REPORT OF SUPPLEMENTAL GEOTECHNICAL SUBSURFACE CHARACTERIZATION

OLIVE BRANCH NEIGHBORHOOD
CORE CAPITAL MINE SITE
TALCUM (KNOTT COUNTY), KENTUCKY

PROJECT: 26050007SHE REV. A
KYTC ITEM NUMBER: 12-163

MAY 20, 2026

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May 20, 2026

Mr. John Meyer, PE, RSPI
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Frankfort, KY 40601

Subject: Report of Supplemental Geotechnical Subsurface Characterization
Olive Branch Neighborhood
Core Capital Mine Site
Talcum (Knott County), Kentucky
CTL Project 26050007SHE Rev. A
KYTC Item Number: 12-163

Dear Mr. Meyer,

CTL Engineering, Inc., has completed the supplemental geotechnical subsurface site characterization for the proposed neighborhood development. This exploration was in general accordance with our proposal 25050083SHEPPL, dated September 26, 2025, which was accepted by Mr. John Meyer with HMB. The purpose of this exploration was to obtain supplemental subsurface data to develop site preparation and foundation recommendations for the proposed neighborhood development. This report describes our understanding of the project, summarizes our findings, discusses the geotechnical concerns, and contains our engineering recommendations.

CTL Engineering, Inc. appreciates the opportunity to provide you with these geotechnical services. Should you have questions or require any additional information, please contact us.

Respectfully submitted,

CTL Engineering, Inc.

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Geotechnical Manager
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Permit 860-0421 Files from Kentucky Department of Natural Resources

Permit 860-0466 Files from Kentucky Department of Natural Resources

Permit 860-0565 Files from Kentucky Department of Natural Resources

1 PROJECT INFORMATION

Project information was provided to us through correspondence with Mr. John Meyer and our previous experience at the site for the geotechnical report entitled *Core Capital Geotech Report* (Vector project 22050159SHE), dated February 22, 2023. We were provided with a KMZ with the proposed neighborhood development plan for the project, which was prepared by HMB (Figures 1 and 2).

The revised development plan consists of about 130 residential lots on approximately 85.3 acres of land in an area of previous mining near Talcum, Kentucky. The development is being led by the Kentucky Transportation Cabinet (KYTC) as part of the Higher Ground initiative. The project site is located off Highway 80 between Hazard and Hindman, just east of the Perry/Knott County line. The site was primarily mined by mountaintop removal with the potential for some areas of contour mining. The spoils, which consist of soil and bedrock fragments from above and in between the mined coal seams, are placed in valleys (hollow fills), on contour benches (where present), and over the mined top of the mountain. Our previous exploration was limited to an area north of the site, which was indicated as a mine spoil storage area in the latest available mine maps. However, older mine maps indicate that areas outside of this area were also subject to mining. The new neighborhood area overlies much of this previously unexplored area. Therefore, the purpose of this supplemental subsurface exploration is to explore the proposed neighborhood area and review additional mine mapping to better define potential mine benches (if present) and to understand the consistency of the mine spoils.

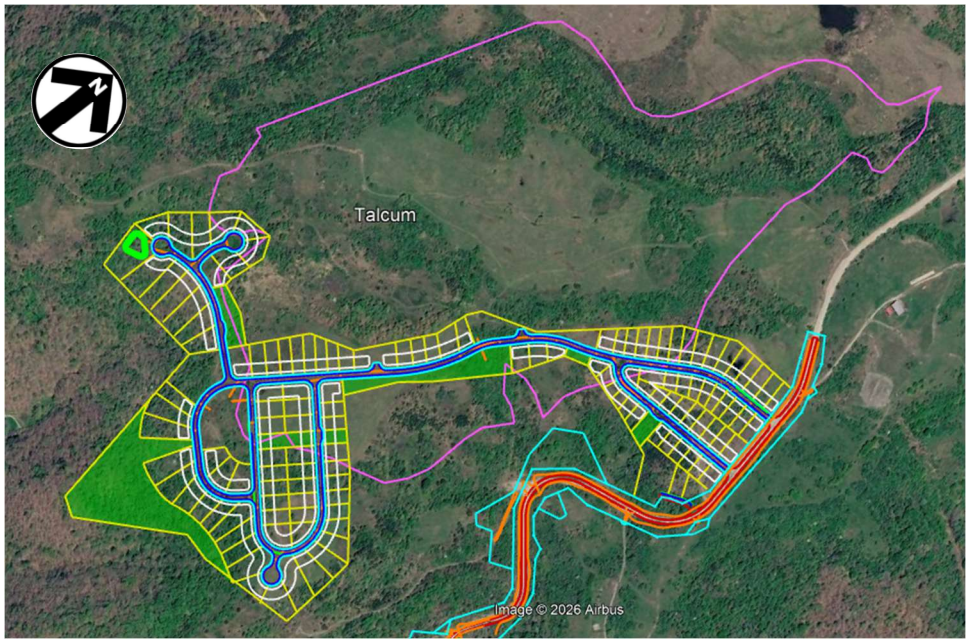


Figure 1: The original neighborhood plan included a spur at the southwest side. The pink outlined area was the general location of the previous exploration.

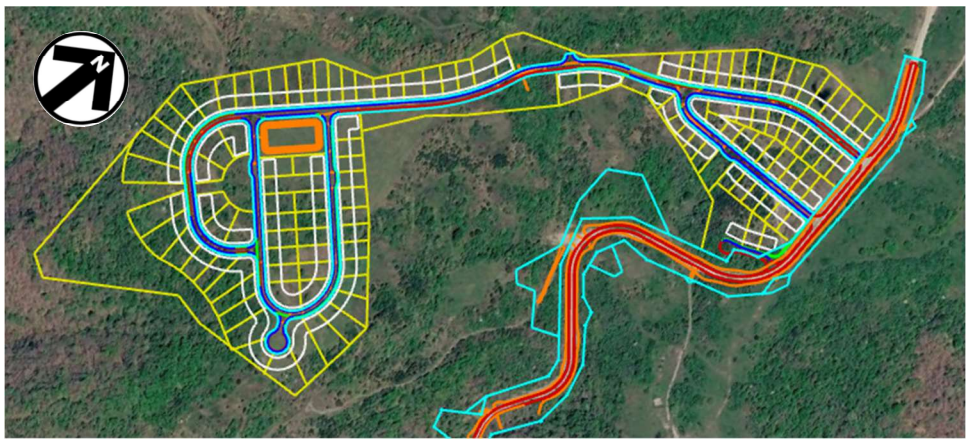


Figure 2: The revised neighborhood plan removes the southwest spur and relocates the drainage basin.

2 FINDINGS

As part of our geotechnical site characterization, we observed site conditions, reviewed regional geological maps, performed a subsurface exploration, and observed the groundwater conditions. The following sections report our findings.

2.1 Site Surface Conditions

Mr. Conner Barnes, EIT, with CTL Engineering, under the direction of Mr. Matthew Slusser, PE, observed the surface conditions on March 17 to 24, 2026, to aid in interpreting the subsurface data and to detect conditions that could affect the project. The following is a general description of the site.

The proposed development is located on top of an abandoned coal surface mine, located north of Kentucky Highway KY-80, and west of the Starfire Mine Haul Road in Talcum, Kentucky. As is typical of surface mines, the site has been extensively graded and disturbed.

At the entrance of the proposed development, just west of the Starfire Haul Road, the current terrain is generally flat, with some minor swales and a steep hillside on the southwestern portion. On the north side of this area, the terrain rises steeply about 10 feet before flattening again. This area at the peak forms a slight bowl and appears to hold water for a significant portion of the year. The surface is generally covered by tall grass, brush, and outcroppings of small trees. The hillside is wooded, and a dirt access road travels along the southern portion. Site drainage in this area was judged to be very poor to poor. As mentioned previously, the plateaued section to the northeast was observed to hold notable amounts of surface water (Figure 3). Substantial standing water was observed along the east portion of this area, near the Starfire Haul Road, with sections of the access road holding up to 2 feet of water (Figure 4).

Figure 3: Notable amounts of water are retained at the northeastern portion of the site.

Figure 4: The eastern portion of the site is generally covered in tall grass and short trees. The dirt access road retains standing water for prolonged periods.

The northwestern side of the site was reclaimed as pastureland (Figure 5). The area marginally slopes down to the west and is covered in short grass. Drainage was judged to be fair, with surface water directed to ditches and swales around the edges of the pastures. The southern portion of the site consists of rolling hills, with a large swale separating the pastureland to the north. This portion of the site is covered in fields of tall grass and brush, and areas that are wooded with small trees, with a dirt access road splitting towards multiple sections of the land (Figure 6). On the southwest portion is a gas pipeline maintenance area, with a gas line extending across the development area. To the west, south, and east, the terrain slopes steeply down a wooded hillside. The drainage in this portion of the site was judged to be good, with surface water drainage directed down the mountainside.

Figure 5: The pastureland at the northwest portion of the site is covered in short grass and slopes gently down to the west.

Figure 6: The southwest portion of the site has rolling hills and is covered by tall grass and small wooded pockets.

Review of the existing site topography indicates that the site elevations on top of the ridge now range from about 1330 to 1370 feet within the neighborhood areas, with lower elevations along the side slopes leading down from the ridge into the valleys. In general, the proposed development lots are located

on the flattened portion of the mountain ridge. However, a few lots located on the southern side of the development and on the south entrance road at the north end of the development are planned for areas sloping down from the ridge.

2.2 Area Geology

The Geologic Map of the Hazard Quadrangle, Kentucky (GQ-1441), published by the U.S. Geological Survey (USGS) indicates the site is underlain by two formations: the Princess Formation and the Four Corners Formation (Figure 7). The Princess Formation consists of sandstone, shale, coal and underclay and is generally located at higher elevations. The Four Corners Formation is generally sandstone, siltstone, shale, coal, and limestone, encountered on the side slopes and in the valley bottoms. The site is rated as non-Karst by the KGS, indicating that the geologic conditions present on site are not typically susceptible to the solutioning activity that causes sinkholes and Karst conditions.

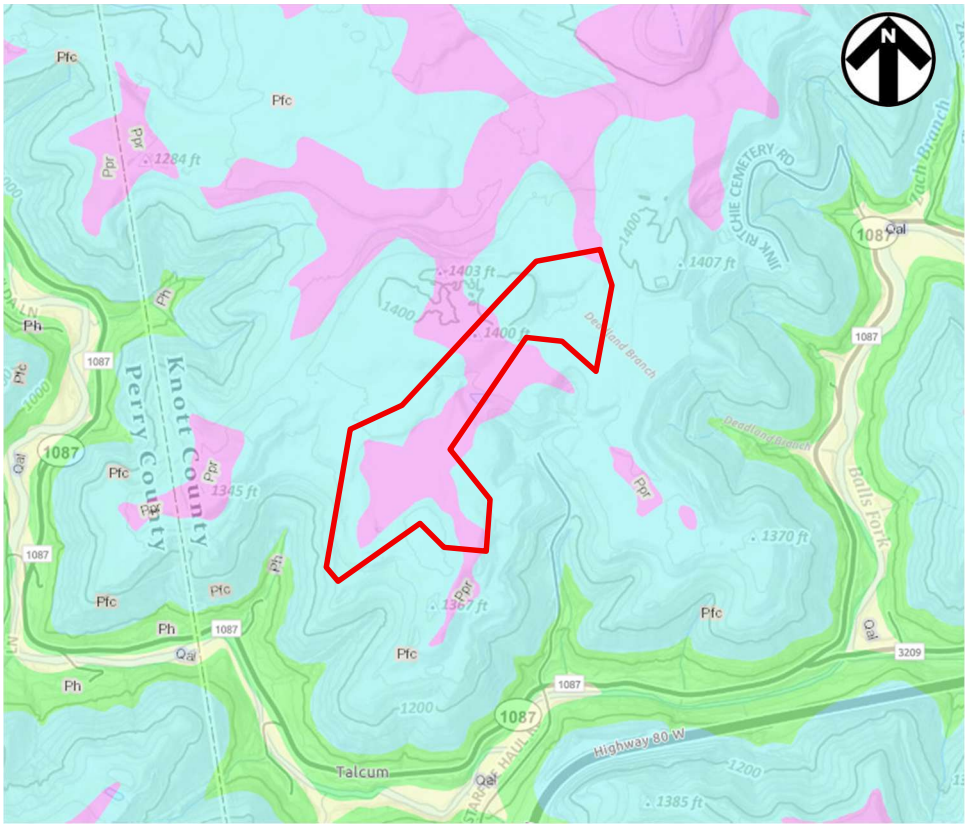


Figure 7: The pink shading indicates areas underlain by the Princess Formation, while the cyan indicates the Four Corners Formation. The green and yellow shading at the low elevations indicate the Hyden Formation and alluvium, respectively. The red outline indicates the approximate neighborhood area.

The Kentucky Geological Survey shows several coal seams that were/are located within the upper portions of the geologic column. Review of the geologic map for the area of the site indicates four possibly mined seams; the Hindman Coal (Hazard No. 9), Francis Coal (Hazard No. 8), Hazard No. 7 (A and B seams), and the Hazard coal beds (Figure 3). Mine mapping for mining north of the site encountered the Hazard No. 10 seam; however, based on the available information, this seam was not present in the project area. Six pre-mining coal borings were observed to be in the general vicinity of the neighborhood development, performed in 1982 and 1983; including two borings within the south portion of the neighborhood (VST 194 and VST 198), three borings about ¼ to a little over ½ mile northwest of the neighborhood site (VST 126, VST 127, and VST 192), and one boring just under a ½ mile north of the north neighborhood entrance (VST 78). Table 1 below indicates the approximate elevation of the encountered coal seams in each boring, with blank cells indicating that the boring did not encounter that seam. Based on these elevations, the coal appears to slope down at just under 1% to the north, which suggests that the bottom of the Hazard 7A coal within the neighborhood area likely ranged from about 1260 to 1230 feet in elevation

Table 1: Mapped coal bed elevations near the Olive Branch Neighborhood

Boring No.	Hazard No. 9 (ft)	Hazard No. 8 (ft)	Hazard No. 7B/Rider (ft)	Hazard No. 7A (ft)	Hazard Bed B (ft)	Hazard Bed A (ft)
VST 78	-	Top: 1267 Bottom: 1260	Top: 1239 Bottom: 1235	Top: 1218 Bottom: 1215	-	-
VST 127	-	Top: 1290 Bottom: 1283	Top: 1250 Bottom: 1246	Top: 1226 Bottom: 1224	Top: 1198 Bottom: 1196	Top: 1130 Bottom: 1127
VST 126	Top: 1380 Bottom: 1374	Top: 1288 Bottom: 1281	Top: 1240 Bottom: 1236	Top: 1226 Bottom: 1223	-	-
VST 192†	Top: 1347 Bottom: 1343	Top: 1266 Bottom: 1262	Top: 1225 Bottom: 1222	Top: 1201 Bottom: 1198	-	-
VST 198	-	Top: 1319 Bottom: 1315	Top: 1268 Bottom: 1263	Top: 1256 Bottom: 1252	-	-
VST 194	-	Top: 1312 Bottom: 1307	Top: 1265 Bottom: 1262	Top: 1260 Bottom: 1256	*	*

* Boring VST 194 encountered small coal seams (about 7 to 12 inches) at elevations of 1213, 1183, and 1166 feet, which may represent the Hazard Coal Bed. However, these seams were unlabeled in the available documentation.

† The elevations of Boring VST 192 are inconsistent with the other borings on site. The boring lists a surface elevation of 1430 feet; however, historic topo suggests that the surface elevation was likely closer to 1480. Raising the elevations 50 feet would make the boring more consistent with the other available data.

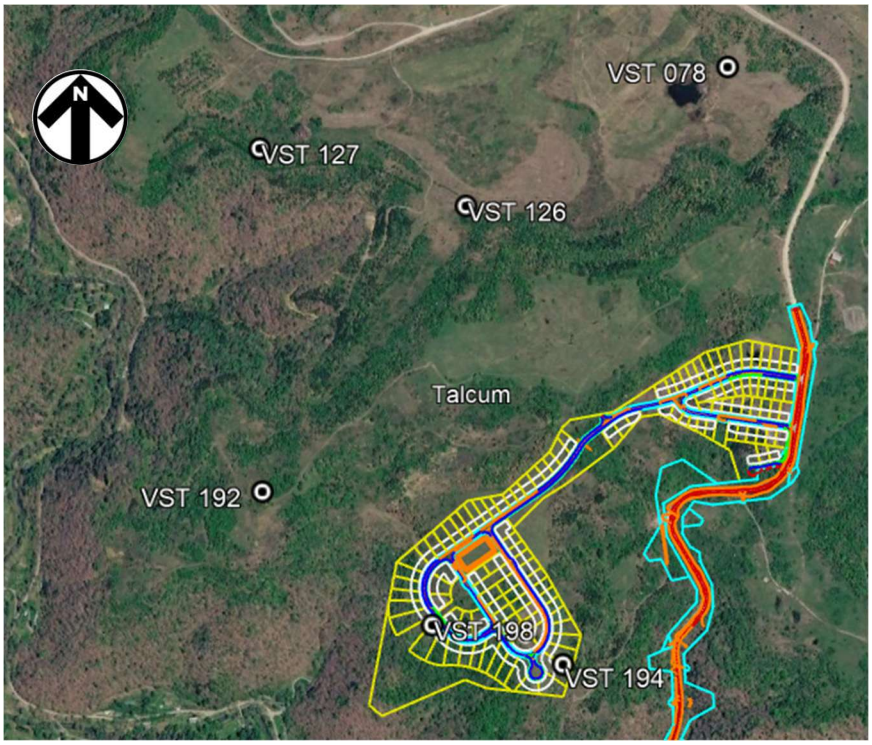


Figure 8: Six pre-mining borings were noted in the project vicinity, including two at the south end of the project.

2.3 Review of Available Mining Information

The Kentucky Mine Mapping Information System was reviewed for available coal mine maps. Additionally, we reached out to the Department of Natural Resources to obtain additional mining data on several of the older permits on site. Based on the available mine maps and historical aerial photographs, it appears that mining commenced in the early 1980's and was completed around 2007, although it is possible some mining may have occurred on the mountaintop in the pre-law (prior to 1982) era, possibly as far back as 1978.

Detailed mining methods for the site have not been conveyed to CTL; however, from the review of available mine mapping and experience on similar sized mines in the area, the surface mining likely consisted of mountaintop removal (strip) mining of the Hazard No. 8, Hazard No. 7 Rider (B), and Hazard No. 7 (A) coal seams, as well as the Hazard No. 9, where present. During our review of the available mine mapping, we did not see indications that the lower Hazard Coal beds were mined, either by contour or underground mining, in the vicinity of the neighborhood. Some of the mine maps indicate that countour mining was performed, but do not indicate the area. However, based on the available information, it appears that the contour mining most likely occurred north of the neighborhood along a highwall in the ridge, which

is outside of the currently planned development. While this mapping may not be exact, the extents noted in the mapping appear generally consistent with the historic aerial photographs.

Typical contour mining consists of stripping and grubbing before constructing drill benches by bulldozers. The overburden is drilled and blasted to expose the coal seam. Bulldozers push the blasted rock to a front-end loader. The loader loads the overburden into haul trucks for transport to the deposition location. Mountaintop or ridge top removal mining removes the entire top of a mountain ridge, creating a level surface at the coal seam. The same type of equipment used for contour mining is used in mountaintop removal. Mountaintop mining does affect much larger areas of land versus the relatively thin bands characteristic of contour mining.

Typically, the excavation begins along the deepest economically removable coal seam outcrop parallel to the ridgeline. To start the operation, the first cut is transferred by haul trucks to the hollow fill. After overburden drilling and blasting, front-end loaders and haul trucks work progressively toward the center of the mountain. Concentrically circling the mountain, the lower benches advance ahead of the upper excavations. The excavation continues with trucks hauling material to the mine spoil storage area using ramps connecting the series of benches until a level surface remains. The bench heights are determined by either the occurrence of a coal seam or by equipment limitations. Typically, the equipment used for placing the mine spoil consisted of bulldozers (most likely Caterpillar model D9's or similar) and Caterpillar model 777B (triple 7's) dump trucks. The dump trucks end-dump the mine spoil into the valley or onto the benches. The bulldozers were used to level the top of the mine spoil piles. No compactive effort, other than the bulldozers tracking in material, is typically conducted in the hollow fills. Based on the available mine mapping, it appears that at least some of the fill within the hollow fill was placed in 4-foot lifts.

We understand that typically, the mine spoils are placed by end-dumping from the top of the mine bench into the valleys. The initial phase of the mining would have used the valleys to place spoil material, with later phases consisting of ridgetop removal and back stacking the spoils against the highwalls created by contouring and on the plateau.

End dumping of the spoil creates a loose structure that tends to consolidate, thereby reducing the void space between particles over a long period. In addition, water infiltration can cause slaking of the shale portion of the mine spoil fills, which can lead to a condition called hydrocompression, where settlement can occur from loss of strength from the reduced rock-to-rock contact points and the creation of conduits that can collapse over time. Due to the variability of the constituents, placement methods, and

thickness of the mine spoil, differential settlement can occur in these fills. The quantity and time for completed settlements cannot be accurately predicted.

During mine mapping review, two areas were identified as hollow fills crossing over the original neighborhood extents. Figure 9 below outlines the identified hollow fill areas near the site.

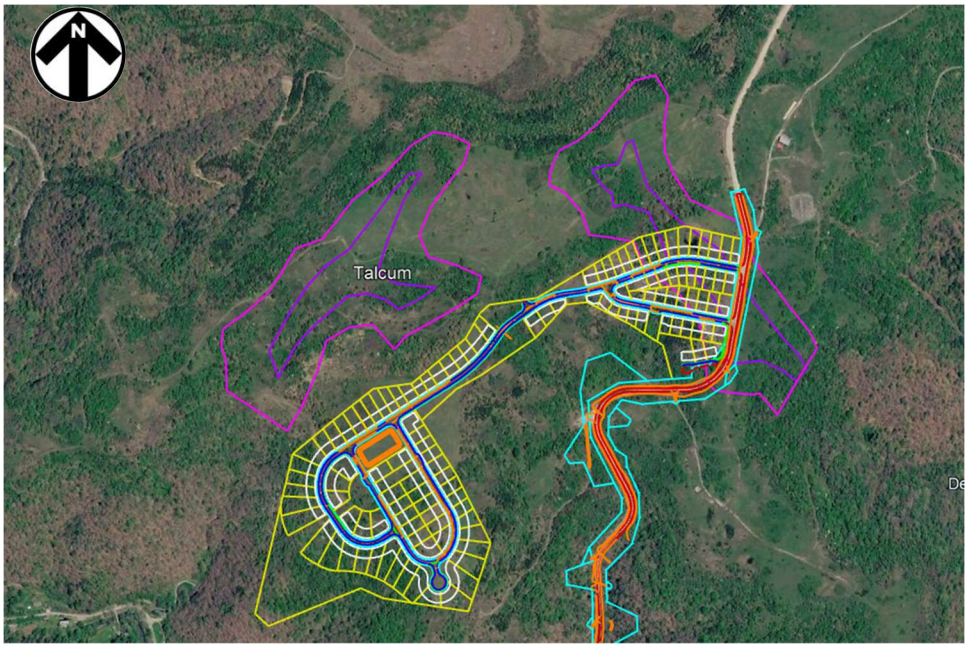


Figure 9: The pink outlines indicate approximately 100 feet of hollow fill, while the purple outlines indicate approximately 200 feet based on comparison of current and historical topography.

