



REPORT OF GEOTECHNICAL INVESTIGATION

**PROPOSED RESIDENTIAL DEVELOPMENT
100 EXECUTIVE DRIVE
CITY OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY**

BY

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PREPARED FOR

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File No. 22023-000

BNE REAL ESTATE GROUP
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Attention: Mr. Charles Thomas Jr. PE PP
Vice President of Land Development

REGARDING: REPORT OF GEOTECHNICAL INVESTIGATION
Proposed Residential Development
100 Executive Drive
City of West Orange, Essex County, New Jersey

Dear Mr. Thomas:

The enclosed report summarizes the results of our geotechnical investigation and recommendations in support of the Proposed Residential Development at the above referenced site. This work was undertaken in accordance with our proposal dated November 19, 2019 (last revised December 2, 2019) and your subsequent authorization on December 11, 2019

We appreciate the opportunity to work with you on this project. Please contact us if you wish to discuss this report or any aspect of the project.

Sincerely,
JZN ENGINEERING, PC.

A handwritten signature in blue ink, appearing to read 'Nejm E. Jundi', is written over the printed name.

Nejm E. Jundi, P.E.
President

Enclosures

EXECUTIVE SUMMARY

This report summarizes our geotechnical study and provides our geotechnical engineering recommendations for the Proposed Residential Development to be located at 100 Executive Drive in the city of West Orange Essex County, New Jersey.

The study was conducted in two (2) phases. A total of 17 exploration borings were drilled within the proposed building footprint with preliminary borings identified as B-1 through B-4 and supplementary borings identified as SB-1 through SB-13. Preliminary borings were drilled to sampler and auger refusals at depths that ranged between approximately 3.4 to 9.5 feet below the exiting ground surface. The supplemental exploration borings were drilled within accessible areas of the existing property to bedrock and rock was cored to a depth of five (5) foot below the bottom of proposed footing with the exception of SB-4 and SB-8 which were terminated after a ten (10) foot and 7.2 foot of rock core respectively ending one (1) foot below the proposed footing elevation. Engineering analyses were performed to evaluate the foundation system for the structure and to develop recommendations for foundation design and construction, utility support and earthwork. A description of site conditions and our evaluation is presented in the following report. The principal conclusions are described below:

- The field exploration revealed a subsurface profile generally consisting of the following: a surface cover consisting of approximately two (2) two nine (9) inches this asphaltic pavement. Underlying the surface cover, existing fill materials were encountered to depths ranging between approximately two (2) and four (4) feet below the existing ground surface. The existing fill materials generally consisted of a mixture of medium to fine sand with varying amounts of silt, and debris (asphalt). Underlying the fill materials, Glacial deposits were encountered to depths ranging between approximately two (2) and 18 feet below existing ground surface. The glacial deposits consisted of medium dense to very dense silty sand deposits with varying amounts of gravel. Underlying the glacial deposits or the fill material in boring SB-9 very hard unweathered basalt bedrock was encountered with gently dipping to very steeply dipping fractures. Recoveries (Rec.) ranged from 78% to 100%, while RQD's ranged from 0% to 100%. Below proposed footing elevations Recoveries (Rec.) ranged from 80% to 100%, while RQD's ranged from 16.7% to 100%. Groundwater conditions were not encountered within the borings; however, it should be noted that perched/trapped water conditions should be anticipated at the soil/rock interface following periods of rain.
- Based on our understanding, the proposed development will include the construction of various three (3) to five (5) story buildings and a parking garage. Based on the subsurface profile obtained from our

field investigations, we expect that building subgrades will vary between being above and below top of bedrock. As such, in order to limit the potential for differential settlement, we recommend that the building be supported on a conventional shallow foundation system bearing on the glacial deposits, or on Compacted Granular Fill (CGF) if bedrock is encountered, which then shall be over-excavated a minimum of two (2) feet below the footing subgrade elevation and the resulting excavation should be backfilled with CGF.

- Due to the proximity of existing structures, including public roadways, existing utilities and high voltage power line towers, every effort to protect these structures during and after construction should be taken. We recommend that a pre/post construction conditions survey, optical monitoring, and vibration-monitoring program be undertaken to document possible effects of the construction.

Detailed recommendations are presented in the following report.

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1. INTRODUCTION

1.1 General

This report summarizes our supplemental geotechnical study and provides our geotechnical engineering recommendations for the Proposed Residential Development to be located at 100 Executive Drive in the city of West Orange, Essex County, New Jersey. This report was prepared based on the information provided to us including the following document:

- A December 18, 2017 *ALTA/NSPS Land Title Survey* of Block 155 lot 42.02 prepared by Partner Engineering and Science;
- A December 18, 2017 *ALTA/NSPS Land Title Survey* of block 155 lot 40.02 prepared by Partner Engineering and Science;
- A November 21, 2018 *Concept Site Plan* prepared by Minno Wasko Architects and Planners;
- An August 14, 2018 *Concept Site Plan* prepared by Minno Wasko Architects and Planners; and
- A September 3, 2019 *Report of Preliminary Geotechnical Due Diligence Investigation* prepared by JZN Engineering, P.C.

1.2 Scope of Services

This geotechnical investigation was undertaken to obtain information on subsurface soil and groundwater conditions, and to provide recommendations for the Proposed Residential Development foundations and related earthwork. The scope of this geotechnical engineering services included:

- Explore the subsurface conditions at the site by means of drilling exploration borings;
- Estimate the engineering characteristics of the subsurface materials;
- Provide geotechnical criteria for use by the design engineers in preparing the foundation design; and
- Provide recommendations for earthwork and construction.

1.3 Existing Site Conditions

At the time of our field investigation, the site was occupied with existing commercial office buildings and associated paved parking lots and driveways. The location of the project site is shown on the *Project Locus Map* included as Figure 1 in this report.



1.4 Report Datum

Topographic information presented in this report is approximate and the elevations are based off the *ALTA/NSPS Land Title Survey* prepared by Partner Engineering and Science. The elevations on the drawing are referenced per the North American Vertical Datum of 1988 (NAVD 1988). All depths in the report are referenced from top of the existing ground surface elevation at the time of the field investigation.

1.5 Proposed Development

At the time of our investigation, we understand that the proposed development is still in the conceptual design phase but at this time will include demolition of the existing structures and the construction of a multiple residential buildings, pool and parking structure, new utilities and stormwater management system.

2. GEOTECHNICAL INVESTIGATION

2.1 Regional Geology Review

The subject site is situated within the Piedmont Physiographic Province of New Jersey. Specifically, the site is located within the Brunswick Group, and is underlain by the Lower Triassic Aged, Orange Mountain Basalt. The formation consists of basalt, fine grained to aphanitic, dark greenish gray, composed mostly of calcic plagioclase and augite. The formation consists of three major tholeiitic lava flow sequences. The lowest flow is generally massive with widely spaced curvilinear joints. The middle flow is massive or has columnar joints. The lower part of the uppermost flow has pillow structures and the upper part has pahoehoe flow structures.

The information presented above was based on the review of published geological data as reported in the Bedrock Geologic Map of Northern New Jersey prepared by United State Geological Survey (USGS).

2.2 Field Exploration

JZN conducted this field investigation in two (2) phases. The preliminary field exploration was carried out by means of drilling four (4) exploration borings. The exploration borings (identified as B-1 through B-4) were drilled within the property to spilt spoon sampler and auger refusals on probable bedrock. JZN then carried out a supplemental field exploration by means of drilling thirteen (13) additional exploration borings identified as SB-1 through SB-13. The supplemental exploration borings were drilled within accessible areas of the existing property to bedrock and rock was cored to a depth of five (5) foot below the bottom of proposed footing with the exception of SB-4 and SB-8 which were terminated after a ten (10) foot and 7.2 foot of rock core respectively ending one (1) foot below the proposed footing elevation. The locations of all of the exploration borings are shown on the accompanying *Boring Location Plan* included as Figure 2, records of the initial and supplemental exploration logs are provided in Appendix A, and photos of the rock cores are provided in Appendix B.

In addition, a rock contour plan(s) were created utilizing the subsurface data form the borings and are included as Figure 3 within this report. These maps are based on our best interpretation of the variations of bedrock elevations based on the limited number of borings performed; thus, should be used for illustration purposes only. Actual bedrock elevations may vary in between boring locations.

The preliminary exploration borings were drilled with a standard truck-mounted drill rig using 3.25 inches inside diameter hollow stem augers (ASTM D6151). The supplemental exploration borings were drilled

with a truck-mounted drill rig in accessible areas mud-rotary drilling techniques (ASTM D5783). Soil samples were obtained by the Standard Penetration Test (SPT) method in general accordance to ASTM D1586 with a 1-3/8-inch inside diameter (I.D.) split spoon sampler driven by a 140-pound hammer free-falling 30 inches. Blows for each six-inches of penetration were recorded on the exploration boring logs. Depth to groundwater was estimated from visual observation of moisture content of split spoon soil samples. The soil matrix was classified in accordance to Unified Soil Classification System (USCS).

Bedrock was cored during the supplemental borings using a double wall core barrel of NQ-size diamond bit, recovering a nominal 1.88-inch diameter core (ASTM D2113). Rock core descriptions, core recoveries, and Rock Quality Designations (RQD) are provided on the Boring Logs in Appendix A. Rock recovery (Rec.) is defined as the length of core recovered divided the length of core run and is expressed as a percentage. RQD (ASTM D6032) is defined as the sum of the length of core fragments four (4) inches or greater between natural breaks divided by the length of the core run and is expressed as a percentage. RQD is an indication of the relative frequency of jointing or natural fracturing of the bedrock.

Both the preliminary and the supplementary field exploration program was monitored, planned, and logged by a JZN Engineer. The exploration locations were determined in the field by a JZN Engineer using normal taping procedures and estimated right angles from existing site features and are presumed to be accurate within a few feet.

The preliminary soil exploration borings were drilled by Environmental Technical Drilling, Inc. of Farmingdale, New Jersey in the presence of a JZN Engineer on August 27th, 2019. The supplemental exploration borings were drilled by Environmental Technical Drilling, Inc. of Farmingdale, New Jersey utilizing two drill rigs working simultaneously in the presence of a JZN Engineer between December 18th and December 23rd, 2019. All exploration borings were backfilled with soil cuttings generated from the investigation and surficially restored with cold patch.

The boring exploration logs and related information depict subsurface conditions only at the specific exploration locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at the exploration boring locations. Also, the passage of time may result in a change in the subsurface conditions at these exploration boring locations.

2.2.1 Subsurface Conditions

Details of the subsurface materials encountered are presented on the Exploration Boring Records presented in Appendix A of this report. The stratification lines designating the interface between soil types on the

boring logs represent approximate boundaries. The transition between materials may be gradual, and one or more strata may be absent at specific locations. In general, the subsurface soils conditions are consistent with the regional geology of the area. The exploration borings revealed the following generalized strata in order of increasing depth below ground surface:

Surface Cover: The surface cover at the boring locations consisted of asphaltic pavement ranging in thickness between approximately two (2) inches to nine (9) inches.

Stratum I – Existing Fill Materials: Existing fill materials were encountered below the surface cover and extended to depths of approximately two (2) to four (4) feet below the existing ground surface. Generally, the existing fill materials consisted of a mixture of medium to fine sand with varying amounts of silt, and debris (asphalt).

Stratum II – Glacial Deposits (USCS-SM, SP, SM, ML): Underlying Stratum I, medium dense to very dense silty sand deposits with varying amounts of gravel were encountered to the boring termination depths that ranged between approximately two (2) feet and 18 feet below the ground surface at the time of our investigation. At boring exploration location SB-7, a three (3) foot thick layer of sandy silt was encountered directly on top of bedrock.

Stratum III – Igneous Bedrock: Underlying the Glacial deposits, or below the existing fill materials at boring location SB-9, competent bedrock consisting of basalt was encountered. Generally, the bedrock was classified as very hard, unweathered, with gently dipping to very steeply dipping fractures. Recoveries (Rec.) ranged from 78% to 100%, while RQD's ranged from 0% to 100%. Below proposed footing elevations Recoveries (Rec.) ranged from 80% to 100%, while RQD's ranged from 16.7% to 100%.

2.2.2 Groundwater Conditions

Groundwater conditions generally were not encountered during this investigation; It should be noted that perched/trapped water conditions should be anticipated at the soil/rock interface.

Groundwater observations in completed test borings do not necessarily represent the true, stabilized groundwater conditions. It should be noted that fluctuations in the level of groundwater may occur due to variations in season, rainfall, snow melt, surface infiltration, temperature, construction activities, pumping of dewatering systems, leakage from utilities, and other factors not evident at the time measurements were made and reported herein. As a result, water levels observed during and after construction may vary from those observed in the test borings during drilling.

3. SITE PREPARATION, EARTHWORK, AND CONSTRUCTION CONSIDERATION

3.1 General

The following sections of the report include comments on items related to excavation, dewatering, earthwork, and related geotechnical engineering aspects of the proposed construction. This section is written primarily for the engineer responsible for preparation of plans and specifications. Since this section identifies potential construction problems related to foundations and earthwork, it will also aid personnel who monitor the construction activity and contractors performing the earthwork.

