



Generated Output



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Input Summary

Start Coordinate	(0.00, 0.00, 144.20) ft
End Coordinate	(662.00, 0.00, 142.90) ft
Project Length	662.00 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: 675.00 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	13.7	20.7
Water Pressure	8.4	8.4
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	22.1	29.1
Deflection		
Earth Load Deflection	3.740	5.644
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	3.769	5.673
Compressive Stress [psi]		
Compressive Wall Stress	99.4	130.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	685.5	685.5
Pullback Stress [psi]	391.7	391.7
Pullback Strain	6.812E-3	6.812E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	391.7	396.8
Tensile Strain	6.812E-3	7.000E-3

Net External Pressure = 20.1 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.769	7.5	2.0	OK
Unconstrained Collapse [psi]	25.0	98.6	3.9	OK
Compressive Wall Stress [psi]	99.4	1150.0	11.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	35.0	234.5	6.7	OK
Tensile Stress [psi]	396.8	1200.0	3.0	OK



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Project Summary

General: HDD #17 - Conduit 2
Ref: BLANK
BLANK
Start Date: 06-17-2022
End Date: 06-17-2022

Project Owner: TDI
Project Contractor: KIEWIT
Project Consultant: CHA

Designer: MCS
CHA
BLANK
BLANK, BLANK
BLANK BLANK
Phone: BLANK
Fax: BLANK
BLANK

Description: BLANK

Input Summary

Start Coordinate	(0.00, 0.00, 144.96) ft
End Coordinate	(575.00, 0.00, 145.00) ft
Project Length	575.00 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: 4.50 ft

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

Depth: 2.50 ft

Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 8.33 [psi]

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

Depth: 3.50 ft

Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 8.33 [psi]

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

Depth: 3.50 ft

Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 8.30 [psi]

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

Depth: 9.50 ft

Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 8.30 [psi]

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

Depth: 9.50 ft

Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 8.30 [psi]

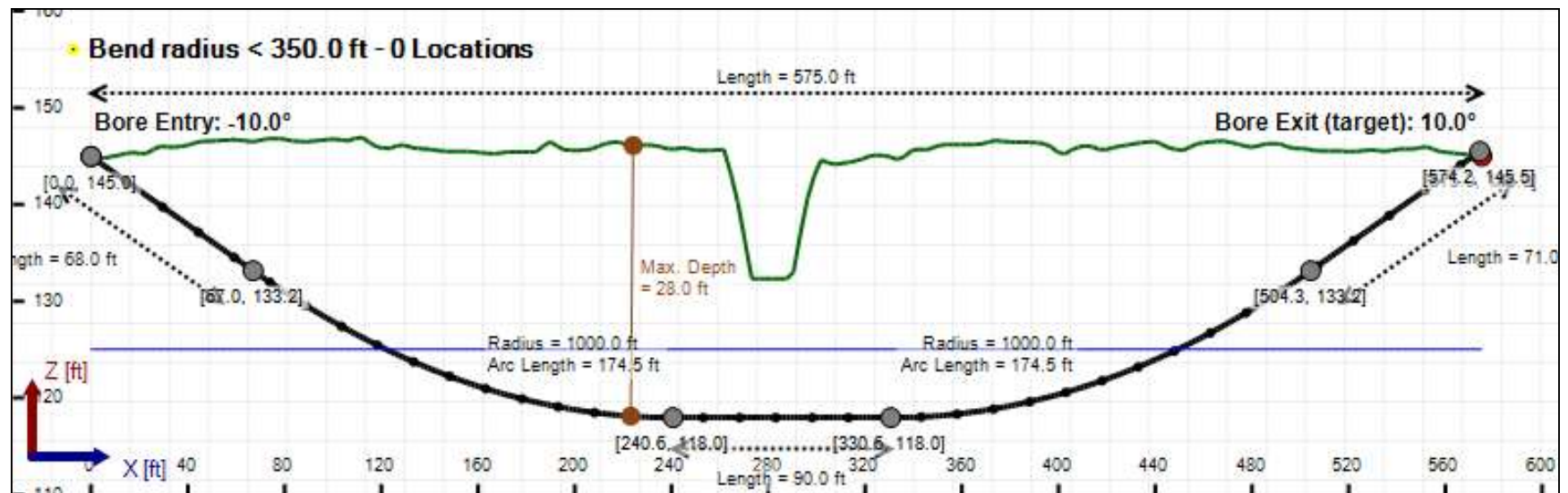
Soil Layer #7 USCS, Clay (C), CL

Depth: 10.00 ft

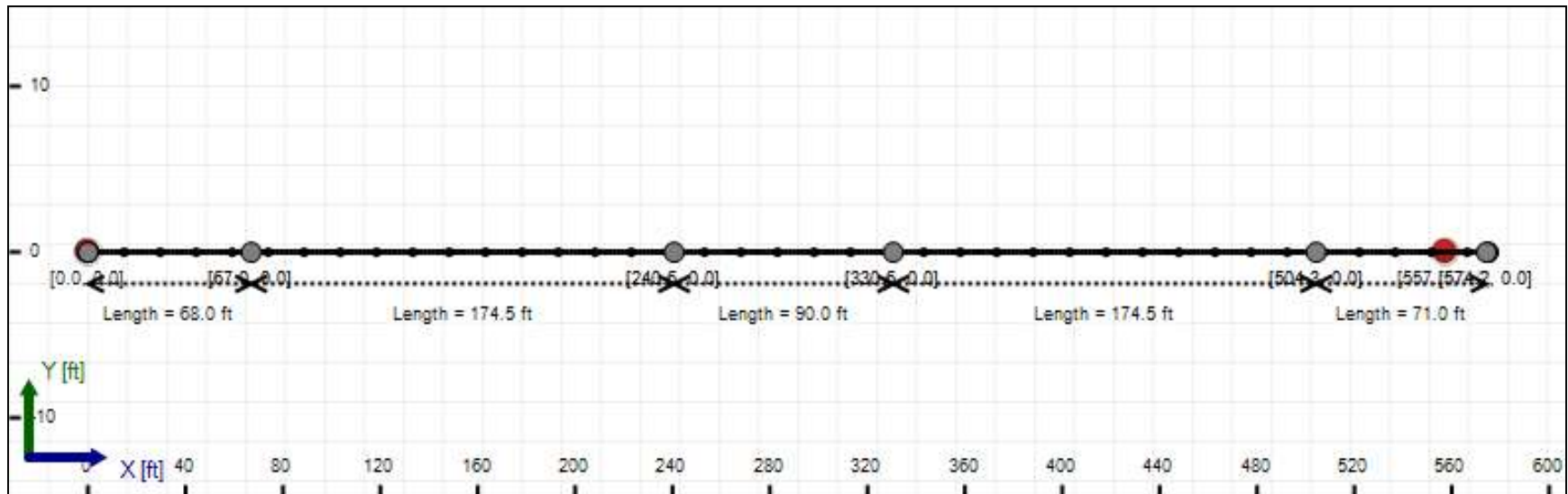
Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft³]

Phi: 0.00, S.M.: 145.00, 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: 10" (10.75")
Pipe DR: 9
Pipe Length: 585.00 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	12.7	17.6
Water Pressure	3.1	3.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	15.8	20.6
Deflection		
Earth Load Deflection	3.464	4.804
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	3.596	4.937
Compressive Stress [psi]		
Compressive Wall Stress	71.0	92.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	9992.2	9992.2
Pullback Stress [psi]	278.7	278.7
Pullback Strain	4.846E-3	4.846E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	278.7	303.8
Tensile Strain	4.846E-3	5.731E-3

Net External Pressure = 17.9 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.596	7.5	2.1	OK
Unconstrained Collapse [psi]	18.7	100.1	5.4	OK
Compressive Wall Stress [psi]	71.0	1150.0	16.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	28.7	239.0	8.3	OK
Tensile Stress [psi]	303.8	1200.0	4.0	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	56.651 psi	52.585 psi
1	8.00 in	12.00 in	56.572 psi	52.484 psi
2	12.00 in	16.13 in	56.460 psi	52.340 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

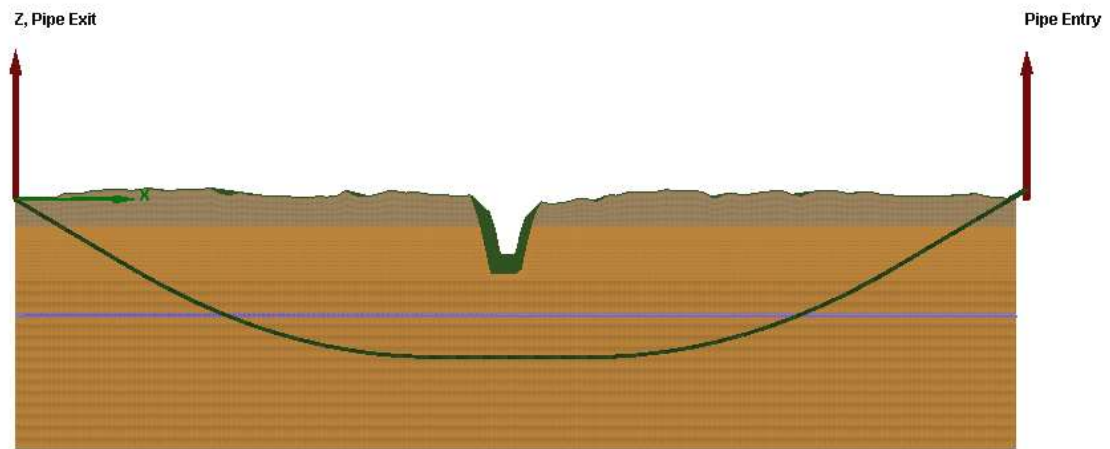
Rheological model: Bingham-Plastic

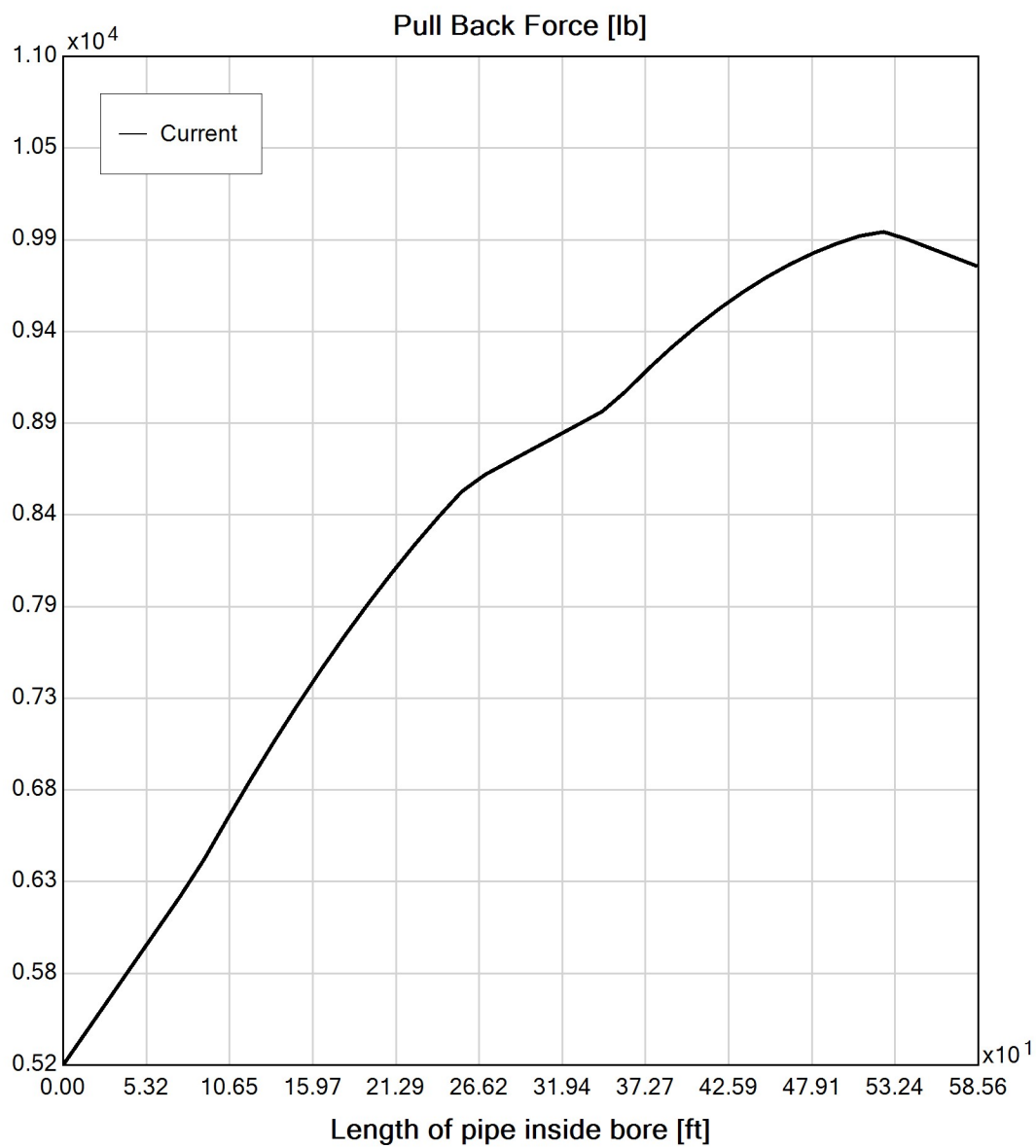
Plastic Viscosity (PV): 25.53

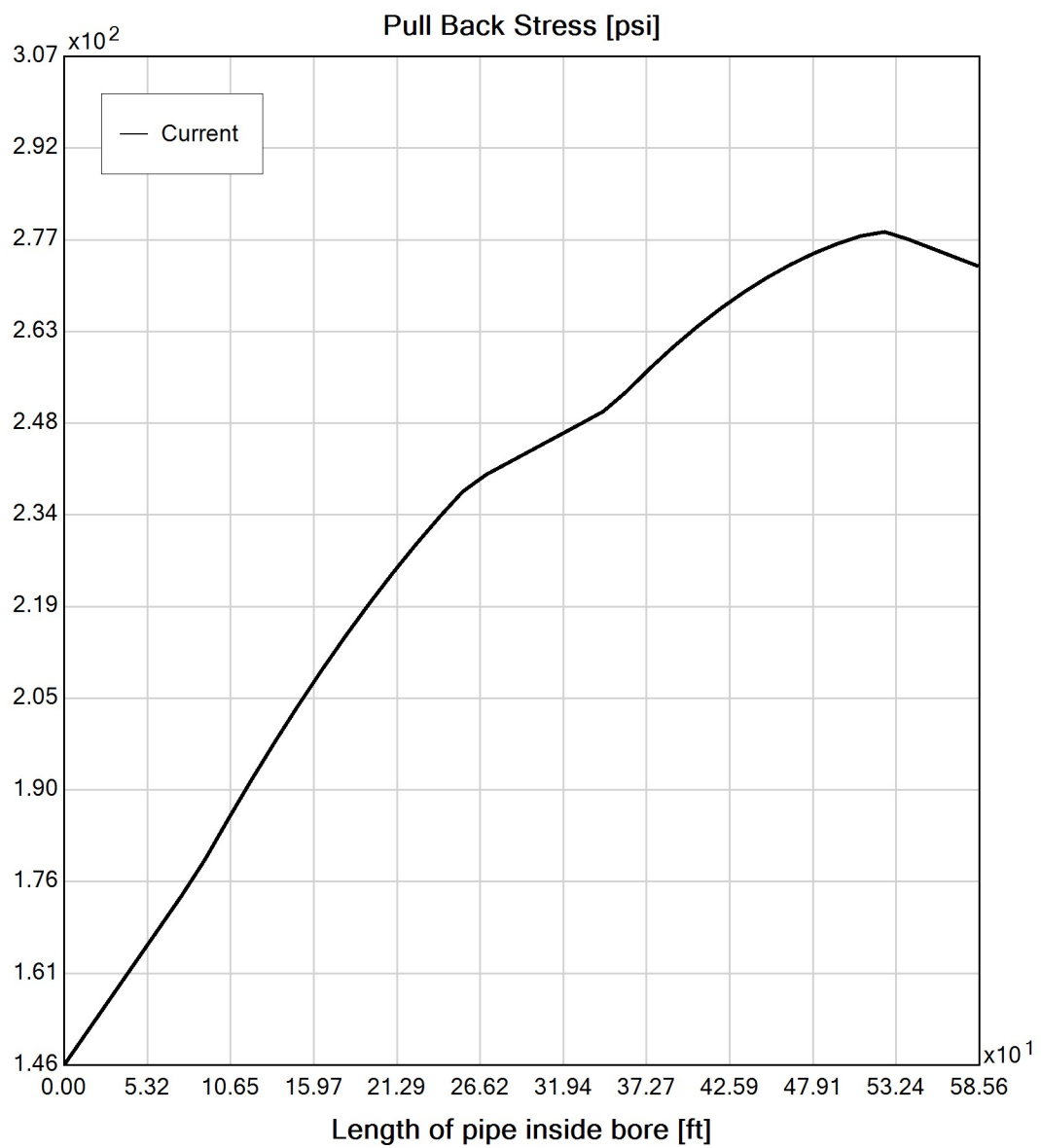
Yield Point (YP): 16.49

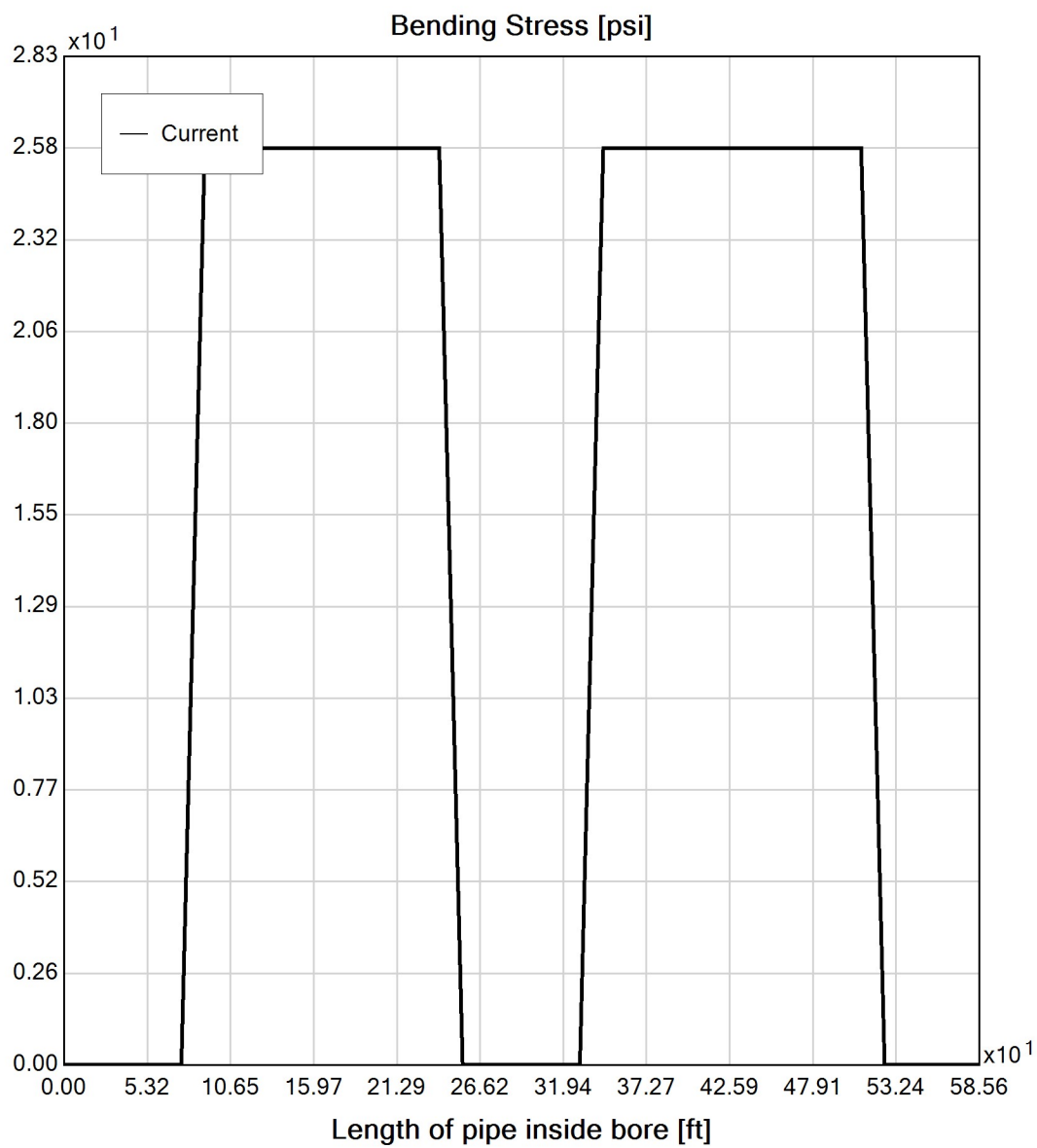
Effective Viscosity (cP): 1202.0

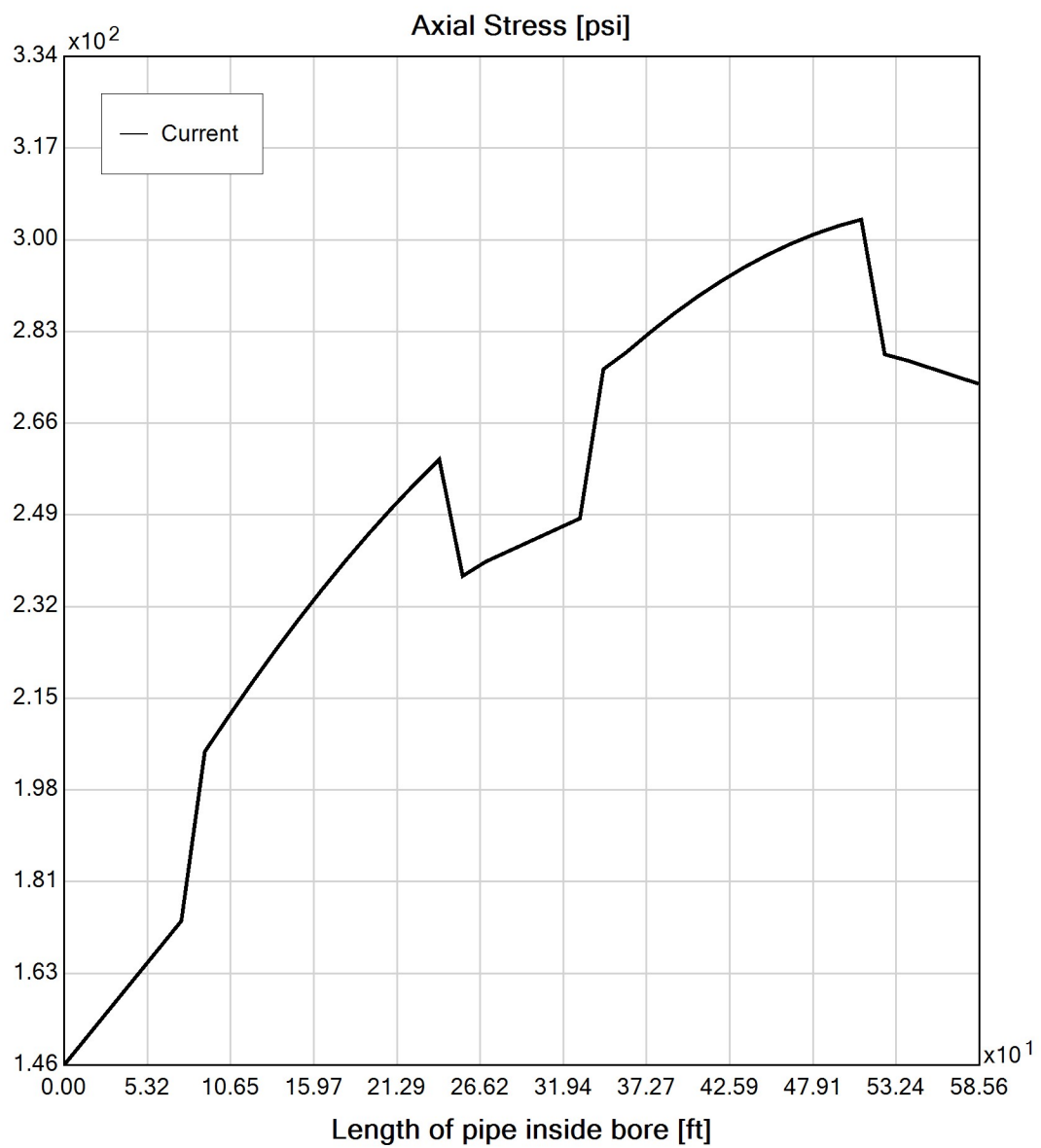
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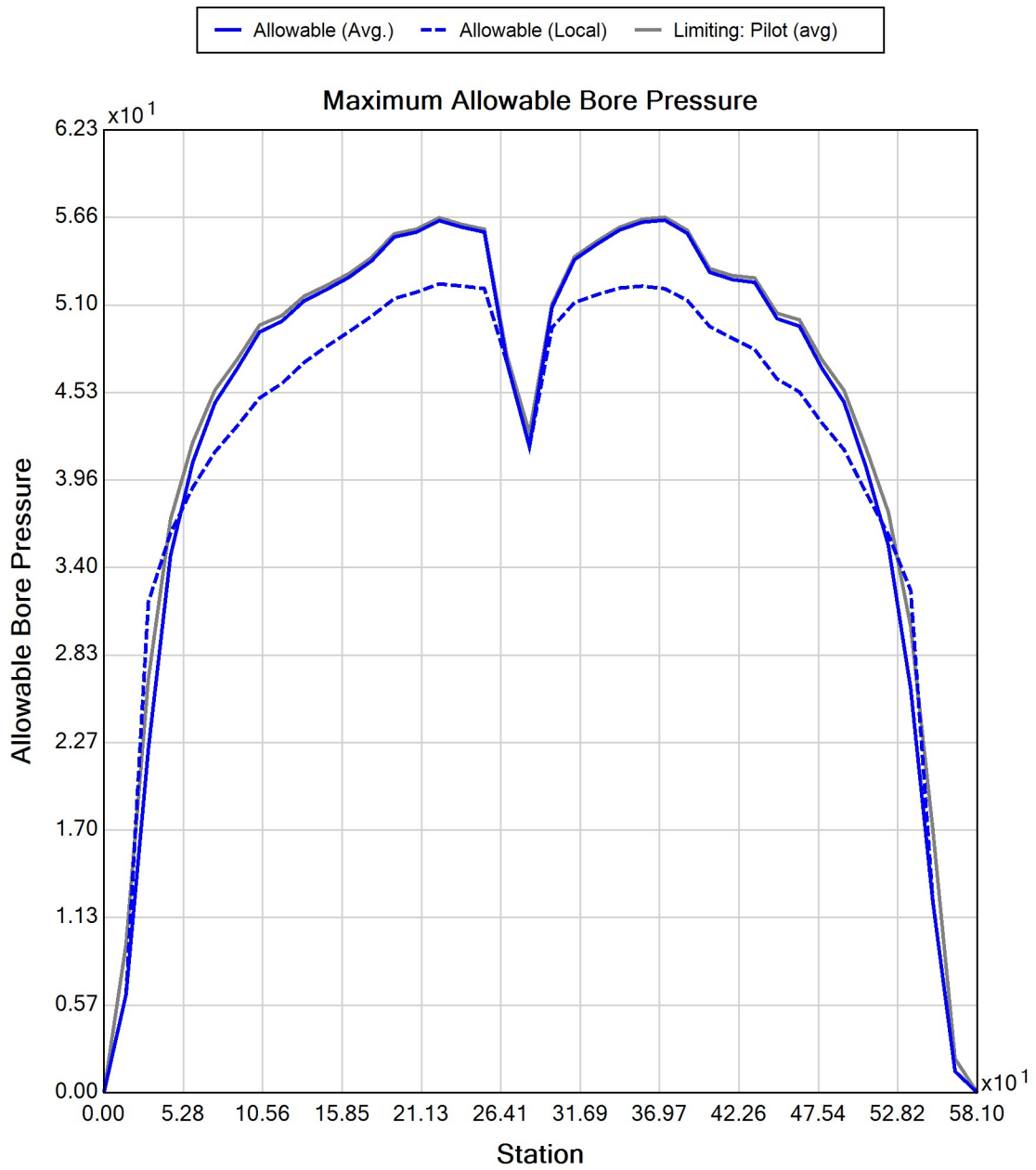


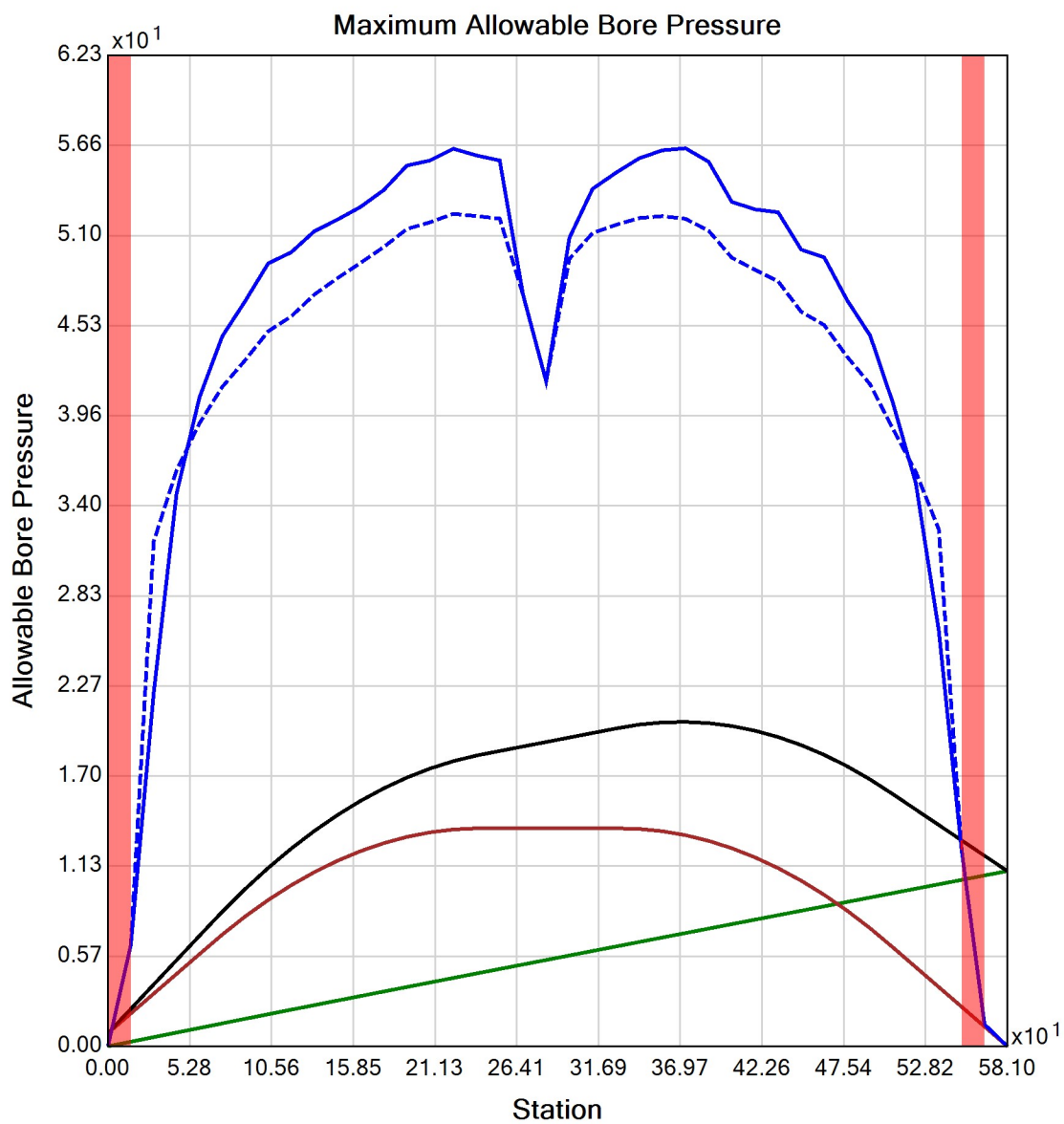














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Input Summary

Start Coordinate	(0.00, 0.00, 144.96) ft
End Coordinate	(575.00, 0.00, 145.00) ft
Project Length	575.00 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: 585.00 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	12.7	17.6
Water Pressure	3.1	3.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	15.8	20.6
Deflection		
Earth Load Deflection	3.464	4.804
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	3.493	4.834
Compressive Stress [psi]		
Compressive Wall Stress	71.0	92.7

