



March 10, 2022

Mr. Josh D. Hoffman, P.E.
Snyder, Secary & Associates, a Division of Pennoni
2000 Linglestown Road, Suite 304
Harrisburg, PA 17110

**RE: Preliminary Geotechnical Summary Report
2951 Betz Court Development
Lowhill Township, Lehigh County, Pennsylvania
Kleinfelder Project Number: 20221785.003A**

Dear Mr. Hoffman:

In accordance with your request, Kleinfelder, Inc. (Kleinfelder) has completed a preliminary geotechnical engineering evaluation of the above referenced project site. This correspondence serves to transmit the results of the data obtained and our preliminary conclusions regarding development of the property.

SITE AND PROJECT DESCRIPTION

The project site currently consists of commercial, wooded, and agricultural properties located at 2591 Betz Court in Lowhill Township, Lehigh County, Pennsylvania. The project site is bordered to the north by agricultural property, to the east by residential properties and Kernsville Road (4003), to the southwest by Betz Court and to the northwest by woods and agricultural property. Topography across the project site slopes downgradient from east to west, with notable soil, mulch, and construction debris stockpiles and hills located in the eastern and central portions of the site, resulting in approximately 140 feet of grade variation across the project site. Within the building footprint, elevations vary from approximately 640 to 670 feet above mean sea level (amsl), resulting in approximately 30 feet of grade variation. It should be noted that a portion of the subject site is currently being used by a mulch supplier (Stone Haven Supply); therefore, stopckpiles of mulch and other debris (e.g. concrete/rock) are present at the site. The approximate location of the site in relation to the surrounding area is shown on the *Topographic Map* (Figure 1) presented within the Appendix.

Based on *Concept Grading and Drainage Plan* (Plan), prepared by Snyder, Secary & Associates, LLC, dated February 4, 2022, the project will consist of constructing a building measuring approximately 299,880 square feet (SF) in plan area with a finished floor elevation (FFE) situated at 653.00. Based on this information, cuts of fills of approximately 17 and 13 feet, respectively, are anticipated.

At the time of this writing, structural loads were not known. For purposes of this report, it was assumed that column and wall loads are not anticipated to exceed 150 kips and 7 kips per linear foot, respectively. Additionally, slab loads have been assumed to range from about 250 to 500 psf. Development of this project site will also include constructing new parking areas, drive lanes, retaining walls, and stormwater management facilities.

SCOPE OF WORK

The objective of our work was to complete a preliminary evaluation of the underlying subsurface conditions to provide preliminary recommendations and conclusions regarding development of the site. The scope of work for this project included completion of a subsurface exploration, laboratory testing program, and preliminary engineering analysis of the data obtained. This report summarizes the results of the work performed and provides preliminary geotechnical and construction recommendations, specific to the aforementioned scope of work.

SITE GEOLOGY

According to the Pennsylvania State Geologic Survey Atlas of Preliminary Geologic Quadrangles, 1981, the project site is underlain by the Ordovician Martinsburg Formation (geologic symbol Om). The project site within its geologic setting is presented on the *Geologic Map* (Figure 2) found within the Appendix.

According to the *Engineering Characteristics of the Rocks of Pennsylvania*, Second Edition 1982, the Martinsburg Formation is composed of buff-weathering dark-gray shale, with thin interbeds of siltstone, metabentonite, and fine-grained sandstone. This formation is well bedded with the sandstone being thick to massive, and shale thin to fissile. The rock of this formation is moderately weathered to a moderate depth with small to large platy fragments resulting. Cleavage is dominant and highly developed with jointing present and irregularly spaced, open and nearly vertical.

SUBSURFACE EXPLORATION PROGRAM

To evaluate the subsurface conditions across the project site, 15 test borings and 8 test pits were completed on February 15 through 17, 2022 and February 23, 2022. Supervision and monitoring of the subsurface exploration were provided by representatives of Kleinfelder, who field located the test locations based on the previously referenced *Plan*. The approximate test locations are shown on the *Exploration Plan* (Figure 3) presented within the Appendix.

The test borings were advanced using a track-mounted Diedrich D-50 drill rig equipped with an automatic hammer and 3 1/4" hollow-stem augers. Split-spoon samples, conducted in general accordance with ASTM standard D1586, were taken at suitable intervals throughout the entire depth of the borings and the Standard Penetration Test (SPT) values were recorded for each sample obtained. The SPT values, which are a measure of density or consistency, are the number of blows required to drive a 2-inch (outer-diameter) split-barrel sampler 2 feet using a 140-pound weight dropped 30 inches. The number of blows required to advance the sampler over the 12-inch interval from 6 to 18 inches is considered the "N" value.

Data pertaining to the subsurface exploration was documented in the field and is presented on the *Test Boring Profiles* (Figure 4) and *Test Boring Logs* within the Appendix. The *Test Boring Profiles* depict cross-sections of the subsurface conditions encountered within each test boring conducted, including: soil types, depths of individual strata and recorded "N" values. The *Test Boring Logs* contain general information about the subsurface program and specific data regarding each test boring, including: sample depths, hammer blows per 6 inches of penetration and visual classifications of the subsurface materials encountered.

The test pits were excavated utilizing a CAT 416 backhoe and extended to depths ranging from approximately 5.5 to 8.5 feet below existing site grades. A detailed account of the material encountered during the excavation of each test pit, as well as groundwater data and infiltration test data, where applicable, is presented on the *Test Pit Logs* within the Appendix.

LABORATORY TESTING

Soil samples retrieved from the site were visually reviewed and classified by Kleinfelder. Representative soil samples were subjected to laboratory analyses to verify visual classifications and aid in establishing the engineering parameters in accordance with the following schedule:

- Natural Moisture Content (ASTM D2216)
- Sieve Analysis (ASTM D422)
- Atterberg Limits Determination (ASTM D4318)

Unified Soil Classification System (USCS) Group Symbols and ASTM Group Names have been assigned to the soils analyzed. The results of the testing conducted are presented within the Appendix and the table below.

LABORATORY TESTING RESULTS											
Location I.D.	Depth (feet)	Soil Type	% Gravel	% Sand	% Fines	LL	PL	PI	As Received Moisture	USCS Group Symbol	ASTM Group Name
B-5	2 – 6	Stratum I	42.2	22.8	35.0	Non-Plastic			14.9%	GM	Silty GRAVEL with Sand
B-9	6 – 8		32.7	56.3	11.0	Non-Plastic			8.9%	SW-SM	Well-Graded SAND with Silt and Gravel

LL-Liquid Limit; PL-Plastic Limit; PI-Plasticity Index

DESCRIPTION OF SUBSURFACE CONDITIONS

SOIL

Surficial Material

The test locations were covered by approximately to 4 to 12 inches of topsoil, 3 to 24 inches of Gravel, or 3 inches of pavement (asphalt and stone subbase); however, the thickness of surficial materials may vary in unexplored areas of the site. Kleinfelder utilized visual classifications in order to field delineate the approximate topsoil and surficial material thicknesses within the test locations completed.

Fill – Orangish brown to gray SILT and SAND with secondary amounts of Gravel

Fill was encountered within test locations B-3, B-5, B-6, B-9 and B-10, and extended to depths ranging from approximately 2 to 6 feet below existing site grades. The “N” values, recorded within this soil ranged from 5 to 50 blows per foot (bpf).

Upon review, this soil was found to be poorly to moderately well graded, non-plastic, and predominantly comprised of SILT and SAND with secondary amounts of Gravel.

The existing Fill was found to contain deleterious material in the form of organic debris (i.e. mulch) in test location B-3. It should be noted, a portion of the project site is occupied by a mulch supplier, so several stockpiles of mulch and other debris (e.g. concrete, rock) are present on site. These samples were taken from discrete locations and the possibility does exist for unsuitable materials (e.g. ash, cinder, slag, and topsoil and/or organic debris) to be present in unexplored portions of the site.

Stratum I – Tan to light brown to gray SAND and GRAVEL with varying amounts of Silt [highly weathered to decomposed rock]

Stratum I was encountered within each test location completed, with the exception of TP-9, and extended to depths ranging from approximately 1 to 20 feet below existing site grades. The “N” value, recorded within this soil was found to range from 4 bpf to 50 blows over 1-inch and shows Stratum I to range from loose to very dense in relative density.

Laboratory testing conducted on representative samples of Stratum I shows this soil to be poorly to moderately well graded and non-plastic, with natural moisture contents ranging from 8.9% to 14.9%. Stratum I is described under the USCS as Silty GRAVEL with Sand (GM) and Well-Graded SAND with Silt and Gravel (SW-SM).

Stratum II – Orangish brown to tan SILT with varying amounts of Sand

Stratum II was encountered within test locations B-1, B-2 and B-10, and extended to depths ranging from approximately 3 to 6 feet below existing site grades. The “N” values, recorded within this soil ranged from 4 to 22 bpf and show Stratum II to range from medium stiff to very stiff in consistency.

Upon review, Stratum II was found to be poorly graded, slightly plastic, and predominantly comprised of SILT with secondary amounts of Sand.

BEDROCK & REFUSAL

Bedrock was encountered within each test boring completed, with the exception of B-6, and test pits IT-5 through IT-7, at depths ranging from approximately 1 to 18.5 feet below existing site grades. Bedrock was defined as the depth as which the drilling augers could no longer penetrate or the depth at which the bucket of the backhoe could no longer excavate.

To determine the composition and integrity of the rock present beneath the site, rock coring was conducted in general accordance with ASTM D 2113. Percent Recovery (REC) was calculated by dividing the length of the rock core retrieved from the core barrel by the total length of the core run and multiplying by 100. Rock Quality Designation (RQD) was calculated by summing the length of the rock fragments in the core run which are greater than or equal to 4 inches in length and dividing by the total length of the core run and multiplying by 100. A visual description of the bedrock encountered is provided on the *Test Boring Logs* within the Appendix and provided in the table below.

ROCK CORING DATA SUMMARY					
Location	Run Number	Rock Core Depth (ft)	REC (%)	RQD (%)	Visual Description
B-11	R-1	1 – 6	100	0	SHALE: light to dark gray, moderately to highly weathered, intensely fractured
B-12	R-1	1.5 – 6.5	100	0	SHALE: light to dark gray, moderately to highly weathered, intensely fractured
B-14	R-1	7 – 12	47	0	SHALE: light to dark gray, moderately to highly weathered, intensely fractured

GROUNDWATER / SOIL MOTTLING

Groundwater was encountered within test locations IT-1 through IT-3. IT-1 had an initial groundwater reading of approximately 5.5 feet below existing site grades and a final groundwater reading of 4 feet below existing site grades at the time of completion. IT-2 encountered perched water at depths ranging from approximately 0.5 to 1.5 feet below existing site grades. IT-3 encountered groundwater at a depth of approximately 3 feet below existing site grades. Soil mottling (indication of poorly draining soils and/or seasonal high-water table) was not encountered within the test locations completed. These observations were made at the time of the field exploration and groundwater table elevations will vary with daily, seasonal, and climatological variations as well as anthropogenic activities.

PRELIMINARY CONCLUSIONS

Based upon geotechnical engineering review of the data gathered during the field exploration, preliminary conclusions have been formulated regarding the project site and are as follows:

Excavation Considerations

At the time of this writing, the proposed FFE of the building is expected to be 653.00 feet. Within the building footprint, existing grades vary from approximately 640 to 670 feet amsl, resulting in approximately 30 feet of grade variation. Based on the test locations completed for the proposed improvements, it is expected that construction of the project will likely take place within the existing Fill, naturally occurring soils of Stratum I and II, and the

underlying bedrock. The existing Fill and the naturally occurring soils of Stratum I and Stratum II may be removed using conventional earth moving equipment and techniques. However, based on the high SPT values obtained, slow advancement of the drilling augers and heavy bucket resistance observed, portions of Stratum I will be difficult to excavate and require the use of larger equipment and/or hydraulic or pneumatic hammering equipment for removal.

Bedrock removal will be required during development of the project site, including to reach the proposed building finished floor elevation. Bedrock excavation will be difficult and require the use of hydraulic or pneumatic "hammering" equipment or blasting techniques for removal. Should blasting be utilized during site development, it is imperative to minimize charges to avoid "over-blasting" of the bedrock beyond required excavation depths. Upon completion of blasting procedures, all loose rock and "over-blast" must be completely excavated from the area. Excavated bedrock may be utilized as structural fill provided it is sufficiently processed to meet the requirements presented in this report.

It must be understood, the test boring and test pit logs may be used to estimate rock excavation based on the refusal depths; however, refusal should not be considered to be a definite indicator of rock excavation required. There are many geologic factors which effect the difficulty of excavation such as rock hardness, bedding, joint spacing, fracture spacing and degree of weathering. The ease of excavation will also be governed by the type of excavation equipment used and the contractor's willingness to utilize the equipment to its full potential. Rock excavation is expected to vary due to the variability in the rock surface between exploration points.

