

Module 7: Geology Information [§77.403-404]

7.1 Stratigraphy.

- a) **Rock Unit:** Period (e.g., Lower Ordovician) Pennsylvanian
Formation (e.g., Rookdale Run) Pittsburgh Formation - Benwood Limestone

Introduction

The proposed SMT East Surface mine site is located in Derry Township, Westmoreland County along Pizza Barn Road and Derry Lane. This site is adjacent to the active SMT SMP (#65140101) and the approved Jelley LNC Site (#65110401); both being permits of Ligonier Stone & Lime. The Benwood Limestone is a consistent unit at the adjacent Jelley site along with the Horn and Horn III SMP's located to the southeast along Pizza Barn Road. This limestone unit is located stratigraphically above the Sewickley Coal seam by approximately 60 to 70-feet (See the Module 7.1a) Attachment – General Geologic Column). Local stratigraphy at the adjacent sites, coupled with topography and regional data, indicates the Benwood Limestone to be located on the proposed SMT East surface mine site. On-site drilling confirmed the depth and thickness of the limestone unit.

- b) **Attach Geologic Logs of test holes or equivalent information on attached data sheet (test holes should be drilled to the ultimate depth of mining unless waived by the Department based on acceptable equivalent information). Log description must include the surface elevation of each hole submitted, lowest elevation of proposed excavation, elevation of static groundwater (method and date of measurement), lithologic description, location and extent of voids and thickness of strata encountered. Drill holes, highwall sections, or equivalent information should be located to represent the thickness of mineral and overburden to be disturbed in areas of maximum thickness.**

See the attached Module 7.1(B) Geologic Logs for test holes drilled at the SMT East site. Air rotary drilling occurred in May 2018 and additional drilling began on site in November 2019. In May 2018 a total of 6 holes were drilled within the proposed permit area and the active SMT Surface Mine area. These holes are identified as DH-1-18 to DH-6-18. (See the Exhibit 6.2 Map for the drill hole locations.) A portion of the area was found to be previously surface mined by Bentley Coal Co. as indicated in the following Module 7.4 and on the Exhibit 6.2 Map.

In November 2019 a total of 14 holes were drilled within the proposed permit area. These holes were drilled through the base of the Benwood Limestone when encountered. They were surveyed for location and elevation and are identified as DH-1 through DH-14 on the Exhibit 6.2 Map. Similar to the previous drilling, a portion of the area was found to be previous surface mining backfill for the Sewickley Coal seam mining conducted by Bentley Coal Co. Note that surface mining of the Benwood Limestone is not proposed within known previously mined areas. See the Exhibit 6.2 Map for proposed mining areas.

In addition to the holes drilled on site, 5 core holes drilled at the adjacent Jelley LNC have been included with this module and are shown on the Exhibit 6.2 Map. Data from these core holes was used as additional information to correlate the Benwood Limestone, its thickness, overburden, etc.

- c) **Provide stratigraphic correlation of the strata by geologic cross sections or fence diagrams to include lithology, stratigraphy, existing ground surface, proposed mining limits, proposed benching, final reclamation slopes, postmining water table, aquifers to be encountered or affected, directions of groundwater movement and underground mines and cave systems. [Horizontal scale shall not be smaller than the scale of Exhibit 6.2 (i.e. not less than 1 inch: 400 feet, or 1 inch: 200 feet), larger scales are acceptable (e.g. 1 inch: 100 feet)]**

Please see the attached Module 7.1c) Geologic Cross Section sheets for a stratigraphic correlation of the above-mentioned Module 7.1 (B) drill logs. The geologic cross section lines (A-A', B-B', and C-C') are depicted on the Exhibit 6.2 Map. Benching is not proposed and the final reclamation will be at approximate original contour.

7.2 Structure.

- a) Describe the local geologic structure and its relationship to the regional structure. Use diagrams and regional structural relief maps where applicable.

Regional Structure: The permit area is located on the Blairsville 7½ Minute USGS Quadrangle and lies approximately 1 mile southwest of Blairsville, PA. The site is found in the Pittsburgh Low Plateaus Section of the Appalachian Plateaus Province. This area is mainly characterized by broad rolling hilltops and steep-walled moderately incised valleys. Regional folds have a general east-west orientation with a gentle dip to the northwest and southeast towards the synclinal axes. The proposed site location is influenced by the Fayette Anticline and the Uniontown (Latrobe) Syncline. The axis of the Fayette Anticline is located approximately 2 miles (perpendicular to strike) northwest of the site. The Uniontown (Latrobe) Syncline lies to the east, as shown on the Exhibit 6.2 Map, and has an approximate N 32° E strike and a southwesterly plunge near the proposed site. (See the Attachment 7.2a) Geologic Structure Map.)

[Revised 12.2021] – Local Structure: The proposed SMT East site area is controlled by the Uniontown (Latrobe) Syncline causing structure to trend in a northeast/southwest direction and turn in an eastern direction as it approaches the syncline. This is similar to the regional structure mapping shown on the Geologic Structure Map. In the Phase 2 mining area the Benwood Limestone has an approximate 2% dip to the southeast (See the Exhibit 6.2 Map for the Benwood Limestone structure.)]

- 7.3 Indicate joint and fracture orientations on the Module 6.2 map (or Module 6.1 if locations not within limits of Module 6.2), using standard joint strike and dip symbols, where fracture/joint measurements were taken. Rose diagrams may be submitted if available.

Type of Joint Or Fracture*	Lithology	Number of Measurements	Depth Below Surface	Aperture (width)	Key to 6.2 (or 6.1)
<u>Stress Relief</u>	<u>Sandstone</u>	<u>2</u>	<u>5 to 6-feet</u>	<u>Open</u>	<u>Exhibit 6.1</u>

*Type of Joint or Fracture refers to tectonic, stress relief, bedding plane, etc.

Source of information (site specific measurements, publication source, etc.) Measurements were taken from the V.P. Smith Company, Inc. – Smith #1 Mine (SMP# 65080101) permit. (Currently SMT Surface Mine) The Measurements were taken from exposed rock outcropping along Stony Run (west of the proposed site). The measurements are N64°E and N70°E.

NOTE: Operations in karst geology areas may be required to complete the *Karst Permitting Supplement* in addition to supplying this information.

7.1(B) GEOLOGIC LOG DRILL HOLES/OVERBURDEN ANALYSIS DATA

Hole No.: _____
 (Key locations to Modules 6.2 and 9)
 Surface Elevation: _____
 Bottom Elevations: _____

Operation Name: _____
 Method of Drilling: _____
 Date Drilled: _____
 Drilled By: _____
 Logged By: _____
 Township: _____
 County: _____

Groundwater Elevations and Date Measured

Quadrangle: _____
 Laboratory: _____
 Latitude: _____ Longitude: _____

Surveyed by: _____
 Method: _____
 Remarks: _____

Depth	Thick-ness	Scale	Graphic Log	Lithologic Description and Water Conditions	Overburden Analysis Logs*					
					Color or Munsell Code	OBA Sample Number	Log Interval	% Total Sulfur	Fizz Rating	Neutralization Potential
				See the attached Module 7.1(B) Drill Logs for the SMT East Site.						
		10								
		20								
		30								
		40								
		50								
		60								
		70								

*When requested by the Department

7.1(B) GEOLOGIC LOG DRILL HOLES/OVERBURDEN ANALYSIS DATA - CONTINUED

Hole No.: _____

Operation Name: _____

Remarks:

Depth	Thick-ness	Scale	Graphic Log	Lithologic Description and Water Conditions	Overburden Analysis Logs*					
					Color or Munsell Code	OBA Sample Number	Log Interval	% Total Sulfur	Fizz Rating	Neutralization Potential
				See the attached Module 7.1(B) Drill Logs for the SMT East Site.						

*When requested by the Department

7.4 Mine Workings and Solid Waste Sites.

Submit the following data on all active, completed and abandoned underground and surface mines and coal refuse disposal sites which are in or within 1000 feet of the permit area: (Key location to Modules 6.2, 9 and 18.)

[Revised 12.2021] –

Surface and Underground Mines

Operator	Permit No.	Map Key	Status	Mineral	Water Sample No.(s)
Ligonier Stone & Lime – SMT	65140101	Permit Line	Active	Pittsburgh Sandstone & Pittsburgh Coal, Redstone Coal & Redstone Sandstone	See the Exhibit 6.2 Map for all water sample point locations.
Ligonier Stone & Lime – Jelley	65110401	Permit Line	Active	Benwood Limestone	
R & K Coal Co.	6579113	A	Completed	Pittsburgh Coal	
V.P. Smith Company, Inc.	65080101	B	Cancelled upon issuance of SMT (65140101)	Pittsburgh Coal	
Bentley Coal Co., Inc.	65823013	C	Completed	Sewickley Coal	
H.C. Frick Mining & Coke Co. / American Steel Hoop Co.	Unknown	D	Abandoned (underground)	Pittsburgh Coal	
Westmoreland Mining Co.	Unknown	E	Abandoned (underground)	Pittsburgh Coal	

List the operator permit number, and type of any solid waste disposal sites in or within 1000 feet of the permit area.

