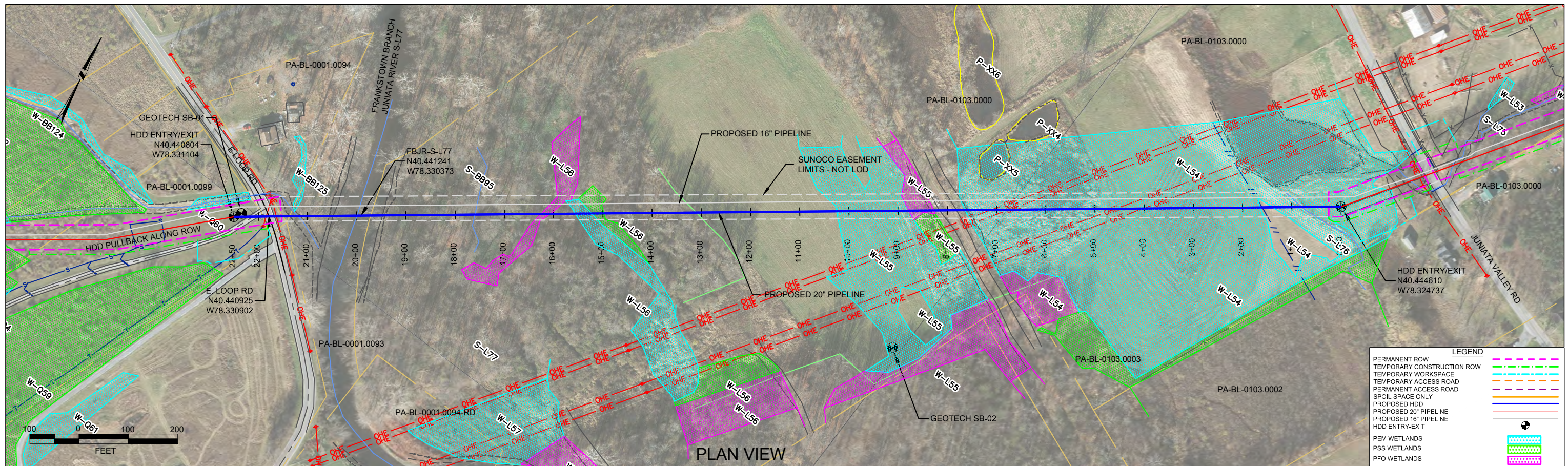


HDD PA-BL-0001.0094-WX (S-BB92) (S-L77) (S-BB95) (W-L56) (W-L55) (W-L54) (S-L76)

Given the design, the threat of inadvertent return has been reduced to the maximum extent practicable and in this case that threat is considered to be *medium*. Implementing this design, along with adherence to the Pennsylvania Pipeline Project Inadvertent Return Contingency Plan will ensure inadvertent impacts, if they were to occur, are also minimized to the maximum extent.