The field exploration revealed a subsurface profile generally consisting of the following: a surface cover consisting of approximately two (2) to nine (9) inches of asphaltic pavement. Underlying the surface cover, existing fill materials were encountered to depths ranging between approximately two (2) and four (4) feet below the existing ground surface. The existing fill materials generally consisted of a mixture of medium to fine sand with varying amounts of silt, and debris (asphalt). Underlying the fill materials, Glacial deposits were encountered to depths ranging between approximately two (2) and 18 feet below existing ground surface. The glacial deposits consisted of medium dense to very dense silty sand deposits with varying amounts of gravel. Underlying the glacial deposits or the fill material in boring SB-9 very hard unweathered basalt bedrock was encountered with gently dipping to very steeply dipping fractures. Recoveries (Rec.) ranged from 78% to 100%, while RQD's ranged from 0% to 100%. Below proposed footing elevations Recoveries (Rec.) ranged from 80% to 100%, while RQD's ranged from 16.7% to 100%. Groundwater conditions were not encountered within the borings; however, it should be noted that perched/trapped water conditions should be anticipated at the soil/rock interface following periods of rain.

Based on our understanding, the proposed development will include the construction of various three (3) to five (5) story buildings and a parking garage. Based on the subsurface profile obtained from our field investigations, we expect that building subgrades will vary between being above and below top of bedrock. As such, in order to limit the potential for differential settlement, we recommend that the building be supported on a conventional shallow foundation system bearing on the glacial deposits, or on Compacted Granular Fill (CGF) if bedrock is encountered, which then shall be over-excavated a minimum of two (2) feet below the footing subgrade elevation and the resulting excavation should be backfilled with CGF.

Due to the proximity of existing structures, including public roadways, existing utilities and high voltage power line towers, every effort to protect these structures during and after construction should be taken.

We recommend that a pre/post construction conditions survey, optical monitoring, and vibration-monitoring program be undertaken to document possible effects of the construction.

3.2 Earthwork

The subsurface materials that may be encountered during construction will include the existing fill materials, natural sand deposits, and bedrock. We anticipate that soil excavation of the overburden soils (existing fill materials and sand deposits) can be accomplished using conventional earth-moving equipment; and that bedrock can be excavated using conventional rock-chipping equipment. A temporary cut slope within the fill materials and natural sand deposits will be difficult to maintain if excavated steeper than about 1.5H:1V, and protected from erosion due to surface water and freeze/ thaw. Some sloughing and raveling should be anticipated in such temporary earth slopes. All temporary excavation slopes should be constructed to comply with all OSHA and other applicable regulations.

Rock removal is expected at parts of the site to achieve design elevations. Based on local experience, we expect that only the upper few inches of weathered rock can be excavated with large excavation equipment with rock teeth. Excavation depths beyond refusal depths and in confined excavations, such as for footings and utility trenches, will require ripping tools and/or pneumatic hammers. Heavy excavating equipment with ripping tools may be effective in removing only the uppermost decomposed rock and uppermost weathered rock during site excavation. The speed and ease of excavation will depend on the type of grading equipment, the skill of the equipment operators, and the geologic structure of the material itself, such as the direction of bedding, planes of weakness, and spacing between discontinuities. Below the upper few inches on top of rock, hard rock excavation methods will be necessary. The site is situated in a well-developed area, as such rock blasting is not recommended. If blasting is proposed, reviewing municipal requirements and extensive vibration controls would be necessary.

Care must be exercised during excavations within 15 feet next to adjacent existing developments (roads, building, and utilities) and neighboring buildings foundations zone of influence (ZOI). These excavations must be conducted in such a manner not to undermine these existing buildings foundation elements and disturb the bearing surfaces and under the direction and system design of a professional engineer licensed in the State of New Jersey.

The site should be sealed on a daily basis using a smooth drum roller at the completion of each workday or if rainfall is imminent, work areas should be graded and smooth-wheel rolled to permit runoff of rainfall. Care must be exercised during excavations in areas next to adjacent existing developments (roads,

commercial/residential buildings and parking lots). Excavations must be conducted in such a manner not to undermine these existing neighboring buildings foundation elements and disturb their bearing services.

3.3 Earthwork During Freezing Weather

The moisture within the soil matrix may freeze when temperatures fall below freezing. Frozen soil or soil containing snow or ice should not be used as fill. Placement of fills should not be conducted when air temperatures are low enough to cause freezing of the moisture in the fill during or before placement.

Fill materials should not be placed on water, snow, ice or frozen soil. No fill should be allowed to freeze prior to compaction. At the end of each work day, the last lift of fill, after compaction, should be rolled by a smooth-wheeled roller to eliminate ridges of un-compacted soil. Soils with high fine content (such as silt) and/or with high moisture content are susceptible to disturbance by freezing, especially in the presence of water and construction traffic.

Soil bearing surfaces below completed foundations and slabs must be protected against freezing before and after foundation construction. If construction is performed during freezing weather, foundations and grade beams should be backfilled to a sufficient depth (up to four feet) as soon as possible after they are constructed. Alternatively, insulating blankets, heating or other means may be used for protection against freezing. Placement and compaction of fill materials should be conducted only when ambient air temperatures are above 30 degrees Fahrenheit.

3.4 Bearing Surfaces Preparation

3.4.1 General

Prior to placing any fill materials to raise or restore grades, the exposed soils should be compacted to a firm and unyielding surface with several passes of a minimum five-ton roller. In confined areas, hand-guided compacting equipment imparting a dynamic force of at least 5,000-lbs should be used and the loose lift thickness should not exceed six inches.

3.4.1 Shallow Foundations/Slab-on-Grade

All existing asphalt pavement structures, existing fill materials, remnant foundation elements, and any encountered site utilities should be removed from within the zone of influence (ZOI) beneath proposed foundations down to the suitable bearing stratum. Following the excavation to the suitable bearing

stratum, the exposed surface should be compacted to an unyielding surface. The contractor should be prepared to overexcavate areas where the existing fill materials may extend to deeper elevations. Final determination of suitability for shallow foundation support shall be made by a qualified Geotechnical Engineer during earthwork activities.

The Zone Of Influence (ZOI) is defined as the area below the footings and below imaginary lines that extend two feet laterally beyond the footing outer bottom edges and down on a one horizontal to one vertical (1H:1V) slope to the naturally deposited bearing soils.

If bedrock is encountered within two (2) feet of the design slab/footing bearing elevation, the bedrock should be over-excavated such that the top of bedrock is a minimum of two (2) feet below the design subgrade, followed by backfilling with Compacted Granular Fill (CGF).

The exposed subgrade should be observed in the field by the Geotechnical Engineer's representative to confirm the assumed foundation bearing conditions. Use of the allowable bearing pressures recommended in this report is contingent upon such observation and documentation that the field conditions are consistent with the assumptions made within this report.

It is necessary to overexcavate and replace disturbed or otherwise unacceptable foundation bearing materials. Following overexcavation to a suitable subgrade material, the exposed surfaces should be re-compacted prior to placing Compacted Granular Fill (CGF) or constructing foundations with a minimum of two passes with a heavy vibratory plate compactor or vibratory roller. If weaving or other disturbance is noticed during re-compaction, vibratory re-compaction should be discontinued.

Care should be taken to prevent surface water from collecting on exposed soil bearing surfaces. Worker and equipment traffic over bearing surfaces should be minimized. When exposed, it may be difficult to prepare soil subgrades in cold and wet weather.

Soil bearing surfaces below completed foundations must be protected against freezing before and after foundation construction. If construction is performed during freezing weather, foundations should be backfilled to a sufficient depth (up to three feet) as soon as possible after they are constructed. Alternatively, insulating blankets, heating or other means may be used for protection against freezing.

Footing subgrades in bedrock should be prepared as flat as practical, with all areas of the subgrade flatter than 10 horizontal to 1 vertical. If fill containing soil is to be placed above a bedrock surface containing

fractures or voids, the rock surface must be choked off to prevent the migration of overlying fine-grained material that could induce loss-of-ground related settlements. The rock surface may be choked with processed rock fill, lean concrete, $\frac{3}{4}$ -inches. crushed stone or other suitable material depending on the rock condition and the gradation of the material to be placed above. If uniform crushed stone or crushed rock fill is used, the portion exposed to finer backfill materials should be covered with a suitable woven filter fabric.

When excavated rock subgrades are exposed in footing excavations, significantly disturbed rock material should be removed and replaced with crushed stone or other acceptable backfill. Fractured rock may remain in place if it is judged by the Geotechnical Engineer to be not significantly heaved and/or disturbed, and it is proof-compacted with a heavy self-propelled vibratory roller.

To avoid non-uniform bearing, footings should not bear partially on soil and partially on bedrock. Where bedrock is exposed at the bearing elevation for a part of footing (including wall or strip footing), the excavation should be extended at least two feet deeper and backfilled with CGF. A similar procedure should be utilized where bedrock is encountered beneath a portion of an individual spread footing.

3.5 Backfilling

Compacted Granular Fill (CGF) should be used for filling within the proposed building footprint area, foundation zone of influence (ZOI), and pavement areas. Fill materials should be placed in lifts not to exceed 12 inches in loose thicknesses. Compaction equipment in open areas should consist of self-propelled minimum 10-tons vibratory drum rollers. In confined areas, hand-guided equipment such as a trench compactor imparting a dynamic force of at least 5,000 lbs. should be used and the loose lift thickness should not exceed six inches. Areas within 15 feet of existing structures should be compacted using lighter compaction equipment (two tons or less) with an increased number of passes to achieve required compaction. Subgrades with high fines content (silt or clay) should not be proof-compacted using vibratory equipment; final excavations in high fines content subgrades should be made by hand or smooth-bladed excavation equipment to create a stable, undisturbed bearing surface. Lift thickness should be reduced to a minimum of six inches where lighter compaction equipment is used.

A minimum of four perpendicular passes of the compaction equipment should be used to compact each lift. Cobbles or boulders having a size exceeding three inches in size should be removed prior to compaction. The minimum recommended compaction requirements are summarized in Table 1.

Table 1: Minimum Recommended Compaction Requirements	
Location	Compaction Requirement ¹
Building Foundation, Slab-on-Grade, and Structural Elements	95%
Landscape and Non-Structural Areas	92%

Notes:

¹ As determined in accordance with ASTM D1557

3.6 Backfill Materials

3.6.1 Compacted Granular Fill (CGF)

Compacted Granular Fill (CGF) should consist of clean, well-graded sand and gravel, free of organic material, clay clumps, snow, ice, or other deleterious materials & should meet the criteria in Table 2:

Table 2: Compacted Granular Fill Gradation	
Sieve Size	Percent Finer by Weight
3-in.	100
No. 4	30 – 90
No. 40	10 – 50
No. 200	0 – 5

3.6.2 Common Fill

Common Fill may be used to raise grades in sidewalk and landscape areas, subject to design and drainage requirements and is suitable for general landscape grading. Common Fill should be granular soil free from organic material, clay clumps, snow, ice, or other deleterious materials. Common Fill should not contain stones larger than 3-in, and have a maximum of 80 percent passing the No. 40 sieve and a maximum of five percent passing the No. 200 sieve.

Additionally, inorganic soil including soils with higher percentages of fine material may be considered during favorable weather periods subject to the Geotechnical Engineer's approval, provided that the required moisture content and compaction controls are met.

3.6.3 Onsite Soil

The granular portions of the existing fill materials and glacial deposits may be suitable for reuse contingent on any weather-related compaction limitations and removal of over-sized particles and deleterious materials, and on the Geotechnical Engineer visual observation during construction. These materials may be used as fill materials beneath the slab-on-grade, and other areas subject to the Geotechnical Engineer's

approval. Existing fill materials containing deleterious materials or excessive amounts of debris are not suitable for use and if excavated should be stockpiled for offsite disposal.

Soils containing high fine content will be difficult to be re-used as backfill materials and will degrade rapidly during periods of precipitation and when subjected to repeated construction traffic. These materials, if excavated, should be stockpiled for off-site disposal.

Final determination of suitability of onsite soils for reuse as CGF and/or Common Fill will have to be made during construction when the materials are exposed during excavation. Reuse of onsite materials should be observed and documented in the field by the Geotechnical Engineer. Moisture conditioning (drying), particularly during periods of wet weather, and removal of any oversized and deleterious materials may be required to permit placement in lifts to the required compaction.

We recommend the following be considered when evaluating the use of the on-site soils in lieu of CGF:

- Soil moisture content, weather conditions and placement procedures are very important to the successful use of silty soils as engineered fill.
- Generally, the use of the natural soils in lieu of CGF may be difficult or impossible during the period between late September through mid-June area due to difficulties of moisture control and/or freezing temperatures. Precipitation and/or lack of dry weather may inhibit its use during other periods also. Even if the natural soils can be used, careful control of moisture content will be required to achieve the necessary compaction. Moisture conditioning by drying or adding water may be necessary.
- Placement and compaction of the on-site soils should be conducted only when ambient air temperatures are above 30 degrees Fahrenheit.
- Fill which is placed during the day should be fully compacted and smooth-rolled at the end of the work day.
- Any soils used in lieu of CGF which freeze overnight should be removed from the construction areas prior to placing additional fill, or recompacted after thawing.

