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August 8, 2018

Trinitas Ventures, LLC
201 Main Street, Suite 1000
Lafayette, IN 47901
Attn.: Ms. Kimberly Hansen
Manager, Design & Development

Subject: **Preliminary Geotechnical Engineering Services Addendum Report**
Proposed Student Housing Development
Seven (7) Parcels in the vicinity of 959 Dryden Road
Ithaca, Tompkins County, New York 14850
PSI Project No.: 0806962 – Addendum Report

Dear Ms. Hansen:

Thank you for choosing Professional Service Industries Engineering, PLLC (PSIE, PLLC) as your consultant for the above referenced project.

Per your authorization, Professional Service Industries Engineering, PLLC has completed a Preliminary Geotechnical Engineering Study for the above referenced project. The results of the study are discussed in the accompanying report. An electronic PDF copy has previously been emailed.

Please note that the executed subsurface exploration scope of work is considered preliminary. Additional test borings will be required to provide final recommendations. This work should be performed after the building locations within the site and building footprint(s) have been established.

It is considered imperative that the geotechnical engineer and/or their representative be present during earthwork operations, foundation and floor slab installations to observe the field conditions with respect to the design assumptions and specifications. Professional Service Industries Engineering, PLLC will not be held responsible for interpretations and field quality control observations made by others.

Should there be any questions, please do not hesitate to contact our office at (716) 694-8657. Professional Service Industries Engineering, PLLC would be pleased to continue providing geotechnical services throughout the implementation of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES ENGINEERING, PLLC

Steven Pump

Paul S. Hundley

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Branch Manager

David B. Sabol, PE
Vice President

Paul S. Hundley
Principal Consultant

PRELIMINARY GEOTECHNICAL ENGINEERING SERVICES ADDENDUM REPORT

For the proposed

STUDENT HOUSING DEVELOPMENT
SEVEN (7) PARCELS IN THE VICINITY OF 959 DRYDEN ROAD
ITHACA, TOMPKINS COUNTY, NEW YORK 14850

Prepared for

Trinitas Ventures, LLC
201 Main Street, Suite 1000
Lafayette, IN 47901

Prepared by

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PSI PROJECT NO.: 0806962 – ADDENDUM

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1 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Professional Service Industries Engineering, PLLC (PSIE, PLLC) has completed a preliminary geotechnical engineering exploration for the proposed Student Housing Development project located at on seven (7) parcels of land in the vicinity of 959 Dryden Road in Ithaca, Tompkins County, New York. Written authorization to proceed with this geotechnical engineering evaluation and analysis was provided by Ms. Kimberly Hansen, Manager, Design & Development of Trinitas Ventures, LLC in the form of a signed copy of PSI Proposal No. 0806-237428 by Ms. Kimberly Hansen on March 6, 2018. Professional Service Industries Engineering, PLLC's services for this project were performed in accordance with PSI Proposal No. 0806-237428, dated March 5, 2018 and 0806-237428 – Rev. 1, dated June 18, 2018.

1.2 PROJECT DESCRIPTION

Project information was obtained from Mr. Damian VanMatre, Vice President with Trinitas Ventures, LLC. The following drawings were provided to develop the scope of work:

- One (1) Trinitas Ventures, LLC project drawing un-dated, un-numbered, and titled "The Project" containing the approximate property boundaries and the locations of the existing on-site and surrounding structures.

Based on the information provided, it is understood that the project is going to consist of the construction of one-hundred ninety-five (195) new two-story cottage and three-story townhome structures having a concrete slab-on-grade floor system to be located on seven (7) parcels of land in the vicinity of 959 Dryden Road in Ithaca, Tompkins County, New York. It is unknown if the structures will be steel and/or wood frame with block walls or masonry bearing wall construction. Asphaltic concrete parking and drive areas and Portland cement concrete sidewalks are also planned.

Structural loadings and grade changes were not provided. Therefore, this report is based upon wall loadings of three (3) kips per lineal foot, column loads, if any, of seventy-five (75) kips. The floor slab design is based on a maximum floor load of one hundred fifty (150) psf.

At this time, specific building locations, the proposed Finished Floor Elevations (FFE), and final grading plans were not provided. Therefore, this preliminary report is based upon the proposed building(s) footprint(s) and parking area and drive area final grades relatively following the existing site topography. It is estimated that the proposed building(s) footprint(s) and parking lot and drive areas will require earthwork operations consisting of between two (2) and three (3) feet of cut and fill to achieve final grades after removal of the topsoil and/or surficial materials. If the final grading plans and proposed building locations are known, we request to be retained to review the grading plans and submit supplemental recommendations based on these plans, if appropriate.

Vehicle and pavement loadings are indicated to be automobile traffic only; however some truck traffic is expected to service the facility. Therefore, vehicle and pavement loadings and asphaltic concrete pavement criteria for this report are as follows:

Design Life (years):	20
Terminal Serviceability:	2.5
Reliability Level	85%
Initial Serviceability:	4.2
Standard Deviation for	
Flexible Pavement:	0.45
Rigid Pavement:	0.35

In addition, the report is based upon *light duty* pavement having an Equivalent Single Axle Loading of 7,500 ESALs and *heavy duty* pavement having an Equivalent Single Axle Loading of 75,000 ESALs, respectively.

The information presented in this section was used in our evaluation. Estimated loads and corresponding foundation sizes have a direct effect on the recommendations, including the type of foundation, the allowable bearing pressure, and the estimated settlement. In addition, estimated subgrade elevations and cut/fill amounts can have a direct effect on the provided recommendations. If any of the noted information has changed or additional information becomes available, PSIE, PLLC should be notified so that we may amend the recommendations presented in this report, if appropriate.

Please note that the executed subsurface exploration scope of work is considered preliminary. Additional test borings will be required to provide final recommendations. This work should be performed after the building locations within the site and building footprint(s) have been established.

1.3 PURPOSE AND SCOPE OF WORK

1.3.1 FIELD EXPLORATION

The purpose of this preliminary study was to evaluate the subsurface conditions at the site and to develop preliminary geotechnical related foundation, slab-on-grade, pavement, and fill recommendations. Professional Service Industries Engineering, PLLC's scope of services included site reconnaissance of the project area, a review of geologic maps of the area, and drilling eighteen (18) test borings within the project area, performed in two (2) phases. Phase I of the field drilling consisted of using a truck mount drill rig to perform nine (9) test borings within the project area to boring termination and/or auger refusal depths ranging from twenty-one (21) to twenty-five (25) feet below the existing ground surface on March 28 and 29, and April 9, 2018. Phase II of the field drilling consisted of using a track mount drill rig (performed by NYEG Drilling, LLC) to perform nine (9) test borings within the project area to boring termination and/or auger refusal depths ranging from twenty-one (21) to twenty-seven (27) feet below the existing ground surface on July 16, 17, and 18, 2018. The split spoon sampling procedures used during this exploration are in basic accordance with ASTM Designation D-1586.

Professional Service Industries Engineering, PLLC selected the borings' positions and the borings' depths. The borings were located in the field by representatives of PSIE, PLLC by measuring distances from known reference points. Top-of-hole elevations were not determined or provided for this preliminary report. Following completion of the field services, the recovered soil samples were returned to PSIE, PLLC's office for review, evaluation, and laboratory testing. The results of PSIE PLLC's subsurface exploration and soil sample documentation and testing are presented herein together with geotechnical recommendations for site preparation and building foundation support.

As directed by the client, PSIE, PLLC did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Client further acknowledges that site conditions are outside of PSIE, PLLC's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSIE, PLLC cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

The scope of services also does not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

1.3.2 LABORATORY TESTING

The samples obtained during the drilling operation were placed in sealed and labeled containers and transported to our North Tonawanda, New York laboratory. Representative soil samples were selected for laboratory testing to determine their index properties. The laboratory-testing program included: natural moisture content determination tests (ASTM D2216). The laboratory test results are presented further within the report. Laboratory testing was performed in general accordance with ASTM procedures. Unless otherwise informed, the soil samples will be discarded ninety (90) days from the issuance of the report.

2 SITE AND SUBSURFACE CONDITIONS

2.1 SITE LOCATION AND DESCRIPTION

The project site is located on seven (7) parcels of land in the vicinity of 959 Dryden Road in Ithaca, Tompkins County, New York. Primary access to the property is from either Dryden Road or Mt. Pleasant Road. The Boring Location Plan in the Appendix indicates the location of the seven (7) parcels of land with respect to Dryden Road and Mt. Pleasant Road.

Figure 1 – Site Location Map

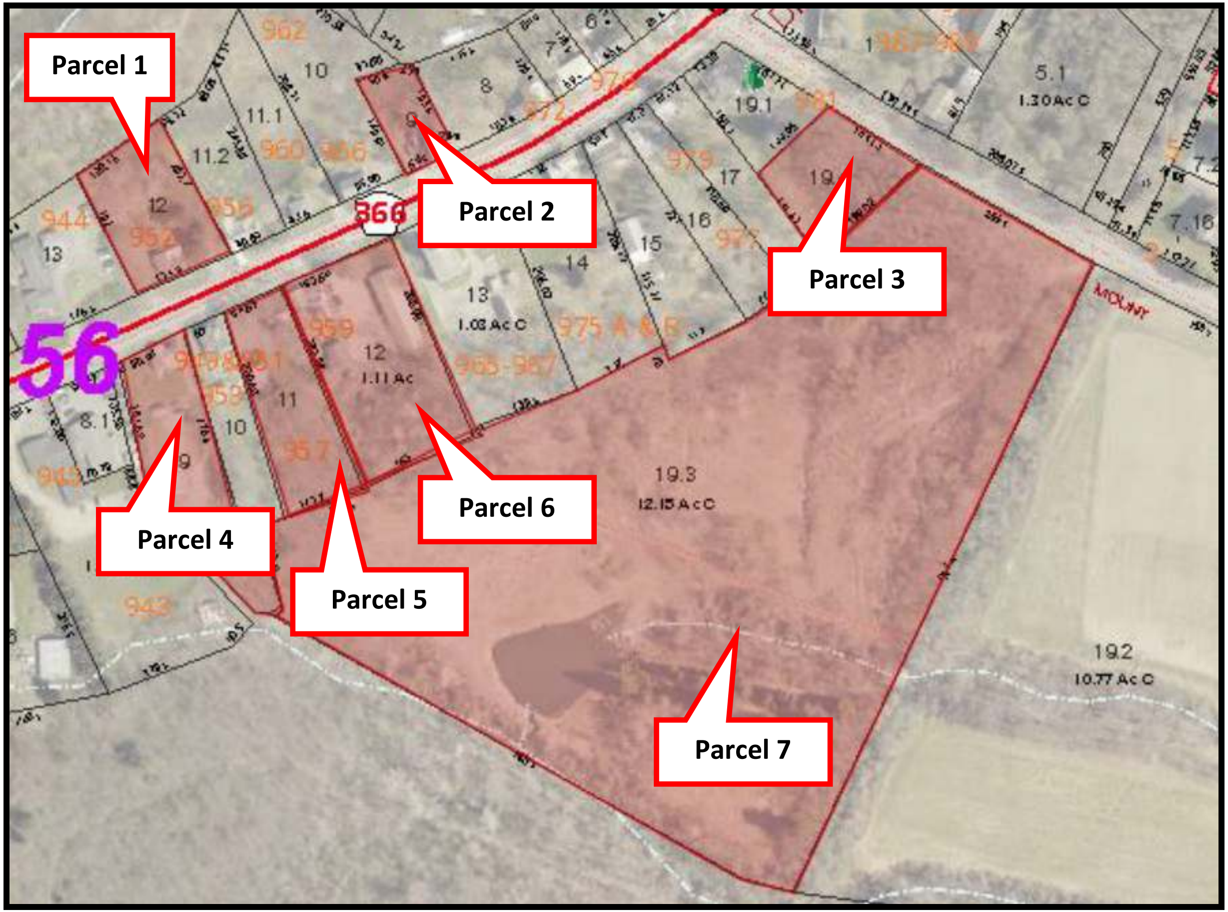


Image obtained from Bing Maps ™

At the time of the drilling operations, the site PSIE, PLLC is designating as "Parcel 1" contained a two-story wood framed residential structure with an associated aggregate driveway. The remainder of the site was surfcially covered in grass with scattered mature trees. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from northwest to southeast towards Dryden road approximately two (2) to three (3) feet. At the time of drilling operations and boring layout, no ponded water surfaces, drainage ditches, or catch basins were observed within the proposed project area. During the field operations, the truck-mounted drill rig experienced some difficulty accessing and traversing the site surface and boring locations due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt.

At the time of the drilling operations, the site PSIE, PLLC is designating as "Parcel 2" contained a two-story wood framed residential structure with an associated aggregate driveway. The remainder of the site was surfcially covered in grass with dense brush cover and mature trees located to the rear or north side of the property. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from northwest to southeast towards Dryden road approximately two (2) to three (3) feet. At the time of drilling operations and boring layout, no ponded water surfaces, drainage ditches, or catch basins were observed within the proposed project area. During the field operations, the truck-mounted drill rig experienced difficulty accessing and traversing the site surface and boring locations due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt.

At the time of the drilling operations, the site PSIE, PLLC is designating as “Parcel 3” was currently undeveloped and contained dense brush cover and mature trees. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from southeast to northwest approximately ten (10) to fifteen (15) feet. At the time of drilling operations and boring layout, no ponded water surfaces, drainage ditches, or catch basins were observed within the proposed project area. During the field operations, the truck-mounted drill rig experienced some difficulty accessing and traversing the site surface and boring locations due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt.

At the time of the drilling operations, the site PSIE, PLLC is designating as “Parcel 4” contained three (3) two-story wood framed residential structures and a single-story garage structure, with an associated asphaltic concrete pavement driveway. The remainder of the site was surfcially covered in grass along with medium dense brush cover and/or mature trees located along the west, east, and south property lines. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from south to north towards Dryden road approximately three (3) to four (4) feet. At the time of drilling operations and boring layout, no ponded water surfaces, drainage ditches, or catch basins were observed within the proposed project area. During the field operations, the truck-mounted drill rig experienced some difficulty accessing and traversing the site surface and boring locations due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt.

At the time of the drilling operations, the site PSIE, PLLC is designating as “Parcel 5” contained a two-story wood framed residential structure with an associated aggregate driveway. The remainder of the site was surfcially covered in grass with scattered mature trees. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from northwest to southeast towards Dryden road approximately three (3) to four (4) feet. At the time of drilling operations and boring layout, no ponded water surfaces, drainage ditches, or catch basins were observed within the proposed project area. During the field operations, the truck-mounted drill rig experienced some difficulty accessing and traversing the site surface and boring locations due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt.

At the time of the drilling operations, the site PSIE, PLLC is designating as “Parcel 6” contained a single-story wood framed commercial structure with an associated aggregate driveway and parking areas. The remainder of the site was surfcially covered in grass with dense brush cover and mature trees located to the rear or south side of the property. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from south to north towards Dryden road approximately four (4) to six (6) feet. At the time of drilling operations and boring layout, no ponded water surfaces, drainage ditches, or catch basins were observed within the proposed project area. During the field operations, the truck-mounted drill rig experienced some difficulty accessing and traversing the site surface and boring locations due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt.

At the time of the drilling operations, the site PSIE, PLLC is designating as "Parcel 7" was currently undeveloped and contained medium dense to very brush cover and mature trees. Within the northeastern portion of the site near the access point off of Mt. Pleasant Road, various piles of fill and/or debris were observed. Please see Figure 2 for an example of the piles of fill and/or debris observed at the site. Based on visual observations of the site by a PSIE, PLLC representative, it appears that the site slopes downward from southeast to northwest approximately twenty (20) to fifty (50) feet. At the time of drilling operations and boring layout, no drainage ditches or catch basins were observed within the proposed project area. However, a pond was observed within the southwestern portion of the site. During the field operations, due to the wet/loose/soft surficial soils due to recent rain events and/or snow melt along with medium dense to dense brush cover, the truck mounted drill rig was not able to access some of the boring locations.

Figure 2 – Various Piles of fill and/or Debris Located in the Northeastern portion of the Site.

2.2 SUBSURFACE CONDITIONS

2.2.1 LOCAL GEOLOGY

The project site in Dryden, Tompkins County, New York area is located within the glaciated portion of the Finger Lakes physiographic province. As noted on the 1986 "Surficial Geologic Map of New York", surface soils in the area generally consist of lacustrine silt and clay. Bedrock in the general site area is part of the Paleozoic, upper Devonian age, Genesee Group and Tully Limestone Group which consists of West River Shale, Genundewa Limestone, Penn Yan and Geneseo Shales. Glacial imprints dominate the landscapes of central New York. Only small areas remain of the prior landforms that existed prior to the Pleistocene glaciation. Post-glacial processes have reshaped the flood plains and valley walls. In areas of steep slope, a cover of drift generally mantles the bedrock.

2.2.2 TEST BORINGS

Professional Service Industries Engineering, PLLC performed a total of eighteen (18) test borings at the site. These borings were drilled on March 28 and 29, and April 9, 2018 for Phase I and July 16, 17, and 18, 2018 for Phase II. Professional Service Industries Engineering, PLLC selected the borings' positions and selected the borings' depths. The borings were located in the field by a representative of PSIE, PLLC by measuring distances from known reference points and located to avoid conflict with existing utilities. Professional Service Industries Engineering, PLLC notified Dig Safely New York for public utility clearance, prior to drilling the site.

