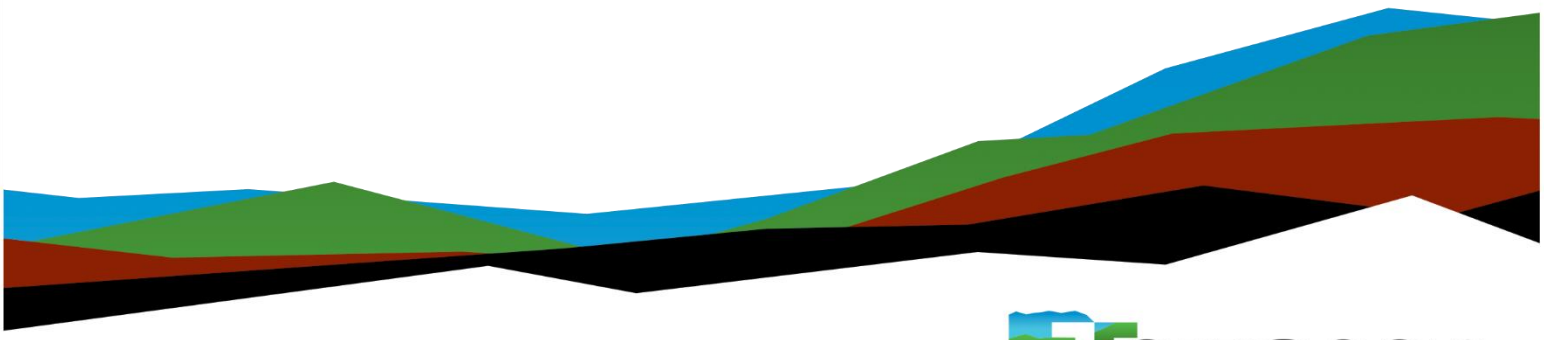
Falls Centre

Revised Geotechnical Engineering Report

February 10, 2025 | Terracon Project No. 70245232

Prepared for:

Fairway Investments
728 Shades Creek Parkway, Suite 210
Birmingham, AL 35209



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February 10, 2025

Fairway Investments
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Attn: Paul T. Darden
P: (205) 802-7202
E: pauldarden@fairwayinvestments.com

Re: Revised Geotechnical Engineering Report
Falls Centre
4500 Falls of Neuse Road
Raleigh, North Carolina
Terracon Project No. 70245232

Dear Mr. Darden:

We have completed the scope of Revised Geotechnical Engineering services for the above-referenced project in general accordance with Terracon Proposal No. P70245232 dated September 24, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon



Taylor Y. Dowell, P.E.
Department Manager I

Andrew A. Nash, P.E.,
Department Manager III

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Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Revised Geotechnical Engineering services performed for the proposed building and parking areas to be located at 4500 Falls of Neuse Road in Raleigh, North Carolina.

The geotechnical engineering Scope of Services for this project included the advancement of SPT borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and exploration locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the SPT boring logs and as separate graphs in the **Exploration Results** section.

Project Description

Our understanding of the project is as follows:

Item	Description
Information Provided	This proposal is based on the following sources of information: ■ Phone conversation between Terracon and Fairway Investments on September 19, 2024. ■ Email conversations between Terracon, EM Structural and BB+M Architectural between September 16, 2024 and February 10, 2025. ■ Previous Terracon Geotechnical Engineering Report for a different site plan, dated October 4, 2023. ■ Site Plan Concept A, prepared by BB+M Architecture, dated September 16, 2024. ■ Wake County GIS ■ Google Earth
Project Description	The project includes redevelopment of a 10.75-acre site.
Proposed Structures	The recently provided Concept A Site Plan includes the development of a new 5-story structure with a combination of a center parking deck and perimeter residential apartments. There will also be six new 1 to 2-story retail buildings and several buildings that will have interior renovations for new tenants.

Item	Description
Building Construction	Steel-framed retail buildings, wood-framed multi-family residential buildings, and concrete-framed parking garages. The buildings will have slab-on-grade ground floors.
Finished Floor Elevations	Within 5 feet of existing grades
Maximum Loads	Anticipated structural loads were provided as follows: ■ 5-Story Building Columns (wood framed areas): 30 kips ■ 5-Story Building Columns (transfer/podium column areas): 450 kips typical, 850 kips maximum ■ 5-Story Building Walls: 6 kips per linear foot (klf) ■ 5-Story Parking Garage Columns: 1,200 kips ■ 5-Story Parking Garage Walls: 60 kips per linear foot (klf) ■ 1 to 2-Story Retail Building Columns: 100 kips ■ 1 to 2-Story Retail Building Columns: 4 kips per linear foot (klf)
Grading/Slopes	Less than 5 feet of cut and 5 feet of fill will be required to develop final grades, excluding foundations, underground utilities, and stormwater system.
Below-Grade Structures	Parking deck ramp. Basements and below-grade parking levels are not anticipated.
Free-Standing Retaining Walls	None anticipated

Item	Description
Pavements	We assume both rigid (concrete) and flexible (asphalt) pavement sections will be used. Pavements will include private parking and drive aisles, and private streets. Unless information is provided prior to the report, we assume that the traffic classification for asphalt pavements will consist of: ■ Class I: Parking stalls for autos and pickup trucks ■ Class III: Delivery lanes with up to ten single-unit or 3-axle semi-trailer trucks per day Unless information is provided prior to the report, we assume the ACI concrete pavement traffic categories will be: ■ Category B: Entrance and truck service lanes, bus parking areas and interior lanes, single-unit truck parking areas ■ Category D: Tractor-trailer truck entrance and exterior lanes The pavement design period is 20 years.
Building Code	2024 North Carolina

Terracon should be notified if any of the above information is inconsistent with the planned construction, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is located at 4500 Falls of Neuse Road in Raleigh, North Carolina. (See Exhibit D) Project site is approximately 10.75 acres.
Existing Improvements	Retail buildings and pavements constructed in 1993.

Item	Description
Current Ground Cover	Pavements and landscaped areas with grass and trees.
Existing Topography	The ground surface is approximately at elevation 346 feet in the central portion of the site, sloping down radially in all directions. The ground surface at the site boundary varies from elevation 344 feet to elevation 326 feet, with the lowest areas in the northeastern corner of the site.

Geotechnical Characterization

GeoModel

We have developed a general characterization of the subsurface conditions based upon the recent Terracon subsurface explorations, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** and the GeoModel can be found in the **Figures** attachment of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	FILL	Medium dense silty SAND (SM) and firm to very stiff sandy SILT (ML) and sandy fat CLAY (CH). Contains some crushed aggregate and wood fragments.
2	RESIDUUM: SILT AND SAND	Loose to medium dense silty SAND (SM) and medium stiff to very stiff sandy SILT (ML)
3	WEATHERED ROCK	Sampled as silty SAND (SM) and sandy SILT (ML)
4	INTERBEDDED SOIL SEAMS	Medium dense silty SAND (SM)
5	AUGER REFUSAL MATERIALS	Auger refusal, followed by a SPT N value of 50/0" with no recovery

Partially Weathered Rock

Partially weathered rock (PWR) was encountered at seven locations. PWR was encountered approximately 8 to 32 feet below the ground surface. PWR is defined as an intermediate geomaterial with rock-like structure that could be penetrated with the exploration method and drill rig used and which exhibited a Standard Penetration Test value of at least 100 blows per foot (i.e., 50 blows with 6 inches or less of penetration).

It is important to note that partially weathered rock may exist at depths less than or more than those listed on the boring logs. Due to the high variability of the geologic weathering profile, linear interpolation between boring locations can be highly inaccurate.

Auger Refusal

Borings B-3 and B-3A encountered auger refusal at a depth of 3 feet below the existing pavement surface. As both borings encountered fill above this depth, we interpret auger refusal at these two boring locations to be some type of obstruction, such as a concrete slab, concrete foundation, or boulder within the fill.

Borings C-1 to C-5, and C-11 encountered auger refusal after drilling. This auger refusal conditions indicates harder rock than the weathered rock, which must be cored to classify.

Groundwater

The borings were advanced using a hollow stem auger drilling technique that allows short term groundwater observations to be made while drilling and at the completion of drilling. Groundwater seepage was generally not encountered above the borehole cave-in depths at the time of our field exploration, except for Boring C-1 at approximately 24 feet below the ground surface. Borehole cave-in depths were measured at depths of about 3 to 17.8 feet.

Groundwater conditions may be different at the time of construction. Groundwater conditions may change because of seasonal variations in rainfall, runoff, nearby surface water levels, leaking utilities, and other conditions not apparent at the time of drilling. Long-term groundwater monitoring was outside the scope of services for this project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design

Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration test (SPT) resistance (N-values), or undrained shear strength in accordance with the 2024 North Carolina Building Code. Based on the soil properties observed at the site, as described on the exploration logs, and shear wave velocity test results, our professional opinion is that a **Seismic Site Classification of C** be considered for the project.. Subsurface explorations at this site were extended to a maximum depth of 35.5 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Measured shear wave velocities ranged between 1,632 to 2,149 ft/s.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the SPT borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

To mitigate risk, the **undocumented existing fill** (encountered in Borings B-3, B-3A, C-4, and C-5) should be completely excavated, removed, and replaced with engineered fill in the building and pavement areas where present. To take advantage of the cost benefit of not removing the entire amount of undocumented existing fill, the owner must be willing to accept the risk of increased differential performance which can result in increased cracking and abrupt differential settlement. Should this risk be acceptable, foundations, floor slabs, and pavements can be supported on or above the existing fill as discussed in this report.

Expansive soils were encountered on the site and should not be placed as new structural fill within 2 feet of pavement, floor slabs, and footings.

Based on the encountered subsurface conditions, we believe **difficult excavation** may be necessary to remove the obstruction (or boulder) encountered in Borings B-3 and B-3A.

Based on the conditions encountered and estimated load-settlement relationships, the proposed structure can be supported on conventional continuous or spread **footings**, however, see the **Shallow Foundations** section for details about embedment depths and settlement. If either of these are an issue, then the parking deck should be placed on shallow foundations with ground improvement (aggregate piers) to limit settlement.

Our opinion of **pavement section thickness** design has been developed based on our understanding of the intended use, assumed traffic, and subgrade preparation recommended herein using methodology contained in NAPA IS-109 "Design of Hot Mix Asphalt Pavements" and ACI 330 "Guide to Design and Construction of Concrete Parking

Lots" and adjusted with consideration to the North Carolina Department of Transportation Pavement Design Manual (2019). The **Pavements** section includes minimum pavement component thickness.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include demolition, clearing and grubbing, stripping, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for earthwork. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our Geotechnical Engineering evaluation for foundations, floor slabs, and pavements.

Demolition

Site demolition should include the removal of existing asphalt, concrete pavement, concrete slabs, concrete curb and gutter, underground utilities, underground stormwater structures and pipes, buried structures, and foundations from the proposed construction areas. Any underground utilities that may exist within the proposed building areas should be relocated, and any within proposed pavement areas should be evaluated by the design team and relocated or filled with grout, if necessary. The crushed stone on the ground surface in the existing pavement areas can be left in place in areas to be filled or can be excavated and re-used as engineered fill. Excavations or cavities resulting from demolition should be backfilled with engineered fill.

The existing concrete pavements, slabs, and foundations at the site could be re-used as engineered fill, provided the concrete is first crushed to less than 1-1/2 inch in maximum particle size and is well-graded. Reinforcing steel should be removed from the crushed concrete. Properly crushed concrete may also be used as a subgrade stabilization material in building and pavement areas and as backfill where foundation undercut is required to remove unsuitable materials. It may also be used as new aggregate base course (ABC) in private pavement areas, provided it meets the NCDOT standard specifications for ABC gradation.

