REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING SERVICES

Mitsubishi Warehouse Addition

Chesapeake, Virginia

G E T Project No: VB19-202G

July 10, 2018

PREPARED FOR:

BRINKLEY
C.W. BRINKLEY, INC. CONSTRUCTION

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GET
Solutions, Inc.
Geotechnical • Environmental • Testing

July 10, 2019

TO: **CW Brinkley**
3005 Corporate Lane Suite 100
Suffolk, VA 23434

Attn: Mr. Mark H. Brinkley

RE: Report for Subsurface Exploration and Geotechnical Engineering Services
Mitsubishi Warehouse Addition
Chesapeake, Virginia
G E T Project No: VB19-202G

Dear Mr. Brinkley:

In compliance with your instructions, we have completed our Subsurface Exploration and Geotechnical Engineering Services for the above referenced project. The results of this study, together with our recommendations, are presented in this report.

Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the project implementation.

We appreciate the opportunity to work with you on this project. We trust that the information contained herein meets your immediate need, and should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Respectfully Submitted,
G E T Solutions, Inc.

Jordan M. Moran
Project Geologist

Chris M. Caton, P.E., P.G.
Geotechnical Engineer/Geologist
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COMMONWEALTH OF VIRGINIA
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PROFESSIONAL ENGINEER

Copies: (1) Client

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EXECUTIVE SUMMARY

The project site is located at 401 Volvo Parkway in Chesapeake, Virginia. The proposed construction will consist of building an addition onto the west end of the existing warehouse (Building 2). The addition will be approximately 33,000 square feet in plan area. The maximum wall and column loads are not expected to exceed 4 klf and 150 kips. The floor loads are expected to be on the order of 150 psf. The finish grades are expected to coincide with current grades, thus cuts and fills are not expected to exceed 1 to 2 feet.

Our field exploration program included three (3) 25-foot deep Standard Penetration Test (SPT) borings within the addition's footprint. The initial groundwater level was measured to occur at depths ranging from 6.25 to 6.50 feet below existing grades at the boring locations. A summary of the subsurface and groundwater conditions encountered at the SPT soil test borings is presented in Section 3.0 of this report.

The following evaluations and recommendations were developed based on our field exploration and laboratory-testing program:

- A field testing program during construction is recommended, which should include subgrade proofrolling, compaction testing and foundation excavation observations for bearing capacity verification.

- The shallow subsurface Clayey SAND (SC) and CLAY (CL) soils encountered at the boring locations do not appear to meet the criteria recommended in this report for reuse as structural fill. The project's budget should include an allowance for subgrade improvements (undercut and backfill with structural fill).

- The proposed addition can be supported by means of shallow spread footings designed using an allowable bearing capacity of 2000 pounds per square foot (psf) (minimum 24-inch embedment and minimum 24-inch width). Isolated square column footings are recommended to be a minimum of 3 feet by 3 feet in area for bearing capacity consideration. Estimated post-construction total and differential settlements may range up to 1-inch and ½-inch, respectively.

- Floor slabs may be constructed as slab-on-grade members provided the subsurface recommendations are carried out properly.

- Based on the information obtained at the boring locations (to a maximum depth of 25 feet) and our experience within the vicinity of the project site, it is our opinion that this site may be classified as a Site Class "D" in accordance with Table 20.3-1 of ASCE 7-10 as referenced by the 2015 International Building Code (IBC).

This summary briefly discusses some of the major topics mentioned in the attached report. Accordingly, this report should be read in its entirety to thoroughly evaluate the contents.

1.0 PROJECT INFORMATION

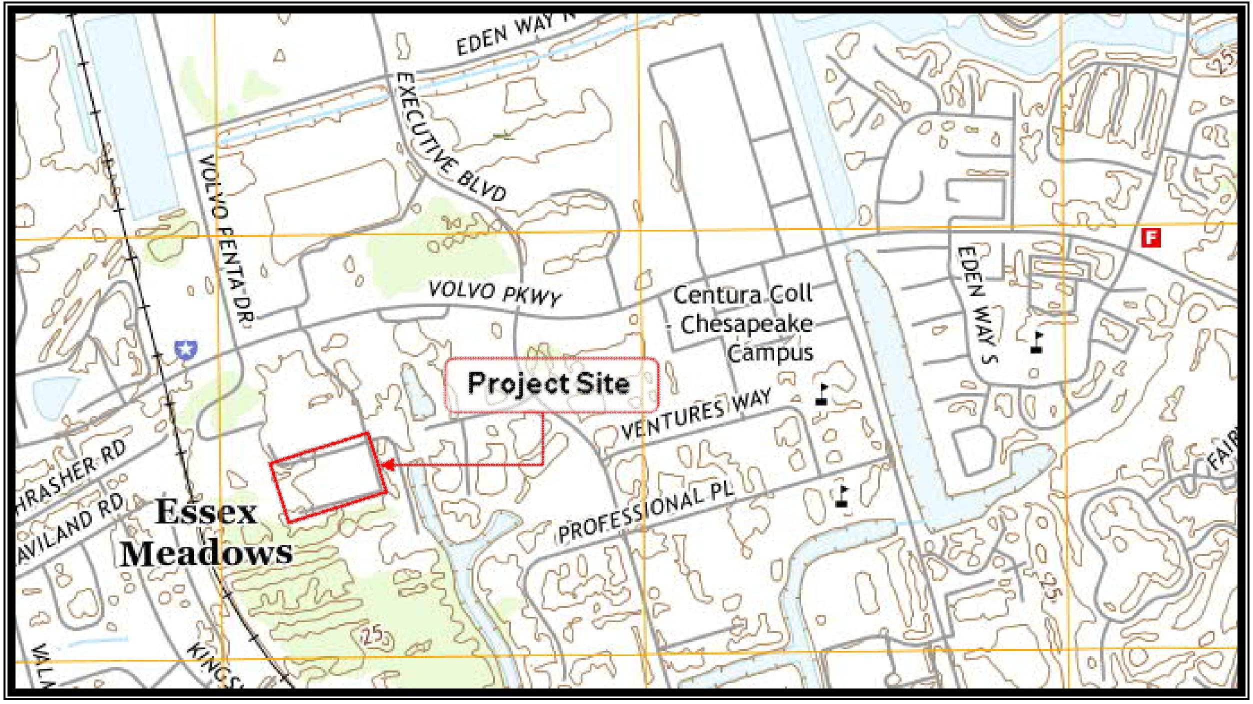
1.1 Project Authorization

G E T Solutions, Inc. has completed our subsurface exploration and geotechnical engineering services for the proposed Mitsubishi Warehouse Addition project located in Chesapeake, Virginia. The geotechnical engineering services were conducted in general accordance with the scope presented in **G E T** Proposal No. PVB19-341G. Authorization to proceed with our services was received from the client in the form of an executed Work Authorization Form dated May 4, 2019.

