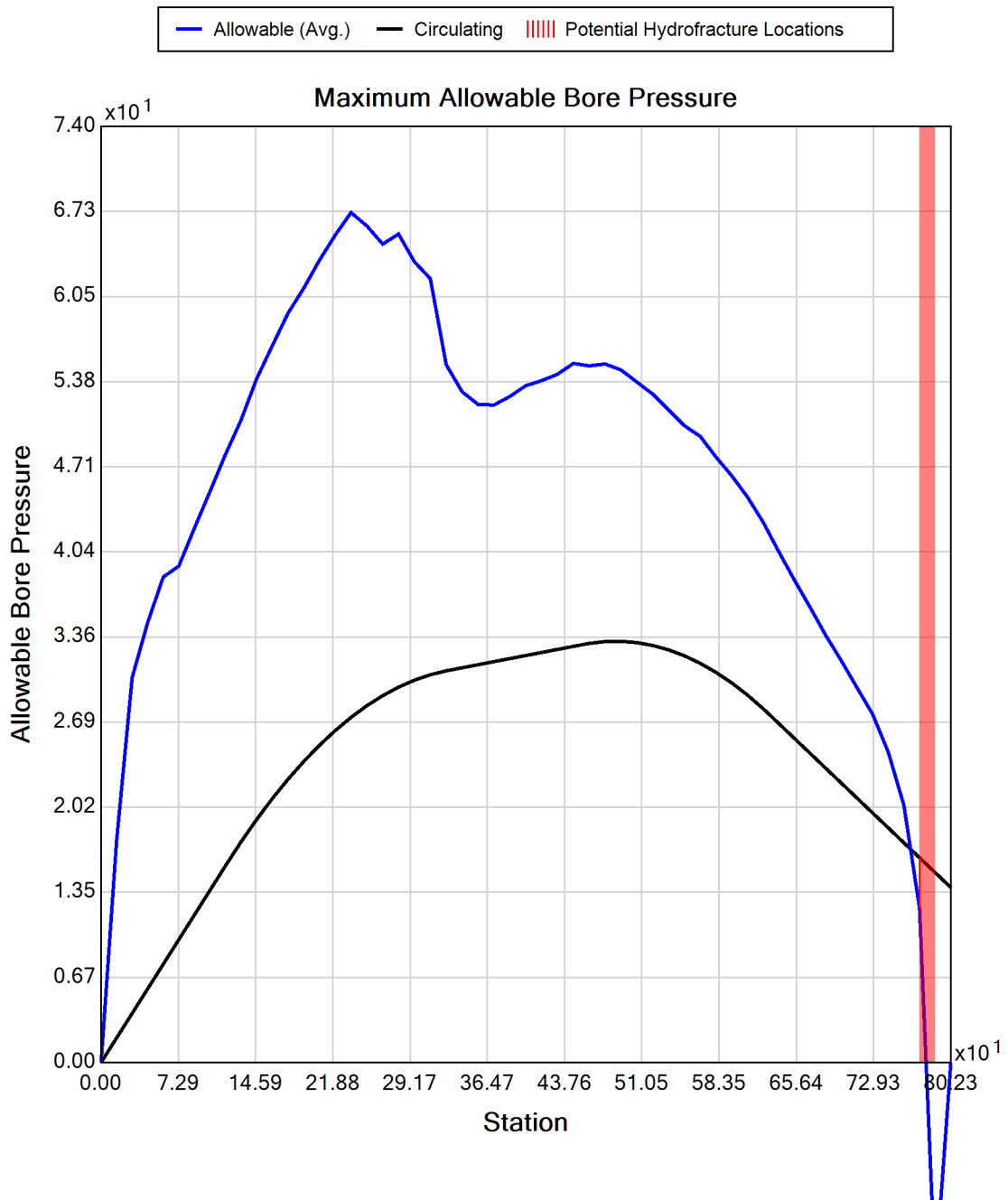
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





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Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 117
DWG C-317.2

Input Summary

Start Coordinate	(0.00, 0.00, 105.20) ft
End Coordinate	(790.00, 0.00, 101.50) ft
Project Length	790.00 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: 6

Soil Layer #1 USCS, Sand (S), SP

Depth: 2.00 ft

Unit Weight: 14.6454 (dry), 16.9323 (sat) [lb/US (liquid) gallon]

Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #3 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]

Soil Layer #4 USCS, Silt (M), ML

Depth: 29.00 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 #5 USCS, Silt (M), MH

Depth: 10.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

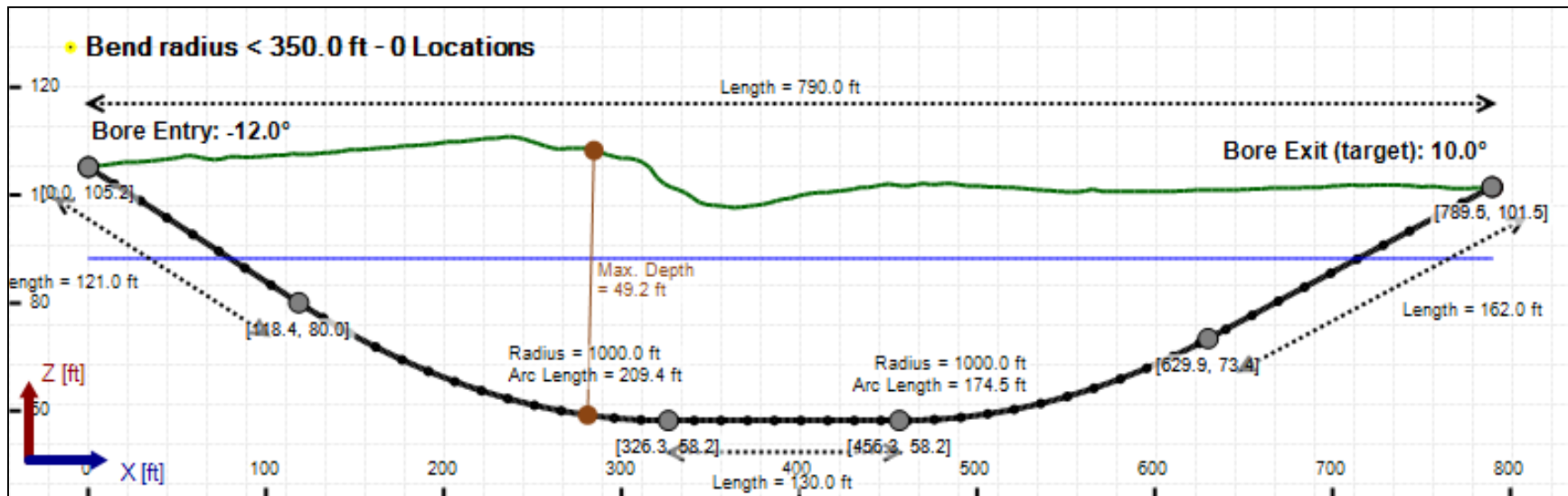
Soil Layer #6 USCS, Silt (M), ML

Depth: 37.00 ft

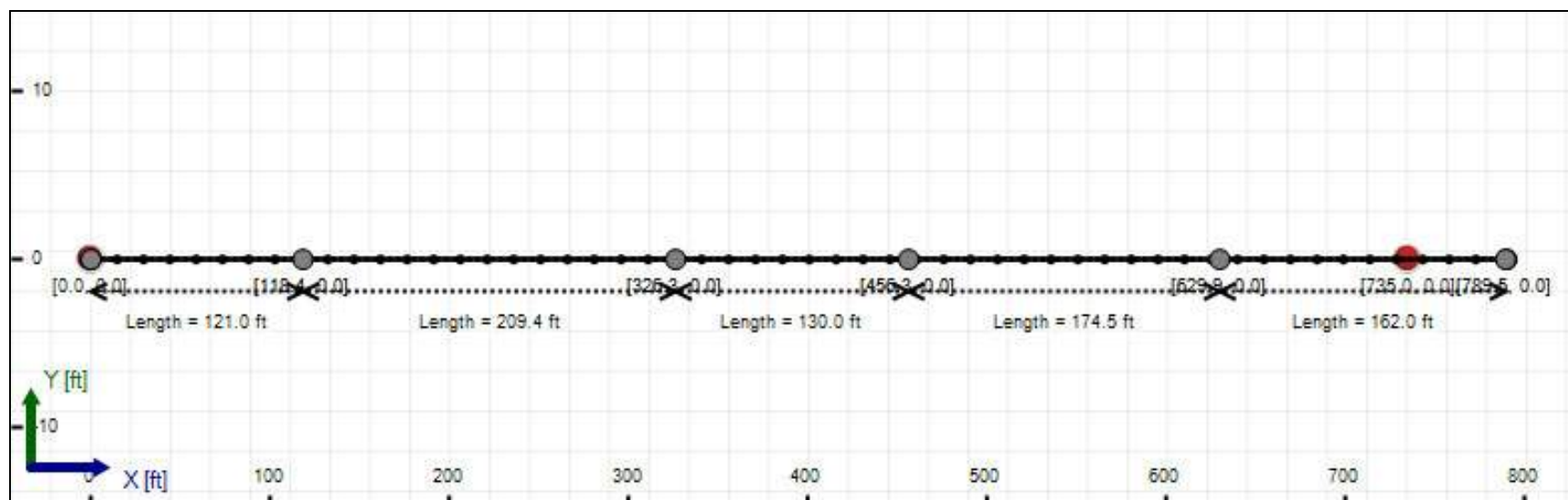
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

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: HDPE
Classification: IPS
Pipe OD: 3" (3.5")
Pipe DR: 9
Pipe Length: 810.00 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	22.2	26.9
Water Pressure	13.0	12.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	35.3	39.5
Deflection		
Earth Load Deflection	6.056	7.481
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	6.099	7.524
Compressive Stress [psi]		
Compressive Wall Stress	158.7	177.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1602.0	1602.0
Pullback Stress [psi]	421.5	421.5
Pullback Strain	7.330E-3	7.330E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	421.5	428.5
Tensile Strain	7.330E-3	7.597E-3

Net External Pressure = 26.2 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	6.099	7.5	1.2	OK
Unconstrained Collapse [psi]	35.3	80.2	2.3	OK
Compressive Wall Stress [psi]	158.7	1150.0	7.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	40.6	232.8	5.7	OK
Tensile Stress [psi]	428.5	1200.0	2.8	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	8.75 in	67.239 psi	59.266 psi
1	8.75 in	12.00 in	67.217 psi	59.239 psi
2	12.00 in	16.13 in	67.179 psi	59.192 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): 70.00 US (liquid) gallon/min

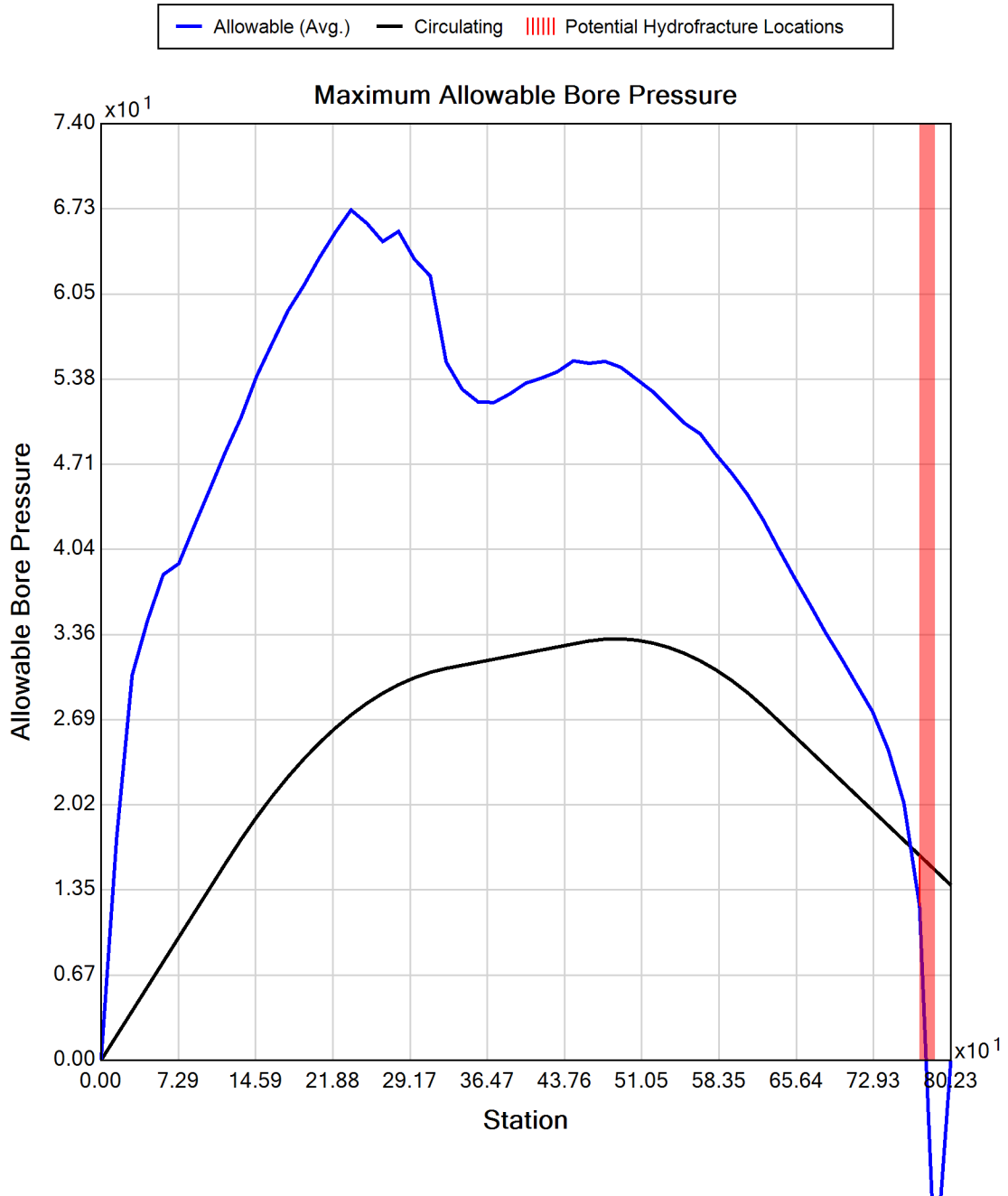
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2 & 3 Equivalent Pipe Bundle
HDD 117
DWG C-317.2

Input Summary

Start Coordinate	(0.00, 0.00, 105.20) ft
End Coordinate	(790.00, 0.00, 101.50) ft
Project Length	790.00 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: 810.00 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	22.2	26.9
Water Pressure	13.0	12.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	35.3	39.5
Deflection		
Earth Load Deflection	27.829	34.373
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	28.519	35.063
Compressive Stress [psi]		
Compressive Wall Stress	252.2	282.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	11898.2	11898.2
Pullback Stress [psi]	297.1	297.1
Pullback Strain	5.167E-3	5.167E-3
Bending Stress [psi]	33.5	33.5
Bending Strain	5.833E-4	5.833E-4
Tensile Stress [psi]	330.6	330.6
Tensile Strain	6.334E-3	6.334E-3

Net External Pressure = 16.1 [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]	20.2	50.2	2.5	OK
Tensile Stress [psi]	330.6	1200.0	3.6	OK



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 118
DWG C-318

Input Summary

Start Coordinate	(0.00, 0.00, 134.19) ft
End Coordinate	(850.00, 0.00, 122.96) ft
Project Length	850.00 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), GW

From Assistant

Unit Weight: 17.3250 (dry), 18.9651 (sat) [lb/US (liquid) gallon]

Phi: 40.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks

From Assistant

Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Diagram illustrating a borehole layout with a horizontal section and a curved section.

Horizontal Section:

- Length = 850.0 ft
- Bore Entry: -14.0°
- Bore Exit (target): 12.0°

Curved Section:

- Radius = 1000.0 ft
- Arc Length = 244.3 ft

Vertical Segment:

- Length = 56.0 ft

Horizontal Segment:

- Length = 100.0 ft

Coordinate System:

- X-axis: X [ft]
- Y-axis: Y [ft]

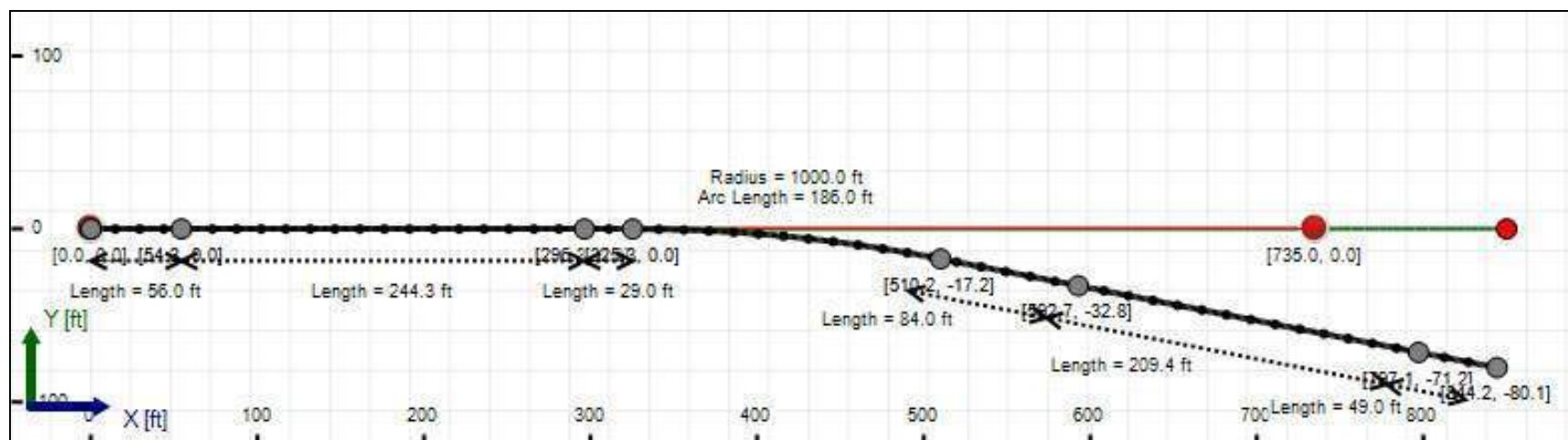
Key Points and Coordinates:

- Point 1: $[0.0, 134.2]$
- Point 2: $[54.3, 120.6]$
- Point 3: $[296.3, 80.9]$
- Point 4: $[325.3, 80.9]$
- Point 5: $[510.2, 80.9]$
- Point 6: $[582.7, 90.9]$
- Point 7: $[797.1, 112.8]$
- Point 8: $[844.2, 123.0]$

Lengths:

- Length = 29.0 ft
- Length = 186.0 ft
- Length = 84.0 ft

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: 869.99 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	21.0	31.9
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	21.0	31.9
Deflection		
Earth Load Deflection	5.731	8.693
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.863	8.825
Compressive Stress [psi]		
Compressive Wall Stress	94.7	143.6

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	15404.2	15404.2
Pullback Stress [psi]	429.6	429.6
Pullback Strain	7.471E-3	7.471E-3
Bending Stress [psi]	25.8	25.8
Bending Strain	4.479E-4	4.479E-4
Tensile Stress [psi]	455.4	455.4
Tensile Strain	8.367E-3	8.367E-3

Net External Pressure = 19.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.863	7.5	1.3	OK
Unconstrained Collapse [psi]	27.8	81.9	2.9	OK
Compressive Wall Stress [psi]	94.7	1150.0	12.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	38.1	230.3	6.0	OK
Tensile Stress [psi]	455.4	1200.0	2.6	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	8.75 in	897.089 psi	1329.070 psi
1	8.75 in	12.00 in	896.960 psi	1328.895 psi
2	12.00 in	16.13 in	896.737 psi	1328.594 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 inadvertent 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): 70.00 US (liquid) gallon/min

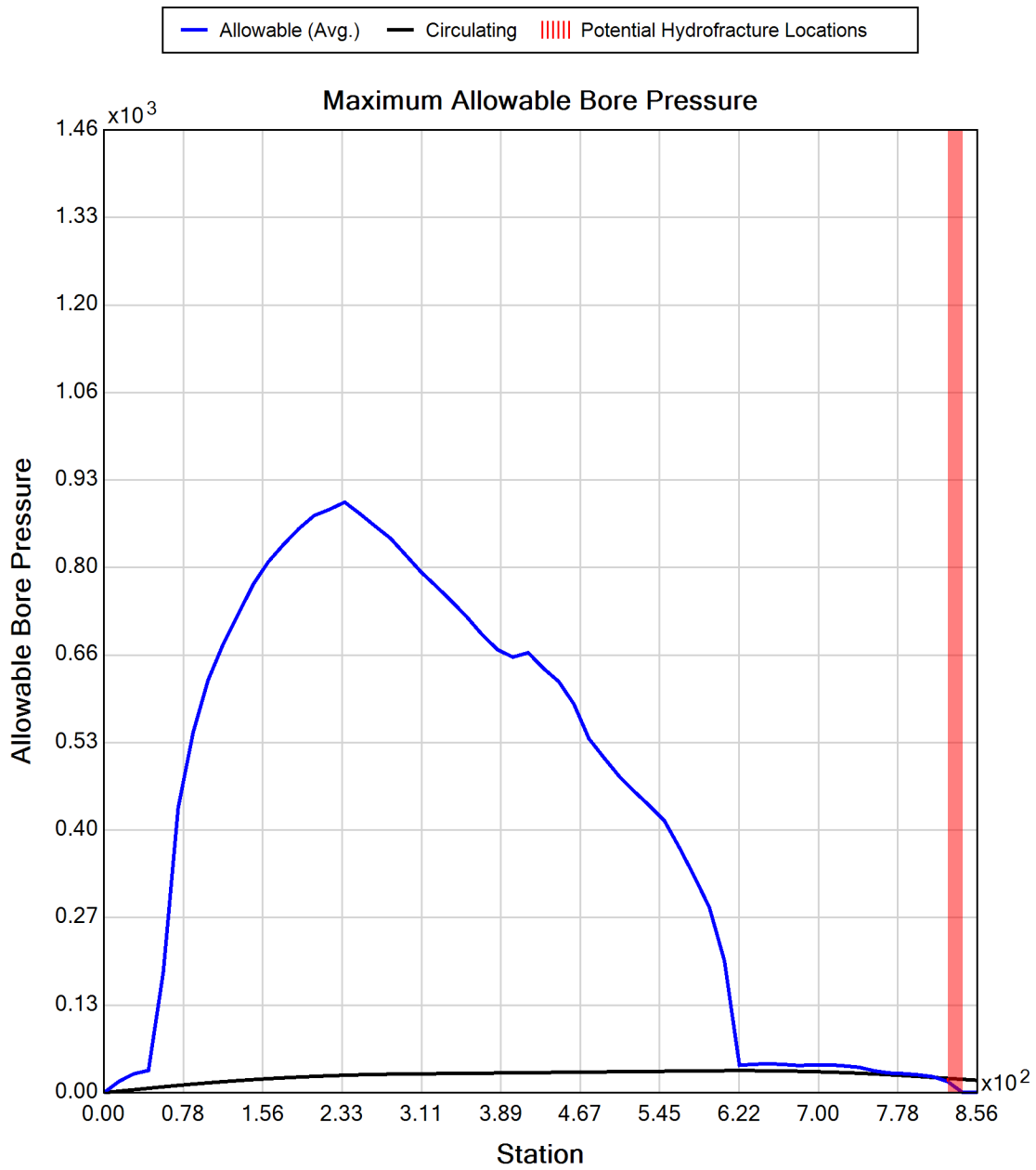
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
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United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 118
DWG C-318.2

Input Summary

Start Coordinate	(0.00, 0.00, 133.93) ft
End Coordinate	(854.50, 0.00, 121.52) ft
Project Length	854.50 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), GW

From Assistant

Unit Weight: 17.3250 (dry), 18.9651 (sat) [lb/US (liquid) gallon]

Phi: 40.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

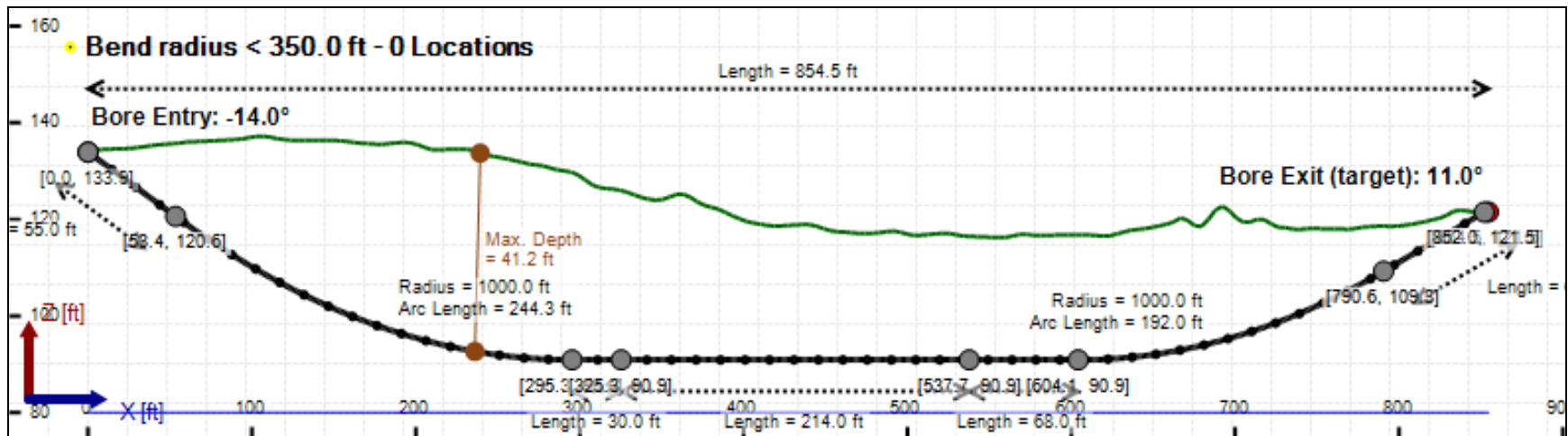
Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks

From Assistant

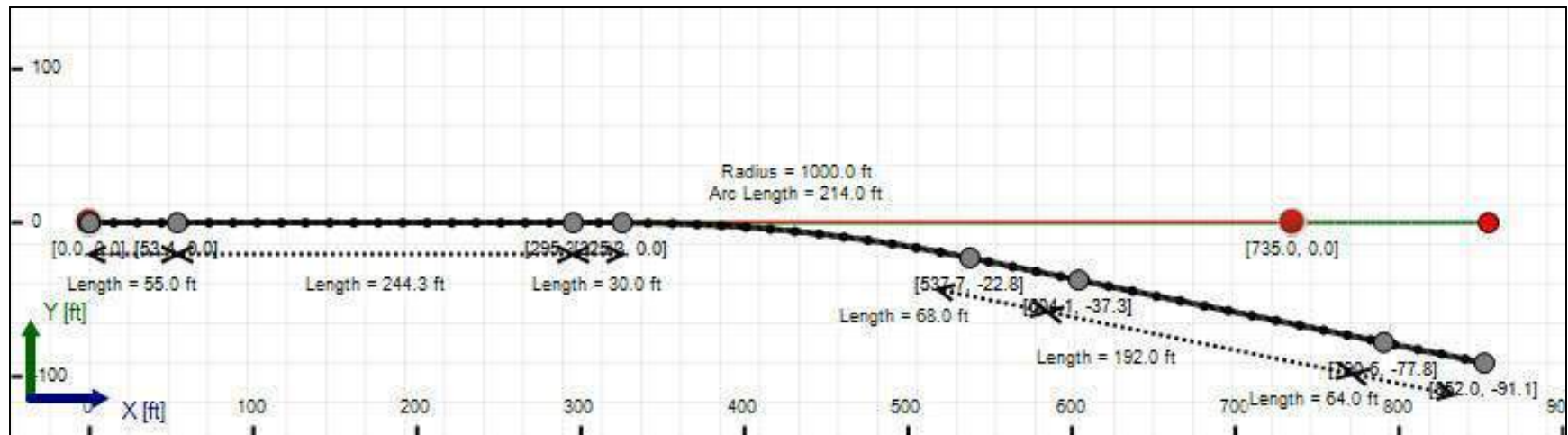
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 869.99 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	18.8	31.2
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.8	31.2
Deflection		
Earth Load Deflection	5.112	8.492
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.244	8.624
Compressive Stress [psi]		
Compressive Wall Stress	84.5	140.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	15189.1	15189.1
Pullback Stress [psi]	423.6	423.6
Pullback Strain	7.367E-3	7.367E-3
Bending Stress [psi]	25.8	25.8
Bending Strain	4.479E-4	4.479E-4
Tensile Stress [psi]	449.4	449.4
Tensile Strain	8.263E-3	8.263E-3

