GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF A GEOTECHNICAL SITE EXPLORATION

DOLLAR GENERAL – LAKE CITY WINFIELD
LAKE CITY, COLUMBIA COUNTY, FLORIDA

GSE PROJECT NO. 16317

Prepared For:

CONCEPT DEVELOPMENT, INC.

NOVEMBER 2023

GSE Engineering & Consulting, Inc.

November 28, 2023

Andrea Barnett
Concept Development, Inc.
1449 SW 74th Drive, Suite 200
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Subject: Summary Report of a Geotechnical Site Exploration
Dollar General – Lake City Winfield
Lake City, Columbia County, Florida
GSE Project No. 16317

GSE Engineering & Consulting, Inc. (GSE) is pleased to submit this geotechnical site exploration report for the above referenced project.

Presented herein are the findings and conclusions of our exploration, including the geotechnical parameters and recommendations to assist with building foundation, pavement, and stormwater management designs.

GSE appreciates this opportunity to have assisted you on this project. If you have any questions or comments concerning this report, please contact us.

Sincerely,

GSE Engineering & Consulting, Inc.

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LICENSE
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STATE OF FLORIDA
PROFESSIONAL ENGINEER

This item has been digitally signed and sealed by
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1.0 INTRODUCTION

1.1 General

GSE Engineering & Consulting, Inc. (GSE) has completed this geotechnical exploration for the proposed Dollar General – Lake City Winfield located in Lake City, Columbia County, Florida. This exploration was performed in accordance with GSE Proposal No. 2023-680 dated October 23, 2023. Andrea Barnett, Development Project Manager, of Concept Development, Inc. authorized our services on October 23, 2023.

1.2 Project Description

We understand that you are coordinating due diligence related work related to the development of this site into a commercial retail store. The site is located on US Highway 41, approximately 800 ft NW of the intersection of NW Falling Creek Road and US Highway 41 in Columbia County. The subject site has an area of +/- 1.74 acres, which makes up a portion of the +/- 12.95-acre parent parcel.

You provided GSE with information about the project. We understand the project will consist of an approximate 10,640 square foot building, a parking lot, and a stormwater management facility.

The structure is expected to be single-story, high wall concrete masonry unit (CMU) and steel frame construction. Structural loads have not been provided but are expected to be on the order of 1 to 2 kips per foot for non-load bearing CMU walls, and less than 50 kips for columns. The finished floor of the structure is anticipated to be constructed within 1 to 2 feet of the existing site grades.

The building will be located near the southeastern portion of the site. The parking lot will be located northwest and northeast of the structure. The stormwater management facility will be located on the southwestern portion of the site.

A recent aerial photograph of the site was obtained. The site plan and aerial photograph were used in preparation of this exploration and report.

1.3 Purpose

The purpose of this geotechnical exploration was to determine the general subsurface conditions, evaluate these conditions with respect to the proposed construction, and prepare geotechnical parameters and recommendations to assist with building foundation, stormwater management, and pavement designs.

2.0 FIELD AND LABORATORY TESTS

2.1 General Description

The procedures used for field sampling and testing are in general accordance with industry standards of care and established geotechnical engineering practices for this geographic region. This exploration consisted of performing four (4) Standard Penetration Test (SPT) borings to depths of 20 feet below land surface (bls) within the proposed building area, four (4) auger borings to depths of 5 feet bls in the area of the parking lot and driveways, and four (4) auger borings to depths of 15 feet bls in the area of the proposed stormwater management facility.

The soil borings were performed at the approximate locations as shown on Figure 2. The borings were located at the site using the provided site plan and obvious site features as reference. The boring locations should be considered approximate. The soil borings were performed on November 14, 2023.

2.2 Auger Borings

The auger borings were performed in accordance with ASTM D1452. The borings were performed with flight auger equipment that was rotated into the ground in a manner that reduces soil disturbance. After penetrating to the required depth, the auger was retracted and the soils collected on the auger flights were field classified and placed in sealed containers. Representative samples of each stratum were retained from the auger boring. Results from the auger borings are provided in Section 5.1.

2.3 Standard Penetration Test Borings

The soil borings were performed with a drill rig employing flight auger drilling techniques and Standard Penetration Testing (SPT) in accordance with ASTM D1586. The SPTs were performed continuously to 10 feet and at 5-foot intervals thereafter. Soil samples were obtained at the depths where the SPTs were performed. The soil samples were classified in the field, placed in sealed containers, and returned to our laboratory for further evaluation.

After drilling to the sampling depth, the standard two-inch O.D. split-barrel sampler was seated by driving it 6 inches into the undisturbed soil. Then the sampler was driven an additional 12 inches by blows of a 140-pound hammer falling 30 inches. The number of blows required to produce the next 12 inches of penetration were recorded as the penetration resistance (N-value). These values and the complete SPT boring logs are provided in Section 5.2.

Upon completion of the sampling, the boreholes were abandoned in accordance with Water Management District guidelines.

2.4 Soil Laboratory Tests

The soil samples recovered from the soil borings were returned to our laboratory, and examined to confirm the field descriptions. Representative samples were then selected for laboratory testing. The laboratory tests consisted of eight (8) percent soil fines passing the No. 200 sieve determinations, eight (8) natural moisture content determinations, two (2) Atterberg Limits tests, and three (3) constant head hydraulic conductivity tests. These tests were performed in order to aid in classifying the soils and to further evaluate their engineering properties. The laboratory tests are provided in Section 5.3.

3.0 FINDINGS

3.1 Surface Conditions

Mrs. Karen Roylos with GSE visited the site on November 2, 2023 to observe the site conditions and mark the boring locations.

The majority of the site is open and is a staging area for trailers. However, the eastern portion of the site is partially wooded. The site is bordered by US Highway 41 to the east and wooded areas to the north and west. Commercial buildings are present south of the site.

The topography at the site is gently to moderately sloping down toward the north from the south. Regional topography is gently rolling hills. The Lake City West USGS Topographic Map indicates the ground surface elevations at the site are near elevations 120 to 125 feet[1] NAVD 88.

3.2 Subsurface Conditions

The locations of the auger and SPT borings are provided on Figure 2. Complete logs for the borings are provided in Sections 5.1 and 5.2. Descriptions for the soils encountered are accompanied by the Unified Soil Classification System symbol (SM, SP-SM, etc.) and are based on visual examination of the recovered soil samples and the laboratory tests performed. Stratification boundaries between the soil types should be considered approximate, as the actual transition between soil types may be gradual.

The auger borings located in the proposed stormwater management facility indicate the soils across this area are relatively consistent. The auger borings initially penetrated 1.5 to 5.5 feet of sand with silt, silty sand, and silty clayey sand (SP-SM, SM, SC/SM) overlying clayey to very clayey sand (SC, SC/CL) to depths of 5 to 6 feet bls. This was underlain by clay-rich soils consisting of clay with sand and clay (CL/CH) to the explored depths of 15 feet bls.

The auger borings located in the proposed parking lot and driveways generally encountered a near-surface sandy stratum consisting of poorly graded sand and sand with silt (SP, SP-SM) to depths of 3 to 5 feet bls. This was underlain by sand with clay and clayey sand (SP-SC, SC) to the explored depths of 5 feet bls.

The SPT borings within the area of the proposed building initially penetrated a 3 to 4.5 feet thick stratum of poorly graded sand and sand with silt (SP, SP-SM). This was underlain by clayey to very clayey sand (SC, SC/CL) to depths of 5 to 12.5 feet bls. This was underlain by clay-rich soils consisting of sandy clay, clay with sand, and clay (CL/CH, CH) to the explored depths of 20 feet bls.