1.2 Project Site Location and Description

The project site is located at 401 Volvo Parkway in Chesapeake, Virginia. Specifically, the site is a located adjacent to the existing Mitsubishi facility. At the time of our reconnaissance the site was a mostly undeveloped, relatively flat, grassy field with wooded areas and associated landscaping. A site vicinity map is provided in Figure 1 with the project site indicated.

Figure 1: Project Site Vicinity Map



USGS Kempsville Quadrangle 7.5-Minute Series Map (2016)

1.3 Project Construction Description

The proposed construction will consist of building an addition onto the west end of the existing warehouse (Building 2). The addition will be approximately 33,000 square feet in plan area. The maximum wall and column loads are not expected to exceed 4 klf and 150 kips. The floor loads are expected to be on the order of 150 psf. The finish grades are expected to coincide with current grades, thus cuts and fills are not expected to exceed 1 to 2 feet.

If any of the noted information is incorrect or has changed, please inform GET Solutions, Inc. so that we may amend the recommendations presented in this report, if appropriate.

1.4 Purpose and Scope of Services

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings performed at the proposed development.

2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress or structure performance, including existing fills or surficial/subsurface organics.

3. Construction considerations for soil subgrade preparation (stripping, grading, and compaction) and foundation excavations. Engineering criteria for placement and compaction of approved structural fill material.

4. Feasibility of utilizing a shallow foundation system for support of the proposed addition. Design parameters required for the foundation system, including foundation sizes, allowable bearing pressures, foundation levels, and expected total and differential settlements.

5. Assessment of the shallow subsurface soils’ expansive properties.

6. Seismic site class determination in accordance with the 2015 International Building Code.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site.

2.0 FIELD AND LABORATORY PROCEDURES

2.1 Field Exploration

In order to explore the general subsurface soil types and to aid in developing associated design parameters and recommendations three (3) 25-foot deep SPT borings (designated as B-1, B-2, and B-3) were drilled within the footprint of the proposed addition.

Standard Penetration Tests were performed in the field in general accordance with ASTM D 1586. The tests were performed continuously from the existing ground surface to a depth of 12 feet, and at 5-foot intervals thereafter, starting at a depth of 13 feet below grade. The soil samples were obtained with a standard 1.4” I.D., 2” O.D., 30” long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches, using a safety hammer. The number of blows required to drive the sampler each 6-inch increment of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value (uncorrected for automatic hammer and overburden pressure). A representative portion of each disturbed split-spoon sample was collected with each SPT, placed in a sealed glass jar, and returned to our laboratory for review.

The boring locations were established by the design team and staked in the field by a representative of **G E T Solutions, Inc.** with the use of a hand-held Global Positioning System (GPS) device and by corroborating with easily identifiable landmarks. Upon completion of the soil borings, the boreholes were backfilled with the soil clippings. Approximate soil boring locations are shown on the attached “Boring Location Plan” (Appendix I).

2.2 Field and Laboratory Testing

Soil testing provided by **G E T Solutions, Inc.** was performed in accordance with American Society for Testing and Materials (ASTM) standards. All soils and materials tests were performed in our AASHTO re:source (formally AMRL) and US Army Corps of Engineers certified Virginia Beach laboratory.

Representative portions of all soil samples collected during drilling operations were labeled, preserved and transferred to our laboratory in accordance with ASTM D4220 for classification and analysis. Soil descriptions on the boring logs are provided using visual-manual methods in general accordance with ASTM D2488 using the Unified Soil Classification System (USCS). Soil samples that were selected for index testing were classified in general accordance with ASTM D2487. It should be noted that some variation can be expected between samples classified using the visual-manual procedure (ASTM D2488) and the USCS (ASTM D2487). A summary of the soil classification system is provided in Appendix II.

Representative split-spoon soil samples were selected and subjected to natural moisture, #200 sieve wash, and Atterberg Limits testing in order to corroborate the visual classification. These test results are presented in Appendix III and on the soil test boring logs provided in Appendix IV. A generalized subsurface soil profile is provided in Appendix V.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Geology

The project site lies within a major physiographic province called the Atlantic Coastal Plain. Numerous transgressions and regressions of the Atlantic Ocean have deposited marine, lagoonal, and fluvial (stream lain) sediments. The regional geology is very complex, and generally consists of interbedded layers of varying mixtures of sands, silts and clays. Based on our review of existing geologic and soil boring data, the geologic stratigraphy encountered in our subsurface explorations generally consisted of marine deposited Sands, Silts and Clays.

3.2 Recent Land Reclamation and Site Development

Based on a review of historical United States Geological Survey (USGS) topographic maps of Norfolk, Cape Henry, and Kempsville, Virginia produced between the years of 1902 and 1994, the project site does not appear to be located within a previously reclaimed area.

3.3 Subsurface Soil Conditions

A summary of the subsurface soils conditions encountered at the SPT boring locations is presented in Table I.

Table I – Subsurface Soil Conditions

Average Depth (ft)	Stratum	Description	Ranges of SPT(1) N-Values
0 to 1.25 – 1.58	Surficial	➢ 15” to 19” Topsoil/Cultivated Soil	–
1.25 – 1.58 to 3.8 – 5.8	I	➢ SAND (SC) **Boring B-1 only* ➢ CLAY (CL)	<u>Granular</u> 9 – 15 <u>Cohesive</u> 6 - 11
3.8 – 5.8 to 25 (Boring Termination Depth)	II	➢ SAND (SP)	4 – 35
Note(s): (1) SPT = Standard Penetration Test, N-Values in Blows-per-foot (uncorrected)			

The subsurface descriptions are of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration are included in Appendix IV (Boring Log sheets) and in Appendix V (Generalized Soil Profile) which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual. It is noted that the “Topsoil” designation references the presence of surficial organic laden soil, and does not represent any particular quality specification. It is recommended that this material be tested for approval prior to use as topsoil.

3.4 Groundwater Discussion

The groundwater level was recorded at the boring locations and as observed through the relative wetness of the recovered soil samples during the drilling operations. The initial groundwater level was measured to occur at depths ranging from 6.25 to 6.5 feet below current grades.

The soils encountered within numerous borings at the presumed groundwater levels consisted of relatively “clean” granular soils; thus, drilling fluids (water) were introduced into the boreholes during the drilling operations to prevent cave-ins from occurring, impairing the ability to accurately determine the groundwater levels. Therefore, the reported initial groundwater levels may not be indicative of the static groundwater level.

Groundwater conditions will vary with environmental variations seasonal conditions, such as the frequency and magnitude of rainfall patters, as well as man-made influences, such as existing swales, drainage ponds, underdrains, and areas of covered soils (paved parking lots, sidewalks, etc.). In the project’s area, seasonal groundwater fluctuations of ±2 feet are common; however greater fluctuations have been documented. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedures, if necessary.