The borings were advanced with hollow stem augers to boring termination and/or auger refusal depths ranging from twenty-one (21) to twenty-seven (27) feet below the existing ground surface. For each boring, Standard Penetration Tests (SPT's) were performed and split spoon samples were obtained at regular intervals to the boring termination depth. The split spoon sampling procedures used during this exploration are in basic accordance with ASTM Designation D-1586. The soil samples will be stored in our laboratory for further analysis, if requested. Unless notified otherwise, the samples will be disposed of after six (6) months.

The soil types encountered at the specific boring locations (see Boring Location Diagram) are presented in the form of individual soil profiles on the attached Boring Logs. The stratification presented is based on visual examination of the recovered soil samples and the interpretation of field logs by a geotechnical professional. Included on the profiles are the Standard Penetration Test values (N-values) for the borings. The N-values have been empirically correlated with various soil properties and are considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive soils. A brief description of the soils encountered at this site is presented in this section.

The following subsurface description is of a generalized nature and intended to highlight the major subsurface stratification features and material characteristics. Professional Service Industries Engineering, PLLC was not provided with existing topographic information; therefore, ground surface elevations are not presented on the boring logs or referenced in this report. Professional Service Industries Engineering, PLLC recommends that the boring positions be established by a licensed surveyor. The Boring Logs illustrated in the Appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data. The stratifications shown on the Boring Logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.

TOPSOIL: At the ground surface at boring locations B-3, B-5, B-7, B-8, B-9, B-10, B-11, B-12, B-13, B-15, B-16, B-17, and B-18, topsoil having a thickness of ranging from approximately one (1) to six (6) inches was encountered. Please note that the actual amount of topsoil may vary widely between boring locations. *The contractor should determine the depth of topsoil to quantify topsoil depths for removal purposes.*

AGGREGATE BASE FILL: At the ground surface at boring locations B-4 and B-6, aggregate base fill was encountered. At these boring locations, the aggregate base fill ranged from approximately three (3) to six (6) inches in thickness. Please note that the actual amount of aggregate base fill may vary widely between boring locations.

UNDOCUMENTED FILL MATERIALS: At the surface at boring locations B-1, B-2, underlying the topsoil at boring locations B-5 and B-8, undocumented man placed fill materials consisting of silt/sand mixtures with gravel containing varying fractions of man-made materials such as organics, slag, and asphalt was encountered to approximate depths ranging from three and one-half (3-1/2) to eight (8) feet below existing site grades. Standard Penetration resistance ("N"-values) for the fill soils ranged from eight (8) to thirty-one (31) blows per foot. In natural soils, the "N"-values would indicate a loose to dense relative densities in granular soils. However, in miscellaneous fill, the "N"-values can be erratic, reflecting the variable composition of the fill material. The presence of obstruction and/or cobbles within fill can result in locally high "N"-values, even in a very loose condition. Other obstructions may be present in a miscellaneous uncontrolled fill, and may not be readily detectable with exploratory drill rig methods. Moisture contents of selected samples of the fill material ranged from five (5) to twenty-five (25) percent.

GRANUALR SOILS: At the surface at boring location B-14 and underlying the surface materials at all of the boring locations, granular soils of various textures extended to boring termination and/or auger refusal depths ranging from twenty-one (21) to twenty-seven (27) feet below existing grades. The granular soils were generally sampled as SILT (ML), CLAYEY SILT (ML), SANDY SILT (ML), SILTY SAND (SM), and/or POORLY GRADED SAND (SP). Standard Penetration resistance ("N"-values) ranged from eight (8) blows per foot to fifty (50) blows per two (2) inches, indicating loose to very dense relative densities. However, because of cobbles and boulders encountered in the soil profile, N-values in the granular soils may not be indicative of the actual relative density. Moisture contents of selected samples of the strata ranged from two (2) to twenty-seven (27) percent.

CLAYEY SOILS – Underlying the granular soils at boring locations B-10, B-11, B-12, B-17, and B-18, clayey soils consisting of SILTY CLAY (CL-ML) containing varying fractions of sand and gravel extended to an approximate depths ranging from six (6) to twenty-five (25) feet below existing site grades. The Standard Penetration resistance ("N"-values) for the clayey soils ranged from fifteen (15) to thirty -six (36) blows per foot, indicating stiff to hard consistencies. Based on penetrometer measurements of the clayey soils, which are an approximate measure of soil strength, the soil unconfined compressive strength of selected samples ranged from 1.5 to 3.5 tsf. Moisture content of selected samples from these clayey soils ranged from fourteen (14) to nineteen (19) percent.

2.3 GROUNDWATER CONDITIONS

At the time of the site Phase I fieldwork on March 28 and 29 and April 9, 2018 and the Phase II fieldwork on July 16, 17, and 18, 2018, the following table illustrates the infiltrating groundwater levels encountered at the test boring locations prior to auger removal during the field drilling operations:

Table 1 – Groundwater Levels (As Measured Beneath the Existing Site Grade)

Boring Number	Phase of Drilling (I or II)	Groundwater Levels		Borehole Cave Depth
		During Drilling Activities	At Completion of Drilling Activities	
		(feet)	(feet)	(feet)
B-1	I	None	22.0	8.0
B-2	I	22.0	None	5.5
B-3	I	None	None	7.0
B-4	I	None	None	12.0
B-5	I	22.0	6.0	10.0
B-6	I	None	None	11.0
B-7	II	None	None	12.1
B-8	II	None	None	14.5
B-9	II	None	None	12.3
B-10	II	None	None	16.2
B-11	II	None	None	12.5
B-12	II	None	None	14.2
B-13	II	None	None	17.2
B-14	I	None	None	7.0
B-15	I	None	None	5.0
B-16	I	None	None	5.0
B-17	II	None	None	18.7
B-18	II	None	None	16.3

For safety purposes, all test borings were backfilled at the time of drilling completion.

These observations represent the groundwater conditions at the time of measurement and may not be indicative of other times. However, **discontinuous zones of perched water will exist within the shallower overburden materials** and the builder should anticipate surface and subsurface seepage into any subsurface excavations during high moisture periods of the year. Variations in groundwater levels should be expected seasonally, annually, and from location to location.

3 PRELIMINARY OBSERVATIONS AND EVALUATIONS

3.1 GEOTECHNICAL DISCUSSION

The following preliminary geotechnical design recommendations have been developed on the basis of the previously described project characteristics and encountered subsurface conditions. If there are any changes in these project criteria, including building location on the site of final floor elevations, a review should be made by Professional Service Industries Engineering, PLLC to determine if modifications to the recommendations are necessary.

Once final design plans and specifications are available, a general review by Professional Service Industries Engineering, PLLC is recommended as a means to check that the evaluations made in preparation of this report are consistent with final construction plans and that earthwork and foundation recommendations are properly interpreted and implemented.

Based on the results of Professional Service Industries Engineering, PLLC's preliminary fieldwork, laboratory testing, and engineering analyses, the site appears suitable for the proposed structure and associated improvements provided the following recommendations are incorporated into the design and construction of the project. The primary geotechnical considerations for the development of this property will be the previous site development, the presence of old fill materials, the presence of cobbles and boulders, the potential thickness (height) of engineered fill materials, the moisture susceptibility of the on-site soils, and the wet/very loose surfical soils.

Due to the site development history, it must be recognized that subsurface conditions within the footprints of the proposed buildings may vary from conditions encountered at the boring locations.

Man-placed fill soils were observed in boring locations B-1, B-2, B-5, and B-8. A representative of the geotechnical engineer should verify the depth of fill at the time of construction. Based on the boring, the existing man-placed fill is considered suitable for support of foundations and floor slabs, provided proofroll/compaction acceptance utilizing a minimum fifteen (15) ton smooth drum vibratory roller operating in the vibratory mode.

The presence of cobbles and boulders encountered in the soils may present difficulty of their removal during trenching operations when utilizing standard backhoe type equipment; therefore, the utilization of large excavation equipment may be necessary.

Control points should be established within the anticipated fill areas (more than four [4] feet) to monitor, during and subsequent to the completion of the fill operations, any and all settlements of the final grade resulting from consolidation/compression of the area's subsurface materials under the weight of the engineered fill, and from the engineered fill under their own weight, if applicable. Settlement-time data, thus developed, should be employed to establish the time of placement of the building structures and pavement areas.

During the construction of soil slopes, whenever fill sectors meet the existing natural slopes and/or cut slopes, the structural fill is to be tied into the existing cut slopes by means of properly constructed benches or keys. Construction areas should be continuously benched over those areas where it is required as the work is brought up in layers. Bench/key construction should be of sufficient width to permit operation of placing and operation of compaction equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Fill construction operation over the sloping sectors should be initiated from the toe and worked up the slope while cut operations should progress downward from the top.

It must be recognized that soils that contain silt and clay are difficult to dry during wet or cool season. Careful attention to moisture content and compactive effort is important in dealing with such soils. The soils may need to be scarified and dried to a moisture content that will facilitate compaction in accordance with the structural fill requirements of this report. **Portland cement stabilization for silty soils (a fly ash / lime / kilndust for cohesive soils) may be necessary in order to expedite the work and achieve the required level of soil compaction**.

Depending on weather conditions and precipitation at the time of construction, the use of additional stabilization techniques such as choking the subgrade with coarse aggregate may be required in the upper twelve (12) to eighteen (18) inches of the exposed subgrade. Field conditions will dictate the extent of any undercuts.

With the previous mentioned considerations in mind, it is Professional Service Industries Engineering, PLLC's opinion that the proposed structures can be supported on shallow spread-type footings bearing on existing natural soils and/or compacted engineered fill. The building interior floors can be constructed on properly prepared subgrades following proofroll/proof-compaction acceptance of existing natural soil subgrade, qualified existing man-placed fill materials, and/or compacted engineered fill. The proposed pavement can be constructed on properly prepared subgrades following proofroll/compaction acceptance of natural soil subgrade, qualified existing man-placed fill materials, and/or compacted engineered fill.

Please note that the executed subsurface exploration scope of work is considered preliminary. Additional test borings will be required to provide final recommendations. This work should be performed after the building locations within the site and building footprint(s) have been established.

3.2 SITE PREPARATION

Unless specifically indicated otherwise in the drawings and/or specifications, the limits of this subsurface preparation are considered to be that portion directly beneath and ten (10) feet beyond the building and appurtenances. Appurtenances are those items attached to the building and typically include, but are not limited to, the building sidewalks, porches, stoops, etc.

Site preparation should commence with the removal of the existing debris noted within the northeast portion of "Parcel 7" at the time of the drilling operations, any other debris/trash, existing foundations of existing on-site structures, floor slabs, walls, utilities, grass, topsoil, vegetation, any deleterious materials. The geotechnical engineer of record or his representative should determine the depth of removal at the time of construction. Underground storage tanks, abandoned utilities, old foundations or other features not evident at the time of Professional Service Industries Engineering, PLLC's investigation should also be removed. Professional Service Industries Engineering, PLLC recommends that all topsoil and loose and wet or deleterious soils in the construction areas be stripped from the site and either wasted or stockpiled for later use in landscaping. The geotechnical engineer of record or his representative should determine the depth of removal at the time of construction.

After removal of the existing debris/trash, any other debris/trash, existing old foundations, floor slabs, walls, utilities, grass, topsoil, vegetation, and loose and wet soils and other deleterious materials, the exposed undercut areas should be brought back up to proposed grades with compacted engineered fill. Prior to placement of the engineered fill, the geotechnical engineer of record or his representative should observe the subgrade condition. Fill material and compaction requirements are discussed in more detail in the following paragraphs.

Professional Service Industries Engineering, PLLC has not been provided with any specific building locations and/or final grading plans and we do not know at this time how surface elevations will change at the time of construction. Additional site preparation will depend upon the proposed site grades and building features. Prior to the beginning of fill placement activities, PSIE, PLLC recommends that all areas receiving new fill be proof-compacted. Proof-compaction operations should be performed using a minimum fifteen (15) ton smooth drum vibratory roller, operating in the vibratory mode. Proof-compaction operations should be observed by the geotechnical engineer of record or his representative and should continue until a firm and unyielding condition exists (typically less than three-quarters inch ruts). Unstable soils which are revealed by proof-compaction and which cannot be adequately densified in place should be removed and replaced with crushed limestone (NYSDOT 304) or choked with coarse aggregate such as NYSDOT No. 4 stone under the recommendations of the geotechnical engineer of record or his representative. Field conditions will dictate the extent of any undercuts.

Proof-compaction operations should be observed by the geotechnical engineer of record or his representative and should continue until a firm and unyielding condition exists (typically less than three-quarters inch ruts). Unstable soils which are revealed by proof-compaction and which cannot be adequately densified in place should be removed and replaced with crushed limestone (NYSDOT 304) and/or choked with coarse aggregate such as NYSDOT No. 4 stone under the recommendations of the geotechnical engineer of record or his representative. Additionally, depending on weather conditions and precipitation at the time of construction, the use of additional stabilization techniques such as choking the subgrade with coarse aggregate may be required in the upper eighteen (18) to twenty-four (24) inches of the exposed subgrade. Field conditions will dictate the extent of any undercuts.

During the site area grading, zones of perched groundwater may be encountered. Local undercutting and pumping to remove water may be required when such zones are encountered, and provisions should be made in this regard by the builder.

After subgrade preparation and observation have been completed, fill placement may begin. The first layer of fill material should be placed in a relatively uniform horizontal lift and be adequately keyed into the stripped subgrade soils.

During site preparation, filled sidewalk vaults, burn pits, old foundations, trash pits or other isolated disposal areas may be encountered. All too frequently such buried material occurs in isolated areas outside boring locations. Any such material encountered during site work or foundation construction should be excavated and removed from the site.

3.3 FILL MATERIAL AND PLACEMENT

After the performance of cutting to design subgrade, PSIE, PLLC recommends that proof-compaction operations should be performed using a 10 to 15-ton (static weight) smooth drum vibratory roller. Proof-compaction operations should be observed by a representative of PSIE, PLLC and should continue until a firm and unyielding condition exists (typically less than three-quarters inch ruts). Unstable soils which are revealed by proof-compaction and which cannot be adequately densified in-place should be removed and replaced with structural fill.

Excavations or depressions left from removal of trees should be backfilled with compacted structural fill. Subgrade areas should be kept properly drained and free of ponded water surfaces. This may be achieved by sloping the exposed pad so that storm water can flow off the pad.

Control points should be established within the anticipated fill areas (more than four [4] feet) to monitor, during and subsequent to the completion of the fill operations, any and all settlements of the final grade resulting from consolidation/compression of the area's subsurface materials under the weight of the engineered fill, and from the engineered fill under their own weight, if applicable. Settlement-time data, thus developed, should be employed to establish the time of placement of the building structure and pavement areas.

Based on the results of soil classifications, the existing surface soils at the boring locations B-1, B-2, and B-5, generally consist of existing granular fill. The on-site fill containing non-soil material such as slag is not suitable for reuse as structural fill material. The on-site soils at the remaining boring locations and the soils below the existing fill at boring locations B-1, B-2, and B-5 can be considered for reuse as structural fill, as long as the soils are placed within an acceptable moisture condition. It must be recognized that soils that contain silt and clay are difficult to dry during wet or cool season. Careful attention to moisture content and compactive effort are important in dealing with such soils and it is typical for wet or cool season grading operations to be hindered by the continual need to dry back silty and clayey soils during placement. It is advantageous to place a working course of compacted graded aggregate base over building and roadway areas between the time of initial grading and final floor slab construction. The graded aggregate base may need periodic replenishment depending on weather and traffic conditions during construction.

The on-site soils will be somewhat sensitive to moisture content variations. This general sensitivity to water will influence construction, since subgrade support capacities may deteriorate when this soil type becomes wet and/or disturbed. It is not unusual for wet or cool season grading operations to be hindered by the continual need to dry back the on-site natural soils during placement. If fill placement must proceed during other than the summer months, the use of imported granular fill with less than ten (10) percent passing the No. 200 sieve may be necessary.

On-site or imported structural fill materials should be free of organic or other deleterious materials. If grading results in a need for additional fill materials, the imported structural fill should have a maximum particle size less than three (3) inches, a modified Proctor maximum dry density greater than one hundred ten (110) pounds per cubic foot (pcf) and less than twenty (20) percent passing the No. 200 sieve. Structural fill should consist of non-expansive materials and not contain more than three (3) percent (by weight) of organic matter or other detrimental material. Typically, the Plasticity Index (PI) for the material should not exceed fifteen (15), and the Liquid Limit (LL) for the material should not exceed forty (40) (Unified Soil Classifications of GW, GM, GC, GP, SW, SM, SP, SC), unless otherwise allowed by the geotechnical engineer.

It must be recognized that soils that contain silt and clay are difficult to dry during wet or cool season. Careful attention to moisture content and compactive effort is important in dealing with such soils. The soils may need to be scarified and dried to a moisture content that will facilitate compaction in accordance with the structural fill requirements of this report. **Portland cement stabilization for silty soils (a fly ash/ lime / kilndust for cohesive soils) may be necessary in order to expedite the work and achieve the**

required level of soil compaction.

If the structural fill for the site is imported, the geotechnical engineer should test and report on the proposed imported fill prior to purchase and delivery. Based upon the topography and location of the site, imported fill will probably be required. Fine-grained soils and the on-site soils used for fill require close moisture content control to achieve the recommended degree of compaction and are not recommended for use during wet weather construction. Structural fill soils should be moisture conditioned to between two (2) percent below and two (2) percent above optimum moisture content and placed in maximum eight (8)-inch lifts in the excavation. Structural fill should be compacted to at least ninety-five (95) percent of the maximum density as determined by the Modified Proctor Test (ASTM D-1557). Each lift of compacted fill should be tested for density by a representative of the geotechnical engineer prior to placement of subsequent lifts. If fill placement must proceed during other than the summer months, the use of imported granular fill with less than ten (10) percent passing the No. 200 sieve may be necessary.

