9232 RHEA DRIVE, SUITE L
ODESSA, FL 33556

REPORT OF GEOTECHNICAL EXPLORATION
MERES BOULEVARD TOWNHOMES
PARCEL ID 13-27-15-00000-240-0400
TARPON SPRINGS, FL
PINELLAS COUNTY
GDE PROJECT NO.: 14-244

Prepared For:

Riverside Custom Homes
Tarpon Springs, FL

December 2014

GROUND DOWN ENGINEERING

December 16, 2014

Doug Matthews
Riverside Custom Homes
29 N. Pinellas Avenue, Suite B
Tarpon Springs, FL 34689

Report of Geotechnical Exploration
Meres Boulevard Townhomes
Parcel ID 13-27-15-00000-240-0400
Tarpon Springs, FL
Pinellas County
GDE Project No.: 14-244

Dear Mr. Matthews:

Ground Down Engineering, Inc. (GDE) has completed the geotechnical exploration for the referenced project that you authorized. The purposes of this study were to explore general subsurface conditions at the proposed site and to use the data obtained to develop engineering recommendations to guide the design of foundation recommendations, soil suitability, pavement recommendations and estimated seasonal high groundwater levels. This report describes our exploration procedure, presents the data obtained, and presents our conclusions and recommendations regarding the geotechnical engineering aspects of site and foundation design.

In summary, based on the results of this subsurface exploration, due to the extremely soft organic soils encountered in the upper ten feet of the borings, it appears that the soils at the site are NOT suitable for development of the proposed residential structures on traditional shallow foundations. We recommend that the structures be supported on timber pile foundations.

GDE appreciates the opportunity to participate in this project and we trust that the information included in this report is sufficient for your design. If you have any questions or comments concerning the contents of this report, please contact us.

Sincerely,

Ground Down Engineering, Inc.
GDE FL Certificate of Authorization No. 9599

Laurel A. Hall

Laurel A. Hall, P.E.
President
FL Reg. No. 38392

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PROJECT INFORMATION

Existing Site

Based on the information provided for our review, we understand that the site is located on the northwest corner of Meres Boulevard and S. Pinellas Avenue in Tarpon Springs, Pinellas County, Florida (Figure 1). The proposed development will consist of residential townhome structures. Our study addresses geotechnical design and construction recommendations for the foundations of the residential structures along with recommendations for structural fill.

We have assumed minor earthwork will be associated with the site development and anticipated cut and fill quantities will be less than 2 to 3 feet. Structural loading data was not available at the time of this report**.**

Project Approach

The objective of the geotechnical investigation for the proposed project was to obtain information concerning the general subsurface conditions over the site in order to make geotechnical engineering estimates and recommendations in each of the following areas:

- Soil stratigraphy at the boring locations and the development of the approximate soil profile.
- General location and description of potentially deleterious materials which may interfere with construction progress or new structure performance, including buried or surficial existing fills, organics, construction debris, etc.
- Identification of some critical design or construction details, including present groundwater levels, estimated wet season levels and seasonal fluctuations across the site.
- Engineering criteria and recommendations for the placement and compaction of approved fill materials (if necessary) in and around the structure areas and all proposed pavement areas.
- Design and construction recommendations considering the water table conditions.

Scope of Work

In order to address the above objectives, our scope of work for this project included the following:

- Reviewed available published information on the site, including the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) soil survey data for Pinellas County.
- Conducted a subsurface exploration program consisting of soil borings and subsurface sampling. Our exploration program for this project consisted of:
    - Performing a total of 4 SPT borings to competent limestone (depths of 25 to 50 feet) within the proposed structure footprint.
- Measured the stabilized groundwater levels at the boring locations.
- Reviewed and visually classified the recovered soils in the laboratory using the Unified Soils Classification System. Developed the general soil stratigraphy over the site. Performed laboratory testing as necessary.

- Performed geotechnical engineering studies and analyses in order to develop geotechnical engineering recommendations for each of the objectives previously discussed for the proposed project.

- Prepared a geotechnical report that summarizes the course of our study, the field data generated, the subsurface conditions encountered, and our geotechnical engineering recommendations for the proposed project.