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	597.3	597.3
Pullback Stress [psi]	341.3	341.3
Pullback Strain	5.935E-3	5.935E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	341.3	346.3
Tensile Strain	5.935E-3	6.122E-3

Net External Pressure = 17.9 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.493	7.5	2.1	OK
Unconstrained Collapse [psi]	18.7	101.0	5.4	OK
Compressive Wall Stress [psi]	71.0	1150.0	16.2	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	28.7	237.4	8.3	OK
Tensile Stress [psi]	346.3	1200.0	3.5	OK



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Project Summary

General: HDD #18
Start Date: 02-28-2022
End Date: 02-28-2022

Project Owner: TDI
Project Contractor: KIEWIT
Project Consultant: CHA

Designer: MCS
CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 141.72) ft
End Coordinate	(620.76, 0.00, 141.30) ft
Project Length	620.76 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), SM

Depth: 3.00 ft

Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]

Phi: 34.00, S.M.: 300.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Organic (O), OH

Depth: 6.00 ft

Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3]

Phi: 30.00, S.M.: 100.00, Coh: 0.00 [psi]

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

Depth: 7.00 ft

Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3]

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

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

Depth: 7.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

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

Soil Layer #5 USCS, Sand (S), SP

Depth: 3.50 ft

Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]

Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

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

Depth: 5.00 ft

Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]

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

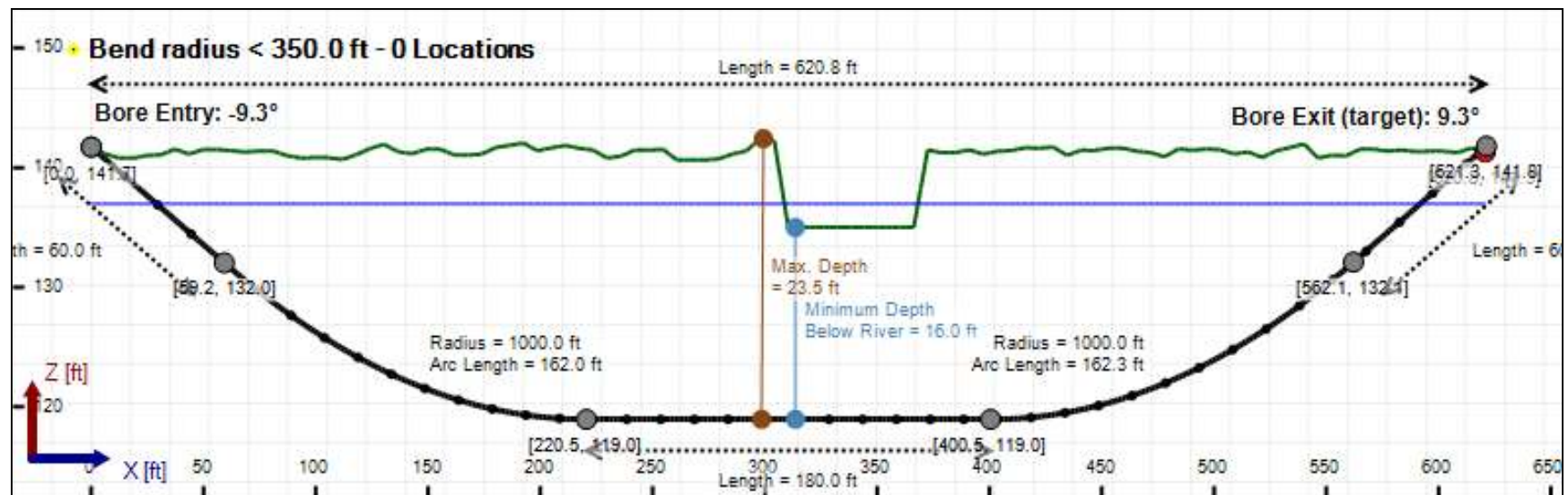
Soil Layer #7 USCS, Clay (C), CH

Depth: 15.00 ft

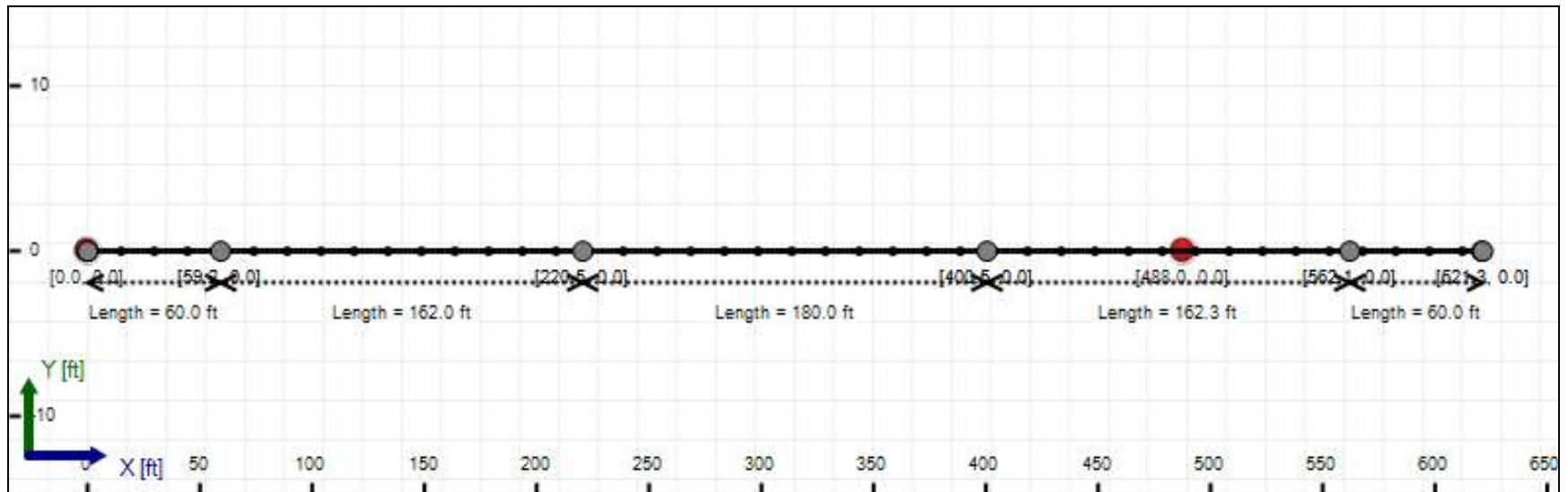
Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft³]

Phi: 0.00, S.M.: 145.00, Coh: 3.12 [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: 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	9.0
Water Pressure	7.8	7.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	10.6	16.8
Deflection		
Earth Load Deflection	0.759	2.446
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	0.891	2.578
Compressive Stress [psi]		
Compressive Wall Stress	47.7	75.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10420.8	10420.8
Pullback Stress [psi]	290.6	290.6
Pullback Strain	5.054E-3	5.054E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	290.6	314.8
Tensile Strain	5.054E-3	5.923E-3

Net External Pressure = 15.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.891	7.5	8.4	OK
Unconstrained Collapse [psi]	15.5	127.5	8.3	OK
Compressive Wall Stress [psi]	47.7	1150.0	24.1	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	25.4	238.2	9.4	OK
Tensile Stress [psi]	314.8	1200.0	3.8	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	45.272 psi	32.677 psi
1	8.00 in	12.00 in	45.065 psi	32.491 psi
2	12.00 in	16.13 in	44.773 psi	32.240 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

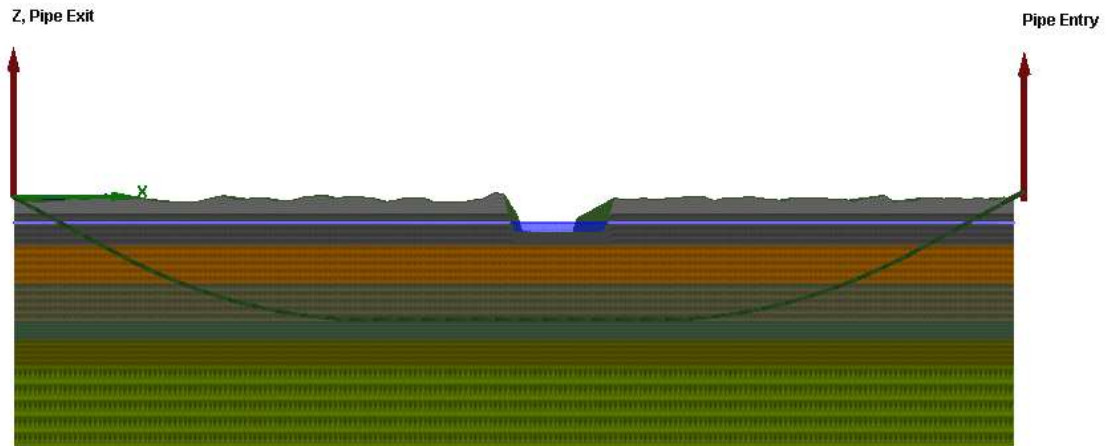
Rheological model: Bingham-Plastic

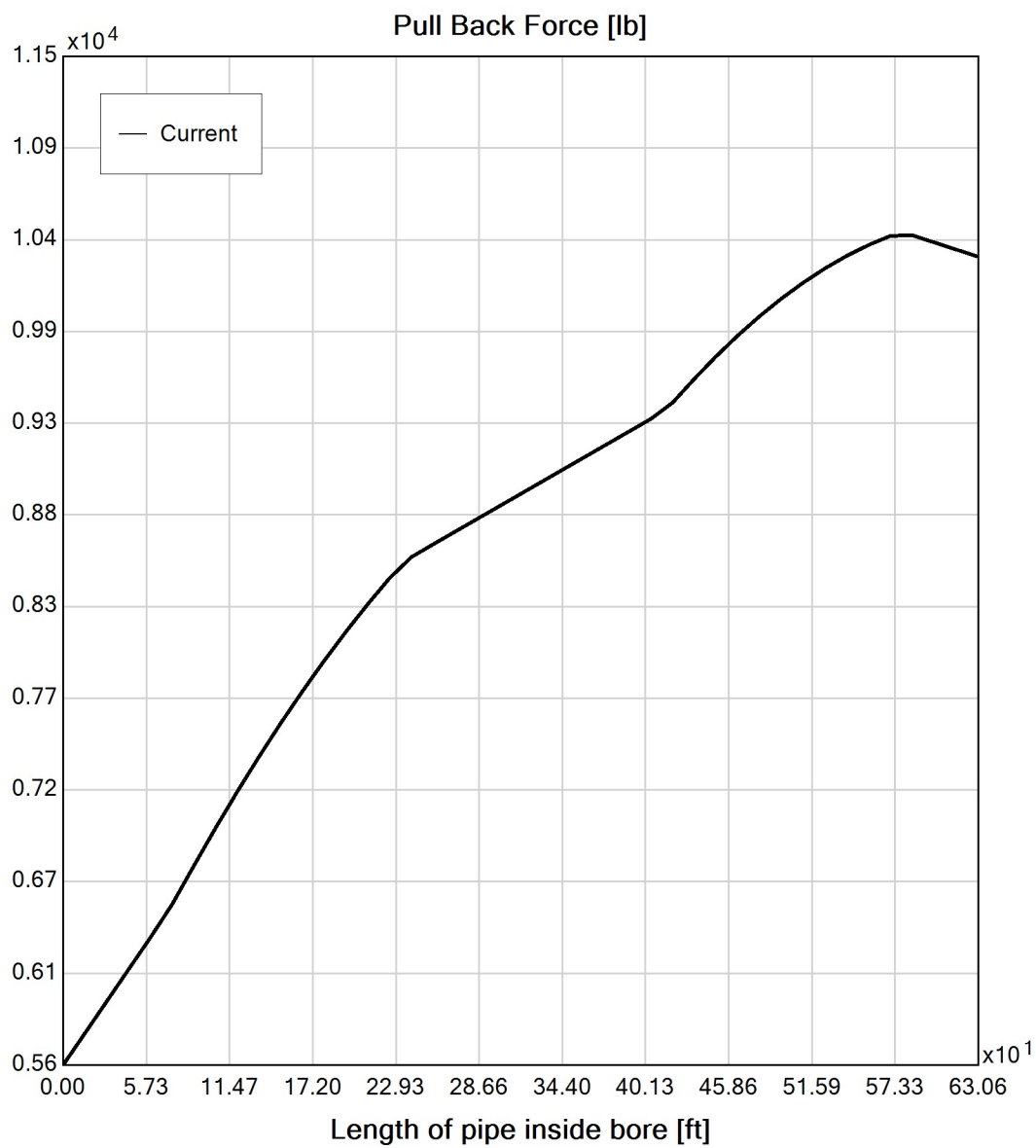
Plastic Viscosity (PV): 25.53

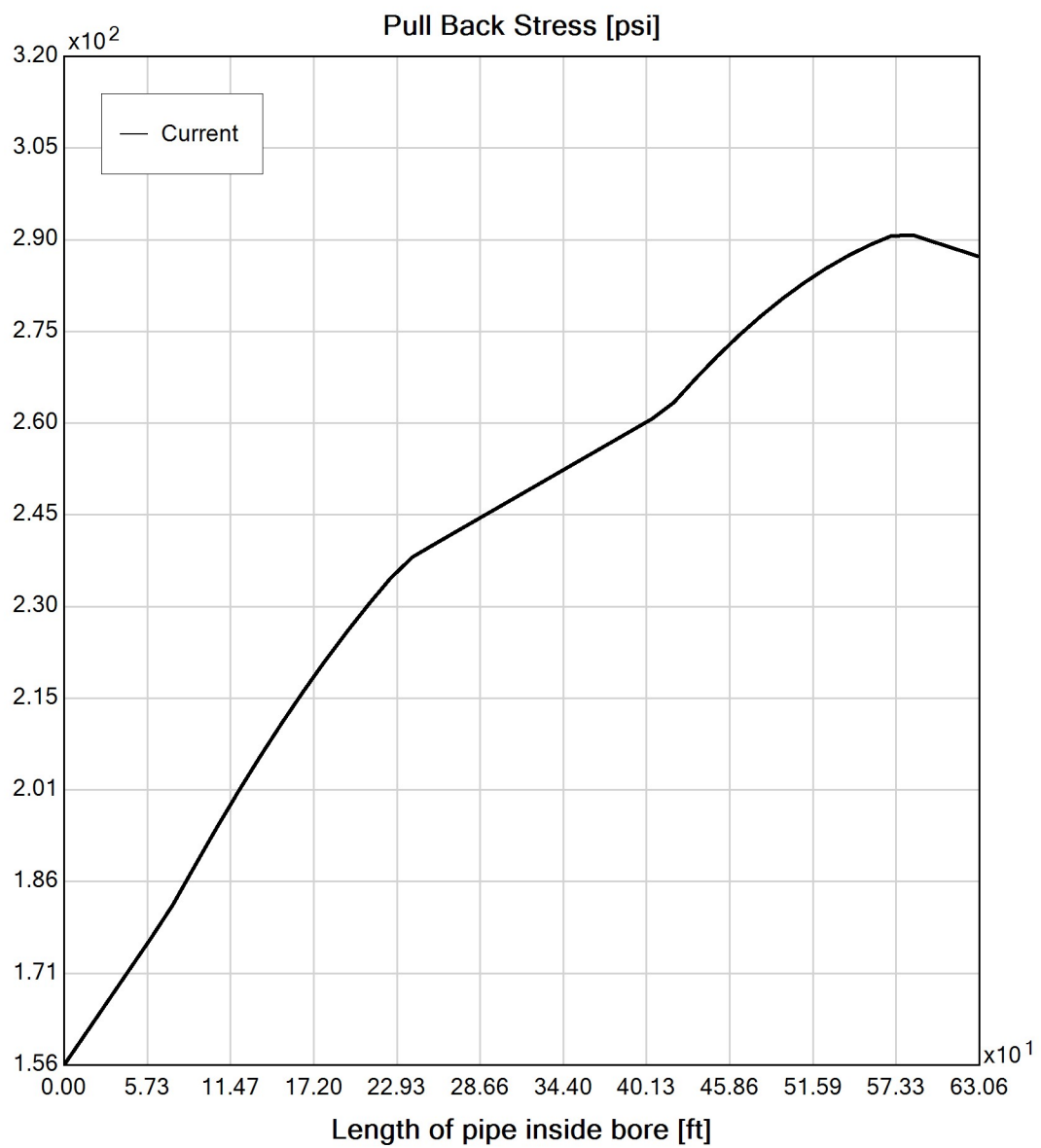
Yield Point (YP): 16.49

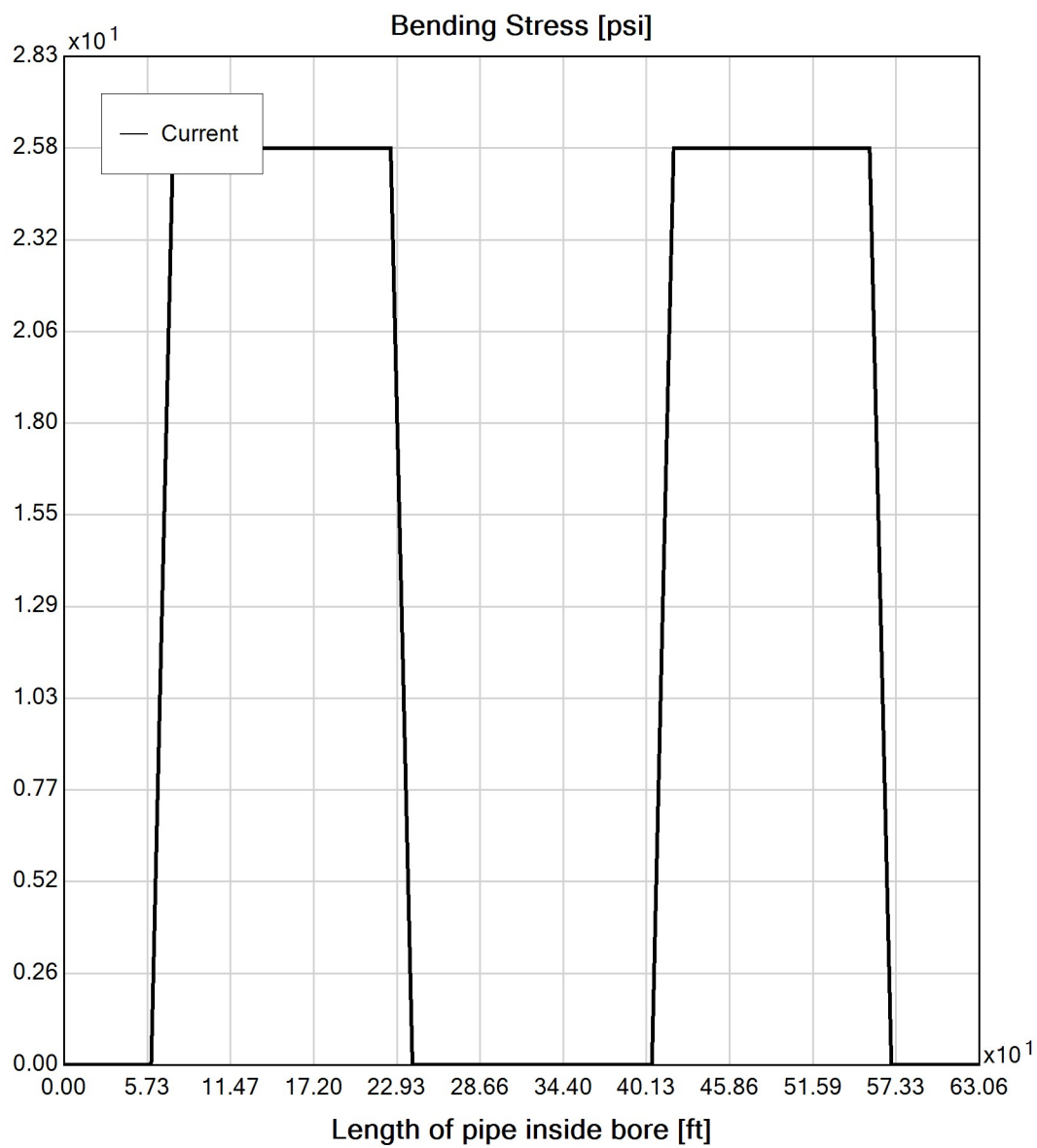
Effective Viscosity (cP): 1202.0

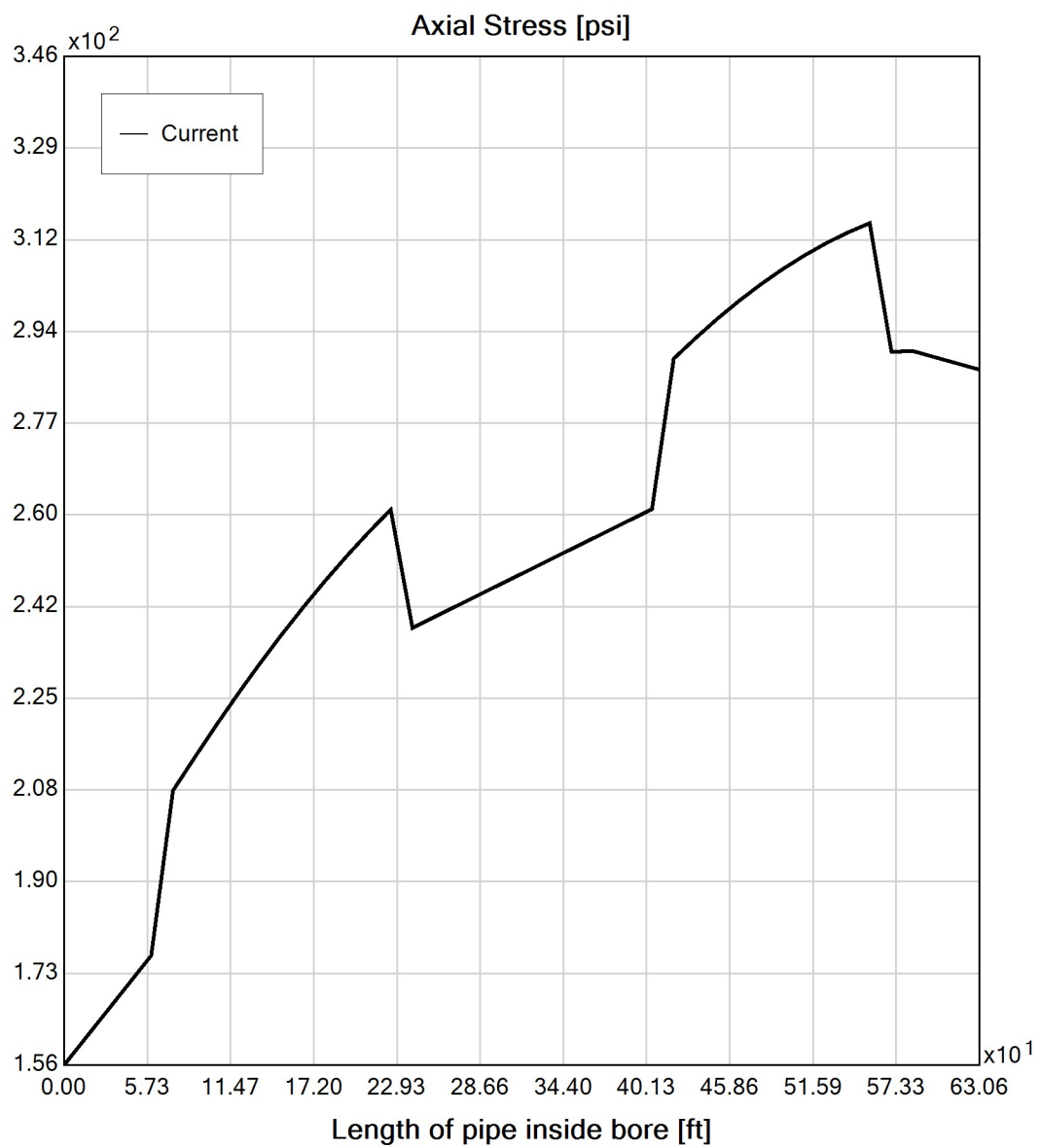
Virtual Site

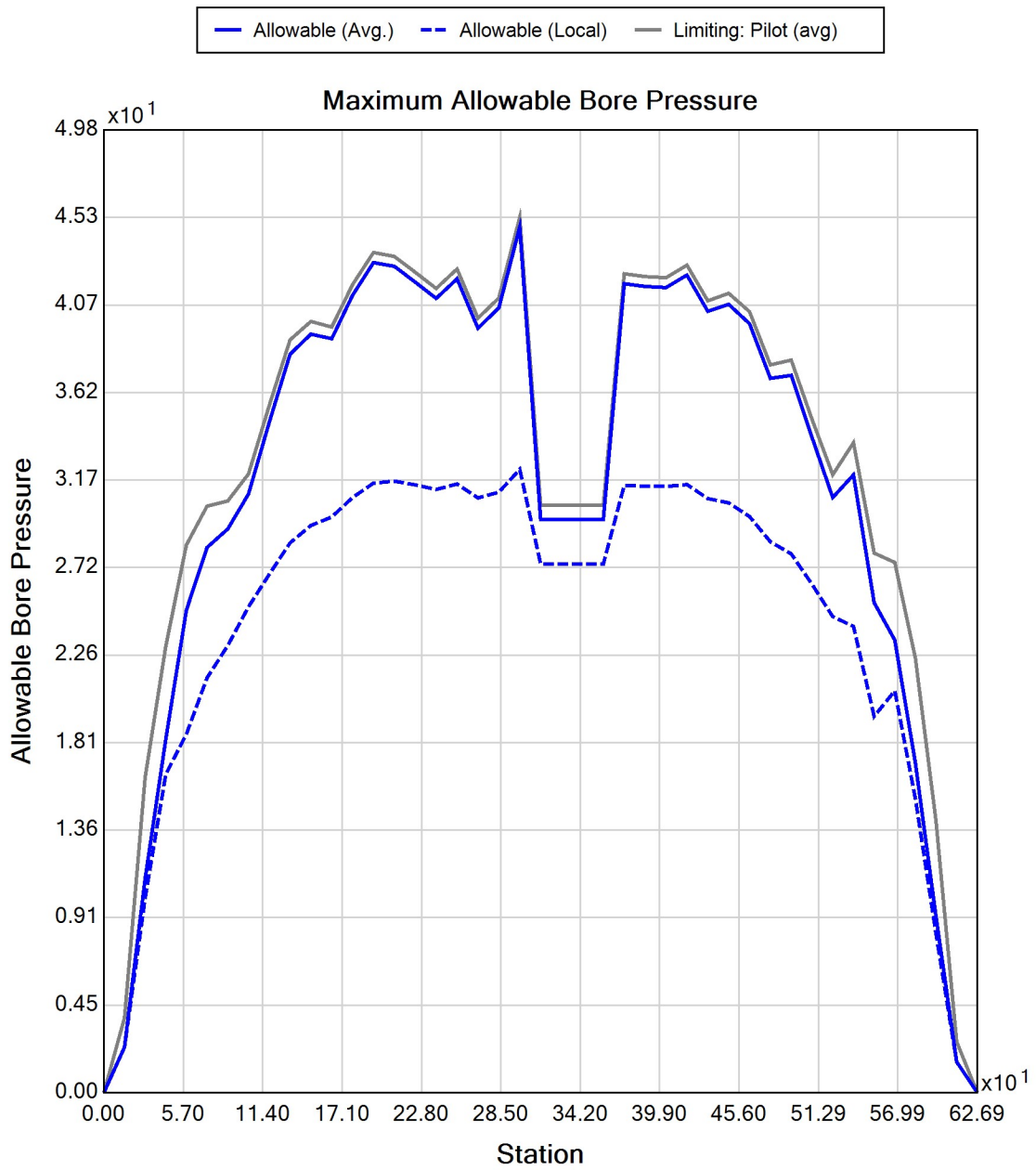


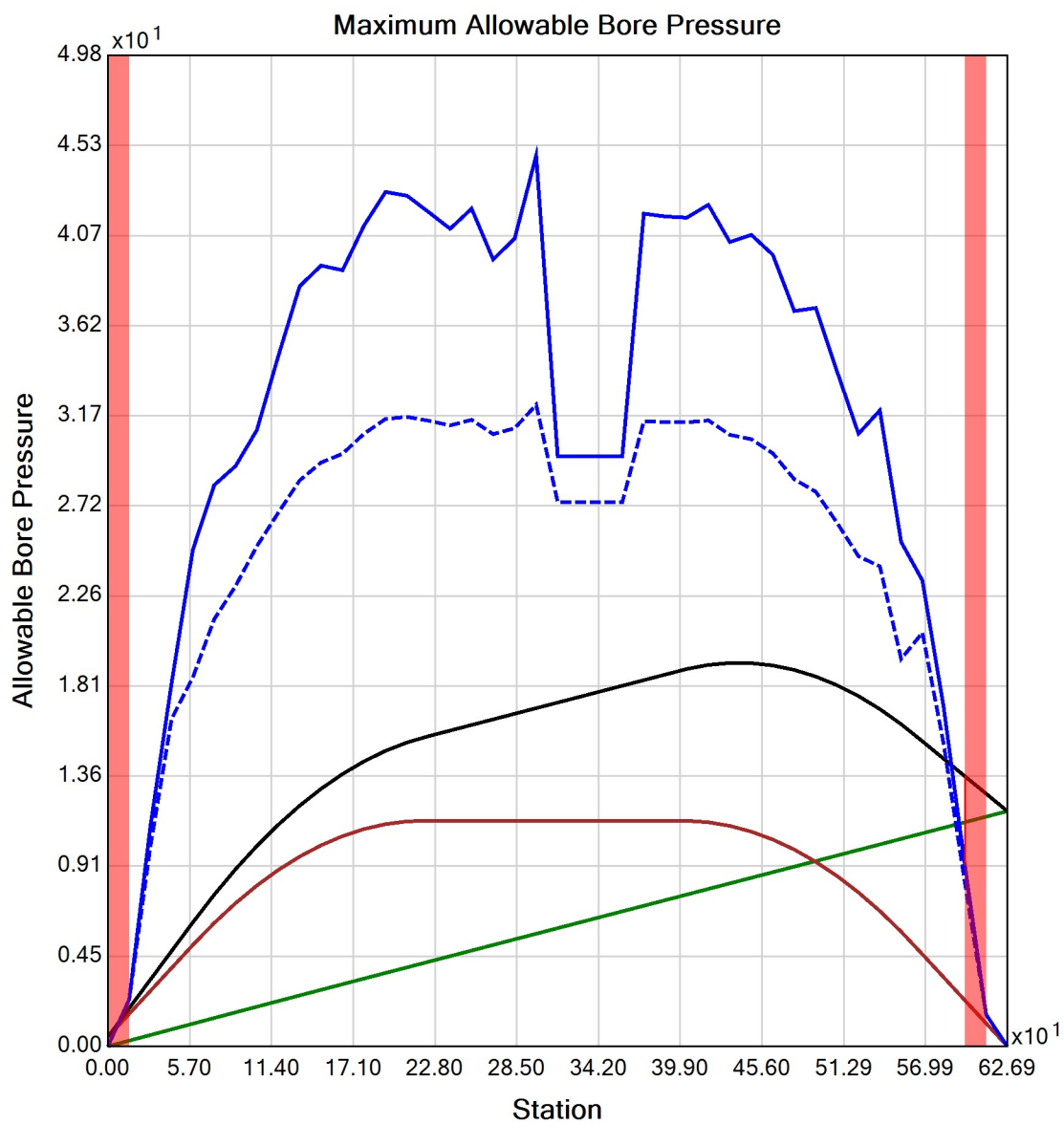














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Input Summary

Start Coordinate	(0.00, 0.00, 141.72) ft
End Coordinate	(620.76, 0.00, 141.30) ft
Project Length	620.76 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: 630.00 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	1.2	9.0
Water Pressure	7.8	7.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	9.0	16.8
Deflection		
Earth Load Deflection	0.409	2.446
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.439	2.476
Compressive Stress [psi]		
Compressive Wall Stress	40.4	75.6