3.5 Shrink-Swell Soils Discussion

The soils recovered during our field investigation were tested and evaluated for their potential to expand or contract with moisture changes (typically termed shrink-swell). Shallow foundations and other on-grade features constructed on expansive soils at certain depths may be subjected to detrimental uplift or horizontal forces caused by the swelling of these soils as a result of an increase in the moisture content. Conversely, as these Clays lose moisture they may shrink, adversely affecting the foundations. The depth to which soils are normally affected by moisture changes extends from the ground surface to approximately 30 inches below existing grades in this area, depending on site topography and drainage characteristics.

Based on the laboratory classification test results, the shallow (upper 10 feet) CLAY (CL) and SAND (SC) soils possess Liquid Limits (LL) ranging from 21% to 42% and Plasticity Indices (PI) ranging from 9 to 17 generally indicative of possessing low shrink-swell potential and in agreement with the soil survey. As such, remediation efforts do not appear to be required for shrink/swell considerations.

4.0 EVALUATIONS AND RECOMMENDATIONS

Our recommendations are based on the previously discussed project information, our interpretation of the soil test borings and laboratory data, and our observations during our site reconnaissance. If the proposed construction should vary from what was described, we request the opportunity to review our recommendations and make any necessary changes.

4.1 Clearing and Grading

The proposed construction areas should be cleared by means of removing the topsoil/cultivated material, trees, root mat and any other unsuitable materials. It is estimated that a cut of 15 to 19 inches in depth will be required to remove the topsoil and cultivated soil material. This cut is expected to extend deeper in isolated areas (particularily within the wooded areas) to remove deeper deposits of organic soils, or unsuitable soils, which become evident during the clearing. It is recommended that the clearing operations extend laterally at least 5 feet beyond the perimeter of the proposed construction area.

The results of our field exploration program indicated that the soils below the surficial materials were generally comprised of Clayey SAND (SC) and CLAY (CL). Accordingly, combinations of excess surface moisture from precipitation ponding on the site and the construction traffic, including heavy compaction equipment, may create pumping and general deterioration of the bearing capabilities of the surface soils. Therefore, undercutting to remove very soft/loose soils should be anticipated. The extent of the undercut will be determined in the field during construction based on the outcome of the field testing procedures (subgrade proofroll).

To reduce the potential for subgrade improvements (undercutting due to saturated soils in conjunction with heavy construction traffic), it is recommended that the grading operations be performed during the drier months of the year (historically April through November as indicated by the NCDC *Climate Atlas of the United States*). This should minimize these potential problems, although they may not be eliminated. If grading is attempted during the winter months, stabilization of wet soils should be anticipated. Methods to address wet soils may include excavation-substitution (undercutting and backfilling with structural fill) or the introduction of chemical additives (cement, lime, etc.). However, during the drier months of the year, wet soils could be dried by discing or implementing other drying procedures (stockpiling or spreading in thin lifts) to achieve moisture contents necessary to achieve adequate degrees of compaction. The project's budget should include an allowance for subgrade improvements as described above.

The site should be graded to enhance surface water runoff to reduce the ponding of water. Ponding of water often results in softening of the near-surface soils. In the event of heavy rainfall within areas to receive fill, we recommend that the grading operations cease until the site has had a chance to dry. If the subgrade becomes deteriorated due to the above-mentioned or other reasons, difficulty maneuvering construction equipment and machinery is likely.

The undercut and backfill should be performed under the observation of a representative of **G E T Solutions, Inc.** who will evaluate the composition of the recovered soils. Recommendations concerning the subgrade improvements (as necessary) will be provided in the field following the testing procedures.

4.2 Subgrade Preparation

Following the clearing operation, the exposed subgrade soils should be densified with a large static drum roller. After the subgrade soils have been densified, they should be evaluated by **G E T Solutions, Inc.** for stability. Accordingly, the subgrade soils should be proofrolled to check for pockets of loose material hidden beneath a crust of better soil. Several passes should be made by a large rubber-tired roller or loaded dump truck over the construction areas. The number of passes will be determined in the field by the Geotechnical Engineer depending on the soils conditions. Any pumping or unstable areas observed during proofrolling (beyond the initial cut) should be undercut and/or stabilized at the direction of the Geotechnical Engineer.

4.3 Structural Fill and Placement

Following the approval of the natural subgrade soils by the Geotechnical Engineer, the placement of the fill required to establish the design grades may begin. Any material to be used for structural fill should be evaluated and tested by **G E T Solutions, Inc.** prior to placement to determine if they are suitable for the intended use. Suitable structural fill material should consist of sand or gravel containing less than 20% by weight of fines (SP, SM, SW, GP, GW), having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris and other unsuitable material.

All structural fill should be compacted to a dry density of at least 98% of the Standard Proctor maximum dry density (ASTM D 698) unless specified differently in this report. In general, the compaction should be accomplished by placing the fill in maximum 10-inch loose lifts and mechanically compacting each lift to at least the specified minimum dry density. A representative of **G E T Solutions, Inc.** should perform field density tests on each lift as necessary to assure that adequate compaction is achieved.

Backfill material in utility trenches within the construction areas should consist of structural fill (as described above), and should be compacted to at least 98% of ASTM D 698. This fill should be placed in 4 to 6 inch loose lifts when hand compaction equipment is used.

Care should be used when operating the compactors near existing structures to avoid transmission of the vibrations that could cause settlement damage or disturb occupants. In this regard, it is recommended that the vibratory roller remain at least 25 feet away from existing structures; these areas should be compacted with small, hand-operated compaction equipment.

4.4 Suitability of On-site Soils

Based on the laboratory testing program, the shallow subsurface Clayey SAND (SC) and CLAY (CL) soils encountered at the boring locations do not appear to meet the criteria recommended in this report for reuse as structural fill; however, may be used as fill in green areas. Further classification testing (natural moisture content, gradation analysis, and Proctor testing) should be performed in the field during construction to evaluate the suitability of excavated soils for reuse as structural fill. The project’s budget should include an allowance for imported structural fill.

4.5 Shallow Foundation Design Recommendations

Provided that the construction procedures are properly performed, the proposed addition can be supported by isolated spread footings bearing upon firm natural soil or well-compacted structural fill material**.** These footings can be designed using a net allowable soil pressure of 2,000 pounds per square foot (psf). In using net pressures, the weight of the footings and backfill over the footings, including the weight of the floor slab, need not be considered. Hence, only loads applied at or above the finished floor need to be used for dimensioning the footings.

In order to develop the recommended bearing capacity of 2,000 pounds per square foot (psf), the base of the footings should have a minimum embedment of 24 inches beneath finished grades and should have a minimum width of 24 inches. In addition, isolated square column footings (if deemed necessary) are recommended to be a minimum of 3 feet by 3 feet in area for bearing capacity consideration. The recommended 24-inch footing embedment is considered sufficient to provide adequate cover against frost penetration to the bearing soils.