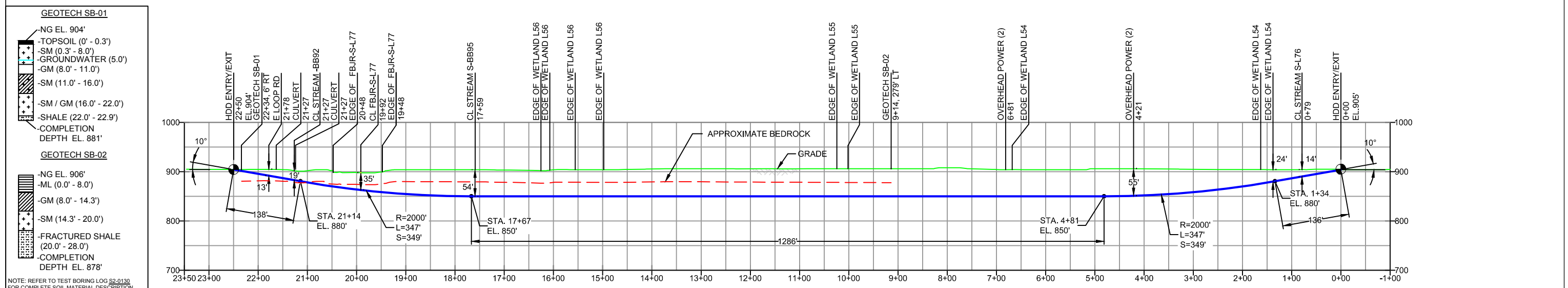
The drill will enter/exit 130 feet from the edge of the western most boundary of the stream S-BB92. The drill will travel beneath stream S-BB92 for 7 feet. Using the results of the geotechnical investigation, as well as several other data points, the entry/exit, angles, and depths have been configured to pass through the best substrates while maintaining pipe integrity (e.g., no large bends). The majority of the substrate that will be passed through is estimated to be decomposed shale, weathered to a silty fine to medium sand and gravel. The drill will continue beneath the eastern most boundary of the stream S-BB92 and will travel 110 feet from the eastern most edge of stream S-BB92 to the western most edge of stream S-L77. The drill will pass 55 feet under the stream S-L77. The majority of the substrate that will be passed through is estimated to be partially weathered shale. The drill will travel from the eastern most edge of stream S-L77 for 180 feet to the western most boundary of stream S-BB95. The drill will pass 8 feet under stream S-BB95. The majority of the substrate that will be passed through is estimated to be partially weathered shale. The drill will travel from the eastern most edge of stream S-BB95 for 130 feet to the western most boundary of wetland W-L56. The drill will travel 130 feet under wetland W-L56. The majority of the substrate that will be passed through is estimated to be partially weathered shale. The drill will travel from the eastern most edge of stream W-L56 for 450 feet to the western most boundary of wetland W-L55. The drill will travel 200 feet under wetland W-L55. The majority of the substrate that will be passed through is estimated to be partially weathered shale. The drill will travel from the eastern most edge of stream W-L55 for 60 feet to the western most boundary of wetland W-L54. The drill will travel 685 feet under wetland W-L54. The majority of the substrate that will be passed through is estimated to be partially weathered shale to highly fractured gray shale. The drill will travel under stream S-L76 for 7 feet. The majority of the substrate that will be passed through is estimated to be partially weathered shale to highly fractured gray shale. The drill will continue to travel for 96 feet under wetland W-L54 where it will enter/exit at the eastern most edge of wetland W-L54. The majority of the substrate that will be passed through is estimated to be highly fractured gray shale. The drill will travel 330 feet from the eastern most edge of stream W-L54 where it will enter/exit.

The medium designation for risk of inadvertent returns is based on a few factors. The drill will be travelling through fractured shale with layers of medium sand and fine to coarse gravel above which may allow the drilling fluid to reach the surface. The eastern entry/exit of the drill is within the wetland L54 where the drilling fluid could permeate the surface more readily. As such it is recommended that additional inspection in the area surrounding the drill be in place to monitor for potential inadvertent returns along the drill.



BLAIR COUNTY, PENNSYLVANIA - FRANKSTOWN TOWNSHIP
S2-0130

PROFILE VIEW



NOTE: REFER TO TEST BORING LOG S2-0130 FOR COMPLETE SOIL MATERIAL DESCRIPTION

- DESIGN AND CONSTRUCTION:**
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L)=2250'
HDD PIPE LENGTH (S)=2258'
20" x 0.456" W.T., X-65, API 5L PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE R95)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED.
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER.
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
 - SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
 - SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

NOTES

- ALL COORDINATES SHOWN ARE IN LATITUDE AND LONGITUDE. ALL MSL ELEVATIONS ARE NAD83
- STATIONING IS BASED ON HORIZONTAL DISTANCES.
- ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP ARE NOT RESPONSIBLE FOR LOCATION OF FOREIGN UTILITIES SHOWN IN PLOT PLAN OR PROFILE. THE INFORMATION SHOWN HEREON IS FURNISHED WITHOUT LIABILITY ON THE PART OF ROONEY ENGINEERING, INC. AND SUNOCO PIPELINE, LP. FOR ANY DAMAGES RESULTING FROM ERRORS OR OMISSIONS THEREIN.
- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
- SUNOCO EMERGENCY HOTLINE NUMBER IS 1-800-786-7440.