All excavations should be adequately sloped, benched, or supported to minimize collapse and protect personnel. All excavations should be completed in accordance with OSHA requirements.

Reuse of On-Site Soils

Topsoil - The topsoil will not be suitable for reuse as structural fill, however, the topsoil may be stockpiled for reuse within landscaping areas, non-structural areas, berms, etc. As written above, Kleinfelder utilized visual classifications to estimate the topsoil thicknesses encountered during the field explorations. The Client or construction team (i.e., general contractor, earthwork contractor, etc.) may consider the topsoil depth information in their evaluation of the project site, however, we recommend they complete their own evaluation prior to the start of construction. The Geotechnical of Record and/or other professionals (i.e. soil agronomist) should be consulted during the pre-construction process in order to reduce the risk of incorrect estimation of topsoil thickness.

Fill – This soil was found to be poorly to moderately well graded, non-plastic, and predominately comprised of SILT and SAND with secondary amounts of Gravel. The existing Fill was found to be contain deleterious material in the form of organic debris (i.e. mulch) in test location B-3. **It should be noted, a portion of the project site is currently occupied by a mulch supplier, so several stockpiles of mulch and other debris (e.g. concrete, rock) are present on site. During grading operations, care should be given to ensure that the mulch, and any other deleterious material, if encountered, not be combined with the on-site soils.**

Based on this information, this soil is considered marginally suitable for re-use as structural fill, provided any deleterious materials, if encountered, is removed prior to placement.

Stratum I - This soil was found to be poorly to moderately well graded, non-plastic, and predominantly comprised of SAND and GRAVEL with varying amounts of Silt. Based on this information, this soil is considered suitable for reuse as structural fill. It should be noted, portions of this soil Stratum may have to be processed and/or resized prior to placement per the criteria within the **Processed Bedrock** section below.

Stratum II - This soil was found to be poorly graded, slightly plastic, and predominantly comprised of SILT with secondary amounts of Sand. Based on this information, this soil is considered to be marginally suitable for reuse as structural fill.

Due to the content of fines (SILT), portions of the Fill and Stratum II soils may be moisture sensitive and difficult to place during periods of adverse weather. Additionally, based on our experience with this geologic setting and similar project sites, earthwork activities during construction of the project site may cause the breakdown of weathered rock material within the naturally-occurring soils. Therefore, the amount of fines (clay and/or silt) may be higher post construction than in-situ during the geotechnical field exploration.

Processed Bedrock – Bedrock excavation will be required during site development. The excavated bedrock is considered well-suited for use as structural fill provided the following criteria are adhered to:

- Within the **upper 4 feet** of the proposed building pad subgrade elevation and within the **upper 1 foot** of the pavement subgrade elevation: *Well graded mixture with a maximum particle size of 6 inches.*
- **4 feet or more** below the proposed building pad subgrade elevation and **1 foot or more** below of the pavement subgrade: *Well graded mixture with a maximum particle size of 12 inches.*

Should consideration be given to processing the rock for use as pavement, concrete slab and/or asphalt pavement subbase material, the bedrock should be crushed and screened to meet PennDot (PADOT) 2A gradation and meet all quality requirements.

Our analysis of the suitability of the on-site soil for use as structural fill is based on data collected from the test locations completed at the site. Soil suitability should be confirmed in the field by Kleinfelder during construction.

Removal and Replacement of Existing Fill

According to the subsurface data obtained, portions of the proposed development are underlain by a layer of existing Fill, which extended to depths ranging from approximately 2 to 6 feet below existing site grades. Due to the lack of historical data indicating the fill materials were placed under engineering control, support of the proposed structures on conventional shallow foundations bearing directly on the existing Fill is not recommended due to the potential for intolerable post-construction settlement. Therefore, it is recommended the existing Fill be excavated in it's entirety and replaced under engineering control. Details concerning the removal and replacement of the Fill are presented below.

- The existing Fill, where encountered, should be excavated in it's entirety from beneath the proposed structural areas (areas to be covered by the structures or pavement elements). The excavation sidewalls should be adequately sloped or benched, as necessary, to minimize collapse and protect personnel.
- Once excavated, the base of the resulting excavation should be thoroughly compacted utilizing appropriate equipment and reviewed by Kleinfelder. Should any weak or yielding areas be encountered, excavation should continue until suitable stable soils are encountered.
- Following review, the excavation may be backfilled to the prevailing subgrade elevations with structural fill. The previously excavated material may be used provided any deleterious materials are discarded prior to placement. The placement and compaction of structural fill should be completed in accordance with this Report.

Foundation Considerations

Based on the data obtained during the preliminary subsurface exploration, and engineering review of the conditions encountered, it is estimated that allowable soil bearing capacities ranging from 2,500 to 4,000 psf should be considered for foundation design. Conventional shallow foundations are expected to be suitable for support of the proposed building provided it is founded on stable naturally occurring soils and/or properly compacted structural fill placed under engineering control. Foundation bearing surfaces should be cleaned of loose material or debris immediately prior to the placement of concrete. Localized weak and yielding areas may be encountered during construction. Any weak or yielding areas encountered should be re-compacted in place or

removed and replaced with suitable structural fill. To protect against frost heave, spread footing foundations, including those in unheated areas, should extend to depths specified by the building code or local code amendments.

Floor Slab

The floor of the proposed structure may be constructed as a conventional slab-on-grade and may be supported on properly placed structural fill or firm and stable existing soils. These soils are expected to exhibit a modulus of subgrade reaction between 95 and 150 pounds per cubic inch (pci), provided they are compacted to a minimum of 95 percent Modified Proctor maximum dry density (ASTM D1557) or 98 percent Standard Proctor maximum dry density (ASTM D698).

STORMWATER INFILTRATION ANALYSIS

To evaluate the feasibility of infiltration of stormwater, infiltration tests were conducted within each test pit excavated, with the exception of IT-1 and IT-3, utilizing the “double-ring” infiltrometer method in accordance with the Pennsylvania Stormwater Best Management Practices Manual, latest Edition. The infiltration test pits extended to depths of approximately 2 feet below existing site grades in an effort to review the presence of limiting zones (i.e. bedrock, groundwater and/or soil mottling). Information regarding the results of the infiltration testing is provided within the table below.

INFILTRATION TEST RESULTS			
Test Location	Actual Test Elevation (ft)	Limiting Zone Depth (ft)	Infiltration Rate (in/hr)*
IT-1	No Test	Groundwater encountered at 4	No Test
IT-2	6	Perched Water encountered from 0.5 to 1.5	0.0
IT-3	No Test	Groundwater Encountered at 3	No Test
IT-4	5.5	Not Encountered at 8 feet	15.0
IT-5	4	Bedrock Encountered at 6	10.8
IT-6	3.5	Bedrock Encountered at 5.5	15.0
IT-7	5	Bedrock Encountered at 7	4.2
IT-8	6	Not Encountered at 8	15.0

**Infiltration rates represent the rates recorded in the field and no safety factor has been applied*

Based on the results of our field exploration we offer the following comments:

- The final groundwater reading in test pit IT-1 was 4 feet below existing site grades; however, the water was percolating in from the side walls between 1.5 to 3 feet below existing site grades. Therefore, no infiltration test was conducted.
- In test location IT-2, water was percolating in from the side walls between 0.5 to 1.5 feet below existing site grades. An infiltration test was still conducted to gather data.

- Test location IT-3 was excavated to 8 feet below existing site grades; however, groundwater was percolating in and caused the collapse of the side walls to 4 feet below existing site grades. A final groundwater reading was taken after the collapse, measuring approximately 3 feet below existing site grades.
- The bedrock surface was encountered within test pits IT-5 through IT-7 at depths of approximately 5.5 to 7 feet below existing site grades. The bedrock surface was defined as the depth at which the bucket of the backhoe could no longer excavate.
- Soil mottling was not encountered within the test locations completed.
- The unfactored infiltration rates were found to range from 0.0 to 15.0 inches per hour. The PADEP recommended rate for infiltration of stormwater is 0.1 to 10 inches per hour.

It should be noted, these are the field rates obtained from the in-situ soils at the project site. The project site is situated within the Martinsburg Formation, which is comprised of gray to dark gray shale and slate. Based on our experience with this geologic setting and similar project sites, earthwork activities during construction of the project site may cause the breakdown of weathered rock material within the naturally-occurring soils. Therefore, the amount of fines (clay/silt) may be higher post construction than in situ during the geotechnical field exploration. Consequently, infiltration results may vary.

FINAL GEOTECHNICAL ENGINEERING SERVICES

The scope of work completed for this report was intended to provide preliminary review of the subsurface conditions beneath the project site for anticipated improvements. It is recommended Kleinfelder review updated design plans and loading data for the proposed structure in order to finalize geotechnical and construction recommendations prior to issuance of final design criteria for the project.

LIMITATIONS

The conclusions and recommendations contained in this report are preliminary in nature due to the conceptual site layout, structure loading and other site features, and based upon the subsurface data collected and on details stated in this report. Should conditions arise which differ from those specifically stated herein, our office should be notified immediately so that our recommendations can be reviewed and revised, if necessary.

It is emphasized that this preliminary engineering analysis was completed for the proposed development at Betz Court in Lowhill Township, Lehigh County, Pennsylvania. Kleinfelder does not warrant the use of the data presented herein for any other purpose.

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Further, Kleinfelder assumes no liability for interpolation of data between the specific testing locations discussed herein. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than 2 years from the date of the report.

Our scope of services for this exploration and report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.

Mr. Josh D. Hoffman, P.E.
2951 Betz Court Development
March 10, 2022
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CLOSING

We thank you for the opportunity to work on this project with you. Should you have any questions or require any additional information, please do not hesitate to contact us.

Sincerely,
KLEINFELDER, INC.



Bailey J. Wildasin
Project Manager



Mark A. Giunta, P.E.
Principal Professional
PA License No: PE-073764



Trevor L. Dombach
Program Manager



APPENDIX

FIGURE 1 – TOPOGRAPHIC MAP

FIGURE 2 – GEOLOGIC MAP

FIGURE 3 – EXPLORATION PLAN

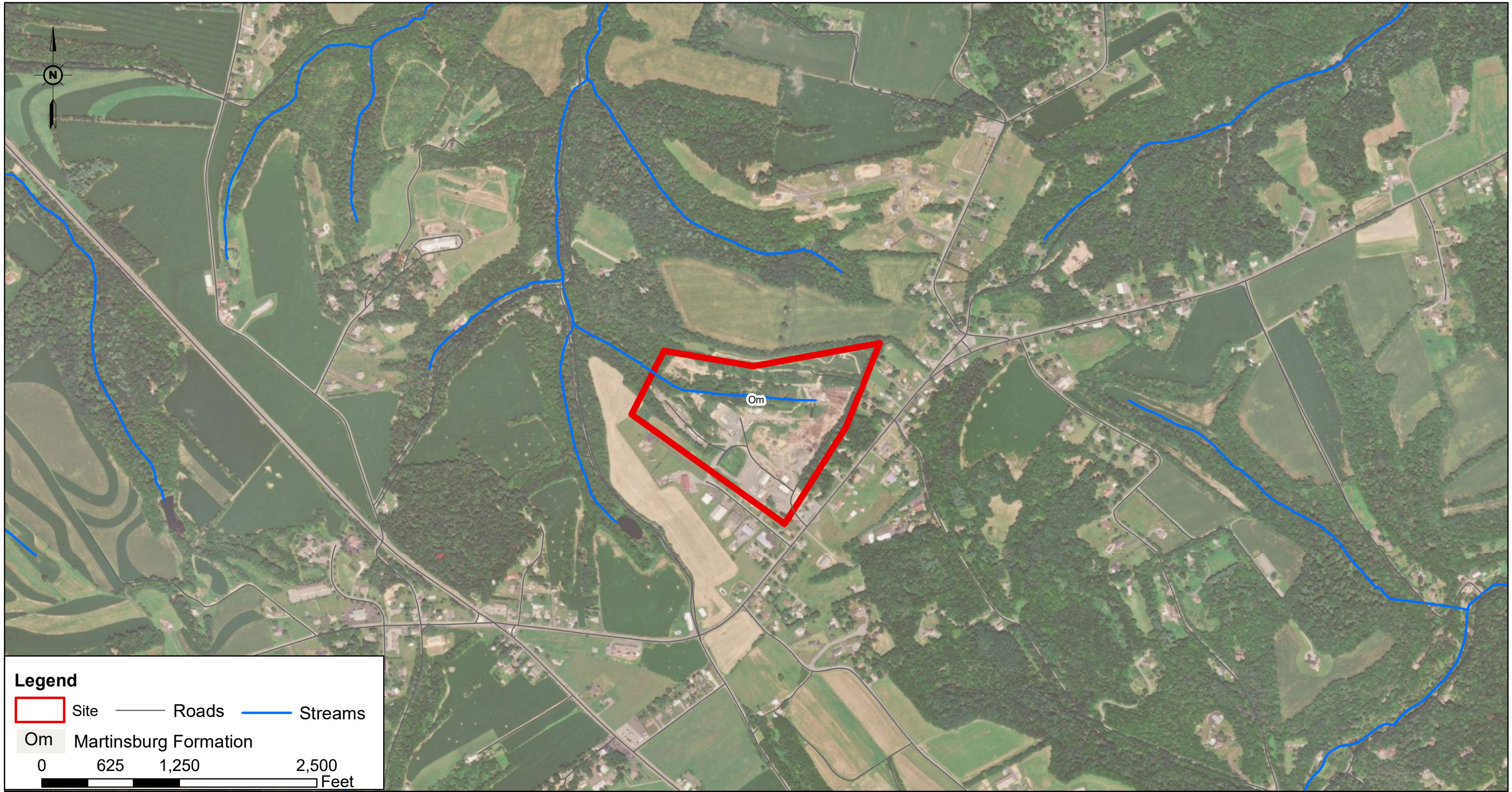
FIGURES 4 & 5 – TEST BORING PROFILES

FIGURE 6 – GRAPHICS KEY

LABORATORY TEST RESULTS

TEST BORING LOGS

TEST PIT LOGS



Legend

Site
 Roads
 Streams

Om Martinsburg Formation

0 625 1,250 2,500
Feet

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

SCALE: AS SHOWN	DRAWING NUMBER: FIGURE 2
DRAWN BY: E. HINKLE	CHECKED BY: B. WILDASIN
APPROVED BY: M. GIUNTA	DATE: 03-03-2022

