Zannino Engineering, Inc.
9915 Greenwood Road
Glen Allen, Virginia 23060
(804) 262-0299 Fax (804) 262-8479
www.ZanninoEngineering.com

June 7th, 2022

Sekiv Solutions
14207 Pond Chase Place
Midlothian, Virginia 23113
(o) (804) 938-8864

Attention: Mr. Stig Owens, P.E., DBIA & LEED® Professional
E sowens@sekivsolutions.com

Regarding: Geotechnical Soil Study- Project #22-0126
Geotechnical Engineering Study
2730 Maidens Loop
Maidens, Goochland County, Virginia 23102

Dear Mr. Owens:

We have completed our evaluation of the subsurface conditions at this site based on our May 12th test borings. This report has been prepared in accordance with our proposal dated March 30th, 2022.

We evaluated the subsurface data and the soil samples taken during this study to analyze the site for the construction of 6,000 square foot metal building. This report summarizes our analysis of subsurface conditions and presents our recommendations for foundation support and site grading needed to construct this building.

We appreciate the opportunity to be of service to you. Please contact us if you have any questions regarding our findings or if there are any additional services that we could offer you.

Sincerely,
ZANNINO ENGINEERING, INC.

Grant Missimer
Engineering Aide

Mark E. McLain, P.E.
Senior Engineer

GEOTECHNICAL ENGINEERING STUDY- PROJECT NUMBER 22-0126
2730 MAIDENS LOOP
MAIDENS, GOOCHLAND COUNTY, VIRGINIA 23102

PREPARED FOR:

SEKIV SOLUTIONS
14207 POND CHASE PLACE
MIDLOTHIAN, VIRGINIA 23113

PREPARED BY:

ZANNINO ENGINEERING
9915 GREENWOOD ROAD
GLEN ALLEN, VIRGINIA 23060

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1.0 Executive Summary

The engineering related subsurface conditions of this property were relatively uniform throughout the test borings. The test borings indicate that foundation support can be derived by conventional spread footings bearing on either firm, natural soil or compacted fill. The soil profiles consisted of sandy, lean CLAYS (CL) over silty SANDS (SM) to the boring termination depths. Also, borings B-1 and B-3 encountered auger refusal at depths of 15 feet and 13 feet respectively.

Due to the soil and groundwater conditions, we recommend the following:

- Site work:
  - Anticipated stripping depth: 6 inches
  - Controlled Fill: minimum 95% of the maximum dry density by the Standard Proctor Method (ASTM D 698)
- Foundation:
  - Minimum Footing Depth: 24 inches below final exterior grades
  - Maximum Allowable Soil Bearing Pressure: 3,000 pounds per square foot (psf)
  - Estimated total settlement: less than ½ inch

Site work should be performed during dry weather conditions typically between the months of May through November to avoid any seasonal shallow water table above the observed permanent water table.

Any party that relies on this report should read the report completely since additional details which may be important in design and plan preparation for the project are included in the body of this report.

1.1 Site Specific Issues

While not likely, it is possible that deeper cuts and excavations may encounter rock outcroppings or other difficult excavation conditions.

Based on the boring logs, it is possible that soft areas at the bearing elevation may be encountered. Should soft soils be encountered during footing excavations, ZEI recommends that the footings be undercut at the direction of an experienced Geotechnical Engineer or his representative to expose firm soils. Undercuts less than 6 inches may be restored to grade with extra concrete. Deeper undercuts should be restored to grade with gravel (#57 Stone) to the planned bottom of footing depth.

2.0 Introduction

2.1 Project Description

The proposed 6,000 square foot metal building is planned to be behind the former building location. Based on the conceptual grading plan and GIS contours, we understand that the site is on a spur at the apparent southern end of a north to south ridge that slopes downhill from an approximate elevation of 222 feet near the northeastern corner to an approximate elevation of 180 feet near the western edge of the property. Assuming the final grading plan is not very different from the conceptual plan provided, we understand that approximately 3 to 18 feet of cut will be required to reach the building slab subgrade elevation.

We understand that the metal building package is not available but based on previous experience, estimate wall loads of less than 2 kips per linear foot and assuming a maximum 25-foot column spacing, a maximum column load of 30 kips.

2.2 Site Description

The approximately 1.4-acre project site is north of the intersection of Maidens Loop and Maidens Road in southern Goochland County, Virginia. The County GIS indicates that there was a building near the street side of the site, which may have been demolished in 2021.

At the time of this investigation, the site was clear with short to medium height grass. There was a gravel road built up to approximately the center of the site, extending from Maidens Loop. The site is on a spur at the apparent southern end of a north to south ridge that slopes downhill from an approximate elevation of 222 feet near the northeastern corner to an approximate elevation of 180 feet near the western edge of the property. The center area of the property was a more gradual slope.

3.0 Subsurface Exploration and Laboratory Testing

3.1 Investigational Procedures

We explored the subsurface conditions on this site by two (2) test borings to depths of twenty (20) feet below existing grades in the high end of the proposed building area and two (2) test borings at depths of fifteen (15) feet below existing grades in the low end of the building area. The boring locations were chosen based on the site plans provided by Sekiv Solutions and a copy of the site layout is included as the Boring Location Diagram.

We returned the soil samples to our soil laboratory for further testing. The drilling subcontractor completed the test borings with an All-Terrain-Vehicle mounted drill rig using continuous flight, hollow stem augers to advance the boreholes. Representative samples were obtained from the soil borings by means of the split-barrel sampling procedure in general accordance with ASTM D1586-00 (Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils). In this procedure, an automatic

hammer simulates a 140-lb. hammer falling 30 inches to drive a 2-inch O.D. split-barrel sampler a minimum distance of 18 inches, or three 6-inch increments, the first of which is a seating interval. The Standard Penetration, or "N" value, is derived by summing the number of blows required to drive the sample through the next two 6-inch intervals.