Net External Pressure = 19.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.244	7.5	1.4	OK
Unconstrained Collapse [psi]	27.9	87.2	3.1	OK
Compressive Wall Stress [psi]	84.5	1150.0	13.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	37.9	230.5	6.1	OK
Tensile Stress [psi]	449.4	1200.0	2.7	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	8.75 in	903.243 psi	1328.445 psi
1	8.75 in	12.00 in	903.110 psi	1328.261 psi
2	12.00 in	16.13 in	902.881 psi	1327.943 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): 70.00 US (liquid) gallon/min

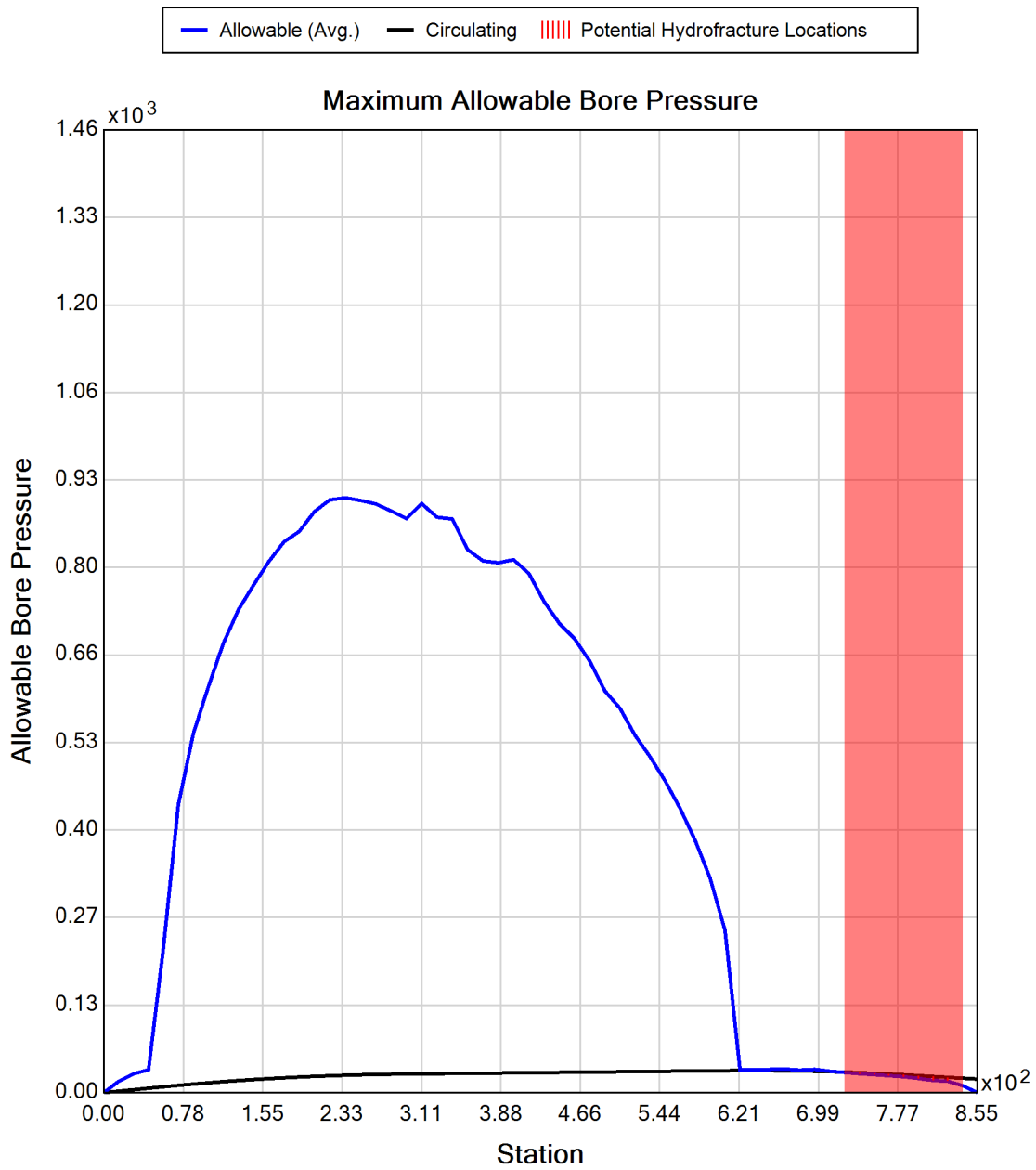
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





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Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer:

Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description:

Segment 11 (Package 7A)
Conduit 3
HDD 118
DWG C-318.2

Input Summary

Start Coordinate	(0.00, 0.00, 133.93) ft
End Coordinate	(854.50, 0.00, 121.52) ft
Project Length	854.50 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), GW

From Assistant

Unit Weight: 17.3250 (dry), 18.9651 (sat) [lb/US (liquid) gallon]

Phi: 40.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

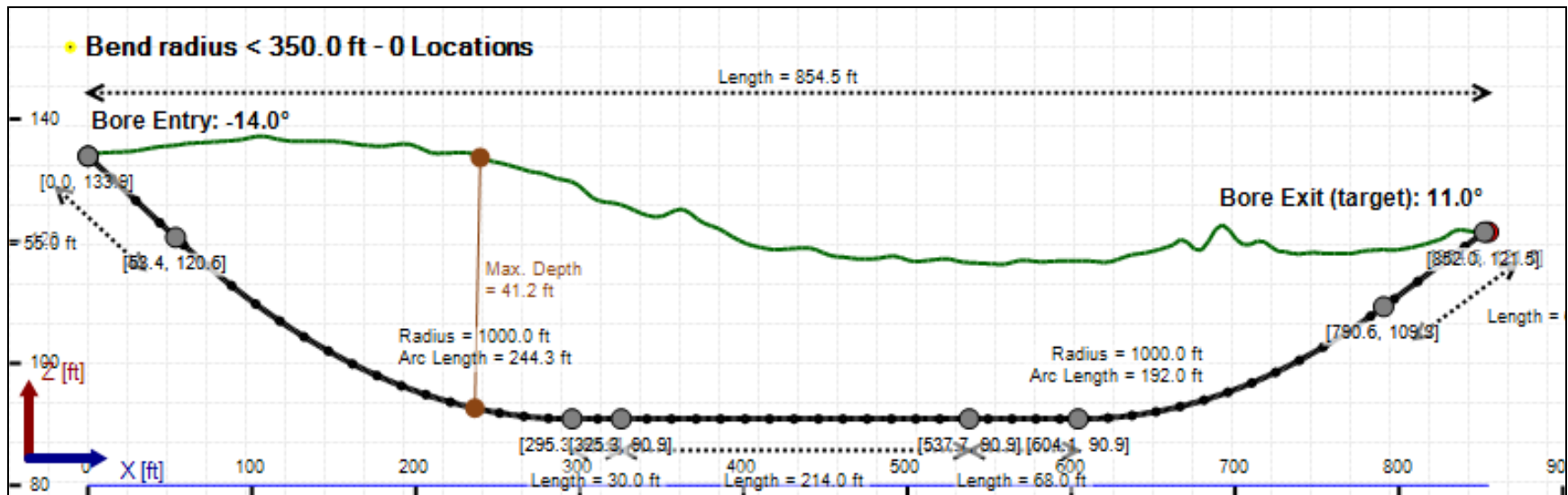
Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks

From Assistant

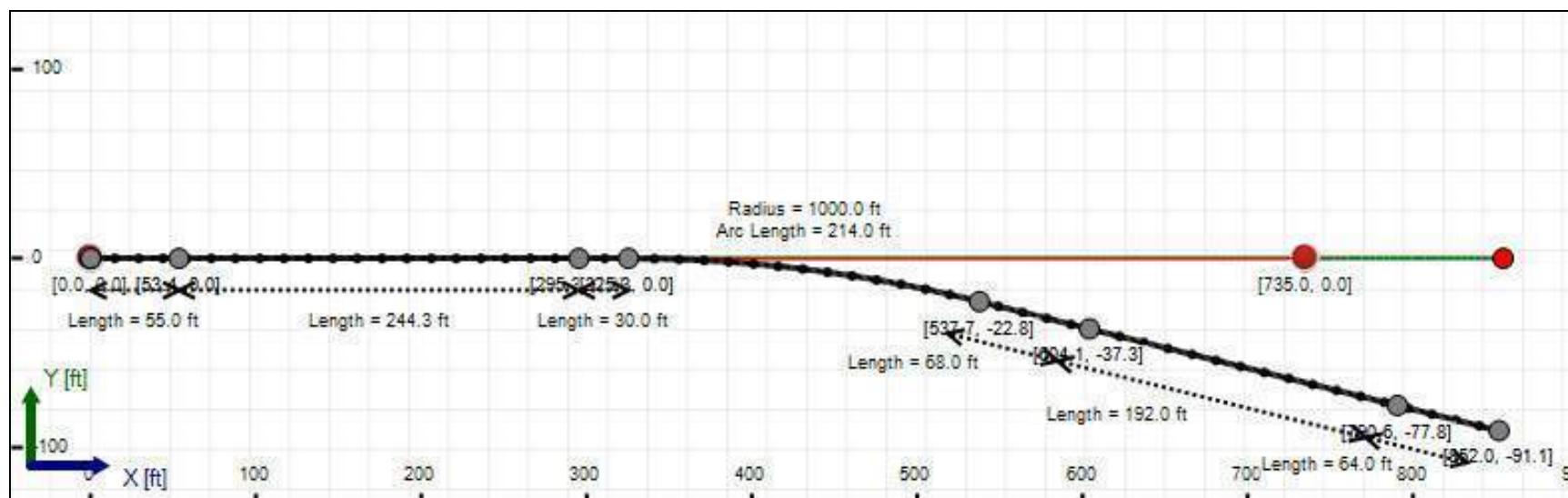
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 869.99 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	18.8	31.2
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.8	31.2
Deflection		
Earth Load Deflection	5.112	8.492
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	5.155	8.535
Compressive Stress [psi]		
Compressive Wall Stress	84.5	140.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	1722.7	1722.7
Pullback Stress [psi]	453.2	453.2
Pullback Strain	7.882E-3	7.882E-3
Bending Stress [psi]	8.4	8.4
Bending Strain	1.458E-4	1.458E-4
Tensile Stress [psi]	461.6	461.6
Tensile Strain	8.174E-3	8.174E-3

Net External Pressure = 19.4 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.155	7.5	1.5	OK
Unconstrained Collapse [psi]	27.9	87.8	3.2	OK
Compressive Wall Stress [psi]	84.5	1150.0	13.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	37.9	230.5	6.1	OK
Tensile Stress [psi]	461.6	1200.0	2.6	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	8.75 in	903.243 psi	1328.445 psi
1	8.75 in	12.00 in	903.110 psi	1328.261 psi
2	12.00 in	16.13 in	902.881 psi	1327.943 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): 70.00 US (liquid) gallon/min

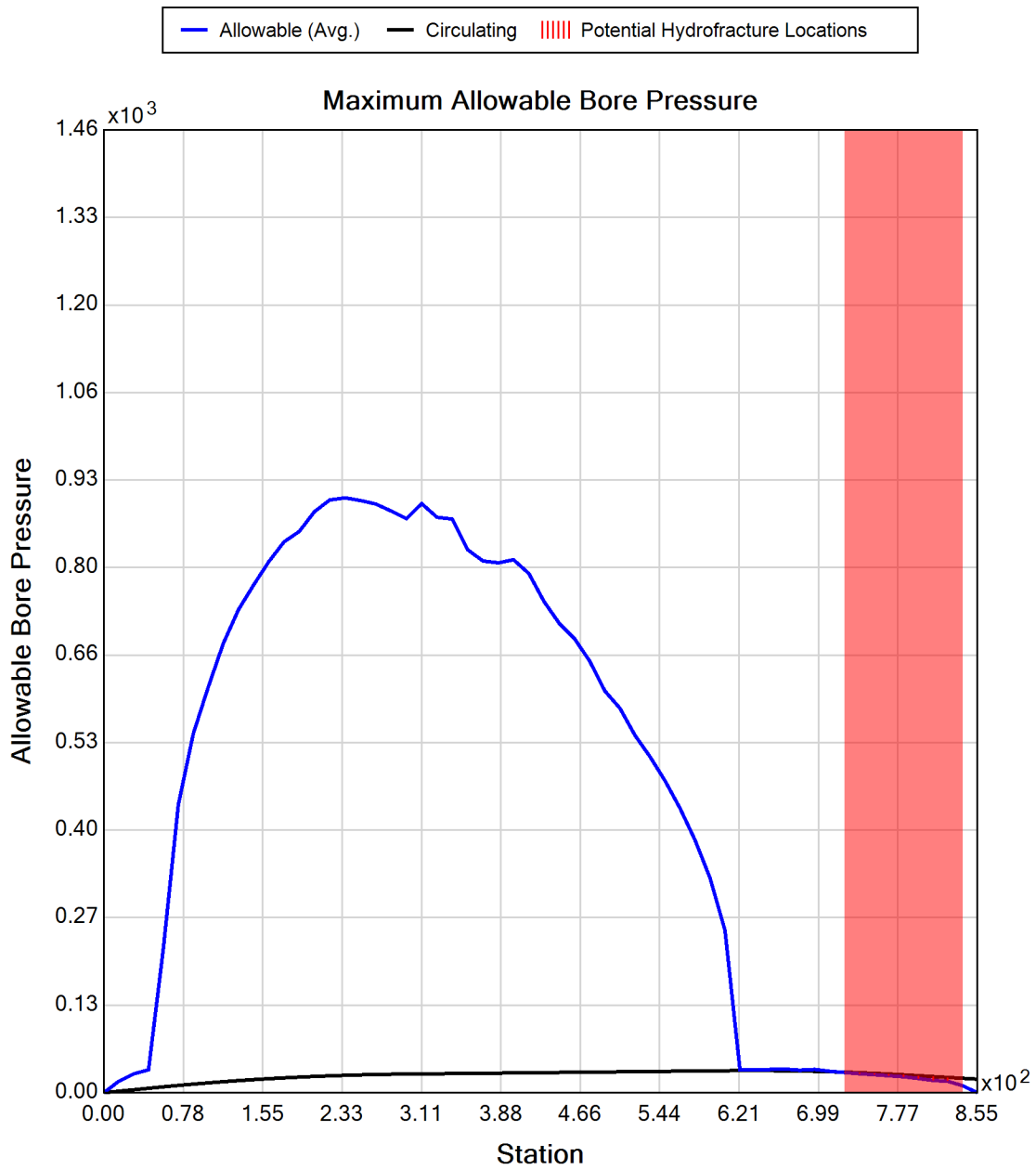
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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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: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2 & 3 Equivalent Pipe Bundle
HDD 118
DWG C-318.2

Input Summary

Start Coordinate	(0.00, 0.00, 133.93) ft
End Coordinate	(854.50, 0.00, 121.52) ft
Project Length	854.50 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: 869.99 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	18.8	31.2
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.8	31.2
Deflection		
Earth Load Deflection	23.489	39.021
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	24.179	39.711
Compressive Stress [psi]		
Compressive Wall Stress	134.2	222.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	12736.8	12736.8
Pullback Stress [psi]	318.0	318.0
Pullback Strain	5.531E-3	5.531E-3
Bending Stress [psi]	33.5	33.5
Bending Strain	5.833E-4	5.833E-4
Tensile Stress [psi]	351.6	351.6
Tensile Strain	6.698E-3	6.698E-3

Net External Pressure = 15.2 [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]	19.3	49.9	2.6	OK
Tensile Stress [psi]	351.6	1200.0	3.4	OK



Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 119
DWG C-319

Input Summary

Start Coordinate	(0.00, 0.00, 94.50) ft
End Coordinate	(840.00, 0.00, 116.17) ft
Project Length	840.00 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: 6

Soil Layer #1 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #2 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 32.00, S.M.: 100.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Clay (C), CH

From Assistant

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #4 USCS, Silt (M), ML

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #5 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

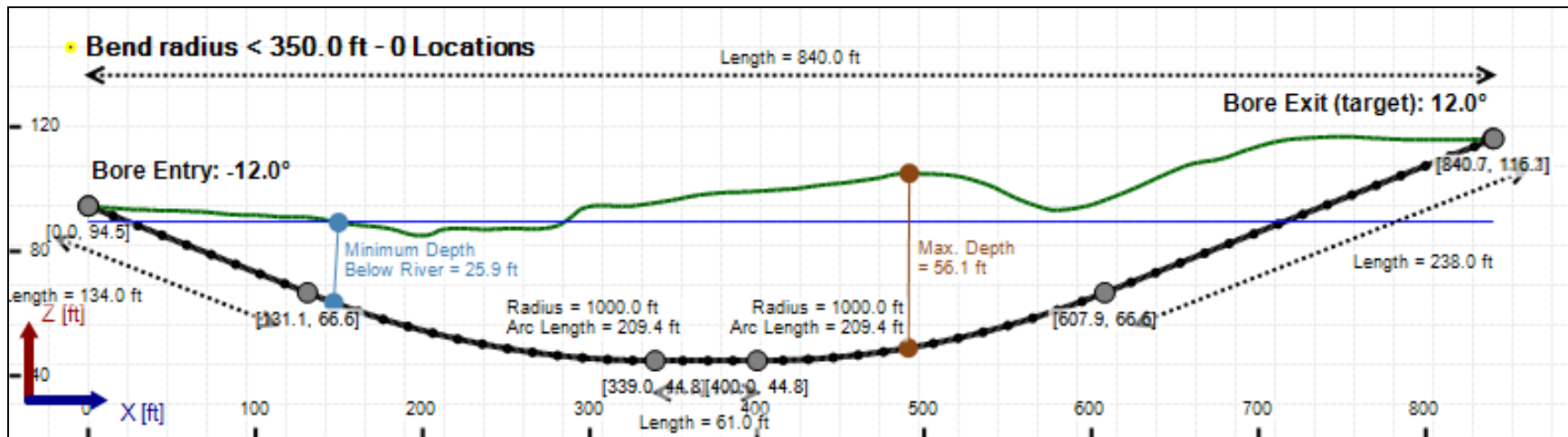
Soil Layer #6 USCS, Clay (C), CL

From Assistant

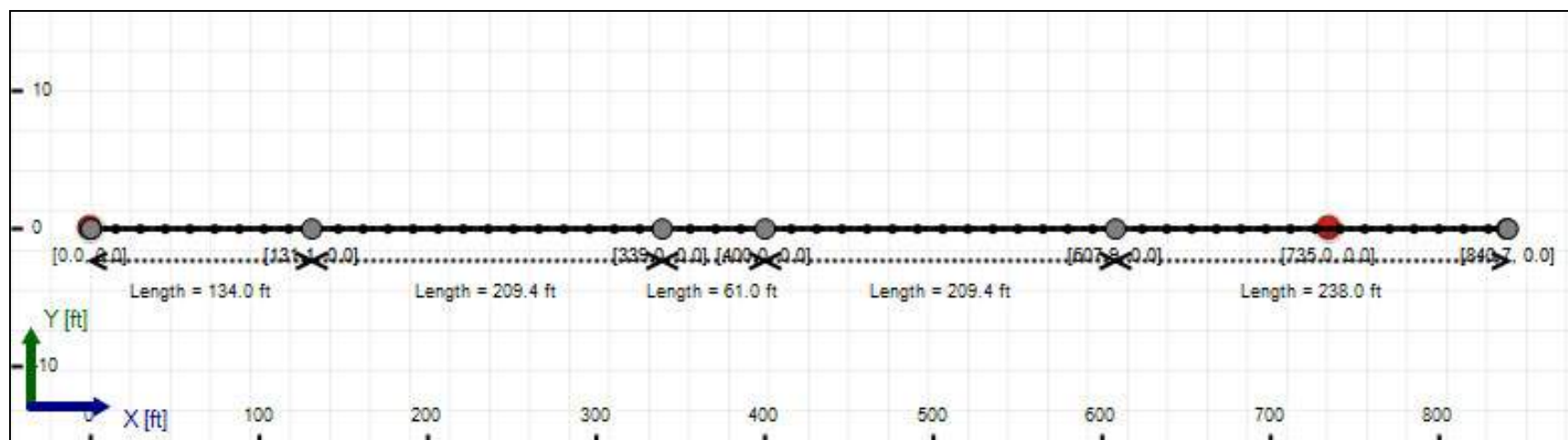
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [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: 855.00 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	3.1	24.7
Water Pressure	19.4	18.9
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	22.5	43.6
Deflection		
Earth Load Deflection	2.065	4.733
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	2.125	4.793
Compressive Stress [psi]		
Compressive Wall Stress	202.3	392.7

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	11045.4	11045.4
Pullback Stress [psi]	900.8	900.8
Pullback Strain	2.252E-3	2.252E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	900.8	1042.5
Tensile Strain	2.252E-3	2.966E-3

Net External Pressure = 40.7 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.125	7.5	3.5	OK
Unconstrained Collapse [psi]	46.8	179.8	3.8	OK
Compressive Wall Stress [psi]	202.3	3200.0	15.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	56.8	171.9	3.0	OK
Tensile Stress [psi]	1042.5	2800.0	2.7	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	8.75 in	88.204 psi	77.160 psi
1	8.75 in	12.00 in	88.177 psi	77.154 psi
2	12.00 in	12.94 in	88.167 psi	77.151 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 inadvertent 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): 70.00 US (liquid) gallon/min

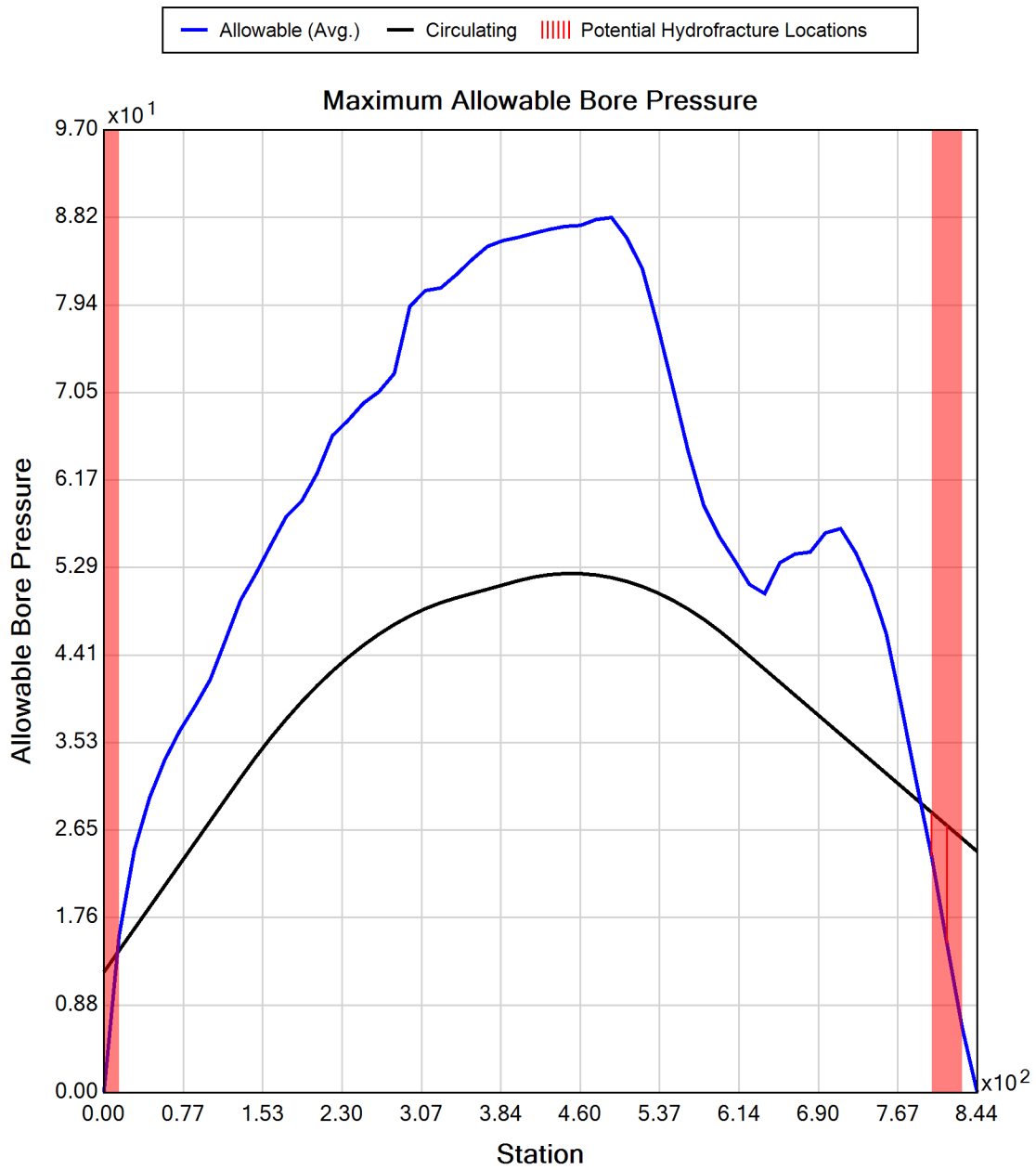
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Designer: Aaron Coady
Tetra Tech Rooney
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United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 119
DWG C-319.2

Input Summary

Start Coordinate	(0.00, 0.00, 95.00) ft
End Coordinate	(840.00, 0.00, 116.84) ft
Project Length	840.00 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: 6

Soil Layer #1 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #2 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 32.00, S.M.: 100.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Clay (C), CH

From Assistant

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #4 USCS, Silt (M), ML

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #5 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #6 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Bend radius < 350.0 ft - 0 Locations