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	618.2	618.2
Pullback Stress [psi]	353.2	353.2
Pullback Strain	6.143E-3	6.143E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	353.2	357.4
Tensile Strain	6.143E-3	6.314E-3

Net External Pressure = 15.4 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.439	7.5	17.1	OK
Unconstrained Collapse [psi]	15.5	133.9	8.7	OK
Compressive Wall Stress [psi]	40.4	1150.0	28.5	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	25.4	236.5	9.3	OK
Tensile Stress [psi]	357.4	1200.0	3.4	OK



Generated Output



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Project Summary

General: HDD #19 - Conduit 1
Ref: BLANK
BLANK
Start Date: 06-20-2022
End Date: 06-20-2022

Project Owner: TDI
Project Contractor: KIEWIT
Project Consultant: CHA

Designer: MCS
CHA
BLANK
BLANK, BLANK
BLANK BLANK
Phone: BLANK
Fax: BLANK
BLANK

Description: BLANK

Input Summary

Start Coordinate	(0.00, 0.00, 141.86) ft
End Coordinate	(589.00, 0.00, 141.77) ft
Project Length	589.00 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, Clay (C), CL

Depth: 6.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

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

Depth: 7.50 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

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

Depth: 10.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

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

Depth: 5.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

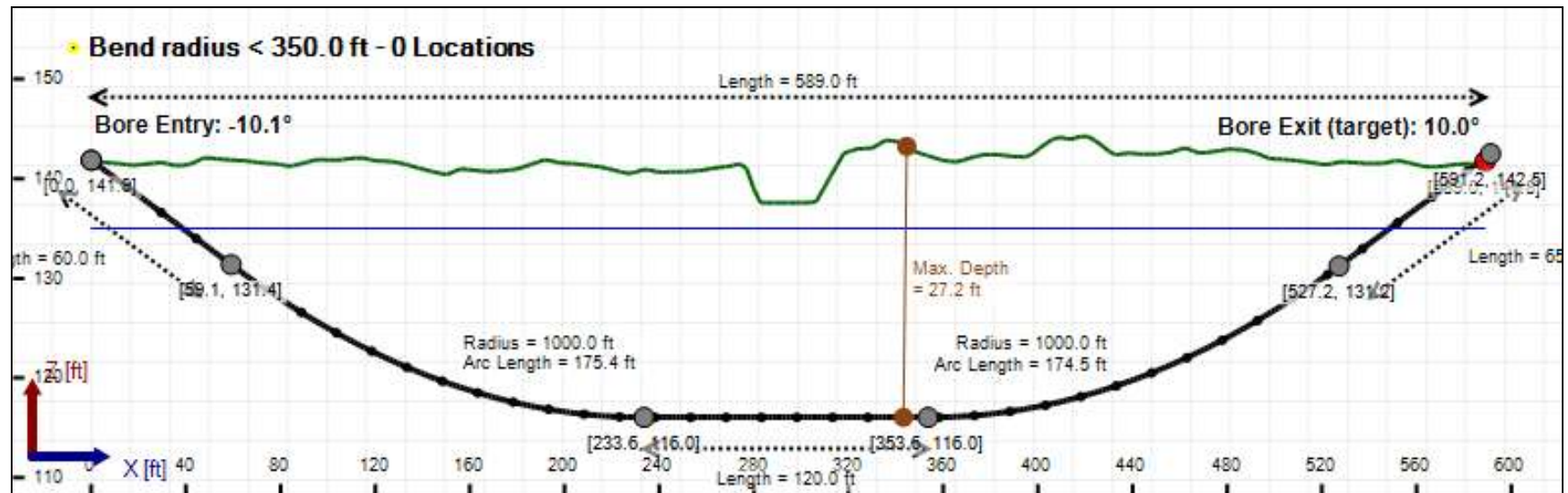
Soil Layer #5 USCS, Sand (S), SM

Depth: 15.00 ft

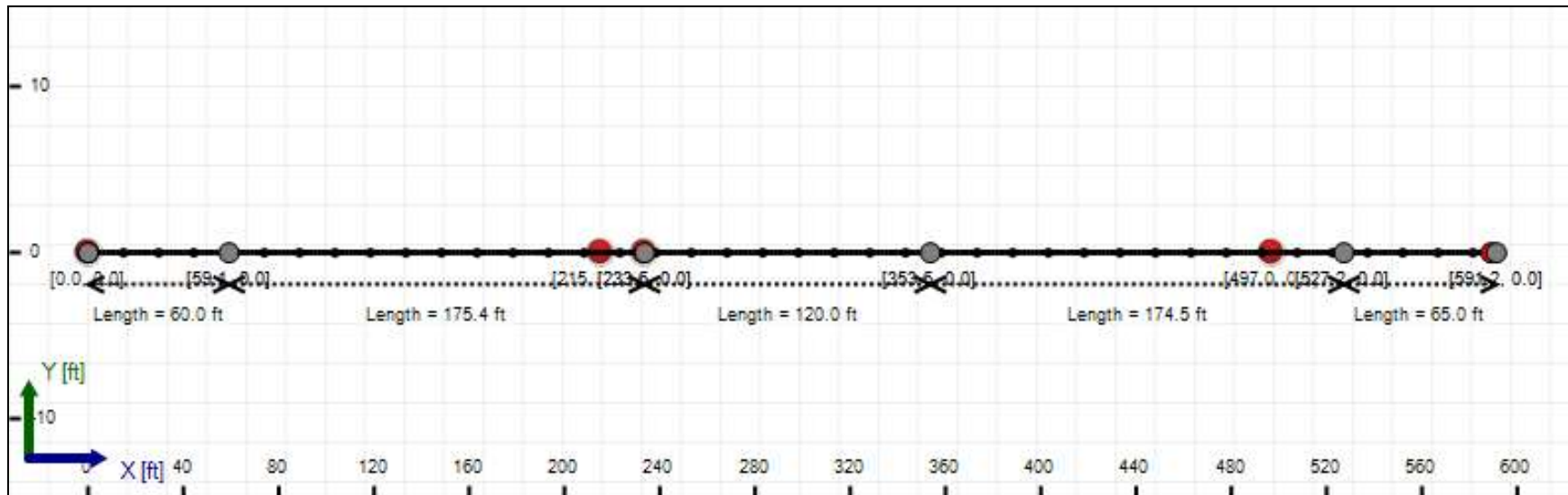
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]

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: 600.00 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	11.0	11.0
Water Pressure	8.2	8.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.2	19.2
Deflection		
Earth Load Deflection	2.987	2.987
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	3.119	3.119
Compressive Stress [psi]		
Compressive Wall Stress	86.3	86.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10173.5	10173.5
Pullback Stress [psi]	283.7	283.7
Pullback Strain	4.934E-3	4.934E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	283.7	308.4
Tensile Strain	4.934E-3	5.811E-3

Net External Pressure = 17.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.119	7.5	2.4	OK
Unconstrained Collapse [psi]	19.2	104.5	5.4	OK
Compressive Wall Stress [psi]	86.3	1150.0	13.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	27.8	238.6	8.6	OK
Tensile Stress [psi]	308.4	1200.0	3.9	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	42.935 psi	42.935 psi
1	8.00 in	12.00 in	42.830 psi	42.830 psi
2	12.00 in	16.13 in	42.682 psi	42.682 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

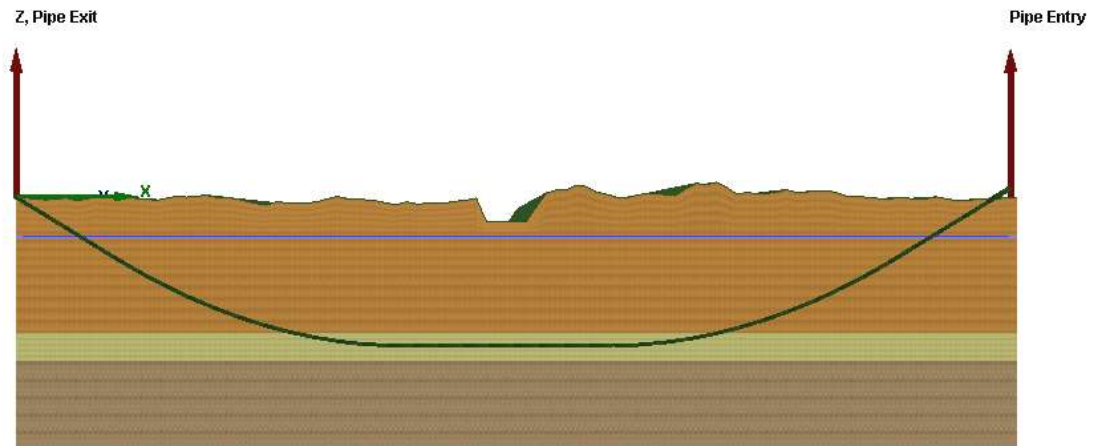
Rheological model: Bingham-Plastic

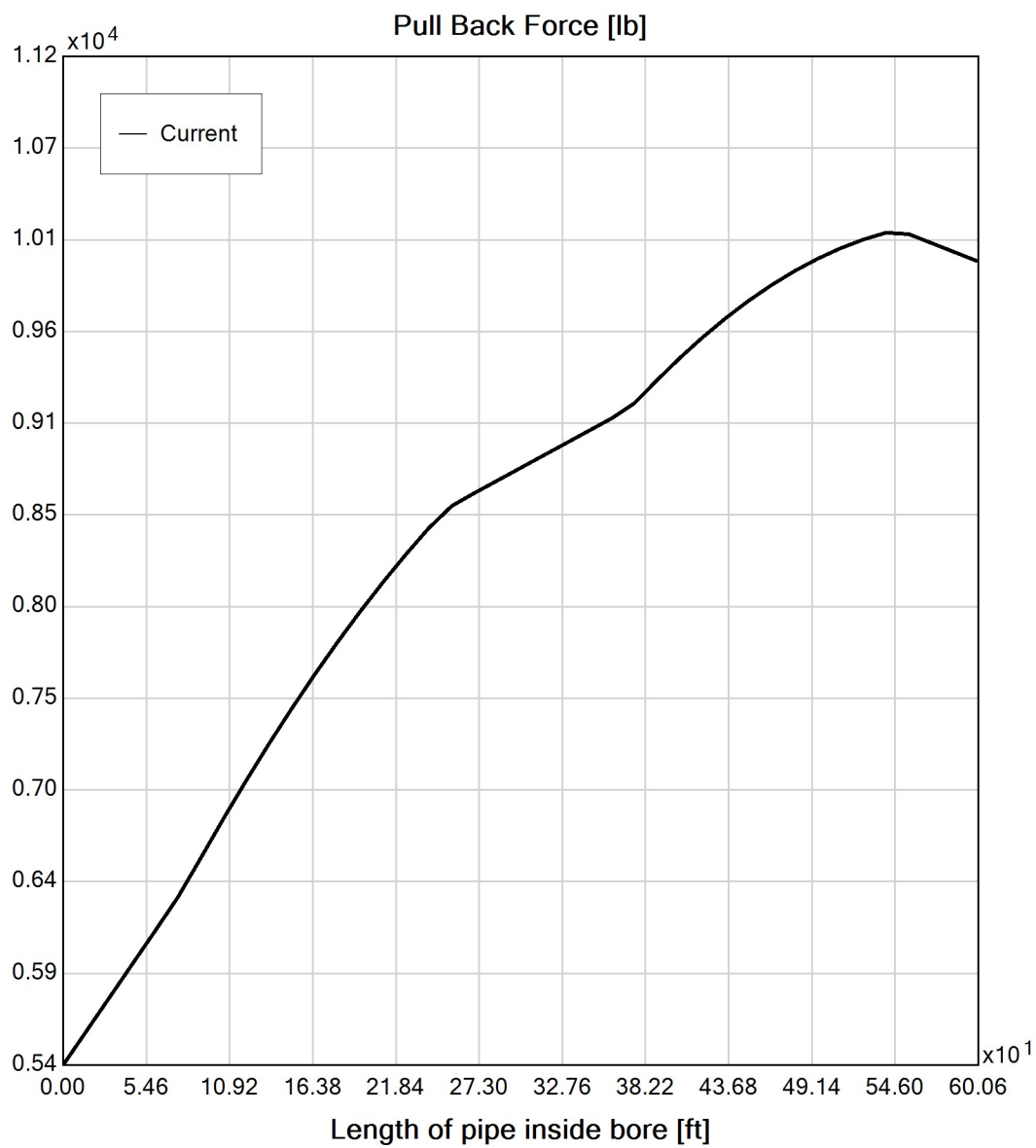
Plastic Viscosity (PV): 25.53

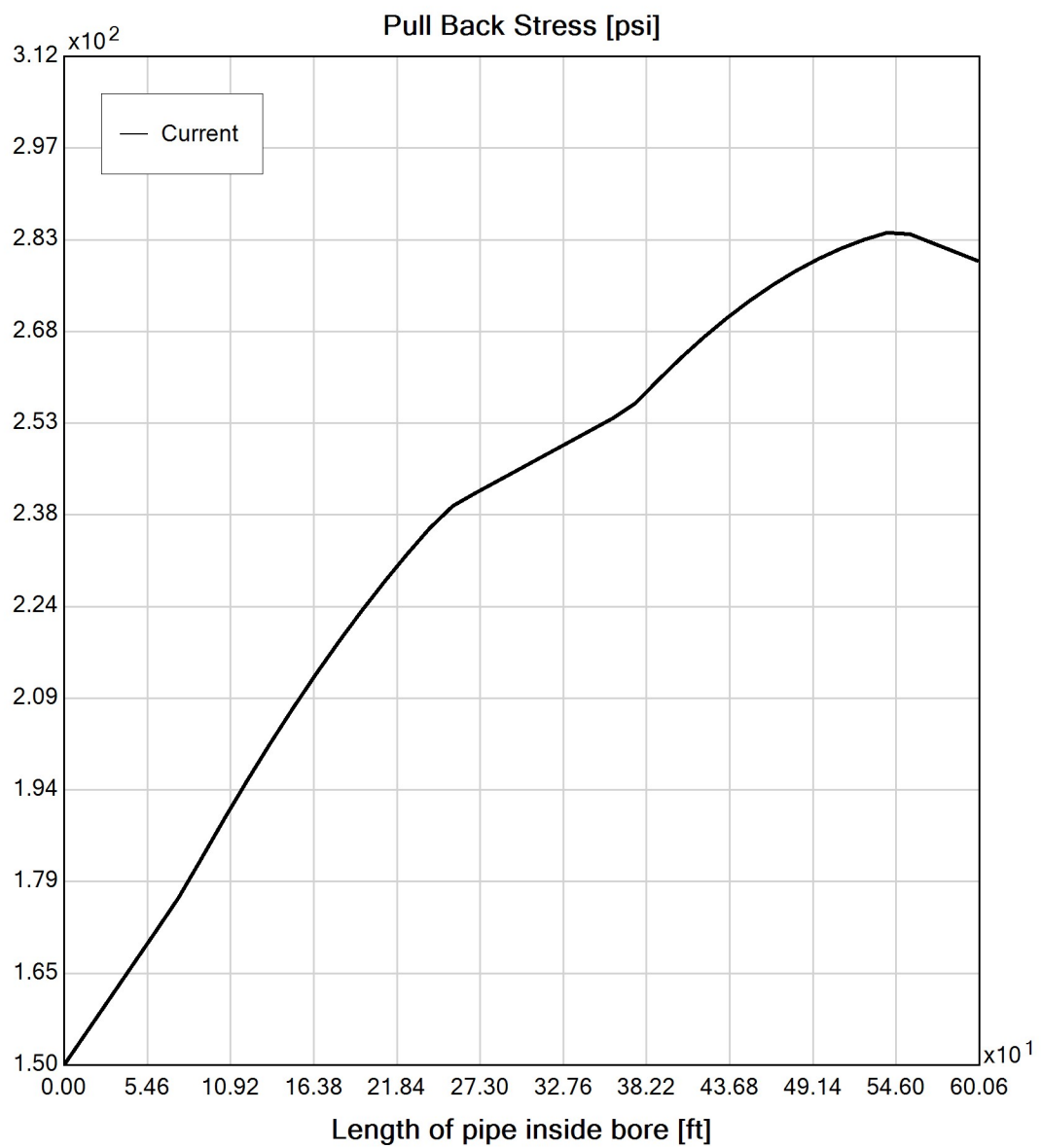
Yield Point (YP): 16.49

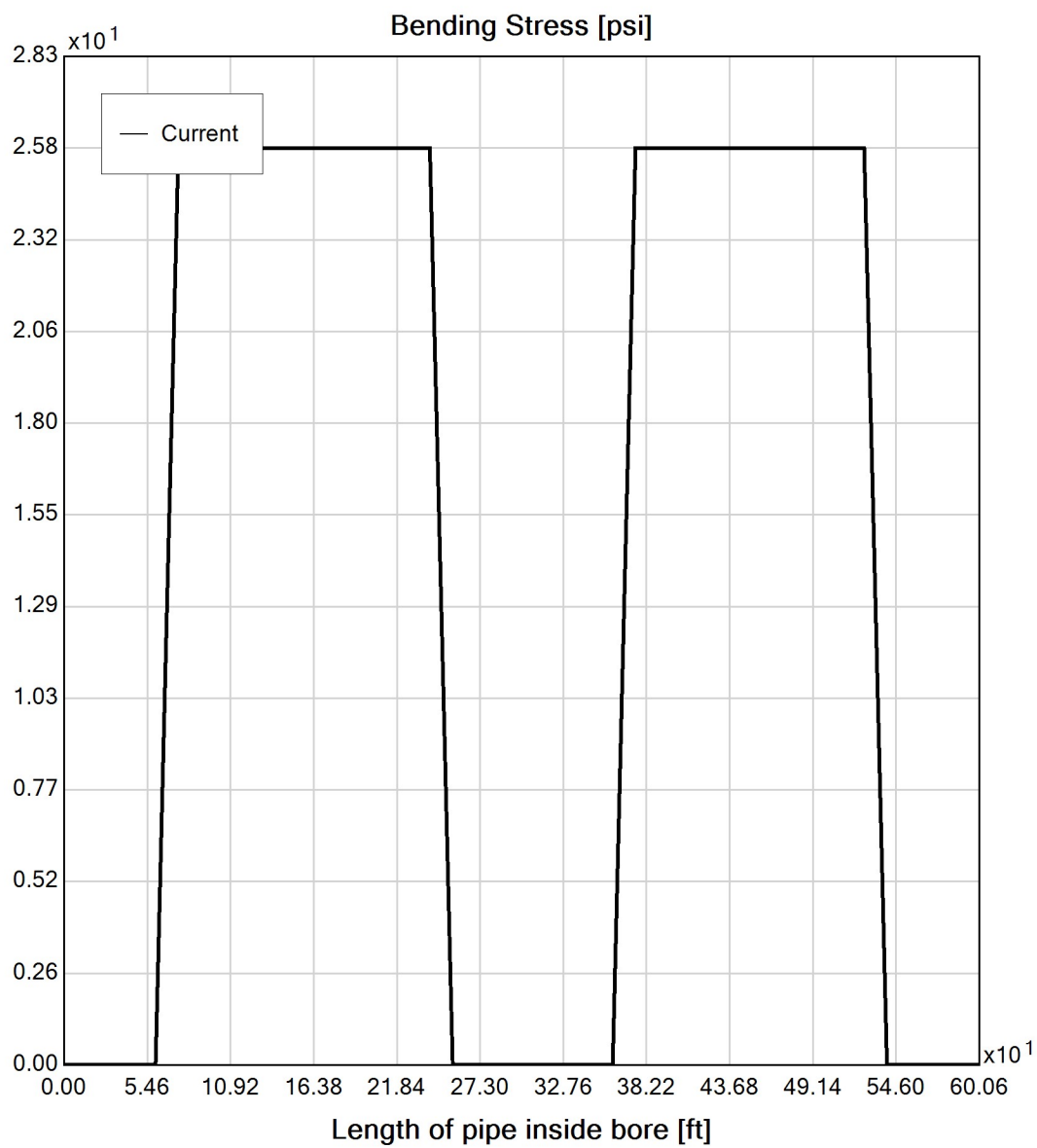
Effective Viscosity (cP): 1202.0

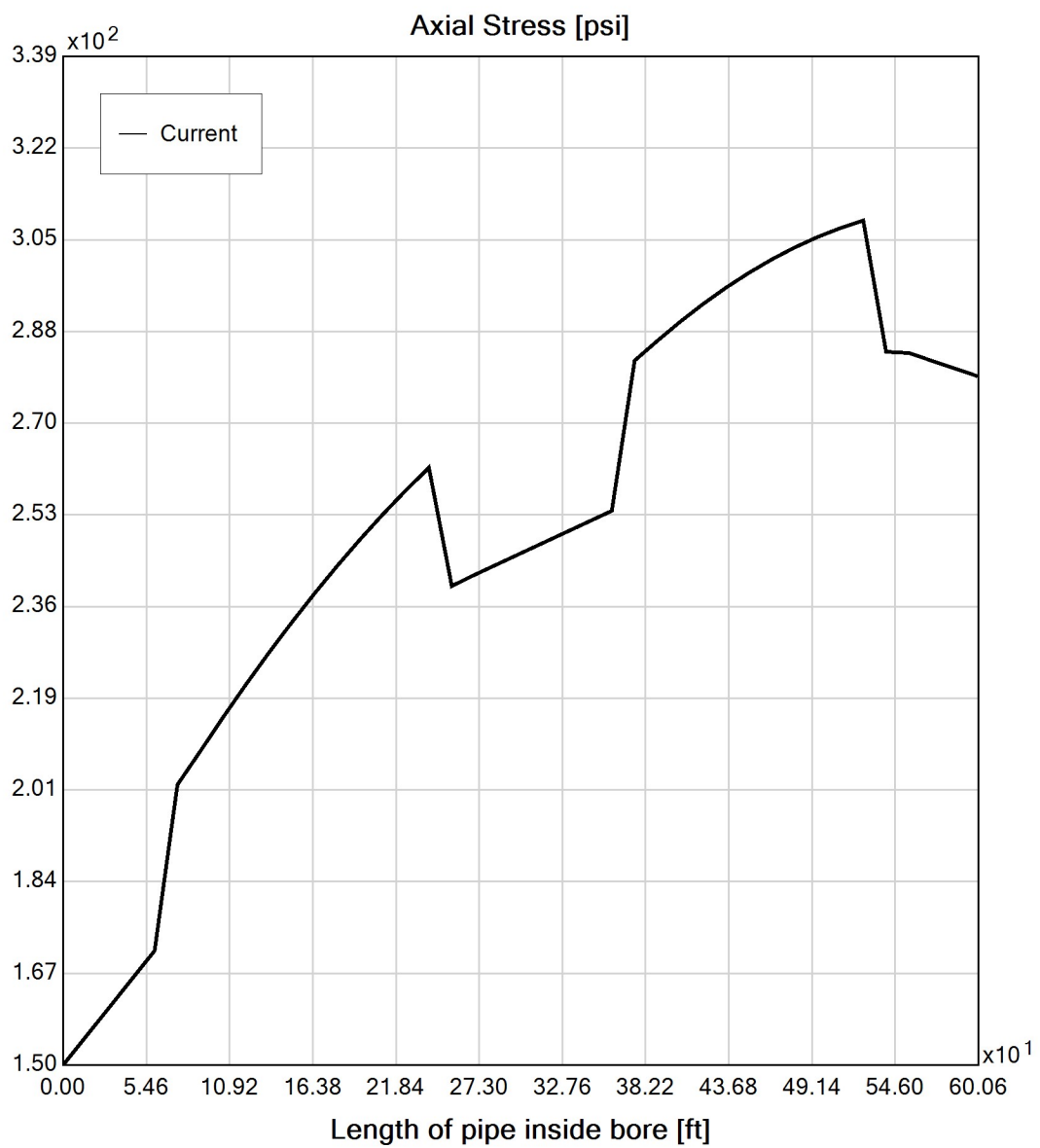
Virtual Site

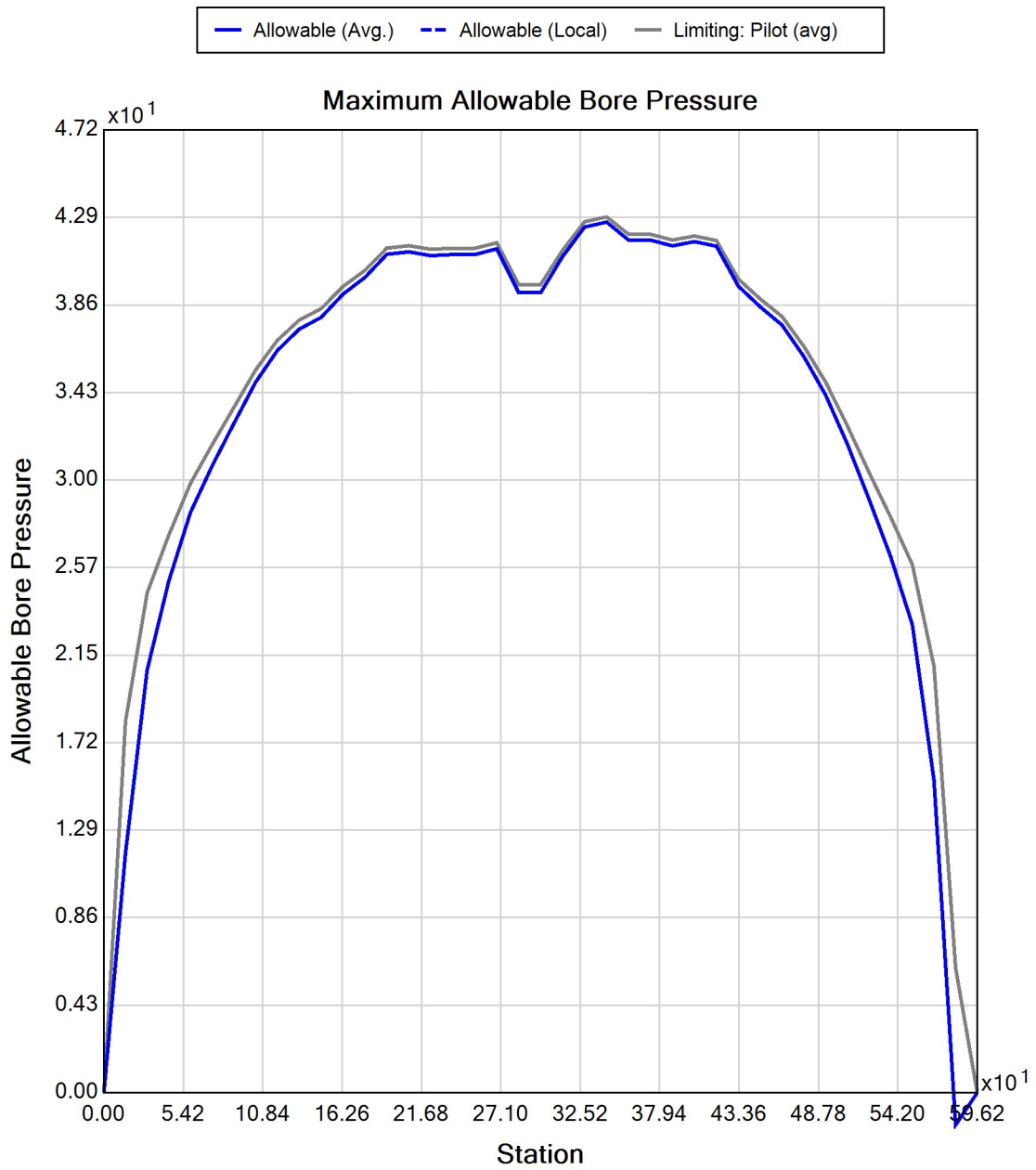


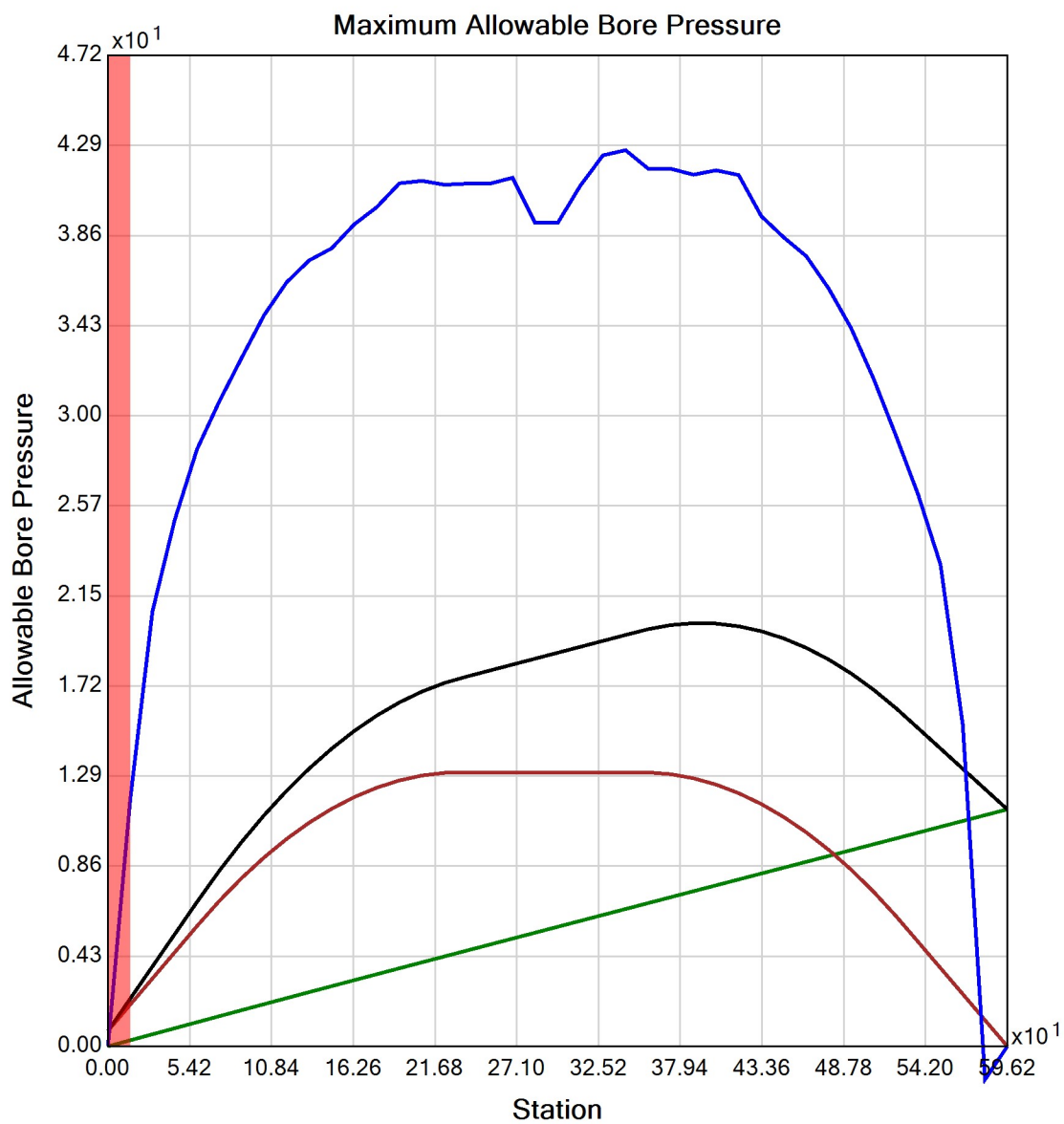














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Input Summary

Start Coordinate	(0.00, 0.00, 141.86) ft
End Coordinate	(589.00, 0.00, 141.77) ft
Project Length	589.00 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: 600.00 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	11.0	11.0
Water Pressure	8.2	8.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	19.2	19.2
Deflection		
Earth Load Deflection	2.987	2.987
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	3.017	3.017
Compressive Stress [psi]		
Compressive Wall Stress	86.3	86.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	606.2	606.2
Pullback Stress [psi]	346.3	346.3
Pullback Strain	6.023E-3	6.023E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	346.3	350.9
Tensile Strain	6.023E-3	6.202E-3