The surficial layer of poorly graded sand and sand with silt (SP, SP-SM) is generally in a loose to medium dense condition with N-values ranging from 6 to 17 blows per foot. The underlying clayey to very clayey sand (SC, SC/CL) is generally in a loose to medium dense condition with N-values ranging from 6 to 30 blows per foot. The clay-rich soils (CL/CH, CH) are generally in a firm to very stiff condition with N-values ranging from 6 to 24 blows per foot.

The groundwater table was only encountered in auger boring A-3 at a depth of 3.5 feet bls at the time of our investigation.

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[1] United States Geological Survey, Lake City West Quadrangle, 2021.

3.3 Review of Published Data

The majority of the site is mapped as two soil series by the Soil Conservation Service (SCS) Soil Survey for Columbia County[2]. The following soil descriptions are from the Soil Survey.

Pelham fine sand, 0 to 2 percent slopes - This is a nearly level, poorly drained soil in shallow depressions, on broad low-lying flats in the flatwoods, and in nearly level areas on the uplands. The areas range from 5 to 100 acres and are irregularly shaped. The slope ranges from 0 to 2 percent.

Typically, the surface layer is very dark gray fine sand about 6 inches thick. The subsurface layer is fine sand. In the upper 10 inches it is a grayish brown, and in the next 15 inches it is a dark gray. The subsoil extends to a depth of 66 inches or more. In the upper 20 inches it is gray sandy clay loam with yellowish brown, brownish yellow, light yellowish brown, gray, and light gray mottles; and in the next 15 inches it is mottled gray, light gray, and yellowish red sandy clay loam. The substratum is gray fine sandy loam with yellowish red mottles.

Included with this soil in mapping are small areas of Plummer, Surrency, Ocilla, Albany, and Mascotte soils. Also included are soils that have a loamy subsoil within a depth of 20 inches and soils that have clay in the upper 20 inches of the subsoil. The included soils make up about 25 percent of the map unit.

This Pelham soil has a water table at a depth of 6 to 18 inches for about 3 months in most years. The water table is at or above the surface for brief periods after heavy rains. The available water capacity is high. Permeability is rapid in the surface and subsurface layers and moderate in the subsoil. Natural fertility is low. The organic matter content is moderate in the surface layer and low in all other layers.

Sapelo fine sand, 0 to 2 percent slopes - This is a nearly level, poorly drained soil in the flatwoods. The areas are mostly irregular in shape and range from 5 to 500 acres. The slope is 0 to 2 percent.

Typically, the surface layer is black fine sand about 4 inches thick. The subsurface layer is gray fine sand about 7 inches thick. The upper part of the subsoil to a depth of 17 inches is very dark brown fine sand. The sand grains in this layer are coated with organic matter. The next layer is 33 inches of fine sand that separates the upper and lower parts of the subsoil. It is pale yellow in the upper part and light gray in the lower part. The lower part of the subsoil, from 50 to 80 inches or more, is sandy clay loam. The upper 12 inches is light gray, and the lower part is gray with olive yellow and yellowish red mottles.

Included with this soil in mapping are small areas of Mascotte, Leon, and Pelham soils. Also included are small areas of poorly drained soils that are underlain by limestone, soils that have a loamy sand or course sand subsoil and substratum, and soils that have a clay subsoil. The included soils make up about 15 percent of the map unit.

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[2] Soil Survey of Columbia County, Florida. Soil Conservation Service, U.S. Department of Agriculture.

The water table is at a depth of 15 to 30 inches for 2 to 4 months during most years. Permeability is rapid in the surface and subsurface layers, moderate in the upper and lower parts of the subsoil, and rapid in the layer between the upper and lower parts of the subsoil. The available water capacity and the organic matter content are low in the surface and subsurface layers and moderate to low in the subsoil. Natural fertility is very low.

3.4 Laboratory Soil Analysis

Selected soil samples recovered from the soil borings were analyzed for the percent soil fines passing the No. 200 sieve, natural moisture content, Atterberg Limits, and hydraulic conductivity. Samples selected for laboratory testing were collected at depths ranging from 0 to 10 feet bls. These tests were performed to confirm visual soil classification and evaluate their engineering properties. The complete laboratory report is provided in Section 5.3.

The laboratory tests indicate the tested soils consist of silty sand, clayey sand, very clayey sand, and sandy clay. The tested silty sand (SM) contains approximately 13 to 17 percent soil fines passing the No. 200 sieve with natural moisture contents of about 11 to 20 percent. The tested clayey sand (SC) contains approximately 20 to 28 percent soil fines passing the No. 200 sieve with natural moisture contents of about 13 to 18 percent. The tested very clayey sand (SC/CL) contains approximately 31 to 43 percent soil fines passing the No. 200 sieve with natural moisture contents of about 13 to 22 percent. The tested sandy clay (CH) contains approximately 67 percent soil fines passing the No. 200 sieve with a natural moisture content of about 30 percent.

Atterberg Limits tests indicate the tested very clayey sand (SC/CL) has a Liquid Limit (LL) value of 37, Plastic Limit (PL) value of 12, and Plasticity Index (PI) value of 25. This corresponds to a material with low potential ($LL < 50$ and $PI < 25$) for expansive behavior[3]. The tested sandy clay (CH) has a LL value of 53, PL value of 13, and PI value of 40. This corresponds to a material with marginal ($50 \leq LL \leq 60$ and $25 \leq PI \leq 35$) to high ($LL > 60$ and $PI > 35$) potential for expansive behavior.

The constant head hydraulic conductivity test results indicate the near-surface silty sand (SM) has hydraulic conductivity values of 0.7 to 2.2 feet per day.

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[3] U.S. Department of the Army USA, 1983, Foundations in Expansive Soils, TM 5-818-7, p. 4-1.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 General

The following recommendations are made based upon our understanding of the proposed construction, a review of the attached soil borings and laboratory test data, and experience with similar projects and subsurface conditions. If plans or the location of proposed construction changes from those discussed previously, GSE requests the opportunity to review and possibly amend our recommendations with respect to those changes.

The final design of a foundation system is dependent upon adequate integration of geotechnical and structural engineering considerations. Consequently, GSE must review the final foundation design in order to evaluate the effectiveness and applicability of our initial analyses, and to determine if additional recommendations may be warranted. Without such a review, the recommendations presented herein could be misinterpreted or misapplied resulting in potentially unacceptable performance of the foundation system.

The performance of site improvements may be sensitive to their post-construction relationship to site groundwater levels, seepage zones, or soil/rock characteristics exposed at final site grades. GSE recommends that use of boring information for final design of all site improvements be predicated on proper horizontal and vertical control of borings.

In this section of the report, we present our geotechnical parameters and recommendations to assist with building foundation, stormwater management, and pavement designs as well as our general site preparation guidelines.

4.2 Groundwater

The groundwater table was encountered in auger boring A-3 at a depth of 3.5 feet bls at the time of our exploration. However, you should expect the seasonal high groundwater table to be at a depth of approximately 1 feet bls after periods of heavy and seasonal rainfall.

4.3 Building Foundations

The soil borings near the proposed building footprint indicate the soils at the site are relatively consistent. The borings initially penetrated a 3 to 4.5 feet thick stratum of poorly graded sand and sand with silt (SP, SP-SM). This was underlain by clayey to very clayey sand (SC, SC/CL) to depths of 5 to 12.5 feet bls. This was underlain by clay-rich soils consisting of sandy clay, clay with sand, and clay (CL/CH, CH) to the explored depths of 20 feet bls. Laboratory tests conducted on the very clayey sand (SC/CL) indicate it has a low potential for expansive behavior. Laboratory tests conducted on the sandy clay (CH) indicate it is marginally to highly expansive; however, during most of the wet season these soils will be below the water table.