Soil Survey Review

According to the U.S.D.A. "Soil Survey of Pinellas County", the soil types present on the subject site are:

- Matlacha and St. Augustine soils and Urban land – Matlacha consists of somewhat poorly drained fine sand to a depth of 80 inches. Historic seasonal high groundwater level is 24 to 35 inches below grade. St. Augustine consists of somewhat poorly drained sand and sandy loam. Historic seasonal high groundwater level is 18 to 36 inches. In Urban Land areas, the original soil has been modified through cutting, grading, filling, and shaping for urban development. The soils in these areas have been so altered that identification is not feasible.

SUBSURFACE EXPLORATION

Field Exploration

The procedures used by Ground Down Engineering, Inc. for field sampling and testing are in general accordance with industry standards of care and established geotechnical engineering practice. GDE located the borings within the site as indicated per the attached Boring Location Plan (Figure 2). The field testing locations should be considered approximate. Actual boring locations were determined with use of a hand held GPS unit based on the latitude and longitude coordinates from Google Earth. Although latitude and longitude coordinates were used to locate the field testing locations, these locations should still be considered approximate as they were not surveyed and may have been moved slightly to avoid field discovered obstacles.

Approximate Boring Coordinates

Boring Number	Latitude	Longitude
B-1	28° 08.272'	82° 45.516'
B-2	28° 08.269'	82° 45.497'
B-3	28° 08.272'	82° 45.480'
B-4	28° 08.270'	82° 45.466'

Standard Penetration Test Borings

The SPT borings were advanced by means of a track-mounted drill rig employing wet rotary drilling techniques. The SPT testing was performed continuously in the upper ten feet and at five-foot intervals thereafter. The soil samples were obtained at the depths where the SPT testing was performed. The soil samples were then classified in the field, placed in sealed containers, and returned to our laboratory for further evaluation by a geotechnical engineer. The SPT borings were performed in general compliance with standard field penetration test procedures (ASTM D 1586-99). After drilling to the sampling depth and flushing the borehole, the standard two-inch O.D. split-barrel sampler was seated by driving it six inches into the undisturbed soil at the bottom of the borehole. The sampler was then driven an additional 12 inches by a 140-pound hammer falling 30 inches. The number of blows required to produce the 12 inches of penetration is recorded as the standard penetration test value (N). These values are plotted on the left side of the boring logs in Figure 3.

Sampling performed in the upper ten feet utilized a 24-inch long split spoon. The sampler was driven 24 inches and the blows required to drive the sampler the middle two 6-inch increments were recorded as the "N" value. Through this technique, the upper ten feet of the soil was sampled continuously. Detailed descriptions of the soils encountered during the advancement of the SPT borings are presented in the boring logs (Figure 3).

Soil Sample Handling and Classification

The soil samples obtained during the SPT borings were placed in sealed containers to retain moisture and returned to our laboratory. The samples were then reviewed by a geotechnical engineer to confirm classifications, visually estimate the relative percentages of the soil's constituents (sand, clay, etc.), and identify pertinent structural features. We visually classified the soils according to the Unified Soil Classification System (ASTM D 2487). The stratification lines shown on the boring records represent our interpretation of approximate boundaries between soil types. The transition between strata may be gradual. Our classifications are based on a visual estimation of the soil properties and our engineering experience with the soils found in this geologic area.

RESULTS

Subsurface Conditions

Hand augers were performed in the first 4 feet of all of the borings in order to avoid possible conflicts with any underground utilities. Below 10 feet a rotary drilling technique was used along with the circulation of a clay bentonite drilling slurry in order to stabilize the borehole and prevent cave-in. The groundwater table was encountered at depths of 2 to 3 feet below existing grade.

Boring B-1 generally encountered a sequence of fine SAND, PEAT, fine SAND, clayey fine SAND and LIMESTONE to a depth of 38 feet below existing grade. ("N" values ranged from 2 blows per foot of penetration to 50 blows for 0 inches of penetration.)

Boring B-2 generally encountered a sequence of clayey fine SAND, fine SAND, PEAT, fine SAND, clayey fine SAND, CLAY, clayey fine SAND, CLAY, clayey fine SAND, CLAY and LIMESTONE to a depth of 50 feet below existing grade. ("N" values ranged from 3 blows per foot of penetration to 50 blows for 6 inches of penetration.)

Boring B-3 generally encountered a sequence of fine SAND, fine SAND with organics, silty fine SAND, fine SAND, clayey fine SAND, fine SAND and LIMESTONE to a depth of 50 feet below existing grade. ("N" values ranged from 2 to 55 blows per foot of penetration.)