4.6 Settlements

It is estimated that, with proper site preparation, the maximum resulting post-construction total settlement of the proposed building foundations should be up to 1 inch. The maximum differential settlement magnitude is expected to be less than ½ -inch between adjacent footings (wall footings and column footings of widely varying loading conditions). The settlements were estimated on the basis of the results of the field penetration tests. Careful field control will contribute substantially towards minimizing the settlements.

It is expected that some of the new foundations associated with the addition will be located adjacent to those of the existing structure. As such, the underlying soils at these locations will be subjected to a stress increase as a result of the new foundation structural loads and fill loads. This stress increase is anticipated to result in an additional ¼ to ½-inch of settlement at the new and old foundation interface. This additional settlement may result in some minor cracking of the existing masonry or a widening or lengthening of any existing cracks.

4.7 Foundation Excavations

In preparation for shallow foundation support, the footing excavations should extend into firm natural soil or well-compacted structural fill. The foundation bearing capacities should be verified in the field during construction by means of performing a footing inspection for each foundation structure. At that time, the Geotechnical Engineer should also explore the extent of excessively loose, soft, or otherwise unsuitable material within the exposed excavations. Also, at the time of footing observations, the Geotechnical Engineer should advance hand auger borings or use a hand penetration device in the bases of the foundation excavations to verify that the recovered soils are consistent with those documented in this report. The necessary depth of penetration will be established during the subgrade observations.

If pockets of unsuitable soils requiring undercut are encountered in the footing excavations, the proposed footing elevation should be re-established by means of backfilling with “flowable fill” or a suitable structural fill material compacted to a dry density of at least 98% of the standard Proctor maximum dry density (ASTM D 698), as described in Section 4.3 of this report, prior to concrete placement. This construction procedure will provide for a net allowable bearing capacity of 2,000 psf.

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition such as from physical disturbance, rain or frost. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all footing concrete should be placed the same day the excavation is made. If this is not possible, the footing excavations should be adequately protected.

All foundation excavations adjacent to existing footings should be monitored full time. The existing structure should be properly supported/braced during the excavation to prevent damage to the structure (such as undermining the existing foundations).

4.8 Slab-on-Grade Design

Floor slabs may be constructed as slab-on-grade members provided the previously recommended earthwork activities and evaluations are carried out properly. It is recommended that all ground floor slabs be directly supported by at least a 4-inch layer of relatively clean, compacted, poorly graded sand (SP) or gravel (GP) with less than 5% passing the No. 200 Sieve (0.074 mm). The purpose of the 4-inch layer is to act as a capillary barrier and equalize moisture conditions beneath the slab. A subgrade modulus of 125-pounds per square inch per inch (psi/in) should be used when analyzing the slabs under this construction procedure. Alternately, the concrete slabs may be directly supported by a 6 to 8-inch layer of well-compacted aggregate base stone (VDOT 21A or 21B). Furthermore, a subgrade modulus of 150-pounds per square inch per inch (psi/in) should be used when analyzing the slabs under this construction procedure.

It is also recommended that the floor slab bearing soils be covered by a vapor barrier or retarder in order to minimize the potential for floor dampness, which can affect the performance of glued tile and carpet. Generally, use a vapor retarder for minimal vapor resistance protection below the slab on grade. When floor finishes, site conditions, or other considerations require greater vapor resistance protection; consideration should be given to using a vapor barrier. Selection of a vapor retarder or barrier should be made by the architect based on project requirements.

4.9 Seismic Evaluation

Based on our experience in the vicinity of the project site and the composition of the soils recovered within the upper 25 feet (maximum explored depth) at the boring locations, it is our opinion that the site characteristics are indicative of a Site Class “D” in accordance with Table 20.3-1 of ASCE 7-10 as referenced by the 2015 International Building Code (IBC); however, the seismic evaluation requires soils information associated with the upper 100 feet. If the site classification is critical to the structural design, it will be necessary to perform a 100-foot deep Cone Penetration Test (SCPTu) boring with shear wave velocity testing to substantiate this site classification.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Anticipated Excavation Characteristics

Based on the results of this exploration, varying soil conditions and compositions are expected to be encountered throughout the project limits. Open-cut excavations will extend through natural soils that are considered to be relatively “clean” (i.e. soil that is relatively free of deleterious debris that may hinder excavation or installation). Debris typically considered unsuitable consist of wood, glass, organics, plastics, coal, brick or any other material larger than 2 inches in diameter. Based on these characteristics it is anticipated that some of the shallow subsurface materials encountered within the project alignment may be reusable as backfill. Soils containing appreciable amounts of deleterious debris should be discarded; however, an effort should be made during excavation to segregate potentially suitable in-situ soils for reuse. Information pertaining to backfill criteria was provided previously in Section 4.3.

5.2 Excavation Stability

The shallow subsurface within the project limits is comprised of clayey and granular soils; however, the Contractor should anticipate these soils to have relatively little cohesion and have a high potential for caving. Additionally, water seepage at varying elevations should be expected within the side walls of the open cut areas, increasing the potential for caving. Based on these mentioned characteristics, it is recommended that all subsurface soils be considered Type C in accordance with Occupational Safety and Health Administration (OSHA) criteria.

Temporary Slopes

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its “Construction Standards for Excavations, 29 CFR, part 1926, Subpart P”. This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavations, or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the Contractor could be liable for substantial penalties.

Temporary slopes may not be a feasible option. The Contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The Contractor’s responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the Contractor’s safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

Where temporary slopes are not feasible, shoring by means of sheeting and/or trench shields may be appropriate. Where the stability of adjoining structures, pavements, or other improvements is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability. Shoring, bracing, or underpinning required for this project (if required) should be designed by a professional engineer.

Shoring

Shoring design and installation should be the responsibility of the Contractor. Shoring systems required for this project should be designed by a professional engineer. Shoring systems should be designed to provide positive restraint of trench walls in an effort to protect against lateral deformation that may result in ground cracks, settlement, and/or other ground movements that may affect adjacent underground utilities and pavements as well as surface improvements. The Contractor should be made aware of this potential condition in order that preventative measures can be implemented or repair measures provided for.

Depending on the shoring system used, the removal process may create voids along the walls of the excavations. If these voids are left in place and are significant, backfill and/or the retained soil may shift laterally resulting in settlement of overlying structures/pavements. As such, care should be taken to remove the shoring systems and backfill the trenches in a manner as to not create these voids.

In all cases, the Contractor should select an excavation and/or shoring scheme that will protect adjacent and overlying improvements, including below grade utilities.