REF. DRAWING	NO.	DESCRIPTION
ES-3.44	TO ES-3.46	EROSION & SEDIMENT PLAN
SHEET 29	TO SHEET 29	AERIAL SITE PLAN
DWG NO	DWG NO	DESCRIPTION

REVISIONS	NO.	DESCRIPTION
DLM	09/30/16	RMB 09/30/16 AAW 09/30/16
DLM	05/18/16	MRS 05/18/16 AAW 05/18/16
MRS	11/23/15	RMB 11/23/15 AAW 11/23/15
MRS	09/03/15	RMB 09/03/15 AAW 09/03/15
JAM	07/31/15	RMB 07/31/15 AAW 07/31/15
RTT	3/19/15	RMB 3/19/15 AAW 3/19/15
BY	DATE	CHK DATE APP DATE

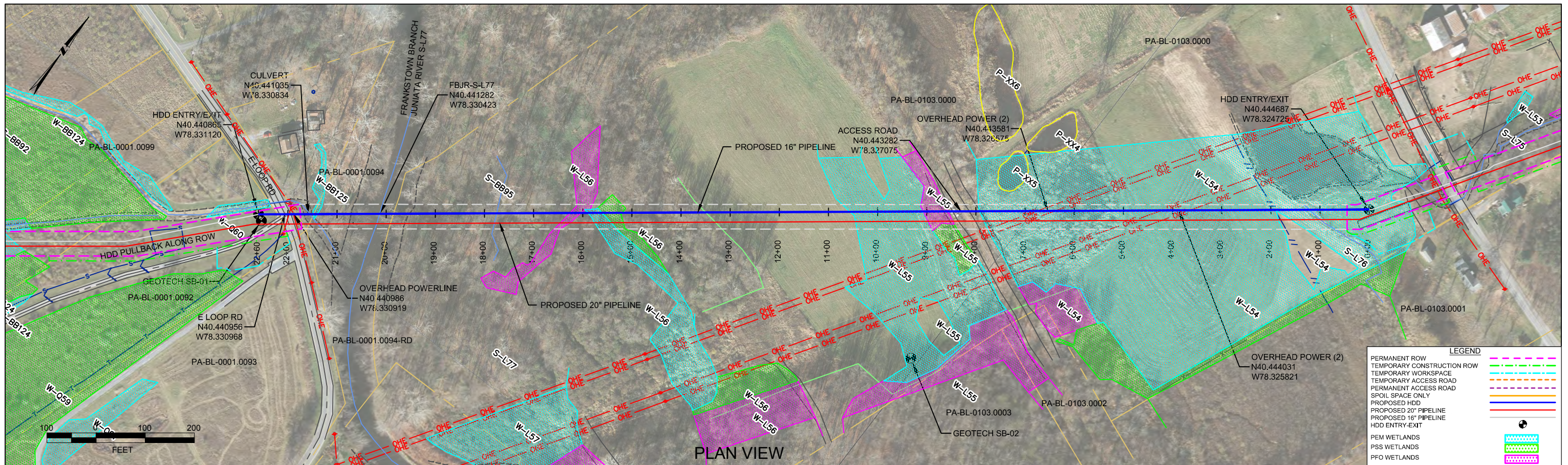
Sunoco Logistics Partners L.P.

Tetra Tech Rooney
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
FRANKSTOWN BRANCH JUNIATA RIVER
PENNSYLVANIA PIPELINE PROJECT

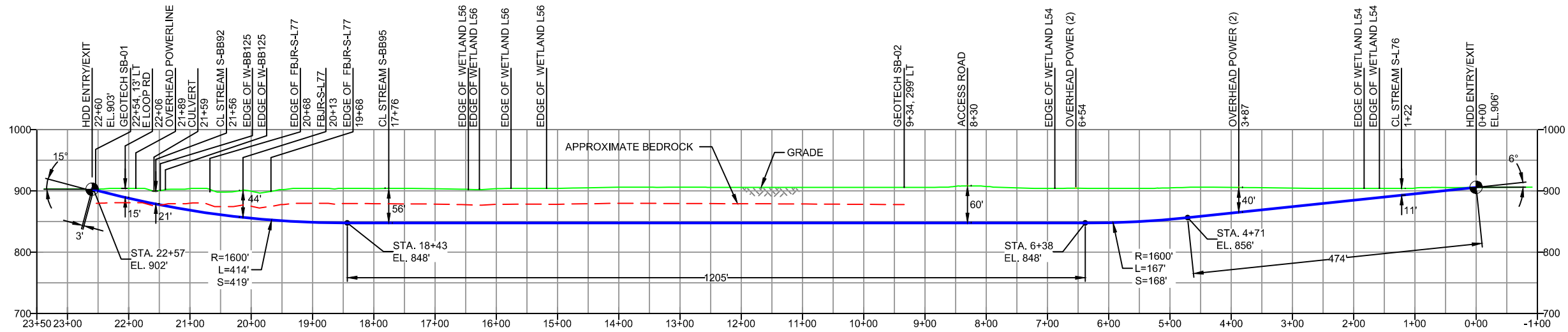
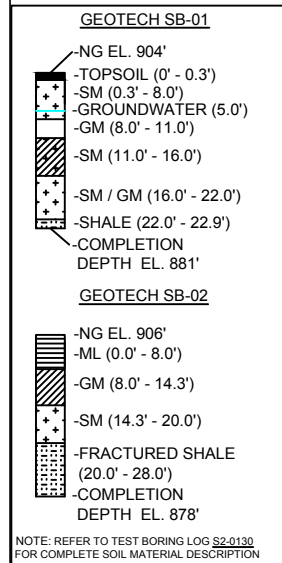
SCALE: 1"=200'
DWG. NO: PA-BL-0001.0094-WX