Boring B-4 generally encountered a sequence of fine SAND with roots, fine SAND, slightly clayey fine SAND, PEAT, fine SAND, CLAY, LIMESTONE and CLAY to a depth of 25 feet below existing grade. ("N" values ranged from 1 blow per foot of penetration to 50 blows for 0 inches of penetration.)

Please note that the SPT "N" values are presented adjacent to the boring logs in Figure 3. The correlation of the SPT "N" values with relative density, unconfined compressive strength, and consistency are provided in the following table:

Coarse Grained Soils		**Fine Grained Soils**		
Penetration Resistance N (blows/ft)	Relative Density of Sand	Penetration Resistance N (blows/ft)	Unconfined Compressive Strength of Clay (tons/ft^2)	Consistency of Clay
0-4	Very Loose	<2	<0.25	Very Soft
4-10	Loose	2-4	0.25-0.50	Soft
10-30	Medium-Dense	4-8	0.50-1.00	Medium
30-50	Dense	8-15	1.00-2.00	Stiff
>50	Very Dense	15-30	2.00-4.00	Very Stiff
		>30	>4.00	Hard

Groundwater

Boring Number	Depth to Groundwater (feet)*	Seasonal High Groundwater Table (ft)
B-1	3	1
B-2	3	1
B-3	2.5	0
B-4	2	0

*Groundwater measured October 2014

Significant fluctuations in the groundwater levels should be expected due to seasonal variations in rainfall, runoff, and other site-specific factors.

LABORATORY TESTING

GDE performed organic content, percent fines (percent passing the #200 sieve), and natural moisture content testing on representative samples of near-surface soils encountered during our exploration. The results of the testing are included in the Appendix.

Soils that exhibit organic contents of 5 percent or greater are considered to be unsuitable for use as foundation materials beneath structures. The soils encountered near the surface (top ten feet) at the site exhibited tested organic contents well above 5 percent (13 to 30 percent) in the peat materials.

In addition, moisture contents can be correlated to the potential consolidation characteristics of an organic soil. Moisture contents near or over 100 percent are an indication that the soil is highly compressible. The soils at the site exhibited tested moisture contents ranging from 100 to 184 percent in the peat materials. The organic soils encountered within the first 10 feet of the subsurface are not suitable for shallow foundation support of the proposed townhome structures.

SUBSURFACE ANALYSIS

Foundation Analysis

The residential townhouse structures planned for the site cannot be supported on shallow foundations due to the excessive settlement that would be caused by compression and decay of highly organic soils encountered within the top ten feet of the borings. We have calculated that settlement on the order of 4 inches would occur with the application of the fill and structural loads. This report provides allowable capacities for timber piles which are commonly used for residential structures. The driven timber piles should be tipped in the competent limestone encountered at depths of approximately 20 to 50 feet below existing grade within the proposed structural footprint at the site. NOTE: The pile contractor should expect differences in the depth to limestone across the site. Our axial/uplift pile capacity analysis was performed using the computer program SPT-97 which is used by the Florida Department of Transportation.

In addition to the load bearing members of the structures, it is our recommendation that floor slabs of the residence also be pile supported due to the amount of settlement that the proposed fill heights will induce on the near-surface highly organic soils.

NOTE: In addition, we recommend that the fill be placed as soon in the construction schedule as possible. The fill load will induce a significant amount of the settlement predicted in the organic soils. If the fill is placed and the piles installed soon after, the settlement of the fill may impart additional load to the piles by downdrag (or negative skin friction) which will need to be factored into the total load by the structural engineer.

Foundation Recommendations

Pile Foundations

Based on the results of the subsurface exploration, it appears that the soils at the site are suitable for support of the proposed residential structure on timber pile-supported foundations. Based on the results of the field investigation, review of our structural borings, and our pile capacity analysis, we offer the following recommendations to assist in determining the pile driving criteria for timber piles driven to an approximate depth of 35 feet below existing grade to the competent limestone layer.

Axial and Uplift Capacities

Recommended Allowable Capacities	Allowable Axial Pile Capacity (tons)	Allowable Uplift Pile Capacity (tons)
	10” Average Timber Cross-section	10” Average Timber Cross-section
	10	**3**

Notes:
1) All piles for this project should be installed in accordance with FDOT Specification No. 455.
2) Minimum tip depth approximately 20 feet below existing grade.