There are no known solid waste disposal sites within 1,000-feet of the proposed permit area. The Smith Disposal Site 1, a municipal waste operation, was proposed within the SMT and SMT East area but never initiated.

7.5 Overburden Analysis.

Note: Typically overburden analysis is not required for noncoal mining operations. However, there are geologic conditions that may make overburden analysis necessary due to the potential for surface and/or groundwater pollution. Examples are mines in coal field strata that may be acid-forming, and sites where rock has undergone sulfide mineralization. The necessity for overburden analysis should be determined prior to permit application submittal. This can be done by contacting the appropriate District Mining Office.

The interpretation of overburden analysis should be provided in this Module. However, the operational plans for material placement should be provided in Module 10.

The Module 7.5 "Overburden Analysis" is not included in this section since there is no potential for surface and/or groundwater pollution associated with the proposed extraction of the Benwood Limestone. The mining area is not situated in coal field strata with strata that may be acid-forming or has undergone a high degree of sulfide mineralization. Up to 10% of the alkaline Benwood Limestone unit will remain during backfilling due to current mining practices and operations. This material is also a Best Mining Practice as the alkaline material will allow for alkaline backfill and post mining conditions.

There are no coal seams located above the Benwood Limestone within the proposed mining area, as indicated by the on-site drilling. Previous surface mining was conducted on the Sewickley Coal seam within a portion of the proposed permit area and was noted during the exploration drilling. (See the attached drill logs and the Exhibit 6.2 Map). As noted in section 7.1a) above, the Sewickley Coal seam is stratigraphically located below the Benwood Limestone and therefore will not be encountered during mining.

a) Overburden Analysis Report

The overburden analysis report must include at a minimum:

- 1) geologic logs of overburden analysis test holes including Munsell color codes. This must include the information requested in Module 7.1b. Overburden holes must be logged by a geologist. Water condition information is the same as that requested in Module 7.1b. This information is to be presented on a completed Module 7.1(B) "Geologic Log Drill Holes/ Overburden Analysis Data."
- 2) an explanation of considerations employed in determining
 - aa) drill hole spacing and number of holes,
 - bb) sampling depth; and
 - cc) sampling intervals of overburden analysis test holes.
- 3) a series of stratigraphic cross-sections or fence diagrams including all overburden analysis test holes, plus other representative test holes. The vertical scale must be sufficient to show all potentially acidic and alkaline zones and any zones proposed for special handling; a scale of one (1) inch to twenty (20) feet or greater is recommended. The stratigraphic correlations between overburden holes and other test holes must be shown. In addition, hydrogeologic information (such as water table, perched systems and so forth) should be portrayed.
- 4) overburden holes accurately located on Exhibit 6.2. Overburden holes must be surveyed such that surface elevations and hole locations are accurately determined and plotted.
- 5) results of the chemical analysis of all overburden strata and strata immediately below the lowest stratum being mined. Acid-base accounting data must be presented on Module 7.1(B) "Geologic Log Drill Holes/ Overburden Analysis Data." Actual laboratory analysis sheets may be submitted in addition to Module 7.1(B). Forms of sulfur (when submitted) should be submitted on a separate sheet.
- 6) techniques and methods of chemical analyses. References pertaining to technique or method should be cited as appropriate (e.g. Sobek, and others 1978, p. 47-50; ASTM Method D2492-84) and where a standard method is not used or has been modified, the method used should be described in detail.
- 7) an identification of any stratigraphic units possessing the potential for significant acid or alkaline production and an overall interpretation of the overburden analysis data. The criterion and rationale by which the overburden is being judged must be explained.
- 8) the name, address and telephone number of the individual(s) responsible for the collection and analysis of the data and interpretation of the data.

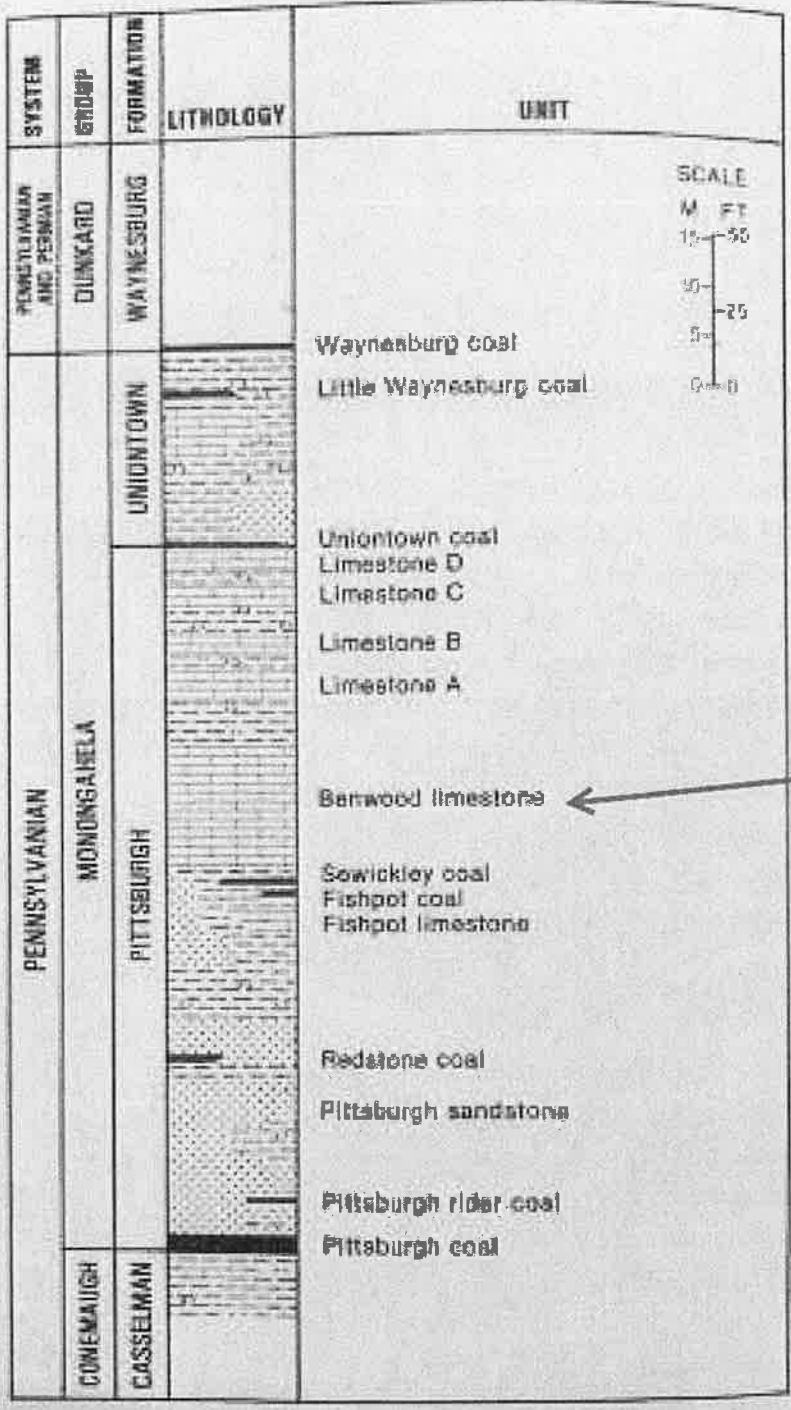


Figure 10-10. Generalized stratigraphic section of the Monongahela Group of western Pennsylvania.

Module 7.1a) Attachment
Typical Stratigraphic Column

Ligonier Stone & Lime Company
SMT East Surface Mine

Derry Township / Westmoreland County, PA

Note that the arrow designates the unit proposed for mining.

Source: PAGES – The Geology of Pennsylvania, 1999, page 156

Module 7.1(B) Geologic Log Drill Holes

SMT East Drill Hole Logs

The following pages contain geologic logs for air rotary holes drilled for the proposed SMT East site. Fourteen (14) holes were drilled in November 2019 (identified as DH-1 to DH-14) and six (6) air rotary holes were drilled in May 2018 (identified as DH-1-18 to DH-6-18).