We are providing this information solely as a service to our client. **G E T Solutions, Inc.** is not assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

5.3 Dewatering

It is expected that dewatering will be required for excavations that extend near or below the existing groundwater table. Temporary dewatering will impact construction and be dependent on construction methods and scheduling. For those reasons, we recommend the Contractor be solely responsible for the design, installation, maintenance, and performance of all temporary dewatering systems. The dewatering system should be designed to maintain a controlled environment suitable for the proposed construction and specified construction methods. Where temporary shoring is employed, the dewatering system should be compatible with the type of shoring to be used. We recommend the Contractor verify groundwater conditions and evaluate dewatering requirements prior to construction.

Lowering the groundwater table during dewatering activities will result in an increase in effective stresses and may induce settlements of the soils underlying adjacent structures/pavements. Additionally, hydraulic compaction of predominately granular soils (e.g. SP, SP-SM, SM soils) should be anticipated as a result of lowering the groundwater table. We recommend that the dewatering be performed such that the groundwater level is lowered no more than approximately 5 feet below the proposed excavation depth. It may be advantageous to install settlement monuments in areas where dewatering by means of well pointing is required.

5.4 Site Utility Installation

The base of the utility trenches should be observed by a qualified inspector prior to the pipe placement to verify the suitability of the bearing soils. It is expected that the utilities will be located above or near the groundwater level (at the time of this reporting 6.25 to 6.5 feet below current grades), bearing in moist to wet granular soils. In these instances, the bearing soils may require some stabilization to provide suitable bedding. This stabilization is commonly accomplished by adding 12 inches or more of bedding stone (Type VDOT No. 57). The resulting excavations should be backfilled with structural fill, as described in Section 4.3 of this report. As mentioned previously, some of the shallow subsurface materials encountered within the project site may be suitable for reuse as backfill. Soils containing appreciable amounts of fines or deleterious debris should be discarded. Imported fill should be included in the construction budget for backfilling the utility excavations within the construction areas.

6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by the client and their designated agents for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the Geotechnical Engineer should be provided the opportunity to review the final design plans and specifications to make sure our engineering recommendations have been properly incorporated into the design documents, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations.

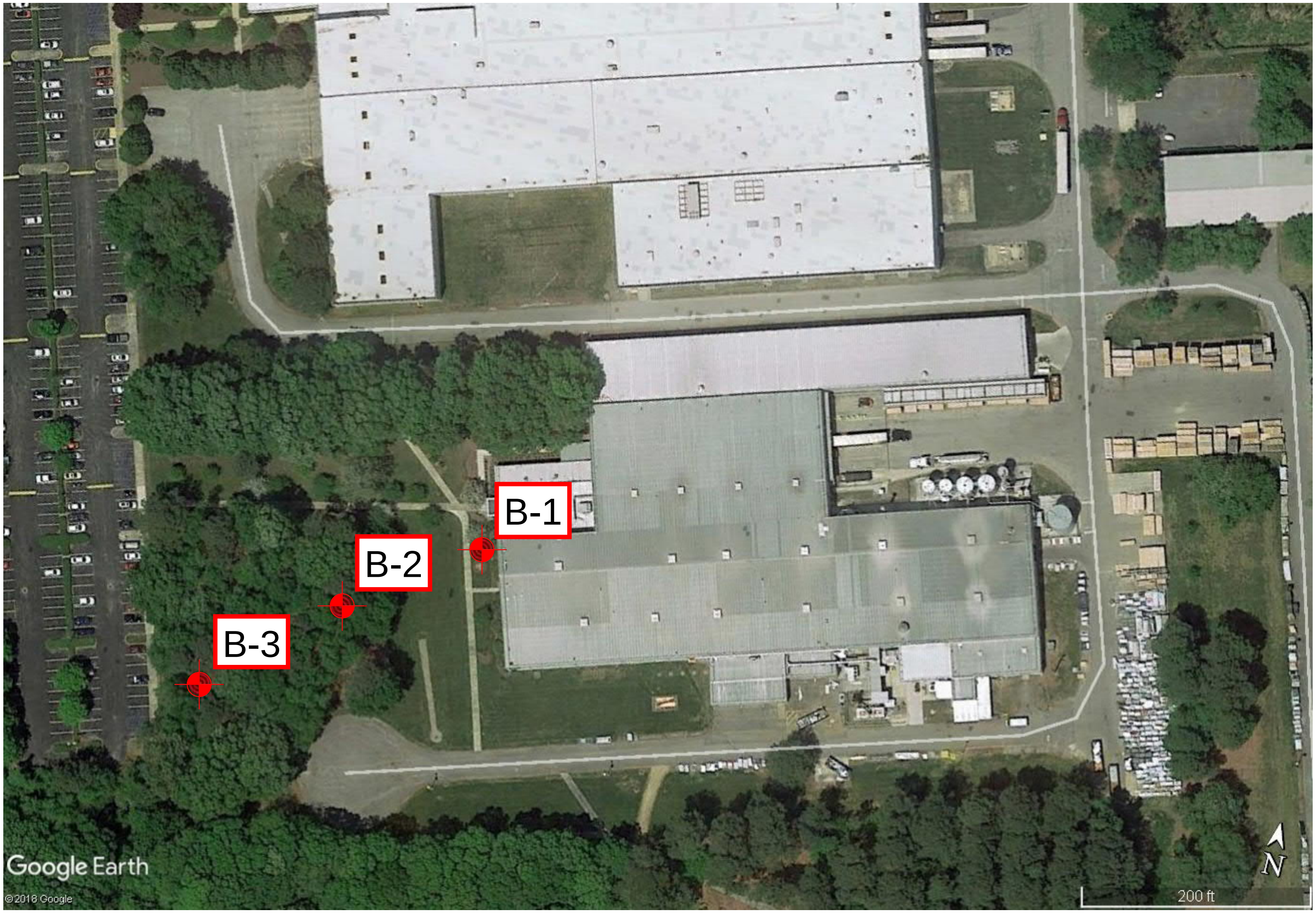
This report has been prepared for the exclusive use of the client and their designated agents for the specific application to the proposed Mitsubishi Warehouse Addition project in Chesapeake, Virginia.

APPENDICES

APPENDIX I

BORING LOCATION PLAN

GET Solutions, Inc.



Boring Location Plan

PROJECT: Mitsubishi Warehouse Addition
PROJECT LOCATION: Chesapeake, Virginia
PROJECT NO: VB19-202G
CLIENT: CW Brinkley
PLOT BY: J. Moran

GET Solutions, Inc.
Geotechnical • Environmental • Testing

APPENDIX II

CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

GET Solutions, Inc.