Anticipated Site Preparation

Conventional site preparation, including stripping, grubbing and compaction, should be adequate. After stripping and grubbing, the existing ground should be proof rolled with multiple passes of a large vibratory roller. Proofrolling can also be used to locate weak and unstable shallow soils that may require improvement prior to filling. Heavy vibratory compaction is routinely performed to improve the density and uniformity of density of the upper sands, reducing settlement and improving the support for pavements, concrete slabs and shallow foundations (for lightly loaded buildings). After proofrolling of the natural ground, approved fill can be placed and compacted in lifts to develop grades, as needed. The ground water table should be considered when designing pavement and building grades.

Utility/Storm Sewer Installation

Results of our exploration indicate that dewatering may be necessary for utility construction, dependent upon the time of year and installation depth. If required, dewatering should be accomplished, where necessary, to about 2 feet below the bottom of the excavation. Dewatering at this site can probably be accomplished with well points or a sumped ditch system. Off-site discharge of groundwater should comply with NPDES permitting requirements (e.g., Chapter 62-21, F.A.C.). Backfill of utility trenches (and all backfill) should be performed in compacted lifts. All excavations should be braced in accordance with the Florida Trench Safety Act.

Structural Fill

Definition

Soil used for structural fill can be defined as clean fine sand containing less than twelve percent material by weight that is finer than a number 200 sieve (fines) (material conforming to SP to SP-SM in the Unified Soil Classification System) and less than 5 percent organics by weight. However, materials containing up to 25 percent fines (materials conforming to SC or SM in the Unified Soil Classification System) may be utilized as structural fill, if their plasticity index is less than 20 and the working subgrade is at least 2 feet above water or groundwater level.

If fill material with higher fines content is used (< 25 percent fines), the material will require the use of compaction equipment designed for clayey soils. This includes a sheeps foot or vibratory pad foot roller. In addition, a disk could be required to assist with drying the clayey soils in order to place them at or near their optimum moisture content. These materials must be placed in 6-inch thick maximum lifts so that they can be effectively compacted with a vibratory pad foot roller.

Placement

Fill should be placed in lifts not to exceed one foot thick. The fill material should be compacted to at least 95 percent of its modified Proctor maximum dry density (ASTM D 1557). Confined areas, such as utility trenches, should be compacted with manually operated vibratory compaction equipment.

TESTING AND MONITORING

Construction monitoring and testing are essential to proper site construction and performance. Compliance with the recommended construction specification for compaction and soil types must be verified by our engineering technician familiar with the project construction. Observation of site preparation work is an integral part of the engineering recommendations contained in this report. Density tests should be performed for each lift of structural fill placed and per Pinellas County Specifications.

LIMITATIONS

This report has been prepared for the exclusive use of **Riverside Custom Homes** for the specific application to the project previously discussed. Our conclusions and recommendations have been rendered using generally accepted standards of geotechnical engineering geology practice in the state of Florida. No other warranty is expressed or implied.

Our conclusions and recommendations are based on the design information furnished to us, the data obtained from our subsurface exploration, and our experience. They do not reflect variations in the subsurface conditions that are likely to exist in the region of our borings and in unexplored areas of the site. These variations are due to the inherent variability of the subsurface conditions in this geologic region. Should variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon our on-site observations of the conditions.

