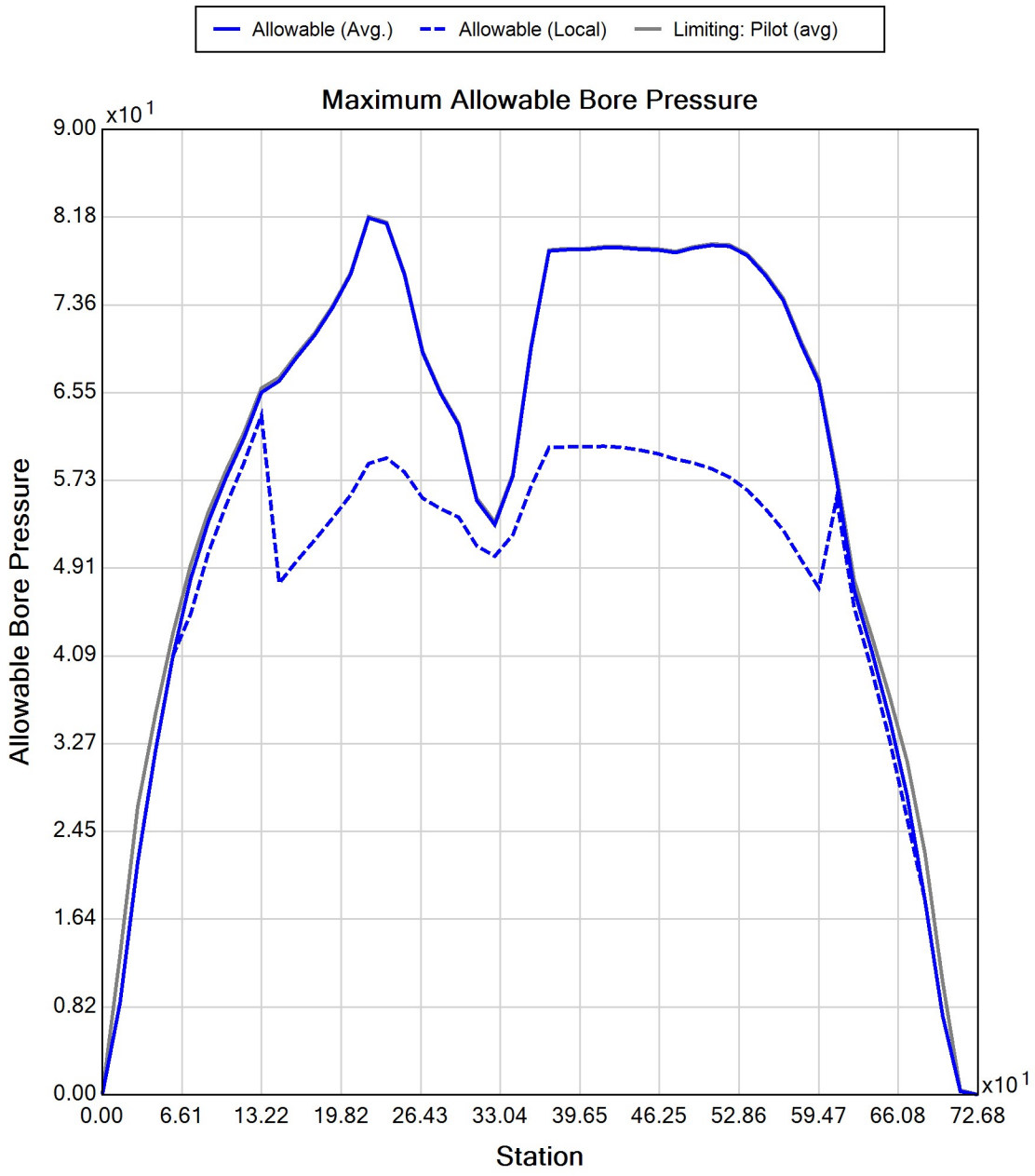

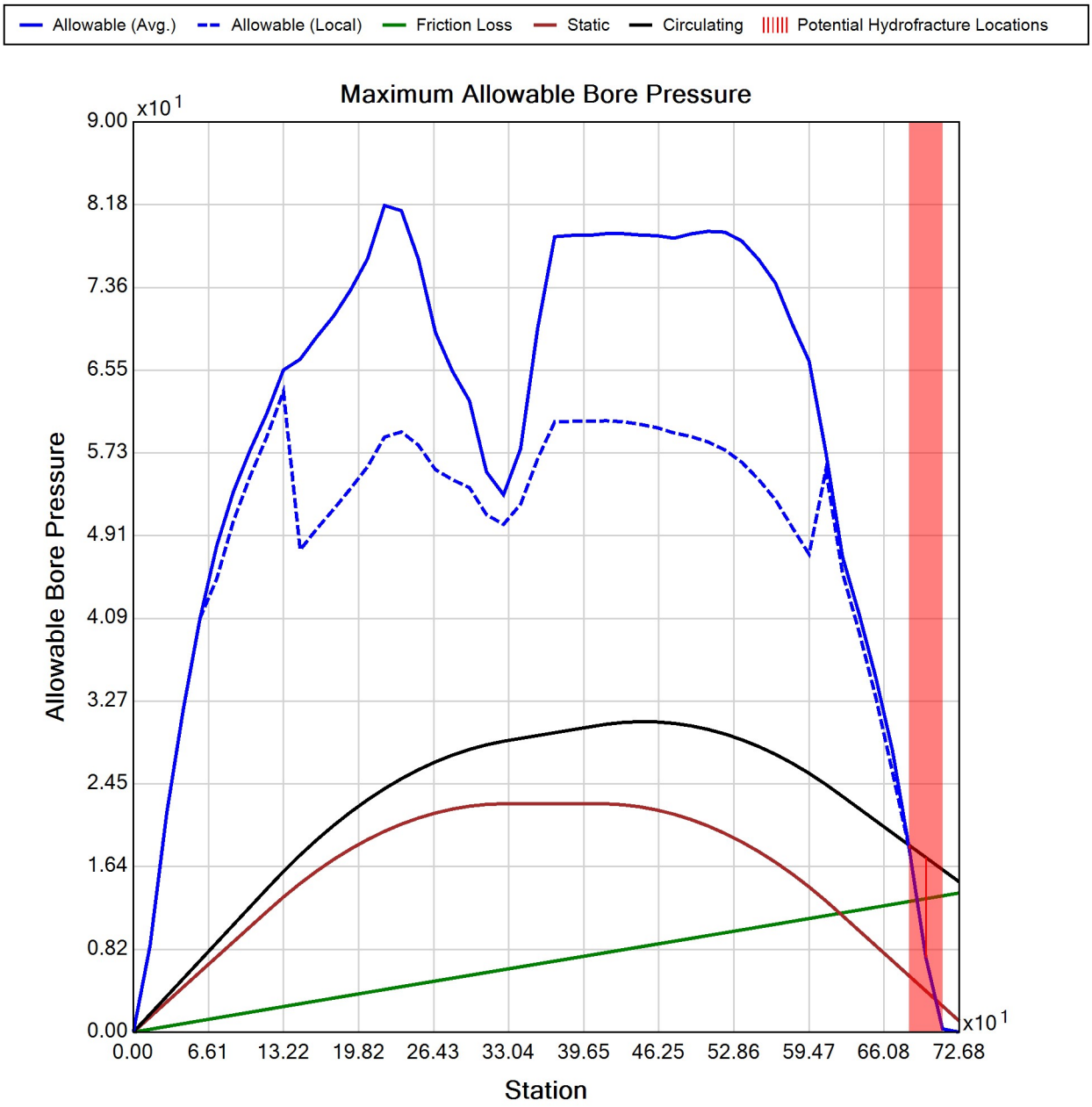

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Project Summary

General:	CHPE HDD 62A
	P4B
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR
	CHA
Description:	HDD 62A 2-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 284.00) ft
End Coordinate	(714.40, 0.00, 279.00) ft
Project Length	714.40 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 735.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.7	18.6
Water Pressure	18.3	18.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	20.1	36.9
Deflection		
Earth Load Deflection	0.512	5.291
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.541	5.320
Compressive Stress [psi]		
Compressive Wall Stress	90.2	165.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	744.0	744.0
Pullback Stress [psi]	425.1	425.1
Pullback Strain	7.393E-3	7.393E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	425.1	429.8
Tensile Strain	7.393E-3	7.574E-3

Net External Pressure = 26.2 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.541	7.5	13.9	OK
Unconstrained Collapse [psi]	30.8	132.0	4.3	OK
Compressive Wall Stress [psi]	90.2	1150.0	12.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	40.8	232.5	5.7	OK
Tensile Stress [psi]	429.8	1200.0	2.8	OK

Generated Output

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Project Summary

General:	CHPE
	Ref: Schnectedy Couty, NY
	HDD 63
	Start Date: 07-24-2023
	End Date: 07-24-2023
Project Owner:	TDI
Project Contractor:	Kiewit + Subs
Project Consultant:	Kiewit, CHA, BCE
Designer:	M Boscardin
	BCE
Description:	HDD 63 10-inch HDPE, DR9

Input Summary

Start Coordinate	(0.00, 0.00, 289.00) ft
End Coordinate	(1237.00, 0.00, 294.00) ft
Project Length	1237.00 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

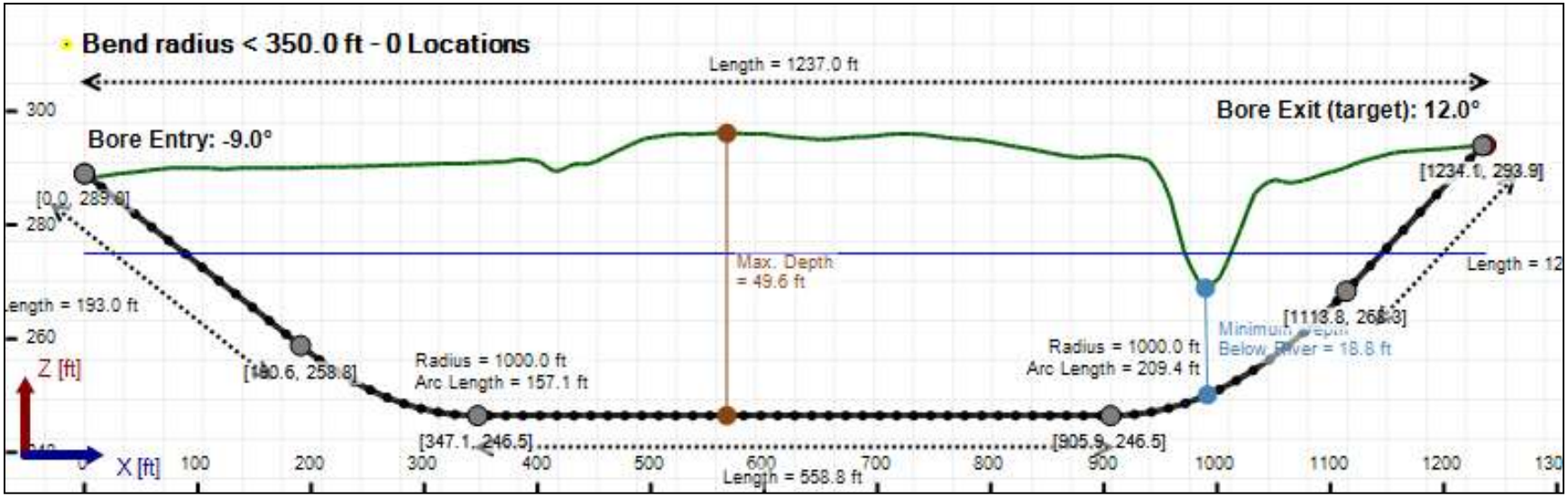
Soil Layer #1 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL
From Assistant
Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 300.00, Coh: 5.10 [psi]

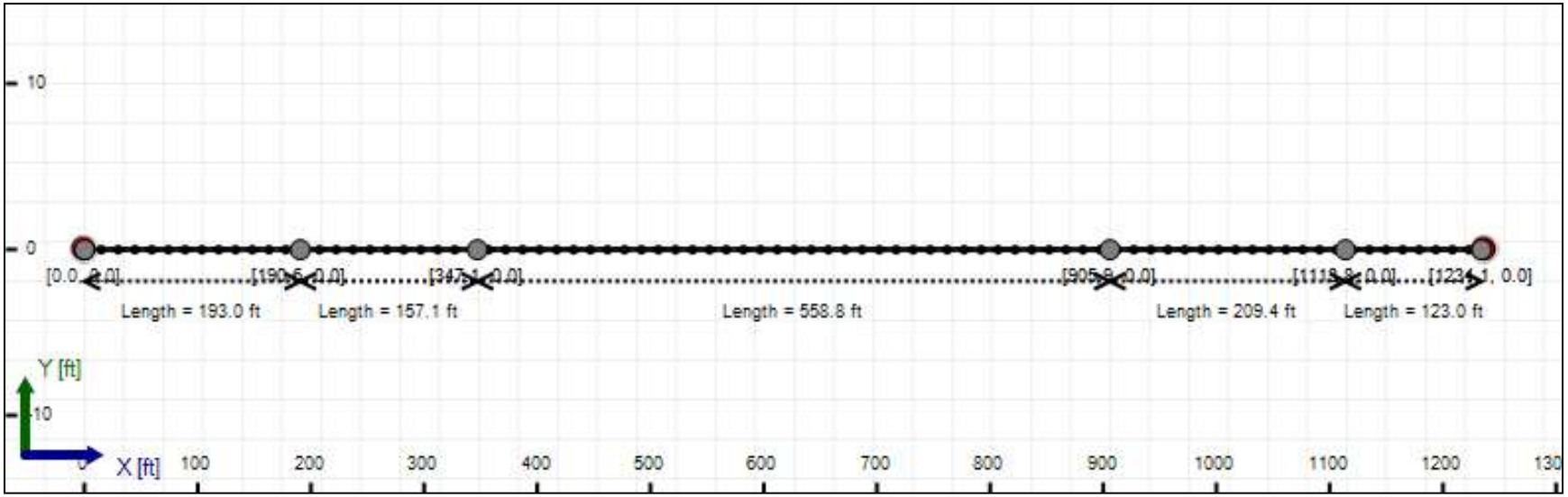
Soil Layer #3 USCS, Gravel (G), GP
From Assistant
Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #4 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [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: 1245.00 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	8.1	34.5
Water Pressure	11.4	12.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.5	46.9
Deflection		
Earth Load Deflection	2.206	9.409
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.338	9.541
Compressive Stress [psi]		
Compressive Wall Stress	87.8	211.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	20700.3	20700.3
Pullback Stress [psi]	577.3	577.3
Pullback Strain	1.004E-2	1.004E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	577.3	601.1
Tensile Strain	1.004E-2	1.090E-2

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 [%]	2.338	7.5	3.2	OK
Unconstrained Collapse [psi]	29.9	112.0	3.7	OK
Compressive Wall Stress [psi]	87.8	1150.0	13.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	41.3	220.6	5.3	OK
Tensile Stress [psi]	601.1	1200.0	2.0	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	8.00 in	1578.189 psi	2021.920 psi
1	8.00 in	12.00 in	1577.950 psi	2021.678 psi
2	12.00 in	16.13 in	1577.604 psi	2021.327 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: 68.700 lb/ft3