Based on the mine mapping, it appears that most, if not all, of the project area has been filled with mine spoils. Based on the top of ground elevations from available topographic data and the mine mapping, the depth of mine spoil fill in the general project vicinity generally ranges from about 70 to 100 feet at the south end of the development to about 120 to 140 in the northern portion, excluding hollow fills where 200 to 300 feet of fill was likely placed.

The mining permits contained documentation of the pre-mining exploration, including geologic information and slake durability index (SDI) testing results. The geologic information indicated that the coal beds were anticipated to fall about ½% to the north, which is generally consistent but slightly flatter than our calculations based on the six nearby borings. The SDI testing was conducted on 13 samples from 11 to 372 feet deep on site. The SDI results ranged from 69.8% to 97.7% with an average of about 91% and a median of about 95%. This indicates that the bedrock that forms the constituents of the mine spoil

fill have a relatively high resistance to slaking, generally classified as "Class 1 Non-Durable" based on KYTC standards.

2.4 Subsurface Exploration

After researching the readily available published geological and mining information, a preliminary subsurface profile is formulated. The soil boring program is a means to substantiate the assumptions made in our preliminary profile and assist us in developing a representative subsurface profile of the site. The subsurface conditions will vary between borings thereby making the development of a representative and reliable profile dependent upon the number of borings or data points obtained during the field operations. The following discusses our interpretation of the subsurface profile on the site based on the published information and the results of our borings. The individual Boring Logs attached to this report will have specific details at the location of the boring.

2.4.1 Field Exploration and Laboratory Testing Methods

We drilled four supplemental borings to explore the subsurface conditions across the site. Mr. Conner Barnes, EIT, under the guidance of Mr. Matthew Slusser, PE, directed drilling operations. The boring locations were located in the field by using a recreational Garmin Etrex 22x handheld GPS. Boring surface elevations were interpolated from a topographic map provided to us. Because of the methods used, the soil boring locations shown on the Boring Location Plan and the surface elevations shown on the Test Boring Records in the attachments are approximate. The stratification lines shown on the Boring Logs represent the approximate boundaries between soil or rock types. The transitions may be more gradual than shown.

We obtained soil samples using a split-barrel sampler driven by an automatic hammer assembly in general accordance with ASTM D1586. The soil samples were sealed in the field and returned to our laboratory where Mr. Slusser assigned the applicable laboratory tests. The soil samples were visually classified, by Mr. Slusser, the project geotechnical engineer, according to the Unified Soil Classification System (USCS, ASTM D2487). We conducted moisture contents on several soil samples. Atterberg limits tests were performed on selected soil samples to determine the engineering index properties of the soil.

The procedures used by CTL Engineering for field and laboratory sampling and testing are in general accordance with ASTM procedures and established engineering practice. A brief summary of the field and laboratory procedures is included in the attachments.

2.4.2 Subsurface Conditions

The borings generally deep fill extending to bedrock (or the termination depth of the boring). The soil borings encountered a thin layer of topsoil (0 to 3 inches) underlain by mine spoil fill soils consisting of a mixture of primarily gravel with lean clay, sand, silt, weathered shale, and sandstone fragments. The standard penetration tests ranged from 4 blows per foot (bpf) to in excess of 50 bpf (split spoon sampling was terminated if the blow counts exceeded 50 blows per 6-inch increment). A statistical analysis of the N-values indicates an average value of 25 bpf, a median value of 19 bpf, and a standard deviation of 16. The result of the statistical analysis matches well with penetration data from other sites in the area; therefore, we have incorporated our experience with previously explored sites with this site. A slake durability test performed on rock samples from the samples indicated an SDI of 92.5%, indicating rock generally consistent with class 1, non-durable bedrock shale and friable sandstone.

Table 2: Statistical Analysis of SPT N-Values for the Grandview Access Road and other mine sites in the Eastern Kentucky area.

	Maximum SPT N-Value	Minimum SPT N-Value	Mean SPT N-Value	Median SPT N-Value	Standard Deviation
Grandview Access Road	50+	3	26	19	17
Grandview Neighborhood	50+	6	24	16	16
Chestnut Ridge Mine Site	50+	2	24	18	16
Core Capital Mine Site (2022)	50+	4	20	14	16
Olive Branch Neighborhood	50+	4	25	19	16

The borings were generally terminated at depths of 100 to 101 feet without encountering obvious bedrock, although we suspect that the damp shale encountered at about 99 feet deep in Boring B-12 may indicate the top of bedrock. However, at a depth of 75 feet in B-13, rock coring was commenced and continued to a depth of 94½ feet. From 75 to about 86 feet, the cores recovered mixtures of lean clay, shale, and sandstone that appeared consistent with mine spoil fill. A recovery of 62 percent and a rock quality designation (RQD) of 28 percent were obtained within this segment. Below 86 feet, the coring encountered consistent, relatively continuous shale extending to the termination depth. Recoveries of 98 to 100 percent with RQD values of 57 and 83 percent indicate fair to good quality rock. Based on the continuity and relatively flat bedding of the shale, which is consistent with the native mapped bedrock geology beneath the Hazard No. 7 seam, we believe that bedrock was encountered at about 86 feet (Elevation of about 1251 feet).

2.5 Groundwater

Groundwater was not encountered in the borings prior to the use of a rock core bit or casing advancer. Since rock coring and casing advancing uses water during drilling, an accurate groundwater level reading cannot be obtained after coring/casing advancing.

It has been CTL's experience that groundwater does exist at the bottom of the mine spoil fill and within perched zones within the fill. Additionally, some damp to wet samples were encountered in the borings, supporting the likelihood of perched water. CTL's previous experience on mine spoil fill sites and research conducted by the Kentucky Geological Survey suggests that groundwater typically enters the fill from infiltration of surface water and through buried coal seams. Typically, groundwater issues when working in mine spoil fills are related to trapped or perched water which occurs in irregular, discontinuous locations within the fill, or near a bedrock/soil interface. When these water-bearing strata are exposed in excavations, such as cut slopes and utility or footing trenches, they can produce widely varying seepage duration and rates depending on recent rainfall activity and other site-specific characteristics of the area.

2.6 Geophysical Testing

To further evaluate the extent of mine spoil fill, a geophysical survey was conducted by Mr. Fred Schoen, PE (OH, IN, MI) with CTL Engineering. The purpose of the geophysical survey was to attempt to determine if the old subsurface mine benches and/or edges of the hollow fill are located along particular areas of the proposed development. Differing mine spoil thicknesses are more common at benches and hollow fills and will result in differential settlement which could be detrimental to the long-term performance of structures, roads, and utilities.

Six geophysical arrays were conducted utilizing Multichannel Analysis of Surface Waves (MASW). MASW evaluates ground stiffness by measuring shear wave velocity (Vs) of the subsurface materials. The seismic waves are generated using a steel plate and sledgehammer, with the waves collected using geophones spaced along a line. The shear wave velocity is a direct indicator of the soil and bedrock stiffness. A low shear wave velocity indicates a soil material, and a high velocity would represent bedrock. Table 3 illustrates typical ranges for the various materials.

Table 3: Shear Wave Velocities and Earth Material Type

Site Class	General description	Detailed Description	Shear Wave velocity		Blows/Foot (N value)	Shear Stregth S_u (psf)
			m/sec	ft/sec		
A	Hard Rock	Includes unweathered intrusive igneous rock. Soil types A and B do not contribute greatly to shaking amplification.	> 1,500	> 5,000		
B	Rock	Volcanics, slightly weathered intrusive igneous, and high-grade crystalline metamorphic bedrock (upper range) to well-cemented and lithified coarse-grained sedimentary or low-grade metamorphic rock (lower range)	750 - 1,500	2,500 - 5,000		
C	Soft rock and Very dense Soil	poorly-cemented coarse-grained to fine-grained sedimentary rock to dense Early to mid Pleistocene or older granular sediment	350 - 750	1,200 - 2,500	> 50	> 2,000
D	Stiff Soil	Mid to Late Pleistocene granular sediment or properly Enginered Fill (post 1985)	200 - 350	600 - 1,200	15 - 50	1,000 - 2,000
E	Soft Soil	Holocene granular sediment, pre-1985 artificial fill, includes some Late Quaternary muds, sands, gravels, silts and mud. Significant amplification of shaking by these soils is generally expected.	< 200	< 600	< 15	< 1,000
F	Unstable Soil	Includes water-saturated mud and undocumented or pre-1950 artificial fill. The strongest amplification of shaking due is expected for this soil type.	requires site specific measurement	requires site specific measurement		

Compressional-wave velocity is a function of the density, bulk modulus, and shear modulus of the material. The data was used in combination with boring data to estimate the characteristics of the soil materials. The MASW survey line locations are shown in Figure 10.

The MASW data was collected prior to the drilling exploration and was used to evaluate if proposed boring locations should be adjusted. The field procedures involved use of a 24-channel 4.5-Hz geophone array with a geophone spacing of ten feet. The energy source used during the MASW surveys was a sledgehammer striking a high-density polyethylene plate approximately 80 feet from the array. The seismic data were recorded digitally using a Seismic Source DAQ Link-IV data recorder.

The MASW data was processed using software to produce compressional-wave velocity models of the subsurface. One velocity model (profile) was produced for each geophysical survey line. The ground surface of each model is based on available topographic data for the site and should be considered approximate.

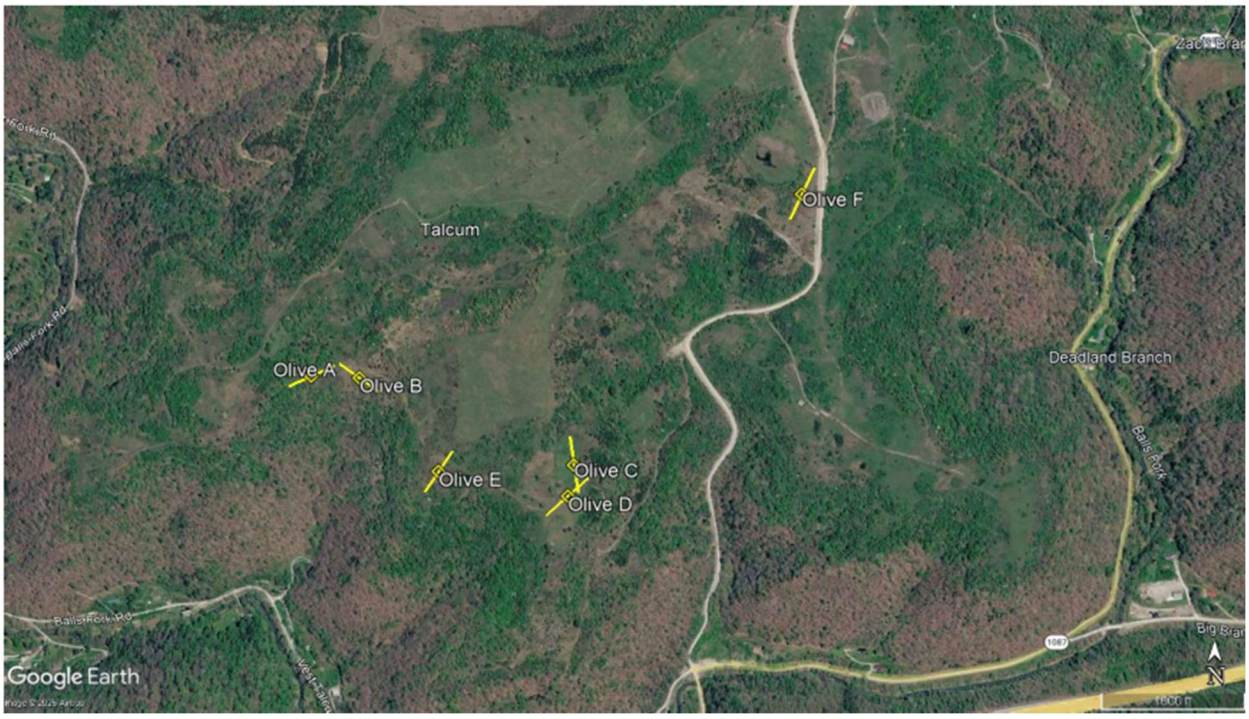


Figure 10: MASW lines are indicated in yellow.

Compressional-wave (i.e. P-wave) velocities varied laterally and with depth based on the materials encountered. Shallow soil, fill, and weathered rock generally exhibited lower velocity values than materials at greater depths, indicating a weaker soil/fill structure near the surface. The MASW report is included in the Appendix and contains additional details about the geophysical exploration, including the profile figures for each survey line. However, the results from line Olive B are illustrated in Figure 11. The MASW shear wave velocities over about 2,500 feet per second (green, yellow, orange, and red) would generally indicate weathered bedrock while lower shear wave velocities (blue) represents soil or mine spoil fill. The teal shading could be indicative of very soft, highly weathered bedrock or very dense soil.

MASW Line Olive B was performed at the southwest hollow fill and suggests bedrock is about 60 feet deep (elevation of about 1250) at the southeast end of the line on the mountaintop mine bench and over 120 feet (elevation below 1140) at the northwest end, which terminated over the hollow fill. This is generally consistent with the information obtained from previous topographic and mine mappings. It should be noted that lines Olive C, D, and E encountered shear wave velocities indicative of soil to depths of 1220 to 1200 feet. However, the reviewed mining data indicates that mining in this area was limited to the Hazard No. 7 seam at the lowest, which likely terminated at between 1260 to 1240 feet. Boring VST 194 did indicate some small coal seams (7 to 12 inches thick) below 1220 feet; however, based on our review of

the mining data, it does not appear that these seams were mined. The other Lines, which were performed in areas of suspected hollow fills, encountered conditions generally consistent with the our exploration and the generally available mine mapping.

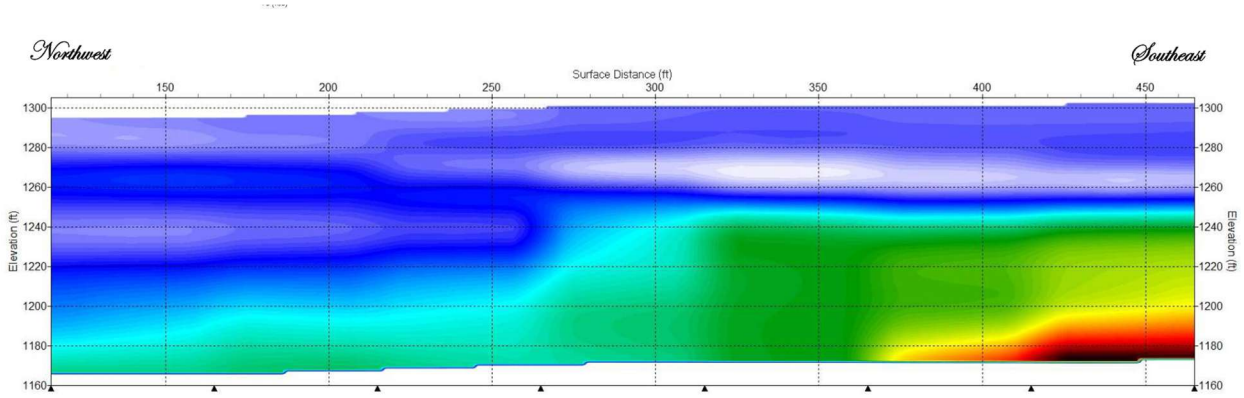


Figure 11: Results of MASW Survey along line Olive B. The yellow, red, and brown areas represent suspected bedrock. The green area represents very dense soil or hard rock, while the blue areas represent soil and soft rock.

3 DISCUSSION

Based on the results of our borings and our understanding of the proposed project, we believe that much of the site can be developed for the proposed light residential neighborhood. However, the mine spoil fills at this site represent a risk of differential settlement. Additionally, the presence of hollow fills and steep existing spoil fill slopes represent additional geotechnical challenges for portions of the site. The following subsections provide additional details and discuss these geotechnical concerns.

3.1 Mine Spoil Fill

There have been several developments on mine spoil fill sites throughout the region, including residential, commercial, educational, and industrial. The primary concern of building on mine spoil fill sites is the amount of differential settlement that can occur. Settlement will generally result from two primary processes: the consolidation settlement of the fill under its own weight and degradation of the shale portion of the fill over time due to water infiltration. The initial settlement of mine spoil fill is primarily due to a reduction in void space within the material from self-weight. The amount of time for this primary initial settlement to occur will vary based on the individual site conditions. However, previous research indicates that for fills less than about 100 feet thick, the majority of the settlement occurs within the first 8 to 10 years after the mine spoil was placed. Additionally, research conducted by the Kentucky Geological Survey also indicates that the initial settlement in mine spoil studied at an Eastern Kentucky mine had

occurred within 8 years of placement. Once the void space reduction occurs, additional initial settlement results for short-term compression as the fine-grained material is loaded. Short-term compression will continue until the stresses are distributed uniformly throughout the fill at which time long-term or secondary settlement begins. While the fill deposits at this site are deeper than 100 feet over much of the development area, the fills have been in place for 20 or more years. Therefore, we believe that this initial settlement has likely completed within the mine spoil fill on site.

After the initial settlement phase of mine spoil fills has occurred, the secondary settlement phase can produce significant magnitudes of settlement, although they are not as severe as the settlement for the initial phase. However, changes in water infiltration through subsurface groundwater recharge and/or surface water infiltration drastically affect the settlement of mine spoil fills.

Observations of numerous mine spoil sites in Eastern Kentucky generally indicate that on relatively new sites and sites that have been recently regraded, evidence of water infiltration from rainfall, such as sinkholes and piping into the subsurface, is common. On older sites, large amounts of water infiltration into the surface of the mine spoil fill is not as prevalent. This is evidenced by the presence of ponds and wetland-type vegetation. On established mine spoil fill sites, the surface will develop a crust. The weathering process of the upper materials results in voids within the upper portions of the mine spoil becoming filled by the downward migration of small particles, thus increasing the density of the spoil and prohibiting the infiltration of water. Desiccation of the surface layer of mine spoil may also contribute to the formation of a surface crust. Desiccation is a process where the soil moisture in clay is drawn to the surface and evaporated. During this process, the clay becomes stiffer. Since natural precipitation does not expel more than a small part of the air contained in the voids of surface soil, cohesion in the soil can survive wet periods of long duration. However, once a site is disturbed by construction activity, the crust is disturbed, and the weathering process is reinitiated.

The age, placement methods, and type of mine spoil material would indicate that the primary consolidation period for the project site has been achieved. However, as mentioned, there is a risk of secondary consolidation that could take many years. Based on our prior research on similar sites, we are anticipating secondary settlements over the next 10 to 20 years for the fills between 50 to 100 feet thick to be up to 1 to 3 inches. For fills between 100 and 150 feet, we anticipate additional long-term settlement over the next 10 to 20 years to be up to 3 to 5 inches. Typically, to reduce the risk of differential settlements, individual structures should be located on a generally uniform fill thickness. Considering that the site

appears to have largely been mined down to the same seam, we believe that the fill thickness within individual lots is likely to be generally uniform, with the possible exception of the hollow fill areas.

A higher risk concern is the amount of water infiltration that can occur soon after construction has been completed. Previous experience and research suggests that the hydrocompression process is accelerated by introduction of water into the subsurface from poor site drainage, building gutters, septic tank fields, and runoff from paved and landscaped areas. Water infiltration can rapidly (within a few years) cause detrimental settlement issues.

As previously mentioned, the weathering process of the upper materials results in voids within the mine spoil being filled, eventually preventing infiltration of surface water. However, the process of regrading and developing a site for construction destroys this crust. Newly disturbed construction sites will allow the infiltration of water until the crusting process reestablishes itself. Therefore, it is imperative that the development have adequate positive drainage away from the roadway and structures. Additionally, the implementation of roadside ditches, storm sewers, and other prudent forms of stormwater management will be critical to reducing the risks of excessive settlement and poor roadway and structure performance. Roadside ditches, catch basins, and stormwater management systems should be inspected and maintained at regular intervals to lessen the risk of overflow into the mine spoils. We anticipate that settlement from hydrocompression could range 1 to 3 percent of the wetted thickness in addition to the secondary settlement. Our research indicates that saturated thickness due to surface water infiltration can approach up to 10 feet and therefore could range between 1 and 4 inches. However, the slake durability data from the original mine permit indicates a generally durable rock fill. Therefore, settlement amounts could be less than predicted.

3.2 Additional Geotechnical Exploration/Analyses

Based on the findings of our exploration and mining map review, we have outlined a general area that can currently be developed for residential lots in Figure 12. This area should be consistent with the previously discussed conditions on the mountaintop mine bench. This includes most of the site, but excludes a portion of the northern end of the lot, where the proposed development crosses an area of hollow fill. In this hollow fill area, our concerns are that the fill depths may be subject to significant changes in depth within a single building pad and may exceed 200 feet in areas. However, the fill placement methods described for these hollow fills suggest that compaction within these fills may be similar to those used on the mine bench. Therefore, provided the Commonwealth understands that these areas represent an

increased settlement risk, we can provide a scope for additional exploration to evaluate the hollow fill areas for fill depth and consistency to evaluate whether portions of this area can be developed with a more robust building pad preparation method.