Individual Soil Boring Logs can be found in the Appendix of this report. A copy of the "Unified Soil Classification System" and "Reference Notes for Boring Logs" are also included herein.

3.2 Laboratory Testing

All soil samples were delivered to our soil laboratory where they were examined by the geotechnical engineer. Representative samples were subjected to laboratory testing at the direction of the engineer to define physical and engineering properties of the soil. Laboratory test included moisture content (ASTM D2166), grain size analysis (ASTM D1140), and Atterberg limits (ASTM D4318). The results of laboratory testing have been summarized and are tabulated below.

Based on the results of laboratory testing, the examination by the engineer and the drilling inspector's notes, test boring logs were prepared for each test location and have been included in the appendix of this report.

Laboratory Testing Summary

Boring	Depth (ft.)	Moisture Content	% Passing #200 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	USCS Classification
B-1	6-8	8.9	--	--	--	--	SM
B-2	13-15	15.5	42.1	NV	NP	NP	SM
B-3	2-4	10.8	--	--	--	--	SM
B-3	6-8	6.7	--	--	--	--	SM
B-4	2-4	28.4	56.4	34.7	22.5	12.2	CL
B-4	8-10	5.8	--	--	--	--	SM

NOTES
-- Not Tested
NP Non-Plastic

4.0 Subsurface Conditions

4.1 Regional Geology

The site lies on soils of the Piedmont Plateau. According to the United States Department of Agriculture's Natural Resources Conservation Service's Web Soil Survey and Goochland County, Virginia Soil Survey, the most likely soils to be encountered on the site are Louisburg, fine sandy loam (25%-45% eroded slopes) with a small area of

Madison clay loam (15%-25%, severely eroded slopes) at the eastern edge of the site. Louisburg soils are moderately deep to deep, moderately well to excessively drained soil formed material weathered from granite and gneiss and may have shallow bedrock. These soils have rapid runoff velocity and a severe erosion hazard. Typically, the subsoils have a LOW shrink-swell potential with a moderate corrosion potential for concrete and low corrosion potential for uncoated steel. Madison soils are deep, well-drained soil formed material weathered from gneiss and schist with mica. These soils have rapid runoff velocity and a severe erosion hazard. Typically, the subsoils have a LOW shrink-swell potential with a moderate corrosion potential for concrete and high corrosion potential for uncoated steel.

According to a digital copy of the Geological Map of Virginia, this site lies in the Eastern Piedmont geophysical province. Specifically, this site is identified as lying on Porphyroblastic garnet-biotite gneiss, which layered in a varied sequence and is mostly biotite gneiss with garnet and porphyroblastic (large metamorphic crystals in a finer matrix) gneiss mixed with a number of other metamorphic rock types.

4.2 Subsurface Profile

The surface of the study area was covered with four to six inches of topsoil.

The subsoils can be divided into two generalized strata as depicted on the boring logs and summarized below:

Stratum A consists of mostly brown with red or gray hues, sandy, lean CLAY (CL) at all borings from below the topsoil to depths of 2 to 8 feet. This stratum was generally in a moist and medium stiff to hard condition with N-values of 5 to 36 blows per foot (bpf).

Stratum B consists of brown, gray, red, white and/or yellow, silty SANDS with traces of gravel (SM) at all borings from below stratum A to boring termination or auger refusal at depths of 13 to 19.5 feet. This stratum was generally in a dry to moist and medium dense to very dense condition with N-values of 20 to over 50 bpf.

We encountered auger refusal conditions as shallow as 13 feet, which indicates that the

Laboratory testing indicates that the soils on this site are of a LOW Shrink-Swell potential.

4.3 Groundwater Conditions

We did not encounter groundwater at any boring. We observed grey mottles and hues (a generally recognized indicator of a seasonal high-water table or a perched water table) at all borings except B-2 starting generally between 2 and 6 feet in depth. The presence of possible seasonal or perched groundwater conditions may impact the construction activities, such as grading and utility installation, during wet weather conditions. Typically, shallow perched water conditions could occur outside of the normal growing season or between the months of November and April. Groundwater elevations may vary with time of year, and precipitation.

5.0 Analysis and Recommendations

5.1 Site Work Recommendations

5.1.a Site Specifications

- Based on the conceptual grading plan provided, it appears that one to 18 feet of cut will be required for the building pad and up to approximately five feet of fill will be required for the parking lot.
- Anticipated stripping depth of 6 inches of across the site to remove existing topsoil and root mat.
- On-Site Soils at Fill: The contractor should be allowed to use all on-site soils for grading operations on the site.
- Borrow Soil Specifications:
    - Soil should consist of lean CLAYS (**CL**), non-elastic, sandy SILTS (**ML**) with a Liquid Limit less than 40 and no more than 70% passing the 200 sieve or better (**SC, SM, SP, SW, GC, GM, GP, GW**).
    - Open graded aggregates such as VDOT No. 57 stone or other stone that meets the recommendations stated above should also be permitted for use if the excavation is lined with a woven or non-woven geotextile.
- Compaction Specifications by Standard Proctor, ASTM D698:
    - Building Area(s): 95% - one test per 2,500 square feet
    - Parking and Drive Area(s): 95% - one test per 10,000 square feet
    - Landscape Area(s): 90% - one test per 10,000 square feet

5.1.b General Instructions

Generally speaking, all earthwork activities should be performed during the normal construction months of May through October when the contractor is more likely to encounter dry weather conditions. Grading work performed outside of these months will be more difficult and may require undercut and replacement of wet surface soils before the contractor can begin grading operations.