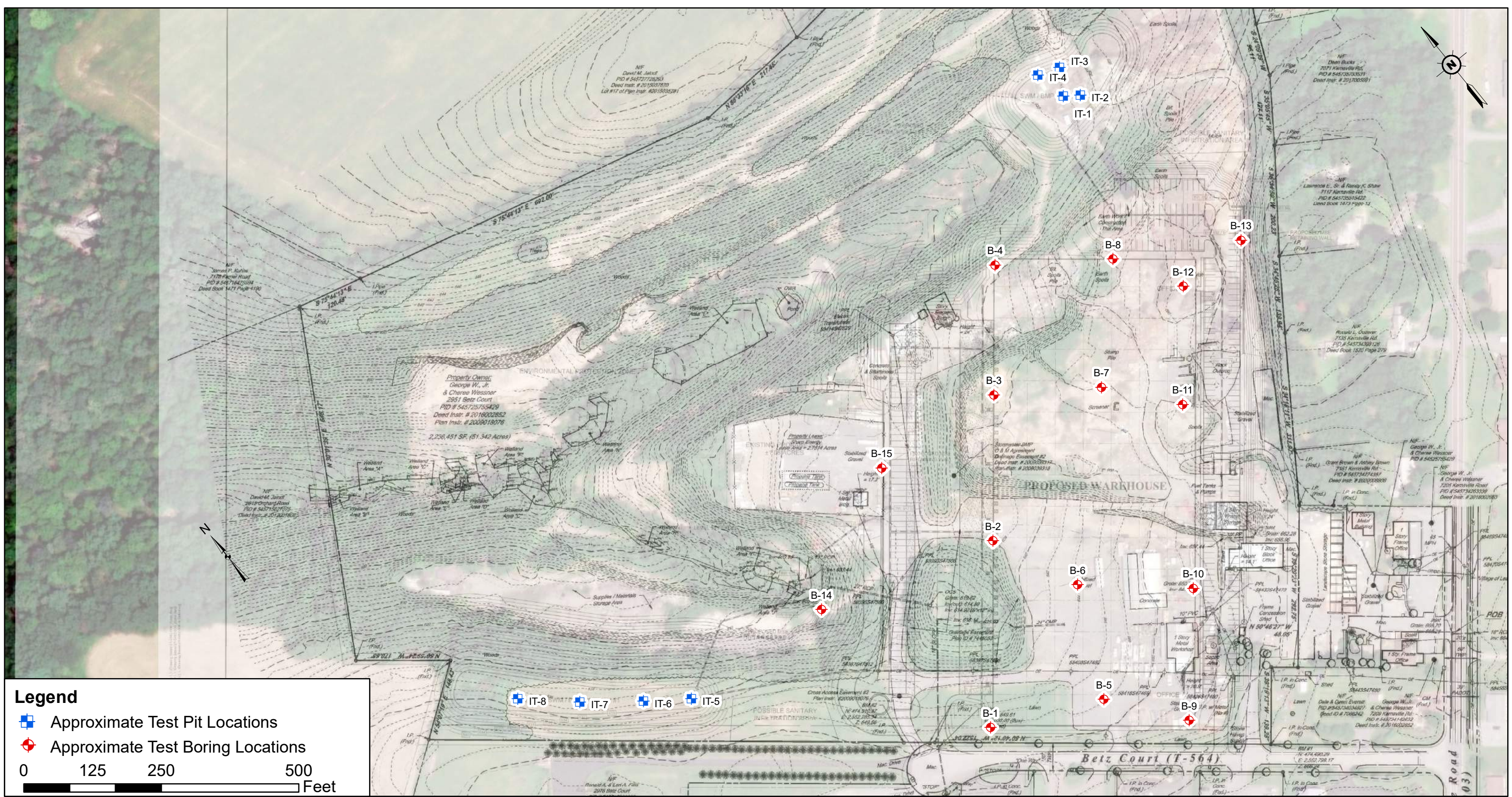
BASE PLAN: N/A
PROVIDED BY: N/A
DATE: N/A

GEOLOGIC MAP
 PREPARED FOR
2951 BETZ COURT DEVELOPMENT

 LOWHILL TOWNSHIP LEHIGH COUNTY PENNSYLVANIA


KLEINFELDER
Bright People. Right Solutions.

 6330 HEDGEWOOD DR. SUITE 310
 ALLENTOWN, PA, 18106
 PH (610) 366-7120
 FAX (610) 366-7121



Legend

- Approximate Test Pit Locations
- ◆ Approximate Test Boring Locations

0 125 250 500 Feet

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

SCALE: AS SHOWN		DRAWING NUMBER: FIGURE 3	
DRAWN BY: E. HINKLE		CHECKED BY: B. WILDASIN	
APPROVED BY: M. GIUNTA		DATE: 03-03-2022	