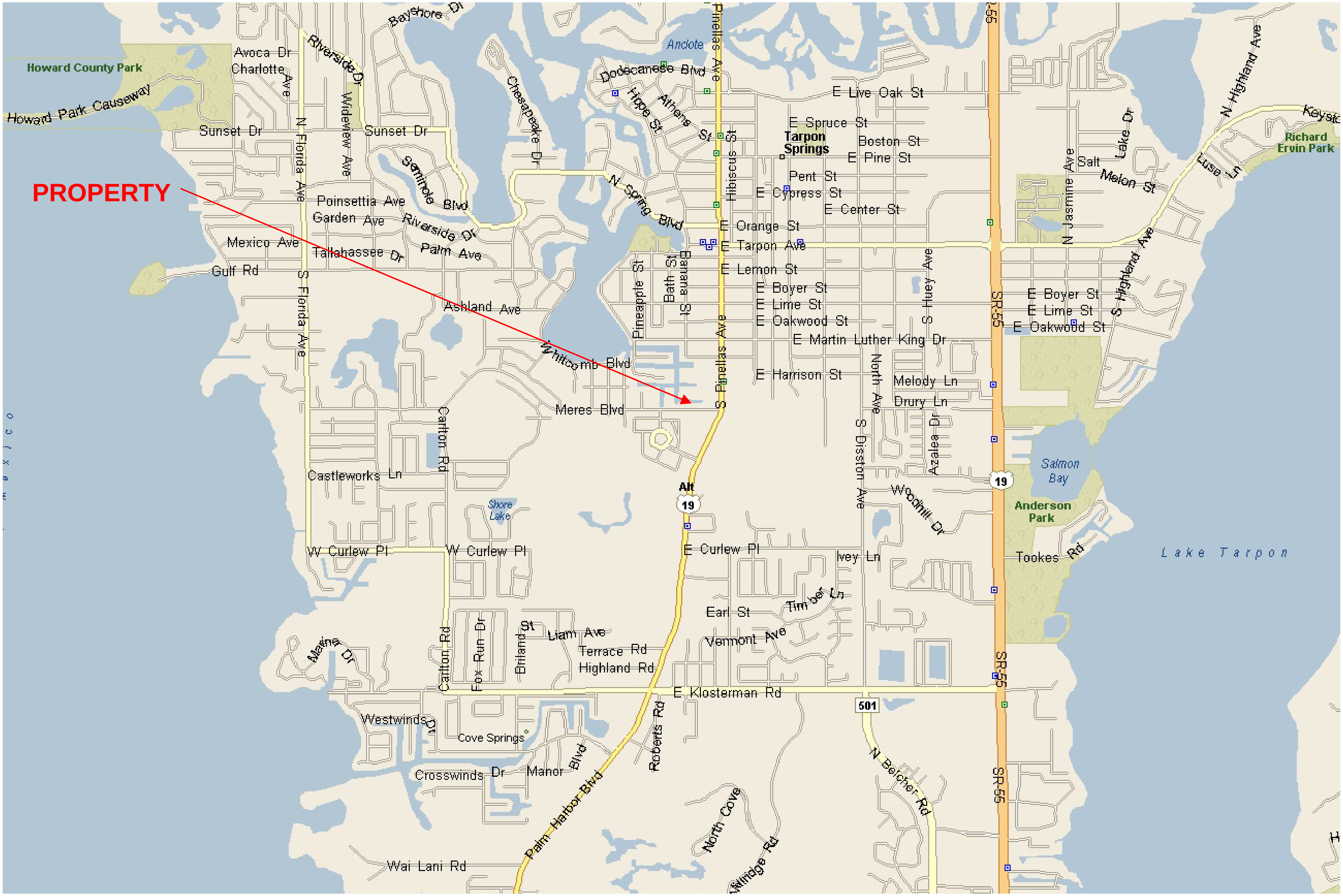
As is true with this area of Florida, the site is underlain by limestone bedrock that is susceptible to dissolution and the subsequent development of karst features such as voids and sinkholes in the natural soil overburden. Construction in a sinkhole prone area is therefore accompanied by some risk that internal soil erosion and ground subsidence could affect new structures in the future. It is not possible to investigate or design to completely eliminate the possibility of future sinkhole related problems. In any event, the Owner must understand and accept this risk.

The scope of our services does not include any environmental assessments or investigations for the possible presence of hazardous or toxic materials in the soil, groundwater or surface water within or in the general vicinity of the site studied. Any statements made in this report or shown on the test boring logs regarding unusual subsurface conditions and/or composition, odor, staining, origin or other characteristics of the surface and/or subsurface materials are strictly for the information of our client and may or may not be indicative of an environmental problem.

If changes are made in the overall design or the location of the proposed facilities, or if the finish grades differ from those discussed herein, the recommendations presented in this report must not be considered valid unless the changes are reviewed by our firm and recommendations modified or verified in writing. We should be given the opportunity to review the foundation plan, grading plan and the applicable portions of the project specifications when the design is finalized. This review will allow us to check whether these documents are consistent with the intent of our recommendations.