Rainfall or melting snow can readily saturate stockpiled soils. Providing drainage from or covering a stockpile can help limit this potential problem. However, it has been our experience that these soils will probably require considerable drying if left in an unprotected stockpile for an extended period of time, especially over winter and spring seasons.

Cobbles/boulders and rock fragments greater than three inches in diameter will need to be separated from on-site soils to be placed as Common Fill. Rock fragments between three to 12 inches may be crushed or individually placed in fill layers deeper than two feet below proposed slab subgrade levels. Care must be taken to individually seat any large particles and to compact soil around large particles with hand operated equipment to minimize the risk of void formation. Rock fragments larger than approximately 12 inches in diameter may be crushed into smaller sizes adequate for use as fill or backfill or removed from the site.

3.6.4 Crushed Stone Fill

Crushed stone is recommended within the underslab and foundation drainage systems. It should consist of 3/4-inch size crushed stone in accordance to AASHTO No. 57.

3.6.5 Geogrid

If the soil softens due to weather conditions or construction traffic, a reinforcing geogrid (such as Tensar TX130S, or engineering equivalent) may be used to distribute load and reinforce the soil / backfill matrix subject to further design and construction considerations. If the contractor elects to use geogrid to stabilize disturbed site soils, we request notifications to provide further recommendations.

3.7 **Fill and Backfill Testing**

A sample of any material scheduled for use as Compacted Granular Fill (CGF) should be submitted to the geotechnical laboratory for testing and analysis and approval prior to its use. The placement of all fill and backfill should be monitored by a qualified Geotechnical Engineer to ensure that the specified material and lift thicknesses are properly installed.

The samples should be tested to determine the maximum dry density, optimum moisture content, natural moisture content, gradation, organic content, and plasticity of the soil prior to construction in order to avoid construction delays. These tests are needed for quality control during compaction and also to determine if the fill material is acceptable as CGF. The minimum frequency of in-place density tests indicated in Table 3 should be performed to ensure that the specified compaction is achieved throughout the height of the fill or backfill:

Table 3: Compaction Frequency Testing	
Structural Elements	One test per 500 square feet per lift (minimum five tests per lift)
Non-Structural Areas	One test per each 2,500 square feet per lift (minimum five tests per lift)

3.8 Groundwater Control/ Dewatering

Groundwater conditions were generally not encountered during this investigation. However, it should be noted that perched/trapped water conditions should be anticipated at the soil/rock interface following rain events. Final excavation, subgrade preparation, filling, and foundation construction should be conducted "in the dry". We anticipate that construction dewatering requirements will be minor, consisting primarily of control of surface water runoff into excavations and possible perched water. It is anticipated that dewatering can typically be accomplished by open pumping from sumps, temporary ditches, and trenches within and around excavations. More proactive dewatering, such as bedrock depressurizing or use of deeper wells, is not anticipated.

Surface water runoff during construction should be controlled and directed away from excavations, as on-site soils are highly erodible and susceptible to disturbance due to water and frost action. When exposed, it may be difficult to prepare and maintain soil subgrades in cold and wet weather.

3.9 Excavation and Shoring

All excavation, excavation support, and backfilling must be performed in accordance with OSHA and all other applicable local, state, and federal regulatory requirements.

Excavation at the site may require the use of temporary excavation support system depending on the purpose of the excavation (i.e. requires personal presence inside the excavation). The design of such system is beyond the scope of this report. As such, it is the SOE design engineer responsibility to protect these structures by employing such measures during design and taking into account the subsurface soils and groundwater information and the neighbors building foundation setting and conditions. The SOE contractor should demonstrate to the owner, the completion of five recent successful similar SOE projects and have comprehensive experience with SOE and underpinning construction.

Generally, the site near surface soils encountered during the investigation (fill materials, natural sand deposits) are consistent with Type C Soil Conditions as defined by 29 CFR Part 1926 (OSHA) which require a maximum unbraced excavation angle of 1.5H:1V. Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA) to ensure that safe excavation methods and/or shoring and bracing requirements are implemented.

Deep excavations adjacent to public street/sidewalks, existing buildings, and public utilities will require temporary excavation support. Any excavation support installed will need to be designed and constructed to accomplish the following:

- Retain the excavation & minimize the effects of excavation movements beyond the limits of the site;
- Allow for the excavation at the site; and
- Permit foundation construction to proceed in the “dry”, given the groundwater level is above the proposed bottom of excavation.

Care must be exercised during excavations within 15 feet next to adjacent existing developments (roads, building, and utilities) and neighboring buildings foundations zone of influence (ZOI). These excavations must be conducted in such a manner not to undermine these existing buildings foundation elements and disturb the bearing services and under the direction and system design of a professional engineer licensed in the State of New Jersey.

3.10 Vibration Induced During Rock Chipping

The subject site is situated within a well-developed area. The surrounding development includes structures such as public roadways, existing utilities and high voltage power line towers. As such, care should be maintained during rock excavation.

During the rock excavation operation, the use of heavy machinery may induce vibrations which typically may be transmitted to varying distances from the point of impact. When performing rock excavation within the interior of a large site, the offsite effects of the ground vibrations are usually negligible. However, when rock excavation are conducted near the edges of the property in a developed area, or at a small site, such as the subject site, ground vibrations can be transmitted into the adjacent facilities and in some instances may cause annoyance or structural damage. Based on the site layout in relation to the adjacent structures, and our understanding of the proposed construction, we anticipate that vibrations can be properly controlled to prevent structural damage to the adjacent structures. However, due to the proximity of the public roadways, existing utilities and high voltage power line towers, we recommend monitoring vibrations during construction, especially during rock excavation to demonstrate that vibrations do not affect the adjacent sensitive structures.



3.11 Adjacent Structures

Buried utilities and other structures observed at the site may need to be moved or supported so as not to interfere or be damaged by the new construction.

We recommend that a pre/post construction conditions surveys, vibration-monitoring program, and optical monitoring programs be undertaken to document possible effects of the construction. These monitoring program shall be designed by a qualified professional engineer licensed in the State of New Jersey. Optical monitoring shall be undertaken by a licensed professional surveyor in the State of New Jersey.

4. GEOTECHNICAL DESIGN RECOMMENDATIONS

4.1 General

This section of the report provides recommendations for design of the Proposed Residential Development's foundations for the subject site. Foundations should be designed and constructed in accordance with the applicable International Building Code- New Jersey 2018 edition (NJBC-2015), and the recommendations provided in the following sections.

This foundation investigation has been prepared for the proposed development taking into consideration the layout, site grading, and structural configuration as understood at the time this report was prepared. When and if further information is developed by the project team concerning final design column loadings, building configuration, etc., for the structure, the recommendations and design criteria presented herein should be reviewed by JZN. If any changes to our recommendations should result from this review, we will confirm these changes in writing.

4.2 Suggested Soil Parameters for Analysis and Design

Soil properties for engineering evaluation have been developed based on visual soil classification, penetration test data, published data, laboratory test results, and our experience with similar formations in the area of the project. The suggested soil properties are provided in Table 4. These properties have been used to develop the evaluation and recommendations contained in this report.

Table 4: Suggested Density and Strength Parameters for Design						
Soil Stratum	Unit Weight (pcf ¹)		Strength Parameters			
	Total	Submerged	Drained Strength		Undrained Strength	
			c (psf) ²	φ°	S _u (psf)	φ°
Compacted Granular Fill (CGF) ³	125	63	0	34	0	34
Existing Fill Materials	115	53	0	30	0	30
Glacial Deposits	125	63	0	36	0	36
Basalt Bedrock	145	83	777,000	40	777,000	40

Notes:

1- Pounds per cubic foot (pcf)

2- Pounds per square foot (psf)

3- Based on attaining the minimum required compaction as recommended requirements recommended in Section 3.5

4.3 Suggested Soil Parameters for Seismic Load Evaluation

The subject site area is considered to be an area of low to moderate seismic risk. The applicable design standard selected for seismic load evaluation is based on the NJBC-2015.

Published data for the USGS Seismic Hazard Website provides seismic acceleration criteria for Site Class “B” or rock with shear wave velocity greater than 5,000 feet per second. The seismic site characteristics are based on average blow counts and undrained shear strength in the upper 100 feet of the profile and under. In our opinion, the conditions at the site subsurface profile indicate that the site characteristics correspond to Site Class “C”. The parameters as indicated in Table 5 below are representative of the appropriate design class using procedures contained in the NJBC-2015. Code loadings are generally based on the two percent probability of exceedance event with modifying factors.

Table 5: Seismic Response Criteria for Site Class “C” Based on the NJBC-2015	
Spectral Response Acceleration at 0.2 Sec. Period	Spectral Response Acceleration at 1.0 Sec. Period
$S_s = 0.284g$	$S_1 = 0.059g$
$F_a = 1.3$	$F_v = 1.5$

Based on the site subsurface profile, groundwater, and soil relative densities the potential for liquefaction is considered unlikely.

4.4 Foundations

Based on the results of this investigation, we anticipate that some of the building footings will bear on soils and others will bear on bedrock. As such, in order to limit the potential for differential settlements, we recommend that where rock is encountered at the footing bearing elevation, the rock should be removed a minimum of two feet and the resulting excavation backfilled with Compacted Granular Fill (CGF) to the foundation subgrade elevation.

All unsuitable materials should be removed from within the zone of influence (ZOI) beneath foundations down to the suitable bearing strata as discussed above as recommended in Section 3.4 of this report. Following the removal of the existing fill materials and any unsuitable materials, the proposed building columns and bearing walls can be supported on conventional reinforced concrete isolated spread footings and continuous wall footing foundations bearing on the natural sand deposits or on Compacted Granular

Fill (CGF) provided the subgrade has been prepared as outlined in Section 3.4 of this report. If boulders or outcropped rock are encountered within the footings ZOI it should be entirely removed to a minimum of two (2) feet below the design subgrade elevation and the resulting excavation should be backfilled with CGF in controlled manner. We recommend that the building columns and bearing walls be supported on footings designed in accordance with the following:

The ZOI is defined as the area below the footings and below imaginary lines that extend two feet laterally beyond the footing outer bottom edges and down on a one horizontal to one vertical (1H:1V) slope.

We recommend the footings to be designed and constructed to bear directly on glacial deposits or on CGF following the subgrade preparation as recommended in Section 3.4.2. The proposed footings may be sized using an allowable bearing capacity of eight (8) kips per square foot (ksf) for axial loading conditions. A maximum footing contact pressure of nine (9) ksf is acceptable for eccentric loading conditions as long as the maximum contact pressure acts over less than 33 percent of the footing contact area and the average contact pressure over the entire footing does not exceed eight (8) ksf. We recommend that the continuous wall footings should be sized no less than minimum dimensions of 24 inches and isolated foundations be sized no less than 36 inches. Bottoms of exterior footings should be located a minimum of three (3) feet below adjacent grade and bottoms of interior footings should be located a minimum of two (2) feet below adjacent grade.

Lateral loads can be resisted by a combination of friction along the base of the footings and passive pressure on the vertical faces of footings. Frictional resistance should be computed using an ultimate base friction coefficient ($\tan \delta$) between the footing concrete and subgrade equal to 0.35.

The passive pressure of the soil between the ground surface and the bottom of the footing should be ignored unless it is confined by a slab or bituminous concrete. If the horizontal distance between adjacent footings or walls is less than twice the height of the subject structural element (measured from bottom of element to bottom of slab/ground surface), the passive pressure must be discounted proportionately to the distance (full pressure at twice the height away) to accommodate for interaction of the elements.

At the recommended allowable bearing pressure, we anticipate that the maximum post construction settlement of isolated shallow foundation under static loading conditions, constructed as recommended herein, will not exceed one (1) inch, and differential settlement between adjacent foundation elements will be less than 1/2 inch. Our settlement estimate is based on the design column loads for similar structures.

Most of the settlement should occur during construction, shortly after structure dead loads are placed on the foundations and during the initial snow loading of the roof.

4.5 Lowest Building Slab/ Slab-on-Grade

Following the subgrade preparation outlined in Section 3.4, the proposed building lowest level slab may be designed as a concrete slab-on-grade bearing on the glacial deposits, or on Compacted Granular Fill (CGF). Any areas that become softened or disturbed as a result of wetting and/or repeated construction traffic should be removed and replaced with CGF.

It is recommended that the lowest building slab be placed on a minimum four-inch thick layer of compacted crushed stone. The resulting excavations below slab-on-grade, such as those for foundations and utilities, should be backfilled with CGF below the crushed stone. Slab subgrade soils should consist of CGF placed following the subgrade preparation as outlined in Section 3.4.