Stripping should take place in all areas within the limits of the tank farm footprint. If soft soil is encountered, the lateral and vertical extent of any undercut should be evaluated in the field by Zannino Engineering. The undercut soils will need to be replaced with compacted fill to provide support for surface slabs or foundations. If compacted fill is used to replace undercut soils below and near foundations, the foundation excavations should be widened one foot for each foot of undercut below design foundation grades. Undercut may be replaced with suitable soils as recommended below in this section of the report.

After stripping, drying (if necessary) and compaction of the exposed subgrade, all proposed pavement and building areas should be subjected to a proof rolling operation in the presence of the geotechnical engineer. Proof rolling should occur with either a loaded tandem dump truck or similar rubber-tired construction equipment by making several overlapping passes with the equipment and observing if any pumping or yielding occurs. Any areas that yield excessively during the proof rolling will require some means of stabilization. If the yielding is due to unsuitable soils, topsoil or foreign material, these areas will need to be undercut and replaced with suitable materials. If

the instability is due to high surface moisture down to as much as 12 inches, the soil may be scarified and dried to acceptable moisture content and re-compacted to the specified densities. If the soil is wet below depths of 12 inches, the wet soil should be undercut and replaced. The existing subgrade where scarified should be compacted to the specification above.

Once a stable subgrade has been achieved, the site-grading contractor may place additional fill as required by the plans.

Both existing grades and fill areas will need to be protected by the contractor during the construction process to prevent the deterioration of soil conditions prior to final grade work.

Samples of any proposed borrow soils should be obtained and tested in the laboratory for maximum dry density and classification. Samples of proposed borrow should be submitted to our soil laboratory for testing at least 1 week prior to construction. The soil to be used as fill should not contain organics or any rock pieces greater than 4 inches in any dimension. The fill should be placed in maximum loose lifts of 8 inches.

Zannino Engineering personnel should monitor the compaction operation and evaluate the soil subgrades prior to placement of fill and foundations.

5.1.c Drainage

The contractor should be responsible for controlling surface water and groundwater during construction as well as completing drainage features required by the construction documents.

5.1.d Difficult Excavation and Rock Excavation

Based on high SPT N-values at some borings, we anticipate the potential for some difficult excavation or rock excavation at deeper cut areas and at lower elevations of the site. Because of the site location, we recommend that difficult excavation and rock excavation be defined in the project specifications in the event that they are encountered.

A sample definition of difficult excavation:

"Material that has N-values of 100 to 200 blows per foot. This material can be excavated by a D-9 bulldozer with a single or double shank ripper though production will be slow. Difficult excavation/weathered rock can be anticipated and shall be accomplished within the base bid."

A sample definition of rock:

"Rock excavation for trenches and pits includes removal and disposal of materials and obstructions encountered that cannot be excavated with a track-mounted power excavator, equivalent to a Caterpillar Model No. 215C LC, rated not less than 115 HP flywheel power and 32,000-pound drawbar pull equipped with a short stick and a 42-inch wide, short tip radius rock bucket rated at 0.81 cubic yard (heaped) capacity.

Trenches in excess of 10 ft in width and pits in excess of 30 ft in either length or width are classified as open excavation."

"Rock excavation in open excavations includes removal and disposal of materials and obstructions that cannot be dislodged and excavated with modern, track-mounted, heavy-duty excavating equipment without drilling or blasting. Rock excavation equipment is defined as Caterpillar Model No. 973 or equivalent track-mounted loader, rated at not less than 210 HP flywheel power and developing minimum of 45,000-pound breakout force (measured in accordance with SAE J732). Typical materials classified as rock are boulders 1 cubic yard or more in volume, solid rock, rock in ledges, and rock-hard cementitious deposits. Intermittent drilling or blasting performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation."

5.2 Foundations and Floor Slab Recommendations

Based on the subsurface conditions at this site, we recommend the following parameters for use in the foundation design:

- Type: conventional spread footings on firm natural soil of controlled fill
- Frost Depth: 18 inches
- Minimum Footing Depth Below Final Exterior Grades: 24 inches
- Minimum Footing Width: 2 feet
- Maximum Allowable Soil Bearing Pressure: 3,000 pounds per square foot

The geotechnical engineer or his designated representative should evaluate the footing subgrade bearing capacity during footing construction. If the recommended bearing capacity is not available, the footing trench should be undercut and replaced with extra concrete for depths of up to 6 inches or #57 Stone for deeper undercuts.

Assuming uniform loading and linear elastic settlement, we estimate maximum total settlements of less than ½ inch, and differential settlement of about half the total settlements between similarly loaded foundations.

