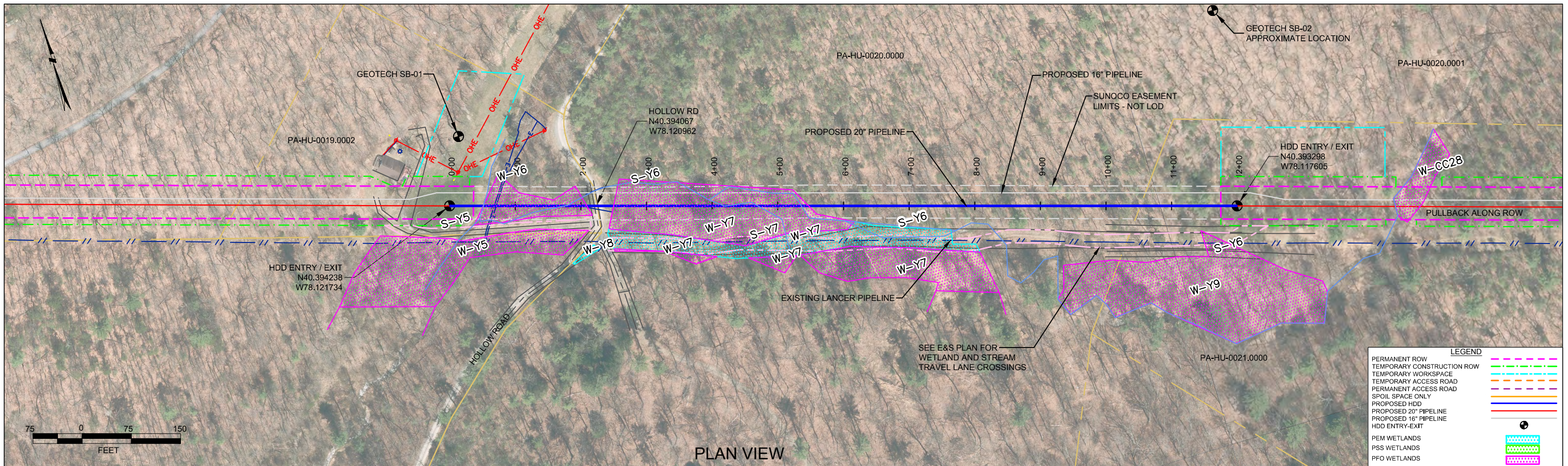


HDD PA-HU-0019.0002-RD (S-Y5) (W-Y6) (S-Y6) (W-Y7) (S-Y7)

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 *low*. 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.