Based upon the soil conditions encountered and our limited understanding of the structural loads and site grading, we recommend the building be supported by conventional, shallow strip and/or spread foundations. We recommend the shallow foundations be designed for a maximum allowable gross bearing pressure of 3,000 psf. The gross bearing pressure is defined as the soil contact pressure that can be imposed from the maximum structural loads, weight of the concrete foundations, and weight of the soil above the foundations. The foundations should be designed based upon the maximum load that could be imposed by all loading conditions.

The foundations should be embedded a minimum of 18 inches below the lowest adjacent grade. Interior foundations or thickened sections should be embedded a minimum of 12 inches. The foundations should have minimum widths of 18 inches for strip footings, and 24 inches for columns, even though the maximum soil bearing pressure may not be fully developed.

Due to the mostly sandy nature of the majority of the near-surface soils, we expect settlement to be mostly elastic in nature. The majority of the settlement will occur on application of the loads, during and immediately following construction. Using the recommended maximum bearing pressure, the assumed maximum structural loads, and the field and laboratory test data which we have correlated into the strength and compressibility characteristics of the subsurface soils, we estimate the total settlements of the structure to be 1 inch or less, with approximately half of it occurring upon load application (during construction).

Differential settlement results from differences in applied bearing pressures and the variations in the compressibility characteristics of the subsurface soils. For the building pad prepared as recommended, we anticipate differential settlement of less than 1/2 inch.

Post-construction settlement of the structures will be influenced by several interrelated factors, such as (1) subsurface stratification and strength/compressibility characteristics of the bearing soils; (2) footing size, bearing level, applied loads, and resulting bearing pressures beneath the foundation; (3) site preparation and earthwork construction techniques used by the contractor, and (4) external factors, including but not limited to vibration from off-site sources and groundwater fluctuations beyond those normally anticipated for the naturally-occurring site and soil conditions which are present.

Our settlement estimates for the structure are based upon our limited understanding of the structural loads and site grading and the use of successful adherence to the site preparation recommendations presented later in this report. Any deviation from our project understanding and/or our site preparation recommendations could result in an increase in the estimated post-construction settlement of the structure.

4.4 Flexible Pavement

Overall soil conditions encountered by our borings at this site are suitable for supporting conventional limerock base and asphalt wearing surface pavements. We have not been provided the anticipated traffic loading conditions; therefore, the following pavement component recommendations should be used only as guidelines. The below recommendations are intended to be minimums. Increasing base course and asphalt thicknesses would increase the design life of the pavement.

We recommend a minimum separation of 24 inches be present between the bottom of the base course and the top of the clay-rich soils containing greater than about 25 percent soil fines. Review of the boring logs suggests this separation will likely be present along the majority of the alignment. A roadway grading plan is not available at this time. The presence of shallow clay-rich soils is expected to be sporadic and not easily predicted without a grading plan.

In areas where the minimum 24 inch separation is not able to be achieved through grading design, we recommend these soils be undercut. The undercut should extend a minimum of 24 inches beneath the bottom of the base course. The undercut should extend laterally until the clay-rich soils are no longer encountered and free-draining sandy soils have been penetrated. The undercut should be backfilled with either on-site or imported sandy free-draining soils containing less than 10 percent soil fines. The backfill should be placed in maximum 24-inch loose lifts that are compacted to a minimum 95 percent of the Modified Proctor maximum dry density (ASTM D1557).

The seasonal high groundwater table is estimated to be approximately 12 inches beneath existing grade at the site. We recommend a minimum of either 12 to 24 inches of separation (depending upon the pavement section design) be present between the bottom of the base course and the estimated seasonal high groundwater table. If this separation cannot be achieved by site grading, GSE recommends underdrains be used beneath the base course.

4.4.1 Stabilized Subgrade

If a crushed limerock or recycled concrete base is used, we recommend a stabilized subgrade be located beneath the base. The stabilized subgrade should have a minimum Limerock Bearing Ratio (LBR) of 40, with minimum thicknesses of 6 inches for automobile parking areas and 12 inches for driveways.

The stabilized subgrade can be imported material or a mixture of imported and on-site material. If a mix is proposed, a mix design should be performed to determine the optimum mix proportions. The stabilized subgrade should be compacted to a minimum of 98 percent of the Modified Proctor maximum dry density (ASTM D1557) for soils with less than 15 percent fines content. Soils with 15 percent or greater fines content should be compacted to 100 percent of the Standard Proctor maximum dry density (ASTM D698).

4.4.2 Base Course

The base course can consist of either crushed limerock, soil cement, or recycled concrete. If you should use a soil cement base course, a stabilized subgrade is not required.

Limerock should have a LBR of at least 100, be obtained from a FDOT approved source and meet FDOT gradation requirements. The base course thickness should be a minimum of 6 inches in automobile parking areas, and 8 inches in driveway areas. The base course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D1557). We recommend a minimum 24 inches separation between the bottom of the limerock base course and the estimated seasonal high-water table. If site grading does not allow for this separation, we recommend underdrains be considered.

Soil cement can consist of an imported material or a blend of the on-site soils and cement. A mix design should be performed to determine the optimum cement content. We recommend the soil cement have a minimum 28-day compressive strength of 500 psi. Soil cement can be blended off-site (in a pug mill) or on site. Soil cement pills should be cast from each day’s production to verify the recommended compressive strength has been achieved at 28 days. We recommend the soil cement base course be a minimum of 8 inches thick throughout the project. We recommend a minimum 18 inches separation between the bottom of the soil cement base course and the estimated seasonal high-water table. If site grading does not allow for this separation, we recommend underdrains be considered.

Recycled concrete should have an LBR of at least 150, be obtained from a FDOT approved source and meet FDOT gradation requirements. The base course thickness should be a minimum of 8 inches. The base course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (ASTM D1557). We recommend a minimum 12 inches separation between the bottom of the recycled concrete base course and the estimated seasonal high-water table. If site grading does not allow for this separation, we recommend underdrains be considered.

4.4.3 Wearing Surface

The asphalt-wearing surface should consist of an FDOT Type SP Hot Mix Asphalt mixture. For automobile parking areas, the thickness should be a minimum of 1.5 inches. For driveway areas, the thickness should be a minimum of 2 inches. The asphalt-wearing surface should consist of an SP-12.5 mix. The asphalt should be compacted to at least 95 percent of the mix design density.

The constructability of differing asphalt thicknesses may be difficult, and having a uniform 2-inch thick asphalt wearing surface may be more practical.

4.5 Rigid Pavement

Concrete pavement is a rigid pavement that results in smaller load transfers to the subgrade soils than flexible pavement. For concrete pavement subgrade, we recommend using the existing surficial sands or recommended clean sand (SP) fill, compacted to at least 98 percent of the Modified Proctor maximum dry density without additional stabilization with the following stipulations:

1. Subgrade soils must be compacted to at least 98 percent of Modified Proctor maximum dry density to a depth of at least 2 feet prior to placement of concrete.
2. The surface of the subgrade soils must be smooth and any disturbances or wheel rutting corrected prior to placement of the concrete.
3. The subgrade soils must be moistened prior to placement of concrete.
4. Concrete pavement thickness should be uniform throughout, with the exception of thickened edges (curb or footing).
5. The bottom of the pavement should be separated from the estimated seasonal high groundwater level by at least 18 inches.
6. Limerock or any other impermeable base is not suitable unless it meets the minimum recommended permeability of 10 feet/day.
7. The upper 12 inches of subgrade underlying the base course must also be “free-draining” and water that enters the base and subgrade must be allowed to seep out by gravity or if this is not possible, underdrains must be incorporated into the subgrade. A “bathtub” condition within the base/subgrade must be avoided.