5.2.a Seismic Site Classification

The Site Classification as defined in Section 1613 of the International Building Code for this site is Class D. The seismic loading values should be determined from the VCC2015 and ASCE 7-16. The Site Classification was determined based on the results of the soil test borings and our experience with the subsurface conditions in this geographic region. Deep exploration to determine the seismic design criteria was not performed. Using the California Structural Engineer Association's seismicmaps.org model website and the Seismic Site Classification, we calculated the seismic site coefficients as follows:

- S_s (Mapped Spectral Acceleration for short periods) = 0.364
- S_1 (Mapped Spectral Acceleration for 1 sec period) = 0.068
- Fa (Seismic Site Coefficient for short period) = 1.51
- Fv (Seismic Site Coefficient for 1 sec period) = 2.4
- S_{ms} (Maximum considered earthquake spectral response for short periods) = 0.549

- S_{m1} (Maximum considered earthquake spectral response for 1 sec. periods) = 0.164
- S_{Ds} (Design earthquake spectral response for short periods) = 0.366
- S_{D1} (Design earthquake spectral response for 1 sec. periods) = 0.109

5.2.b Surface Slabs

Surface slabs may be supported on firm natural soil or compacted structural fill. Some re-compaction of the soil may be required due to disturbance from underground utility trench installation. Utility backfill should also conform to the compaction requirements recommended above. A modulus of subgrade reaction of 100 pci (pounds per cubic inch) may be used to design the slab. A 4-inch layer of free draining granular material such as #57 Stone should underlie the concrete slab.

6.0 Continuing Services

Based on our existing familiarity with this project as well as other projects in Goochland County, we suggest that we be hired to provide construction testing and Special Inspections services for this project. We can provide a separate proposal for these services upon request.

7.0 Limitations

This report has been prepared for use by Sekiv Solutions and their agents to aid in the design of this project. The report has been prepared in accordance with generally acceptable geotechnical engineering practices and no other warranties, either expressed or implied, are made.

Recommendations presented in this report are based on data obtained from test borings drilled by others at the locations shown on the boring location drawing. Variations occurring between borings may not become evident until or during construction. If significant variations are noted, we should be contacted so that field conditions can be evaluated and applicable recommendations revised, if necessary.

If changes in the nature, design or location of the structure are planned, the conclusions and recommendations presented herein should not be considered valid unless we have reviewed the changes and modified or verified the conclusions and recommendations.

FIGURE 1
SITE LOCATION PLAN
SOURCE: GOOGLE EARTH 2022
SCALE: NOT STANDARD

Zannino Engineering, Inc.

Proposed Metal Building
2730 Maidens Loop
Goochland County, VA

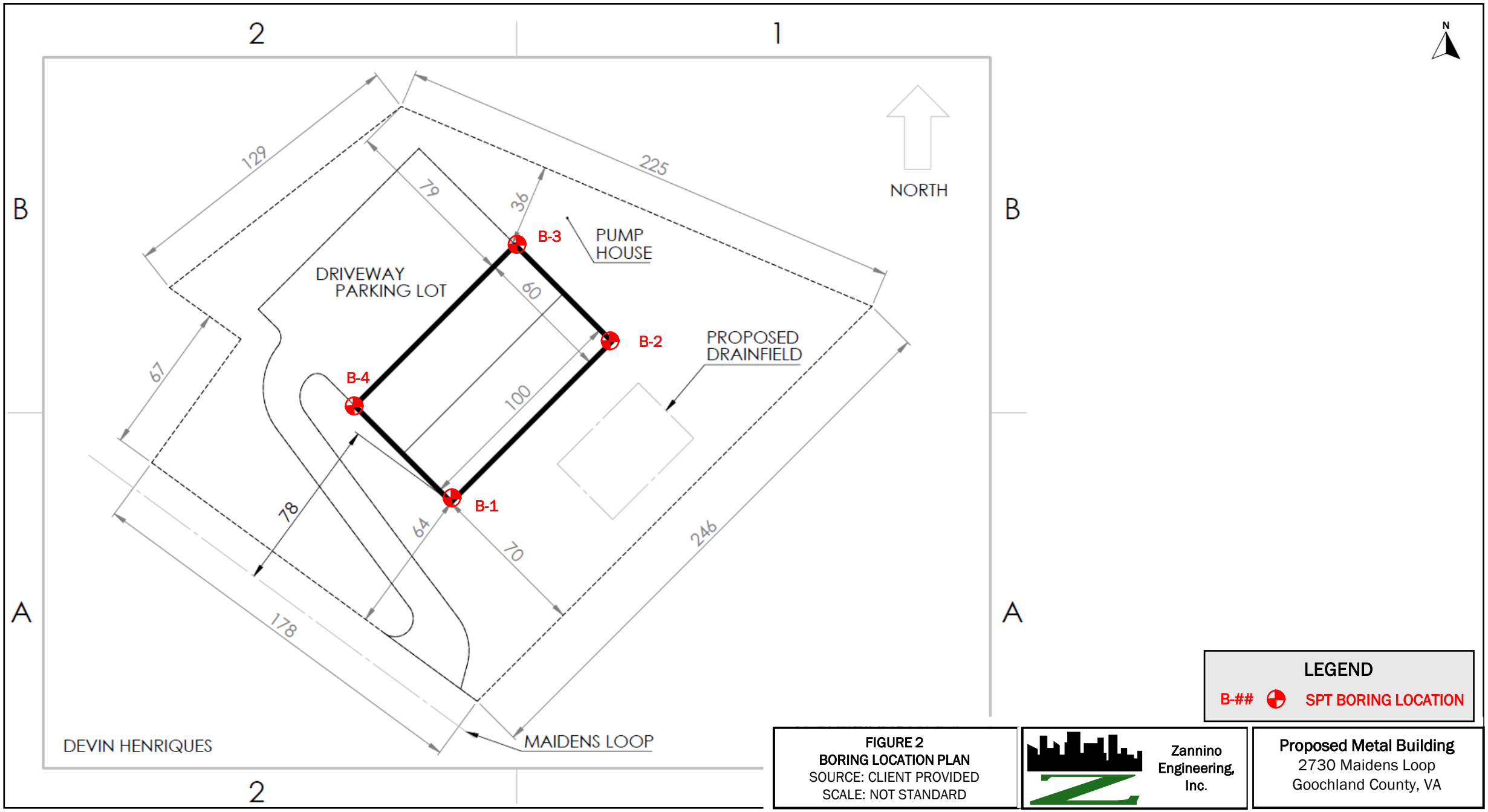


FIGURE 2
BORING LOCATION PLAN
SOURCE: CLIENT PROVIDED
SCALE: NOT STANDARD

Zannino Engineering, Inc.