GET Solutions, Inc.
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Virginia Beach
5465 Greenwich Road
Virginia Beach, VA 23462
(757) 518-1703

Williamsburg
1592 Penniman Rd. Suite E
Williamsburg, Virginia 23185
(757) 564-6452

Elizabeth City
504 East Elizabeth St. Suite 2
Elizabeth City, NC 27909
(252) 335-9765

CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

Standard Penetration Test (SPT), N-value

Standard Penetration Tests (SPT) were performed in the field in general accordance with ASTM D 1586. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches. The number of blows required to drive the sampler each 6-inch increment (4 increments for each soil sample) of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value.

NON COHESIVE SOILS

(SILT, SAND, GRAVEL and Combinations)

Relative Density

Very Loose	4 blows/ft. or less
Loose	5 to 10 blows/ft.
Medium Dense	11 to 30 blows/ft.
Dense	31 to 50 blows/ft.
Very Dense	51 blows/ft. or more

Particle Size Identification

Boulders	8 inch diameter or more	
Cobbles	3 to 8 inch diameter	
Gravel	Coarse	1 to 3 inch diameter
	Medium	$^{1}/_{2}$ to 1 inch diameter
	Fine	$^{1}/_{4}$ to $^{1}/_{2}$ inch diameter
Sand	Coarse	2.00 mm to $^{1}/_{4}$ inch (diameter of pencil lead)
	Medium	0.42 to 2.00 mm (diameter of broom straw)
	Fine	0.074 to 0.42 mm (diameter of human hair)
Silt		0.002 to 0.074 mm (cannot see particles)

CLASSIFICATION SYMBOLS (ASTM D 2487 and D 2488)

Coarse Grained Soils

More than 50% retained on No. 200 sieve

GW - Well-graded Gravel
GP - Poorly graded Gravel
GW-GM - Well-graded Gravel w/Silt
GW-GC - Well-graded Gravel w/Clay
GP-GM - Poorly graded Gravel w/Silt
GP-GC - Poorly graded Gravel w/Clay
GM - Silty Gravel
GC - Clayey Gravel
GC-GM - Silty, Clayey Gravel
SW - Well-graded Sand
SP - Poorly graded Sand
SW-SM - Well-graded Sand w/Silt
SW-SC - Well-graded Sand w/Clay
SP-SM - Poorly graded Sand w/Silt
SP-SC - Poorly graded Sand w/Clay
SM - Silty Sand
SC - Clayey Sand
SC-SM - Silty, Clayey Sand

Fine-Grained Soils

50% or more passes the No. 200 sieve

CL - Lean Clay
CL-ML - Silty Clay
ML - Silt
OL - Organic Clay/Silt
Liquid Limit 50% or greater
CH - Fat Clay
MH - Elastic Silt
OH - Organic Clay/Silt

Highly Organic Soils

PT - Peat

COHESIVE SOILS

(CLAY, SILT and Combinations)

Consistency

Very Soft	2 blows/ft. or less
Soft	3 to 4 blows/ft.
Medium Stiff	5 to 8 blows/ft.
Stiff	9 to 15 blows/ft.
Very Stiff	16 to 30 blows/ft.
Hard	31 blows/ft. or more

Relative Proportions

Descriptive Term	Percent
Trace	0-5
Few	5-10
Little	15-25
Some	30-45
Mostly	50-100

Strata Changes

In the column "Description" on the boring log, the horizontal lines represent approximate strata changes.

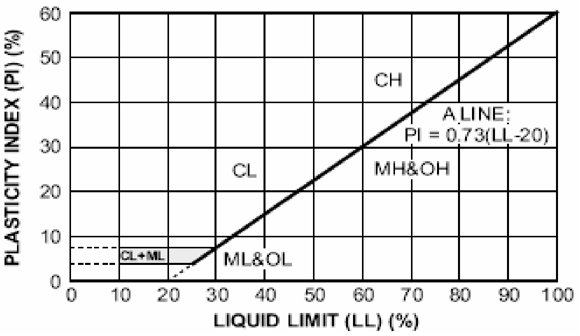
Groundwater Readings

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as tidal influences and man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.).

Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent	GW, GP, SW,SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	Borderline cases requiring dual symbols

Plasticity Chart



APPENDIX III

SUMMARY OF LABORATORY CLASSIFICATION RESULTS

GET Solutions, Inc.

SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT CW Brinkley, Inc.

PROJECT NAME Mitsubishi Warehouse Addition

PROJECT NUMBER VB19-202G

PROJECT LOCATION Chesapeake, Virginia

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-1	3.0	21	12	9	0.075	47	SC	13.6			
B-2	3.0	42	25	17	0.075	63	CL	31.8			
B-2	7.0	NP	NP	NP	4.75	4	SP	24.7			
B-3	11.0	NP	NP	NP	4.75	4	SP	27.9			

(1) GET - LABORATORY TEST SUMMARY - GET_STANDARD_DATATEMPLATE(03-17-14).GDT - 7/10/19 17:33 - G:\GINT\PROJECTS\VB19\VB19-202G MITSUBISHI WAREHOUSE ADDITION.GPJ

APPENDIX IV

BORING LOGS

GET Solutions, Inc.
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RECORD OF SUBSURFACE EXPLORATION

Virginia Beach
5465 Greenwich Road
Virginia Beach, VA 23642
757-518-1703

Williamsburg
1592-E Penniman Road
Williamsburg, VA 23185
757-564-6452

Elizabeth City
106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

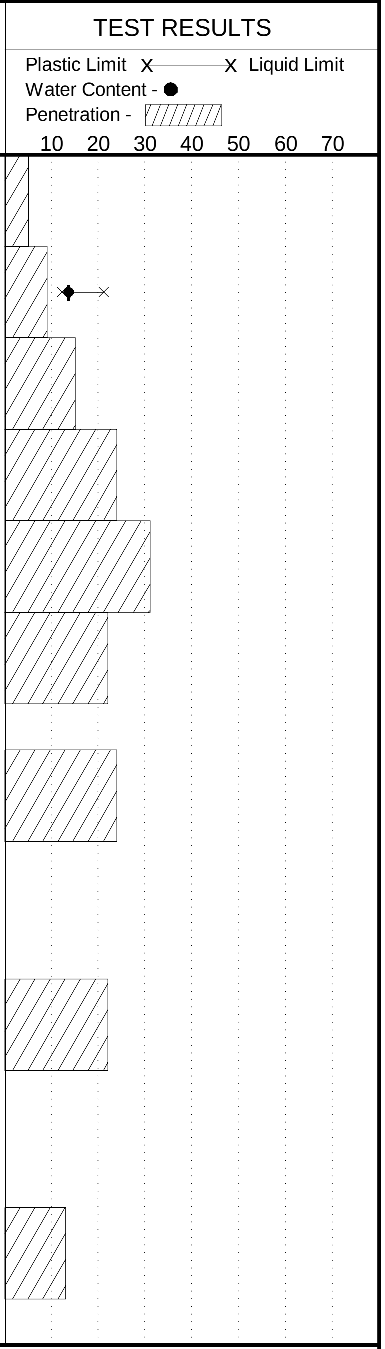
Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

BORING ID
B-1

PROJECT NAME: **Mitsubishi Warehouse Addition**
CLIENT: **CW Brinkley, Inc.**
PROJECT LOCATION: **Chesapeake, Virginia**
BORING LOCATION: **See GET Solutions, Inc. Boring Location Plan**
DRILLING METHOD(S): **Rotary wash "mud"**
GROUNDWATER*: INITIAL (ft) ▽: **6.25** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ⊊: ____
The initial groundwater readings are not intended to indicate the static groundwater level.