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Demolished asphalt pavements should be transported to an approved off-site disposal location or asphalt plant for possible recycling (RAP).

We recommend existing foundations, slabs, and utilities be removed from within the proposed building footprint and at least 5 feet beyond the outer edge of foundations. For areas outside the proposed building footprints and foundation bearing zones, existing foundations, floor slabs, and utilities should be removed where they conflict with proposed utilities, retaining walls, and pavements. In such cases, existing foundations, floor slabs, and utilities should be removed to a depth of at least 2 feet below the affected utility or design pavement subgrade elevation. This could be applicable for the potential obstruction encountered in Borings B-3 and B-3A, as well as at other locations.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, and rootmat should be removed. Complete stripping of the topsoil and rootmat should be performed in the proposed construction areas.

Mature trees are located within or near the footprint of some of the proposed site features, which will require removal at the onset of construction. Where trees are removed, the full root ball should be removed.

Where fill is placed on existing slopes steeper than 4H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and natural soils and reduce the possibility of failure along the fill/natural soil interface. All fill slopes should be overbuilt and then cut back to expose compacted material on the slope face.

Subgrade Preparation

Engineered fill placed beneath the entire footprint of the structures should extend horizontally a minimum distance of 5 feet beyond the outside edge of footings. On-site soils are considered suitable to be used as engineered fill materials. Please note, however, that moisture-conditioning of on-site soils may be required to achieve adequate compaction.

The subgrade should be proofrolled with an adequately loaded vehicle (20 tons minimum) such as a tandem-axle or tri-axle dump truck. The proofrolling should be performed under the observation of the Geotechnical Engineer or representative. Areas excessively deflecting or considered unstable under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by treating/applying/mixing with lime or cement. Excessively wet or dry material should either be removed or moisture conditioned and recompacted.

Compacted engineered fill soils should then be placed to the proposed design grade and the moisture content and compaction of subgrade soils should be maintained until foundation or pavement construction.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable; however, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

Existing Fill

As noted in **Geotechnical Characterization**, Borings B-3 and B-3A encountered previously placed fill to a depth of 3 feet and Borings C-4 and C-5 encountered previously placed fill to depths between 8 and 12 feet. We have no records to indicate the degree of fill placement control. Support of floor slabs and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, inherent risk exists for the owner that compressible fill or unsuitable material, within or buried by the fill will, not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report.

To mitigate risk, the undocumented existing fill, where present**,** should be completely excavated, removed, and replaced with engineered fill in building and pavement areas. To take advantage of the cost benefit of not removing the entire amount of undocumented existing fill, the owner must be willing to accept the risk of increased differential performance which can result in increased cracking and abrupt differential settlement. Should this risk be acceptable, foundations, floor slabs, and pavements can be supported on or above the existing fill as discussed in this report.

Expansive Soils

The on-site high plasticity Fat Clay (CH) is potentially expansive soil, exhibiting the potential to swell with increased water content and shrink upon drying. Construction of the project by revising site drainage, in addition to future weather conditions, create the potential for gradual changes in water contents within the expansive soils. Increases in water content could cause the expansive soils to swell and drying of the expansive soils could cause them to shrink, resulting in damage to the foundations, floor slabs, hardscaping, and pavements. Potentially expansive soils should not be placed within 2 feet of pavements, floor slabs, and footing, and, if present where new fill was placed, they should be removed and replaced with suitable material to a depth of at least 1 foot below the footing bearing elevations.

Based on the assumed site grades relative to the frequency and depths at which these soils were encountered in the borings, we anticipate that construction efforts to ensure this separation will be necessary in localized areas at the site, not across the entire site.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction. Difficult excavation to remove obstruction or boulders could be required, as indicated by the shallow auger refusal encountered in Borings B-3 and B-3A. In addition, underground utilities may encounter difficult excavation at some areas of the site.

Fill Material Types

Fill required to achieve design grade should be classified as engineered fill and general fill. Engineered fill is material used below or within 10 feet of structures, pavements, hardscapes, stormwater control measure embankments, or constructed slopes. General fill is material used to achieve grade outside of these areas.

Reuse of On-Site Materials: Excavated on-site soil may be selectively reused as general fill and structural fill with the below listed limitations regarding deleterious materials, fines content, plasticity, maximum particle size, and dry unit weight. Please note, however, that moisture-conditioning of on-site soils may be required to achieve adequate compaction. Existing fill may be selectively reused as structural fill or general fill, provided it is free of deleterious material (e.g., organics, debris) and is segregated to meet the maximum particle sizes and plasticity values given in the table below. Excavated boulders, partially weathered rock and bedrock may be selectively reused as structural fill, general fill, or blast rock fill, provided it is blasted, crushed, and/or segregated to meet the maximum particle sizes and plasticity values given in the table below.

Material property requirements for on-site soil for use as general fill and engineered fill are noted in the table below:

Property	General Fill	Engineered Fill
Composition	Free of deleterious material	Free of deleterious material
Maximum particle size	6 inches (or 2/3 of the lift thickness)	3 inches

Property	General Fill	Engineered Fill
Fines content	Not limited	Not limited
Plasticity	Not limited	Maximum plasticity index of 30 in upper 2 feet below design subgrade Not limited more than 2 feet below design subgrade

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

Soil Type[1]	USCS Classification	Acceptable Parameters (for Engineered fill)
Low-Plasticity, Fine Grained Soil	CL, CL-ML ML	Liquid Limit less than 50 Plasticity index less than 30
Coarse-Grained Soil	GW, GP, GM, GC, SW, SP, SM, SC	Less than 50% passing No. 200 sieve Liquid Limit less than 50 Plasticity index less than 30
Select Granular Fill[2]	SP, SP-SM, SW, or SW-SM	Less than 12% passing No. 200 sieve Plasticity index less than 10

1. Structural and general fill should consist of approved materials free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site. Additional geotechnical consultation should be provided prior to use of uniformly graded gravel (GP) on the site.
2. NCDOT Class II, Type 1 Select Material. Manufactured materials such as processed fill (i.e., screenings) meeting this specification can be used.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Engineered Fill	General Fill
Maximum Lift Thickness	10 inches in loose thickness when heavy, self-propelled compaction equipment is used 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used	Same as engineered fill
Minimum Compaction Requirements[1,2,3]	98% of max. within 1 foot of finished pavement subgrade 95% of max. above foundations, below floor slabs, and more than 1 foot below finished pavement subgrade	92% of max.
Water Content Range[1]	Low-plasticity fine-grained soil: -3% to +3% of optimum High-plasticity fine-grained soil: 0 to +3% of optimum Coarse-grained soil: -3% to +3% of optimum	As required to achieve min. compaction requirements and stability

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. High plasticity fine-grained fill should not be compacted to more than 100% of standard Proctor maximum dry density.
3. Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.

Grading and Drainage

All grades must provide effective drainage away from the structures during and after construction and should be maintained throughout the life of the structure. Water retained next to the structures can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks.

Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Subgrade Protection

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs, hardscapes, and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

In order to provide a stable subgrade at the bottom of the anticipated excavations during construction in the event of pending precipitation, we recommend either placing a concrete mud mat or a layer of compacted of ABC. Geosynthetics may also be beneficial in providing a stable construction subgrade, depending on the effectiveness of the contractor's dewatering system and the subgrade conditions at the time of construction.

Construction Dewatering

Based on the borings, our experience with groundwater fluctuations on similar sites, and anticipated grades, most of the temporary excavations are unlikely to encounter groundwater. The contractor should be prepared to remove any precipitation or groundwater that may seep into temporary construction excavations using open pumping. Open pumping utilizes submersible sump pumps in pits or trenches dug below the bottom of the excavation and backfilled with No. 57 stone. If the No. 57 stone is left in place, it should be wrapped with a woven geotextile.

Excavation Safety

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed

by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent to or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of engineered fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of engineered fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. A representative of the Geotechnical Engineer should use a combination of hand auger borings and dynamic cone penetrometer (DCP) testing to determine the suitability of the bearing materials for the design bearing pressure. DCP testing should be performed to a depth of 3 to 5 feet below the bottom of foundation excavation. If existing fill is found below the proposed foundation the hand auger and DCP should be extended to natural soils. In areas were existing fill remains under the proposed building the frequency of testing should be increased. If unanticipated conditions are observed, the Geotechnical Engineer should recommend mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

The proposed building can be supported by shallow foundations. If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

Design Parameters – Compressive and Lateral Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2]	3,000 psf
Required Bearing Stratum [3]	Undisturbed low-plasticity (PI<30) native soils or structural fill.
Minimum Foundation Dimensions	Per 2024 North Carolina Building Code
Ultimate Passive Resistance[4] **(equivalent fluid pressures)**	315 pcf (fine-grained backfill)
Sliding Resistance [5]	0.30 ultimate coefficient of friction – Fine sandy silt, nonplastic silt
Minimum Embedment below Finished Grade [6]	■ 1 foot (retail buildings <= 2 stories) ■ 1 foot (wood-framed apartment buildings <= 5 stories) ■ 4 feet (apartment building with transfer concrete podium<=5 stories) ■ 5 feet (parking deck <=5 stories)
Estimated Total Settlement from Structural Loads [2]	■ Less than 1 inch (retail buildings <= 2 stories) ■ 0.25 inches (wood-framed apartment buildings <= 5 stories) ■ 1 inch (apartment building with transfer concrete podium<=5 stories ■ 1 inch (parking deck <=5 stories)
Estimated Differential Settlement [2, 7]	■ About 1/2 of total settlement ■ The differential settlement between the parking deck, concrete podium, and wood-framed structures should be considered where the structures connect. This does not account for building material shrinkage.

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.
2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.

Item	Description

3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted engineered fill be placed against the vertical footing face. Assumes no hydrostatic pressure.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance is dependent on the bearing pressure which may vary due to load combinations. For fine-grained materials, lateral resistance using adhesion should not exceed ½ the dead load.
6. Embedment necessary to minimize the effects of frost and to limit total settlement to 1 inch. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., e < b/6, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the applicable building code basic load combinations.

Item	Description
Soil Moist Unit Weight	115 pcf
Soil Effective Unit Weight[1]	52.6 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing vertically to ground surface

1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable.

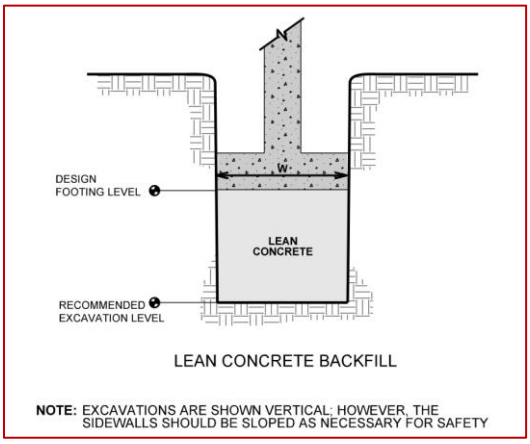
Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon

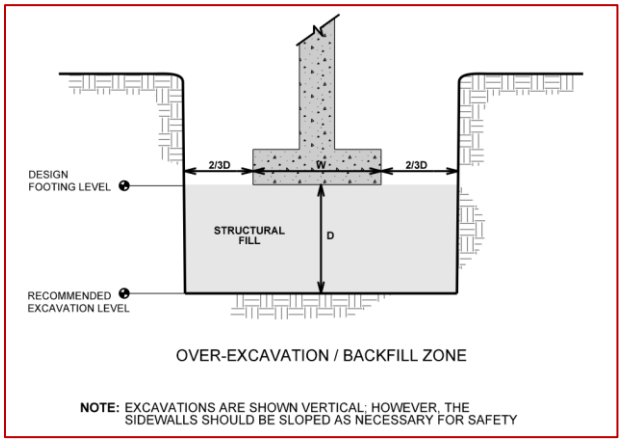
after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Loose or soft soils exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing engineered fill, reinforcing steel, and/or concrete. Should surficial compaction not be adequate, construction of a working surface consisting of either well-graded crushed stone (ABC) or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.