Proposed Metal Building
2730 Maidens Loop
Goochland County, VA

REFERENCE NOTES FOR BORING LOGS

I. TYPICAL DRILLING AND SAMPLING METHODS:

Hollow Stem Auger (**HSA**) or Mud-Rotary (**Wash**) with Split Spoon Sampling (**SPT**= Standard Penetration Test or **N-Value**). Rock Coring is performed with NX size core barrel unless otherwise noted on logs.

II. CORRELATION OF PENETRATION RESISTANCES TO SOIL PROPERTIES:

COHESIVE SOILS
(CLAYS, SILTS AND COMBINATIONS)
[CL, CH, ML AND MH]

CONSISTENCTY	SPT, N (BLOWS/FT.)	UNDRAINED SHEAR STRENGTH, C (PSF)
VERY SOFT	0-1	<250
SOFT	2-4	250-500
MEDIUM STIFF	5-8	500-1000
STIFF	9-15	1000-2000
VERY STIFF	16-30	2000-4000
HARD	>31	>4000

NON-COHESIVE SOILS
(SAND AND GRAVEL AND COMBINATIONS)
[SC, SM, GW, GP, GM AND GC]

DENSITY	SPT, N (BLOWS/FT.)
VERY LOOSE	0-3
LOOSE	4-9
MEDIUM DENSE	10-29
DENSE	30-50
VERY DENSE	>50

III. VISUAL IDENTIFICATION CRITERIA AND TERMS

- ❖ BOULDERS: 12" (+) diameter (considered rounded pieces of rock)
- ❖ COBBLES: 3" to 12" diameter (considered rounded pieces of rock)
- ❖ GRAVEL: COARSE: 3/4" to 3"
  FINE: No. 4 Sieve Opening (4.76 mm) to 3/4"
- ❖ SAND: COARSE: No. 10 Sieve to No. 4 Sieve (diameter of a heavy broom straw)
  MEDIUM: No. 40 Sieve to No. 10 Sieve (diameter of a pencil lead)
  FINE: No. 200 Sieve to No. 20 Sieve (diameter of a human hair)
- ❖ FINES (SILT/CLAY): Material passing No. 200 Sieve
- ❖ DISINTEGRATED ROCK: Residual rock materials with an SPT between 60 bpf and refusal. Refusal is defined as a SPT of 100 blows for 2" or less of penetration. **Rock Fragments** are angular pieces of rock which have separated from the original vein or strata and are present in a soil matrix.
- ❖ FILL: Man-made deposits containing soil, rock and often foreign matter
- ❖ SOIL DESCRIPTION MODIFERS:
  TRACE: 1% to 15%
  SOME: 15% to 35%
  AND/WITH: 35% to 50%

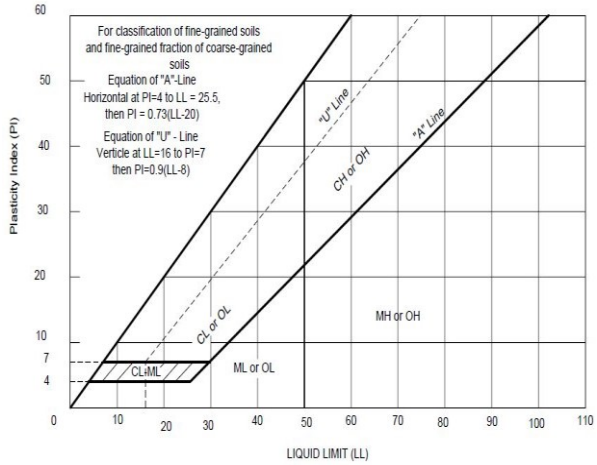
IV MOISTURE DESCRIPTIONS

- ❖ SATURATED: Very wet to liquified. Usually below the groundwater table.
- ❖ WET: Significant moisture is visually present on soil particles and in void spaces
- ❖ MOIST: Soil particles are damp, but free water is not visually present.
- ❖ DRY: Soil material is somewhat friable and dusty.

NOTE: The water level indicated on the boring logs are those water levels actually measured in the borehole at the times indicated on the boring log. The measurements are relatively reliable when augering and without adding drilling fluids in a granular soil. In clays and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurements are generally applied.

UNIFIED SOIL CLASSIFICATION SYSTEM - "USCS CHART" (ASTM D 2487)