Net External Pressure = 17.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.017	7.5	2.5	OK
Unconstrained Collapse [psi]	19.2	105.4	5.5	OK
Compressive Wall Stress [psi]	86.3	1150.0	13.3	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	27.8	237.0	8.5	OK
Tensile Stress [psi]	350.9	1200.0	3.4	OK



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Project Summary

General: HDD #19 - Conduit 2
Start Date: 06-20-2022
End Date: 06-20-2022

Project Owner: TDI
Project Contractor: KIEWIT
Project Consultant: CHA

Designer: MCS
CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 145.90) ft
End Coordinate	(550.00, 0.00, 144.18) ft
Project Length	550.00 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, Clay (C), CL

Depth: 6.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

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

Depth: 7.50 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

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

Depth: 10.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

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

Depth: 5.00 ft

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.60 [psi]

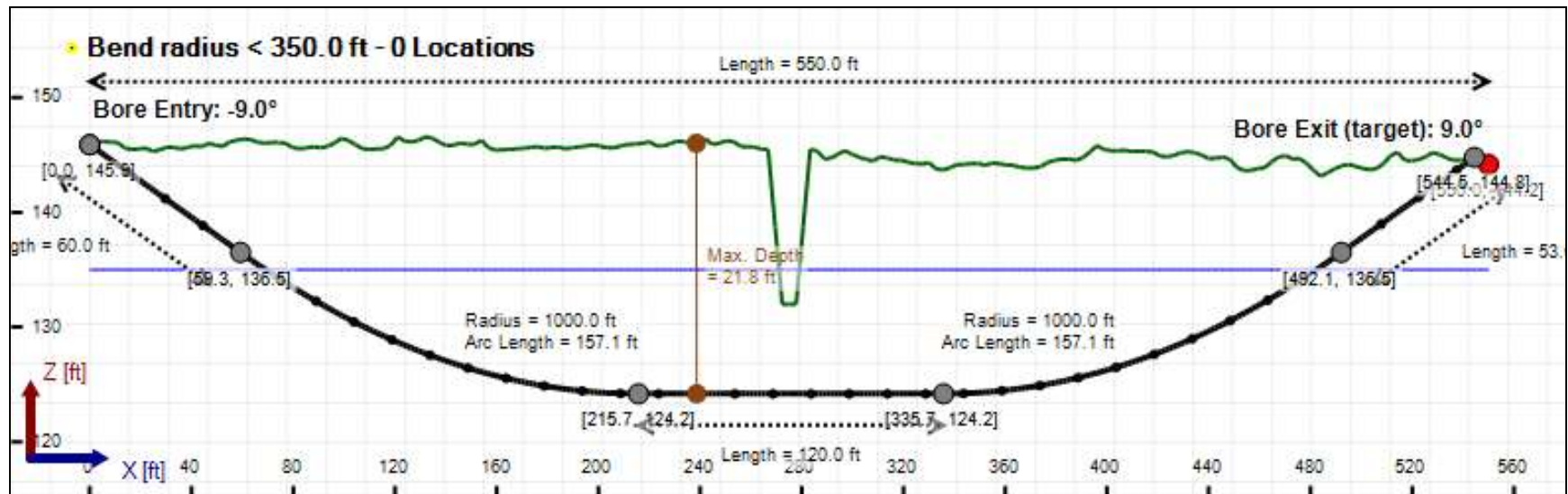
Soil Layer #5 USCS, Sand (S), SM

Depth: 15.00 ft

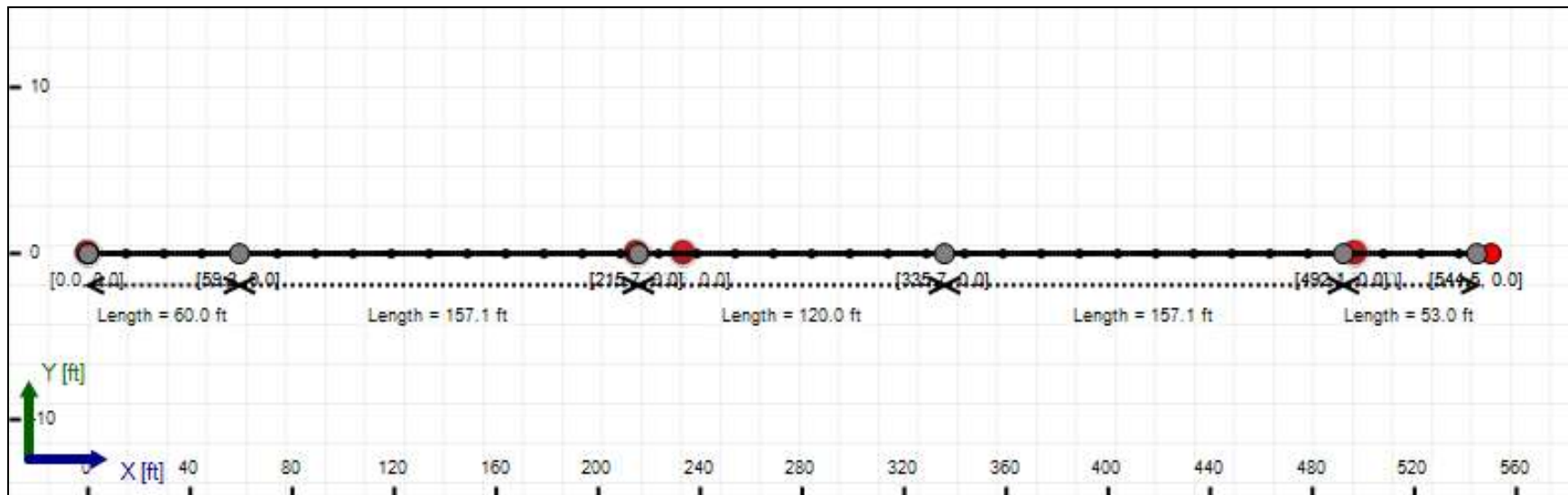
Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3]

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: 555.00 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	9.7	9.7
Water Pressure	4.7	4.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.4	14.4
Deflection		
Earth Load Deflection	2.650	2.650
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.782	2.782
Compressive Stress [psi]		
Compressive Wall Stress	64.8	64.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	9180.4	9180.4
Pullback Stress [psi]	256.0	256.0
Pullback Strain	4.453E-3	4.453E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	256.0	280.5
Tensile Strain	4.453E-3	5.325E-3

Net External Pressure = 14.7 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.782	7.5	2.7	OK
Unconstrained Collapse [psi]	14.4	107.7	7.5	OK
Compressive Wall Stress [psi]	64.8	1150.0	17.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	24.2	240.2	9.9	OK
Tensile Stress [psi]	280.5	1200.0	4.3	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	8.00 in	38.110 psi	38.110 psi
1	8.00 in	12.00 in	37.948 psi	37.948 psi
2	12.00 in	16.13 in	37.721 psi	37.721 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

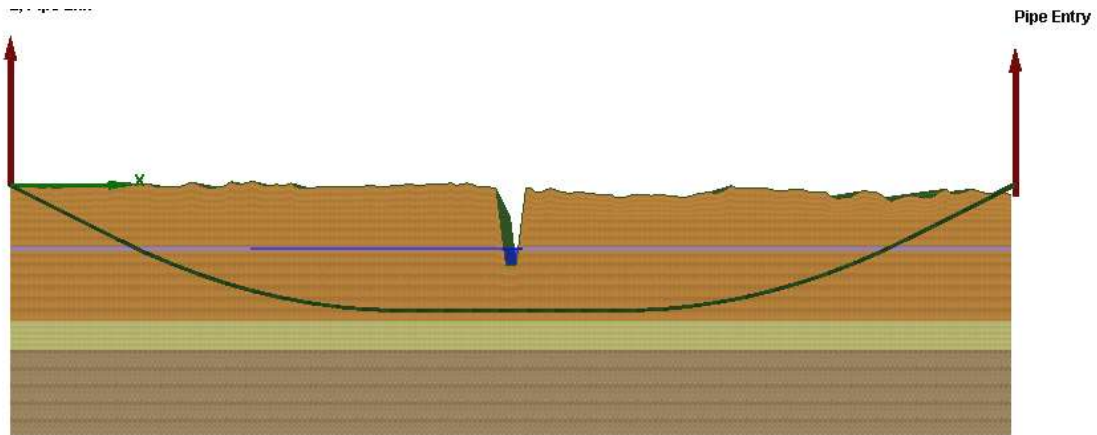
Rheological model: Bingham-Plastic

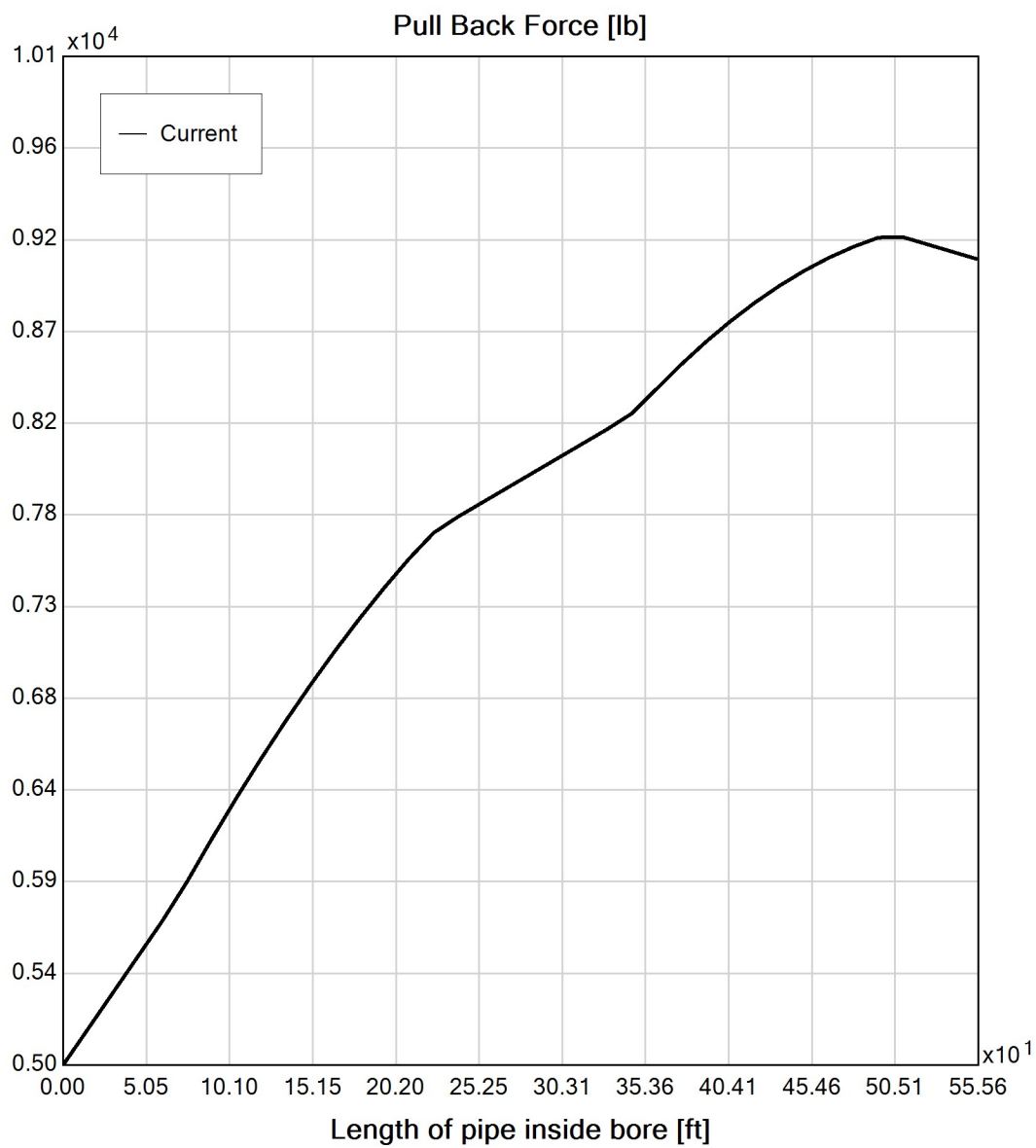
Plastic Viscosity (PV): 25.53

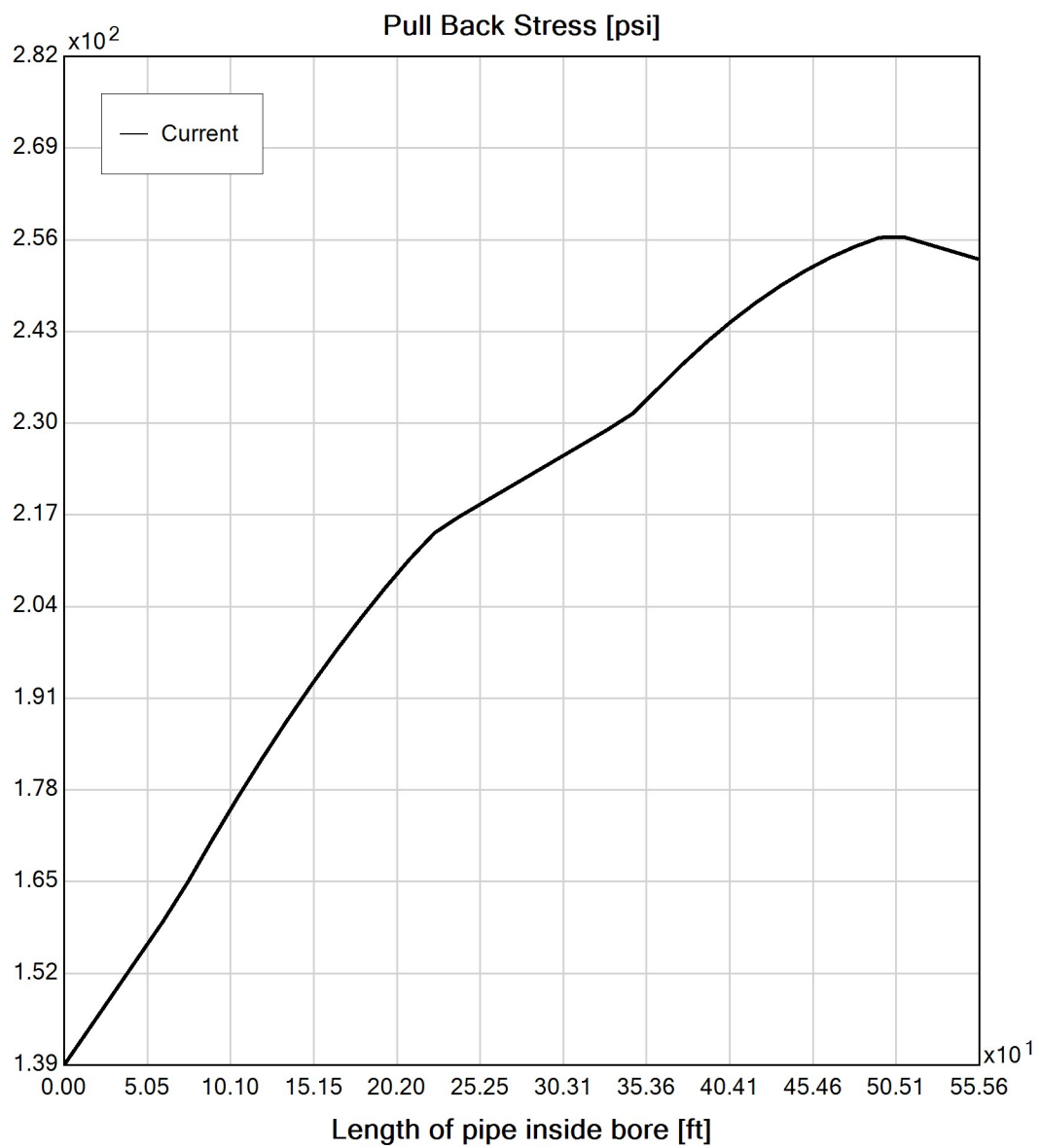
Yield Point (YP): 16.49

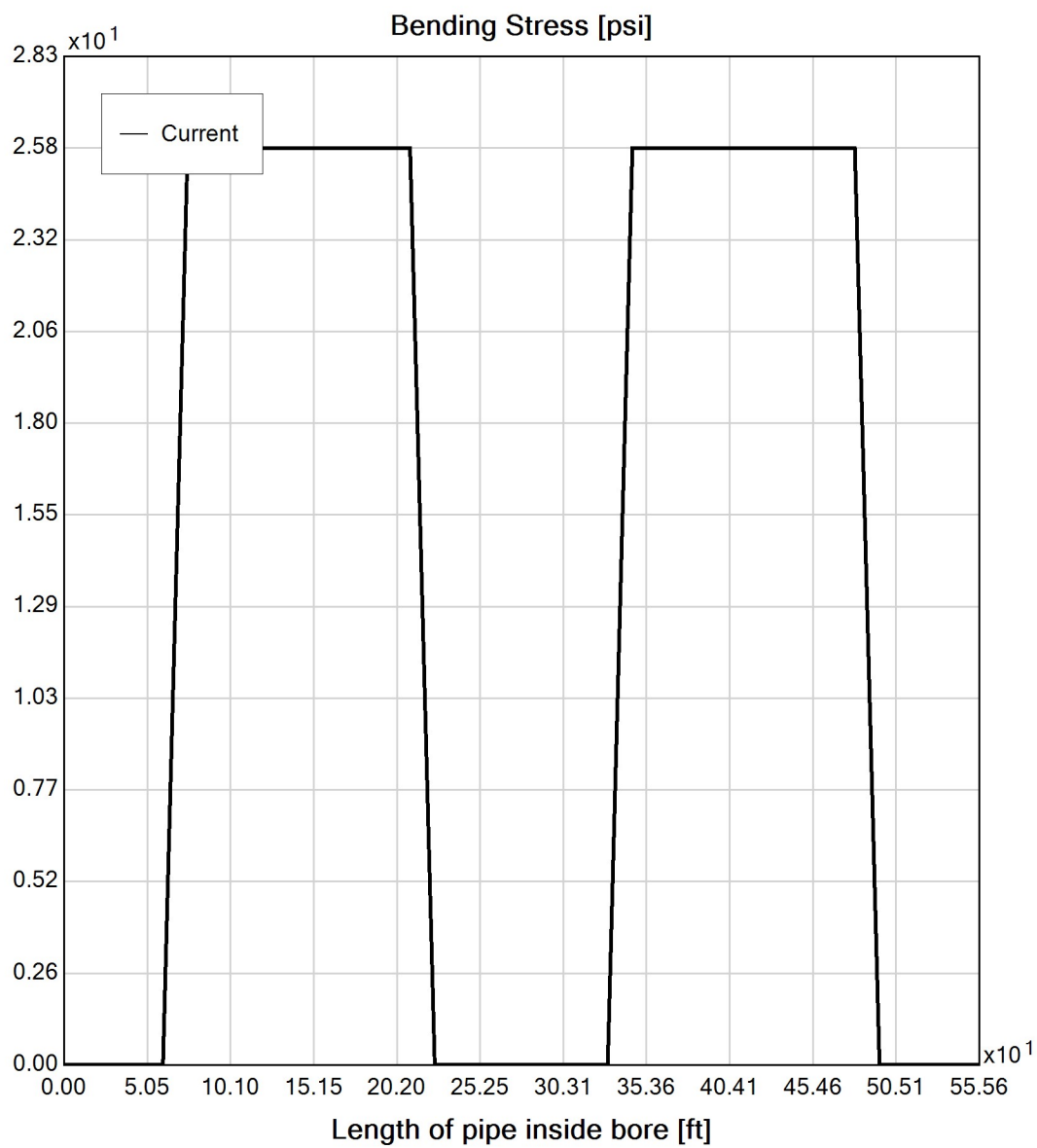
Effective Viscosity (cP): 1202.0

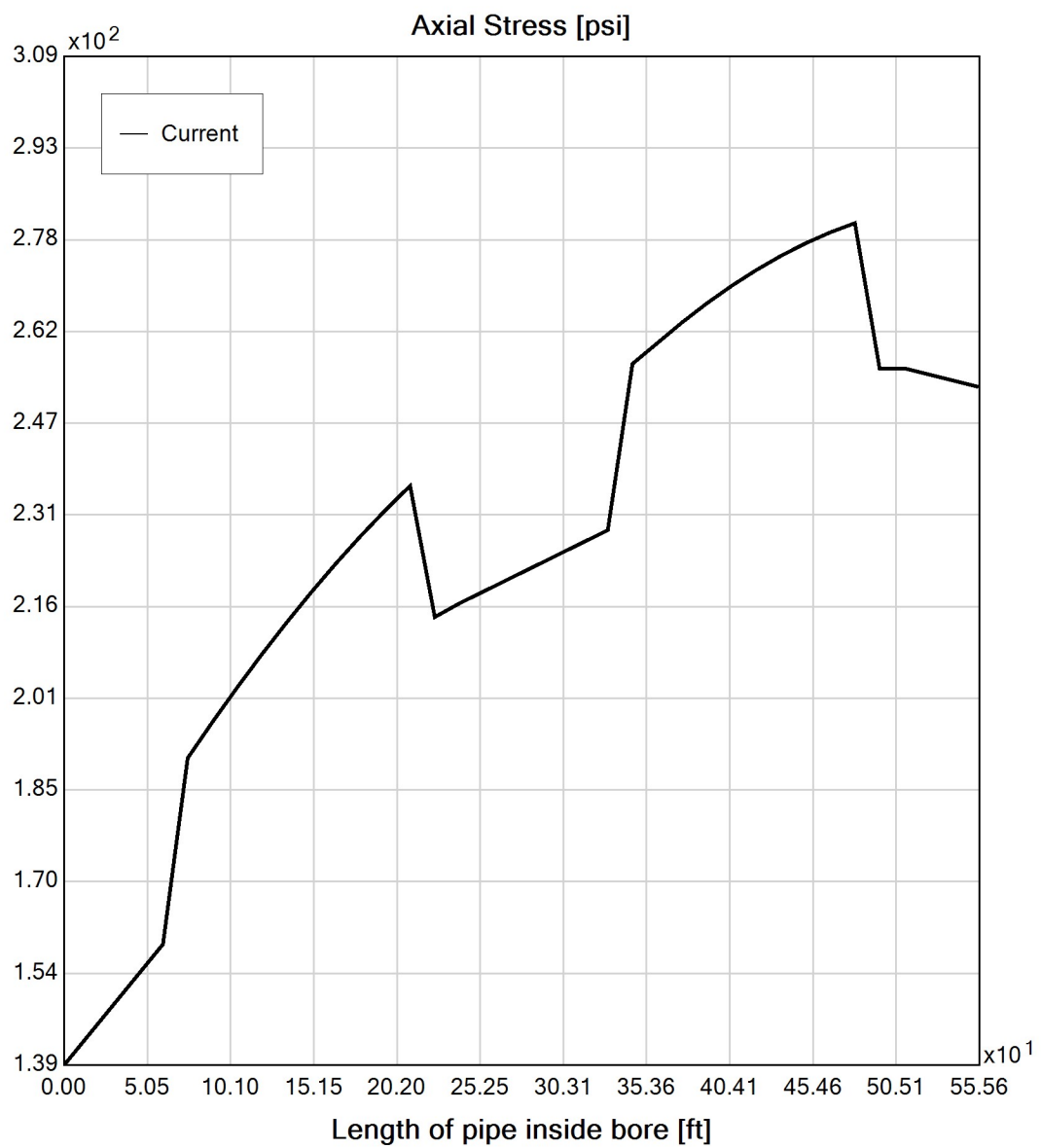
Virtual Site

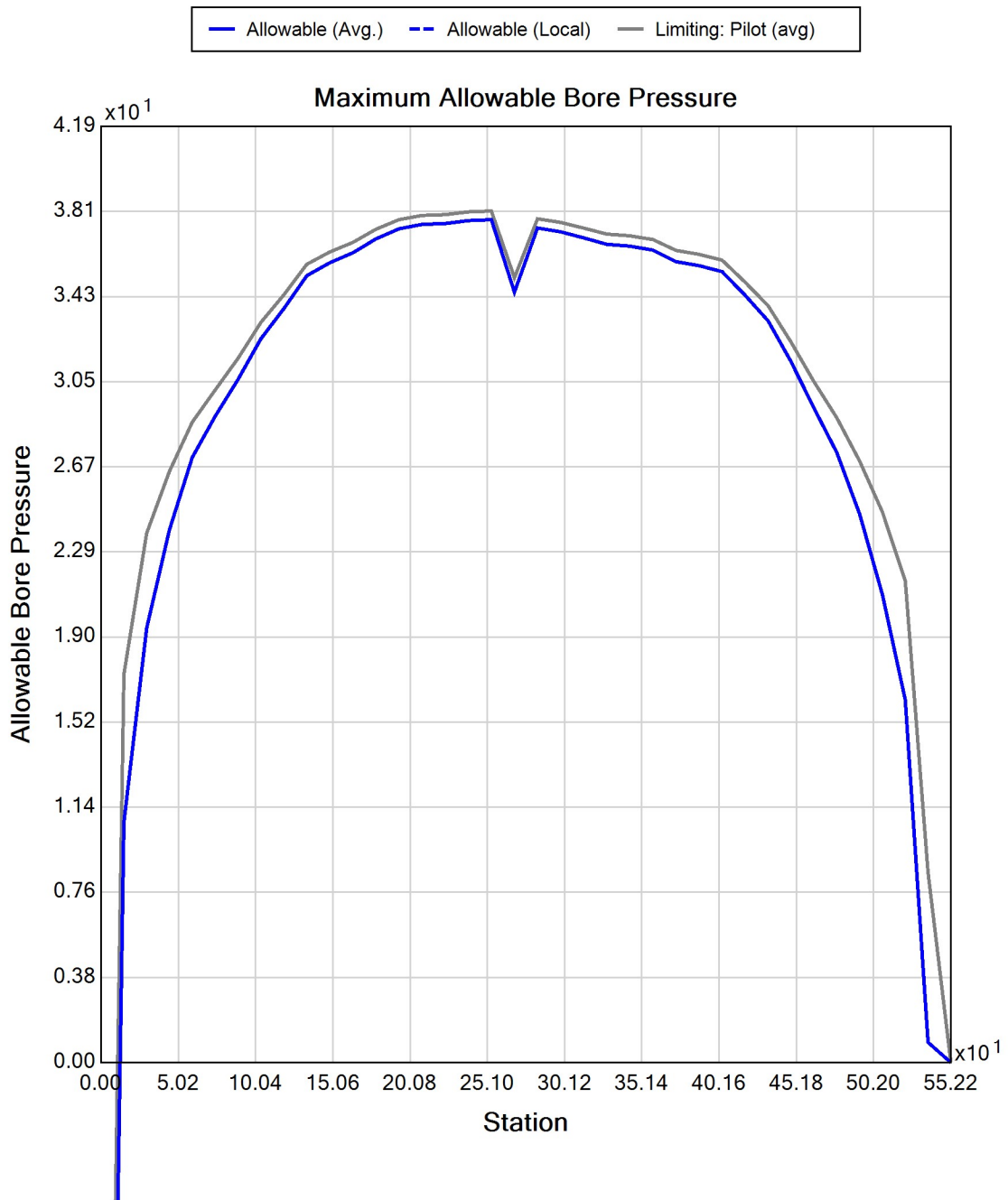


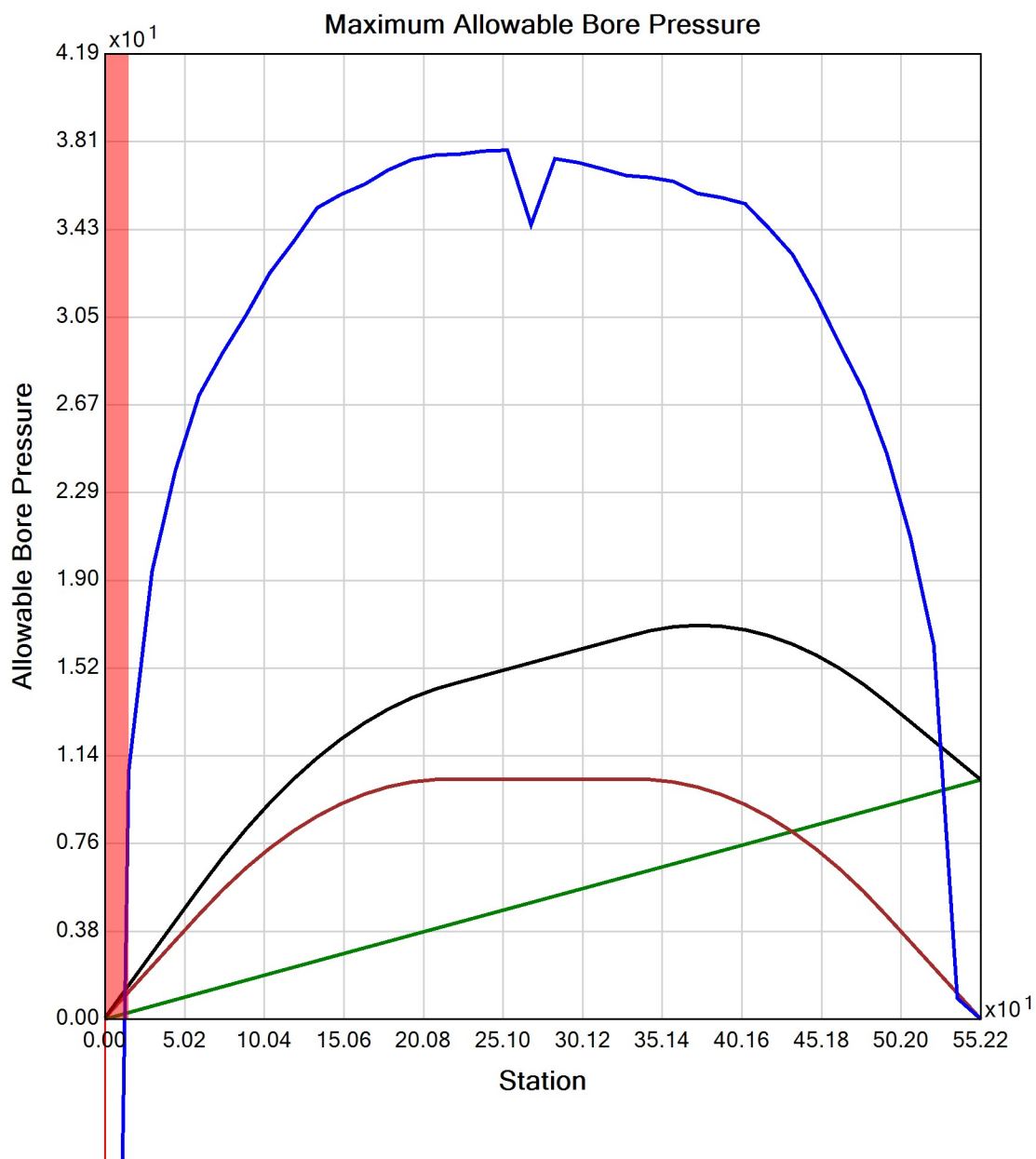














Generated Output



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Input Summary

Start Coordinate	(0.00, 0.00, 145.90) ft
End Coordinate	(550.00, 0.00, 144.18) ft
Project Length	550.00 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: 555.00 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	9.7	9.7
Water Pressure	4.7	4.7
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.4	14.4
Deflection		
Earth Load Deflection	2.650	2.650
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	2.679	2.679
Compressive Stress [psi]		
Compressive Wall Stress	64.8	64.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	557.7	557.7
Pullback Stress [psi]	318.6	318.6
Pullback Strain	5.542E-3	5.542E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	318.6	323.0
Tensile Strain	5.542E-3	5.716E-3

Net External Pressure = 14.7 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.679	7.5	2.8	OK
Unconstrained Collapse [psi]	14.4	108.6	7.5	OK
Compressive Wall Stress [psi]	64.8	1150.0	17.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	24.2	238.6	9.9	OK
Tensile Stress [psi]	323.0	1200.0	3.7	OK



