Stormwater Management Narrative

Project:

FKC Clermont Clinic @ Groveland Shoppes
NWQ SR 50 and CR 565A
Groveland, Lake County, Florida

Prepared for:

St. Johns River Water Management District

Prepared by:

FORESITE group

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Date: 6/2/2016

FG Project No. 865.001

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PART 1: NARRATIVE

Project Description

The existing project site is currently an undeveloped 1.14 acre lot (Lot 4C) of the Groveland Shoppes master development. The proposed improvements to the project site are the construction of a 7,104 square foot dialysis clinic known as FKC Clermont Clinic and the associated parking, utility, and stormwater infrastructure improvements.

SJRWMD Permit History

The subject parcel was originally permitted as a portion of an existing master drainage permit known as Groveland Shoppes (SJRWMD permit number 112078-1). Under the master permit, the subject parcel is included in Basin 2 with water quality and treatment provided in Pond 2. The master permit accounted for 5.06 acres of impervious area within Basin 2, which is based on an assumed 80% impervious surface ratio for each lot within the basin. The master permit has been subsequently modified as follows:

Project Name	SJRWMD Permit Number	Impervious Area (acres)
Hess	112078-2	1.25
Walgreens	112078-3	1.48
Dollar General	112078-4	0.76
Total Permitted Impervious Area for Basin 2		***3.49***

Therefore, the remaining impervious area for Basin 2 = 1.57 acres.

Proposed Condition

Cover Type	Area (acres)	%
Impervious Area (Pavement/Curbing, Building and Sidewalks)	0.74	65
Pervious Area (Grass / Landscaping)	0.40	35
Total	***1.14***	***100***

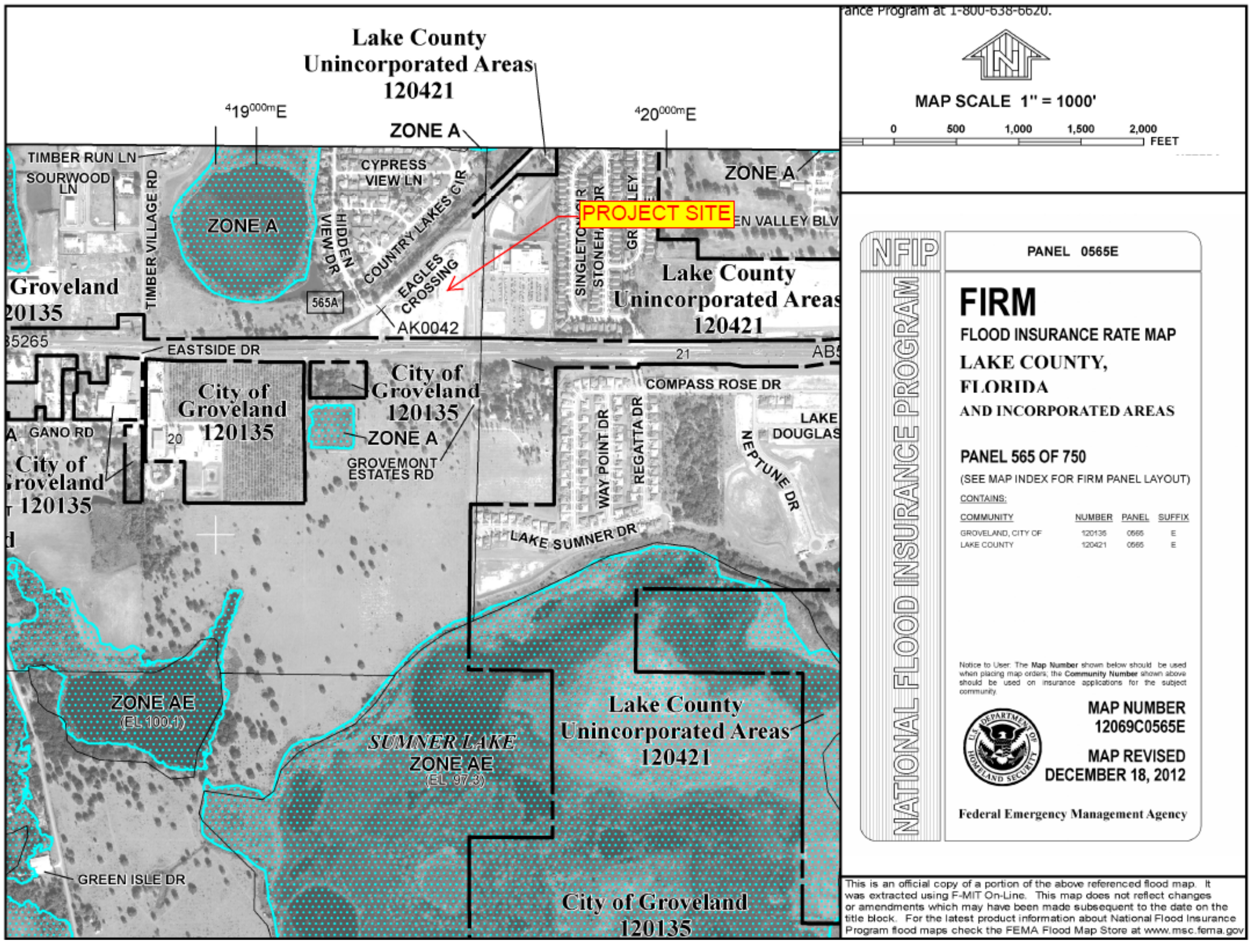
The table above demonstrates that the proposed impervious area for the subject project does not exceed the maximum allowable 80% impervious surface ratio, nor does it exceed the remaining allowable impervious area for Basin 2.

Therefore, it can reasonably be concluded that the proposed improvements will have no negative impact to the existing, permitted receiving waters.