Length = 840.0 ft

Bore Entry: -12.0°

Bore Exit (target): 12.0°

Minimum Depth Below River = 23 ft

Maximum Depth = 57.6 ft

Radius = 1000.0 ft
Arc Length = 209.4 ft

Length = 136.0 ft

Length = 55.0 ft

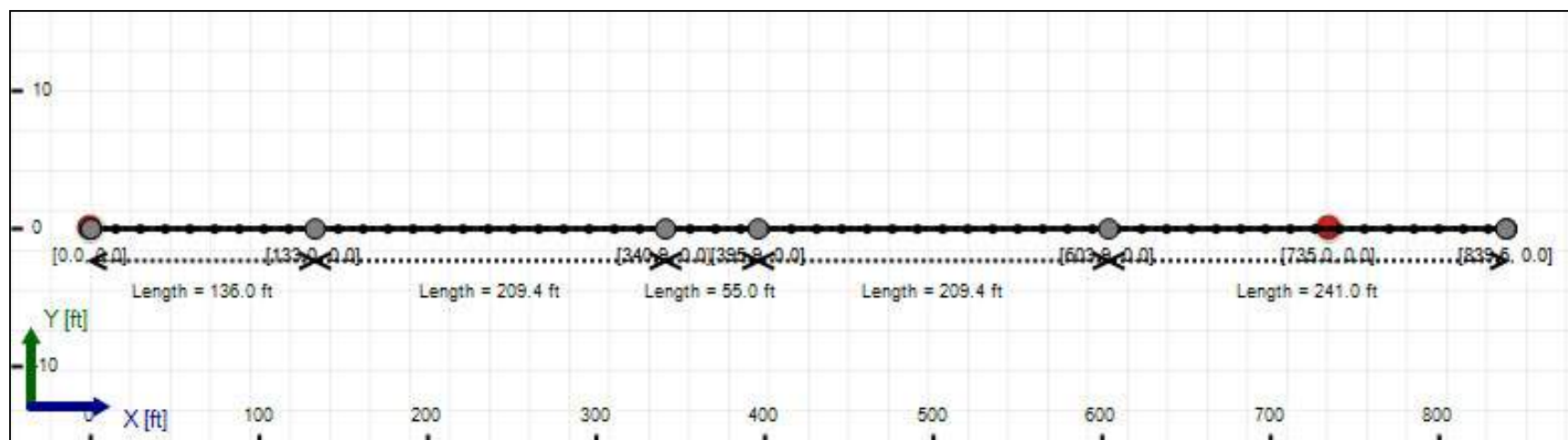
Length = 241.0 ft

Stationing points: [0.0, 95.0], [123.0, 66.7], [340.9, 44.4], [395.9, 44.9], [603.9, 66.7], [839.6, 116.8]

Elevation Z [ft]

Stationing X [ft]

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: 855.00 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	3.2	26.0
Water Pressure	19.3	18.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	22.5	44.4
Deflection		
Earth Load Deflection	2.000	4.869
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	2.060	4.928
Compressive Stress [psi]		
Compressive Wall Stress	202.6	400.0

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	11066.5	11066.5
Pullback Stress [psi]	902.5	902.5
Pullback Strain	2.256E-3	2.256E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	902.5	1039.5
Tensile Strain	2.256E-3	2.958E-3

Net External Pressure = 41.0 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.060	7.5	3.6	OK
Unconstrained Collapse [psi]	47.3	179.6	3.8	OK
Compressive Wall Stress [psi]	202.6	3200.0	15.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	57.4	172.1	3.0	OK
Tensile Stress [psi]	1039.5	2800.0	2.7	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	8.75 in	90.150 psi	78.459 psi
1	8.75 in	12.00 in	90.124 psi	78.453 psi
2	12.00 in	12.94 in	90.115 psi	78.450 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 inadvertent 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): 70.00 US (liquid) gallon/min

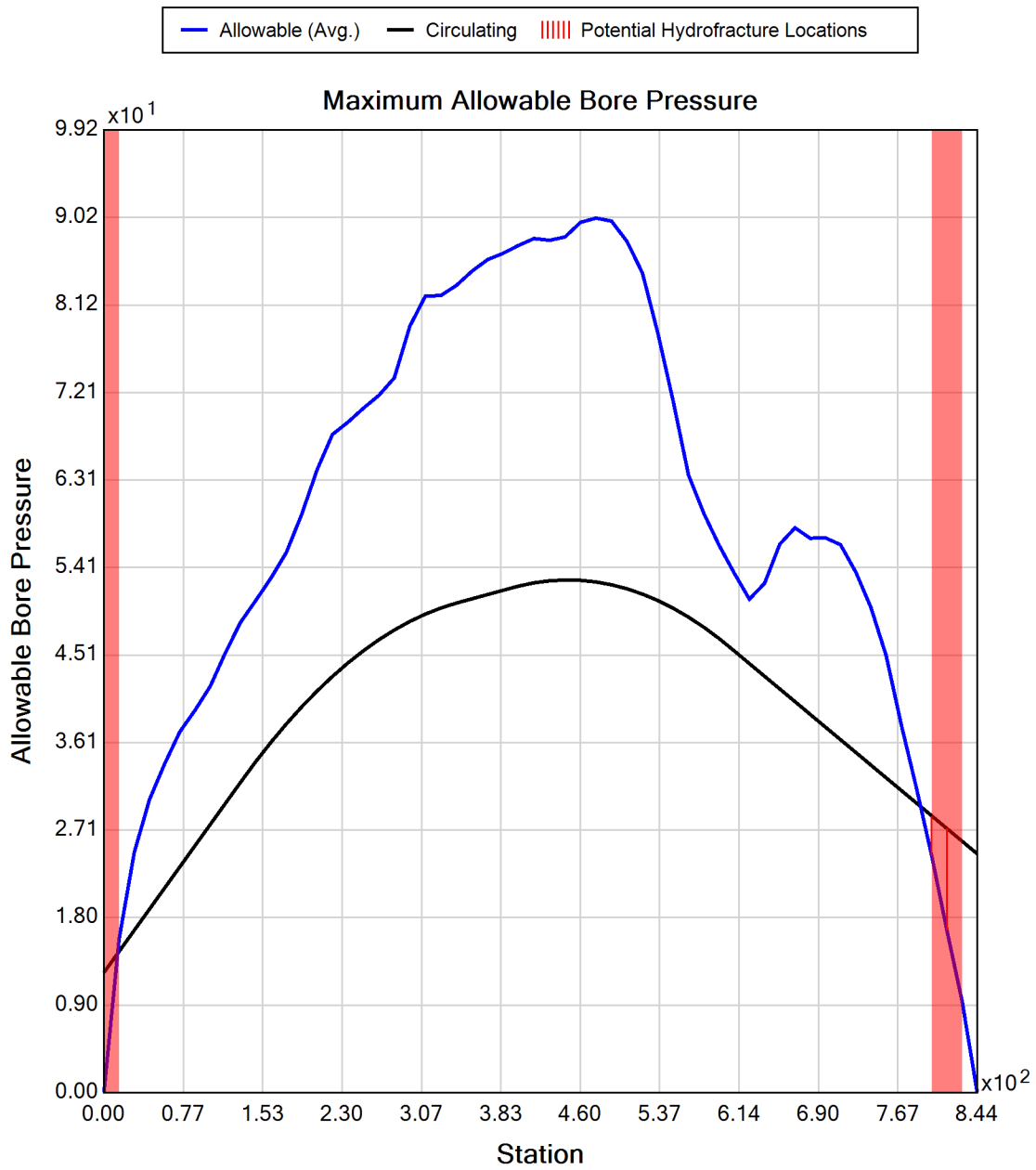
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 119
DWG C-319.2

Input Summary

Start Coordinate	(0.00, 0.00, 95.00) ft
End Coordinate	(840.00, 0.00, 116.84) ft
Project Length	840.00 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: 6

Soil Layer #1 USCS, Clay (C), CL

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #2 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 32.00, S.M.: 100.00, Coh: 0.00 [psi]

Soil Layer #3 USCS, Clay (C), CH

From Assistant

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #4 USCS, Silt (M), ML

From Assistant

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #5 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

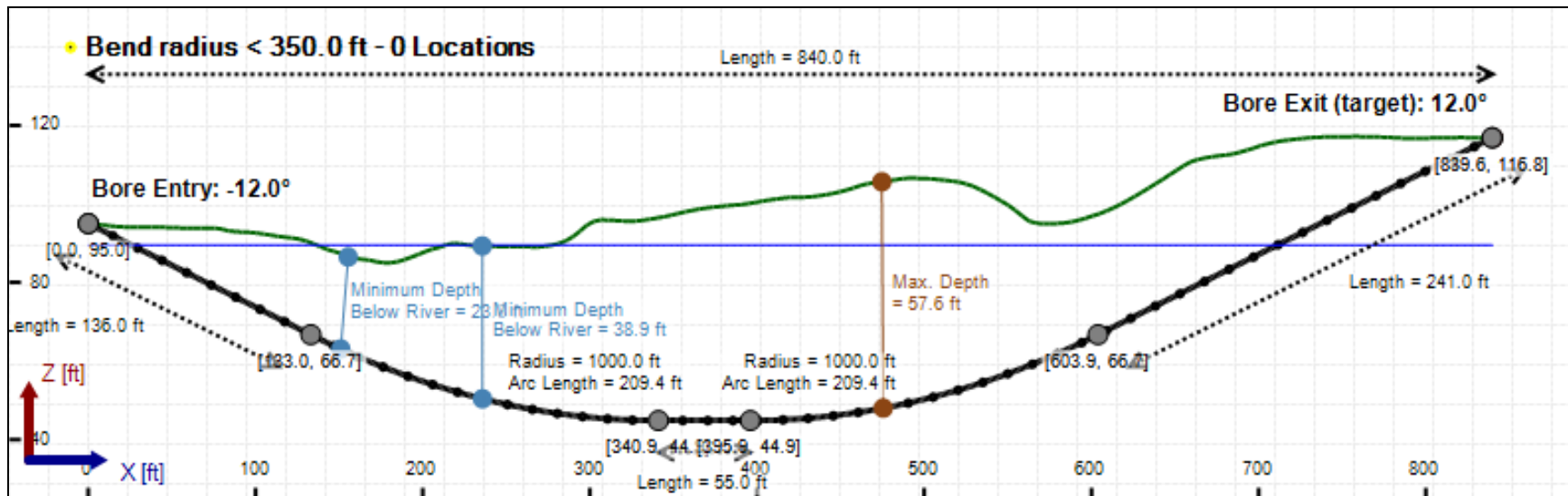
Soil Layer #6 USCS, Clay (C), CL

From Assistant

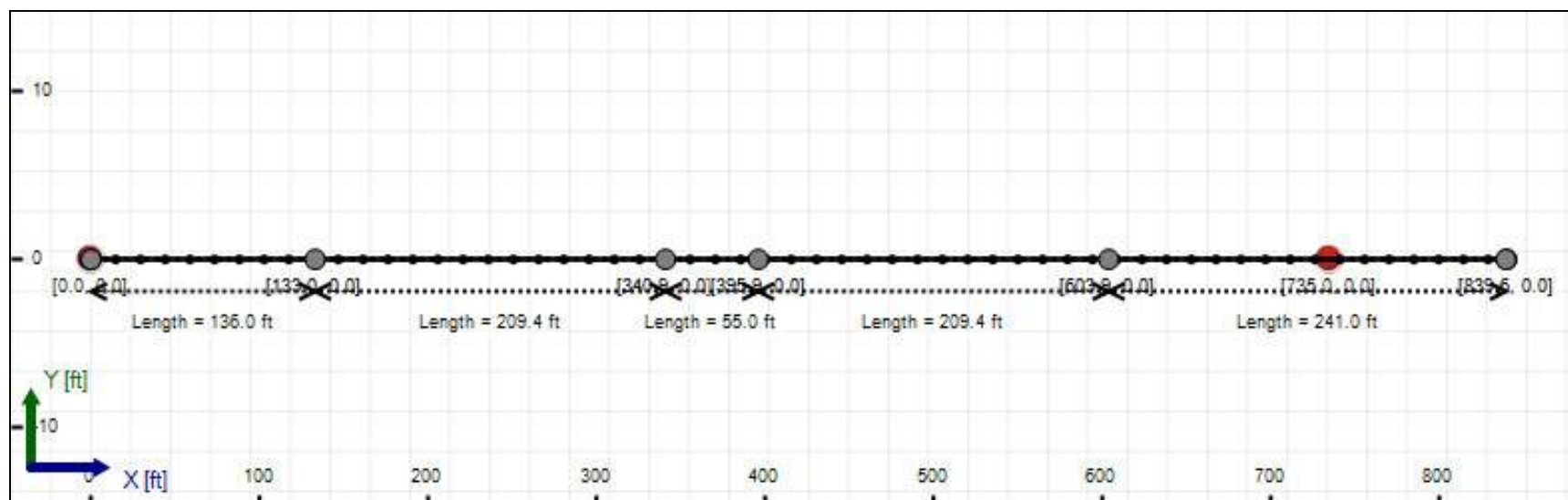
Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [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: 855.00 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	1.8	26.0
Water Pressure	19.3	18.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	21.2	44.4
Deflection		
Earth Load Deflection	2.475	7.197
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	2.518	7.240
Compressive Stress [psi]		
Compressive Wall Stress	95.3	200.0

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	1862.3	1862.3
Pullback Stress [psi]	490.0	490.0
Pullback Strain	8.521E-3	8.521E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	490.0	496.4
Tensile Strain	8.521E-3	8.780E-3

Net External Pressure = 43.0 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.518	7.5	3.0	OK
Unconstrained Collapse [psi]	47.3	131.5	2.8	OK
Compressive Wall Stress [psi]	95.3	1150.0	12.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	57.4	228.6	4.0	OK
Tensile Stress [psi]	496.4	1200.0	2.4	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	8.75 in	90.150 psi	78.459 psi
1	8.75 in	12.00 in	90.124 psi	78.453 psi
2	12.00 in	12.94 in	90.115 psi	78.450 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 inadvertent 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): 70.00 US (liquid) gallon/min

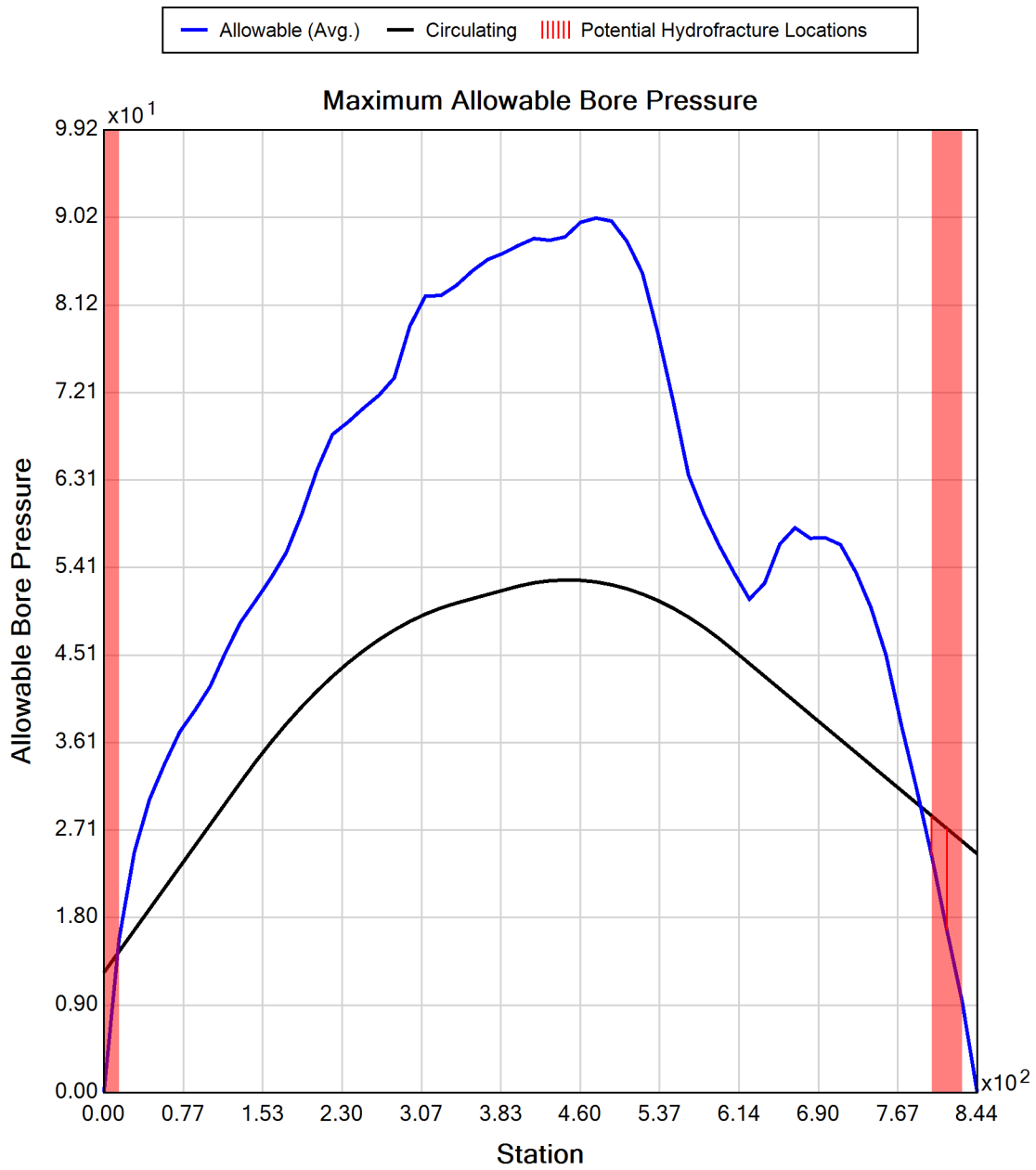
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 & 3 Equivalent Pipe Bundle HDD 119 DWG C-319.2

Input Summary

Start Coordinate	(0.00, 0.00, 95.00) ft
End Coordinate	(840.00, 0.00, 116.84) ft
Project Length	840.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	12.750 in
Pipe DR	25.0
Pipe Thickness	0.51 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: PVC
Classification: IPS
Pipe OD: 12" (12.75")
Pipe DR: 25
Pipe Length: 855.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.59400002161662 ft
Silo Width: 1.59400002161662 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	4.8	26.0
Water Pressure	19.3	18.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	24.0	44.4
Deflection		
Earth Load Deflection	6.121	13.699
Buoyant Deflection	0.237	0.237
Reissner Effect	0	0
Net Deflection	6.357	13.936
Compressive Stress [psi]		
Compressive Wall Stress	300.1	555.5

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	9974.7	9974.7
Pullback Stress [psi]	508.6	508.6
Pullback Strain	1.272E-3	1.272E-3
Bending Stress [psi]	0.0	212.5
Bending Strain	0	5.313E-4
Tensile Stress [psi]	508.6	720.8
Tensile Strain	1.272E-3	2.333E-3

Net External Pressure = 21.0 [psi]

Buoyant Deflection = 0.2

Hydrokinetic Force = 798.4 lb

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.237	7.5	31.7	OK
Unconstrained Collapse [psi]	25.8	61.9	2.4	OK
Tensile Stress [psi]	720.8	2800.0	3.9	OK



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General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 120
DWG C-320

Input Summary

Start Coordinate	(0.00, 0.00, 119.72) ft
End Coordinate	(1470.00, 0.00, 122.35) ft
Project Length	1470.00 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: 5

Soil Layer #1 USCS, Clay (C), CH

Depth: 25.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Silt (M), MH

Depth: 20.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks

Depth: 10.00 ft

Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

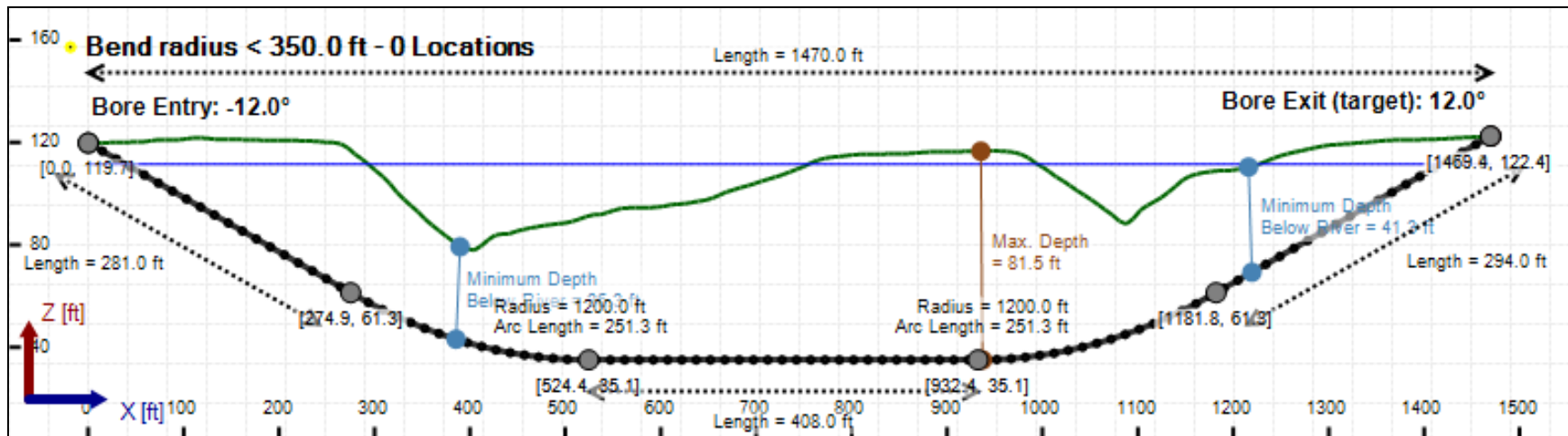
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 38.00 ft

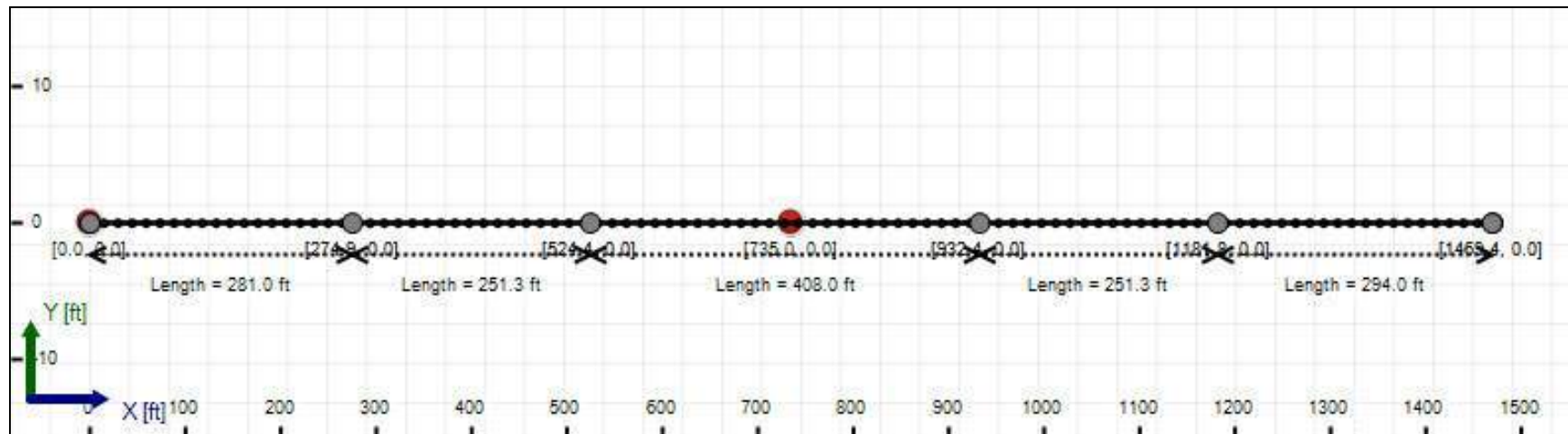
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: PVC
Classification: IPS
Pipe OD: 8" (8.625")
Pipe DR: 18
Pipe Length: 1500.00 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	3.9	46.6
Water Pressure	33.1	33.1
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.0	79.7
Deflection		
Earth Load Deflection	3.493	8.589
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	3.553	8.649
Compressive Stress [psi]		
Compressive Wall Stress	333.2	717.5

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	17770.9	17770.9
Pullback Stress [psi]	1449.2	1449.2
Pullback Strain	3.623E-3	3.623E-3
Bending Stress [psi]	0.0	119.8
Bending Strain	0	2.995E-4
Tensile Stress [psi]	1449.2	1563.6
Tensile Strain	3.623E-3	4.209E-3

Net External Pressure = 50.2 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.553	7.5	2.1	OK
Unconstrained Collapse [psi]	58.7	177.4	3.0	OK
Compressive Wall Stress [psi]	333.2	3200.0	9.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	68.6	161.6	2.4	OK
Tensile Stress [psi]	1563.6	2800.0	1.8	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	8.75 in	1141.125 psi	1374.555 psi
1	8.75 in	12.00 in	1140.919 psi	1374.507 psi
2	12.00 in	12.94 in	1140.848 psi	1374.491 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

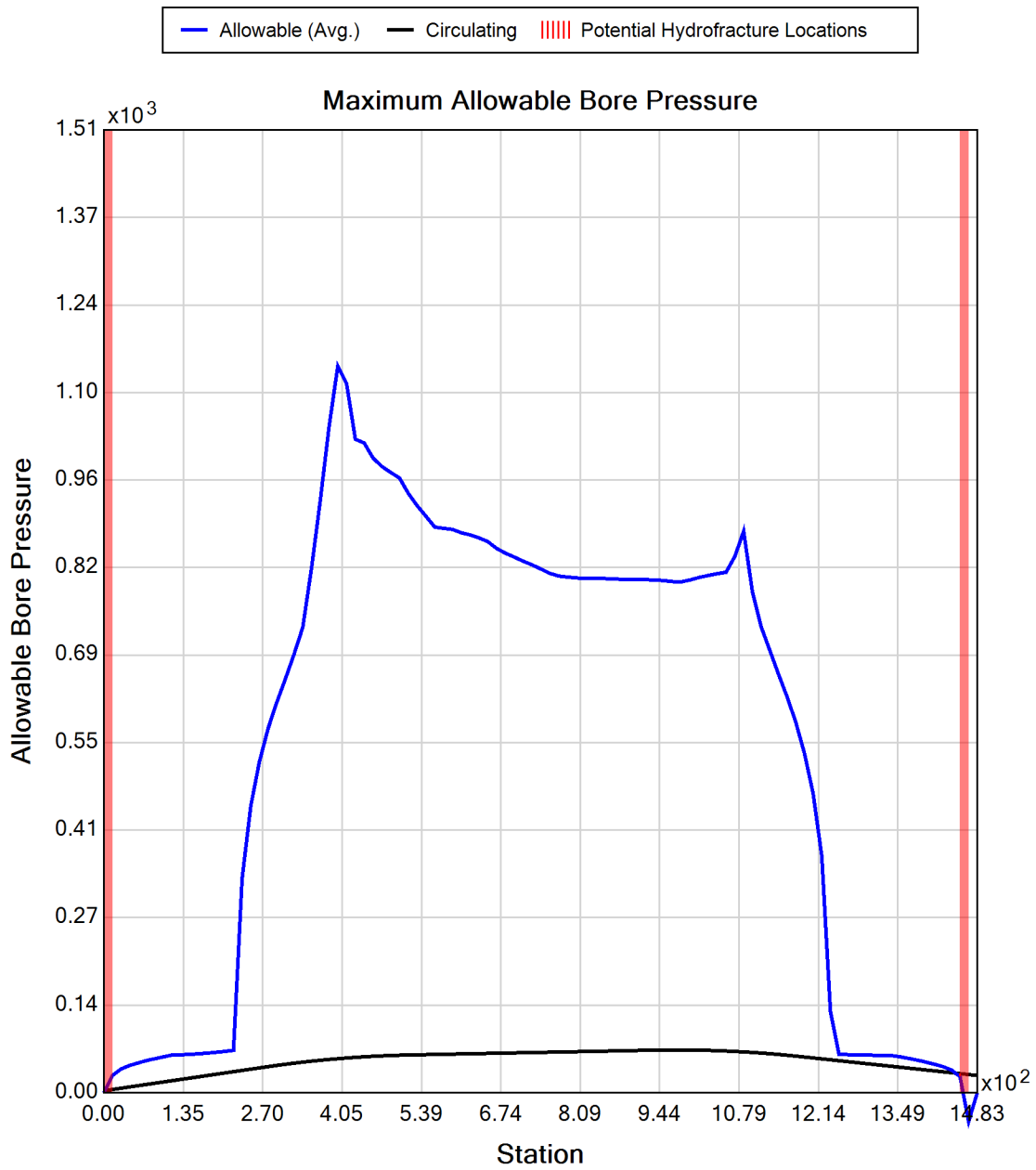
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