BASE PLAN:
Concept Grading & Drainage Plan

PROVIDED BY:
Snyder, Secary & Associates,
a Division of Pennoni

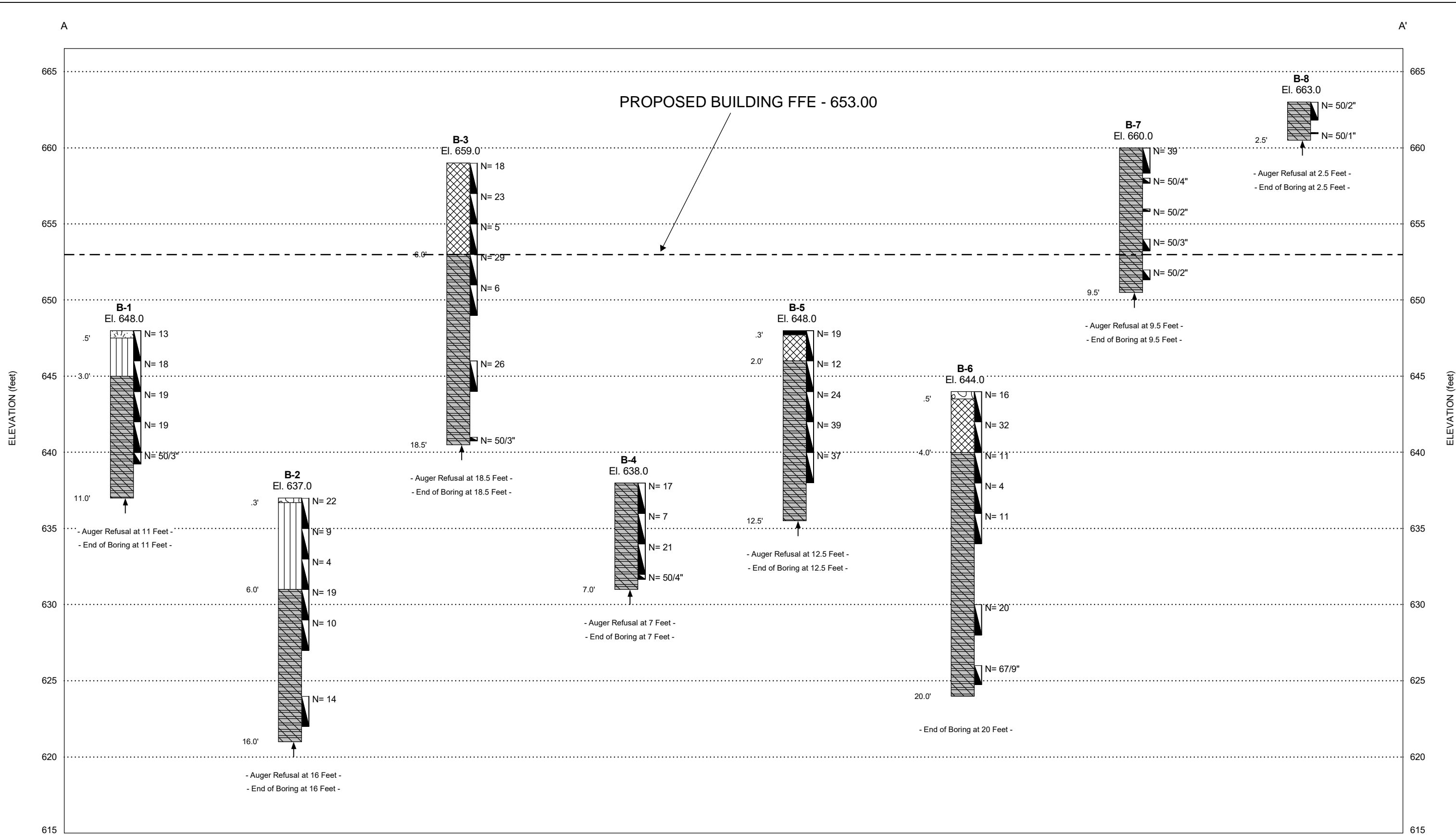
DATED:
February 4, 2022

EXPLORATION PLAN
PREPARED FOR
2951 BETZ COURT DEVELOPMENT

LOWHILL TOWNSHIP LEHIGH COUNTY PENNSYLVANIA

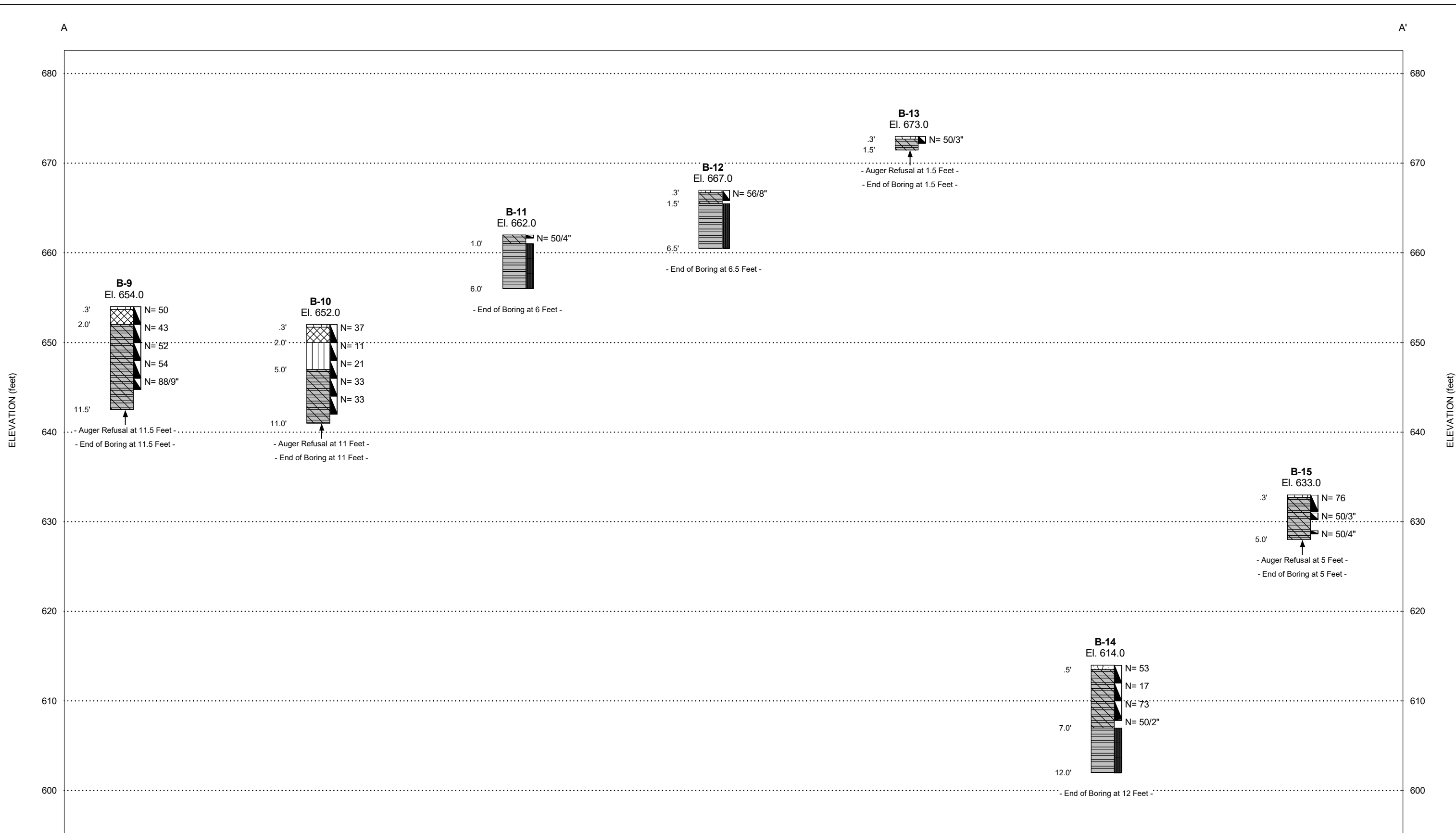


6330 HEDGEWOOD DR. SUITE 310
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NOTE: REFER TO INDIVIDUAL LOGS FOR DETAILED INFORMATION AND THE GRAPHIC LEGEND KEYS FOR GRAPHICAL SYMBOL INFORMATION.

	PROJECT NO.: 20221785.003A	TEST BORING PROFILES 2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania	FIGURE 4
	DRAWN BY: EH		
	CHECKED BY: BW		
DATE: 3/3/2022			



NOTE:
 REFER TO INDIVIDUAL LOGS FOR DETAILED INFORMATION AND THE GRAPHIC LEGEND KEYS FOR GRAPHICAL SYMBOL INFORMATION.

	PROJECT NO.: 20221785.003A	TEST BORING PROFILES 2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania	FIGURE 5
	DRAWN BY: EH CHECKED BY: BW DATE: 3/3/2022		

SAMPLE/SAMPLER TYPE GRAPHICS

- NQ CORE SAMPLE (1.874 in. (47.6 mm.) core diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

ROCK LITHOLOGY GRAPHICS

- SHALE

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, i.e., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

- WOH - Weight of Hammer
- WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

GRAVELS (More than half of coarse fraction is larger than the #200 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES	
		Cu < 4 and/or 1 > Cc > 3		GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES	
	GRAVELS WITH 5% TO 12% FINES	Cu ≥ 4 and 1 ≤ Cc ≤ 3		GW-GM	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES	
				GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES	
		Cu < 4 and/or 1 > Cc > 3		GP-GM	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES	
				GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES	
	GRAVELS WITH > 12% FINES			GM	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES	
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	
				GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES	
	SANDS (Half or more of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu < 6 and/or 1 > Cc > 3		SP	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu ≥ 6 and 1 ≤ Cc ≤ 3		SW-SM	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES	
Cu < 6 and/or 1 > Cc > 3				SP-SM	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES	
				SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES	
SANDS WITH > 12% FINES				SM	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES	
				SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES	
				SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES	
FINE GRAINED SOILS (Half or more of material is smaller than the #200 sieve)		SILTS AND CLAYS (Liquid Limit less than 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY	
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
				CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	SILTS AND CLAYS (Liquid Limit 50 or greater)		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY		
			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT		
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY			

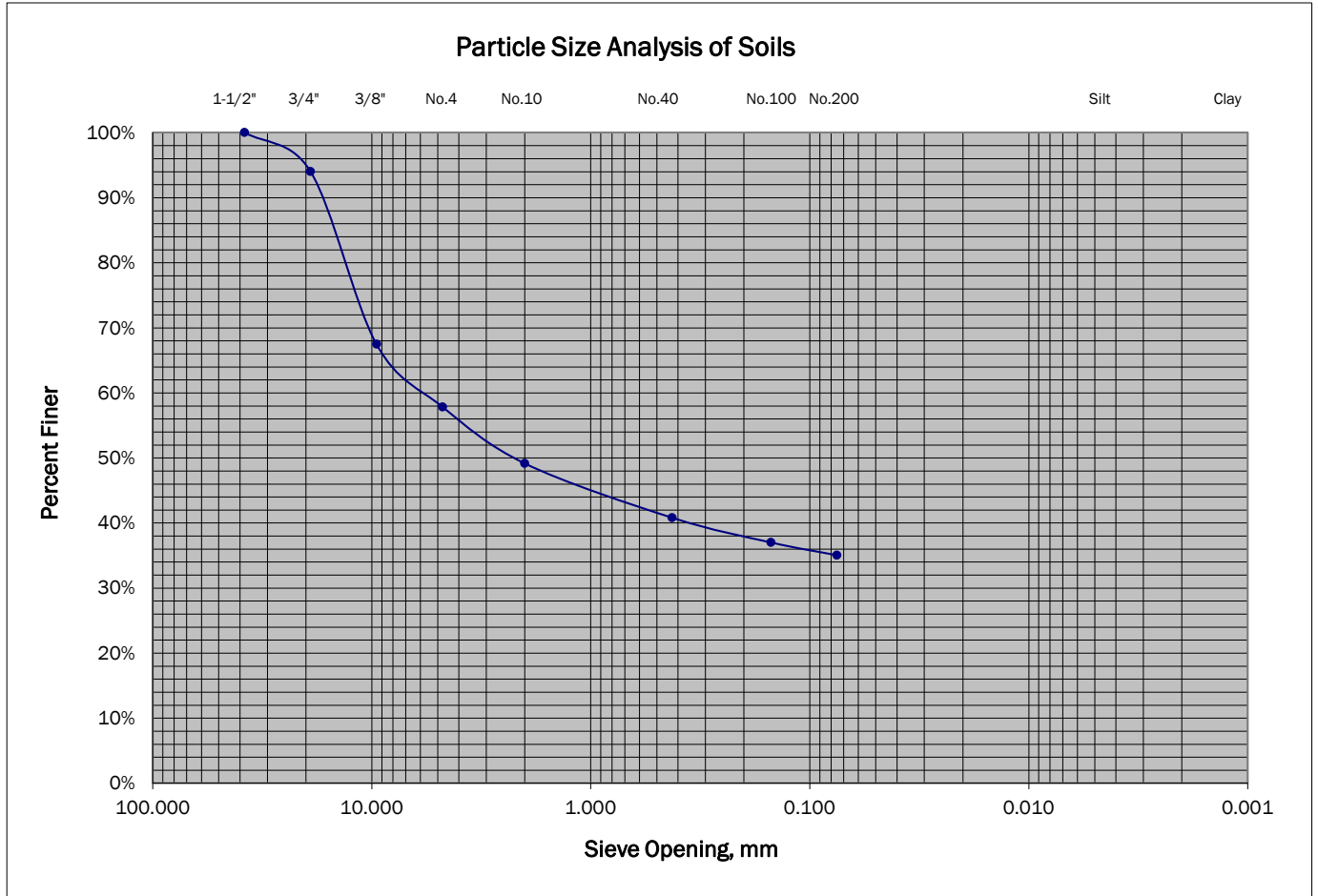
NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.

<p>KLEINFELDER Bright People. Right Solutions.</p>	PROJECT NO.: 20221785.003A	<p>GRAPHICS KEY</p> <p>2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania</p>	<p>6</p>
	DRAWN BY: EH CHECKED BY: BW DATE: 3/3/2022		



Soil Classification Report

Per ASTM Designations D 2487 and D 2488

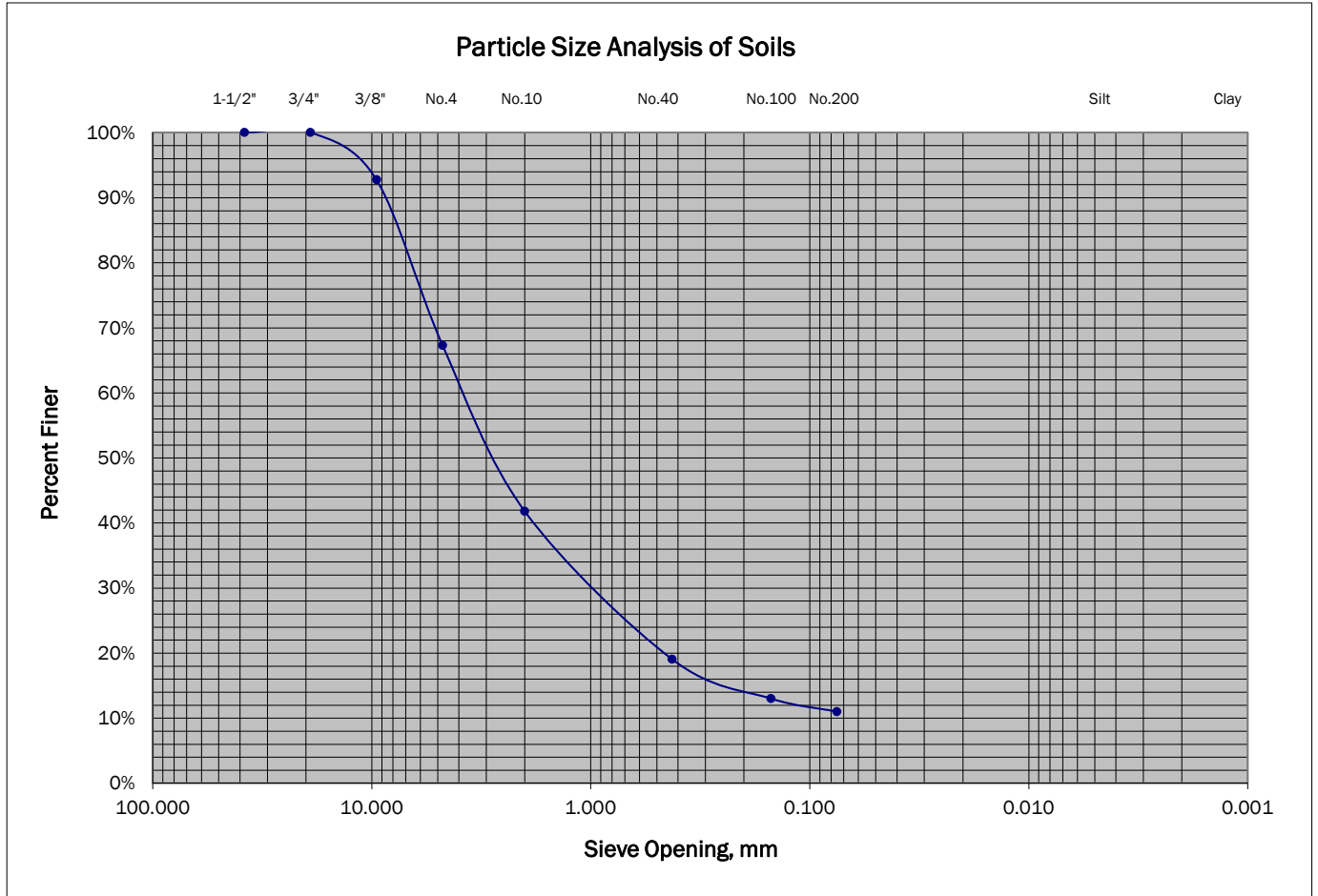


As-Received Moisture 14.9%		Particle Size Distribution				
USCS Classification: Silty GRAVEL with Sand (GM)		US Standard Sieve Size		Opening (mm)	%Finer	
Gravel: 42.2%	Coarse: 6.0%	Fine: 36.2%		GRAVEL	Coarse	
Sand: 22.8%	Coarse: 8.7%	Medium: 8.3%	Fine: 5.8%		1-1/2"	
Fines: 35.0%	Silt:	Clay:			3/4"	
Gravel Description: Subangular					3/8"	
Sand Description: Subangular					No. 4	
Consistency: N/A	Dry Strength: N/A				Coarse	
Dilatancy: N/A	Toughness: N/A				No. 10	
Structure: Homogeneous	Cementation: Moderate				Medium	
				No. 40		
				No. 100		
				No. 200		
				Hydrometer Analysis		
				Silt Size		0.005
				Clay Size		0.001
				D ₆₀ :	D ₃₀ :	D ₁₀ :
				Cu:		Cc:
Boring: B-5			Atterberg Limits		LL: NP	PL: NP
Sample: S-2, S-3	Depth: 2' - 6'		Description:		Brown to tan Silty GRAVEL with Sand	
Project: 2951 Betz Court Development			Remarks:		Stratum I	
Client: Snyder, Secary & Associates, a Division of Pennoni			Report Date:		March 3, 2022	
Kleinfelder Project Number: 20221785.003A						