Our recommendations for slab thickness for both light-duty and heavy-duty concrete pavements is based on a.) subgrade soils are compacted to 98 percent of the Modified Proctor maximum dry density, b.) modulus of subgrade reaction (k) of 200 pounds per cubic inch, c.) a 20-year design life, and d.) previously stated design parameters. For an anticipated light-duty traffic group, a minimum pavement thickness of 5.5 inches is recommended, using Table 2.4 from the ACI 330 Guide for Design and Construction of Concrete Parking Lots, ACI 330R-01. For an anticipated heavy-duty traffic group, a minimum pavement thickness of 8 inches is recommended, using Table 3.4 from the FDOT *Rigid Pavement Design Manual*, January 2019.

We recommend using concrete with a minimum 28-day compressive strength of 4,000 pounds per square inch and a minimum 28-day flexural strength (modulus of rupture) of at least 600 pounds per square inch based on the third point loading of concrete beam test samples. Maximum control joint spacing of 12.5 by 12.5 feet is suggested for light-duty concrete pavements. Maximum control joint spacing of 15 by 15 feet is suggested for heavy-duty concrete pavements. Layout of sawcut control joints should form square panels, and the depth of sawcut joint should be at least 1/4 of the concrete slab thickness. The joints should be sawed within six hours of concrete placement or as soon as the concrete has developed sufficient strength to support workers and equipment.

For further details on concrete pavement construction, refer to "Guide to Jointing Non-reinforced Concrete Pavements" published by the Florida Concrete and Products Associates, Inc. and "Building Quality Concrete Parking Areas", published by the Portland Cement Association.

4.6 Site Preparation

The soils at this site should be suitable for supporting the proposed construction using normal, good practice site preparation procedures. The following recommendations are our general guidelines for site preparation.

4.6.1 Stripping

Strip the construction limits and 10 feet beyond the perimeter of all grass, roots, topsoil, and other deleterious materials. You should expect to strip to depths of 12 or more inches. Deeper stripping will likely be necessary due to major root systems present at the site.

4.6.2 Dewatering

Temporary dewatering may be necessary for this project. If needed, we anticipate dewatering can be accomplished with sumps placed near the construction area, or with underdrains connected to a vacuum pump.

In any case, the site should always be graded to promote runoff and limit the amount of ponding. Localized ponding of stormwater is expected without proper grading during construction, and could render previously acceptable surfaces unacceptable.

4.6.3 Proof-Rolling

Proof-roll the subgrade with heavy rubber-tired equipment, such as a loaded front-end loader or dump truck, to identify any loose or soft zones not found by the soil borings. The proof-rolling should be monitored by a geotechnical engineer or qualified technician. Undercut or otherwise treat these zones as recommended by the geotechnical engineer in this report.

4.6.4 Proof Compaction

Compact the subgrade to a density of at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557). The specified compaction should be obtained to a depth of 1 foot below the foundation bottoms and the existing grade prior to placing fill. Vibratory roller equipment should not be used within approximately 100 feet of existing structures. Lighter "walk-behind" compaction equipment may be used to achieve the degree of compaction.

Should clayey sand be encountered at the bearing surface, this material should be probed and visually confirmed to be unyielding in the upper 12 inches in lieu of density testing. If the foundation excavations penetrate the clayey sand, the excavation should be performed in a manner that reduces soil disturbance. Clayey sand soils (with fines content in excess of 15 percent) that are removed and replaced or appreciably disturbed need to be re-compacted to 98 percent of the Standard Proctor maximum dry density (ASTM D698).

4.6.5 Fill Placement

Imported fill placed to raise the site grades should consist of clean sand having less than 10 percent passing the No. 200 sieve. On-site soils meeting the requirements of Section 4.10 may also be used as structural fill. The fill should be placed in maximum 12-inch loose lifts that are compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D1557). If lighter “walk-behind” compaction equipment is used, this may require lifts of 4 inches or less to achieve the required degree of compaction.

4.7 Quality Control and Construction Materials Testing

It should be noted that the geotechnical engineering design does not end with the advertisement of the construction documents. As the geotechnical engineer of record, GSE is the most qualified to perform the construction materials testing that will be required for this project. The benefits of having the geotechnical engineer of record also perform the construction materials testing are numerous. If GSE continues to be involved with the project through construction, we will be able to constantly re-evaluate and possibly alter our geotechnical recommendations in a timely and cost-effective manner once final design and construction techniques are developed. This often results in cost savings for the project.

We recommend performing compaction testing beneath the concrete floor slab and the building foundations. We recommend one test be performed every 50 linear feet of continuous footing and every other column footing, per foot depth of fill or native material. We recommend a compaction test be performed for each 2,500 square feet of floor area or 10,000 square feet of pavement area per foot of fill or native material, or a minimum of three tests each, whichever is greater. Test all footing excavations to a depth of 12 inches at the frequencies stated above.

4.8 Stormwater Management

The soil conditions at the stormwater management facility are relatively consistent; initially penetrating 1.5 to 5.5 feet of sand with silt, silty sand, and silty clayey sand (SP-SM, SM, SC/SM) overlying clayey to very clayey sand (SC, SC/CL) to depths of 5 to 6 feet bls. This was underlain by clay-rich soils consisting of clay with sand and clay (CL/CH) to the explored depths of 15 feet bls.

The water table was not encountered in the auger borings at the time of our exploration. We anticipate the seasonal high groundwater table to be at a depth of approximately 1 feet bls.

The laboratory permeability tests indicate the surficial layer of silty sand has hydraulic conductivity values of 0.7 to 2.2 feet per day. The underlying very clayey sand, clay with sand, and clay are expected to be confining soils.

Based upon our findings and test results, our recommended soil parameters for the stormwater management design in the explored areas are presented below. The recommended parameters consider the results of the permeability tests, wash 200 determinations, and our experience with these types of soils. The parameters below do not consider a factor of safety.

1. Base elevation of effective or mobilized aquifer (average depth of confining layer) equal to 7 feet bls.
2. Unsaturated vertical infiltration rate of 3.2 feet per day.
3. Horizontal hydraulic conductivity equal to 4.8 feet per day.
4. Specific yield (fillable porosity) of 20 percent.
5. Average seasonal high groundwater table depth equal to 1 feet bls.
6. Average seasonal low groundwater table depth equal to 6 feet bls.

4.9 Fill Suitability

The soils encountered at this site within the explored depths range from sands (SP) to clays (CL/CH). A discussion of the suitability for reuse as structural fill for each soil classification according to the Unified Soil Classification System (USCS) designation is provided below.

SP, SP-SM – Sands (SP) and sand with silt (SP-SM) have less than 5 percent and 12 percent soil fines passing the No. 200 sieve, respectively, and are typically well draining soils that are suitable for reuse as structural fill. The sands with silt may require moisture conditioning (drying) to make the material more workable. These soils will require stockpiling and drying before they are reused if they are excavated from below the water table.

SM – Silty sands (SM) can have between 12 percent and 50 percent soil fines passing the No. 200 sieve. Silty sands are typically non-plastic or have low plasticity, and can be reused as structural fill with precautions. Silty sands can be moisture sensitive and difficult to work and compact and can rut if the moisture content is near or above the optimum moisture content. We recommend these soils be moisture conditioned (dried) so that the moisture content during use is at or below the optimum moisture content. Aerating and exposure to the sun is typically the most effective methods of drying these soils. It may not be practical to reuse these materials during the wet season, as frequent rain showers may not allow these soils to dry to a workable moisture content. Suitable silty sands are limited to soil having less than 30 percent soil fines passing the No. 200 sieve. Silty sands with more than 30 percent soil fines are especially moisture sensitive, and are not recommended for reuse as structural fill. These soils will behave more as sandy silt, and for this reason, very silty sands having more than 30 percent soil fines passing the No. 200 sieve have been assigned a dual classification of SM/ML. Silty sand soils that are excavated from below the water table are not recommended for reuse as structural fill due to the amount of time that will be required to dry these soils to a workable condition.