Designs of slabs typically require a modulus of subgrade reaction (Winkler spring) or a similar elastic analysis method to determine thickness and reinforcing requirements for the concrete slab-on-grade. We recommend that a modulus of subgrade reaction (k_s) of 195 pounds per square inch per inch (psi/in) be used. The recommended modulus value provided is for a one-foot square plate and must be corrected for slab size.

Post-construction settlements of slab-on-grade designed and installed in accordance with the recommendations outlined in this report are estimated to be on the order of 1/2-inch.

We recommend that a vapor barrier in accordance to ACI 302 with a minimum thickness of 10 mils be placed below the building lowest floor slab. The vapor barrier should be placed on top of the crushed stone below the bottom of the slab. If more durability is needed to protect against the barrier tears during construction, we recommend that a thicker or more puncture resistant product, conforming to ASTM E 2856 Class A, be used if heavy construction equipment may be operated directly on the vapor barrier.

4.6 Lateral Earth Pressures

Design of below grade walls, and temporary shoring system and/or any wall that will act as a retaining wall using recommendations for restrained or unrestrained walls as appropriate. Earth pressures for restrained walls should be computed considering at rest conditions, and unrestrained walls should be designed considering active conditions. Typically, restrained walls are braced at the top, and unrestrained below-

grade walls are not braced at the top. The following recommendations assume grades are level to a distance equal to the wall height behind the wall, the walls are backfilled with Compacted Granular Fill, and that the walls are drained (i.e. hydrostatic pressures are not considered). The parameter values presented in Table 6 can be used to calculate earth pressures.

Table 6: Lateral Earth Pressure Parameters							
Material	Internal Friction Angle (deg)	Undrained Cohesion (psf)	Moist Unit Weight (pcf)	Active Earth Pressure Coefficient K_a^1	Passive Earth Pressure Coefficient K_p^1	At-Rest Earth Pressure Coefficient K_o^1	Earthquake Induced Active Earth Pressure K_{ae}
Compacted Granular Fill (CGF) ³	34	0	125	0.283	3.537	0.441	0.435
Existing Fill Materials	30	0	115	0.333	3.000	0.500	0.472
Glacial Deposits	36	0	120	0.260	3.852	0.412	0.418

Notes:

- 1- Lateral Earth Pressure Parameters are Based on Coulomb Theory
- 2- Based on attaining the minimum required compaction as recommended requirements recommended in Section 3.4

The effect of surcharge pressure should be included in earth pressure calculations, including the loads imposed by adjacent foundations, structures, and traffic.

Hydrostatic pressures are not considered if the walls will be drained. If the drainage system is not installed, hydrostatic pressures should be included in the design with a design groundwater depth at existing ground surface elevation. For seismic loading conditions, walls should be designed to resist static plus seismic earth pressures. Surcharge loading does not need to be considered for seismic design unless the surcharge will be applied over an extended time.

Retaining structures should be designed for a minimum factor of safety against sliding and overturning of 1.5.

4.7 Utilities

We recommend that utilities beneath the building be soil-supported bearing on prepared subgrade soils. Utilities should be located above foundation bearing levels or outside the foundation zone of influence.



Buried site utilities may bear on undisturbed, glacial deposits, or on compacted Common Fill/ CGF placed following the removal of exposed unsuitable bearing materials.

We recommend that in situations where utilities will be located within bedrock, the bedrock should be over-excavated approximately six inches below the utility invert and backfilled with clean sand to prevent any possibility of stressing the utility lines due to sharp rock edges.

5. ADDITIONAL CONSIDERATIONS

5.1 Specification and Plan Review

This report was prepared without the benefit of reviewing the project plans and design. JZN requests notification once a building design has been completed to revise this report accordingly. The recommendations presented herein are contingent on the assumed grading and foundation layouts. We request notification upon completion of a final grading plan.

5.2 Pre and Post Construction Conditions Surveys

Due to the proximity of the adjacent structures (existing buildings, utilities, and roadways, high voltage power line towers), we recommend that a pre and construction conditions surveys of adjacent structures and right-of ways be conducted to document conditions relevant to potential damage claims prior to commencement of construction.

5.3 Construction Testing and Monitoring

The recommendations contained in this report are based on known and reasonably predictable behavior of properly engineered and constructed foundations and other facilities. A Geotechnical Engineer should perform quality control, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing also should be performed to verify that the recommendations contained in this report are implemented. Geotechnical construction monitoring should include:

- installation of shoring system if one is used;
- removal of unsuitable soil materials;
- preparation of slab, footing, and fill subgrades prior to concrete placement;
- vibration monitoring;
- construction of building foundations; and
- suitability of backfill materials as Controlled Fill.

6. LIMITATION

The recommendations contained in this report represent our best professional judgment based on soils conditions encountered in the limited number of test borings performed for this study, and the structural and grading design criteria described in the report. Variations in the types of structures and design grading may change from the criteria assumed in preparation of the report. JZN should be advised of changes in the design criteria so that an evaluation can be made to determine if design recommendations should be revised. The nature and extent of variations in subsurface conditions between explorations may not become evident until construction. If variations appear, it may be necessary to reevaluate the information presented in this report. Conditions may be encountered during construction beyond and between borings that vary from the conditions reported herein. We recommend that foundation construction, earthwork and subgrade preparation be observed by a qualified Geotechnical Engineer familiar with the anticipated conditions and the basis of the foundation design recommendations. Any variations encountered should be brought to our attention so that their effect on the recommendations presented herein can be reevaluated and modified if necessary. Our work has been performed in accordance with current standards of practice for geotechnical engineering for buildings based on the conditions encountered in the explorations. No other warranty is made, either expressed or implied.

FIGURES

-
- FIGURE 1: PROJECT SITE LOCUS**
FIGURE 2: BORING LOCATION PLAN
FIGURE 3: BEDROCK CONTOUR PLAN (ALTERNATIVE 1 AND 2)



GOOGLE MAPS 2018

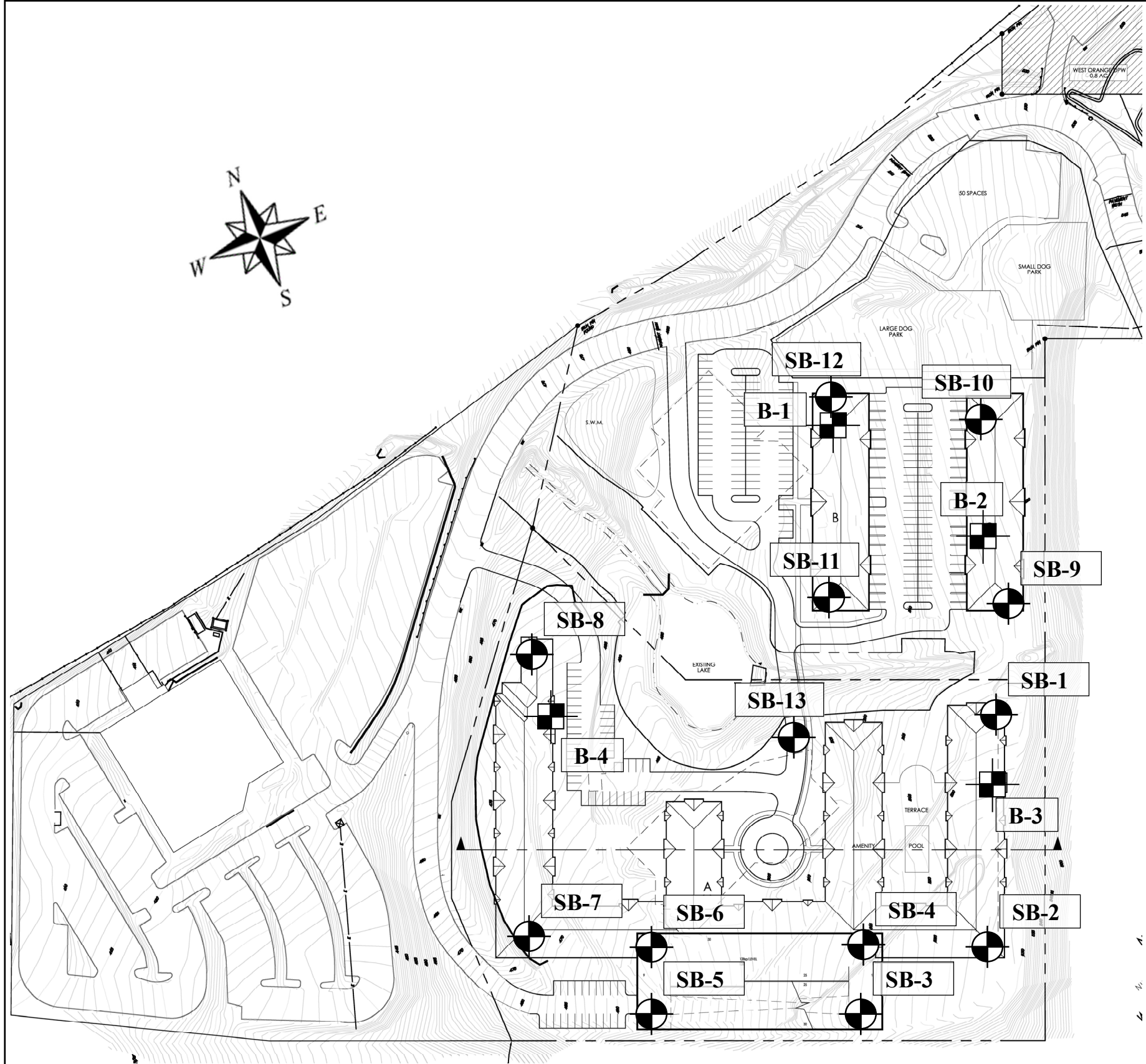


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PROPOSED MIXED-USE DEVELOPMENT
100 EXECUTIVE DRIVE
CITY OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY
22023-000

PROJECT SITE LOCUS

FIGURE 1



LEGEND



B-1: APPROXIMATE PRELIMINARY SOIL EXPLORATION BORING LOCATION



SB-1: APPROXIMATE SUPPLEMENTARY SOIL EXPLORATION BORING LOCATION

NOTES

BASE PLAN OBTAINED FROM AN AUGUST 14, 2018 CONCEPT PLAN PREPARED NY MINNO WASKO ARCHITEVTS AND PLANNERS,

SOIL EXPLORATIONS WERE LOCATED IN THE FIELD BY A REPRESENTATIVE OF JZN ENGINEERING, PC. USING NORMAL TAPING PROCEDURES AND ESTIMATED RIGHT ANGLES FROM EXISTING SITE FEATURES AND ARE PRESUMED ACCURATE WITHIN FEW FEET.

THE SOIL EXPLORATION BORINGS WERE DRILLED BY ENVIRONMENTAL TECHNICAL DRILLING OF FARMINGDALE, NEW JERSEY IN THE PRESENCE OF A JZN ENGINEER ON AUGUST 27/, 2019

SUPPLEMENTAL SOIL EXPLORATION BORINGS WERE DRILLED BY ENVIRONMENTAL TECHNICAL DRILLING OF FARMINGDALE, NEW JERSEY IN THE PRESENCE OF A JZN ENGINEER BETWEEN DECEMBER 18 AND DECEMBER 23, 2019

SOIL BORING LOCATIONS WERE BACKFILLED TO THE SURFACE WITH SOIL CUTTING GENERATED FROM THE INVESTIGATION AND SURFICIALLY RESTORED WITH COLD PATCH.