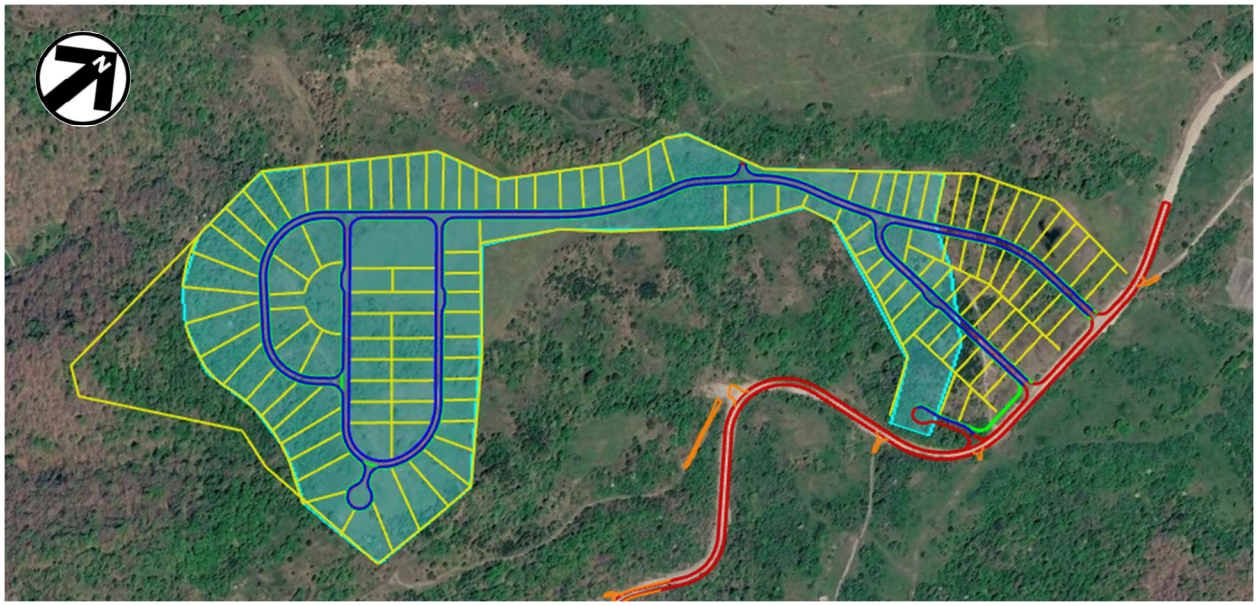


Figure 12: The cyan shaded area is the area we currently believe is suitable for residential development based on our explorations and mine mapping review

Additionally, upon review of the proposed grading plans (MicroStation files), we have identified approximately 5 lots within the area currently outlined development area where a proposed 2H:1V embankment fill slope extends to the rear of the proposed house building pad (Figures 13 and 14). Stability analysis has not been performed on these slopes; however, based on previous experience, we anticipate that houses should be offset at least 15 feet from the crest of these slopes, as the factor of safety against slope failure is likely lower than prudent (less than 1.4) within 15 feet of the slope crest. We understand that HMB may be able to change the grading on some of these lots to allow for this offset; however, some of the lots cannot allow for this offset without either encroaching on the house building pad or implementing some form of slope modification (retaining wall, steeper slope with stability enhancements, etc.). For these lots, we recommend that they are not developed without an engineering evaluation of the slope stability and, if desired, potential methods of slope modification.

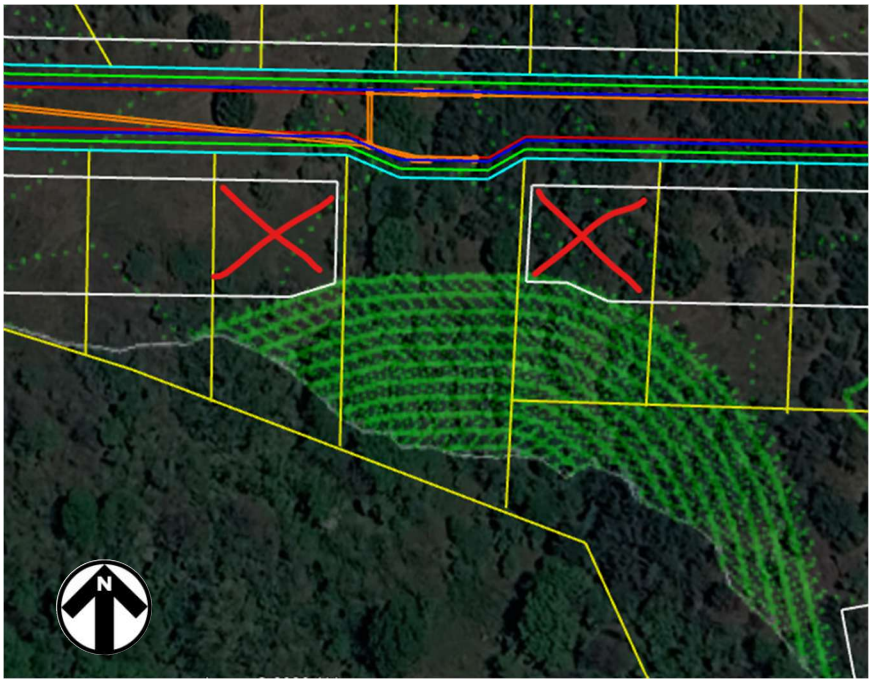


Figure 13: The two lots marked with red "Xs" currently show the slope extending up to the proposed building pad at the north end of the site.

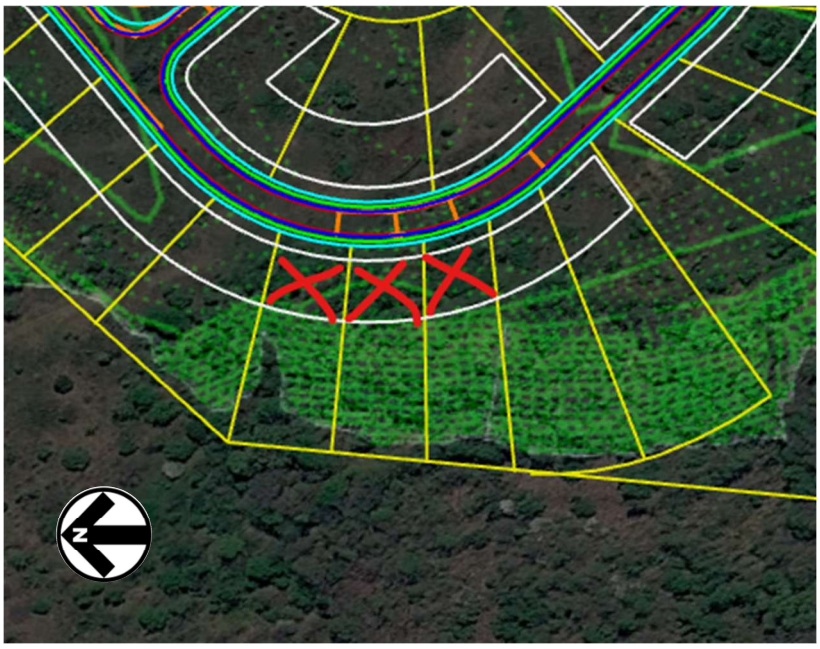


Figure 14: The three lots marked with red "Xs" currently show the slope extending up to the proposed building pad at the south end of the site.

4 LIMITATIONS OF RECOMMENDATIONS

When building on old mine spoil sites, the owner must understand and accept that no matter how much evaluation and exploration is conducted, there will be a risk of unsuitable building and structure performance. There are numerous documented building settlement and distress issues when building on old mine sites. Therefore, the information provided in this report is to assist in understanding, but not eliminating, the risk of building on this site. It must be noted that the building pad and foundation recommendations below are selected to function together as a system to reduce the risk of differential settlement. Deviation from any of the recommendations below represents a potential change to the risk profile of the site. CTL should be contacted if deviations from the recommendations below are proposed.

This report has been prepared for the exclusive use of HMB Professional Engineers, Inc. for specific application to the project site. Our recommendations have been prepared using generally accepted standards of geotechnical engineering practice in the Commonwealth of Kentucky. No other warranty is expressed or implied. This company is not responsible for the conclusions, opinions, or recommendations of others based on these data. Additionally, our conclusions and recommendations are based on the information provided to us, the data obtained from our subsurface exploration, and our experience. They do not reflect variations in the subsurface conditions which are likely to exist between borings and in unexplored areas of the site. These variations result from the both geologic variability of the subsurface conditions and variations due to mining activity. If conditions are different than those encountered in our exploration, it will be necessary for us to re-evaluate our conclusions and recommendations based upon on-site observation of the conditions. For more information on the use and limitations of this report, please read the GBA document included in the attachments.

If the overall design or location of the project is changed, the recommendations contained in this report must not be considered valid unless our firm reviews the changes and our recommendations are modified. When the design is finalized, we should be allowed to provide the additional service of reviewing the grading plan and applicable portions of the project specifications. This review will allow us to check whether these documents are consistent with the intent of our recommendations.

We may recommend that a supplementary exploration be performed when significant design changes such as the movement of the project are incorporated into the final design after the geotechnical exploration has been completed. This supplementary exploration may include obtaining additional soil data along the new alignment to provide specific recommendations.

5 RECOMMENDATIONS

5.1 Site Preparation Recommendations

From our experience with mine spoil sites and the information obtained on this site, we believe that this site is suitable for the proposed development of residential buildings provided the owner/developer understands and accepts the risk of unanticipated settlement. Individual houses can be designed based on general subsurface information provided in this report. If larger structures are to be considered, CTL should be notified to evaluate if additional evaluation is necessary for these structures.

To provide a uniform bearing surface for the lightly loaded, residential buildings, we recommend undercuts of at least 3 feet below the bottom of the proposed foundation bearing elevation. The undercut should extend at least 5 feet beyond the house. The undercut area is backfilled with recompacted mine spoil fill placed in thin lifts of about 12 inches and recompacted using bulldozers and compactors. The recompacted mine spoil acts as a "mat" supporting the entire building within the uncompacted mine spoil. The type of equipment used for recompaction varies, however, typically consists of Caterpillar D-8 bulldozers or similar spreading the mine spoil and Caterpillar 825 sheepsfoot rollers or similar compacting the mine spoil. The compaction of the fill should be tested to at least 98 percent of the mine spoils maximum dry density as determined by the standard Proctor compaction test (ASTM D698). From previous research, the maximum dry unit weight of mine spoil in this area ranges from about 120 pcf to 125 pcf with optimum moisture contents of 10 to 20 percent.

The mine spoil fill must be relatively consistent in composition and relative density as determined by exploration of the site. For the proposed residential structures, we recommend dynamic cone penetrometer (DCP) testing within the foundation excavations prior to placing concrete. Statistical comparisons of the DCP values obtained provide an indication of the degree of compaction of the fill. The mine spoil fill thickness must be consistent beneath the proposed building footprint. The risk of differential settlement due to varying mine spoil thickness under the building is not quantifiable. Therefore, to reduce the risk, the fill thickness should be consistent under any individual building. The depth to bedrock must also be relatively consistent beneath the building locations. The buildings must not straddle areas of large variations in bedrock depths between benches or be located over a site with a partially buried mine bench.

KYTC specifies that embankment benching is required in areas where new fill will be placed in areas where the existing groundline has an incline greater than 15 percent (approximately 6H:1V). This embankment benching allows for the fill to be compacted to interlock with the existing soil on site, reducing

the risk of sliding between the new fill and existing soils. The embankment benches should be placed in general accordance with Standard Drawing RGX-010-04. While this standard drawing is prepared for a roadway, it can be applied to landscaped and building areas as well. The benches shall be constructed one at a time, beginning with the lower bench. Each bench shall be backfilled prior to excavation of the next bench. This procedure should be followed to help maintain the stability of the existing slopes.

5.2 Foundation Recommendations

Due to several building failures on mine spoil sites, we recommend a modified spread footing consisting of an inverted "T" type footing that is rigid to allow for uniform movements and reduce the risk of differential settlements. The foundation can be designed using a bearing capacity for the mine spoil of up to 3,000 psf. The structural engineer should consider top and bottom reinforcement in all foundations as well as reinforcement in the stem wall.

Even though the computed footing dimensions may be less, column footings should be at least 24 inches wide and strip footings should be at least 18 inches wide. These dimensions facilitate hand cleaning and allow for proper placement of the reinforcement bars. All exterior footings should be at least 30 inches below the lowest adjacent grade to reduce the risk of frost heave during winter months. Due to the risk of settlement on this site, we recommend that buildings limit the use of masonry or ceramic.

5.3 Floor Recommendations

For residential buildings, we recommend the use of a crawl space floor system. Grade supported floor slabs should be avoided as they will have a risk of cracking due to subgrade movements.

5.4 Seismic Site Classification

The current seismic design procedures outlined in the NEHRP (National Earthquake Hazard Reduction Program) guidelines mandate structural design loads be based on the seismic coefficients of the site. Based on the results of our exploration and the geology of the area, we assigned a site seismic classification of "D".

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be,* and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

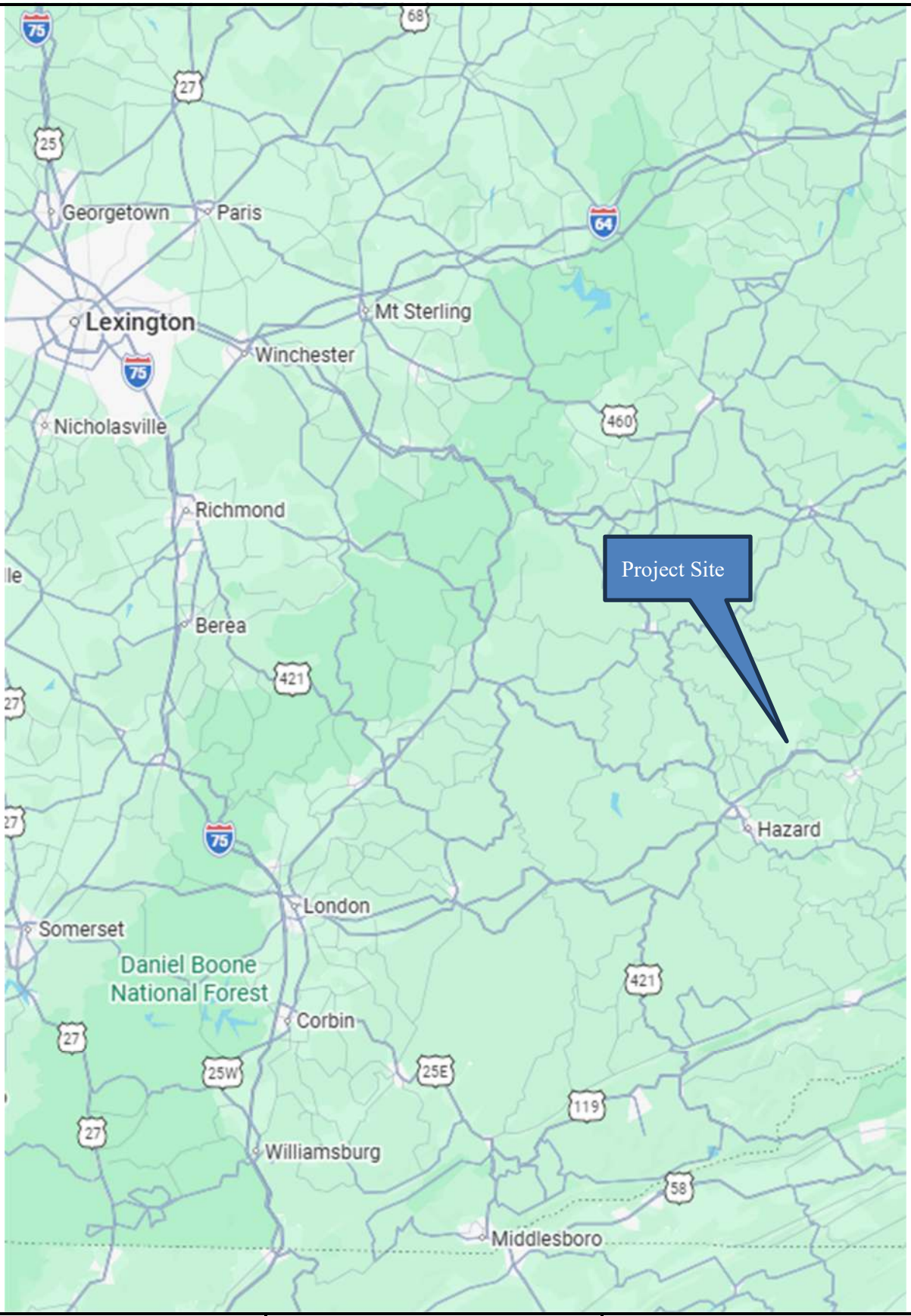
The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org



HMB Professional Engineers, Inc.

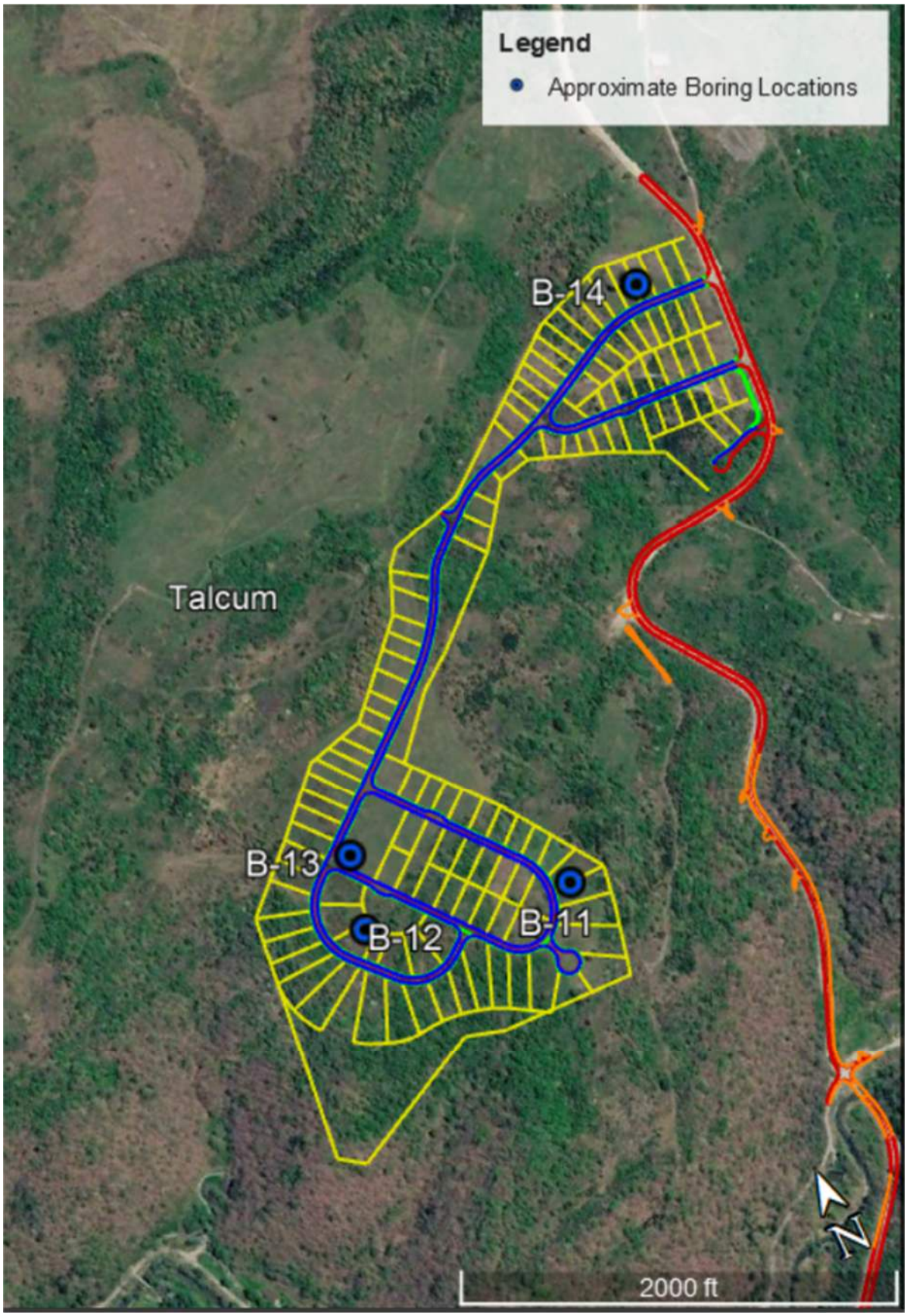
CTL ENGINEERING INC

Site Location Map

Olive Branch Neighborhood

Talcum, Kentucky

CTL Project 26050007SHE



HMB Professional Engineers, Inc.