PART 2: EXHIBITS

AERIAL LOCATION MAP

FEMA FLOOD MAP



NOTE: PROJECT IS LOCATED WITHIN FLOOD ZONE X (UNSHADED), WHICH ARE AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE (500-YEAR) FLOODPLAIN

LAKE COUNTY WEB SOIL SURVEY

Hydrologic Soil Group—Lake County Area, Florida

Natural Resources Conservation Service | Web Soil Survey National Cooperative Soil Survey | 6/2/2016 Page 1 of 4

Hydrologic Soil Group— Summary by Map Unit — Lake County Area, Florida (FL607)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Candler sand, 0 to 5 percent slopes	A	1.7	100.0%
Totals for Area of Interest			**1.7**	**100.0%**

PART 3: APPENDIX

Geotechnical Engineering Report

Groveland Shoppes North
County Road 565A and Broad Street
Groveland, Lake County, Florida

April 27, 2016
Terracon Project No. H1165093

Prepared for:
MGB Development Group
Dallas, Texas

Prepared by:
Terracon Consultants, Inc.
Winter Park, Florida

April 27, 2016

MGB Development Group
3010 LBJ Freeway, Suite 1400
Dallas, Texas 75234

Attn: Ms. Diana Zike
P: 214.369.3939 Ex. 100
E: DZike@mgbusa.com

Re: Geotechnical Engineering Report
Groveland Shoppes North
County Road 565A and Broad Street
Groveland, Lake County, Florida
Terracon Project Number: H1165093

Dear Ms. Zike:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project in Groveland, Florida. This study was performed in general accordance with Terracon proposal number PH1165093, dated March 9, 2016.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, the design and construction of foundations and pavements, and geotechnical considerations for the proposed project.

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

Sincerely,
Terracon Consultants, Inc.
Certificate of Authorization Number 8830

Lacey C. Thompson, P.E.
Project Engineer

Jay W. Casper, P.E.
Florida P.E. No.: 36330
Principal

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EXECUTIVE SUMMARY

Geotechnical exploration has been performed for the proposed development planned near the northwest corner of the intersection of County Road 565A and Broad Street in Groveland, Lake County, Florida. Five test borings, designated B-1 through B-5, have been performed to a depth of about 15 feet below existing grade in the area of the proposed building, along with nine test borings, designated B-6 through B-14, to a depth of approximately 10 feet in the proposed pavement areas.

Based on the information obtained from our geotechnical exploration, it appears that the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Groundwater was not observed during our field program (April 2016) at borings B-1 through B-14. Normal seasonal high groundwater levels are expected to be about 10 feet or deeper below existing grade.

- The site appears to be nearly level. Therefore, Terracon anticipates approximately less than 2 feet of fine grading fill may be necessary in order to achieve final grade.

- The proposed building may be supported on shallow footings bearing on the existing site soil or on newly placed engineered fill.

- The site appears to be suitable for support of concrete and/or asphalt pavements. Stabilizing material will likely be necessary for the construction of subgrades for asphalt pavements.

- The in-place sands appear suitable for re-use as general engineered fill.

- The general guidelines included in this report are not intended to supersede any more stringent requirements mandated by Lake County specifications.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
GROVELAND SHOPPES NORTH
COUNTY ROAD 565A AND BROAD STREET
GROVELAND, LAKE COUNTY, FLORIDA

Terracon Project No. H1165093

April 27, 2016

1.0 INTRODUCTION

This geotechnical engineering report has been prepared for the proposed development planned near the northwest corner of the intersection of County Road 565A and Broad Street in Groveland, Lake County, Florida, as shown on the Topographic Vicinity Map included as Exhibit A-1 in Appendix A. Five test borings, designated B-1 through B-5, have been performed to a depth of about 15 feet below existing grade in the area of the proposed building, along with nine test borings, designated B-6 through B-14, to a depth of approximately 10 feet in the proposed pavement areas. Logs of the borings along with a Boring Location Diagram (Exhibit A-2) are included in Appendix A of this report. Laboratory testing procedures are included in Exhibit B-1 in Appendix B.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- general site preparation
- foundation design and construction
- pavement design and construction
- floor slab design and construction

2.0 PROJECT INFORMATION

2.1 Project Description

Item	Description
Site Layout	See Appendix A, Exhibit A-3: Boring Location Plan
Proposed Improvements	▪ A single-story building with a footprint area of approximately 7,104 square feet. ▪ Associated pavements for parking and drive lanes.
Building Construction (assumed)	Steel-frame construction.
Finished floor elevation	Assumed to be at or near existing grade

Item	Description
Maximum Loads (assumed)	Column loads: 50 kips. Wall loads: 3 kips per linear foot. Floor slab pressure: 150 pounds per square foot (psf).
Grading (assumed)	Minimal fill – estimated at less than 2 feet
Design Traffic (assumed)	Standard duty: 30,000 E_{18}SALs[1] Heavy duty: 50,000 E_{18}SALs[1]
Stormwater Management System	No drainage areas have been identified. We have assumed the site is part of a master drainage system.

1. Pavement design to be based on the indicated total number of 18-kip equivalent single axle load repetitions (E_{18}SALs) over a 20-year design life.

2.2 Site Location and Description

Item	Description
Location	This project site is located near the northwest corner of the intersection of County Road 565A and Broad Street in Groveland, Lake County, Florida.
Current Ground Cover	Grass. Additionally, asphalt pavement was observed during our field program along the eastern portion of the project site.
Existing Conditions	The site was vacant at the time of our field program.
Existing Topography	Relatively level.
Surface Water	The USGS topographic quadrangle map "Orange City, Florida" depicts a wetland area to the northeastern portion of the site.

3.0 SUBSURFACE CONDITIONS

3.1 Soil Survey

The Soil Survey of Lake County Area, Florida as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), dated April 1979, identifies the pre-development soil type at the subject site as Astatula sand, dark surface, 0 to 5 percent slopes (AtB). It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate (included in Appendix as Exhibit A-2). A description of the mapped soil unit is included in Appendix A as Exhibit A-3.

3.2 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/ Density
1	2 to 8[1]	Brown to light brown fine sand	Loose to Medium Dense
2	8 to 13.5[2]	Orange clayey sand to silty clayey sand	Loose to Dense
3	13.5 to 15[3]	Light orange to gray fine sand with silt to silty sand	Medium Dense

1. The depth of the stratum varied from 2 to 8 feet below existing grade.
2. Borings B-6 through B-14 were terminated at a depth of 10 feet below existing grade.
3. Borings B-1 through B-5 were terminated at a depth of 15 feet below existing grade.