Boring #	Rock Elev.
SB-1	508.00
SB-2	523.50
SB-3	518.20
SB-4	509.00
SB-5	483.00
SB-6	477.50
SB-7	462.00
SB-8	476.20
SB-9	516.00
SB-10	511.50
SB-11	485.00
SB-12	496.50
SB-13	488.00



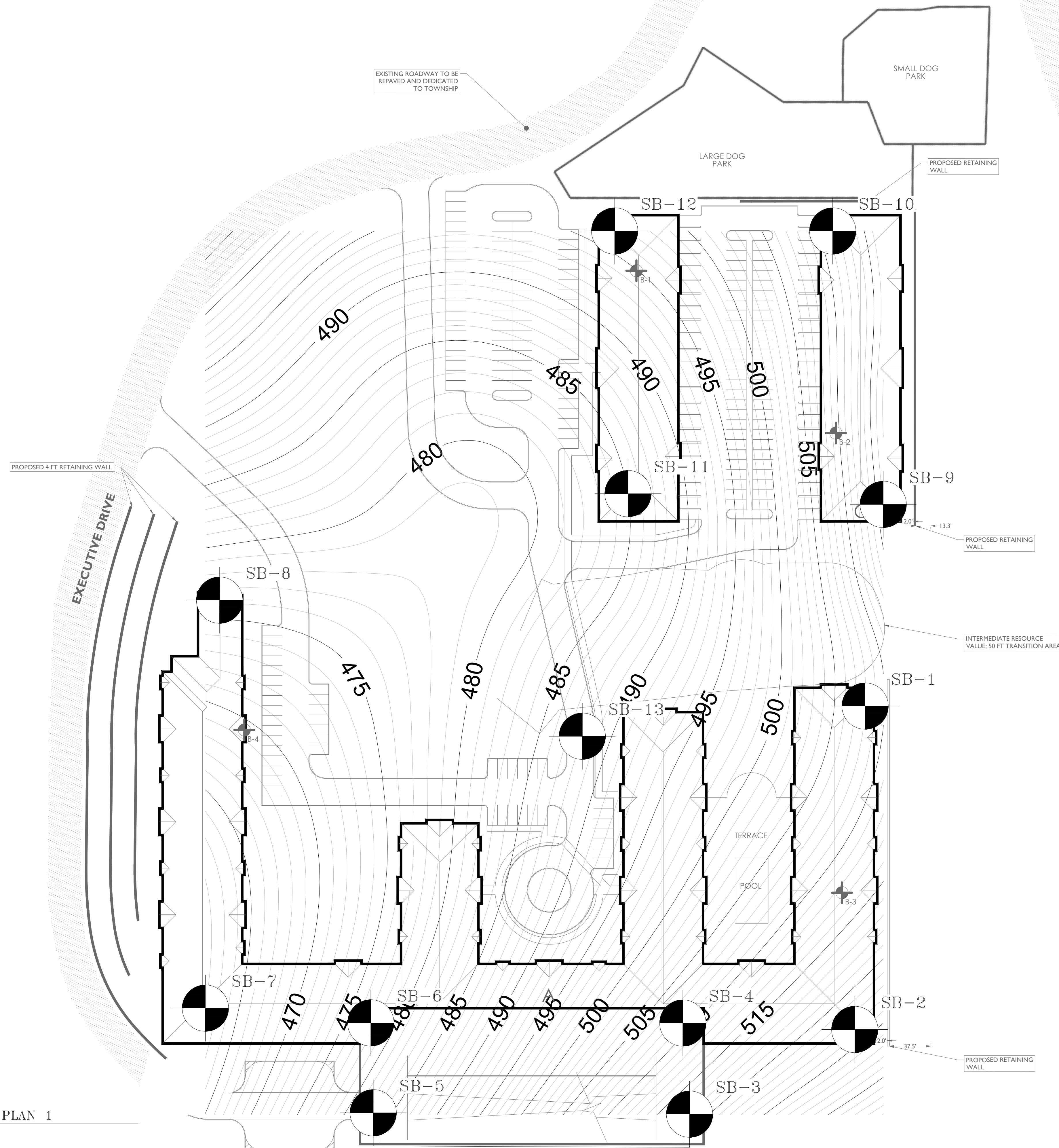
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PROPOSED MIXED-USE DEVELOPMENT
100 EXECUTIVE DRIVE
CITY OF WEST ORANGE, ESSEX COUNTY, NEW JERSEY
22023-000

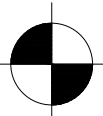
BORING LOCATION PLAN

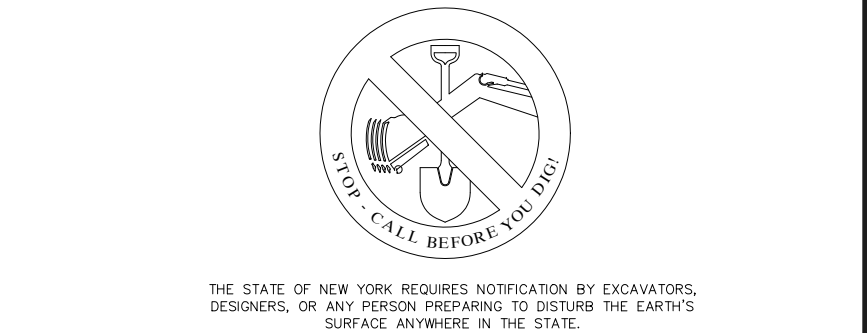
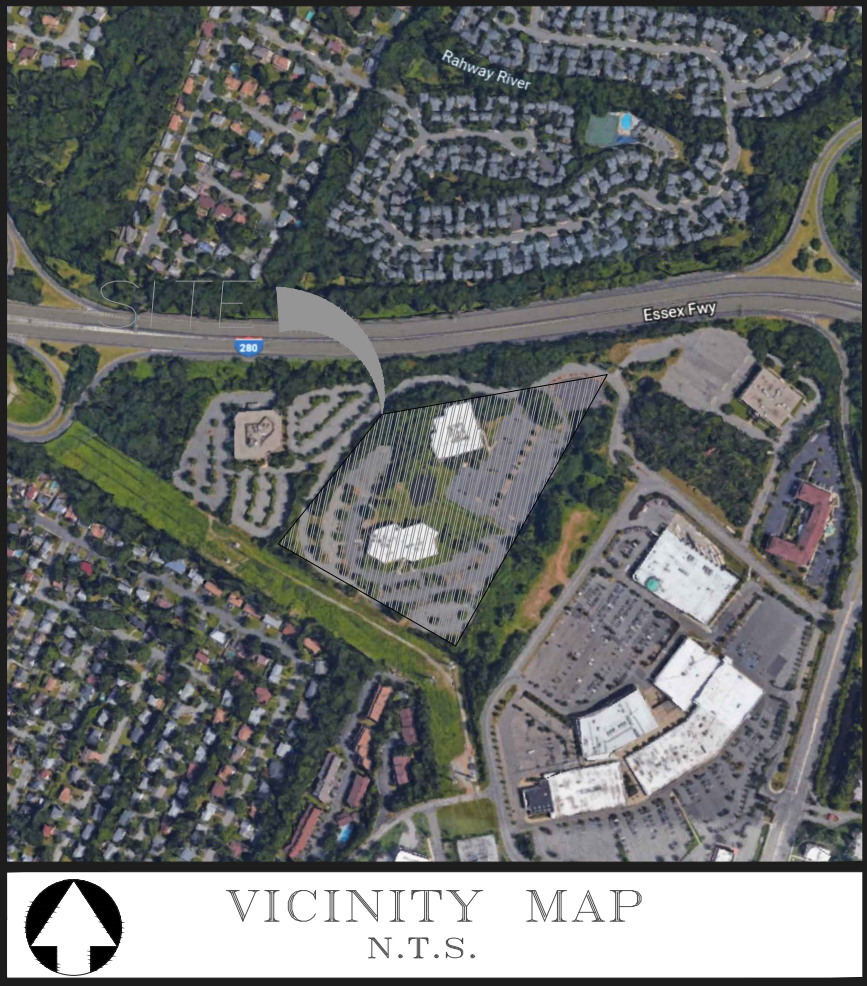
SCALE: NOT TO SCALE

FIGURE 2



BORING #	ROCK ELEV.
SB-1	508.0
SB-2	523.5
SB-3	518.2
SB-4	509.0
SB-5	483.0
SB-6	477.5
SB-7	462.0
SB-8	476.2
SB-9	516.0
SB-10	511.5
SB-11	485.0
SB-12	496.5
SB-13	488.0

- LEGEND:
-  SB-1: APPROXIMATE LOCATION OF SOIL EXPLORATION BORINGS PERFORMED BY JZN ENGINEERING, PC.
- BASE PLAN OBTAINED FROM AN AUGUST 14, 2018 CONCEPT SITE PLAN PREPARED BY MINNO WASKO ARCHITECTS AND PLANNERS
 - ELEVATIONS SHOWN ARE BASED OFF OF THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
 - THIS MAP IS BASED ON OUR BEST INTERPRETATION OF THE VARIATIONS OF BEDROCK ELEVATIONS BASED ON THE LIMITED NUMBER OF BORINGS PERFORMED; THUS, SHOULD BE USED FOR ILLUSTRATION PURPOSES ONLY. ACTUAL BEDROCK ELEVATIONS MAY VARY IN BETWEEN BORING LOCATIONS.



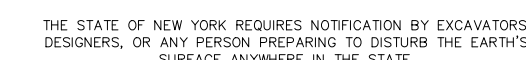
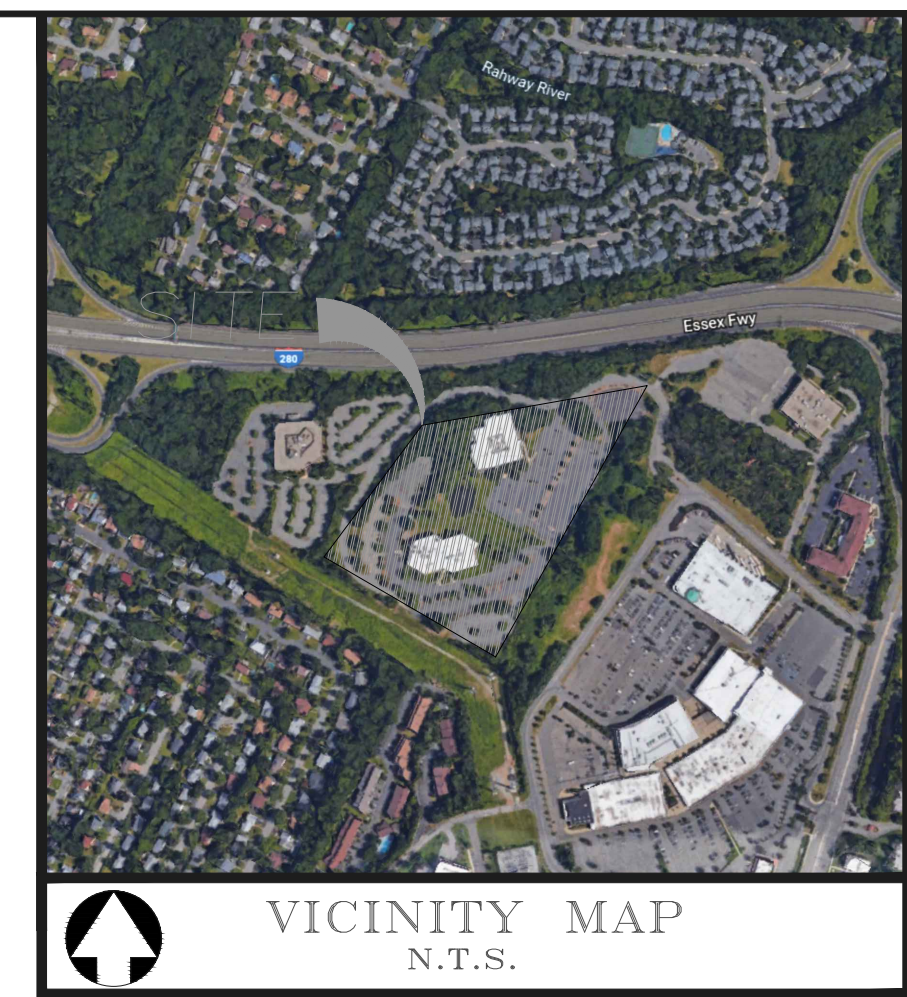
PREPARED BY:
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NEW JERSEY 07081 F: (732) 412-9343

NO.	DATE	BY	DESCRIPTION	APPROVED
REVISIONS				

PROJECT NAME:
PROPOSED MIXED-USE DEVELOPMENT
EXECUTIVE DRIVE
CITY OF WEST ORANGE,
ESSEX COUNTY, NEW JERSEY

DRAWING TITLE:
BEDROCK CONTOUR PLAN
VARIATION 1

SEAL & SIGNATURE NOT VALID UNTIL SEALED	ALTERATION OR ADDITION TO THIS DOCUMENT EXCEPT BY A LICENSED PROFESSIONAL ENGINEER IS A VIOLATION OF THE STATE LAW.	
	DATE: 12/30/19	SCALE: 1"=50'
NEJM E. JUNDI NEW JERSEY STATE PROFESSIONAL ENGINEER #246204440000	PROJECT No: 22023-000	PAGE No: 1 of 2
	DRAWING BY: AGB	
	CHK BY: NEJ	
	APPROVED BY: NEJ	
DWG No: BC-001.00	CAD FILE No: 22023000	
	DATE: 12/30/19	



LEGEND:

- PREPARED BY:**
- JZN**
ENGINEERING
- 99 MORRIS AVENUE, SUITE 302
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NEW JERSEY 07081 F: (732) 412-9343

[illegible]

PROJECT NAME:
PROPOSED MIXED-USE DEVELOPMENT
EXECUTIVE DRIVE
CITY OF WEST ORANGE,
ESSEX COUNTY, NEW JERSEY

DRAWING TITLE:
BEDROCK CONTOUR PLAN
VARIATION 2

SEAL & SIGNATURE	ALTERNATION OR ADDITION TO THIS DOCUMENT EXCEPT BY A LICENSED PROFESSIONAL ENGINEER IS A VIOLATION OF THE STATE LAW.
	DATE: 12/30/19
	SCALE: 1"=50'
	PROJECT No: 22023-000
	DRAWING BY: AGB
	CHK BY: NEJ
APPROVED BY: NEJ	
DWG No:	BC-002.00
DATE	CAD FILE No
NEJM E. JUNDI	22023000
NEW JERSEY STATE PROFESSIONAL ENGINEER #24G00444800	PAGE No: 2 of 2