CTL ENGINEERING

Boring Location Aerial

Olive Branch Neighborhood

Talcum, Kentucky

CTL Project 26050007SHE

TEST BORING RECORD

CLIENT	: HMB Professional Engineers	BORING NO.:	**B-11**
PROJECT	: Olive Branch Project - Additional Drilling	SHEET	1 OF 5
LOCATION	: Talcum, Kentucky	DATE STARTED	: 03-20-26
PROJECT NO.	: 26050007SHE	DATE COMPLETED	: 03-23-26

BORING	ELEVATION : 1351.0 Feet	BORING METHOD	: 3 1/4" HSA	HAMMER	: Automatic
	STATION :	RIG TYPE	: Deitrich D.50	DRILLER	: Horn Drilling
	OFFSET :	CASING DIA.	: 3"	TEMPERATURE	: 50-60
	DEPTH : 101.3 Feet	CORE SIZE	: 2 7/8"	WEATHER	: Clear

GROUNDWATER: ▼ Encountered at Dry ▽ At completion ▽ Delayed Reading ▨ Caved in at

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1350.7		TOPSOIL (3 inches)	0.3										
		MINE SPOILS - VERY STIFF, gray to brown, gravelly LEAN CLAY (CL) with sand, dry (shale fragments)		SS-1	13 12 9	21	16						
1347.5			3.5										
	5			SS-2	27 11 8	19	16						
				SS-3	5 5 5	10	12	6					
	10	MINE SPOILS - FIRM, gray to brown, poorly graded GRAVEL with (GP-GM) with silt, clay and sand, moist (sandstone fragments)		SS-4	15 5 6	11	9	7					
	15			SS-5	3 12 11	23	8	8					
1335.5		Auger kick at 15.5 feet, switch to casing advancer.	15.5										
		MINE SPOILS - DENSE, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)											
	20				19								

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-11**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 2 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
				SS-6	25 25	50	14						
		MINE SPOILS - DENSE, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)											
1328.0			23.0										
	25			SS-7	6 7 9	16	9						
		MINE SPOILS - FIRM, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)											
	30			SS-8	8 10 7	17	11						
1318.0			33.0										
	35	MINE SPOILS - DENSE, gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand with clay and sand, damp (sandstone fragments)		SS-9	3 8 27	35	10						
1313.0			38.0										
	40	MINE SPOILS - FIRM, gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, damp (sandstone fragments)		SS-10	4 4 15	19	12						
1306.0	45	Begin coring at 45 feet. MINE SPOILS - MODERATELY HARD, gray, coarse grained SANDSTONE boulders	45.0	SS-11	50/3"		3						

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
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WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-11**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 3 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1302.7		MINE SPOILS - MODERATELY HARD, gray, coarse grained SANDSTONE boulders	48.3	CR-1 RQD= 43%			66						
	50	MINE SPOILS - SOFT, gray, fine grained SHALE boulders											
1297.8			53.2										
	55	MINE SPOILS - gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand (shale fragments)		CR-2 RQD= 12%			24						
1293.5		Switch to casing failed due to corehole, offset borehole 10 feet north.	57.5										
	60			SS-12	21 10 11	21	13						
	65	MINE SPOILS - VERY FIRM to FIRM, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)											
	70			SS-13	11 10 11	21	10						

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-11**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 4 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
	75												
	80	MINE SPOILS - VERY FIRM to FIRM, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)		SS-14	19 10 7	17	17						
	85												
1265.0			86.0										
	90	MINE SPOILS - DENSE to VERY DENSE, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)		SS-15	21 32 23	55	11						
	95												

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-11**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 5 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
	100	MINE SPOILS - DENSE to VERY DENSE, brown to gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, moist (sandstone fragments)											
1249.7		Split spoon refusal at 101.3 feet, boring hole terminated.	101.3	SS-16	50/3"		1						
	105												
	110												
	115												
	120												

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT	: HMB Professional Engineers	BORING NO.:	**B-12**
PROJECT	: Olive Branch Project - Additional Drilling	SHEET	1 OF 5
LOCATION	: Talcum, Kentucky	DATE STARTED	: 03-23-26
PROJECT NO.	: 26050007SHE	DATE COMPLETED	: 03-24-26

BORING	ELEVATION : 1345.0 Feet	BORING METHOD	: 3 1/4" HSA	HAMMER	: Automatic
	STATION :	RIG TYPE	: Deitrich D.50	DRILLER	: Horn Drilling
	OFFSET :	CASING DIA.	: 3"	TEMPERATURE	: 30-40
	DEPTH : 99.8 Feet	CORE SIZE	: 2 7/8"	WEATHER	: Clear

GROUNDWATER: ▼ Encountered at Dry ▽ At completion ▽ Delayed Reading ▨ Caved in at

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1344.7		TOPSOIL (3 inches)	0.3										
				SS-1	50/0"		0						
	5	MINE SPOILS - VERY DENSE to DENSE, brown to light brown SILTY SAND (SM) with gravel, moist (sandstone fragments)		SS-2	13 18 25	43	18	12					
				SS-3	9 15 9	24	14						
1336.0			9.0										
	10	MINE SPOILS - FIRM, light brown to gray, poorly graded SAND (SP-SM) with silt, clay and gravel, moist (sandstone fragments)		SS-4	1 3 8	11	9	6					
1331.0			14.0										
	15	MINE SPOILS - VERY DENSE, light brown, poorly graded GRAVEL (GP), moist (sandstone fragments)		SS-5	16 50/2"		3						
1325.0	20		20.0										

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-12**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 2 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
		MINE SPOILS - VERY DENSE, gray to brown, poorly graded (GP-GM) with silt, clay and sand, moist (mostly shale fragments, few sandstone fragments)		SS-6	11 17 18	35	16						
1320.0	25		25.0										
		MINE SPOILS - FIRM, gray, poorly graded GRAVEL (GP-GM) with silt, clay and sand, damp (mostly shale fragments, trace sandstone fragments)		SS-7	6 4 8	12	10						
1316.0			29.0										
	30												
		MINE SPOILS - VERY DENSE, brown CLAYEY SAND (SC) with trace coal and sandstone fragments, moist		SS-8	4 4 50/1"		14						
1310.0	35		35.0										
		MINE SPOILS - FIRM, gray to light brown CLAYEY GRAVEL (GC) with sand, moist (sandstone fragments)		SS-9	12 9 9	18	10						
1305.0	40		40.0										
		MINE SPOILS - FIRM, brown CLAYEY SAND (SC) with gravel, damp (sandstone fragments)		SS-10	9 4 8	12	15						
	45												

BORING METHOD

- HSA - Hollow Stem Auger
- SFA - Solid Flight Auger
- RC - Rock Coring
- MD - Mud Drilling
- WD - Wash Drilling
- HA - Hand Auger

SAMPLING METHOD

- SS - Split Spoon Sample
- ST - Shelby Tube Sample
- CR - Rock Core Sample
- BS - Bag Sample

ABBREVIATIONS

- * - Hand Penetrometer
- LL - Liquid Limit
- PL - Plastic Limit
- PI - Plasticity Index
- SPT - Standard Penetration Test

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-12**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 3 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
		MINE SPOILS - FIRM, brown CLAYEY SAND (SC) with gravel, damp (sandstone fragments)		SS-11	7 8 9	17	9						
1295.0	50		50.0										
		MINE SPOILS - LOOSE, brown, poorly graded GRAVEL (GP-GC) with clay and sand, moist (mostly shale fragments, few sandstone fragments)		SS-12	3 5 4	9	10						
1290.0	55		55.0										
				SS-13	8 12 5	17	7						
	60												
		MINE SPOILS - VERY DENSE, light brown to grayish brown, poorly graded GRAVEL (GP), moist (sandstone fragments)		SS-14	5 11 50/3"		7						
	65												
	70			SS-15	27 50/2"		4						

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-12**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 4 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
	75												
	80	MINE SPOILS - VERY DENSE, light brown to grayish brown, poorly graded GRAVEL (GP), moist (sandstone fragments)		SS-16	50/3"		3						
	85												
1255.0	90		90.0										
				SS-17	3 7 8	15	12						
	95	MINE SPOILS - FIRM, light brown to black CLAYEY SAND (SC) with gravel and coal, moist (sandstone fragments)											

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-12**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 5 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1246.0			99.0										
1245.2	100	MINE SPOILS - weathered SHALE, damp	99.8	SS-18	50/2"		2						
		Split spoon refusal at 99.8 feet, boring hole terminated.											
	105												
	110												
	115												
	120												

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT	: HMB Professional Engineers	BORING NO.:	**B-13**
PROJECT	: Olive Branch Project - Additional Drilling	SHEET	1 OF 4
LOCATION	: Talcum, Kentucky	DATE STARTED	: 03-19-26
PROJECT NO.	: 26050007SHE	DATE COMPLETED	: 03-20-26

BORING	ELEVATION : 1337.0 Feet	BORING METHOD	: 3 1/4" HSA	HAMMER	: Automatic
	STATION :	RIG TYPE	: Deitrich D.50	DRILLER	: Horn Drilling
	OFFSET :	CASING DIA.	: 3"	TEMPERATURE	: 40-50
	DEPTH : 94.5 Feet	CORE SIZE	: 2 7/8"	WEATHER	: Clear

GROUNDWATER: ▼ Encountered at Dry ▽ At completion ▽ Delayed Reading ▨ Caved in at

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1336.7		TOPSOIL (3 inches)	0.3										
		MINE SPOILS - STIFF to FIRM, brown to dark brown, CLAYEY SAND (SC) with gravel, moist (sandstone fragments)		SS-1	5 6 8	14	17						
	5			SS-2	2 3 5	8	9	11					
1331.0			6.0										
		MINE SPOILS - SOFT, brown to black, sandy LEAN CLAY (CL) with trace coal fragments, moist		SS-3	2 2 2	4	11						
1328.5			8.5										
	10	MINE SPOILS - LOOSE to VERY LOOSE, poorly graded GRAVEL (GP), moist (shale fragments)		SS-4	19 4 2	6	10						
1324.0			13.0										
	15	MINE SPOILS - VERY LOOSE, light brown CLAYEY SAND (SC) with gravel and trace coal fragments, moist (shale fragments)		SS-5	3 2 2	4	7	10					
1319.0			18.0										
	20	MINE SPOILS - Assumed SANDSTONE boulder Auger kick at 20.5 feet, switch to casing		SS-6	50/1"		0						

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-13**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 2 OF 4

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
		advancer.											
		MINE SPOILS - Assumed SANDSTONE boulder											
1314.0			23.0										
	25			SS-7	3 10 8	18	11						
		MINE SPOILS - VERY FIRM to FIRM, brown, poorly graded GRAVEL (GP-GC) with clay and sand, moist (sandstone fragments)											
	30			SS-8	8 14 13	27	5						
1304.0			33.0										
	35	MINE SPOILS - STIFF, brown to black LEAN CLAY (CL) with gravel and trace coal, moist (little shale fragments, little sandstone fragments)		SS-9	6 4 7	11	12						
1299.0			38.0										
	40	MINE SPOILS - VERY FIRM, light brown, poorly graded GRAVEL (GP), moist (sandstone fragments)		SS-10	9 17 14	31	10						
1294.0			43.0										
	45	MINE SPOILS - VERY STIFF, brown to light brown, sandy LEAN CLAY (CL) with gravel, moist (few sandstone fragments, few shale fragments)		SS-11	4 6 20	26	14						

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-13**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 3 OF 4

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
	50	MINE SPOILS - VERY STIFF, brown to light brown, sandy LEAN CLAY (CL) with gravel, moist (few sandstone fragments, few shale fragments)		SS-12	7 7 14	21	10						
1284.0			53.0										
	55	MINE SPOILS - FIRM, brown to gray to black, poorly graded GRAVEL (GC) with clay and sand, with trace coal fragments, damp (sandstone fragments)		SS-13	3 8 5	13	7						
1279.0			58.0										
	60	MINE SPOILS - FIRM, brownish gray, poorly graded GRAVEL (GP), moist (sandstone fragments)		SS-14	6 4 8	12	12						
1272.0	65		65.0										
	70	MINE SPOILS - VERY DENSE, brownish gray, poorly graded GRAVEL (GP), moist (sandstone fragments)		SS-15	31 50/1"		7						

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-13**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 4 OF 4

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
		MINE SPOILS - VERY DENSE, brownish gray, poorly graded GRAVEL (GP), moist (sandstone fragments)											
1262.0	75		75.0										
1261.3		Begin coring at 75 feet. MINE SPOILS - MODERATELY HARD, brownish gray, coarse grained SANDSTONE	75.7										
		MINE SPOILS - gray LEAN CLAY (CL) with sand											
1259.0		Water loss at 77 feet	78.0										
1258.4		MINE SPOILS - MEDIUM HARD, gray, medium to coarse grained SANDSTONE	78.6										
		MINE SPOILS - gray LEAN CLAY (CL) with sand											
1257.0	80		80.0	CR-1 RQD= 28%			74						
		MINE SPOILS - MEDIUM HARD, gray, medium to coarse grained SANDSTONE with trace coal partings											
1255.7			81.3										
1255.2		MINE SPOILS - SOFT, gray, fine grained SHALE	81.8										
		MINE SPOILS - MEDIUM HARD, gray to brownish gray, medium to coarse grained SANDSTONE with trace coal partings											
	85	Void from 83 to 85 feet											
1250.7			86.3										
				CR-2 RQD= 57%			54						
	90	APPARENT BEDROCK - SOFT, gray, fine grained SHALE, flatly bedded											
				CR-3 RQD= 83%			59						
1242.5			94.5										
	95	Coring hole terminated at 94.5 feet.											

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers
PROJECT : Olive Branch Project - Additional Drilling
LOCATION : Talcum, Kentucky
PROJECT NO. : 26050007SHE

BORING NO.: **B-14**
SHEET 1 OF 5
DATE STARTED : 03-17-26
DATE COMPLETED : 03-19-26

BORING	ELEVATION : 1373.0 Feet	BORING METHOD : 3 1/4" HSA		HAMMER : Automatic	
	STATION :	RIG TYPE : Deitrich D.50		DRILLER : Horn Drilling	
	OFFSET : 10 feet east	CASING DIA. : 3"		TEMPERATURE : 20-30	
	DEPTH : 100.0 Feet	CORE SIZE : 2 7/8"		WEATHER : Snow	

GROUNDWATER: ▼ Encountered at Dry ▽ At completion ▽ Delayed Reading ▨ Caved in at

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
		MINE SPOILS - VERY FIRM, brown, poorly graded GRAVEL (GP-GC) with clay and sand, moist (mostly shale fragments, few sandstone fragments)		SS-1	9 7 18	25	15						
1369.0			4.0										
	5	MINE SPOILS - LOOSE, brown, poorly graded GRAVEL (GP-GC) with clay and sand, moist (mostly shale fragments, few sandstone fragments)		SS-2	4 4 4	8	10	8					
				SS-3	3 5 3	8	9						
1364.5			8.5										
	10	MINE SPOILS - LOOSE, dark gray, poorly graded GRAVEL (GP-GC) with clay and sand, moist (shale fragments)		SS-4	2 3 2	5	14	10					
1360.0			13.0										
	15	MINE SPOILS - VERY DENSE, dark gray, poorly graded GRAVEL (GP-GC) with clay and sand, moist (shale fragments)		SS-5	6 3 50/4"		8	6					
1356.0			17.0										
	20	MINE SPOILS - LOOSE, dark brown to gray, poorly graded GRAVEL (GP-GC) with clay and sand, moist (sandstone fragments)		SS-6	5 2 4	6	11	9					

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-14**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 2 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1351.0		MINE SPOILS - LOOSE, dark brown to gray, poorly graded GRAVEL (GP-GC) with clay and sand, moist (sandstone fragments)	22.0										
	25	MINE SPOILS - LOOSE, dark brown to light brown, CLAYEY GRAVEL (GC) with sand, moist (shale fragments)		SS-7	12 3 5	8	15	8					
1346.0			27.0										
	30	MINE SPOILS - VERY FIRM, dark brown, poorly graded GRAVEL (GP) with sand, moist (sandstone fragments)		SS-8	31 19 16	35	18	8					
1341.0			32.0										
	35	MINE SPOILS - VERY STIFF to HARD, dark brown to brown, CLAYEY SAND (SC) with gravel, moist (sandstone fragments)		SS-9	3 4 13	17	12	14			24	16	8
	40			SS-10	5 3 50/4"		11	11					
1331.0			42.0										
	45	MINE SPOILS - FIRM, dark brown to brown, gravelly LEAN CLAY (CL) with sand, moist (shale fragments)		SS-11	5 5 3	8	10	11					

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-14**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 3 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1326.0			47.0										
	50	MINE SPOILS - VERY FIRM, gray to brown, poorly graded GRAVEL (GP-GC) with clay and sand, moist (mostly shale fragments, trace sandstone fragments)		SS-12	15 12 14	26	18	7					
1321.0			52.0										
	55			SS-13	4 13 13	26	14	10					
	60	MINE SPOILS - FIRM, gray mottled brown CLAYEY SAND (SC) with gravel, moist (few shale fragments, some sandstone fragments)		SS-14	14 9 5	14	0						
1308.0	65		65.0										
		MINE SPOILS - VERY DENSE, dark brown to gray CLAYEY SAND (SC) with gravel, with trace coal, moist (few shale fragments, few sandstone fragments)											
	70												
1302.5			70.5										
		Auger refusal at 70.5 feet. Switch to casing advancer. Tooling unavailable to remove tri-cone bit from casing advancer, proceed without sampling.											

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
RC - Rock Coring	CR - Rock Core Sample	PL - Plastic Limit
MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
WD - Wash Drilling		SPT - Standard Penetration Test
HA - Hand Auger		

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-14**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 4 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
		Difficult drilling, probable sandstone boulder											
1299.0			74.0										
	75												
		Easy drilling, probable CL/SC mine spoils											
	80												
1292.0			81.0										
1291.0		Difficult drilling, probable sandstone boulder	82.0										
		Easy drilling, probable CL/SC mine spoils											
1289.0			84.0										
1288.0	85	Difficult drilling, probable sandstone boulder	85.0										
		Easy drilling, probable CL/SC mine spoils											
1285.0			88.0										
		Moderately difficult drilling, probable shale boulder											
1283.0	90		90.0										
		Easy drilling, probable CL/SC mine spoils											
	95												

BORING METHOD

- HSA - Hollow Stem Auger
- SFA - Solid Flight Auger
- RC - Rock Coring
- MD - Mud Drilling
- WD - Wash Drilling
- HA - Hand Auger

SAMPLING METHOD

- SS - Split Spoon Sample
- ST - Shelby Tube Sample
- CR - Rock Core Sample
- BS - Bag Sample

ABBREVIATIONS

- * - Hand Penetrometer
- LL - Liquid Limit
- PL - Plastic Limit
- PI - Plasticity Index
- SPT - Standard Penetration Test

OLD TEST BORING/PIT RECORD BORING LOGS - OLIVE BRANCH.GPJ NEW CTL.GDT 5/15/26

TEST BORING RECORD

CLIENT : HMB Professional Engineers

BORING NO.: **B-14**

PROJECT : Olive Branch Project - Additional Drilling

SHEET 5 OF 5

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	STRATUM DEPTH	SAMPLE NUMBER	SPT per 6"	BLOWS per 6" (N)	Recovery	MOISTURE CONTENT	PERCENT FINER THAN #200	UNCONFINED COMPRESSIVE STRENGTH KSF	ATTERBERG LIMITS LL	PL	PI
1273.0	100	Easy drilling, probable CL/SC mine spoils	100.0										
		Boring hole terminated at 100 feet.											
	105												
	110												
	115												
	120												

BORING METHOD	SAMPLING METHOD	ABBREVIATIONS
HSA - Hollow Stem Auger	SS - Split Spoon Sample	* - Hand Penetrometer
SFA - Solid Flight Auger	ST - Shelby Tube Sample	LL - Liquid Limit
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MD - Mud Drilling	BS - Bag Sample	PI - Plasticity Index
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HA - Hand Auger		

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Report on Geophysical Seismic MASW Survey

Report Date: May 7, 2026

Project: Olive Branch Neighborhood Core Capital Mine Site
Location: Talcum, Kentucky – Knott County
CTL Project No: 26050007SHE

Survey Type: Combined Multi-Channel Analysis of Surface Waves (MASW)

PROJECT LOCATION AND DESCRIPTION

It is understood that the Commonwealth of Kentucky plans to develop about 130 residential lots on approximately 85.3 acres of land in an area of previous mining near Talcum, Kentucky. The development is being led by the Kentucky Transportation Cabinet (KYTC) as part of the Higher Ground initiative. The project site is located off Highway 80 between Hazard and Hindman, just east of the Perry/Knott County line. The site was primarily mined by mountaintop removal with the potential for some areas of contour mining. The spoils, which consist of soil and bedrock fragments from above and in between the mined coal seams, are placed in valleys (hollow fills), on contour benches (where present), and over the mined top of the mountain. The new neighborhood area overlies much of previously unexplored areas. The purpose of this exploration is to explore the proposed neighborhood area to better define potential mine benches (if present) and to understand the consistency of the mine spoils.

EXISTING CONDITIONS

Review of the existing site topography indicates that the site elevations on top of the ridge now range from about 1330 to 1370 feet within the neighborhood areas, with lower elevations along the side slopes leading down from the ridge into the valleys. In general, the proposed development lots are located on the flattened portion of the mountain ridge. However, a few lots located on the southern side of the development and on the south entrance road at the north end of the development are planned for areas sloping down from the ridge.

GEOLOGY

The Geologic Map of the Hazard Quadrangle, Kentucky (GQ-1441), published by the U.S. Geological Survey (USGS) indicates the site is underlain by two formations: the Princess Formation and the Four Corners Formation. The Princess Formation consists of sandstone, shale, coal and underclay and is generally located at higher elevations. The Four Corners Formation is generally sandstone, siltstone, shale, coal, and limestone, encountered on the side slopes and in the valley bottoms. The site is rated as non-Karst by the KGS, indicating that the geologic conditions present on site are not typically susceptible to the solutioning activity that causes sinkholes and Karst conditions.

The Kentucky Geological Survey shows several coal seams that were/are located within the upper portions of the geologic column. Review of the geologic map for the area of the site indicates four possibly mined seams; the Hindman Coal (Hazard No. 9), Francis Coal (Hazard No. 8), Hazard No. 7 (A and B seams), and the Hazard coal beds.

EXPLORATION METHODOLOGY

Geophysical testing using active and passive seismic Multi-Channel Analysis of Surface Waves (MASW) test methods were performed at the project site by CTL Engineering, Inc (CTL). The MASW surveys were used to model the shear wave velocity profiles of the subsurface materials at each test location. The shear wave velocity (Vs) of a material may be used in material characterization and is related to the materials mass density. The Vs of a soil or rock also provides a general estimate of its stiffness and/or degree of weathering.

MASW is based on evaluating shear waves in the subsurface materials based on surface Rayleigh waves. The technology functions by recording ambient noise (Microtremor) and measuring the velocity of ambient acoustic waves (Rayleigh waves) beneath the surface, effectively returning a reviewable image of subsurface conditions. The acoustic waves and ambient noise are collected by receivers, known as geophones, and are placed at regularly-spaced intervals at the ground surface along a predefined alignment for the area being explored. These receivers take individual readings of incoming shear wave velocities and CTL compiles them digitally for subsequent analysis and evaluation.

Since Rayleigh waves are dispersive, the propagating waves are measured along a seismic array and evaluated relative to wave frequency and slowness (or the inverse of the velocity). Due to the dispersive characteristics of higher frequency waves travelling through the shallower conditions and lower frequency waves passing through deeper materials, 1-D and 2-D subsurface profiles can be generated based on the velocity with depth. A profile (shear wave velocity versus depth) is then created from the analyzed data. Based on interpretation of the data collected, CTL can develop a subsurface profile of the materials beneath the ground surface.

During testing, geophones are placed along an array at even spacing. The length of survey and the spacing of geophones determine the depth of penetration and resolution of the survey. When increasing array dimensions, it enables measurements of greater depth; but in contrast, reduces the resolution of the imaging, especially at greater depths.

Rayleigh waves are typically generated from seismic sources described to be active, passive, or a combination of both. As an example, active sources can be generated sources from a sledge hammer striking a plate or other sources that are created near the traverse. Passive sources can be nearby highway traffic, construction equipment working in the distance, etc.

FINDINGS

At the referenced project site, CTL conducted six (6) MASW surveys at the test locations and using the test parameters listed in Table 1; and using the equipment and collection parameters listed in Table 2.

Table 1. Schedule of Survey Lines

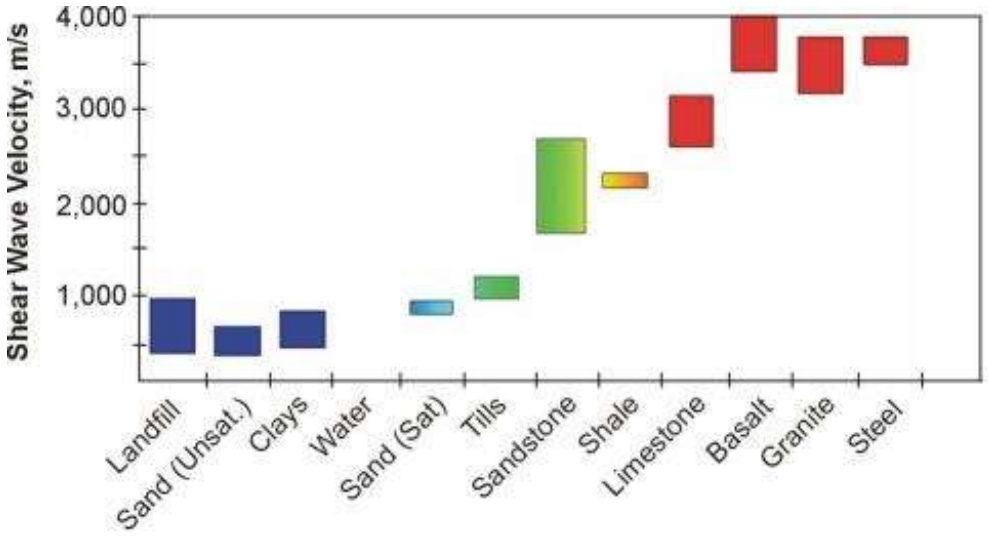
Survey ID:	Olive A	Olive B	Olive C	Olive D	Olive E	Olive F
Starting Latitude:	37.378392	37.378496	37.375526	37.375194	37.376893	37.380874
Starting Longitude:	-83.114429	-83.114991	-83.108888	-83.109962	-83.111712	-83.104036
End Latitude:	37.377741	37.377609	37.377193	37.376317	37.375559	37.382276
End Longitude:	-83.116233	-83.113407	-83.109199	-83.108438	-83.112832	-83.103269
Survey Length:	580 ft.	580 ft.	630 ft.	630 ft.	580 ft.	630 ft.
No. Channels:	24	24	24	24	24	24
Channel Spacing:	10 ft.	10 ft.	10 ft.	10 ft.	10 ft.	10 ft.
Source Offset:	80 ft.	80 ft.	80 ft.	80 ft.	80 ft.	80 ft.