PLAN VIEW

BLAIR COUNTY, PENNSYLVANIA - FRANKSTOWN TOWNSHIP
S2-0130-16

PROFILE VIEW



- DESIGN AND CONSTRUCTION:
- CONTRACTOR SHALL FIELD VERIFY DEPTH OF ALL EXISTING UTILITIES SHOWN OR NOT SHOWN ON THIS DRAWING.
 - THE MINIMUM SEPARATION DISTANCE FROM EXISTING SUBSURFACE UTILITIES SHALL NOT BE LESS THAN 10 FEET AS MEASURED FROM THE OUTSIDE EDGE OF THE UTILITY TO OUTSIDE OF PROPOSED PIPELINE.
 - DESIGNED IN ACCORDANCE WITH CFR 49 195 & ASME B31.4
 - CROSSING PIPE SPECIFICATION:
HDD HORZ. LENGTH (L-): 1788'
HDD PIPE LENGTH (S-): 1794'
16" x 0.438" W.T., X-70, API5L, PSL2, ERW, BFW
COATING: 14-16 MILS FBE WITH 30-35 MIL ARO (POWERCRETE R95)
 - INTERNAL DESIGN PRESSURE 1480 PSIG (SEAM FACTOR 1.0, DESIGN FACTOR 0.50).
 - INSTALLATION METHOD: HORIZONTAL DIRECTIONAL DRILL (HDD).
 - PIPELINE WARNING MARKERS SHALL BE INSTALLED ON BOTH SIDES OF ALL ROAD, RAILWAY, AND STREAM CROSSINGS.
 - CARRIER PIPE NOT ENCASED
 - PIPE / AMBIENT TEMPERATURE MUST BE NO LESS THAN 30°F DURING PULLBACK WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENGINEER
 - CONDUCT 4-HOUR PRE-INSTALLATION HYDROTEST OF HDD PIPE STRING TO MINIMUM 1850 PSIG.
 - SEE SUNOCO PENNSYLVANIA PIPELINE PROJECT ESRI WEBMAP FOR ACCESS ROAD ALIGNMENT.
 - SUNOCO PIPELINE, L.P.'S HORIZONTAL DIRECTIONAL DRILL INADVERTENT RETURN CONTINGENCY PLAN WILL BE IMPLEMENTED AT ALL TIMES.
 - SUNOCO PIPELINE, L.P.'S EROSION AND SEDIMENTATION CONTROL PLAN WILL BE IMPLEMENTED AT ALL TIMES.

NOTES

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- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL UTILITIES. CONTACT ONE CALL AT 811 PRIOR TO DIGGING.
- SUNOCO EMERGENCY HOTLINE NUMBER IS #1-800-786-7440.

REF. DRAWING	NO.	DESCRIPTION	NO.	DESCRIPTION	
ES-3.44	TO	ES-3.46	EROSION & SEDIMENT PLAN	EP2	REVISED PER PADEP COMMENTS RECIVED 09-06-16
SHEET 29	TO	SHEET 29	AERIAL SITE PLAN	EP1	REVISED PER PADEP COMMENTS
				EP	
				C	REDESIGN
				B	ADDED GEOTECH INFO
				A	ISSUED FOR BID

REVISIONS

BY	DATE	CHK	DATE	APP	DATE
DLM	10/07/16	RMB	10/07/16	AAW	10/07/16
DLM	05/18/16	RMB	05/18/16	AAW	05/18/16
MRS	03/15/16	RMB	03/15/16	AAW	03/15/16
MRS	10/08/15	RMB	10/08/15	AAW	10/08/15
MRS	09/03/15	RMB	09/03/15	AAW	09/03/15
MRS	08/31/15	RMB	08/31/15	AAW	08/31/15




SUNOCO PIPELINE, L.P.