1 ROCK CONTOUR PLAN 2
SCALE: 1"=50'

APPENDIX A

SUPPLEMENTAL EXPLORATION RECORDS

INITIAL SOIL BORINGS:

B-1 THROUGH B-4

SUPPLEMENTAL EXPLORATION BORINGS: SB-1 THROUGH SB-13

JZN Engineering, PC.		TEST BORING LOG				Boring No.		JZN B-1			
						Page		1 of 1			
Project Name		Proposed Mixed-Use Development				Project No.		22023-000			
Client		BNE Real Estate Group				Representative		D. Palaj			
Project Location		100 Executive Drive				Contractor		ETD, INC.			
		City of West Orange, Essex County, New Jersey				Driller		Scott Pierce			
Boring Location						Date Started		08/27/2019			
Ground Surface Elev.		+/- Elev. +505 ft.				Date Finished		08/27/2019			
		Datum NAVD 88									
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	HSA	S.S.	--	GeoProbe	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	3.25"	1.4	--	7822 DT							
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)	--	30		N/A	--	--	--	--	--	--	
Hammer Type	--	Auto									
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks	
0				A.P.	Approx. 2 inches of Asphaltic Pavement +/- 0.2'						
	S-1 6 in.	0- 2 ft.	5 16 19 16	Fill	Fill: Reddish brown medium fine sand, little silt, moist						
	S-2 8 in.	2- 3.4 ft.	17 40 50/5"	SM	Reddish brown medium fine SAND, little Silt, very dense +/- 3' Gray completely fractured and weathered rock in split-spoon sampler tip						
5					Soil boring B-1 terminated at 3.4 feet Below Ground Surface due to split-spoon sampler and auger refusals on probable bedrock						
Summary		Overburden (Linear ft.)		3.4	Rock Cored (Linear ft.)		--	No. of Samples		3.4	

JZN Engineering, PC.				TEST BORING LOG				Boring No.		JZN B-2		
								Page		1 of 1		
Project Name		Proposed Mixed-Use Development						Project No.		22023-000		
Client		BNE Real Estate Group						Representative		D. Palaj		
Project Location		100 Executive Drive						Contractor		ETD, INC.		
		City of West Orange, Essex County, New Jersey						Driller		Scott Pierce		
Boring Location								Date Started		08/27/2019		
Ground Surface Elev.		+/- Elev. +517.5 ft.						Datum NAVD 88		Date Finished		
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data						
Type		HSA	S.S.	--	GeoProbe	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)		3.25"	1.4	--	7822 DT							
Hammer Weight (lbs.)		--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)		--	30		N/A	--	--	--	--	--	--	
Hammer Type		--	Auto									
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification						Remarks	
0				A.P.	Approx. 2 inches of Asphaltic Pavement +/- 0.2'							
	S-1 2 in.	0- 2 ft.	41 10 10 14	Fill	Fill: Asphalt Fragments +/- 2'							
	S-2 11 in.	2- 4 ft.	12 11 8 19	SM	Reddish brown medium fine SAND, little Silt, very dense							
5	S-3 14 in.	4- 6 ft.	24 20 13 11	SM	Reddish brown medium to fine SAND, little Silt, little Gravel, very dense, moist							
	S-4 11 in.	7-8.5 ft.	20 50 100/6"	SM	Reddish brown medium to fine SAND, little Silt, very dense, moist +/- 8'							
					Gray completely fractured and weathered rock in split spoon sampler tip							
10					Soil Boring B-2 terminated at 8.5 feet Below Ground Surface due to split spoon sampler and auger refusals on probable bedrock							
Summary		Overburden (Linear ft.)		8.5	Rock Cored (Linear ft.)		--	No. of Samples		4		

JZN Engineering, PC.			TEST BORING LOG				JZN B-3			
Project Name			Proposed Mixed-Use Development				Boring No. 22023-000			
Client			BNE Real Estate Group				Representative D. Palaj			
Project Location			100 Executive Drive				Contractor ETD, INC.			
			City of West Orange, Essex County, New Jersey				Driller Scott Pierce			
Boring Location							Date Started 08/27/2019			
Ground Surface Elev. +/- Elev. +520 ft.			Datum NAVD 88				Date Finished 08/27/2019			
Item	Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	HSA	S.S.	--	GeoProbe	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)	3.25"	1.4	--	7822 DT						
Hammer Weight (lbs.)	--	140		Drill Mud						
Hammer Fall (in)	--	30		N/A						
Hammer Type	--	Auto								
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification				Remarks	
0				A.P.	Approx. 2 inches of Asphaltic Pavement				+/- 0.2'	
5	S-1 2 in.	0- 2 ft.	46 14 18 38	Fill	Fill: No recovery . Gravel in Split Spoon Sampler Tip				+/- 2'	
	S-2 14 in.	2- 4 ft.	21 18 20 19	SM 3b	Reddish brown medium fine SAND, little Silt, very dense					
	S-3 6 in.	4- 6 ft.	10 18 5 6	SM 3b	Reddish brown medium to fine SAND, some Silt, trace of Gravel, medium dense,					
	S-4 3 in.	6- 8 ft.	6 7 12 14	SM 3b	Reddish brown medium to fine SAND, some Silt, trace of Gravel, medium dense, wet					
	S-5 5 in.	8- 8.75 ft.	9 50/5"	SM 3b	Reddish brown medium to fine SAND, some Silt, trace of Gravel, medium dense, wet					
10					Soil boring B3 terminated at +/- 8.75 feet Below Ground Surface due to split spoon sampler and auger refusals on probable bedrock					
Summary		Overburden (Linear ft.) 8.8		Rock Cored (Linear ft.) --		No. of Samples 5				

JZN Engineering, PC.		TEST BORING LOG				Boring No.		JZN B-4			
						Page		1 of 1			
Project Name		Proposed Mixed-Use Development				Project No.		22023-000			
Client		BNE Real Estate Group				Representative		D. Palaj			
Project Location		100 Executive Drive				Contractor		ETD, INC.			
		City of West Orange, Essex County, New Jersey				Driller		Scott Pierce			
Boring Location						Date Started		08/27/2019			
Ground Surface Elev.		+/- Elev. +482 ft.				Datum		NAVD 88			
Date Finished								08/27/2019			
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	HSA	S.S.	--	Geoprobe	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	3.25"	1.4	--	7422 DT							
Hammer Weight (lbs.)	--	140		Drill Mud							
Hammer Fall (in)	--	30		N/A							
Hammer Type	--	Auto									
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks	
0				A.P.	Approx. 2 inches of Asphaltic Pavement +/- 0.2'					Obstruction Encountered at 3 to 4 feet. Possible Cobbles	
5	S-1 4 in.	0- 2 ft.	89 16 11 22	Fill	No Recovery Debris: Asphalt +/- 2'						
	S-2 5 in.	2- 4 ft.	26 73 34 12	SM	Reddish brown medium fine SAND, little Silt, very dense						
	S-3 1 in.	4- 6 ft.	26 29 16 15	SM	Reddish brown medium to fine SAND, little silt, little Gravel, dense, dry						
	S-4 6 in.	6- 8 ft.	19 12 10 11	SM	Reddish brown medium to fine SAND, little silt, little Gravel, dense, dry						
	S-5 8 in.	8- 9.5 ft.	10 17 50 50/5"	SM	Reddish brown medium to fine SAND, little Silt, little Gravel, very dense, wet						
10					Soil Boring B-4 terminated at 9.5 feet Below Ground Surface due to split spoon sampler and auger refusals on probable bedrock						
Summary		Overburden (Linear ft.)		9.5	Rock Cored (Linear ft.)		--	No. of Samples			5

JZN Engineering, PC.			TEST BORING LOG					Boring No.		JZN SB-1			
								Page		1 of 1			
Project Name			Proposed Mixed-Use Development					Project No.		22023-000			
Client			BNE Real Estate Group					Representative		F. Ayoub			
Project Location			100 Executive Drive					Contractor		ETD, INC.			
			City of West Orange, Essex County, New Jersey					Driller		V. Cipolletti			
Boring Location			Northeast Corner of Proposed Building D					Date Started		12/18/2019			
Ground Surface Elev.			+/- Elev. +520 Datum NAVD 88					Date Finished		12/18/2019			
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data							
Type		--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)		
Inside Diameter (in)		--	1.4	--	Diedrich D50								
Hammer Weight (lbs.)		--	140		Drill Mud	--	--	--	--	--	--		
Hammer Fall (in)		--	30		Water	--	--	--	--	--	--		
Hammer Type		--	Auto		Bentonite								
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks			
0					8" Asphalt pavement Fill: Brown coarse to fine SAND, little Silt, trace Gravel, dry +/- 2'								
	S-1 14 in.	0 - 2 ft	74 30 13 9	A.P. Fill									
	S-2 24 in.	2 - 4 ft	12 25 22 19	SM	Brown medium to fine SAND and SILT, trace Gravel, dense, dry								
5					Brown medium to fine SAND and SILT, trace Gravel, medium dense, dry								
	S-3 14 in.	5 - 7 ft	10 6 13 18	SM									
	S-4 14 in.	7 - 9 ft	12 8 7 9	SM	Reddish brown medium to fine SAND and SILT, little Gravel, medium dense, moist								
10					Reddish brown medium to fine SAND and SILT, little Gravel, medium dense, moist								
	S-5 8 in.	9 - 11 ft	4 6 11 30	SM									
15	R-1 REC: 60 in. 100%	12 - 17 ft	6 min.	RQD: 14 in. 23.30%	Banded BASALT; Very Hard; Unweathered; Closely Spaced Fractures; Very Steeply Dipping Inclination								
			6 min.										
			5 min.										
			7 min.										
			7 min.										
20					End of Soil Boring SB-1 at approximately 17 feet below the existing ground surface								
25													
Summary		Overburden (Linear ft.)		12	Rock Cored (Linear ft.)		5	No. of Samples				6	

JZN Engineering, PC.				TEST BORING LOG				Boring No.		JZN SB-2	
Project Name		Proposed Mixed-Use Development						Project No.		22023-000	
Client		BNE Real Estate Group						Representative		F. Ayoub	
Project Location		100 Executive Drive						Contractor		ETD, INC.	
		City of West Orange, Essex County, New Jersey						Driller		V. Cipolletti	
Boring Location		Southeast Corner of Proposed Building D						Date Started		12/18/2019	
Ground Surface Elev.		+/- Elev. +528 Datum NAVD 88						Date Finished		12/18/2019	
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type		--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)		--	1.4	--	Diedrich D50						
Hammer Weight (lbs.)		--	140		Drill Mud	--	--	--	--	--	--
Hammer Fall (in)		--	30		Water	--	--	--	--	--	--
Hammer Type		--	Auto		Bentonite						
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification						Remarks
0	S-1 16 in.	0 - 2 ft	22 9 12 27	A.P. SM	4" Asphalt Pavement Brown medium to fine SAND and SILT, little Gravel, dry						-Cobble/boulder obstruction at 2'-2.5', then refusal on bedrock at 4.5'
5	R-1 REC: 60" 100%	5 - 10 ft	4 min. 5 min. 5 min. 5 min. 6 min.	RQD: 47 in. 78.30%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Moderately Close Fracture Spacing; Gently Dipping Inclination; Clean Fractures						
10	R-2 REC: 56" 93.3%	10 - 15 ft	5 min. 5 min. 5 min. 8 min. 10 min.	RQD: 25 in. 44.60%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Close Fracture Spacing; Steeply Dipping Inclination; Clean Fractures						
15					End of Soil Boring SB-2 at approximately 15 feet below the existing ground surface						
20											
25											
Summary		Overburden (Linear ft.)		4.5	Rock Cored (Linear ft.)		10	No. of Samples		3	