Generated Output



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Project Summary

General: HDD #20
Start Date: 12-10-2021
End Date: 12-10-2021

Designer: AJB
CHA

Description:

Input Summary

Start Coordinate	(0.00, 0.00, 147.20) ft
End Coordinate	(1200.00, 0.00, 141.00) ft
Project Length	1200.00 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), SM

Depth: 6.00 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, Sand (S), SM

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, Clay (C), CH

Depth: 4.00 ft

Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 3.13 [psi]

Soil Layer #4 USCS, Sand (S), SM

Depth: 5.00 ft

Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3]

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

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

Depth: 10.00 ft

Unit Weight: 70.0000 (dry), 105.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 3.13 [psi]

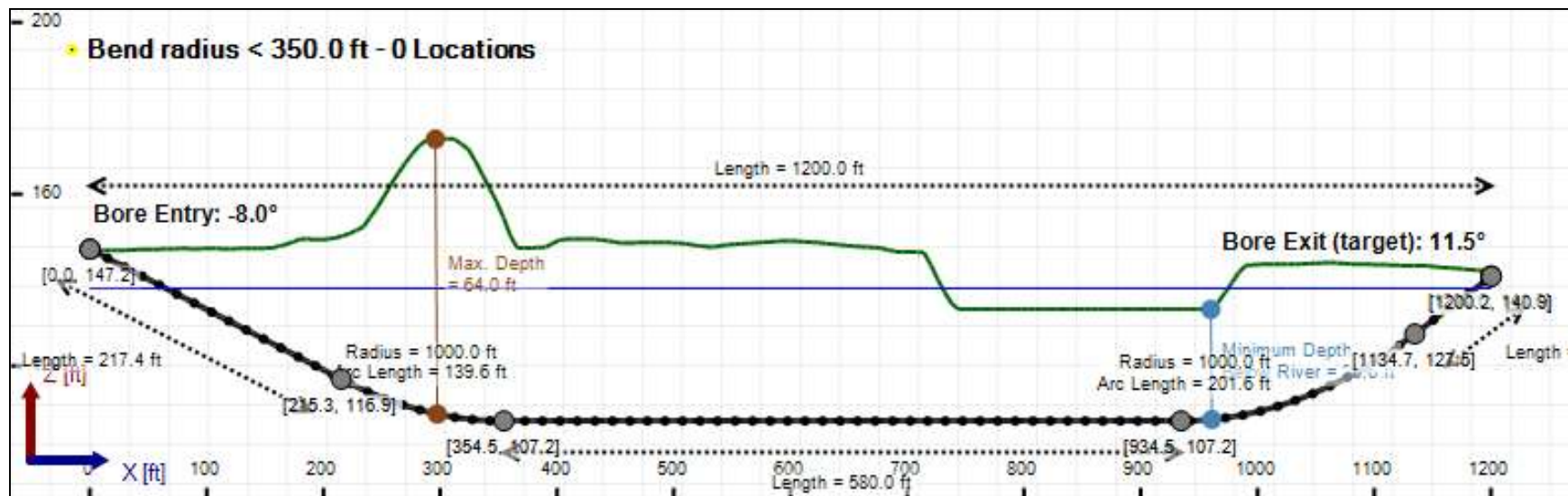
Soil Layer #6 USCS, Clay (C), CH

Depth: 23.00 ft

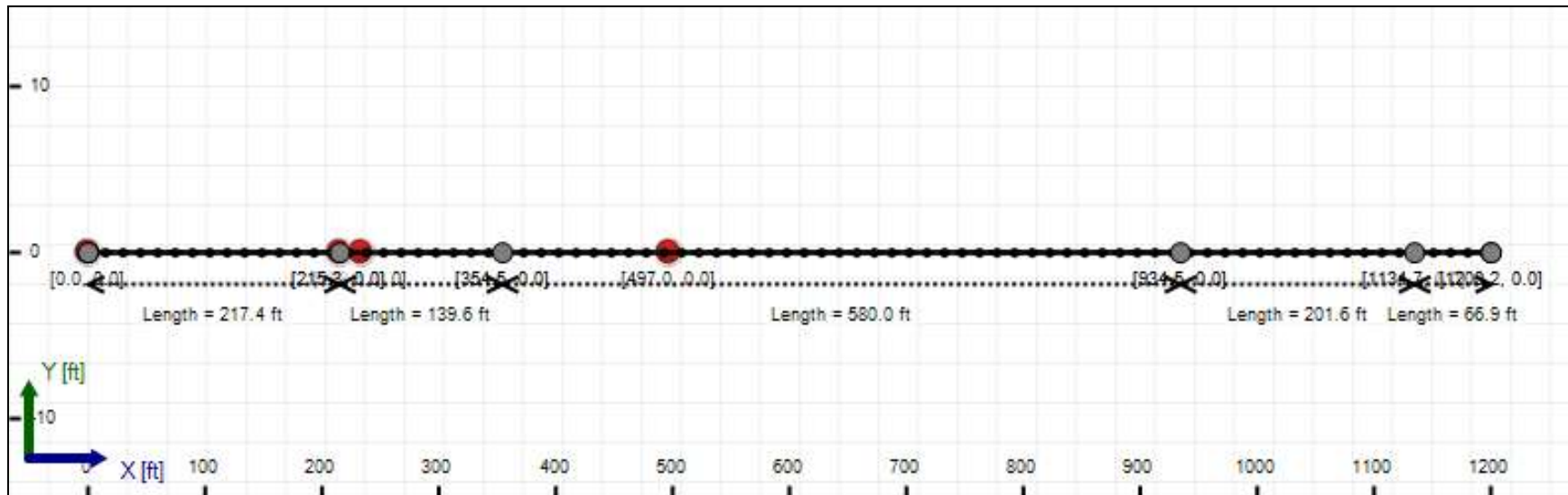
Unit Weight: 70.0000 (dry), 105.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 3.13 [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: 1215.00 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	4.9	35.2
Water Pressure	13.3	13.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.3	48.2
Deflection		
Earth Load Deflection	1.338	9.595
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.470	9.727
Compressive Stress [psi]		
Compressive Wall Stress	82.2	216.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	19255.7	19255.7
Pullback Stress [psi]	537.0	537.0
Pullback Strain	9.339E-3	9.339E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	537.0	559.4
Tensile Strain	9.339E-3	1.018E-2

Net External Pressure = 29.0 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.470	7.5	5.1	OK
Unconstrained Collapse [psi]	26.0	121.0	4.7	OK
Compressive Wall Stress [psi]	82.2	1150.0	14.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	36.0	222.8	6.2	OK
Tensile Stress [psi]	559.4	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	8.00 in	104.761 psi	63.326 psi
1	8.00 in	12.00 in	104.741 psi	63.307 psi
2	12.00 in	16.13 in	104.712 psi	63.279 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: 68.670 lb/ft³

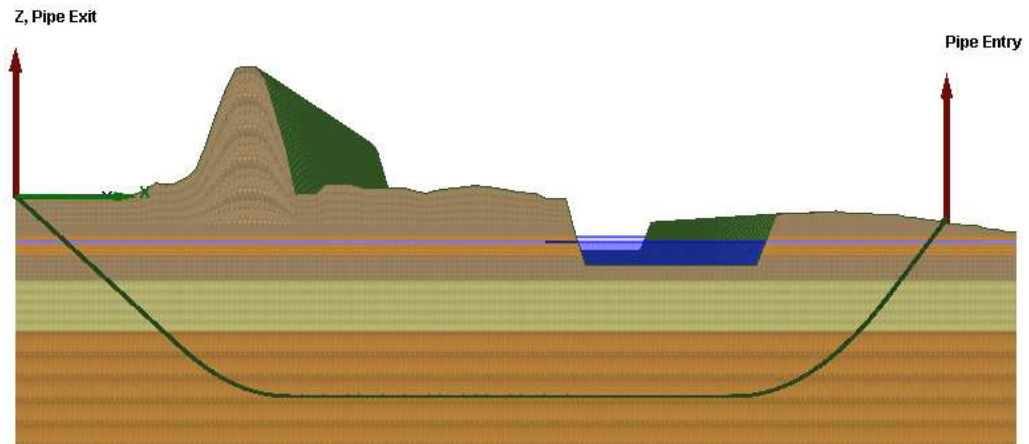
Rheological model: Bingham-Plastic

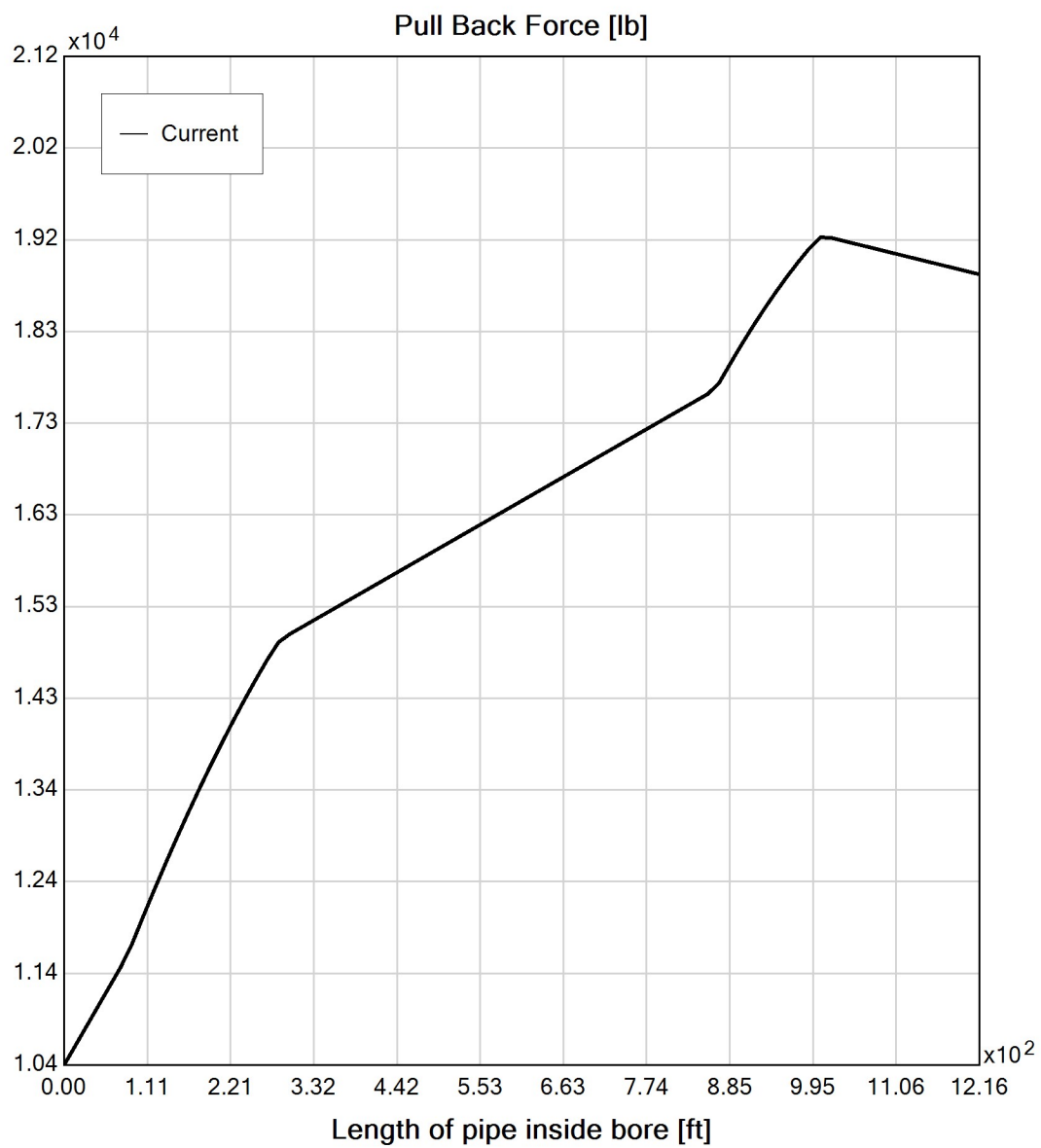
Plastic Viscosity (PV): 25.53

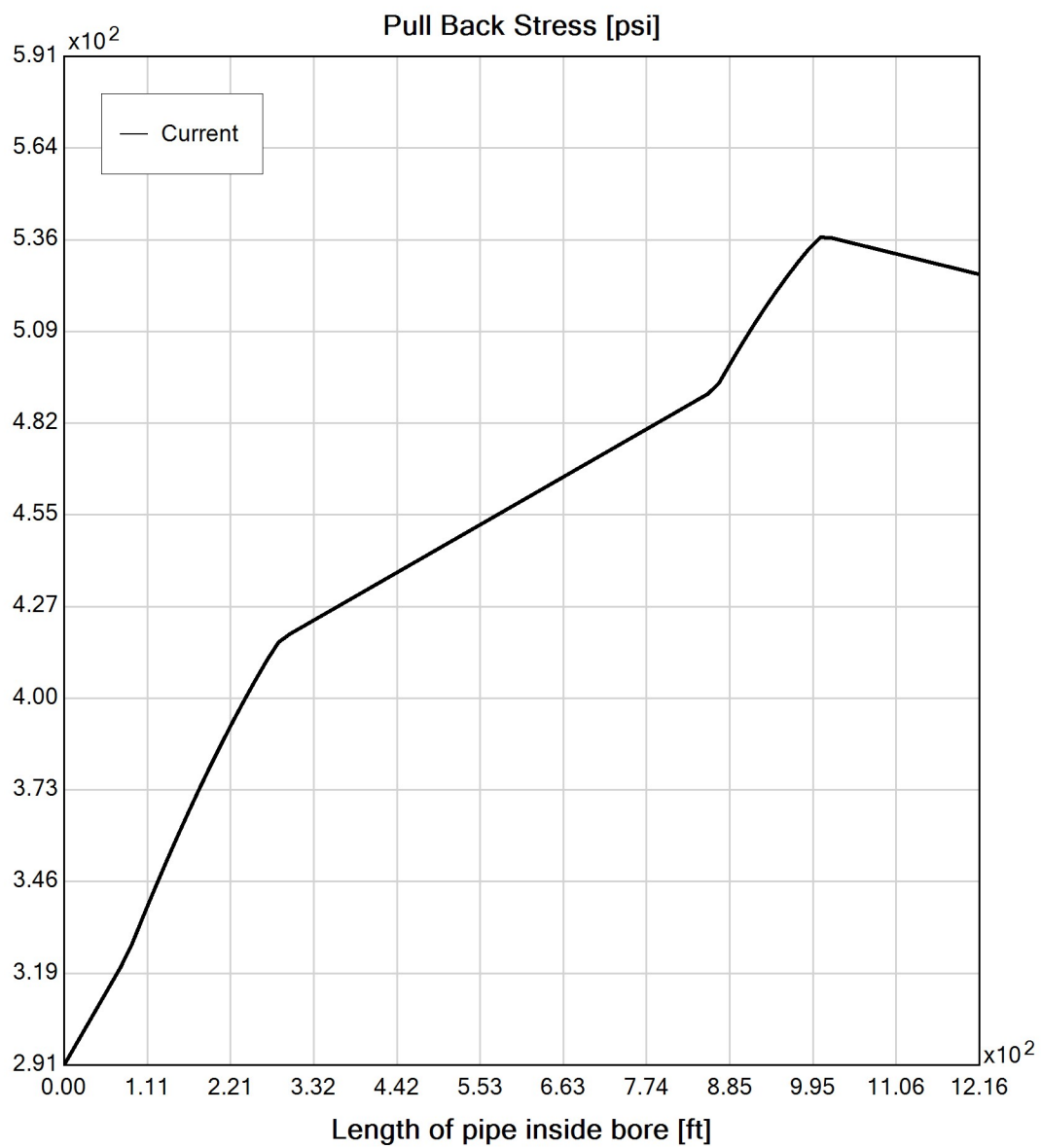
Yield Point (YP): 16.49

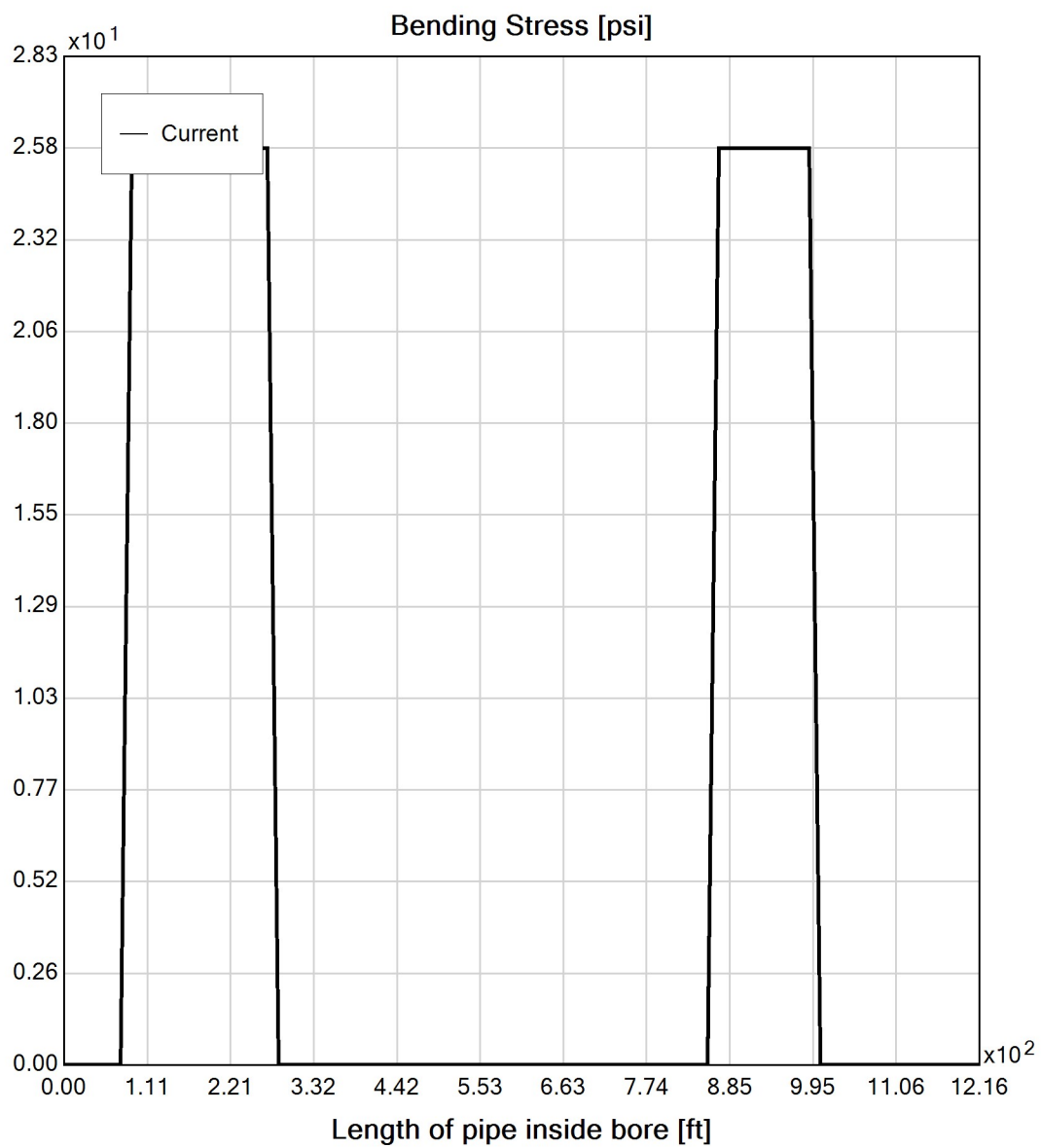
Effective Viscosity (cP): 1202.0

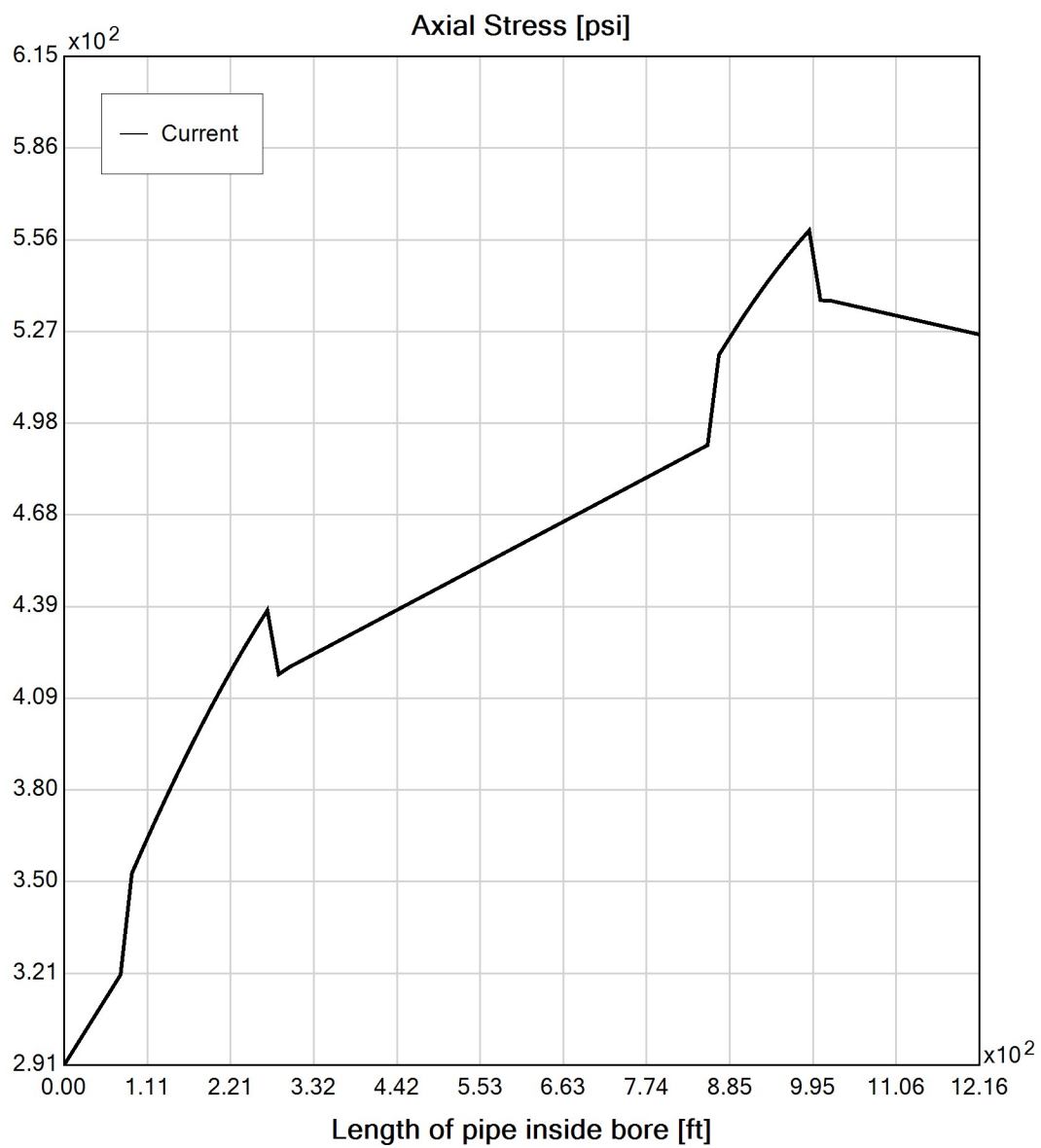
Virtual Site

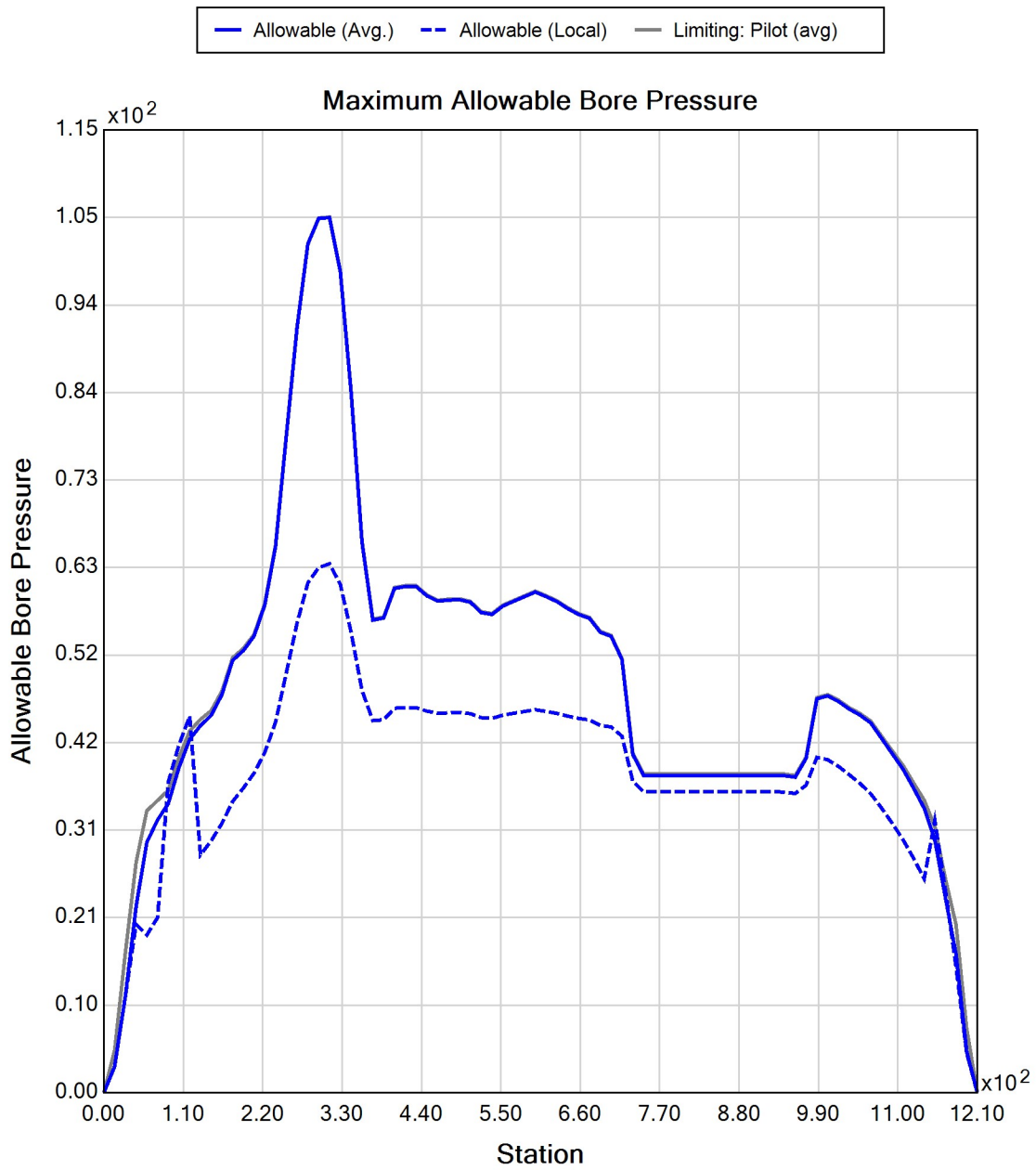


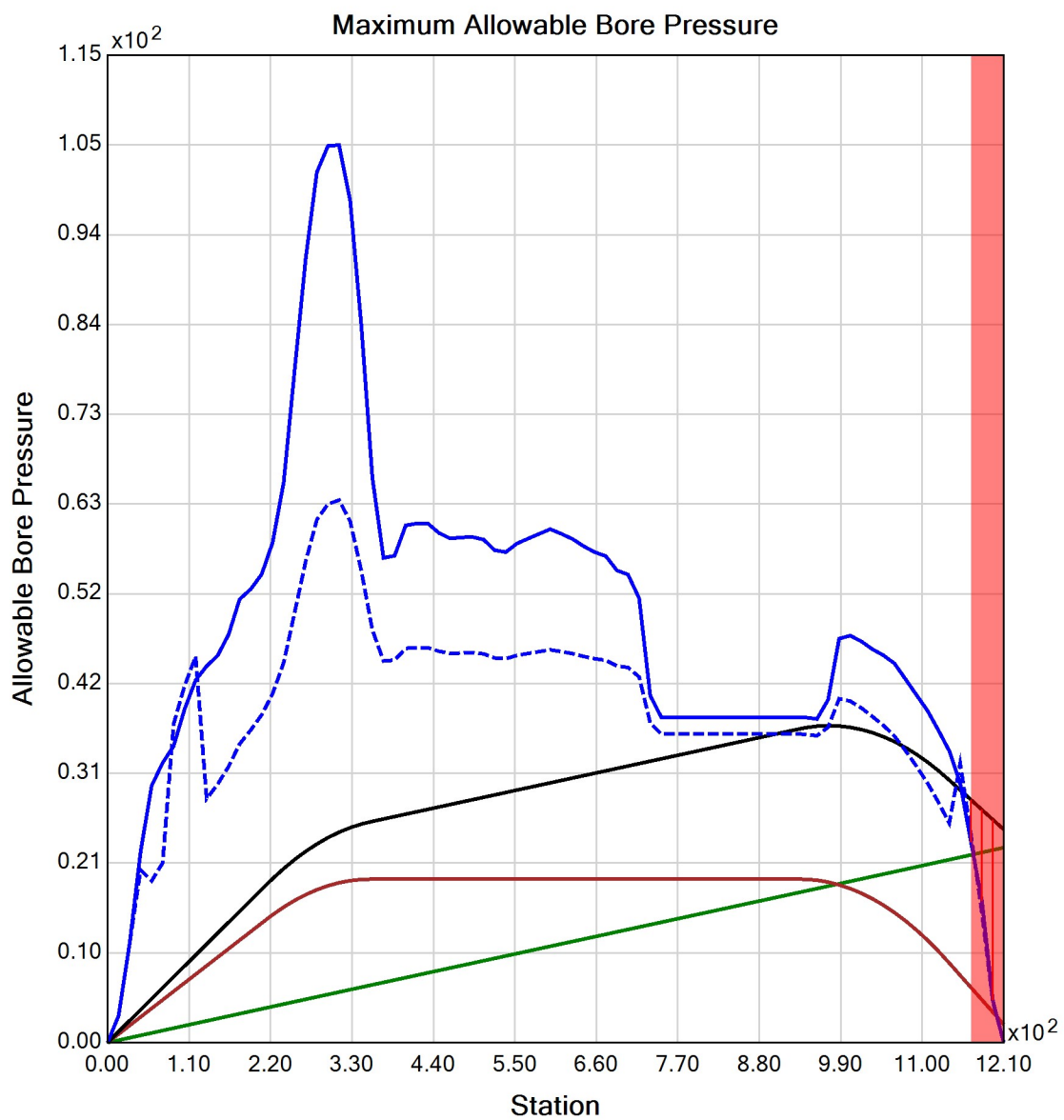














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Input Summary

Start Coordinate	(0.00, 0.00, 147.20) ft
End Coordinate	(1200.00, 0.00, 141.00) ft
Project Length	1200.00 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: 1215.00 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	2.8	35.2
Water Pressure	13.3	13.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.1	48.2
Deflection		
Earth Load Deflection	0.760	9.595
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.789	9.624
Compressive Stress [psi]		
Compressive Wall Stress	72.6	216.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1049.5	1049.5
Pullback Stress [psi]	599.6	599.6
Pullback Strain	1.043E-2	1.043E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	599.6	602.0
Tensile Strain	1.043E-2	1.057E-2

Net External Pressure = 29.0 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.789	7.5	9.5	OK
Unconstrained Collapse [psi]	26.0	128.7	4.9	OK
Compressive Wall Stress [psi]	72.6	1150.0	15.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	36.0	220.8	6.1	OK
Tensile Stress [psi]	602.0	1200.0	2.0	OK



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Project Summary

General:	HDD #21 CHPE Start Date: 09-14-2022 End Date: 09-14-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	MDB BCE Amherst, Massachusetts
Description:	South to North 10" DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 134.00) ft
End Coordinate	(1975.00, 0.00, 135.00) ft
Project Length	1975.00 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	2.875 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: 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: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

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

Soil Layer #3 USCS, Organic (O), OL

From Assistant

Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3]