3.4 SOIL SLOPES

Based on our knowledge of shear strength characteristics of the encountered overburden soils, the following permanent construction slopes are recommended:

Silty Clays ……………………..………2.5:1 (horizontal:vertical)
Silts…………………………….………2.5:1 (horizontal:vertical)
Sands/Silty Sands…………………………3:1 (horizontal:vertical)

If space limitations do not make it possible to achieve these configurations, reinforced earth structures and/or reinforced concrete retaining structures may need to be introduced at the toe of the slopes. The height of the retaining structures should be adjusted to achieve final slope configurations as recommended above. Also, the toe area of all sloping sectors should be graded in a manner such that the possibility of any water accumulation and coincidental softening of the toe support materials is precluded.

During the construction of soil slopes, whenever fill sectors meet the existing natural slopes and/or cut slopes, the structural fill is to be tied into the existing cut slopes by means of properly constructed benches or keys. Construction areas should be continuously benched over those areas where it is required as the work is brought up in layers. Bench/key construction should be of sufficient width to permit operation of placing and operation of compaction equipment. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Fill construction operation over the sloping sectors should be initiated from the toe and worked up the slope while cut operations should progress downward from the top.

3.5 PRELIMINARY FOUNDATION RECOMMENDATIONS – SHALLOW FOUNDATIONS

Based on the findings at the boring locations during our preliminary geotechnical exploration, it is PSIE, PLLC's opinion that the proposed structures can be supported on shallow spread-type footings bearing on the existing natural soils and/or compacted engineered fill.

Shallow foundations consisting of conventional spread and strip footings should provide adequate support for the proposed construction. Allowable bearing pressures are expected to be **2,000 psf** when founded on the existing soils and/or engineered fill. However, a final subsurface exploration will be required to provide final geotechnical recommendations once the building locations and footprints have been established.

For preliminary planning purposes, minimum lateral footing dimensions of about thirty (30) inches for column footings and twenty-four (24) inches for wall footings are recommended. Exterior foundations should be designed for a minimum embedment of forty-eight (48) inches below final exterior grades to provide adequate cover for frost protection. However, in areas where interior foundations are constructed in heated areas, the footings may be constructed at a minimum depth of eighteen (18) inches below final exterior grades. Wall footings should be provided with nominal, continuous, longitudinal steel reinforcement for greater bending strength so they can span across small areas of loose or soft soils that may go undetected during construction.

The foundation walls may not be free standing in the overburden soils; therefore the sides of the cut excavation for the footings may need to be sloped and the footings formed and backfilled in order to maintain a vertical concrete face.

Footing soils need to be observed and documented and concrete placed as quickly as possible to avoid exposure of the bottom of footing soils to disturbance due to construction traffic, drying or water accumulation. If concrete will not be placed the same day a foundation excavation is cut to grade, the contractor should be required to place three (3) to five (5) inches of compacted crushed aggregate or a concrete “mud mat” within the footing excavation. The foundation excavations should be observed by a representative of PSIE, PLLC prior to steel or concrete placement to document that the foundation materials are consistent with the report.

Once the footing concrete is placed, the foundations should be backfilled with structural fill as soon as it is safe to do so without causing damage to them. The backfill serves to protect the footing, is a component of overturning resistance and prevents accumulation of water around the foundations which can soften and weaken the bearing soils. The ground surface near the completed foundations should be sloped to drain away from the foundations throughout construction to avoid accumulation of moisture in the subgrade soils.

The foundation excavations should be observed by the geotechnical engineer of record or his representative prior to steel or concrete placement to document that the foundation materials are consistent with the report.

3.6 SEISMIC DESIGN

The 2010 New York State Building Code is an adaptation/incorporates the 2015 International Building Code (IBC). As part of this code, the design of structures must consider dynamic forces resulting from seismic events. These forces are dependent upon the magnitude of the earthquake event as well as the properties of the soils that underlie the site.

Part of the IBC code procedure to evaluate seismic forces, requires the evaluation of the Seismic Site Class, which categorizes the site based upon the characteristics of the subsurface profile within the upper one hundred (100) feet BGS. To define the Seismic Site Class for this project, PSIE, PLLC has interpreted the results of the soil test borings drilled within the project site and estimated appropriate soil properties below the base of the borings to a depth of one (100) feet, as permitted by Section 1615.1.1 of the code. The estimated soil properties were based upon data available in published regional geologic reports as well as Professional Service Industries Engineering, PLLC's experience with subsurface conditions in the general site area. Professional Service Industries Engineering, PLLC anticipates that the subsurface conditions below the explored depth may generally consist of dense to very dense granular soils overlying shale and/or limestone. Based on the review of the available data, knowledge of regional geology and the Standard Penetration Test (SPT) N values, we have assigned a **Soil Site Class D,** based on the preliminary borings performed, as defined in Section 1615.1.1. It must be noted that the value may be modified to "D" when the final geotechnical exploration is completed. The recommended seismic vales are presented in Table 2, Recommended Seismic Values.

The USGS-NEHRP probabilistic ground motion values for the site which were obtained from the USGS geohazards web page (http://eqdesign.cr.usgs.gov/html/design-lookup.html) and are as follows:

Table 2 – Recommended Seismic Values

Parameter	**NY Building Code Reference**	**Value**
Site Class	Table 1615.1.1	D
Mapped spectral accelerations for short periods (S_S)	Figure 1615(1)	0.126 g
Mapped spectral accelerations for a 1-second period (S_1)	Figure 1615(2)	0.056 g
Site coefficient F_a	Table 1615.1.2(1)	1.6
Site coefficient F_V	Table 1615.1.2(2)	2.4
Maximum considered earthquake spectral response for short periods (S_{MS}) adjusted for site class effects	Equation 16-38	0.201 g
Maximum considered earthquake spectral response for 1-second period (S_{M1}), adjusted for site class effects	Equation 16-39	0.136 g
Design Spectral Response acceleration at short periods (S_{DS})	Equation 16-40	0.134 g
Design Spectral Response acceleration at 1-second periods (S_{D1})	Equation 16-41	0.090 g

NOTES: *Based upon a 2% Probability of Exceedence in 50 years
MCE = Maximum Considered Earthquake
g = acceleration due to gravity

The Site Coefficients, Fa and Fv presented in the above table were interpolated from IBC Tables 1613.5.3(1) and 1613.5.3(2) as a function of the site classification and mapped spectral response acceleration at the short (S_s) and 1 second (S_1) periods.

A **Seismic Design Category B** was assigned as determined for the intended building use (Occupancy Category II) and the IBC Tables 1613.5.6(1) and 1613.5.6(2). For the assigned Design Category, Section 1802 of the Code does not require an assessment of slope stability, liquefaction potential, and surface rupture due to faulting or lateral spreading. Detailed evaluations of these factors were beyond the scope of this study.

3.7 PRELIMINARY FLOOR SLAB RECOMMENDATIONS

Based upon the preliminary subsurface exploration, PSIE, PLLC anticipates that concrete slab for the proposed buildings can be ground-supported (slab on-grade) on natural soils, qualified existing man-placed fill materials, and/or compacted engineered fill placed over a natural soil subgrade, provided the upper soils have been proof-compacted with a minimum fifteen (15) ton smooth drum, vibratory roller, operating in the vibratory mode in order to confirm their suitability. Any observed soft/loose or otherwise unsuitable areas should be over-excavated down to firm subgrade and replaced with compacted engineered fill.

For the subgrade prepared as recommended and properly compacted fill, a modulus of subgrade reaction, *k* value, of 110 pounds per cubic inch (pci) may be used in the grade slab design based on a one (1) foot by one (1) foot plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohessionless soil:

Modulus of Subgrade Reaction, $k_s = k\left(\frac{B+1}{2B}\right)^2$ for cohessionless soil

where: k_s = coefficient of vertical subgrade reaction for loaded area,
k = coefficient of vertical subgrade reaction for 1 x 1 square foot area,
B = width of area loaded, in feet.

In order to provide uniform subgrade reaction beneath any proposed floor slab-on-grade, we recommend that floor slabs be underlain by a minimum of six (6) inches of free-draining compactible, trimmable (a maximum particle size of three-quarters (¾) inch with less than five (5) percent material passing the no. 200 sieve), well-graded gravel or crushed rock base course. Base course material should be moisture conditioned to within +/- two (2) percent of optimum moisture content and compacted by mechanical means to a minimum of ninety-five (95) percent of the material's maximum dry density as determined in accordance with ASTM D 1557 (Modified Proctor).

The crushed stone should provide a capillary break to limit migration of moisture through the slab. If additional protection against moisture vapor is desired, a vapor retarding membrane may also be incorporated into the design. Factors such as cost, special considerations for construction, and the floor coverings suggest that the architect and owner make decisions on the use of vapor retarding membranes.

The precautions listed below should be followed for construction of slabs-on-grade pads. These details will not reduce the amount of movement, but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content is inevitable because of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

- Cracking of slabs-on-grade is normal and should be expected. Cracking can occur because of not only heaving or compression of the supporting soil and/or bedrock material, but also as a result of concrete curing stresses. The occurrence of concrete shrinkage cracks, and problems associated with concrete curing may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement, finishing, and curing, and by the placement of crack control joints at frequent intervals, particularly, where re-entrant slab corners occur. The American Concrete

Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. For example, joints are recommended at a maximum spacing of twelve (12) feet assuming a four-inch thick slab. Professional Service Industries Engineering, PLLC also recommends that the slab be independent of the foundation walls. Using fiber reinforcement in the concrete can also control shrinkage cracking.

- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted.

- Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.

3.8 UTILITIES TRENCHING

Excavation for utility trenches shall be performed in accordance with OSHA regulations as stated in 29 CFR Part 1926. It should be noted that utility trench excavations have the potential to degrade the properties of the adjacent fill materials. Utility trench walls that are allowed to move laterally can lead to reduced bearing capacity and increased settlement of adjacent structural elements and overlying slabs.

Backfill for utility trenches is as important as the original subgrade preparation or structural fill placed to support either a foundation or slab. Therefore, it is imperative that the backfill for utility trenches be placed to meet the project specifications for the structural fill of this project and/or any local municipal requirements for utility backfill. In areas that are not accessible to construction personnel and standard compaction equipment, PSIE, PLLC recommends that flowable fill or lean mix concrete be utilized for utility trench backfill. If on-site soils are placed as trench backfill, the backfill for the utility trenches should be placed in four (4) to six (6) inch loose lifts and compacted to a minimum of ninety-five (95) percent of the maximum dry density achieved by the modified Proctor test (ASTM D-1557).

The backfill soil should be moisture conditioned to be within two (2) of the optimum moisture content as determined by the modified Proctor test. Up to four (4) inches of bedding material placed directly under the pipes or conduits placed in the utility trench can be compacted to the ninety (90) percent compaction criteria with respect to the modified Proctor (ASTM D-1557). Compaction testing should be performed for every two hundred (200) cubic yards of backfill placed or each lift within two hundred (200) linear feet of trench, whichever is less. Backfill of utility trenches should not be performed with water standing in the trench. If granular material is used for the backfill of the utility trench, the granular material should have a gradation that will filter protect the backfill material from the adjacent soils.

If material having this gradation is not available, a geosynthetic non-woven filter fabric should be used to reduce the potential for the migration of fines into the backfill material. Granular backfill material shall be compacted to meet the above compaction criteria. The clean granular backfill material should be compacted to achieve a relative density greater than 75% or as specified by the geotechnical engineer for the specific material used.

Utility trenches should be connected to a suitably located outlet point with an invert elevation two (2) feet below the minimum elevation along the utility trenches. The purpose of this outlet is to allow removal of water which may accumulate in the six (6) inches of bedding material. The outlet points should preferably discharge by gravity to the storm sewer system, but may discharge to sumps equipped with pumps if necessary.

3.9 RETAINING WALL STRUCTURE DESIGN AND CONSTRUCTION (*IF APPLICABLE)

Below-grade retaining walls should be designed to resist lateral earth pressures. Lateral earth pressure is developed from the soils present within a wedge formed by the vertical below-grade wall and an imaginary line extending up and away from the bottom of the wall at an approximate 45° angle. The lateral earth pressures are determined by multiplying the vertical applied pressure by the appropriate lateral earth pressure coefficient K. If the walls are rigidly attached to the structure and not free to rotate or deflect at the top, PSIE, PLLC recommends designing the walls for the "at-rest" lateral earth pressure condition using K_o. Walls that are permitted to rotate and deflect at the top can be designed for the active lateral earth pressure condition using K_a. Passive pressure can be determined using K_p, with a factor of safety of 2.0. Recommended parameters for use in below grade walls are as follows:

Table 3 – Soil Parameters and Lateral Earth Pressures

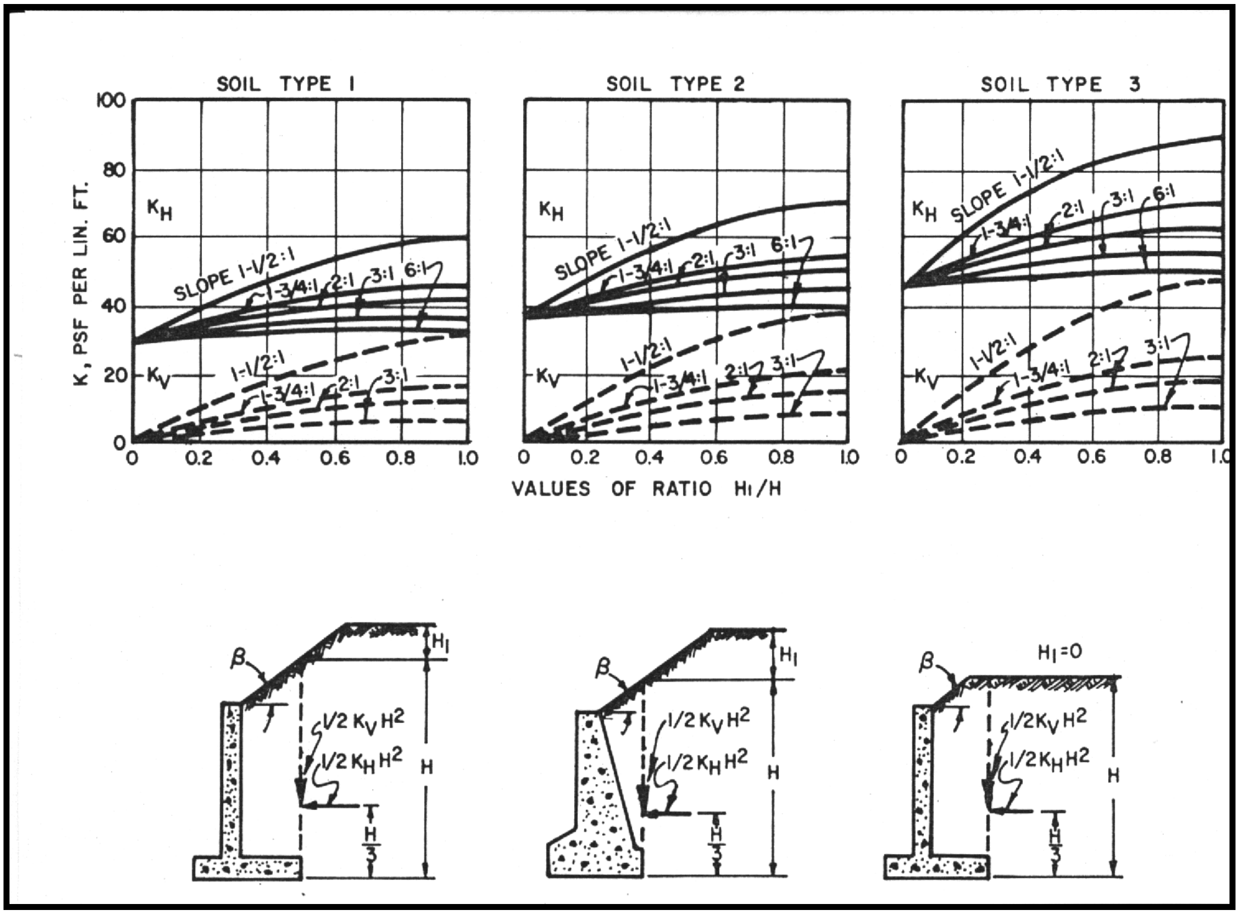
<table>
<tr><th colspan="5">Recommended Parameters for use in Retaining Wall Design</th></tr>
<tr><th>Material Type</th><th colspan="4">Angle of Internal Friction (ϕ)</th></tr>
<tr><td>1) Silty Sand (SM)</td><td colspan="4">28°</td></tr>
<tr><td>2) Silt (ML)</td><td colspan="4">22°</td></tr>
<tr><td>3) Poorly Graded Sand (SP)</td><td colspan="4">32°</td></tr>
<tr><td>4) Clean Crushed Limestone</td><td colspan="4">35°</td></tr>
<tr><td>Total Soil Density (pcf)</td><td colspan="4">125</td></tr>
<tr><td>Cohesion for Clay Soils (psf) (undrained, $\phi = 0$)</td><td colspan="4">500</td></tr>
<tr><td>Groundwater Elevation</td><td colspan="4">At bottom of the wall</td></tr>
<tr><th>Parameters specific to soil type</th><th>1</th><th>2</th><th>3</th><th>4*</th></tr>
<tr><td>Friction Factor for Base</td><td>0.27</td><td>0.25</td><td>0.32</td><td>0.47</td></tr>
<tr><td>Coefficient of Active Pressure (K_a) **</td><td>0.36</td><td>0.45</td><td>0.31</td><td>0.27</td></tr>
<tr><td>Coefficient of Passive Pressure (K_p) **</td><td>2.77</td><td>2.20</td><td>3.24</td><td>3.69</td></tr>
<tr><td>Coefficient of At-Rest Pressure (K_o) **</td><td>0.53</td><td>0.63</td><td>0.47</td><td>0.43</td></tr>
</table>

* These values may be used for design only if the crushed limestone backfill extends back from the wall certain distances. These are a horizontal distance approximately equal to or greater than the total height of the wall at the surface, and at least one-foot beyond the heel of the wall footing.