Table 2. Data Acquisition Parameters

Survey Type:	Combined Active and Passive MASW
Survey Purpose:	2D Shear Wave Velocity Soil Profiling
Recording Device:	DAQ-Link IV
Geophone Type:	4.5 Hz vertical
Source:	10 lbs. Sledgehammer on aluminum plate
Sampling Interval:	2.000 msec
Record Length:	30.000 sec
Filters:	None

The shear wave velocities from the MASW testing may be used in correlating the material types for the project. The data found in *Figure 1* may be used in providing a general guideline of various soil and rock types, and their corresponding range of shear wave velocity values. It should be noted that these are approximate values.

Figure 1. Typical Ranges of Shear Wave Velocities of Earth Materials



Note: 1 m/s = 3.2808 ft/s or 1 ft/s = 0.3048 m/s

The shear wave velocities from the MASW testing may be used in identifying the stiffness of the subsurface materials. When calculating the average shear-wave velocity at the test location and comparing the results to the tabulated data found in Table 3, the classification of the geomaterials may be assigned.

Table 3. NEHRP Soil Hazard Classification

Soil Class	Soil Description	Shear Wave Velocity (fps)	Susceptibility to Amplification Rating
A	Hard Rock	> 5,000	Negligent
B	Firm to Hard Rock	2,500 – 5,000	Very Low
C	Dense Soil and Soft Rock	1,200 – 2,500	Low
D	Stiff Soil	600 – 1,200	Moderate
E	Soft Soil	< 600	High

Field testing exhibited Vs values which ranged from less than ±500 to nearly ±5,000 feet per second (ft/s or fps) across the site. The MASW shear wave velocities over about 2,500 fps would generally indicate weathered rock. The interpretation of the modeled shear wave velocities to the soil/rock descriptions were aided by the comparison of the MASW data to the geotechnical borings drilled for the project.

CONCLUSIONS

Based on the MASW surveys performed, the following conclusions are presented:

1) Line Olive A suggests that depths to bedrock is variable, ranging from greater than 140 feet at the northeast end to less than 50 feet deep at the southwest end of the line. This is generally consistent with historical mine records for the project and indicates that northeast of the line overlies a hollow fill area. The fill materials generally exhibited shear wave velocities values less than 2,000 fps (soft to very dense consistencies); and the deeper rock exhibited values of 2,500 to less than 4,000 fps.

2) Line Olive B suggests that depths to bedrock is also variable, ranging from greater than 140 feet at the northwest end to near 50 feet deep at the southeast end of the line. This is also generally consistent with the findings of document research for the project and indicates that northwest of the line overlies a hollow fill area. The fill materials generally exhibited shear wave velocities values less than 2,500 fps (soft to very dense consistencies); and the deeper rock exhibited values of 2,500 to near 5,000 fps.

3) Line Olive C was interpreted as not encountering rock in the upper 140 feet of the subsurface profile and consisting of mine spoil fill materials. The fill materials generally exhibited shear wave velocities values less than 1,500 fps (soft to stiff consistencies) at the southern portion of the line; and shear wave velocities values less than 2,500 fps (soft to very dense consistencies) at the northern portion.

4) Line Olive D was interpreted as being similar to line Olive C by not encountering rock in the upper 140 feet of the subsurface profile and materials interpreted as consisting of mine spoil fill materials. The fill materials generally exhibited shear wave velocities values less than 1,250 fps (soft to stiff consistencies) in the upper 40 to 50 feet; and shear wave velocities values between 1,250 to 2,500 fps (stiff to very dense consistencies) at depth.

5) Line Olive E was interpreted as not encountering rock in the upper 140 feet of the subsurface profile and consisting of mine spoil fill materials. The fill materials generally exhibited shear wave velocities values less than 1,100 fps (soft to stiff consistencies) throughout the entire test area.

6) Line Olive F was the only MASW line positioned along the northern portion if the development. Modeling suggests that materials in the upper 140 feet of the subsurface profile consist mostly of hollow fill materials. The fill materials generally exhibited shear wave velocities values less than 2,000 fps (soft to dense consistencies). Soils below elevation 1260 feet (depth of about 100 feet) near the mid-span of the test line was interpreted as exhibiting shear wave velocities values between 2,000 to 3,000 fps. This region of subsurface materials exhibiting slightly higher shear wave velocities may represented fill materials consisting of large boulders or weathered rock.

SURVEY LIMITATIONS

This exploration included a limited set of geophysical readings across limited portions of the project site. The results and interpretations of the geophysical exploration performed are considered generally reliable and were conducted in a manner consistent with practitioners in the field of geophysical engineering. The methods used in this exploration are considered reliable; however, there may exist localized variations in the subsurface conditions that have not been completely defined at this time.

It should be noted that the results are not unique to subsurface features and more than one geologic feature or model may give similar results. Therefore, properly conducted soil/bedrock test borings and other exploratory techniques should be used to confirm the interpretations provided herein and to determine the subsurface conditions more completely at the site.

The site features presented on the plan sheets are for informational purposes only and no representation is made as to the accuracy or completeness of this information. It is recommended that a practicing engineering professional be contacted prior to conducting verification drilling or excavating activities.

CHANGED CONDITIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field data obtained during the exploration, our understanding of the project, and our experience with similar sites and subsurface conditions using generally accepted engineering practices. Although individual test surveys are representative of the subsurface conditions at the test locations on the dates performed, they are not necessarily representative of the subsurface conditions between test locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can be modified, if required.

CLOSING

The report was prepared by CTL Engineering, Inc. solely for the use of the Client in accordance with an executed contract. The Client's use of or reliance on this report is limited by the terms and conditions of the contract and by the qualifications and limitations stated in the report. It is also acknowledged that the Client's use of and reliance of this report is limited for reasons which include: actual site conditions that may change with time; hidden conditions, not discoverable within the scope of the assessment, may exist at the site; and the scope of the investigation may have been limited by time, budget and other constraints imposed by the Client.

Neither the report, nor its contents, conclusions or recommendations, are intended for the use of any party other than the Client. Consultant and the Client assume no liability for any reliance placed on this report by such party. The rights of the Client under contract may not be assigned to any person or entity, without the consent of the Consultant which consent shall not be unreasonably withheld.

This report does not address the environmental conditions of the site. CTL is not responsible for consequences or conditions arising from facts that were concealed, withheld, or not fully disclosed at the time the assessment was conducted.

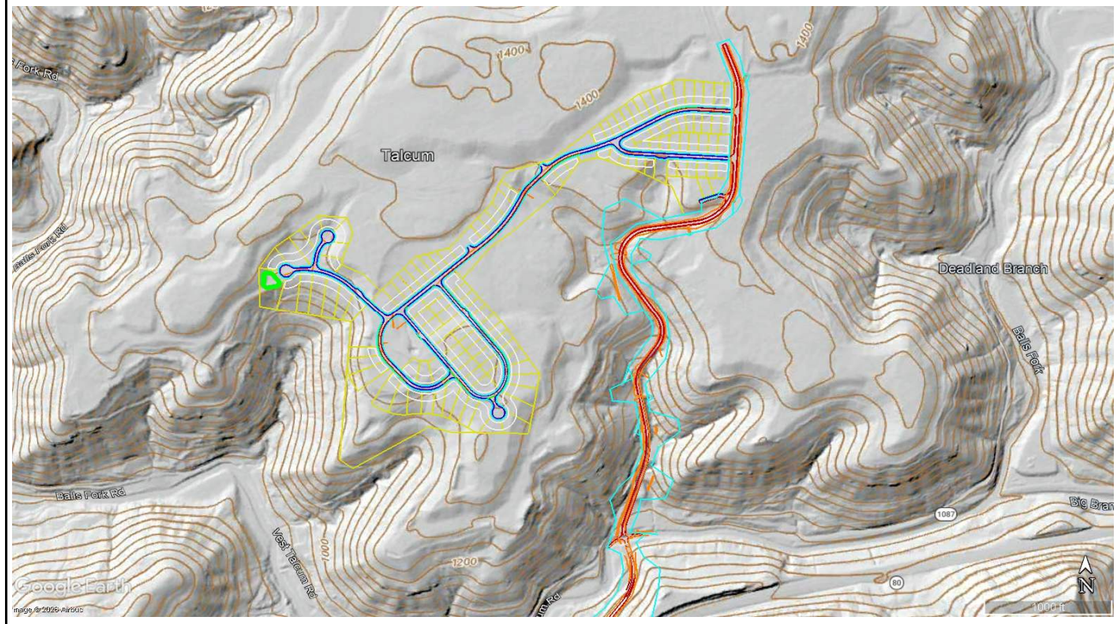
Thank you for the opportunity to be of service to you on this project. If you have any questions regarding our services, please contact our office.

Respectfully Submitted,
CTL ENGINEERING, INC.

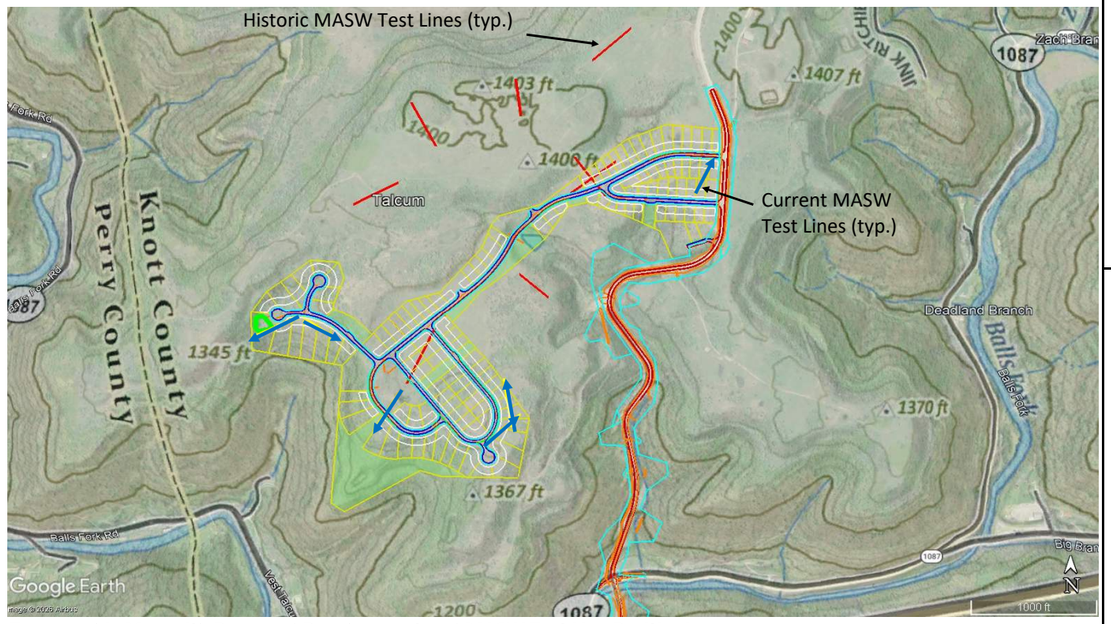
Frederick Schoen, P.E. (OH, IN, MI)
Geotechnical Service Line Manager - Wapakoneta

Matthew Slusser, P.E.
Geotechnical Service Line Manager - Kentucky

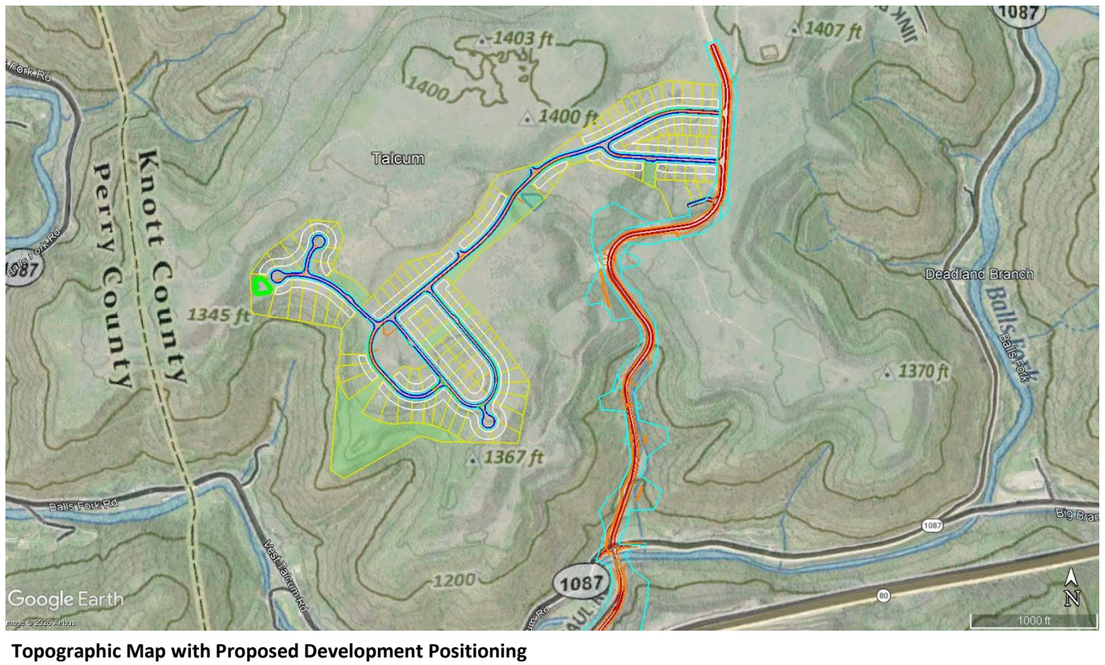
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)



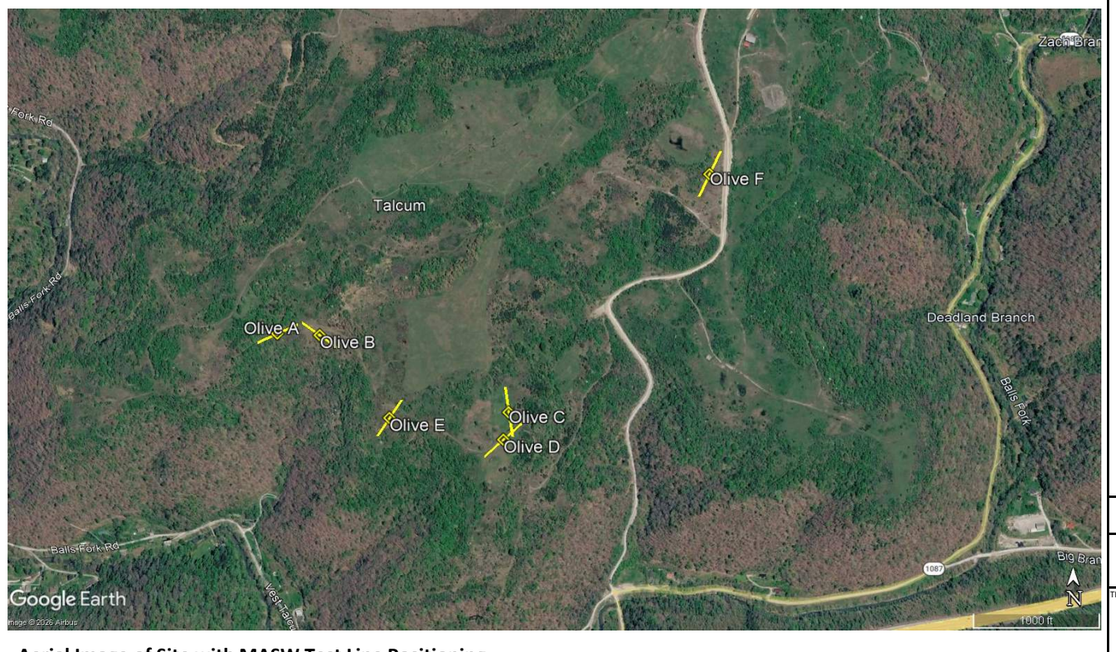
USGS National Map Hillshade and Topographic Contour Map with Proposed Development Positioning



Topographic Map with Proposed Development and MASW Test Line Positioning



Topographic Map with Proposed Development Positioning



Aerial Image of Site with MASW Test Line Positioning

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OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - PROJECT PLAN VIEWS

TALCUM, KENTUCKY - KNOTT COUNTY

3/26/2026
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Drawn: FS
Checked: MS

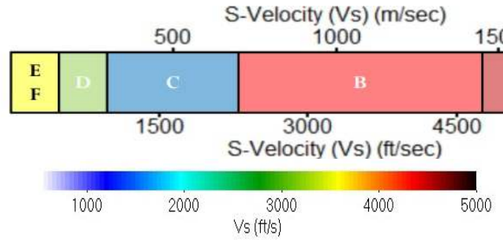
TITLE
GEOPHYSICAL EXPLORATION

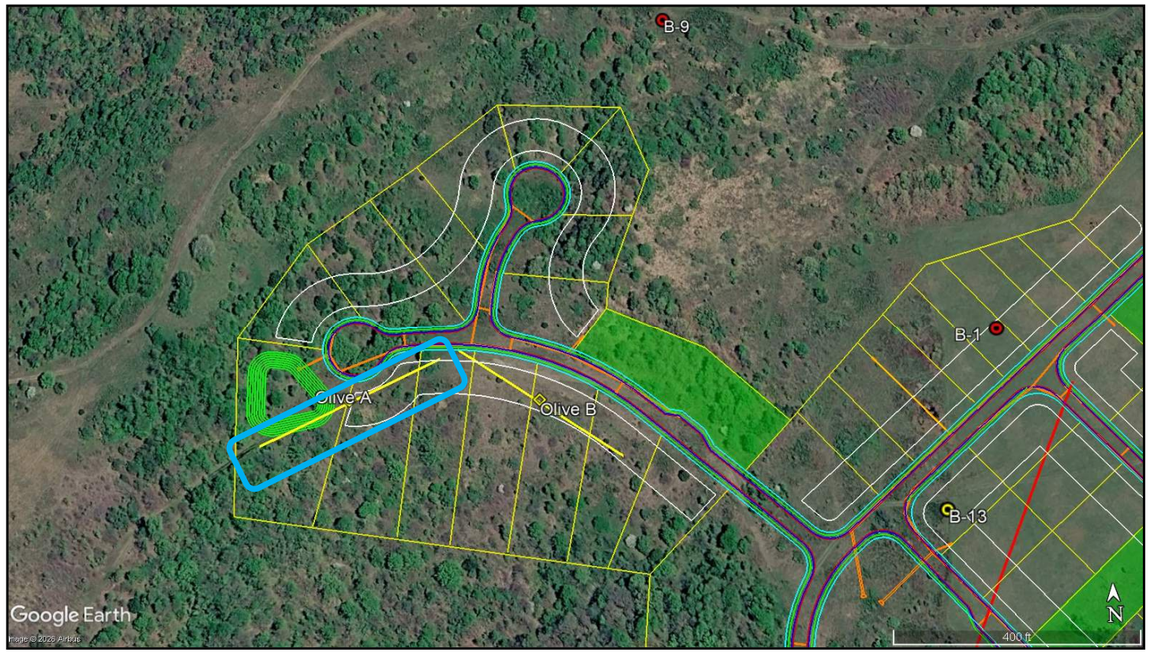
SHEET NO.
GEO-1

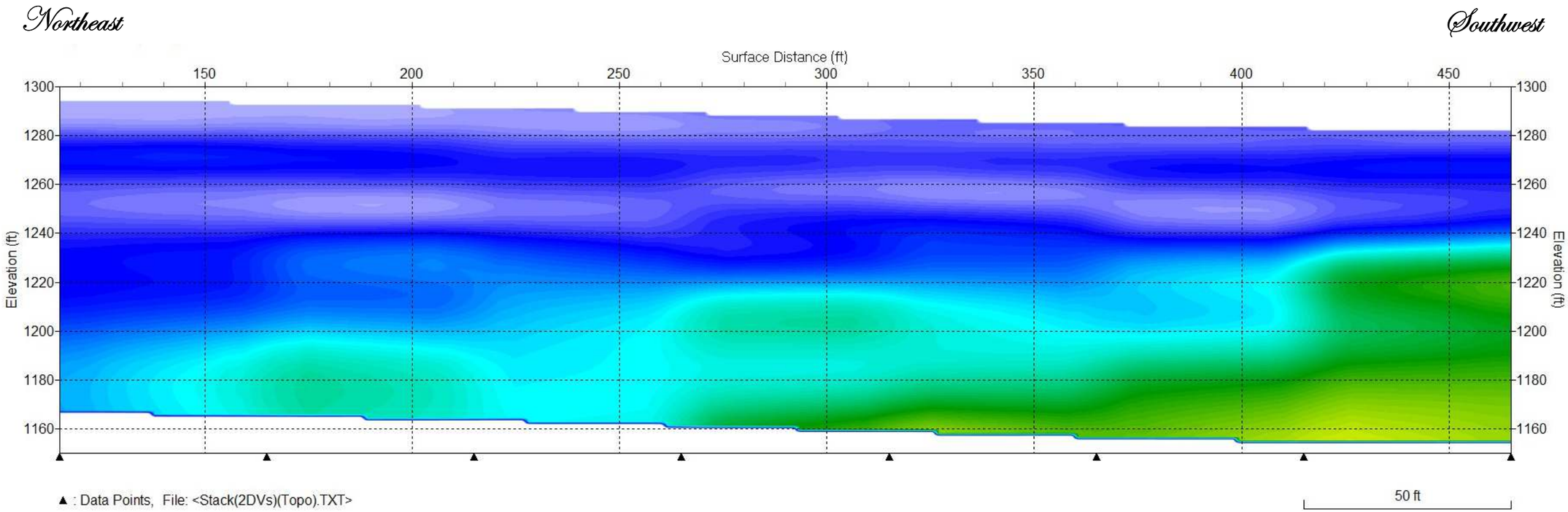
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW): OLIVE A