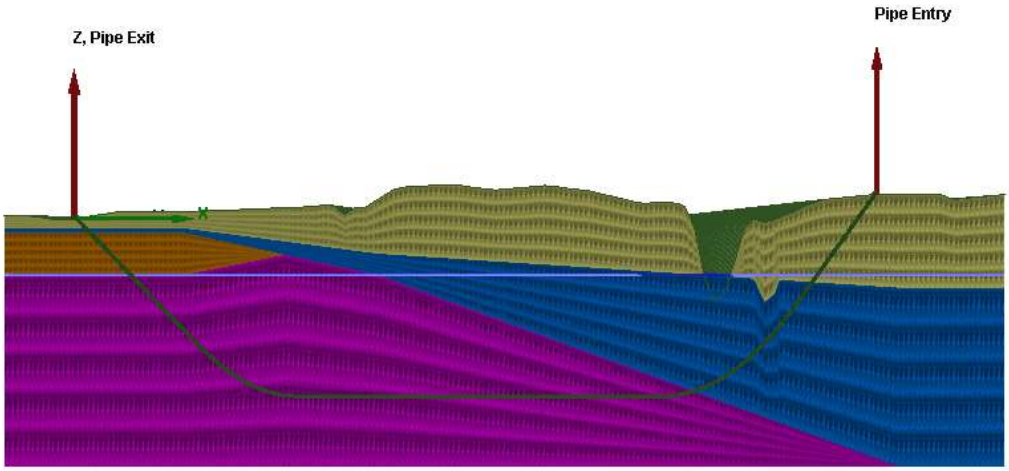
Rheological model: Power-Law

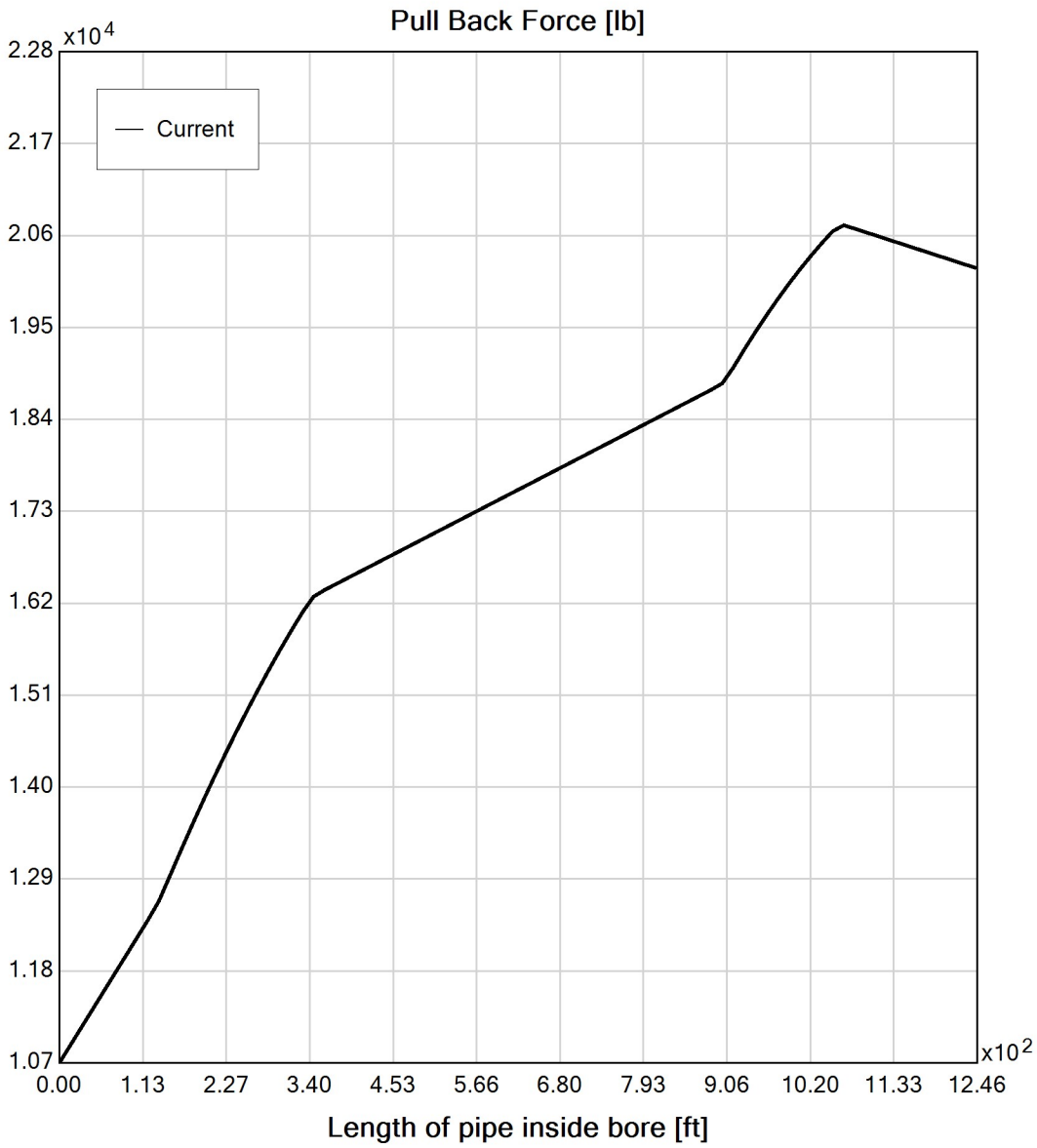
Fluid Consistency Index (K): 63.17

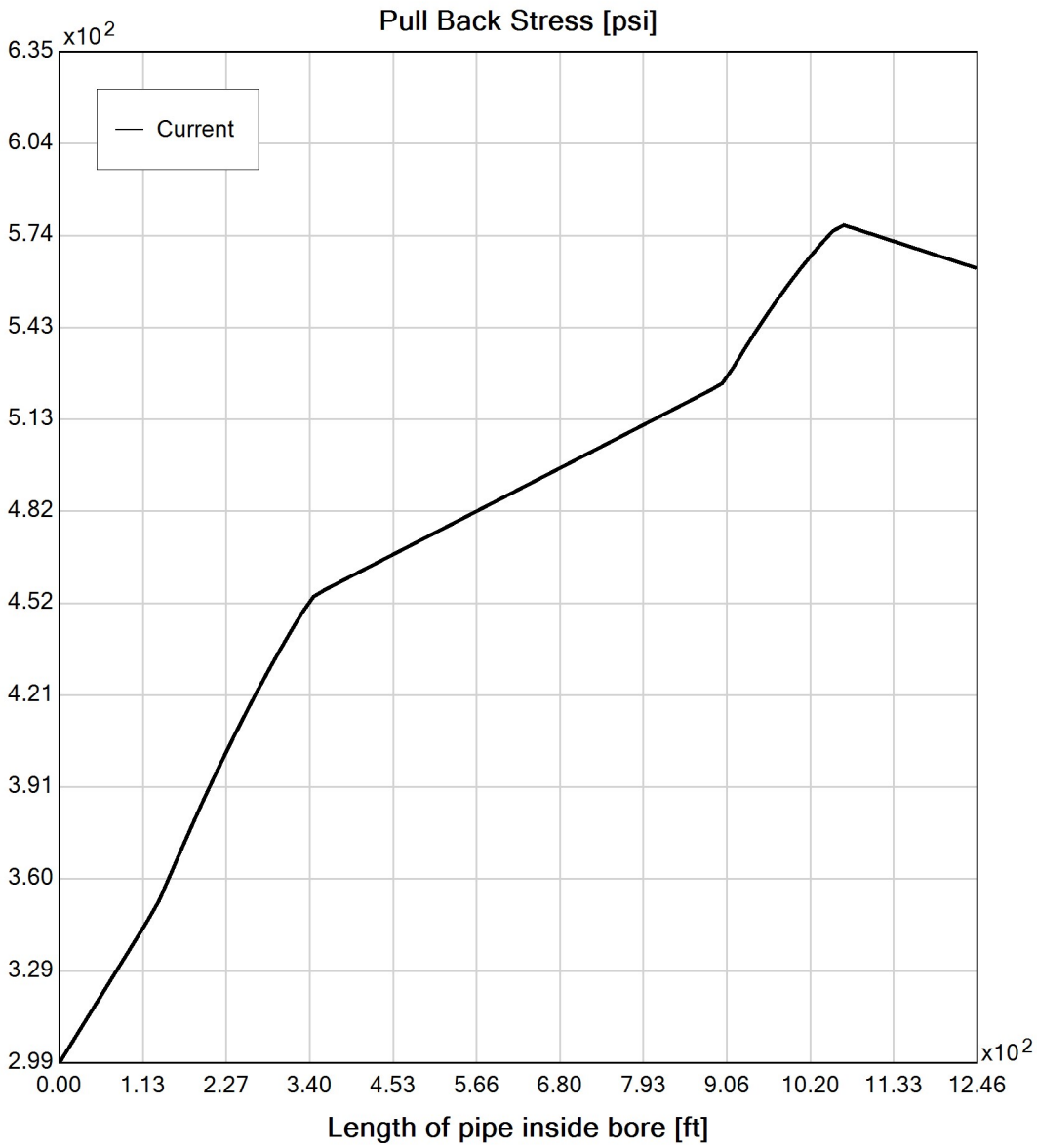
Power Law Exponent (n): 0.14

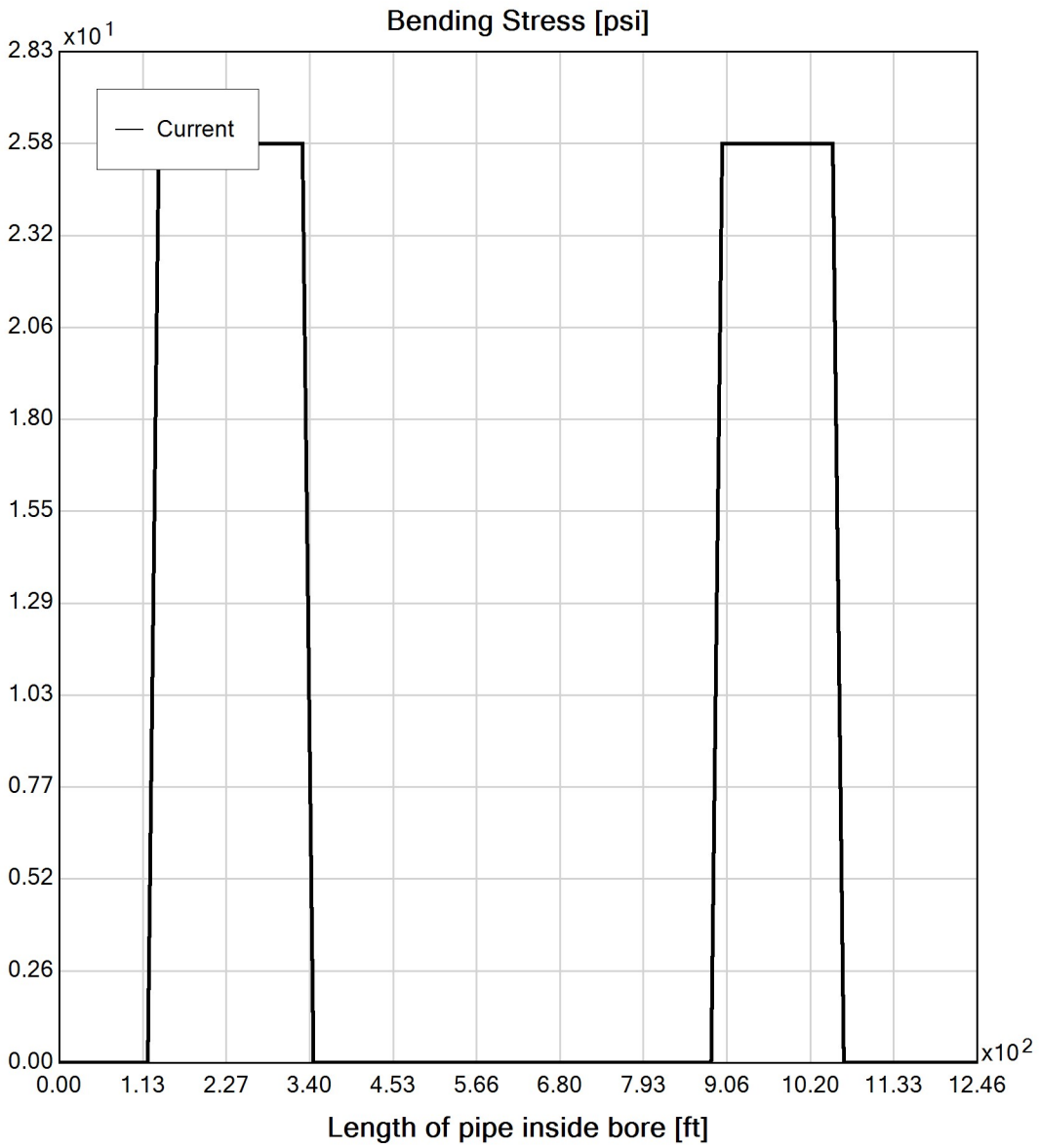
Effective Viscosity (cP): 333.0

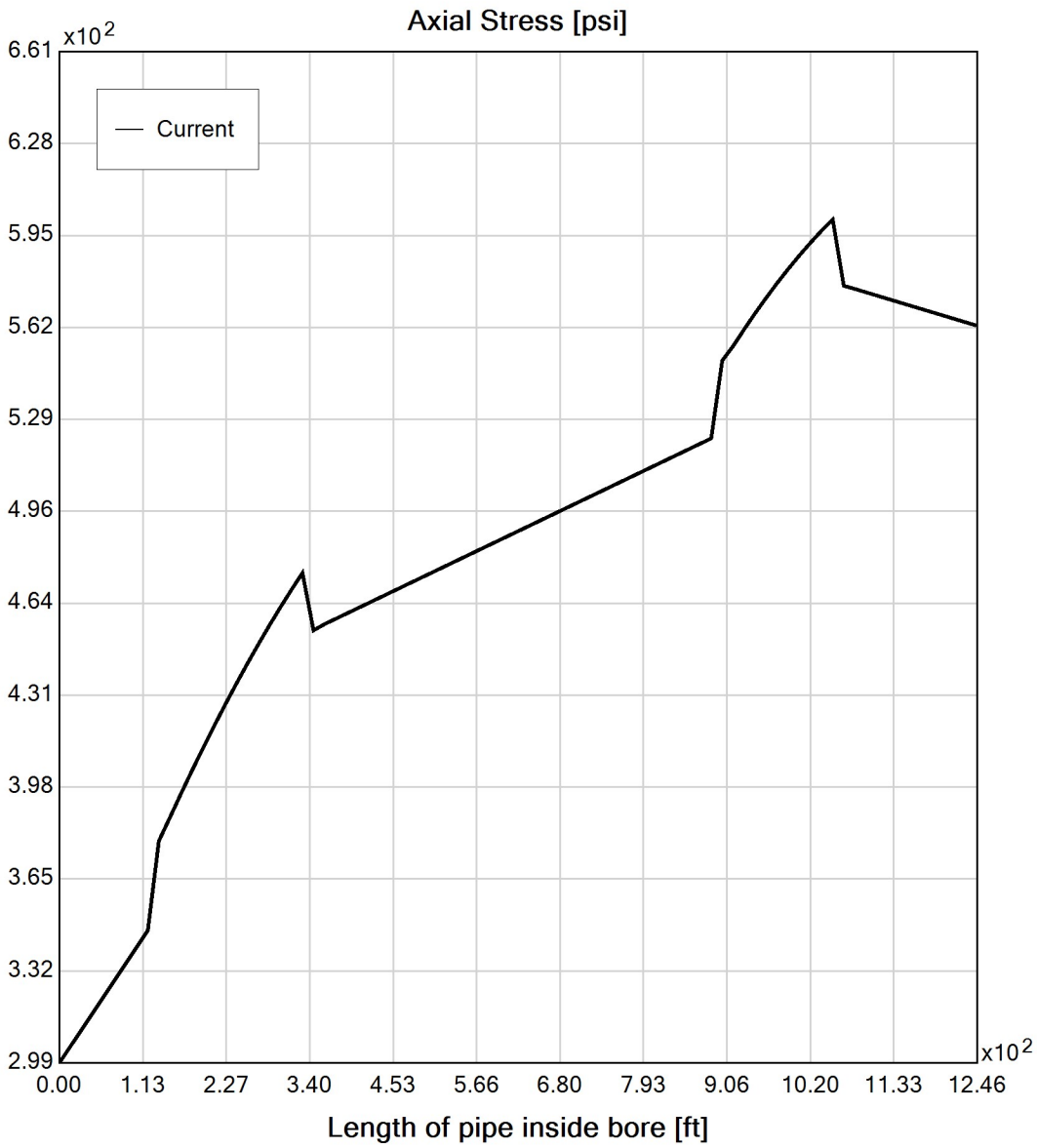
Virtual Site

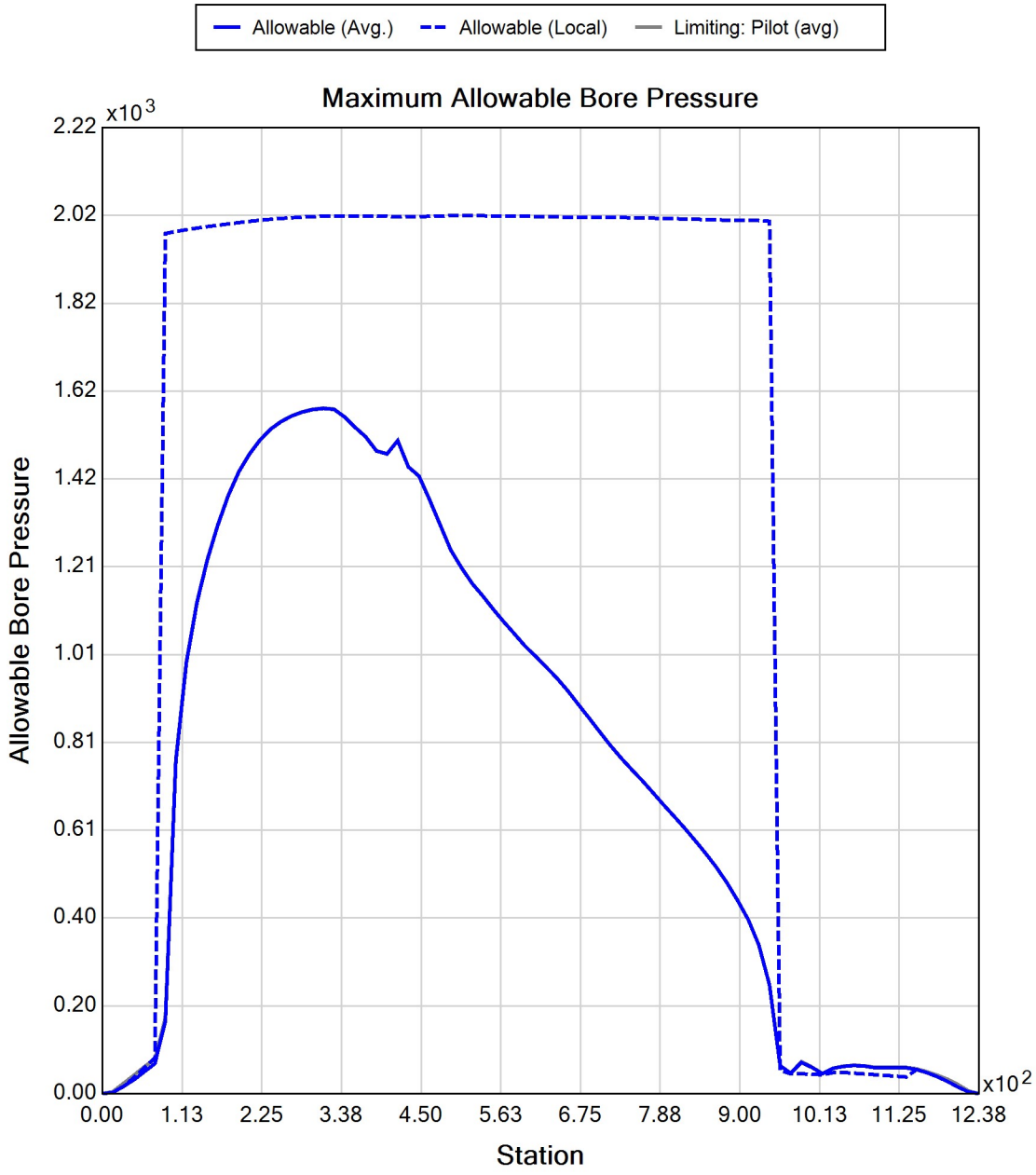


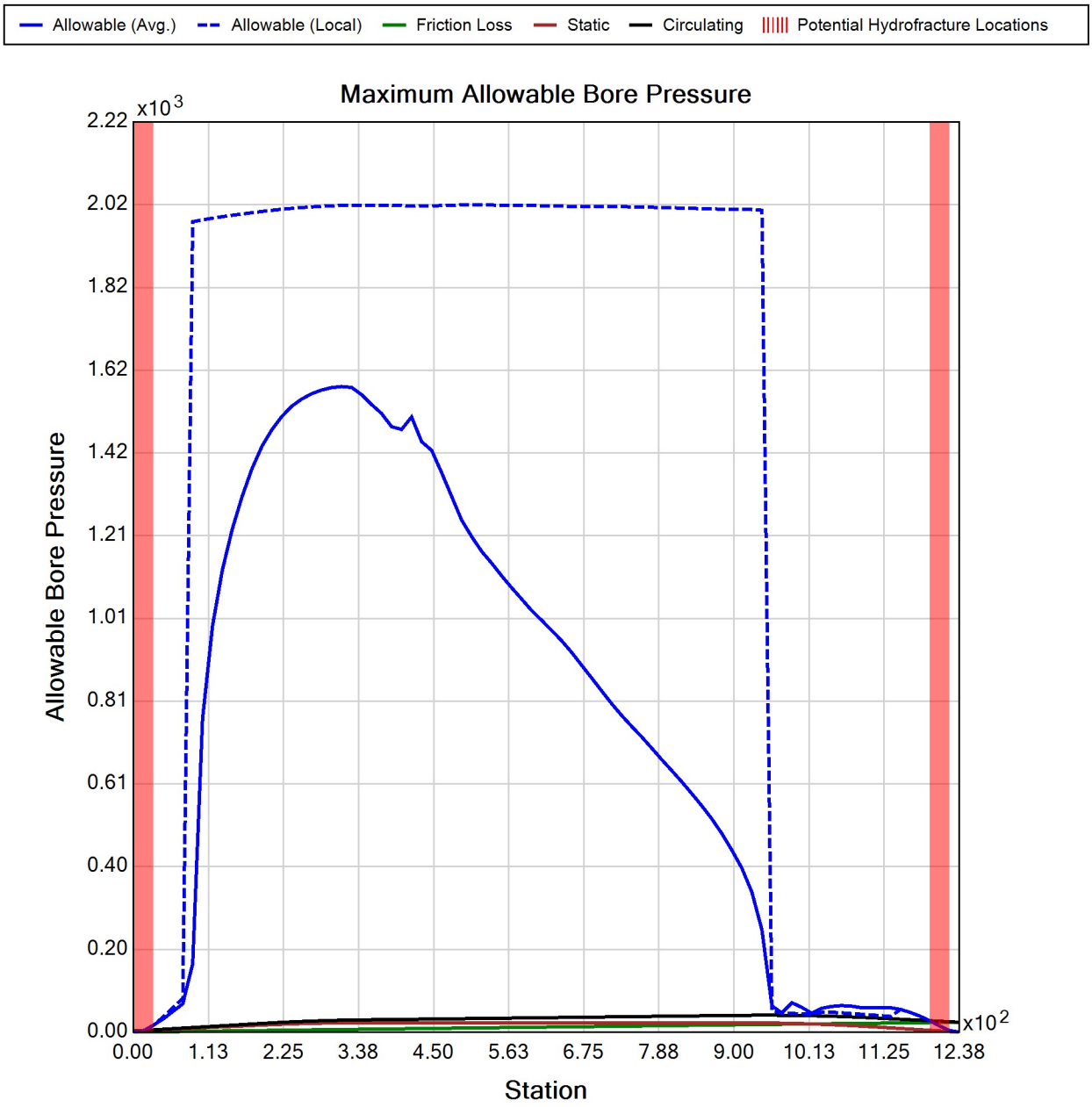












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Project Summary

General:	CHPE
	Ref: Schnectedy Couty, NY
	HDD 63
	Start Date: 07-24-2023
	End Date: 07-24-2023
Project Owner:	TDI
Project Contractor:	Kiewit + Subs
Project Consultant:	Kiewit, CHA, BCE
Designer:	M Boscardin
	BCE
Description:	HDD 63 2-inch HDPE, DR9

Input Summary

Start Coordinate	(0.00, 0.00, 289.00) ft
End Coordinate	(1237.00, 0.00, 294.00) ft
Project Length	1237.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 1245.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	7.1	34.5
Water Pressure	11.4	12.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.5	46.9
Deflection		
Earth Load Deflection	1.934	9.409
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	1.963	9.438
Compressive Stress [psi]		
Compressive Wall Stress	83.3	211.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1120.0	1120.0
Pullback Stress [psi]	639.9	639.9
Pullback Strain	1.113E-2	1.113E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	639.9	643.6
Tensile Strain	1.113E-2	1.129E-2

Net External Pressure = 32.0 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.963	7.5	3.8	OK
Unconstrained Collapse [psi]	29.9	115.8	3.9	OK
Compressive Wall Stress [psi]	83.3	1150.0	13.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	41.3	218.5	5.3	OK
Tensile Stress [psi]	643.6	1200.0	1.9	OK

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Project Summary

General:	CHPE HDD 64 P4B Start Date: 06-27-2023 End Date: 06-27-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR/MDB rev CHA
Description:	HDD 64 10-inch DR9 Conduit 2 revised

Input Summary

Start Coordinate	(0.00, 0.00, 284.00) ft
End Coordinate	(1352.00, 0.00, 289.70) ft
Project Length	1352.00 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), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

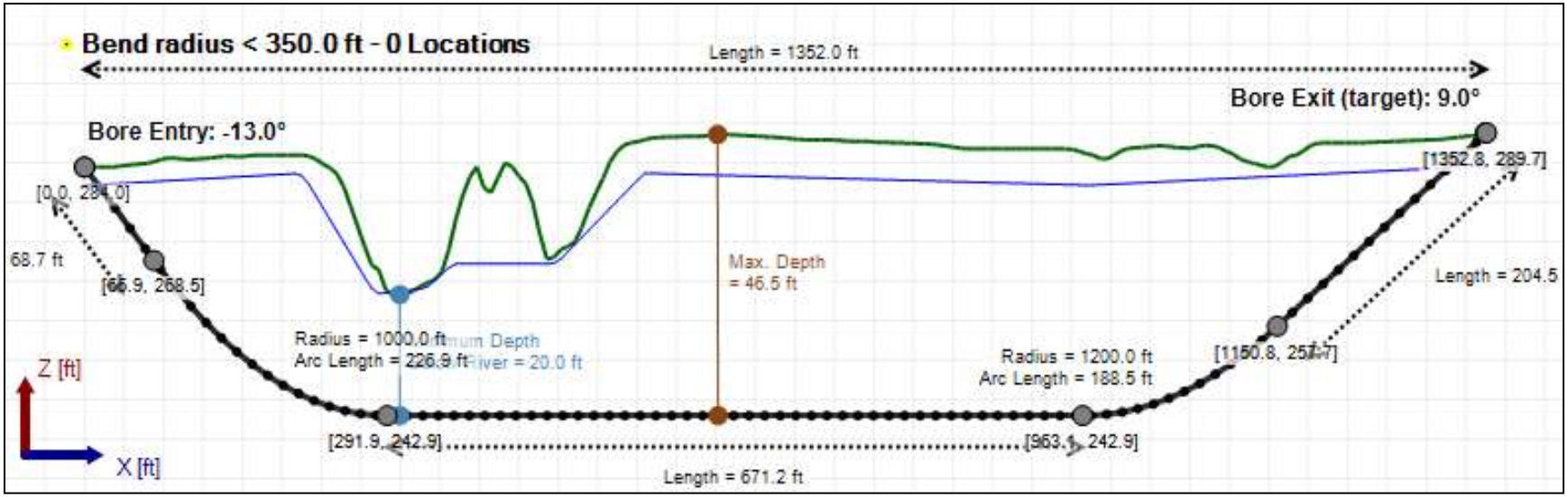
Soil Layer #3 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Sand (S), SM
From Assistant
Unit Weight: 115.0000 (dry), 130.0000 (sat) [lb/ft3]
Phi: 35.00, S.M.: 650.00, Coh: 0.00 [psi]

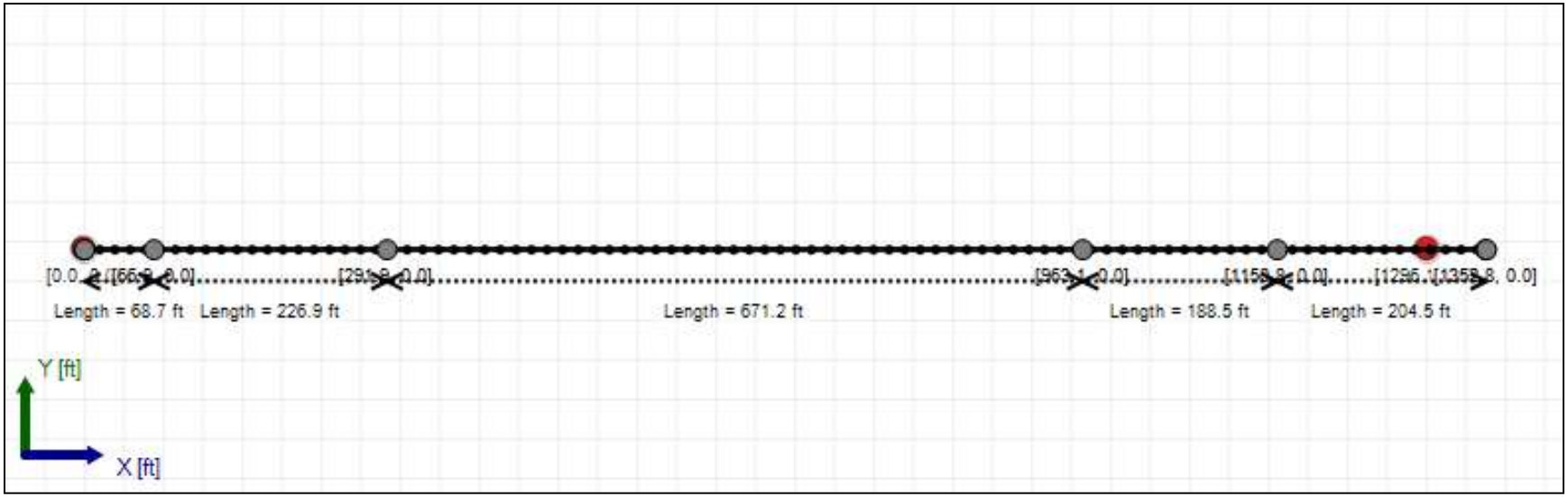
Soil Layer #5 USCS, Clay (C), CL
From Assistant
Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 400.00, Coh: 8.20 [psi]

Soil Layer #6 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [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: 1365.00 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.6	22.7
Water Pressure	17.4	17.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	21.0	39.9
Deflection		
Earth Load Deflection	1.262	6.611
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.394	6.743
Compressive Stress [psi]		
Compressive Wall Stress	94.5	179.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	23026.4	23026.4
Pullback Stress [psi]	642.2	642.2
Pullback Strain	1.117E-2	1.117E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	642.2	665.6
Tensile Strain	1.117E-2	1.202E-2

Net External Pressure = 23.0 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.394	7.5	5.4	OK
Unconstrained Collapse [psi]	30.9	121.9	3.9	OK
Compressive Wall Stress [psi]	94.5	1150.0	12.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	40.9	217.4	5.3	OK
Tensile Stress [psi]	665.6	1200.0	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	8.00 in	865.436 psi	2015.708 psi
1	8.00 in	12.00 in	864.541 psi	2015.439 psi
2	12.00 in	16.13 in	863.244 psi	2015.049 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): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

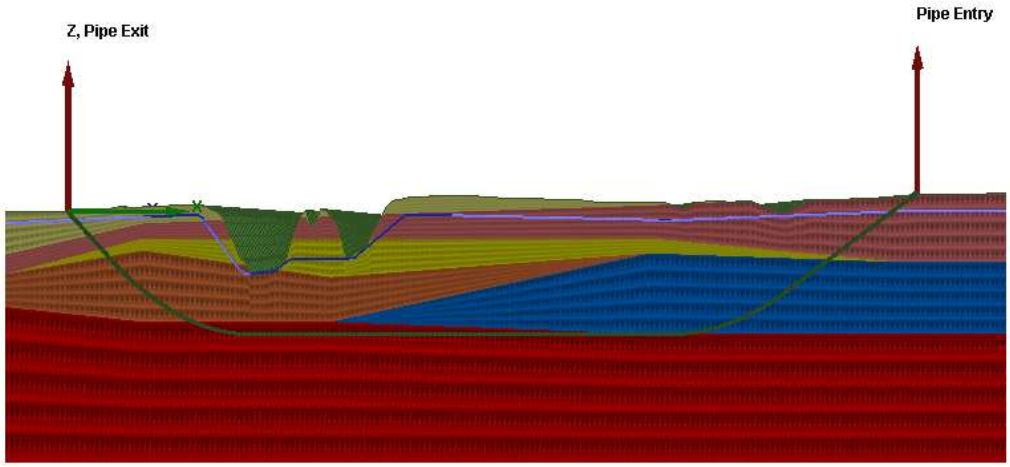
Rheological model: Bingham-Plastic

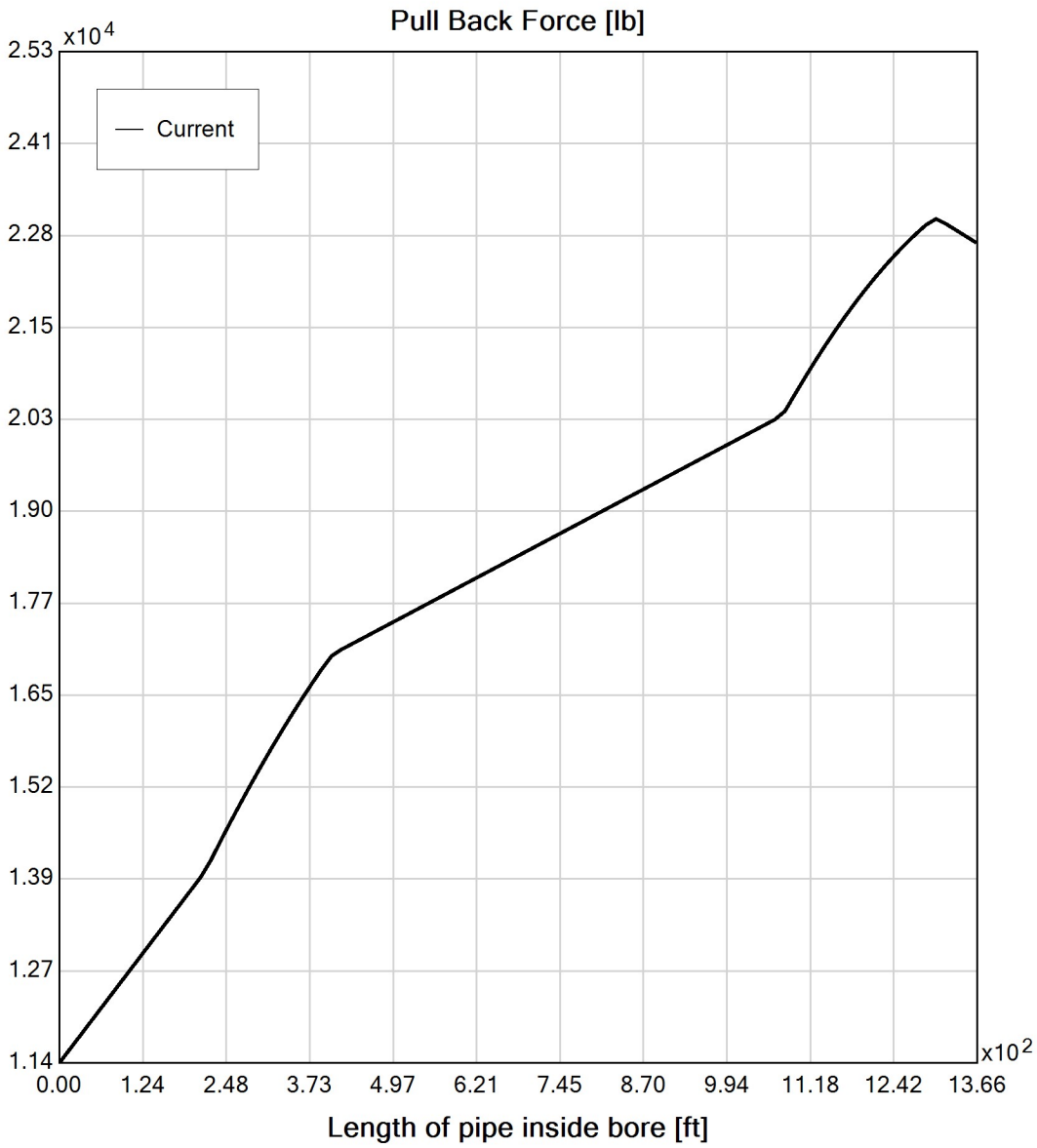
Plastic Viscosity (PV): 25.53

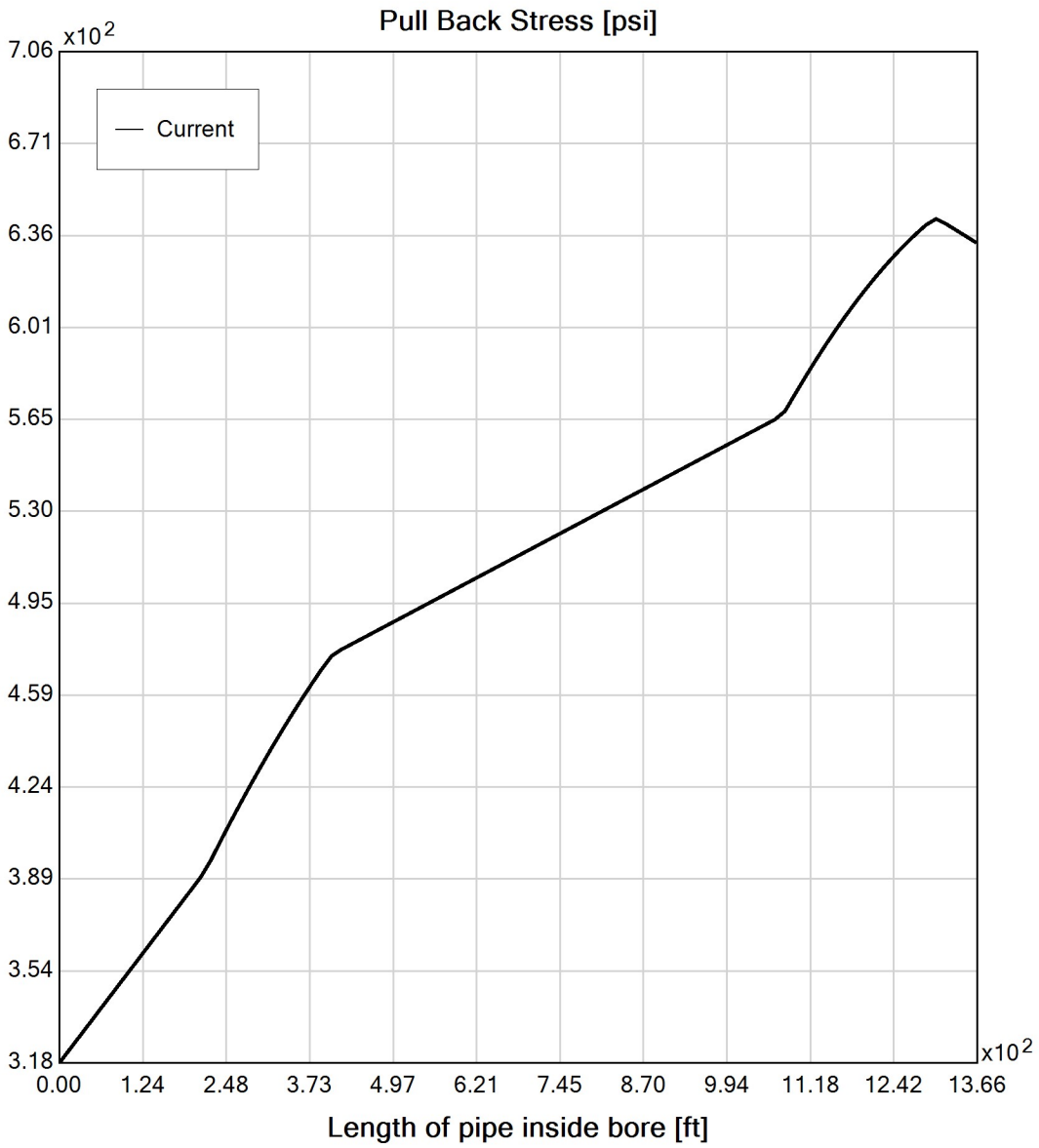
Yield Point (YP): 16.49

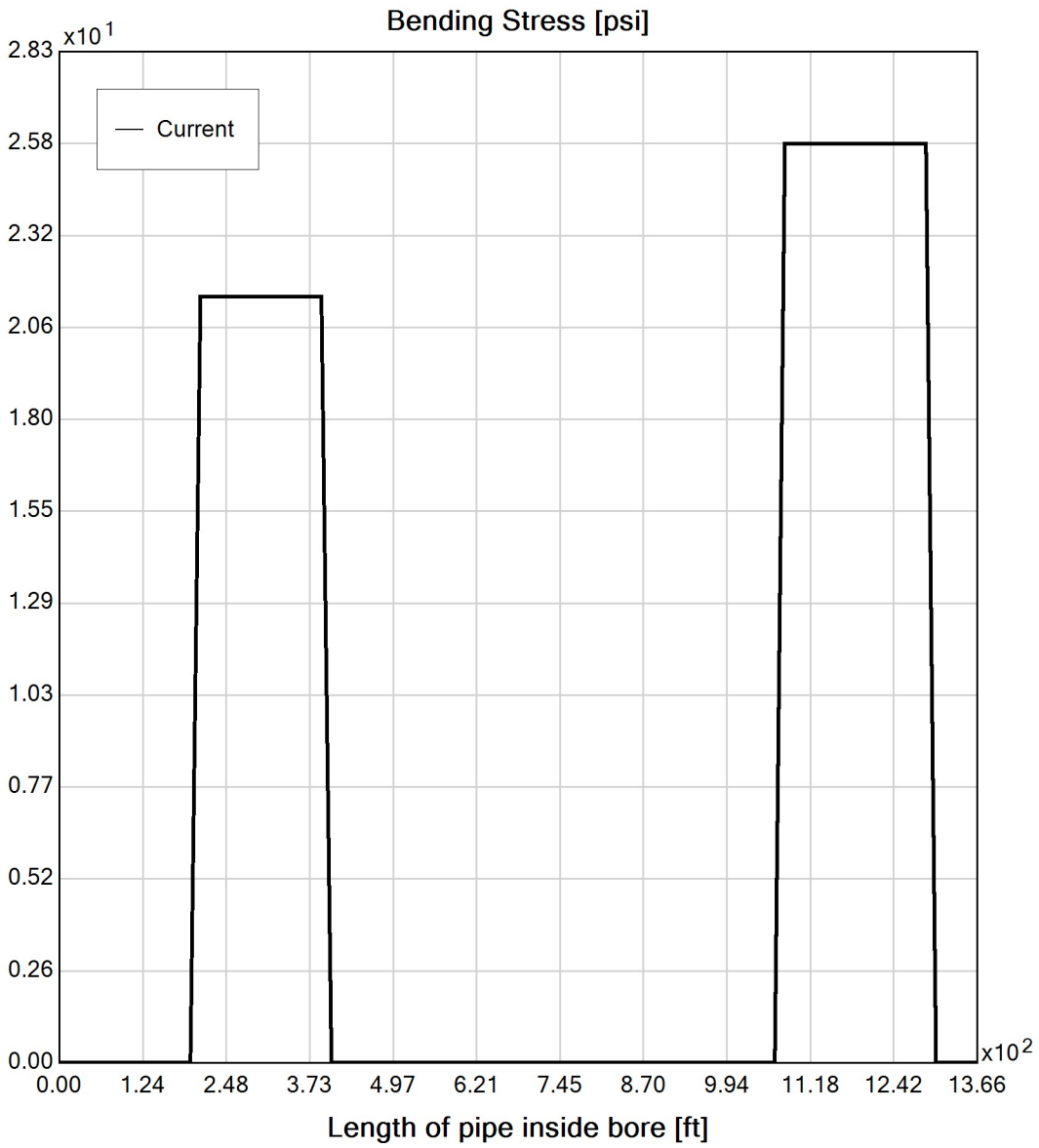
Effective Viscosity (cP): 1202.0

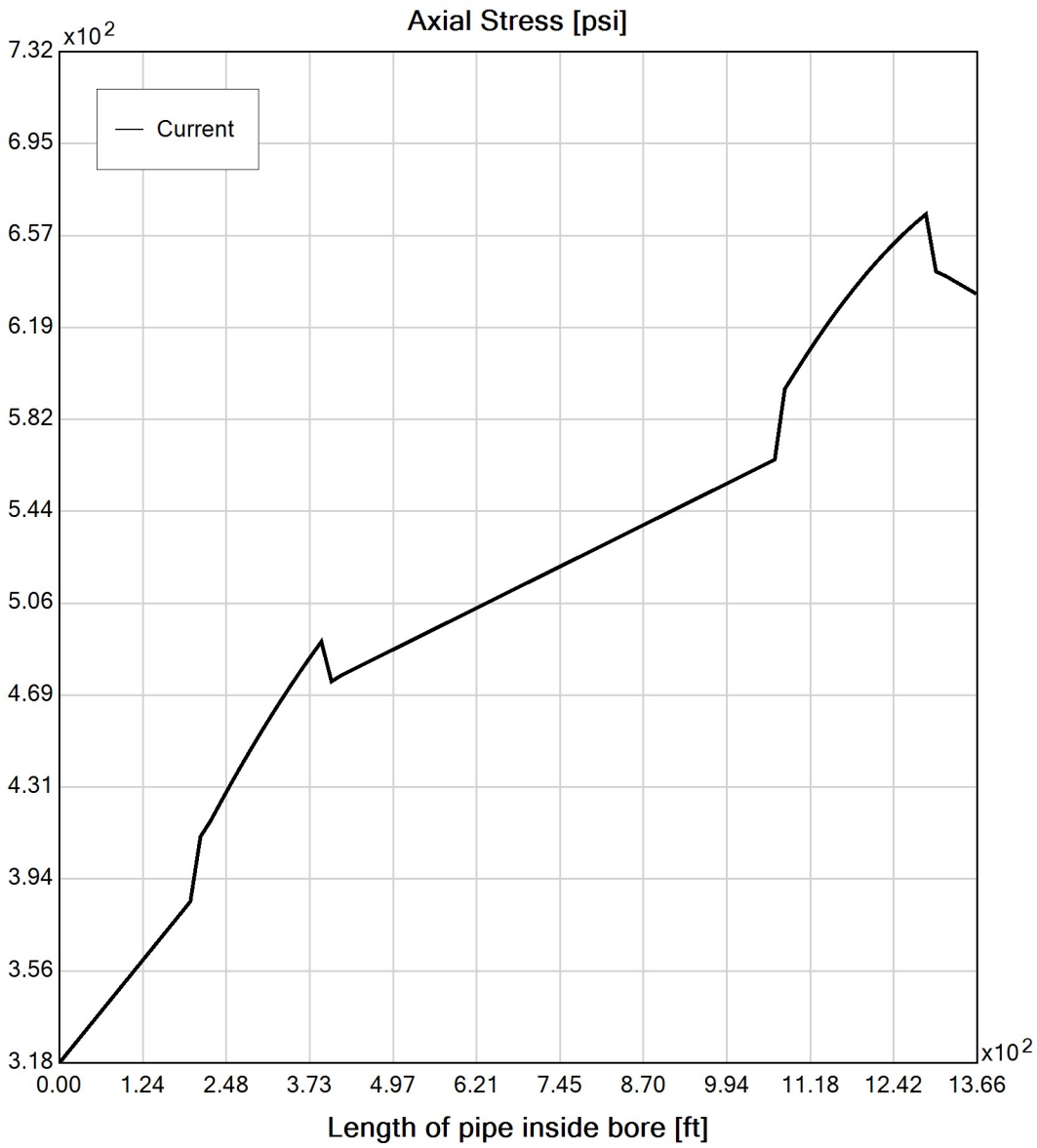
Virtual Site

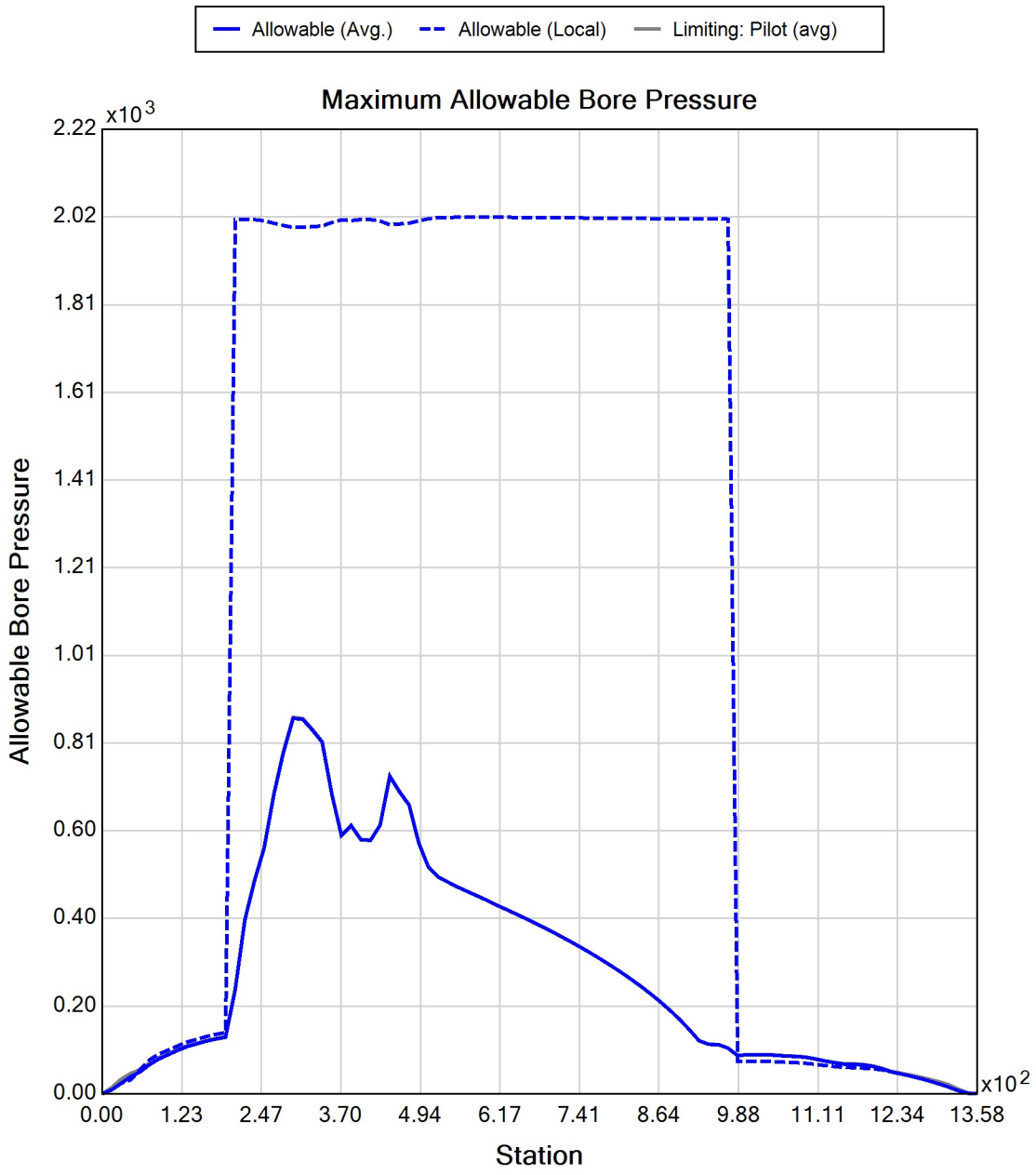


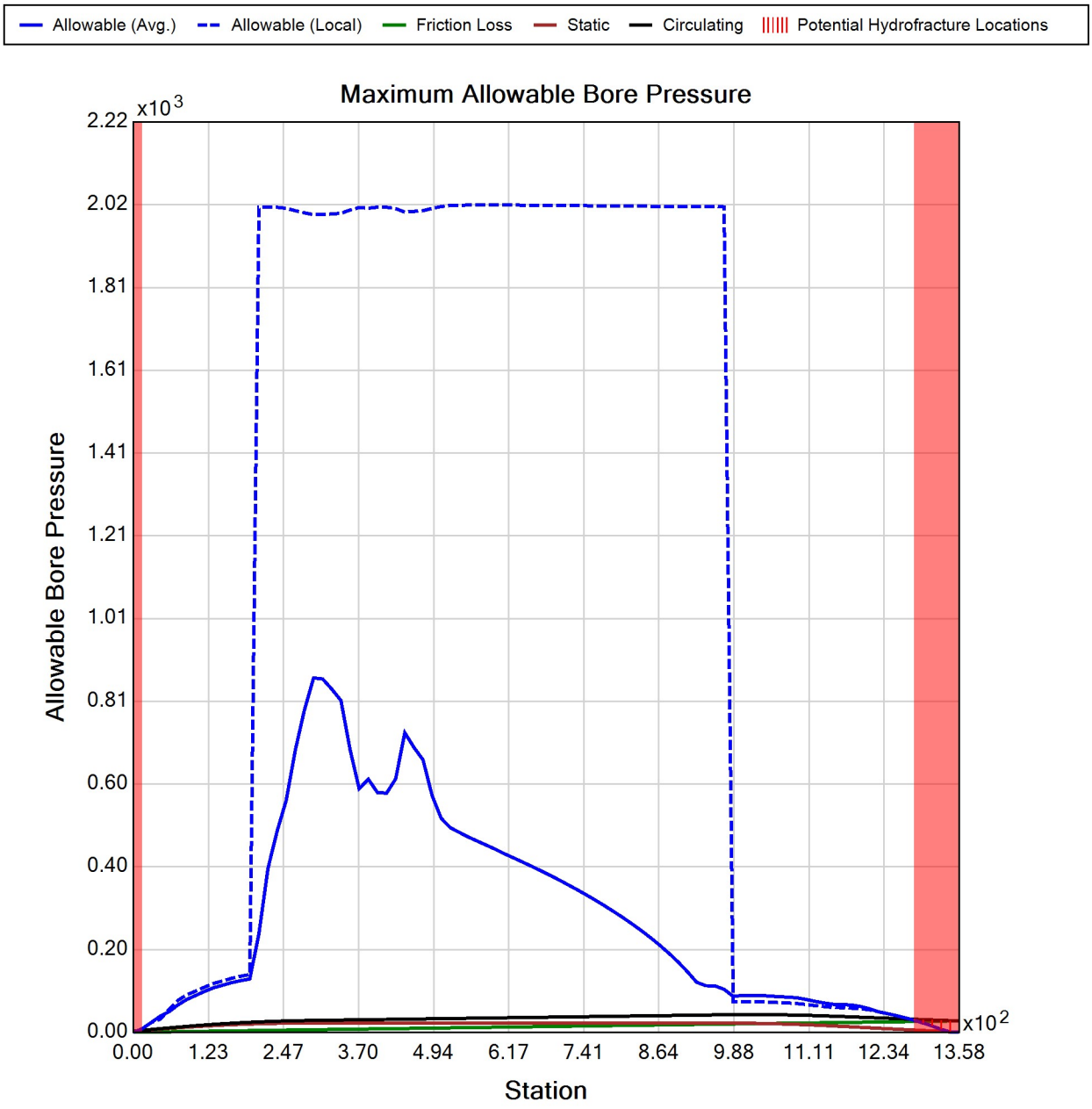












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Project Summary

General:	CHPE HDD 64 P4B Start Date: 06-27-2023 End Date: 06-27-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR/MDB rev CHA
Description:	HDD 64 2-inch DR9 Conduit 1