** Earth pressure coefficients valid for level backfill conditions with no surcharge.

The values presented above were calculated based on positive foundation drainage is provided to prevent the buildup of hydrostatic pressure. If surface loads are placed near the walls, such as traffic loads, they should be designed to resist an additional uniform lateral load of one-half of the vertical surface loads. An "equivalent fluid" pressure can be obtained from the above chart by multiplying the appropriate K-factor times the total unit weight of the soil. This applies to unsaturated conditions only. If a saturated "equivalent fluid" pressure is needed, the effective unit weight (total unit weight minus unit weight of water) should be multiplied times the appropriate K-factor and the unit weight of water added to that resultant. However, PSIE, PLLC does not recommend that earth retaining walls be designed with a hydrostatic load and that drainage should be provided to relieve the pressure.

The designs of retaining walls need to take into account the effects of geometry and loading conditions. The following charts have been included from NAVFAC 7.02 concerning slopes in the grade at the top of below grade wall. Depending on the geometry of the site, the lateral loading on the below grade wall should be modified according to these charts.



Soil Type 1 – Clean Sand and Gravel, GW, GP, SW, SP
Soil Type 2 – Dirty Sand and Gravel of Restricted Permeability, GM, GM-GP, SM-SP, SM
Soil Type 3 – Stiff Residual Silts and Clays, Silty Fine Sands, Clayey Sands and Gravels: CL, ML, CH, MH, SM, SC, GC

Special consideration must also be given to the stability of the natural cut ground when supporting substantial fills, to structural fills themselves, and to cut surfaces in natural soil. The evaluation of slope stability aspects of this site and the proposed development is beyond the scope of this exploration. A global slope stability evaluation should be performed by qualified geotechnical engineering personnel for the proposed retaining wall. The design of the walls for internal and external stability is typically the contractor/manufacturer's responsibility.

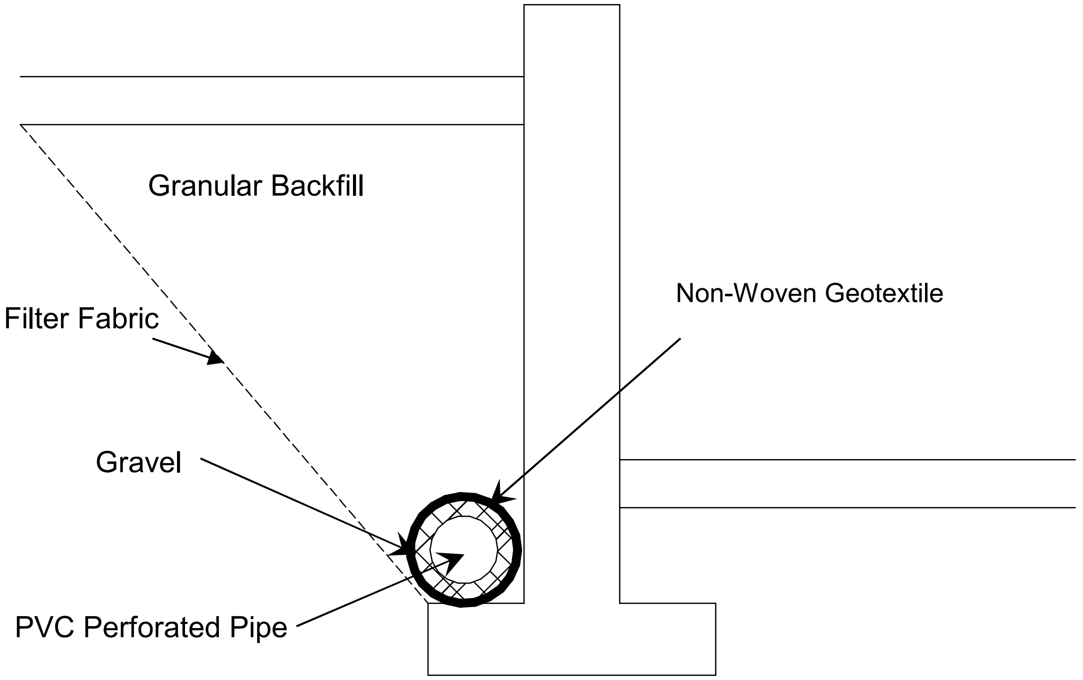
3.10 RETAINING WALL BACK-DRAIN (*IF APPLICABLE)

Professional Service Industries Engineering, PLLC recommends that the retaining wall be adequately water-proofed and be provided with a wall back-drain system. One possible drainage system is shown in the sketch below and would include:

1) A four (4) or six (6) inch diameter perforated drain tile at the bottom of the backfill to collect seepage water with the tile connected to a suitable means of disposal.

2) Clean one-half (½) inch or one (1) inch gravel classified as "GP" and containing less than five (5) percent passing a #200 sieve surrounding the drain-tile.
3) Non-woven four (4) ounce per square yard geotextile between the drainage material and the on-site soils to prevent infiltration of fine grained soils into the drain-tile, granular drainage blanket, or granular backfill.

The placement of a limited amount of granular material behind a retaining wall does not appreciably change the coefficient of lateral earth pressure acting on that wall. The lateral earth pressure acting on a below-grade structure is a function of the weight of the soil that exists above the theoretical plane projecting up from the base of the wall. The soil above this plane is held in place by two forces, the strength of the soil itself and the lateral resistance of the below-grade wall. Therefore, a thin layer of granular material behind the wall is of little consequence on the forces acting on the wall.



3.11 BELOW-GRADE WALL BACKFILL AND COMPACTION (*IF APPLICABLE)

Professional Service Industries Engineering, PLLC suggests using granular material to provide improved drainage and to reduce lateral pressures on the walls resulting from water pressure. The backfill materials should be placed in lifts that do not exceed eight (8)-inches loose. The lift thickness may need to be reduced to thinner lifts immediately behind the walls to achieve the desired about of compaction without overstressing the wall with the compaction process. Shale shall not be used for fill behind retaining walls.

Backfill should be placed in thin lifts and mechanically compacted to at least ninety-five (95) percent of the materials' maximum dry density and within two (2) percent of the optimum water content as determined by the modified Proctor test. Professional Service Industries Engineering, PLLC advises performing field density tests on the backfill to monitor compliance with the recommendations provided. Care should be exercised during the backfilling operation to prevent overstressing and damaging the walls.

3.12 SILTATION CONTROL

The Clean Water Act, implemented in 1990 includes a federal permit program called the National Pollutant Discharge Elimination System (NPDES). This program requires that projects sites in excess of one (1) acre or are part of a development which exceeds one (1) acre be covered under a permit. This typically includes the development of a storm water pollution prevention plan (SWPPP) as well as period inspections (typically once a week plus after significant rainfall). Professional Service Industries Engineering, PLLC is available to assist with these services.

3.13 PAVEMENT DESIGN

Based upon the preliminary completed geotechnical exploration, the existing subgrade soils and subbase material encountered at the soil boring locations are considered suitable for support of the proposed pavement provided the soils and subbase material have been proof-compacted with a minimum fifteen (15) ton smooth drum vibratory roller, operating in the vibratory mode making a minimum of four (4) passes, in order to confirm stability/suitability. However, additional soil borings will be required to confirm preliminary recommendations once final pavement areas have been established. Proof-compaction should also be performed immediately prior to the placement of any aggregate base stone. Unstable soils which are revealed by proof-compaction and which cannot be adequately densified in place should be removed and replaced with crushed limestone (NYSDOT 304) or similar material under the recommendations of the geotechnical engineer of record or his representative. Additionally, depending on weather conditions and precipitation at the time of construction, the use of additional stabilization techniques such as choking the subgrade with coarse aggregate may be required.

The following pavement recommendations are presented as preliminary for your consideration. The civil engineer for the project may have more traffic and project design data available than is presently known, and may wish to modify and refine these pavement sections. Professional Service Industries Engineering, PLLC will, upon request, be pleased to provide detailed pavement design recommendations when definite traffic and building plans are available. Note where streets are to be dedicated to the public jurisdiction, pavement sections should comply to local minimum standards.

Prior to placing the base or leveling course, the subgrade should be proof-compacted with a smooth steel drum vibratory roller weighing at least fifteen (15) tons and operating in the vibratory mode, in order to detect areas or pockets of unusually soft material. These areas, if encountered, should be over-excavated and replaced with crushed limestone (NYSDOT 304) or similar material under the recommendations of the geotechnical engineer of record or his representative.

Should the subgrade be wet and/or earthwork is anticipated during the wet seasons, a woven geotextile such as a Mirafi 500x (Grab Tear Strength, 200-300 lbs; Trapezoid Tear Strength, 75-120 lbs; Apparent Opening Size, US Sieve size 40 to 50 or 0.30 to 0.45 mm) or equivalent can be placed upon all the approved pavement subgrades prior to placing the subbase course materials.

3.13.1 DRAINAGE OF PAVEMENT STRUCTURES

Design for drainage is of the utmost importance to minimize detrimental effects that may shorten the service life of the pavements. Inclusion of adequate surface and subsurface drainage systems within the pavement areas is considered imperative in order to maintain the compacted subgrades as close to optimum moisture conditions as possible. The pavement should be crowned or sloped in order to promote effective surface drainage and reduce the risk of water ponding. We recommend a minimum slope of one and one-half percent for the pavement surfaces. In addition, the subgrade should be similarly sloped to promote effective subgrade drainage. We recommend “stub” or “finger” drains be provided around catch basins, and in other low areas of the proposed pavements to limit the accumulation of water on the frost susceptible subgrade soils. Overall surface grades should be such that no pavement sectors are allowed to impound water. Surface water should be directed to a system of catch basins.

Subsurface drainage systems should be installed at least forty-two (42) inches below the design subgrade elevations at regular intervals including landscape areas, sidewalk areas and along the perimeter of the pavement areas. Subsurface drainage system consisting of perforated drain pipes bedded in and backfilled over with suitable filter materials (No. 57 coarse aggregate per AASHTO M-43) should be installed. The filter around the drainage members is to terminate in direct contact with the aggregate base course for the pavements. Also, all unpaved areas should be isolated from the paved sectors by including additional subsurface drainage lines following the above-outlined recommendations. Final grading plans should be reviewed to determine necessity and location of subsurface drains.

3.13.2 PAVEMENT DESIGN

AASHTO design methodology could be used to design the pavements. According to AASHTO design methodology, the pavement design thickness primarily depends on strength of the subgrade soils and type of traffic. Traffic includes several types of vehicles with various magnitudes of axle loads that may be subjected to the pavement during its service life. The design involves a traffic analyses that converts various types of vehicles with various magnitudes axle loads to a number of 18-kip equivalent single axle load repetitions.

Based on the anticipated traffic, the design engineer should perform the traffic analyses to compute the number of ESALs repetitions that would be subjected to the pavement during its service life or design life. Based on the computed ESALs, the pavements should be designed accordingly.

Based on previous experience, we have provided pavement thickness for both flexible pavement and rigid pavement systems in the tables below. The tables below include thickness design corresponding to two levels of traffic (light and heavy). The life expectancy in ESALs for each design is also presented. We recommend that the pavement design thicknesses correspond to low or medium traffic condition be used for parking areas. We recommend that the thickness design corresponding to high traffic condition be used for driveways, exit and entry lanes and frequently used areas. Where repeated high axle loading and heavy traffic is anticipated, such as the drive lanes and loading dock area for the over the road semi-tractor trailer trucks, rigid pavement is recommended or the equivalent flexible pavement ESAL design capacity be provided.

Table 4 – Pavement Design Traffic

Pavement Design Traffic	
Traffic Category	**Design ESALS**
Light Duty Section	7,500
Heavy Duty Section	75,000

In addition, specific design parameters considered in the pavement analysis are as follows:

Table 5 – Pavement Analysis Specific Design Parameters

CBR (Estimated)	3.0
Modulus of subgrade Reaction, K	110 psi/in
Soil Resilient Modulus	4,118 psi
Reliability	85%
Deviation	0.45 Asphalt
Deviation	0.35 Rigid
Combined Standard Error (S_0)	0.5
Initial Serviceability	4.2
Terminal Serviceability	2.0
Modulus of Rupture	650 psi
Load Transfer	3.2 Dowels or Keys
Drainage Coefficient	1.0
Layer Coefficients	0.44 Asphalt
	0.12 Crushed Aggregate Base

3.13.3 FLEXIBLE PAVEMENT SECTION

Based on a design California Bearing Ratio (CBR) value of three (3.0) for the subgrade soils, and design ESALs for the various traffic types, Table 6 presents required structural numbers and typical flexible pavement sections.

Table 6 – Flexible Pavement Minimum Sections (20-Year Design Life)

Pavement Materials	Recommended Pavement Thickness (inches)	
	Light Duty Section	Heavy Duty Section
Required Structural Number, SN	1.90	2.72
Asphalt Top Course 9.5 mm F2 HMA	1.5	1.5
Asphalt Binder Course 19 mm F9 HMA	2.0	2.5
Aggregate Base Course (NYSDOT 304 Type 2)	8.0	10.0

A light-duty section is recommended in typical parking areas where cars and lightly loaded trucks are anticipated. A heavy-duty pavement section should be utilized in paved areas where traffic flow is channelized.

The following materials are recommended for the previously mentioned asphalt pavement structure components:

- Asphaltic Concrete Top Course-NYSDOT Standard Specification, Item No. 402.127202 – 12.5 mm F2 Hot Mix Asphalt.
- Asphaltic Concrete Binder Course-NYSDOT Standard Specification, Item No. 402.197902 – 19 mm F9 Hot Mix Asphalt.
- Crushed Aggregate Base (Subbase) Course-NYSDOT Standard Specification, Item No. 304.12 – Crushed Aggregate Base, Type 2.

If the anticipated traffic exceeds these values, PSIE, PLLC should be informed so that a specific pavement design can be made for the project, or the site Civil Engineer can modify the design.

In general, pavement construction should be performed in accordance with the New York State Department of Transportation specifications unless otherwise noted.

Aggregate base course material should be moisture conditioned to within two (2) percent of optimum moisture content and compacted by mechanical means to a minimum of ninety-five (95) percent of the material's maximum dry density as determined in accordance with ASTM D 1557 (Modified Proctor). Fill materials should be placed in layers that, when compacted, do not exceed about eight (8) inches. The granular base course should be built at least two (2) feet wider than the pavement on each side to support the tracks of the slipform paver. This extra width is structurally beneficial for wheel loads applied at pavement edge. The asphaltic concrete material should be compacted to at least ninety-two (92) percent of the material’s theoretical maximum density as determined in accordance ASTM D 2041 (Rice Specific Gravity).

Periodic maintenance of the pavement should be anticipated. This should include sealing of cracks and joints and by maintaining proper surface drainage to avoid ponding of water on or near the pavement area.

3.13.4 RIGID CONCRETE PAVEMENT

Rigid concrete pavement is recommended where trash dumpsters are to be parked on the pavement or where a considerable load is transferred from relatively small steel wheels and for semi-tractor trailer traffic. This should provide better distribution of surface loads to subgrade without causing deformation of the surface.

Professional Service Industries Engineering, PLLC recommends that concrete pavement be designed for a modulus of subgrade reaction of 110 pci. A typical concrete pavement section would be:

Table 7 – Typical Rigid Pavement Section

Rigid (Concrete) Pavement	Light-Duty	Heavy-Duty
Portland Cement Concrete (4,000 psi)	5 inches	8 inches
Aggregate Base Course (NYSDOT 304 Type 2) NYSDOT Item 304.11 or 304.12	6 inches	6 inches

The following materials are recommended for the previously mentioned rigid pavement structure components:

- Portland Cement Concrete Slabs - 4,000 psi minimum compressive strength and the Portland Cement Concrete meeting the requirements of NYSDOT Standard Specifications 501.

- Crushed Aggregate Base (Subbase) Course-NYSDOT Standard Specification, Item No. 304.12 M – Crushed Aggregate Base, Type 2.

3.13.5 CIVIL DESIGN CONSIDERATIONS PAVEMENTS

Related civil design factors such as drainage, cross-sectional configurations, surface elevations and environmental factors that will significantly affect the service life of the pavement must be included in the preparation of the construction drawings and specifications. Concrete pavement slabs should be provided with adequate steel reinforcement. Proper finishing of concrete pavements requires the use of sawed and sealed joints, which should be designed in accordance with current Portland Cement Association guidelines. Joint spacing intervals for plain concrete shall be in accordance with PCA guidelines according to pavement thickness. Dowel bars should be used to transfer loads at the transverse joints. Normal periodic maintenance will be required.

Surface water infiltration to the pavement subgrade layers may soften the subgrade soils. Considering several factors in the pavement design can reduce surface infiltration. To summarize, the following are some of the factors that need to be emphasized in order to maintain proper drainage.