Soil Classification Report

Per ASTM Designations D 2487 and D 2488




As-Received Moisture 8.9%		Particle Size Distribution				
USCS Classification: Well-graded SAND with Silt and Gravel (SW-SM)		US Standard Sieve Size		Opening (mm)	%Finer	
Gravel: 32.7%	Coarse: 0.0%	Fine: 32.7%		GRAVEL	Coarse	
Sand: 56.3%	Coarse: 25.5%	Medium: 22.8%	Fine: 8.0%		1-1/2"	
Fines: 11.0%	Silt:	Clay:			3/4"	
Gravel Description: Subangular					3/8"	
Sand Description: Subangular to subrounded					No. 4	
Consistency: N/A	Dry Strength: N/A				Coarse	
Dilatancy: N/A	Toughness: N/A				No. 10	
Structure: Homogeneous	Cementation: Weak				Medium	
				No. 40		41.8%
				No. 100		19.0%
				No. 200		11.0%
				Hydrometer Analysis		
				Silt Size		0.005
				Clay Size		0.001
		D ₆₀ : 4.7		D ₃₀ : 1	D ₁₀ : 0.077	Cu: 61
						Cc: 2.76
Boring: B-9	Atterberg Limits		LL: NP	PL: NP	PI: NP	
Sample: S-4	Depth: 6' - 8'		Description: Tan SAND with Silt and Gravel			
Project: 2951 Betz Court Development			Remarks: Stratum I			
Client: Snyder, Secary & Associates, a Division of Pennoni			Report Date: March 3, 2022			
Kleinfelder Project Number: 20221785.003A						

PLOTTED: 03/09/2022 01:00 PM BY: BWildasin

Date Begin - End: 2/15/2022	Drilling Company: Eichelbergers, Inc.	BORING LOG B-2	
Logged By: Z. Isenhour	Drill Crew: Ben/Chris		
Hor.-Vert. Datum: Not Available	Drilling Equipment: Diedrich D-50		Hammer Type - Drop: 140 lb. Auto - 30 in.
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger		
Weather: 20, cloudy	Auger Diameter: 3.25 in. I.D.		

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS			
			Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. ROD=%	● Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)
Approximate Ground Surface Elevation (ft.): 637.0 Surface Condition: Aggregate										
Lithologic Description										
635	5	Gravel: 4" Gray GRAVEL Stratum II Sandy SILT: tan, dry to moist, medium stiff to very stiff	S-1	BC=16 15 7 6	22	20"				
			S-2	BC=8 5 4 2	9	12"				
			S-3	BC=4 2 2 13	4	8"				
630	10	Stratum I Silty GRAVEL with Sand: tan, dry, medium dense	S-4	BC=8 2 17 9	19	10"				
			S-5	BC=4 4 6 8	10	18"				
625	15		S-6	BC=8 7 7 14	14	20"				
620	20	The boring was terminated because of auger refusal (↑) at approximately 16 ft. below ground surface on bedrock. The boring was backfilled with auger cuttings on February 15, 2022. Rock was encountered at a depth of 16 ft. during this exploration.	GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES: The exploration location and elevation are approximate and were estimated by Kleinfelder.							
615										

PROJECT NUMBER: 20221785.003A
 OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]

	PROJECT NO.: 20221785.003A	BORING LOG B-2 2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania
	DRAWN BY: TB CHECKED BY: BW DATE: 2/18/2022	

PLOTTED: 03/09/2022 01:00 PM BY: BWildasin

BORING LOG B-3

Date Begin - End: 2/16/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 18, partly cloudy **Auger Diameter:** 3.25 in. I.D.

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION					LABORATORY RESULTS				
			Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. ROD=%	● Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Additional Tests/ Remarks
			Approximate Ground Surface Elevation (ft.): 659.0 Surface Condition: Bare Earth									
			Fill Sandy SILT with Gravel: orangish brown, dry	S-1	▲	BC=4 7 11 11	18	20"				
			SILT: brown to gray, dry, contains organic debris (mulch)	S-2	▲	BC=8 12 11 7	23	4"				
655	5			S-3	▲	BC=3 2 3 4	5	12"				
				Stratum I Silty SAND with Gravel: brown, dry, loose to medium dense	S-4	▲	BC=5 12 17 7	29	16"			
650	10			S-5	▲	BC=4 3 3 4	6	16"				
645	15			S-6	▲	BC=3 4 22 12	26	2"				
640	20		very dense	S-7	▲	BC=50/3"	50/3"	3"				
635			The boring was terminated because of auger refusal (↑) at approximately 18.5 ft. below ground surface on bedrock. The boring was backfilled with auger cuttings on February 16, 2022.									

GROUNDWATER LEVEL INFORMATION:
 Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
 The exploration location and elevation are approximate and were estimated by Kleinfelder.

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



PROJECT NO.: 20221785.003A
 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

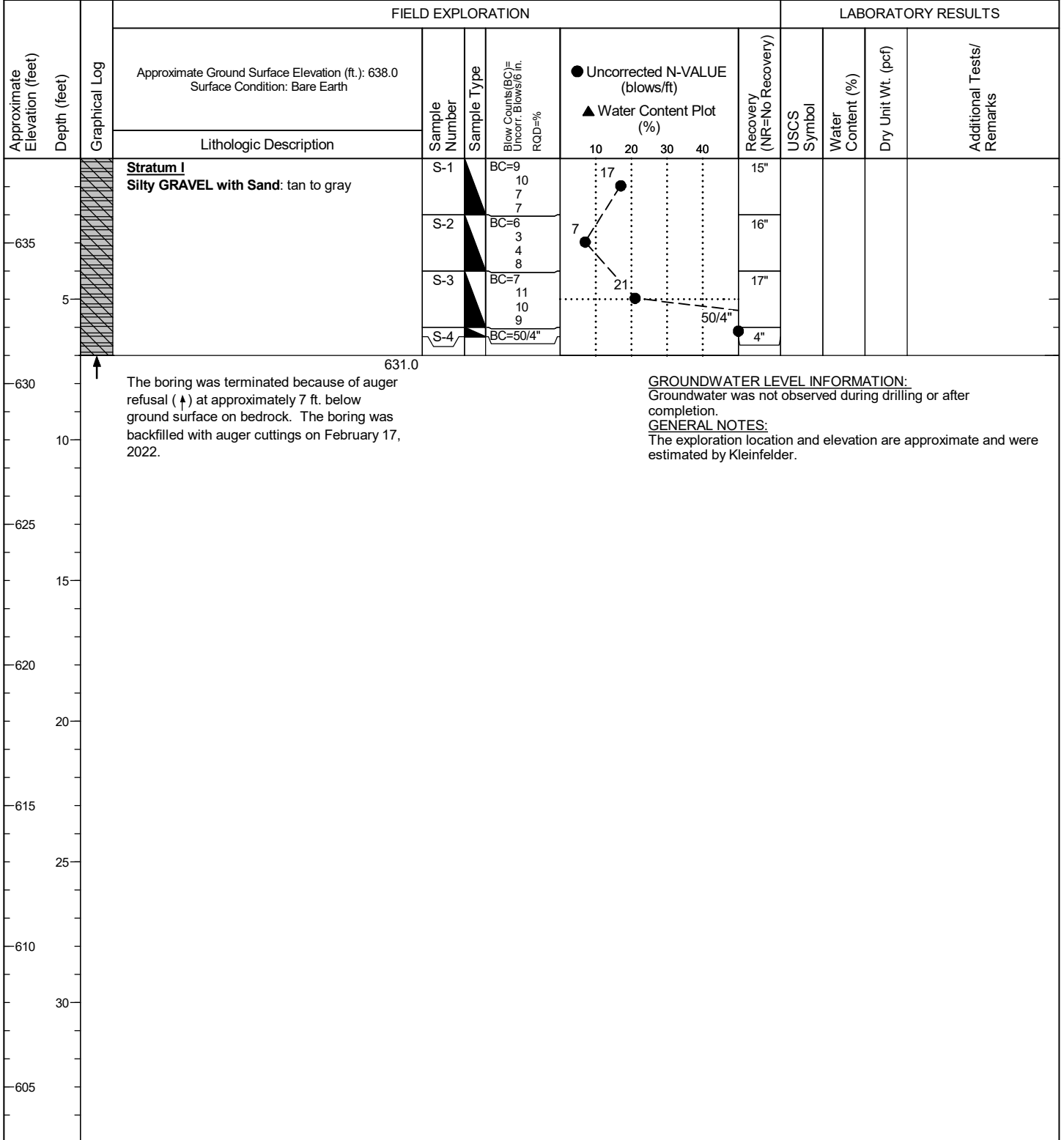
BORING LOG B-3

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

BORING LOG B-4

Date Begin - End: 2/17/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 20, cloudy **Auger Diameter:** 3.25 in. I.D.



PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



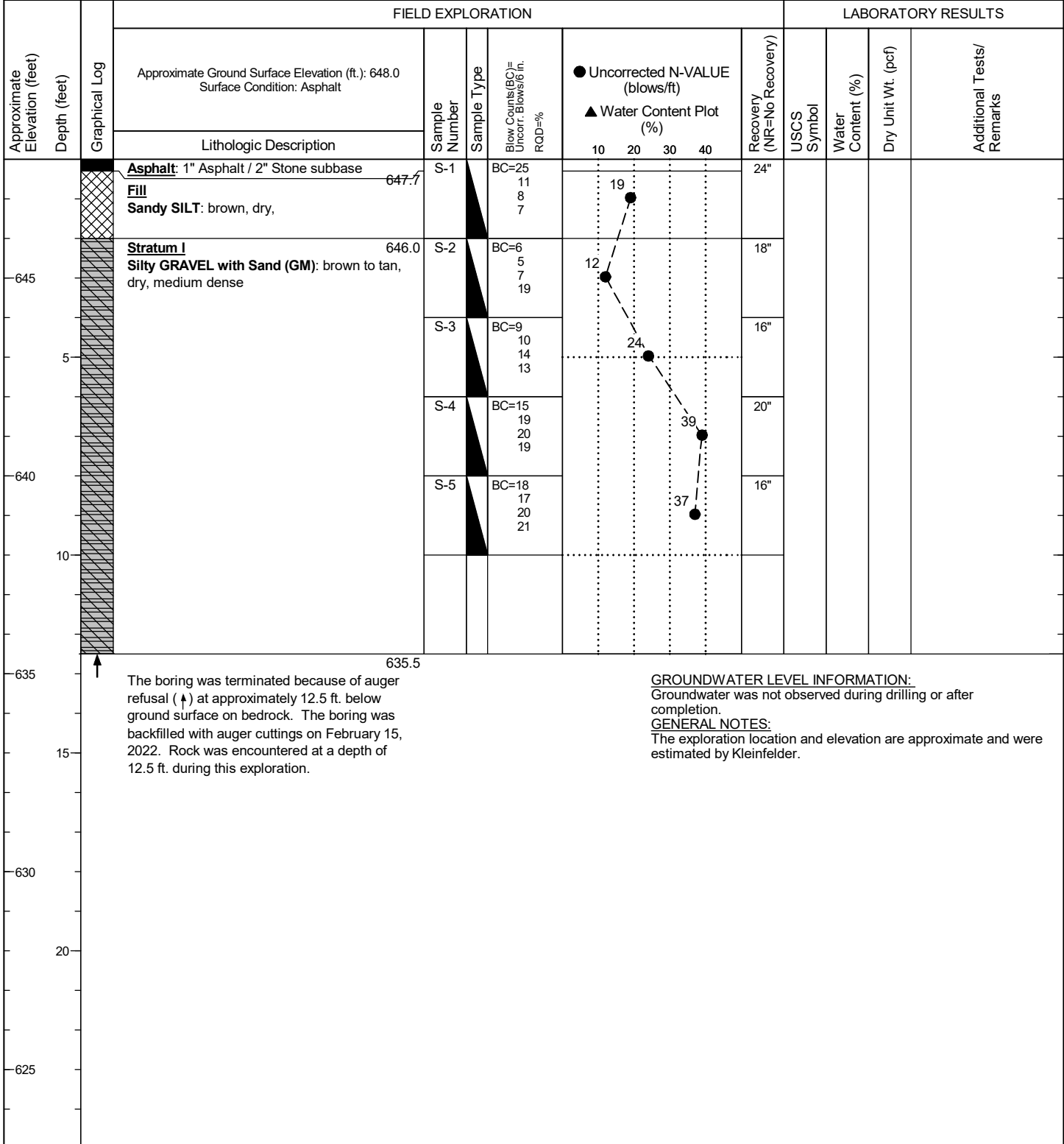
PROJECT NO.: 20221785.003A
 DRAWN BY: EH
 CHECKED BY: BW
 DATE: 3/1/2022

BORING LOG B-4

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

Date Begin - End: 2/15/2022 **Drilling Company:** Eichelbergers, Inc. **BORING LOG B-5**
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 20, cloudy **Auger Diameter:** 3.25 in. I.D.