If unsuitable bearing soils are observed at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The lean concrete replacement zone is illustrated on the sketch below.



Overexcavation for engineered fill placement below footings should be conducted as shown below. The overexcavation should be backfilled up to the footing base elevation with engineered fill placed as recommended in the **Earthwork** section. If poorly-graded gravel (e.g., GP, No. 57 stone, or No. 67 stone) is used, it should be wrapped in a woven geotextile.



Shallow Foundations with Ground Improvement

The previous section **Shallow Foundations** recommended footing embedment depths below final grade and listed the total and differential settlements per structure. If a five feet embedment depth for the footing of the parking deck is too costly, and/or the differential settlement between the parking deck and apartment buildings is too high, then the proposed parking deck should be supported by shallow foundations bearing on or above ground improvement elements consisting of aggregate piers. Ground improvement methods are proprietary systems designed by licensed subcontractors who could provide further information regarding support options.

An aggregate pier consists of a stone-filled column constructed by excavating a cylindrical hole or driving/vibrating a mandrel into the ground and backfilling it with crushed stone placed in lifts and applying a high degree of compactive effort resulting in stone-filled piers. The aggregate pier construction process not only results in a stone-filled column stiffer than the surrounding soils, the process also helps to densify the soils surrounding the pier. Aggregate pier foundations are a proprietary product and should be designed and installed by a specialty contractor. Due to the specialty of this soil improvement procedure, we recommend that a performance specification be used for this project to limit total settlement to 1 inch and differential settlement to ½ inch. Please note that most specialty contractors recommend against using aggregate piers in very soft to soft clays, very loose sand, or organic soils. Aggregate piers tend to bulge and require excessive stone quantities when installed in these conditions.

If aggregate piers are used but the footings do not bear directly on the aggregate piers, a load transfer platform should be utilized. Load transfer platforms distribute loads induced by footing and the fill soils to the underlying aggregate piers.

The ground improvement subcontractor should design and install the ground improvement elements, including selection of design parameters for the planned

foundation system including, but not limited to, allowable bearing capacity, settlement estimates, foundation-specific earthwork recommendations, and installation means and methods that will provide the load capacities indicated on the project structural drawings without exceeding the settlement criteria. The ground improvement subcontractor should submit complete design calculations and shop drawings signed and sealed by a Professional Engineer. They should be submitted to the Geotechnical Engineer (Terracon) and Structural Engineer for review and approval at least 30 days before the planned start of ground improvement elements.

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations bearing on or above aggregate piers.

Design Parameters – Compressive and Lateral Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1]	6,000 psf (preliminary for aggregate piers)
Minimum Foundation Dimensions	Per 2024 North Carolina Building Code
Ultimate Passive Resistance[4] **(equivalent fluid pressures)**	315 pcf
Sliding Resistance [5]	0.45 ultimate coefficient of friction for footings bearing on aggregate piers or gravel load-transfer platform under entire footing and above rigid inclusions
Minimum Embedment below Finished Grade [6]	12 inches
Design Settlement Tolerances [2]	1 inch total settlement ½ inch differential settlement[7]

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume are preliminary and should be verified/determined by the ground improvement design engineer.
2. Performance specification for design of ground improvement element support of shallow foundations
3. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure.

Item	Description

5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Frictional resistance is dependent on the bearing pressure which may vary due to load combinations.
6. Embedment necessary to minimize the effects of frost (12-inch design frost depth for this site), and to achieve recommended allowable bearing pressure with a factor of safety of at least 2.5. Finished grade is the lowest adjacent grade for perimeter footings and final building pad grade for interior footings. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.
7. Differential settlements are for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., e < b/6, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the IBC basic load combinations.

Item	Description
Soil Moist Unit Weight	115 pcf
Soil Effective Unit Weight[1]	52.6 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing vertically to ground surface

1. Effective (or buoyant) unit weight should be used for soil above the foundation level and below a water level. The high groundwater level should be used in uplift design as applicable.

Construction Adjacent to Existing Building

Differential settlement between the additions and the existing building is expected to approach the magnitude of the total settlement of the addition. Expansion joints should be provided between the existing building and the proposed addition to accommodate differential movements between the two structures. Underground piping between the two structures should be designed with flexible couplings and utility knockouts in foundation walls should be oversized so minor deflections in alignment do not result in

breakage or distress. Care should be taken during excavation adjacent to existing foundations to avoid disturbing existing foundation bearing soils.

Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Very loose to loose soil exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment and/or undercutting and replacement prior to placing structural fill, steel, and/or concrete. Repair of foundation bearing conditions, if necessary, should be determined by the ground improvement subcontractor.

Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure(s) and positive drainage of the base course beneath the floor slab(s).

Existing fill materials and materials described as possible fill were observed at the site to depths of 3 feet below existing grade in Borings B-3 and B-3A. As previously described, any existing fill present beneath floor slabs should be completely removed or further evaluated by the Geotechnical Engineer during construction.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	Subgrade compacted to recommendations in **Earthwork** For slabs above exterior grades[2], the base course material should be at least 4 inches thick and should consist of compactible, easy-to-trim, granular fill that will remain stable and support construction traffic. Suitable materials include soil which classifies as SP, SW, or SM, in addition to ABC[3].

Item	Description
Estimated Modulus of Subgrade Reaction [4]	150 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation (unless a post-tensioned monolithic slab is used).
2. A base course is not required by 2024 NC Building Code nor ACI 302 for floor slabs above exterior grade. However, it is good design and construction practice to include a base course to provide uniform support and improve constructability, especially over fine-grained subgrade soils.
3. Per ACI 360R-12, ABC produces more uniform support and provides an all-weather working surface to speed construction during inclement weather.
4. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder or vapor barrier should be considered beneath concrete slabs-on-grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder or barrier, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder or barrier.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams, and/or post-tensioned elements.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and engineered fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Pavements

General Pavement Comments

Pavement section thicknesses are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement section thicknesses noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Pavement Design Parameters

A California Bearing Ratio (CBR) of 4 was used for the subgrade for the asphaltic concrete (AC) pavement designs. A modulus of subgrade reaction of 125 pci was used for the Portland cement concrete (PCC) pavement designs. The value was empirically derived based upon our experience with the sandy silt and silty sand subgrade soils and our expectation of the quality of the subgrade as prescribed by the **Site Preparation** conditions as outlined in **Earthwork**. A modulus of rupture of 550 psi was used in design for the concrete (based on correlations with a minimum 28-day compressive strength of 4,000 psi).

Pavement Section Thicknesses

The following table provides our opinion of minimum thickness for AC sections for drive aisles and parking areas:

Asphaltic Concrete Design

Layer	Thickness (inches)	
	Traffic Class I [1]	Traffic Class III [1]
AC Surface Course [2]	3[3]	1.5[3]
AC Intermediate Course [2]	--	2.5
Aggregate Base Course (ABC)	6	6

1. See **Project Description** for more specifics regarding traffic assumptions.
2. All materials should meet the current North Carolina Department of Transportation (NCDOT) Standard Specifications for Highway and Bridge Construction.
   - Asphaltic Surface - NCDOT Type S9.5B Asphaltic Cement Concrete: Section 600
   - Asphaltic Intermediate Course – NCDOT Type 19.0C Asphaltic Cement Concrete: Section 600
3. Placed in two equal-thickness lifts

The following table provides our estimated minimum thickness of PCC pavements for drive aisles and parking areas:

Portland Cement Concrete Design

Layer	Thickness (inches)	
	Traffic Category B [1]	Traffic Category D [1]
PCC [2]	6	8
Aggregate Base	4	4

1. See **Project Description** for more specifics regarding traffic classifications.
2. All materials should meet the current North Carolina Department of Transportation (NCDOT) Standard Specifications for Highway and Bridge Construction.
   - Concrete Pavement - NCDOT Portland Cement Concrete: Sections 710 and 1000.

A modulus of rupture of 550 psi was used in analysis for the concrete (based on correlations with a minimum 28-day compressive strength of 4,000 psi).

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers should consist of PCC pavement and could require thicker pavement sections. Edge

restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

The placement of a partial pavement thickness for use during construction is not suggested without a detailed pavement analysis incorporating construction traffic. In addition, we should be contacted to confirm the traffic assumptions outlined above. If the actual traffic varies from the assumptions outlined above, modification of the pavement section thickness could be required.

Although not required for structural support, a minimum 4-inch-thick base course layer under concrete pavements is recommended to help reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer. PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the stormwater collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted Geotechnical Engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

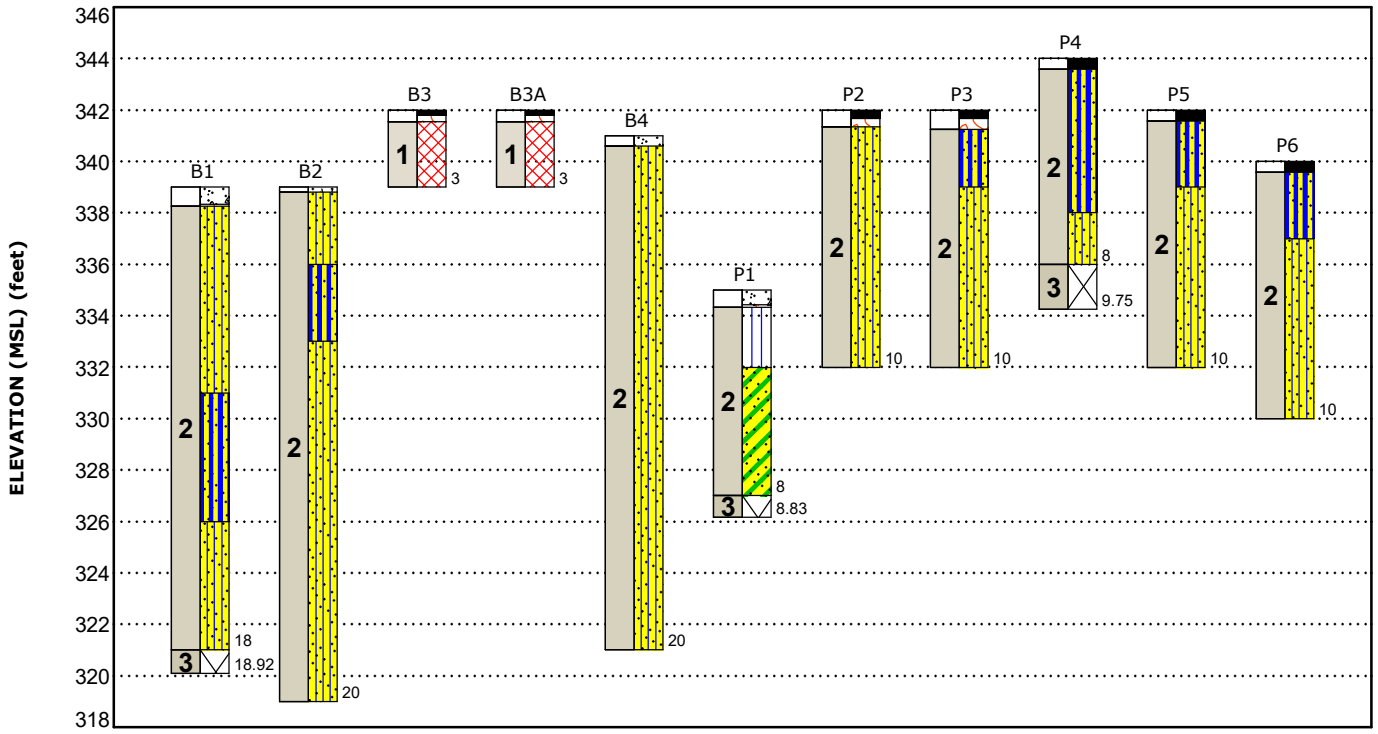
Contents:

GeoModel (two pages)

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	FILL	Medium dense silty SAND (SM) and firm to very stiff sandy SILT (ML) and sandy fat CLAY (CH). Contains some crushed aggregate and wood fragments.
2	RESIDUUM: SILT AND SAND	Loose to medium dense silty SAND (SM) and medium stiff to very stiff sandy SILT (ML)
3	WEATHERED ROCK	Sampled as silty SAND (SM) and sandy SILT (ML)
4	INTERBEDDED SOIL SEAMS	Medium dense silty SAND (SM)
5	AUGER REFUSAL MATERIALS	Auger refusal, followed by a SPT N value of 50/0" with no recovery

Legend

Concrete	Aggregate Base Course
Silty Sand	Sandy Silt
Weathered Rock	Topsoil
Asphalt	Fill
Silt	Clayey Sand

▽ First Water Observation

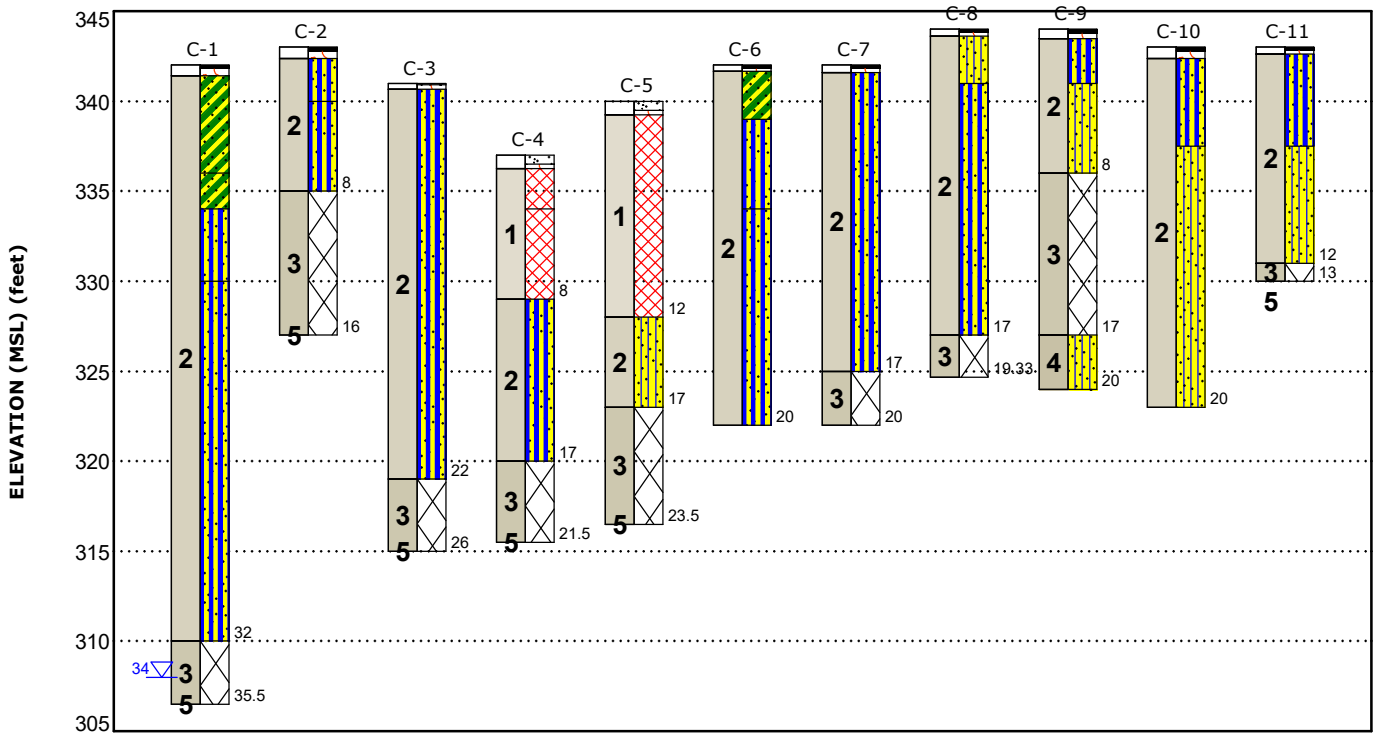
Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
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Terracon
3150 Spring Forest Rd Ste 100
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4	INTERBEDDED SOIL SEAMS	Medium dense silty SAND (SM)
5	AUGER REFUSAL MATERIALS	Auger refusal, followed by a SPT N value of 50/0" with no recovery

Legend

- Asphalt
- Aggregate Base Course
- Sandy Fat Clay
- Sandy Silt
- Weathered Rock
- Topsoil
- Concrete
- Fill
- Silty Sand

▽ First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
9 plus 1 offset attempt	3 to 35.5 feet	Apartment building and parking deck structure
11	9.75 to 20 feet	Retail buildings and pavement area

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±20 feet) and referencing existing site features. Approximate ground surface elevations were obtained by interpolation from the Wake County GIS contour layers over aerial imaging and Google Earth Pro.

Subsurface Exploration Procedures: We advanced the borings with a truck-mounted rotary drill rig using continuous flight hollow stem augers. Four samples were obtained in the upper 10 feet of each boring and at intervals of 5 feet thereafter. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths. For safety purposes, all borings were backfilled with auger cuttings after their completion. Pavements were patched with cold-mix asphalt and/or pre-mixed concrete, as appropriate.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by geotechnical staff. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent our interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

Geotechnical staff reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Atterberg Limits
- Amount of Material Finer than 75-mm (No. 200) Sieve
- Standard Proctor Moisture-Density
- California Bearing Ratio

The laboratory testing program included examination of soil samples by geotechnical staff. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

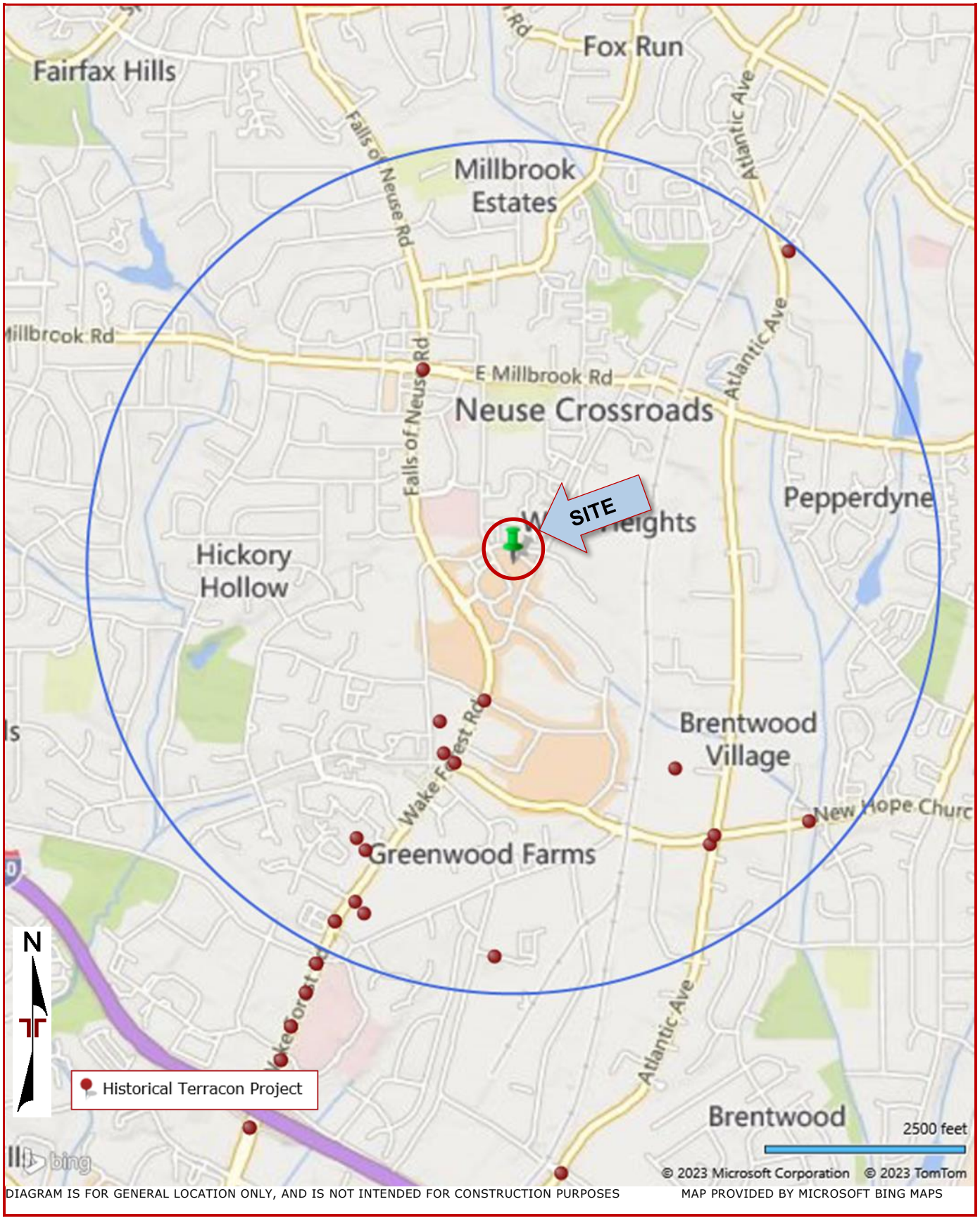


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

SITE PLAN CONCEPT A, PREPARED BY BB+M ARCHITECTURE, DATED SEPTEMBER 16, 2024

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-4, P-1 through P-6, and C-1 through C-11)
Atterberg Limits and Percent Passing No. 200 Sieve
CBR
Moisture Density Relationship

Note: All attachments are one page unless noted above.