Site Class	Soil Profile Name	Average Shear Wave Velocity in Upper 100 feet of Subsurface	
		Vs (feet/sec)	Vs (m/sec)
A	Hard Rock	> 5000	> 1525
B	Rock	2500 - 5000	760 - 1525
C	Very Dense Soil and Soft Rock	1200 - 2500	365 - 760
D	Stiff Soil	600 - 1200	180 - 365
E	Soft Soil	< 600	< 180
Site Classifications adopted from Table 1613.5.2 Site Class Definitions published in International Building Code (IBC)			

MASW Survey Line Details:
Test Date: February 18, 2026
Line Label: Olive A
Survey Length: 580 ft.
2D Model Length: 350 ft.
Approx. Depth: 140 ft.
Channel Spacing: 10 ft.
Starting Coordinates:
N 37.378392, E -83.114429
Ending Coordinates:
N 37.377741 E -83.116233







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OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - MASW PROFILE

TALCUM, KENTUCKY - KNOTT COUNTY

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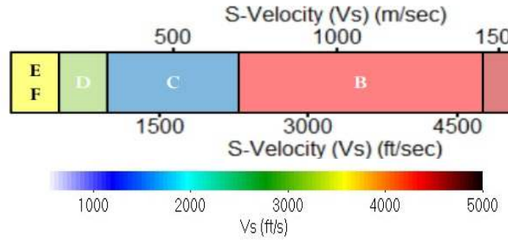
TITLE
GEOPHYSICAL EXPLORATION

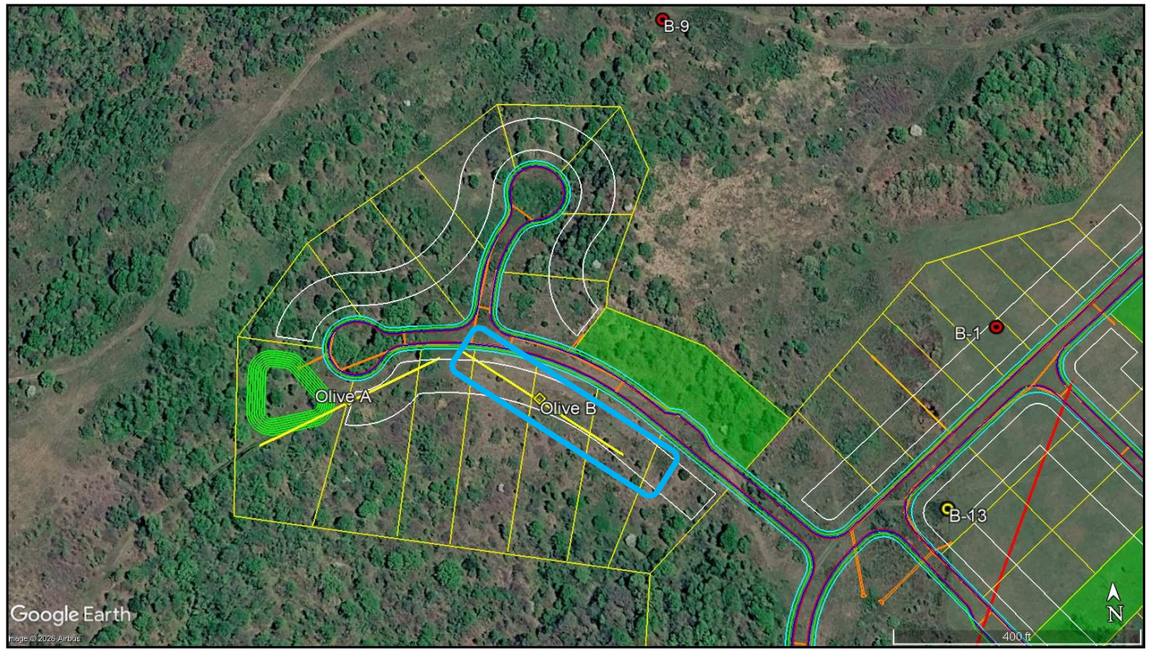
SHEET NO.
GEO-2

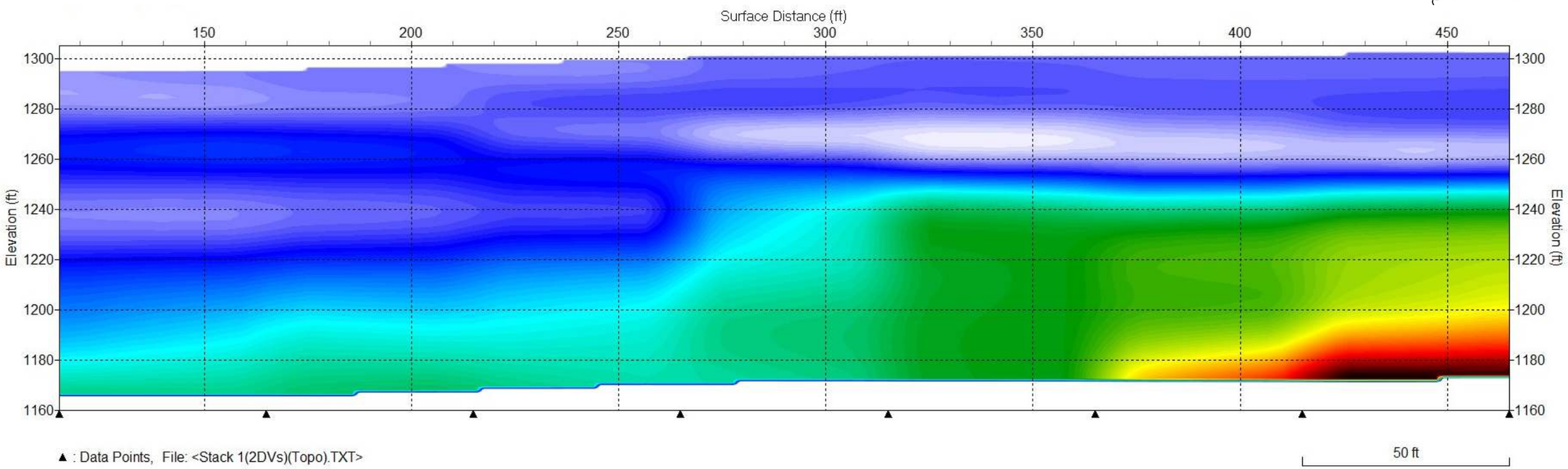
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW): OLIVE B

Site Class	Soil Profile Name	Average Shear Wave Velocity in Upper 100 feet of Subsurface	
		Vs (feet/sec)	Vs (m/sec)
A	Hard Rock	> 5000	> 1525
B	Rock	2500 - 5000	760 - 1525
C	Very Dense Soil and Soft Rock	1200 - 2500	365 - 760
D	Stiff Soil	600 - 1200	180 - 365
E	Soft Soil	< 600	< 180
Site Classifications adopted from Table 1613.5.2 Site Class Definitions published in International Building Code (IBC)			

MASW Survey Line Details:
Test Date: February 18, 2026
Line Label: Olive B
Survey Length: 580 ft.
2D Model Length: 350 ft.
Approx. Depth: 140 ft.
Channel Spacing: 10 ft.
Starting Coordinates:
N 37.378496, E -83.114991
Ending Coordinates:
N 37.377609, E -83.113407







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CTL ENGINEERING

OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - MASW PROFILE

TALCUM, KENTUCKY - KNOTT COUNTY

5/7/2026
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TITLE
GEOPHYSICAL EXPLORATION

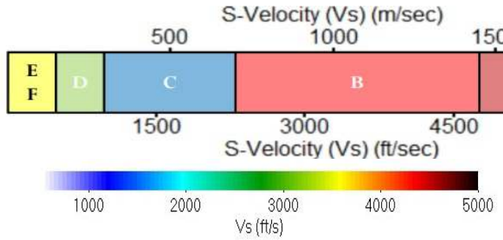
SHEET NO.
GEO-3

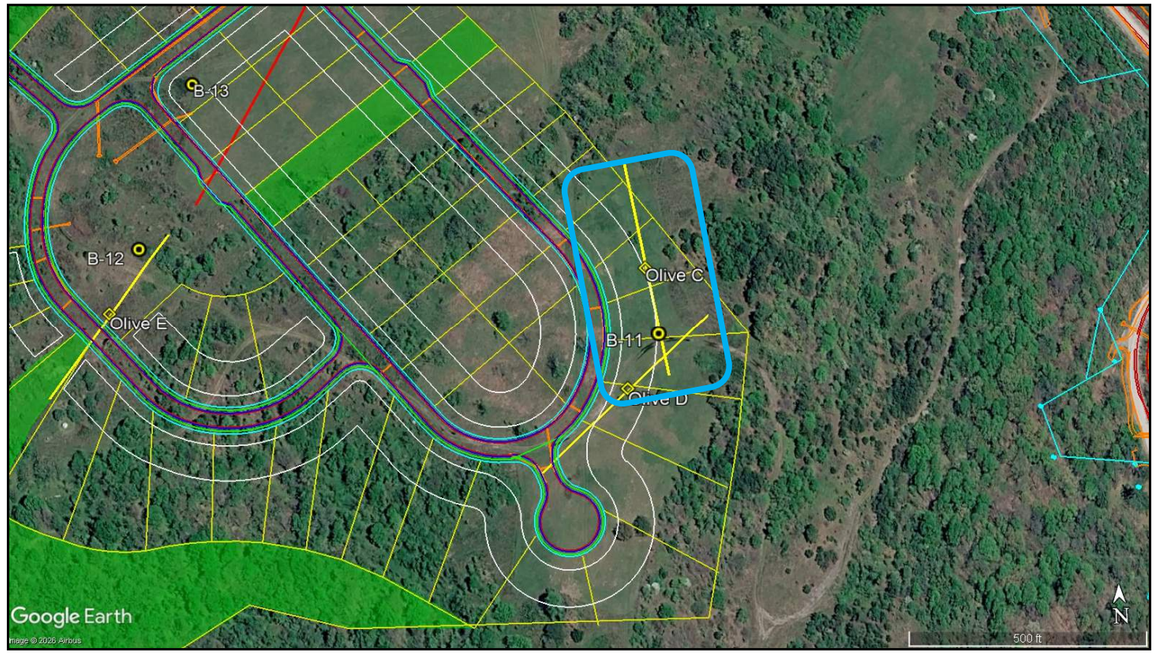
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW): OLIVE C

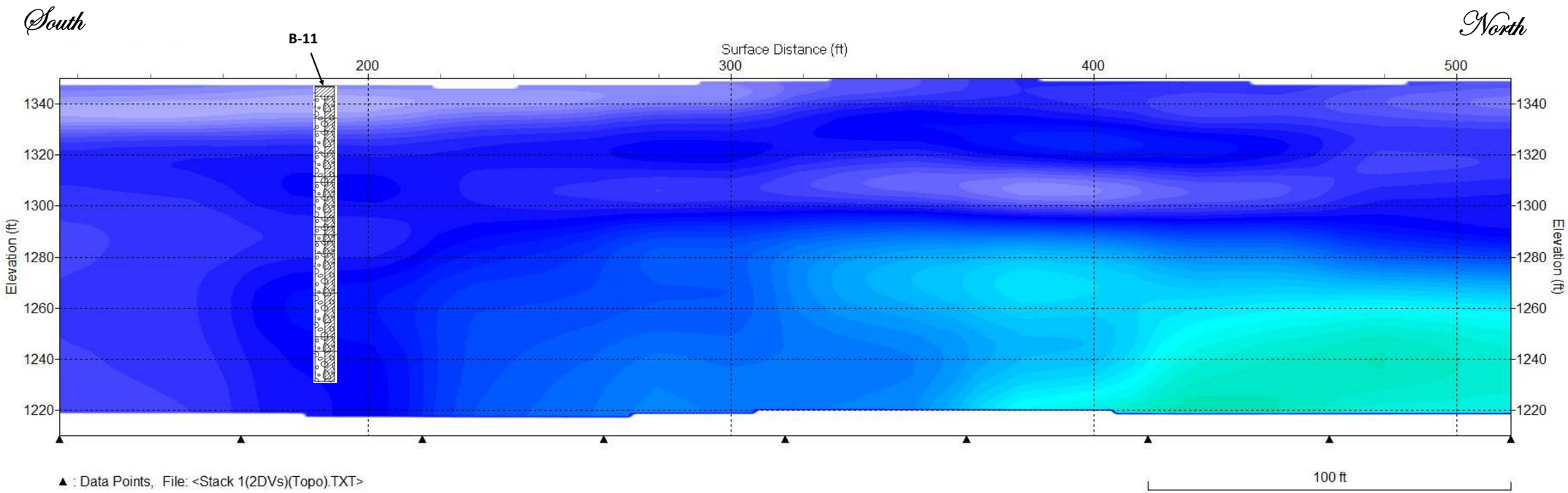
Site Class	Soil Profile Name	Average Shear Wave Velocity in Upper 100 feet of Subsurface	
		Vs (feet/sec)	Vs (m/sec)
A	Hard Rock	> 5000	> 1525
B	Rock	2500 - 5000	760 - 1525
C	Very Dense Soil and Soft Rock	1200 - 2500	365 - 760
D	Stiff Soil	600 - 1200	180 - 365
E	Soft Soil	< 600	< 180

Site Classifications adopted from Table 1613.5.2 Site Class Definitions published in International Building Code (IBC)

MASW Survey Line Details:
Test Date: February 17, 2026
Line Label: Olive C
Survey Length: 630 ft.
2D Model Length: 400 ft.
Approx. Depth: 140 ft.
Channel Spacing: 10 ft.
Starting Coordinates:
N 37.375526, E -83.108888
Ending Coordinates:
N 37.377193, E -83.109199







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OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - MASW PROFILE

TALCUM, KENTUCKY - KNOTT COUNTY

5/7/2026
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TITLE
GEOPHYSICAL EXPLORATION

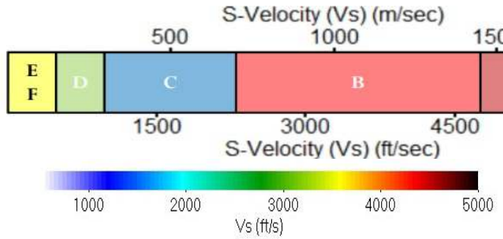
SHEET NO.
GEO-4

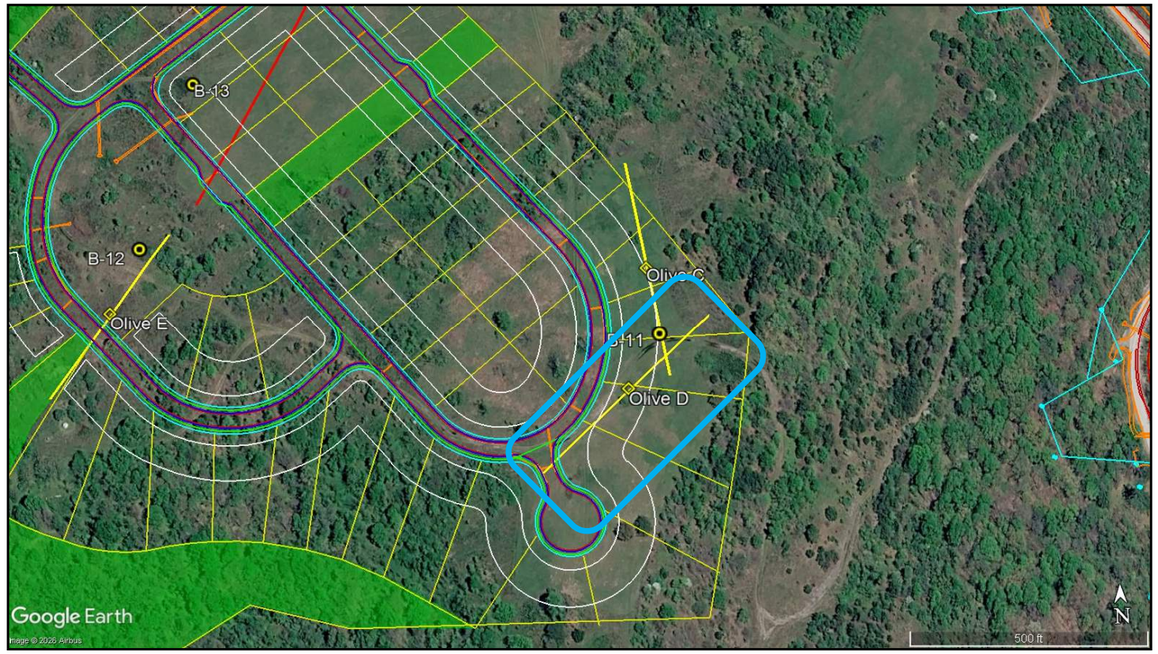
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW): OLIVE D

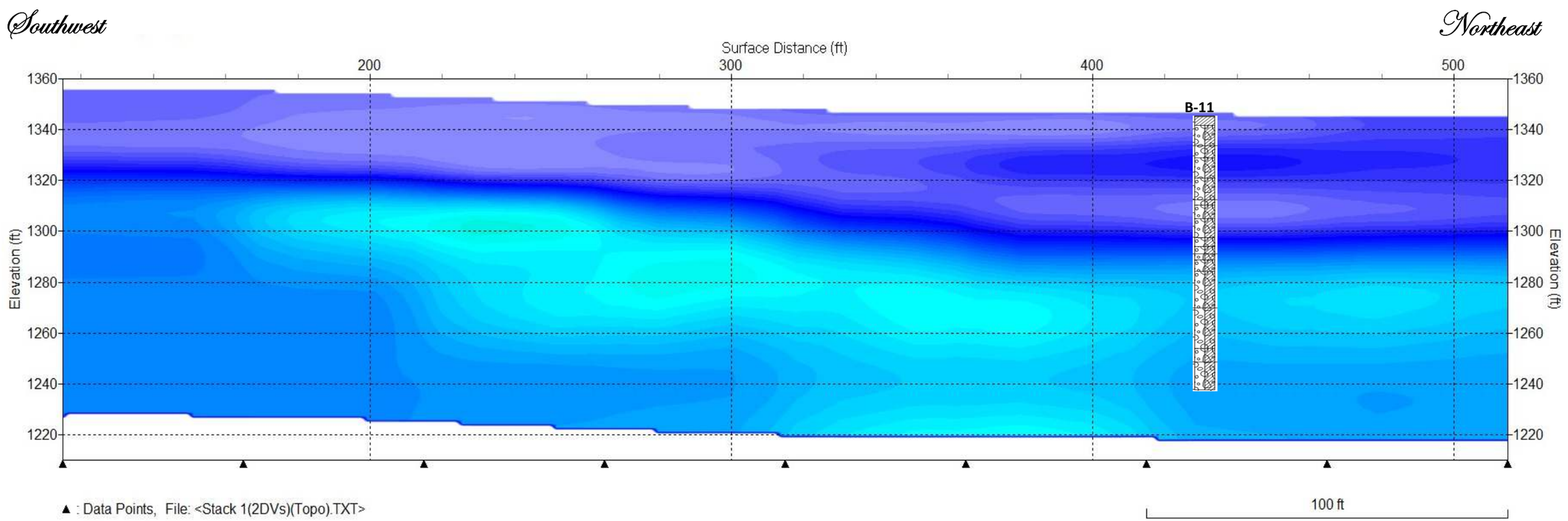
Site Class	Soil Profile Name	Average Shear Wave Velocity in Upper 100 feet of Subsurface	
		Vs (feet/sec)	Vs (m/sec)
A	Hard Rock	> 5000	> 1525
B	Rock	2500 - 5000	760 - 1525
C	Very Dense Soil and Soft Rock	1200 - 2500	365 - 760
D	Stiff Soil	600 - 1200	180 - 365
E	Soft Soil	< 600	< 180

Site Classifications adopted from Table 1613.5.2 Site Class Definitions published in International Building Code (IBC)

MASW Survey Line Details:
Test Date: February 17, 2026
Line Label: Olive D
Survey Length: 630 ft.
2D Model Length: 400 ft.
Approx. Depth: 140 ft.
Channel Spacing: 10 ft.
Starting Coordinates:
N 37.375194, E -83.109962
Ending Coordinates:
N 37.376317, E -83.108438