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL and GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	**CLEAN GRAVELS** (LITTLE OR NO FINES)	---	**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			---	**GP**	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	---	**GM**	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			---	**GC**	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND and SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	**CLEAN SANDS** (LITTLE OR NO FINES)	---	**SW**	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			---	**SP**	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	---	**SM**	SILTY SANDS, SAND-SILT MIXTURES
			---	**SC**	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	**"LOW PLASTICITY"** LIQUID LIMIT LESS THAN 50	---	**ML**	INORGANIC SILTS, CLAYEY SILTS, SILT-VERY FINE SAND MIXTURES, ROCK FLOUR
			---	**CL**	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTY &Lean clays
			---	**OL**	ORGANIC SILTS AND ORGANIC CLAYS OR LOW PLASTICITY
		"HIGH PLASTICITY" LIQUID LIMIT GREATER THAN 50	---	**MH**	INORGANIC ELASTIC SILTS, MICACEOUS AND DIATOMACEOUS ELASTIC SILTY SOILS
			---	**CH**	INORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, FAT CLAYS
			---	**OH**	ORGANIC CLAYS OR HIGH PLASTICITY, ORGANIC SILTS
OTHER SOILS	HIGHLY ORGANIC SOILS		---	**PT**	PEAT, HUMMUS, MUCK, SWAMP SOILS WITH VERY HIGH ORGANIC CONTENTS
	UNCONTROLLED FILLS		---	DISTURBED SOILS WITH POSSIBLE DECRIS AND RUBBLE, OLD CONSTRUCTION WASTES, NON-ENGINEERED BACKFILLS	
	DECOMPOSED OR PARTIALLY WEATHERED ROCK		---	TRAINSITIONAL MATERIAL BETWEEN SOILS AND ROCK WHICH RETAIN THE RELICT STRUCTURES OF THE PARENT ROCK	



BOULDERS:		Greater than 300 mm (12 in.)
COBBLES:		75 mm to 300 mm (3-12 in.)
GRAVEL:	COARSE:	19.0 mm to 75 mm (0.75 - 3 in.)
	FINE:	4.75 mm to 19.0 mm (#4 - 0.75 in.)
SANDS:	COARSE:	2.00 mm to 4.75 mm (No. 10 Sieve - No. 4 Sieve)
	MEDIUM:	0.425 mm to 2.00 mm (No. 40 Sieve - No. 10 Sieve)
	FINE:	0.075 mm to 0.425 mm (No. 200 Sieve - No. 40 Sieve)
SILTS/CLAYS:		less than 0.075 mm (Finer than No. 200 Sieve)

PLASTICITY INDEX (PI) & SHRINK SWELL POTENTIAL

0--4	None
4--15	Slight or Low
15--30	Medium to High
31+	High to Very High

ADDITIONAL RELATIVE DESCRIPTIVE VALUES

Trace: <15% Some: 15%to 35% And/With: 35%to 50%

BORING LOG

ZANNINO ENGINEERING, INC.	**BORING NO.** B-1
PROJECT NAME: 2730 Maidens Loop	**SHEET** 1 of 1
LOCATION: Maidens, Goochland County, Virginia 23102	
PROJECT NUMBER: 22-0126	**SURFACE ELEV. (FT):** 196
DRILLING METHOD: Hollow-stem Auger	**DRILLER:** Houff Drilling
BORING STARTED: 5/12/2022	**COMPLETED:** 5/12/2022

ELEV. (FEET)	DEPTH (FEET)	SAMPLE	DESCRIPTION OF MATERIALS (CLASSIFICATION)	BLOWS	N (bpf)	PPT	STRATUM	NOTES
	0		TOPSOIL - 4"	2				
195		1	Brown, sandy, lean CLAY, CL, moist, stiff	8 5 5	13			
			Grayish-brown, sandy, lean CLAY with gravel, CL, moist, hard	6 13 23	36		A	
192	3	2		18				
		3	Brown, sandy, lean CLAY, CL, moist, hard	5 14 21 40	35			FFE = 191.50 FT
189	6	4	Grayish-brown, silty SAND with gravel, SM, moist, very dense	11 50	50			Soil appears to be multilayered NMC = 8.9%
		5	Brown, silty SAND with gravel, SM, moist, very dense	26 50	50		B	
186	9							
183	12	6	Brown, silty SAND with gravel, SM, dry, very dense	50	50			
180	15		AUGER REFUSAL AT 15 FEET				-	
177	18							
	21							

WATER DEPTH AFTER DRILLING: DRY	**CAVE-IN DEPTH:** 13.5 FT

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES.
THE STANDARD PENETRATION RESISTANCE (N-VALUE) IS THE SUM OF THE 2nd AND 3rd SET OF BLOWS (6" INCREMENTS) REQUIRED TO DRIVE A 2" O.D. (1.375" I.D.) SPLIT-SPOON SAMPLER A DISTANCE OF 18" OR 24", USING A 140 LB. HAMMER DROPPING 30".

BORING LOG

ZANNINO ENGINEERING, INC.	**BORING NO.** B-2
PROJECT NAME: 2730 Maidens Loop	**SHEET** 1 of 1
LOCATION: Maidens, Goochland County, Virginia 23102	
PROJECT NUMBER: 22-0126	**SURFACE ELEV. (FT):** 202
DRILLING METHOD: Hollow-stem Auger	**DRILLER:** Houff Drilling
BORING STARTED: 5/12/2022	**COMPLETED:** 5/12/2022

ELEV. (FEET)	DEPTH (FEET)	SAMPLE	DESCRIPTION OF MATERIALS (CLASSIFICATION)	BLOWS	N (bpf)	PPT	STRATUM	NOTES
	0		TOPSOIL - 6"	2				
201		1	Reddish-brown, sandy, lean CLAY, CL, moist, stiff	5 7 7	12			
			Reddish-brown, sandy, lean CLAY with mica, CL, moist, stiff	2 5				
	3	2		5	10			
198				5				
		3	Yellowish-brown, sandy, lean CLAY, CL, moist, stiff	4 5 8	13		A	
				8				
	6		Yellowish-brown, sandy lean CLAY with gravel, CL, moist, very stiff	4 9				
195		4		14	23			
				15				
		5	Yellow and white, silty SAND with gravel, SM, moist, dense	10 13	32			FFE = 191.50 FT
	9			19				
192				13				
	12							
189								
		6	Yellowish-brown, silty, fine to coarse grained SAND with trace gravel, SM, moist, medium dense	6 8	20		B	NMC = 15.5%
				12				
	15			15				
186								
	18							
183		7	Brown, silty SAND with gravel, SM, moist, very dense	12 19	69			
				50				
			Boring terminated at 19.5 feet				-	
	21							