1) Appropriate slopes should be provided.

2) Joints should be properly sealed and maintained.

3) Side drains or sub drains along a pavement section may be provided.

4) Proper pavement maintenance programs such as sealing surface cracks, and immediate repair of distressed pavement areas should be adopted.

5) During and after the construction, site grading should be kept in such a way that the water drains freely off the site and off any prepared or unprepared subgrade soils. Excavations should not be kept open for a long period of time.

4 CONSTRUCTION CONSIDERATIONS

4.1 GROUNDWATER CONTROL

Water should not be allowed to collect near or below the foundation or floor slab areas of the building either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater or surface runoff. Positive site drainage should be provided at all times to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. All grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill of the building. It is anticipated that foundation excavations and construction control of water may be accomplished with pumps pumping from properly filtered open sumps.

Proper perimeter drainage mechanisms should be provided along all exterior foundation members. The elevation of the drainage lines should be adjusted to keep water a minimum of two (2) feet below the design subgrade elevation. A free flowing granular drainage fill such as crushed stone is to be employed around all drainage lines with the granular drainage fill encased in a geotextile filter fabric. The perimeter drains should discharge to a storm sewer or drainage ditch by gravity.

4.2 SUBGRADE PREPARATION

The near surface soils present at this site are somewhat sensitive to softening due to rainfall and traffic. It is our experience that damp or wet soils tend to rut under rubber tire vehicle traffic. Maintenance of entrance roads and other areas subjected to construction traffic, such as floor slab areas, is typically required until floor slab construction is completed. If near surface soils become wet and disturbed, excavation and replacement with suitable compacted fill will be necessary. For this site during wet or cool seasons, it is advantageous to place a working course of compacted graded aggregate base over building and road way areas between the time of initial grading and final floor slab construction. The graded aggregate base may need periodic replenishment depending on weather and traffic conditions during construction.

Professional Service Industries Engineering, PLLC recommends that immediately prior to placement of stone and the beginning of floor slab construction, a representative of the Geotechnical Engineer evaluate the floor slab subgrades. If low density or otherwise unsuitable soils are encountered which cannot be adequately densified in place, such soils should be removed and replaced with well-compacted fill material placed in accordance with a previous section of this report or with well-compacted crushed stone materials.

5 EXCAVATIONS

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P". This document was established to ensure the safety of workers entering trenches or excavations.

Federal regulation mandates that all excavations, whether they be utility trenches, basement or footing excavations or others (i.e. underground storage tanks), be constructed in accordance with the OSHA requirements. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could risk injury to workers and be liable for substantial financial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in “29 CFR Part 1926”, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. Professional Service Industries Engineering, PLLC is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6 RECOMMENDATIONS FOR FINAL SUBSURFACE EXPLORATION

The final subsurface exploration will depend on the final footprint locations and the anticipated loads. Based upon the current preliminary site plans, Professional Service Industries Engineering, PLLC recommends additional borings within the proposed building footprints and parking/drive areas, once the building locations and parking/drive areas have been finalized within the proposed sites.

7 CONSTRUCTION OBSERVATION AND TESTING

Professional Service Industries Engineering, PLLC should be retained to examine and identify soil exposures created during project excavations in order to verify that soil conditions are as anticipated. Professional Service Industries Engineering, PLLC further recommends that compacted engineered fill be continuously observed and tested during placement by our representative in order to document the compaction effort. Samples of fill materials should be submitted to Professional Service Industries Engineering, PLLC's laboratory for testing prior to placement of fills on site and should include a moisture-density relationship (Proctor) and sieve analysis including a minus 200 sieve test. Density testing should be performed at a rate of one per 2,500 square feet per six (6)-inch lift in building areas, one test per 10,000-square feet per six (6)-inch lift in pavement areas and one per one hundred linear feet per six (6)-inch lift in utility trench backfill.

Professional Service Industries Engineering, PLLC should also be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related vertical construction activities of this project. Professional Service Industries Engineering, PLLC cannot accept any responsibility for any conditions that deviated from those described in this report, nor for the performance of the foundation, if not engaged to also provide construction observation and testing for this project.

Costs for the recommended observations during construction are beyond the scope of this current consultation. Such future services would be at an additional charge.

8 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. Site exploration identifies actual subsurface conditions only at those points where samples are taken. A geotechnical report is based on conditions that existed at the time of the subsurface exploration. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitute Professional Service Industries Engineering, PLLC's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and Professional Service Industries Engineering, PLLC's experience in working with these conditions.

9 REPORT LIMITATIONS

Professional Service Industries Engineering, PLLC's professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Professional Service Industries Engineering, PLLC is not responsible for the conclusions, opinions or recommendations made by others based on these data. No other warranties are implied or expressed.

The scope of investigation was intended to evaluate soil conditions within the influence of the proposed foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed structure.

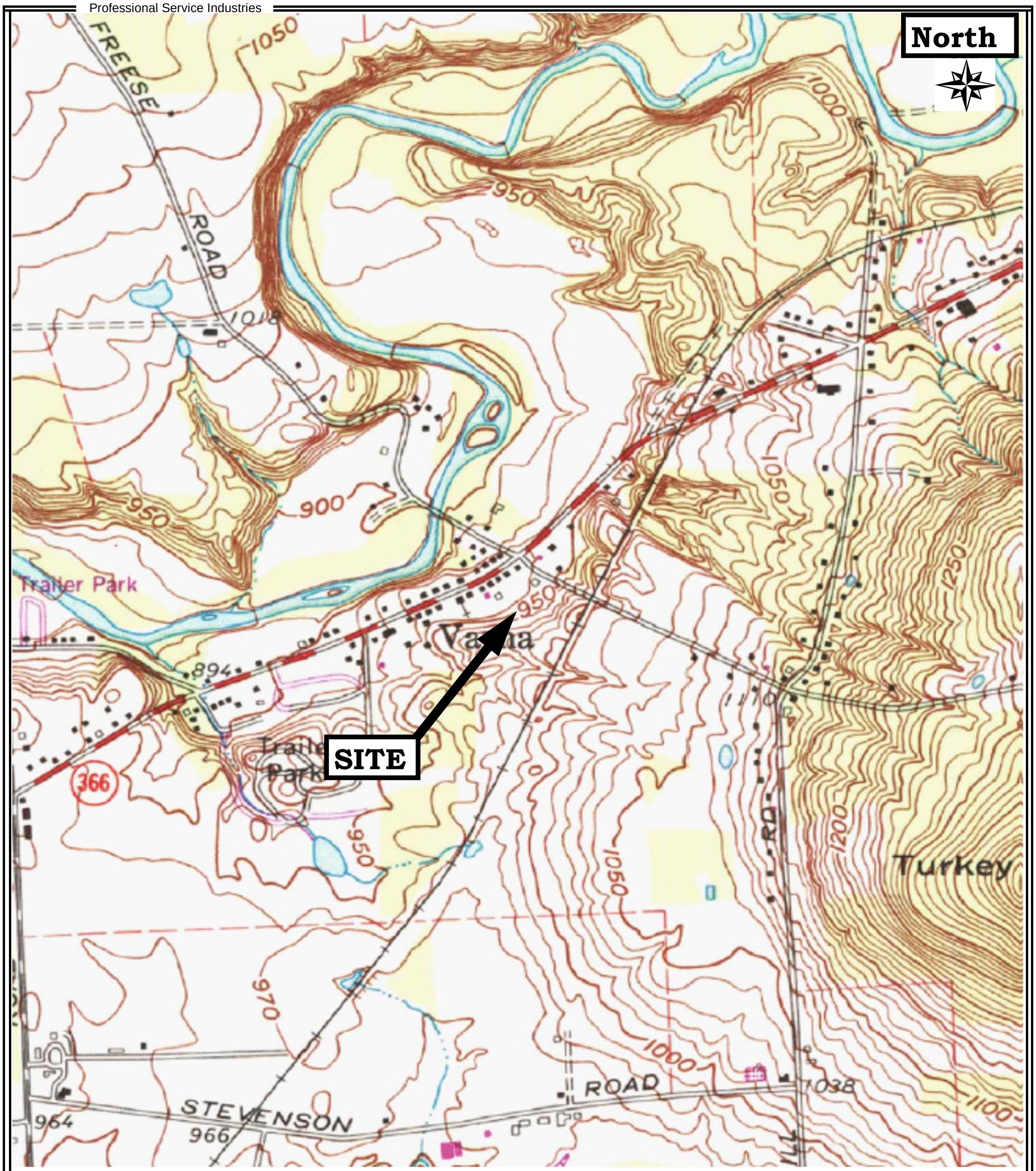
The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

Professional Service Industries Engineering, PLLC did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminate in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Site conditions are outside of Professional Service Industries Engineering, PLLC's control, and mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, Professional Service Industries Engineering, PLLC cannot and shall not be held responsible of the occurrence or recurrence of mold amplification.

This report has been prepared for the exclusive use of Trinitas Ventures, LLC and their intermediaries, consultants for the specific application to this project at this site. Professional Service Industries Engineering, PLLC warrants that the evaluations and recommendations contained in this report are based on generally accepted professional engineering practices in the field of geotechnical engineering in the local area at the time of this report. No other warranties are implied or expressed.

FIGURES

Professional Service Industries



Base map provided by Microsoft Research Maps

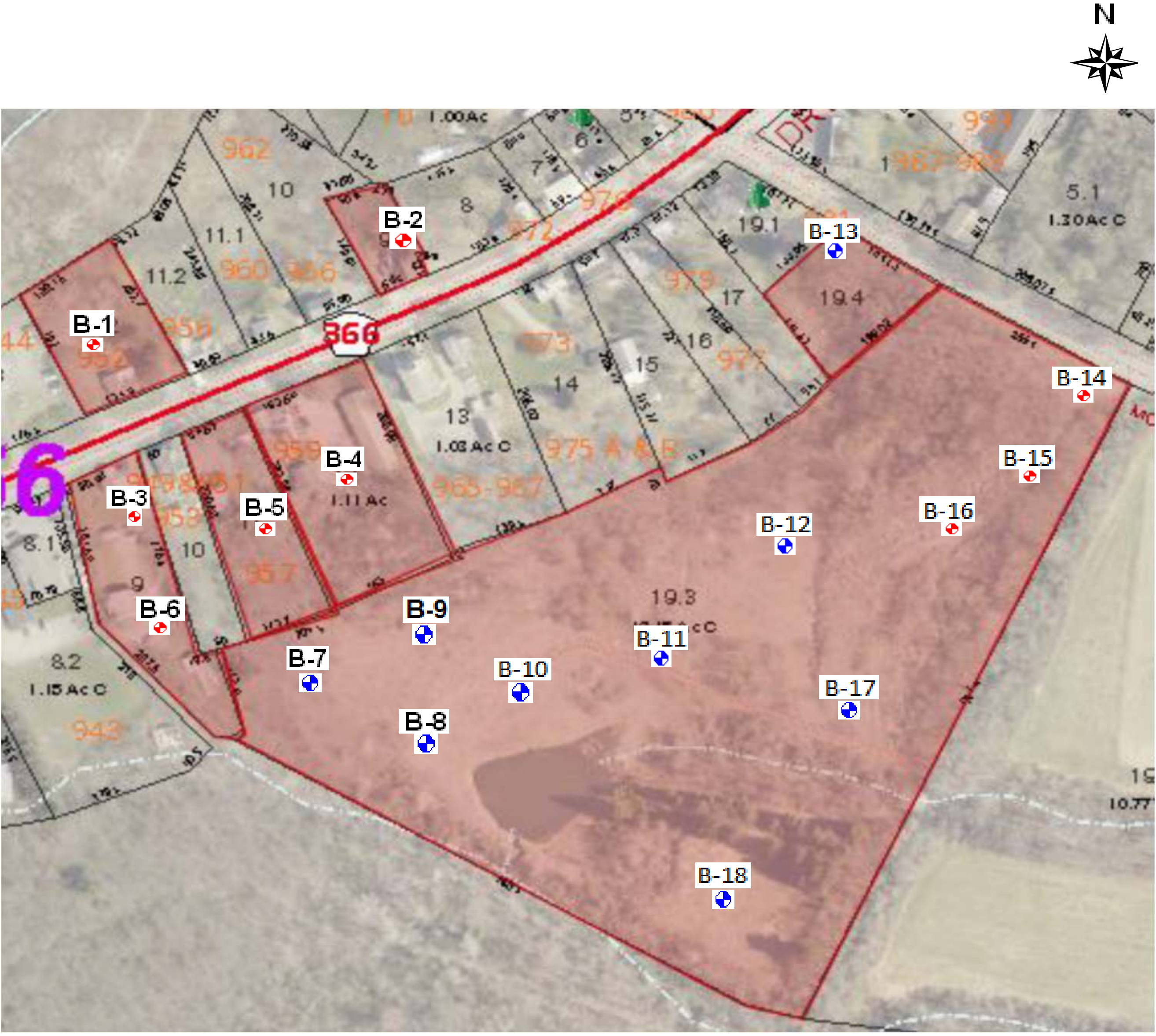
Project Name:
Proposed Student Housing Development
Seven (7) Parcels in the vicinity of 959 Dryden Rd.
Ithaca, Tompkins County, New York 14850

General Site Location Plan

Project No.: 0806962 - Addendum

Date: August 8, 2018

Professional Service Industries



🔴 - Soil Borings Performed During Phase I (March 28 & 29 and April 9, 2018)
🔵 - Soil Borings Performed Durring Phase II (July 16, 17, 18, 2018)

NOT TO SCALE

Project Name:
Proposed Student Housing Development
Seven (7) Parcels in the vicinity of 959 Dryden Rd.
Ithaca, Tompkins County, New York 14850

Boring Location Plan

Project No.: 0806962 - Addendum

Date: August 8, 2018

APPENDIX A

Boring Logs

General Notes

Unified Soil Classification System

BORING B-1

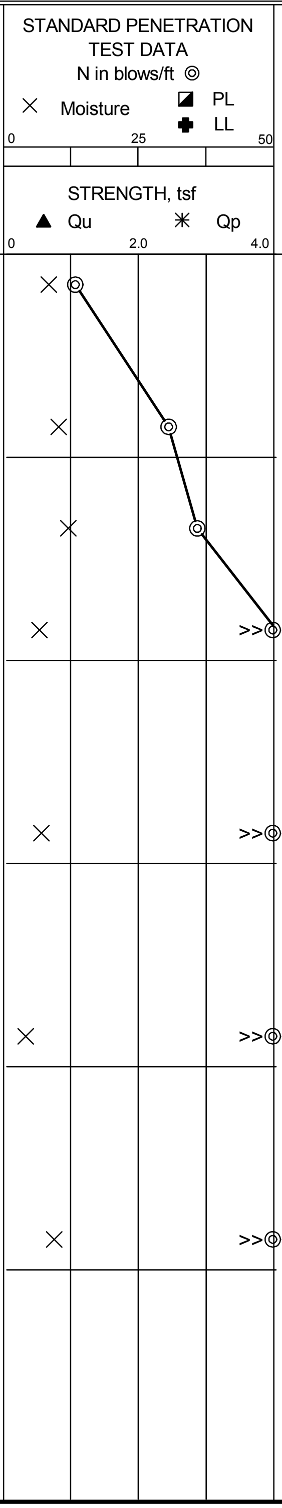
DATE STARTED: 3/29/18
DATE COMPLETED: 3/29/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 8'

DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

Water			
▽	While Drilling	None	feet
▼	Upon Completion	22	feet
▽	Delay		N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0		☒	1	12	FILL, coarse to fine sand, little medium to fine gravel and silt, trace slag, brown, medium dense, moist	FILL	5-5-5 N_{60}=13	8	
	5		☒	2	18	POORLY GRADED SAND (SP), medium to fine sand, some coarse to fine gravel, little silt, brown, dense, moist	SP	14-14-9 N_{60}=31	10	
			☒	3	12	SANDY SILT (ML), medium to fine sand, little clay and medium to fine gravel, brown, dense, moist ** Cobbles noted	ML	13-14-13 N_{60}=36	12	
	10		☒	4	5			10-20-18 N_{60}=51	7	
	15		☒	5	10	SILTY SAND (SM), medium to fine sand, some coarse to fine gravel, brown to gray, very dense, moist ** Cobbles noted	SM	21-22-25 N_{60}=63	7	
	20		☒	6	14			28-23-27 N_{60}=67	4	
	25		☒	7	18			31-30-18 N_{60}=64	9	
						Boring Terminated at 25'				



Professional Service Industries, Inc.
3784 Commerce Court, Suite 300
North Tonawanda, NY 14120
Telephone: (716) 694-8657

PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
959 Dryden Road
Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 7/17/18
DATE COMPLETED: 7/17/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 16.2'

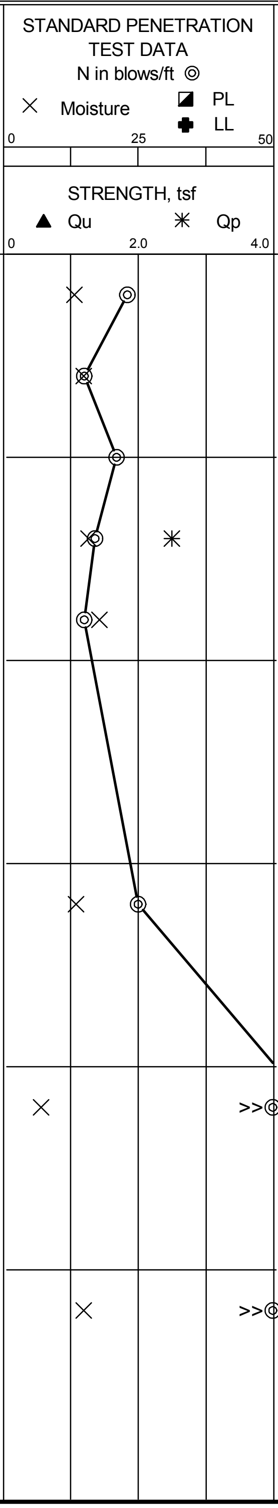
DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