Input Summary

Start Coordinate	(0.00, 0.00, 285.00) ft
End Coordinate	(1338.10, 0.00, 288.10) ft
Project Length	1338.10 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 1350.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.4	22.6
Water Pressure	17.0	16.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.4	39.5
Deflection		
Earth Load Deflection	0.488	6.144
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.517	6.174
Compressive Stress [psi]		
Compressive Wall Stress	82.8	177.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1218.8	1218.8
Pullback Stress [psi]	696.4	696.4
Pullback Strain	1.211E-2	1.211E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	696.4	700.1
Tensile Strain	1.211E-2	1.227E-2

Net External Pressure = 22.2 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.517	7.5	14.5	OK
Unconstrained Collapse [psi]	30.3	132.0	4.4	OK
Compressive Wall Stress [psi]	82.8	1150.0	13.9	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	40.3	215.8	5.4	OK
Tensile Stress [psi]	700.1	1200.0	1.7	OK

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Project Summary

General:	CHPE HDD 64 P4B Start Date: 06-27-2023 End Date: 06-27-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR/MDB rev CHA
Description:	HDD 64 10-inch DR9 Conduit 1

Input Summary

Start Coordinate	(0.00, 0.00, 285.00) ft
End Coordinate	(1338.10, 0.00, 288.10) ft
Project Length	1338.10 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), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

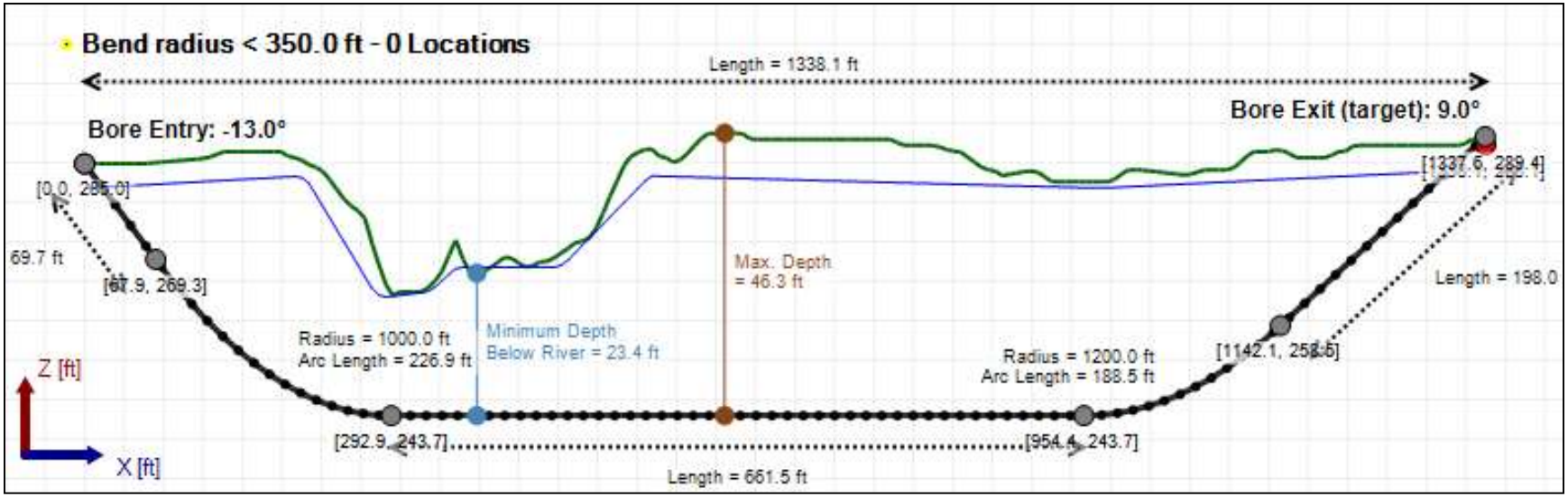
Soil Layer #3 USCS, Sand (S), SW
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Sand (S), SM
From Assistant
Unit Weight: 115.0000 (dry), 130.0000 (sat) [lb/ft3]
Phi: 35.00, S.M.: 650.00, Coh: 0.00 [psi]

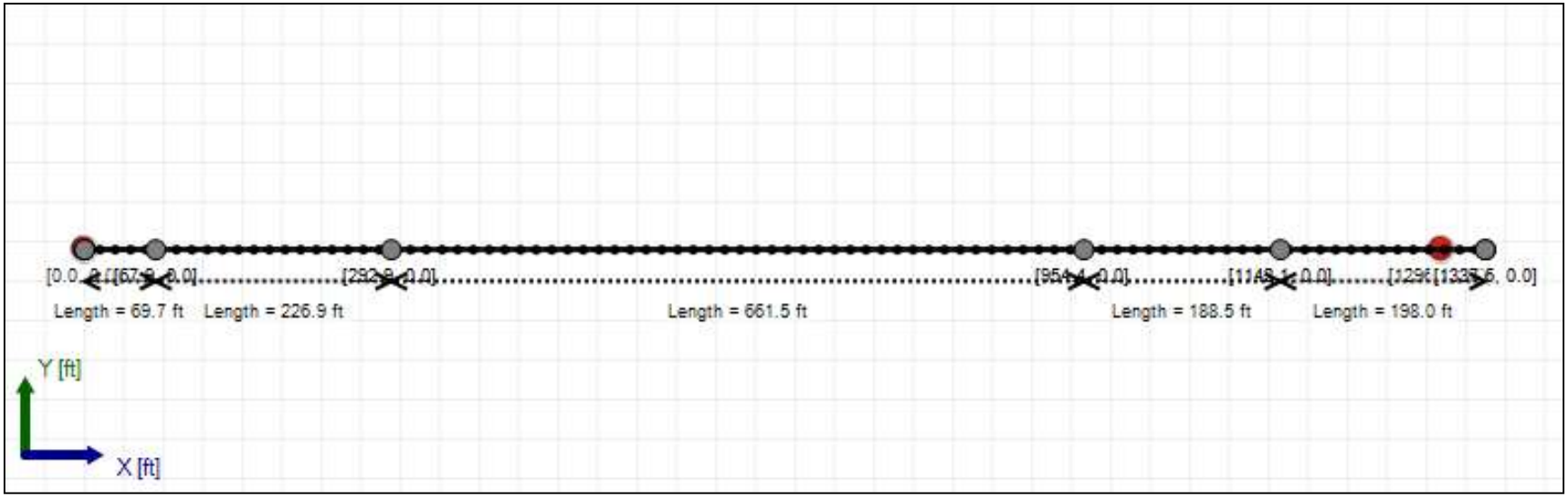
Soil Layer #5 USCS, Clay (C), CL
From Assistant
Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 400.00, Coh: 8.20 [psi]

Soil Layer #6 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [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: 1350.00 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.6	22.6
Water Pressure	16.9	16.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	20.6	39.5
Deflection		
Earth Load Deflection	1.215	6.144
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.347	6.277
Compressive Stress [psi]		
Compressive Wall Stress	92.5	177.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	22724.9	22724.9
Pullback Stress [psi]	633.8	633.8
Pullback Strain	1.102E-2	1.102E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	633.8	657.5
Tensile Strain	1.102E-2	1.188E-2

Net External Pressure = 22.2 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.347	7.5	5.6	OK
Unconstrained Collapse [psi]	30.3	122.9	4.1	OK
Compressive Wall Stress [psi]	92.5	1150.0	12.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	40.3	217.9	5.4	OK
Tensile Stress [psi]	657.5	1200.0	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	8.00 in	787.532 psi	2015.297 psi
1	8.00 in	12.00 in	786.627 psi	2015.025 psi
2	12.00 in	16.13 in	785.318 psi	2014.631 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): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

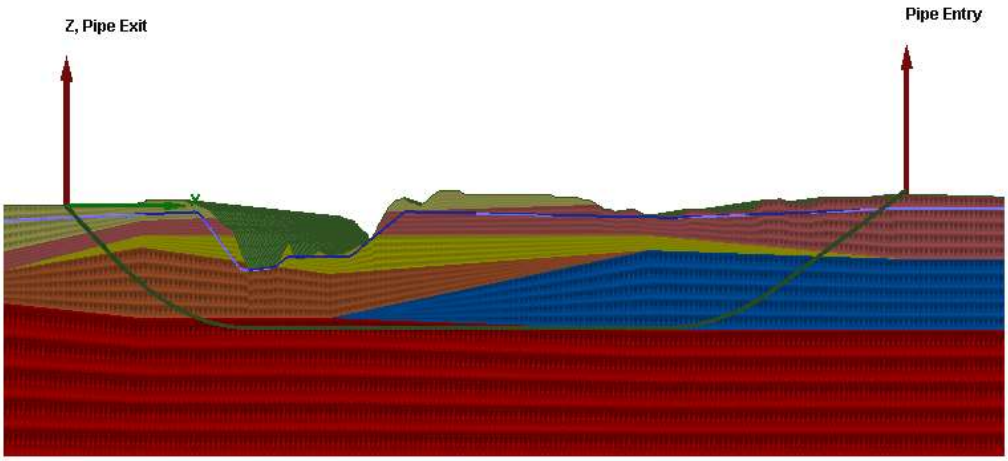
Rheological model: Bingham-Plastic

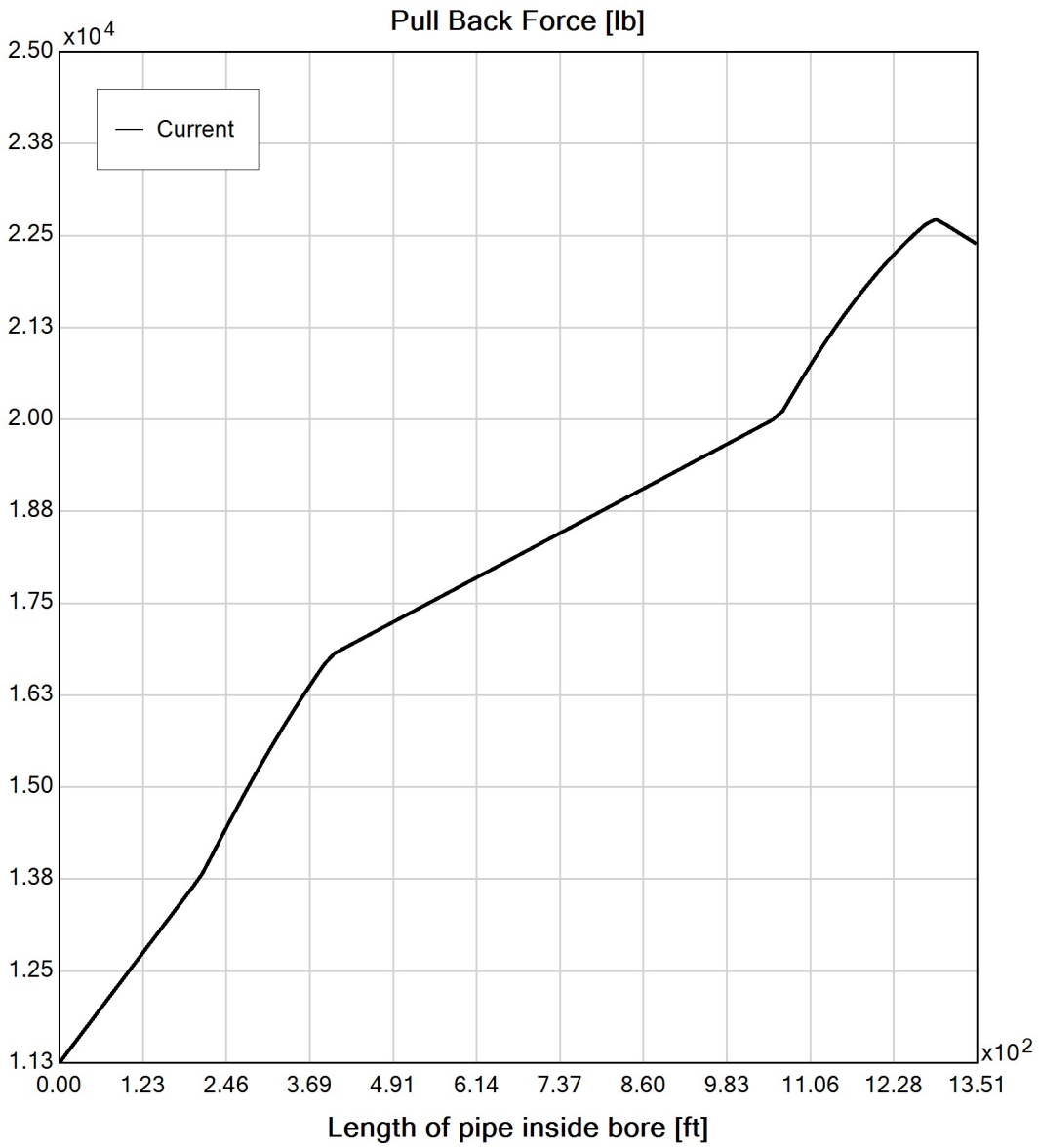
Plastic Viscosity (PV): 25.53

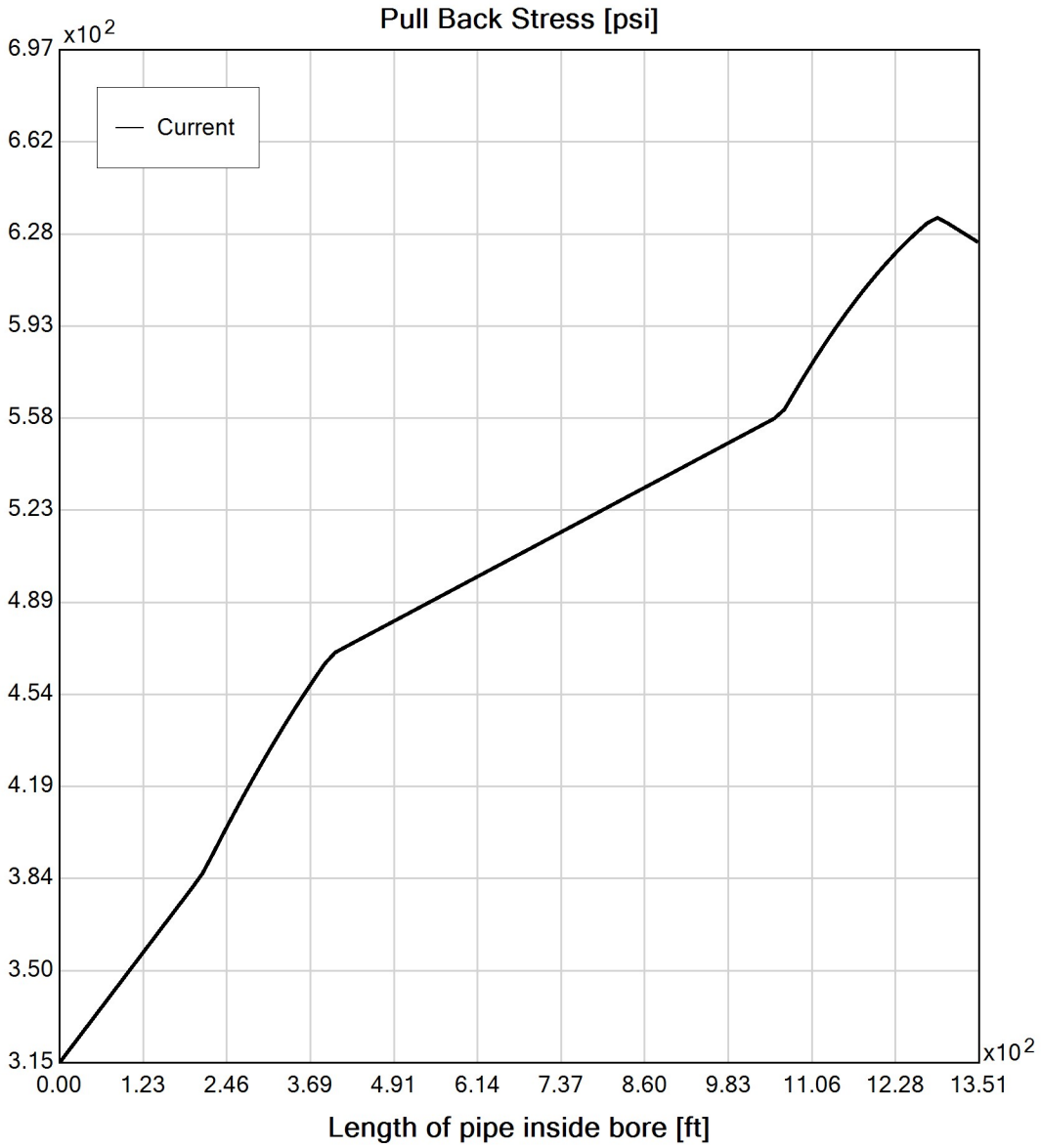
Yield Point (YP): 16.49

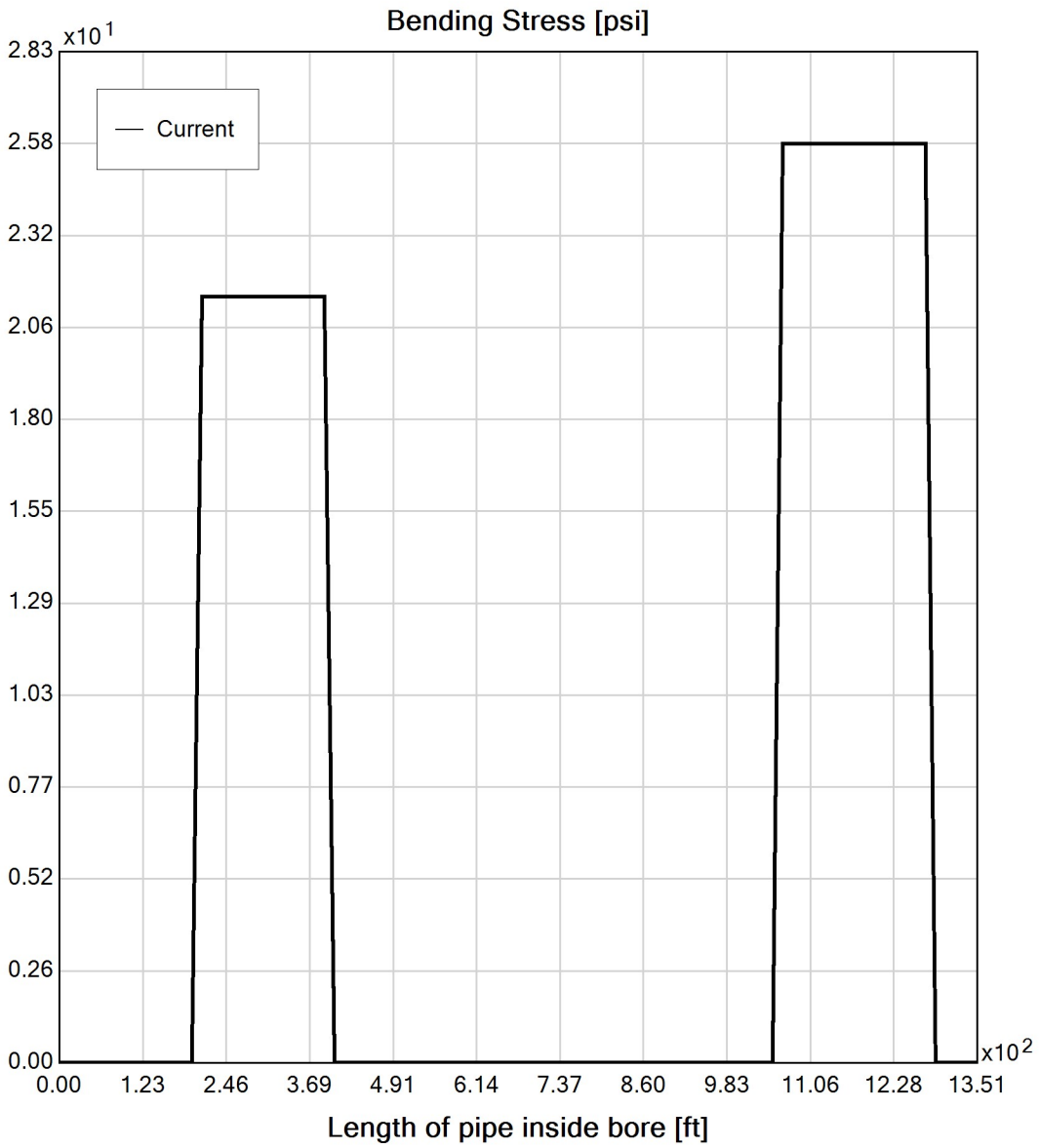
Effective Viscosity (cP): 1202.0

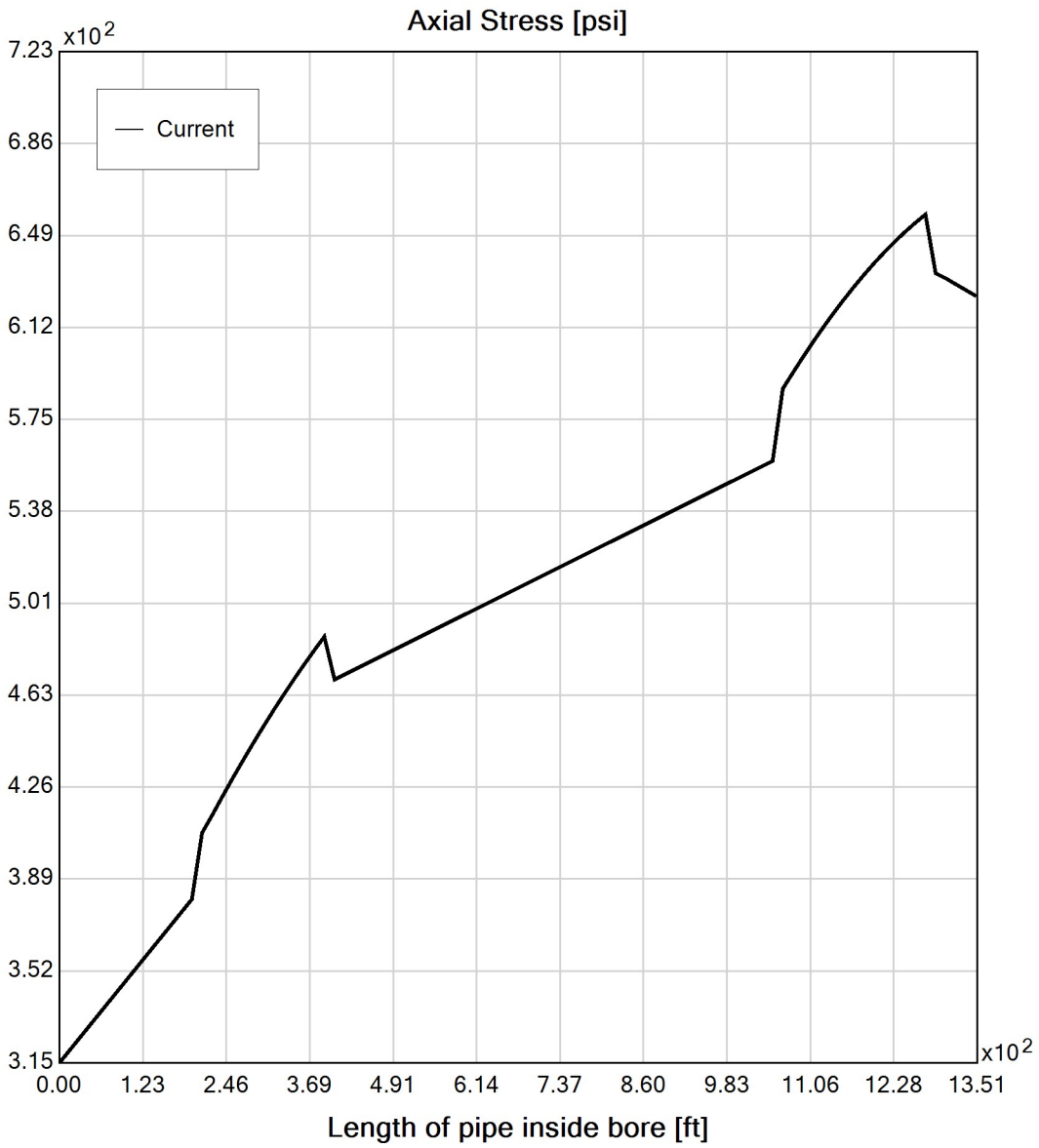
Virtual Site

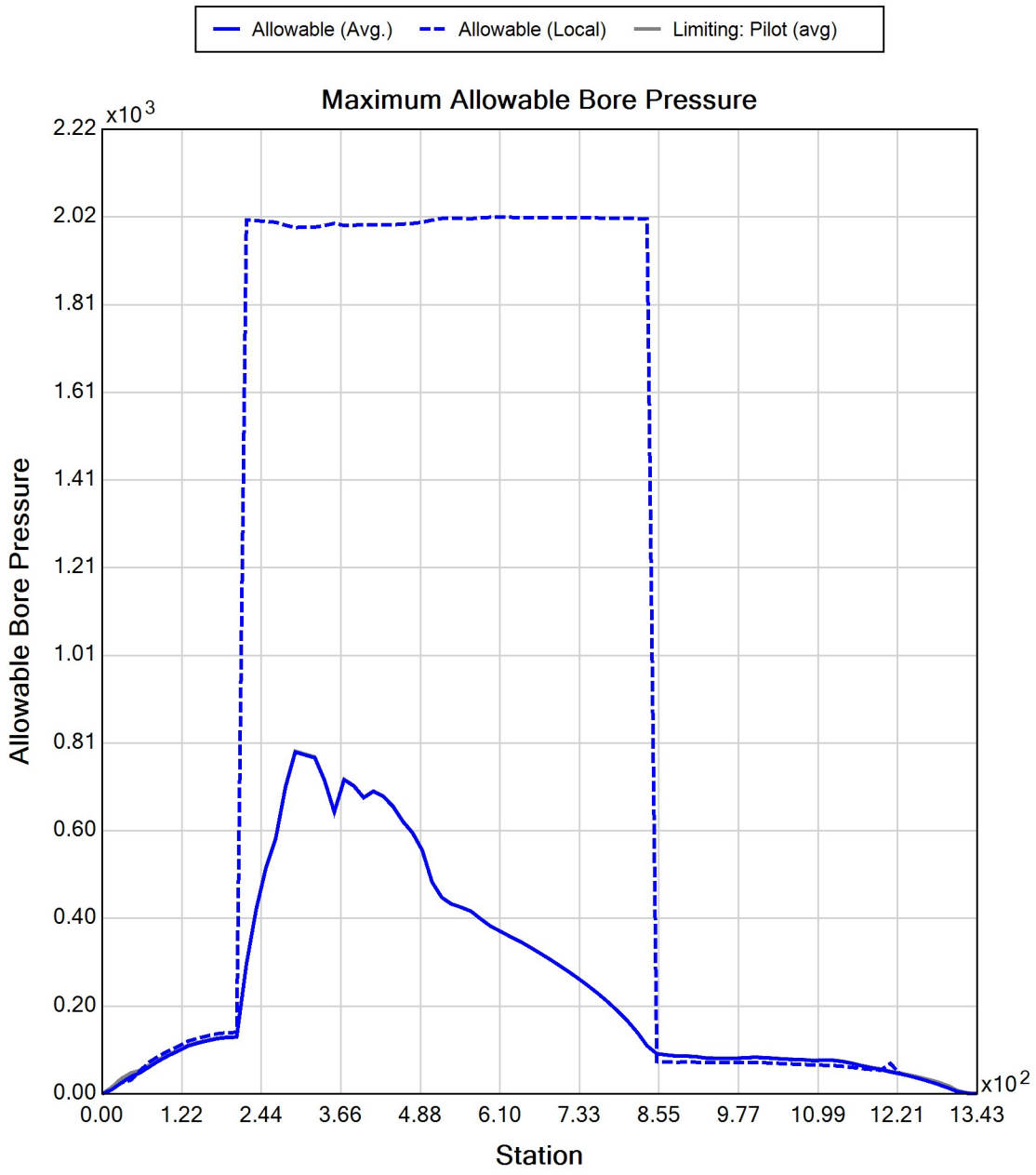


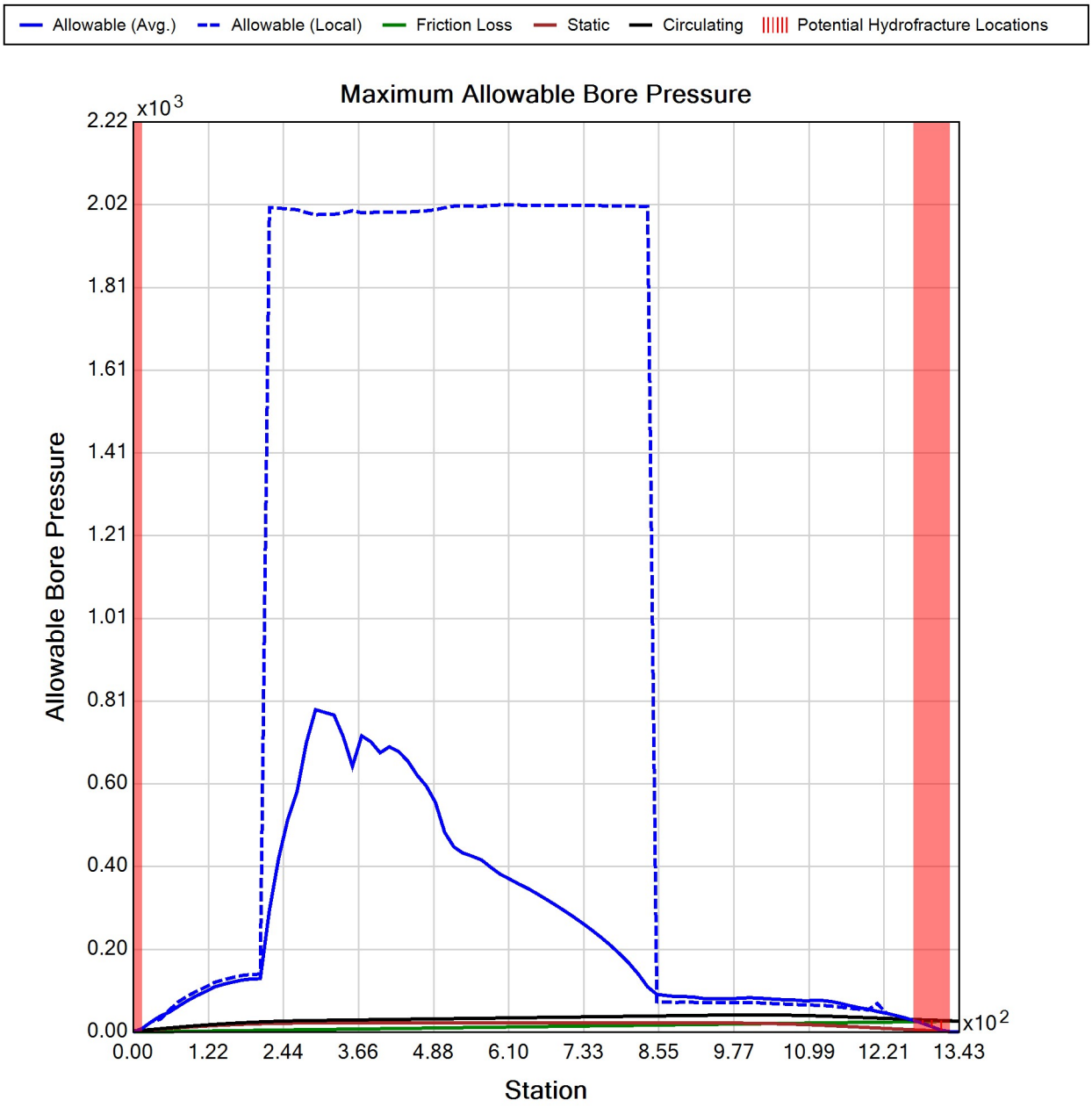












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Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR/MDB rev CHA
Description:	HDD 64 2-inch DR9 Conduit 2 revised