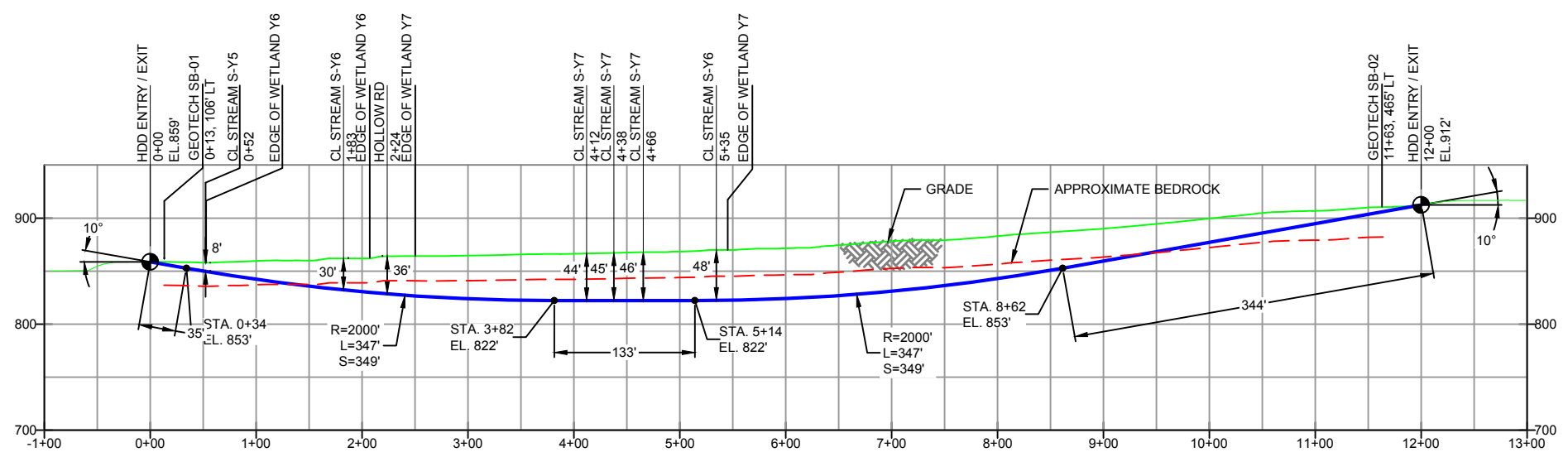
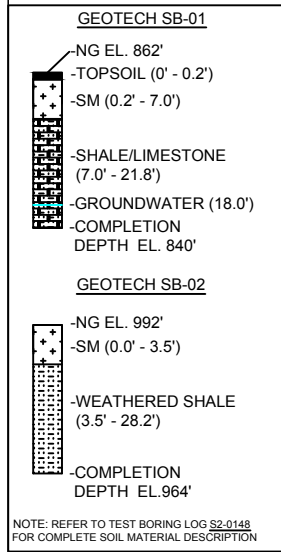
The drill will enter/exit 65 feet from the edge of the western most boundary of the stream S-Y5 and wetland W-Y6. The drill will travel beneath stream S-Y5 for 8 feet and wetland for 155 feet. The drill will also travel beneath stream S-Y7 and stream S-Y6 at 120 feet and 125 feet east of the western most edge of wetland W-Y6 and will pass under stream S-Y7 for 3 feet and S-Y6 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 weathered shale. The drill will continue beneath wetland W-Y6 and will exit 670 feet from the eastern most boundary of wetland W-Y6.



PLAN VIEW

HUNTINGDON COUNTY PENNSYLVANIA, PENN TOWNSHIP
S2-0148

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=): 1200'
 HDD PIPE LENGTH (S=): 1210'
 20" x 0.456" W.T., X-65, API5L, PSL2, ERW, 8FW
 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-3.11 TO ES-3.12	EP2	EROSION & SEDIMENT PLAN
SHEET 7 TO SHEET 8	EP1	AERIAL SITE PLAN
	EP	
	C	ADDED GEOTECH INFO
	B	ISSUED FOR BID
	A	ISSUED FOR REVIEW

REVISIONS	NO.	DESCRIPTION
DLM 09/30/16	RMB 09/30/16	AAW 09/30/16
DLM 05/09/16	RMB 05/09/16	AAW 05/09/16
MRS 03/15/16	RMB 03/15/16	AAW 03/15/16
MRS 09/10/15	RMB 09/10/15	AAW 09/10/15
DLM 07/31/15	RMB 07/31/15	AAW 07/31/15
JAM 03/24/15	RMB 03/24/15	AAW 03/24/15
BY	DATE	CHK