Hole No. : DH-1
 Surface Elevation : 1142.1'
 Top of Stone Elev. : 1117.1' (Benwood LS)
 Bottom of Stone Elev. : 1099.1' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : DRY
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-25-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 22" W 79° 16' 33"

Depth in Feet	Surf. Elev. 1142.1	Start Depth	End Depth	Thickness	GRAPHIC	DESCRIPTION	REMARKS
0	1142					SOILS & CLAY, brown, soft, wet, 0 fizz	
5	1137	0.0	9.0	9.0			
10	1132	9.0	17.0	8.0		SHALE, brown, soft, dry, 0 fizz	
15	1127					SHALE, gray to dark gray, moderately hard, dry, 0 fizz	
20	1122	17.0	25.0	8.0			
25	1117					LIMESTONE (Benwood), gray, very hard, dry, 2-3 fizz	Occasional thin clay and shale partings
30	1112						
35	1107	25.0	43.0	18.0			
40	1102						
45	1097	43.0	45.0	2.0		SHALE, gray, moderately hard, dry, 0 fizz	
		45.0	49.0	4.0		SANDSTONE, gray, hard, dry, 0 fizz	

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Hole No. : DH-2
 Surface Elevation : 1135.7'
 Top of Stone Elev. : 1109.7' (Benwood LS)
 Bottom of Stone Elev. : 1093.7' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1095.8'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
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Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-25-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 20" W 79° 16' 31"

Depth in Feet	Surf. Elev. 1135.7	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1135					SOILS & CLAY, brown, soft, wet, 0 fizz	
5	1130	0.0	9.0	9.0			
10	1125	9.0	15.0	6.0		SHALE, brown and gray, soft to moderately hard, dry, 0 fizz	
15	1120					SHALE, gray to dark gray, moderately hard to hard, dry, 0 fizz	
20	1115	15.0	26.0	11.0			
25	1110					LIMESTONE (Benwood), gray, very hard, dry, 2-3 fizz	Occasional thin clay and shale partings
30	1105	26.0	42.0	16.0			
35	1100					SHALE, gray, moderately hard to hard, dry, 0 fizz	
40	1095						
45	1090	42.0	48.5	6.5			
50							

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Hole No. : DH-3
 Surface Elevation : 1155.7'
 Top of Stone Elev. : 1125.7' (Benwood LS)
 Bottom of Stone Elev. : 1108.7' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1105.4'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-25-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 24" W 79° 16' 38"

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Depth in Feet	Surf. Elev. 1155.7	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1155						
		0.0	6.0	6.0		SOILS & CLAY, brown, soft, damp, 0 fizz	
5	1150						
		6.0	19.0	13.0		SHALE, brown, soft to moderately hard, dry, 0 fizz	
10	1145						
		19.0	23.5	4.5		SANDSTONE, gray, hard, dry, 0 fizz	
15	1140						
		23.5	30.0	6.5		SHALE, dark gray, moderately hard, dry, 0 fizz	
20	1135						
		30.0	47.0	17.0		LIMESTONE (Benwood), gray, very hard, dry, 1-2 fizz	Occasional shale partings
25	1130						
		47.0	53.0	6.0		SANDSTONE, gray, hard, dry, 0 fizz	
30	1125						
35	1120						
40	1115						
45	1110						
50							

Hole No. : DH-3
 Surface Elevation : 1155.7'
 Top of Stone Elev. : 1125.7' (Benwood LS)
 Bottom of Stone Elev. : 1108.7' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1105.4'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-25-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 24" W 79° 16' 38"

Depth in Feet	Surf. Elev. 1155.7	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1105	47.0	53.0	6.0		SANDSTONE, gray, hard, dry, 0 fizz	
55	1100						
60	1095						
65	1090						
70	1085						
75	1080						
80	1075						
85	1070						
90	1065						
95	1060						
100							

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Hole No. : DH-4
 Surface Elevation : 1151.3'
 Top of Stone Elev. : 1135.3' (Benwood LS)
 Bottom of Stone Elev. : 1132.8' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : Closed
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
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Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-25-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 27" W 79° 16' 42"

Depth in Feet	Surf. Elev. 1151.3	Start Depth	End Depth	Thick- ness	GRAPHIC	DESCRIPTION	REMARKS
0	1151					SOILS & CLAY, brown, soft, damp, 0 fizz	
5	1146	0.0	10.0	10.0			
10	1141	10.0	16.0	6.0		SHALE & CLAY, brown, soft, dry, 0 fizz	
15	1136	16.0	18.5	2.5		LIMESTONE (Benwood), brown and gray, very hard, dry, 1-2 fizz	
20	1131	18.5	25.0	6.5		SANDSTONE, brown, soft to moderately hard, dry, 0 fizz	
25	1126	25.0	30.0	5.0		SHALE, brown and gray, soft to moderately hard, dry, 0 fizz	
30	1121	30.0	33.5	3.5		SANDSTONE, gray, moderately hard, dry, 0 fizz	
35	1116					SANDSTONE, gray, hard, dry, 0 fizz	
40	1111	33.5	50.0	16.5			
45	1106						
50							

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Hole No. : DH-5
 Surface Elevation : 1150.5'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1098.3'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
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Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 31" W 79° 16' 49"

Depth in Feet	Surf. Elev. 1150.5	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1150					SOILS & CLAY, brown, soft, damp, 0 fizz	
5	1145	0.0	5.0	5.0		BACKFILL (Previously Mined)	
10	1140						
15	1135						
20	1130						
25	1125	5.0	46.0	41.0			
30	1120						
35	1115						
40	1110						
45	1105						
		46.0	48.0	2.0		SHALE, dark gray, hard, dry, 0 fizz	
		48.0	53.0	5.0		SANDSTONE, gray, hard, dry, 0 fizz	
50							

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Hole No. : DH-5
 Surface Elevation : 1150.5'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1098.3'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
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Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 31" W 79° 16' 49"

Depth in Feet	Surf. Elev. 1150.5	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1100	48.0	53.0	5.0		SANDSTONE, gray, hard, dry, 0 fizz	
55	1095	53.0	61.0	8.0		SHALE, dark gray, hard, dry, 0 fizz	
60	1090						
65	1085						
70	1080						
75	1075						
80	1070						
85	1065						
90	1060						
95	1055						
100							

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Hole No. : DH-6
 Surface Elevation : 1136.8'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1081.0'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 31" W 79° 16' 47"

Depth In Feet	Surf. Elev. 1136.8	Start Depth	End Depth	Thick- ness	GRAPHIC	DESCRIPTION	REMARKS
0	1136	0.0	2.0	2.0		SOILS & CLAY, brown, soft, damp, 0 fizz	
5	1131					BACKFILL (Previously Mined)	
10	1126						
15	1121						
20	1116	2.0	36.0	34.0			
25	1111						
30	1106						
35	1101	36.0	37.0	1.0		SHALE, black, moderately hard, dry, 0 fizz	
40	1096	37.0	43.0	6.0		SANDSTONE, gray, hard, dry, 0 fizz	
45	1091	43.0	57.0	14.0		SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
50							

Hole No. : DH-6
 Surface Elevation : 1136.8'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1081.0'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 31" W 79° 16' 47"

Depth in Feet	Surf. Elev. 1136.8	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1086					SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
55	1081	43.0	57.0	14.0			
60	1076	57.0	60.0	3.0		SANDSTONE, gray, hard, dry, 0 fizz	
65	1071						
70	1066						
75	1061						
80	1056						
85	1051						
90	1046						
95	1041						
100							

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Hole No. : DH-7
 Surface Elevation : 1129.4'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : 1094.9' (Coal streak)
 Groundwater Elev. : 1088.3'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 30" W 79° 16' 45"

Depth in Feet	Surf. Elev. 1129.4	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1129	0.0	2.0	2.0		SOILS & CLAY, brown, soft, damp, 0 fizz	
5	1124					BACKFILL (Previously Mined)	
10	1119	2.0	24.0	22.0			
15	1114						
20	1109						
25	1104	24.0	25.0	1.0		SHALE, black, moderately hard, dry, 0 fizz	
						SANDSTONE, gray, moderately hard, dry, 0 fizz	
		25.0	32.0	7.0			
		32.0	34.0	2.0		SHALE, dark gray, soft to moderately hard, dry, 0 fizz	
		34.0	34.5	0.5		COAL, black, dry	
		34.5	42.0	7.5		SHALE, gray to dark gray, moderately hard to hard, dry, 0 fizz	
		42.0	45.0	3.0		SANDSTONE, gray, moderately hard to hard, dry, 0 fizz	
		45.0	50.0	5.0		SHALE, gray to dark gray, moderately hard to hard, dry, 0 fizz	