APPENDIX

FIGURES



GROUND DOWN ENGINEERING

VICINITY MAP
FROM
MICROSOFT
STREETS & TRIPS
2010

MERES BOULEVARD TOWNHOMES
VICINITY MAP
PINELLAS COUNTY, FLORIDA

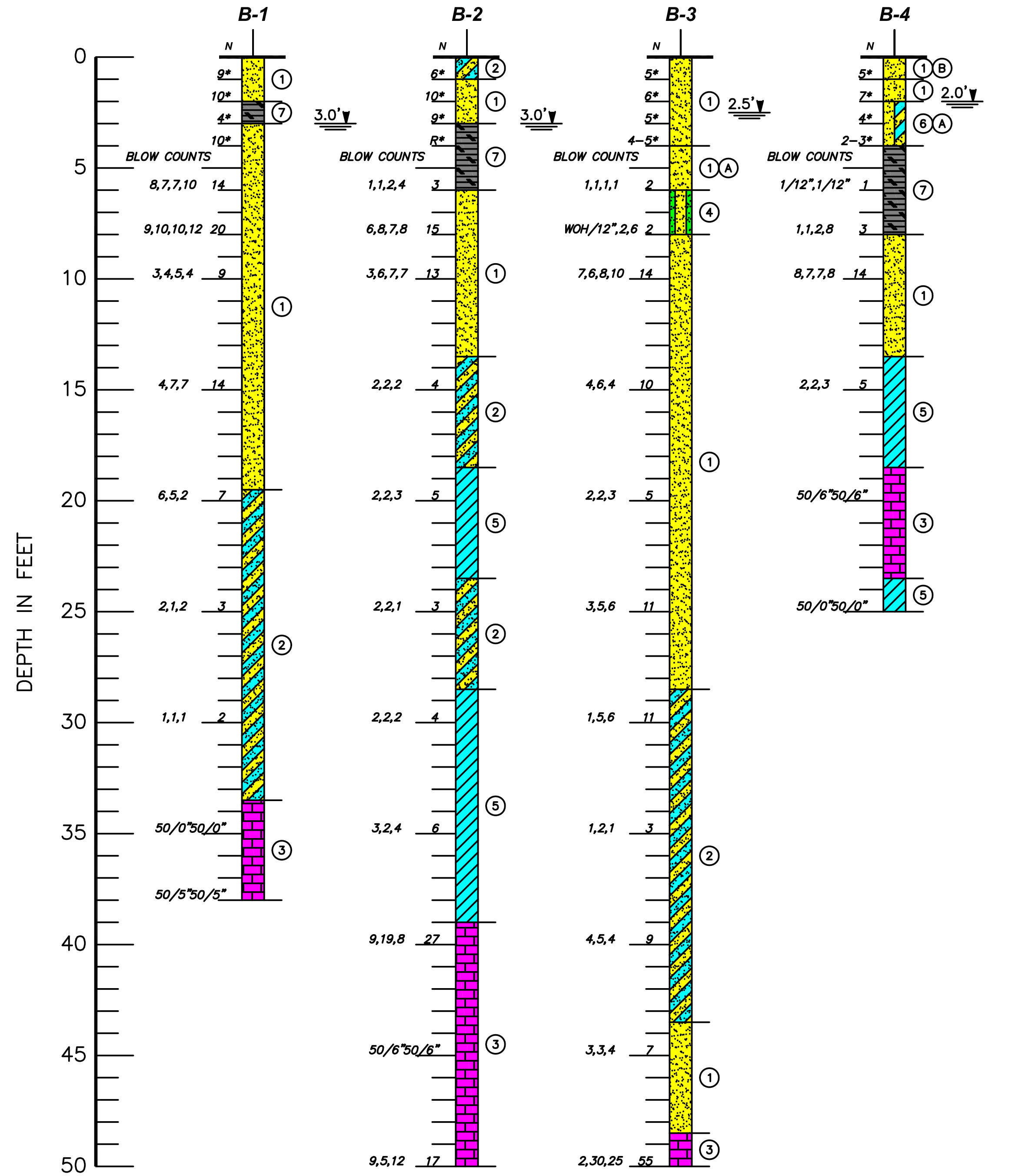
DATE: 10-27-14	SCALE: NO SCALE	JOB NO. 14-244
DRAWN BY: S.CAMACHO		FIGURE 1
CK'D BY: L. HALL		SHEET 1 OF 1

LEGEND

B-1 ⊕ APPROXIMATE LOCATION OF SPT BORING

SCALE: NOT TO SCALE

GROUND DOWN ENGINEERING	MERES BOULEVARD TOWNHOMES SPT LOCATION PLAN PINELLAS COUNTY, FL	DATE: 10-27-14	SCALE: AS SHOWN	JOB NO. 14-244
		DRAWN BY: S.CAMACHO CK'D BY: L. HALL		FIGURE 2 SHEET 1 OF 1



LEGEND

(1) = BROWN, DARK BROWN, GRAY FINE SAND (SP)