BORING B-10

Water			
▽	While Drilling	None	feet
▼	Upon Completion	None	feet
▽	Delay		N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			4" TOPSOIL				
		1	20	SANDY SILT (ML), fine sand, little medium to fine sand, trace clay, brown, medium dense, moist	ML	9-11-12-11 N=23	13	
		2	7	SILT (ML), little clay and fine sand, trace medium to fine gravel, brown, medium dense, moist	ML	10-8-7-8 N=15	15	
	5	3	0			12-10-11-12 N=21		
		4	17	CLAYEY SILT (ML), little fine sand, trace fine gravel, brown, medium dense, moist	ML	9-9-8-12 N=17	16	
		5	4	SILTY CLAY (CL-ML), trace fine sand, brown, stiff, moist	CL-ML	8-8-7-8 N=15	18	
	10							
	15	6	20	SILTY SAND (SM), fine sand, trace clay, brown, medium dense, wet	SM	5-8-17-19 N=25	13	
	20	7	12	SILTY SAND (SM), medium to fine sand, little fine gravel, trace clay, brown and gray, very dense, moist	SM	27-25-32-28 N=57	7	
	25	8	12	SANDY SILT (ML), fine sand, trace clay, gray, very dense, moist	ML	34-32-27-40 N=59	15	
				Boring Terminated at 27'				



Professional Service Industries, Inc.
3784 Commerce Court, Suite 300
North Tonawanda, NY 14120
Telephone: (716) 694-8657

PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
959 Dryden Road
Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

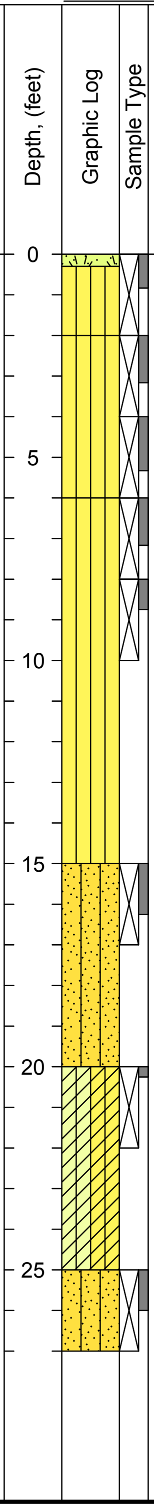
BORING B-11

DATE STARTED: 7/18/18
DATE COMPLETED: 7/18/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 12.5'

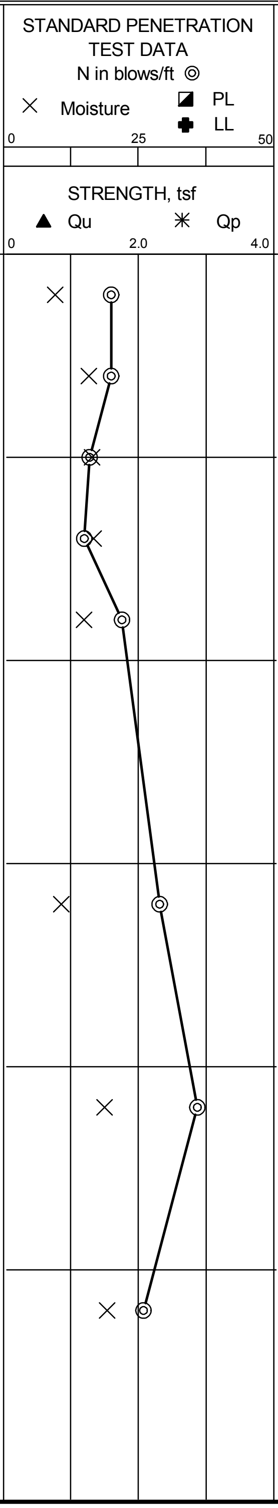
DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
⊻	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan



Elevation (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
			4" TOPSOIL				
	1	10	SILT (ML), little medium to fine sand and fine gravel, trace clay, brown, medium dense, moist	ML	5-9-11-6 N=20	10	
	2	14	CLAYEY SILT (ML), little fine sand, trace fine gravel, brown, medium dense, moist	ML	7-10-10-10 N=20	16	
	3	16			7-7-9-9 N=16	16	
	4	14	CLAYEY SILT (ML), little fine sand, brown, medium dense, moist	ML	8-7-8-9 N=15	17	
	5	9			9-11-11-13 N=22	15	
	6	15	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, brown, medium dense, moist	SM	12-18-11-13 N=29	11	
	7	3	SILTY CLAY (CL-ML), trace fine sand, gray, hard, moist	CL-ML	16-20-16-21 N=36	19	
	8	12	SILTY SAND (SM), fine sand, trace clay, gray, medium dense, moist	SM	14-12-14-18 N=26	19	
			Boring Terminated at 27'				



Professional Service Industries, Inc.
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North Tonawanda, NY 14120
Telephone: (716) 694-8657

PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
959 Dryden Road
Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 7/18/18
DATE COMPLETED: 7/18/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 14.2'

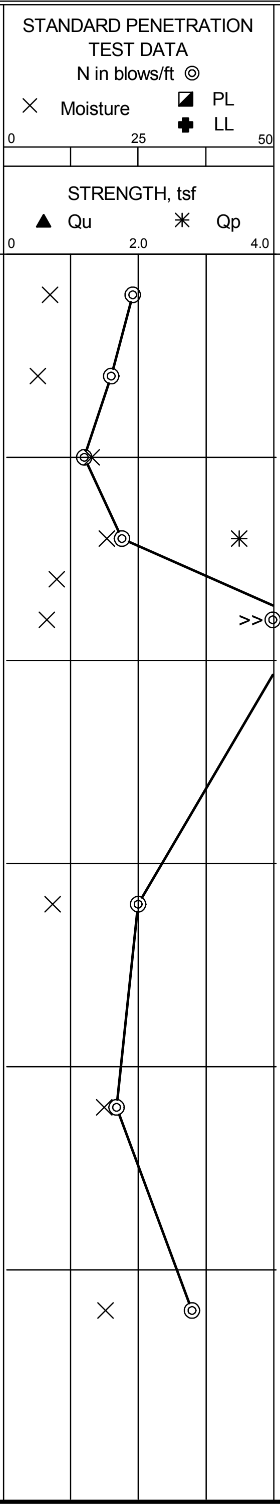
DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

BORING B-12

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA	Additional Remarks
	0					6" TOPSOIL					
				1	22	SANDY SILT (ML), medium to fine sand, little medium to fine gravel, trace clay, brown, medium dense, moist	ML	10-14-10-16 N=24	9		
				2	10	POORLY GRADED SAND (SP), coarse to fine sand, some medium to fine gravel, little silt, brown, medium dense, moist	SP	7-9-11-11 N=20	6		
	5			3	10	CLAYEY SILT (ML), little fine sand, trace fine gravel, brown, medium dense, moist	ML	5-5-10-8 N=15	16		
				4	12	SILTY CLAY (CL-ML), trace fine sand, brown, very stiff, moist	CL-ML	6-12-10-15 N=22	19		
									10		
				5	18	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, trace clay, brown, very dense, moist	SM	17-29-27-31 N=56	8		
	10					SANDY SILT (ML), medium to fine sand, some medium to fine gravel, trace clay, brown, very dense, moist	ML				
	15			6	14	SILTY SAND (SM), coarse to fine sand, some medium to fine gravel, brown, medium dense, moist	SM	14-14-11-14 N=25	9		
	20			7	18	SILT (ML), little clay, trace fine sand, gray, medium dense, moist	ML	10-8-13-24 N=21	19		
	25			8	14	CLAYEY SILT (ML), trace fine sand, gray, dense, moist	ML	14-16-19-21 N=35	19		
						Boring Terminated at 27'					



Professional Service Industries, Inc.
3784 Commerce Court, Suite 300
North Tonawanda, NY 14120
Telephone: (716) 694-8657

PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
959 Dryden Road
Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-13

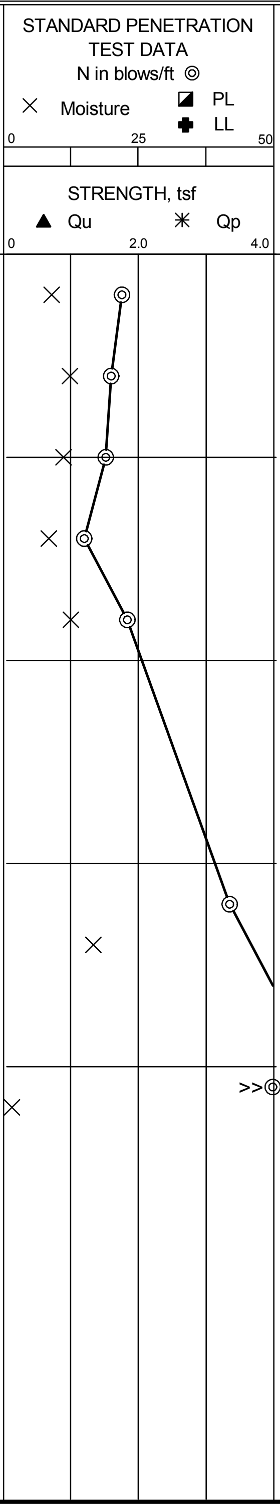
DATE STARTED: 7/18/18
DATE COMPLETED: 7/18/18
COMPLETION DEPTH 21.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 17.2'

DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▼	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					1" TOPSOIL				
				1	20	SILTY SAND (SM), coarse to fine sand, some medium to fine gravel, trace clay, brown, medium dense, moist	SM	11-11-11-11 N=22	9	
				2	17	SANDY SILT (ML), fine sand, little clay and fine gravel, brown, medium dense, moist	ML	8-9-11-13 N=20	12	
	5			3	21	POORLY GRADED SAND (SP), medium to fine sand, little silt, trace fine gravel, brown, medium dense, moist	SP	17-9-10-7 N=19	11	
				4	16	POORLY GRADED SAND (SP), medium to fine sand, little silt and medium to fine gravel, brown, medium dense, moist	SP	11-7-8-11 N=15	8	
	10			5	4	SILTY SAND (SM), fine sand, trace fine gravel and clay, gray, medium dense, moist	SM	12-12-11-14 N=23	13	
	15			6	16	SANDY SILT (ML), fine sand, trace clay, gray, dense, wet	ML	17-19-23-14 N=42	17	
	20			7	0	SEVERELY WEATHERED BEDROCK, trace coarse to fine sand, brown, very dense, moist			2	
						Auger Refusal at 21'				



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PROJECT: Proposed Student Housing Development
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959 Dryden Road
Ithaca, Tompkins County, NY 14850

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BORING B-14

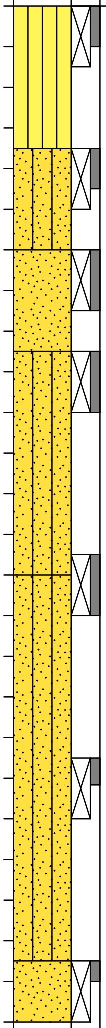
DATE STARTED: 3/28/18
DATE COMPLETED: 3/28/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 7'

DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

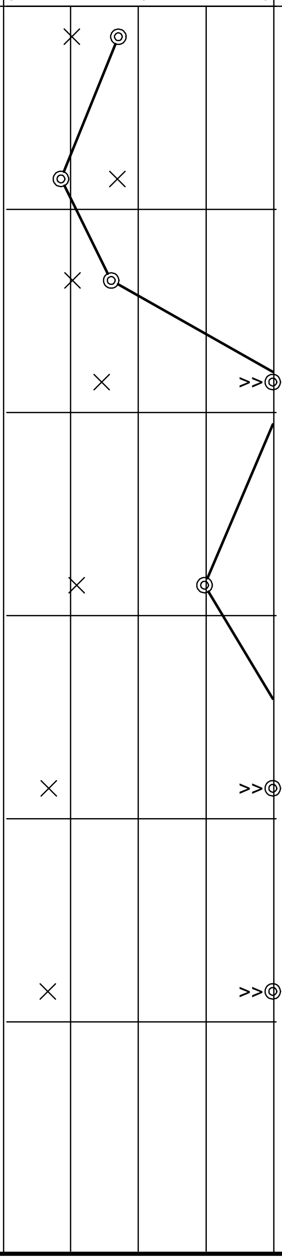
Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			1	12	SANDY SILT (ML), medium to fine sand, little medium to fine gravel, trace clay, brown, medium dense, moist ** Cobbles noted	ML	7-8-8 N_{60}=21	13	
	5			2	12	SILTY SAND (SM), medium to fine sand, trace fine gravel, brown, medium dense, wet	SM	3-3-5 N_{60}=11	21	
				3	18	POORLY GRADED SAND (SP), fine sand, little silt, trace fine gravel, gray, medium dense, wet	SP	6-6-9 N_{60}=20	13	
	10			4	18	SILTY SAND (SM), fine sand, gray, very dense, wet	SM	12-15-25 N_{60}=53	18	
	15			5	18	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, trace clay, gray, dense to very dense, moist ** Cobbles noted		12-13-15 N_{60}=37	14	
	20			6	8		SM	26-50/3"	8	
	25			7	6	POORLY GRADED SAND (SP), fine sand, trace silt, brown, very dense, moist ** Cobbles noted	SP	30-50/6"	8	
						Boring Terminated at 25'				



STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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PROJECT: Proposed Student Housing Development
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959 Dryden Road
Ithaca, Tompkins County, NY 14850

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DATE STARTED: 3/28/18
DATE COMPLETED: 3/28/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 5'

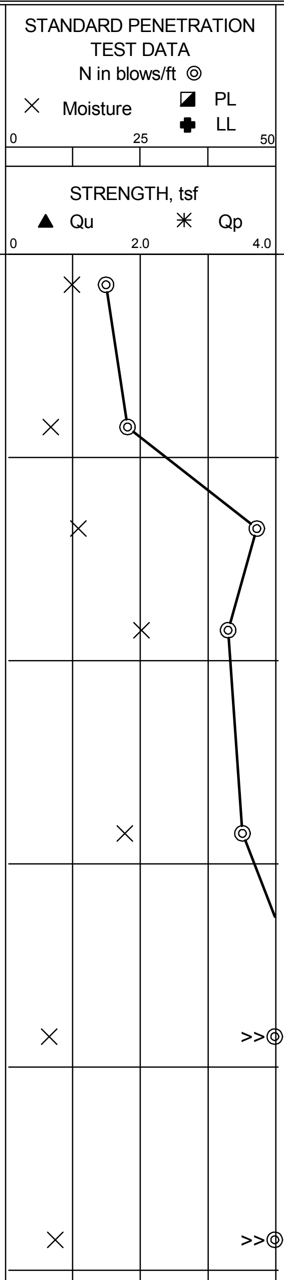
DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

BORING B-15

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					2" TOPSOIL				
			☒	1	12	SANDY SILT (ML) medium to fine sand, little clay and fine gravel, brown, medium dense, moist ** Cobbles noted	ML	4-6-8 N_{60}=19	12	
	5		☒	2	12	SILTY SAND (SM), medium to fine sand, trace clay and fine gravel, brown, medium dense to dense, moist ** Cobbles noted	SM	5-4-13 N_{60}=23	8	
			☒	3	18			12-15-20 N_{60}=47	14	
	10		☒	4	18	SANDY SILT (ML), fine sand, trace clay, brown, dense, moist	ML	12-14-17 N_{60}=41	25	
	15		☒	5	18	SILTY SAND (SM), fine sand, trace clay, gray, dense, wet	SM	13-15-18 N_{60}=44	22	
	20		☒	6	18	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, trace clay, gray, very dense, moist	SM	11-17-27 N_{60}=59	8	
	25		☒	7	18			25-40-31 N_{60}=95	9	
						Boring Terminated at 25'				



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BORING B-16

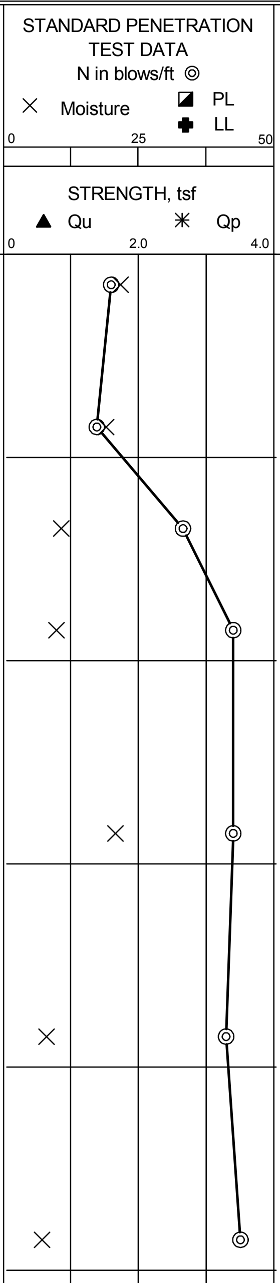
DATE STARTED: 3/28/18
DATE COMPLETED: 3/28/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▼	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 5'