Input Summary

Start Coordinate	(0.00, 0.00, 284.00) ft
End Coordinate	(1352.00, 0.00, 289.70) ft
Project Length	1352.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 1365.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.4	22.7
Water Pressure	17.4	17.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.8	39.9
Deflection		
Earth Load Deflection	0.501	6.611
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.530	6.640
Compressive Stress [psi]		
Compressive Wall Stress	84.6	179.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1233.5	1233.5
Pullback Stress [psi]	704.8	704.8
Pullback Strain	1.226E-2	1.226E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	704.8	708.2
Tensile Strain	1.226E-2	1.242E-2

Net External Pressure = 23.0 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.530	7.5	14.1	OK
Unconstrained Collapse [psi]	30.9	131.7	4.3	OK
Compressive Wall Stress [psi]	84.6	1150.0	13.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	40.9	215.3	5.3	OK
Tensile Stress [psi]	708.2	1200.0	1.7	OK

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Project Summary

General:	CHPE HDD 64A
	P4B
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AB
	CHA
Description:	HDD 64A 10-inch DR 9 Conduit 1

Input Summary

Start Coordinate	(0.00, 0.00, 280.80) ft
End Coordinate	(936.90, 0.00, 279.10) ft
Project Length	936.90 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), SW
Depth: 2.20 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Sand (S), SP
Depth: 2.00 ft
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

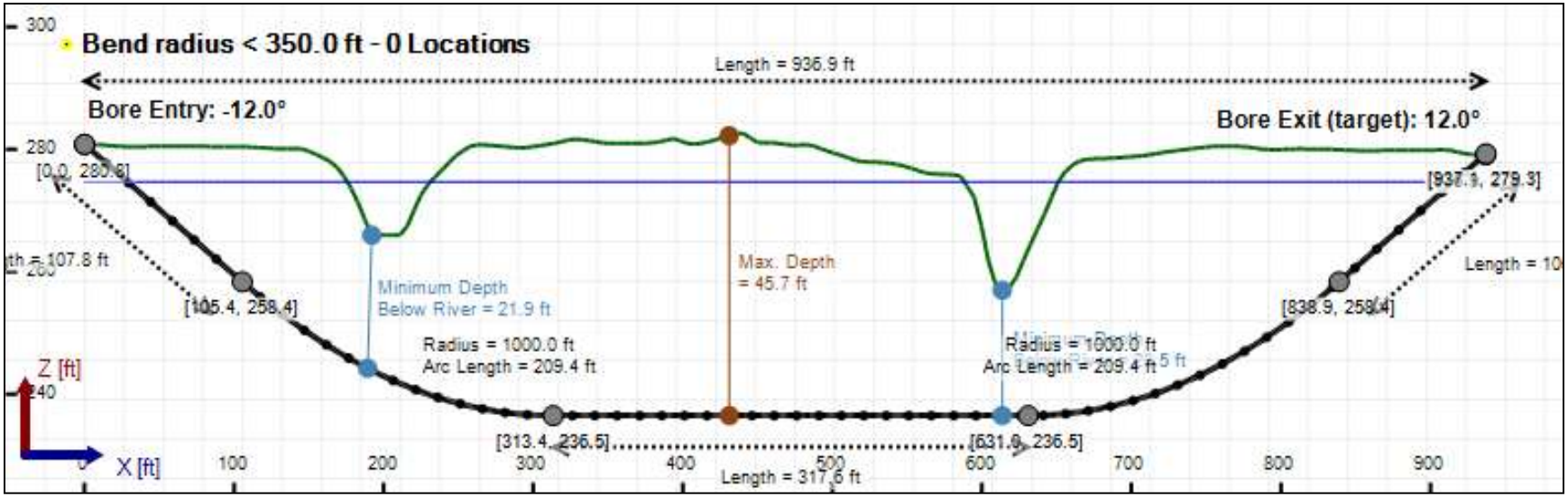
Soil Layer #3 USCS, Sand (S), SM
Depth: 8.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Sand (S), SP
Depth: 5.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

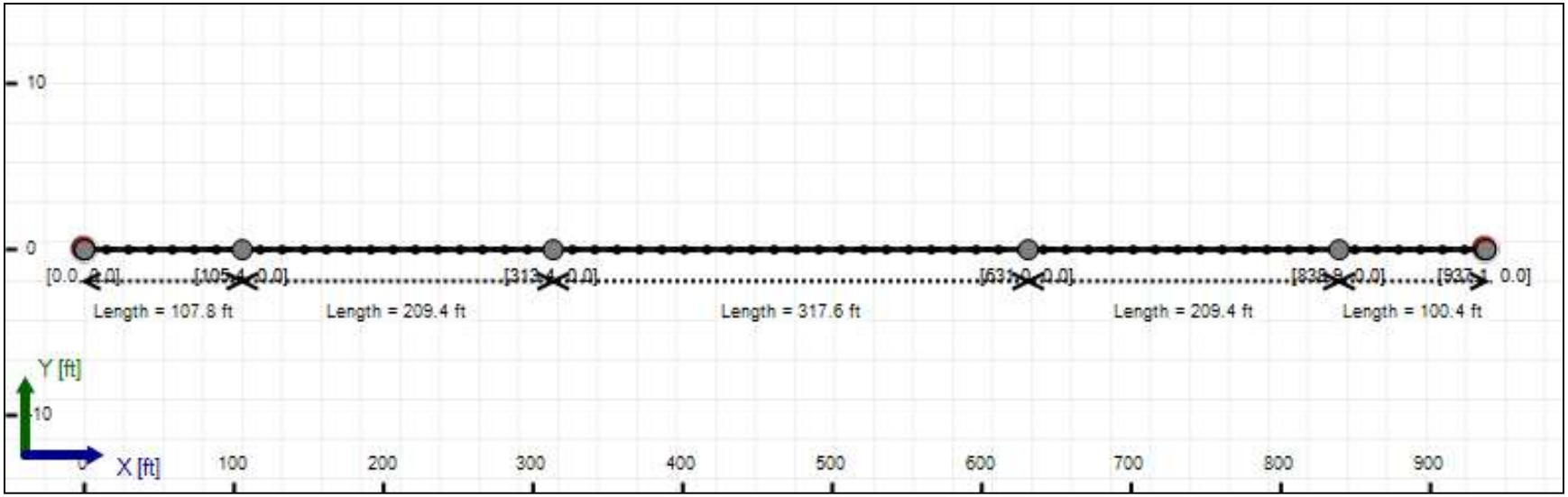
Soil Layer #5 USCS, Clay (C), CL
Depth: 15.00 ft
Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 145.00, Coh: 5.56 [psi]

Soil Layer #6 USCS, Sand (S), SW
Depth: 20.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [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: 945.00 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.4	20.7
Water Pressure	16.5	16.5
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	20.0	37.3
Deflection		
Earth Load Deflection	1.006	5.640
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.138	5.772
Compressive Stress [psi]		
Compressive Wall Stress	89.8	167.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	16224.3	16224.3
Pullback Stress [psi]	452.5	452.5
Pullback Strain	7.869E-3	7.869E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	452.5	476.5
Tensile Strain	7.869E-3	8.735E-3

Net External Pressure = 24.2 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.138	7.5	6.6	OK
Unconstrained Collapse [psi]	28.8	125.6	4.4	OK
Compressive Wall Stress [psi]	89.8	1150.0	12.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	38.8	229.0	5.9	OK
Tensile Stress [psi]	476.5	1200.0	2.5	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	85.940 psi	96.438 psi
1	8.00 in	12.00 in	85.894 psi	96.384 psi
2	12.00 in	16.13 in	85.827 psi	96.307 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): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

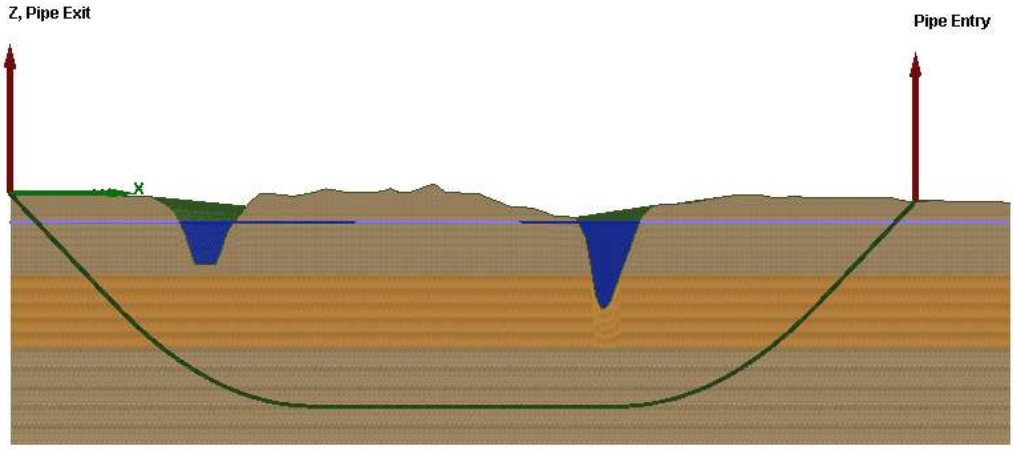
Rheological model: Bingham-Plastic

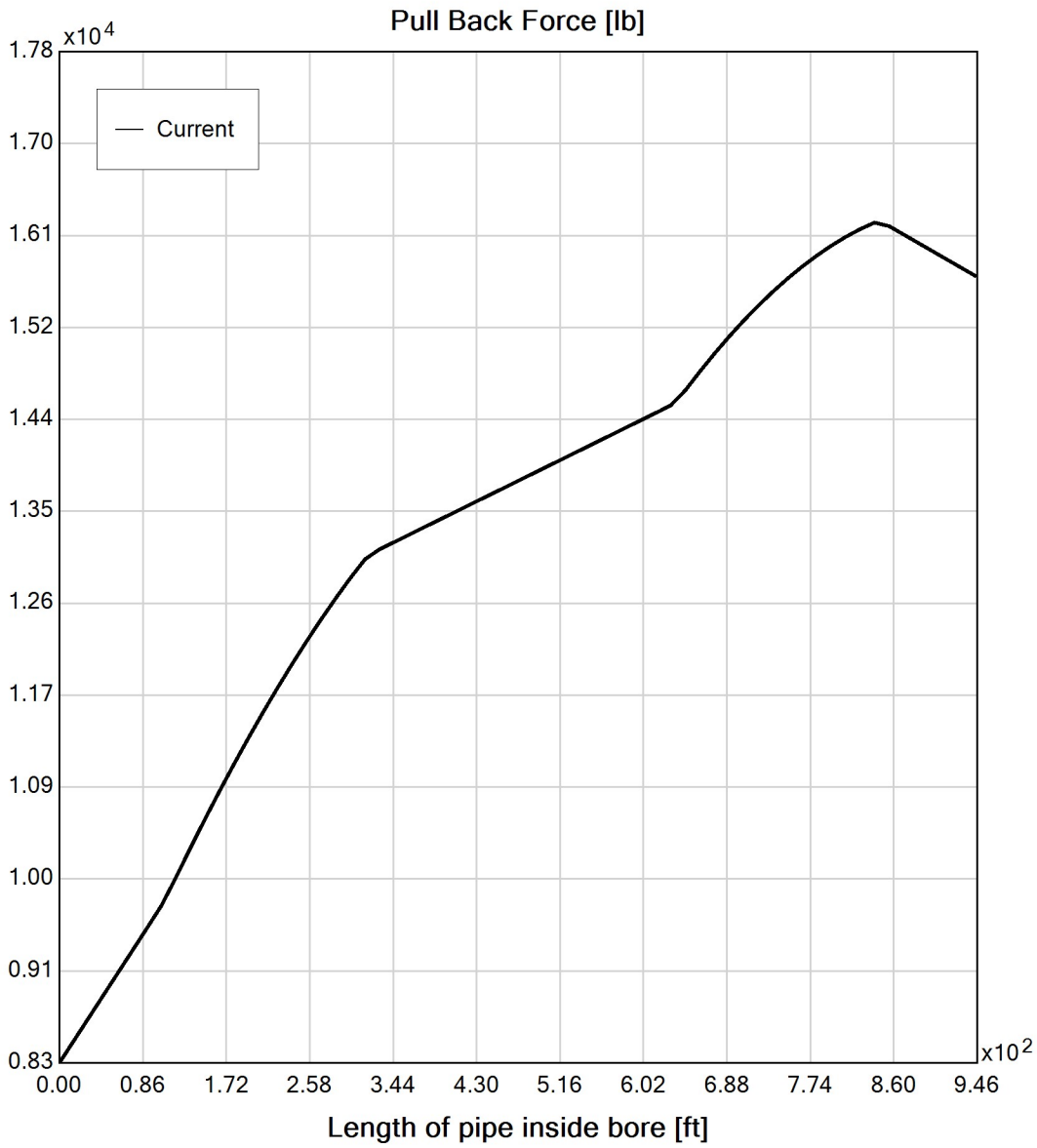
Plastic Viscosity (PV): 25.53

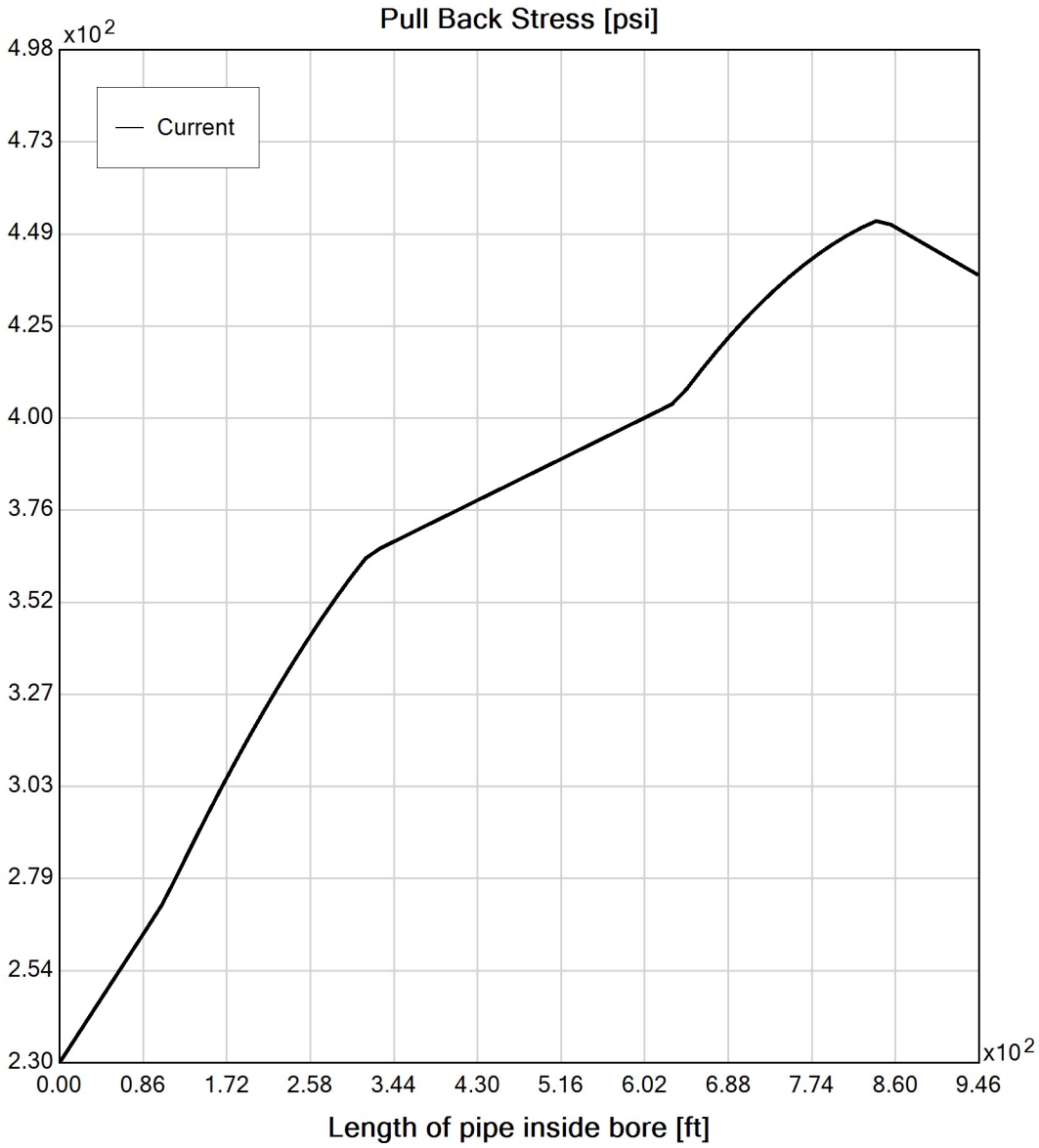
Yield Point (YP): 16.49

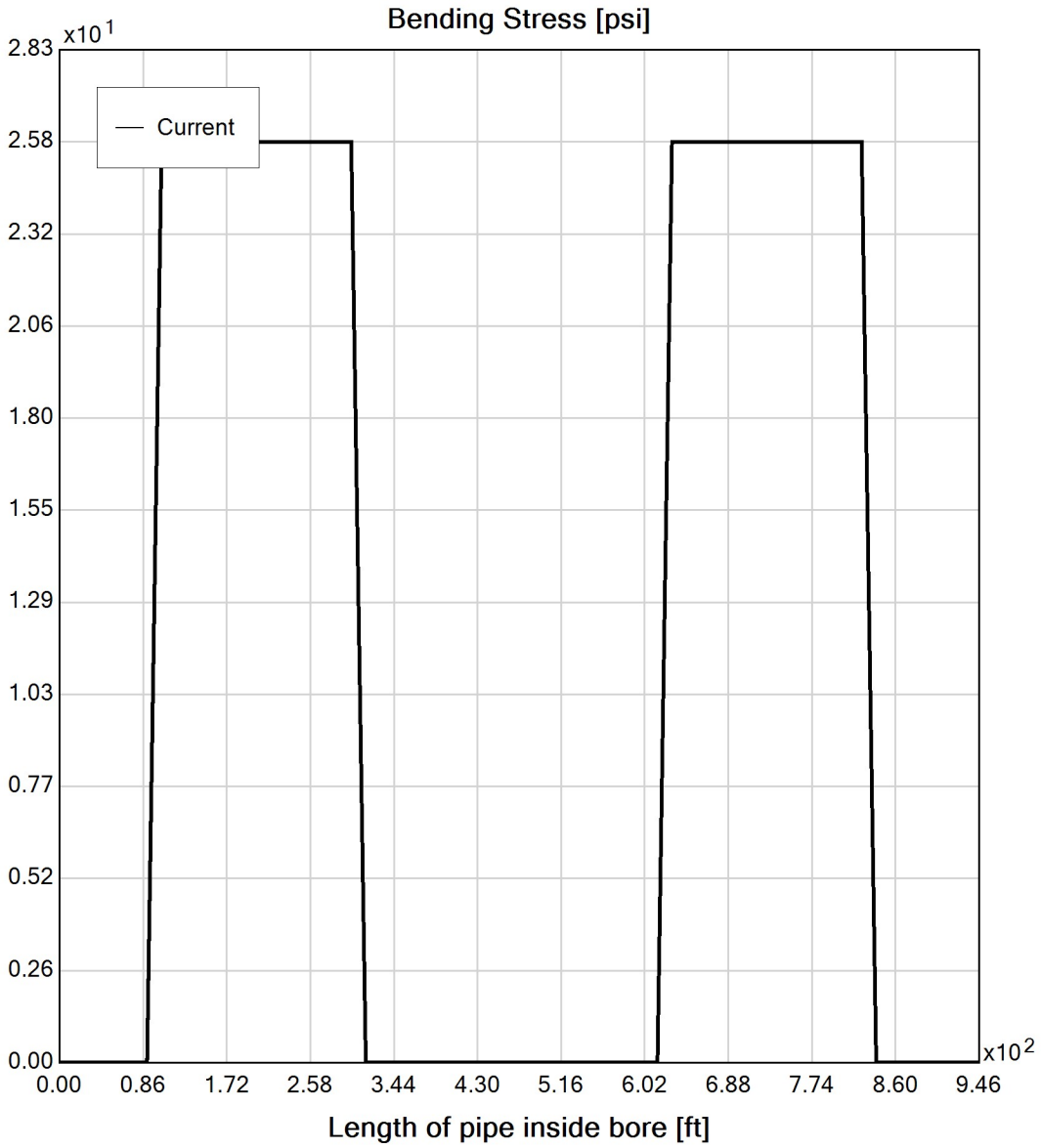
Effective Viscosity (cP): 1202.0

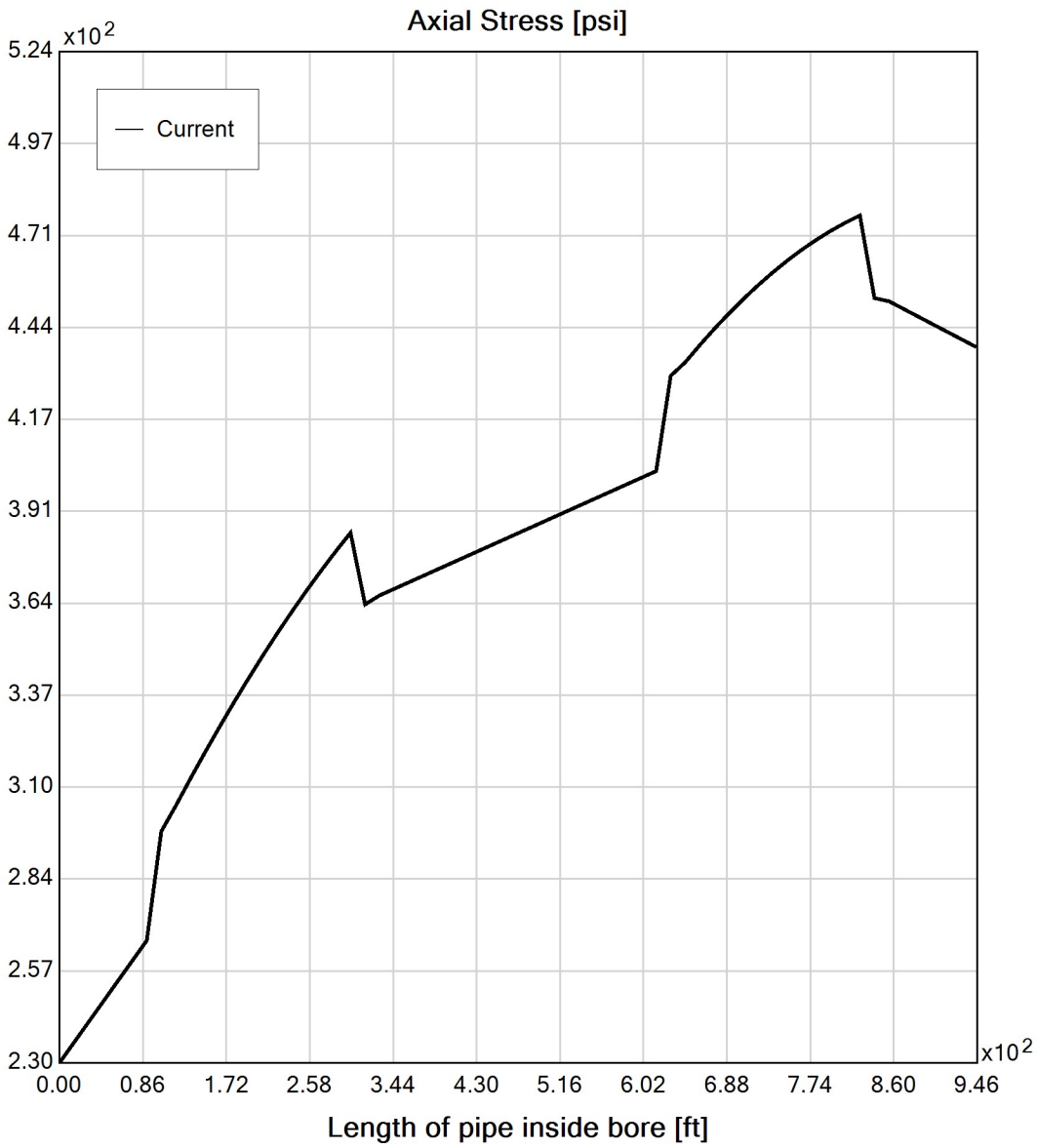
Virtual Site

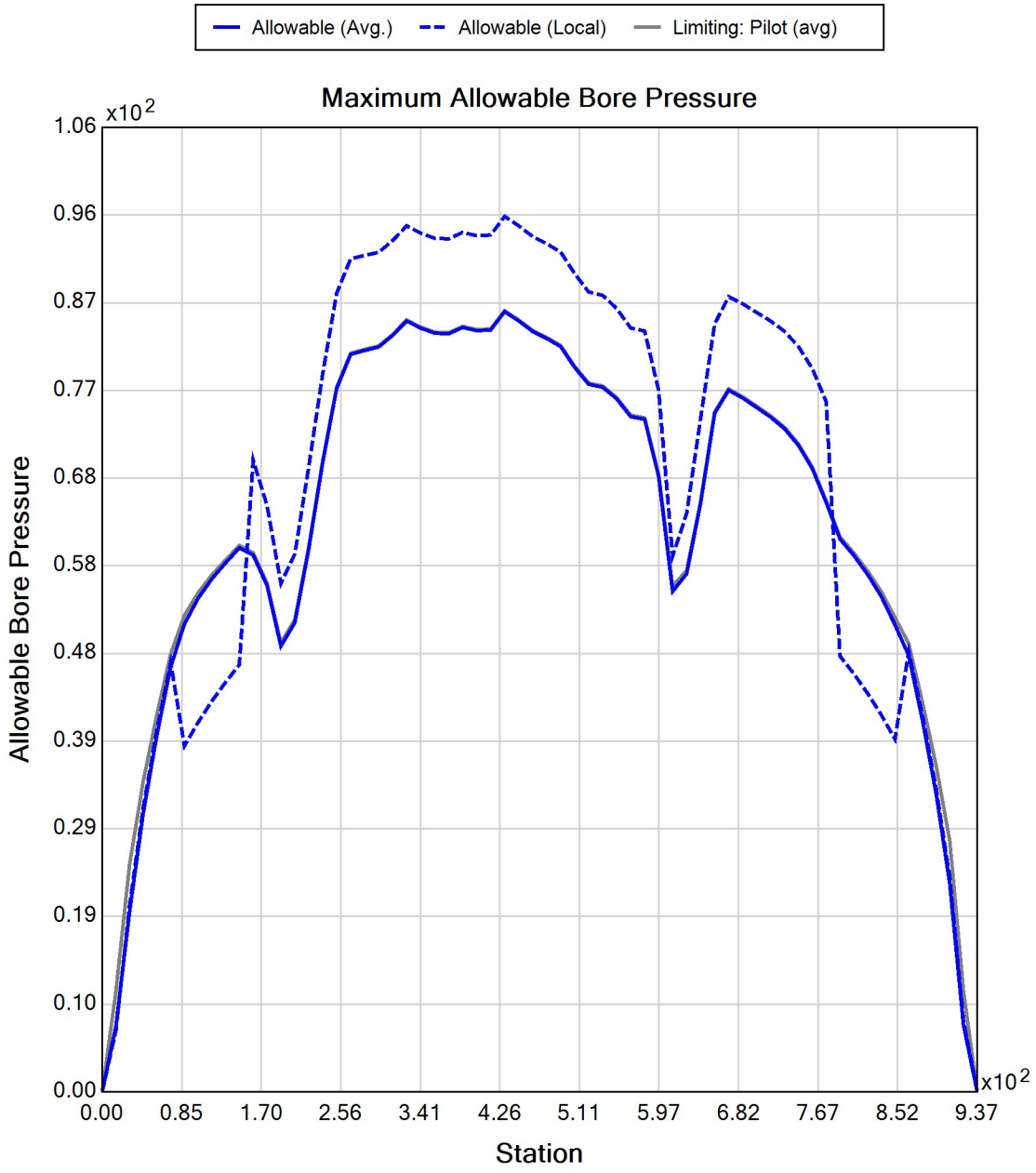


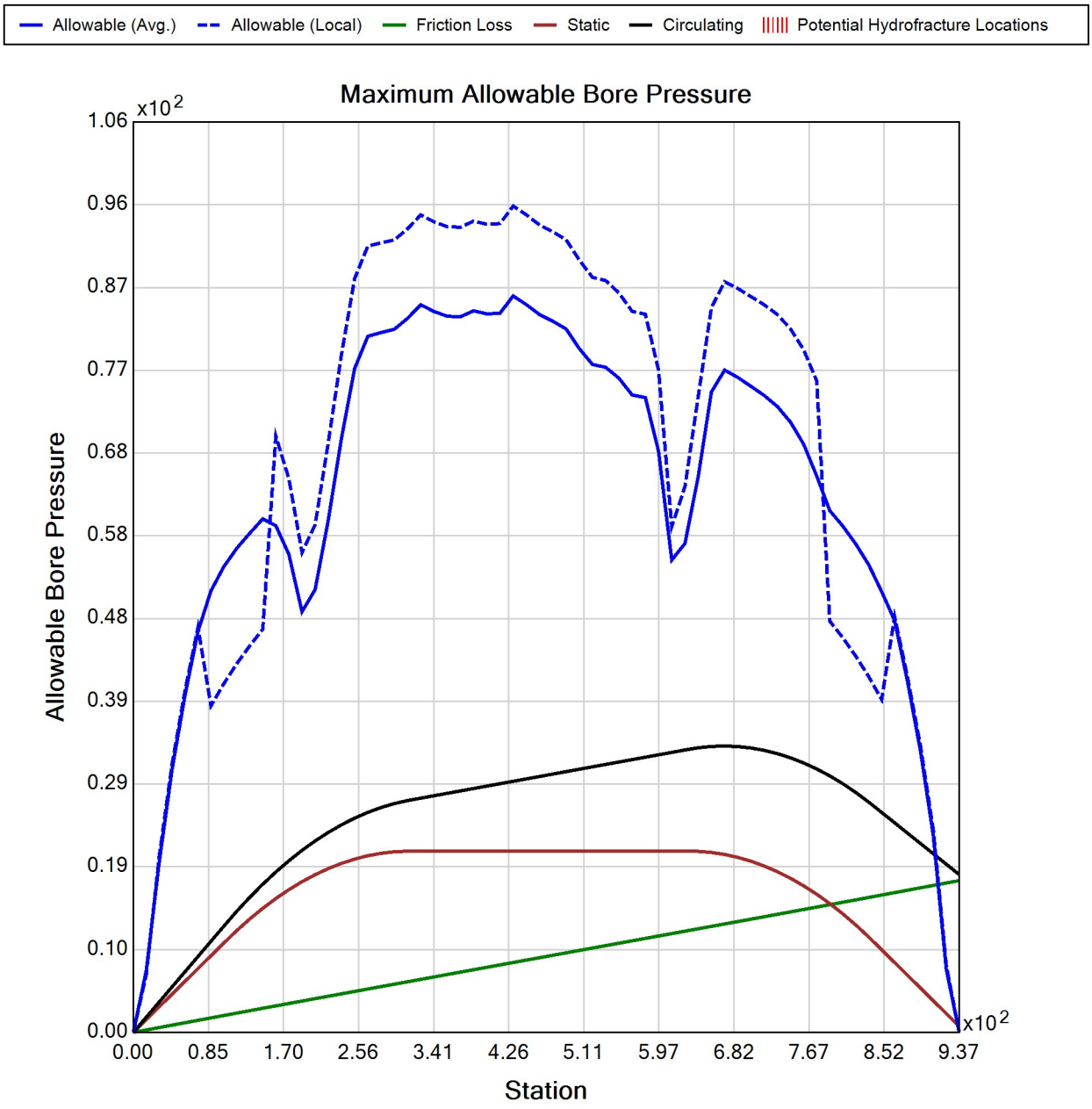












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Project Summary

General:	CHPE HDD 64A
	P4B
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	AB
	CHA
Description:	HDD 64A 2-inch DR 9 Conduit 1

Input Summary

Start Coordinate	(0.00, 0.00, 280.80) ft
End Coordinate	(936.90, 0.00, 279.10) ft
Project Length	936.90 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 945.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.4	20.7
Water Pressure	16.5	16.5
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	17.9	37.3
Deflection		
Earth Load Deflection	0.525	5.640
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.555	5.669
Compressive Stress [psi]		
Compressive Wall Stress	80.5	167.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	901.5	901.5
Pullback Stress [psi]	515.1	515.1
Pullback Strain	8.958E-3	8.958E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	515.1	519.0
Tensile Strain	8.958E-3	9.126E-3