(2) = GRAY, GREEN CLAYEY FINE SAND (SC)

(3) = GRAY, CREAM LIMESTONE (LS)

(4) = DARK BROWN, GRAY SILTY FINE SAND (SM)

(5) = GRAY, GREEN CLAY (CH)

(6) = DARK BROWN SLIGHTLY CLAYEY FINE SAND (SP-SC)

(7) = DARK BROWN, GRAY PEAT (PT)

(A) = WITH ORGANICS

(B) = WITH ROOTS

(SP) = UNIFIED SOIL CLASSIFICATION GROUP SYMBOL

N = STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

0* = N VALUE CORRELATED FROM CPT RESULTS

1/0" = ONE BLOW OF HAMMER FOR "0" INCHES OF PENETRATION

WOH/0" = WEIGHT OF HAMMER FOR "0" INCHES OF PENETRATION

0.0' = DEPTH TO EXISTING GROUNDWATER

NOTE: BORINGS PERFORMED ON OCTOBER 9, 2014.

GROUND DOWN ENGINEERING

MERES BOULEVARD TOWNHOMES
BORING LOGS
PINELLAS COUNTY, FL

DATE:	SCALE:	JOB NO.
10-27-14	AS SHOWN	14-244
DRAWN BY: S.CAMACHO		FIGURE 3
CK'D BY: L. HALL		SHEET 1 OF 1

LABORATORY TESTING RESULTS

LABORATORY TESTING RESULTS

GROUND DOWN ENGINEERING

Client	**Ground Down Engineering, Inc.**
Project Name	**Meres Blvd.**
Report Number	**14-00189A**
Report Date	**October 22,2014**
Submitted By	**Laurel A. Hall, P.E.**
GDE Project Number	**14-244**

Boring No.	Sample Depth (ft)	USCS Symbol	Percent Passing #200 Sieve[1]	Atterberg Limits (%)[2]			Organic Content (%)[3]	Natural Moisture Content (%)[4]
				LL	PL	PI		
B-1	2-3	PT	1.0				14.5	100
B-2	3-6	PT	2.1				29.9	184.1
B-4	2-4	SP-SM*	6.5				5.9	43.5
B-4	4-8	PT	2.8				12.9	102.4
								*With Organics

Laurel A. Hall, P.E.