16-INCH HORIZONTAL DIRECTIONAL DRILL
FRANKSTOWN BRANCH JUNIATA RIVER
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=200' DWG. NO: PA-BL-0001.0094-WX-16



LEGEND:

 Geotechnical Soil Boring (SB) Locations



TETRA TECH

GEOTECHNICAL BORING LOCATIONS
HDD S2-0130 E LOOP ROAD
BLAIR COUNTY, FRANKSTOWN TOWNSHIP, PA
SUNOCO PENNSYLVANIA PIPELINE PROJECT



TETRA TECH

240 Continental Drive, Suite 200
 Newark, Delaware 19713
 302.738.7551
 fax: 302.454.5988

TEST BORING LOG

Project Name: SUNOCO PENNSYLVANIA PIPELINE PROJECT			Project No.: 103IP3406		
Project Location: EAST LOOP ROAD, HOLLIDAYSBURG, PA			Page 1 of 1		
HDD No.: S2-0130		Dates(s) Drilled: 04-23-15		Inspector: E. WATT	
Boring No.: SB-01		Drilling Method: SPT - ASTM D1586		Driller: S. HOFFER	
Drilling Contractor: HAD DRILLING		Groundwater Depth (ft): 5.0		Total Depth (ft): 22.9	
Boring Location Coordinates:			40° 26' 27.043" N		78° 19' 51.865" W

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (ft)	Strata (USCS)	Description of Materials	6" Increment Blows *				N	
	From	To	From	To									
			0.0	0.3			TOPSOIL (4")						
1	3.0	5.0	0.3		15	SM	VARIEGATED BROWN FINE TO MEDIUM SAND WITH A LITTLE SILT, WITH A LITTLE FINE TO COARSE GRAVEL.	3	12	14	13		26
2	8.0	10.0	8.0		9	GM	FINE TO COARSE QUARTZ GRAVEL WITH SOME FINE TO COARSE SAND, AND SOME SILT.	6	10	7	7		17
3	13.0	13.5	11.0		5	SM	GRAY FINE TO MEDIUM SAND WITH SOME SILT, WITH A LITTLE FINE TO COARSE GRAVEL. (WEATHERED SHALE).	50/6"					>50
4	18.0	18.8	16.0		5	SM/GM	DECOMPOSED SHALE, WEATHERED TO A SILTY FINE TO MEDIUM SAND AND GRAVEL.	35	50/4"				>50
5	22.0	22.9	22.0	22.9	1		PARTIALLY WEATHERED SHALE.	4	50/5"				>50
							AUGUR REFUSAL AT 22'.						
							WET ON SPOON AT 5'.						
							WATER LEVEL THROUGH AUGERS AT 7'.						
							CAVED AT 11', WATER LEVEL ON CAVE AT 2.5'.						

Notes/Comments:
Pocket Pentrometer Testing

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
 N: Number of blows to drive spoon from 6" to 18" interval.



TETRA TECH

240 Continental Drive, Suite 200
Newark, Delaware 19713
302.738.7551
fax: 302.454.5988

TEST BORING LOG

Project Name: SUNOCO PENNSYLVANIA PIPELINE PROJECT				Project No.: 103IP3406			
Project Location: JUNIATA VALLEY ROAD, HOLLIDAYSBURG, PA				Page 1 of 1			
HDD No.: S2-0130		Dates(s) Drilled: 04-24-15		Inspector: E. WATT			
Boring No.: SB-02		Drilling Method: SPT - ASTM D1586		Driller: S. HOFFER			
Drilling Contractor: HAD DRILLING		Groundwater Depth (ft): SEE BELOW		Total Depth (ft): 28.0			
Boring Location Coordinates:				40° 26' 37.589" N		78° 19' 32.863" W	