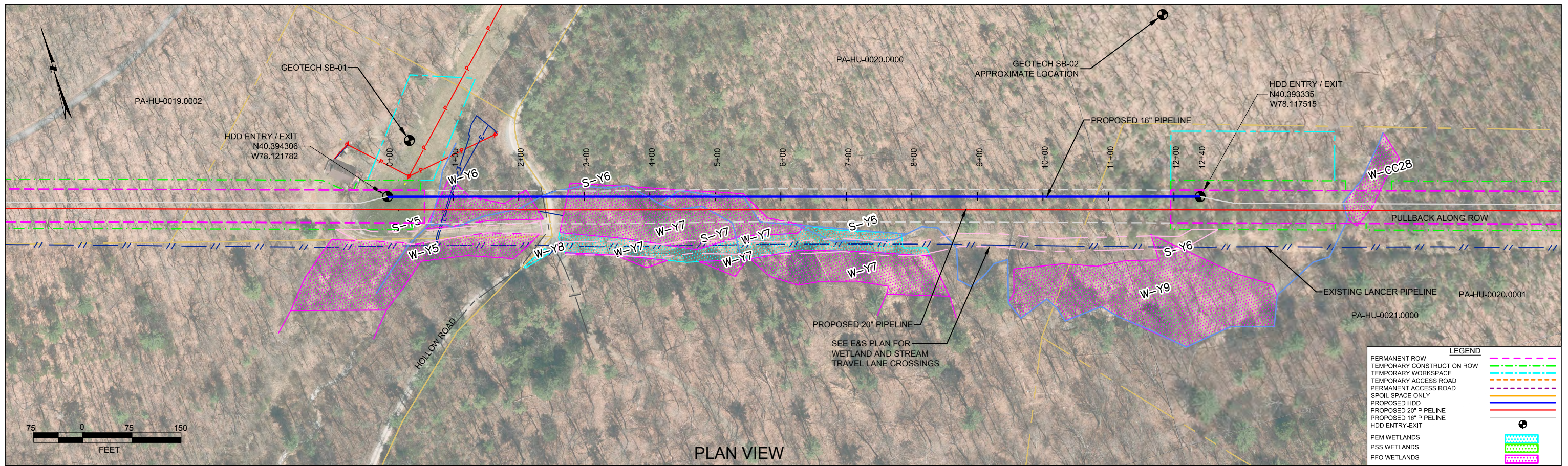
**Sunoco Logistics
Partners L.P.**

TETRA TECH ROONEY
(303) 792-5911

SUNOCO PIPELINE, L.P.