[1]ASTM C 117-04
[2]ASTM D4318
[3]ASTM D2974
[4]ASTM D2216

USDA SOIL SURVEY

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Pinellas County, Florida

November 25, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

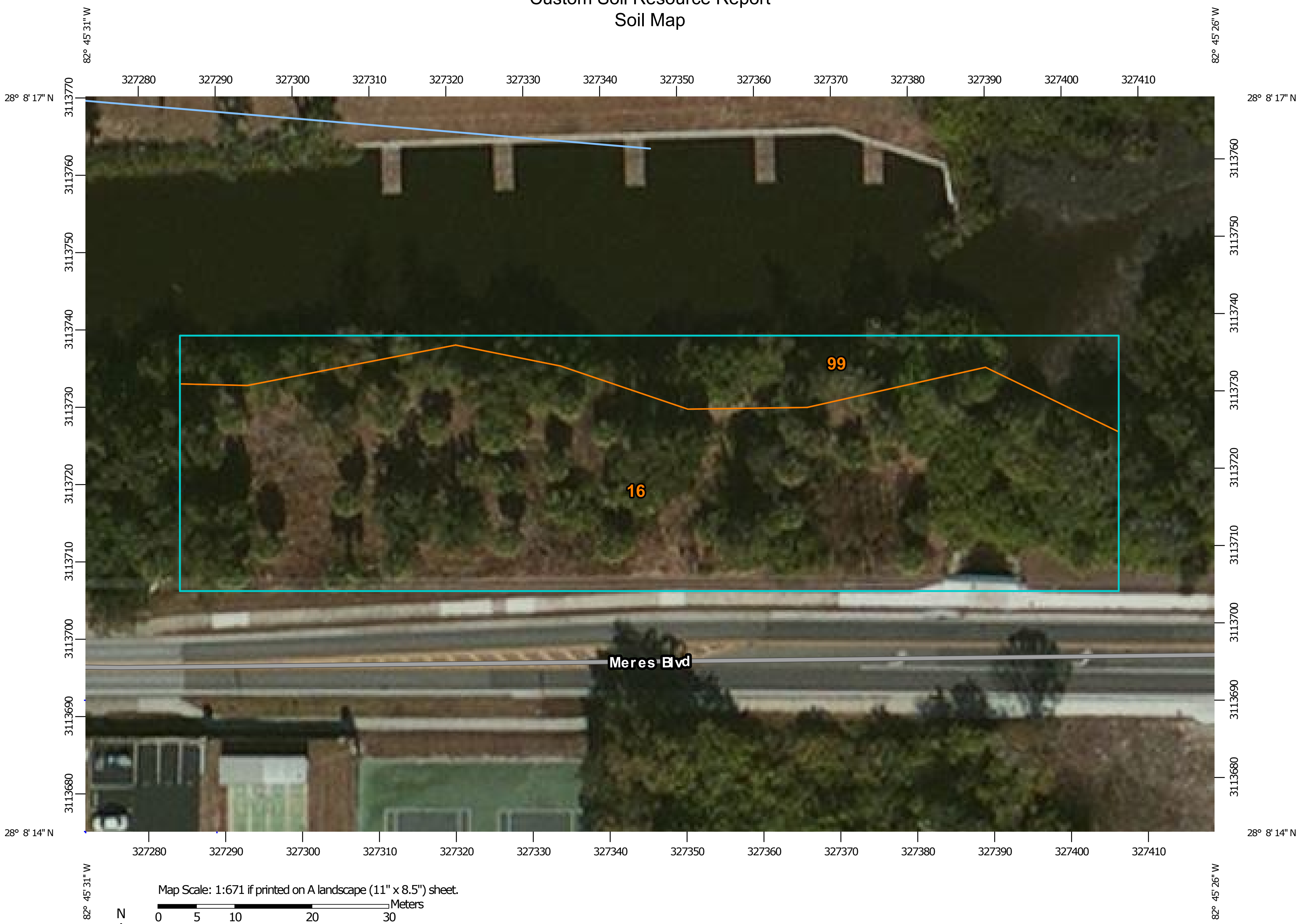
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:671 if printed on A landscape (11" x 8.5") sheet.

Meters: 0 5 10 20 30

Feet: 0 30 60 120 180

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Pinellas County, Florida
Survey Area Data: Version 10, Sep 23, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 10, 2010—Mar 13, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Pinellas County, Florida (FL103)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
16	Matlacha and St. Augustine soils and Urban land	0.8	81.4%
99	Water	0.2	18.6%
Totals for Area of Interest		**1.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Pinellas County, Florida

16—Matlacha and St. Augustine soils and Urban land

Map Unit Setting

National map unit symbol: 134ch
Mean annual precipitation: 48 to 56 inches
Mean annual air temperature: 70 to 77 degrees F
Frost-free period: 335 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

St. augustine and similar soils: 32 percent
Urban land: 32 percent
Matlacha and similar soils: 32 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Matlacha

Setting

Landform: Ridges on marine terraces
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy mine spoil or earthy fill

Typical profile

C - 0 to 42 inches: sand
A/Eb - 42 to 80 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Other vegetative classification: Forage suitability group not assigned (G154XB999FL)

Description of Urban Land

Setting

Landform: Marine terraces

Landform position (three-dimensional): Interfluve, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: No parent material

Interpretive groups
Land capability classification (irrigated): None specified
Other vegetative classification: Forage suitability group not assigned (G154XB999FL)

Description of St. Augustine

Setting
Landform: Ridges on marine terraces, rises on marine terraces
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Sandy mine spoil or earthy fill

Typical profile
A - 0 to 8 inches: sand
C1 - 8 to 33 inches: loamy fine sand
C2 - 33 to 48 inches: fine sand
C3 - 48 to 63 inches: sandy loam
C4 - 63 to 80 inches: sand

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (2.00 to 20.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 4.0
Available water storage in profile: Low (about 3.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Other vegetative classification: Forage suitability group not assigned (G154XB999FL)

Minor Components

Kesson
Percent of map unit: 2 percent
Landform: Tidal marshes on marine terraces
Landform position (three-dimensional): Interfluve, talf
Down-slope shape: Linear
Across-slope shape: Linear

Other vegetative classification: Forage suitability group not assigned (G154XB999FL)

Wulfert

Percent of map unit: 2 percent
Landform: Tidal marshes on marine terraces
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: Forage suitability group not assigned (G154XB999FL)

99—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups

Land capability classification (irrigated): None specified
Other vegetative classification: Forage suitability group not assigned (G154XB999FL)

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