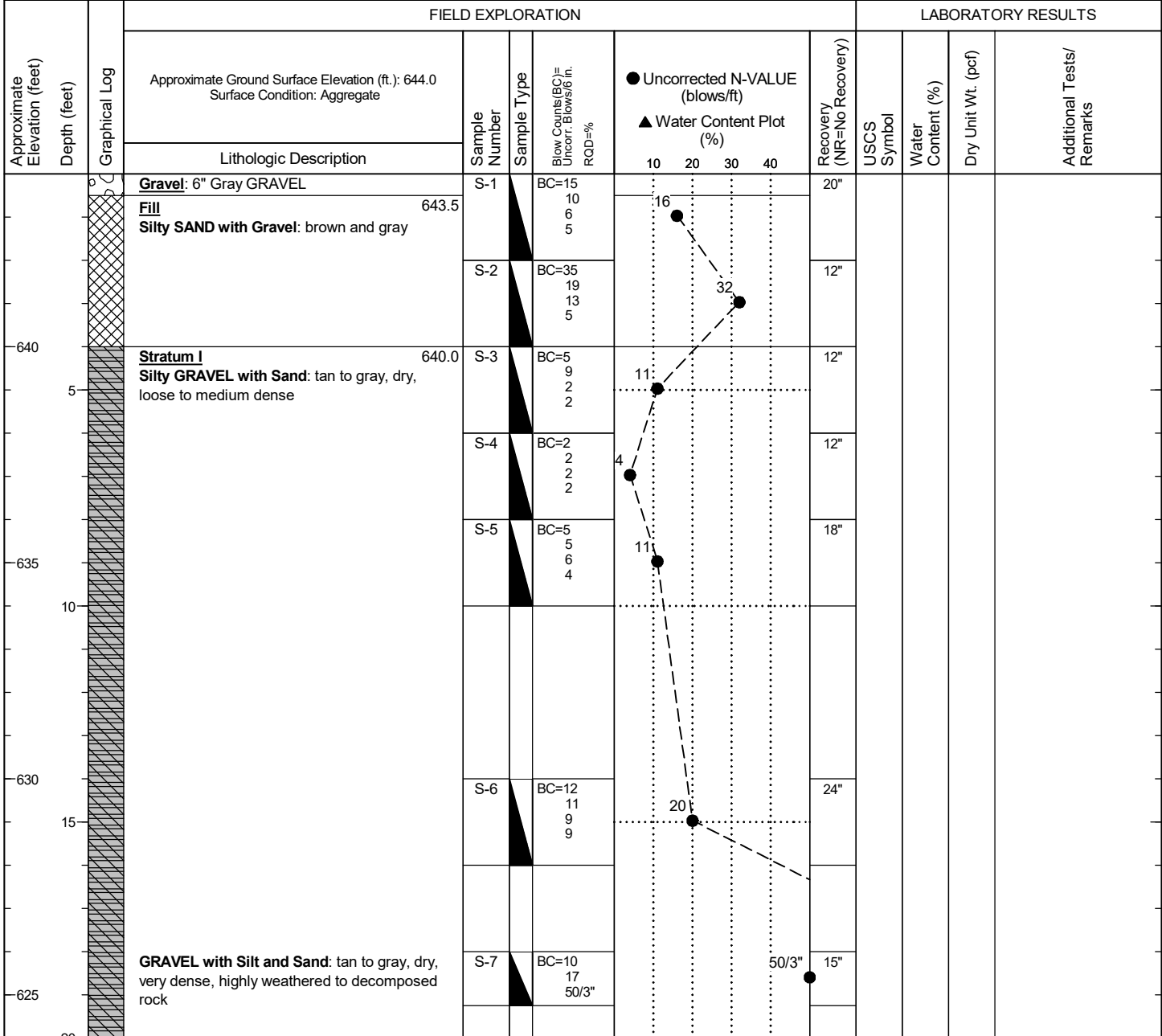
GROUNDWATER LEVEL INFORMATION:
 Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
 The exploration location and elevation are approximate and were estimated by Kleinfelder.

PROJECT NUMBER: 20221785.003A
 OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]

	PROJECT NO.: 20221785.003A	BORING LOG B-5 2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania
	DRAWN BY: TB CHECKED BY: BW DATE: 2/18/2022	

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin


Date Begin - End: <u>2/15/2022</u>	Drilling Company: <u>Eichelbergers, Inc.</u>	BORING LOG B-6
Logged By: <u>Z. Isenhour</u>	Drill Crew: <u>Ben/Chris</u>	
Hor.-Vert. Datum: <u>Not Available</u>	Drilling Equipment: <u>Diedrich D-50</u>	Hammer Type - Drop: <u>140 lb. Auto - 30 in.</u>
Plunge: <u>-90 degrees</u>	Drilling Method: <u>Hollow Stem Auger</u>	
Weather: <u>20, cloudy</u>	Auger Diameter: <u>3.25 in. I.D.</u>	



The boring was terminated at approximately 20 ft. below ground surface. The boring was backfilled with auger cuttings on February 15, 2022.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

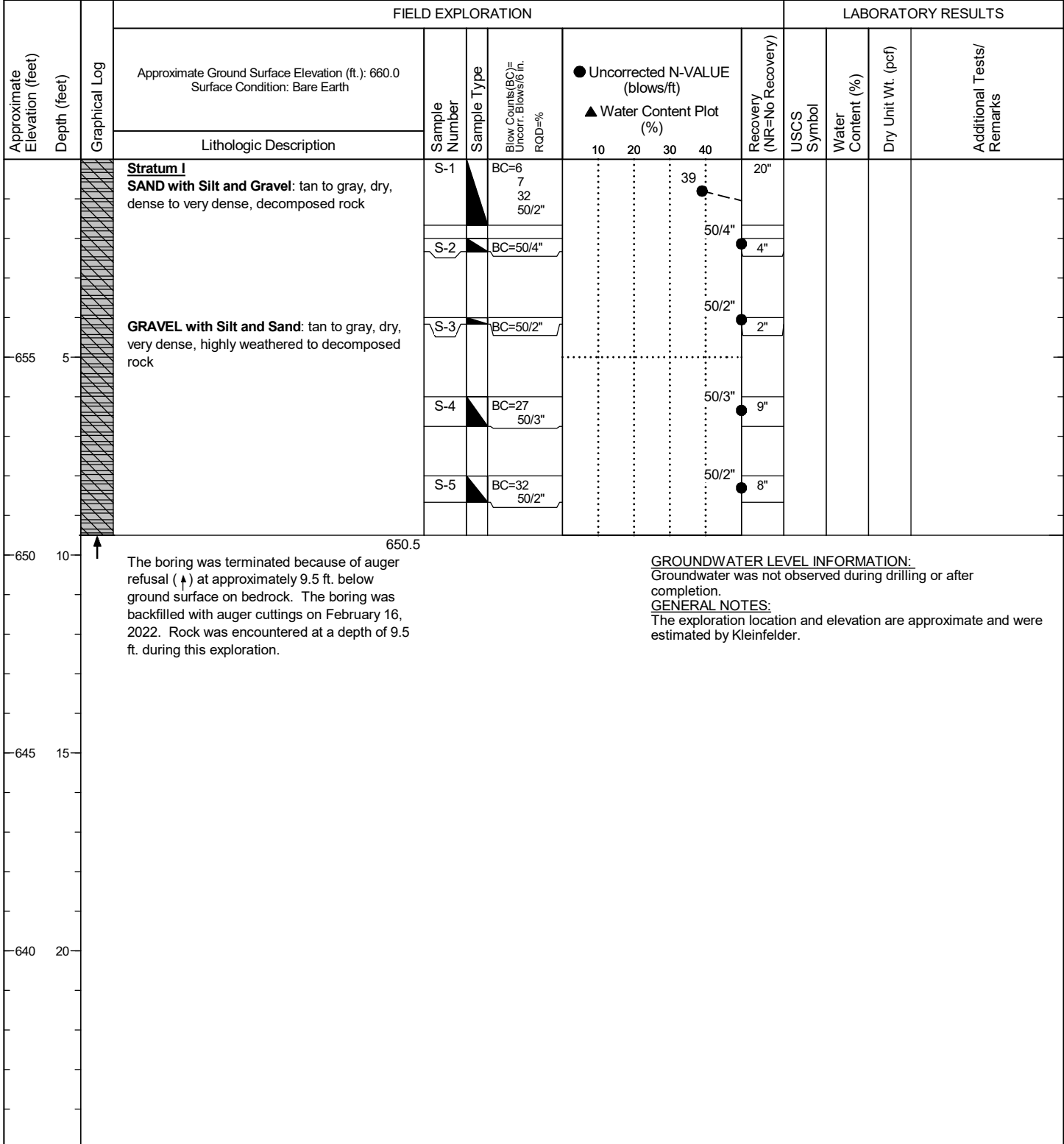
PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]

 <p>KLEINFELDER Bright People. Right Solutions.</p>	PROJECT NO.: 20221785.003A	BORING LOG B-6
	DRAWN BY: TB CHECKED BY: BW DATE: 2/18/2022	2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

BORING LOG B-7

Date Begin - End: 2/16/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 18, partly cloudy **Auger Diameter:** 3.25 in. I.D.



GROUNDWATER LEVEL INFORMATION:
 Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
 The exploration location and elevation are approximate and were estimated by Kleinfelder.

PROJECT NUMBER: 20221785.003A
 OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



PROJECT NO.: 20221785.003A
 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

BORING LOG B-7

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

Date Begin - End: 2/17/2022 **Drilling Company:** Eichelbergers, Inc. **BORING LOG B-8**
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 20, cloudy **Auger Diameter:** 3.25 in. I.D.

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION						LABORATORY RESULTS						
			Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. ROD=%	● Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%)				Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Additional Tests/Remarks
			Approximate Ground Surface Elevation (ft.): 663.0 Surface Condition: Bare Earth												
			Stratum I Silty GRAVEL with Sand: tan to gray, dry, very dense	S-1		BC=16 50/2" 9					50/2"	9"			
			GRAVEL: highly weathered rock, gray, dry, very dense	S-2		BC=50/1"					50/1"	1"			
660															
5															
655															
10															
650															
15															
645															
20															
640															

The boring was terminated because of auger refusal (↑) at approximately 2.5 ft. below ground surface on bedrock. The boring was backfilled with auger cuttings on February 17, 2022. Rock was encountered at a depth of 2.5 ft. during this exploration.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

GINT FILE: KLF_gint_master_2022 PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