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Hole No. : DH-8
 Surface Elevation : 1129.2'
 Top of Stone Elev. : 1054.7' (Fishpot LS)
 Bottom of Stone Elev. : 1042.2' (Fishpot LS)
 Bottom of Coal Elev. : 1094.7' (Coal streak)
 Groundwater Elev. : 1087.2'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 30" W 79° 16' 44"

Depth in Feet	Surf. Elev. 1129.2	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1129	0.0	2.0	2.0		SOILS, brown, soft, damp, 0 fizz	
5	1124					BACKFILL (Previously Mined)	
10	1119	2.0	24.0	22.0			
15	1114						
20	1109						
25	1104	24.0	25.0	1.0		SHALE, black, moderately hard, dry, 0 fizz	
						SANDSTONE, gray, moderately hard, dry, 0 fizz	
30	1099	25.0	32.0	7.0			
						SHALE, dark gray, soft to moderately hard, dry, 0 fizz	
35	1094	34.0	34.5	0.5		COAL, black, dry	
						SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
40	1089	40.0	43.0	3.0		SANDSTONE, gray, hard, dry, 0 fizz	
45	1084	43.0	57.0	14.0		SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
50							

Hole No. : DH-8
 Surface Elevation : 1129.2'
 Top of Stone Elev. : 1054.7' (Fishpot LS)
 Bottom of Stone Elev. : 1042.2' (Fishpot LS)
 Bottom of Coal Elev. : 1094.7' (Coal streak)
 Groundwater Elev. : 1087.2'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 30" W 79° 16' 44"

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Depth in Feet	Surf. Elev. 1129.2	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1079					SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
55	1074	43.0	57.0	14.0			
		57.0	58.0	1.0		LIMESTONE, gray, hard, dry, 1 fizz	
60	1069	58.0	64.0	6.0		SANDSTONE, gray, hard, dry, 0 fizz	
65	1064					SHALE, gray to dark gray, moderately hard, dry, 0 fizz	
70	1059	64.0	74.5	10.5			
75	1054					LIMESTONE (Fishpot), gray, very hard, dry, 1-2 fizz	
80	1049	74.5	87.0	12.5			
85	1044					SHALE, dark gray, moderately hard, dry, 0 fizz	
90	1039	87.0	95.0	8.0			
95	1034					SANDSTONE, gray, moderately hard, dry, 0 fizz	
		95.0	100.0	5.0			
100							

Hole No. : DH-9
 Surface Elevation : 1145.0'
 Top of Stone Elev. : 1118.0' (Benwood LS)
 Bottom of Stone Elev. : 1002.0' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1106.0'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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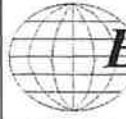
7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 26" W 79° 16' 24"

Depth in Feet	Surf. Elev. 1145.0	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1145					SOILS & CLAY, brown, soft, dry, 0 fizz	
5	1140	0.0	8.0	8.0			
10	1135					SHALE, brown and gray, soft to moderately hard, dry, 0 fizz	
15	1130	8.0	22.0	14.0			
20	1125					SHALE, dark gray, moderately hard, dry, 0 fizz	
25	1120	22.0	27.0	5.0			
30	1115					LIMESTONE (Benwood), gray, very hard, dry, 1-2 fizz	Occasional thin clay and shale partings
35	1110	27.0	43.0	16.0			
40	1105					SHALE, gray, moderately hard, dry, 0 fizz	
45	1100	43.0	50.0	7.0			
50							

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Hole No. : DH-10
 Surface Elevation : 1136.6'
 Top of Stone Elev. : 1122.6' (Benwood LS)
 Bottom of Stone Elev. : 1104.6' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1100.8'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 28" W 79° 16' 26"

Depth in Feet	Surf. Elev. 1136.6	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1136					SOILS & CLAY, brown, soft, dry, 0 fizz	Occasional thin clay and shale partings
5	1131	0.0	8.0	8.0		SHALE, dark gray, soft, dry, 0 fizz	
10	1126	8.0	12.0	4.0		CLAY, brown, soft, dry, 0 fizz	
15	1121	12.0	14.0	2.0		LIMESTONE, brown, hard, dry, 1 fizz	
20	1116	14.0	16.0	2.0		LIMESTONE (Benwood), gray, very hard, dry, 1-2 fizz	
25	1111	16.0	32.0	16.0		SHALE, gray, hard, dry, 0 fizz	
30	1106	32.0	34.0	2.0		SANDSTONE, gray, hard, dry, 0 fizz	
35	1101	34.0	37.0	3.0		SHALE, gray, moderately hard, dry, 0 fizz	
40	1096	37.0	40.0	3.0			
45	1091						

Hole No. : DH-11
 Surface Elevation : 1109.5'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1082.9'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 32" W 79° 16' 27"

Depth in Feet	Surf. Elev. 1109.5	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1109					SOILS & CLAY, brown, soft, damp, 0 fizz	Occasional rock fragments
5	1104						
10	1099	0.0	23.0	23.0			
15	1094						
20	1089						
25	1084					SHALE, dark gray, soft to moderately hard, dry, 0 fizz	
30	1079						
35	1074	23.0	45.0	22.0			
40	1069						
45	1064						
50		45.0	50.0	5.0		SANDSTONE, gray, hard, dry, 0 fizz	

Hole No. : DH-12
 Surface Elevation : 1142.0'
 Top of Stone Elev. : 1129.0' (Benwood LS)
 Bottom of Stone Elev. : 1121.0' (Benwood LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1100.9'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 36" W 79° 16' 28"

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Depth in Feet	Surf. Elev. 1142.0	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1142						
		0.0	7.0	7.0		SOILS & CLAY, brown, soft, dry, 0 fizz	
5	1137						
		7.0	8.0	1.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
10	1132						
		8.0	13.0	5.0		SANDSTONE & CLAY, brown, soft to moderately hard, dry, 0 fizz	
15	1127						
		13.0	21.0	8.0		LIMESTONE (Benwood), brown and gray, hard to very hard, dry, 1-2 fizz	Top is weathered
20	1122						
		21.0	29.0	8.0		SHALE, gray, moderately hard, dry, 0 fizz	
25	1117						
		29.0	38.0	9.0		SANDSTONE, gray, moderately hard, dry, 0 fizz	
30	1112						
		38.0	42.0	4.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
35	1107						
40	1102						
45	1097						
50							

Hole No. : DH-13
 Surface Elevation : 1160.4'
 Top of Stone Elev. : 1136.4' (Benwood LS)
 Bottom of Stone Elev. : N/A (See Log Below)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1119.7'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 37" W 79° 16' 25"

Depth in Feet	Surf. Elev. 1160.4	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1160					SOILS & CLAY, brown, soft, dry, 0 fizz	
5	1155	0.0	8.0	8.0			
10	1150					SHALE, brown and gray, soft to moderately hard, dry, 0 fizz	
15	1145	8.0	21.0	13.0			
20	1140	21.0	23.0	2.0		LIMESTONE, brown and gray, moderately hard, dry, 1-2 fizz	
23		23.0	24.0	1.0		SHALE, brown, moderately hard, dry, 0 fizz	
25	1135	24.0	28.0	4.0		LIMESTONE (Benwood), gray, very hard, dry, 1-2 fizz	
30	1130	28.0	34.0	6.0		NO RETURN - Drilled very hard like still in the Benwood Limestone	
35	1125					NO RETURN - Drilled faster like no longer in the limestone	
40	1120	34.0	45.0	11.0			
45	1115						
50							

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Hole No. : DH-14
 Surface Elevation : 1131.2'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : 1069.2'
 Groundwater Elev. : 1071.8'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 36" W 79° 16' 31"

Depth in Feet	Surf. Elev. 1131.2	Start Depth	End Depth	Thick- ness	GRAPHIC	DESCRIPTION	REMARKS
0	1131					SOILS & CLAY, brown, soft, dry, 0 fizz	
5	1126	0.0	10.0	10.0			
10	1121					SHALE, brown, soft, dry, 0 fizz	
15	1116	10.0	24.0	14.0			
25	1106					SHALE, gray, soft to moderately hard, dry, 0 fizz	
30	1101	24.0	34.0	10.0			
35	1096					SANDSTONE, gray, hard, dry, 0 fizz	
40	1091	34.0	40.0	6.0			
45	1086					SANDY SHALE, gray, moderately hard, dry, 0 fizz	
50		40.0	46.0	6.0			
		46.0	58.0	12.0		SHALE, dark gray, moderately hard, dry, 0 fizz	