20-INCH HORIZONTAL DIRECTIONAL DRILL
HOLLOW RD
PENNSYLVANIA PIPELINE PROJECT

SCALE: 1"=150' DWG. NO: PA-HU-0019.0002-RD



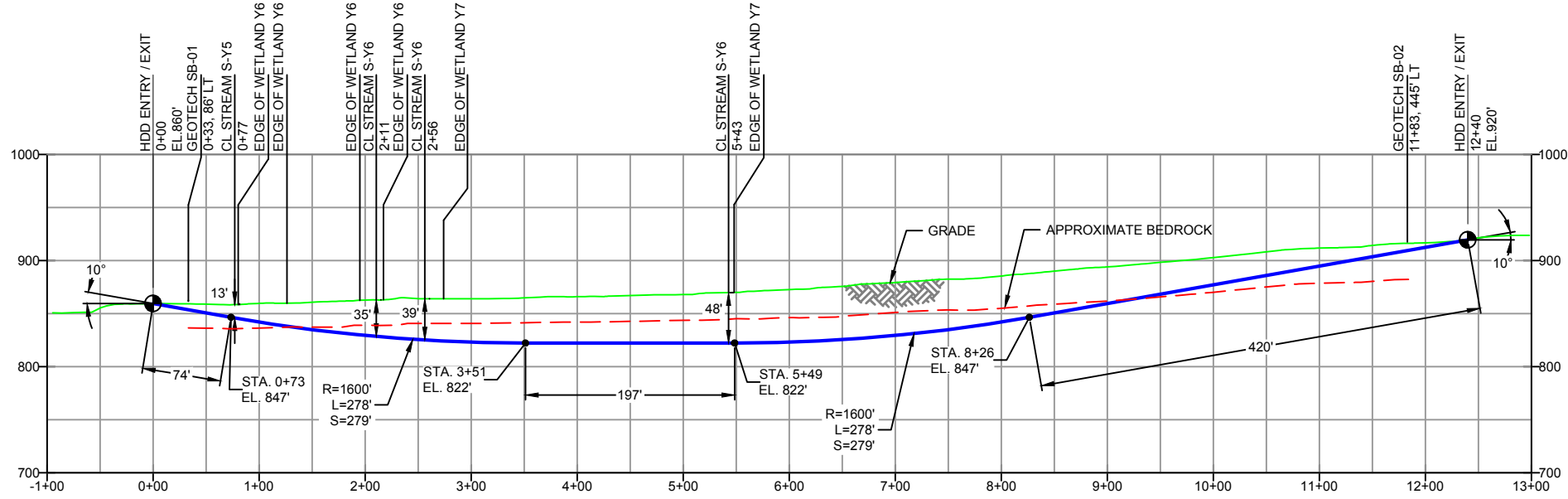
PLAN VIEW

HUNTINGDON COUNTY PENNSYLVANIA, PENN TOWNSHIP
S2-0148-16

PROFILE VIEW

GEOTECH SB-01	
NG EL. 862'	-TOPSOIL (0' - 0.2')
	-SM (0.2' - 7.0')
	-SHALE/LIMESTONE (7.0' - 21.8')
	-GROUNDWATER (18.0')
	-COMPLETION DEPTH EL. 840'
GEOTECH SB-02	
NG EL. 992'	-SM (0.0' - 3.5')
	-WEATHERED SHALE (3.5' - 28.2')
	-COMPLETION DEPTH EL. 964'

NOTE: REFER TO TEST BORING LOG S2-0148 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-): 1240'
HDD PIPE LENGTH (S-): 1249'
16" x 0.438" W.T., X-70, APISL, 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, L.P. 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, L.P. 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		REVISIONS		
ES-3.11	TO ES-3.12	EROSION & SEDIMENT PLAN		
SHEET 7	TO SHEET 8	AERIAL SITE PLAN	EP2 REVISED PER PADEP COMMENTS RECEIVED 09-06-16	
			EP1 REVISED PER PADEP COMMENTS	
			EP	
			B ADDED GEOTECH INFO	
			A ISSUED FOR BID	
DWG NO	DWG NO	DESCRIPTION	NO.	DESCRIPTION

Sunoco Logistics Partners L.P.

SUNOCO PIPELINE, L.P.

16-INCH HORIZONTAL DIRECTIONAL DRILL
HOLLOW RD
PENNSYLVANIA PIPELINE PROJECT

TETRA TECH ROONEY
(303) 792-5911

SCALE: 1"=150'

DWG. NO: PA-HU-0019.0002-RD-16



LEGEND:

⊙ Geotechnical Soil Boring (SB) Locations



GEOTECHNICAL BORING LOCATIONS
 HDD S2-0148
 HUNTINGDON COUNTY, PENN 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:		HOLLOW ROAD, HESSTON, PA	Page 1 of 1	
HDD No.:	S2-0148	Dates(s) Drilled: 01-14-15	Inspector: E. WATT	
Boring No.:	SB-01	Drilling Method: SPT - ASTM D1586	Driller: S. HOFFER	
Drilling Contractor:	HAD DRILLING	Groundwater Depth (ft): 18	Total Depth (ft): 21.8	

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	0.2			TOPSOIL (2").						
1	3.0	5.0	0.2		11	SM	MOTTLED (GRAY, ORANGE BROWN, YELLOW BROWN) SILTY FINE SAND, WITH A LITTLE FINE GRAVEL.	1	10	12	11	22	
2	8.0	8.4	7.0		3	WEATHERED SHALE AND LIMESTONE	LIGHT GRAY WEATHERED FISSILE SHALE.	50/5"				>50	
3	13.0	13.4			3		GRAY WEATHERED LIMESTONE.	50/5"				>50	
4	18.0	18.4			4		GRAY WEATHERED FISSILE SHALE.	50/5"				>50	
5	21.0	21.8		21.8	5		GRAY WEATHERED SHALE AND SAND/GRAVEL.	10	50/3"			>50	
							STARTED GRINDING BETWEEN 9 AND 10'.						
							AUGER REFUSAL AT 21'.						
							WATER LEVEL THROUGH AUGERS AT 18'.						
							CAVED AT 21', WATER LEVEL ON CAVE AT 18'.						