Net External Pressure = 24.2 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.555	7.5	13.5	OK
Unconstrained Collapse [psi]	28.8	133.3	4.6	OK
Compressive Wall Stress [psi]	80.5	1150.0	14.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	38.8	227.1	5.9	OK
Tensile Stress [psi]	519.0	1200.0	2.3	OK

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Project Summary

General:	CHPE HDD 65A P4B Start Date: 05-16-2023 End Date: 05-16-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA
Designer:	MDB BCE
Description:	HDD 65A Conduit 1, 8- inch DR18 Ballasted possibly can do with rollers and no ballast border line Estimated water 5 ft above top of rock, Estimated Shale to below HDD Bore Path. DR18 as estimate for DR17 installation

Input Summary

Start Coordinate	(0.00, 0.00, 270.00) ft
End Coordinate	(2555.00, 0.00, 246.40) ft
Project Length	2555.00 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	8.625 in
Pipe DR	18.0
Pipe Thickness	0.48 in
Rod Length	20.00 ft
Rod Diameter	5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

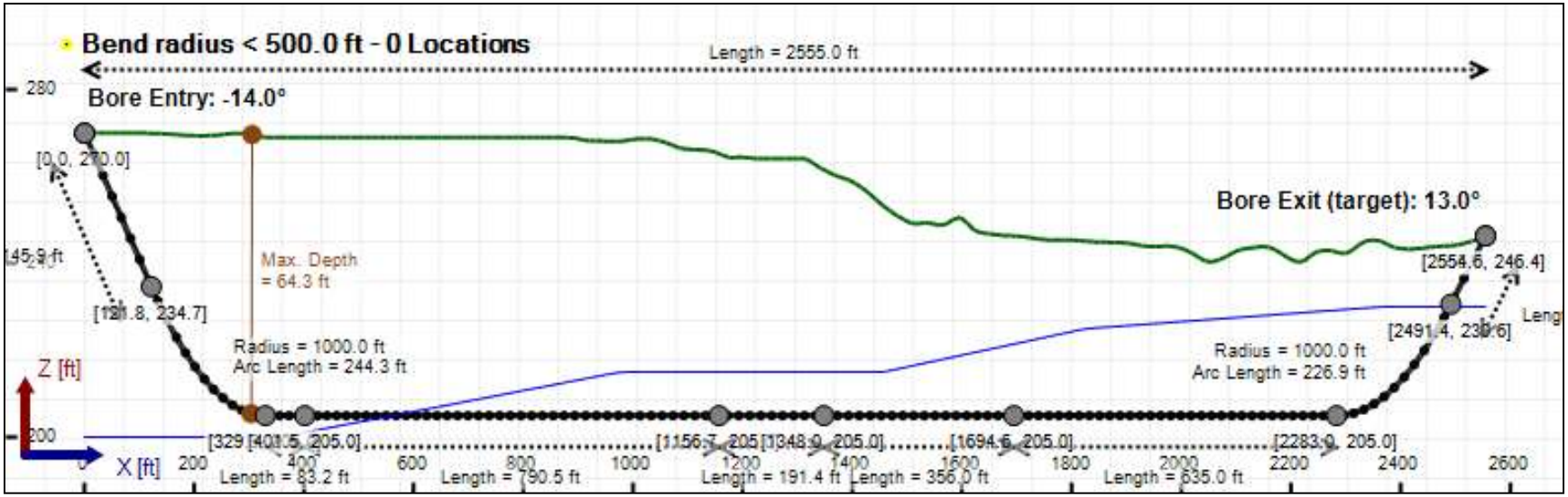
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SP
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

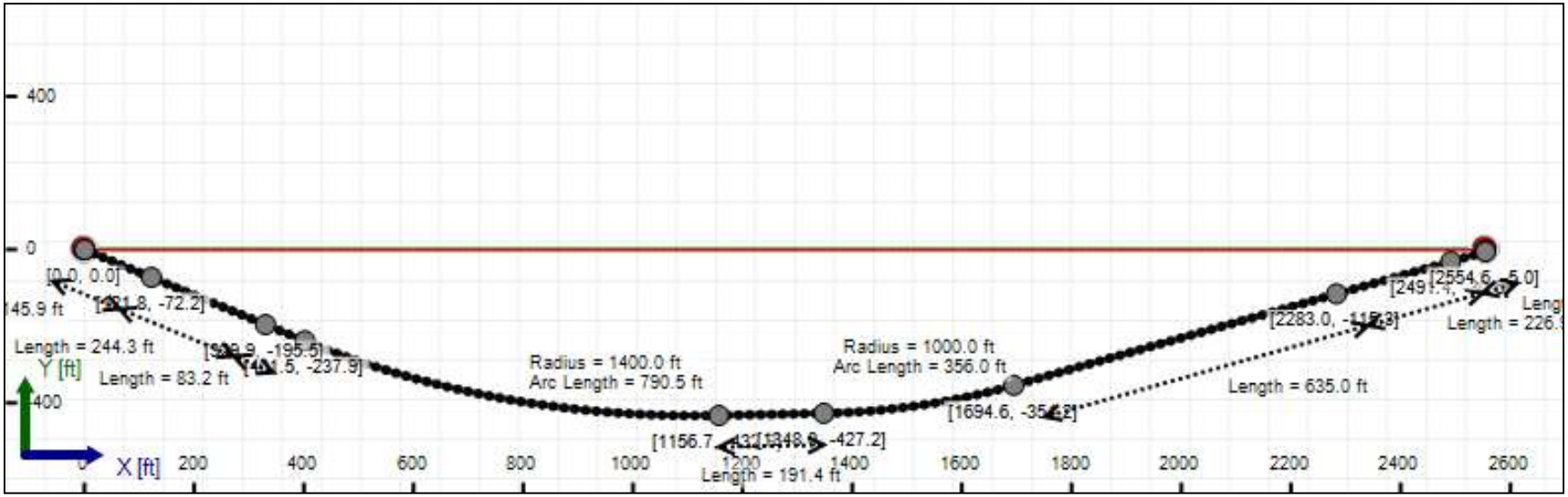
Soil Layer #2 USCS, Sand (S), SW
From Assistant
Unit Weight: 125.0000 (dry), 135.0000 (sat) [lb/ft3]
Phi: 36.00, S.M.: 800.00, Coh: 0.00 [psi]

Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [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: 2759.98 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: 87.40220 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	4.7	50.1
Water Pressure	10.5	4.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	15.2	54.4
Deflection		
Earth Load Deflection	0.967	9.810
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	1.026	9.870
Compressive Stress [psi]		
Compressive Wall Stress	137.0	489.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	16686.4	16686.4
Pullback Stress [psi]	1360.8	1360.8
Pullback Strain	3.402E-3	3.402E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	1360.8	1498.3
Tensile Strain	3.402E-3	4.105E-3

Net External Pressure = 17.3 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.026	7.5	7.3	OK
Unconstrained Collapse [psi]	42.3	173.5	4.1	OK
Compressive Wall Stress [psi]	137.0	3200.0	23.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	24.1	161.3	6.7	OK
Tensile Stress [psi]	1498.3	2800.0	1.9	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	8.00 in	1410.292 psi	2028.411 psi
1	8.00 in	16.00 in	1409.450 psi	2028.068 psi
2	16.00 in	19.13 in	1408.968 psi	2027.871 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): 280.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

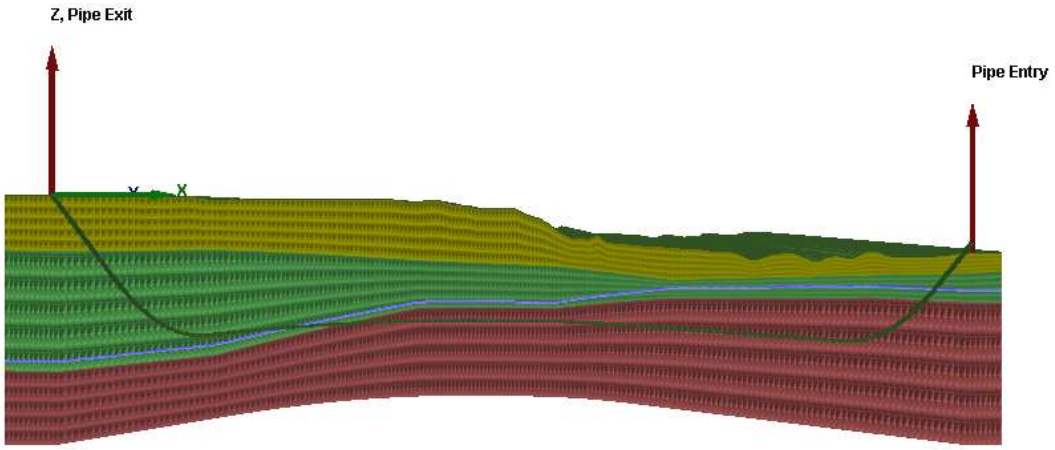
Rheological model: Power-Law

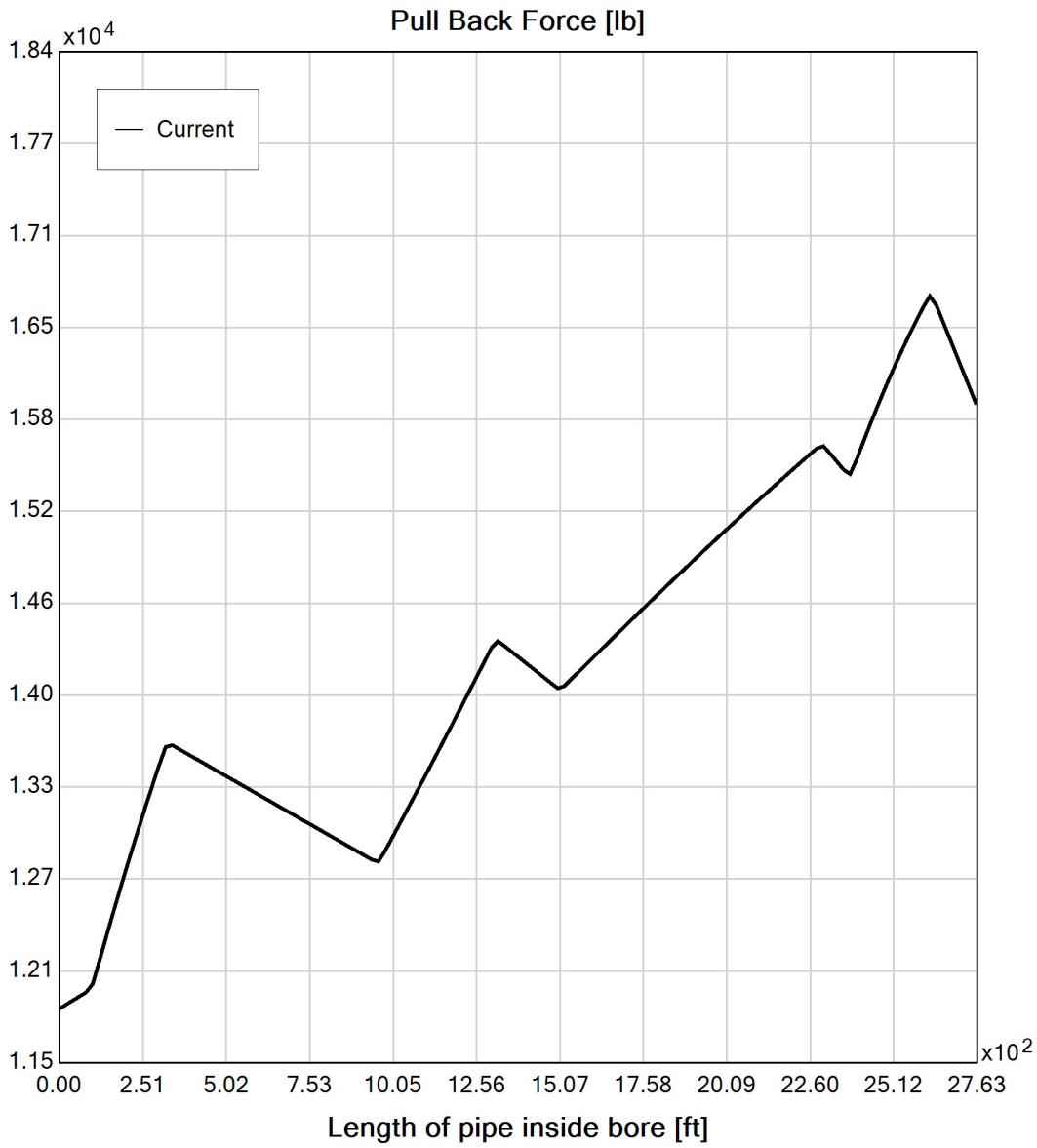
Fluid Consistency Index (K): 63.17

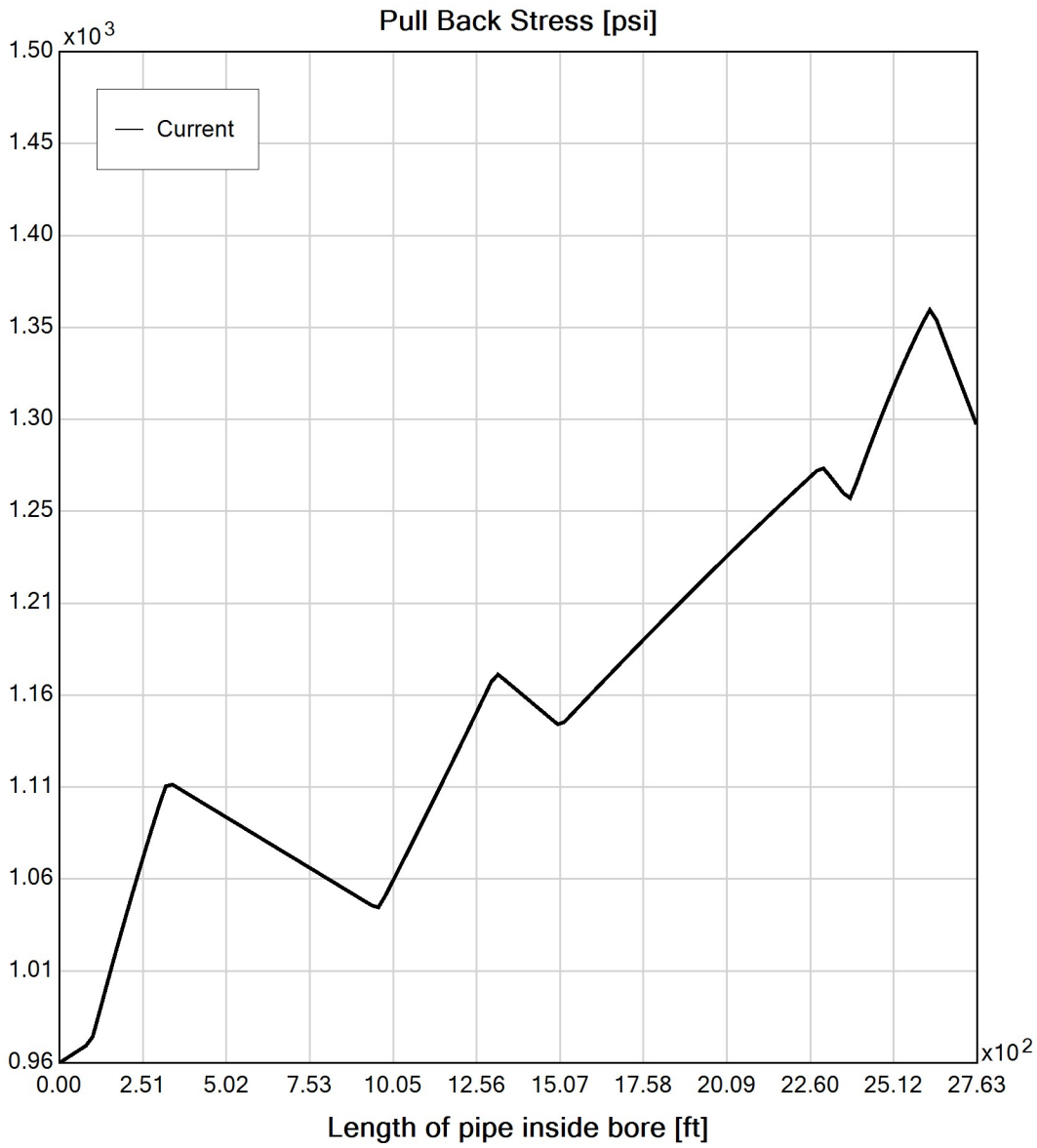
Power Law Exponent (n): 0.14

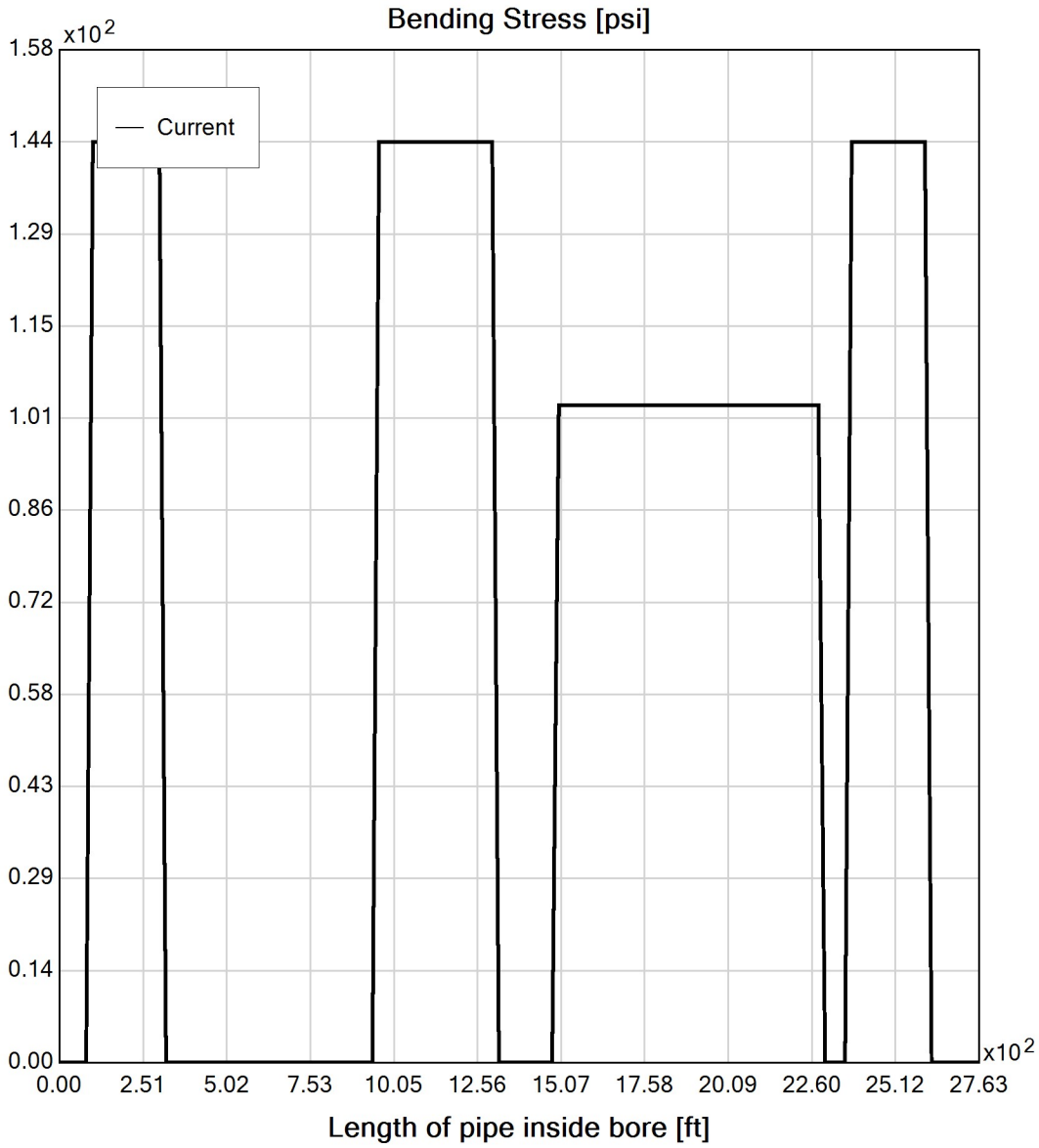
Effective Viscosity (cP): 88.5

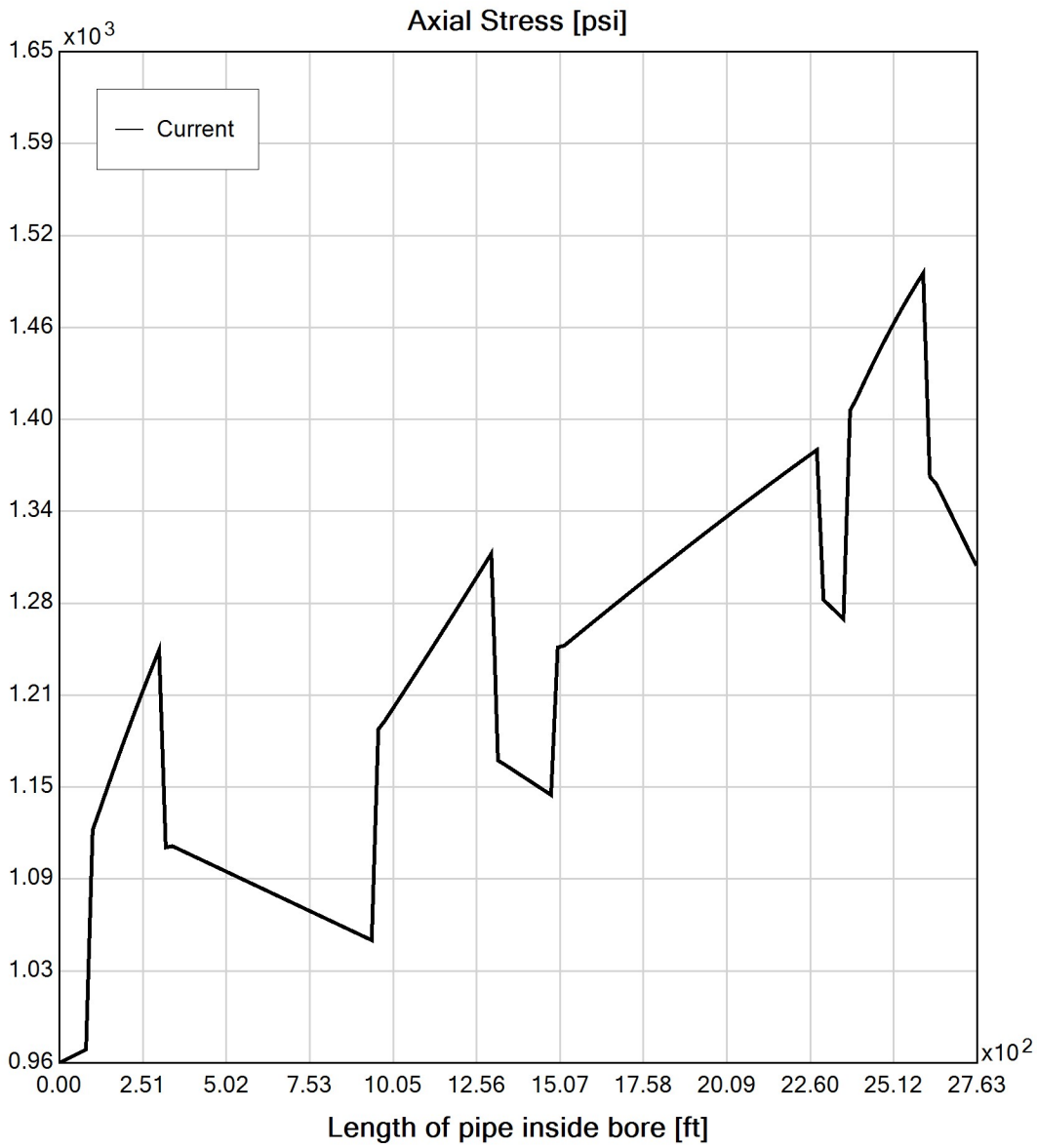
Virtual Site

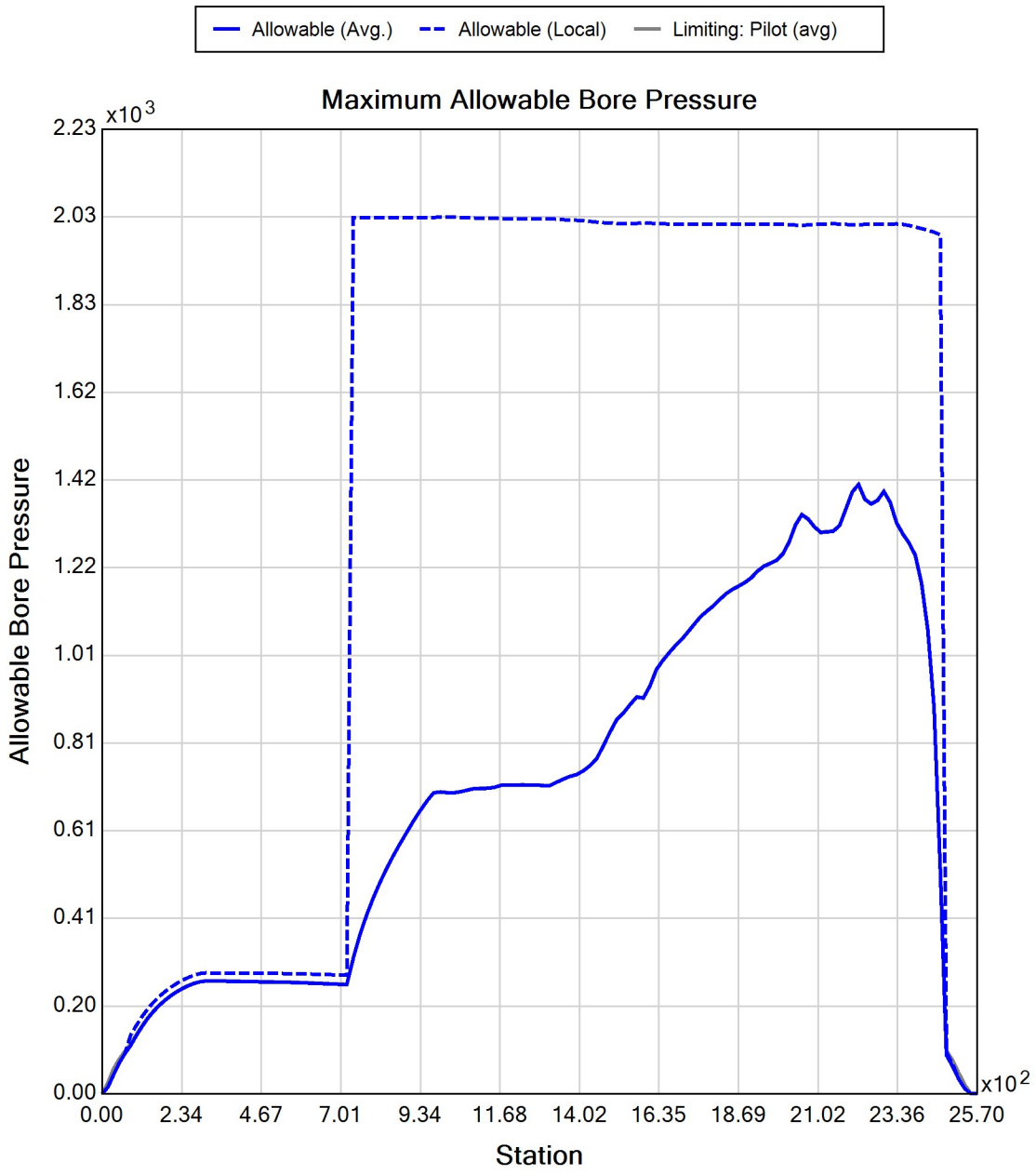


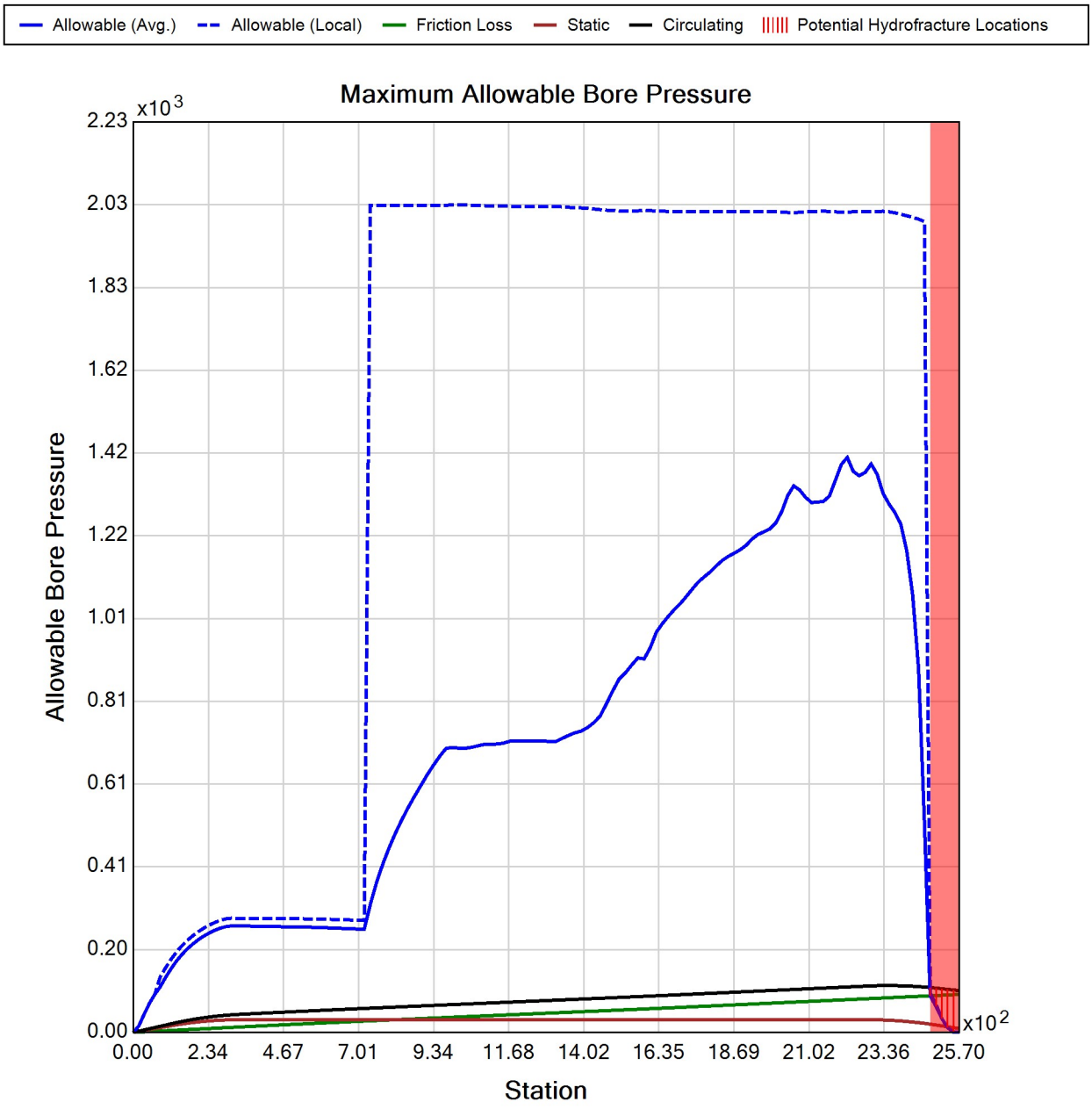












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Project Summary

General:	CHPE HDD 65A
	P4B
	Start Date: 05-16-2023
	End Date: 05-16-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA
Designer:	MDB
	BCE
Description:	HDD 65A Telecom 3- inch DR 7 Ballasted HDPE Conduit 1

Input Summary

Start Coordinate	(0.00, 0.00, 270.00) ft
End Coordinate	(2555.00, 0.00, 246.40) ft
Project Length	2555.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	7.0
Pipe Thickness	0.50 in
Rod Length	20.00 ft
Rod Diameter	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: 3" (3.5")
Pipe DR: 7
Pipe Length: 2759.98 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.7	50.1
Water Pressure	10.5	4.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.3	54.4
Deflection		
Earth Load Deflection	0.349	6.118
Buoyant Deflection	0.020	0.020
Reissner Effect	0	0
Net Deflection	0.370	6.138
Compressive Stress [psi]		
Compressive Wall Stress	46.4	190.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	3791.4	3791.4
Pullback Stress [psi]	804.6	804.6
Pullback Strain	1.399E-2	1.399E-2
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	804.6	810.4
Tensile Strain	1.399E-2	1.424E-2

Net External Pressure = 17.3 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.370	7.5	20.3	OK
Unconstrained Collapse [psi]	42.3	316.7	7.5	OK
Compressive Wall Stress [psi]	46.4	1150.0	24.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.010	7.5	756.1	OK
Unconstrained Collapse [psi]	24.1	484.3	20.1	OK
Tensile Stress [psi]	810.4	1200.0	1.5	OK

Generated Output

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Project Summary

General:	CHPE HDD 65A P4B Start Date: 05-16-2023 End Date: 05-16-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA
Designer:	MDB BCE
Description:	HDD 65A Conduit 2, 8- inch DR18 PVC Ballasted possibly can do with rollers and no ballast border line, Estimated water 5 ft above top of rock, Estimated Shale to below HDD bore path. DR18 as estimate for DR 17 installation.