Because of concerns for buried utilities at the SPT boring locations, the upper few feet were originally advance with hand auger equipment. To provide data in that interval for the building location, at boring locations B-1 and B-3 Dynamic Cone penetration (DCP) testing was performed in the upper 4 feet. For compacted soils, the DCP blow counts correlate roughly equivalent to SPT N-values. The average DCP ‘n’ values are slightly over 16, correlating to a medium dense condition.

Conditions encountered at each boring location and results of laboratory testing are indicated on the individual boring logs and tabulated DCP logs (Exhibit 20). Stratification boundaries on the boring logs represent the approximate location of changes in soil types; the in-situ transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report. Descriptions of our field exploration are included as Exhibit A-5 in Appendix A. Descriptions of our laboratory testing procedures are included as Exhibit B-1 in Appendix B. General notes for SPT borings can be found in Exhibit C-1. A more detailed description of the Unified Soil Classification System (USCS) is included as Exhibit C-2 in Appendix C.

3.3 Groundwater

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was not observed during our field program at borings B-1 through B-14. Longer term monitoring in cased holes or piezometers, possibly installed to greater depths than explored under this project scope, would be required to better define groundwater conditions at the site.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the normal wet season with rainfall and recharge at a maximum, groundwater levels will be about 10 feet or deeper below the existing grade. Our estimates of the normal seasonal groundwater conditions are based on the USDA Soil Survey, available survey data, the encountered soil types, recent weather conditions, and the encountered water levels.

These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. Water levels may temporarily perch at higher levels above the observed clayey sand strata following unusually wet weather. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The seasonal high water table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on or around the site following the date of this report.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The materials encountered at the boring locations are generally suitable for construction of the proposed foundations, floor slabs, and pavements following the recommended Earthwork portions of this report.

Seasonal high groundwater levels should not be a factor in the civil engineering design for site grading, utility construction, and pavements if grades remain within a couple feet of existing grades.

Given the consistency of the natural soils encountered in the test borings, shallow foundations bearing on natural sands or engineered fill are recommended for support of the proposed building. The engineered fill should be placed as outlined in section "**4.2 Earthwork**" of this report.

We recommend that the exposed subgrade be thoroughly evaluated after stripping of any topsoil and creation of all cut areas, but prior to the start of structural fill operations (if any). We recommend that Terracon be retained to evaluate the satisfactory preparation of the bearing material for the pavements, foundations, and floor slab subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed building plans known to us at this time.

Design and construction recommendations for foundation systems and other earth connected phases of the project are outlined below.

4.2 Earthwork

4.2.1 Site Preparation

Prior to placing any fill, all vegetation, topsoil, possible fill material, and any otherwise unsuitable material should be removed from the construction areas. Wet or dry material should either be removed or moisture conditioned and re-compacted. After stripping and grubbing and achieving cut grades, the exposed surface should be proofrolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with appropriate heavy equipment to obtain a minimum compaction as defined in section "**4.2.3 Compaction Requirements-Mass Fill Areas**". Unstable soil (pumping) should be removed or moisture conditioned and compacted in place prior to placing fill.

Where fill is placed on existing slopes, we recommend that fill slopes be over filled and then cut back to develop an adequately compacted slope face. Slopes should be provided with appropriate erosion protection.

4.2.2 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (in.)
General [1]	SP (fines content < 5%)	All locations and elevations	12[3]
	SP-SM (fines content between 5 and 12%)[2]	All locations and elevations, except strict moisture control will be required during placement, particularly during the rainy season.	8 to 12[3]
Limited	SM, SC (fines content>12%)	Limited to mass fill greater than 2 feet below final grade; strict moisture control will be required during placement.	6 to 8[4]

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. If fines contents are greater than 12 percent, special design and construction procedures may be necessary.
3. Loose thickness when heavy compaction equipment is used in vibratory mode. Lift thickness should be decreased if static compaction is being used, typically to no more than 8 inches, and the required compaction must still be achieved. Use 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is required.
4. Static equipment should be used.

4.2.3 Compaction Requirements-Mass Fill Areas

Item	Description
Minimum Compaction Requirements [1]	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557).
Moisture Content[2]	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
Minimum Testing Frequency	One field density test per 20,000 square feet or fraction thereof per 1-foot lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

4.2.4 Utility Trench Backfill

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building addition should be backfilled with native soils to avoid creating a preferred flow path through the trenches.

4.2.5 Grading and Drainage

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters, downspouts, or other appropriate methods that direct water a minimum of 10 feet beyond the footprint of the proposed building addition are recommended.

4.2.6 Earthwork Construction Considerations

After initial proofrolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and re-compacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will likely be required during grading operations. The grading contractor, by his contract, is typically 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. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building addition floor slab.

4.3 Foundations

In our opinion, the proposed Groveland Shoppes North can be supported on a shallow foundation system bearing on native soil or newly placed fill extending to native soil. Design recommendations for shallow foundations for the proposed building addition are presented in the following sections.

4.3.1 Foundation Design Recommendations

Description	Column Footing	Wall Footing	Monolithic Slab Foundation [4]
Net allowable bearing pressure [1]	2,500 psf	2,500 psf	2,500 psf
Minimum width	24 inches	18 inches	12 inches
Minimum embedment below finished grade [2]	18 inches	18 inches	12 inches
Compaction requirements	95 percent of the materials maximum Modified Proctor dry density for a depth of 12 inches below footing.		
Minimum Testing Frequency	One field density test per footing for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.
Approximate total settlement [3]	<1 inch	<1 inch	<1 inch