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0		☒	1	12	2" TOPSOIL CLAYEY SILT (ML), little fine sand, trace medium to fine gravel, brown, medium dense, moist	ML	4-6-9 N_{60}=20	22	
	5		☒	2	12			5-5-8 N_{60}=17	19	
			☒	3	18	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, trace clay, brown, dense, moist ** Cobbles noted	SM	6-8-17 N_{60}=33	11	
	10		☒	4	18			9-14-18 N_{60}=43	10	
	15		☒	5	18	SILTY SAND (SM), fine sand, trace fine gravel, gray, dense, wet	SM	10-13-19 N_{60}=43	21	
	20		☒	6	12	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, trace clay, gray, dense, moist	SM	20-15-16 N_{60}=41	8	
	25		☒	7	18	SILTY SAND (SM), medium to fine sand, little clay and medium to fine gravel, gray, dense, moist	SM	16-17-16 N_{60}=44	7	
						Boring Terminated at 25'				



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Ithaca, Tompkins County, NY 14850

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BORING B-17

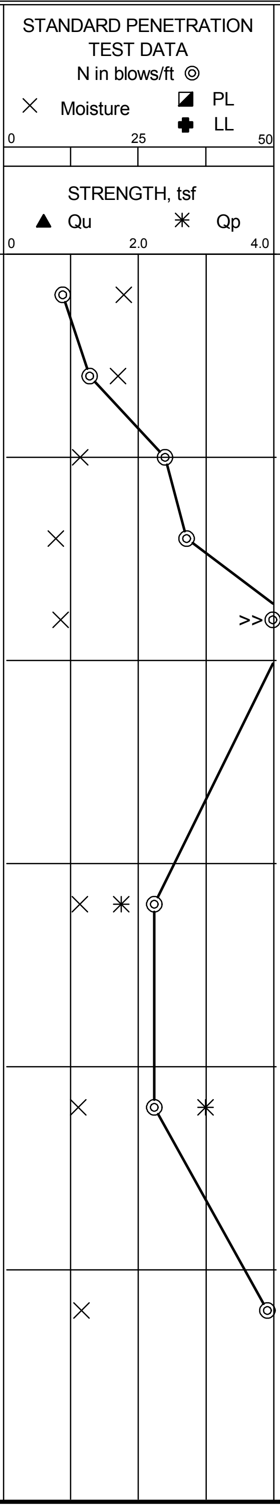
DATE STARTED: 7/18/18
DATE COMPLETED: 7/18/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 18.7'

DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			4" TOPSOIL				
		1	14	CLAYEY SILT (ML), trace fine sand and fine gravel, brown, medium dense, moist	ML	4-5-6-7 N=11	22	
		2	11	CLAYEY SILT (ML), little fine sand, brown, medium dense, wet to moist	ML	7-7-9-10 N=16	21	
	5	3	24			9-16-14-17 N=30	14	
		4	20	SANDY SILT (ML), medium to fine sand, little clay and medium to fine gravel, brown, dense, moist	ML	15-17-17-18 N=34	10	
		5	24	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, trace clay, brown, very dense, moist	SM	20-20-34-32 N=54	11	
	10							
	15	6	6	SILTY CLAY (CL-ML), trace fine sand and fine gravel, brown, very stiff, moist	CL-ML	26-17-11-13 N=28	14	
	20	7	22			15-13-15-20 N=28	14	
	25	8	14	POORLY GRADED SAND (SP), fine sand, trace silt, gray, dense, wet	SP	11-21-28-47 N=49	14	
				Boring Terminated at 27'				



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North Tonawanda, NY 14120
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PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
959 Dryden Road
Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

DATE STARTED: 7/18/18
DATE COMPLETED: 7/18/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 16.3'

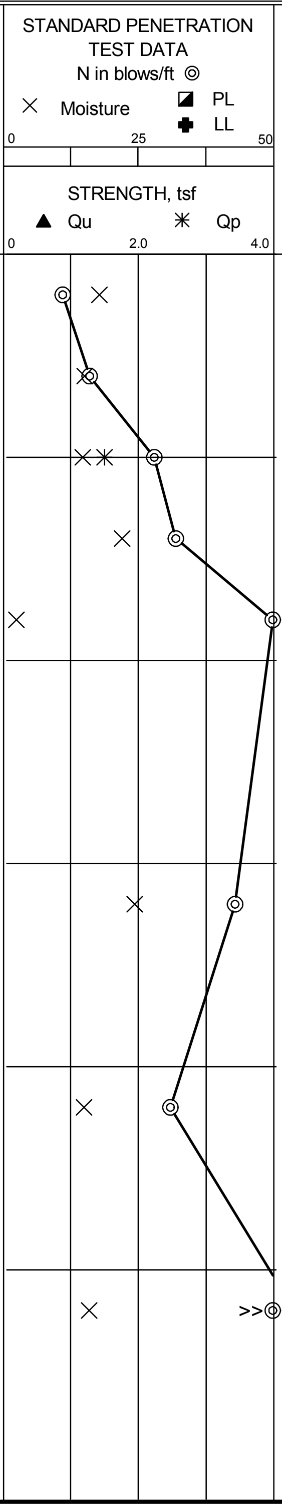
DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

BORING B-18

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			3" TOPSOIL				
		1	10	CLAYEY SILT (ML), trace fine sand and fine gravel, brown, medium dense, moist	ML	6-6-5-7 N=11	18	
		2	14	SANDY SILT (ML), fine sand, trace clay, brown, medium dense, moist	ML	8-8-8-10 N=16	15	
	5	3	17	SILTY CLAY (CL-ML), little fine sand, trace fine gravel, brown, very stiff, moist	CL-ML	11-13-15-12 N=28	15	
		4	11	CLAYEY SILT (ML), little medium to fine sand and medium to fine gravel, brown, dense, moist	ML	17-17-15-21 N=32	22	
	10	5	24	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, brown, dense, moist	SM	23-14-36-35 N=50	2	
	15	6	4	CLAYEY SILT (ML), trace medium to fine sand and fine gravel, brown, dense, wet	ML	17-22-21-23 N=43	24	
	20	7	20	POORLY GRADED SAND (SP), fine sand, little silt, trace clay, gray, dense, wet	SP	14-14-17-16 N=31	15	
	25	8	20	POORLY GRADED SAND (SP), fine sand, trace silt, gray, very dense, saturated	SP	21-23-31-30 N=54	16	
				Boring Terminated at 27'				



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PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
959 Dryden Road
Ithaca, Tompkins County, NY 14850

DATE STARTED: 3/29/18
DATE COMPLETED: 3/29/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 5.5'

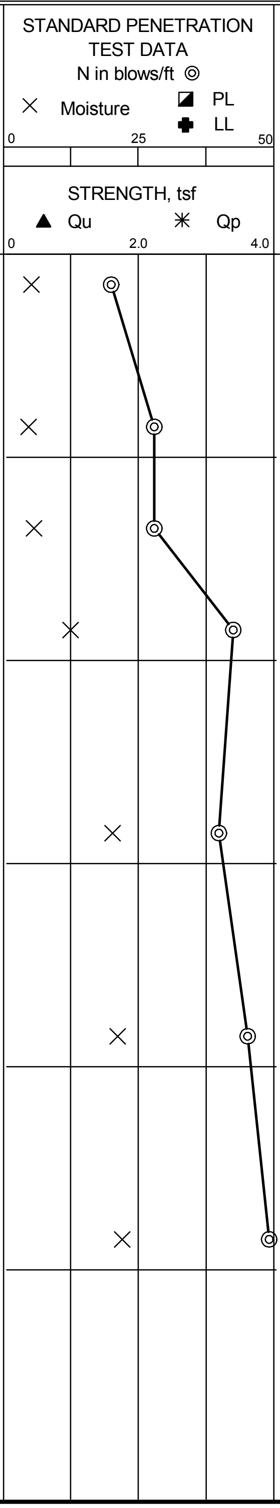
DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

BORING B-2

Water		
∇	While Drilling	22 feet
▼	Upon Completion	None feet
▼	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0	1	12	FILL, silty sand, medium to fine sand, some medium to fine gravel, brown, medium dense, moist ** Cobbles noted	FILL	8-7-8 N_{60}=20	5	
		2	18	FILL, coarse to fine sand, some medium to fine gravel, little silt, brown, medium dense, moist ** Cobbles noted	FILL	9-9-12 N_{60}=28	5	
	5	3	10	POORLY GRADED SAND (SP), coarse to fine sand, some coarse to fine gravel, little silt, brown, medium dense, moist ** Cobbles noted	SP	12-12-9 N_{60}=28	6	
	10	4	14	POORLY GRADED SAND (SP), coarse to fine sand, some coarse to fine gravel, little silt, brown, dense, saturated ** Cobbles noted	SP	12-14-18 N_{60}=43	12	
	15	5	18	SANDY SILT (ML), fine sand, trace clay, brown, dense, saturated	ML	8-13-17 N_{60}=40	20	
	20	6	18	SILTY SAND (SM), fine sand, trace clay, gray, dense, wet	SM	13-15-19 N_{60}=45	21	
			∇					
	25	7	18		SM	12-18-19 N_{60}=49	22	
				Boring Terminated at 25'				



intertek psi

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PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
LOCATION: Seven (7) Parcels of Land
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Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

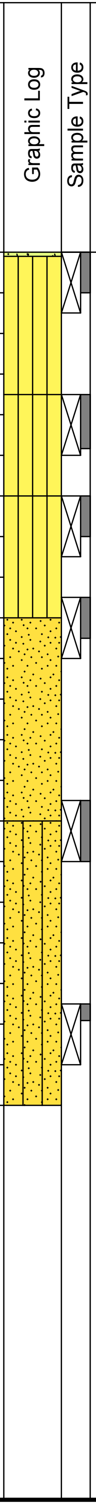
DATE STARTED: 3/29/18
DATE COMPLETED: 3/29/18
COMPLETION DEPTH 21.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 7'

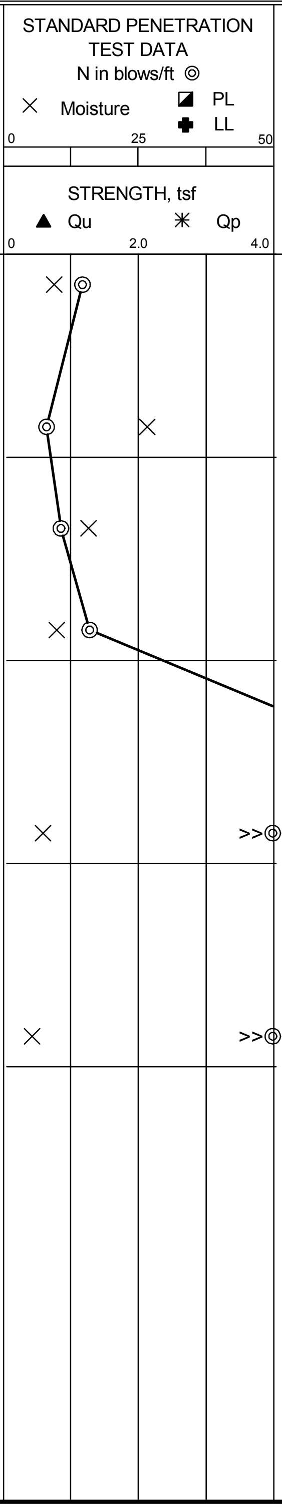
BORING B-3

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0	1	12	1" TOPSOIL CLAYEY SILT (ML), little medium to fine sand and medium to fine gravel, brown, medium dense, moist	ML	6-6-5 N_{60}=15	9	
	5	2	16	CLAYEY SILT (ML), little fine sand, trace organics, brown, loose, wet	ML	5-3-3 N_{60}=8	27	
		3	12	CLAYEY SILT (ML), little medium to fine sand, trace medium to fine gravel, brown, medium dense, wet	ML	4-4-4 N_{60}=11	16	
	10	4	12	POORLY GRADED SAND (SP), coarse to fine sand, some coarse to fine gravel, little silt, brown, medium dense, saturated ** Cobbles noted	SP	6-5-7 N_{60}=16	10	
	15	5	18	SILTY SAND (SM), medium to fine sand, little to some medium to fine gravel, gray, very dense, moist ** Cobbles noted ** Boulder Encountered at 17'	SM	16-30-50 N_{60}=107	7	
	20	6	5			50/4"	5	
				Auger Refusal at 21'				





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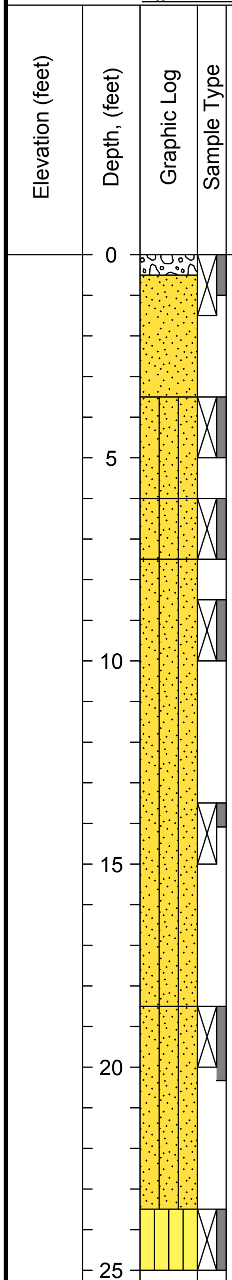
DATE STARTED: 3/28/18
DATE COMPLETED: 3/28/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 12'

DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

BORING B-4

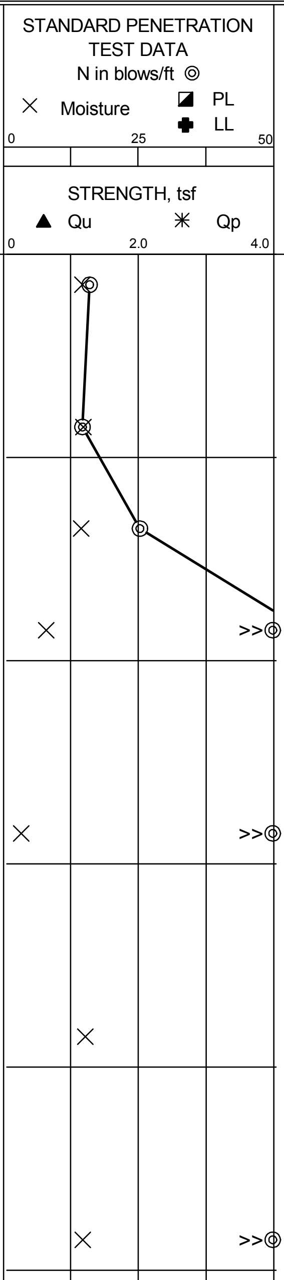
Water
▽ While Drilling None feet
▼ Upon Completion None feet
▽ Delay N/A

BORING LOCATION:
See Attached Boring Location Plan



Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
		6" AGGREGATE FILL			
1	12	POORLY GRADED SAND (SP), medium to fine sand, little silt, trace fine gravel, brown, medium dense, moist ** Cobbles noted	SP	8-7-5 N_{60}=16	15
2	18	SILTY SAND (SM), fine sand, trace fine gravel and clay, brown, medium dense, moist ** Cobbles noted	SM	5-5-6 N_{60}=15	15
3	18	SILTY SAND (SM), fine sand, little clay and medium to fine gravel, brown, medium dense, wet	SM	8-9-10 N_{60}=25	14
4	18	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, gray, very dense, moist ** Cobbles noted	SM	12-15-27 N_{60}=56	8
5	7			50/5"	3
6	22	SILTY SAND (SM), fine sand, trace clay, gray, very dense, moist	SM	40-48-50/5"	15
7	18	SILT (ML), little fine sand, gray, very dense, moist	ML	30-38-45 N_{60}=111	15

Boring Terminated at 25'



Additional Remarks

Professional Service Industries, Inc.
3784 Commerce Court, Suite 300
North Tonawanda, NY 14120
Telephone: (716) 694-8657

PROJECT NO.: 0806962
PROJECT: Proposed Student Housing Development
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959 Dryden Road
Ithaca, Tompkins County, NY 14850

The stratification lines represent approximate boundaries. The transition may be gradual.