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204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
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aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 120
DWG C-320.2

Input Summary

Start Coordinate	(0.00, 0.00, 121.03) ft
End Coordinate	(1470.00, 0.00, 122.91) ft
Project Length	1470.00 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: 5

Soil Layer #1 USCS, Clay (C), CH

Depth: 25.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Silt (M), MH

Depth: 20.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks

Depth: 10.00 ft

Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

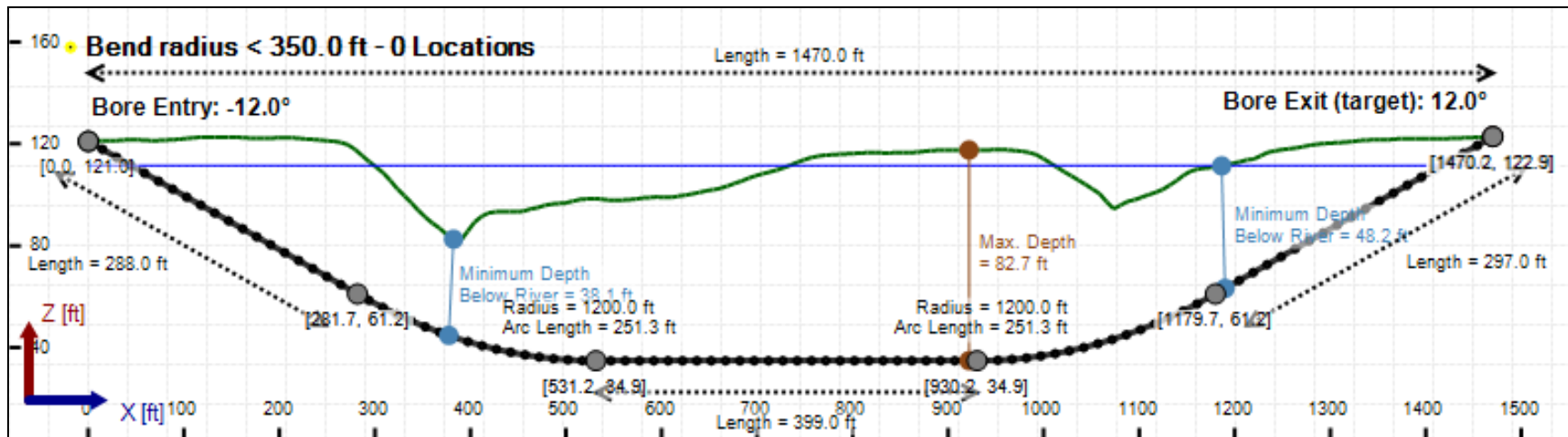
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 38.00 ft

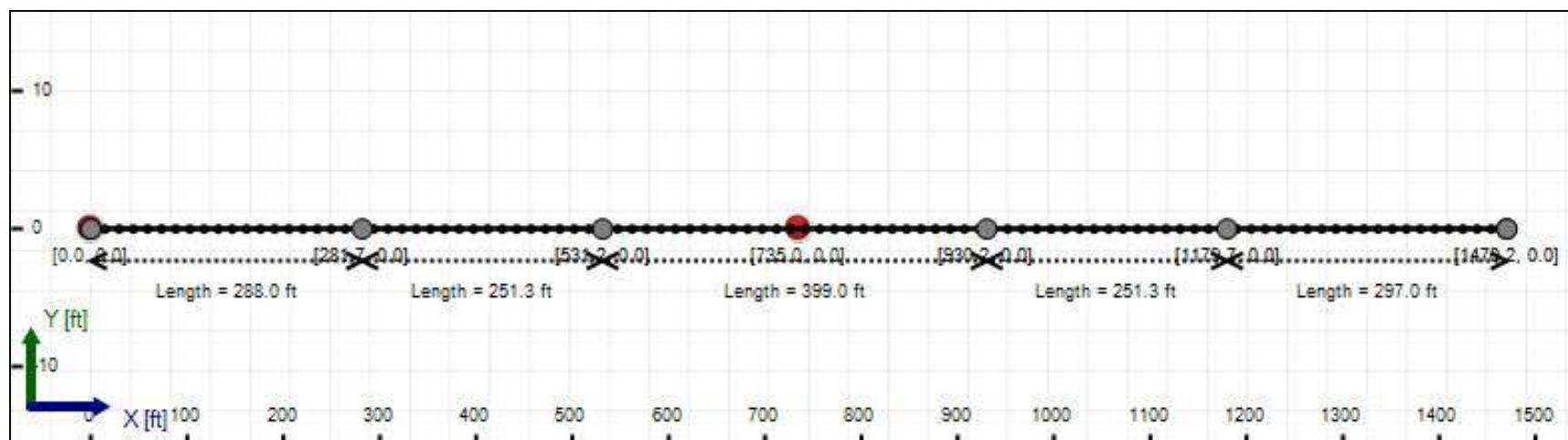
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Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: PVC
Classification: IPS
Pipe OD: 8" (8.625")
Pipe DR: 18
Pipe Length: 1500.00 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	3.9	48.0
Water Pressure	33.2	33.2
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	37.0	81.2
Deflection		
Earth Load Deflection	3.588	8.842
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	3.648	8.901
Compressive Stress [psi]		
Compressive Wall Stress	333.3	730.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	17741.1	17741.1
Pullback Stress [psi]	1446.8	1446.8
Pullback Strain	3.617E-3	3.617E-3
Bending Stress [psi]	0.0	119.8
Bending Strain	0	2.995E-4
Tensile Stress [psi]	1446.8	1557.5
Tensile Strain	3.617E-3	4.193E-3

Net External Pressure = 49.5 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.648	7.5	2.1	OK
Unconstrained Collapse [psi]	59.0	177.6	3.0	OK
Compressive Wall Stress [psi]	333.3	3200.0	9.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	69.0	161.8	2.3	OK
Tensile Stress [psi]	1557.5	2800.0	1.8	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	8.75 in	1050.059 psi	1375.763 psi
1	8.75 in	12.00 in	1049.885 psi	1375.717 psi
2	12.00 in	12.94 in	1049.825 psi	1375.701 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

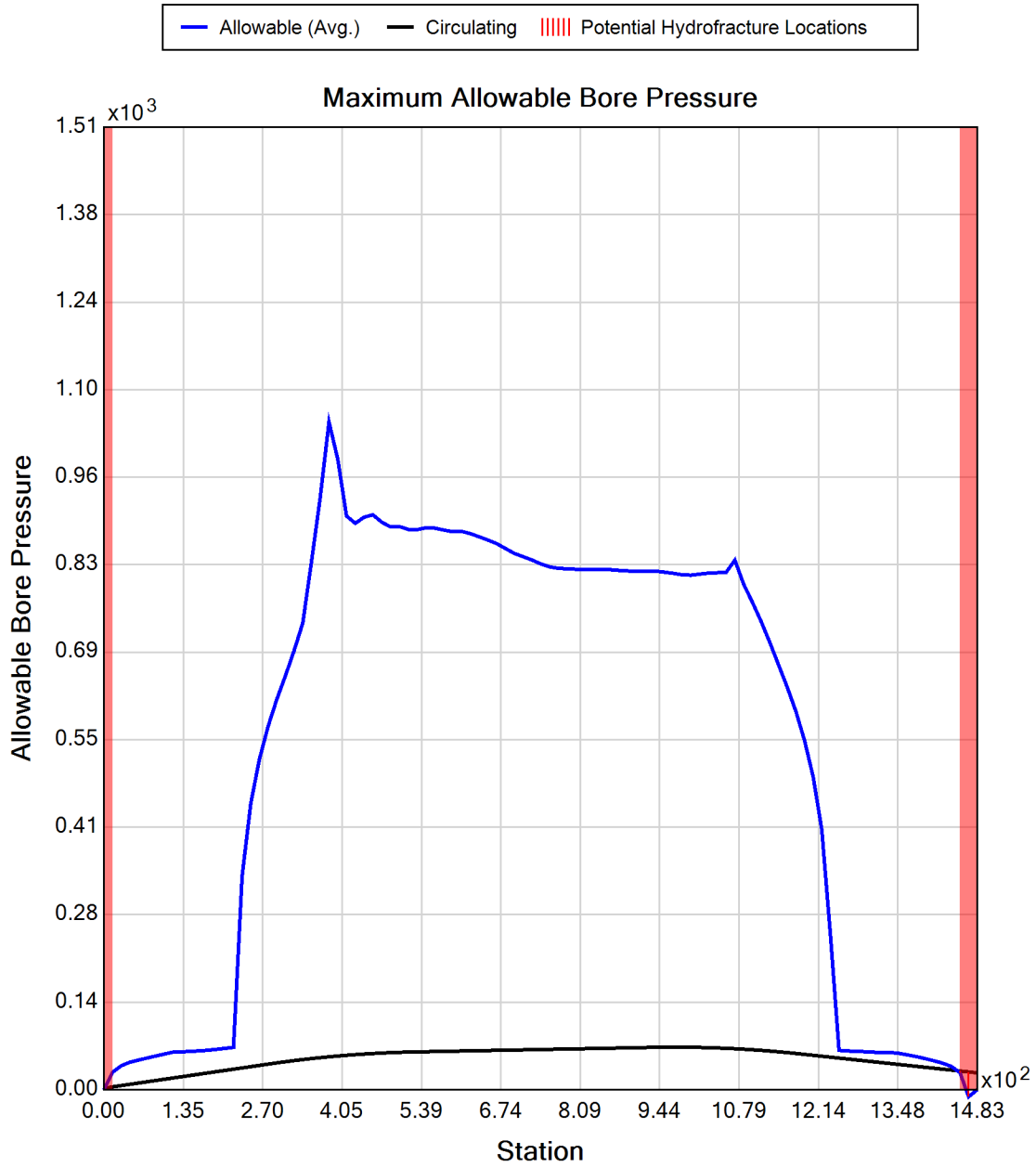
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 120
DWG C-320.2

Input Summary

Start Coordinate	(0.00, 0.00, 121.03) ft
End Coordinate	(1470.00, 0.00, 122.91) ft
Project Length	1470.00 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: 5

Soil Layer #1 USCS, Clay (C), CH

Depth: 25.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #2 USCS, Silt (M), MH

Depth: 20.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks

Depth: 10.00 ft

Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

Phi: 35.00, S.M.: 1450.40, Coh: 2900.80 [psi]

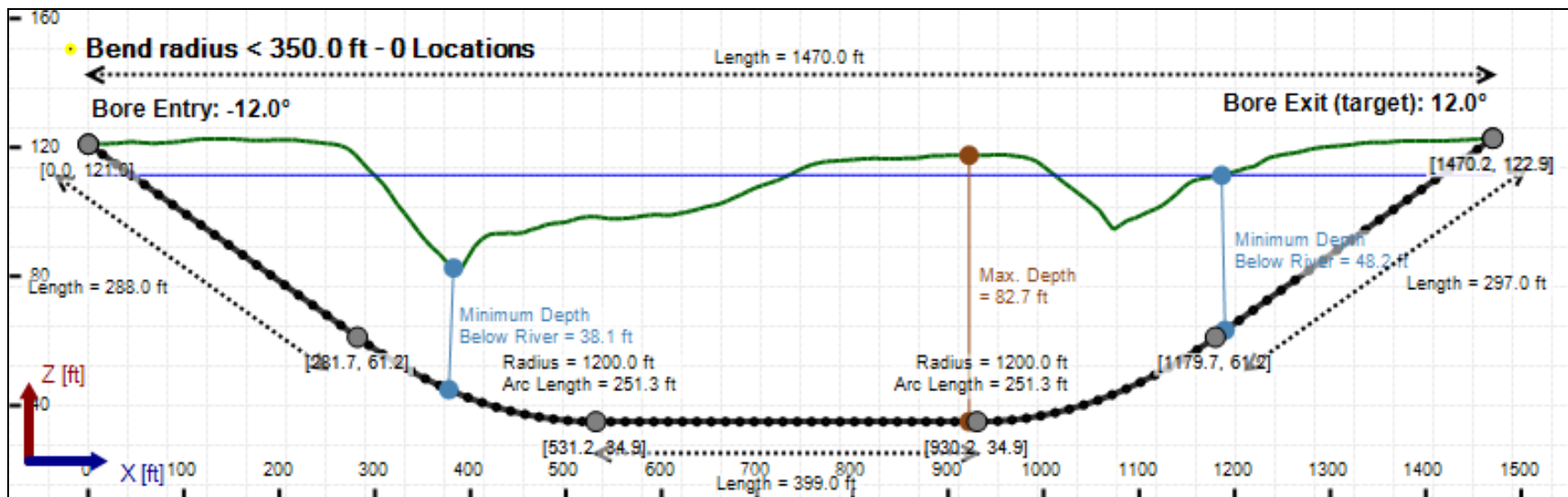
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

Depth: 38.00 ft

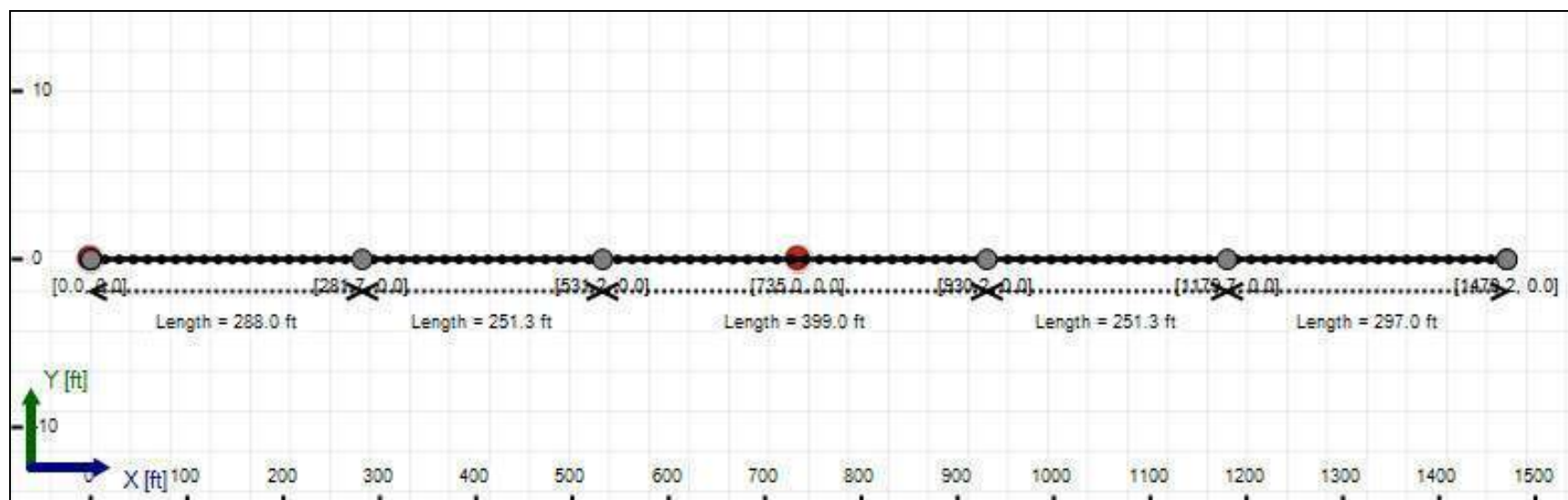
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 1500.00 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	19.5	48.0
Water Pressure	16.1	33.2
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	35.6	81.2
Deflection		
Earth Load Deflection	5.304	13.070
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	5.347	13.113
Compressive Stress [psi]		
Compressive Wall Stress	160.2	365.2

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	2939.3	2939.3
Pullback Stress [psi]	773.3	773.3
Pullback Strain	1.345E-2	1.345E-2
Bending Stress [psi]	0.0	7.0
Bending Strain	0	1.215E-4
Tensile Stress [psi]	773.3	777.1
Tensile Strain	1.345E-2	1.364E-2

Net External Pressure = 51.6 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.347	7.5	1.4	OK
Unconstrained Collapse [psi]	59.0	130.3	2.2	OK
Compressive Wall Stress [psi]	160.2	1150.0	7.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	69.0	210.2	3.0	OK
Tensile Stress [psi]	777.1	1200.0	1.5	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	8.75 in	1050.059 psi	1375.763 psi
1	8.75 in	12.00 in	1049.885 psi	1375.717 psi
2	12.00 in	12.94 in	1049.825 psi	1375.701 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

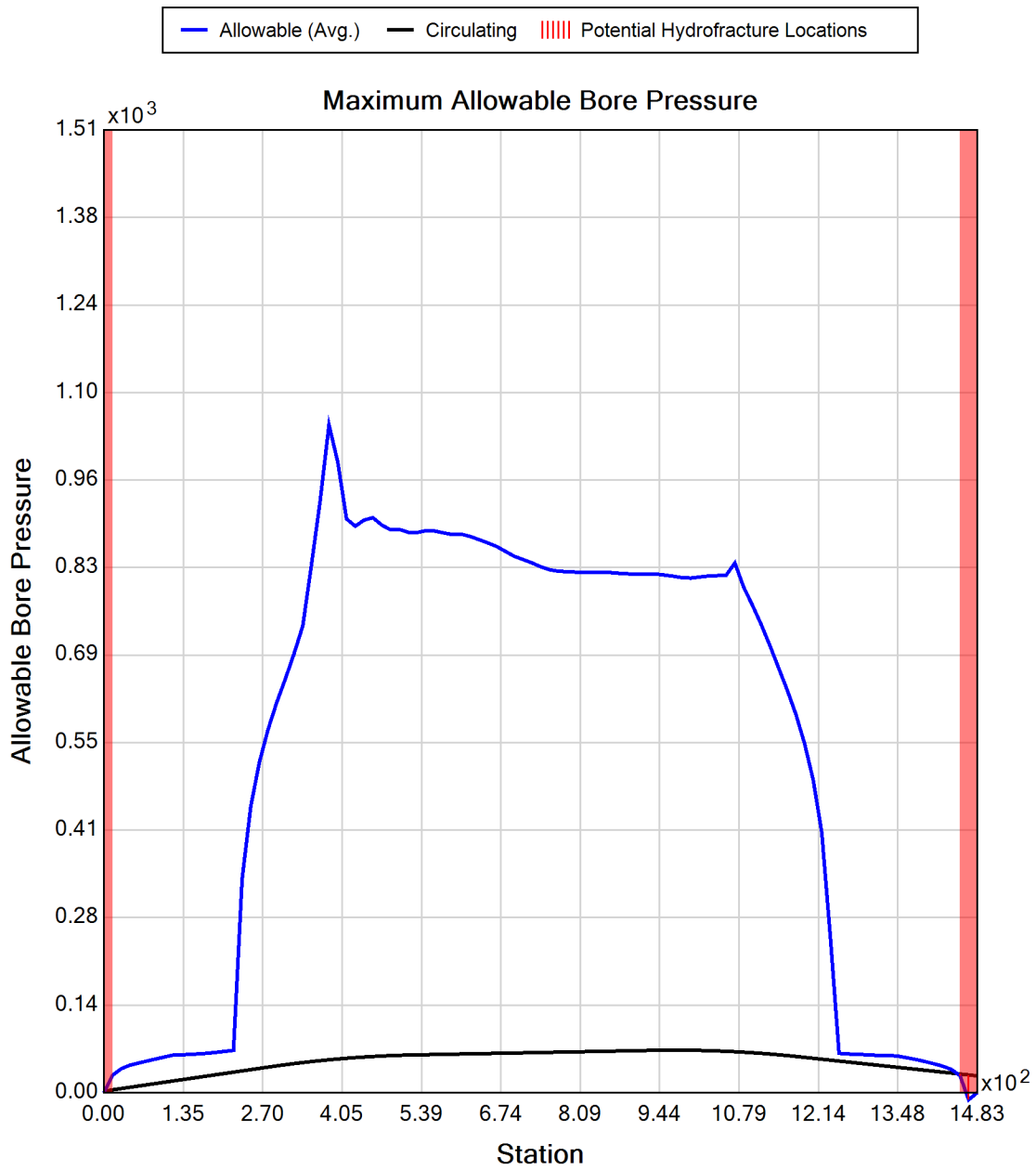
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 & 3 Equivalent Pipe Bundle HDD 120 DWG C-320.2

Input Summary

Start Coordinate	(0.00, 0.00, 121.03) ft
End Coordinate	(1470.00, 0.00, 122.91) ft
Project Length	1470.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	12.750 in
Pipe DR	25.0
Pipe Thickness	0.51 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: PVC
Classification: IPS
Pipe OD: 12" (12.75")
Pipe DR: 25
Pipe Length: 1500.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.59400002161662 ft
Silo Width: 1.59400002161662 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	5.7	48.0
Water Pressure	33.2	33.2
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	38.9	81.2
Deflection		
Earth Load Deflection	10.096	24.878
Buoyant Deflection	0.237	0.237
Reissner Effect	0	0
Net Deflection	10.333	25.115
Compressive Stress [psi]		
Compressive Wall Stress	486.0	1014.5

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	16016.5	16016.5
Pullback Stress [psi]	816.7	816.7
Pullback Strain	2.042E-3	2.042E-3
Bending Stress [psi]	0.0	177.1
Bending Strain	0	4.427E-4
Tensile Stress [psi]	816.7	992.0
Tensile Strain	2.042E-3	2.923E-3

Net External Pressure = 23.9 [psi]

Buoyant Deflection = 0.2

Hydrokinetic Force = 798.4 lb

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.237	7.5	31.7	OK
Unconstrained Collapse [psi]	29.7	60.1	2.0	OK
Tensile Stress [psi]	992.0	2800.0	2.8	OK



Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 121
DWG C-321

Input Summary

Start Coordinate	(0.00, 0.00, 95.95) ft
End Coordinate	(1740.00, 0.00, 90.57) ft
Project Length	1740.00 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: 9

Soil Layer #1 USCS, Gravel (G), GM

Depth: 2.00 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, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 7.30 [psi]

Soil Layer #3 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 #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]

Soil Layer #5 USCS, Clay (C), CH

Depth: 5.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #6 USCS, Clay (C), CH

Depth: 10.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #7 USCS, Clay (C), CL

Depth: 5.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #8 USCS, Clay (C), CH

Depth: 15.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

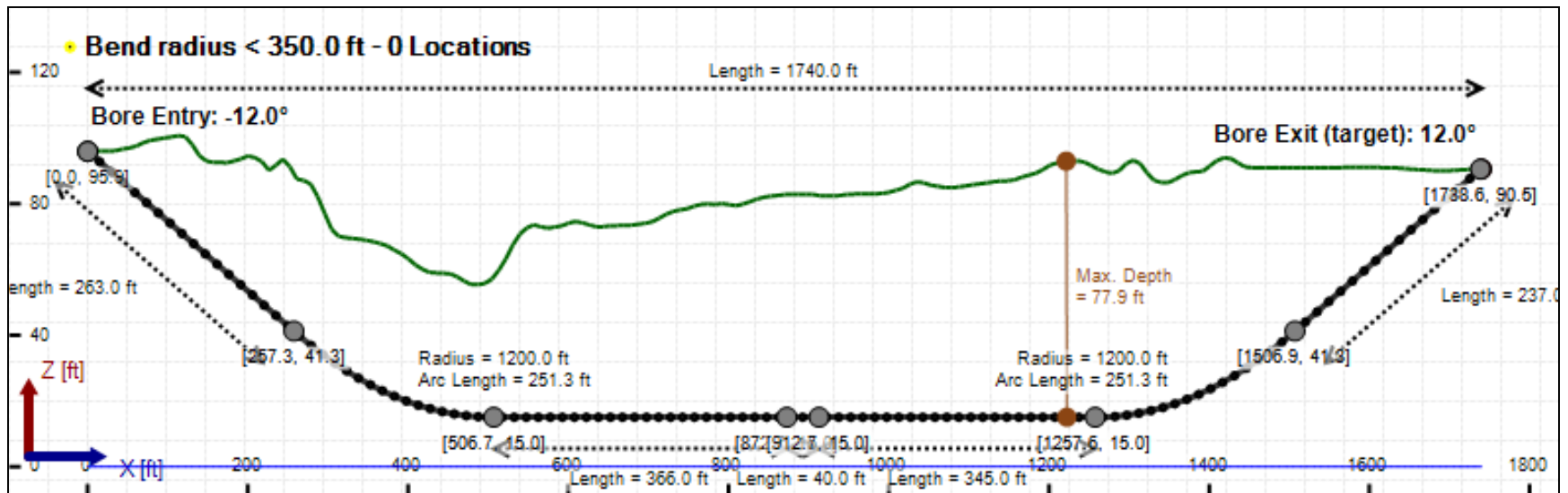
Soil Layer #9 Rock, Geological Classification, Sedimentary Rocks

Depth: 40.00 ft

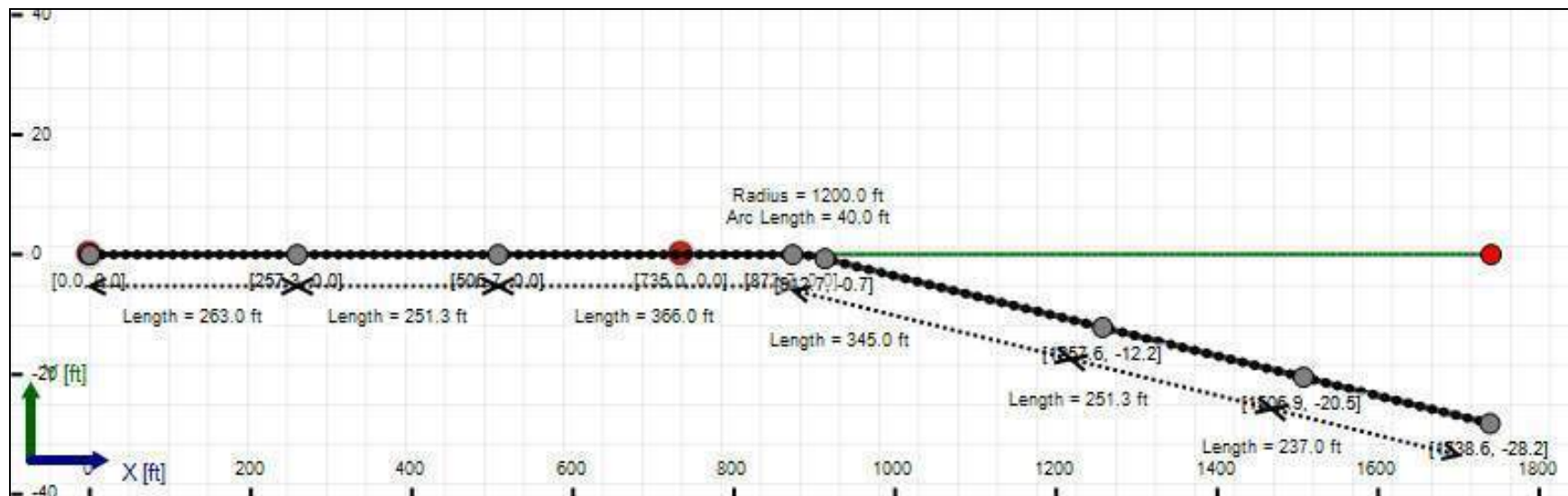
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: PVC
Classification: IPS
Pipe OD: 8" (8.625")
Pipe DR: 18
Pipe Length: 1755.00 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	25.5	54.6
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	25.5	54.6
Deflection		
Earth Load Deflection	4.706	10.066
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	4.766	10.126
Compressive Stress [psi]		
Compressive Wall Stress	229.9	491.7