JZN Engineering, PC.			TEST BORING LOG					Boring No.		JZN SB-3	
								Page		1 of 1	
Project Name			Proposed Mixed-Use Development					Project No.		22023-000	
Client			BNE Real Estate Group					Representative		F. Ayoub	
Project Location			100 Executive Drive					Contractor		ETD, INC.	
			City of West Orange, Essex County, New Jersey					Driller		V. Cipolletti	
Boring Location			Southeast Corner of Proposed Parking Garage					Date Started		12/19/2019	
Ground Surface Elev.			+/- Elev. +522 Datum NAVD 88					Date Finished		12/19/2019	
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	--	--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)	--	--	1.4	--	Diedrich D50						
Hammer Weight (lbs.)	--	--	140		Drill Mud	--	--	--	--	--	--
Hammer Fall (in)	--	--	30		Water	--	--	--	--	--	--
Hammer Type	--	--	Auto		Bentonite						
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification						Remarks
0					4" Asphalt Pavement Brown medium to fine SAND and SILT, little Gravel, medium dense, moist						
	S-1 16 in.	0 - 2 ft	15 13 11 9	A.P. SM							
	S-2	2 - 3.8 ft	6 13 21 50/3"	SM							
5					Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Very Close Fracture Spacing; Very Steeply Dipping Inclination; Stained Fractures						
	R-1 REC: 60 in. 100%	5 - 10 ft	5 min.	RQD: 0 in. 0%							
			6 min.								
			9 min.								
			7 min.								
			7 min.								
10					Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Very Close Fracture Spacing; Very Steeply Dipping Inclination; Stained Fractures						
	R-2 REC: 48 in. 100%	10 - 14 ft	6 min.	RQD: 13 in. 27.10%							
			5 min.								
			8 min.								
			5 min.								
15					Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Gently Dipping Inclination; Close Fracture Spacing; Clean Fractures						
	R-3 REC: 48 in. 100%	14 - 18 ft	5 min.	RQD: 33 in. 68.80%							
			5 min.								
			6 min.								
			6 min.								
20					Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Gently Dipping Inclination; Moderately Close Fracture Spacing; Clean Fractures						
	R-4 REC: 60 in. 100%	18 - 23 ft	5 min.	RQD: 58 in. 96.70%							
			5 min.								
			5 min.								
			4 min.								
			4 min.								
25					Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Gently Dipping Inclination; Moderately Close Fracture Spacing; Clean Fractures						
	R-5 REC: 45 in. 94%	23 - 27 ft	5 min.	RQD: 36 in. 75%							
			5 min.								
Summary		Overburden (Linear ft.)		5	Rock Cored (Linear ft.)		22	No. of Samples		7	

JZN Engineering, PC.				TEST BORING LOG		Boring No. JZN SB-3 Page 2 of 2	
Project Name Proposed Mixed-Use Development						Project No. 22023-000	
Depth (ft)	Sample No. & Rec. (in)	Sample Depth (ft)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification	Remarks	
25	R-5 REC:45 in. 94%	23 - 27 ft		RQD: 36 in. 75%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Gently Dipping Inclination; Moderately Close Fracture Spacing; Clean Fractures		
			5 min.				
			5 min.				
					End of Soil Boring SB-3 at approximately 27 feet below the existing ground surface		
30							
35							
40							
45							
50							
Summary		Overburden (Linear ft) 5		Rock Cored (Linear ft) 22		No. of Samples 7	

JZN Engineering, PC.				TEST BORING LOG				Boring No.		JZN SB-4	
Project Name		Proposed Mixed-Use Development						Project No.		22023-000	
Client		BNE Real Estate Group						Representative		F. Ayoub	
Project Location		100 Executive Drive						Contractor		ETD, INC.	
		City of West Orange, Essex County, New Jersey						Driller		M. Ryan	
Boring Location		Northeast Corner of Proposed Parking Garage						Date Started		12/19/2019	
Ground Surface Elev.		+/- Elev. +515 Datum NAVD 88						Date Finished		12/19/2019	
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type		--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)		--	1.4	--	CME-55						
Hammer Weight (lbs.)		--	140		Drill Mud	--	--	--	--	--	--
Hammer Fall (in)		--	30		Water	--	--	--	--	--	--
Hammer Type		--	Auto		Bentonite						
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks	
0			30	A.P. Fill	Asphalt Pavement						
	S-1 12 in.	0 - 2 ft	9		Fill: Black coarse to fine SAND, trace Gravel, dry						
			5								
			4								
5	S-2 12 in.	2 - 3 ft	5	SM	Reddish brown medium to fine SAND and SILT, trace Gravel, dense, moist						
			43								
			50/3								
10	R-1 REC: 50 in. 83.3%	6 - 11 ft	5 min.	RQD: 10 in. 16.70%	Banded BASALT; Very Hard; Unweathered; Moderately Dipping Inclination; Very Fine Grained; Close Fracture Spacing; Stained Fractures						
			4 min.								
			5 min.								
			6 min.								
15	R-2 REC: 48 in. 80%	11 - 16 ft	6 min.	RQD: 15 in. 25.00%	Banded BASALT; Very Hard; Unweathered; Moderately Dipping Inclination; Very Fine Grained; Close Fracture Spacing; Stained Fractures						
			10 min.								
			6 min.								
			6 min.								
20			5 min.		End of Soil Boring SB-4 at approximately 16 feet below the existing ground surface						
25											
Summary		Overburden (Linear ft.)		6	Rock Cored (Linear ft.)		10	No. of Samples		4	

JZN Engineering, PC.		TEST BORING LOG				Boring No.		JZN SB-5		Page 1 of 1	
Project Name		Proposed Mixed-Use Development				Project No.		22023-000			
Client		BNE Real Estate Group				Representative		F. Ayoub			
Project Location		100 Executive Drive				Contractor		ETD, INC.			
		City of West Orange, Essex County, New Jersey				Driller		M. Ryan			
Boring Location		Southwest Corner of Proposed Parking Garage				Date Started		12/20/2019			
Ground Surface Elev.		+/- Elev. +493 Datum NAVD 88				Date Finished		12/20/2019			
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	--	1.4	--	CME-55							
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)	--	30		Water	--	--	--	--	--	--	
Hammer Type	--	Auto		Bentonite							
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification				Remarks		
0			78	A.P.	Asphalt Pavement						
	S-1 12 in.	0 - 2 ft	14	Fill	Black and Gray coarse to fine SAND, little Gravel, dry						
			10								
			12								
			12								
	S-2 12 in.	2 - 4 ft	10	SM	Brown medium to fine SAND and SILT, medium density, dry						
			8								
			6								
5	S-3 14 in.	4 - 6 ft	9	SM	Brown medium to fine SAND and SILT, medium dense, wet						
			5								
	S-4 14 in.	6 - 8 ft	6	SM	Brown medium to fine SAND and SILT, medium dense, wet						
			9								
			12								
10	S-5 0 in.	10 - 10 ft	50/0"	N.R.	No Recovery						
15											
20											
25											
Summary		Overburden (Linear ft.)		10	Rock Cored (Linear ft.)		0	No. of Samples		5	

JZN Engineering, PC.			TEST BORING LOG					Boring No.		JZN SB-6								
								Page		1 of 1								
Project Name			Proposed Mixed-Use Development					Project No.		22023-000								
Client			BNE Real Estate Group					Representative		F. Ayoub								
Project Location			100 Executive Drive					Contractor		ETD, INC.								
			City of West Orange, Essex County, New Jersey					Driller		M. Ryan								
Boring Location			Northwest Corner of Proposed Parking Garage					Date Started		12/19/2019								
Ground Surface Elev.			+/- Elev. +495 Datum NAVD 88					Date Finished		12/19/2019								
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data												
Type		--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)							
Inside Diameter (in)		--	1.4	--	CME-55													
Hammer Weight (lbs.)		--	140		Drill Mud	--	--	--	--	--	--							
Hammer Fall (in)		--	30		Water	--	--	--	--	--	--							
Hammer Type		--	Auto		Bentonite													
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification						Remarks							
0																		
	S-1 12 in.	0 - 2 ft	26 7 9 11	A.P. Fill								Asphalt Pavement Brown and gray coarse to fine SAND, little Gravel, dry						
			9									+/- 2'						
	S-2 4 in.	2 - 4 ft	13 19 27	SM								Red brown medium to fine SAND and SILT, little Gravel, dense, dry to moist						
	5	S-3 24 in.	4 - 6 ft	37 25 29 26								SM	Reddish brown medium to fine SAND and SILT, trace Gravel, very dense, moist					
		S-4 20 in.	6 - 8 ft	26 27 13 12								SM	Reddish brown medium to fine SAND and SILT, trace Gravel, dense, moist					
S-5 18 in.		8 - 10 ft	12 13 13 11	SM								Reddish brown medium to fine SAND and SILT, trace Gravel, medium dense, moist						
10																		
	S-6 24 in.	13 - 15 ft	25 20 25 30	SM								Reddish brown medium to fine SAND and SILT, trace Gravel, dense, moist						
	15																	
20																		
25																		
Summary		Overburden (Linear ft.)		17.5								Rock Cored (Linear ft.)		0	No. of Samples		6	

JZN Engineering, PC.			TEST BORING LOG				Boring No.		JZN SB-7		
							Page		1 of 1		
Project Name		Proposed Mixed-Use Development					Project No.		22023-000		
Client		BNE Real Estate Group					Representative		F. Ayoub		
Project Location		100 Executive Drive					Contractor		ETD, INC.		
		City of West Orange, Essex County, New Jersey					Driller		V. Cipolletti		
Boring Location		Southwest Corner of Proposed Bulding D					Date Started		12/20/2019		
Ground Surface Elev.		+/- Elev. +480 Datum NAVD 88					Date Finished		12/20/2019		
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type			S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)			1.4	--	Diedrich D50						
Hammer Weight (lbs.)		--	140		Drill Mud	--	--	--	--	--	--
Hammer Fall (in)		--	30		Water	--	--	--	--	--	--
Hammer Type		--	Auto		Bentonite						
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification						Remarks
0			21	A.P.	Asphalt Pavement						
	S-1 8 in.	0 - 2 ft	5	Fill	Fill: Dark brown medium to fine SAND, trace Gravel, dry to moist						
			9								
			14								
5	S-2 20 in.	4 - 6 ft	7	SM	Brown medium to fine SAND and SILT, trace Gravel, dense, moist						
			13								
	S-3 22 in.	6 - 8 ft	14	SM	Brown medium to fine SAND, some Silt, medium dense, moist						
			14								
			14								
10											
	S-4 20 in.	10 - 12 ft	9	SM	Brown medium to fine SAND and SILT, medium dense, moist						
			8								
			10								
			10								
15											
	S-5	15 - 17 ft	8	ML	Brown SILT, some fine SAND, trace Gravel, medium dense, wet						
			8								
			8								
			8								
20	R-1 REC: 48 in. 100%	18 - 22 ft	5 min.	RQD: 8" 16.70%	Banded, BASALT; Very Hard; Unweathered; Very Fine Grained; Close Fracture Spacing; Very Steeply Dipping Inclination; Stained Fractures						
			8 min.								
			10 min.								
			6 min.								
					End of Soil Boring SB-7 at approximately 22 feet below the existing ground surface						
25											
Summary		Overburden (Linear ft.)		18	Rock Cored (Linear ft.)		4	No. of Samples		6	

JZN Engineering, PC.			TEST BORING LOG				Boring No.		JZN SB-8			
							Page		1 of 1			
Project Name			Proposed Mixed-Use Development				Project No.		22023-000			
Client			BNE Real Estate Group				Representative		F. Ayoub			
Project Location			100 Executive Drive				Contractor		ETD, INC.			
			City of West Orange, Essex County, New Jersey				Driller		M. Ryan			
Boring Location			Northwest Corner of Proposed Building D				Date Started		12/20/2019			
Ground Surface Elev.			+/- Elev. +479				Datum		NAVD 88			
Item			Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type			--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)			--	1.4	--	CME-55						
Hammer Weight (lbs.)			--	140		Drill Mud	--	--	--	--	--	--
Hammer Fall (in)			--	30		Water	--	--	--	--	--	--
Hammer Type			--	Auto		Bentonite						
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks		
0			30	A.P.	Asphalt Pavement							
	S-1	0 - 2 ft	15	Fill	Fill: Black and Gray coarse to fine SAND and SILT, little Gravel, dry							
			15									
	S-2	2 - 2.3 ft	50/3"	SM	Brown medium to fine SAND and SILT, dense, moist							
			9									
	R-1	3 - 6 ft	8 min.	RQD: 6 in. 16.70%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Close Fracture Spacing; Very Steeply Dipping Inclination; Stained Fractures							
	REC: 36 in. 100%		11 min.									
			7 min.									
5												
	R-2	6 - 10 ft	5 min.	RQD: 28 in. 58.30%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Close Fracture Spacing; Very Steeply to Gently Dipping Inclination; Stained Fractures							
	REC: 48 in. 100%		4 min.									
			4 min.									
			4 min.									
10					End of Soil Boring SB-8 at approximately 10 feet below the existing ground surface							
15												
20												
25												
Summary			Overburden (Linear ft.)		2.8	Rock Cored (Linear ft.)		7	No. of Samples		4	

JZN Engineering, PC.			TEST BORING LOG				Boring No.		JZN SB-9		
							Page		1 of 1		
Project Name			Proposed Mixed-Use Development				Project No.		22023-000		
Client			BNE Real Estate Group				Representative		F. Ayoub		
Project Location			100 Executive Drive				Contractor		ETD, INC.		
			City of West Orange, Essex County, New Jersey				Driller		V. Cipolletti		
Boring Location			Southern Area of Proposed Building C				Date Started		12/20/2019		
Ground Surface Elev.			+/- Elev. +518				Datum		NAVD 88		
Item			Casing	Sampler	Core Barrel	Rig Type	Water Level Data				
Type	--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	--	1.4	--	Diedrich D50							
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)	--	30		Water	--	--	--	--	--	--	
Hammer Type	--	Auto		Bentonite							
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification				Remarks		
0	S-1 8 in.	0 - 1 ft	68 31	A.P. N.R.	8" Asphalt Pavement No Recovery				-Only asphalt recovery in spoon		
	R-1 REC: 52 in. 86.7%	2 - 7 ft	5 min.	RQD: 27 in. 45%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Moderately Close Fracture Spacing; Gently Dipping Fractures; Clean Fractures						
			6 min.								
			5 min.								
			5 min.								
5			6 min.								
	R-2 REC: 24 100%	7 - 9 ft	5 min.	RQD: 24 in. 100%	Banded BASALT; Very Hard; Unweathered; Very Fine Grained; Moderately Close Fracture Spacing; Gently Dipping Inclination; Clean Fractures						
			5 min.								
10					End of Soil Boring SB-9 at approximately 9 feet below the existing ground surface						
15											
20											
25											
Summary		Overburden (Linear ft.)		2	Rock Cored (Linear ft.)		7	No. of Samples		3	