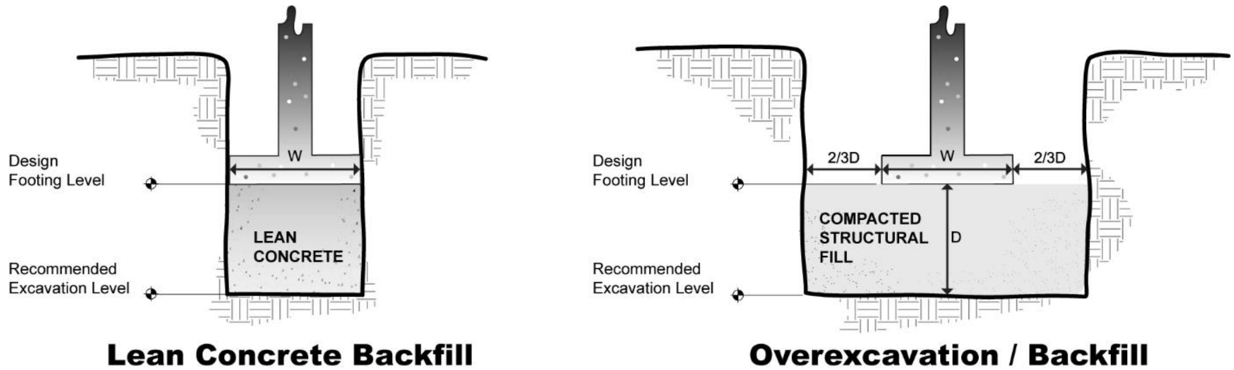
Description	Column Footing	Wall Footing	Monolithic Slab Foundation [4]
Estimated differential settlement [3]	<¾ inch between columns	<¾ inch over 40 feet	<¾ inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. For erosion protection and to reduce effects of seasonal moisture variations in subgrade soils.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing width is 5 feet for column footings and 1.5 feet for continuous footings.
4. Turned-down portion of slab. For slab requirements see Section 4.5.1.

4.3.2 Foundation Construction Considerations

The base of all foundation excavations should be free of water and loose soil and debris prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Should the soils at bearing level become excessively dry, disturbed or saturated, the affected soil should be removed or moisture conditioned and re-compacted prior to placing concrete. Consider placing a lean concrete mud-mat over the bearing soils if the excavations must remain open over night or for an extended period of time. It is recommended that Terracon be retained to observe and test the soil foundation bearing materials.

If unsuitable bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. The footings could also bear on properly compacted backfill extending down to the suitable soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with granular material placed in lifts of 6 inches or less in loose thickness and compacted to at least 95 percent of the material's modified effort maximum dry density (ASTM D-1557). The overexcavation and backfill procedures are described in the figures below. Compaction tests should be performed at a frequency of 1 test per footing per 1-foot lift for square footings, and 1 test per 50 linear feet per 1-foot lift for wall or continuous footings.



NOTE: Excavations in sketches shown vertical for convenience. Excavations should be sloped as necessary for safety.

4.4 Floor Slabs

4.4.1 Floor Slab Design Recommendations

Item	Description
Floor Slab Support	Free draining granular material meeting the general fill specification [1]
Modulus of Subgrade Reaction	100 pounds per square inch per inch (psi/in) for point loading conditions
Compaction Requirements	95 percent of the materials maximum Modified Proctor dry density
Minimum Testing Frequency	One field density test per 2,500 square feet or fraction thereof for a depth of 12 inches. [2]

1. We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompacted. Upon completion of grading operations in the building area, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slab.
2. Density should be re-checked after utility construction.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI and Florida Building Code (FBC) regarding moisture and radon for procedures and cautions regarding the use and placement of a vapor retarder. We note that FBC requires a minimum of 6-mil polyethylene, which is typically used in Florida. However, local requirements that might affect what moisture barrier may use should also be consulted.

4.4.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled prior to final grading. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of concrete and corrective action will be required.

Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of concrete.

4.5 Pavements

4.5.1 Subgrade Preparation

Site grading is typically accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to temporarily improve ride comfort. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the pavement subgrades be proofrolled and tested within two days prior to commencement of actual paving operations. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are found should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and prepared as recommended in the **"4.2 Earthwork"** section of this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.5.2 Design Considerations

Traffic patterns and anticipated loading conditions were not known to us at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute, PCA, and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided. However, absent that data, we recommend the following minimum typical sections.

4.5.3 Estimates of Minimum Pavement Thickness

Typical Pavement Section (inches)						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course**	**Limerock, Soil-Cement or Crushed Concrete Base Course**	**Stabilized Subbase Course[2,3,4]**	**Portland Cement Concrete**	**Free Draining Subgrade**
Car Parking	PCC	--	--		5.0	18.0
	AC	1.5	6.0	12.0	--	--
Truck and Drive Areas	PCC	--	--		6.0	18.0
	AC	2.5	8.0	12.0	--	--
Trash Container Pad [1]	PCC	--	--		6.0	18.0

1. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.
2. Often referred to as Stabilized Subgrade.
3. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade. Clay stabilization is acceptable with deeper seasonal high groundwater.
4. Some municipalities do not require stabilized subbase beneath soil-cement base.

4.5.4 Asphalt Concrete Design Recommendations

The following items are applicable to asphalt concrete pavement sections.

- Terracon recommends a minimum separation of 12 inches for this purpose between the bottom of the base course and the seasonal high water table.

- Natural or fill subgrade soils to a depth of 18 inches below the base should be clean, free draining sands with a fines content passing a No. 200 sieve of 7 percent or less.
- Stabilized subgrade soils (also identified as stabilized subbase) should be stabilized to a minimum Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 40 if they do not already meet this criterion, or modified/replaced with new compacted fill that meets the minimum LBR value. Although LBR testing has not been performed, our experience with similar soils indicates that the near surficial sands encountered in the soil borings are unlikely to meet this requirement.
- The stabilized subgrade course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Limerock base courses from an approved FDOT source should have a minimum LBR value of 100, and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not to exceed 6 inches loose thickness. Recycled limerock is not a suitable substitute for virgin limerock for base courses but may be used as a granular stabilizing admixture.
- Soil cement base courses typically experience shrinkage cracking due to hydration curing of the cement. This shrinkage cracking typically propagates through the overlying asphalt course and reflects in the pavement surface. This reflective cracking is not necessarily indicative of a pavement structural failure, though it is sometimes considered to be aesthetically undesirable.
- Soil cement bases should have 7-day design strength of 300 psi. Soil cement base should be compacted to a minimum of 98 percent of the material's maximum dry density as determined by the Standard Proctor Test for Soil Cement (AASHTO T-134). Higher design strengths may result in increased cracking.
- Crushed (recycled) concrete base should meet the current FDOT specification 204 as modified for recycled materials.
- Asphalt should be compacted to a minimum of 95 percent of the design mix density. Asphalt surface courses should be Type SP, Type S, or other suitable mix design according to FDOT and local requirements.
- To verify thicknesses, after placement and compaction of the pavement courses, core the wearing surface to evaluate material thickness and composition at a minimum frequency of 5,000 square feet or two locations per day's production.
- Underdrains or strip drains should be considered along all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils. Underdrains will

also be required below pavement if the separation between the bottom of the base course and the seasonal high groundwater table is less than 1 foot.