PROJECT NUMBER: **VB19-202G**
SURFACE ELEVATION (NAVD 88) (ft): ____
LOGGED BY: **J. Moran**
DATE STARTED: **5/15/2019**
DATE COMPLETED: **5/15/2019**
DRILLER: **GET Solutions, Inc.**

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
	1.3	15" Topsoil/Cultivated Soil		1	☒	21	1-2-3-6 (5)	
		Gray, moist, Clayey fine to medium SAND (SC), loose to medium dense		2	☒	18	5-5-4-4 (9)	47
	5			3	☒	23	6-8-7-11 (15)	
▽	5.8	Tan-Gray, moist to wet, Poorly graded fine to medium SAND (SP), medium dense to dense		4	☒	23	13-12-12-14 (24)	
				5	☒	24	9-14-17-19 (31)	
	10			6	☒	13	9-10-12-11 (22)	
	15			7	☒	19	7-12-12-15 (24)	
	20			8	☒	18	11-11-11-14 (22)	
	25 25.0			9	☒	19	6-7-6-7 (13)	
		Boring terminated at 25 feet below existing grade.						



Sample Type(s):
☒ SS - Split Spoon

Notes:

RECORD OF SUBSURFACE EXPLORATION

GET Solutions, Inc.
Geotechnical • Environmental • Testing

Virginia Beach
5465 Greenwich Road
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Williamsburg, VA 23185
757-564-6452

Elizabeth City
106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

BORING ID
B-2

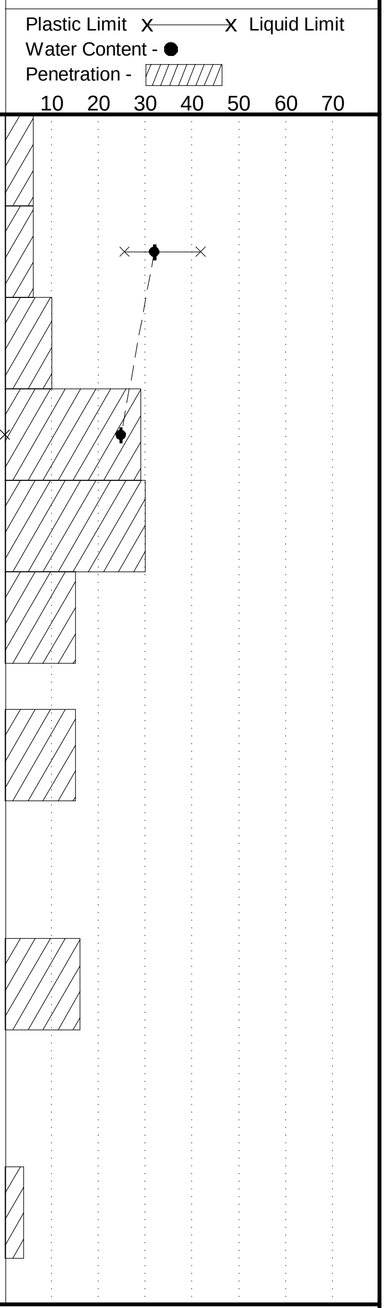
PROJECT NAME: **Mitsubishi Warehouse Addition**
CLIENT: **CW Brinkley, Inc.**
PROJECT LOCATION: **Chesapeake, Virginia**
BORING LOCATION: **See GET Solutions, Inc. Boring Location Plan**
DRILLING METHOD(S): **Rotary wash "mud"**
GROUNDWATER*: INITIAL (ft) ▽: **6.25** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ⊆: ____

The initial groundwater readings are not intended to indicate the static groundwater level.

PROJECT NUMBER: **VB19-202G**
SURFACE ELEVATION (NAVD 88) (ft): ____
LOGGED BY: **J. Moran**
DATE STARTED: **5/15/2019**
DATE COMPLETED: **5/15/2019**
DRILLER: **GET Solutions, Inc.**

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		19" Topsoil/Cultivated Soil		1	☒	20	1-3-3-3 (6)	
		1.6 Dark Gray, moist, Sandy Lean CLAY (CL), medium stiff to stiff	▨	2	☒	19	3-3-3-3 (6)	63
	5	4.8 Tan-Gray, moist to wet, Poorly graded fine to medium SAND (SP), very loose to medium dense		3	☒	17	2-3-7-9 (10)	
▽				4	☒	23	10-12-17-19 (29)	4
				5	☒	24	10-15-15-16 (30)	
	10			6	☒	15	6-5-10-14 (15)	
				7	☒	17	8-8-7-6 (15)	
	15							
				8	☒	16	6-8-8-11 (16)	
	20							
				9	☒	21	3-2-2-2 (4)	
	25	25.0 Boring terminated at 25 feet below existing grade.						

TEST RESULTS



Sample Type(s):
☒ SS - Split Spoon

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

GET Solutions, Inc.
Geotechnical • Environmental • Testing

Virginia Beach	Williamsburg	Elizabeth City	Jacksonville
5465 Greenwich Road Virginia Beach, VA 23642 757-518-1703	1592-E Penniman Road Williamsburg, VA 23185 757-564-6452	106 Capital Trace Unit E Elizabeth City, NC 27909 252-335-9765	415-A Western Blvd Jacksonville, NC 28546 910-478-9915