SC – Clayey sand (SC) soils can have between 12 percent and 50 percent soil fines passing the No. 200 sieve. Clayey sands can have a high range of plasticity, varying from a PI of 7 or greater and plotting above the A-line to highly plastic. Friable clayey sands are typically suitable for use as structural fill with precautions. Clayey sands will be moisture sensitive and difficult to work and compact and can rut during placement if the moisture content is near or above the natural moisture content. We recommend these soils be moisture conditioned (dried) so that the moisture content during use is at or below the optimum moisture content. Aerating and exposure to the sun is typically the most effective methods of drying these soils. It may not be practical to reuse these materials during the wet season, as frequent rain showers may not allow these soils to dry to a workable moisture content. Suitable clayey sands are limited to soil having less than 30 percent soil fines passing the No. 200 sieve. Clayey sands with more than 30 percent soil fines passing the No. 200 sieve are especially moisture sensitive and are typically highly plastic, and are not recommended for reuse as structural fill. These soils will behave more as sandy clay, and for this reason, very clayey sands having more than 30 percent soil fines passing the No. 200 sieve have been assigned a dual classification of SC/CH or SC/CL. Clayey sand soils that are excavated from below the water table are not recommended for reuse as structural fill due to the amount of time that will be required to dry these soils to a workable condition.

ML, MH, CL, CH – Silts and clays are not suitable materials for reuse as structural fill.

When using on-site soils as fill materials, we recommend the silty and clayey sand soils (SM, SC) be used in the lower depths of the fill. Sand and sand with silt (SP, SP-SM) should be used in the upper portions of the fill. We recommend a minimum of 2 feet of sand (SP, SP-SM) cover the silty and clayey sand fill materials to reduce the potential for soggy surface conditions due to the low permeability characteristics of the silty and clayey sand materials.

4.10 Surface Water Control and Landscaping

Roof gutters should be considered to divert runoff away from the building. The gutter downspouts should discharge a minimum of 10 feet from the structure to reduce the amount of water collecting around the foundations. Where possible, the gutter downspouts should discharge directly into the storm sewer system or onto the asphalt paved areas in order to reduce the amount of water collecting around the foundations. Grading of the site should be such that water is diverted away from the building on all sides to reduce the potential for erosion and water infiltration along the foundation.

With respect to landscaping, it is recommended that existing and planted trees and large “tree-like” shrubbery with potential for developing large root systems be planted a minimum distance of half their mature height, and preferably their expected final height, away from the structure. The purpose of this is to reduce the potential for foundation or slab movements from the growth of root systems as the landscaping matures. Consideration should also be given to using landscaping that has a low water demand, so that excessive irrigation is not conducted around the structures.

If excavations for underground utilities encounter the clay-rich soils, the excavations should be made such that they do not trap water (i.e. "swimming pool" or "bowl" effect). Sloping the excavations, installing underdrains, or extending the excavation to a more pervious area can achieve this. Allowing surface water to become trapped within utility trenches or other excavations (including footings) serves as a potential water source for the clay, which can result in shrink swell of these soils. Furthermore, during construction, surface water within the building areas must be controlled such that the water does not become trapped and represent a source of water for the underlying clay-rich soils. Mismanagement of the surface water during construction within the building footprint could result in subsequent post-construction slab movement.

The above recommendations are intended to maintain relatively consistent moisture contents within the clay-rich expansive soils encountered by the borings. The importance of proper surface water control and landscaping placement cannot be overemphasized in accomplishing this objective.

5.0 FIELD DATA

5.1 Auger Boring Logs

GSE Engineering & Consulting, Inc.
GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida

BORING NUMBER A-1

DATE PERFORMED 11/14/2023
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
LOGGED BY WDI
▼ AT TIME OF DRILLING NE
CHECKED BY KPF
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0		AU 1	(SP-SM) Gray SAND with silt
1			▽
2			
3			3.5
		AU 2	(SP) Pale brown SAND
4			
5			5.0
			Bottom of borehole at 5.0 feet.

BORING NUMBER A-2

DATE PERFORMED 11/14/2023
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
LOGGED BY WDI
▼ AT TIME OF DRILLING NE
CHECKED BY KPF
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0		AU 1	(SP) Pale brown SAND
1			▽
2			
3			3.0
		AU 2	(SP-SC) Brown, gray, and orange SAND with clay
4			
5			5.0
			Bottom of borehole at 5.0 feet.

(Continued Next Page)

GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida

DATE PERFORMED 11/14/2023 **BORING NUMBER A-3**
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
LOGGED BY WDI
▼ AT TIME OF DRILLING 3.5 ft
CHECKED BY KPF
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0	░	AU 1	(SP-SM) Brown SAND with silt
1			▽
2			
3			▼
4	▨	AU 2	4.0 (SP-SC) Brown, gray, and orange SAND with clay
5			5.0 Bottom of borehole at 5.0 feet.

DATE PERFORMED 11/14/2023 **BORING NUMBER A-4**
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
LOGGED BY WDI
▼ AT TIME OF DRILLING NE
CHECKED BY KPF
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0	░	AU 1	(SP) Pale brown SAND
1			▽
2			
3	▨		3.5 (SC) Gray clayey SAND
4		AU 2	*%PASS - 200 = 28* *MC = 18*
5			5.0 Bottom of borehole at 5.0 feet.

GSE Engineering & Consulting, Inc.

GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida

DATE PERFORMED 11/14/2023 **BORING NUMBER P-1**
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS: LOGGED BY WDI
▼ AT TIME OF DRILLING NE CHECKED BY KPF
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0.0	AU 1 PS	(SM) Dark gray silty SAND ▽ *%PASS - 200 = 13* *MC = 20* *k_h 1.2 $^{ft}/_{day}$*
2.5	AU 2	(CL/CH) Gray, brown, and orange CLAY with sand
7.0	AU 3 AU 4	(CL/CH) Green CLAY
15.0		Bottom of borehole at 15.0 feet.

DATE PERFORMED 11/14/2023 **BORING NUMBER P-2**
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS: LOGGED BY WDI
▼ AT TIME OF DRILLING NE CHECKED BY KPF
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0.0	AU 1 PS	(SM) Gray and brown silty SAND ▽ *%PASS - 200 = 17* *MC = 11* *k_h 0.7 $^{ft}/_{day}$*
3.0	AU 2	(SC) Gray clayey SAND
6.0	AU 3	(CL/CH) Gray and green CLAY
12.0	AU 4	(CL/CH) Green CLAY
15.0		Bottom of borehole at 15.0 feet.

(Continued Next Page)

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida

BORING NUMBER P-3

DATE PERFORMED 11/14/2023
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
LOGGED BY WDI
CHECKED BY KPF
▼ AT TIME OF DRILLING NE
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0.0			(SM) Dark gray silty SAND
			▽
		AU 1 PS	*%PASS - 200 = 15* *MC = 13* *k_h 2.2 $^{ft}/_{day}$*
3.0		AU 2	(SC/SM) Gray and brown silty clayey SAND
5.5			(CL/CH) Gray, green, and orange CLAY
		AU 3	
13.0		AU 4	(CL/CH) Green and orange CLAY
15.0			Bottom of borehole at 15.0 feet.

BORING NUMBER P-4

DATE PERFORMED 11/14/2023
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
LOGGED BY WDI
CHECKED BY KPF
▼ AT TIME OF DRILLING NE
▽ ESTIMATED SEASONAL HIGH 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE NUMBER	MATERIAL DESCRIPTION
0.0		AU 1	(SP-SM) Brown SAND with silt
			▽
1.5			(SC/CL) Brown, gray, and orange very clayey SAND
		AU 2	
5.0			(CL/CH) Green CLAY
		AU 3	
12.5			(CL/CH) Green and orange CLAY
		AU 4	
15.0			Bottom of borehole at 15.0 feet.