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. B1

Location: See Exploration Plan

Latitude: 35.8442° Longitude: -78.6106°

Model Layer	Depth (Ft.)	Elevation: 339 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.7	**CONCRETE (8 inches)** 338.33							
	0.8	**AGGREGATE BASE COURSE (1 inch)** 338.25							
2		**SILTY SAND (SM)**, orangish tan and reddish brown, medium dense, contains mica				4-8-10 N=18	12.5	41-29-12	34.1
						3-6-8 N=14			
			5						
						6-9-12 N=21			
	8.0	331							
		SANDY SILT (ML), reddish brown, stiff				9-6-8 N=14			
			10						
	13.0	326							
		SILTY SAND (SM), reddish brown, medium dense, contains mica				5-4-7 N=11			
			15						
	18.0	321		▽					
3	18.9	**PARTIALLY WEATHERED ROCK**, dark reddish brown and light tan, Sampled as silty SAND, orange-brown to gray 320.08				50/5"			
		Boring Terminated at 18.9 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

▽ Cave-in at 17.8 feet

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-29-2023

Boring Completed
08-29-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. B2

Location: See Exploration Plan

Latitude: 35.8436° Longitude: -78.6101°

Depth (Ft.) Elevation: 339 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Elevation	Description	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2	338.8	**TOPSOIL (2 inches)**						
2		3.0	336	**SILTY SAND (SM)**, reddish brown, medium dense			6-7-6 N=13			
		6.0	333	**SANDY SILT (ML)**, reddish brown, very stiff			7-9-10 N=19			
				SILTY SAND (SM), gray and tan, loose to medium dense			3-5-6 N=11			
							3-3-4 N=7			
					▨		3-4-7 N=11			
		20.0	319	***Boring Terminated at 20 Feet***			5-8-9 N=17			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

▨ 13.8 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-29-2023

Boring Completed
08-29-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. B3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.8438° Longitude: -78.6112° Depth (Ft.) / Elevation: 342 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **ASPHALT (2 inches)** 341.8 0.5 **AGGREGATE BASE COURSE (3 inches)** 341.5							
1		**SANDY SILT (ML)**, dark brown and red, very stiff, contains rock fragments				12-7-14 N=21			
		3.0 339 ***Auger Refusal at 3 Feet***							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-29-2023

Boring Completed
08-29-2023

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. B3A

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.8438° Longitude: -78.6112° Depth (Ft.) Elevation: 342 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **ASPHALT (2 inches)** 341.8 0.5 **AGGREGATE BASE COURSE (3 inches)** 341.5							
1		**SANDY SILT (ML)**, dark brown and red, contains rock fragments 3.0 339							
		Auger Refusal at 3 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-29-2023

Boring Completed
08-29-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. B4

Location: See Exploration Plan

Latitude: 35.8432° Longitude: -78.6105°

Depth (Ft.) Elevation: 341 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.4 **CONCRETE (5 inches)** 340.6						
2		**SILTY SAND (SM)**, orangish brown and reddish brown, loose to medium dense			10-12-13 N=25			
		5			9-11-12 N=23			
					5-10-19 N=29			
					4-5-3 N=8			
		10						
					2-6-7 N=13			
		15						
					5-6-9 N=15			
		20.0 321						
		20 ***Boring Terminated at 20 Feet***						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

11 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-29-2023

Boring Completed
08-29-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. P1

Location: See Exploration Plan

Latitude: 35.8441° Longitude: -78.6100°

Model Layer	Depth (Ft.)	Elevation: 335 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.6	**CONCRETE (7 inches)** 334.42							
	0.7	**AGGREGATE BASE COURSE (1 inch)** 334.33							
		SILT (ML), orangish brown, medium stiff, contains mica				3-2-5 N=7			
	3.0	332							
2		**CLAYEY SAND (SC)**, orangish brown, medium dense	5			3-5-7 N=12	17.8	47-24-23	44.8
						6-10-11 N=21			
	8.0	327							
3		**PARTIALLY WEATHERED ROCK**, gray and tan, Sampled as silty							
	8.8	SAND, orange-brown to gray 326.17				50/4"			
		Boring Terminated at 8.8 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

7.6 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-28-2023

Boring Completed
08-28-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. P2

Location: See Exploration Plan

Latitude: 35.8440° Longitude: -78.6119°

Model Layer	Graphic Log	Depth (Ft.)	Elevation: 342 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.3	**ASPHALT(4 inches)** 341.67							
		0.7	**AGGREGATE BASE COURSE (4 inches)** 341.34							
2			**SILTY SAND (SM)**, orangish brown, medium dense to loose, contains mica and rock fragments	5			5-7-8 N=15			
							4-5-5 N=10			
							3-5-7 N=12			
							4-4-3 N=7			
		10.0	332	10						
			Boring Terminated at 10 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

7.4 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-28-2023

Boring Completed
08-28-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. P3

Location: See Exploration Plan

Latitude: 35.8435° Longitude: -78.6122°

Model Layer	Depth (Ft.)	Elevation: 342 (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.3	**ASPHALT (4 inches)** 341.67						
	0.8	**AGGREGATE BASE COURSE (5 inches)** 341.25						
2		**SANDY SILT (ML)**, orangish brown, stiff, contains mica			7-8-6 N=14			
	3.0	339						
		SILTY SAND (SM), orangish tan and pink, medium dense to loose			12-10-13 N=23			
					7-12-13 N=25			
	10.0	332			4-5-4 N=9			
		Boring Terminated at 10 Feet						

5

10

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

6.1 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-28-2023

Boring Completed
08-28-2023

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. P4

Location: See Exploration Plan

Latitude: 35.8432° Longitude: -78.6115°

Model Layer	Graphic Log	Depth (Ft.)	Elevation: 344 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.4	**ASPHALT (5 inches)** 343.58							
2			**SANDY SILT (ML)**, orangish brown, stiff				4-3-6 N=9			
				5			3-6-6 N=12			
		6.0	338							
			SILTY SAND (SM), reddish brown and orangish tan, medium dense				4-11-17 N=28			
		8.0	336							
3			**PARTIALLY WEATHERED ROCK**, orangish tan, Sampled as silty SAND, orange-brown to gray				13-20-50/3"			
		9.8	334.25							
			Boring Terminated at 9.8 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

6.9 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-28-2023

Boring Completed
08-28-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. P5

Location: See Exploration Plan

Latitude: 35.8429° Longitude: -78.6121°

Model Layer	Graphic Log	Depth (Ft.)	Elevation: 342 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.4	**ASPHALT (5 inches)** 341.58							
2		3.0	**SANDY SILT (ML)**, orangish brown, stiff, contains mica 339				4-4-5 N=9			
		10.0	**SILTY SAND (SM)**, dark gray and orangish brown, medium dense to loose, contains mica 332	5			3-6-9 N=15			
							5-5-5 N=10			
				10			3-4-5 N=9			
			Boring Terminated at 10 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

7.4 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-28-2023

Boring Completed
08-28-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. P6

Location: See Exploration Plan

Latitude: 35.8428° Longitude: -78.6111°

Depth (Ft.) Elevation: 340 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.4 **ASPHALT (5 inches)** 339.58						
		SANDY SILT (ML), reddish brown, stiff, contains mica			5-6-7 N=13			
		3.0 337						
2		**SILTY SAND (SM)**, dark gray and reddish brown, medium dense			2-4-7 N=11			
		5						
					3-6-8 N=14			
		10.0 330			4-4-6 N=10			
		10						
		Boring Terminated at 10 Feet						

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from a topographic site plan.

Water Level Observations
Borehole dry to cave-in depth.

6.4 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 45

Hammer Type
Automatic

Driller
Bridger Drilling

Logged by
Rachel Zelinsky

Boring Started
08-28-2023

Boring Completed
08-28-2023

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-1

Location: See Exploration Plan

Latitude: 35.8442° Longitude: -78.6115°

Depth (Ft.) | Approximate Elevation: 342 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **ASPHALT**, 2 inches (341.83)						
		0.6 **AGGREGATE BASE COURSE**, 5 inches (341.42)						
		SANDY FAT CLAY (CH), orange-brown, stiff			2-5-6 N=11			
					3-5-6 N=11	21.9	62-30-32	53.6
		6.0 (336)						
		SANDY FAT CLAY (CH), orange-brown, very stiff, contains rock fragments			4-8-13 N=21			
		8.0 (334)						
		SANDY SILT (ML), orange-brown, stiff			4-6-8 N=14			
		12.0 (330)						
2		**SANDY SILT (ML)**, orange-brown to gray and black, stiff to very stiff			4-6-7 N=13			
					4-5-5 N=10			
					8-10-9 N=19			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Wet spoon
24 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-23-2025

Boring Completed
01-23-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-1

Location: See Exploration Plan

Latitude: 35.8442° Longitude: -78.6115°

Depth (Ft.) Approximate Elevation: 342 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
2		**SANDY SILT (ML)**, orange-brown to gray and black, stiff to very stiff *(continued)*						
		32.0 / 310			4-5-5 N=10			
3		**PARTIALLY WEATHERED ROCK**, Sampled as sandy SILT w/ rock fragments, orange-brown			50/2"			
5		35.5 / 306.5						
		Auger Refusal at 35.5 Feet			50/0"			

30

35

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Wet spoon

24 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-23-2025

Boring Completed
01-23-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-2

Location: See Exploration Plan

Latitude: 35.8436° Longitude: -78.6111°

Depth (Ft.) Approximate Elevation: 343 (Ft.)

Model Layer	Depth (Ft.)	Elevation	Material Description	Field Test Results
	0.2	342.79	**ASPHALT**, 2.5 inches	
	0.6	342.37	**AGGREGATE BASE COURSE**, 5 inches	
2			**SANDY SILT (ML)**, orange brown, stiff, contains rock fragments	7-6-5 N=11
	3.0	340		
			SANDY SILT (ML), orange-brown, stiff to very stiff	5-6-9 N=15
				11-17-12 N=29
	8.0	335		
3			**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, orange-brown to gray and black	14-50/5"
				38-50/4"
5	16.0	327	***Auger Refusal at 16 Feet***	50/0"

Depth (Ft.): 5, 10, 15

Water Level Observations: 11 ft

Atterberg Limits: LL-PL-PI

Percent Fines

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-3

Location: See Exploration Plan

Latitude: 35.8435° Longitude: -78.6103°

Model Layer	Depth (Ft.)	Approximate Elevation: 341 (Ft.)	Field Test Results
2	0.1	**TOPSOIL**, 1 inch — 340.92	
	0.3	**AGGREGATE BASE COURSE**, 3 inches — 340.67	
		SANDY SILT (ML), orange-brown to black and white, medium stiff to stiff	3-5-6 N=11
			4-4-5 N=9
			4-4-4 N=8
			3-5-5 N=10
			5-6-7 N=13
			6-7-8 N=15
3	22.0	319	50/1"
		PARTIALLY WEATHERED ROCK, Sampled as silty SAND, orange-brown to gray and black	

Depth (Ft.): 5, 10, 15, 20, 25

Water Level Observations: 17.3 ft

Sample Type

Water Content (%)

Atterberg Limits: LL-PL-PI

Percent Fines

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-23-2025

Boring Completed
01-23-2025

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-3

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 35.8435° Longitude: -78.6103° Depth (Ft.) Approximate Elevation: 341 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
3 5		**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, orange-brown to gray and black *(continued)* 26.0 315							
		Auger Refusal at 26 Feet				50/0"			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

17.3 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-23-2025

Boring Completed
01-23-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-4

Location: See Exploration Plan

Latitude: 35.8441° Longitude: -78.6101°

Model Layer	Depth (Ft.)	Approximate Elevation: 337 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.5	**CONCRETE**, 6 inches 336.5							
	0.8	**AGGREGATE BASE COURSE**, 3 inches 336.25							
1		**FILL - SANDY FAT CLAY (CH)**, orange-brown, stiff, contains rock fragments				2-7-6 N=13			
	3.0	334							
		FILL - SANDY FAT CLAY (CH), orange-brown, stiff, contains some wood fragments				2-5-6 N=11	29.6	54-24-30	64.1
			5			7-5-9 N=14			
2		**SANDY SILT (ML)**, orange-brown to gray and black, stiff to very stiff	10			5-9-14 N=23			
			15			4-4-6 N=10			
	17.0	320							
3		**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, gray and black	20			50/4"			
5	21.5	315.5							
		Auger Refusal at 21.5 Feet				50/0"			

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

15.3 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-23-2025

Boring Completed
01-23-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-5

Location: See Exploration Plan

Latitude: 35.8442° Longitude: -78.6106°

Approximate Elevation: 340 (Ft.)