WATER DEPTH AFTER DRILLING: DRY	**CAVE-IN DEPTH:** 14.75 FT

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES.
THE STANDARD PENETRATION RESISTANCE (N-VALUE) IS THE SUM OF THE 2nd AND 3rd SET OF BLOWS (6" INCREMENTS) REQUIRED TO DRIVE A 2" O.D. (1.375" I.D.) SPLIT-SPOON SAMPLER A DISTANCE OF 18" OR 24", USING A 140 LB. HAMMER DROPPING 30".

BORING LOG

ZANNINO ENGINEERING, INC.	**BORING NO.** B-3
PROJECT NAME: 2730 Maidens Loop	**SHEET** 1 of 1
LOCATION: Maidens, Goochland County, Virginia 23102	
PROJECT NUMBER: 22-0126	**SURFACE ELEV. (FT):** 192
DRILLING METHOD: Hollow-stem Auger	**DRILLER:** Houff Drilling
BORING STARTED: 5/12/2022	**COMPLETED:** 5/12/2022

ELEV. (FEET)	DEPTH (FEET)	SAMPLE	DESCRIPTION OF MATERIALS (CLASSIFICATION)	BLOWS	N (bpf)	PPT	STRATUM	NOTES
	0	1	TOPSOIL - 4"	3	18		A	FFE = 191.50 FT
			Brown, sandy, lean CLAY, CL, moist, very stiff	6				
				12				
				18				
189	3	2	Grayish-brown, silty SAND, SM, moist, medium dense	6	23		B	NMC = 10.8%
				8				
				15				
				15				
		3	Brownish-red, silty SAND with gravel, SM, moist, very dense	12	62			
				29				
				33				
186	6			35				
		4	Brown, silty SAND with gravel, SM, dry, very dense	26	50			NMC = 6.7%
				50				
		5	Brown, silty SAND with gravel, SM, dry, very dense	20	50			
183	9			50				
180	12		AUGER REFUSAL AT 13 FEET				-	
177	15							
174	18							
171	21							

WATER DEPTH AFTER DRILLING: DRY	**CAVE-IN DEPTH:** 9.6 FT

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES.
THE STANDARD PENETRATION RESISTANCE (N-VALUE) IS THE SUM OF THE 2nd AND 3rd SET OF BLOWS (6" INCREMENTS) REQUIRED TO DRIVE A 2" O.D. (1.375" I.D.) SPLIT-SPOON SAMPLER A DISTANCE OF 18" OR 24", USING A 140 LB. HAMMER DROPPING 30".

BORING LOG

ZANNINO ENGINEERING, INC.	**BORING NO.** B-4
PROJECT NAME: 2730 Maidens Loop	**SHEET** 1 of 1
LOCATION: Maidens, Goochland County, Virginia 23102	
PROJECT NUMBER: 22-0126	**SURFACE ELEV. (FT):** 194
DRILLING METHOD: Hollow-stem Auger	**DRILLER:** Houff Drilling
BORING STARTED: 5/12/2022	**COMPLETED:** 5/12/2022

ELEV. (FEET)	DEPTH (FEET)	SAMPLE	DESCRIPTION OF MATERIALS (CLASSIFICATION)	BLOWS	N (bpf)	PPT	STRATUM	NOTES
	0		TOPSOIL - 6"	2				
		1	Red, sandy, lean CLAY, CL, moist, medium stiff	2 3 8	5			
192								
			Reddish-brown, fine to coarse grained sandy, lean CLAY, CL, moist, stiff	3 5 7 7	12		A	FFE = 191.50 FT NMC = 28.4%
	3	2						
		3	Brown, silty SAND with gravel, SM, moist, medium dense	6 8 14 24	22			
189								
	6		Gray and white, silty SAND with gravel, SM, dry, very dense	12 16 36 35	52			
		4						
186								
		5	Brownish-white, silty SAND with gravel, SM, dry, very dense	29 50	50		B	NMC = 5.8%
	9							
183								
	12							
		6	NO RECOVERY, very dense	50				
180			BORING TERMINATED AT 13.5 FEET				-	
	15							
177								
	18							
174								
	21							

WATER DEPTH AFTER DRILLING: DRY	**CAVE-IN DEPTH:** 10.25 FT

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES.
THE STANDARD PENETRATION RESISTANCE (N-VALUE) IS THE SUM OF THE 2nd AND 3rd SET OF BLOWS (6" INCREMENTS) REQUIRED TO DRIVE A 2" O.D. (1.375" I.D.) SPLIT-SPOON SAMPLER A DISTANCE OF 18" OR 24", USING A 140 LB. HAMMER DROPPING 30".

Particle Size Distribution Report

ASTM D6913

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	2.9	11.8	42.8	42.1	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/8"	100.0			
#4	99.6			
#10	96.7			
#16	93.9			
#40	84.9			
#100	64.3			
#200	42.1			

* (no specification provided)

Material Description

Yellowish-brown, silty, fine to coarse grained SAND with trace gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Classification

USCS= SM AASHTO= A-4(0)

Test Remarks

NMC = 15.5%

Source of Sample: B-2 Depth: 13
Sample Number: 6

Sample Date: 5/12/2022

ZANNINO ENGINEERING, INC.