Input Summary

Start Coordinate	(0.00, 0.00, 270.00) ft
End Coordinate	(2590.40, 0.00, 253.00) ft
Project Length	2590.40 ft
Pipe Type	PVC
OD Classification	IPS
Pipe OD	8.625 in
Pipe DR	18.0
Pipe Thickness	0.48 in
Rod Length	20.00 ft
Rod Diameter	5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

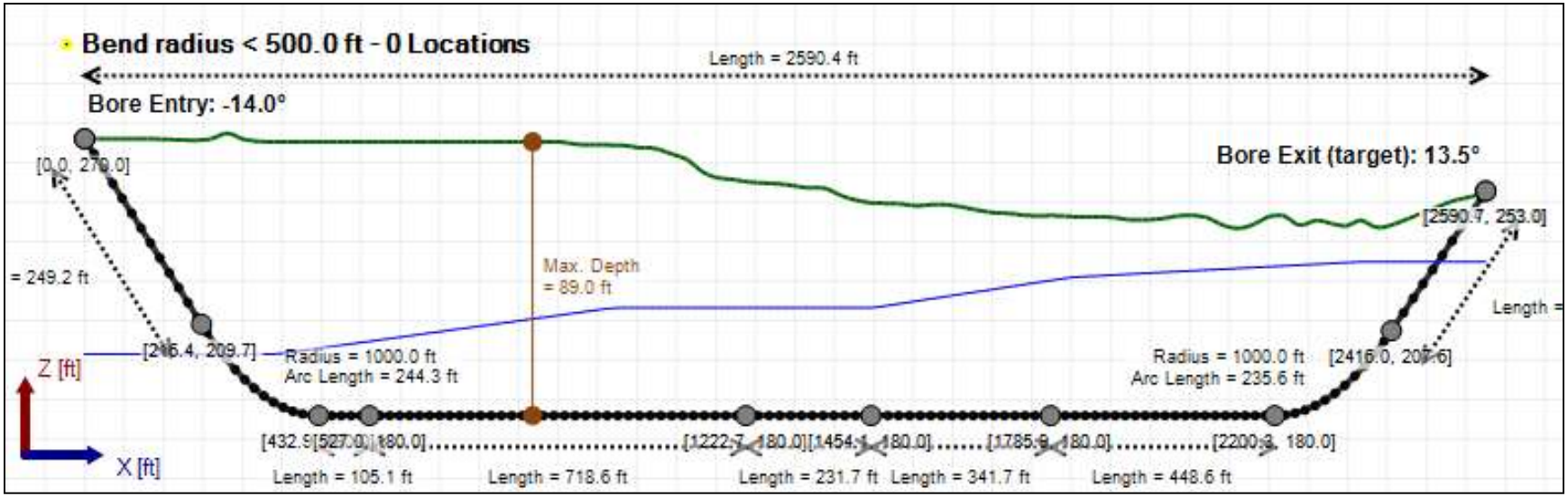
Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SP
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

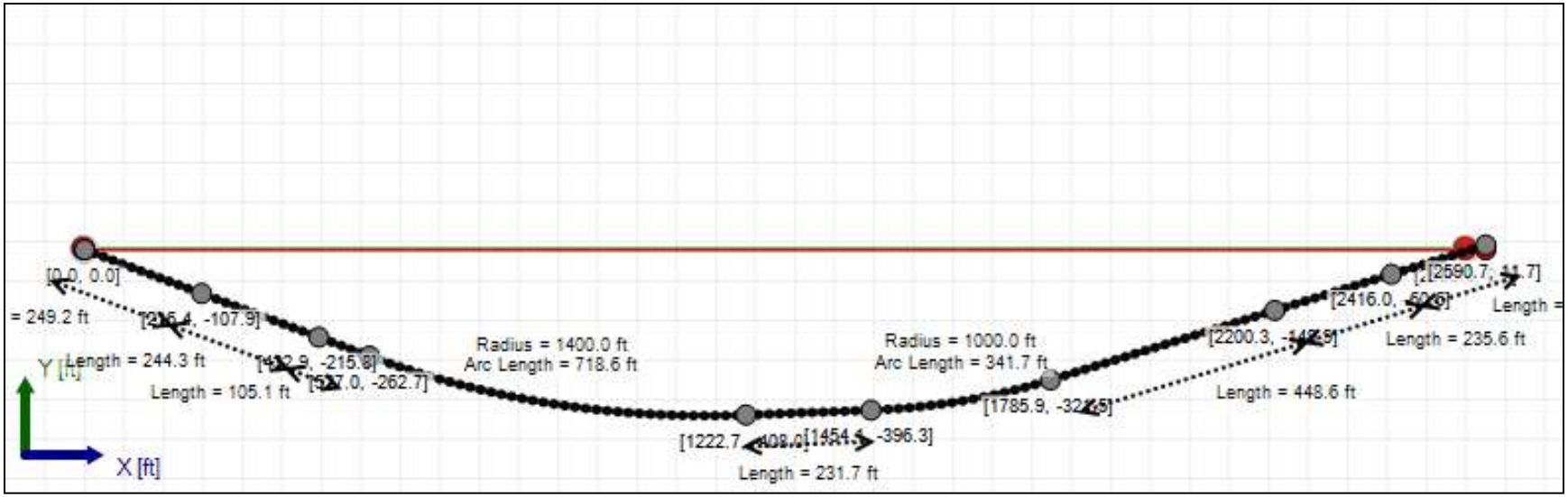
Soil Layer #2 USCS, Sand (S), SW
From Assistant
Unit Weight: 125.0000 (dry), 135.0000 (sat) [lb/ft3]
Phi: 36.00, S.M.: 800.00, Coh: 0.00 [psi]

Soil Layer #3 Rock, Geological Classification, Sedimentary Rocks
From Assistant
Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3]
Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [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: 2779.98 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: 87.40220 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	4.7	69.1
Water Pressure	21.0	14.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	25.8	83.4
Deflection		
Earth Load Deflection	0.967	13.048
Buoyant Deflection	0.060	0.060
Reissner Effect	0	0
Net Deflection	1.027	13.108
Compressive Stress [psi]		
Compressive Wall Stress	232.0	750.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	17379.5	17379.5
Pullback Stress [psi]	1417.3	1417.3
Pullback Strain	3.543E-3	3.543E-3
Bending Stress [psi]	0.0	143.8
Bending Strain	0	3.594E-4
Tensile Stress [psi]	1417.3	1555.2
Tensile Strain	3.543E-3	4.247E-3

Net External Pressure = 22.6 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 365.0 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.027	7.5	7.3	OK
Unconstrained Collapse [psi]	58.5	174.1	3.0	OK
Compressive Wall Stress [psi]	232.0	3200.0	13.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.060	7.5	125.5	OK
Unconstrained Collapse [psi]	29.5	160.2	5.4	OK
Tensile Stress [psi]	1555.2	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	8.00 in	1665.044 psi	2056.083 psi
1	8.00 in	16.00 in	1664.728 psi	2055.905 psi
2	16.00 in	19.13 in	1664.548 psi	2055.804 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): 280.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

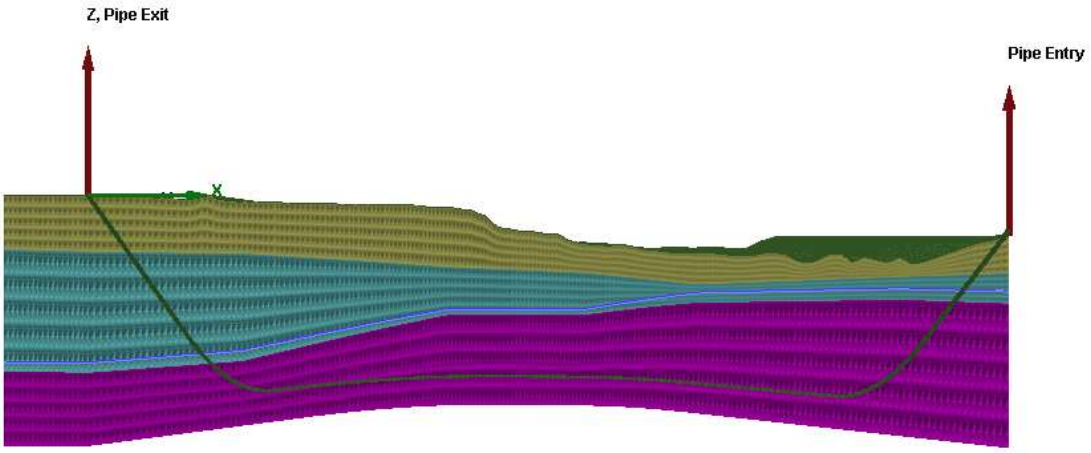
Rheological model: Power-Law

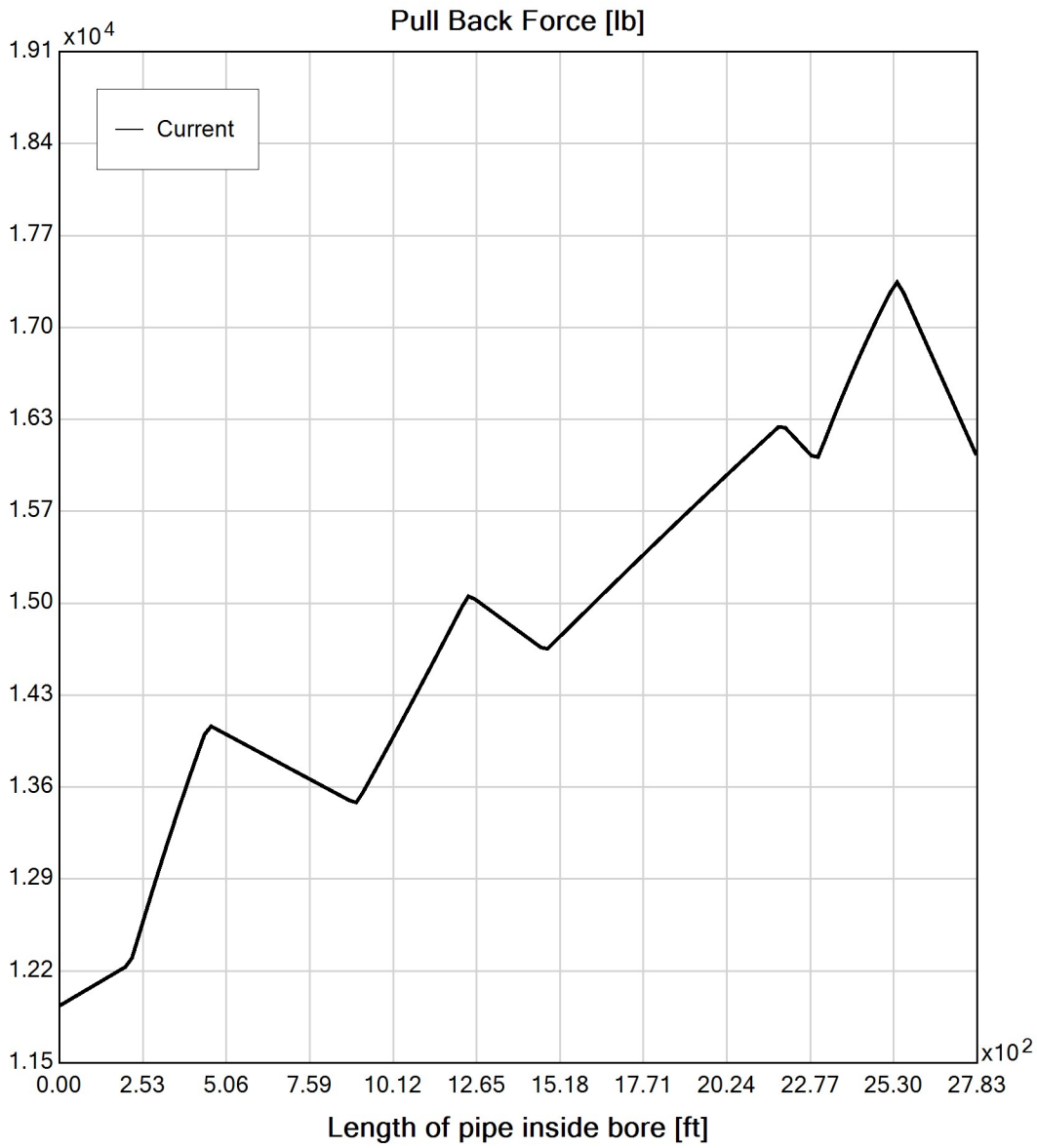
Fluid Consistency Index (K): 63.17

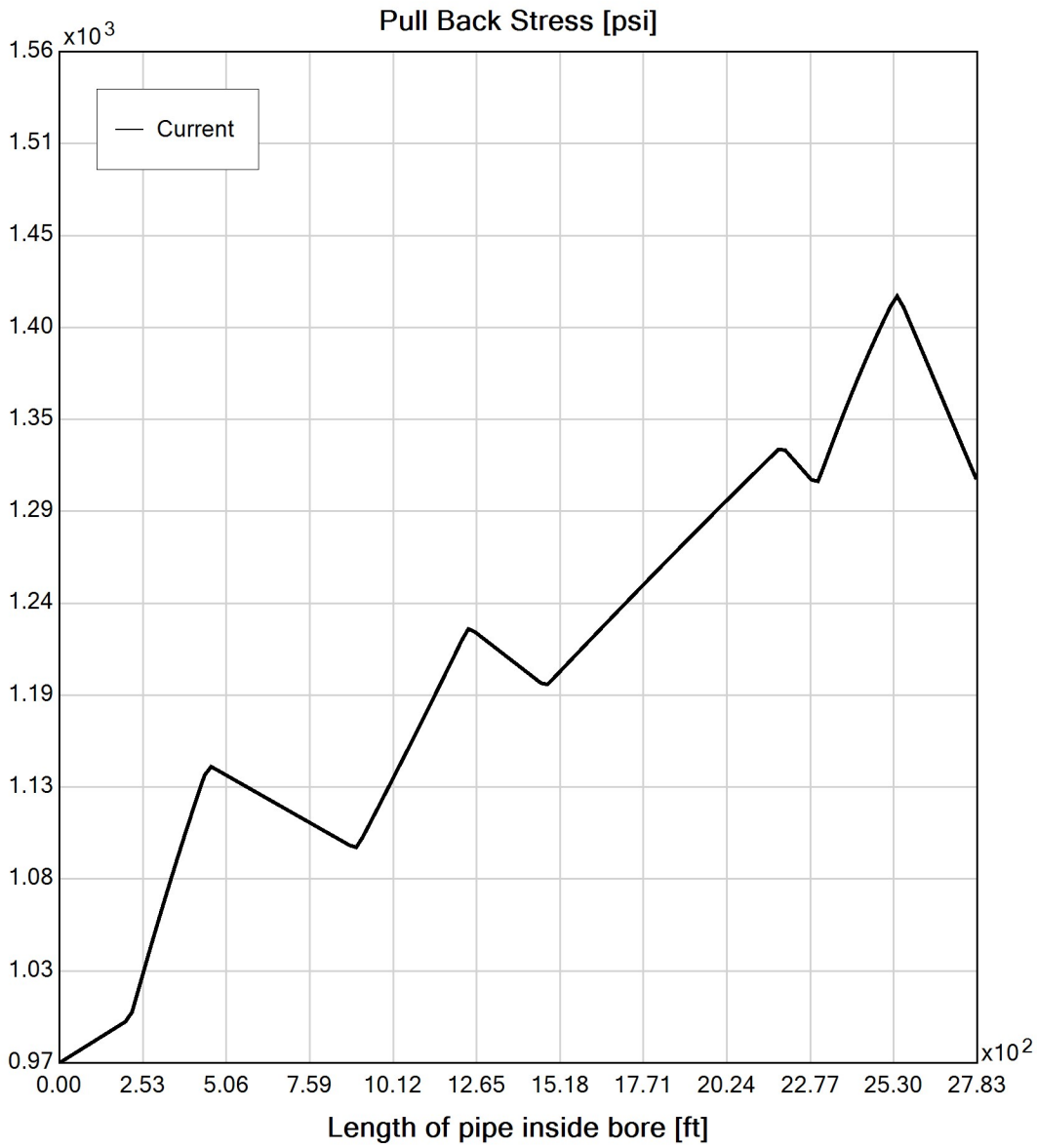
Power Law Exponent (n): 0.14

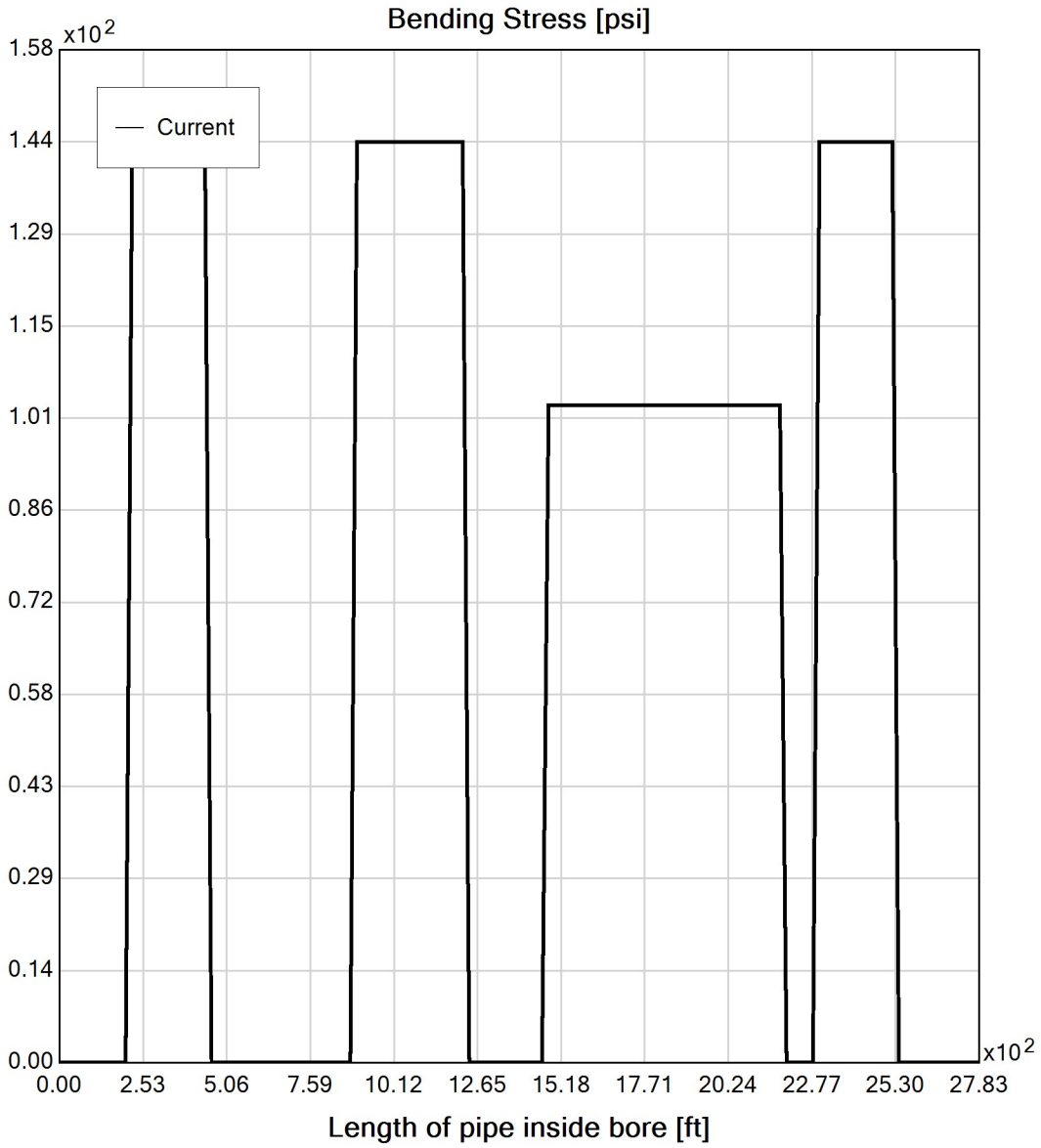
Effective Viscosity (cP): 88.5

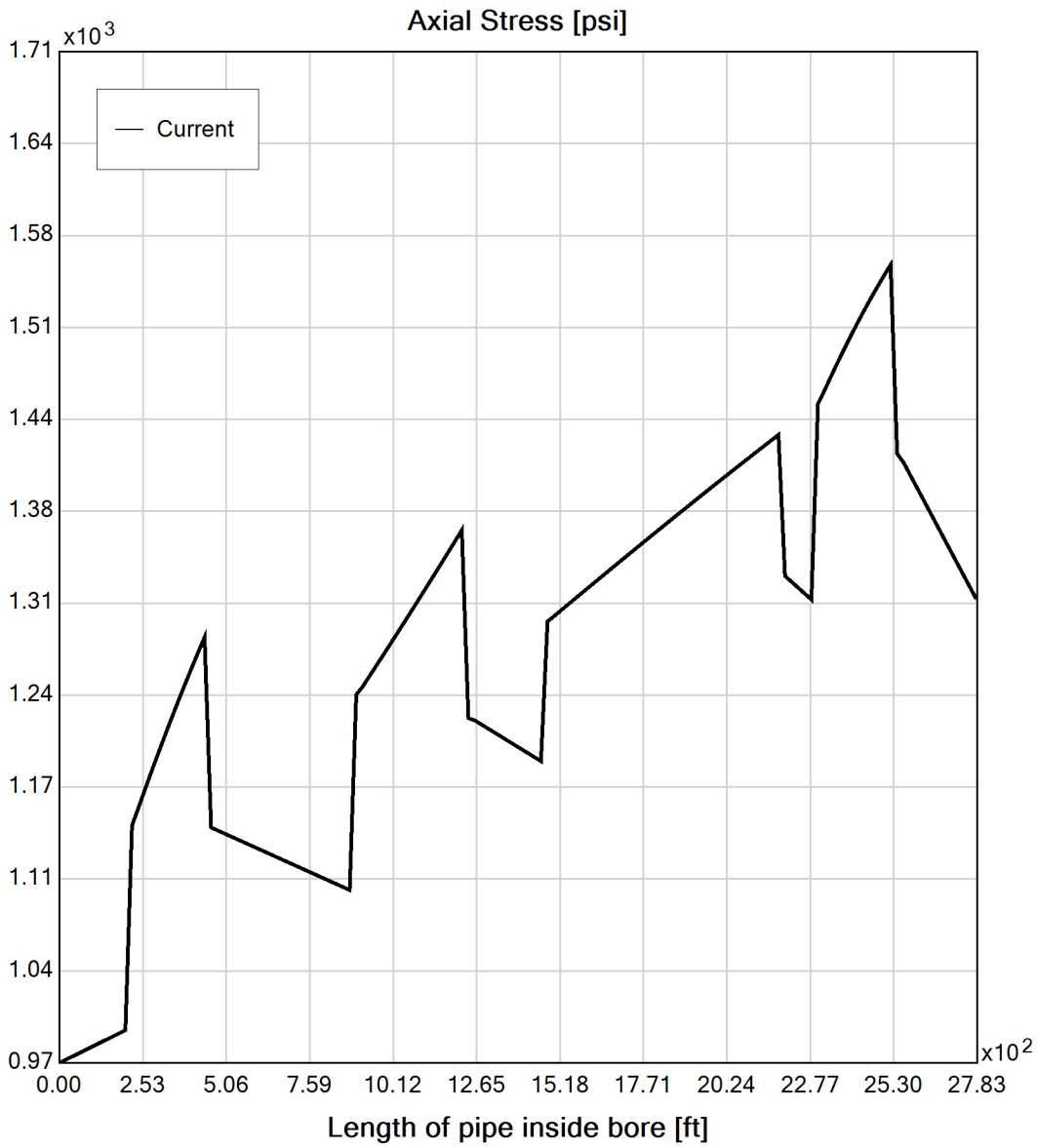
Virtual Site

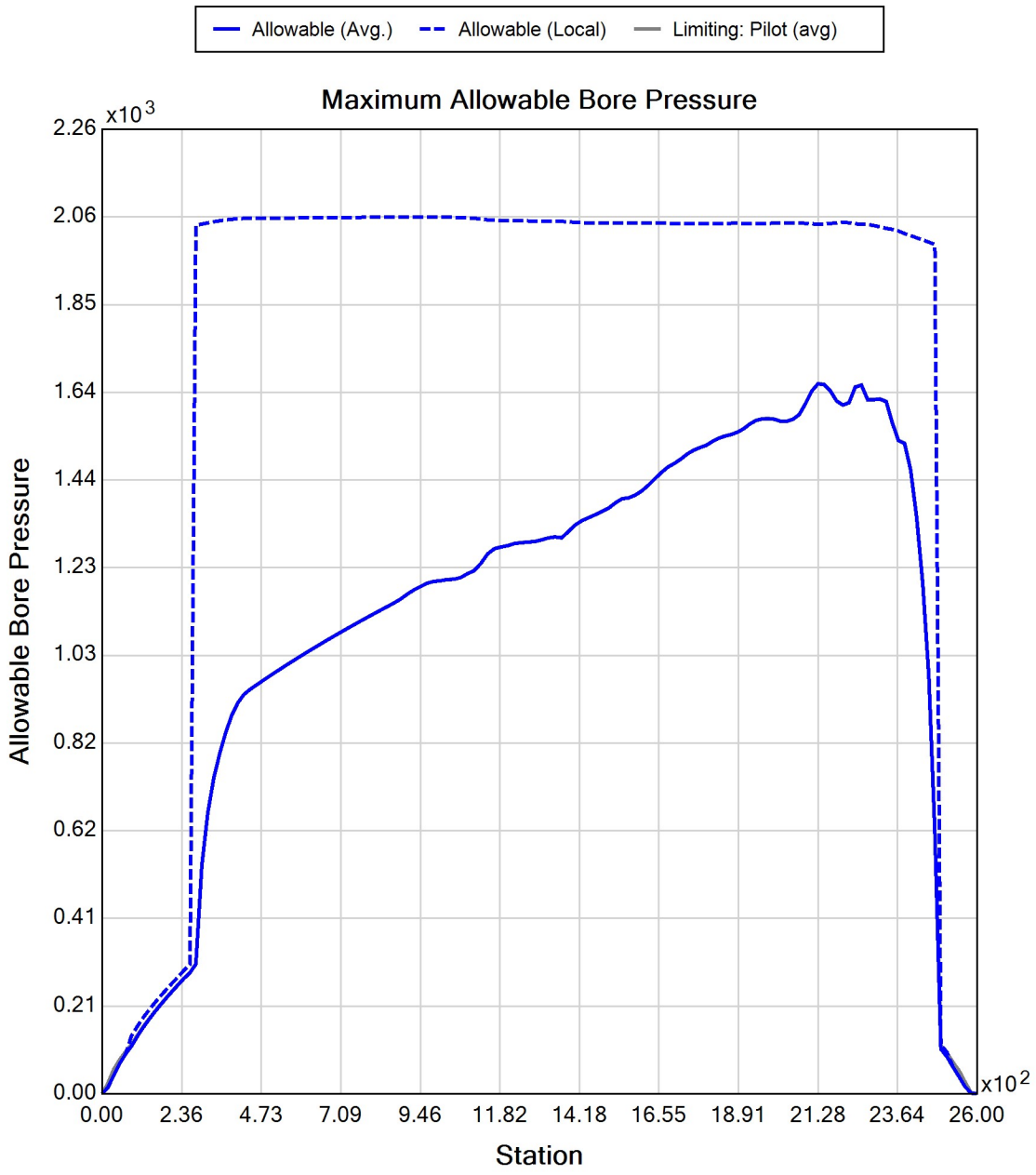


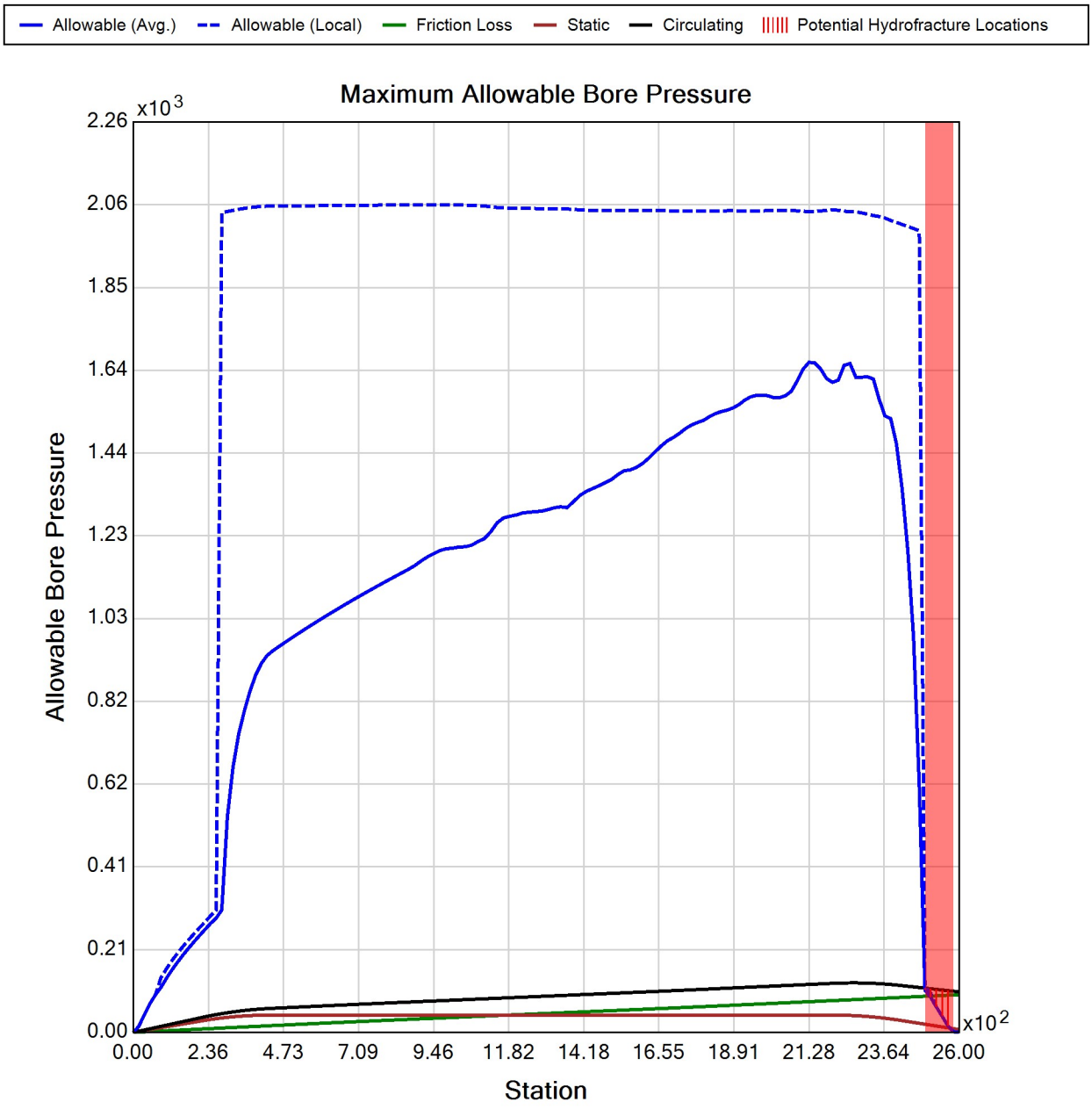












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Project Summary

General:	CHPE HDD 65A P4B Start Date: 05-16-2023 End Date: 05-16-2023
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA
Designer:	MDB BCE
Description:	HDD 65A Telecom 3- inch DR 7 Ballasted HDPE Conduit 2

Input Summary

Start Coordinate	(0.00, 0.00, 270.00) ft
End Coordinate	(2590.40, 0.00, 253.00) ft
Project Length	2590.40 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	3.500 in
Pipe DR	7.0
Pipe Thickness	0.50 in
Rod Length	20.00 ft
Rod Diameter	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: 3" (3.5")
Pipe DR: 7
Pipe Length: 2779.98 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.8	69.1
Water Pressure	21.0	14.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	23.8	83.4
Deflection		
Earth Load Deflection	0.350	8.137
Buoyant Deflection	0.020	0.020
Reissner Effect	0	0
Net Deflection	0.370	8.157
Compressive Stress [psi]		
Compressive Wall Stress	83.2	291.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	3967.5	3967.5
Pullback Stress [psi]	841.9	841.9
Pullback Strain	1.464E-2	1.464E-2
Bending Stress [psi]	0.0	8.4
Bending Strain	0	1.458E-4
Tensile Stress [psi]	841.9	847.9
Tensile Strain	1.464E-2	1.489E-2

Net External Pressure = 22.6 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 172.8 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.370	7.5	20.3	OK
Unconstrained Collapse [psi]	58.5	317.1	5.4	OK
Compressive Wall Stress [psi]	83.2	1150.0	13.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.010	7.5	756.1	OK
Unconstrained Collapse [psi]	29.5	477.6	16.2	OK
Tensile Stress [psi]	847.9	1200.0	1.4	OK

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Project Summary

General:	CHPE HDD 66 P4B Start Date: 12-10-2021 End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR CHA
Description:	HDD 66 10-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 284.00) ft
End Coordinate	(970.70, 0.00, 287.00) ft
Project Length	970.70 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, Sand (S), SW
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

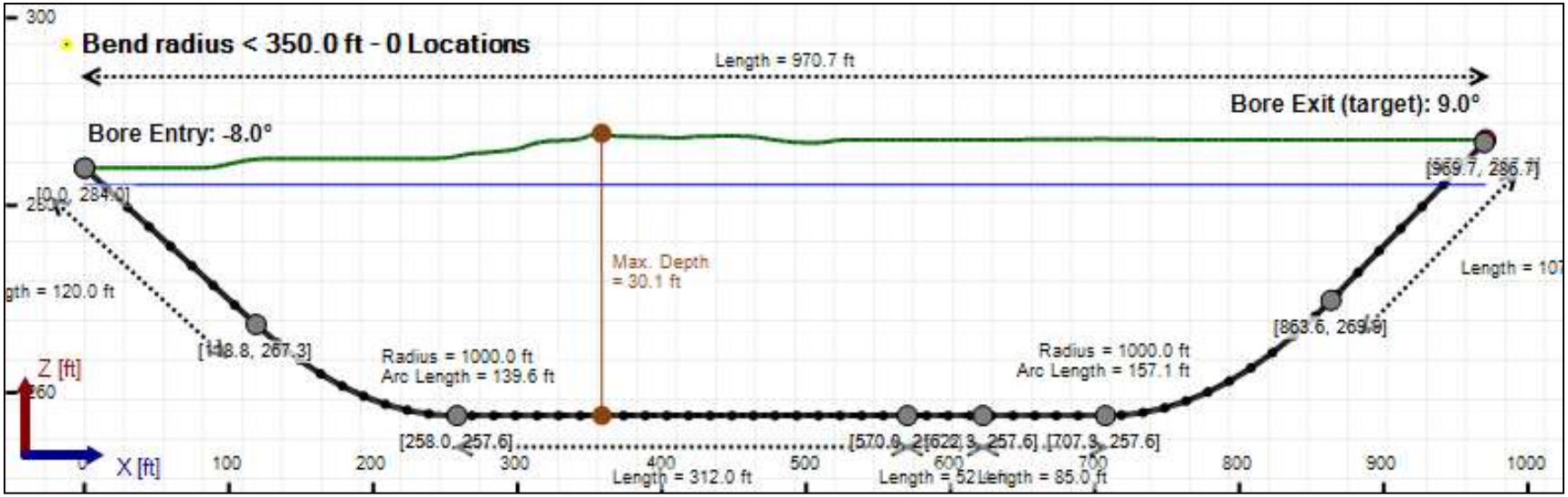
Soil Layer #2 USCS, Clay (C), CL
From Assistant
Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]
Phi: 0.00, S.M.: 145.00, Coh: 3.13 [psi]