Model Layer	Depth (Ft.)	Description	Elevation	Field Test Results
	0.5	**CONCRETE**, 6 inches	339.5	
	0.8	**AGGREGATE BASE COURSE**, 3 inches	339.25	
1		**FILL - SANDY FAT CLAY (CH)**, orange-brown to gray and black, medium stiff to very stiff, contains some wood fragments and rock fragments		3-5-8 N=13; 3-4-5 N=9; 4-4-4 N=8; 5-11-13 N=24
	12.0		328	
2		**SILTY SAND (SM)**, orange-brown to black, loose		4-4-6 N=10
	17.0		323	
3		**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, gray and black		50/4"
	23.5		316.5	
5		***Auger Refusal at 23.5 Feet***		50/0"

Depth (Ft.): 5, 10, 15, 20

Water Level Observations: 16.2 ft

Water Content (%)

Atterberg Limits: LL-PL-PI

Percent Fines

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-23-2025

Boring Completed
01-23-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-6

Location: See Exploration Plan

Latitude: 35.8441° Longitude: -78.6118°

Depth (Ft.) Approximate Elevation: 342 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **ASPHALT**, 2 inches (341.83)						
		0.3 **AGGREGATE BASE COURSE**, 2 inches (341.67)						
		SANDY FAT CLAY (CH), orange-brown, stiff		X	3-5-8 N=13	21.9	73-30-43	58.5
		3.0 (339)						
		SANDY SILT (ML), red-brown, very stiff		X	7-9-12 N=21			
				X	4-7-9 N=16			
		8.0 (334)						
2		**SANDY SILT (ML)**, orange-brown to gray and black, medium stiff to very stiff	▨ 13 ft	X	3-3-5 N=8			
				X	3-5-11 N=16			
				X	7-8-8 N=16			
		20.0 (322)						
		Boring Terminated at 20 Feet						

5 10 15 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

▨ 13 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-7

Location: See Exploration Plan

Latitude: 35.8438° Longitude: -78.6115°

Model Layer	Depth (Ft.)	Approximate Elevation: 342 (Ft.)	Field Test Results
	0.1	**ASPHALT**, 1.5 inches — 341.87	
	0.4	**AGGREGATE BASE COURSE**, 3.5 inches — 341.58	
2		**SANDY SILT (ML)**, orange-brown to gray and black, stiff to very stiff	3-5-6 N=11
2			5-5-6 N=11
2			3-4-5 N=9
2			3-5-6 N=11
2			3-5-13 N=18
2	17.0	325	
3		**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, orange-brown to gray and black	50/0"
3	20.0	322	
		Boring Terminated at 20 Feet	

Depth (Ft.): 5, 10, 15, 20

Water Level Observations: 12.5 ft

Water Content (%)

Atterberg Limits: LL-PL-PI

Percent Fines

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-8

Location: See Exploration Plan

Latitude: 35.8435° Longitude: -78.6117°

Model Layer	Graphic Log	Depth (Ft.)	Approximate Elevation: 344 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.1	**ASPHALT**, 1.5 inches 343.87							
		0.4	**AGGREGATE BASE COURSE**, 3 inches 343.62							
2			**SILTY SAND (SM)**, orange-brown, medium dense, contains rock fragments				7-8-10 N=18			
		3.0	341							
2			**SANDY SILT**, orange-brown, stiff to very stiff, contains rock fragments	5			5-6-7 N=13			
2							4-5-8 N=13			
2				10			5-8-8 N=16			
2					▨		3-6-12 N=18			
2				15						
3			**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, orange-brown to gray and black							
3		19.3	324.67				12-50/4"			
			Boring Terminated at 19.3 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

▨ 14 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-9

Location: See Exploration Plan

Latitude: 35.8432° Longitude: -78.6120°

Model Layer	Depth (Ft.)	Approximate Elevation: 344 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
	0.2	**ASPHALT**, 2.5 inches (343.79)							
	0.5	**AGGREGATE BASE COURSE**, 4 inches (343.46)							
2		**SANDY SILT (ML)**, red-orange, very stiff				6-8-10 N=18			
	3.0	(341)							
2		**SILTY SAND (SM)**, orange-brown, medium dense	5			7-9-11 N=20			
						4-6-7 N=13			
	8.0	(336)							
3		**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, orange-brown to gray				17-50/5"			
			10						
				▨		19-50/3"			
			15						
	17.0	(327)							
4		**SILTY SAND (SM)**, orange-brown, medium dense				3-8-11 N=19			
	20.0	(324)	20						
		Boring Terminated at 20 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

▨ 13.5 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-10

Location: See Exploration Plan

Latitude: 35.8430° Longitude: -78.6117°

Depth (Ft.) Approximate Elevation: 343 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.2 **ASPHALT**, 2.5 inches (342.79)						
		0.6 **AGGREGATE BASE COURSE**, 5 inches (342.37)						
		SANDY SILT (ML), red-orange, stiff			3-4-6 N=10			
					3-4-5 N=9			
		5.5 (337.5)						
2		**SANDY SILT (SM)**, orange and tan to gray and white, medium dense, Contains some rock fragments			5-6-8 N=14			
					6-10-11 N=21			
			▨		4-6-7 N=13			
		20.0 (323)			7-11-12 N=23			
		Boring Terminated at 20 Feet						

5 10 15 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

▨ 15 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Falls Centre - Additional Services 1
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70245232

3150 Spring Forest Rd Ste 100
Raleigh, NC

Boring Log No. C-11

Location: See Exploration Plan

Latitude: 35.8432° Longitude: -78.6112°

Model Layer	Graphic Log	Depth (Ft.)	Approximate Elevation: 343 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Water Content (%)	Atterberg Limits LL-PL-PI	Percent Fines
		0.1	**ASPHALT**, 1.5 inches — 342.87							
		0.4	**AGGREGATE BASE COURSE**, 3 inches — 342.62							
2			**SANDY SILT (ML)**, red-orange, stiff				2-3-7 N=10			
							3-6-9 N=15			
		5.5	337.5	5						
			SILTY SAND (SM), red-orange, medium dense				5-7-22 N=29			
							8-7-6 N=13			
		12.0	331	10						
3 5			**PARTIALLY WEATHERED ROCK**, Sampled as silty SAND, orange-brown to gray							
		13.0	330				50/0"			
			Auger Refusal at 13 Feet							

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were obtained through Google Earth Pro

Water Level Observations
Borehole dry to cave-in depth.

9 ft

Notes

Advancement Method
Hollow Stem Auger

Abandonment Method
Boring backfilled with auger cuttings upon completion.