- All curbing should be full depth. Use of extruded curb sections which lie on top of asphalt surface courses can allow migration of water between the surface and base courses, leading to rippling and pavement deterioration.

4.5.5 Portland Cement Concrete Design Recommendations

The following items are applicable to rigid concrete pavement sections.

- At least 18 inches of free-draining material should be included directly beneath rigid concrete pavement. Fill meeting the requirements presented in Section 4.2 (Earthwork) of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose.
- The PCC should be a minimum of 4,000 psi at 28 days. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
- The upper 1 foot of rigid pavement subgrade soils should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.
- Adequate separation should be provided between the bottom of the concrete and the seasonal high water table. Terracon recommends that in no case should less than 1 foot of separation be provided. Based on the encountered conditions and anticipated development, we anticipate this requirement can be readily met.
- Sawcut patterns should generally be square or rectangular but nearly square, and extend to a depth equal to a quarter of the slab thickness. If the bottom of the concrete pavement is separated from the seasonal high water table by at least 1 foot, filter fabric will not be necessary beneath the expansion joints.

4.5.6 Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

4.5.7 Pavement Maintenance

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

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

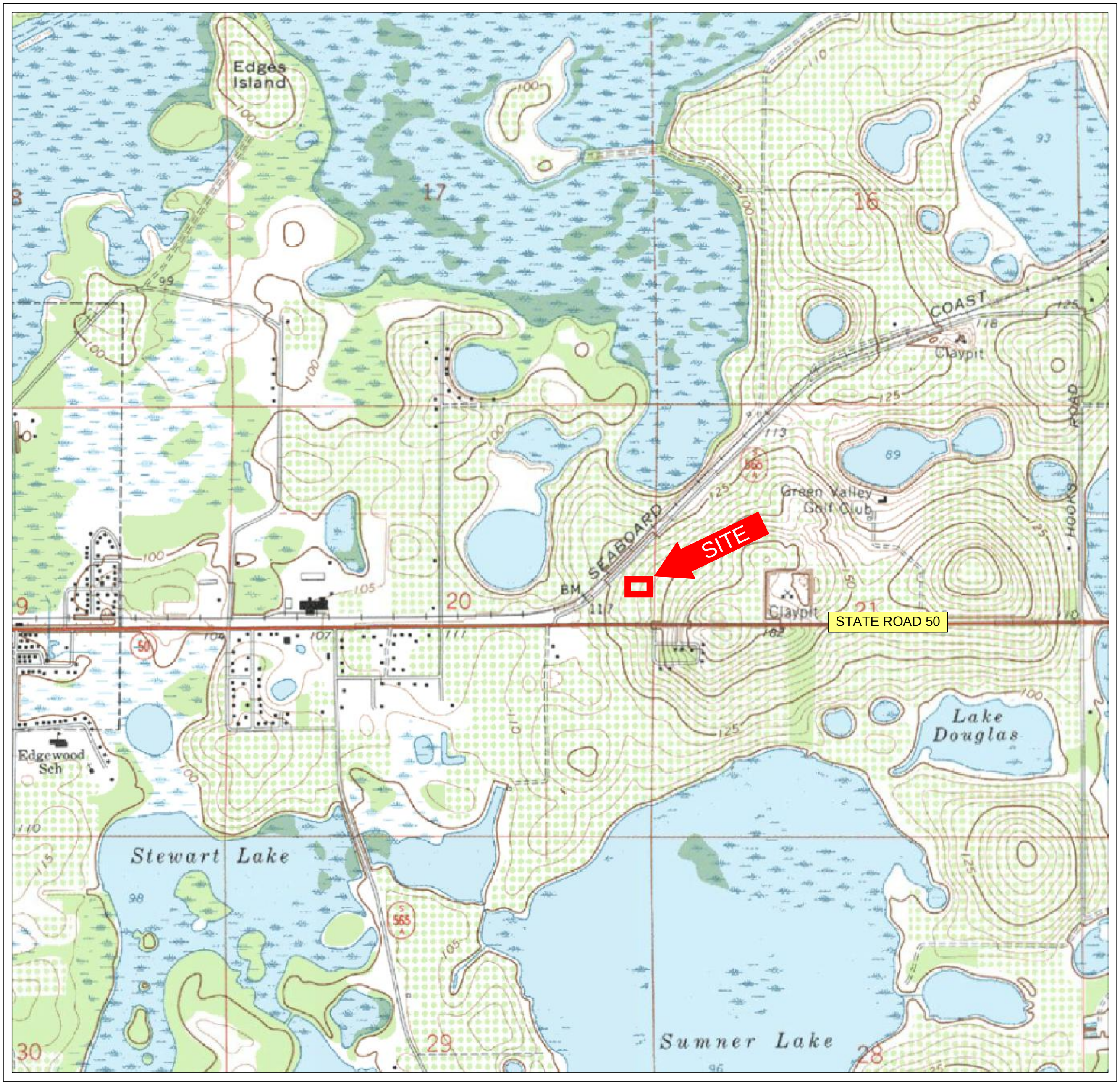
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

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

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION

UNITED STATES — DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY



SCALE 1:24 000

KILOMETERS: 1 .5 0 1 2

MILES: 1000 0 1000 2000 — 1 .5 0 1

FEET: 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 5 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

N

SECTION: 20
TOWNSHIP: 22 SOUTH
RANGE: 25 EAST

CLERMONT WEST, FLORIDA
1969
7.5 MINUTE SERIES (QUADRANGLE)

Project Mngr: LT	Project No. H1165093	Terracon — Consulting Engineers and Scientists	TOPOGRAPHIC VICINITY MAP
Drawn By: MG	Scale: AS SHOWN		GEOTECHNICAL ENGINEERING REPORT
Checked By: LT	File No. H1165093	1675 LEE ROAD — WINTER PARK, FLORIDA 32789	GROVELAND SHOPPES NORTH
Approved By: JWC	Date: 4-26-16	PH. (407) 740-6110 — FAX. (407) 740-6112	CR 565A AND BROAD STREET, GROVELAND, LAKE COUNTY, FLORIDA