Hole No. : DH-14
 Surface Elevation : 1131.2'
 Top of Stone Elev. : N/A
 Bottom of Stone Elev. : N/A
 Bottom of Coal Elev. : 1069.2'
 Groundwater Elev. : 1071.8'
 Date Measured : 11-29-2019
 Surveyed by : Earthtech, Inc.
 Method : Survey Grade GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 11-26-2019
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 36" W 79° 16' 31"

Depth in Feet	Surf. Elev. 1131.2	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1081					SHALE, dark gray, moderately hard, dry, 0 fizz	
55	1076	46.0	58.0	12.0			
		58.0	58.5	0.5		COAL, black, dry	
		58.5	60.0	1.5		SHALE, dark gray, moderately hard, dry, 0 fizz	
60	1071	60.0	62.0	2.0		COAL (Sewickley), black, dry	
		62.0	64.0	2.0		SHALE, gray, moderately hard, dry, 0 fizz	
65	1066	64.0	68.0	4.0		SANDSTONE, gray, moderately hard, dry, 0 fizz	
70	1061						
75	1056						
80	1051						
85	1046						
90	1041						
95	1036						
100							

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Hole No. : DH-1-18
 Surface Elevation : 1158'
 Top of Stone Elev. : 1090' (Fishpot LS)
 Bottom of Stone Elev. : 1074' (Fishpot LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1069.8'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 54" W 79° 16' 28"

Depth in Feet	Surf. Elev. 1158	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1158					BACKFILL (Previously Mined)	
5	1153						
10	1148	0.0	20.0	20.0			
15	1143						
20	1138	20.0	25.0	25.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
25	1133						
30	1128					SANDY SHALE, dark gray, moderately hard, dry, 0 fizz	
35	1123	25.0	48.0	23.0			
40	1118						
45	1113						
50		48.0	60.0	12.0		SHALE, dark gray, moderately hard, dry, 0 fizz	

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Hole No. : DH-1-18
 Surface Elevation : 1158'
 Top of Stone Elev. : 1090' (Fishpot LS)
 Bottom of Stone Elev. : 1074' (Fishpot LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1069.8'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 54" W 79° 16' 28"

Depth in Feet	Surf. Elev. 1158	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1108					SHALE, dark gray, moderately hard, dry, 0 fizz	
55	1103	48.0	60.0	12.0			
60	1098	60.0	61.0	1.0		SHALE with Coal, dark gray and black, moderately hard, dry, 0 fizz	
65	1093	61.0	68.0	7.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
70	1088	68.0	77.0	9.0		LIMESTONE, gray, hard, dry, 1-2 fizz	
75	1083	77.0	79.0	2.0		LIMESTONE and SHALE, interbedded, gray, hard, dry, 2 fizz	
80	1078	79.0	84.0	5.0		LIMESTONE, gray, hard, dry, 2 fizz	
85	1073	84.0	90.0	6.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
90	1068					SANDSTONE, gray, hard, dry, 0 fizz	
95	1063	90.0	100.0	10.0			
100							

Hole No. : DH-2-18
 Surface Elevation : 1151'
 Top of Stone Elev. : 1075' (Fishpot LS)
 Bottom of Stone Elev. : 1061' (Fishpot LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1071.5'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 51" W 79° 16' 27"

Depth in Feet	Surf. Elev. 1151	Start Depth	End Depth	Thick- ness	GRAPHIC	DESCRIPTION	REMARKS
0	1151					BACKFILL (Previously Mined)	
5	1146						
10	1141	0.0	24.0	24.0			
15	1136						
20	1131						
25	1126	24.0	31.0	7.0		SHALE, light gray, soft to moderately hard, dry, 0 fizz	
30	1121						
35	1116	31.0	38.0	7.0		SANDSTONE, gray, moderately hard to hard, dry, 0 fizz	
40	1111	38.0	45.0	7.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
45	1106	45.0	52.0	7.0		SANDY SHALE, gray, moderately hard, dry, 0 fizz	
50							

Hole No. : DH-2-18
 Surface Elevation : 1151'
 Top of Stonel Elev. : 1075' (Fishpot LS)
 Bottom of Stone Elev. : 1061' (Fishpot LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1071.5'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 51" W 79° 16' 27"

Depth in Feet	Surf. Elev. 1151	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1101	45.0	52.0	7.0		SANDY SHALE, gray, moderately hard, dry, 0 fizz	
55	1096					SHALE, dark gray, soft to moderately hard, dry, 0 fizz	
60	1091						
65	1086	52.0	76.0	24.0			
70	1081						
75	1076						
80	1071	76.0	84.0	8.0		LIMESTONE and SHALE, interbedded, gray to dark gray, moderately hard, dry, 1-2 fizz	
85	1066					LIMESTONE, dark gray, hard, dry, 1-2 fizz	
90	1061	84.0	90.0	6.0			
95	1056	90.0	92.0	2.0		SHALE, dark gray, moderately hard, dry, 0-1 fizz	
100		92.0	100.0	8.0		SANDSTONE, gray, moderately hard, dry to wet, 0 fizz	

Water at @ 98'

Hole No. : DH-3-18
 Surface Elevation : 1147'
 Top of Stone Elev. : 1079' (Fishpot LS)
 Bottom of Stone Elev. : 1066' (Fishpot LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1072.1'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 51" W 79° 16' 29"

Depth in Feet	Surf. Elev. 1147	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1147					BACKFILL (Previously Mined)	
5	1142						
10	1137	0.0	22.0	22.0			
15	1132						
20	1127						
25	1122					SHALE, gray to dark gray, soft to moderately hard, dry, 0 fizz	
30	1117					moderately hard begins	
35	1112	22.0	68.0	46.0			
40	1107						
45	1102						
50							

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Hole No. : DH-3-18
 Surface Elevation : 1147'
 Top of Stone Elev. : 1079' (Fishpot LS)
 Bottom of Stone Elev. : 1066' (Fishpot LS)
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1072.1'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 51" W 79° 16' 29"

Depth in Feet	Surf. Elev. 1147	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1097					SHALE, gray to dark gray, moderately hard, dry, 0 fizz	
55	1092						
60	1087	22.0	68.0	46.0			
65	1082						
70	1077	68.0	72.0	4.0		LIMESTONE and SHALE, interbedded, gray, moderately hard to hard, dry, 0-1 fizz	
		72.0	74.0	2.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
75	1072					LIMESTONE, gray, moderately hard to hard, dry, 2 fizz	
		74.0	81.0	7.0			
80	1067					SANDY SHALE, gray, moderately hard, dry, 0 fizz	
85	1062	81.0	90.0	9.0			
90	1057					SANDSTONE, gray, moderately hard to hard, dry, 0 fizz	
		90.0	94.0	4.0			
95	1052					SHALE, gray, moderately hard, dry, 0 fizz	
		94.0	100.0	6.0			
100							

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Hole No. : DH-4-18
 Surface Elevation : 1147'
 Top of Stone Elev. : 1056' Limestone
 Bottom of Stone Elev. : 1038' Limestone
 Bottom of Coal Elev. : 1057.5'
 Groundwater Elev. : 1060.3'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 45" W 79° 16' 24"

Depth in Feet	Surf. Elev. 1147	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1147					BACKFILL (Previously Mined)	
5	1142						
10	1137						
15	1132						
20	1127	0.0	40.0	40.0			
25	1122						
30	1117						
35	1112						
40	1107	40.0	41.0	1.0		SHALE and COAL, black, moderately hard, dry, 0 fizz	
45	1102	41.0	54.0	13.0		SHALE, gray to dark gray, moderately hard to hard, dry, 0 fizz	
50							

Hole No. : DH-4-18
 Surface Elevation : 1147'
 Top of Stone Elev. : 1056' Limestone
 Bottom of Stone Elev. : 1038' Limestone
 Bottom of Coal Elev. : 1057.5'
 Groundwater Elev. : 1060.3'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 45" W 79° 16' 24"

Depth in Feet	Surf. Elev. 1147	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1097	41.0	54.0	13.0		SHALE, gray to dark gray, moderately hard to hard, dry, 0 fizz	
55	1092	54.0	57.0	3.0		LIMESTONE, gray, moderately hard to hard, dry, 1-2 fizz	
60	1087					SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
65	1082						
70	1077						
75	1072	57.0	89.0	32.0			
80	1067						
85	1062						
90	1057	89.0 89.5	89.5 91.0	0.5 1.5		COAL, black, moderately hard, dry, 0 fizz	
95	1052	91.0	109.0	18.0		SHALE, dark gray to black, moderately hard, dry, 0 fizz LIMESTONE, gray, hard, dry, 2 fizz	
100							