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *				N
	From	To	From	To								
			0.0	0.0			TOPSOIL (<1")					
1	3.0	5.0	0.0		20	ML	MOTTLED BROWN AND GRAY SILT AND FINE TO MEDIUM SAND.	1	4	6	11	10
				8.0			(USCS: ML).					
2	8.0	10.0	8.0		13	GM	MULTICOLORED FINE TO COARSE GRAVEL WITH QUARTZ, AND	4	10	13	12	23
				14.3			MEDIUM TO COARSE SAND, WITH A LITTLE SILT.					
3	13.0	15.0	14.3		20	SM	REDDISH BROWN AND GRAY DECOMPOSED SHALE, WEATHERED TO	2	7	8	11	15
							A SILTY FINE TO MEDIUM SAND, SOME F-C GRAVEL. (USCS: SM).					
4	18.0	18.8			8		REDDISH BROWN AND GRAY DECOMPOSED SHALE, WEATHERED TO	11	50/5"			>50
				20.0			A SILTY FINE TO MEDIUM SAND, SOME F-C GRAVEL.					
							AUGER REFUSAL AT 20'.					
							ROCK CORING					
RUN 1	20.0	23.0	20.0		36	SHALE	HIGHLY FRACTURED GRAY SHALE	TCR: 100%, SCR: 22%, RQD: 0%				
RUN 2	23.0	28.0		28.0	60		HIGHLY FRACTURED GRAY SHALE	TCR: 100%, SCR: 17%, RQD: 0%				

Notes/Comments:
Pocket Pentrometer Testing
 S4: 2.75 TSF

Strata (USCS) Designations are approximated based on visual review, except where indicated in Description of Materials.

* Number of blows of 140 lb. Hammer dropped 30 in. required to drive 2 in. split-spoon sampler in 6 in. increments.
 N: Number of blows to drive spoon from 6" to 18" interval.

**GEOTECHNICAL LABORATORY TESTING SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0130 E Loop Road**

HDD No.	Test Boring No.	Sample No.	Depth of Sample (ft.)		Water Content, % (ASTM D2216)	Percent Silts/Clays, % (ASTM D1140)	Atterburg Limits (ASTM D4318)			USCS Classif. (ASTM D2487)
			From	To			Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	
S2-0130	SB-01	1	3.0	5.0	11.6	20.2	-	-	-	-
		2	8.0	10.0	18.3	24.3	-	-	-	-
		3	13.0	13.5	9.6	22.8	-	-	-	-
		4	18.0	18.8	5.7	28.7	NL	NP	NP	SM/GM
	SB-02	1	3.0	5.0	16.3	53.3	33	25	8	ML
		2	8.0	10.0	13.6	12.0	-	-	-	-
		3	13.0	15.0	11.4	42.1	30	24	6	SM
		4	18.0	18.8	14.0	34.8	-	-	-	-

Notes:

- 1) Sample depths based on feet below grade at time of exploration.

**ROCK CORE DESCRIPTION SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0130 E LOOP ROAD**

Location	Boring No.	Core Run	Core Depth (ft)		TCR (%)	SCR (%)	RQD (%)	Depth (ft)		Weathering	Classification	Bedding Thickness (ft)	Color	Discontinuity Data
			From	To				From	To					
S2-0130	SB-02	1	20	23	100	22	0	20	28	Heavily	Shale	Very thin beds, Massive formation	Light gray	Very broken up, nearly horizontal bedding; fractures along bedding surfaces, nearly horizontal
		2	23	28	100	17	0							

**REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0130 E Loop Road**

HDD No.	NAME	BORING NO.	REGIONAL GEOLOGY DESCRIPTION	GENERAL TOPOGRAPHIC SETTING	BEDROCK FORMATION	GENERAL ROCK TYPE	APPROX MAX FM THICKNESS (FT)	DEPTH TO ROCK (Ft bgs) based on nearby well drilling logs	NOTES / COMMENTS
S2-0130	E. Loop Rd.	SB-01	Brallier and Harrell Formations (undivided) - composed of interbedded light-gray, graded, siliceous siltstone beds and light-gray, hard, silty shales, sparsely fossiliferous.	Valley Floor	Brallier-Harrell	The beds of <u>Brallier</u> are mostly thin; however, the shales may be very thick. The <u>Harrell</u> Formation consists of well-bedded, fissile to very thin, gray to black silty shale with thin argillaceous limestone, calcareous shale, and limestone nodules at the base.	1,800 (Brallier)	11-30	Yields range from 5 to 20 gpm
		SB-02					100-200 (Harrell)		

Note : Source of well log data - <http://www.dcnr.state.pa.us/topogeo/groundwater/pagwis/records/index.htm>. All other sources as referenced in comments section.