EXHIBIT A-1

N:\Projects\2016\H1165093\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\H1165093-Exhibit-A-1.dwg

SCALE 1" = 2000'

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

U.S.D.A. SOIL SURVEY FOR LAKE COUNTY, FLORIDA
ISSUED: 1971

N

SECTION: 20
TOWNSHIP: 22 SOUTH
RANGE: 25 EAST

SOIL LEGEND

AtB ASTATULA SAND, DARK SURFACE, 0 TO 5 PERCENT SLOPES

Project Mngr: LT	Project No. H1165093
Drawn By: MG	Scale: AS SHOWN
Checked By: LT	File No. H1165093
Approved By: JWC	Date: 4-26-16

Terracon
Consulting Engineers and Scientists
1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

SOILS MAP
GEOTECHNICAL ENGINEERING REPORT
GROVELAND SHOPPES NORTH
CR 565A AND BROAD STREET
GROVELAND, LAKE COUNTY, FLORIDA

EXHIBIT
A-2

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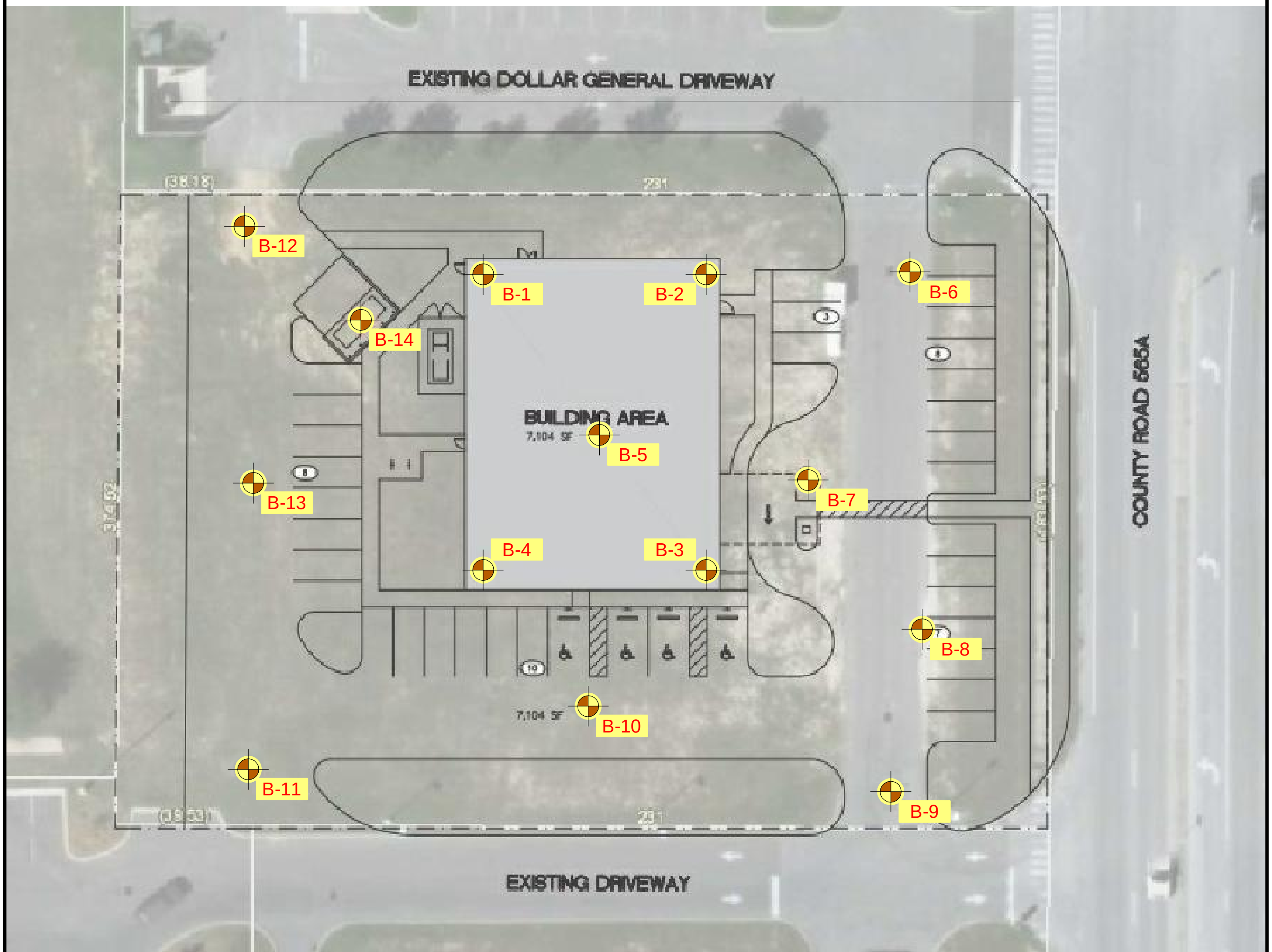
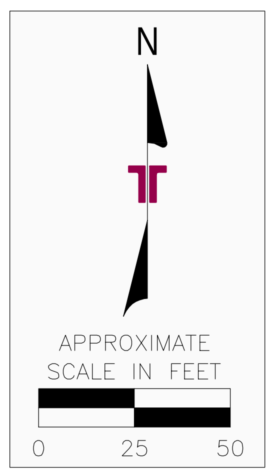
Soil Survey Descriptions

AtB – Astatula sand, dark surface, 0 to 5 percent slopes. This soil type is nearly level to gently sloping and excessively drained. It is typically found on rolling uplands of the central ridge. This soil type has a seasonal high water table at a depth of greater than 120 inches (10 feet). This soil type is predominantly sandy to a typical depth of 95 inches (7.9 feet). Thereafter, to the maximum defined depth of 99 inches (8.3 feet), this soil type exists as silty sand (USCS Classification symbol SM).