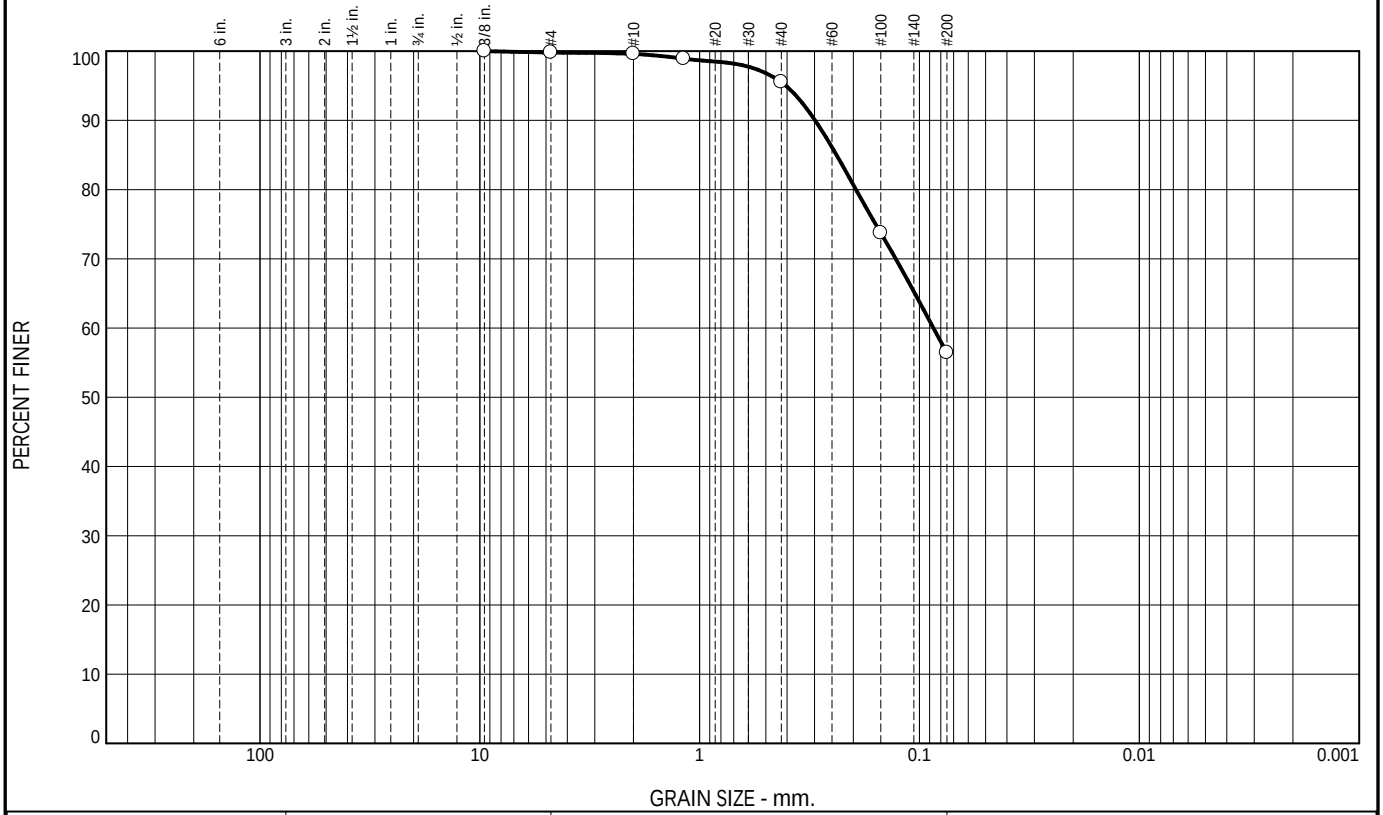
Client: Sekiv Solutions
Project: 2730 Maidens Loop

Project No: 22-0126 Figure

Tested By: Greg Cox Checked By: Grant Missimer

Particle Size Distribution Report

ASTM D6913



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.2	4.1	39.1	56.4	

Test Results (ASTM D6913)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
3/8"	100.0			
#4	99.8			
#10	99.6			
#16	98.9			
#40	95.5			
#100	73.7			
#200	56.4			

* (no specification provided)

Material Description

Reddish-brown, fine to coarse grained sandy, lean CLAY

Atterberg Limits

PL= 22.5 LL= 34.7 PI= 12.2

Classification

USCS= CL AASHTO= A-6(5)

Test Remarks

NMC = 28.4%

Source of Sample: B-4 Depth: 2
Sample Number: 2

Sample Date: 5/12/2022

ZANNINO ENGINEERING, INC.

Client: Sekiv Solutions
Project: 2730 Maidens Loop

Project No: 22-0126 Figure

Tested By: Greg Cox Checked By: Grant Missimer

To: Commercial Geotechnical Engineering Study and Residential Soil Study Clients

Regarding: Storing of Soil Samples Following your Final Report

Thank you for choosing Zannino Engineering to complete the shrink-swell soil study for your proposed construction project.

Unless you request otherwise, we will preserve and store the soil samples from your report for thirty (30) days from the date of your final report. After those thirty days, we will dispose of the samples in order to make room for new samples. If, for some reason, you believe you will need these samples after those thirty days, please notify us immediately.

We greatly appreciate your business and look forward to working with you again soon.

Sincerely,
ZANNINO ENGINEERING, INC.

Mark E. McLain

Mark E. McLain, P.E.
Engineering Services Manager