PROJECT NO.:
20221785.003A

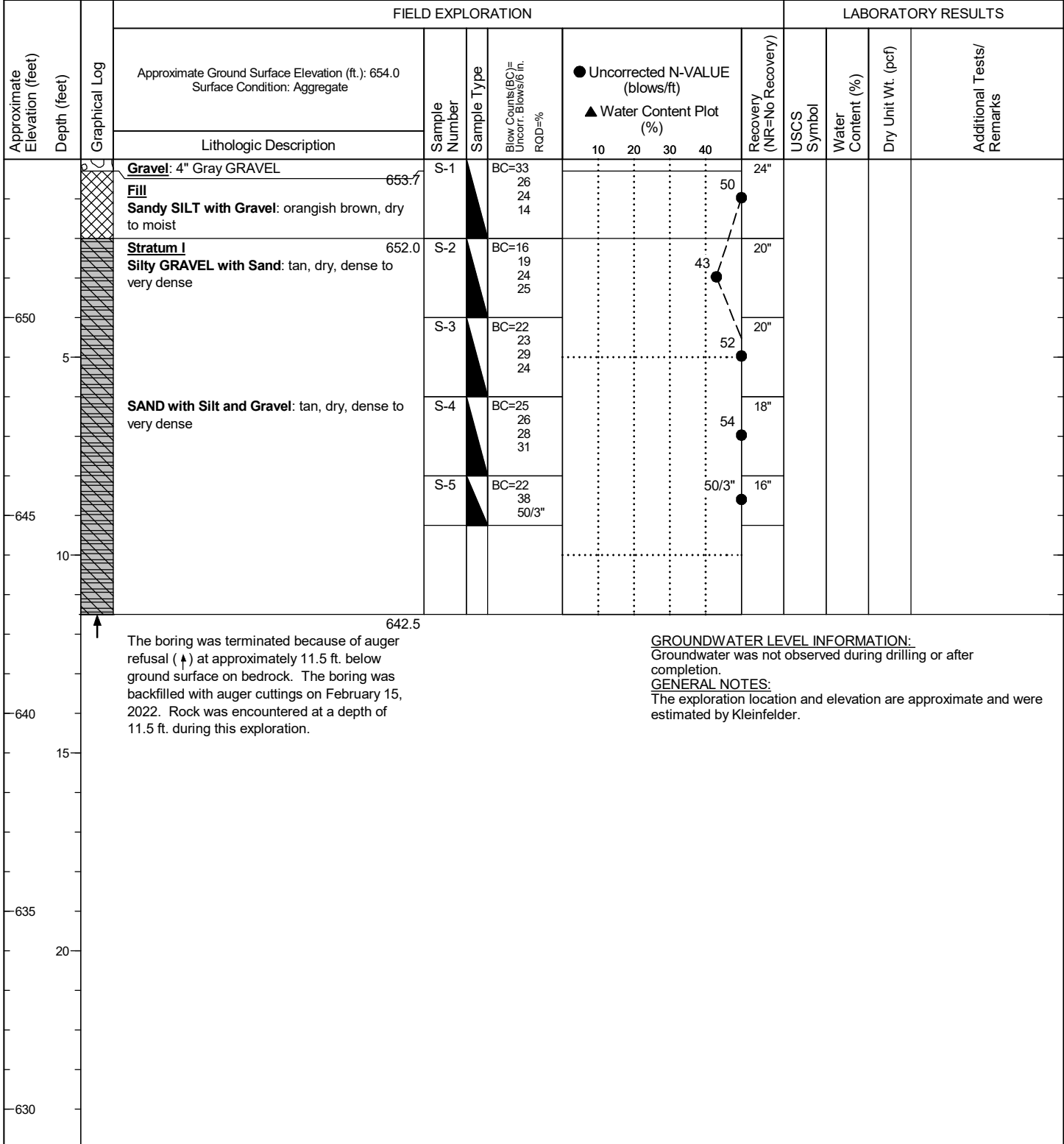
 DRAWN BY: EH
 CHECKED BY: BW
 DATE: 3/1/2022

BORING LOG B-8


2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

Date Begin - End: 2/15/2022 **Drilling Company:** Eichelbergers, Inc. **BORING LOG B-9**
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 20, cloudy **Auger Diameter:** 3.25 in. I.D.



PROJECT NUMBER: 20221785.003A
 OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]


	PROJECT NO.: 20221785.003A	BORING LOG B-9 2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania
	DRAWN BY: TB CHECKED BY: BW DATE: 2/18/2022	

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

Date Begin - End: 2/15/2022 **Drilling Company:** Eichelbergers, Inc. **BORING LOG B-10**
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 20, cloudy **Auger Diameter:** 3.25 in. I.D.

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS						
			Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. ROD=%	Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Additional Tests/Remarks	
652.0			Approximate Ground Surface Elevation (ft.): 652.0 Surface Condition: Aggregate										
651.7		Gravel: 3" Gray GRAVEL Fill Silty SAND with Gravel: brown, dry to moist	S-1	BC=36 23 14 11		11, 37	20"						
650.0		Stratum II Sandy SILT with Gravel: tan, dry to moist, stiff	S-2	BC=6 6 5 7		11	18"						
647.0		Stratum I Silty GRAVEL with Sand: tan to gray, dry, dense, highly weathered rock	S-3	BC=4 9 12 12		21	18"						
645			S-4	BC=15 16 17 18		33	24"						
641.0			S-5	BC=18 18 15 21		33	24"						
640		The boring was terminated because of auger refusal (↑) at approximately 11 ft. below ground surface on bedrock. The boring was backfilled with auger cuttings on February 15, 2022. Rock was encountered at a depth of 11 ft. during this exploration.				GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES: The exploration location and elevation are approximate and were estimated by Kleinfelder.							

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT LIBRARY: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]

	PROJECT NO.: 20221785.003A	BORING LOG B-10 2951 Betz Court Development Lowhill Township Lehigh County, Pennsylvania
	DRAWN BY: TB CHECKED BY: BW DATE: 2/18/2022	

Date Begin - End: 2/16/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 18, partly cloudy **Auger Diameter:** 3.25 in. I.D.

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION						LABORATORY RESULTS						
			Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. RQD=%	● Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%)				Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Additional Tests/Remarks	
			Approximate Ground Surface Elevation (ft.): 662.0 Surface Condition: Bare Earth												
			Lithologic Description												
			S-1	BC=50/4"					4"						
660		Stratum I SAND with Silt and Gravel: dark gray, dry, very dense, highly weathered to decomposed rock	R-1	RQD=0					100%					Auger refusal at 1 foot	
	5	BEDROCK SHALE: light to dark gray, moderately to highly weathered, intensely fractured													
	655	The boring was terminated at approximately 6 ft. below ground surface. The boring was backfilled with auger cuttings on February 16, 2022. Rock was encountered at a depth of 1 ft. during this exploration.						GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES: The exploration location and elevation are approximate and were estimated by Kleinfelder.							
	10														
	650														
	15														
	645														
	20														
	640														



PROJECT NO.: 20221785.003A
 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

BORING LOG B-11

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

BORING LOG B-12

Date Begin - End: 2/16/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 18, partly cloudy **Auger Diameter:** 3.25 in. I.D.

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION					LABORATORY RESULTS					
			Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. RQD=%	Uncorrected N-VALUE (blows/ft) Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Additional Tests/Remarks	
667.0			Approximate Ground Surface Elevation (ft.): 667.0 Surface Condition: Bare Earth and Grass										
666.7			Topsoil: 4" Brown organic soil	S-1		BC=4			12"				
665.5			Stratum I Silty GRAVEL with Sand: gray, dry, very dense, highly weathered to decomposed rock			6 50/2"							
665.5			BEDROCK SHALE: light to dark gray, moderately to highly weathered, intensely fractured	R-1		RQD=0			100%			Auger refusal at 1.5 feet	
660.5			The boring was terminated at approximately 6.5 ft. below ground surface. The boring was backfilled with auger cuttings on February 16, 2022. Rock was encountered at a depth of 1.5 ft. during this exploration.										
										GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during drilling or after completion. GENERAL NOTES: The exploration location and elevation are approximate and were estimated by Kleinfelder.			

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



PROJECT NO.: 20221785.003A
 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

BORING LOG B-12

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

BORING LOG B-13

Date Begin - End: 2/16/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 18, partly cloudy **Auger Diameter:** 3.25 in. I.D.

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS				
			Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. ROD=%	● Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Additional Tests/Remarks
		Approximate Ground Surface Elevation (ft.): 673.0 Surface Condition: Gravel									
		Lithologic Description									
		Gravel: 4" Gray GRAVEL	S-1	BC=14 50/3"							
		Stratum I SAND with Silt and Gravel: tan, dry, very dense									
670											
5											
665											
10											
660											
15											
655											
20											
650											

The boring was terminated because of auger refusal (↑) at approximately 1.5 ft. below ground surface on bedrock. The boring was backfilled with auger cuttings on February 16, 2022.

GROUNDWATER LEVEL INFORMATION:

Groundwater was not observed during drilling or after completion.

GENERAL NOTES:

The exploration location and elevation are approximate and were estimated by Kleinfelder.

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



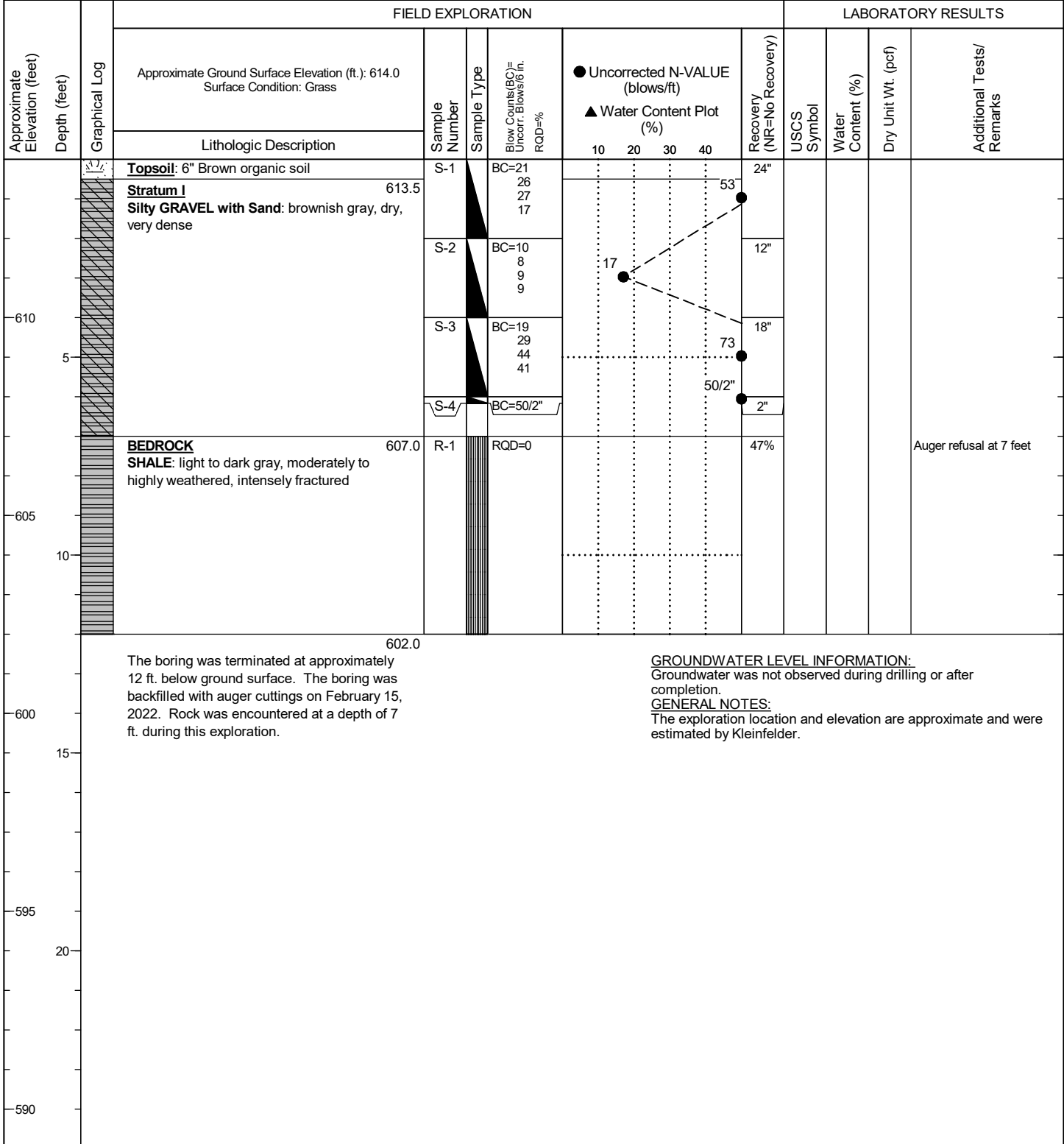
PROJECT NO.: 20221785.003A
 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

BORING LOG B-13

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

Date Begin - End: 2/15/2022	Drilling Company: Eichelbergers, Inc.	BORING LOG B-14	
Logged By: Z. Isenhour	Drill Crew: Ben/Chris		
Hor.-Vert. Datum: Not Available	Drilling Equipment: Diedrich D-50		Hammer Type - Drop: 140 lb. Auto - 30 in.
Plunge: -90 degrees	Drilling Method: Hollow Stem Auger		
Weather: 20, cloudy	Auger Diameter: 3.25 in. I.D.		