LEGEND

APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING



Project Mngr:	LT
Drawn By:	MG
Checked By:	LT
Approved By:	JWC

Project No.	H1165093
Scale:	AS SHOWN
File No.	H1165093
Date:	4-26-16

Terracon
Consulting Engineers and Scientists

1675 LEE ROAD WINTER PARK, FLORIDA 32789
PH. (407) 740-6110 FAX. (407) 740-6112

BORING LOCATION PLAN

GEOTECHNICAL ENGINEERING REPORT
GROVELAND SHOPPES NORTH

CR 565A AND BROAD STREET
GROVELAND, LAKE COUNTY, FLORIDA

EXHIBIT
A-4

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Field Exploration Description

The boring locations were laid out at the project site by Terracon personnel. The locations indicated on the attached diagram are approximate and were measured by pacing distances and estimating right angles, across the site. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

Dynamic cone penetrometer testing was performed at the selected boring locations to aid in our assessment of the subgrade soil. A dynamic cone penetrometer was used to record "n" values (penetration of 1¾ inches of the cone) that correlate to soil consistency and/or relative density. The "n" value is the number of blows required to advance a 2-inch diameter cone 1¾ inches with a 15-pound sliding weight free falling 20 inches after seating the cone 2 inches into the soil to be tested. This method was originally proposed in ASTM Special Technical Publication STP 399, by Sowers and Hedges, 1965.

The SPT soil borings were drilled using truck-mounted, rotary drilling rig equipped with an automatic-operated safety hammer. The boreholes were advanced with a cutting head and stabilized with the use of bentonite (drillers' mud). Soil samples were obtained by the split spoon sampling procedure in general accordance with the Standard Penetration Test (SPT) procedure. In the split spoon sampling procedure, the number of blows required to advance the sampling spoon the last 12 inches of an 18-inch penetration or the middle 12 inches of a 24-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs.

Portions of the samples from the borings were sealed in glass jars to reduce moisture loss, and then the jars were taken to our laboratory for further observation and classification. Upon completion, the boreholes were backfilled with the on-site soils.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation of the samples.

A CME automatic SPT hammer was used to advance the split-barrel sampler in the borings performed on this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the SPT-N value. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

BORING LOG NO. B-1

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group Dallas, Texas

SITE: County Road 565A and Broad Street Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559524° Longitude: -81.823373°

GRAPHIC LOG / DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), brown							
4.0	**CLAYEY SAND (SC)**, orange, medium dense to dense	5			2-3-4-8 N=7	14		36
					12-15-14-16 N=29			
		10			15-15-13-14 N=28			
13.5	**SILTY SAND (SM)**, light orange to gray, medium dense				7-6-7 N=13			
15.0	***Boring Terminated at 15 Feet***	15						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-6

BORING LOG NO. B-2

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group, Dallas, Texas

SITE: County Road 565A and Broad Street, Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559514° Longitude: -81.823154°

DEPTH	Material Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown, medium dense							
		5			3-3-5-3 N=8			
6.0	**CLAYEY SAND (SC)**, orange, medium dense				3-3-4-5 N=7			
					6-6-8-8 N=14			
		10						
13.5	**SILTY SAND (SM)**, light orange to gray, medium dense				8-7-8 N=15			
15.0	***Boring Terminated at 15 Feet***	15						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-7

BORING LOG NO. B-3

PROJECT: Groveland Shoppes North

**CLIENT: MGB Development Group
Dallas, Texas**

**SITE: County Road 565A and Broad Street
Groveland, Florida**

LOCATION See Exhibit A-4

Latitude: 28.559284° Longitude: -81.823152°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown to tan, loose							
		5			3-2-3-4 N=5			
	6.0 **CLAYEY SAND (SC)**, orange, medium dense				7-8-10-11 N=18			
					9-10-11-13 N=21			
		10						
	13.5 **SILTY SAND (SM)**, light orange to gray, medium dense, with clay pockets				9-8-9 N=17			
	15.0	15						
	Boring Terminated at 15 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-8

BORING LOG NO. B-4

PROJECT: Groveland Shoppes North

**CLIENT: MGB Development Group
Dallas, Texas**

**SITE: County Road 565A and Broad Street
Groveland, Florida**

LOCATION See Exhibit A-4

Latitude: 28.559284° Longitude: -81.82337°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown to orange							
4.0	**SILTY CLAYEY SAND (SC-SM)**, orange, loose to medium dense	5			3-2-3-4 N=5	11	19-14-5	28
					5-5-6-6 N=11			
		10			6-6-6-6 N=12			
13.5	**SAND W/ SILT (SP-SM)**, light orange, medium dense				7-6-7 N=13			
15.0	***Boring Terminated at 15 Feet***	15						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-9

BORING LOG NO. B-5

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group Dallas, Texas

SITE: County Road 565A and Broad Street Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559389° Longitude: -81.823257°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown, loose							
		5			3-3-3-5 N=6			
	6.0 **CLAYEY SAND (SC)**, orange, medium dense to dense				8-8-12-14 N=20	11	24-15-9	27
		10			12-16-17-19 N=33			
	13.5 **SILTY SAND (SM)**, light orange to gray, medium dense				6-6-7 N=13			
	15.0	15						
	Boring Terminated at 15 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-10

BORING LOG NO. B-6

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group, Dallas, Texas

SITE: County Road 565A and Broad Street, Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559523° Longitude: -81.82296°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown							
2.0	**CLAYEY SAND (SC)**, orange, medium dense							
		5			4-5-5-5 N=10			
					5-7-7-9 N=14			
8.0	**SILTY SAND (SM)**, light orange, medium dense				7-9-9-11 N=18			
10.0	***Boring Terminated at 10 Feet***	10						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-11

BORING LOG NO. B-7

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group Dallas, Texas

SITE: County Road 565A and Broad Street Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559355° Longitude: -81.823061°

GRAPHIC LOG	DEPTH	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SAND (SP), light brown, loose							
			5			2-2-2-2 N=4			
	6.0	**SILTY SAND (SM)**, light brown, medium dense, with clay pockets							
						5-9-8-8 N=17	7		15
						7-7-7-9 N=14			
	10.0	***Boring Terminated at 10 Feet***	10						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-12