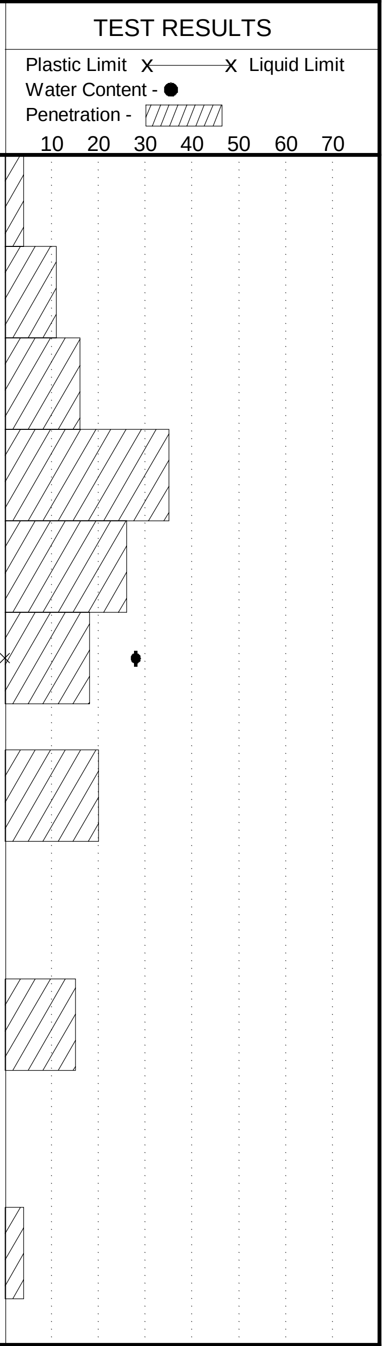
BORING ID
B-3

PROJECT NAME: **Mitsubishi Warehouse Addition**
CLIENT: **CW Brinkley, Inc.**
PROJECT LOCATION: **Chesapeake, Virginia**
BORING LOCATION: **See GET Solutions, Inc. Boring Location Plan**
DRILLING METHOD(S): **Rotary wash "mud"**
GROUNDWATER*: INITIAL (ft) ▽: **6.5** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ⊆: ____
The initial groundwater readings are not intended to indicate the static groundwater level.

PROJECT NUMBER: **VB19-202G**
SURFACE ELEVATION (NAVD 88) (ft): ____
LOGGED BY: **J. Moran**
DATE STARTED: **5/15/2019**
DATE COMPLETED: **5/15/2019**
DRILLER: **GET Solutions, Inc.**

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		18" Topsoil/Cultivated Soil		1	☒	23	1-2-2-3 (4)	
	1.5	Gray, moist, Lean CLAY (CL), soft to stiff		2	☒	20	3-4-7-7 (11)	
	3.8	Tan- Gray, moist to wet, Poorly graded fine to medium SAND (SP), very loose to dense						
	5			3	☒	23	6-7-9-13 (16)	
▽				4	☒	24	9-16-19-19 (35)	
				5	☒	24	11-12-14-15 (26)	
	10			6	☒	17	5-6-12-4 (18)	4
				7	☒	17	7-8-12-17 (20)	
	15							
				8	☒	17	5-6-9-10 (15)	
	20							
				9	☒	19	4-2-2-2 (4)	
	25	25.0 Boring terminated at 25 feet below existing grade.						

TEST RESULTS



Sample Type(s):
☒ SS - Split Spoon

Notes:

PAGE 1 OF 1

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

APPENDIX V

GENERALIZED SOIL PROFILES

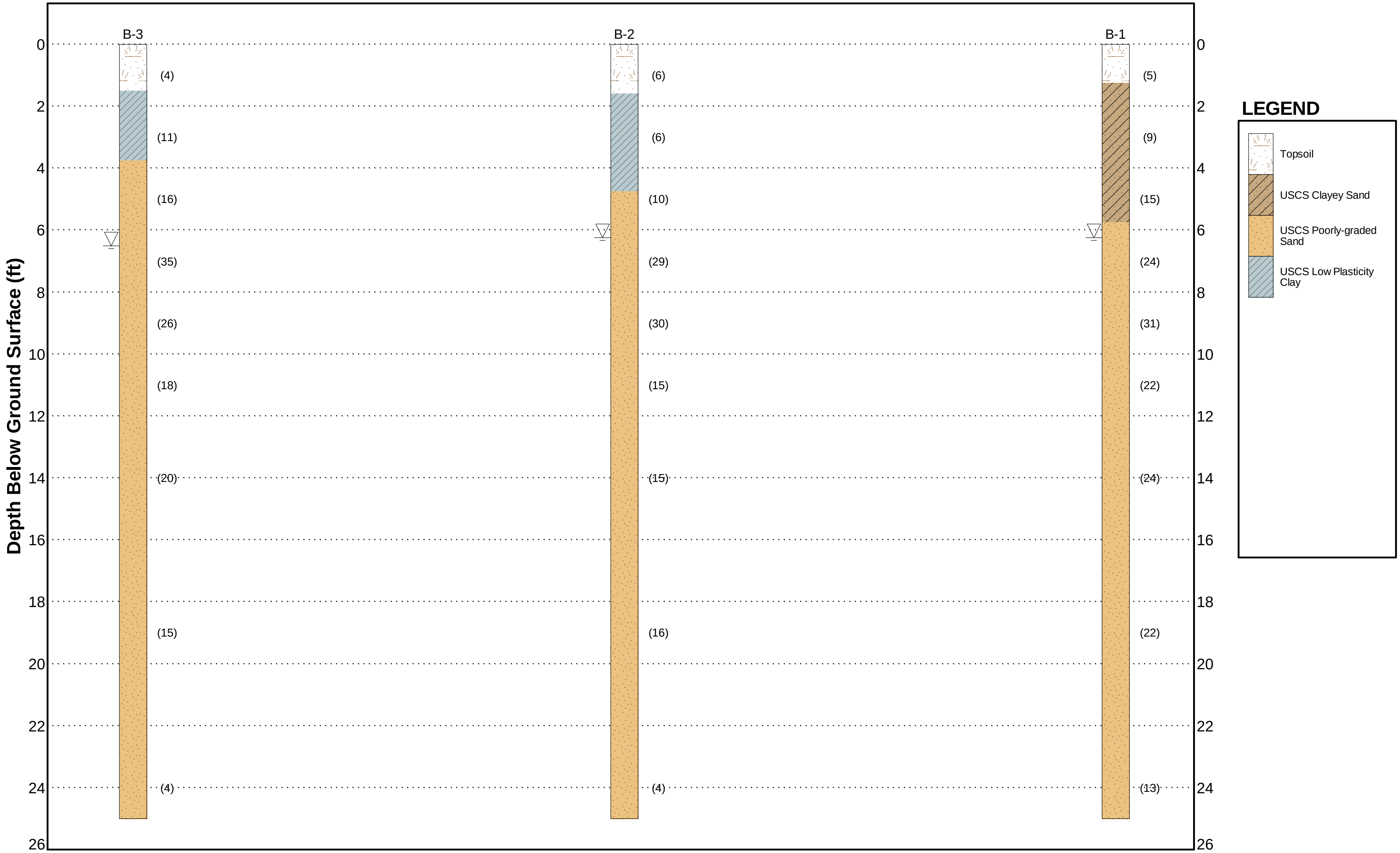
GENERALIZED SOIL PROFILE

PROJECT NAME: **Mitsubishi Warehouse Addition**

PROJECT NUMBER: **VB19-202G**

PROJECT LOCATION: **Chesapeake, Virginia**

CLIENT: **CW Brinkley, Inc.**



(Numerical Value) = Sample N-Value