FIELD DESCRIPTION AND LOGGING SYSTEM FOR SOIL EXPLORATION

GRANULAR SOILS

(Sand, Gravel & Combinations)

<u>Density</u>	<u>N (blows)*</u>
Very Loose	5 or less
Loose	6 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 or more

Particle Size Identification

Boulders	8 in. diameter or more
Cobbles	3 to 8 in. diameter
Gravel	Coarse (C) 3 in. to ¾ in. sieve
	Fine (F) ¾ in. to No. 4 sieve
Sand	Coarse (C) No. 4 to No. 10 sieve (4.75mm-2.00mm)
	Medium (M) No. 10 to No. 40 sieve (2.00mm – 0.425mm)
	Fine (F) No. 40 to No. 200 sieve (0.425 – 0.074mm)
Silt/Clay	Less Than a No. 200 sieve (<0.074mm)

Relative Proportions

<u>Description Term</u>	<u>Percent</u>
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS

(Silt, Clay & Combinations)

<u>Consistency</u>	<u>N (blows)*</u>
Very Soft	3 or less
Soft	4 to 5
Medium Stiff	6 to 10
Stiff	11 to 15
Very Stiff	16 to 30
Hard	31 or more

Plasticity

<u>Degree of Plasticity</u>	<u>Plasticity Index</u>
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	> 22

ROCK

(Rock Cores)

<u>Rock Quality Designation (RQD), %</u>	<u>Rock Quality Description</u>
0-25	Very Poor
25-50	Poor
50-75	Fair
75-90	Good
90-100	Excellent

***N - Standard Penetration Resistance.** Driving a 2.0" O.D., 1-3/8" I.D. sampler a distance of 18 inches into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. The number of hammer blows to drive the sampler through each 6 inch interval is recorded; the number of blows required to drive the sampler through the final 12 inch interval is termed the Standard Penetration Resistance (SPR) N-value. For example, blow counts of 6/8/9 (through three 6-inch intervals) results in an SPR N-value of 17 (8+9).

Groundwater observations were made at the times indicated. Groundwater elevations fluctuate throughout a given year, depending on actual field porosity and variations in seasonal and annual precipitation.

UNIFIED SOIL CLASSIFICATION SYSTEM [Casagrande (1948)]

Major Divisions		Group Symbols	Typical Descriptions	Laboratory Classifications				
Coarse Grained Soils (More than half of material is larger than No. 200 sieve)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravel (Little or no fines)	GW Well-graded gravels, gravel-sand mixtures, little or no fines	Determine Percentage of sand and gravel from grain size curve. Depending on Percentage of fines (fraction smaller than No. 200 sieve), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP More than 12 percent GM, GC, SM, SC 5 to 12 percent Borderline cases requiring dual symbols ⁽¹⁾	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3			
		GP Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting C_u or C_c requirements for GW					
		Gravel with fines (Appreciable amount of fines)	GM Silty gravels, gravel-sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols		
			GC Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above A line with I_p greater than 7			
	Sands (More than half of coarse fraction is smaller than No. 4 Sieve)	Clean sands (Little or no fines)	SW Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6: $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3			
			SP Poorly graded sands, gravelly sands, little or no fines		Not meeting C_u or C_c requirements for SW			
		Sands with fines (Appreciable amount of fines)	SM Silty sands, sand-silt mixtures		Atterberg limits below A Line or I_p less than 4	Limits Plotting in hatched zone with I_p between 4 and 7 are borderline cases requiring use of dual symbols		
			SC Clayey sands, sand-clay mixtures		Atterberg limits above A line with I_p greater than 7			
						For soils plotting nearly on A line use dual symbols i.e., $I_p = 29.5$, $w_L = 60$ gives CH-MH. When w_L is near 50 use CL-CH or ML-MH. Take near as ± 2 percent.		
		Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silt and clays (Liquid limit less than 50)		ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays								
OL Organic silts and organic silty clays of low plasticity								
Silt and Clays (Liquid limit greater than 50)	MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts							
	CH Inorganic clays of high plasticity, fat clays							
	OH Organic clays of medium to high plasticity, organic silts							
Highly organic soils	Pt Peat and other highly organic soils							

(1) Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC. well-graded gravel-sand mixture with clay binder.