BORING LOG NO. B-8

PROJECT: Groveland Shoppes North

**CLIENT: MGB Development Group
Dallas, Texas**

**SITE: County Road 565A and Broad Street
Groveland, Florida**

LOCATION See Exhibit A-4

Latitude: 28.55924° Longitude: -81.822953°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown to orange, loose to medium dense							
		5			2-2-5-5 N=7			
					5-5-5-4 N=10			
					6-5-6-6 N=11			
	10.0	10						
	Boring Terminated at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-13

BORING LOG NO. B-9

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group, Dallas, Texas

SITE: County Road 565A and Broad Street, Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559108° Longitude: -81.822991°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown							
	2.0 **CLAYEY SAND (SC)**, orange, medium dense to dense							
		5			7-9-9-10 N=18			
					15-23-16-12 N=39			
					10-10-10-10 N=20			
	10.0	10						
	Boring Terminated at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-14

BORING LOG NO. B-10

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group Dallas, Texas

SITE: County Road 565A and Broad Street Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.55918° Longitude: -81.823269°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), light brown							
	4.0 **CLAYEY SAND (SC)**, orange, medium dense to very dense							
		5			5-6-12-13 N=18	19		45
					16-23-20-20 N=43			
					18-18-20-23 N=38			
	10.0	10						
	Boring Terminated at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-15

BORING LOG NO. B-11

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group Dallas, Texas

SITE: County Road 565A and Broad Street Groveland, Florida

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.55913° Longitude: -81.823583° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), brown							
	4.0							
	CLAYEY SAND (SC), orange, medium dense to very dense	5			4-8-10-12 N=18			
					17-25-24-27 N=49	11	37-17-20	34
					17-26-23-20 N=49			
	10.0	10						
	Boring Terminated at 10 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:	See Exhibit A-3 for description of field procedures. See Appendix B for description of laboratory procedures and additional data (if any).	Notes:
Abandonment Method:	See Appendix C for explanation of symbols and abbreviations.	

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-16

BORING LOG NO. B-12

PROJECT: Groveland Shoppes North

**CLIENT: MGB Development Group
Dallas, Texas**

**SITE: County Road 565A and Broad Street
Groveland, Florida**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.559556° Longitude: -81.823588° DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), brown to orange, loose							
		5			3-2-3-3 N=5			
					3-3-2-2 N=5			
	8.0 **CLAYEY SAND (SC)**, orange, medium dense				4-8-12-18 N=20	11		29
	10.0 ***Boring Terminated at 10 Feet***	10						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-17

BORING LOG NO. B-13

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group Dallas, Texas

SITE: County Road 565A and Broad Street Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559354° Longitude: -81.823588°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), dark brown, medium dense							
		5			4-5-6-6 N=11			
6.0	**CLAYEY SAND (SC)**, orangish-brown, medium dense to dense				5-5-12-16 N=17			
					14-17-17-20 N=34			
10.0	***Boring Terminated at 10 Feet***	10						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-18

BORING LOG NO. B-14

PROJECT: Groveland Shoppes North

CLIENT: MGB Development Group
Dallas, Texas

SITE: County Road 565A and Broad Street
Groveland, Florida

LOCATION See Exhibit A-4

Latitude: 28.559481° Longitude: -81.823486°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SAND (SP), brown							
	4.0 **SILTY CLAYEY SAND (SC-SM)**, orange, medium dense to dense	5			8-7-9-11 N=16			
					12-16-19-19 N=35			
					15-18-18-21 N=36			
	10.0 ***Boring Terminated at 10 Feet***	10						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:

Abandonment Method:

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Groundwater not observed

Terracon
1675 Lee Rd
Winter Park, FL

Boring Started: 4/6/2016	Boring Completed: 4/6/2016
Drill Rig: BR-2500	Driller: Brian
Project No.: H1165093	Exhibit: A-19

Dynamic Cone Penetrometer Record

Boring No.	Depth (feet)	Description	Penetrometer* DCP 'n'
B-1	0 to 0.5	Light brown to brown sand (SP)	11
	1 to 1.5		12
	2 to 2.5		24
	3 to 3.5		27
	4 to 4.5		11
B-3	0 to 0.5	Light brown to brown sand (SP)	5
	1 to 1.5		16
	2 to 2.5		13
	3 to 3.5		3
	4 to 4.5		4

APPENDIX B
LABORATORY TESTING

Laboratory Testing

During the field exploration, a portion of each recovered sample was sealed in a glass jar and transported to our laboratory for further visual observation and laboratory testing. Selected samples retrieved from the borings were tested for moisture (water) content, and fines content (soil passing a US standard #200 sieve). Those results are included in this report and on the respective boring logs. The visual-manual classifications were modified as appropriate based upon the laboratory testing results.

The soil samples were classified in general accordance with the appended General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of the Unified Soil Classification System is included in Appendix B. The results of our laboratory testing are presented in the Laboratory Test Results section of this report and on the corresponding borings logs.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING		WATER LEVEL		FIELD TESTS	
	Auger Cuttings; Rock Core; Grab Sample; No Recovery; Shelby Tube; Standard Penetration Test		Water Initially Encountered; Water Level After a Specified Period of Time; Water Level After a Specified Period of Time. Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.		(HP) Hand Penetrometer; (T) Torvane; (DCP) Dynamic Cone Penetrometer; (PID) Photo-Ionization Detector; (OVA) Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Safety Hammer SPT N-Value (Blows/Ft.)**	**Automatic Hammer SPT N-Value (Blows/Ft.)**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (psf)**	**Safety Hammer SPT N-Value (Blows/Ft.)**	**Automatic Hammer SPT N-Value (Blows/Ft.)**
Very Loose	0 - 3	< 3	Very Soft	less than 500	0 - 1	< 1
Loose	4 - 9	3 - 8	Soft	500 to 1,000	2 - 4	1 - 3
Medium Dense	10 - 29	8 - 24	Medium-Stiff	1,000 to 2,000	4 - 8	3 - 6
Dense	30 - 50	24 - 40	Stiff	2,000 to 4,000	8 - 15	6 - 12
Very Dense	> 50	> 40	Very Stiff	4,000 to 8,000	15 - 30	12 - 24
			Hard	> 8,000	> 30	> 24

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

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

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains ≥ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] PI ≥ 4 and plots on or above “A” line.

[O] PI < 4 or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.