5.2 Standard Penetration Test Soil Boring Logs

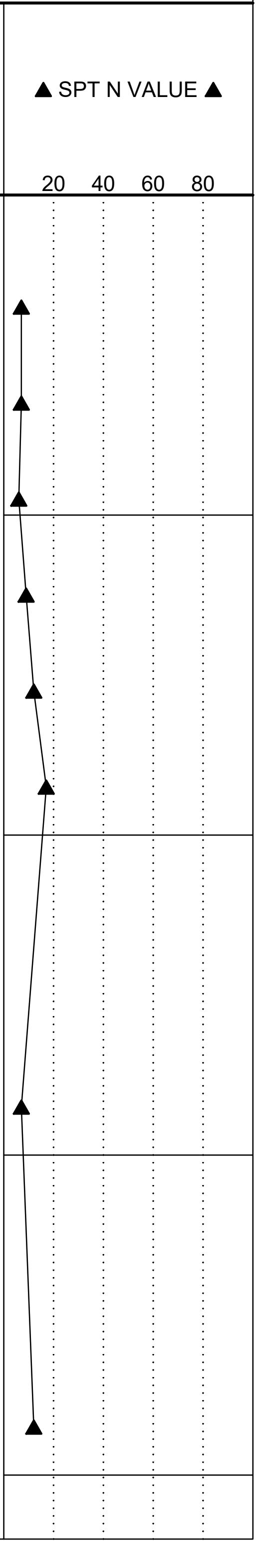
GSE
Engineering & Consulting, Inc.

GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

BORING NUMBER B-1

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida
DATE STARTED 11/14/23 **COMPLETED** 11/14/23
GROUND ELEVATION **HOLE SIZE**
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Flight Auger
▼ **AT TIME OF DRILLING** NE
LOGGED BY WDI **CHECKED BY** KPF
▽ **ESTIMATED SEASONAL HIGH** 1.0 ft
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0		(SP) Loose gray SAND ▽								
				SPT 1	3-4-3 (7)					
		(SC) Loose gray, brown, and orange clayey SAND	3	SPT 2	3-3-4 (7)					
				SPT 3	3-3-3 (6)					
5		(CH) Firm to stiff gray sandy CLAY	5	SPT 4	3-4-5 (9)	53	13	40	67	30
		(CL/CH) Stiff gray and green CLAY	6.5	SPT 5	3-5-7 (12)					
		(CL/CH) Firm to very stiff green and orange CLAY	7.5	SPT 6	6-7-10 (17)					
10										
15				SPT 7	2-3-4 (7)					
20		(CL/CH) Stiff green and orange CLAY with sand	18.5	SPT 8	3-5-7 (12)					
		Bottom of borehole at 20.0 feet.	20							



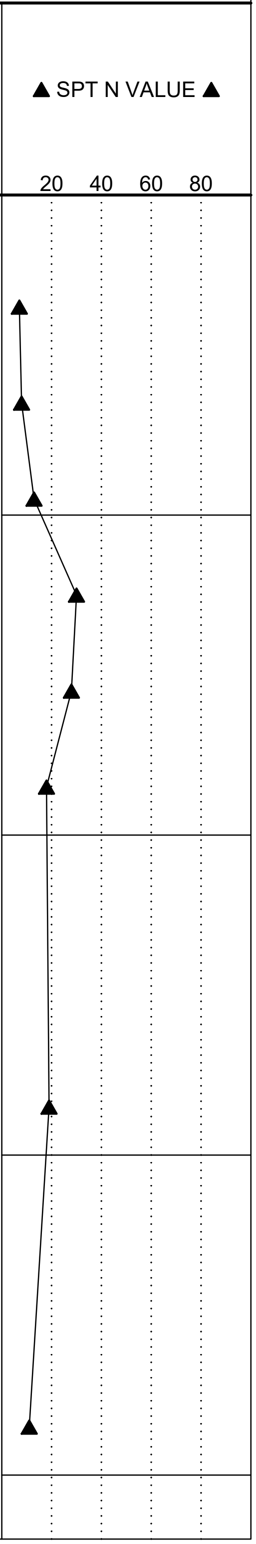
GSE Engineering & Consulting, Inc.

GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

BORING NUMBER B-2

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida
DATE STARTED 11/14/23 **COMPLETED** 11/14/23
GROUND ELEVATION
HOLE SIZE
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Flight Auger
▼ **AT TIME OF DRILLING** NE
LOGGED BY WDI **CHECKED BY** KPF
▽ **ESTIMATED SEASONAL HIGH** 1.0 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0	(SP) Loose to medium dense brown SAND ▽								
			SPT 1	3-3-4 (7)					
			SPT 2	3-4-4 (8)					
		4.5	SPT 3	6-6-7 (13)					
5	(SC) Medium dense brown, gray, and orange clayey SAND								
			SPT 4	11-16-14 (30)					
		8	SPT 5	12-13-15 (28)					
	(SC/CL) Medium dense brown, gray, and orange very clayey SAND								
			SPT 6	5-7-11 (18)				31	13
10		12.5							
	(CL/CH) Stiff to very stiff green and orange CLAY								
			SPT 7	5-8-11 (19)					
15									
20		20	SPT 8	3-5-6 (11)					
	Bottom of borehole at 20.0 feet.								



GSE Engineering & Consulting, Inc.
GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

BORING NUMBER B-3

CLIENT Concept Development, Inc.

PROJECT NAME Dollar General - Lake City Winfield

PROJECT NUMBER 16317

PROJECT LOCATION Lake City, Columbia County, Florida

DATE STARTED 11/14/23 **COMPLETED** 11/14/23

GROUND ELEVATION

HOLE SIZE

DRILLING CONTRACTOR Whitaker Drilling, Inc.

GROUND WATER LEVELS:

DRILLING METHOD Flight Auger

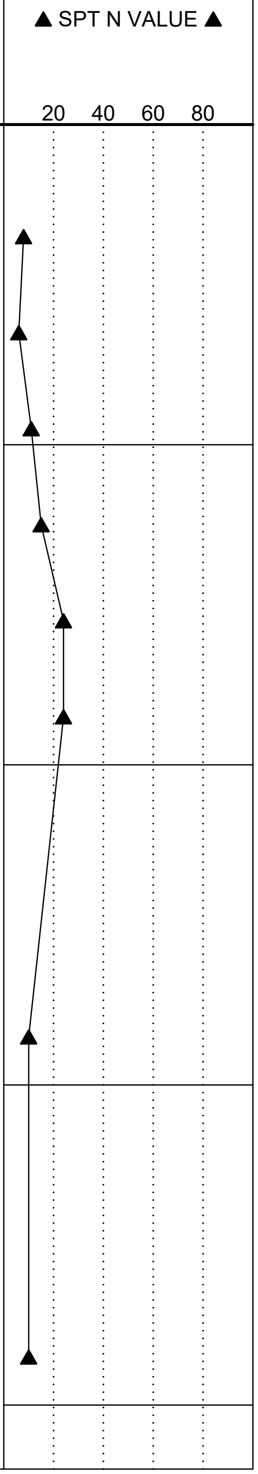
▼ **AT TIME OF DRILLING** NE

LOGGED BY WDI **CHECKED BY** KPF

∇ **ESTIMATED SEASONAL HIGH** 1.0 ft

NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0		(SP-SM) Loose gray SAND with silt ∇	1.5							
		(SP) Loose pale brown and orange SAND	3	SPT 1	2-4-4 (8)					
		(SC/CL) Loose to medium dense gray and orange very clayey SAND		SPT 2	2-3-3 (6)					
5			5.5	SPT 3	3-5-6 (11)	37	12	25	43	22
		(CL/CH) Stiff to very stiff gray and brown CLAY with sand and lenses of green clay	7.5	SPT 4	6-8-7 (15)					
		(CL/CH) Very stiff green and orange CLAY with lenses of brown sand	9.5	SPT 5	7-12-12 (24)					
10		(CL/CH) Stiff to very stiff green and gray CLAY		SPT 6	11-12-12 (24)					
15			16	SPT 7	3-4-6 (10)					
		(CL/CH) Stiff green and orange CLAY	20	SPT 8	3-4-6 (10)					
20		Bottom of borehole at 20.0 feet.								