JZN Engineering, PC.			TEST BORING LOG					Boring No.		JZN SB-10 Page 1 of 1	
Project Name		Proposed Mixed-Use Development						Project No.		22023-000	
Client		BNE Real Estate Group						Representative		A. Barish	
Project Location		100 Executive Drive						Contractor		ETD, INC.	
		City of West Orange, Essex County, New Jersey						Driller		Mike Kane	
Boring Location		Northern Area of Proposed Building C						Date Started		12/23/2019	
Ground Surface Elev.		+/- Elev. +518.0 Datum NAVD 88						Date Finished		12/23/2019	
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	--	S.S.	--	Track Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	--	1.4	--	Detrick D50							
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)	--	30		Water	--	--	--	--	--	--	
Hammer Type	--	Auto		Bentonite							
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks	
0			30	A.P.	2" Asphalt Pavement						
	S-1 4 in.	0- 2 ft.	10 8 7	Fill	Fill: Asphalt						
	S-2 0 in.	2- 4 ft.	5 6 13 11	N.R.	No Recovery						
5	S-3 10 in.	4- 5.2 ft.	15 17 50/2"	SM	Brown red SAND, little silt, trace gravel, dense, dry					Drill 5.2 - 6.5 ft	
	R-1 Rec: 17 in. 94%	6.5- 8 ft	20 min 10 min	RQD: 0 in. 0%	Grey BASALT; Very Hard; Unweathered; Very Fine Grained; Very Steeply Dipping Inclination; Wide Fracture Spacing; Very Narrow Fracture Separation;						
	R-2	8- 8.3 ft	10 min	RQD: 0 in.	Grey BASALT; Very Hard; Unweathered; Very Fine Grained; Very Steeply Dipping Inclination; Close Fracture Spacing; Wide Fracture Separation; Stained					RC-2 Rec: 2 in.	
	R-3 Rec: 26 in. 100%	8.3- 10.5 ft	6 min 7 min	RQD: 26 in. 100%	Grey BASALT; Very Hard; Unweathered; Very Fine Grained; Very Steeply Dipping Inclination; Moderatly Close Fracture Spacing; Narrow Fracture Separation; Stained Fracture Filling						
	R-4 Rec: 47 in. 78%	10.5- 15.5 ft	8 min 9 min 9 min 8 min	RQD: 43 in. 72%	Same as R-3						
15			8 min								
	R-5 Rec: 60 in. 100%	15.5- 19 ft	9 min 8 min 8 min 5 min	RQD: 40 in. 66%	Same as R-3						
	R-6 Rec: 27 in. 100%	19- 21.2 ft	7 min 7 min	RQD: 27 in. 100%	Same as R-3						
20					End of boring SB-10 approximately 21.2 feet below ground surface						
25											
Summary		Overburden (Linear ft.)		6.5	Rock Cored (Linear ft.)		14.7	No. of Samples		3	

JZN Engineering, PC.			TEST BORING LOG				Boring No.		JZN SB-11		
							Page		1 of 1		
Project Name		Proposed Mixed-Use Development					Project No.		22023-000		
Client		BNE Real Estate Group					Representative		A. Barish		
Project Location		100 Executive Drive					Contractor		ETD, INC.		
		City of West Orange, Essex County, New Jersey					Driller		Mike Ryan		
Boring Location		Southern Area of Proposed Building B					Date Started		12/23/2019		
Ground Surface Elev.		+/- Elev. +500 Datum NAVD 88					Date Finished		12/23/2019		
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	--	S.S.	--	Track Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	--	1.4	--	CME 55							
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)	--	30		Water	--	--	--	--	--	--	
Hammer Type	--	Auto		Bentonite							
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks	
0			40	A.P.	2" Asphalt Pavement						
	S-1 6 in.	0- 2 ft	6	Fill	Fill: black and tan fine SAND, little silt, trace gravel, dry						
			6								
			10								
			20								
5	S-2 20 in.	2- 4 ft	20	SM	Red fine SAND, some Silt, trace gravel, dense, dry						
			14								
			10								
	S-3 12 in.	4- 6 ft	8	SM	Same as Sample S-2						
			10								
10			14								
	S-4 18 in.	6- 8 ft	14	SM	Same as Sample S-2						
			14								
			18								
	S-5 6 in.	8- 10 ft	14	SM	Red fine SAND, some Silt, some gravel, very dense, dry						
15			50								
			39								
20											
25											
Summary		Overburden (Linear ft.)		15	Rock Cored (Linear ft.)		0	No. of Samples		6	

JZN Engineering, PC.			TEST BORING LOG				Boring No.		JZN SB-12		
							Page		1 of 1		
Project Name		Proposed Mixed-Use Development					Project No.		22023-000		
Client		BNE Real Estate Group					Representative		A. Barish		
Project Location		100 Executive Drive					Contractor		ETD, INC.		
		City of West Orange, Essex County, New Jersey					Driller		Mike Kane		
Boring Location		Northern Area of Proposed Building B					Date Started		12/23/2019		
Ground Surface Elev.		+/- Elev. +503 Datum NAVD 88					Date Finished		12/23/2019		
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data					
Type	--	S.S.	--	Track Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)	
Inside Diameter (in)	--	1.4	--	CME 50							
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--	
Hammer Fall (in)	--	30		Water	--	--	--	--	--	--	
Hammer Type	--	Auto		Bentonite							
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification					Remarks	
0			45	A.P.	2" Asphalt Pavement						
	S-1 8 in.	0- 1.5ft	11 7 50/0"	SM	Red fine SAND, little silt, dense, dry						
	R-1 REC 20 in.	1.8- 3.5 ft	8 min	RQD: 20 in. 100%	Boulder						
5			9								
	S-2 10 in.	4- 6 ft	12 17 50	SM	Red fine SAND, little Silt, some gravel, dense, dry						
10	R-2 Rec: 52 in. 87%	6.5- 11.5 ft	4 min	RQD: 36 in. 60%	Gray BASALT; Very Hard; Unweathered; Very Fine Grained; Moderately Dipping Inclination; Moderatly Close Fracture Spacing; Narrow Fracture Separation; Stained Fracture Filling						
			7 min								
			8 min								
			7 min								
			8 min								
			4 min								
15	R-3 Rec: 52 in. 96%	11.5 - 16 ft	9 min	RQD: 50 in. 93%	Same As R-2						
			8 min								
			7 min								
			8 min								
			3 min								
20	R-4 Rec: 39 in. 92%	16- 19.5 ft	8 min	RQD: 39 in. 92%	Same As R-2						
			8 min								
			8 min								
			4 min								
25					End of boring SB-12 approximately 21.2 feet below ground surface						
Summary		Overburden (Linear ft.)		6.5	Rock Cored (Linear ft.)		13	No. of Samples		7	

JZN Engineering, PC.			TEST BORING LOG				Boring No.		JZN SB-13	
							Page		1 of 1	
Project Name		Proposed Mixed-Use Development					Project No.		22023-000	
Client		BNE Real Estate Group					Representative		A. Barish	
Project Location		100 Executive Drive					Contractor		ETD, INC.	
		City of West Orange, Essex County, New Jersey					Driller		Mike Kane	
Boring Location		Northern Garage Alternative Location					Date Started		12/23/2019	
Ground Surface Elev.		+/- Elev. +505					Datum		NAVD 88	
Item		Casing	Sampler	Core Barrel	Rig Type	Water Level Data				
Type	--	S.S.	--	Truck Mounted	Date	Time	Bottom of Casing (ft.)	Bottom of Boring (ft.)	Water (ft.)	Cave In (ft.)
Inside Diameter (in)	--	1.4	--	Detrick D50						
Hammer Weight (lbs.)	--	140		Drill Mud	--	--	--	--	--	--
Hammer Fall (in)	--	30		Water	--	--	--	--	--	--
Hammer Type	--	Auto		Bentonite						
Depth (ft.)	Sample No. & Rec. (in)	Sample Depth (ft.)	Sampler Blows per 6 inches	USCS Symbol	Visual Classification				Remarks	
0			1		Red medium to fine SAND, some Silt, loose, wet					
	S-1 10 in.	0- 2 ft	3	SM						
			5							
	S-2 14 in.	2- 4 ft	3	SM	Red medium to fine SAND, some Silt, dense, dry					
			7							
			23							
			30		Red medium to fine SAND, some Silt, very dense, dry					
	S-3 18 in.	4- 6 ft	21	SM						
			26							
5			28						Drill chatter 3- 7 ft	
			25							
10										
15									Chatter 16.5- 17 ft smooth at 17 ft	
					End of boring SB-13 approximately 17 feet below ground surface due to roller bit refusal					
20										
25										
Summary		Overburden (Linear ft.)		17	Rock Cored (Linear ft.)		0	No. of Samples		3

APPENDIX B

SUPPLEMENTAL BORING ROCK CORE PHOTOS

Proposed Mixed Use Development
100 Executive Drive, West Orange, NJ
Rock Coring Diedrich D50 Track Rig, NQ Double Barrel

Boring No. SB-1
Date: 12/18/2019
Logged by: F. Ayoub

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	12—17	100	23.3



<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	5—10	100	78.3
R-2	10—15	93.3	45.6



Proposed Mixed Use Development

100 Executive Drive, West Orange, NJ

Rock Coring Diedrich D50 Track Rig, NQ Double Barrel

Boring No. SB-3

Date: 12/19/2019

Logged by: F. Ayoub

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	5—10	100	0
R-2	10—14	100	27.1
R-3	14—18	100	68.8
R-4	18—23	100	96.7



Boring No. SB-3, R-1 through R-2

Photo 1 of 3



Boring No. SB-3, R-3 through R-4

Photo 2 of 3

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-5	23—27	94	75



Proposed Mixed Use Development
100 Executive Drive, West Orange, NJ
Rock Coring CME-55 Track Rig, NQ Double Barrel

Boring No. SB-4
Date: 12/19/2019
Logged by: F. Ayoub

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	6—11	83.3	16.7
R-2	11—16	80	25



Boring No. SB-4, R-1

Photo 1 of 2



Boring No. SB-4, R-2

Photo 2 of 2

Proposed Mixed Use Development
100 Executive Drive, West Orange, NJ
Rock Coring Diedrich D50 Track Rig, NQ Double Barrel

Boring No. SB-7
Date: 12/20/2019
Logged by: F. Ayoub

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	18—22	100	16.7



Boring No. SB-7, R-1

Proposed Mixed Use Development
100 Executive Drive, West Orange, NJ
Rock Coring CME-55 Track Rig, NQ Double Barrel

Boring No. SB-8
Date: 12/20/2019
Logged by: F. Ayoub

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	3—6	100	16.7
R-2	6—10	100	58.3



Proposed Mixed Use Development
100 Executive Drive, West Orange, NJ
Rock Coring Diedrich D50 Track Rig, NQ Double Barrel

Boring No. SB-9
Date: 12/20/2019
Logged by: F. Ayoub

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	2—7	86.7	45
R-2	7—9	100	100



Boring No. SB-9, R-1 through R-2

Proposed Mixed Use Development

100 Executive Drive, West Orange, NJ

Rock Coring Diedrich D50 Track Rig, NQ Double Barrel

Boring No. SB-10

Date: 12/23/2019

Logged by: A. Barish

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	6.5—8	94	0
R-2	8—8.3	55.6	0
R-3	8.3—10.5	100	100
R-4	10.5—15.5	78	72
R-5	15.5—19	100	66
R-6	19—21.2	100	100



Boring No. SB-10, R-1 through R-5

Photo 1 of 2



Boring No. SB-10, R-5 through R-6

Photo 2 of 2

Proposed Mixed Use Development
100 Executive Drive, West Orange, NJ
Rock Coring CME-50 Track Rig, NQ Double Barrel

Boring No. SB-12
Date: 12/23/2019
Logged by: A. Barish

<u>Run No.</u>	<u>Depth (ft)</u>	<u>Recovery (%)</u>	<u>RQD (%)</u>
R-1	1.8—3.5	100	100
R-2	6.5—11.5	87	60
R-3	11.5—16	96	93
R-4	16—19.5	92	92



Boring No. SB-12, R-1 through R-3

Photo 1 of 2



Boring No. SB-12, R-4 through R-4

Photo 2 of 2