Hole No. : DH-4-18
 Surface Elevation : 1147'
 Top of Stone Elev. : 1056' Limestone
 Bottom of Stone Elev. : 1038' Limestone
 Bottom of Coal Elev. : 1057.5'
 Groundwater Elev. : 1060.3'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 45" W 79° 16' 24"

Depth in Feet	Surf. Elev. 1147	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
100	1047					LIMESTONE, gray, hard, dry, 2 fizz	
105	1042	91.0	109.0	18.0			
110	1037					SHALE, dark gray, moderately hard, dry, 0-1 fizz	
115	1032	109.0	125.0	16.0			
120	1027						
125	1022						
130	1017						
135	1012						
140	1007						
145	1002						
150							

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Hole No. : DH-5-18
 Surface Elevation : 1127'
 Top of Stone Elev. : 1059' Limestone
 Bottom of Stone Elev. : 1044' Limestone
 Bottom of Coal Elev. : 1059.5'
 Groundwater Elev. : 1070.3'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 53" W 79° 16' 34"

Depth in Feet	Surf. Elev. 1127	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1127					SOILS & SUBSOILS, brown, soft, dry, 0 fizz	
5	1122	0.0	8.0	8.0			
10	1117	8.0	13.0	5.0		SHALE, brown, moderately hard, dry, 0 fizz	
13		13.0	13.5	0.5		LIMESTONE, gray, moderately hard, dry, 1 fizz	
15	1112					SHALE, gray, moderately hard, dry, 0 fizz	
20	1107	13.5	25.0	11.5			
25	1102	25.0	26.0	1.0		COAL, black, moderately hard, damp, 0 fizz	
30	1097	26.0	30.0	4.0		SHALE, dark moderately hard, dry, 0 fizz brown and gray,	
35	1092	30.0	38.0	8.0		LIMESTONE (Sandy), gray, hard, dry, 1 fizz	
40	1087	38.0	40.0	2.0		SHALE, dark gray, moderately hard to hard, dry, 0 fizz	
45	1082	40.0	67.0	27.0		SHALE, gray, moderately hard, dry, 0 fizz	
50							

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Hole No. : DH-5-18
 Surface Elevation : 1127'
 Top of Stone Elev. : 1059' Limestone
 Bottom of Stone Elev. : 1044' Limestone
 Bottom of Coal Elev. : 1059.5'
 Groundwater Elev. : 1070.3'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 53" W 79° 16' 34"

Depth in Feet	Surf. Elev. 1127	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
50	1077					SHALE, gray, moderately hard, dry, 0 fizz	
55	1072						
60	1067	40.0	67.0	27.0			
65	1062						
67.5	1062	67.0	67.5	0.5		COAL, black, moderately hard, dry, 0 fizz	
68.5	1062	67.5	68.5	1.0		SHALE, gray, moderately hard, dry, 0 fizz	
70	1057					LIMESTONE, gray to dark gray, hard, dry to wet, 2 fizz	
75	1052	68.0	83.0	15.0			
80	1047					Water @ 77'	
85	1042					SHALE, dark gray, moderately hard, dry, 0-1 fizz	
90	1037	83.0	94.0	11.0			
95	1032					SANDSTONE, gray, hard, dry, 0 fizz	
100		94.0	100.0	6.0			

Hole No. : DH-6-18
 Surface Elevation : 1101'
 Top of Stone Elev. : 1069' Limestone
 Bottom of Stone Elev. : 1058' Limestone
 Bottom of Coal Elev. : 1071.5'
 Groundwater Elev. : 1069.4'
 Date Measured : 5-11-2018
 Surveyed by : Earthtech, Inc.
 Method : Submeter GPS
 Remarks :



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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L- SMT East
 Method of Drilling : Air Rotary
 Date Drilled : 5-2-2018
 Drilled By : Senex Explosives, Inc.
 Logged By : AMR (directed by JSL, PG)
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 52" W 79° 16' 39"

Depth in Feet	Surf. Elev. 1101	Start Depth	End Depth	Thick-ness	GRAPHIC	DESCRIPTION	REMARKS
0	1101					SOILS & SUBSOILS, brown, soft, dry, 0 fizz	
5	1096	0.0	9.0	9.0			
10	1091					SHALE, brown, moderately hard, dry, 0 fizz	
15	1086	9.0	20.0	11.0			
20	1081	20.0	21.0	1.0		COAL, black, moderately hard, dry, 0 fizz	
		21.0	25.0	4.0		SHALE, brown and gray, soft to moderately hard, dry, 0 fizz	
25	1076	25.0	29.0	4.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
30	1071	29.0	29.5	0.5		COAL, black, moderately hard, dry, 0 fizz	
		29.5	32.0	2.5		SHALE, gray, moderately hard, dry, 0 fizz	
35	1066					LIMESTONE, gray, hard, dry, 1-2 fizz	
40	1061	32.0	43.0	11.0			
45	1056	43.0	50.0	7.0		SHALE, dark gray, moderately hard, dry, 0 fizz	
50							

Module 7.1(B) Geologic Log Drill Holes

Jelley LNC Drill Hole Logs

The following pages contain geologic logs for core holes drilled for the adjacent issued Jelley LNC site. Five holes drilled in July 2009 (identified as DH-1 to DH-5) are included. This drill hole data was used to correlate the Benwood Limestone within the proposed SMT East site and the surrounding adjacent areas.

Hole No. : DH-1
 Surface Elevation : 1155'
 Bottom of LS Elev. : 1091'
 Bottom of Coal Elev. : 1037' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1085.4' (TOC)
 Date Measured : 08/05/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll, P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 09" W 79° 16' 43"

Depth in Feet	Surf. Elev. 1155	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
0	1155						SOILS and REGOLITH	
5	1150							
10	1145	0	18.0	18.0				
15	1140							
20	1135	18	28.0	10.0			SHALE, SILTSTONE, and MUDSTONE; (Interbedded); Brown and Light Gray; Soft to Med. Hard; Very to Slightly Broken; Mod. Weathered; No Fizz	
25	1130							
30	1125						SHALE; Very Dark Gray to Black; Medium Hard; Very Broken to Broken; No Fizz	
35	1120	28	43.7	15.7				
40	1115							
45	1110	43.7	45.5	1.8			SHALE w/ Trace Coal; Black; Very Broken to Broken; No Fizz	
		45.5	47.4	1.9			LIMESTONE; Broken	
50	1105						Bennwood LIMESTONE	
55	1100	47.4	64.0	16.6				Static Water Level Reading (8/5/09) SWL = 69.6' TOTAL DEPTH = 126.1' STICK-UP = 1.8'
60								Note: All readings were taken at the top casing.

08-19-2009 C:\Program Files\mtech532\Jelley logs\DH-1.BOR

Hole No. : DH-1
 Surface Elevation : 1155'
 Bottom of LS Elev. : 1091'
 Bottom of Coal Elev. : 1037' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1085.4' (TOC)
 Date Measured : 08/05/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll, P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 09" W 79° 16' 43"

Depth in Feet	Surf. Elev. 1155	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
60	1095	47.4	64.0	16.6				
65	1090	64.0	69.0	5.0			SHALE, LIMESTONE, and SANDSTONE (Interbedded); Dark Gray; Very Broken to Broken; Moderate Fizz	
70	1085	69.0	76.0	7.0			SHALE and MUDSTONE; Dark Gray; Very Broken; Soft to Medium Hard; Slight to Mod. Fizz	
75	1080						SANDSTONE and SHALE (Interbedded); Gray; Very Broken to Slightly Broken; Med. Hard to Hard; No Fizz	
80	1075	76.0	84.5	8.5			SANDSTONE; Light Gray; Broken to Massive; Hard; No Fizz	
85	1070						SANDSTONE; Light Gray; Broken to Massive; Hard; No Fizz	
90	1065	84.5	97.5	13.0			SHALE; Gray to Black; Very Broken to Massive; Med. Hard; No Fizz	
95	1060						SHALE; Gray to Black; Very Broken to Massive; Med. Hard; No Fizz	
100	1055						SHALE; Gray to Black; Very Broken to Massive; Med. Hard; No Fizz	
105	1050	97.5	116.0	18.5			SHALE; Gray to Black; Very Broken to Massive; Med. Hard; No Fizz	Static Water Level Reading (8/5/09) SWL = 69.6' TOTAL DEPTH = 126.1' STICK-UP = 1.8'
110	1045						SHALE; Gray to Black; Very Broken to Massive; Med. Hard; No Fizz	Note: All readings were taken at the top casing.
115	1040	116.0	118.0	2.0			COAL; Sewickley Seam	
120		118.0	119.0	1.0			SHALE; Gray to Black; Very Broken; Med. Hard; No Fizz	