Drill Rig
CME 75

Hammer Type
Automatic

Driller
J&L Drilling

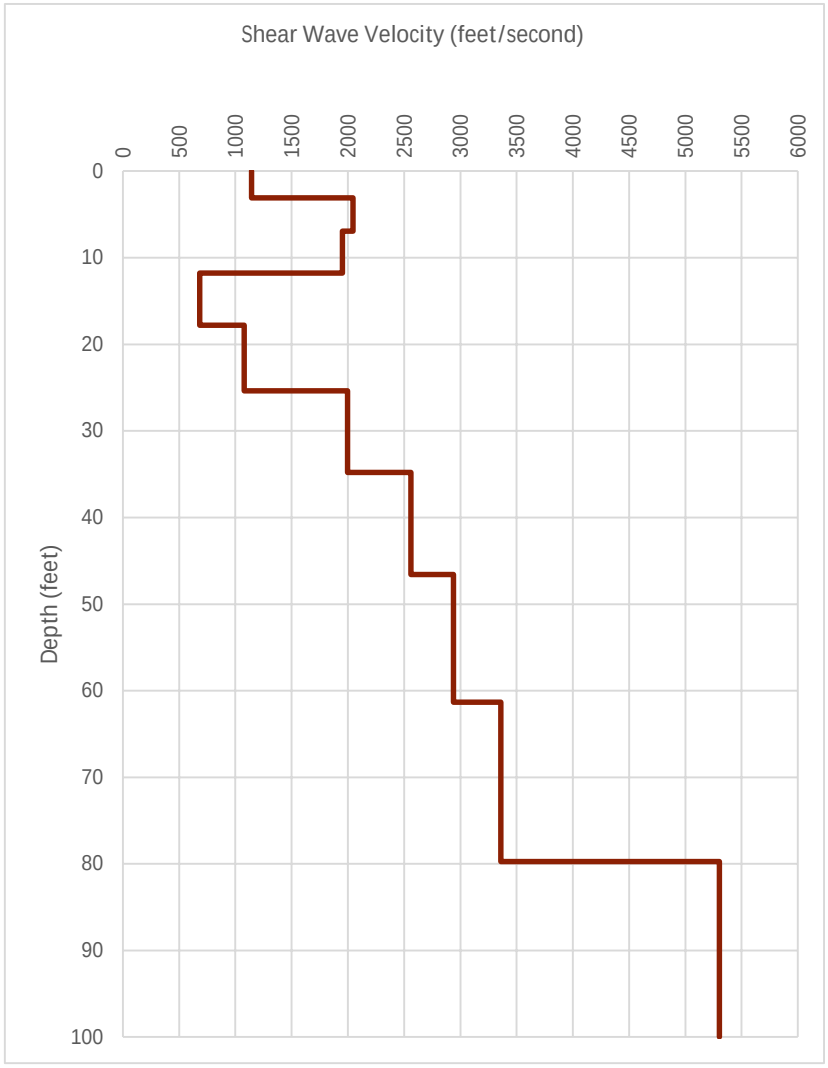
Logged by
T. Dowell

Boring Started
01-21-2025

Boring Completed
01-21-2025

Exploration Results - Seismic Site Class

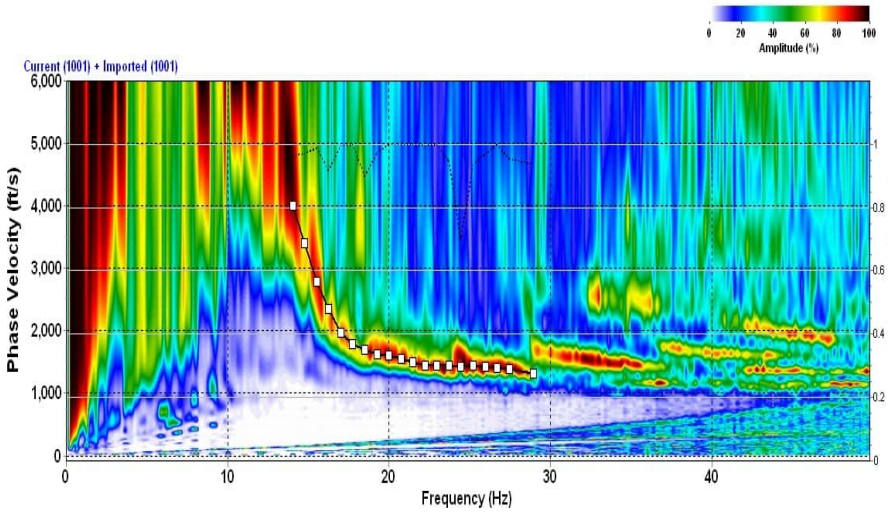
Array 1



Average Weighted Shear Wave Velocity (ft/s)[1,2] = 2,149

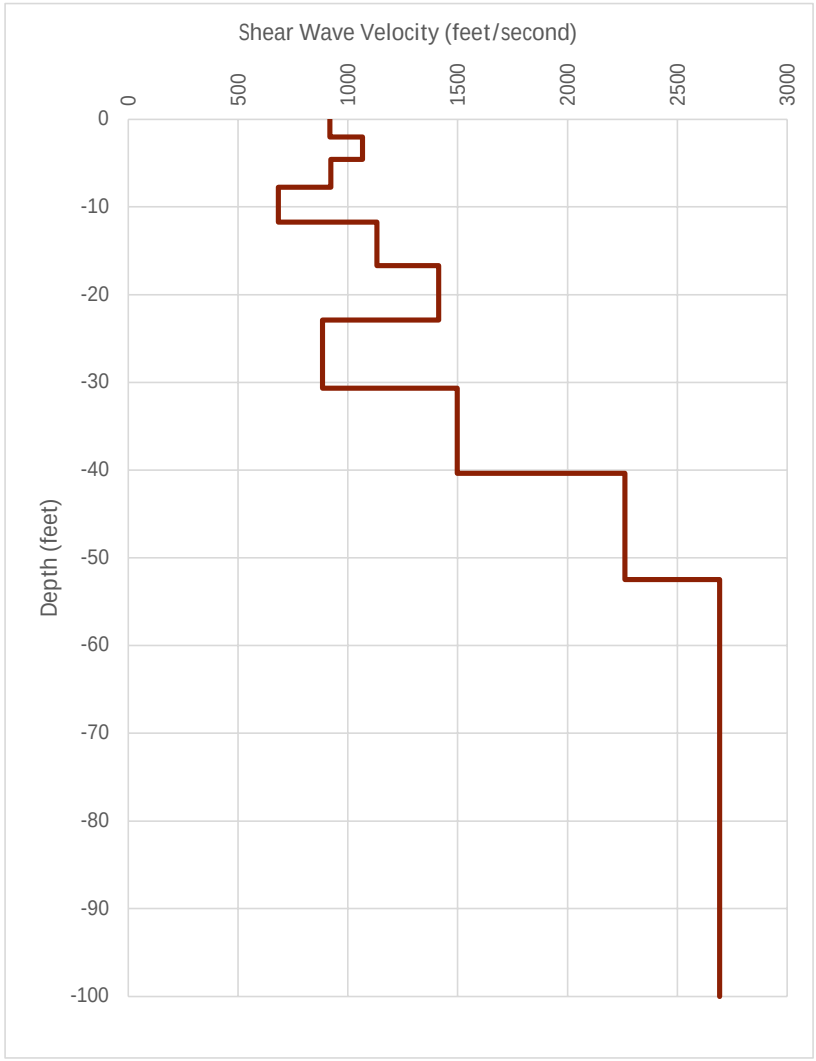
1. measured between 0 ft and 100 ft.

Testing Results	
Depth (ft)	S-wave velocity (ft/s)
0.0	1,144.5
-3.1	1,144.5
-7.0	2,046.3
-11.8	1,952.3
-17.8	683.0
-25.4	1,078.5
-34.8	1,997.2
-46.6	2,560.5
-61.3	2,940.0
-79.7	3,359.8
-100.0	5,303.1

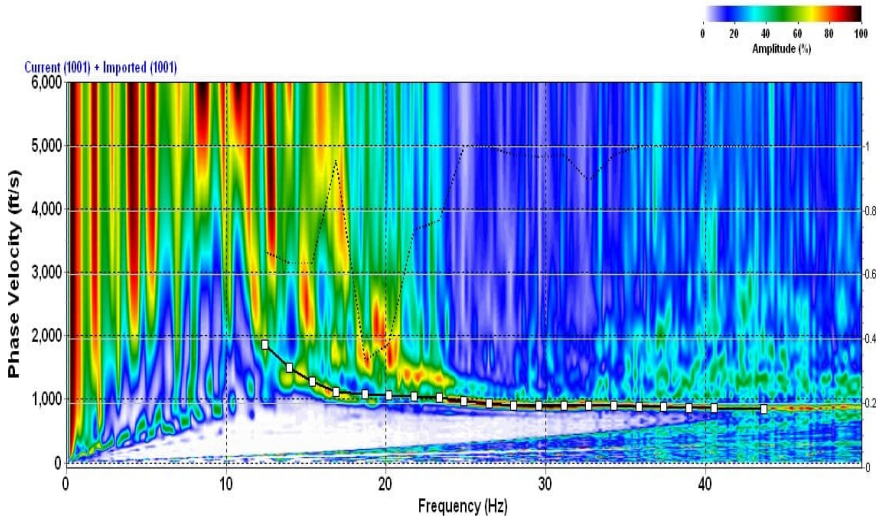


Exploration Results - Seismic Site Class

Array 2



Testing Results	
Depth (ft)	S-wave velocity (ft/s)
0.0	916.9
-2.0	916.9
-4.6	1,066.1
-7.8	922.6
-11.7	683.0
-16.7	1,131.3
-22.9	1,413.6
-30.7	883.6
-40.4	1,498.1
-52.5	2,261.0
-100.0	2,692.2

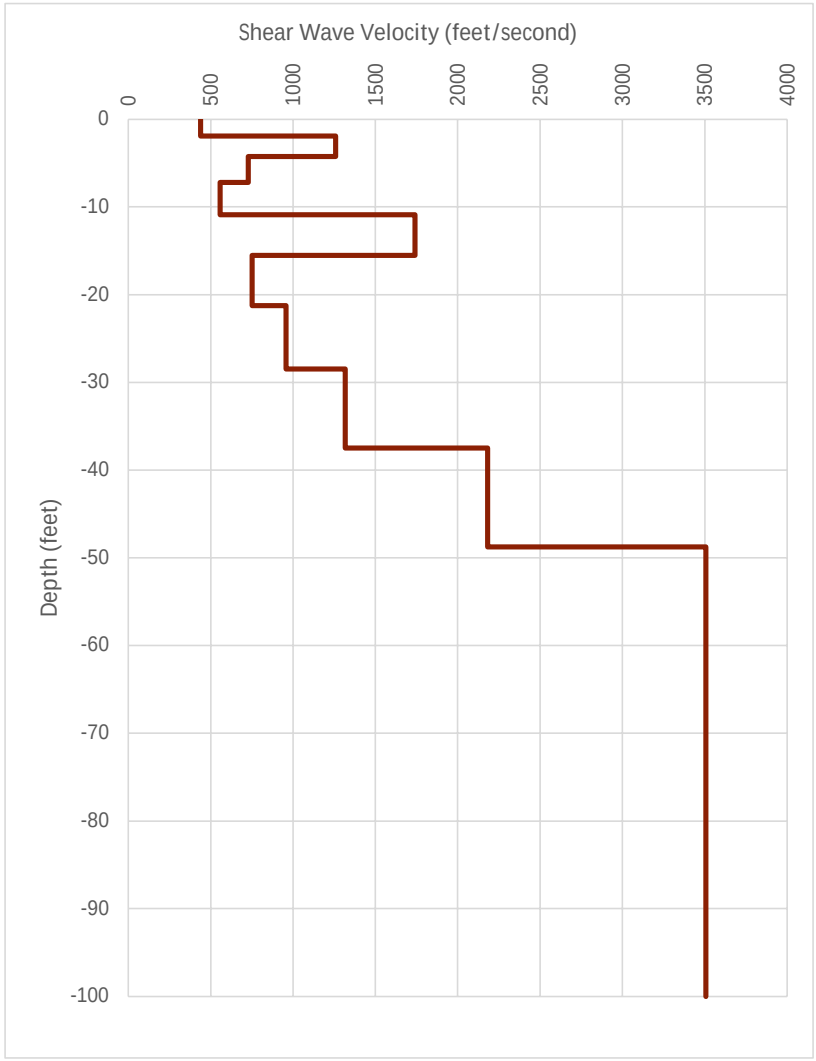


Average Weighted Shear Wave Velocity (ft/s)[1,2] = 1,642

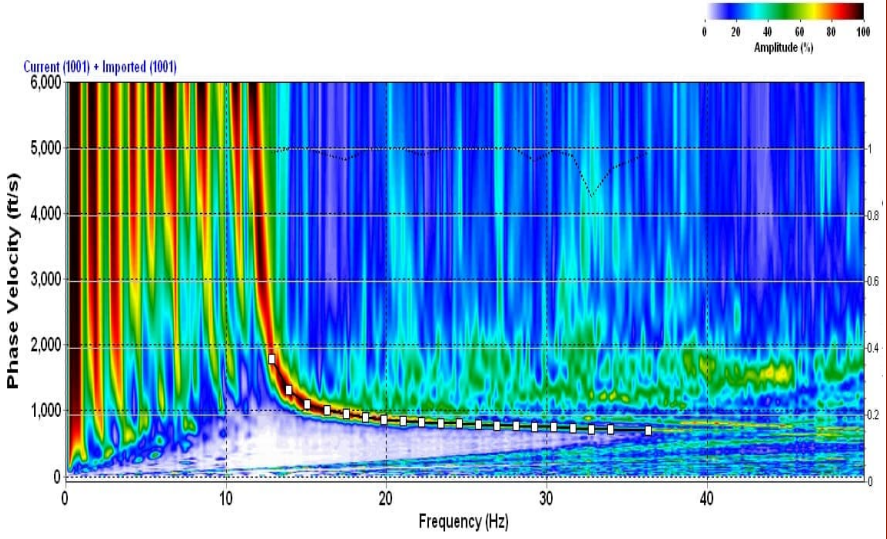
1. measured between 0 ft and 100 ft.

Exploration Results - Seismic Site Class

Array 3



Testing Results	
Depth (ft)	S-wave velocity (ft/s)
0.0	439.0
-1.9	439.0
-4.3	1,259.8
-7.2	729.5
-10.9	557.9
-15.5	1,739.0
-21.3	752.0
-28.5	958.6
-37.5	1,317.2
-48.7	2,182.9
-100.0	3,505.9