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

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

From Assistant

Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 200.00, Coh: 3.13 [psi]

Soil Layer #5 USCS, Gravel (G), GW

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 #6 Rock, Geological Classification, Sedimentary Rocks

From Assistant

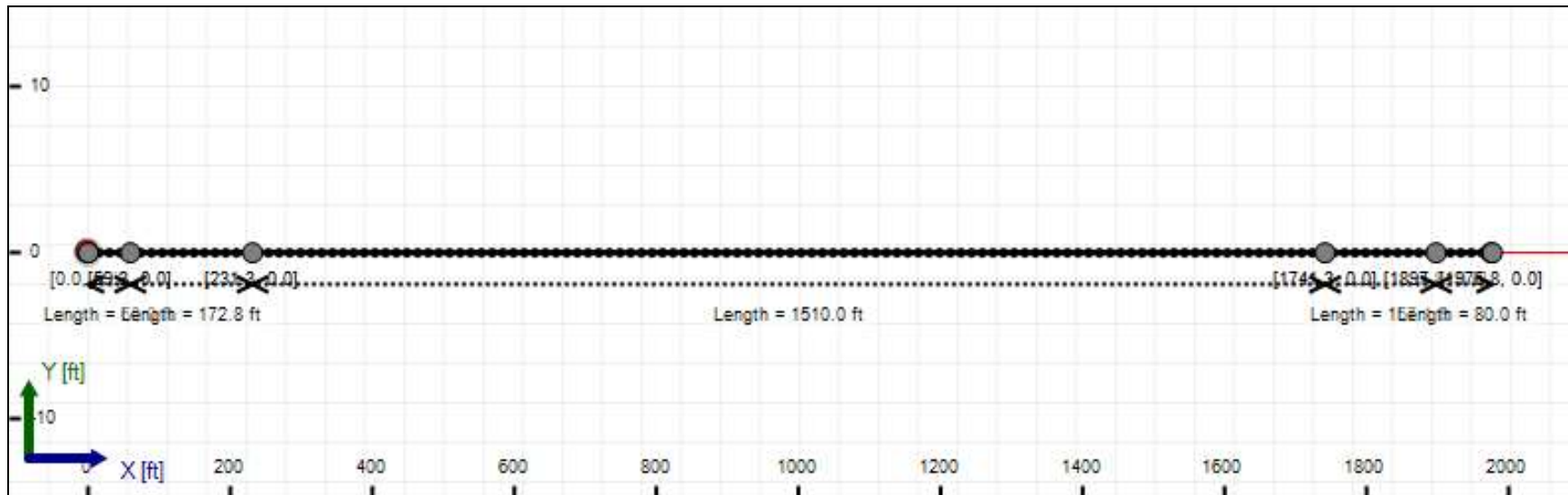
Unit Weight: 165.0000 (dry), 177.0000 (sat) [lb/ft3]

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

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Gas
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1980.00 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	10.5	13.6
Water Pressure	7.8	7.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.3	21.4
Deflection		
Earth Load Deflection	2.868	3.703
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	3.000	3.835
Compressive Stress [psi]		
Compressive Wall Stress	82.4	96.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	30710.4	30710.4
Pullback Stress [psi]	856.5	856.5
Pullback Strain	1.490E-2	1.490E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	856.5	871.5
Tensile Strain	1.490E-2	1.556E-2

Net External Pressure = 15.8 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.000	7.5	2.5	OK
Unconstrained Collapse [psi]	18.3	105.6	5.8	OK
Compressive Wall Stress [psi]	82.4	1150.0	14.0	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	26.1	201.6	7.7	OK
Tensile Stress [psi]	871.5	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	9.50 in	54.748 psi	49.587 psi
1	9.50 in	14.00 in	54.583 psi	48.272 psi
2	14.00 in	16.13 in	54.484 psi	47.566 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): 80.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft³

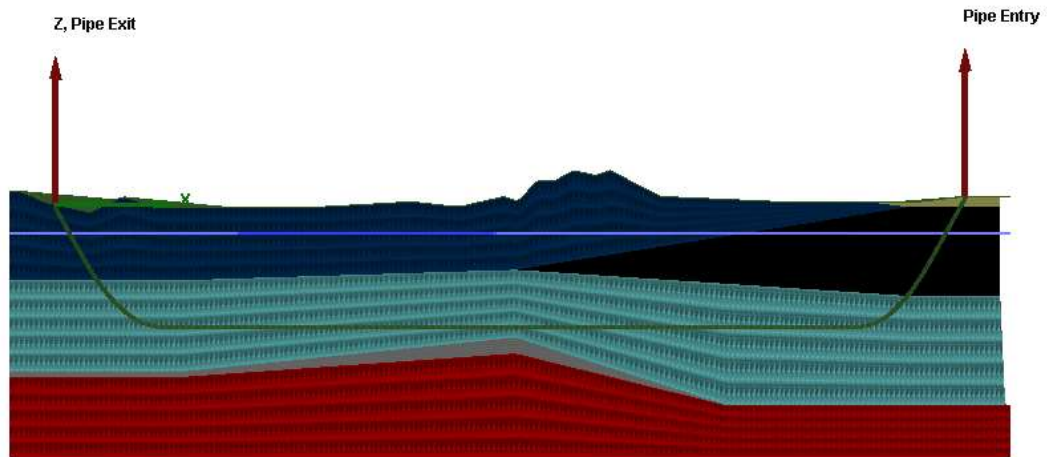
Rheological model: Bingham-Plastic

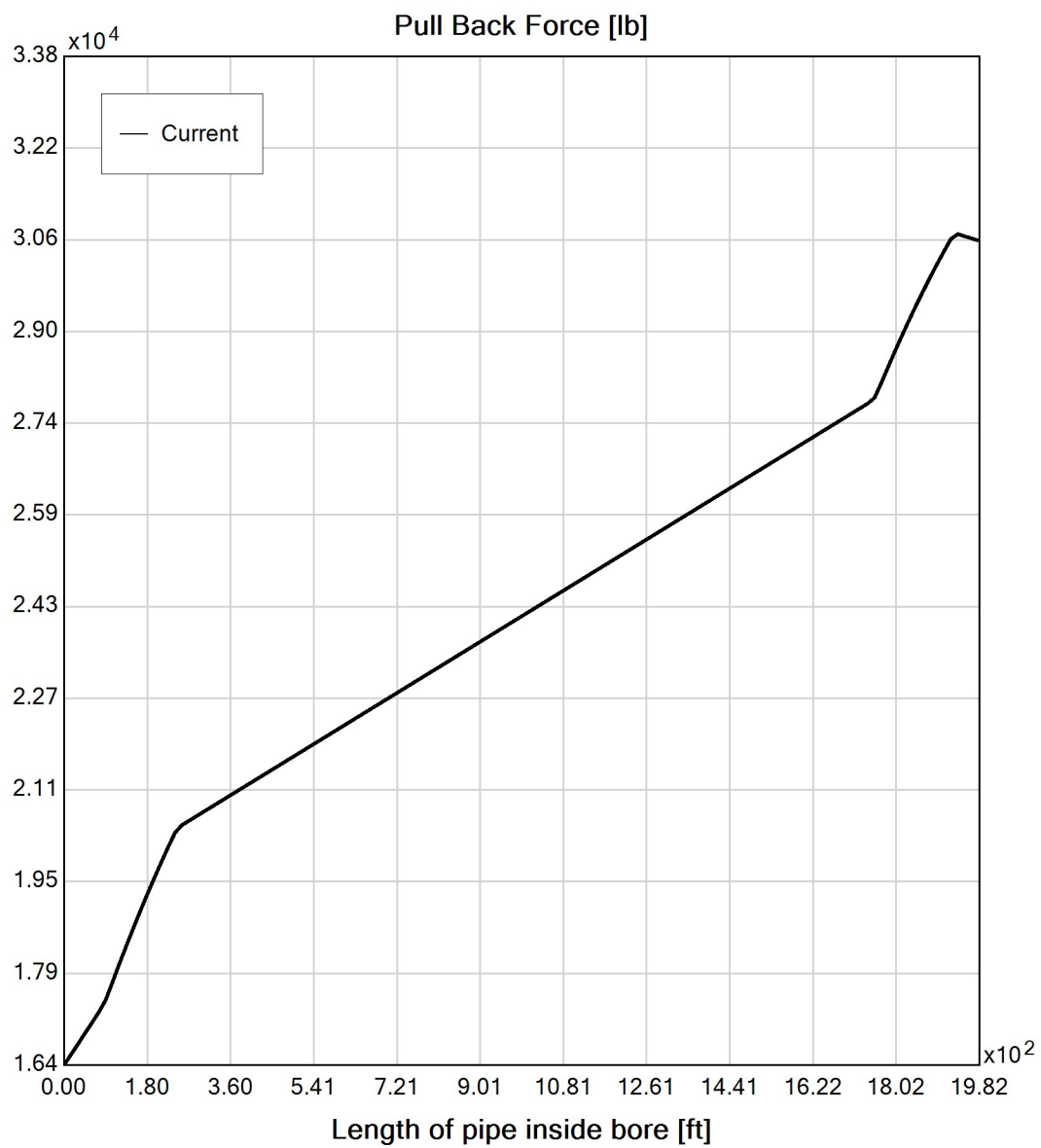
Plastic Viscosity (PV): 25.53

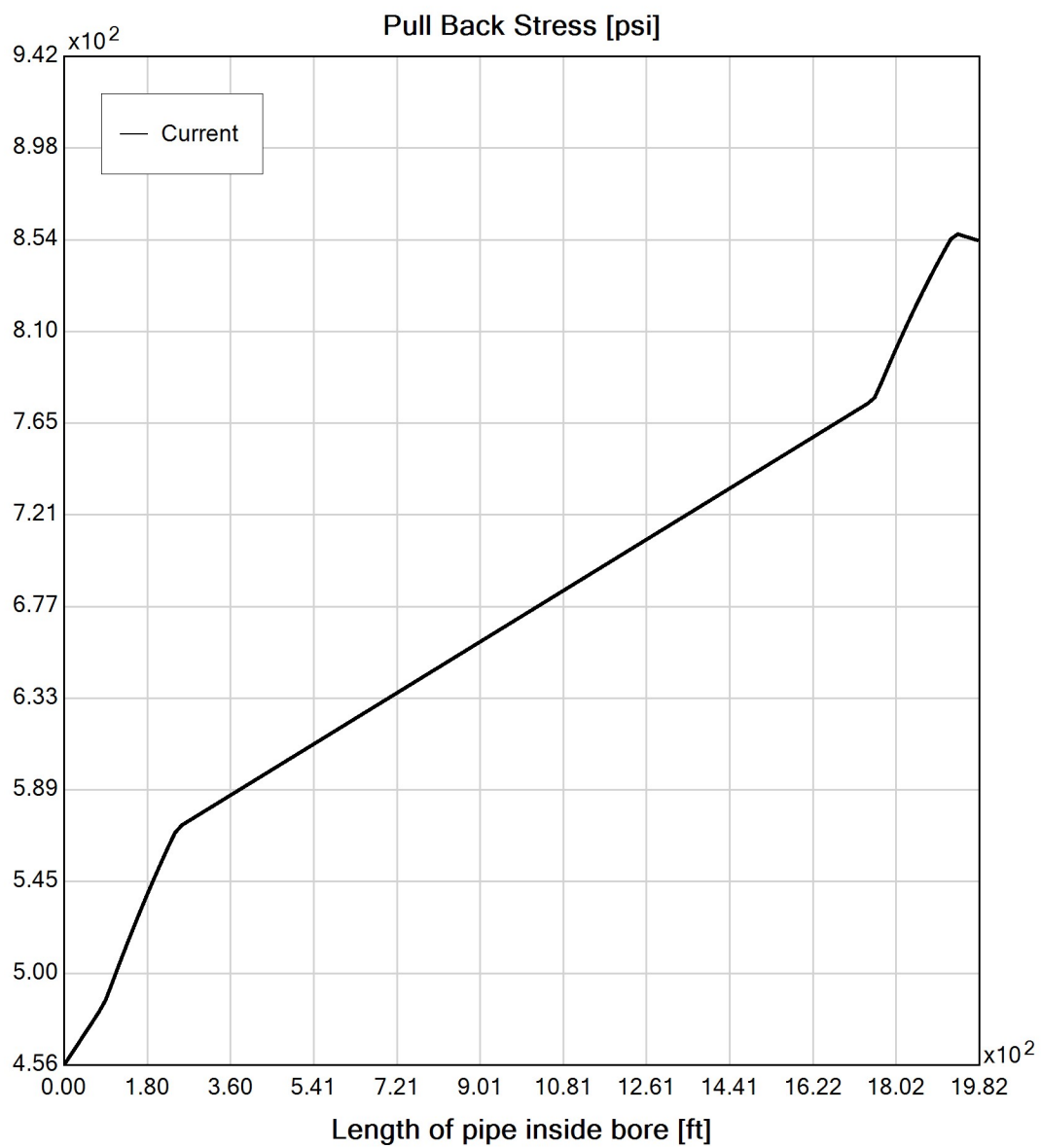
Yield Point (YP): 16.49

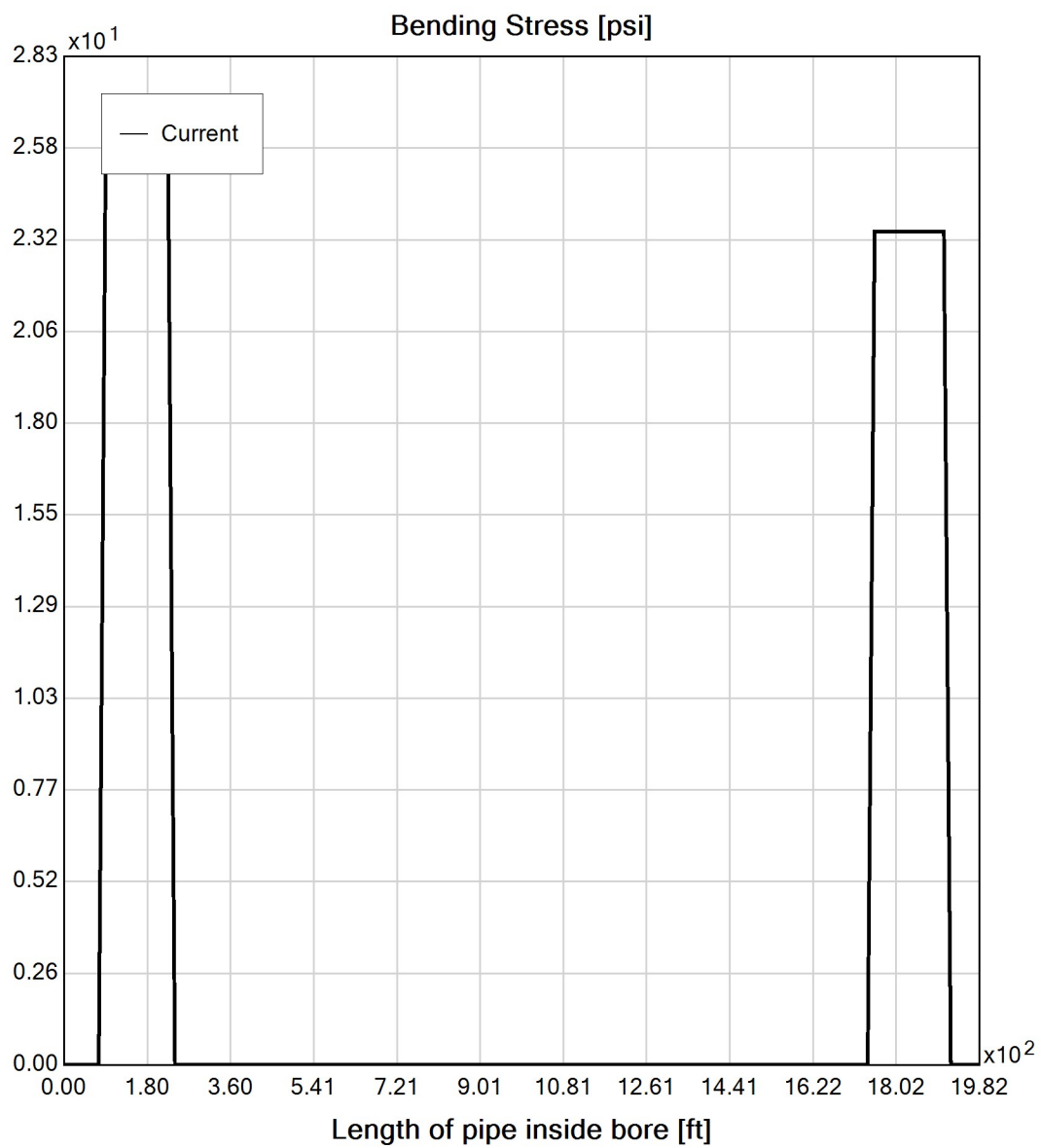
Effective Viscosity (cP): 1397.5

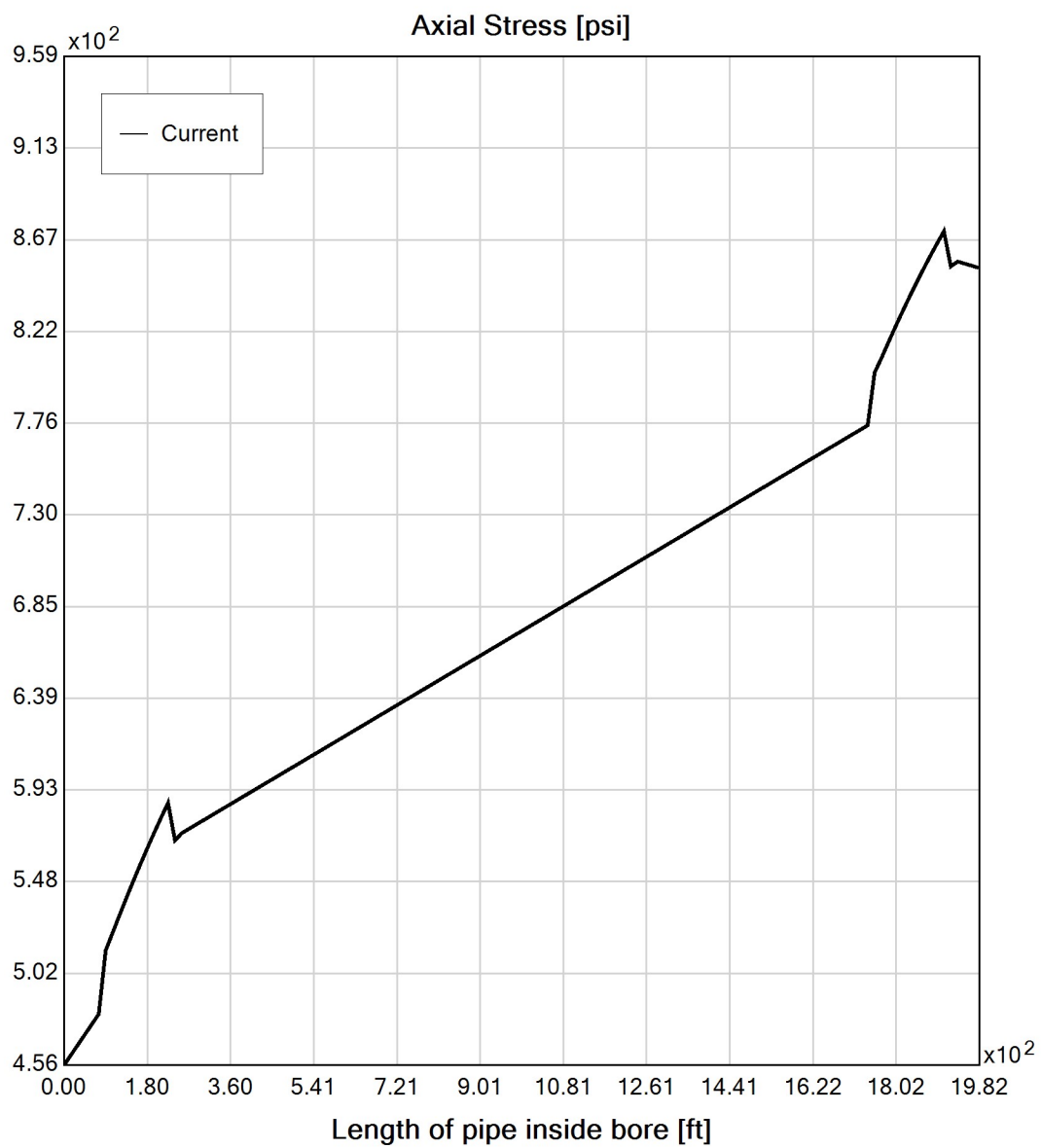
Virtual Site

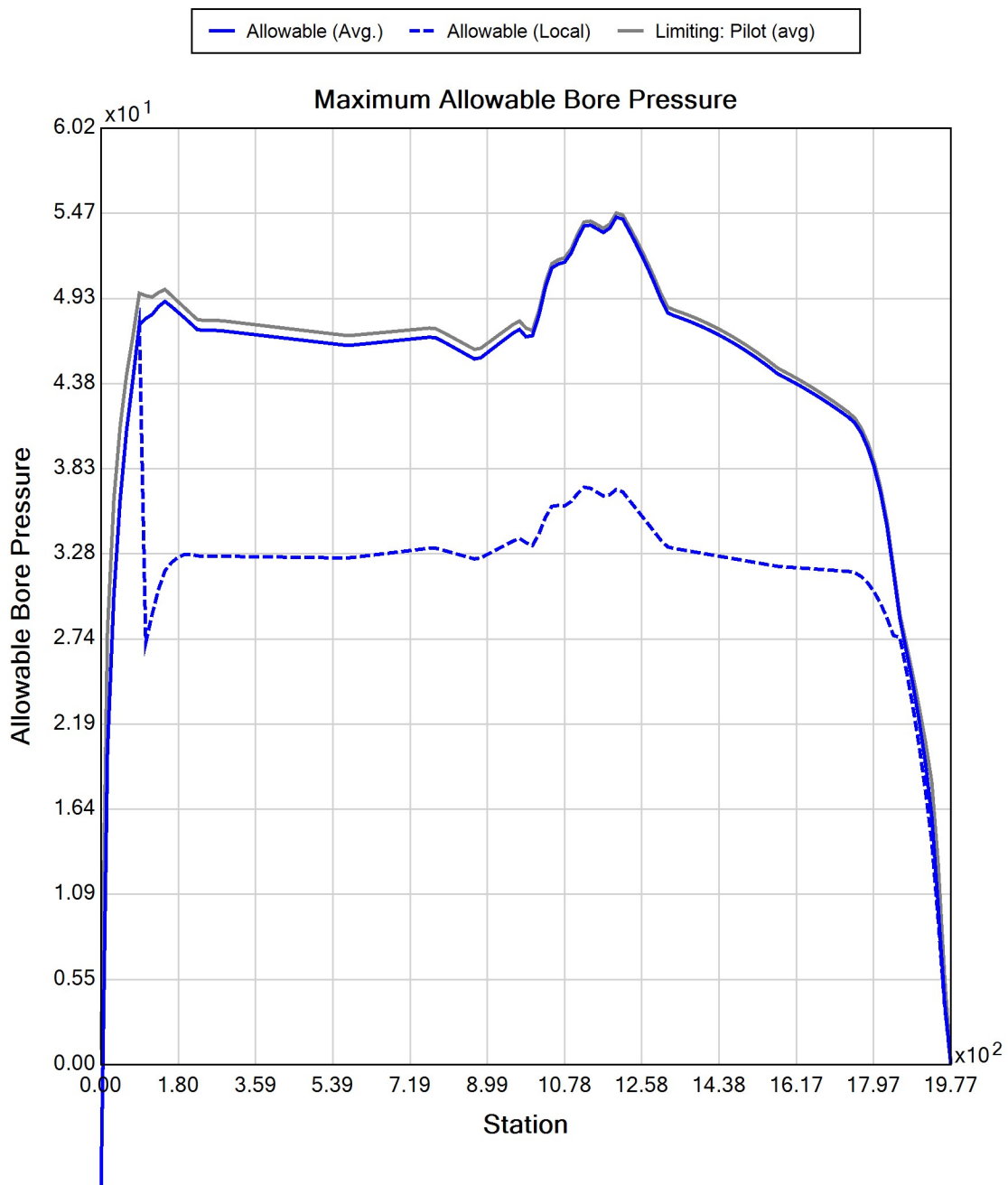


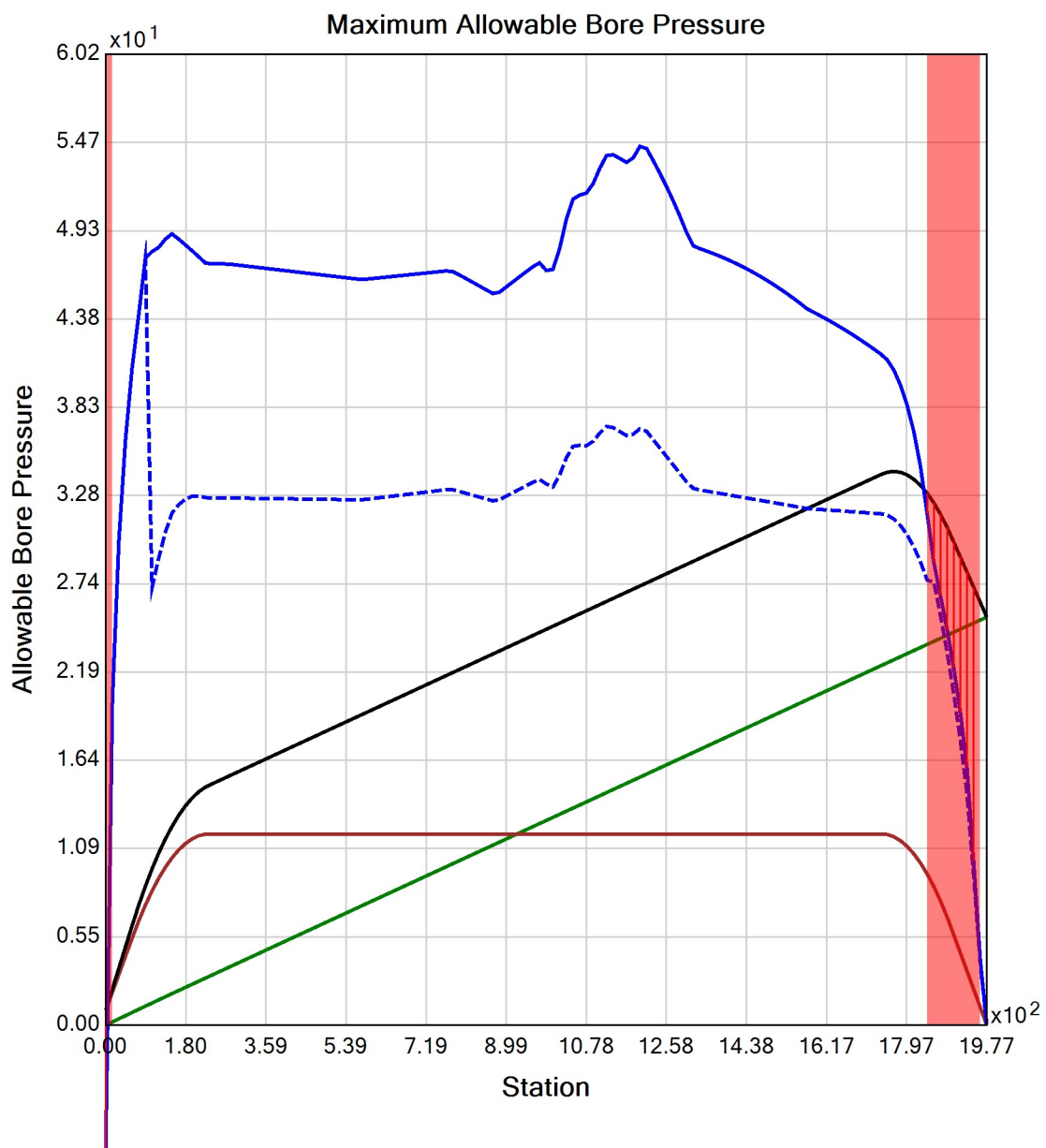














Generated Output



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Input Summary

Start Coordinate	(0.00, 0.00, 134.00) ft
End Coordinate	(1975.00, 0.00, 135.00) ft
Project Length	1975.00 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: Gas
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1980.00 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	10.5	13.6
Water Pressure	7.8	7.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	18.3	21.4
Deflection		
Earth Load Deflection	2.929	3.703
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	2.958	3.732
Compressive Stress [psi]		
Compressive Wall Stress	82.2	96.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1608.6	1608.6
Pullback Stress [psi]	919.1	919.1
Pullback Strain	1.598E-2	1.598E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	919.1	919.1
Tensile Strain	1.598E-2	1.602E-2

Net External Pressure = 15.8 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.958	7.5	2.5	OK
Unconstrained Collapse [psi]	18.3	106.7	5.8	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]	26.1	198.9	7.6	OK
Tensile Stress [psi]	919.1	1200.0	1.3	OK



Generated Output



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Project Summary

General:	HDD #21A Start Date: 09-15-2022 End Date: 09-15-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA/BCE
Designer:	MDB BCE Amherst, Massachusetts
Description:	North to South 10" DR 9

Input Summary

Start Coordinate	(0.00, 0.00, 136.00) ft
End Coordinate	(1965.00, 0.00, 139.00) ft
Project Length	1965.00 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, 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, Clay (C), CL

From Assistant

Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3]

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

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

From Assistant

Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 200.00, Coh: 3.13 [psi]

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

From Assistant

Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3]

Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

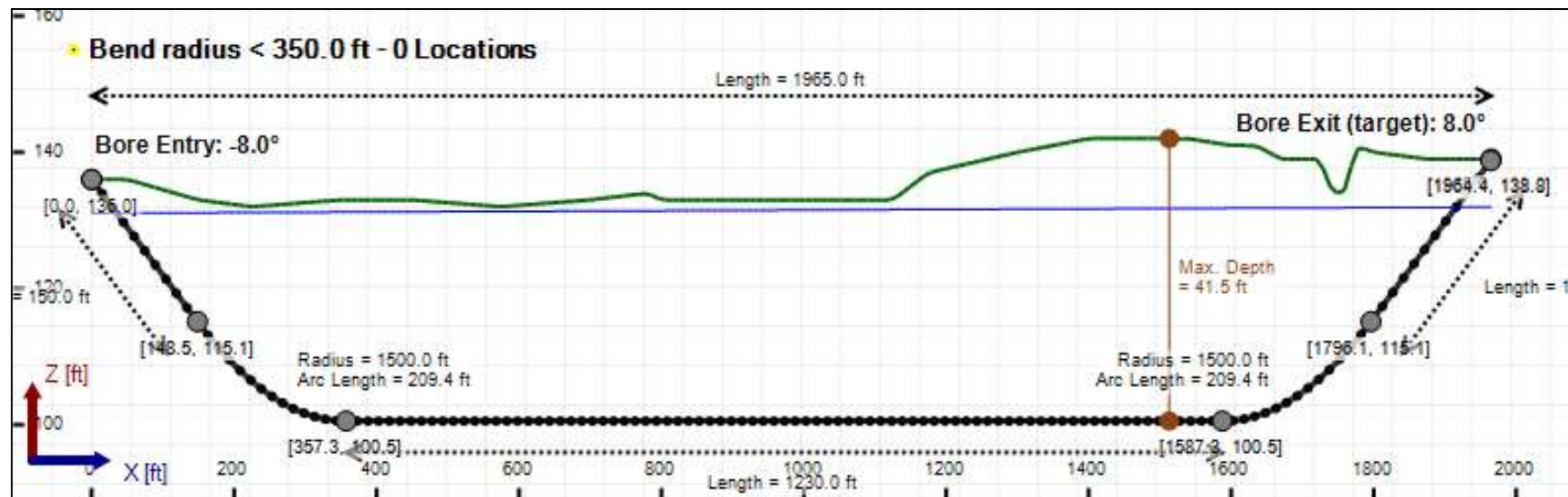
Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks

From Assistant

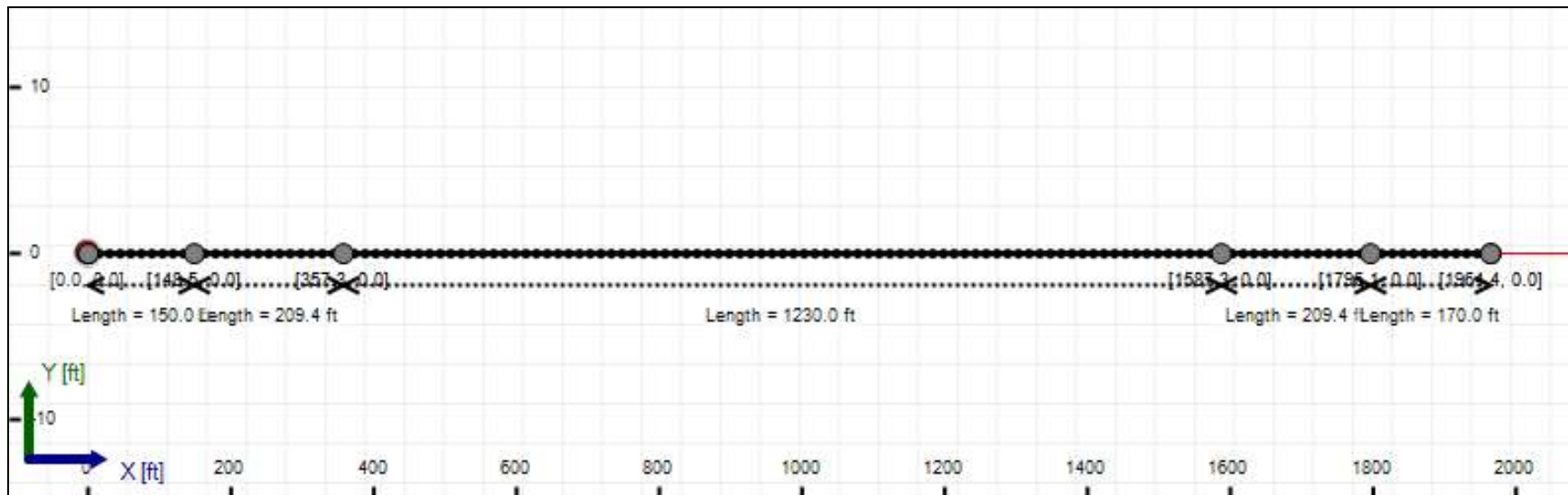
Unit Weight: 165.0000 (dry), 177.0000 (sat) [lb/ft3]

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

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Gas
Pipe Type: HDPE
Classification: IPS
Pipe OD: 10" (10.75")
Pipe DR: 9
Pipe Length: 1980.00 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	10.8	19.9
Water Pressure	13.4	13.5
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	24.1	33.4
Deflection		
Earth Load Deflection	2.944	5.418
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	3.076	5.550
Compressive Stress [psi]		
Compressive Wall Stress	108.5	150.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	30586.0	30586.0
Pullback Stress [psi]	853.0	853.0
Pullback Strain	1.483E-2	1.483E-2
Bending Stress [psi]	0.0	17.2
Bending Strain	0	2.986E-4
Tensile Stress [psi]	853.0	863.8
Tensile Strain	1.483E-2	1.532E-2

Net External Pressure = 25.0 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.076	7.5	2.4	OK
Unconstrained Collapse [psi]	25.9	104.9	4.1	OK
Compressive Wall Stress [psi]	108.5	1150.0	10.6	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.8	201.9	5.6	OK
Tensile Stress [psi]	863.8	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	9.50 in	114.800 psi	107.704 psi
1	9.50 in	14.00 in	114.128 psi	106.581 psi
2	14.00 in	16.13 in	113.735 psi	105.923 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): 80.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft³

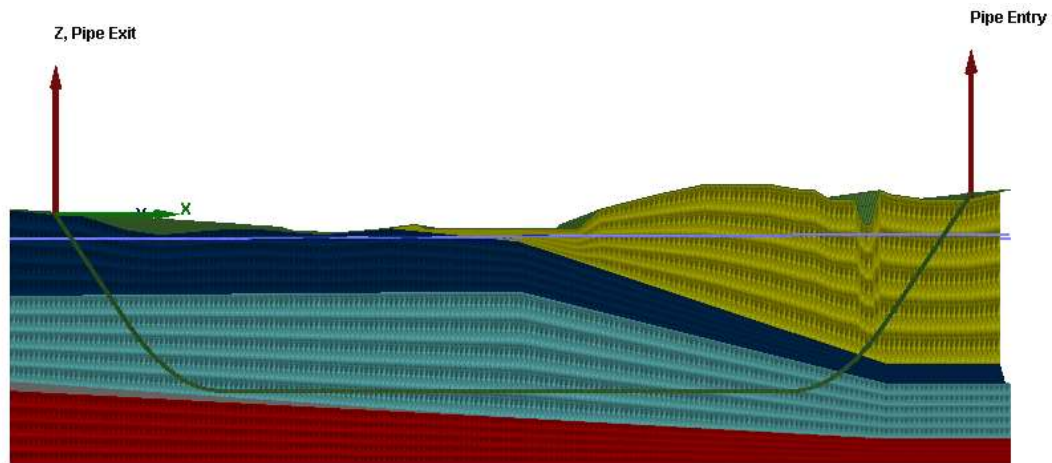
Rheological model: Bingham-Plastic

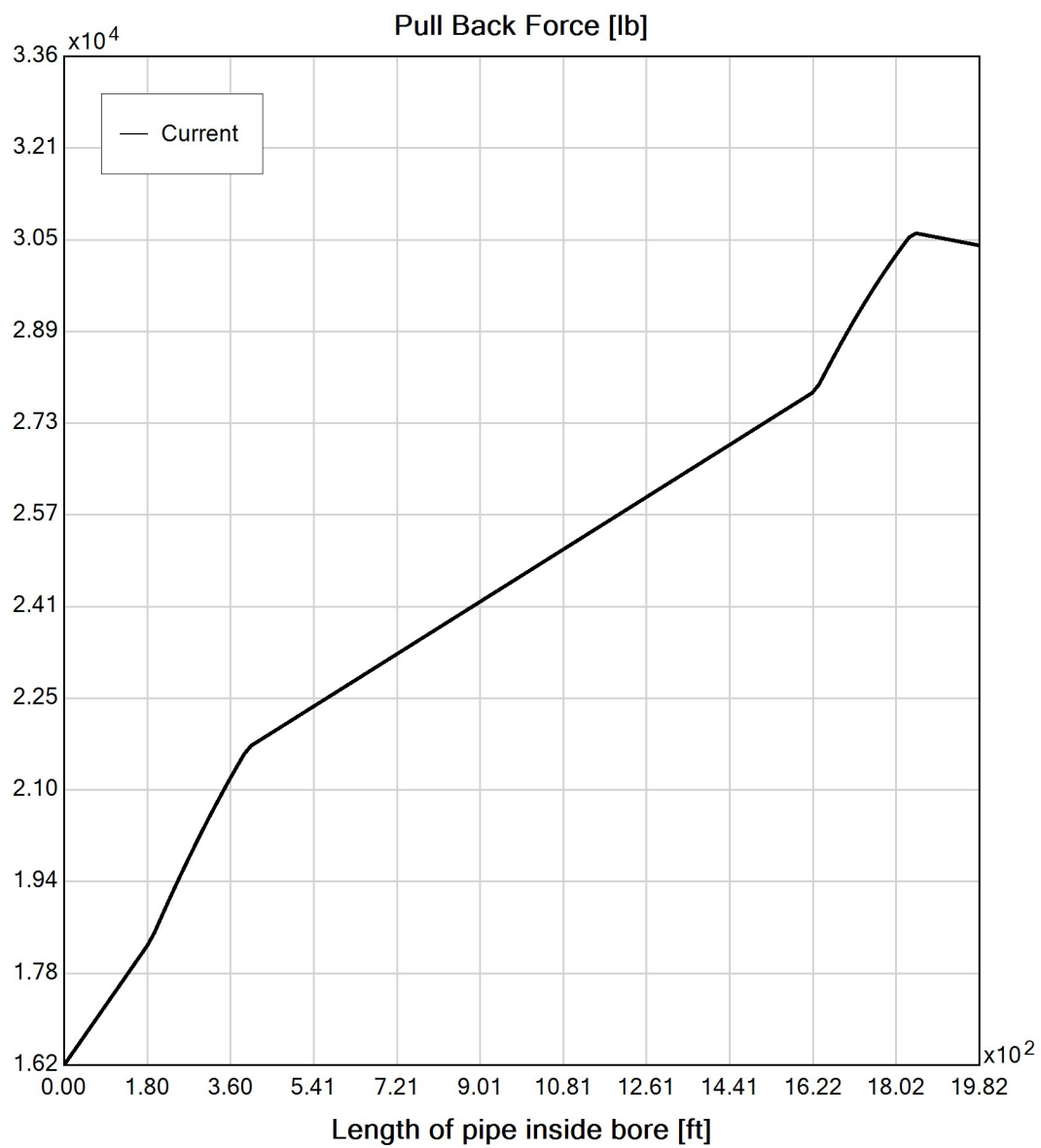
Plastic Viscosity (PV): 25.53

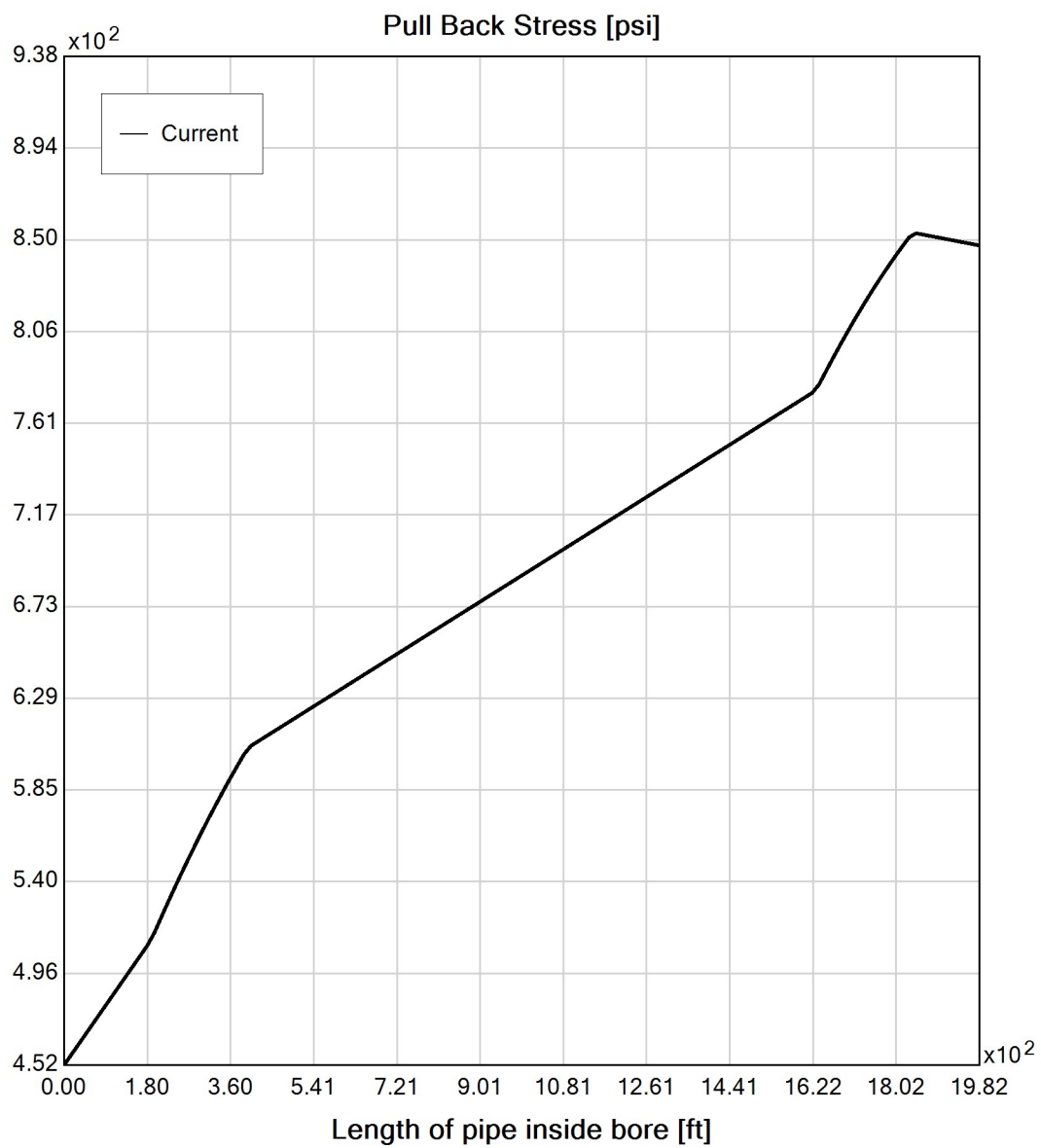
Yield Point (YP): 16.49

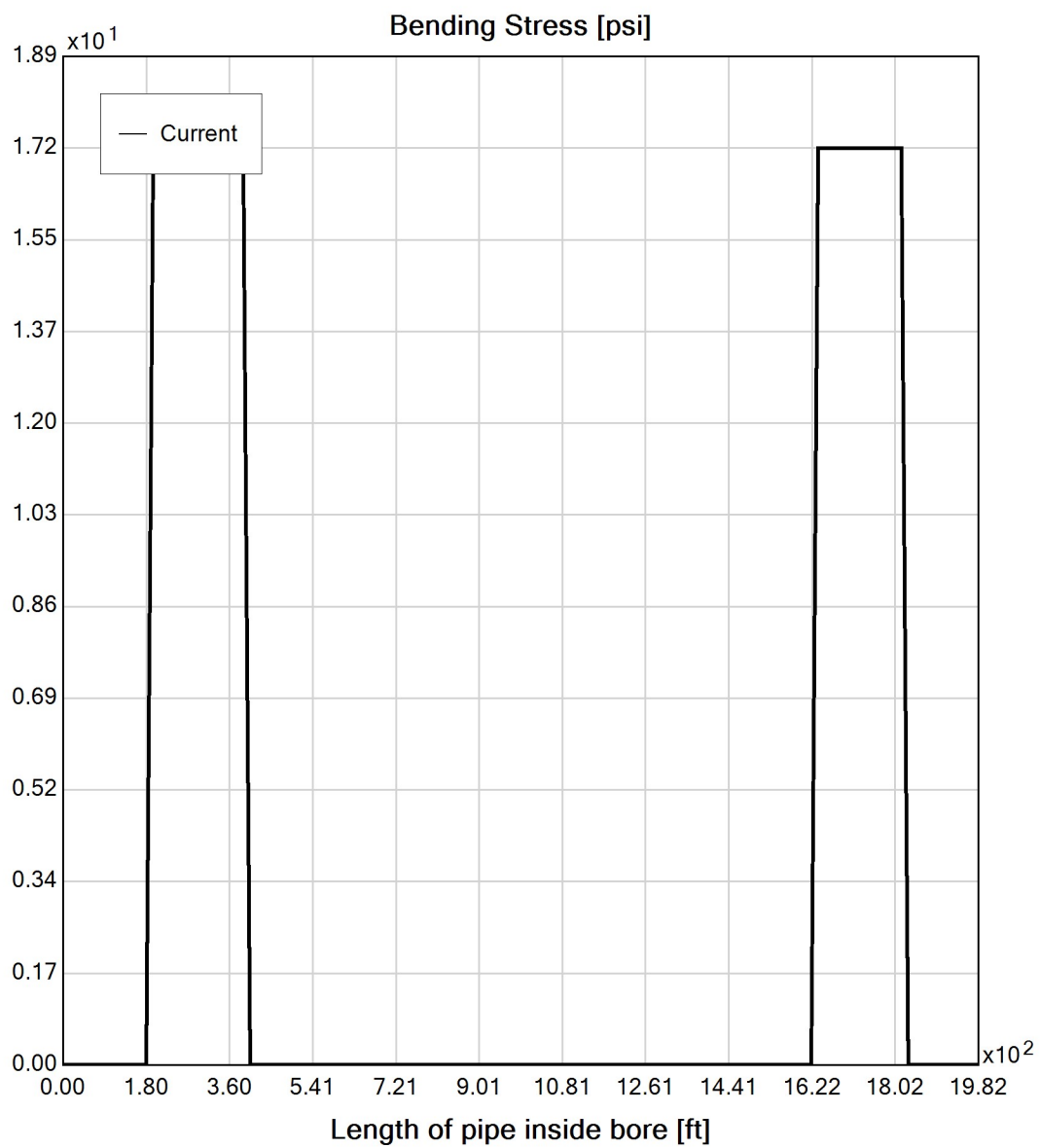
Effective Viscosity (cP): 1207.7

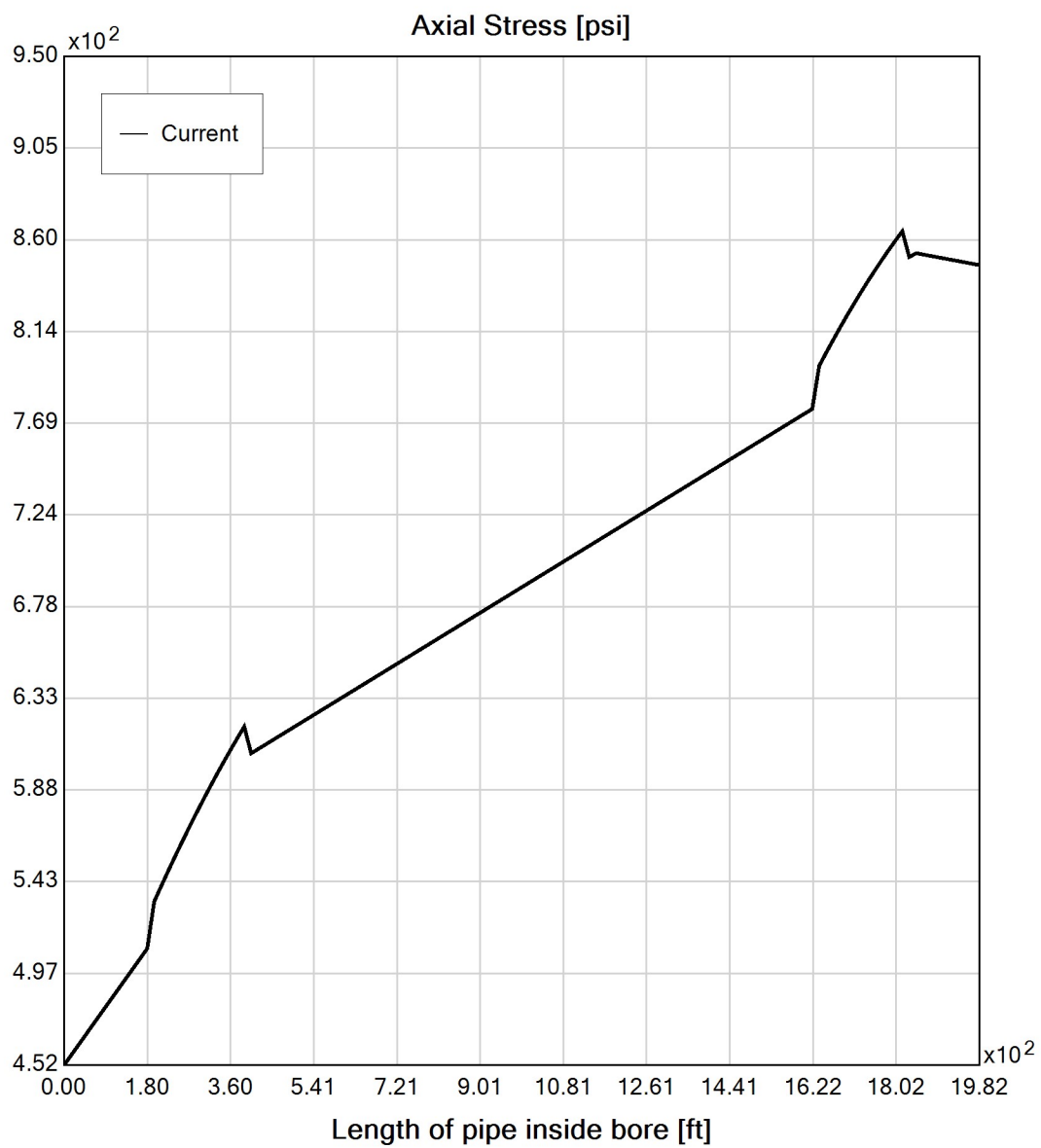
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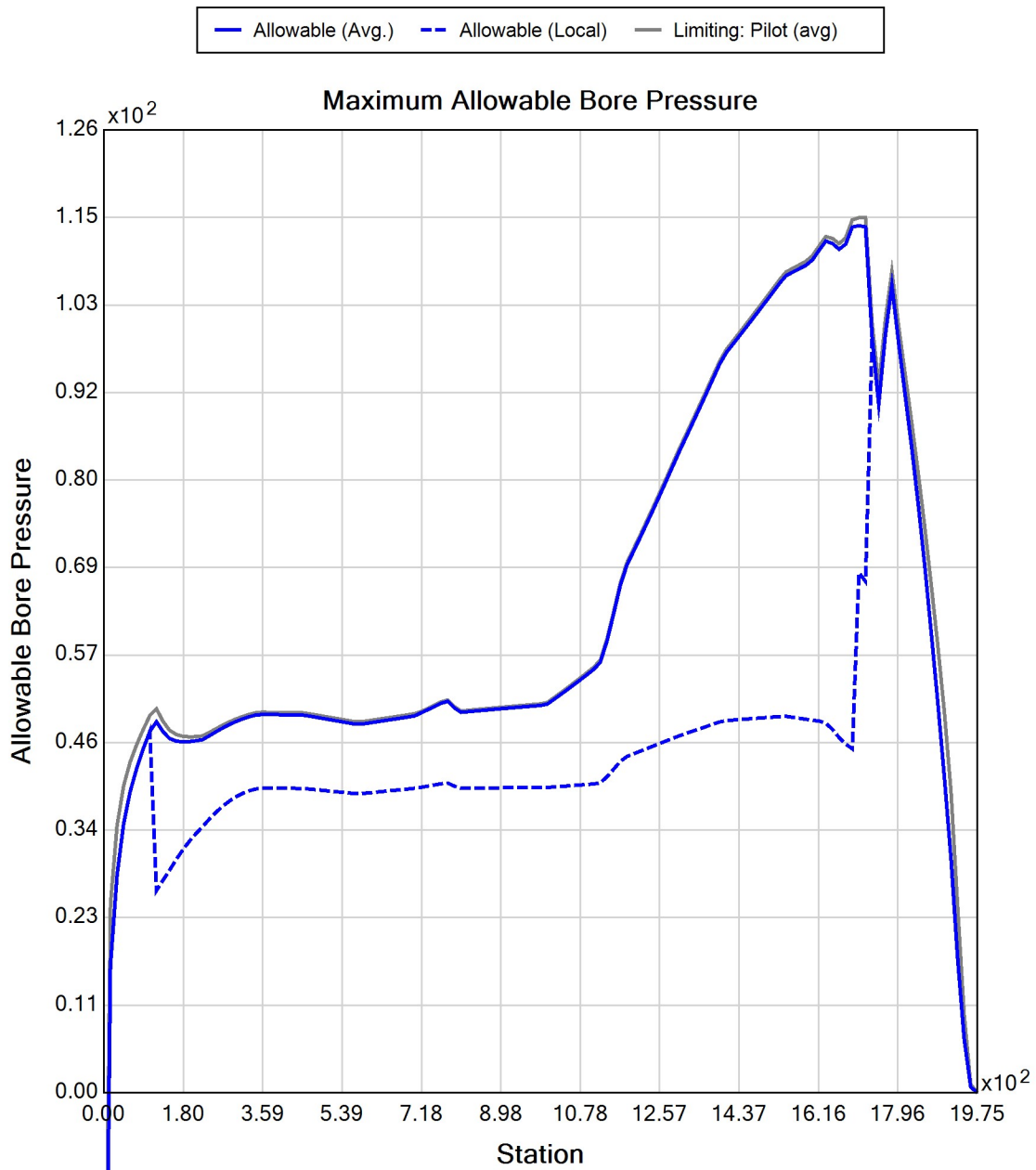


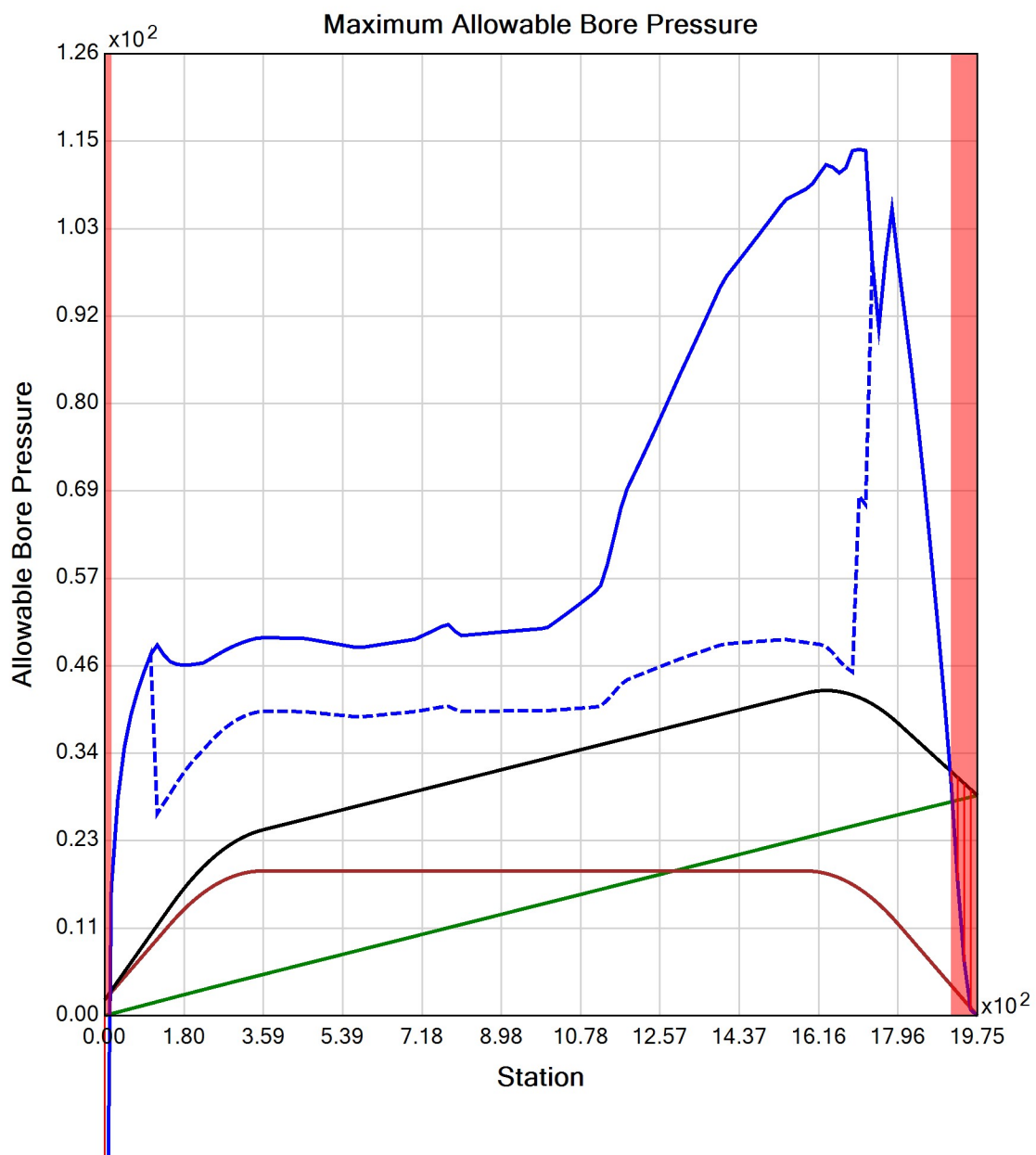














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Input Summary

Start Coordinate	(0.00, 0.00, 136.00) ft
End Coordinate	(1965.00, 0.00, 139.00) ft
Project Length	1965.00 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: Gas
Pipe Type: HDPE
Classification: IPS
Pipe OD: 2" (2.375")
Pipe DR: 9
Pipe Length: 1980.00 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	10.8	19.9
Water Pressure	13.4	13.5
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	24.1	33.4
Deflection		
Earth Load Deflection	2.944	5.418
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	2.973	5.448
Compressive Stress [psi]		
Compressive Wall Stress	108.5	150.5

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1602.5	1602.5
Pullback Stress [psi]	915.6	915.6
Pullback Strain	1.592E-2	1.592E-2
Bending Stress [psi]	0.0	3.8
Bending Strain	0	6.597E-5
Tensile Stress [psi]	915.6	915.6
Tensile Strain	1.592E-2	1.595E-2

Net External Pressure = 25.0 [psi]

Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.973	7.5	2.5	OK
Unconstrained Collapse [psi]	25.9	105.8	4.1	OK
Compressive Wall Stress [psi]	108.5	1150.0	10.6	OK

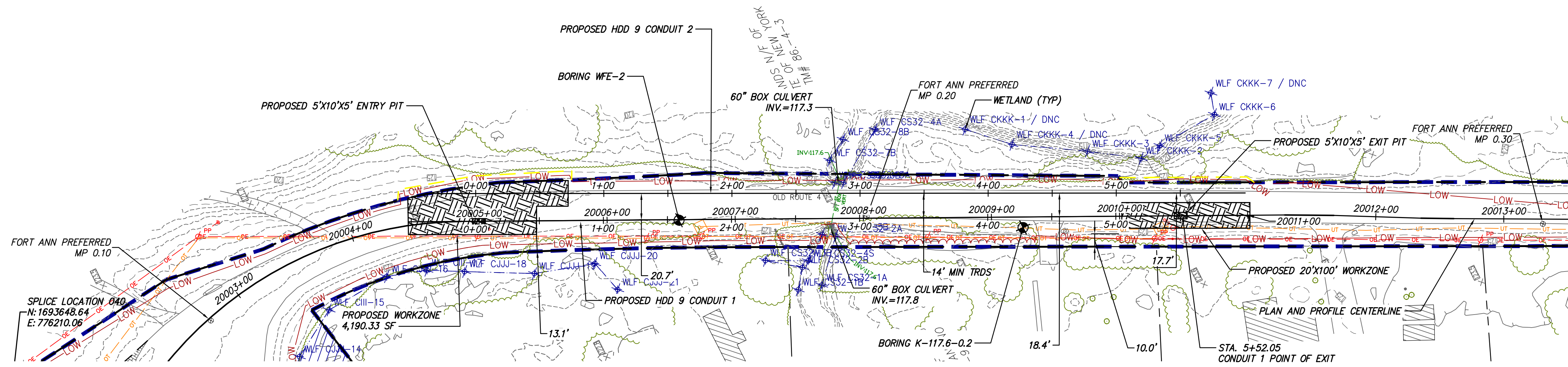
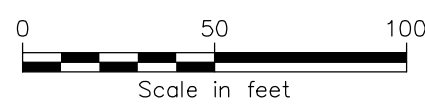
Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	35.8	198.8	5.5	OK
Tensile Stress [psi]	915.6	1200.0	1.3	OK

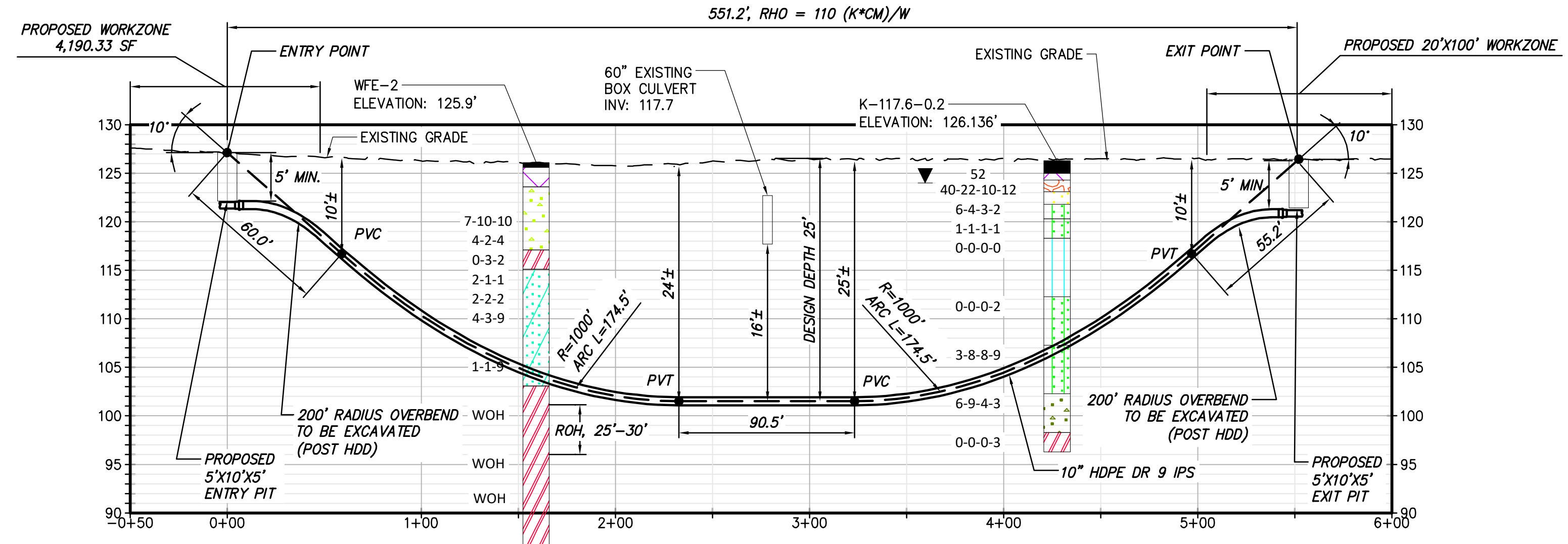
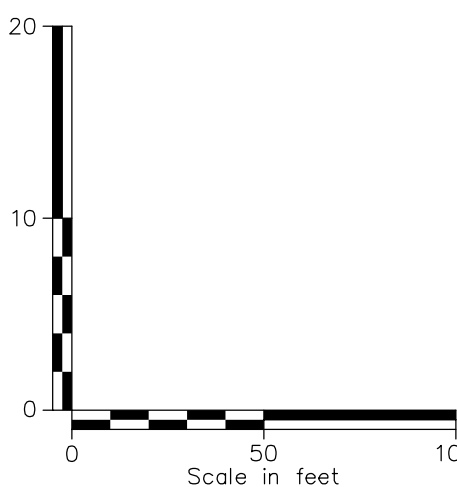
Appendix E

HDD Design Drawings

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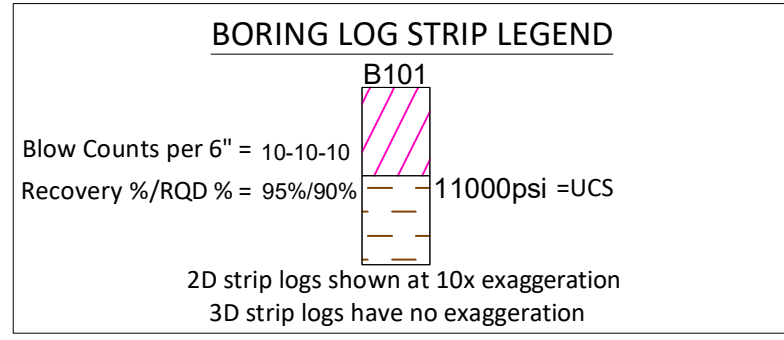


PROPOSED HDD 9 PLAN VIEW
CONDUIT 1



PROPOSED HDD 9 PROFILE
CONDUIT 1

NOTE:
1) DRIVEWAY ACCESS MUST BE MAINTAINED DURING CONSTRUCTION FOR HOMES ON ROUTE 4 PER THE MPT PLAN AND NOTES, C-500 SERIES.