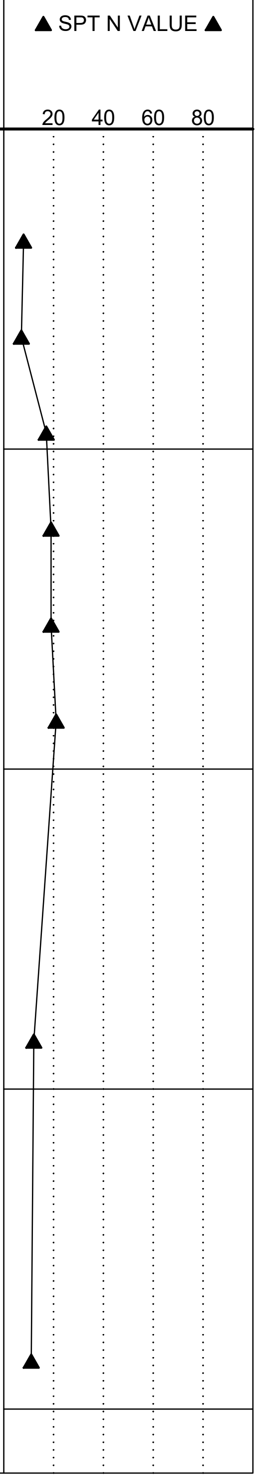
GSE
Engineering & Consulting, Inc.

GSE Engineering
5590 SW 64th St
Gainesville, FL 32608
Telephone: 3523773233

BORING NUMBER B-4

CLIENT Concept Development, Inc.
PROJECT NAME Dollar General - Lake City Winfield
PROJECT NUMBER 16317
PROJECT LOCATION Lake City, Columbia County, Florida
DATE STARTED 11/14/23 **COMPLETED** 11/14/23
GROUND ELEVATION
HOLE SIZE
DRILLING CONTRACTOR Whitaker Drilling, Inc.
GROUND WATER LEVELS:
DRILLING METHOD Flight Auger
▼ **AT TIME OF DRILLING** NE
LOGGED BY WDI **CHECKED BY** KPF
▽ **ESTIMATED SEASONAL HIGH** 1.0 ft
NOTES

DEPTH (ft)	MATERIAL DESCRIPTION	CONTACT DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	LIQUID LIMIT, %	PLASTIC LIMIT, %	PLASTICITY INDEX	PERCENT PASS NO. 200 SIEVE	MOISTURE CONTENT, %
0	(SP) Loose to medium dense brown SAND ▽								
			SPT 1	3-3-5 (8)					
			SPT 2	4-4-3 (7)					
5	(SC) Medium dense brown, gray, and orange clayey SAND	4.5	SPT 3	3-7-10 (17)					
			SPT 4	7-9-10 (19)				20	13
	(CL/CH) Very stiff gray and brown CLAY with sand	7.5	SPT 5	7-8-11 (19)					
10			SPT 6	10-11-10 (21)					
	(CL/CH) Stiff green CLAY	12.5							
15			SPT 7	4-5-7 (12)					
20		20	SPT 8	4-5-6 (11)					
	Bottom of borehole at 20.0 feet.								



5.3 Laboratory Results

GSE Engineering & Consulting, Inc.

SUMMARY REPORT OF LABORATORY TEST RESULTS

Project Number: 16317

Project Name: Dollar General - Lake City Winfield

Boring Number	Depth (ft)	Soil Description	Natural Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Percent Passing No. 200 Sieve	Organic Content (%)	Hydraulic Conductivity (ft/day)	Unified Soil Classification
P-1	0-2	Dark gray silty SAND	20				13		1.2	SM
P-2	1-3	Gray and brown silty SAND	11				17		0.7	SM
P-3	1-3	Dark gray silty SAND	13				15		2.2	SM
B-1	5.5-7	Firm to stiff gray sandy CLAY	30	53	13	40	67			CH
B-2	8.5-10	Medium dense brown, gray, and orange very clayey SAND	13				31			SC/CL
B-3	4-5.5	Loose to medium dense gray and orange very clayey SAND	22	37	12	25	43			SC/CL
B-4	5.5-7	Medium dense brown, gray, and orange clayey SAND	13				20			SC
A-4	4-4.5	Gray clayey SAND	18				28			SC

5.4 Key to Soil Classification

KEY TO SOIL CLASSIFICATION CHART

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests				SYMBOLS		GROUP NAME
				GRAPHIC	LETTER	
COARSE-GRAINED SOILS	Gravels	Clean Gravels	Cu ≥ 4 and 1 ≤ Cc ≤ 3	▨	**GW**	Well graded GRAVEL
More than 50% retained on No. 200 sieve	More than 50% of coarse fraction retained on No. 4 sieve	Less than 5% fines	Cu < 4 and/or 1 > Cc > 3	▨	**GP**	Poorly graded GRAVEL
		Gravels with fines	Fines classify as ML or MH	▨	**GM**	Silty GRAVEL
		More than 12% fines	Fines classify as CL or CH	▨	**GC**	Clayey GRAVEL
	Sands	Clean Sands	Cu ≥ 6 and 1 ≤ Cc ≤ 3	▨	**SW**	Well graded SAND
	50% or more of coarse fraction passes No. 4 sieve	Less than 5% fines	Cu < 6 and/or 1 > Cc > 3	▨	**SP**	Poorly graded SAND
		Sand with fines	Fines classify as ML or MH	▨	**SP-SM**	SAND with silt
		5% ≤ fines < 12%	Fines classify as CL or CH	▨	**SP-SC**	SAND with clay
		Sand with fines	Fines classify as ML or MH	▨	**SM**	Silty SAND
		12% ≤ fines < 30%	Fines classify as CL or CH	▨	**SC**	Clayey SAND
		Sand with fines	Fines classify as ML or MH	▨	**SM**	Very silty SAND
		30% fines or more	Fines classify as CL or CH	▨	**SC**	Very clayey SAND
FINE-GRAINED SOILS	Clays	inorganic	50% ≤ fines < 70%	▨	**CL/CH**	Sandy CLAY
50% or more passes the No. 200 sieve			70% ≤ fines < 85%	▨	**CL/CH**	CLAY with sand
			fines ≥ 85%	▨	**CL/CH**	CLAY
	Silts and Clays	inorganic	PI > 7 and plots on/above "A" line	▨	**CL**	Lean CLAY
	Liquid Limit less than 50		PI < 4 or plots below "A" line	▨	**ML**	SILT
		organic	$\frac{\text{Liquid Limit - oven dried}}{\text{Liquid Limit - not dried}} < 0.75$	▨	**OL**	Organic clay Organic silt
	Silts and Clays	inorganic	PI plots on or above "A" line	▨	**CH**	Fat CLAY
	Liquid Limit 50 or more		PI plots below "A" line	▨	**MH**	Elastic SILT
		organic	$\frac{\text{Liquid Limit - oven dried}}{\text{Liquid Limit - not dried}} < 0.75$	▨	**OH**	Organic clay Organic silt
HIGHLY ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor			▨	**PT**	PEAT

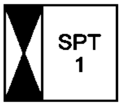
CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	No. OF BLOWS, N	RELATIVE DENSITY
	0 - 4	Very Loose
	5 - 10	Loose
SANDS:	11 - 30	Medium dense
	31 - 50	Dense
	OVER 50	Very Dense