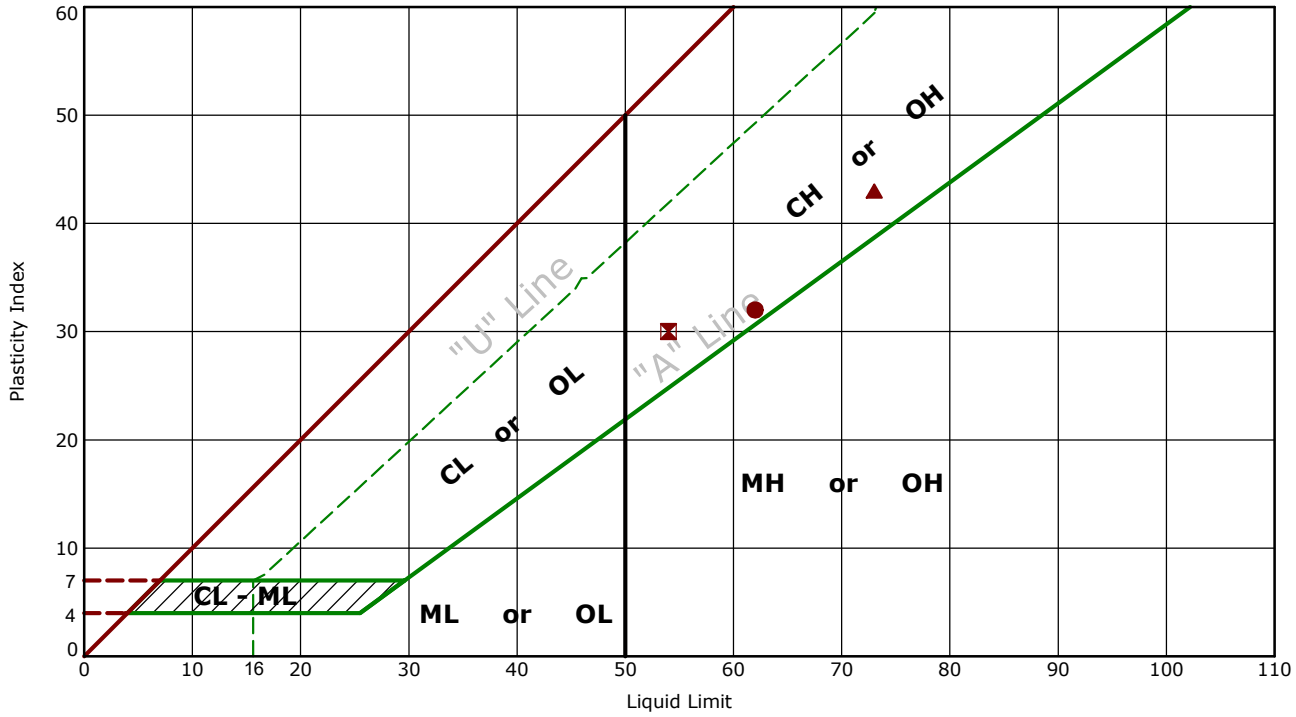
Average Weighted Shear Wave Velocity (ft/s)[1,2] = 1,632

1. measured between 0 ft and 100 ft.

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

Atterberg Limit Results

ASTM D4318



	Boring ID	Depth (Ft)	LL	PL	PI	Fines	USCS	Description
●	C-1	3.5 - 5	62	30	32	53.6	CH	SANDY FAT CLAY
⊠	C-4	3.5 - 5	54	24	30	64.1	CH	SANDY FAT CLAY
▲	C-6	1 - 2.5	73	30	43	58.5	CH	SANDY FAT CLAY

REPORT FOR CALIFORNIA BEARING RATIO

Service Date: 09/06/23
Report Date: 09/22/23

2401 Brentwood Road, Suite 107
Raleigh, NC 27604
919-873-2211

Client

Fairway Investments, LLC
Attn: Paul Darden
728 Shades Creek Parkway
Birmingham, Alabama 35209

Project

Falls Centre
4500 Falls of Neuse Road
Raleigh, North Carolina

Project No. 70235203

SAMPLE INFORMATION

Sample Number:	Bulk Sample	Proctor Method:	ASTM D698 - Method A
Boring Number:	Near B-2	Maximum Dry Density (pcf):	104.7
Sample Location:	Bulk Sample	Optimum Moisture:	18.1
Depth:	1.0 - 2.5'	Liquid Limit:	NP
Material Description:	Light Red Silty Sand	Plasticity Index:	NP

CBR TEST DATA

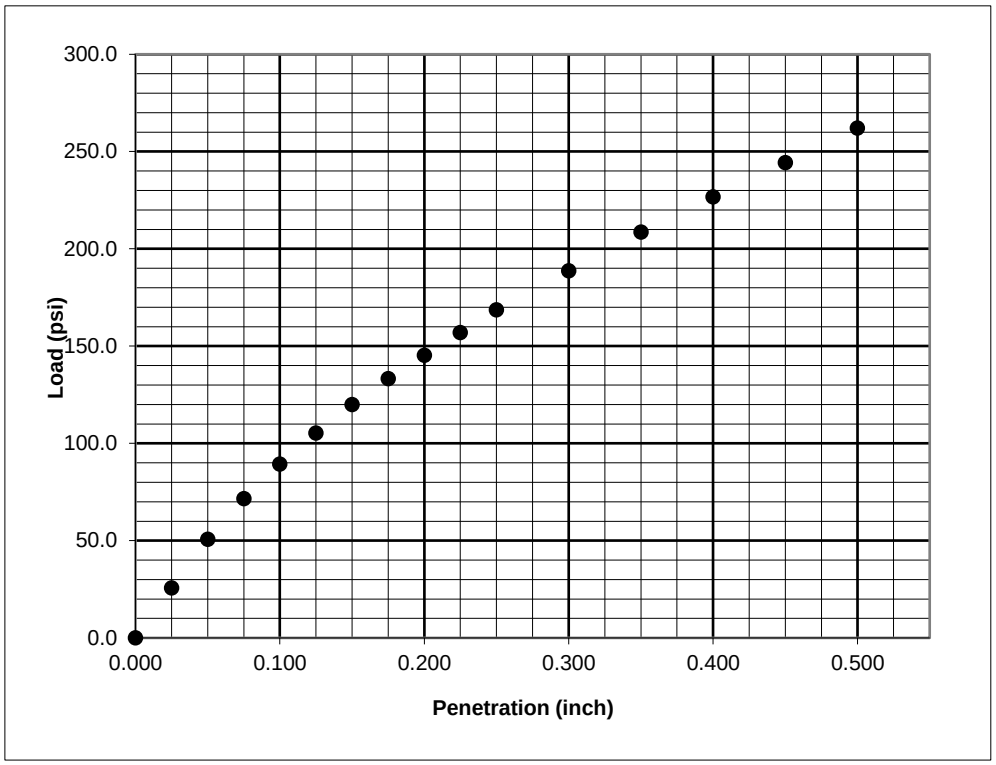
CBR Value at 0.100 inch	**8.9**
CBR Value at 0.200 inch	**9.7**
Surcharge Weight (lbs)	10
Soaking Condition	Soaked
Length of Soaking (hours)	96
Swell (%)	0.1

DENSITY DATA

Dry Density Before Soaking (pcf)	98.8
Compaction of Proctor (%)	94.4

MOISTURE DATA

Before Compaction (%)	17.4
After Compaction (%)	17.3
Top 1" After Soaking (%)	22.5
Average After Soaking (%)	21.4



Comments:

Services: Obtain soil sample and test for California Bearing Ratio

Terracon Rep: Stephanie Huffman
Reported To: Taylor Dowell
Contractor:

Report Distribution

Reviewed by:
Taylor Dowell
Geotechnical Project Manager

Test Methods: ASTM D1883

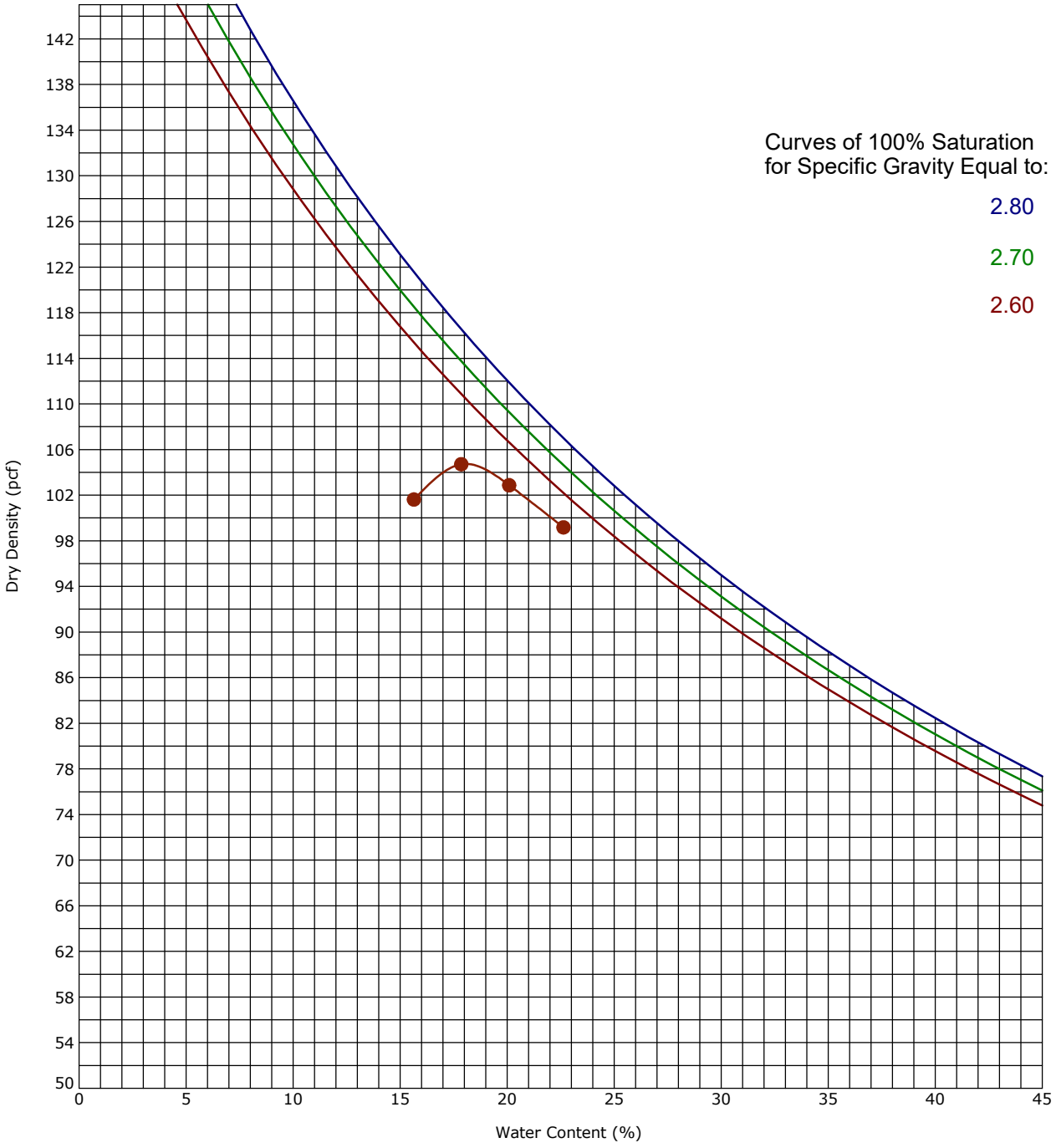
The tests were performed in general accordance with applicable ASTM, AASHTO, or DOT test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written approval of Terracon. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

Falls Centre
4500 Falls of Neuse Road | Raleigh, NC
Terracon Project No. 70235203

2401 Brentwood Rd Ste 107
Raleigh, NC

Moisture-Density Relationship

ASTM D698-Method A



Boring ID	Depth (Ft)	Description of Materials
Bulk near B2	1 - 2.5	SILTY SAND(SM)

Fines (%)	Fraction > mm size	LL	PL	PI	Test Method	Maximum Dry Density (pcf)	Optimum Water Content (%)
13	0.0	NP	NP	NP	ASTM D698-Method A	104.7	18.1

Supporting Information

Contents:

General Notes
Unified Soil Classification System

Terracon
3150 Spring Forest Rd Ste 100
Raleigh, NC

General Notes

Sampling	Water Level	Field Tests
Split Spoon	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

Relative Density	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 50
Very Dense	> 50

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Soft	less than 0.25	0 - 1
Soft	0.25 to 0.50	2 - 4
Medium Stiff	0.50 to 1.00	4 - 8
Stiff	1.00 to 2.00	8 - 15
Very Stiff	2.00 to 4.00	15 - 30
Hard	> 4.00	> 30

Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 4 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.