Legend		
	ASPHALT	Asphalt
	Bedrock	Bedrock
	Boulder	Boulder
	CH	Fat CLAY
	CH-MH	SILTY Fat CLAY
	CL	Lean CLAY
	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	FILL	FILL
	GC	CLAYEY GRAVEL
	GC-GM	SILTY CLAYEY GRAVEL
	GM	SILTY GRAVEL
	GP	Poorly Graded GRAVEL
	GP-GC	Poorly Graded Gravel with CLAY
	GP-GM	Poorly Graded GRAVEL with SILT
	GW	Well Graded GRAVEL
	GW-GC	Well Graded GRAVEL with CLAY
	GW-GM	Well Graded GRAVEL with SILT
	Limestone	Limestone
	MH	Elastic SILT
	ML	SILT
	OH	ORGANIC Fat CLAY
	OL	ORGANIC Lean CLAY
	OL/OH	ORGANIC SOIL
	PT	PEAT
	Rock	Rock
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
	SILTSTONE	Siltstone
	SM	SILTY SAND
	SP	Poorly Graded SAND
	SP-SC	Poorly Graded SAND with CLAY
	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	SW-SM	Well Graded SAND with CLAY
	SW-SM	Well Graded SAND with SILT
	Topsail	Topsail
	USGS 601	Gravel or Conglomerate 1
	USGS 654	Subgrslywacke
	USGS 670	Interbedded Sandstone and Shale
	USGS 702	Quartzite
	USGS 705	Schist
	USGS 705	Schist
	USGS 708	Gneiss
	USGS 708	Gneiss
	USGS 718	Granite 1
	Void	Void
	Water	Water
	Weathered Rock	Undefined
	Water Table	Water Table during drilling
	Delayed Water Table	Water Table after drilling



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	12/18/2022	FINAL EM&CP SUBMISSION	MCS	JEO
No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP

CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 3 - PACKAGE 2 - FORT ANN TO KINGSBURY
PLAN AND PROFILE - HDD 9, CONDUIT 1

DRAWN BY: SK DESIGNED BY: SK APPROVED BY: JEO SCALE AS NOTED DATE 12/16/2022

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO. C-301
DATE 12/16/2022

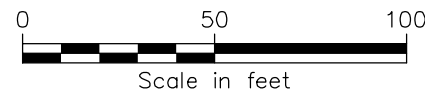
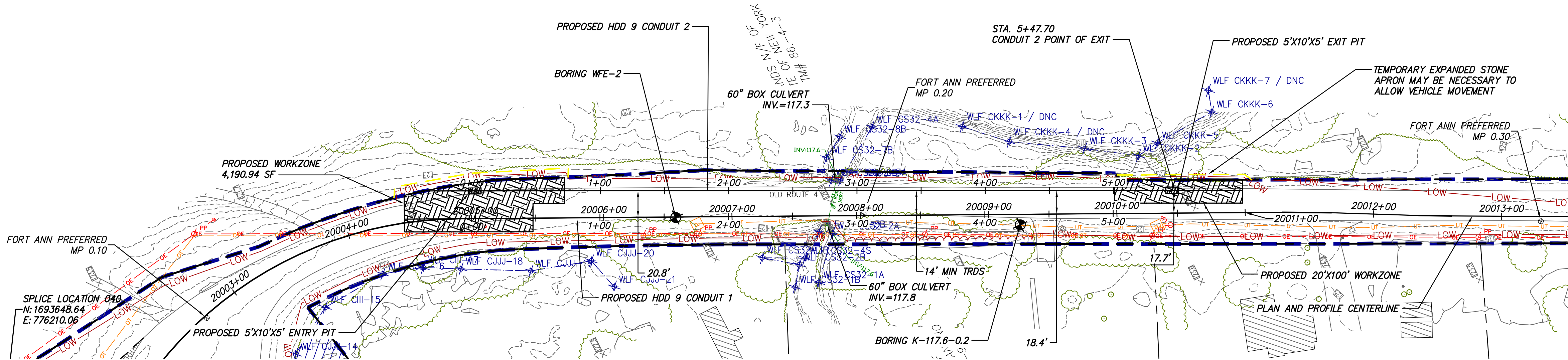
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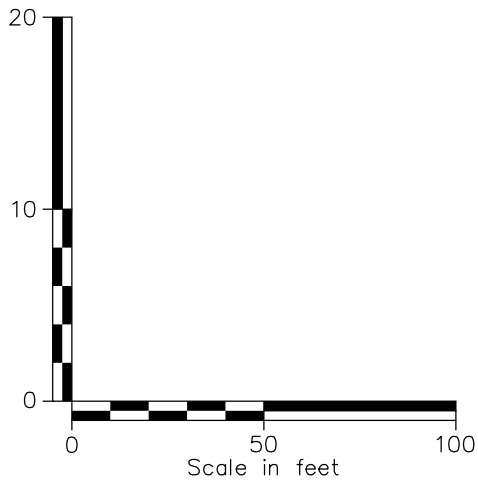
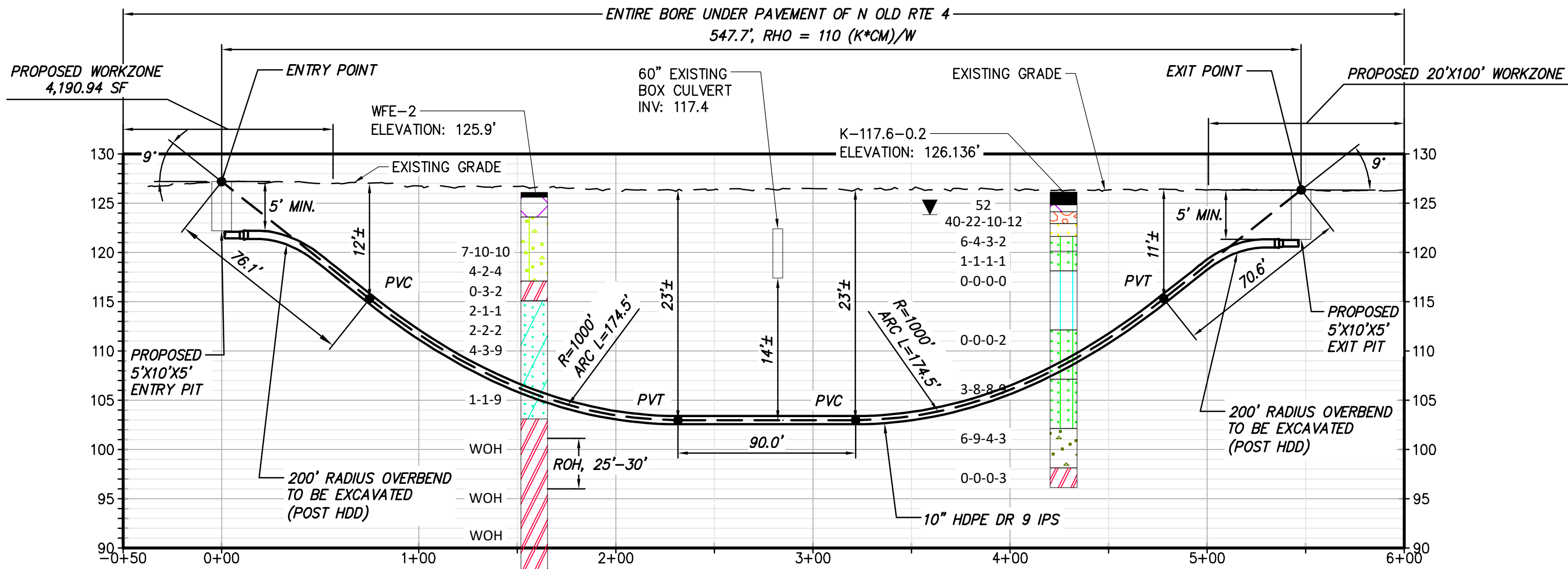
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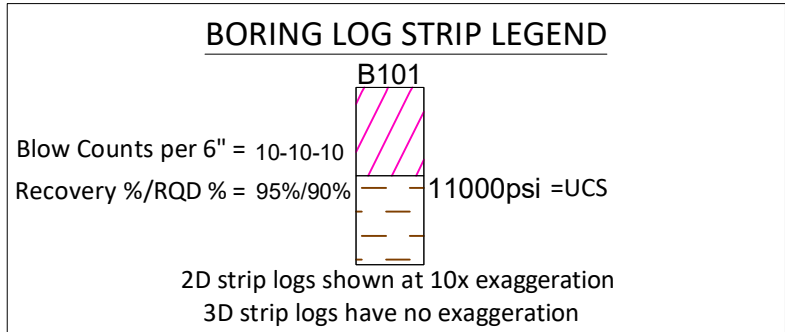


PROPOSED HDD 9 PLAN VIEW
CONDUIT 2



PROPOSED HDD 9 PROFILE
CONDUIT 2

NOTE:
1) DRIVEWAY ACCESS MUST BE MAINTAINED DURING CONSTRUCTION FOR HOMES ON ROUTE 4 PER THE MPT PLAN AND NOTES, C-500 SERIES.



Legend		
	ASPHALT	Asphalt
	Bedrock	Bedrock
	Boulder	Boulder
	CH	Fat CLAY
	CH-MH	SILTY Fat CLAY
	CL	Lean CLAY
	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	FILL	FILL
	GC	CLAYEY GRAVEL
	GC-GM	SILTY CLAYEY GRAVEL
	GM	SILTY GRAVEL
	GP	Poorly Graded GRAVEL
	GP-GC	Poorly Graded Gravel with CLAY
	GP-GM	Poorly Graded GRAVEL with SILT
	GW	Well Graded GRAVEL
	GW-GC	Well Graded GRAVEL with CLAY
	GW-GM	Well Graded GRAVEL with SILT
	Limestone	Limestone
	MH	Elastic SILT
	ML	SILT
	OH	ORGANIC Fat CLAY
	OL	ORGANIC Lean CLAY
	OL/OH	ORGANIC SOIL
	PT	PEAT
	Rock	Rock
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
	SILTSTONE	Siltstone
	SM	SILTY SAND
	SP	Poorly Graded SAND
	SP-SC	Poorly Graded SAND with CLAY
	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	SW-SC	Well Graded SAND with CLAY
	SW-SM	Well Graded SAND with SILT
	Topsoll	Topsoll
	USGS 601	Gravel or Conglomerate 1
	USGS 654	Subgryswacke
	USGS 670	Interbedded Sandstone and Shale
	USGS 702	Quartzite
	USGS 705	Schist
	USGS 705	Schist
	USGS 708	Gneiss
	USGS 708	Gneiss
	USGS 718	Granite 1
	Void	Void
	Water	Water
	Weathered Rock	Undefined
	Water Table	Water Table during drilling
	Delayed Water Table	Water Table after drilling



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.

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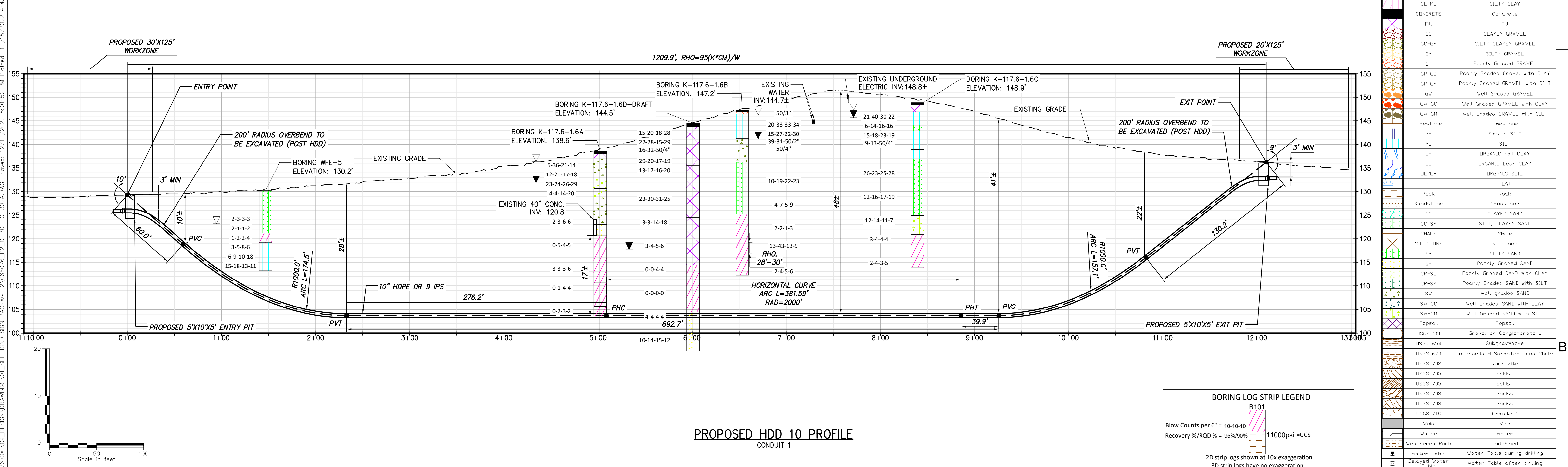
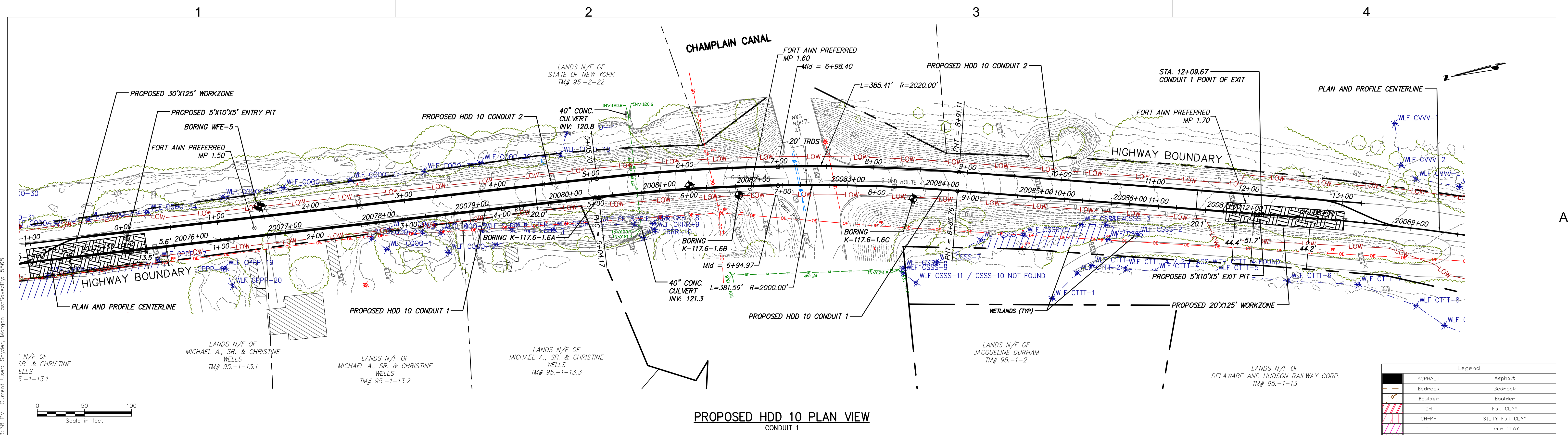
CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 3 - PACKAGE 2 - FORT ANN TO KINGSBURY
PLAN AND PROFILE - HDD 9, CONDUIT 2




DRAWN BY: SK DESIGNED BY: SK APPROVED BY: JEO SCALE AS NOTED REV. NO. X

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO.

C-301A

DATE 12/16/2022





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CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 3 - PACKAGE 2 - FORT ANN TO KINGSBURY
PLAN AND PROFILE - HDD 10, CONDUIT 1

DRAWN BY:

DESIGNED BY:

APPROVED BY:

MCS

MCS

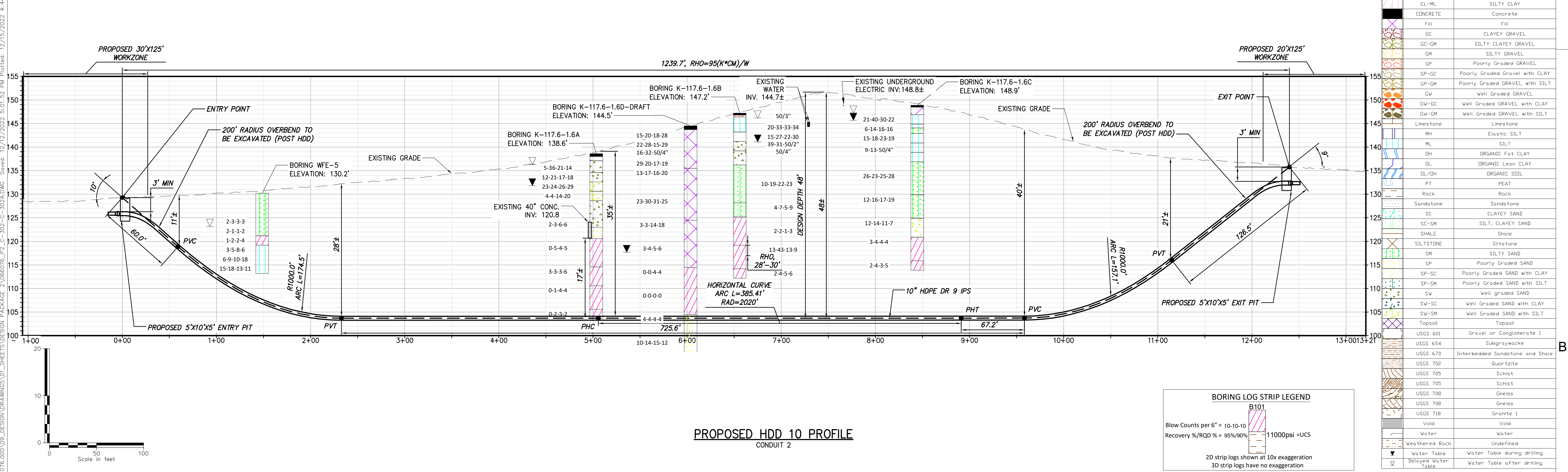
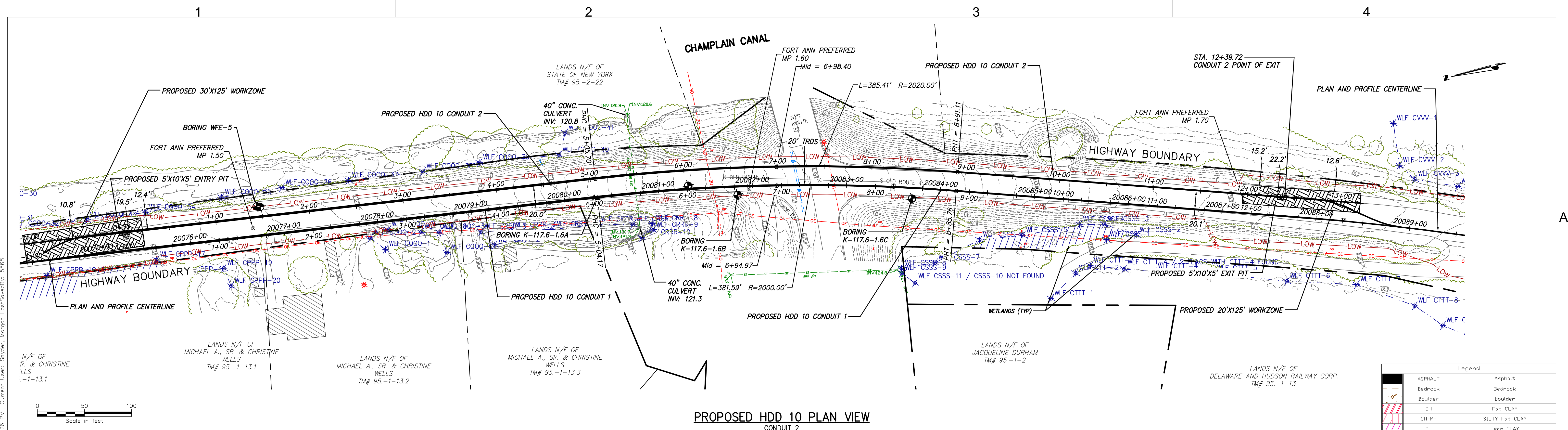
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SCALE

AS NOTED

DATE

12/16/2022





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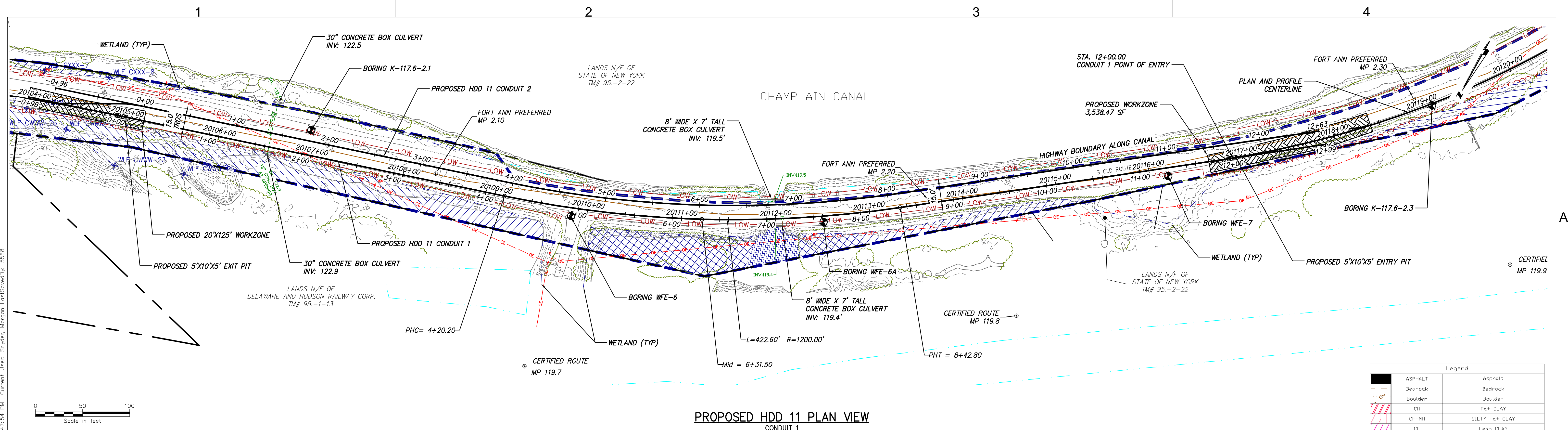
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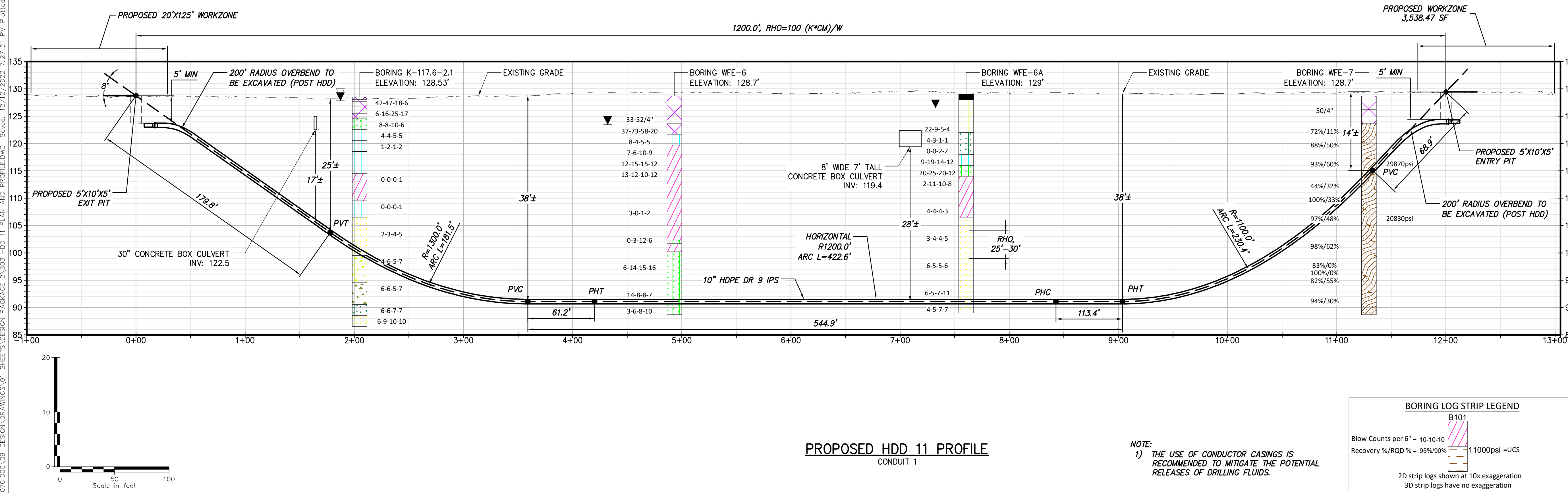
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CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 3 - PACKAGE 2 - FORT ANN TO KINGSBURY
PLAN AND PROFILE - HDD 10, CONDUIT 2

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 068076
DRAWING NO. **C-302A**

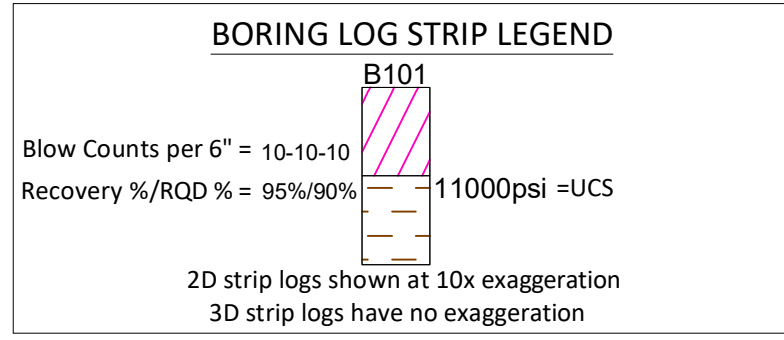


PROPOSED HDD 11 PLAN VIEW
CONDUIT 1




PROPOSED HDD 11 PROFILE
CONDUIT 1


NOTE:
1) THE USE OF CONDUCTOR CASINGS IS
RECOMMENDED TO MITIGATE THE POTENTIAL
RELEASES OF DRILLING FLUIDS.




Legend	
ASPHALT	Asphalt
Bedrock	Bedrock
Boulder	Boulder
CH	Fat CLAY
CH-MH	SILTY Fat CLAY
CL	Lean CLAY
CL-ML	SILTY CLAY
CONCRETE	Concrete
FILL	FILL
GC	CLAYEY GRAVEL
GC-GM	SILTY CLAYEY GRAVEL
GM	SILTY GRAVEL
GP	Poorly Graded GRAVEL
GP-GC	Poorly Graded Gravel with CLAY
GP-GM	Poorly Graded GRAVEL with SILT
GW	Well Graded GRAVEL
GW-GC	Well Graded GRAVEL with CLAY
GW-GM	Well Graded GRAVEL with SILT
Limestone	Limestone
MH	Elastic SILT
ML	SILT
OH	ORGANIC Fat CLAY
DL	ORGANIC Lean CLAY
DL/OH	ORGANIC SOIL
PT	PEAT
Rock	Rock
Sandstone	Sandstone
SC	CLAYEY SAND
SC-SM	SILT, CLAYEY SAND
SHALE	Shale
SILTSTONE	Siltstone
SM	SILTY SAND
SP	Poorly Graded SAND
SP-SC	Poorly Graded SAND with CLAY
SP-SM	Poorly Graded SAND with SILT
SW	Well graded SAND
SW-SC	Well Graded SAND with CLAY
SW-SM	Well Graded SAND with SILT
Topsoil	Topsoil
USGS 601	Gravel or Conglomerate 1
USGS 654	Subgraywacke
USGS 670	Interbedded Sandstone and Shale
USGS 702	Quartzite
USGS 705	Schist
USGS 708	Gneiss
USGS 708	Gneiss
USGS 718	Granite 1
Void	Void
Water	Water
Weathered Rock	Undefined
Water Table	Water Table during drilling
Delayed Water Table	Water Table after drilling



Champlain Hudson
Power Express



Kiewit



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CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 3 - PACKAGE 2 - FORT ANN TO KINGSBURY
PLAN AND PROFILE - HDD 11, CONDUIT 1

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 068076
DRAWING NO. C-303

SCALE AS NOTED
DATE 12/16/2022