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CTL ENGINEERING

OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - MASW PROFILE

TALCUM, KENTUCKY - KNOTT COUNTY

5/7/2026
26050007SHE
Drawn: FS
Checked: MS

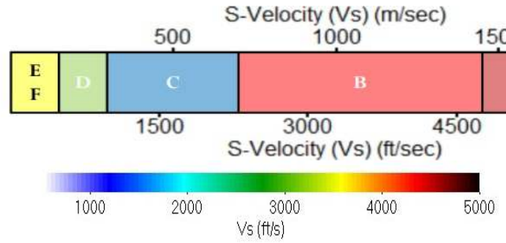
TITLE
GEOPHYSICAL EXPLORATION

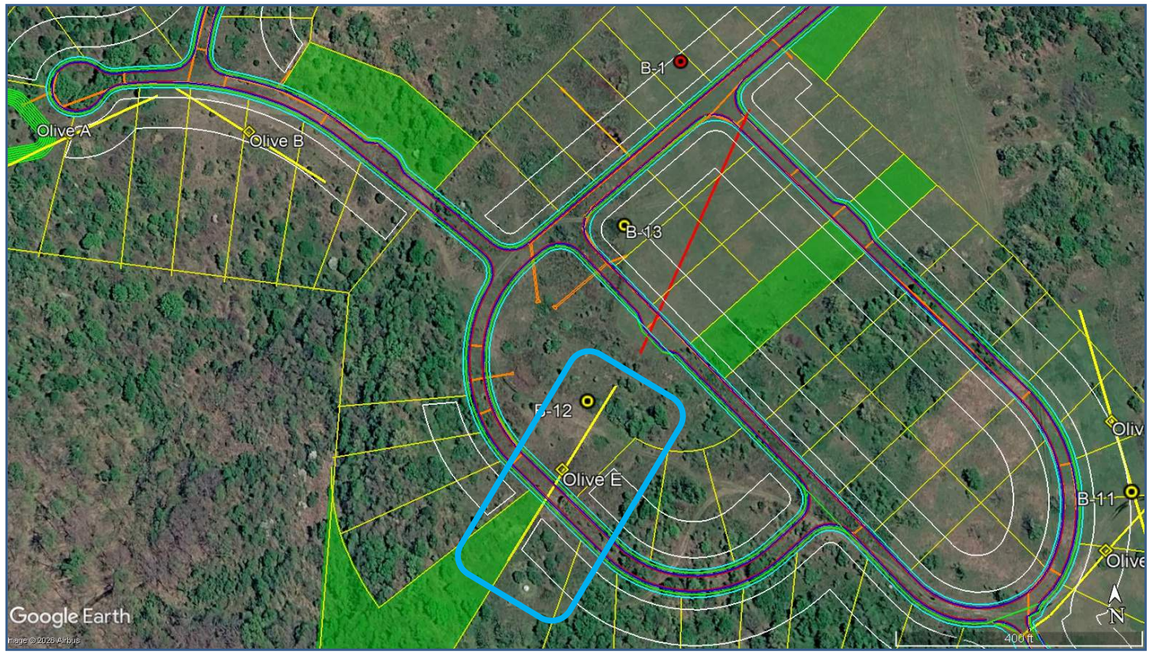
SHEET NO.
GEO-5

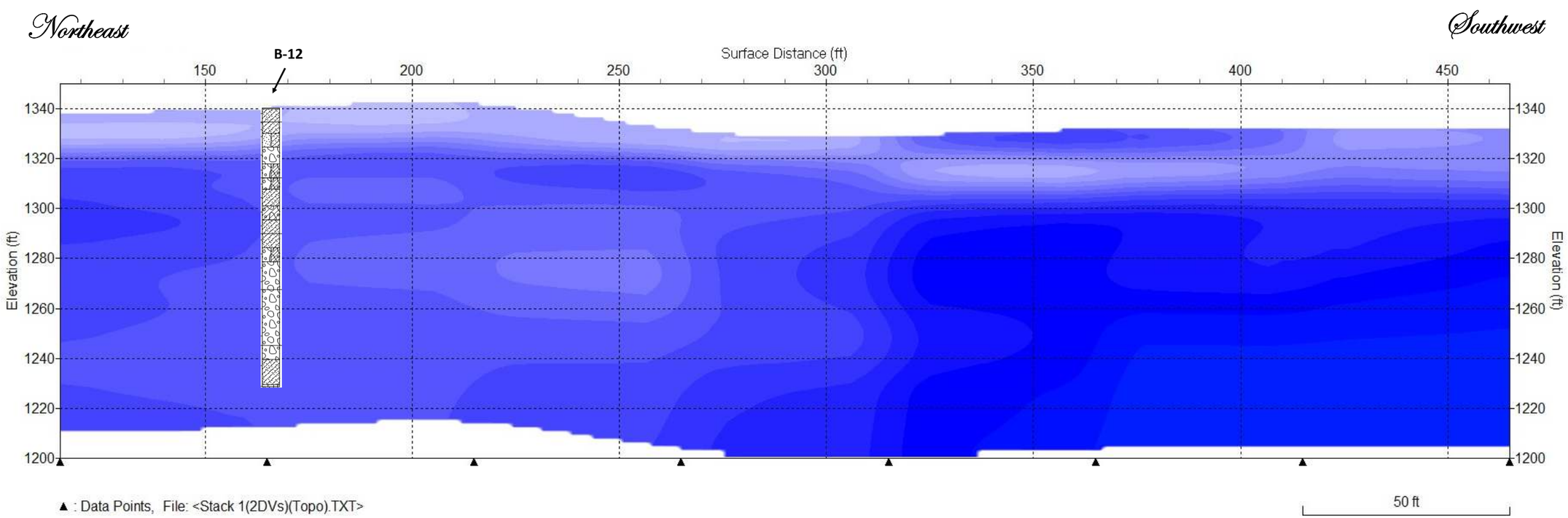
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW): OLIVE E

Site Class	Soil Profile Name	Average Shear Wave Velocity in Upper 100 feet of Subsurface	
		Vs (feet/sec)	Vs (m/sec)
A	Hard Rock	> 5000	> 1525
B	Rock	2500 - 5000	760 - 1525
C	Very Dense Soil and Soft Rock	1200 - 2500	365 - 760
D	Stiff Soil	600 - 1200	180 - 365
E	Soft Soil	< 600	< 180
Site Classifications adopted from Table 1613.5.2 Site Class Definitions published in International Building Code (IBC)			

MASW Survey Line Details:
Test Date: February 19, 2026
Line Label: Olive E
Survey Length: 580 ft.
2D Model Length: 350 ft.
Approx. Depth: 140 ft.
Channel Spacing: 10 ft.
Starting Coordinates:
N 37.376893, E -83.111712
Ending Coordinates:
N 37.375559, E -83.112832







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OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - MASW PROFILE

TALCUM, KENTUCKY - KNOTT COUNTY

5/7/2026
26050007SHE
Drawn: FS
Checked: MS

TITLE
GEOPHYSICAL EXPLORATION

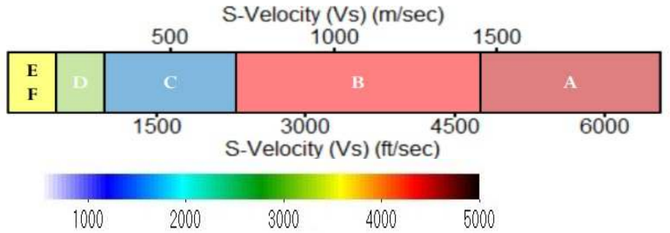
SHEET NO.
GEO-6

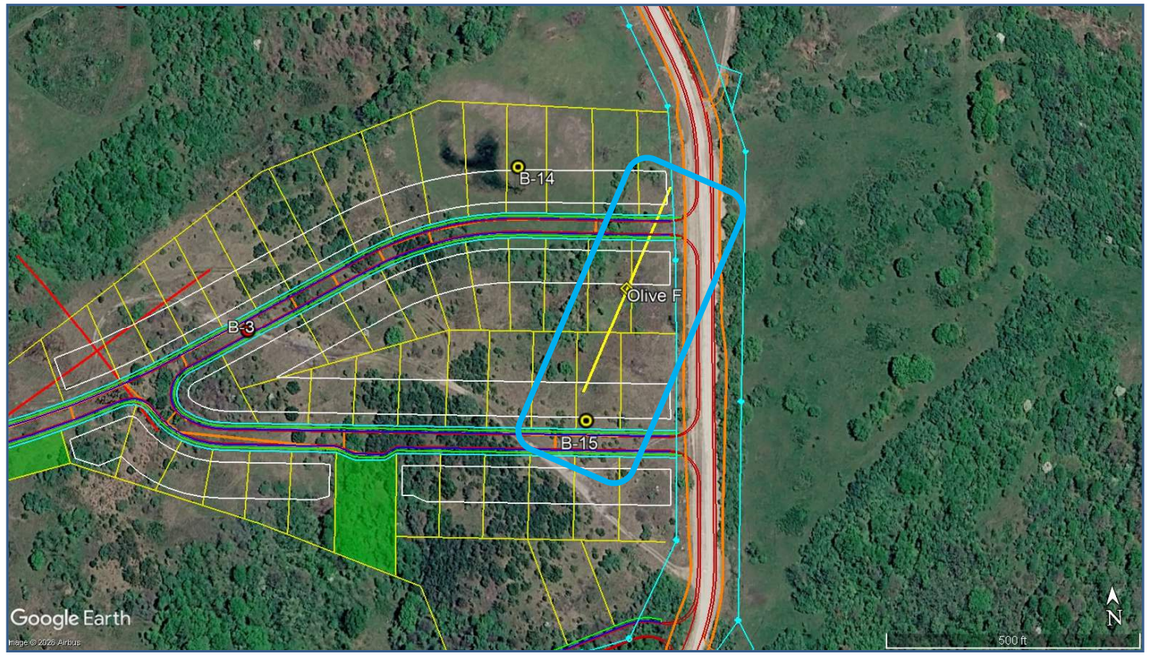
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW): OLIVE F

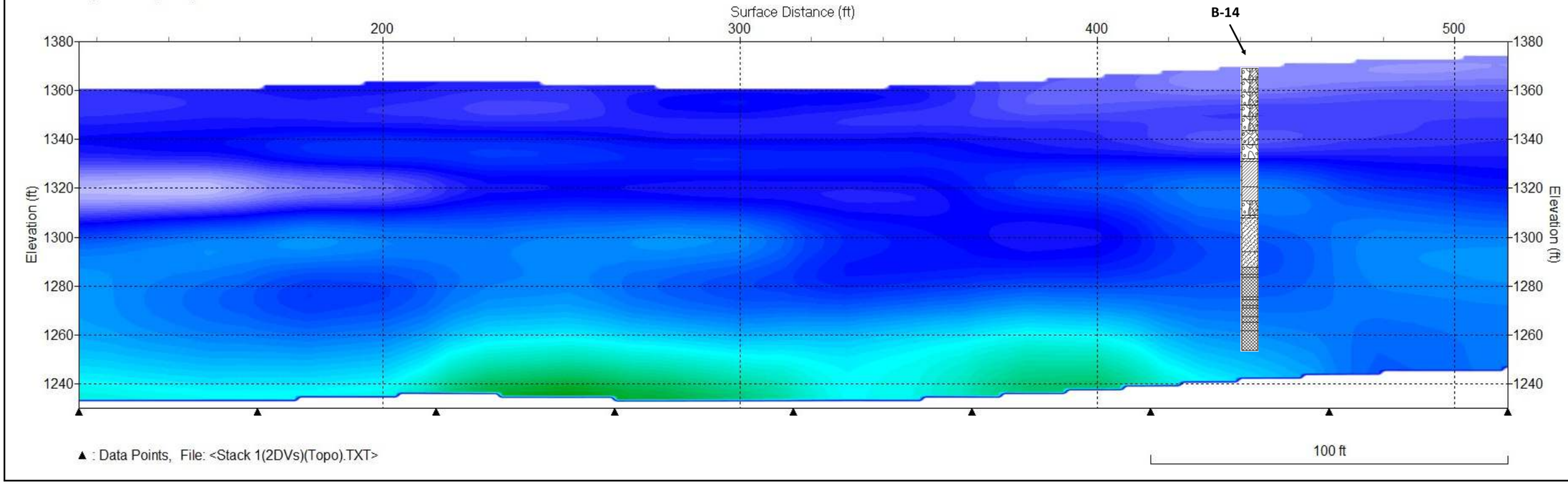
Site Class	Soil Profile Name	Average Shear Wave Velocity in Upper 100 feet of Subsurface	
		Vs (feet/sec)	Vs (m/sec)
A	Hard Rock	> 5000	> 1525
B	Rock	2500 - 5000	760 - 1525
C	Very Dense Soil and Soft Rock	1200 - 2500	365 - 760
D	Stiff Soil	600 - 1200	180 - 365
E	Soft Soil	< 600	< 180

Site Classifications adopted from Table 1613.5.2 Site Class Definitions published in International Building Code (IBC)

MASW Survey Line Details:
Test Date: February 16, 2026
Line Label: Olive F
Survey Length: 630 ft.
2D Model Length: 400 ft.
Approx. Depth: 140 ft.
Channel Spacing: 10 ft.
Starting Coordinates:
N 37.380874, E -83.104036
Ending Coordinates:
N 37.382276, E -83.103269







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CTL ENGINEERING

OLIVE BRANCH DEVELOPMENT

GEOPHYSICAL EXPLORATION - MASW PROFILE

TALCUM, KENTUCKY - KNOTT COUNTY

5/7/2026
26050007SHE

Drawn: FS
Checked: MS

TITLE
GEOPHYSICAL EXPLORATION

SHEET NO.
GEO-7

FIELD TESTING PROCEDURES

CTL Engineering Inc. performs field tests in general accordance with the American Society for Testing and Materials (ASTM). These procedures are generally recognized as the basis for uniformity and consistency of test results in the geotechnical engineering profession. All work is initiated and supervised by qualified geotechnical professionals.

Subsequent portions of this attachment briefly describe our field testing procedures. Where applicable, we have referenced these procedures to ASTM standards, which contain specific descriptions of apparatus, procedures, reporting, etc.

SOIL TEST BORING, ASTM D-1586

The borings were made with a hollow-stem auger powered by a drill rig. At regular intervals, soil samples were obtained through the hollow augers with a standard 1.4-inch I.D., 2.0-inch O.D. split-tube sampler.

The sampler was initially seated 6 inches to penetrate any loose cuttings; then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and is designated as the *standard penetration resistance (SPT N-value)*. Penetration resistance, when properly evaluated, is an index to soil consistency and strength.

In the field, our geotechnical professional logged and described the samples as they were obtained. Representative portions of each soil sample were labeled and sealed, then transported to our laboratory. The samples were examined by a graduate geotechnical engineer/geologist to visually check the field descriptions. Boring data, including sample intervals, penetration resistances, soil descriptions, and groundwater levels, are shown on the attached Test Boring Records.

AUGER REFUSAL MATERIALS

Auger refusal is a term that describes subsurface materials sufficiently competent to prevent further penetration by our drilling augers. Our criterion for auger refusal is the inability of our drill rig to advance the augers with 300 psi down pressure. Typically, refusal materials exhibit penetration resistances in excess of 100 blows per foot. Refusal materials can be hard cemented soil, soft weathered rock, coarse gravel or boulders, rubble or other hard debris, thin rock seams, or the upper surface of sound, continuous rock. Core drilling procedures are required to determine the character and continuity of refusal materials.

CORRELATION
OF
STANDARD
PENETRATION RESISTANCE
WITH
RELATIVE COMPACTNESS AND CONSISTENCY

Sand and Gravel

Standard Penetration Resistance Blows per foot (bpf)	Relative Compactness
0-4	Very Loose
5-10	Loose
11-20	Firm
21-30	Very Firm
31-50	Dense
Over 50	Very Dense

Silt and Clay

Standard Penetration Resistance Blows per foot (bpf)	Consistency
0-2	Very Soft
3-4	Soft
5-8	Firm
9-15	Stiff
16-30	Very Stiff
31-50	Hard
Over 50	Very Hard

FIELD TESTING PROCEDURES

ROCK CORING, ASTM D-2113

After we encountered refusal to the power auger, the refusal materials were cored using a diamond-studded bit fastened to the end of a hollow tube core barrel. This device was rotated at high speed by the drill rig, and the cuttings were brought to the surface by circulating water. Core samples of the materials penetrated were protected and retained in the swivel-mounted inner tube of the core barrel. Upon completion of each coring "run", the core barrel was brought to the surface and the samples removed and placed in core boxes. The samples were logged in the field by the driller, then returned to the laboratory.

At the laboratory, the rock's relative hardness, percent recovery, and rock quality designation were determined by a geotechnical engineer or geologist. Criteria for defining hardness are listed below

Recovery is the ratio of the sample length obtained to the length of the core run, expressed as a percent. The percent recovery is related to rock soundness and continuity. Rock descriptions and recoveries are shown on the Test Boring Records. The NQ size designates a bit which obtains rock cores $1^{7}/_{8}$ inches in diameter.

The rock quality designation (RQD) is also a way of describing the rock's soundness and continuity. RQD is the ratio of the sum of the lengths of rock pieces 4 or more inches long to the length of the core run, expressed as a percent. Rock described as a function of RQD is as follows:

FIELD TESTING PROCEDURES

RELATIVE HARDNESS OF ROCK

Very Soft	Pieces 1 inch or more in thickness can be broken by finger pressure; can be scratched readily by fingernail
Soft	May be broken with fingers.
Medium	May be scratched with a nail; corners and edges may be broken with fingers.
Moderately Hard	Moderate blow of a hammer required to break the sample.
Hard	Hard blow of a hammer required to break the sample.
Very Hard	Several hard blows of a hammer required to break the sample.

RELATIVE QUALITY OF ROCK CORES

Quality:	**RQD:**
Very Poor	0 to 25%
Poor	25 to 50%
Fair	50 to 75%
Good	75 to 90%
Excellent	90 to 100%

ENGINEERING

Laboratory Data Summary

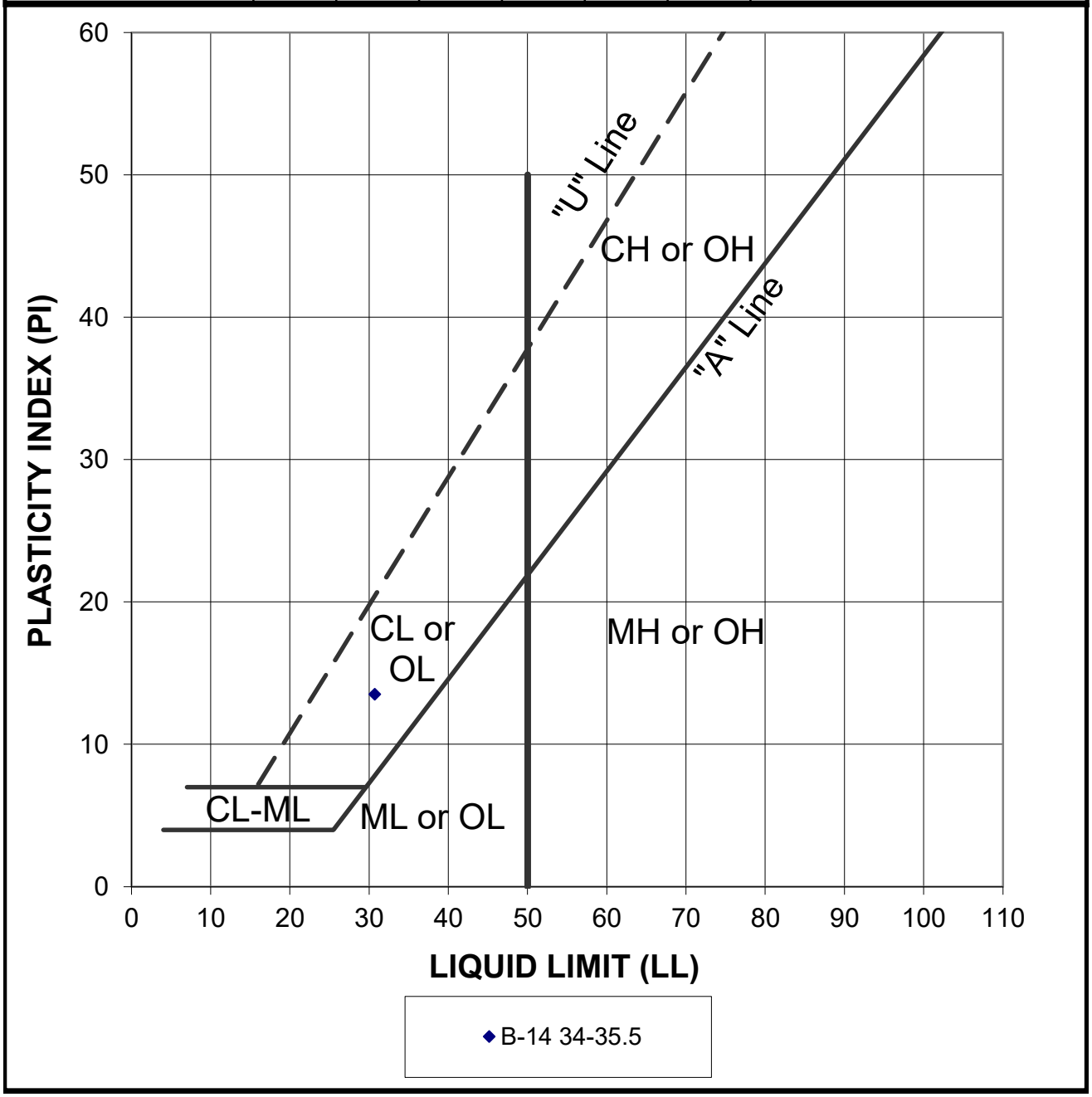
PROJECT NAME: *Olive Branch Neighborhood* **PROJECT NUMBER:** *26050007SHE*

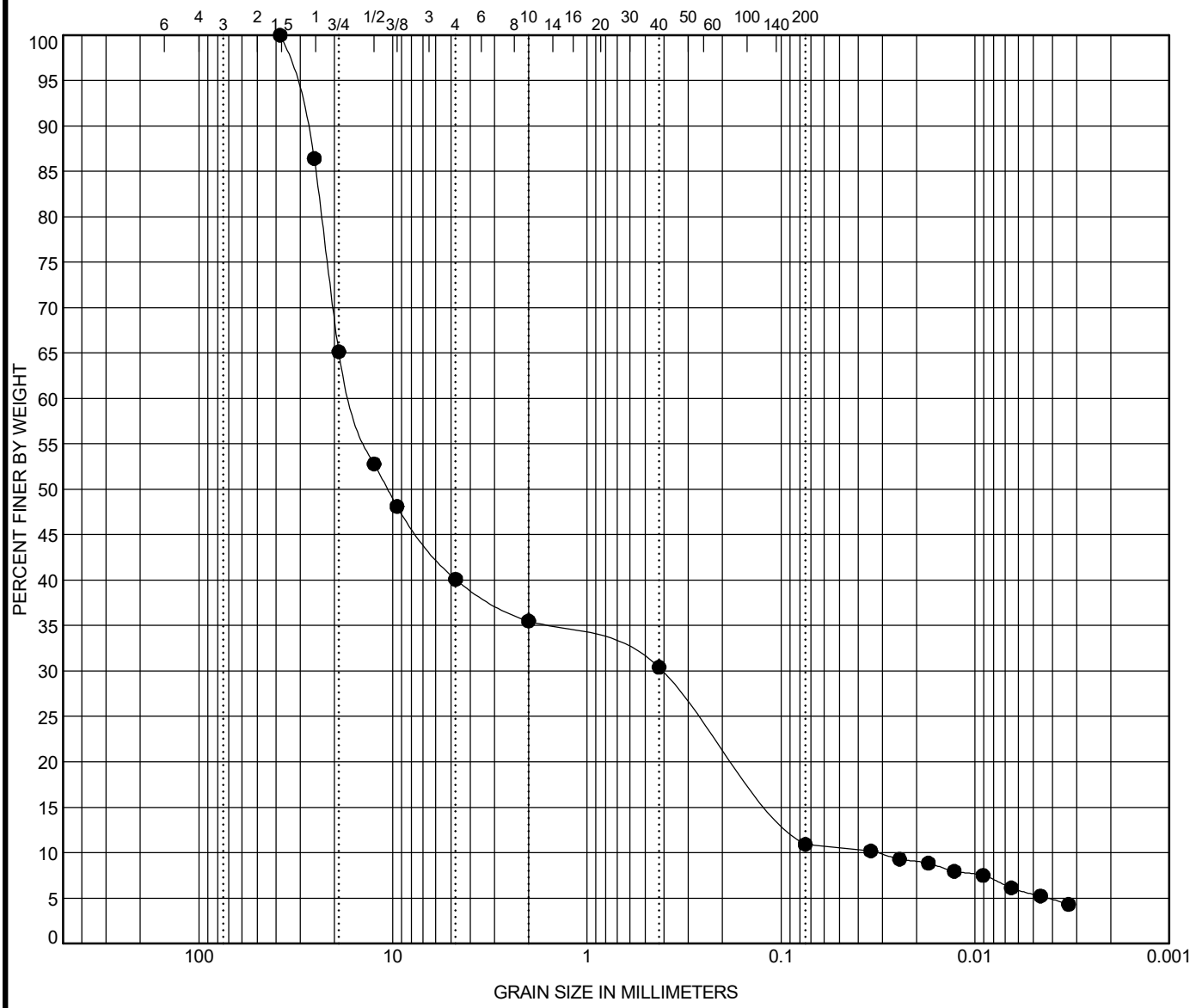
BORING NO.	SAMPLE DEPTH, FT.	SAMPLE TYPE*	USCS	NATURAL MOISTURE CONTENT, %	ATTERBERG LIMITS			MAX. DRY DENSITY PCF /OPTIMUM MOISTURE %	UNIT WEIGHT, PCF		UNCONFINED COMPRESSIVE STRENGTH, KSF	MATERIAL FINER THAN NO. 200, %	ORGANIC CONTENT, %	SLAKE DURABILITY, %
					L.L.	P.L.	P.I.		WET	DRY				
B-11	6.5-8	SS		5.9										
B-11	9-10.5	SS		6.8										
B-11	14-15.5	SS	GP-GM	8.2	NP	NP	NP					11		
B-12	4.5-6	SS	SM	11.5	NP	NP	NP					20		
B-12	9.5-11	SS		6.0										
B-13	4-5.5	SS	SM	10.6	NP	NP	NP					31		
B-13	14-15.5	SS		9.9										
B-14	4.5-6	SS		8.1										
B-14	9-10.5	SS		10.3										
B-14	14-15.5	SS		5.5										
B-14	19-20.5	SS		9.4										
B-14	24-25.5	SS		8.1										
B-14	29-30.5	SS		8.3										
B-14	34-35.5	SS	SC	13.5	24	16	8					24		
B-14	39-40.5	SS		10.7										
B-14	44-45.5	SS		11.2										
B-14	49-50.5	SS		6.7										
B-14	54-55.5	SS		9.5										
Combined		SS		4.8										92.5