Hole No. : DH-2
 Surface Elevation : 1150'
 Bottom of LS Elev. : 1084.7'
 Bottom of Coal Elev. : 1033.2' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1082.9' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll, P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 07" W 79° 16' 55"

Depth in Feet	Surf. Elev. 1150	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
0	1150	0	4.0	4.0			SOILS and REOLITH	
5	1145						SHALE, SANDSTONE (Interbedded); Brown and Gray; Soft to Med. Hard; Very Broken; Highly Weathered; No Fizz	
10	1140	4.0	14.0	10.0			SILTSTONE, MUDSTONE; Gray; Medium Hard; Broken to Massive; Slight to Moderate Fizz	
15	1135	14.0	19.7	5.7			SHALE, SANDSTONE (Interbedded); Gray; Very Broken to Broken; Slightly Weathred; No Fizz	
20	1130						SHALE; Dark Gray; Med Hard; Very Broken; No Fizz	
25	1125	19.7	36.0	16.3			Bennwood LIMESTONE	
30	1120							
35	1115							
40	1110	36.0	45.0	9.0				
45	1105							
50	1100	45.0	65.3	20.3				
55	1095							
60								

Static Water Level Reading (8/6/09)
 SWL = 67.1'
 TOTAL DEPTH = 124.1'
 STICK-UP = 1.0'

Note: All readings were taken at the top casing.

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Hole No. : DH-2
 Surface Elevation : 1150'
 Bottom of LS Elev. : 1084.7'
 Bottom of Coal Elev. : 1033.2' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1082.9' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Mster GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll, P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 07" W 79° 16' 55"

Depth in Feet	Surf. Elev. 1150	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
60	1090							
65	1085	45.0	65.3	20.3				
70	1080	65.3	77.5	12.2			SHALE, LIMESTONE, and SANDSTONE (Interbedded); Gray; Very Broken to Slightly Broken; Moderate Fizz	
75	1075							
80	1070						SHALE, SANDSTONE (Interbedded); Gray to Dark Gray; Very Broken to Broken; Soft to Medium Hard; No Fizz; Micaceous	
85	1065							
90	1060	77.5	103.0	25.5				
95	1055							
100	1050							
105	1045						SHALE; Dark Gray to Black; Very Broken to Massive; Hard; No Fizz	
110	1040	103.0	114.6	11.6				Static Water Level Reading (8/6/09) SWL = 67.1' TOTAL DEPTH = 124.1' STICK-UP = 1.0'
115	1035	114.6	116.8	2.2			COAL; Sewickley Seam	Note: All readings were taken at the top casing.
120		116.8	124.0	7.2				

08-19-2009 C:\Program Files\earthtech\532\Jelley_logs\DH-2_BOR

Hole No. : DH-2
 Surface Elevation : 1150'
 Bottom of LS Elev. : 1084.7'
 Bottom of Coal Elev. : 1033.2' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1082.9' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll, P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 07" W 79° 16' 55"

Depth in Feet	Surf. Elev. 1150	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
120	1030	116.8	124.0	7.2			SHALE, SANDSTONE; Light to Dark Gray; No Fizz; Micaceous; Trace Coal at 117.3' to 117.5'	
125	1025							
130	1020							
135	1015							
140	1010							
145	1005							
150	1000							
155	995							
160	990							
165	985							
170	980							
175	975							
180								

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Hole No. : DH-3
 Surface Elevation : 1103'
 Bottom of LS Elev. : 1061.2'
 Bottom of Coal Elev. : 1000.0' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1057.6' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 23' 59" W 79° 16' 53"

Depth in Feet	Surf. Elev. 1103	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
0	1103						SOILS and REGOLITH	
5	1098	0	11.5	11.5				
10	1093							
15	1088	11.5	17.5	6.0			SHALE, SANDSTONE; (Interbedded); Light Gray to Gray; Soft to Med. Hard; Very to Slightly Broken; Mod. Weathered w/ Some Staining; No Fizz	
20	1083	17.5	21.5	4.0			SHALE; Very Dark Gray to Black; Soft to Medium Hard; Very Broken to Broken; No Fizz	
21.5		21.5	22.2	0.7			COAL	
25	1078						LIMESTONE, Benwood; Light Gray; Hard; Slightly Broken to Massive; Mod. to Strong Fizz; Black Shale Partings @ 29.8' - 30.0', 33.2' - 33.3', and 38.3' - 38.7'	
30	1073	22.2	41.8	19.6				
35	1068							
40	1063							
45	1058	41.8	50.4	8.6			SILTSTONE, LIMESTONE, and SANDSTONE; (Interbedded); Gray to Dark Gray; Very Broken to Broken; Med. Hard; No to Slight Fizz	
50	1053							Static Water Level Reading (8/6/09) SWL = 45.4' TOTAL DEPTH = 101.2' STICK-UP = 2.0'
55	1048	50.4	65.0	14.6			SHALE, LIMESTONE, and SANDSTONE (Interbedded); Light Gray; Broken to Massive; Med. Hard to Hard; No to Slight Fizz	Note: All readings were taken at the top casing.
60								

08-19-2009 C:\Program Files\earthtech\52\Jelley_logs\DH-3.BOR

Hole No. : DH-3
 Surface Elevation : 1103'
 Bottom of LS Elev. : 1061.2'
 Bottom of Coal Elev. : 1000.0' Sewickley
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1057.6' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



Earthtech, Inc.
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7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Nolf P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 23' 59" W 79° 16' 53"

Depth in Feet	Surf. Elev. 1103	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
60	1043	50.4	65.0	14.6				
65	1038						SHALE, SANDSTONE (Interbedded); Light Gray to Gray; Broken to Massive; Hard; No Fizz; Micaceous	
70	1033	65.0	81.0	16.0				
75	1028						SHALE, SILTSTONE (Interbedded); Dark Gray to Black; Broken to Massive; Med. Hard; No Fizz; Coal from 91.5' - 91.7'	
80	1023							
85	1018	81.0	92.7	11.7				Static Water Level Reading (8/6/09) SWL = 45.4' TOTAL DEPTH = 101.2' STICK-UP = 2.0'
90	1013							Note: All readings were taken at the top casing.
95	1008	92.7	95.0	2.3			COAL, Sewickley Rider	
95	1008	95.0	100.2	5.2			SHALE; Very Dark Gray; Broken to Massive; Med. Hard; No Fizz; Coal from 97.2' - 97.4'	
100	1003	100.2	103.0	2.8			COAL; Sewickley Seam	Core ended at 100.2'- Sewickley Coal depths were adjusted from reported depths of 104' to 106.8'
105	998							
110	993							
115	988							
120								

Hole No. : DH-4
 Surface Elevation : 1130'
 Bottom of LS Elev. : 1077.2'
 Bottom of Coal Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1085.5' (TOC)
 Date Measured : 08/05/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 05" W 79° 16' 48"

Depth in Feet	Surf. Elev. 1130	Start Depth	End Depth	Thick- ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
0	1130						SOILS and REGOLITH	
5	1125	0	10.0	10.0				
10	1120	10.0	15.2	5.2			SANDSTONE; Gray; Hard; Slightly Broken to Massive; Mod. Weathered; No Fizz	
15	1115						SHALE, SANDSTONE (Interbedded); Light to Dark Gray; Medium Hard; Very Broken to Broken; No Fizz	
20	1110	15.2	32.0	16.8				
25	1105						SHALE, Black w/ Trace Coal	
30	1100	32.0	34.0	2.0			LIMESTONE, Benwood; Light Gray; Hard; Slightly Broken to Massive; Strong Fizz	
35	1095							
40	1090	34.0	52.8	18.8				
45	1085							
50	1080							
55	1075	52.8	64.0	11.2			SHALE, LIMESTONE, and SANDSTONE; (Interbedded); Gray; Very Broken to Broken; Med. Hard; No to Slight Fizz	
60								Static Water Level Reading (8/5/09) SWL = 44.5' TOTAL DEPTH = 116.1' STICK-UP = 0.0' Note: All readings were taken at the top casing.