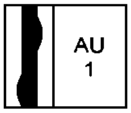
	No. OF BLOWS, N	CONSISTENCY
	0 - 2	Very Soft
SILTS & CLAYS:	3 - 4	Soft
	5 - 8	Firm
	9 - 15	Stiff
	16 - 30	Very Stiff
	31 - 50	Hard
	OVER 50	Very Hard

	No. OF BLOWS, N	RELATIVE DENSITY
	0 - 8	Very Soft
	9 - 18	Soft
LIMESTONE:	19 - 32	Moderately Hard
	33 - 50	Hard
	OVER 50	Very Hard

SAMPLE GRAPHIC TYPE LEGEND



Location of SPT Sample



Location of Auger Sample

PARTICLE SIZE IDENTIFICATION

BOULDERS:		Greater than 300 mm
COBBLES:		75 mm to 300 mm
GRAVEL:	Coarse -	19.0 mm to 75 mm
	Fine -	4.75 mm to 19.0 mm
SANDS:	Coarse -	2.00 mm to 4.75 mm
	Medium -	0.425 mm to 2.00 mm
	Fine -	0.075 mm to 0.425 mm
SILTS & CLAYS:		Less than 0.075 mm

LABORATORY TEST LEGEND

LL = Liquid Limit, %

PL = Plastic Limit, %

PI = Plasticity Index, %

% PASS - 200 = Percent Passing the No. 200 Sieve

MC = Moisture Content, %

ORG = Organic Content, %

k_h = Horizontal Hydraulic Conductivity, ft/day

6.0 LIMITATIONS

6.1 Warranty

This report has been prepared for our client for their exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

6.2 Auger and SPT Borings

The determination of soil type and conditions was performed from the ground surface to the maximum depth of the borings, only. Any changes in subsurface conditions that occur between or below the borings would not have been detected or reflected in this report.

Soil classifications that were made in the field are based upon identifiable textural changes, color changes, changes in composition or changes in resistance to penetration in the intervals from which the samples were collected. Abrupt changes in soil type, as reflected in boring logs and/or cross sections may not actually occur, but instead, be transitional.

Depth to the water table is based upon observations made during the performance of the auger and SPT borings. This depth is an estimate and does not reflect the annual variations that would be expected in this area due to fluctuations in rainfall and rates of evapotranspiration.

6.3 Site Figures

The measurements used for the preparation of the figures in this report were made using the provided site plan and by estimating distances from existing structures and site features. Figures in this report were not prepared by a licensed land surveyor and should not be interpreted as such.

6.4 Unanticipated Soil Conditions

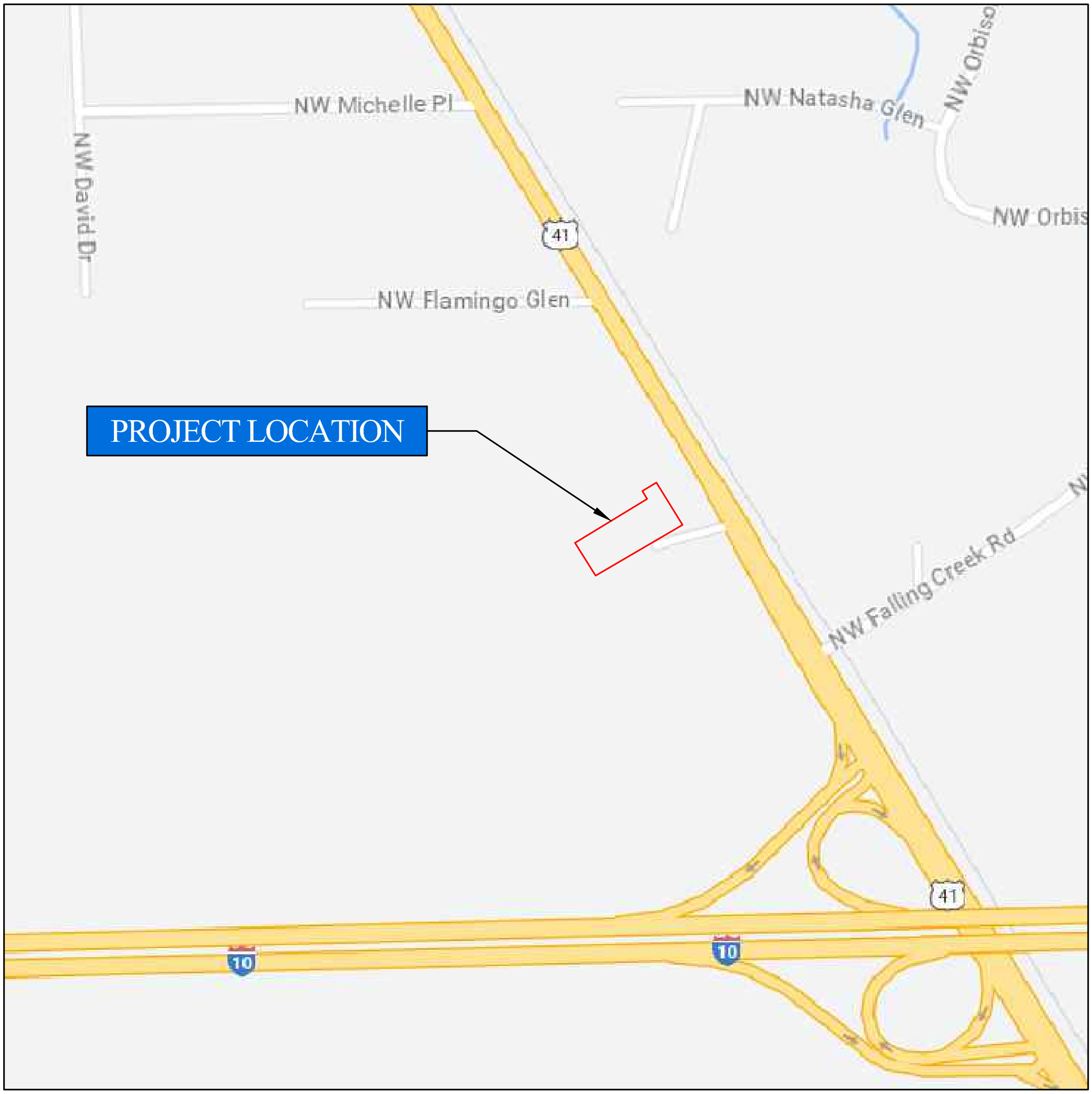
The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on Figure 2. This report does not reflect any variations that may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

6.5 Misinterpretation of Soil Engineering Report

GSE Engineering & Consulting, Inc. is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If others make the conclusions or recommendations based upon the data presented, those conclusions or recommendations are not the responsibility of GSE.

FIGURES



NORTH

NOT TO SCALE

PROJECT SITE LOCATION MAP

DOLLAR GENERAL - LAKE CITY WINFIELD
LAKE CITY, COLUMBIA COUNTY, FLORIDA
GSE PROJECT NO. 16317

DESIGNED BY : KPF
CHECKED BY : JEG
DRAWN BY : EEW

GSE Engineering & Consulting, Inc.

FIGURE

1

LEGEND:

⊕ SPT BORING

⊕ AUGER BORING

NORTH

0 80'

SCALE: 1" = 80' APPROX.

DOLLAR GENERAL - LAKE CITY WINFIELD
LAKE CITY, COLUMBIA COUNTY, FLORIDA
GSE PROJECT NO. 16317

SITE PLAN SHOWING APPROXIMATE LOCATIONS OF FIELD TESTS

DESIGNED BY: KPF
CHECKED BY : JEG
DRAWN BY : EEW

GSE
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FIGURE
2