Atterberg Limits
(ASTM D4318)

PROJECT NAME:	*Olive Branch Neighborhood*	**PROJECT NO.:**	*26050007SHE*
SAMPLE RECEIVED:	*03/24/26*	**TECHNICIAN:**	*Columbus*
TEST DATE:	*05/15/26*	**REVIEWED BY:**	*MJS*
METHOD:	*Multipoint*	**REPORT DATE:**	*05/15/26*

Sample ID / Location	Depth	LL	PL	PI	Moist, %	Est. % retained on No. 40 sieve	Classification - Description
B-14	34-35.5	31	17	14	13.5	62	Brown and Gray (SC)





COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Sample	Classification	%MC	LL	PL	PI	Cc	Cu
●	**B-11**		**POORLY GRADED GRAVEL with SILT and SAND (GP-GM)**		**NP**	**NP**	**NP**	**0.33**	**495.93**

	Specimen ID	Sample	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-11**		**38.1**	**15.958**	**10.628**	**0.41**	**0.032**	**60**	**29**	**6**	**5**

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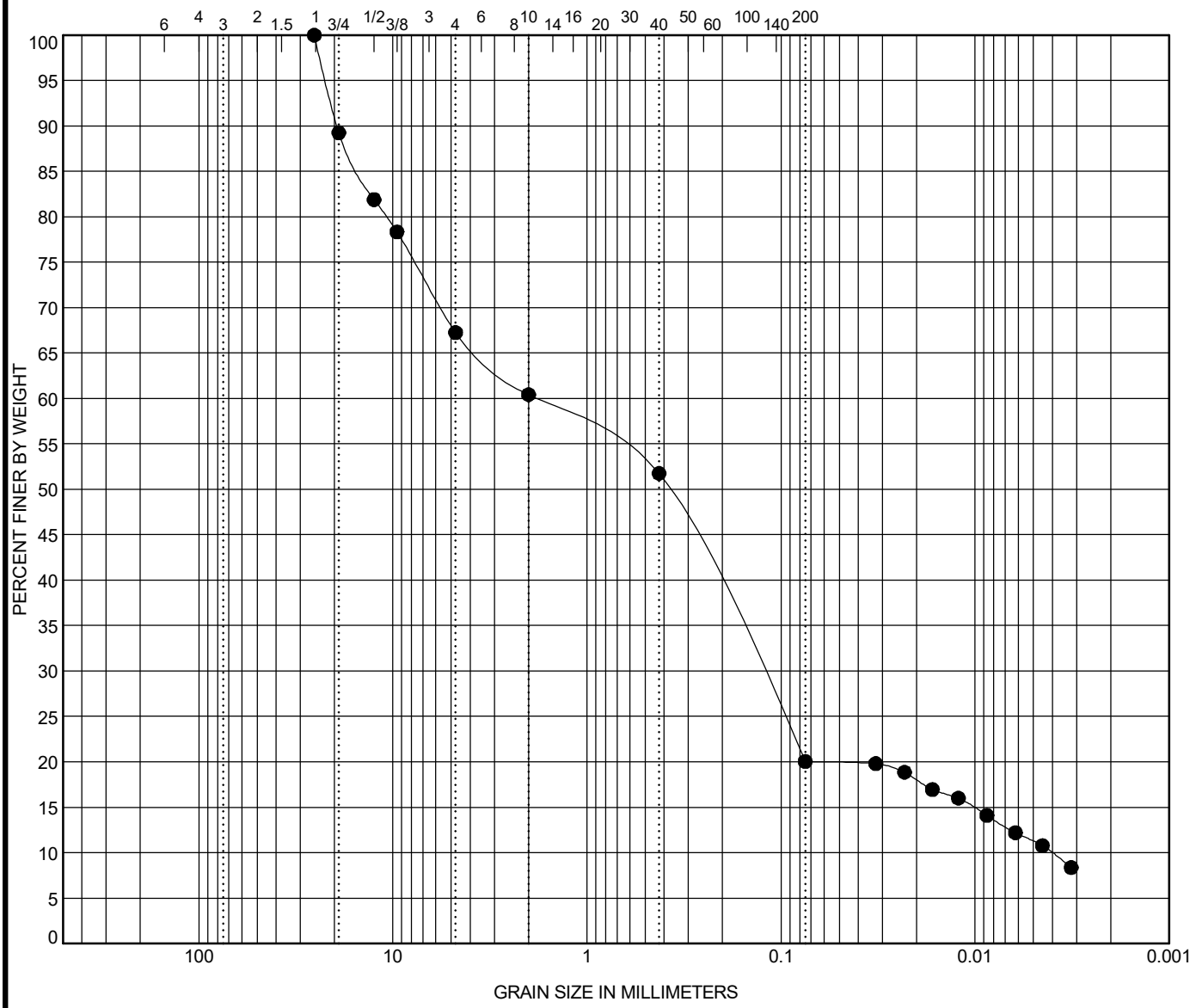
GRAIN SIZE DISTRIBUTION (ASTM D6913, D 7928, D 4318)

Project: Olive Branch Project - Additional Drilling

Location: Frankfort, KY

CTL Project Number: 26050007SHE



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Sample	Classification	%MC	LL	PL	PI	Cc	Cu
●	**B-12**		**SILTY SAND with GRAVEL (SM)**		**NP**	**NP**	**NP**	**2.24**	**459.11**

	Specimen ID	Sample	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-12**		**25.4**	**1.854**	**0.386**	**0.129**	**0.004**	**33**	**47**	**9**	**11**

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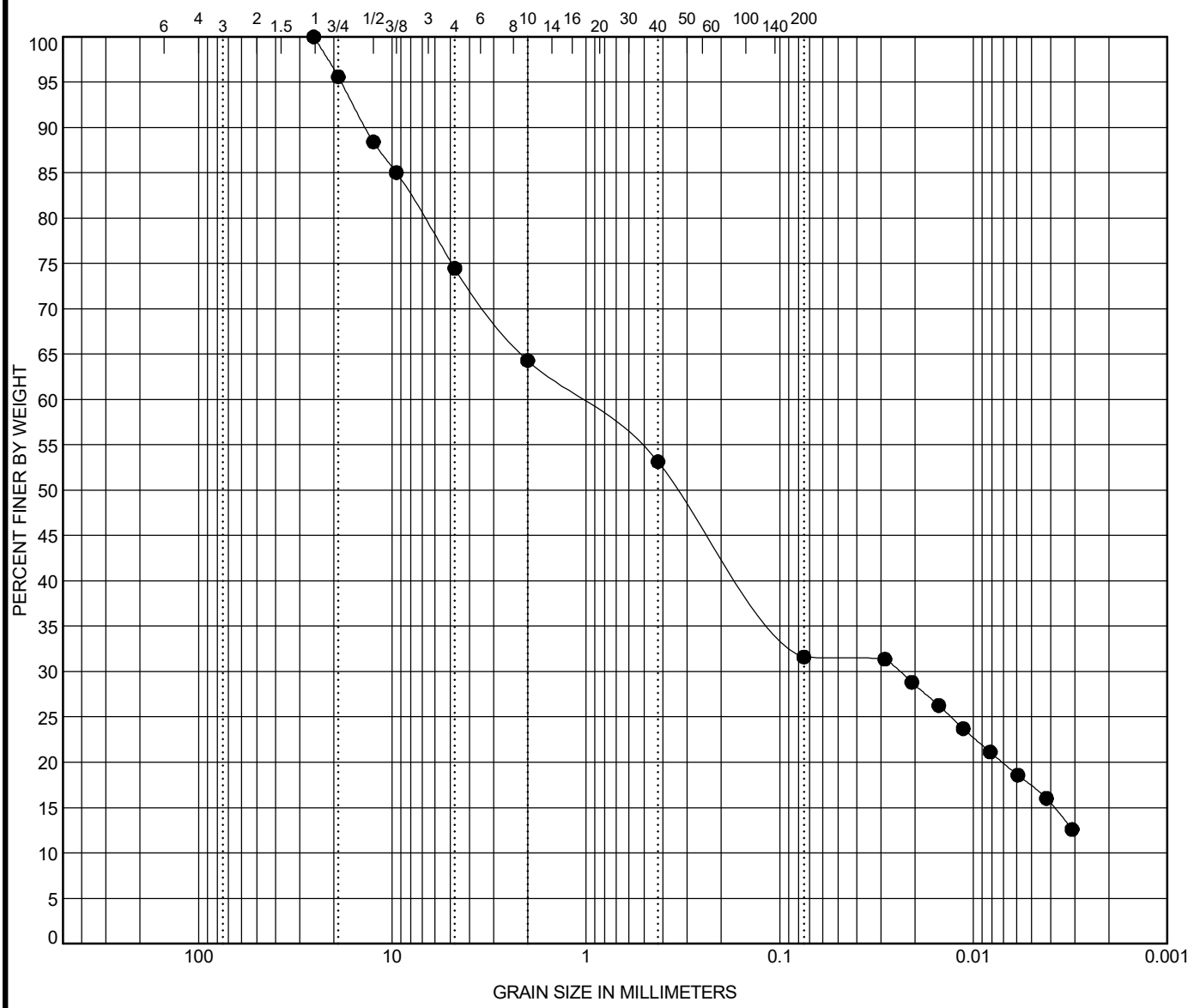
GRAIN SIZE DISTRIBUTION (ASTM D6913, D 7928, D 4318)

Project: Olive Branch Project - Additional Drilling

Location: Frankfort, KY

CTL Project Number: 26050007SHE



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Sample	Classification	%MC	LL	PL	PI	Cc	Cu
●	**B-13**		**SILTY SAND with GRAVEL (SM)**		**NP**	**NP**	**NP**		

	Specimen ID	Sample	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-13**		**25.4**	**1.101**	**0.33**	**0.024**		**26**	**43**	**14**	**17**

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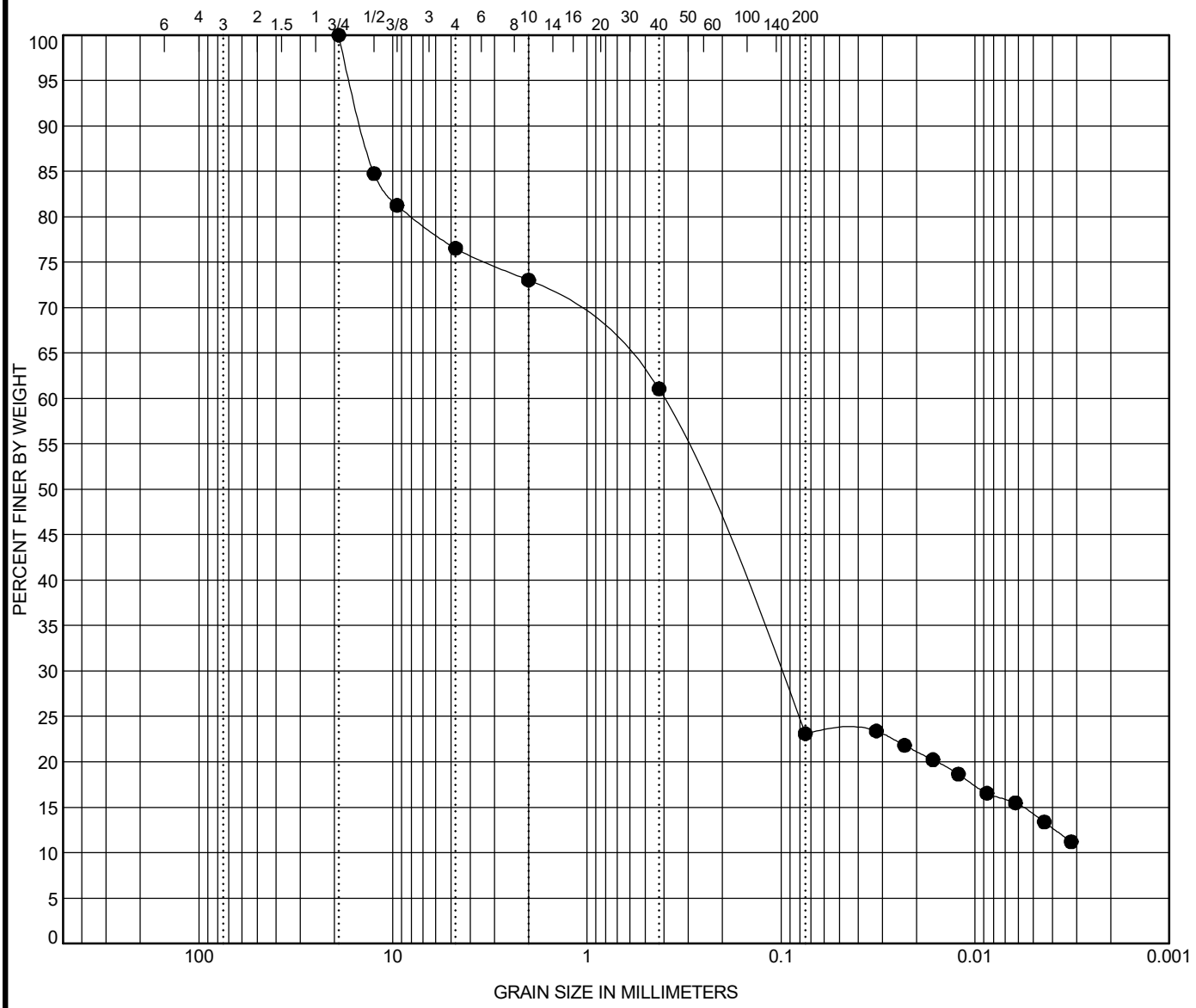
GRAIN SIZE DISTRIBUTION (ASTM D6913, D 7928, D 4318)

Project: Olive Branch Project - Additional Drilling

Location: Frankfort, KY

CTL Project Number: 26050007SHE



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen ID	Sample	Classification	%MC	LL	PL	PI	Cc	Cu
●	**B-14**	**SS**	**CLAYEY SAND with GRAVEL (SC)**		**24**	**16**	**8**		

	Specimen ID	Sample	D100	D60	D50	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-14**	**SS**	**19**	**0.395**	**0.199**	**0.051**		**23**	**53**	**10**	**14**

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GRAIN SIZE DISTRIBUTION (ASTM D6913, D 7928, D 4318)

Project: Olive Branch Project - Additional Drilling

Location: Frankfort, KY

CTL Project Number: 26050007SHE

LABORATORY TESTING PROCEDURES

The laboratory tests are performed in general accordance with the American Society for Testing and Materials (ASTM). These procedures are generally recognized as the basis for uniformity and consistency of test results in the geotechnical engineering profession. The tests are performed by skilled technicians trained in ASTM procedures. The laboratory equipment is well-maintained and calibrated at least yearly.

Subsequent portions of this attachment briefly describe our testing procedures. Where applicable, we have referenced these procedures to ASTM standards, which contain specific descriptions of apparatus, procedures, reporting, etc.

GRAIN SIZE TEST, ASTM D-422

The grain size distribution of soil particles in a specimen is an indicator of physical properties, among which are permeability, compaction characteristics, consolidation, shrinkage and swell parameters, and liquefaction characteristics. The soil specimen is prepared and tested to determine the percentages of particles of various sizes. The cumulative percentages by weight for each size are depicted on a graph showing the distribution of gradations. The distribution of particles larger than 75 microns (retained on No. 200 sieve) is determined by sieving, while the smaller particle sizes are measured by a sedimentation process, using a hydrometer to secure the necessary data.

The soil specimen is prepared by either drying or using a wet method. The wet method is used when the soil specimen is a clay or silt with properties that change if the sample is prepared dry.

After preparation, the coarse material (material retained on the No. 200 sieve) is dried and then passed through a series of nested sieves. The portion retained on each sieve is weighed, and the percent by weight retained on each sieve is computed and plotted on Grain Size Distribution Sheets.

The fine-grained soil distribution (silt and clay-size particles) is determined with a hydrometer. The prepared soil specimen is placed in suspension using distilled water and a dispersing agent. The density of the solution is measured with the hydrometer at selected time intervals, and the particle sizes and weights are computed using Stokes' law. These values give a curve or distribution for various particle sizes of microscopic silt and clay-sized particles. If the distribution of silt and clay-size particles has been determined for a selected soil sample, the data are presented on the Grain Size Distribution Sheet as an extension of the grain size distribution curve for the coarse soil fraction.

MOISTURE CONTENT DETERMINATION, ASTM D-2216

The moisture content of soils is an indicator of various physical properties, including strength and compressibility. Selected samples obtained during exploratory drilling were taken from their sealed containers. Each sample was weighed and then placed in an oven heated to 110ºC $\pm$ 5º. The sample remained in the oven until the free moisture had evaporated. The dried sample was removed from the oven, allowed to cool, and re-weighed. The moisture content was computed by dividing the weight of evaporated water by the weight of the dry sample. The results are expressed as a percent.

ATTERBERG LIMITS DETERMINATION, ASTM D-4318

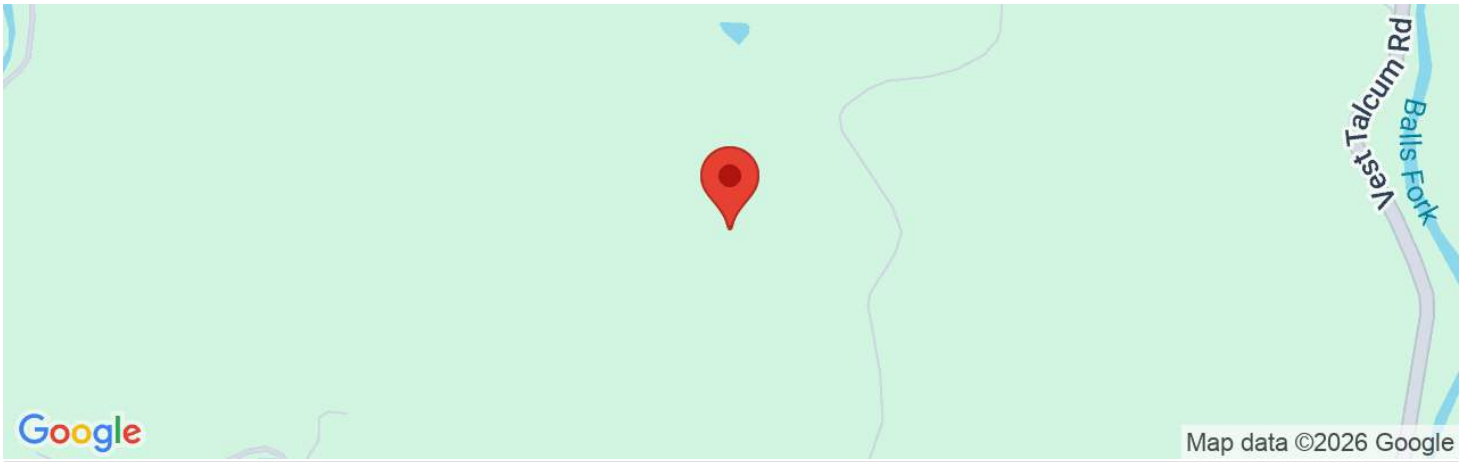
Representative samples were subjected to Atterberg limits testing to determine the soil's plasticity characteristics. The plasticity index (PI) is the range of moisture content through which the soil deforms as a plastic material. It is bracketed by the liquid limit (LL) and the plastic limit (PL). The liquid limit is the moisture content at which the soil becomes wet enough to flow as a viscous fluid. To determine the liquid limit, a soil specimen is first washed through a No. 40 sieve. The materials finer than the No. 40 sieve are retained and dried until the soil is in a viscous fluid state. A portion of this soil is then placed in a brass cup of standardized dimensions. A groove is cut through the middle of the soil specimen with a grooving tool of standard dimensions. The cup is attached to a cam that lifts the cup 10 mm and then allows the cup to fall onto a hard rubber base. The cam is rotated at about 2 cps until the two halves of the soil specimen come in contact at the bottom of the groove for a distance of 1/2 inch. The number of blows required to achieve this 1/2-inch contact is recorded, and part of the specimen is subjected to a moisture content determination. The remainder of the specimen is allowed to air dry for a short time, and the grooving process and cam action are repeated. This testing sequence is repeated until more than 25 blows are required to achieve the required groove contact. After the number of blows vs. moisture content for the various test points is plotted on arithmetic graph paper, the moisture content corresponding to 25 blows is designated the liquid limit.

The plastic limit (PL) is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into threads 1/8" in diameter. The plastic limit is determined by taking a part of soil remaining from the liquid limit test, and repeatedly rolling, kneading, and air drying it until the soil breaks into threads about 1/8 inches in diameter and 3/8 inches long. The moisture content of these soil threads is then determined and is designated the plastic limit.

Announcement
ASCE 7-22 is now available.

Olive Branch

Latitude, Longitude: 37.37702923, -83.10841526



Date	5/15/2026, 2:31:11 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D

Type	Value	Description
S_S	0.203	MCE_R ground motion. (for 0.2 second period)
S_1	0.089	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.324	Site-modified spectral acceleration value
S_{M1}	0.213	Site-modified spectral acceleration value
S_{DS}	0.216	Numeric seismic design value at 0.2 second SA
S_{D1}	0.142	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	C	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.098	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.157	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	0.203	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.22	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.089	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.098	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.098	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.92	Mapped value of the risk coefficient at short periods
C_{R1}	0.906	Mapped value of the risk coefficient at a period of 1 s
C_V		Vertical coefficient