Soil Layer #3 USCS, Sand (S), SM
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

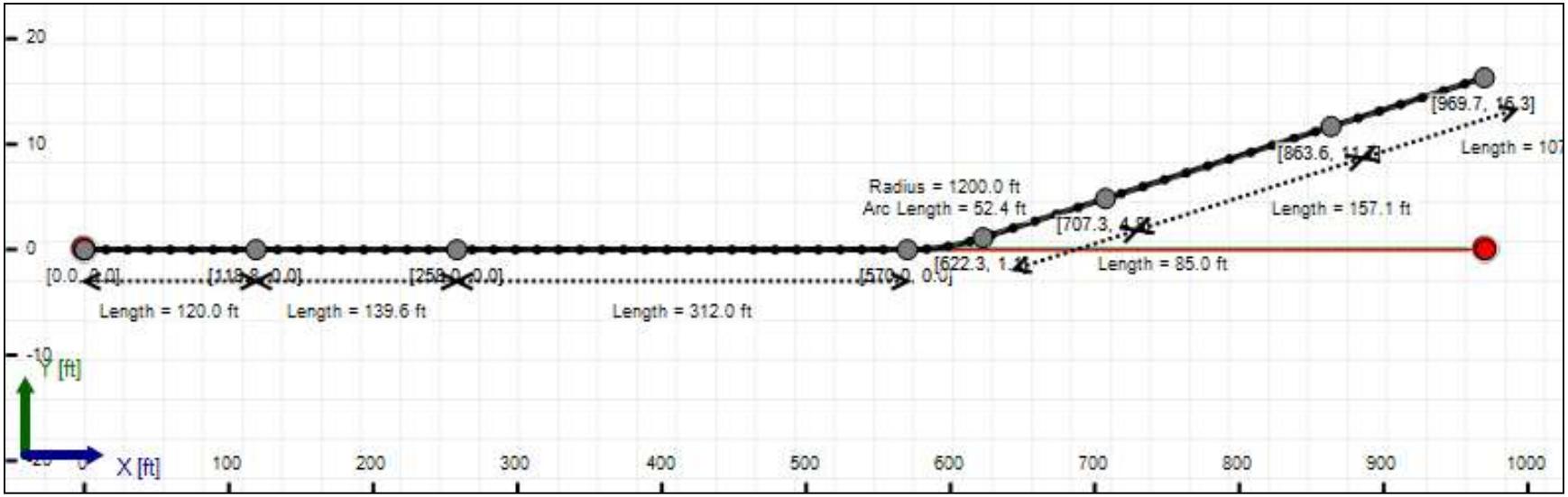
Soil Layer #4 USCS, Sand (S), SP
From Assistant
Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #5 USCS, Sand (S), SM
From Assistant
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.2	13.1
Water Pressure	10.7	10.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.9	23.7
Deflection		
Earth Load Deflection	0.869	3.559
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.001	3.691
Compressive Stress [psi]		
Compressive Wall Stress	62.4	106.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	15723.7	15723.7
Pullback Stress [psi]	438.5	438.5
Pullback Strain	7.626E-3	7.626E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	438.5	459.9
Tensile Strain	7.626E-3	8.446E-3

Net External Pressure = 21.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.001	7.5	7.5	OK
Unconstrained Collapse [psi]	19.1	126.2	6.6	OK
Compressive Wall Stress [psi]	62.4	1150.0	18.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	29.1	229.3	7.9	OK
Tensile Stress [psi]	459.9	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	8.00 in	65.228 psi	70.058 psi
1	8.00 in	12.00 in	65.092 psi	69.914 psi
2	12.00 in	16.13 in	64.898 psi	69.707 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): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

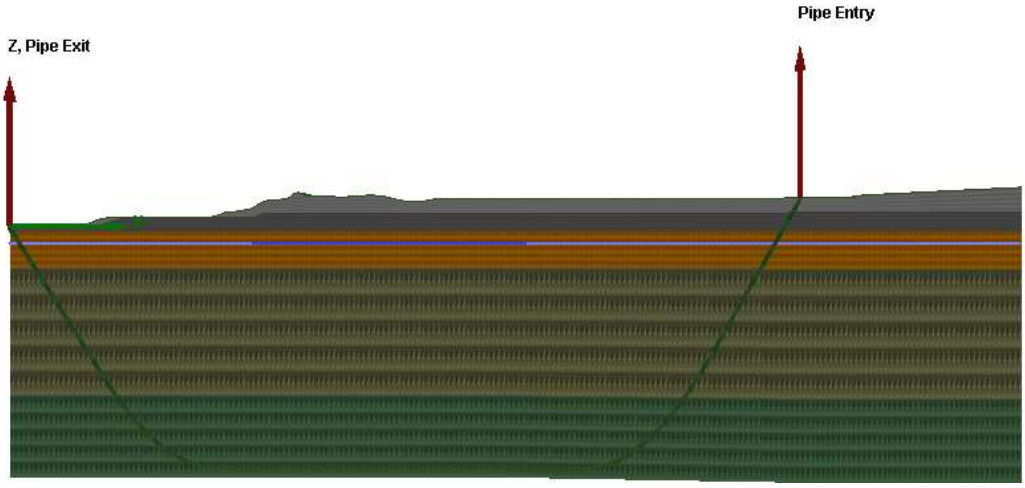
Rheological model: Bingham-Plastic

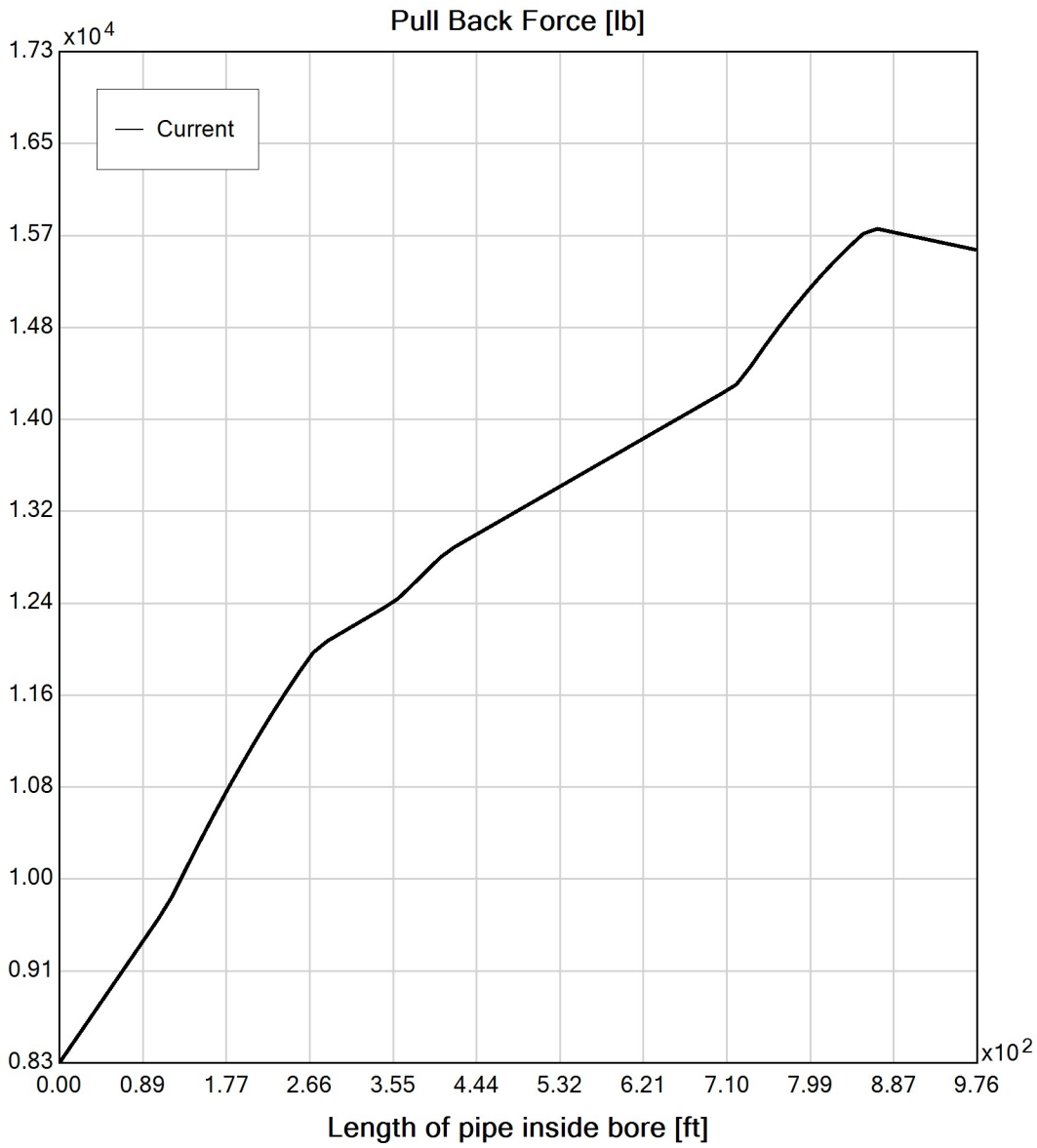
Plastic Viscosity (PV): 25.53

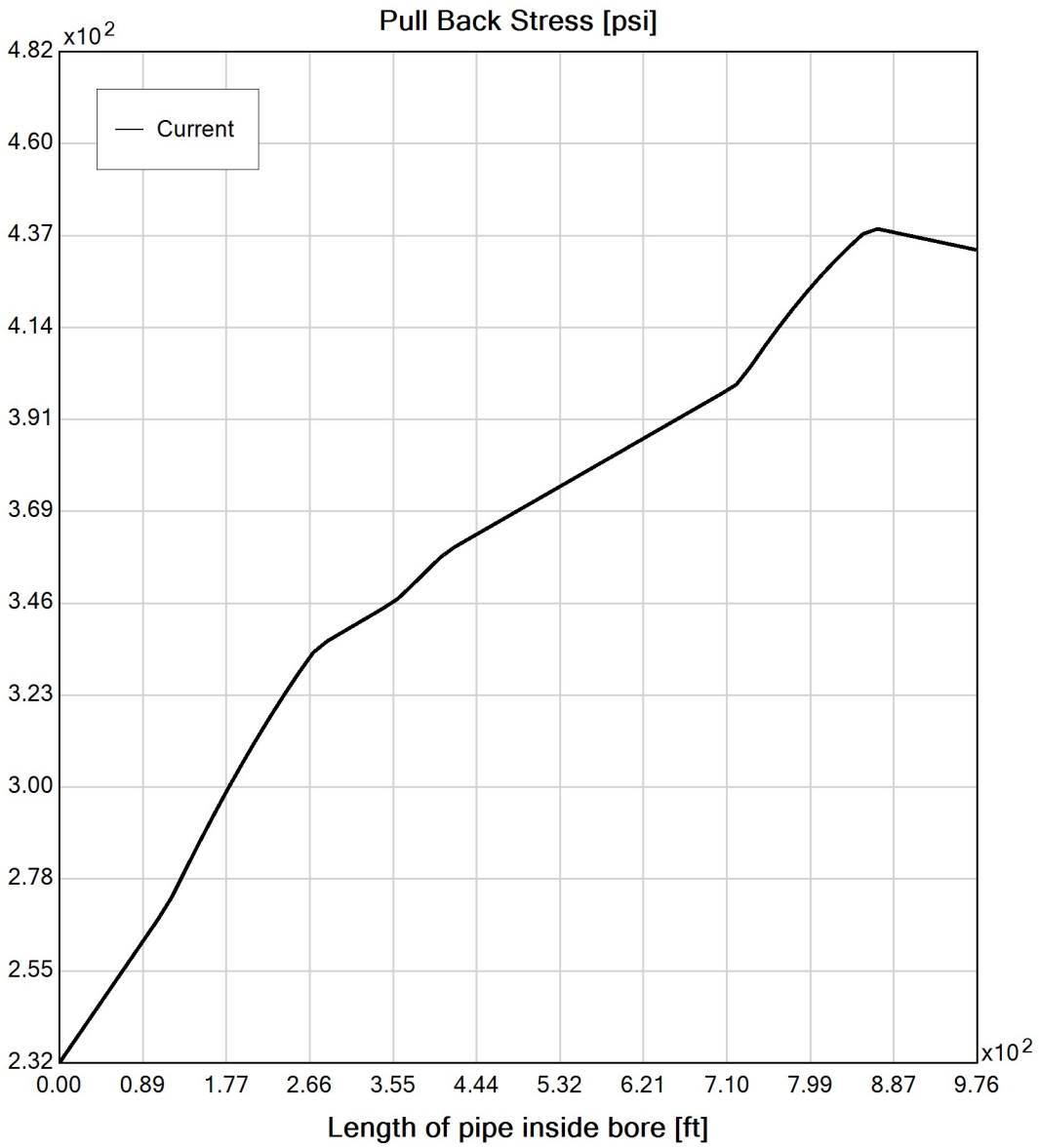
Yield Point (YP): 16.49

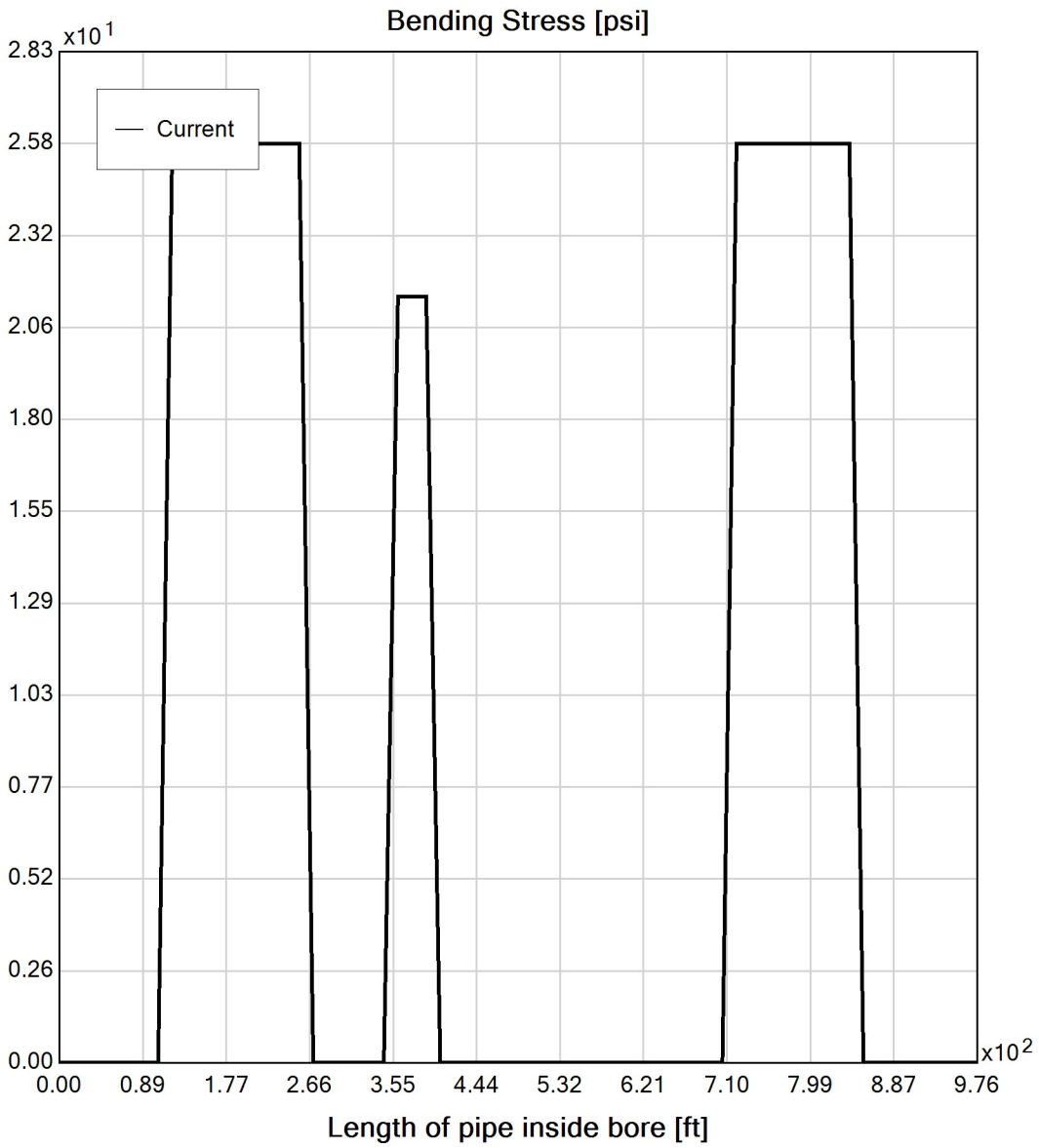
Effective Viscosity (cP): 1202.0

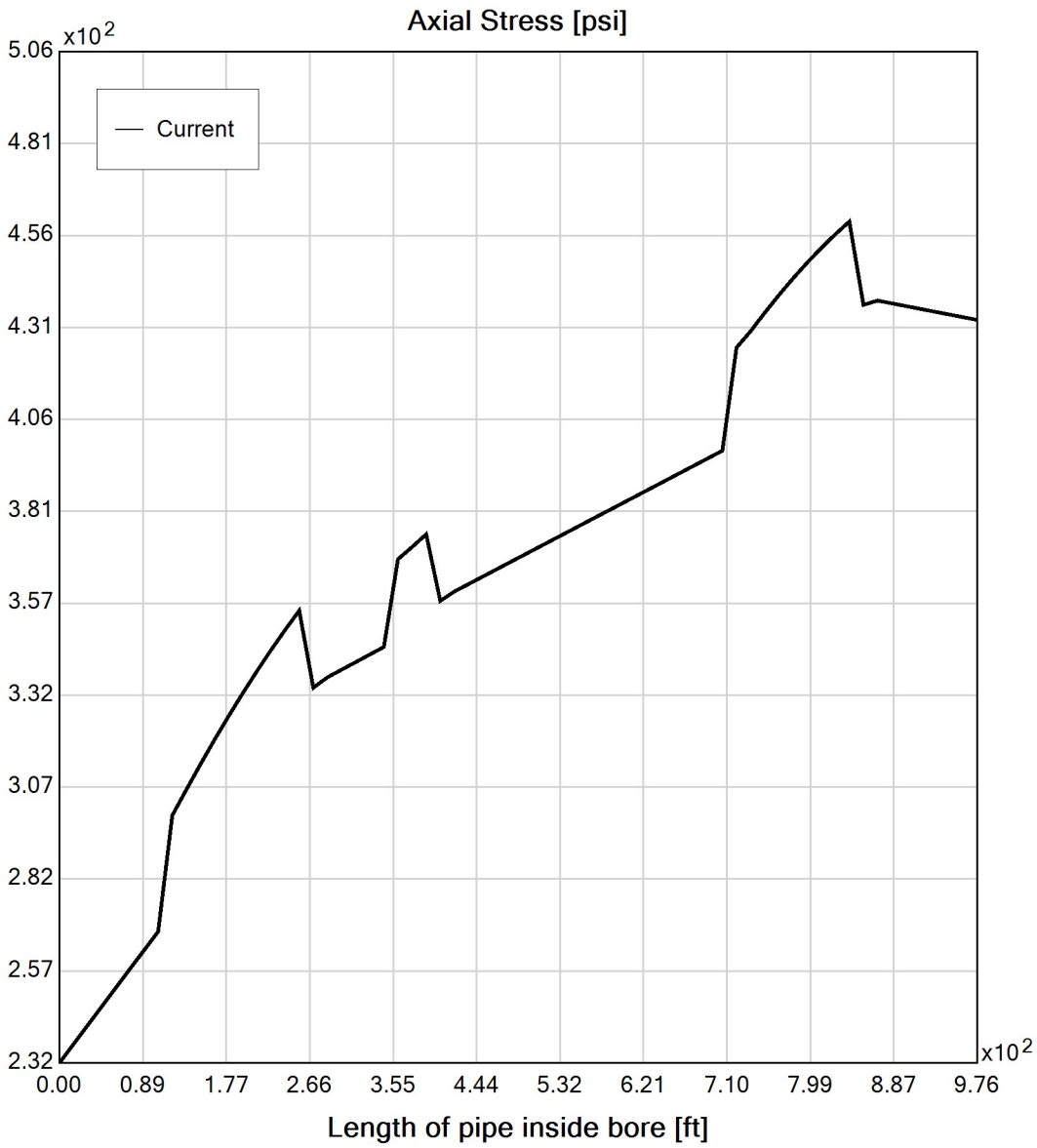
Virtual Site

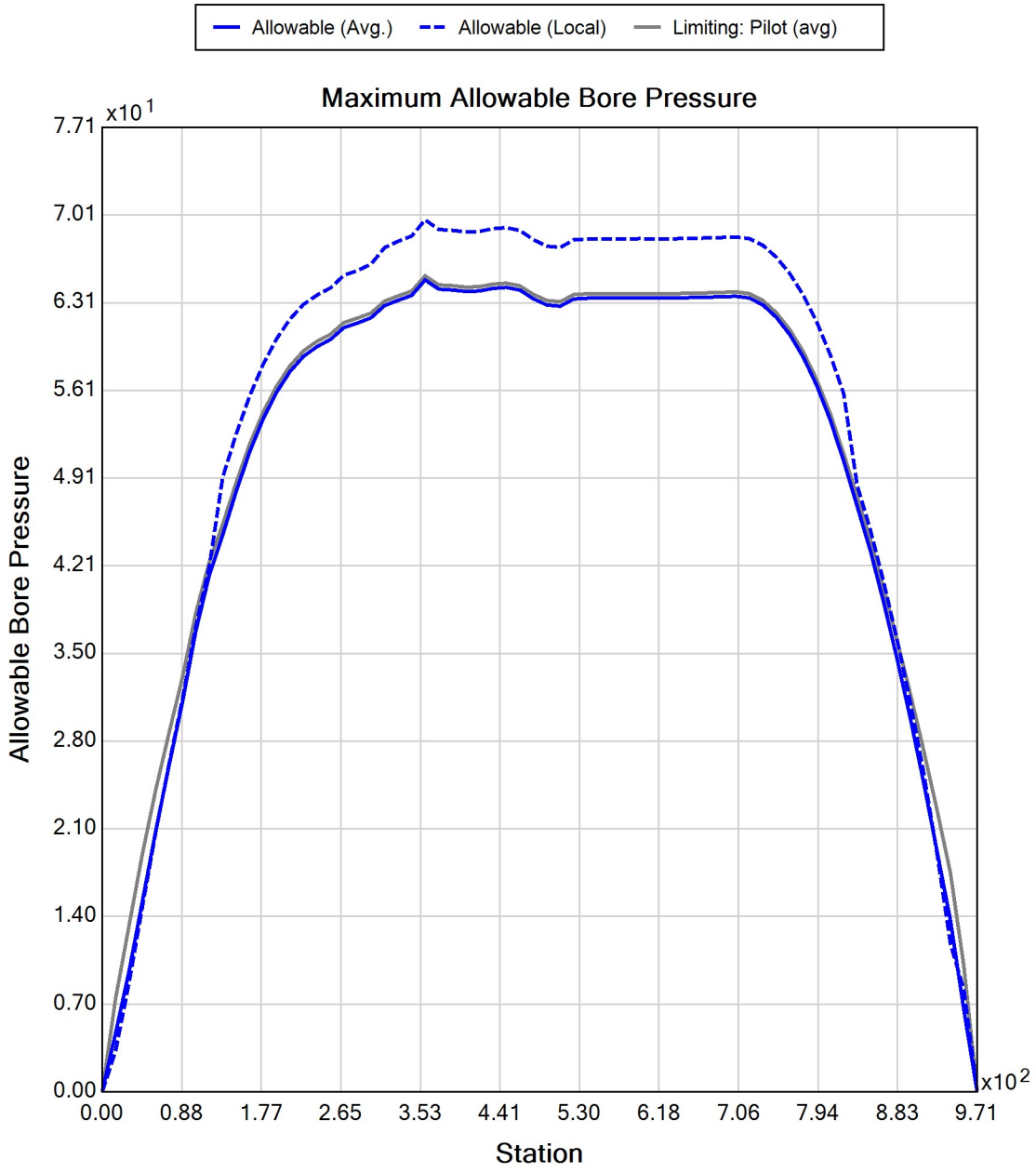


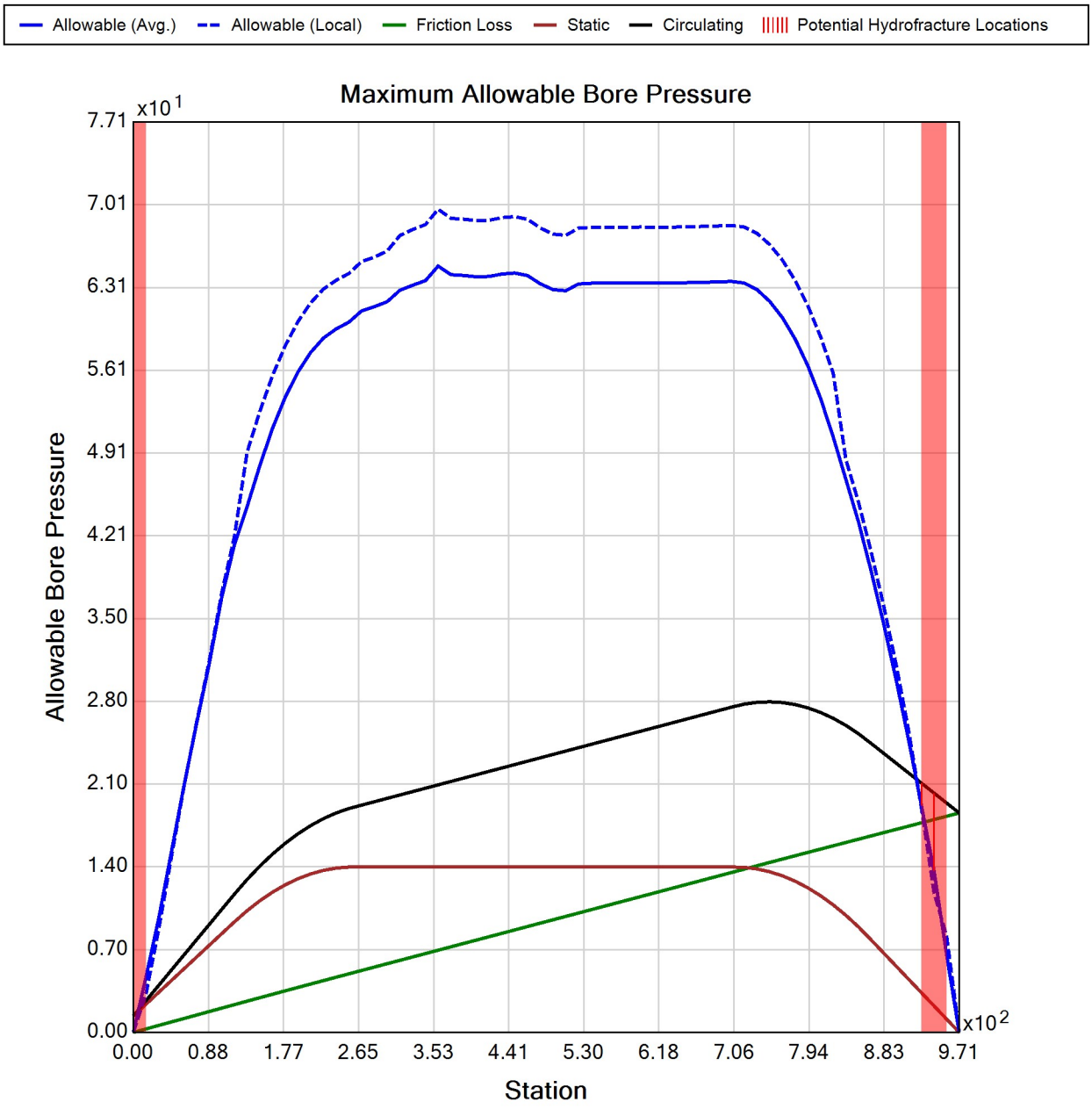












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OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact 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:	CHPE HDD 66
	P4B
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR
	CHA
Description:	HDD 66 2-inch DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 284.00) ft
End Coordinate	(970.70, 0.00, 287.00) ft
Project Length	970.70 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 975.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.3	13.1
Water Pressure	10.7	10.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.0	23.7
Deflection		
Earth Load Deflection	0.425	3.559
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.454	3.588
Compressive Stress [psi]		
Compressive Wall Stress	53.8	106.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	877.1	877.1
Pullback Stress [psi]	501.1	501.1
Pullback Strain	8.715E-3	8.715E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	501.1	502.5
Tensile Strain	8.715E-3	8.837E-3

Net External Pressure = 21.4 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.454	7.5	16.5	OK
Unconstrained Collapse [psi]	19.1	133.5	7.0	OK
Compressive Wall Stress [psi]	53.8	1150.0	21.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	29.1	227.4	7.8	OK
Tensile Stress [psi]	502.5	1200.0	2.4	OK

Generated Output

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Project Summary

General:	CHPE HDD 67 P4B Start Date: 12-10-2021 End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR CHA
Description:	HDD 67 10-inch DR9 Conduit 1

Input Summary

Start Coordinate	(237.00, 0.00, 291.00) ft
End Coordinate	(927.00, 0.00, 289.90) ft
Project Length	690.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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

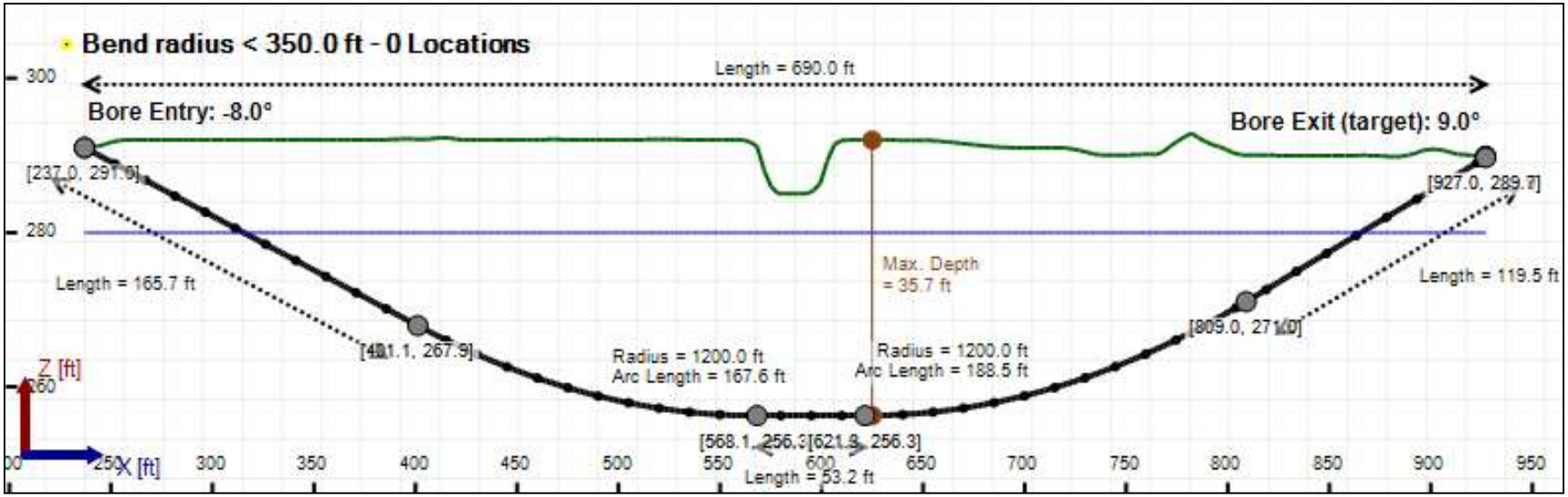
Soil Layer #1 USCS, Sand (S), SP
Depth: 5.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Gravel (G), GP
Depth: 10.50 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