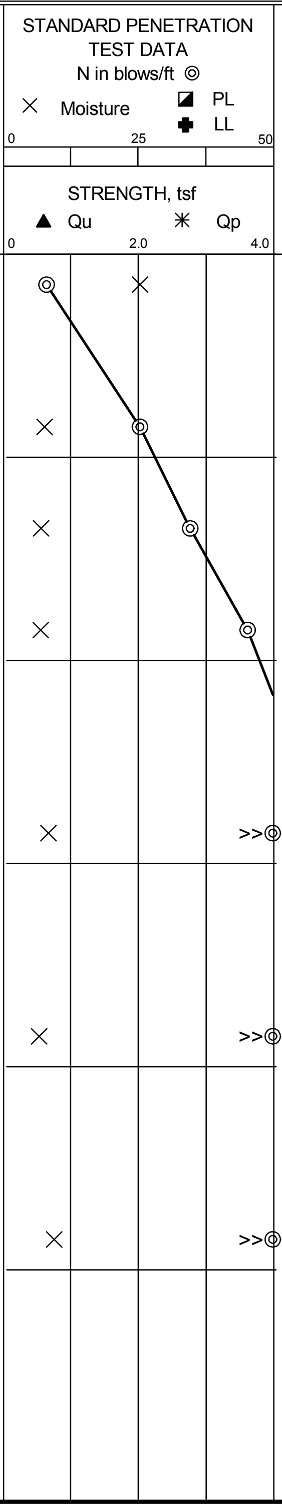
BORING B-5

DATE STARTED: 4/9/18
DATE COMPLETED: 4/9/18
COMPLETION DEPTH 25.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 10'

Water		
▽	While Drilling	22 feet
▼	Upon Completion	6 feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0	1	12	3" TOPSOIL FILL, sandy silt, fine sand, trace fine gravel and slag, brown, loose, moist	FILL	2-2-4 N_{60}=8	25	
		2	5	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, brown and gray, medium dense, moist	SM	10-10-9 N_{60}=25	8	
	5			** Cobbles noted				
		3	7	SILTY SAND (SM), coarse to fine sand, some coarse to fine gravel, trace clay, brown and gray, dense, saturated	SM	17-13-13 N_{60}=35	7	
				** Cobbles noted				
		4	17	POORLY GRADED SAND (SP), medium to fine sand, little silt and medium to fine gravel, trace clay, gray, dense to very dense, moist ** Cobbles noted	SP	13-15-19 N_{60}=45	7	
	10							
		5	12			21-50/5"	8	
	15							
		6	12			15-50/4"	7	
	20							
		7	12			30-50/5"	9	
	25			Boring Terminated at 25'				



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DATE STARTED: 4/9/18
DATE COMPLETED: 4/9/18
COMPLETION DEPTH 23.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633. Hole Cave at 11'

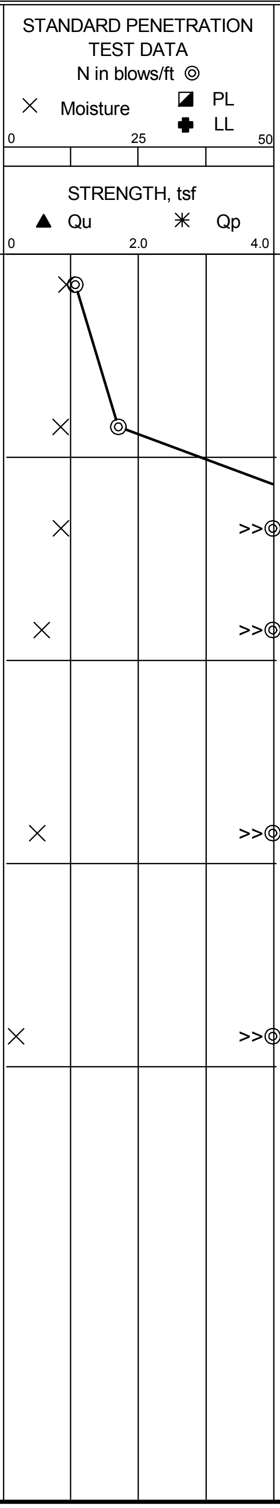
DRILL COMPANY: PSI, Inc.
DRILLER: Carl Rengert **LOGGED BY:** Steven Pump
DRILL RIG: CME 55
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY 80%
REVIEWED BY: DBS

BORING B-6

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▼	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					3" AGGREGATE FILL				
			☒	1	18	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, trace clay, brown, medium dense to very dense, moist ** Cobbles noted	SM	5-5-5 N_{60}=13	12	
	5		☒	2	12			6-7-9 N_{60}=21	11	
			☒	3	18			12-25-29 N_{60}=72	11	
	10		☒	4	16	SILTY SAND (SM), medium to fine sand, some medium to fine gravel, gray, very dense, moist ** Cobbles noted	SM	16-20-27 N_{60}=63	7	
	15		☒	5	10			35-50/2"	6	
	20		☒	6	5			50/5"	2	
						Auger Refusal at 23'				



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BORING B-7

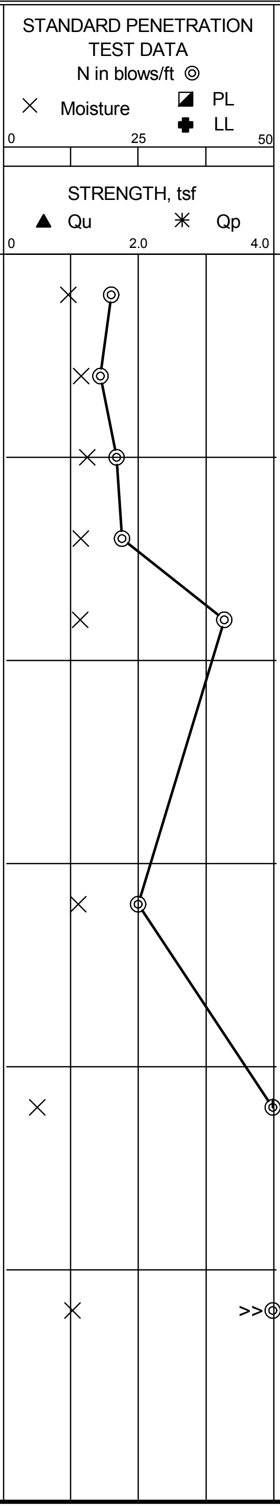
DATE STARTED: 7/16/18
DATE COMPLETED: 7/16/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 12.1'

DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			6" TOPSOIL				
		1	14	SILT (ML), little medium to fine sand and fine gravel, trace clay, brown, medium dense, moist	ML	9-9-11-8 N=20	12	
		2	16	SILT (ML), little fine sand, trace fine gravel and clay, brown, medium dense, moist		8-8-10-7 N=18	14	
	5	3	6		ML	8-10-11-11 N=21	16	
		4	8			10-11-11-9 N=22	14	
		5	12	SILT (ML), little fine sand, trace clay and organics, brown, dense to medium dense, moist		17-21-20-18 N=41	14	
	10							
					ML			
	15							
		6	8			10-9-16-17 N=25	14	
	20							
		7	16	SILT (ML), little medium to fine sand and medium to fine gravel, trace clay, brown, dense, moist		20-26-24-31 N=50	6	
					ML			
	25							
		8	10	CLAYEY SILT (ML), little fine sand, trace fine gravel, brown, very dense, wet	ML	26-26-31-37 N=57	13	
				Boring Terminated at 27'				



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BORING B-8

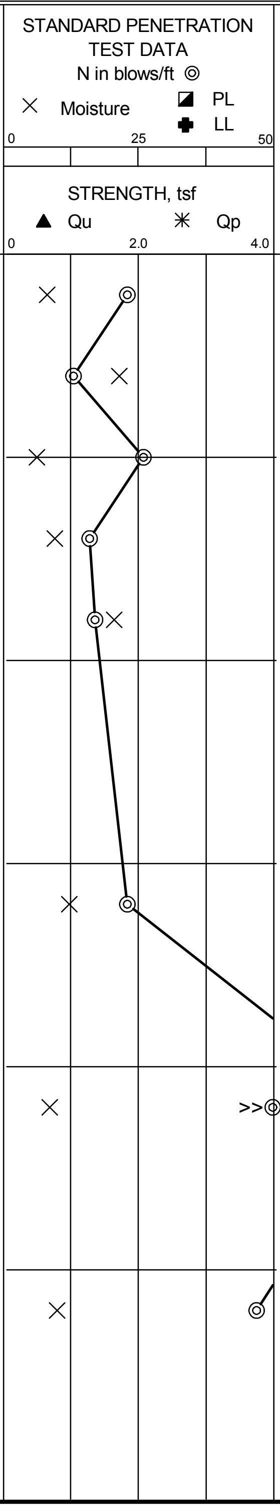
DATE STARTED: 7/17/18
DATE COMPLETED: 7/17/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 14.5'

DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▼	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					3" TOPSOIL				
				1	20	FILL, medium to fine sand and silt, little fine gravel, trace clay and root fragments, brown, medium dense, moist	FILL	10-12-11-13 N=23	8	
				2	4	FILL, silt, little medium to fine sand and clay, trace fine gravel and organics, brown, medium dense, moist	FILL	7-7-6-7 N=13	21	
	5			3	2	FILL, silt and medium to fine sand, little medium to fine gravel, trace to little asphalt, brown and gray, medium dense, moist	FILL	10-11-15-17 N=26	6	
				4	14			6-9-7-11 N=16	10	
				5	12	CLAYEY SILT (ML), little fine sand, trace fine gravel and organics, brown, medium dense, moist	ML	7-8-9-9 N=17	21	
	10									
	15			6	17			7-8-15-21 N=23	12	
	20			7	12	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, gray, very dense, moist	SM	26-38-33-46 N=71	9	
	25			8	12	CLAYEY SILT (ML), little medium to fine gravel and medium to fine sand, brown, dense, wet	ML	16-21-26-36 N=47	10	
						Boring Terminated at 27'				



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BORING B-9

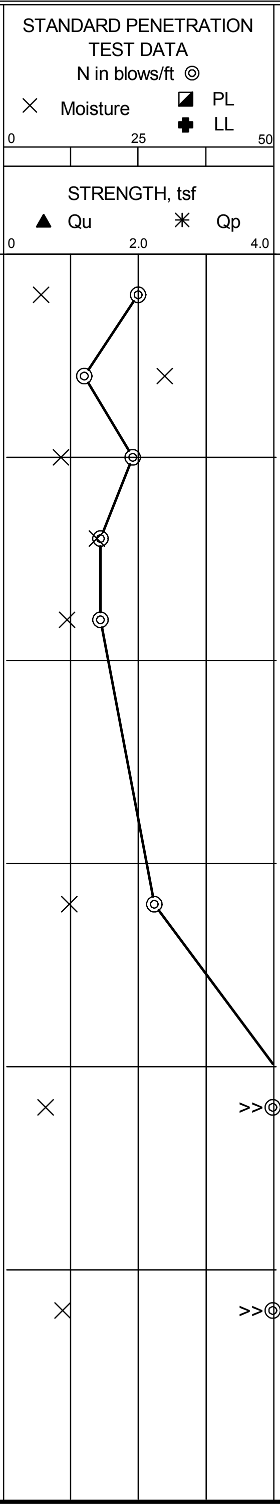
DATE STARTED: 7/17/18
DATE COMPLETED: 7/17/18
COMPLETION DEPTH 27.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A **OFFSET:** N/A
REMARKS: Hole Cave at 12.3'

DRILL COMPANY: NYEG Drilling
DRILLER: Jesse Howe **LOGGED BY:** Steven Pump
DRILL RIG: CME 850
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SS
HAMMER TYPE: Automatic
EFFICIENCY N/A
REVIEWED BY: DBS

Water		
▽	While Drilling	None feet
▼	Upon Completion	None feet
▽	Delay	N/A

BORING LOCATION:
See Attached Boring Location Plan

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0					3" TOPSOIL				
				1	21	SILTY SAND (SM), medium to fine sand, little medium to fine gravel, trace clay, brown, medium dense, moist	SM	11-11-14-12 N=25	7	
				2	6			9-8-7-7 N=15	30	
	5			3	2	SILTY SAND (SM), medium to fine sand, trace fine gravel, organics, and clay, brown, medium dense, moist	SM	11-11-13-11 N=24	11	
				4	11	SANDY SILT (ML), medium to fine sand, trace fine gravel and clay, brown, medium dense, moist	ML	8-9-9-11 N=18	17	
	10			5	8	SILT (ML), little clay and fine sand, trace organics, brown, medium dense, moist	ML	9-8-10-10 N=18	12	
	15			6	10	SANDY SILT (ML), fine sand, little medium to fine gravel, trace clay and organics, brown, medium dense, moist	ML	10-9-19-23 N=28	12	
	20			7	7	SILTY SAND (SM), medium to fine sand, little fine gravel, trace clay, gray, very dense, moist	SM	27-24-32-33 N=56	8	
	25			8	9	SILT (ML), little fine sand, trace fine gravel and clay, brown, very dense, moist	ML	22-30-33-27 N=63	11	
						Boring Terminated at 27'				



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FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

COHESIONLESS SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	5 blows per foot or less
Loose	6 - 10 blows per foot
Medium Dense	11 - 30 blows per foot
Dense	31 - 50 blows per foot
Very Dense	51 blows per foot or more

Particle Size Indentification

Boulders		8 inch diameter or more
Cobbles		3 - 8 inch diameter
Gravel	Coarse	1 - 3 inches
	Medium	1/2 - 1 inch
	Fine	1/4 - 1/2 inch
Sand	Coarse	0.6 mm - 1/4 inch (diameter of pencil lead)
	Medium	0.2 mm - 0.6 mm (diameter of broom straw)
	Fine	0.05 mm - 0.2 mm (diameter of human hair)
Silt		0.002 mm - 0.05 mm (cannot see particles)

Relative Properties

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very soft	3 blows per foot or less
Soft	4 - 5 blows per foot
Medim Stiff	6 - 10 blows per foot
Stiff	11 - 15 blows per foot
Very Stiff	16 - 30 blows per foot
Hard	31 blows per foot or more

Plasticity

Degree of Plasticity	Plasticity Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to very high	over 22

CLASSIFICATION ON LOGS ARE MADE BY VISUAL EXAMINATION OF SAMPLES.

Standard Penetration Test Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. It is customary for ITL to drive the spoon 6.0 inches to seat into undisturbed soil, then perform the test. The quantity of hammer blows for seating the sampler and performing the test are recorded for each 6.0 inches of penetration on the Field Exploration Log (example: 6-10-13). The standard penetration test result can be obtained by adding the last two figures (i.e. 10 + 13 = 23). The reader is referenced to ASTM D1586.

Strata Changes Boundaries between soil layers are considered approximate based upon observed changes during the drilling operations or noted changes within representative samples.

Groundwater Observations were made to determine either the depth or elevation of water at the times indicated on the Soil Exploration Logs. The water so encountered may be groundwater or perched water. The depth or elevations indicated for water may fluctuate due to seasonal changes or other unknown factors.

psi Information To Build On

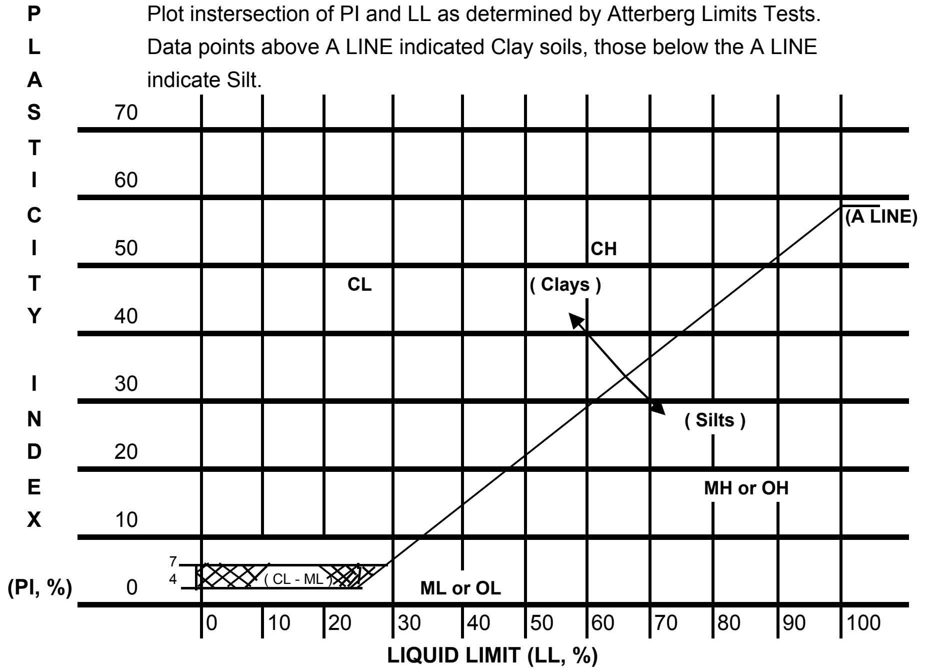
Engineering • Consulting • Testing

United Soil Classification System
ASTM Designation D - 2487

psi Information To Build On
Engineering • Consulting • Testing

Based upon percentage of material passing No. 200 sieve classify as:

Less than 5%	GW, GP, SW, SP
More than 12%	GM, GC, SM, SC
5% to 12%	Borderline, use dual symbols



Plot intersection of PI and LL as determined by Atterberg Limits Tests. Data points above A LINE indicated Clay soils, those below the A LINE indicate Silt.

Coarse Grained Soils (More than half of is larger than No. 200 sieve)	Gravels (More than 50% retained on No.4 sieve)	GW	Well graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}} > 4$	$1 < C_c = \frac{[D_{30}]^2}{D_{10} * D_{60}} < 3$
		GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Does not meet all requirements for GW	
		GM	Silty gravels, gravel-sand-silt mixtures	below A Line, PI < 4	in shaded area 4 < PI < 7 Dual Symbols
		GC	Clayey gravels, gravel-sand-clay mixtures	above A Line, PI > 7	
	Sands (More than 50% passing a No. 4 sieve)	SW	Well graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}} > 6$	$1 < C_c = \frac{[D_{30}]^2}{D_{10} * D_{60}} < 3$
		SP	Poorly graded sands, gravelly sands, little or no fines	Does not meet all requirements for SW	
		SM	Silty sands, sand-silt mixtures	below A Line, PI < 4	in shaded area 4 < PI < 7 Dual Symbols
		SC	Clayey sands, sand-clay mixtures	above A Line, PI > 7	
Fine Grained Soils (More than half of material is smaller than No. 200 sieve)	Silts & Clays (LL less than 50)	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity		
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
		OL	Organic silts and organic silty clays of low plasticity		
	Silts & Clays (LL greater than 50)	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, plastic silts		
		CH	Inorganic clays of high plasticity fat clays		
		OH	Organic clays of medium to high plasticity		
	Highly Organic Soil	Pt	Peat and other highly organic soils		