OFFICE FILTER: ALLENTOWN

PROJECT NUMBER: 20221785.003A

KLF_BORING WITH N-PLOT WITH DRILL NOTES



PROJECT NO.: 20221785.003A
 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

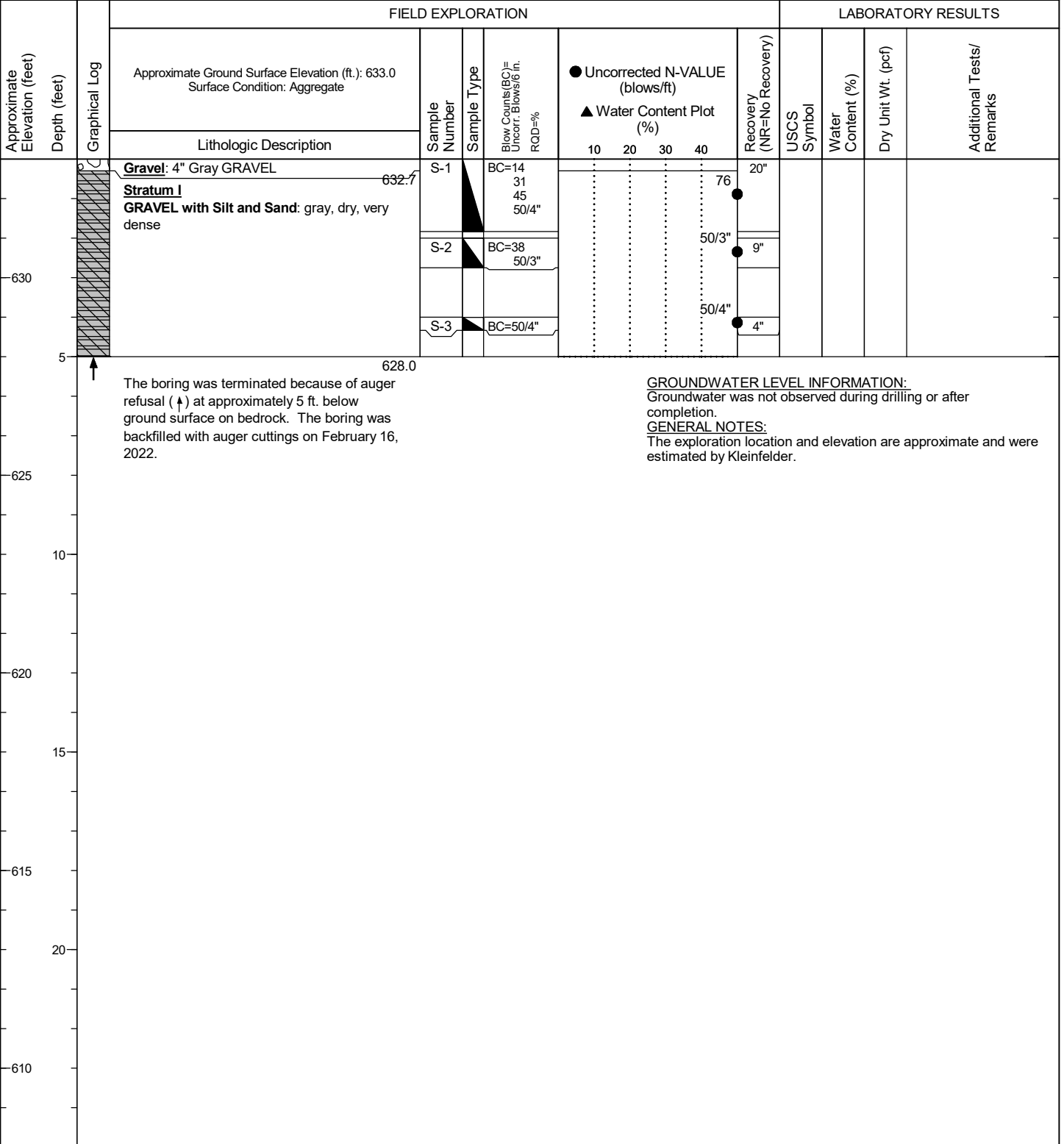
BORING LOG B-14

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/09/2022 01:01 PM BY: BWildasin

BORING LOG B-15

Date Begin - End: 2/16/2022 **Drilling Company:** Eichelbergers, Inc.
Logged By: Z. Isenhour **Drill Crew:** Ben/Chris
Hor.-Vert. Datum: Not Available **Drilling Equipment:** Diedrich D-50 **Hammer Type - Drop:** 140 lb. Auto - 30 in.
Plunge: -90 degrees **Drilling Method:** Hollow Stem Auger
Weather: 18, partly cloudy **Auger Diameter:** 3.25 in. I.D.



PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING WITH N-PLOT WITH DRILL NOTES]



PROJECT NO.:
20221785.003A

 DRAWN BY: TB
 CHECKED BY: BW
 DATE: 2/18/2022

BORING LOG B-15

2951 Betz Court Development
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/01/2022 09:15 PM BY: BWildasin

TEST PIT LOG IT-1

Date Begin - End: 2/23/2022 **Excavation Company:** Joma Excavating
Logged By: E. Hinkle **Excavation Crew:** J. Santos Sr.
Hor.-Vert. Datum: Not Available **Excavation Equip.:** 416 CAT Backhoe
Plunge: N/A degrees **Excav. Dimensions:** ft
Weather: 60 degrees, cloudy

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS					
		Surface Condition: Gravel	Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
		Gravel GRAVEL: 24" dark bluish gray GRAVEL									
		Stratum I -2.0 Silty Clayey GRAVEL: light brown, wet, highly weathered bedrock									

The test pit was terminated at approximately 5.5 ft. below ground surface. The test pit was backfilled with excavated material on February 23, 2022.

GROUNDWATER LEVEL INFORMATION:
 ∇ Groundwater was observed at approximately 5.5 ft. below ground surface during excavation.
 ▼ Groundwater was observed at approximately 4 ft. below ground surface 3.5 hours after excavation completion.
GENERAL NOTES:

PROJECT NUMBER: 20221785.003A
 OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING/TEST PIT SOIL LOG]



PROJECT NO.:
20221785.003A

 DRAWN BY: EH
 CHECKED BY: BW
 DATE: 2/25/2022



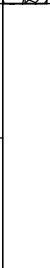
TEST PIT LOG IT-1

2951 Betz Court
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/01/2022 09:15 PM BY: BWildasin

TEST PIT LOG IT-2

Date Begin - End: 2/23/2022 **Excavation Company:** Joma Excavating
Logged By: E. Hinkle **Excavation Crew:** J. Santos Sr.
Hor.-Vert. Datum: Not Available **Excavation Equip.:** 416 CAT Backhoe
Plunge: N/A degrees **Excav. Dimensions:** ft
Weather: 60 degrees, cloudy

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS						
		Surface Condition: Gravel	Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/Remarks
0		Gravel: wet, 18" dark bluish gray GRAVEL										
1.5		Stratum I Silty Clayey GRAVEL: light brown, moist, highly weathered bedrock	-1.5									Basin side walls collapsing
8.0		The test pit was terminated at approximately 8 ft. below ground surface. The test pit was backfilled with excavated material on February 23, 2022.		-8.0	GROUNDWATER LEVEL INFORMATION: <input checked="" type="checkbox"/> Perched groundwater was observed at approximately 0.5 ft. below ground surface during excavation. <input checked="" type="checkbox"/> Perched groundwater was observed at approximately 1.5 ft. below ground surface during excavation. GENERAL NOTES:						Infiltration test at 6 ft Presoak 1 (30min): 0.0" Presoak 2 (30min): 0.0" Reading 1 (30min): 0.0" Reading 2 (30min): 0.0" Reading 3 (30min): 0.0" Reading 4 (30min): 0.0" Field Rate = 0.0 in/hr	

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING/TEST PIT SOIL LOG]



PROJECT NO.:
20221785.003A

 DRAWN BY: EH
 CHECKED BY: BW
 DATE: 2/25/2022

TEST PIT LOG IT-2

2951 Betz Court
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/01/2022 09:15 PM BY: BWildasin

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING/TEST PIT SOIL LOG]


Date Begin - End: <u>2/23/2022</u>	Excavation Company: <u>Joma Excavating</u>	TEST PIT LOG IT-3
Logged By: <u>E. Hinkle</u>	Excavation Crew: <u>J. Santos Sr.</u>	
Hor.-Vert. Datum: <u>Not Available</u>	Excavation Equip.: <u>416 CAT Backhoe</u>	
Plunge: <u>N/A degrees</u>	Excav. Dimensions: <u>ft</u>	
Weather: <u>60 degrees, cloudy</u>		

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS							
		Surface Condition: Gravel		Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/Remarks
	▽												
				Stratum I Silty Clayey GRAVEL: light brown, wet, highly weathered bedrock									
5				-1.0									
				-8.0									Basin side walls collapsing to 4' below existing site grades

The test pit was terminated at approximately 8 ft. below ground surface.
 The test pit was backfilled with excavated material on February 23, 2022.

GROUNDWATER LEVEL INFORMATION:
 ▽ Groundwater was observed at approximately 3 ft. below ground surface 3 hours after excavation completion.

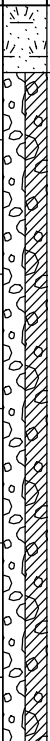
GENERAL NOTES:

	PROJECT NO.: 20221785.003A	TEST PIT LOG IT-3
	DRAWN BY: EH CHECKED BY: BW DATE: 2/25/2022	2951 Betz Court Lowhill Township Lehigh County, Pennsylvania

PLOTTED: 03/01/2022 09:15 PM BY: BWildasin

TEST PIT LOG IT-6

Date Begin - End: 2/23/2022 **Excavation Company:** Joma Excavating
Logged By: E. Hinkle **Excavation Crew:** J. Santos Sr.
Hor.-Vert. Datum: Not Available **Excavation Equip.:** 416 CAT Backhoe
Plunge: N/A degrees **Excav. Dimensions:** ft
Weather: 55 degrees, cloudy

Depth (feet)	Graphical Log	FIELD EXPLORATION			LABORATORY RESULTS							
		Surface Condition: Grass	Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/Remarks
		Topsoil: 6" brown organic soil										
		Stratum I GRAVEL with Sand: dark gray, dry to moist, weathered bedrock	-0.5									
5												
			-5.5									

Infiltration test at 3.5 ft
 Presoak 1 (30min): 6"
 Presoak 2 (30min): 5.8"
 Reading 1 (10min): 2.8"
 Reading 2 (10min): 2.6"
 Reading 3 (10min): 2.5"
 Reading 4 (10min): 2.5"
 Reading 5 (10min): 2.5"
 Reading 6 (10min): 2.5"
 Field Rate = 15 in/hr

The test pit was terminated because of backhoe refusal (↑) at approximately 5.5 ft. below ground surface on bedrock. The test pit was backfilled with excavated material on February 23, 2022.

GROUNDWATER LEVEL INFORMATION:
 Groundwater was not observed during excavation or after completion.
GENERAL NOTES:

PROJECT NUMBER: 20221785.003A
 OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING/TEST PIT SOIL LOG]



PROJECT NO.:
20221785.003A

 DRAWN BY: EH
 CHECKED BY: BW
 DATE: 2/25/2022

TEST PIT LOG IT-6

2951 Betz Court
 Lowhill Township
 Lehigh County, Pennsylvania

PLOTTED: 03/01/2022 09:15 PM BY: BWildasin

TEST PIT LOG IT-8

Date Begin - End: 2/23/2022 **Excavation Company:** Joma Excavating
Logged By: E. Hinkle **Excavation Crew:** J. Santos Sr.
Hor.-Vert. Datum: Not Available **Excavation Equip.:** 416 CAT Backhoe
Plunge: N/A degrees **Excav. Dimensions:** ft
Weather: 60 degrees, cloudy

Depth (feet)	Graphical Log	FIELD EXPLORATION				LABORATORY RESULTS						
		Surface Condition: Grass	Lithologic Description	Sample Type	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/Remarks
		Topsoil: 12" brown organic soil										
		Stratum I Silty Clayey GRAVEL: light brown, dry to moist, highly weathered bedrock	-1.0									
5		GRAVEL with Sand: dark gray, dry to moist, weathered bedrock										
			-8.0	The test pit was terminated at approximately 8 ft. below ground surface. The test pit was backfilled with excavated material on February 23, 2022.		GROUNDWATER LEVEL INFORMATION: Groundwater was not observed during excavation or after completion. GENERAL NOTES:						

Infiltration test at 6 ft
 Presoak 1 (30min): 6"
 Presoak 2 (30min): 6"
 Reading 1 (10min): 3"
 Reading 2 (10min): 2.8"
 Reading 3 (10min): 2.5"
 Reading 4 (10min): 2.5"
 Reading 5 (10min): 2.5"
 Reading 6 (10min): 2.5"
 Field Rate = 15 in/hr

PROJECT NUMBER: 20221785.003A OFFICE FILTER: ALLENTOWN
 GINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2022.GLB [KLF_BORING/TEST PIT SOIL LOG]



PROJECT NO.:
20221785.003A
 DRAWN BY: EH
 CHECKED BY: BW
 DATE: 2/25/2022

TEST PIT LOG IT-8

2951 Betz Court
 Lowhill Township
 Lehigh County, Pennsylvania