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	20139.5	20139.5
Pullback Stress [psi]	1642.4	1642.4
Pullback Strain	4.106E-3	4.106E-3
Bending Stress [psi]	0.0	119.8
Bending Strain	0	2.995E-4
Tensile Stress [psi]	1642.4	1754.2
Tensile Strain	4.106E-3	4.685E-3

Net External Pressure = 44.5 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	4.766	7.5	1.6	OK
Unconstrained Collapse [psi]	52.6	175.1	3.3	OK
Compressive Wall Stress [psi]	229.9	3200.0	13.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	62.5	157.6	2.5	OK
Tensile Stress [psi]	1754.2	2800.0	1.6	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	8.75 in	1178.678 psi	1348.113 psi
1	8.75 in	12.00 in	1178.499 psi	1348.061 psi
2	12.00 in	12.94 in	1178.438 psi	1348.043 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 inadvertent 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

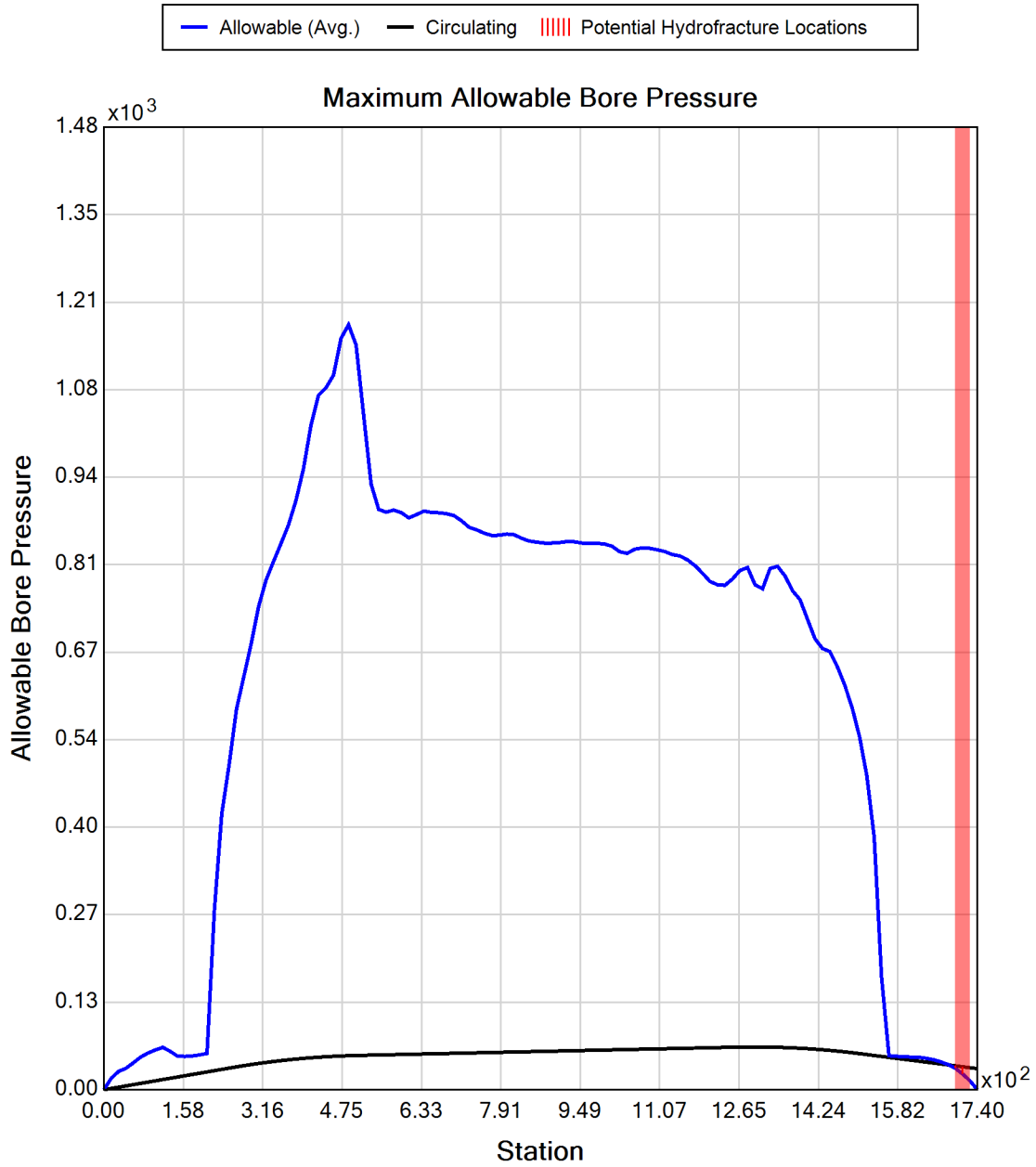
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





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Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 121
DWG C-321.2

Input Summary

Start Coordinate	(0.00, 0.00, 96.04) ft
End Coordinate	(1740.00, 0.00, 91.39) ft
Project Length	1740.00 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: 9

Soil Layer #1 USCS, Gravel (G), GM

Depth: 2.00 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, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 7.30 [psi]

Soil Layer #3 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 #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]

Soil Layer #5 USCS, Clay (C), CH

Depth: 5.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #6 USCS, Clay (C), CH

Depth: 10.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #7 USCS, Clay (C), CL

Depth: 5.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #8 USCS, Clay (C), CH

Depth: 15.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

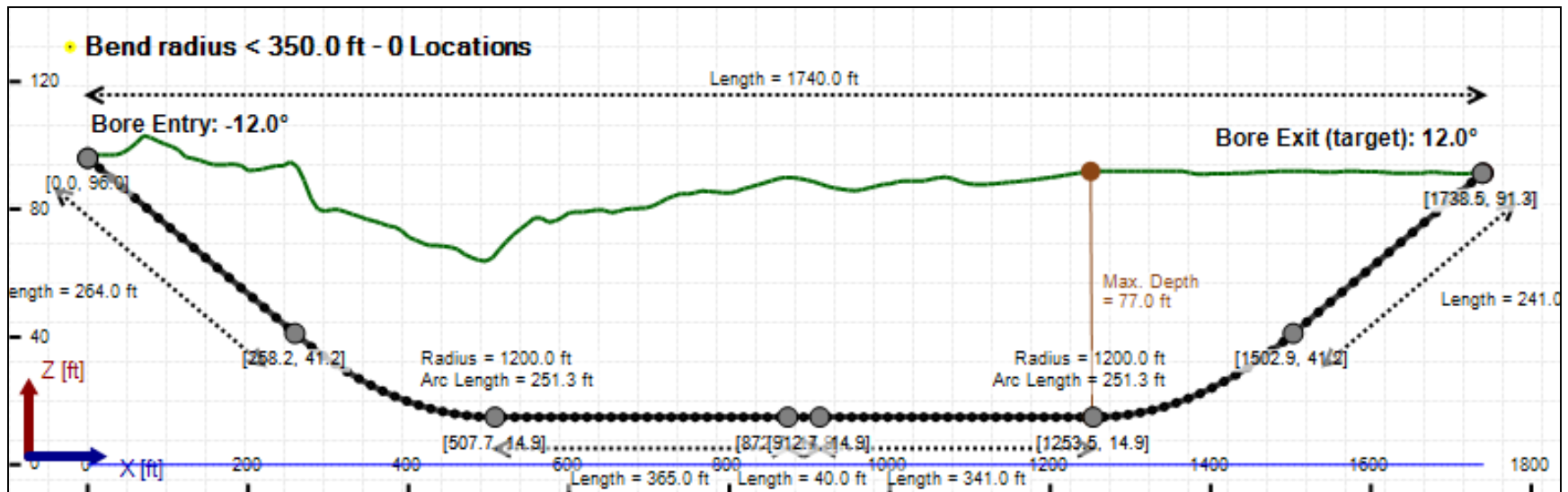
Soil Layer #9 Rock, Geological Classification, Sedimentary Rocks

Depth: 40.00 ft

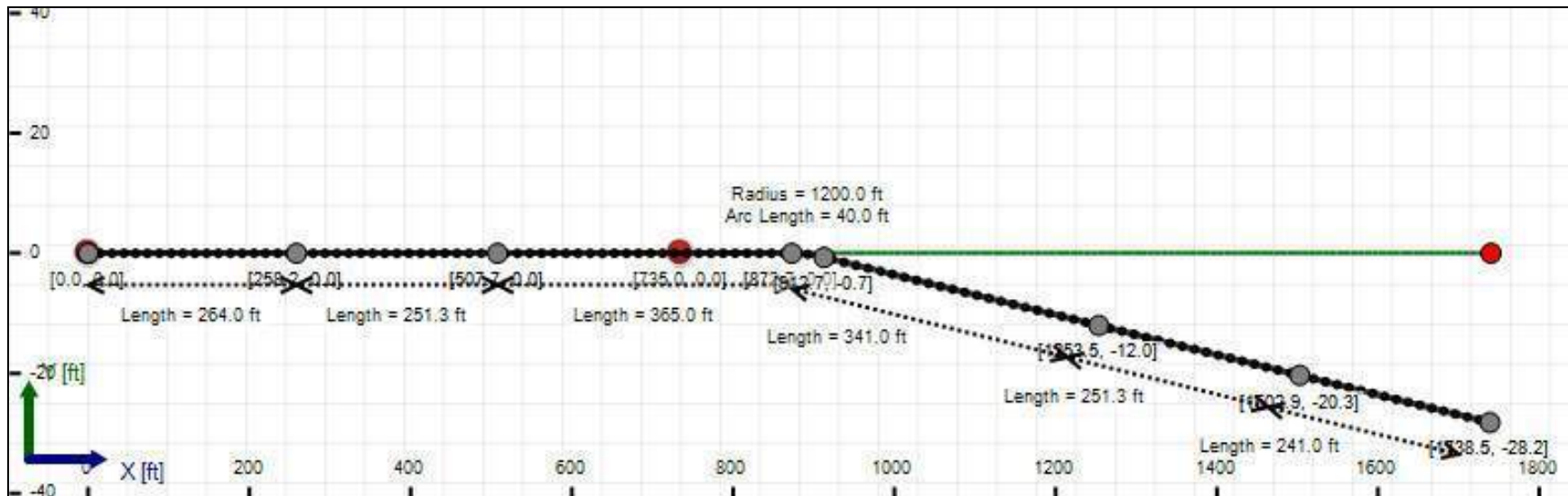
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: PVC
Classification: IPS
Pipe OD: 8" (8.625")
Pipe DR: 18
Pipe Length: 1755.00 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	26.2	53.9
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	26.2	53.9
Deflection		
Earth Load Deflection	4.835	9.923
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	4.895	9.983
Compressive Stress [psi]		
Compressive Wall Stress	236.2	484.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	20172.6	20172.6
Pullback Stress [psi]	1645.1	1645.1
Pullback Strain	4.113E-3	4.113E-3
Bending Stress [psi]	0.0	119.8
Bending Strain	0	2.995E-4
Tensile Stress [psi]	1645.1	1757.4
Tensile Strain	4.113E-3	4.693E-3

Net External Pressure = 44.5 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	4.895	7.5	1.5	OK
Unconstrained Collapse [psi]	52.7	175.2	3.3	OK
Compressive Wall Stress [psi]	236.2	3200.0	13.5	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	62.6	157.5	2.5	OK
Tensile Stress [psi]	1757.4	2800.0	1.6	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	8.75 in	990.680 psi	1347.467 psi
1	8.75 in	12.00 in	990.576 psi	1347.414 psi
2	12.00 in	12.94 in	990.541 psi	1347.395 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

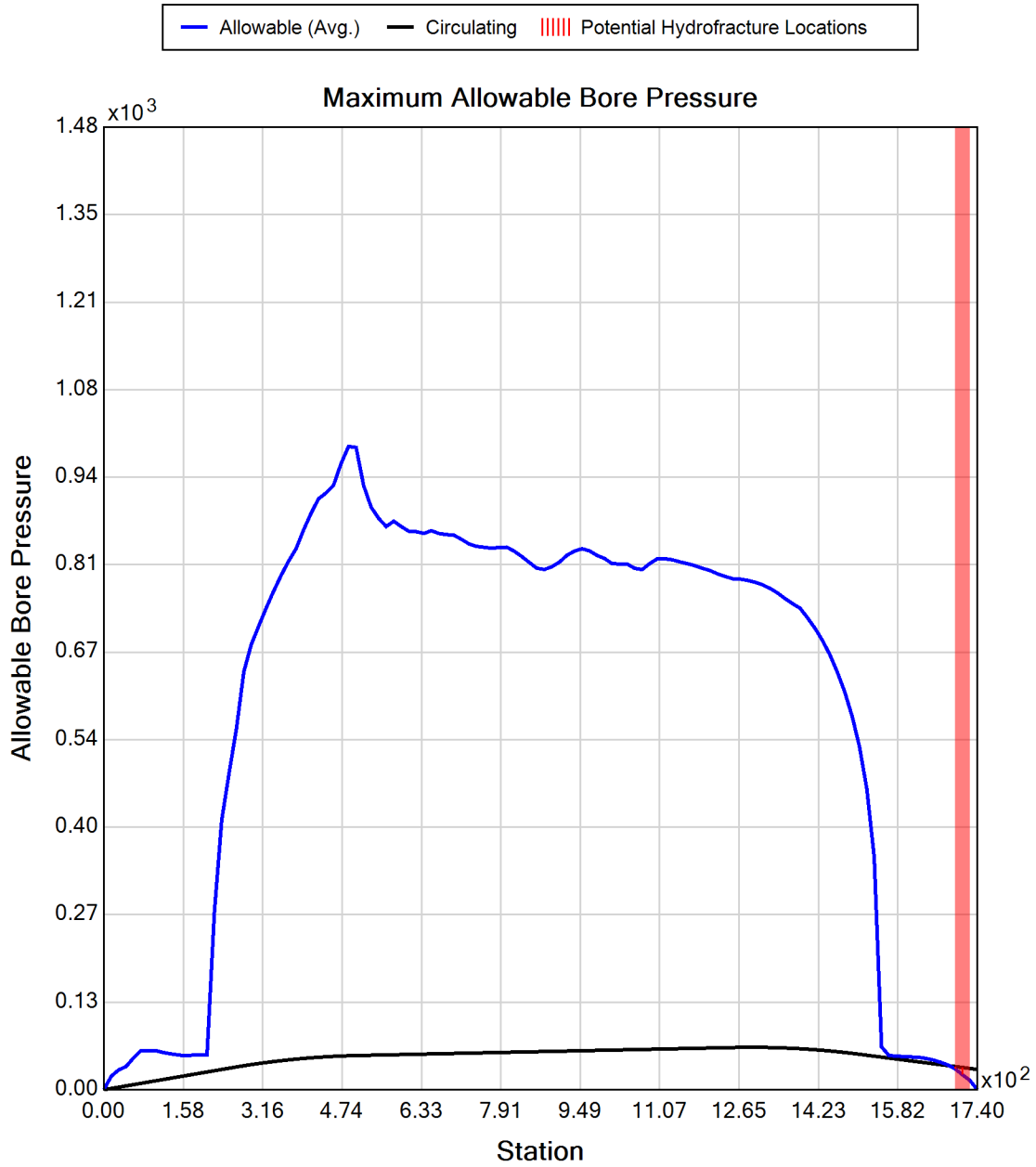
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 594.1





Generated Output



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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: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 3 HDD 121 DWG C-321.2

Input Summary

Start Coordinate	(0.00, 0.00, 96.04) ft
End Coordinate	(1740.00, 0.00, 91.39) ft
Project Length	1740.00 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: 9

Soil Layer #1 USCS, Gravel (G), GM

Depth: 2.00 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, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 7.30 [psi]

Soil Layer #3 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 #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]

Soil Layer #5 USCS, Clay (C), CH

Depth: 5.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #6 USCS, Clay (C), CH

Depth: 10.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

Soil Layer #7 USCS, Clay (C), CL

Depth: 5.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #8 USCS, Clay (C), CH

Depth: 15.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

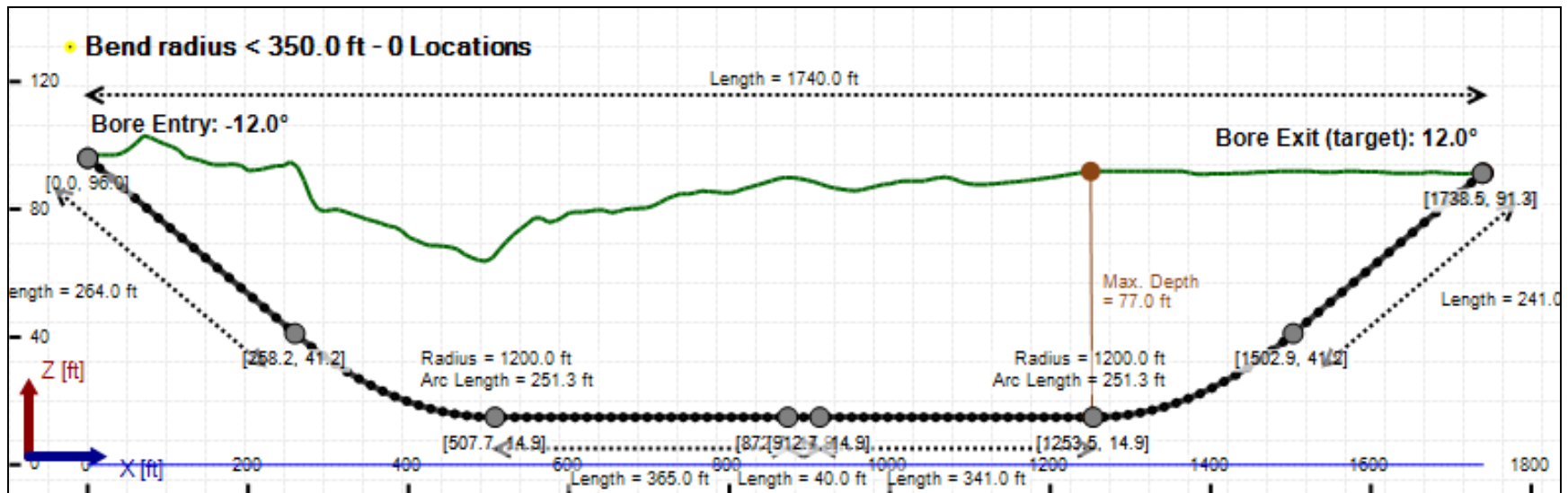
Soil Layer #9 Rock, Geological Classification, Sedimentary Rocks

Depth: 40.00 ft

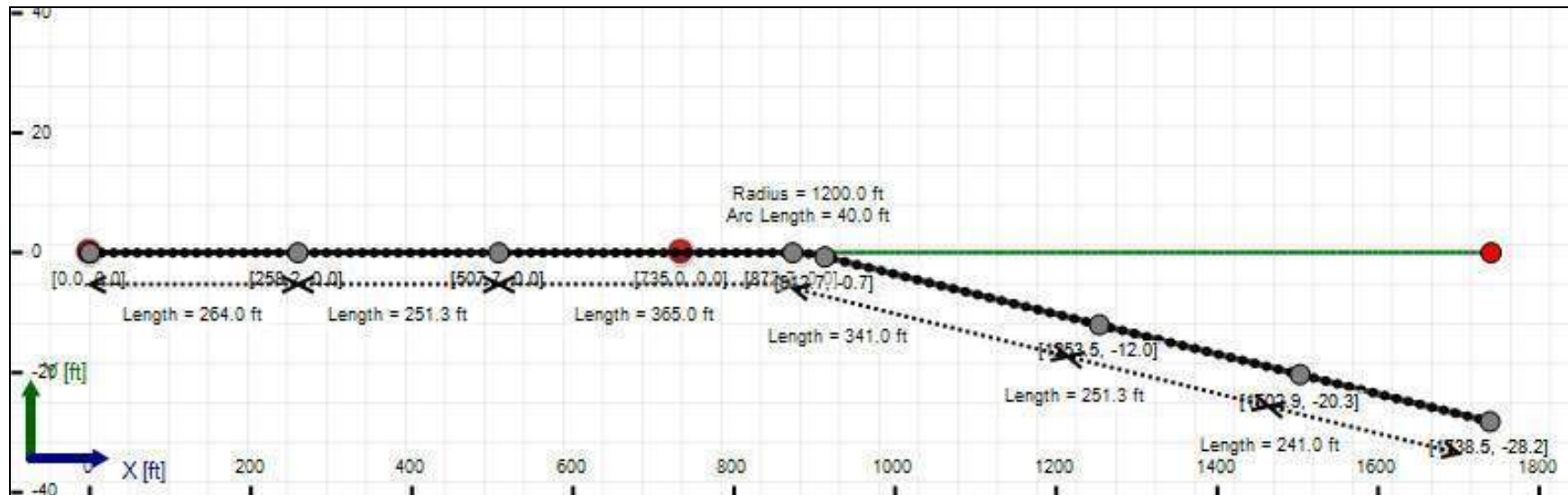
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 1755.00 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	26.2	53.9
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	26.2	53.9
Deflection		
Earth Load Deflection	7.133	14.668
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	7.176	14.711
Compressive Stress [psi]		
Compressive Wall Stress	117.9	242.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	3314.4	3314.4
Pullback Stress [psi]	872.0	872.0
Pullback Strain	1.517E-2	1.517E-2
Bending Stress [psi]	0.0	7.0
Bending Strain	0	1.215E-4
Tensile Stress [psi]	872.0	876.1
Tensile Strain	1.517E-2	1.536E-2

Net External Pressure = 44.5 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	7.176	7.5	1.0	OK
Unconstrained Collapse [psi]	52.7	128.8	2.4	OK
Compressive Wall Stress [psi]	117.9	1150.0	9.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	62.6	203.1	3.2	OK
Tensile Stress [psi]	876.1	1200.0	1.4	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	8.75 in	990.680 psi	1347.467 psi
1	8.75 in	12.00 in	990.576 psi	1347.414 psi
2	12.00 in	12.94 in	990.541 psi	1347.395 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

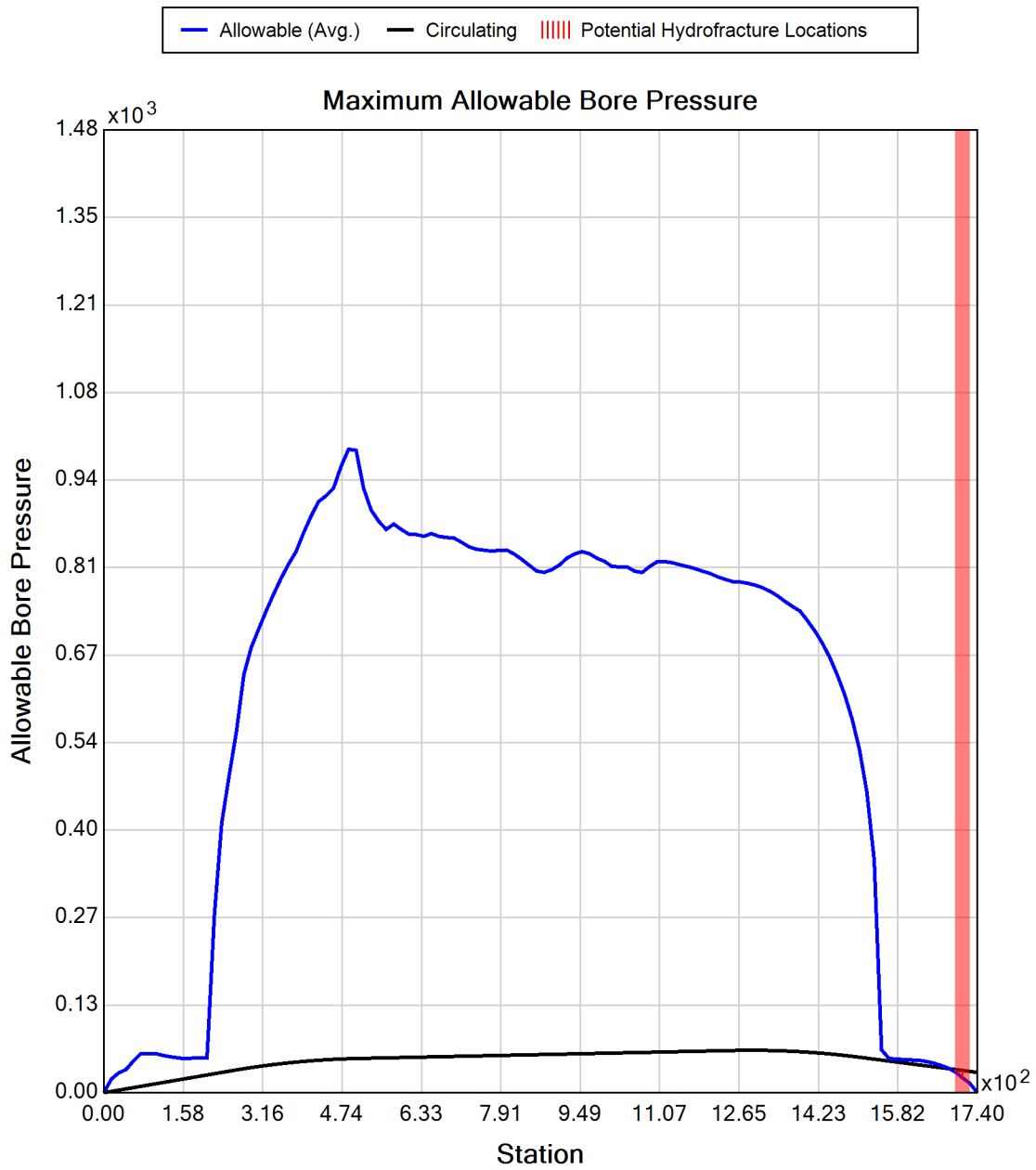
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 594.1





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2 & 3 Equivalent Pipe Bundle
HDD 121
DWG C-321.2

Input Summary

Start Coordinate	(0.00, 0.00, 96.04) ft
End Coordinate	(1740.00, 0.00, 91.39) ft
Project Length	1740.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	12.750 in
Pipe DR	25.0
Pipe Thickness	0.51 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: PVC
Classification: IPS
Pipe OD: 12" (12.75")
Pipe DR: 25
Pipe Length: 1755.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 1.59400002161662 ft
Silo Width: 1.59400002161662 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): 2800 psi
Allowable Tensile Stress (Long Term): 2800 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	26.4	53.9
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	26.4	53.9
Deflection		
Earth Load Deflection	13.662	27.921
Buoyant Deflection	0.237	0.237
Reissner Effect	0	0
Net Deflection	13.899	28.158
Compressive Stress [psi]		
Compressive Wall Stress	329.4	673.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	17956.9	17956.9
Pullback Stress [psi]	915.7	915.7
Pullback Strain	2.289E-3	2.289E-3
Bending Stress [psi]	0.0	177.1
Bending Strain	0	4.427E-4
Tensile Stress [psi]	915.7	1091.4
Tensile Strain	2.289E-3	3.171E-3