Hole No. : DH-4
 Surface Elevation : 1130'
 Bottom of LS Elev. : 1077.2'
 Bottom of Coal Elev. : N/A
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1085.5' (TOC)
 Date Measured : 08/05/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



Earthtech, Inc.
 CONSULTING SCIENTISTS & ENGINEERS

7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 05" W 79° 16' 48"

Depth in Feet	Surf. Elev. 1130	Start Depth	End Depth	Thick- ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
60	1070	52.8	64.0	11.2			SHALE, SANDSTONE (Interbedded); Gray; Broken to Slightly Broken; Med. Hard to Hard; No Fizz	
65	1065							
70	1060							
75	1055	64.0	89.4	25.4			SHALE; Dark Gray to Black; Broken to Massive; Med. Hard; No Fizz;	
80	1050							
85	1045							
90	1040							
95	1035							
100	1030	89.4	114.0	24.6				
105	1025							Static Water Level Reading (8/5/09) SWL = 44.5' TOTAL DEPTH = 116.1' STICK-UP = 0.0'
110	1020						Trace Coal at 107.5'	Note: All readings were taken at the top casing.
115	1015							
120								

Hole No. : DH-5
 Surface Elevation : 1153'
 Bottom of LS Elev. : 1108'
 Bottom of Coal Elev. : 1058'
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1059.6' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :



7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll P.G.
 Township : Derry
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 11" W 79° 17' 03"

Depth In Feet	Surf. Elev. 1153	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
0	1153						SOILS and REGOLITH	
5	1148							
10	1143	0	18.0	18.0				
15	1138							
20	1133	18.0	18.6	0.6			SANDSTONE; Light Gray; Hard; Slightly Broken; Slight Fizz	
25	1128	18.6	25.4	6.8			SHALE, MUDSTONE; Dark Gray to Black; Very Broken to Broken; No Fizz	
30	1123						LIMESTONE, Benwood; Light Gray; Hard; Slightly Broken to Massive; Strong Fizz	
35	1118	25.4	45.0	19.6				
40	1113							
45	1108						SILTSTONE, LIMESTONE, and SANDSTONE; (Interbedded); Gray; Broken to Massive; Hard; Slight to Mod. Fizz	
50	1103	45.0	81.8	36.8				Static Water Level Reading (8/6/09) SWL = 93.4' TOTAL DEPTH = 99.5' STICK-UP = 1.6'
55	1098							Note: All readings were taken at the top casing.
60								

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Hole No. : DH-5
 Surface Elevation : 1153'
 Bottom of LS Elev. : 1108'
 Bottom of Coal Elev. : 1058'
 Bottom of Coal Elev. : N/A
 Groundwater Elev. : 1059.6' (TOC)
 Date Measured : 08/06/2009
 Surveyed by : Earthtech, Inc.
 Method : Sub-Meter GPS
 Remarks :

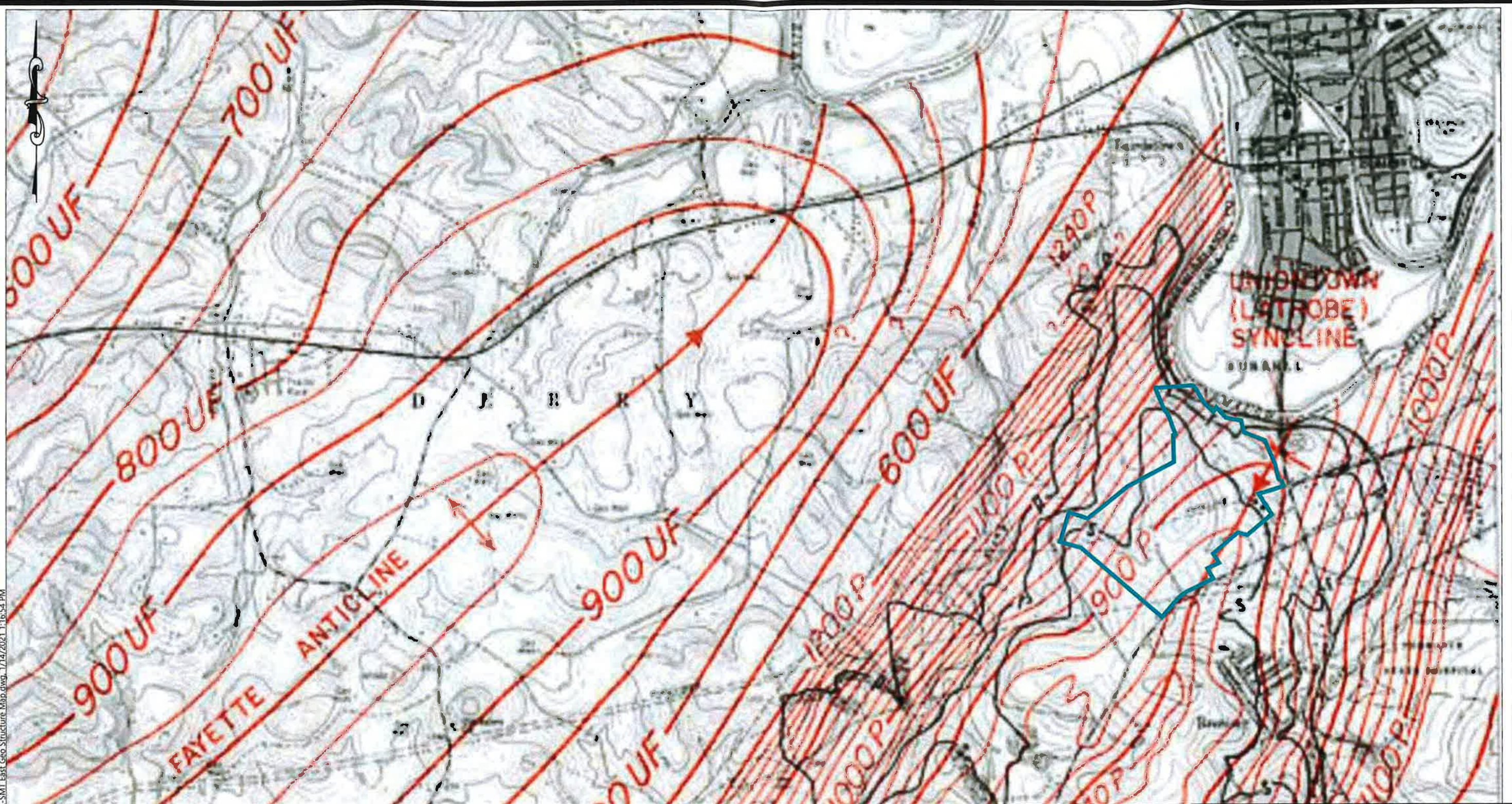


7.1(B) GEOLOGIC LOG DRILL HOLES/
 OVERBURDEN ANALYSIS DATA
 Revised by Earthtech using MTECH Software

Operation Name : Ligonier S&L - Jelley
 Method of Drilling : Continuous Core
 Date Drilled : July 2009
 Drilled By : Ligonier Stone & Lime
 Logged By : ETI - A.R. & D. Noll P.G.
 Township : Dery
 County : Westmoreland
 Quadrangle : Blairsville
 Laboratory : N/A
 Latitude & Longitude : N 40° 24' 11" W 79° 17' 03"

Depth in Feet	Surf. Elev. 1153	Start Depth	End Depth	Thick-ness	Water Level	GRAPHIC	DESCRIPTION	REMARKS
60	1093							
65	1088							
70	1083	45.0	81.8	36.8				
75	1078							
80	1073							
85	1068	81.8	92.6	10.8			SHALE; Dark Gray to Black; Broken to Massive; No Fizz; Carbonaceous; Trace Coal at 92.2'	
90	1063							Static Water Level Reading (8/6/09) SWL = 93.4' TOTAL DEPTH = 99.5' STICK-UP = 1.6'
95	1058	92.6	95.0	2.4			COAL; Sewickley Seam	
95	1058	95.0	100.0	5.0			SANDSTONE, SILTSTONE (Interbedded); Gray; Broken; Med. Hard; No Fizz; Trace Coal from 95.6' to 95.8'	Note: All readings were taken at the top casing.
100	1053							
105	1048							
110	1043							
115	1038							
120								

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LEGEND

PROPOSED SMT EAST PERMIT LINE

GRAPHIC SCALE



1 inch = 2,000 ft.

ATTACHMENT 7.2a)

GEOLOGIC STRUCTURE MAP
FOR
LIGONIER STONE & LIME COMPANY
SMT EAST SURFACE MINE
DERRY TOWNSHIP, WESTMORELAND COUNTY

DATE: 11-24-2020

Earthtech, Inc.
966 Pleasant Hill Road, Somerset, PA 15501
Telephone: (814) 266-6402 Fax: (814) 266-6530
<http://www.earthtechinc.net>

Source: Coal Resources of Westmoreland County, Pennsylvania, Mineral Resource Report 94, Part 1, 1988.