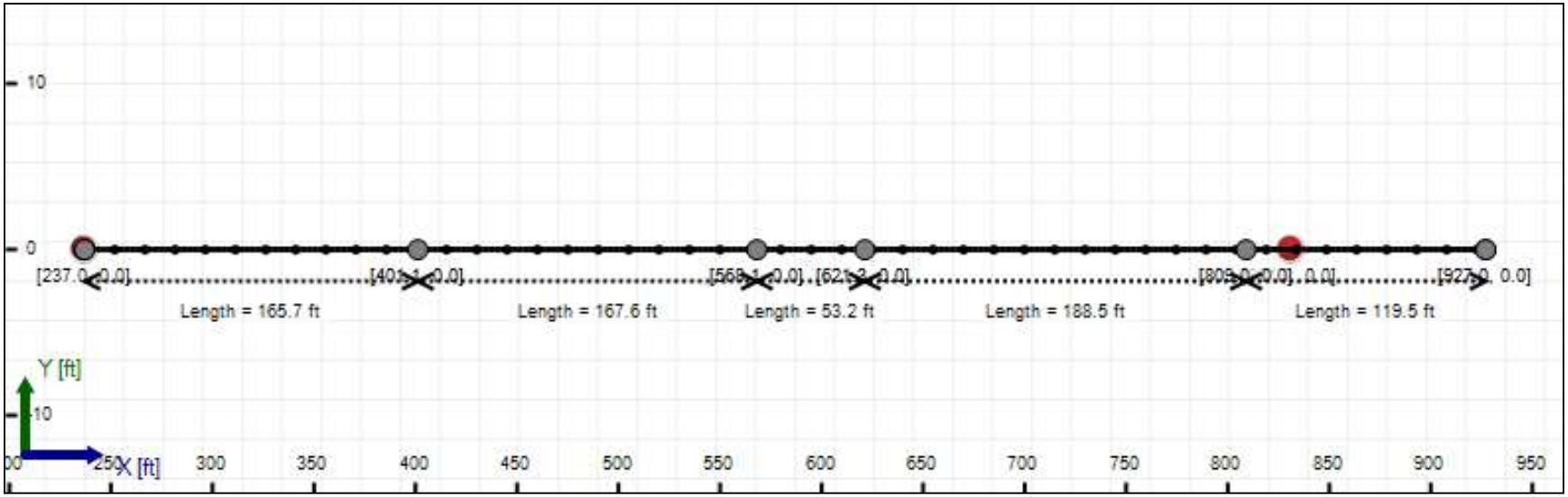
Soil Layer #3 USCS, Gravel (G), GW
Depth: 5.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Gravel (G), GP
Depth: 35.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 705.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.7	19.5
Water Pressure	10.3	10.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.0	29.8
Deflection		
Earth Load Deflection	0.624	5.301
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.653	5.330
Compressive Stress [psi]		
Compressive Wall Stress	53.8	133.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	673.7	673.7
Pullback Stress [psi]	384.9	384.9
Pullback Strain	6.694E-3	6.694E-3
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	384.9	387.6
Tensile Strain	6.694E-3	6.823E-3

Net External Pressure = 23.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.653	7.5	11.5	OK
Unconstrained Collapse [psi]	22.8	132.2	5.8	OK
Compressive Wall Stress [psi]	53.8	1150.0	21.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	32.8	234.8	7.2	OK
Tensile Stress [psi]	387.6	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	8.00 in	87.035 psi	87.035 psi
1	8.00 in	12.00 in	86.946 psi	86.946 psi
2	12.00 in	16.13 in	86.817 psi	86.817 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): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

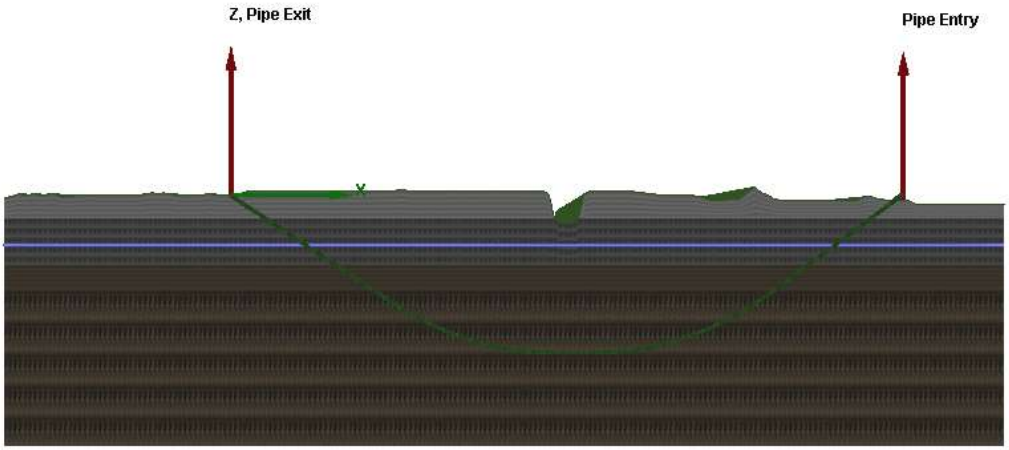
Rheological model: Bingham-Plastic

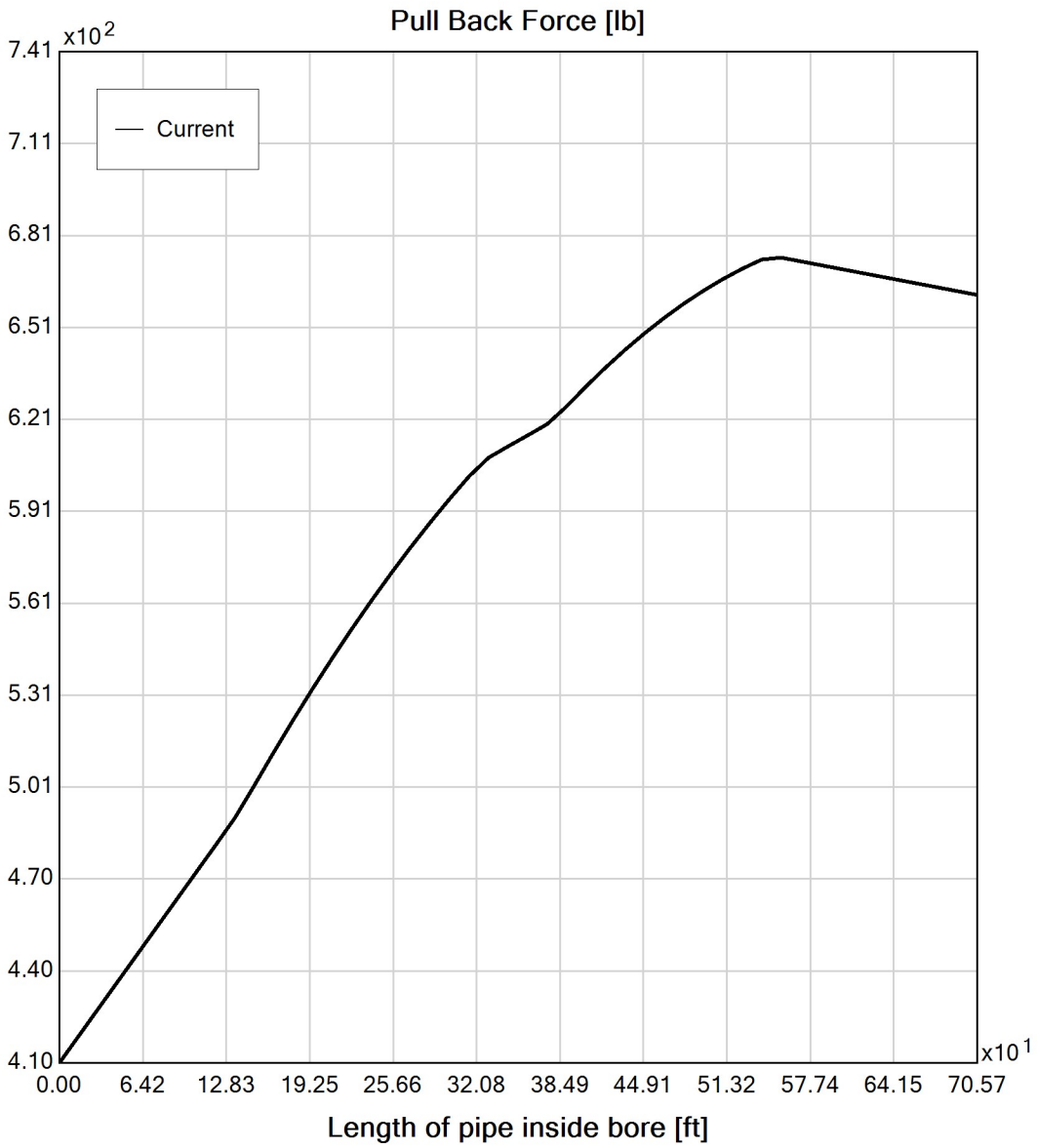
Plastic Viscosity (PV): 25.53

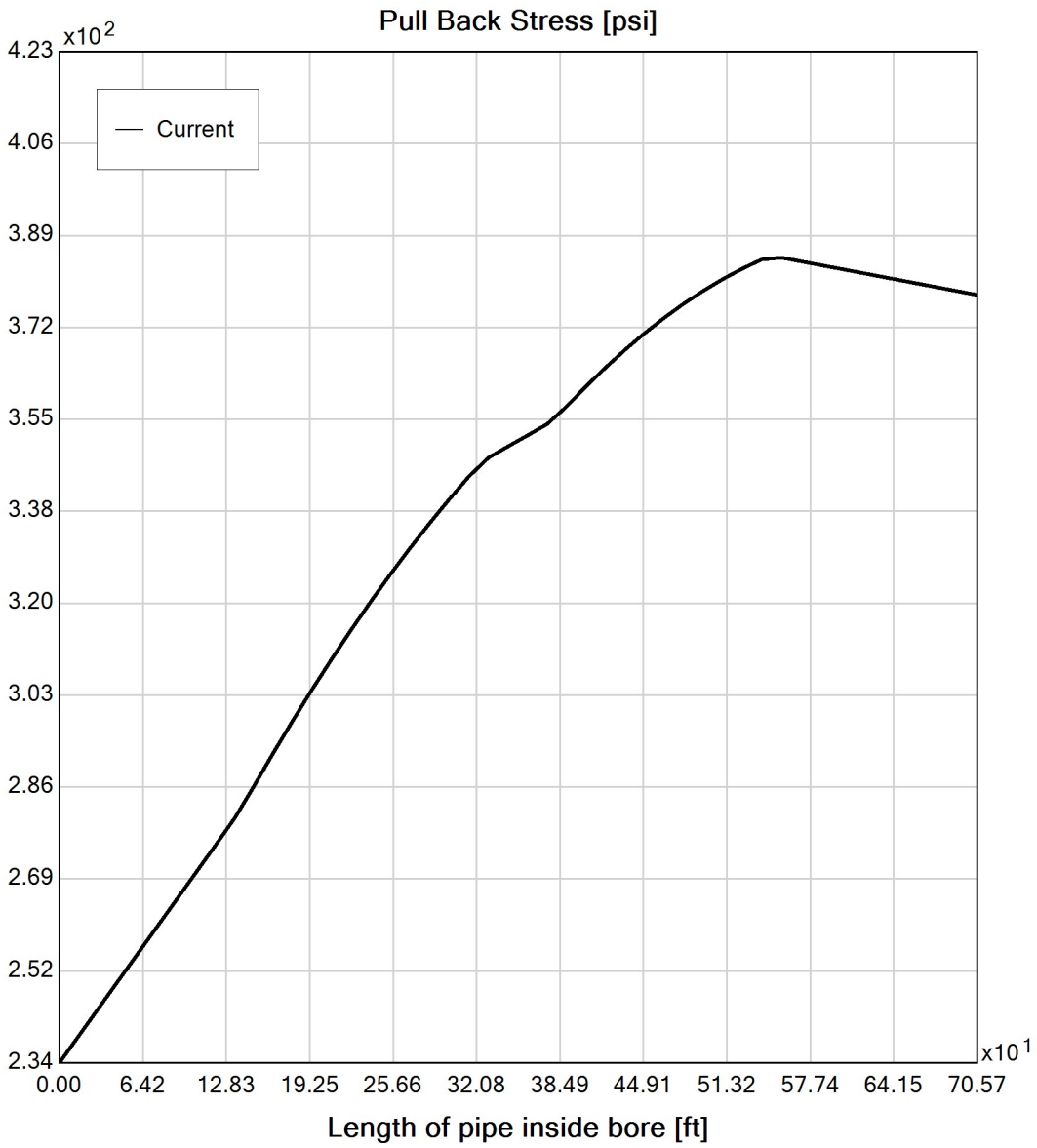
Yield Point (YP): 16.49

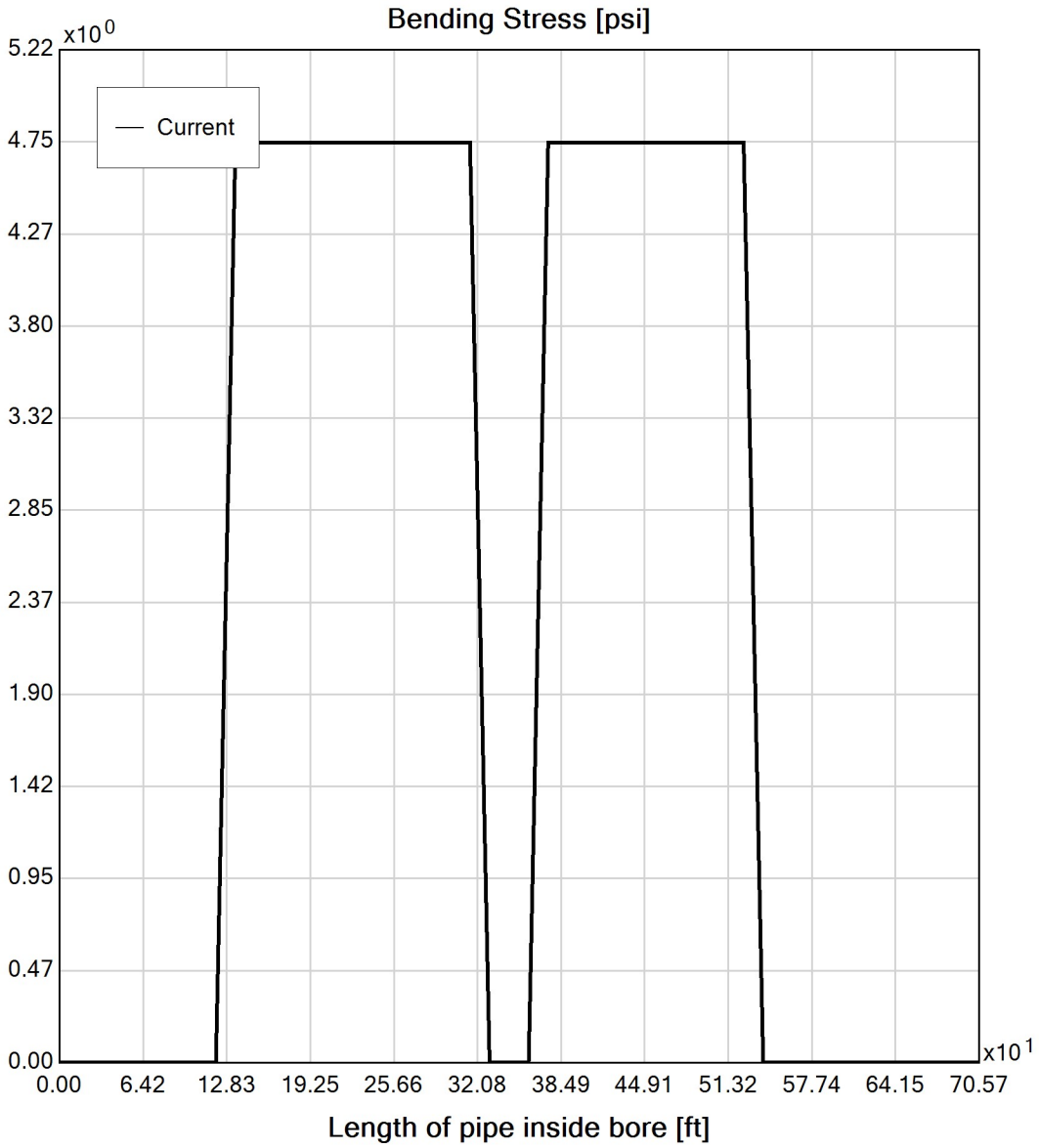
Effective Viscosity (cP): 1202.0

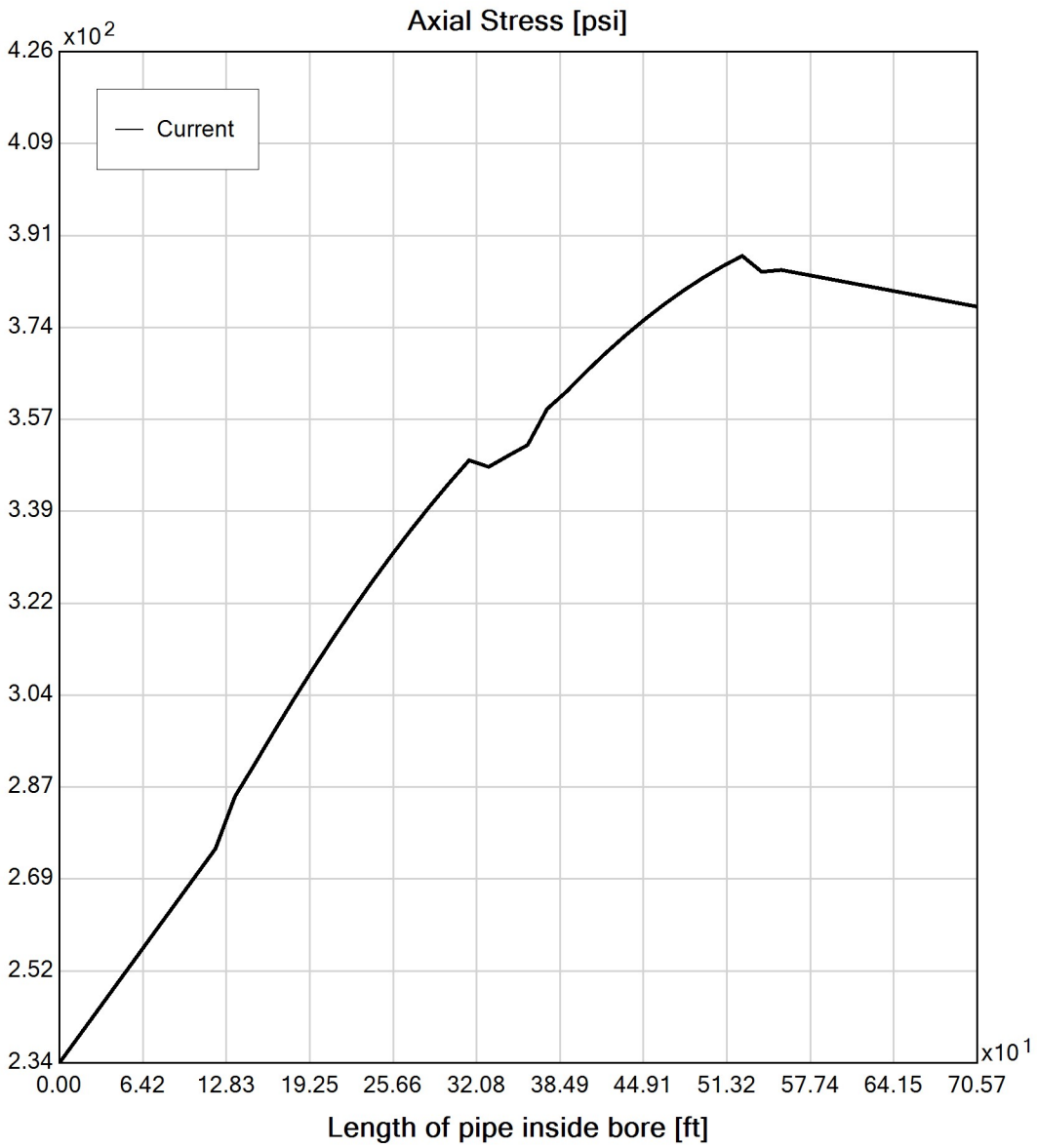
Virtual Site

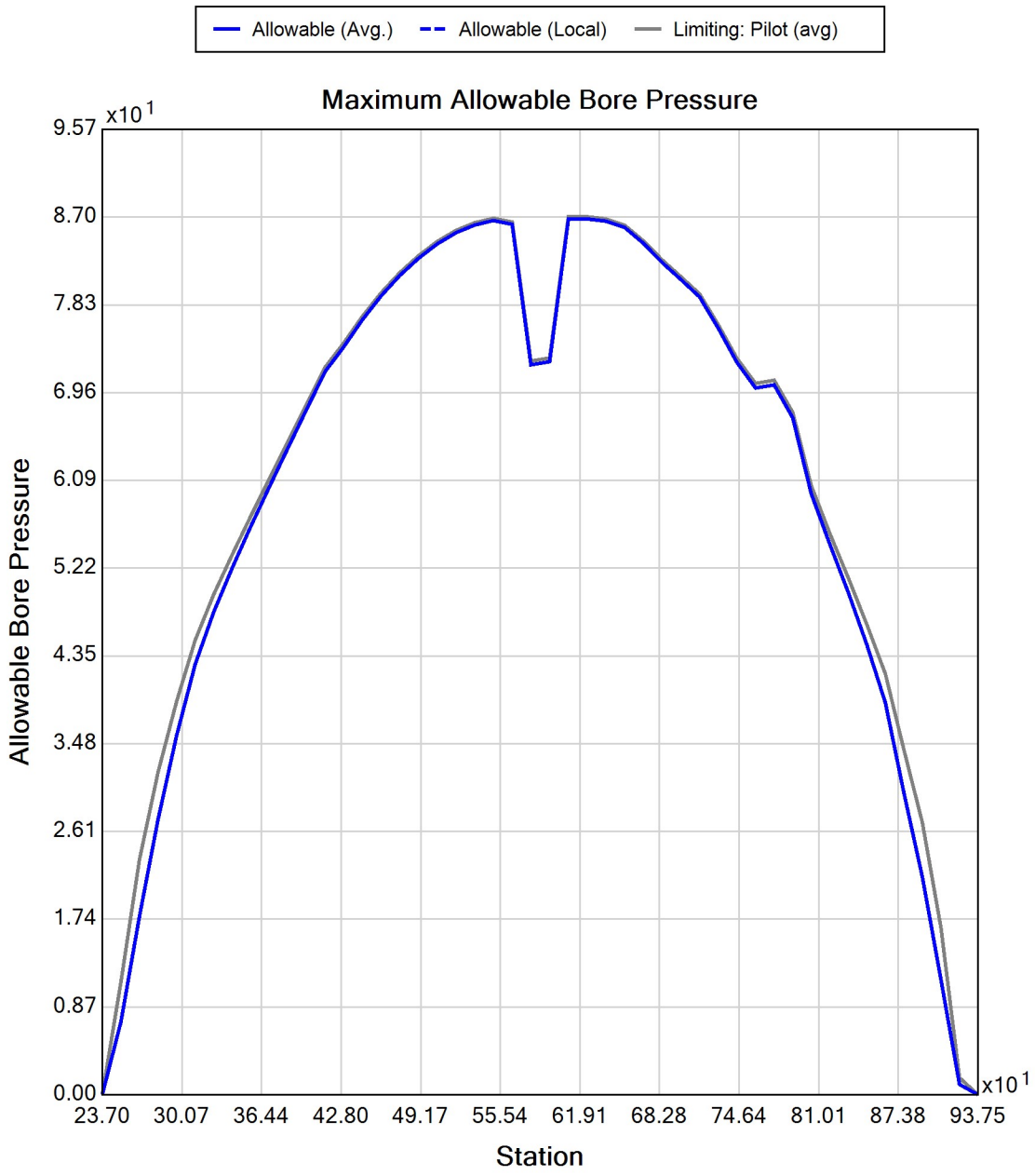


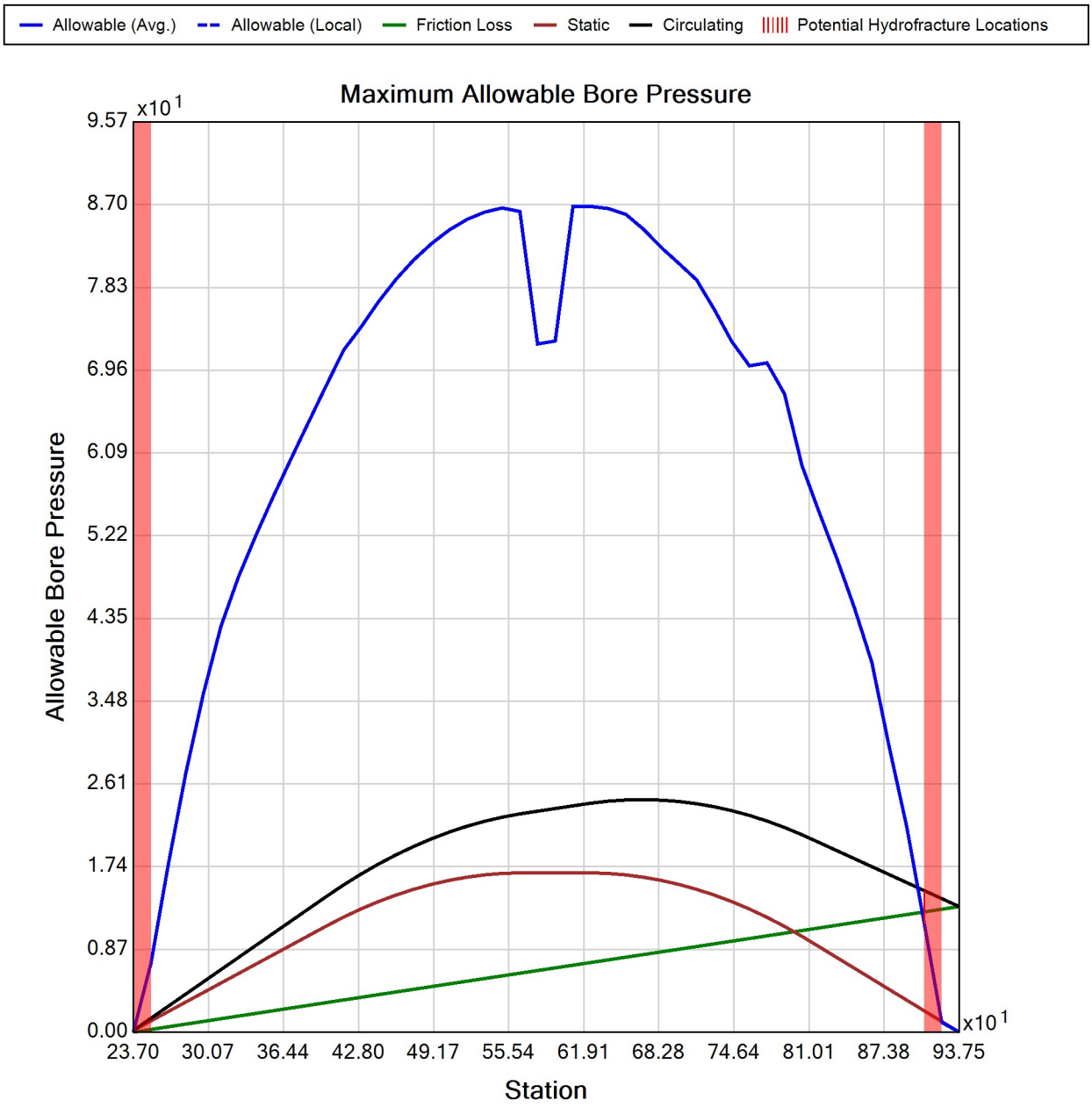












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Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR CHA
Description:	HDD 67 2-inch DR9 Conduit 1

Input Summary

Start Coordinate	(237.00, 0.00, 291.00) ft
End Coordinate	(927.00, 0.00, 289.90) ft
Project Length	690.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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: 2" (2.375")
Pipe DR: 9
Pipe Length: 705.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.7	19.5
Water Pressure	10.3	10.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.0	29.8
Deflection		
Earth Load Deflection	0.624	5.301
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.653	5.330
Compressive Stress [psi]		
Compressive Wall Stress	53.8	133.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	673.7	673.7
Pullback Stress [psi]	384.9	384.9
Pullback Strain	6.694E-3	6.694E-3
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	384.9	387.6
Tensile Strain	6.694E-3	6.823E-3

Net External Pressure = 23.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.653	7.5	11.5	OK
Unconstrained Collapse [psi]	22.8	132.2	5.8	OK
Compressive Wall Stress [psi]	53.8	1150.0	21.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	32.8	234.8	7.2	OK
Tensile Stress [psi]	387.6	1200.0	3.1	OK

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Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	TAR CHA
Description:	HDD 67 10-inch DR9 Conduit 2

Input Summary

Start Coordinate	(138.00, 0.00, 291.30) ft
End Coordinate	(1022.20, 0.00, 289.00) ft
Project Length	884.20 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 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

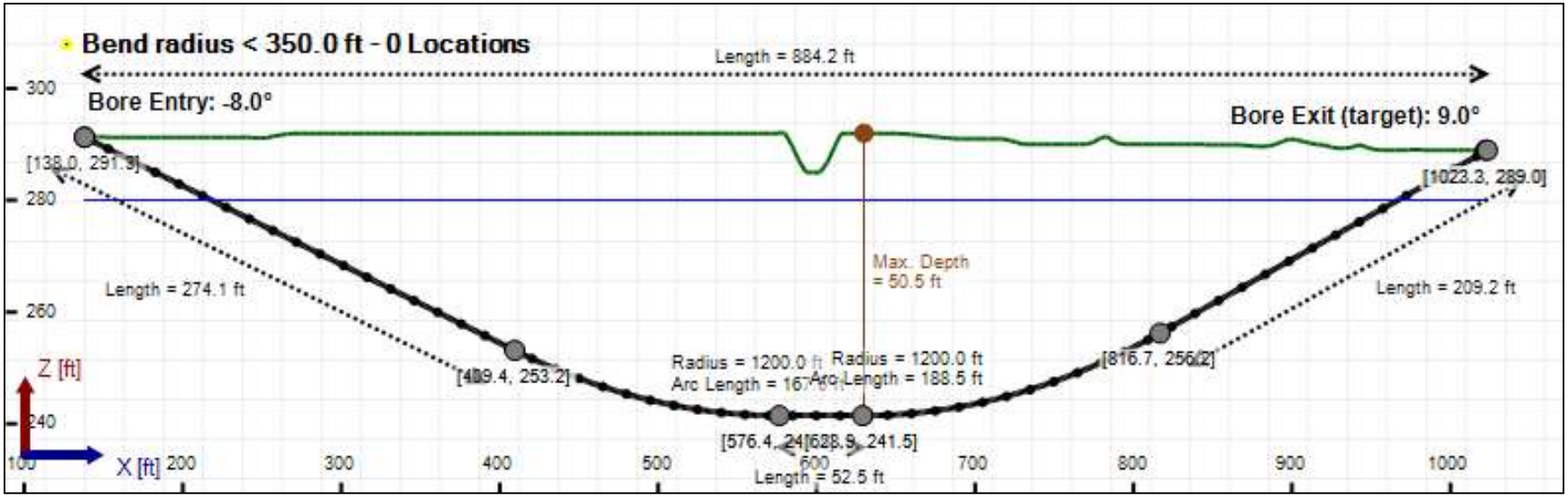
Soil Layer #1 USCS, Sand (S), SP
Depth: 5.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Gravel (G), GP
Depth: 10.50 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

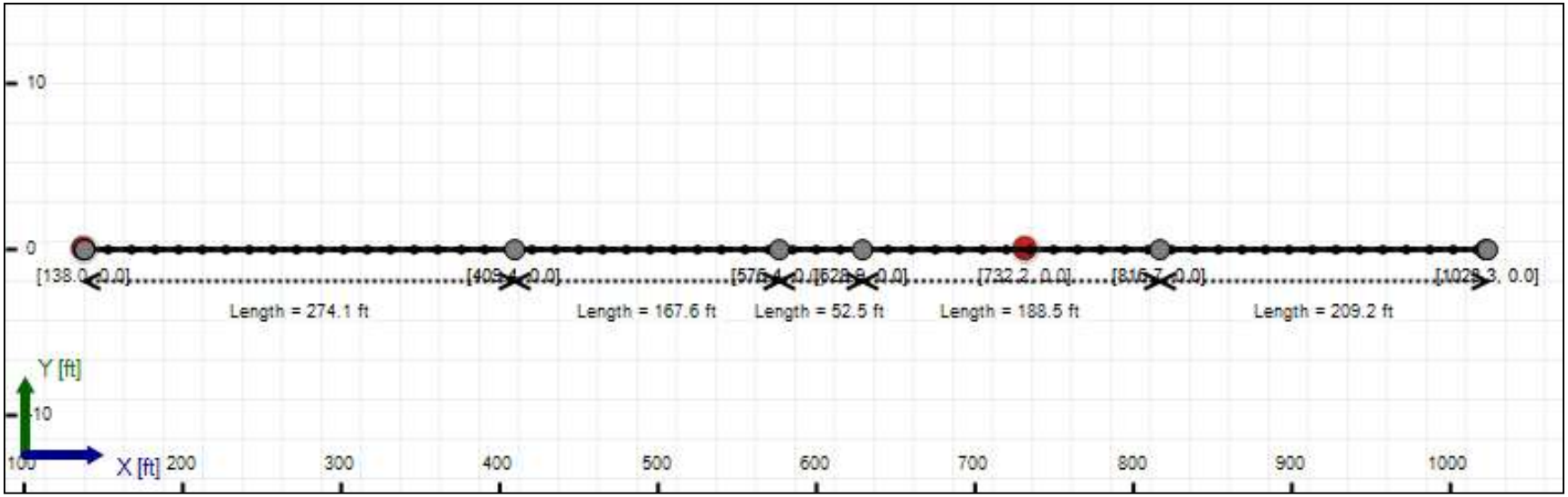
Soil Layer #3 USCS, Gravel (G), GW
Depth: 5.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Gravel (G), GP
Depth: 35.00 ft
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]
Phi: 34.00, S.M.: 145.00, Coh: 0.00 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 900.00 ft
Internal Pressure: 0 psi
Borehole Diameter: 0.531000018119812 ft
Silo Width: 0.531000018119812 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: 59.30500 lb/ft3
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: 93.64118 lb/ft3
Hydrokinetic Pressure: 10 psi
Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.6	25.9
Water Pressure	16.7	16.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.3	42.6
Deflection		
Earth Load Deflection	0.617	7.054
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.647	7.083
Compressive Stress [psi]		
Compressive Wall Stress	82.2	191.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	824.9	824.9
Pullback Stress [psi]	471.3	471.3
Pullback Strain	8.197E-3	8.197E-3
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	471.3	473.8
Tensile Strain	8.197E-3	8.322E-3

Net External Pressure = 33.1 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.647	7.5	11.6	OK
Unconstrained Collapse [psi]	32.4	132.6	4.1	OK
Compressive Wall Stress [psi]	82.2	1150.0	14.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	42.4	229.4	5.4	OK
Tensile Stress [psi]	473.8	1200.0	2.5	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	108.932 psi	108.932 psi
1	8.00 in	12.00 in	108.892 psi	108.892 psi
2	12.00 in	16.13 in	108.833 psi	108.833 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): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site