Net External Pressure = 21.5 [psi]

Buoyant Deflection = 0.2

Hydrokinetic Force = 798.4 lb

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.237	7.5	31.7	OK
Unconstrained Collapse [psi]	27.6	59.4	2.2	OK
Tensile Stress [psi]	1091.4	2800.0	2.6	OK



Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 122
DWG C-322

Input Summary

Start Coordinate	(0.00, 0.00, 90.52) ft
End Coordinate	(1100.00, 0.00, 106.00) ft
Project Length	1100.00 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: 3

Soil Layer #1 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Clay (C), CH

From Assistant

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

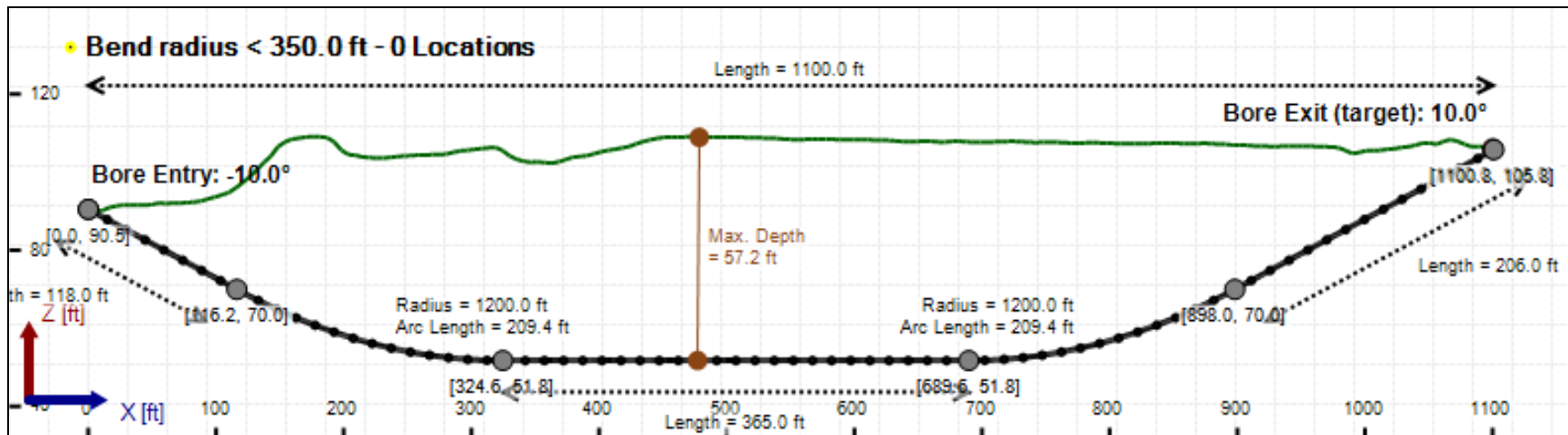
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks

From Assistant

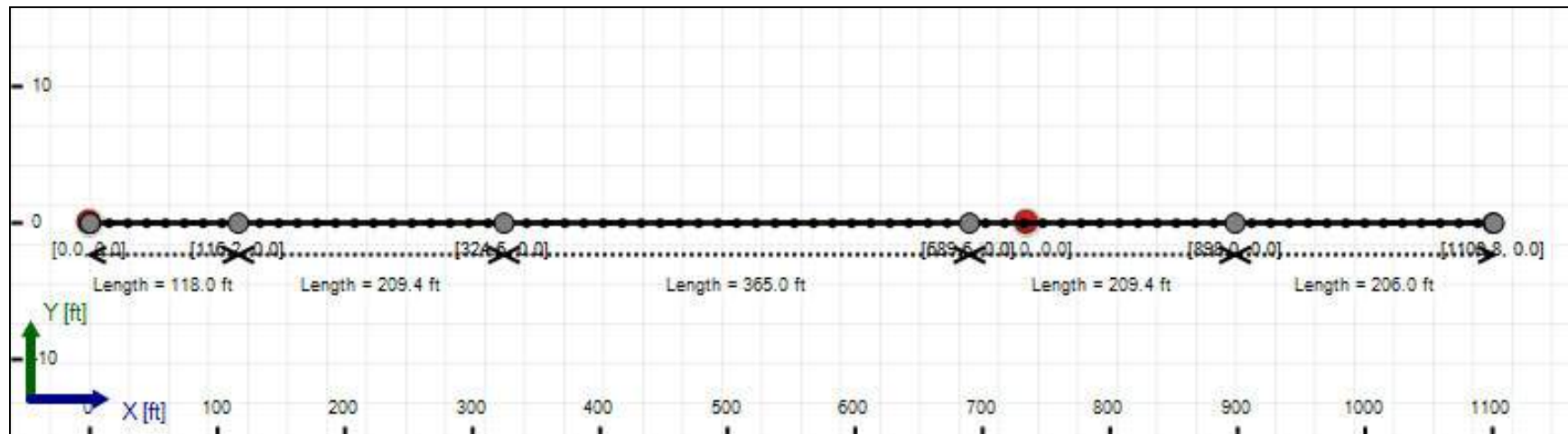
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 1110.00 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	20.7	37.1
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	20.7	37.1
Deflection		
Earth Load Deflection	5.651	10.115
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.783	10.247
Compressive Stress [psi]		
Compressive Wall Stress	93.4	167.1

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	19078.4	19078.4
Pullback Stress [psi]	532.1	532.1
Pullback Strain	9.253E-3	9.253E-3
Bending Stress [psi]	0.0	21.5
Bending Strain	0	3.733E-4
Tensile Stress [psi]	532.1	552.5
Tensile Strain	9.253E-3	9.983E-3

Net External Pressure = 32.0 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.783	7.5	1.3	OK
Unconstrained Collapse [psi]	35.4	116.4	3.3	OK
Compressive Wall Stress [psi]	93.4	1150.0	12.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	45.3	224.0	4.9	OK
Tensile Stress [psi]	552.5	1200.0	2.2	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	8.75 in	722.692 psi	1333.508 psi
1	8.75 in	12.00 in	722.621 psi	1333.411 psi
2	12.00 in	16.13 in	722.500 psi	1333.244 psi

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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

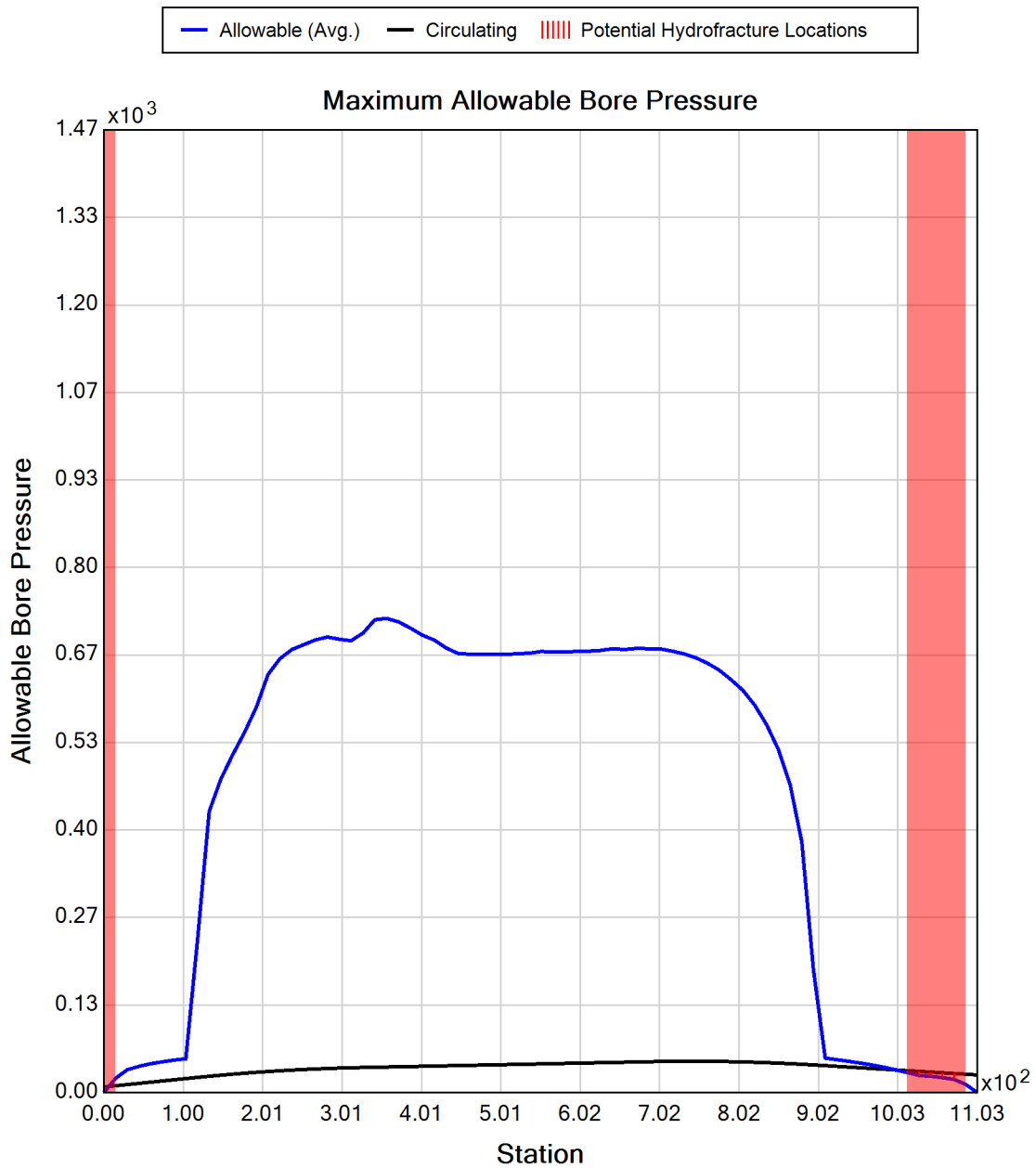
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 122
DWG C-322.2

Input Summary

Start Coordinate	(0.00, 0.00, 92.66) ft
End Coordinate	(1100.00, 0.00, 105.98) ft
Project Length	1100.00 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: 3

Soil Layer #1 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Clay (C), CH

From Assistant

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

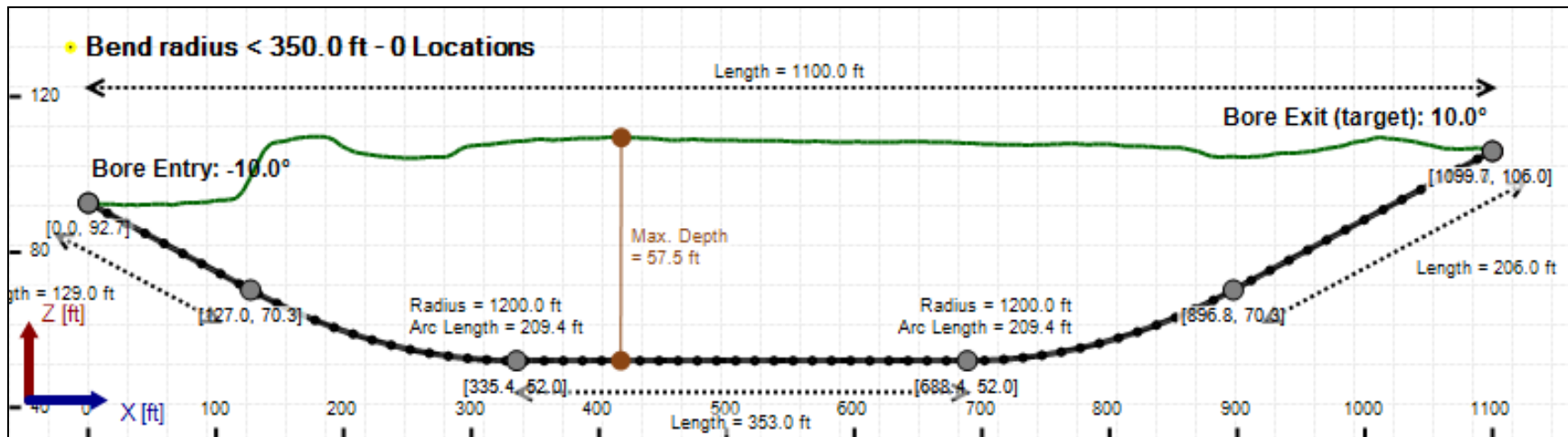
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks

From Assistant

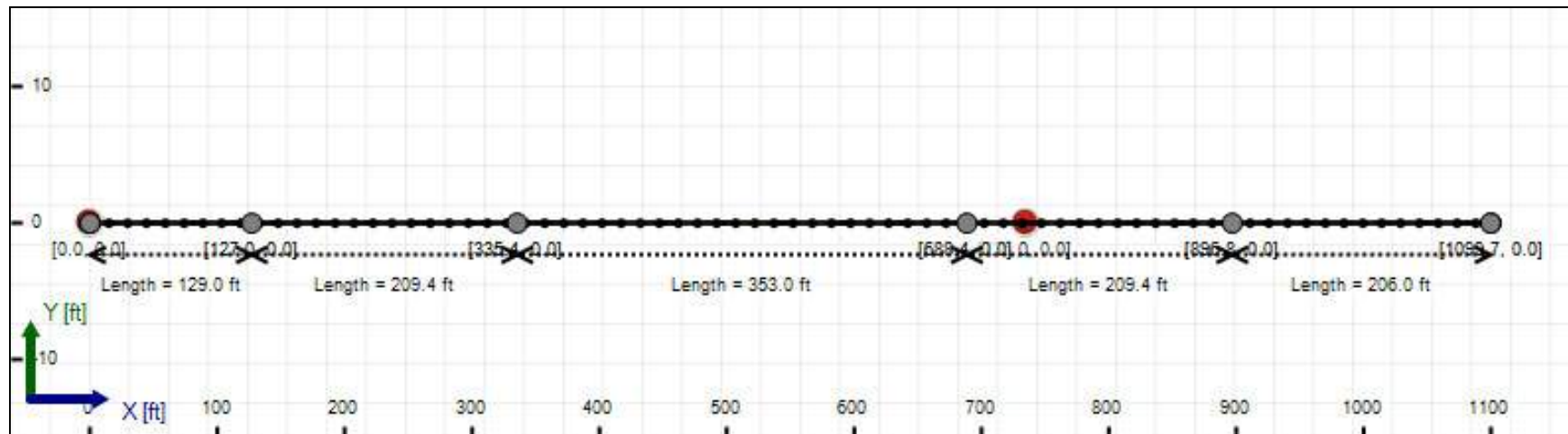
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 1110.00 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	19.6	37.3
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.6	37.3
Deflection		
Earth Load Deflection	5.343	10.145
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	5.475	10.277
Compressive Stress [psi]		
Compressive Wall Stress	88.3	167.6

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	19032.4	19032.4
Pullback Stress [psi]	530.8	530.8
Pullback Strain	9.231E-3	9.231E-3
Bending Stress [psi]	0.0	21.5
Bending Strain	0	3.733E-4
Tensile Stress [psi]	530.8	550.5
Tensile Strain	9.231E-3	9.947E-3

Net External Pressure = 32.6 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.475	7.5	1.4	OK
Unconstrained Collapse [psi]	35.5	116.3	3.3	OK
Compressive Wall Stress [psi]	88.3	1150.0	13.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	45.4	224.2	4.9	OK
Tensile Stress [psi]	550.5	1200.0	2.2	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	8.75 in	688.347 psi	1333.601 psi
1	8.75 in	12.00 in	688.281 psi	1333.504 psi
2	12.00 in	16.13 in	688.169 psi	1333.339 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

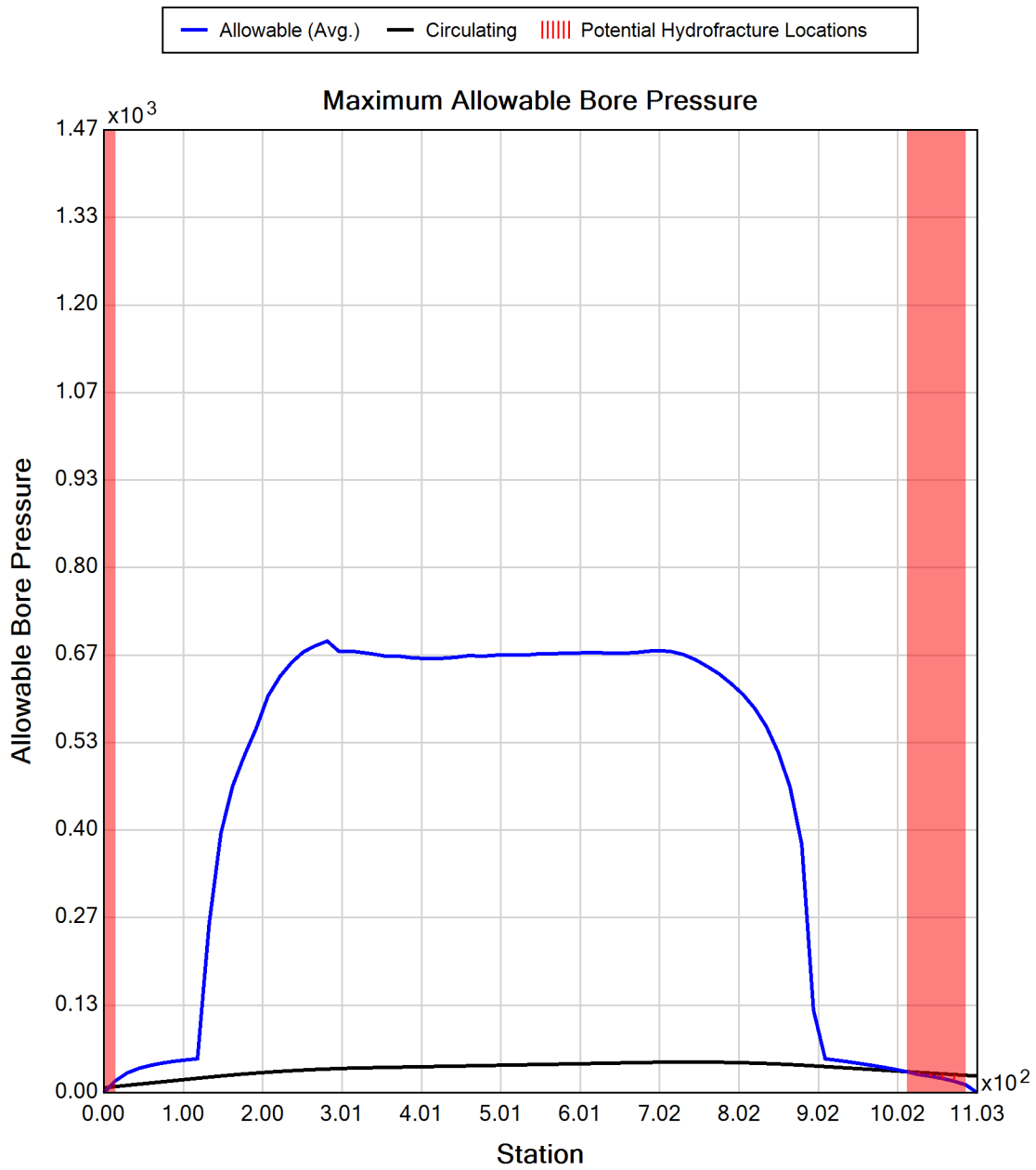
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 122
DWG C-322.2

Input Summary

Start Coordinate	(0.00, 0.00, 92.66) ft
End Coordinate	(1100.00, 0.00, 105.98) ft
Project Length	1100.00 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: 3

Soil Layer #1 USCS, Silt (M), MH

From Assistant

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 4.40 [psi]

Soil Layer #2 USCS, Clay (C), CH

From Assistant

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 400.00, Coh: 8.30 [psi]

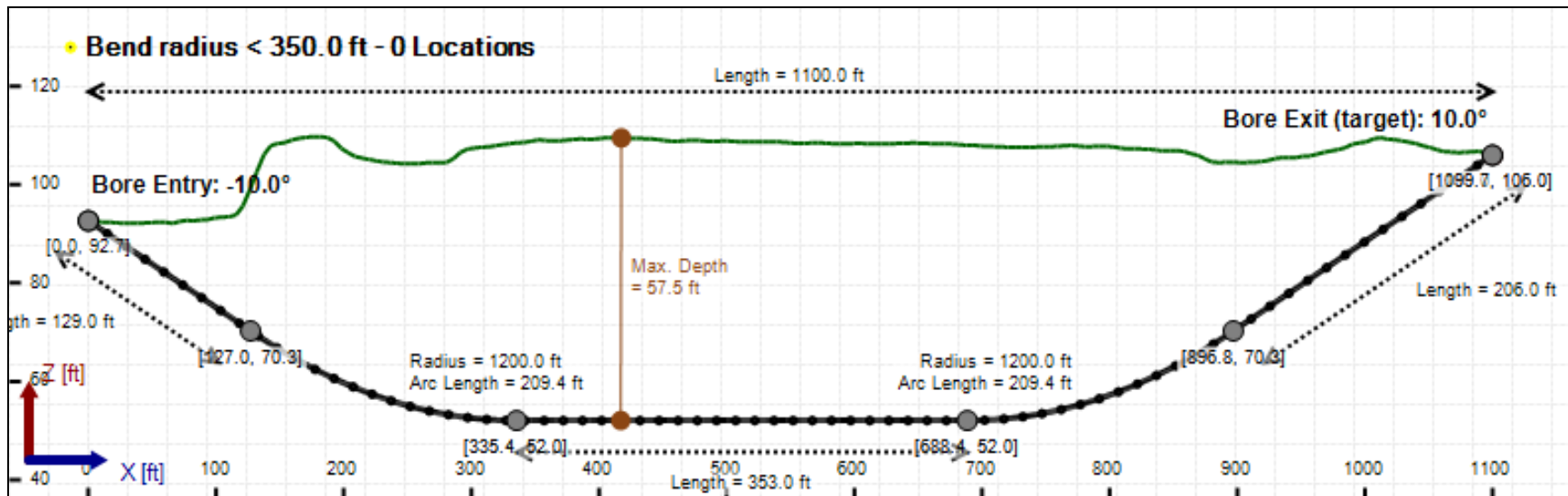
Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks

From Assistant

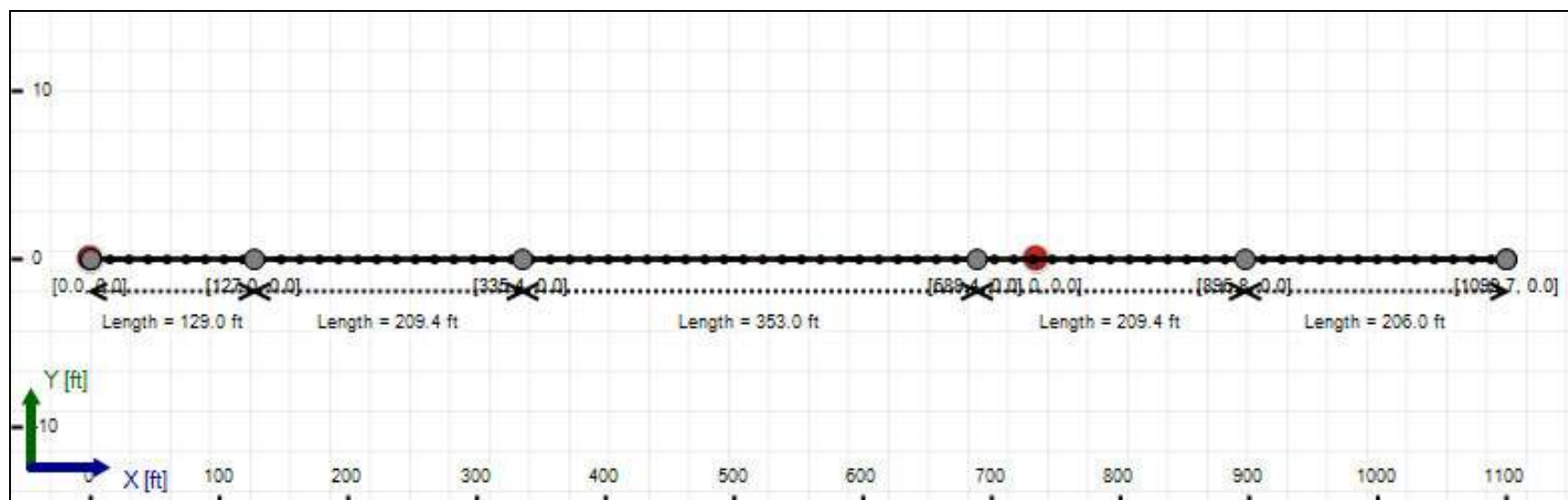
Unit Weight: 14.4144 (dry), 23.7468 (sat) [lb/US (liquid) gallon]

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: 1110.00 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	19.2	37.3
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.2	37.3
Deflection		
Earth Load Deflection	5.236	10.145
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	5.279	10.188
Compressive Stress [psi]		
Compressive Wall Stress	86.5	167.6

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	2130.1	2130.1
Pullback Stress [psi]	560.4	560.4
Pullback Strain	9.746E-3	9.746E-3
Bending Stress [psi]	0.0	7.0
Bending Strain	0	1.215E-4
Tensile Stress [psi]	560.4	565.6
Tensile Strain	9.746E-3	9.959E-3

Net External Pressure = 32.6 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	5.279	7.5	1.4	OK
Unconstrained Collapse [psi]	35.5	127.7	3.6	OK
Compressive Wall Stress [psi]	86.5	1150.0	13.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	45.4	224.0	4.9	OK
Tensile Stress [psi]	565.6	1200.0	2.1	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	8.75 in	688.347 psi	1333.601 psi
1	8.75 in	12.00 in	688.281 psi	1333.504 psi
2	12.00 in	16.13 in	688.169 psi	1333.339 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