Notes/Comments: Pocket Pentrometer Testing DR: DECOMPOSED ROCK

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:	BUNKER HILL ROAD, HESSTON, PA	Page 1 of 1	
HDD No.:	S2-0148	Dates(s) Drilled:	01-20-15
Boring No.:	SB-02	Inspector:	E. WATT
Drilling Contractor:	HAD DRILLING	Drilling Method:	SPT - ASTM D1586
		Driller:	S. HOFFER
		Groundwater Depth (ft):	NOT ENCOUNTERED
		Total Depth (ft):	28.2

Sample No.	Sample Depth (ft)		Strata Depth (ft)		Recov. (in)	Strata (USCS)	Description of Materials	6" Increment Blows *			N
	From	To	From	To							
							NO TOPSOIL				
			0.0			SM	MOTTLED (GRAY, ORANGE BROWN, YELLOW BROWN) SILTY FINE SAND, WITH A LITTLE FINE GRAVEL.				
				3.5							
1	3.0	4.3	3.5		10	WEATHERED SHALE	LIGHT BROWN AND LIGHT GRAY WEATHERED FISSILE SHALE.	1	30	50/4"	>50
2	8.0	8.9			7		LIGHT BROWN AND LIGHT GRAY WEATHERED FISSILE SHALE.	10	50/5"		>50
3	13.0	13.6			7		LIGHT BROWN AND LIGHT GRAY WEATHERED FISSILE SHALE.	30	50/1"		>50
4	18.0	18.5			5		DARK GRAY WEATHERED FISSILE SHALE	50/6"			>50
5	23.0	23.7			6		DARK GRAY WEATHERED FISSILE SHALE	2	50/2"		>50
6	28.0	28.1		28.2	2		DARK GRAY WEATHERED FISSILE SHALE	50/2"			>50
							AUGER REFUSAL AT 28'.				

Notes/Comments:
Pocket Pentrometer Testing DR: DECOMPOSED ROCK

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 S2-0148**

HDD No.	Boring No.	Sample No.	Depth of Sample (ft.)		Water	Percent	Atterburg Limits (ASTM D4318)			USCS
			From	To	Content, % (ASTM D2216)	Silts/Clays, % (ASTM D1140)	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	Classif. (ASTM D2487)
S2-0148	SB-01	1	3.0	5.0	12.8	44.1	-	-	-	-
		2	8.0	8.4	2.4	15.3	-	-	-	-
		3	13.0	13.4	2.9	16.4	-	-	-	-
		4	18.0	18.4	4.1	12.7	-	-	-	-
		5	21.0	21.8	9.4	25.5	-	-	-	-
	SB-02	1	3.0	4.3	8.4	33.5	-	-	-	-
		3	13.0	13.6	5.4	24.2	-	-	-	-
		4	18.0	18.5	4.5	12.6	-	-	-	-
		6	28.0	28.1	2.1	14.7	-	-	-	-

Notes:

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

**REGIONAL GEOLOGY SUMMARY
SUNOCO PENNSYLVANIA PIPELINE PROJECT
HDD S2-0148**

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
S2-0148	Hollow Road	SB-01	Brallier and Harrell Formations (undivided) - composed of interbedded light-gray, graded, siliceous siltstone beds and light-gray, hard, silty shales, sparsely fossiliferous.	Ridge & Valley (Steep relief changes)	Brallier-Harrell	Interbedded subfissile shales, f-c. thinly bedded siltstone and sandstones	1,800	14-50	Depth to bedrock varies considerably with topography
		SB-02							

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.