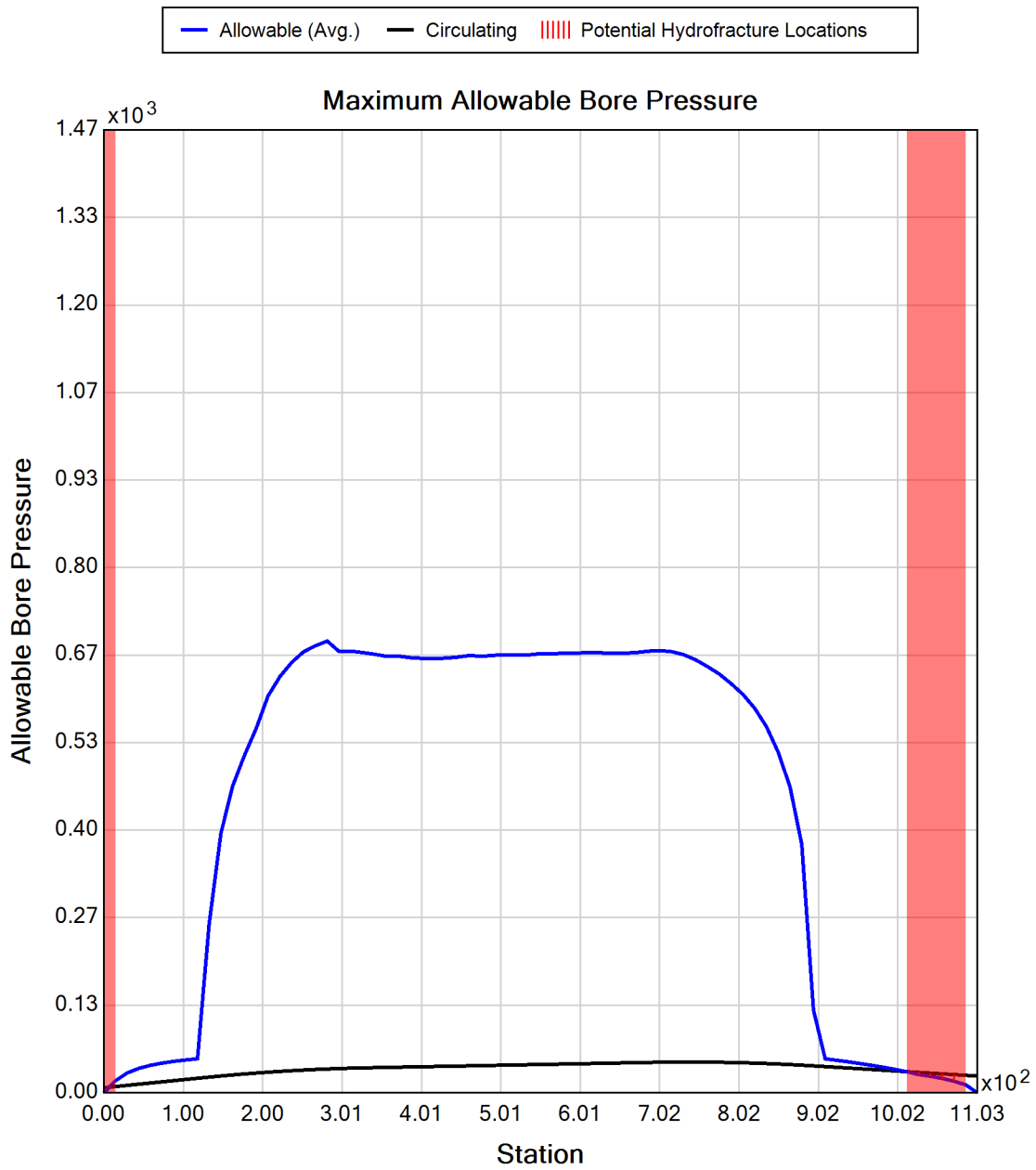
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 366.7





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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 & 3 Equivalent Pipe Bundle HDD 122 DWG C-322.2

Input Summary

Start Coordinate	(0.00, 0.00, 92.66) ft
End Coordinate	(1100.00, 0.00, 105.98) ft
Project Length	1100.00 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: 1110.00 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	19.9	37.3
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.9	37.3
Deflection		
Earth Load Deflection	24.921	46.617
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	25.610	47.307
Compressive Stress [psi]		
Compressive Wall Stress	142.4	266.4

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	15785.6	15785.6
Pullback Stress [psi]	394.2	394.2
Pullback Strain	6.855E-3	6.855E-3
Bending Stress [psi]	0.0	28.0
Bending Strain	0	4.861E-4
Tensile Stress [psi]	394.2	421.9
Tensile Strain	6.855E-3	7.824E-3

Net External Pressure = 17.5 [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]	21.8	49.1	2.2	OK
Tensile Stress [psi]	421.9	1200.0	2.8	OK



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 1
HDD 123
DWG C-323

Input Summary

Start Coordinate	(0.00, 0.00, 108.39) ft
End Coordinate	(850.00, 0.00, 113.09) ft
Project Length	850.00 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: 5

Soil Layer #1 USCS, Gravel (G), GM

Depth: 3.00 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, Clay (C), CL

Depth: 1.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #3 USCS, Silt (M), MH

Depth: 11.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [psi]

Soil Layer #4 USCS, Clay (C), CH

Depth: 10.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

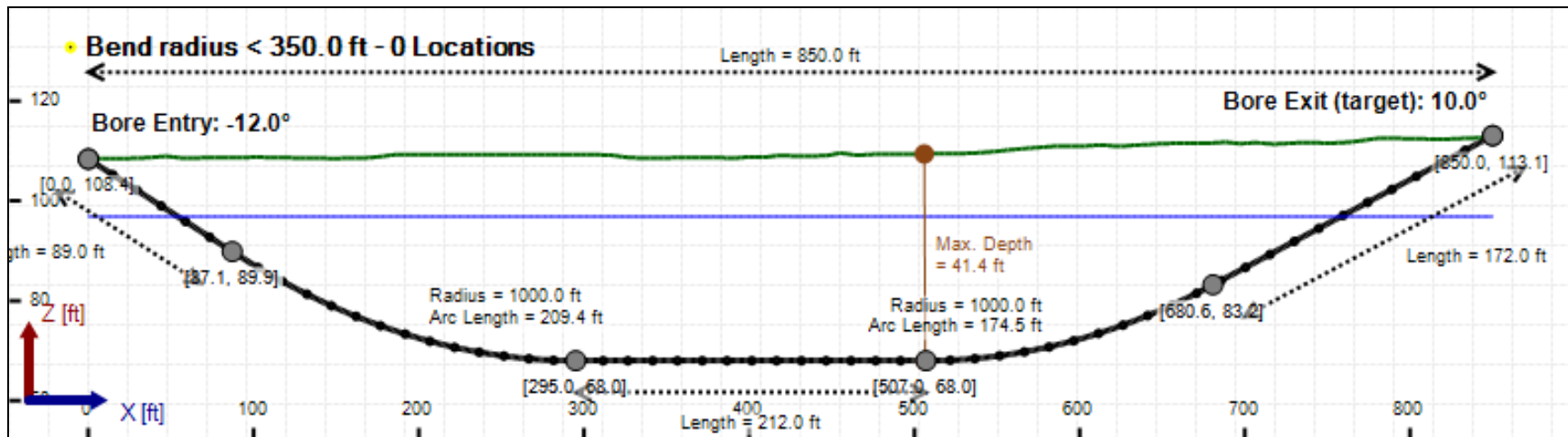
Soil Layer #5 USCS, Silt (M), MH

Depth: 35.00 ft

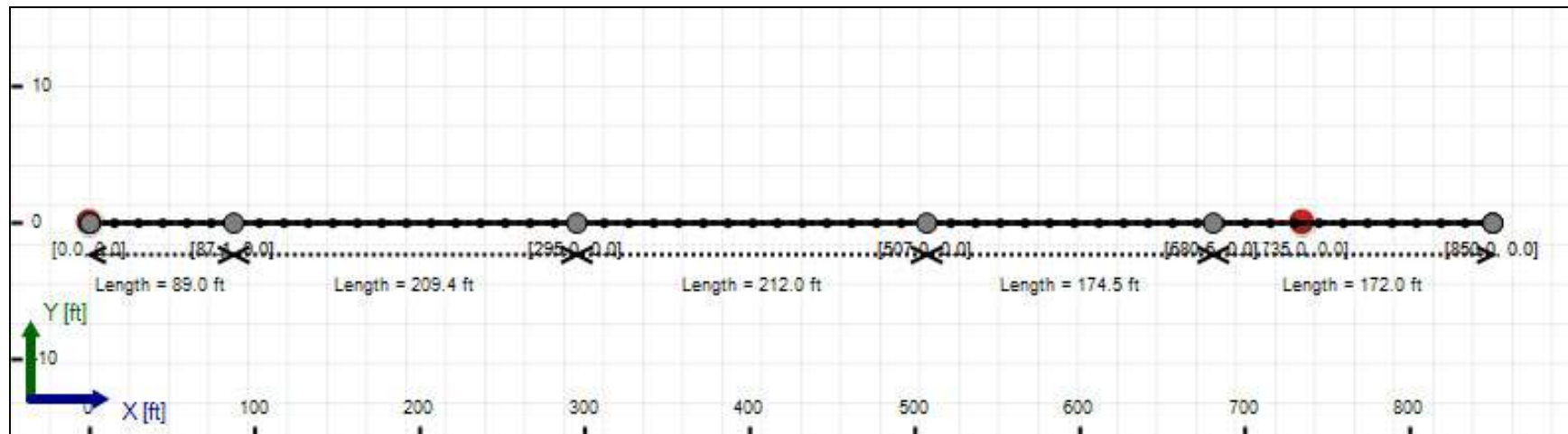
Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [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: 870.00 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	9.8	18.2
Water Pressure	12.5	12.5
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	22.3	30.7
Deflection		
Earth Load Deflection	2.677	5.070
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.809	5.202
Compressive Stress [psi]		
Compressive Wall Stress	100.5	138.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	15258.9	15258.9
Pullback Stress [psi]	425.5	425.5
Pullback Strain	7.401E-3	7.401E-3
Bending Stress [psi]	25.8	25.8
Bending Strain	4.479E-4	4.479E-4
Tensile Stress [psi]	451.3	451.3
Tensile Strain	8.297E-3	8.297E-3

Net External Pressure = 26.7 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.809	7.5	2.7	OK
Unconstrained Collapse [psi]	30.8	107.4	3.5	OK
Compressive Wall Stress [psi]	100.5	1150.0	11.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	40.7	230.5	5.7	OK
Tensile Stress [psi]	451.3	1200.0	2.7	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	8.75 in	55.168 psi	48.335 psi
1	8.75 in	12.00 in	55.128 psi	48.160 psi
2	12.00 in	16.13 in	55.060 psi	47.872 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): 70.00 US (liquid) gallon/min

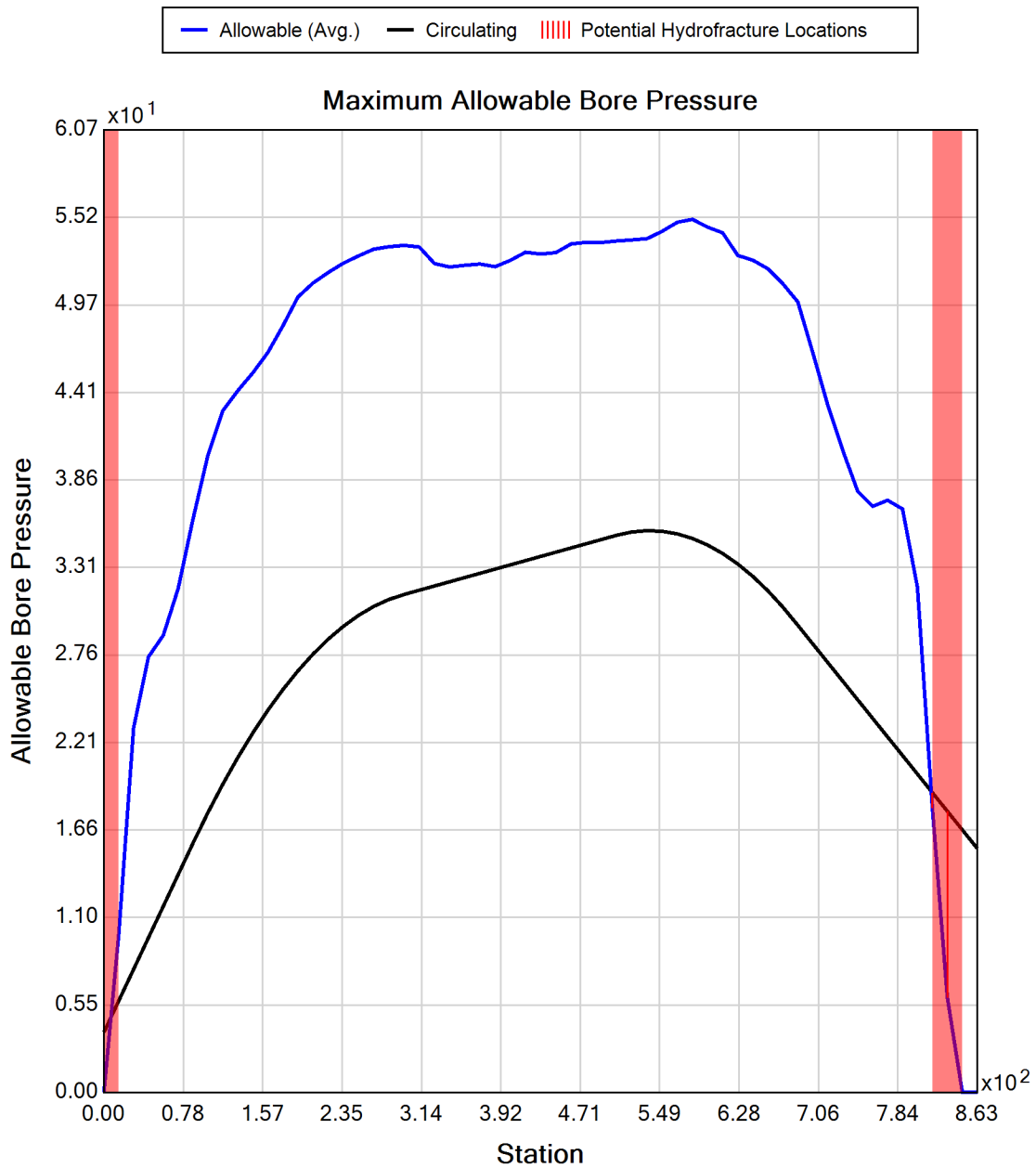
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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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: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 2
HDD 123
DWG C-323.2

Input Summary

Start Coordinate	(0.00, 0.00, 108.68) ft
End Coordinate	(850.00, 0.00, 112.75) ft
Project Length	850.00 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: 5

Soil Layer #1 USCS, Gravel (G), GM

Depth: 3.00 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, Clay (C), CL

Depth: 1.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #3 USCS, Silt (M), MH

Depth: 11.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [psi]

Soil Layer #4 USCS, Clay (C), CH

Depth: 10.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

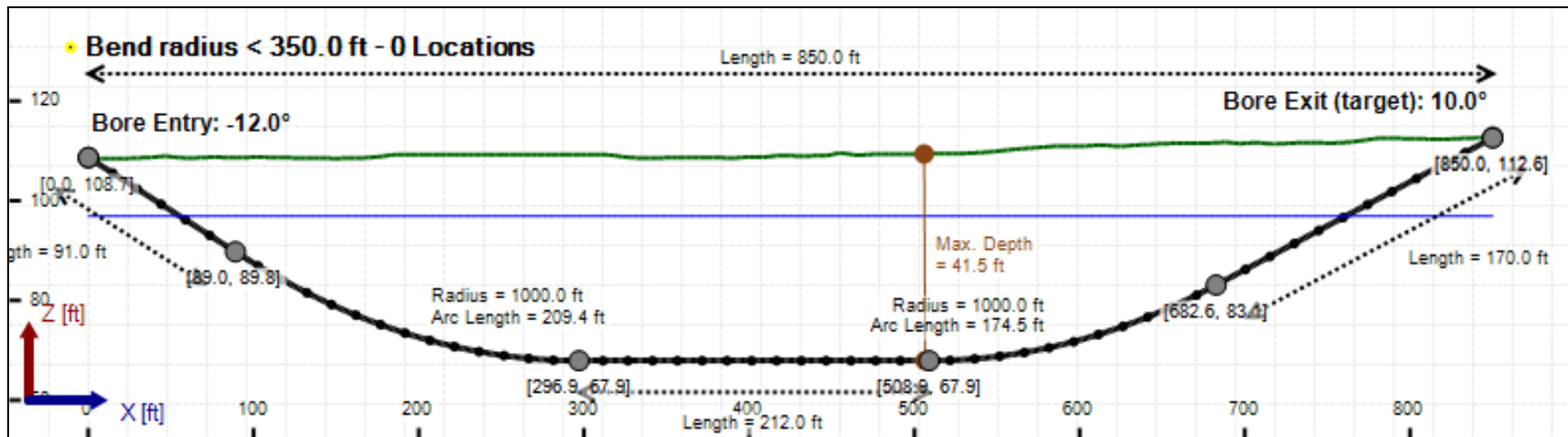
Soil Layer #5 USCS, Silt (M), MH

Depth: 35.00 ft

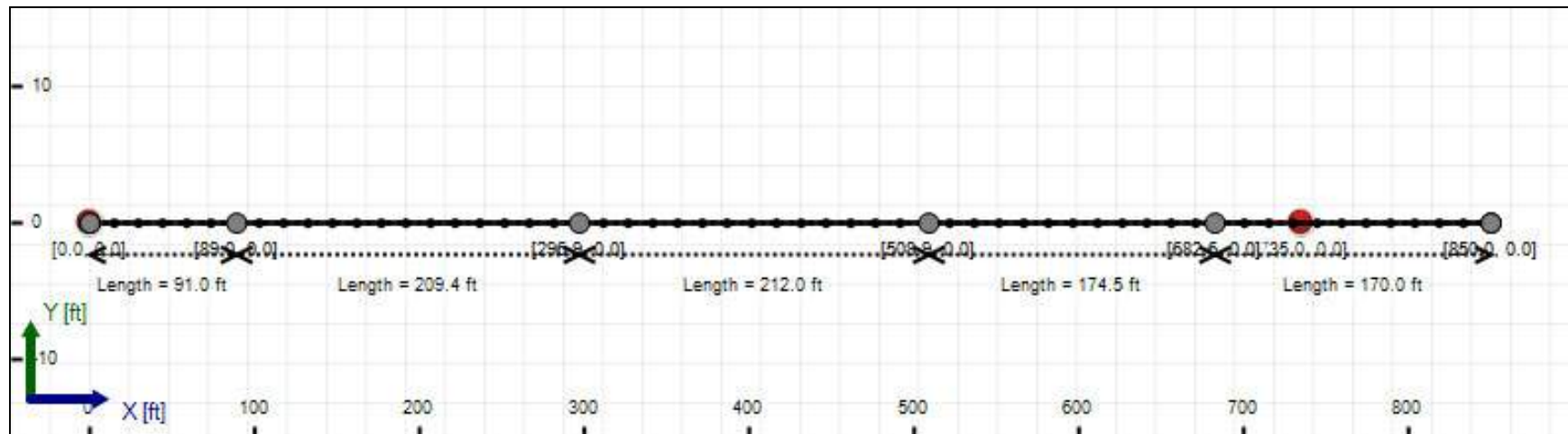
Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [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: 870.00 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	10.2	18.2
Water Pressure	12.6	12.6
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	22.8	30.7
Deflection		
Earth Load Deflection	2.785	5.069
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.917	5.201
Compressive Stress [psi]		
Compressive Wall Stress	102.6	138.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	15233.9	15233.9
Pullback Stress [psi]	424.9	424.9
Pullback Strain	7.389E-3	7.389E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	424.9	448.9
Tensile Strain	7.389E-3	8.255E-3

Net External Pressure = 26.2 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.917	7.5	2.6	OK
Unconstrained Collapse [psi]	30.5	106.4	3.5	OK
Compressive Wall Stress [psi]	102.6	1150.0	11.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	40.5	230.7	5.7	OK
Tensile Stress [psi]	448.9	1200.0	2.7	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	8.75 in	54.849 psi	46.360 psi
1	8.75 in	12.00 in	54.810 psi	46.154 psi
2	12.00 in	16.13 in	54.744 psi	45.815 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): 70.00 US (liquid) gallon/min

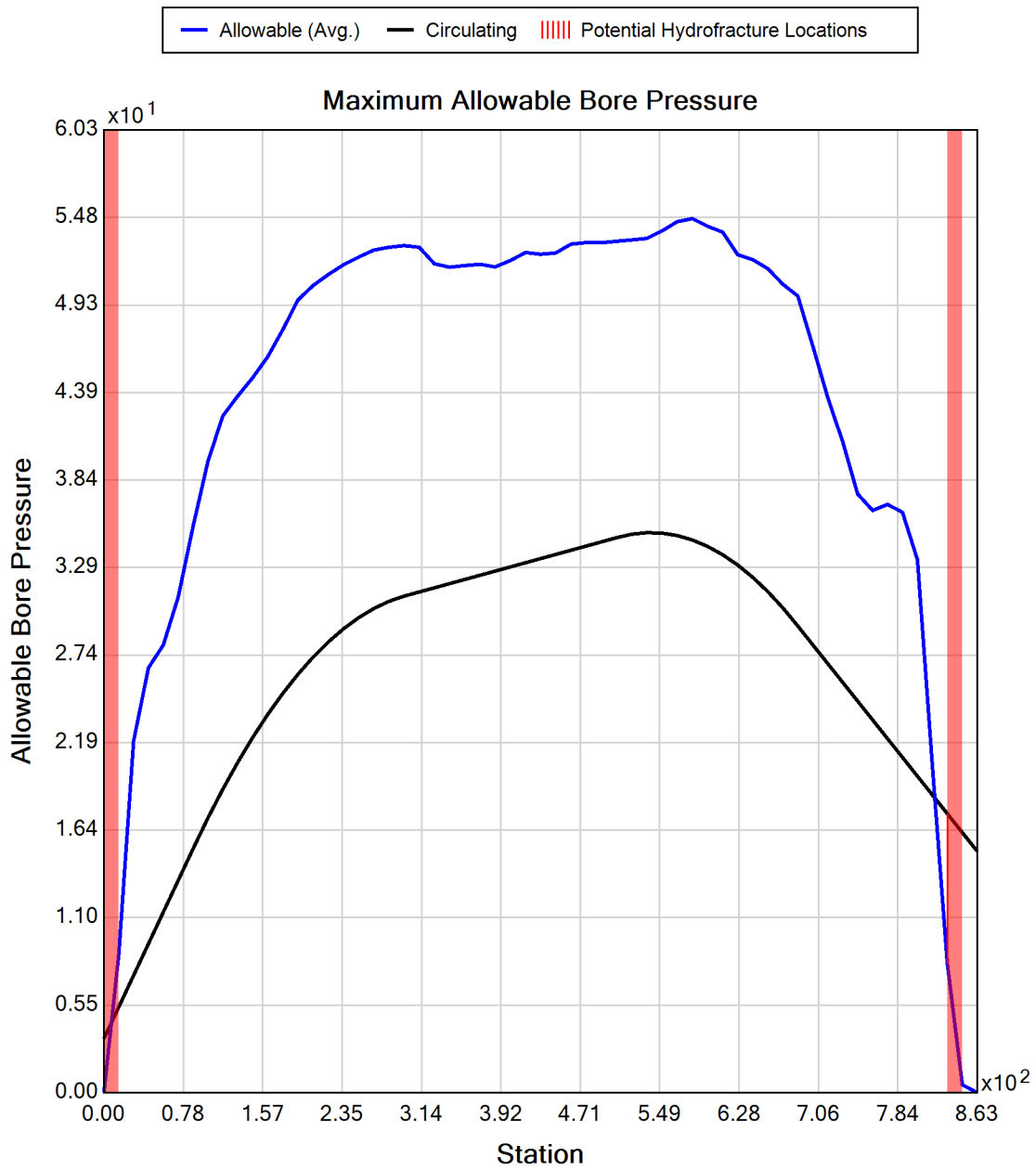
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





Generated Output



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Project Summary

General: Kiewit - CHPE
Ref: New York
204-3701
Start Date: 04-29-2022
End Date: 06-19-2023

Designer: Aaron Coady
Tetra Tech Rooney
115 Inverness Drive East, Suite 300
Englewood, Colorado
United States 80112
aaron.coady@tetrattech.com

Description: Segment 11 (Package 7A)
Conduit 3
HDD 123
DWG C-323.2

Input Summary

Start Coordinate	(0.00, 0.00, 108.68) ft
End Coordinate	(850.00, 0.00, 112.75) ft
Project Length	850.00 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: 5

Soil Layer #1 USCS, Gravel (G), GM

Depth: 3.00 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, Clay (C), CL

Depth: 1.00 ft

Unit Weight: 14.3220 (dry), 16.8861 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

Soil Layer #3 USCS, Silt (M), MH

Depth: 11.00 ft

Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [psi]

Soil Layer #4 USCS, Clay (C), CH

Depth: 10.00 ft

Unit Weight: 11.9889 (dry), 15.2922 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 300.00, Coh: 5.60 [psi]

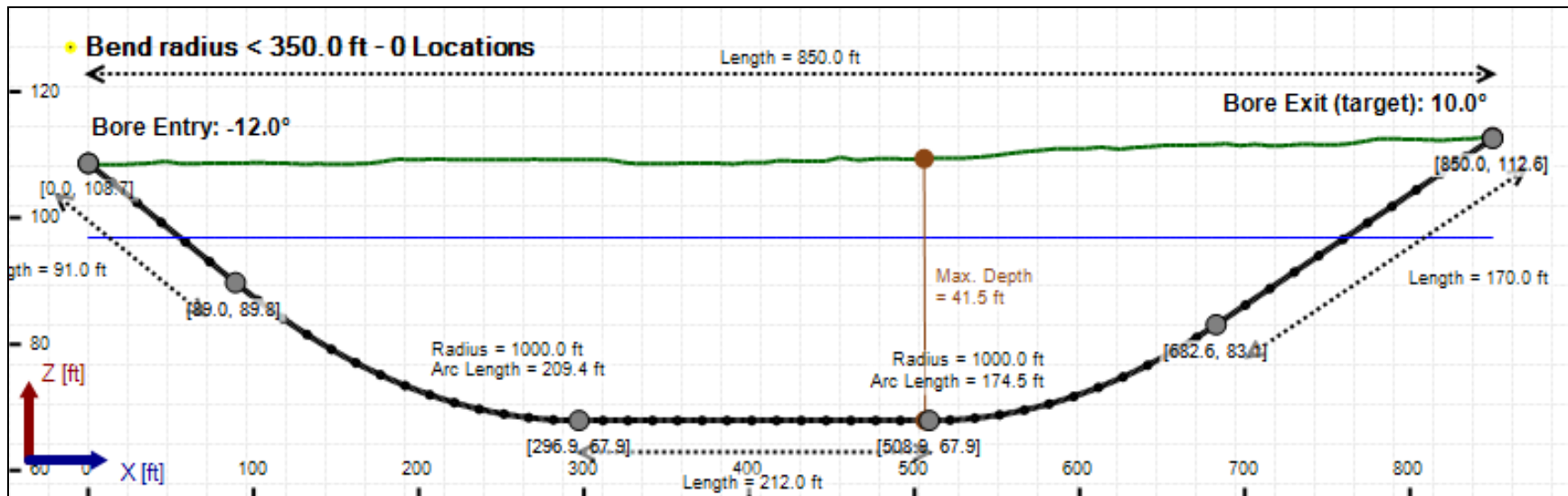
Soil Layer #5 USCS, Silt (M), MH

Depth: 35.00 ft

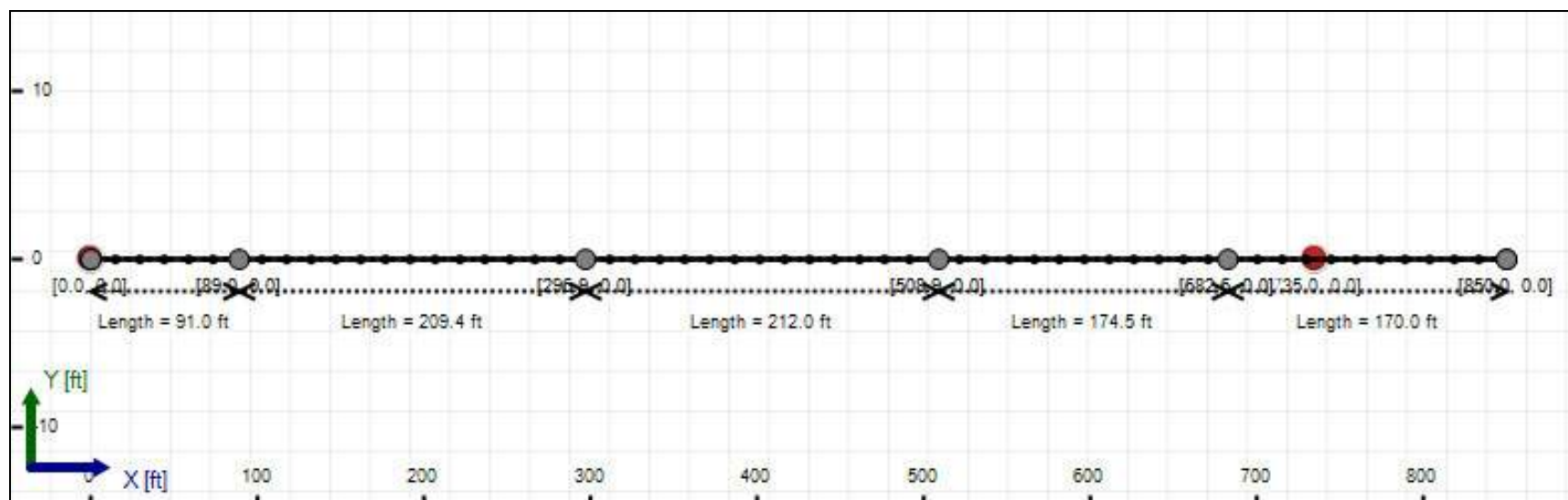
Unit Weight: 10.9956 (dry), 14.5068 (sat) [lb/US (liquid) gallon]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [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: 870.00 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	6.3	18.2
Water Pressure	12.6	12.6
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.9	30.7
Deflection		
Earth Load Deflection	1.719	5.069
Buoyant Deflection	0.043	0.043
Reissner Effect	0	0
Net Deflection	1.762	5.112
Compressive Stress [psi]		
Compressive Wall Stress	85.0	138.3

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	1727.5	1727.5
Pullback Stress [psi]	454.5	454.5
Pullback Strain	7.904E-3	7.904E-3
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	454.5	461.2
Tensile Strain	7.904E-3	8.166E-3

Net External Pressure = 26.2 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.762	7.5	4.3	OK
Unconstrained Collapse [psi]	30.5	117.9	3.9	OK
Compressive Wall Stress [psi]	85.0	1150.0	13.5	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.021	7.5	355.7	OK
Unconstrained Collapse [psi]	40.5	230.8	5.7	OK
Tensile Stress [psi]	461.2	1200.0	2.6	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	8.75 in	54.849 psi	46.360 psi
1	8.75 in	12.00 in	54.810 psi	46.154 psi
2	12.00 in	16.13 in	54.744 psi	45.815 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): 70.00 US (liquid) gallon/min

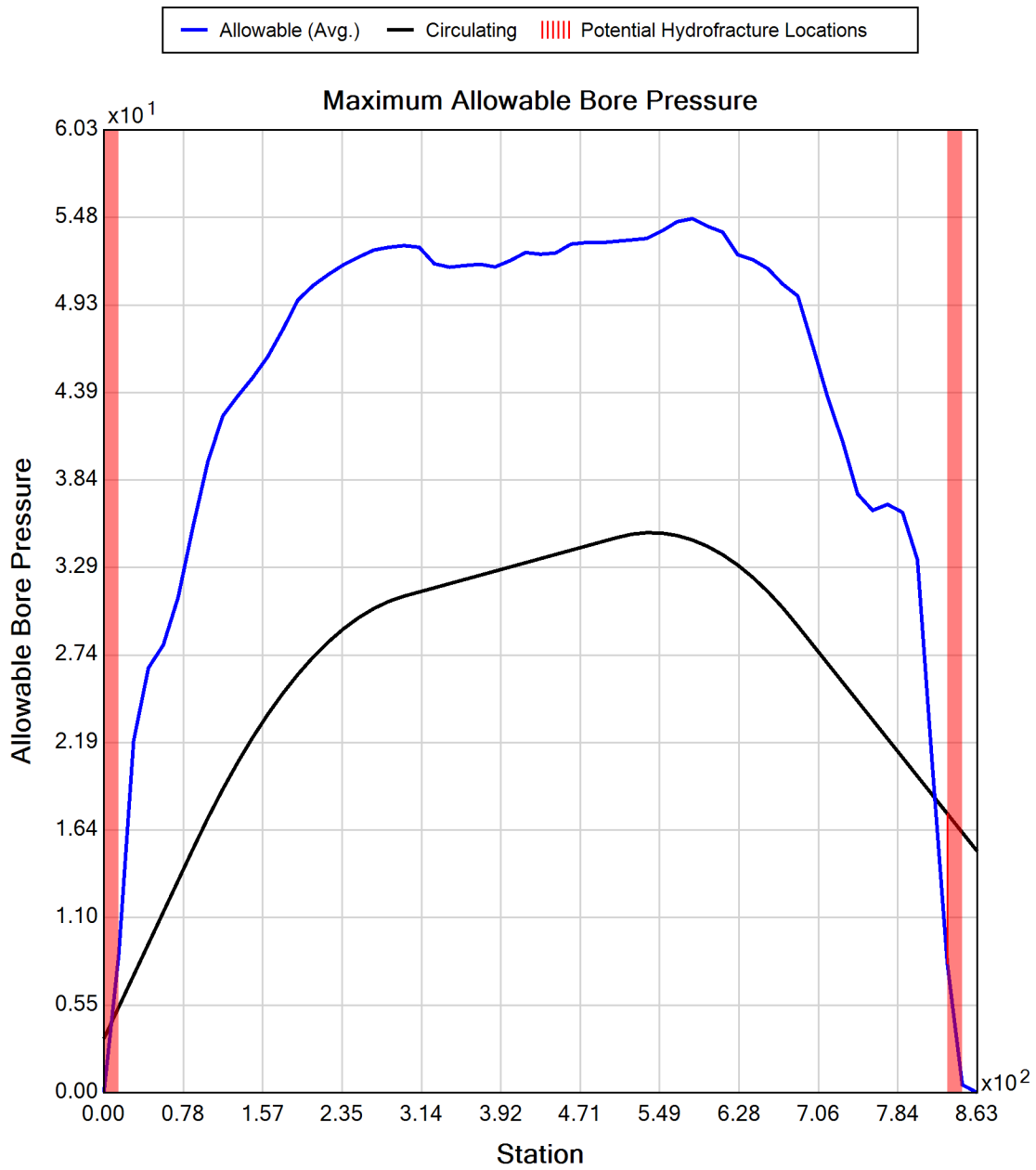
Drill Fluid Density: 10.500 lb/US (liquid) gallon

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1000.2





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Project Summary

General:	Kiewit - CHPE Ref: New York 204-3701 Start Date: 04-29-2022 End Date: 06-19-2023
Designer:	Aaron Coady Tetra Tech Rooney 115 Inverness Drive East, Suite 300 Englewood, Colorado United States 80112 aaron.coady@tetrattech.com
Description:	Segment 11 (Package 7A) Conduit 2 & 3 Equivalent Pipe Bundle HDD 123 DWG C-323.2

Input Summary

Start Coordinate	(0.00, 0.00, 108.68) ft
End Coordinate	(850.00, 0.00, 112.75) ft
Project Length	850.00 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: 870.00 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	11.5	18.2
Water Pressure	12.6	12.6
Surface Surge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	24.0	30.7
Deflection		
Earth Load Deflection	14.339	23.290
Buoyant Deflection	0.690	0.690
Reissner Effect	0	0
Net Deflection	15.029	23.980
Compressive Stress [psi]		
Compressive Wall Stress	171.8	219.7

Installation Load Summary:

Forces/Stresses	@ Maximum Force	Absolute Maximum
Pullback Force [lb]	12724.5	12724.5
Pullback Stress [psi]	317.7	317.7
Pullback Strain	5.526E-3	5.526E-3
Bending Stress [psi]	0.0	33.5
Bending Strain	0	5.833E-4
Tensile Stress [psi]	317.7	351.1
Tensile Strain	5.526E-3	6.690E-3

Net External Pressure = 15.4 [psi]

Buoyant Deflection = 0.3

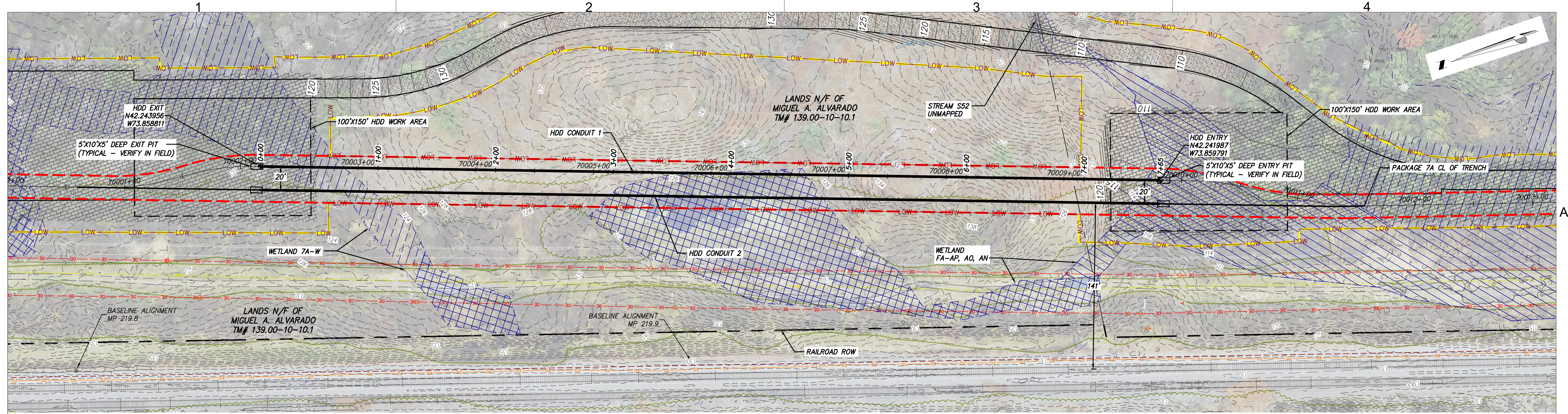
Hydrokinetic Force = 962.1 lb

Installation Analysis

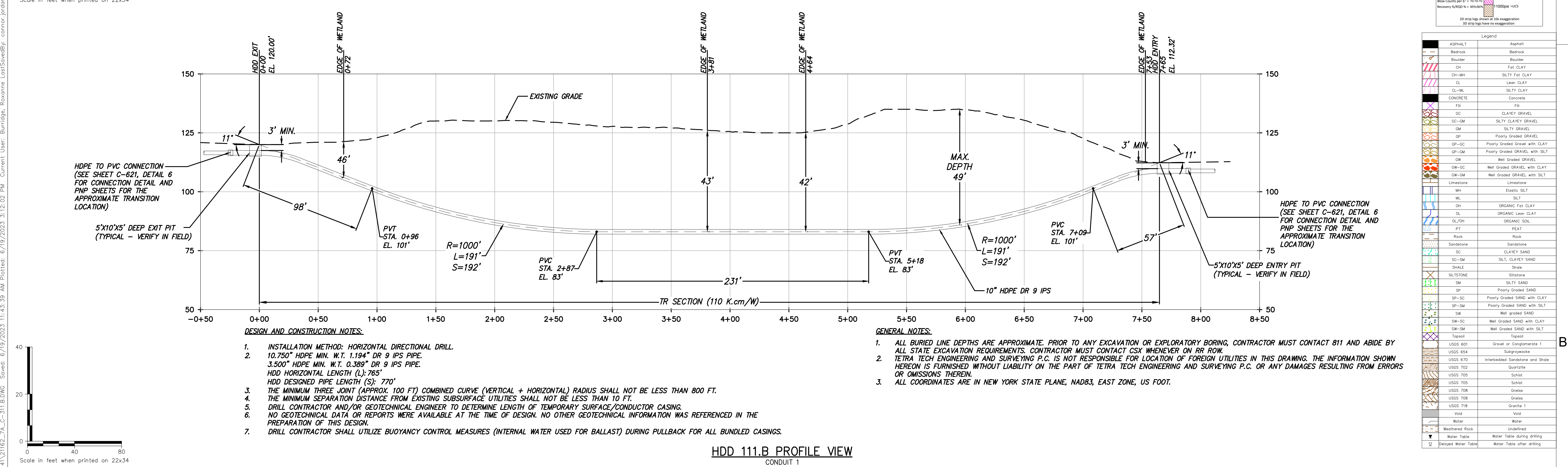
	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.338	7.5	22.2	OK
Unconstrained Collapse [psi]	20.2	50.0	2.5	OK
Tensile Stress [psi]	351.1	1200.0	3.4	OK

Appendix D


HDD Design Drawings




HDD 111.B PLAN VIEW
CONDUIT 1




HDD 111.B PROFILE VIEW
CONDUIT 1



Champlain Hudson
Power Express




Kiewit



TETRA TECH

TETRA TECH ENGINEERING AND SURVEYING P.C.
(A NEW YORK PROFESSIONAL CORPORATION)



STATE OF NEW YORK
EDWARD J. KELLY
LICENSED PROFESSIONAL ENGINEER
094981

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
0	06/19/2023	ISSUED FOR CONSTRUCTION SUBMISSION	MRS	EJK

CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 11 (PACKAGE 7A) - CSX: CATSKILL

PLAN AND PROFILE - HDD 111.B
POND CROSSING - CONDUIT 1
GREENE COUNTY, NY

KIEWIT PROJECT NO.
21162
TT PROJECT NO.
204-3701
DRAWING NO.
C-311.B

DRAWN BY: MRS

DESIGNED BY: AMC

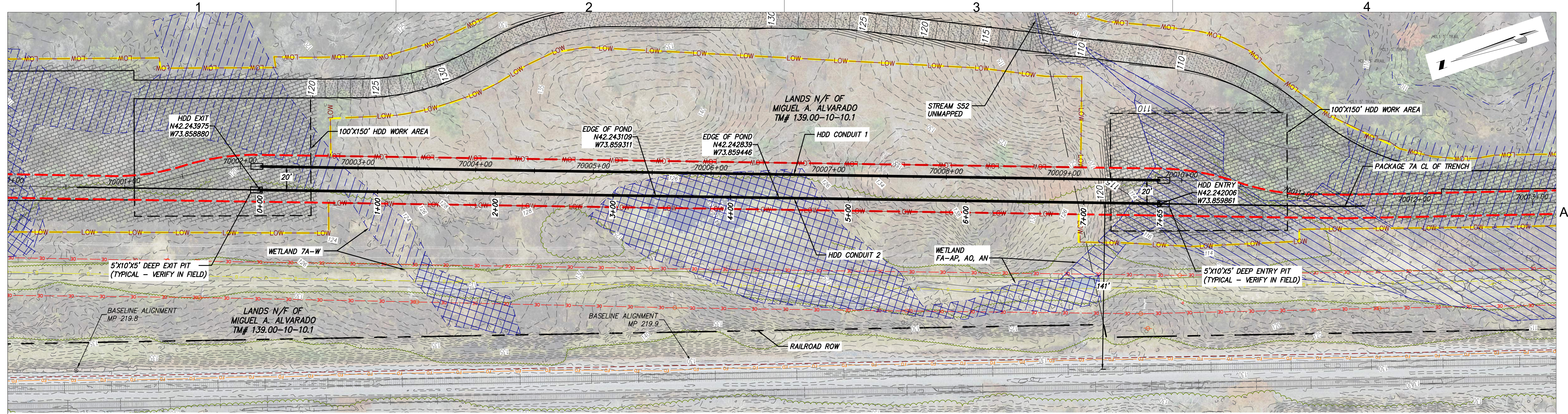
APPROVED BY: EJK

SCALE
REV. NO.

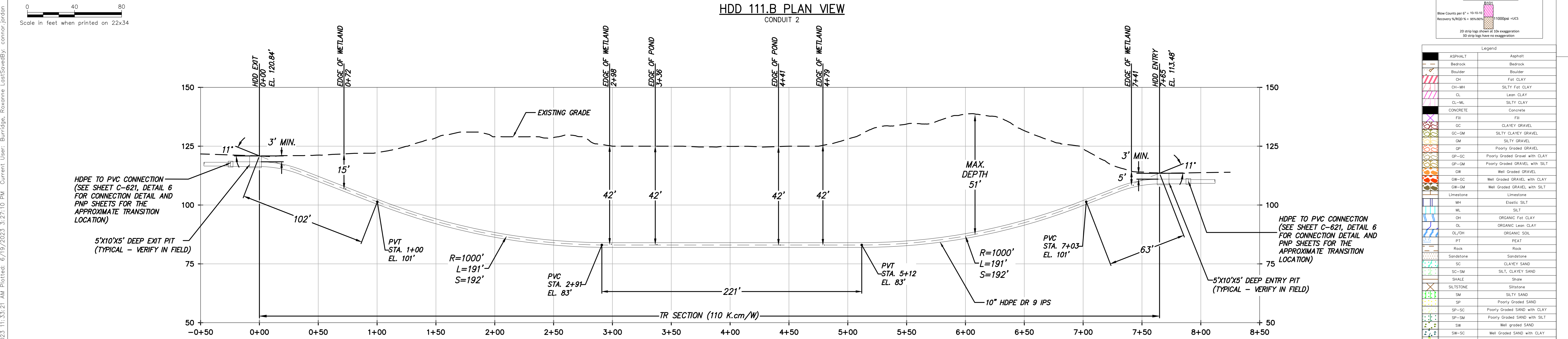
AS SHOWN

DATE
06/19/2023

SH.NO.
OF



HDD 111.B PLAN VIEW
CONDUIT 2



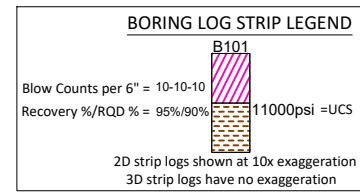
HDD 111.B PROFILE VIEW
CONDUIT 2

DESIGN AND CONSTRUCTION NOTES:

1. INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL.
2. 10.750" HDPE MIN. W.T. 1.194" DR 9 IPS PIPE.
3.500" HDPE MIN. W.T. 0.389" DR 9 IPS PIPE.
HDD HORIZONTAL LENGTH (L): 765'
HDD DESIGNED PIPE LENGTH (S): 770'
3. THE MINIMUM THREE JOINT (APPROX. 100 FT) COMBINED CURVE (VERTICAL + HORIZONTAL) RADIUS SHALL NOT BE LESS THAN 800 FT.
4. THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FT.
5. DRILL CONTRACTOR AND/OR GEOTECHNICAL ENGINEER TO DETERMINE LENGTH OF TEMPORARY SURFACE/CONDUCTOR CASING.
6. NO GEOTECHNICAL DATA OR REPORTS WERE AVAILABLE AT THE TIME OF DESIGN. NO OTHER GEOTECHNICAL INFORMATION WAS REFERENCED IN THE PREPARATION OF THIS DESIGN.
7. DRILL CONTRACTOR SHALL UTILIZE BUOYANCY CONTROL MEASURES (INTERNAL WATER USED FOR BALLAST) DURING PULLBACK FOR ALL BUNDLED CASINGS.

GENERAL NOTES:

1. ALL BURIED LINE DEPTHS ARE APPROXIMATE. PRIOR TO ANY EXCAVATION OR EXPLORATORY BORING, CONTRACTOR MUST CONTACT 811 AND ABIDE BY ALL STATE EXCAVATION REQUIREMENTS. CONTRACTOR MUST CONTACT CSX WHENEVER ON RR ROW.
2. TETRA TECH ENGINEERING AND SURVEYING P.C. IS NOT RESPONSIBLE FOR LOCATION OF FOREIGN UTILITIES IN THIS DRAWING. THE INFORMATION SHOWN HEREON IS FURNISHED WITHOUT LIABILITY ON THE PART OF TETRA TECH ENGINEERING AND SURVEYING P.C. OR ANY DAMAGES RESULTING FROM ERRORS OR OMISSIONS THEREIN.
3. ALL COORDINATES ARE IN NEW YORK STATE PLANE, NAD83, EAST ZONE, US FOOT.



Legend	
	Asphalt
	Bedrock
	Boulder
	Fat CLAY
	SILTY Fat CLAY
	Lean CLAY
	SILTY CLAY
	Concrete
	FILL
	CLAYEY GRAVEL
	SILTY CLAYEY GRAVEL
	SILTY GRAVEL
	Poorly Graded GRAVEL
	Poorly Graded GRAVEL with CLAY
	Poorly Graded GRAVEL with SILT
	Well Graded GRAVEL
	Well Graded GRAVEL with CLAY
	Well Graded GRAVEL with SILT
	Limestone
	Elastic SILT
	SILT
	ORGANIC Fat CLAY
	ORGANIC Lean CLAY
	ORGANIC SOIL
	PEAT
	Rock
	Sandstone
	CLAYEY SAND
	SILT, CLAYEY SAND
	Shale
	Siltstone
	SILTY SAND
	Poorly Graded SAND
	Poorly Graded SAND with CLAY
	Poorly Graded SAND with SILT
	Well graded SAND
	Well Graded SAND with CLAY
	Well Graded SAND with SILT
	Topsoil
	Gravel or Conglomerate 1
	Subgraywacke
	Interbedded Sandstone and Shale
	Quartzite
	Schist
	Schist
	Gneiss
	Gneiss
	Granite I
	Voids
	Water
	Undefined
	Water Table during drilling
	Water Table after drilling



TETRA TECH ENGINEERING AND SURVEYING P.C.
(A NEW YORK PROFESSIONAL CORPORATION)



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

0	06/19/2023	ISSUED FOR CONSTRUCTION SUBMISSION	MRS	EJK
No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP

CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 11 (PACKAGE 7A) - CSX: CATSKILL

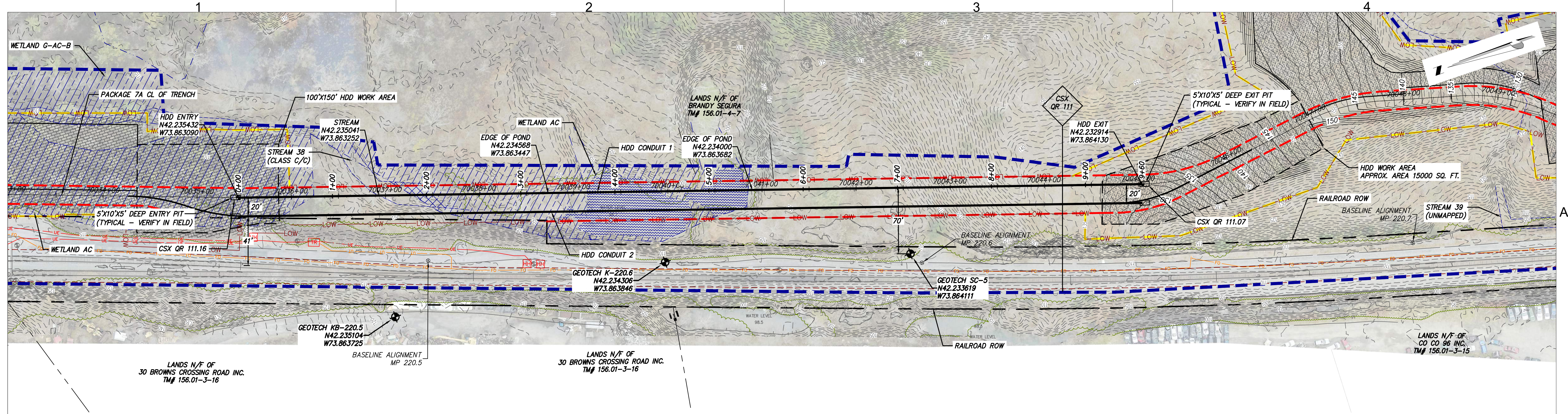
PLAN AND PROFILE - HDD 111.B
POND CROSSING - CONDUIT 2
GREENE COUNTY, NY

DRAWN BY: MRS	DESIGNED BY: AMC	APPROVED BY: EJK	SCALE	AS SHOWN	DATE
0	0	0	REV. NO.	0	SH.NO.

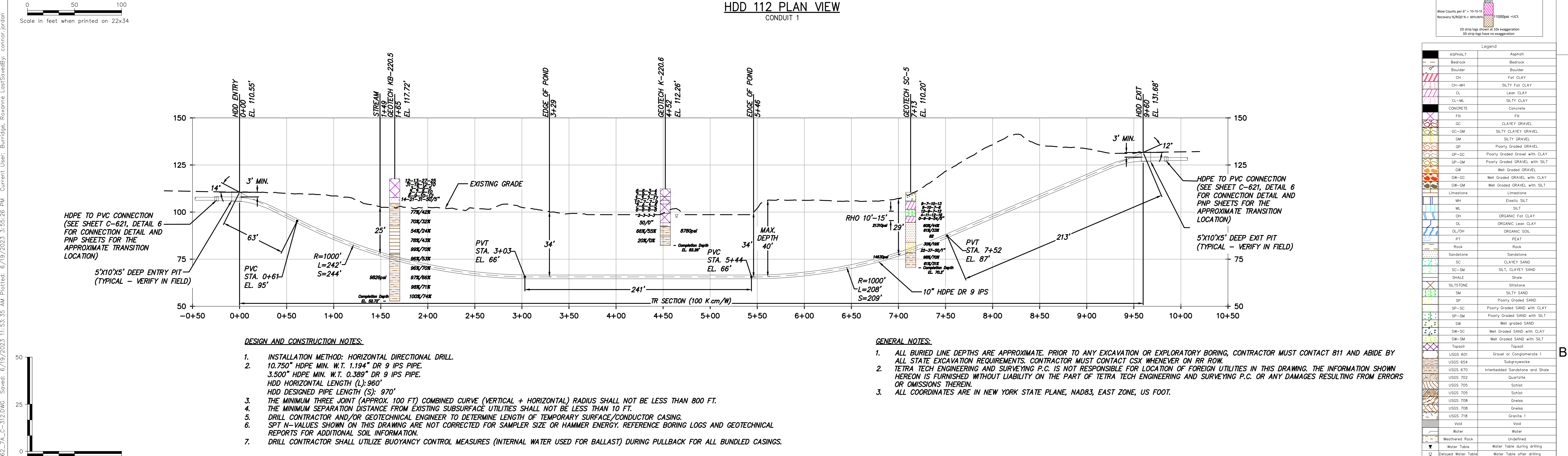
KIEWIT PROJECT NO.
21162
TT PROJECT NO.
204-3701
DRAWING NO.

C-311.B.2


DATE 06/19/2023
OF




HDD 112 PLAN VIEW
CONDUIT 1




HDD 112 PROFILE VIEW
CONDUIT 1



Champlain Hudson Power Express




Kiewit



TETRA TECH

TETRA TECH ENGINEERING AND SURVEYING P.C.
(A NEW YORK PROFESSIONAL CORPORATION)



EDWARD J. KELLY
LICENSED PROFESSIONAL ENGINEER
094981

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CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 11 (PACKAGE 7A) - CSX: CATSKILL

PLAN AND PROFILE - HDD 112
POND CROSSING - CONDUIT 1
GREENE COUNTY, NY

DRAWN BY:	DESIGNED BY:	APPROVED BY:	SCALE	AS SHOWN	DATE
MRS	AMC	EJK	REV. NO.	0	06/19/2023

KIEWIT PROJECT NO. 21162
TT PROJECT NO. 204-3701
DRAWING NO. **C-312**

DATE OF