GEOTECHNICAL ENGINEERING REPORT
PROPOSED 50-ACRE SOLID WASTE MATERIALS RECOVER FACILITY
LEHIGH ACRES, LEE COUNTY, FLORIDA

Ardaman & Associates, Inc.

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

December 28, 2023
Ardaman Project No. 23-33-4545

RRT Design & Construction
1 Huntington Quadrangle Suite 3S01
Melville, NY 11747

Attention: David Weitzman

SUBJECT: Preliminary Geotechnical Engineering Services
Proposed 50-Acre Solid Waste Materials Recovery Facility
11900 State Road 82
Lee County, Florida

Dear Mr. Weitzman:

As requested and authorized by RRT Design & Construction (RRT), Ardaman & Associates, Inc. (Ardaman) has completed a subsurface soil exploration program for the subject project. The purposes of this program were to evaluate the general subsurface conditions at the site and discuss the geotechnical aspects of site development and foundation design at this preliminary stage.

This report documents our findings and conclusions. It has been prepared for the exclusive use of RRT for specific application to the subject project following generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

SCOPE

The scope of our services was limited to the following items:

1. Conducted six (6) Standard Penetration Test (SPT) to determine the nature and condition of the subsurface soils.
2. Reviewed each soil sample obtained in our field exploration program by a geotechnical engineer in our laboratory for further identification and assignment of laboratory tests.
3. Performed the appropriate laboratory tests on selected samples.
4. Prepared this report to document the results of our field exploration and engineering evaluation, and provide preliminary recommendations for site preparation and foundation design.

SITE LOCATION AND SITE DESCRIPTION

The site is generally located south of Colonial Boulevard and west of Gateway Boulevard in Lee County, Florida. The vegetation on the site is somewhat dense in some areas and heavily wooded in some others. The terrain is somewhat sloped and swampy with standing water in parts of the property. The approximate project location is shown in the attached **Site Location Map** included in **Figure 1**.

PROPOSED CONSTRUCTION

We understand that Lee County intends to build a new Solid Waste Materials Recovery Facility and that preliminary information about the subsurface soil conditions is needed for your design. Site grading plans were not available at the time of this report; therefore, site grading is assumed to include no more than 2 to 3 feet of fill. The recommendations contained in this report will not necessarily apply if loading conditions or fill height exceed the above-assumed conditions.

FIELD EXPLORATION PROGRAM

Our initial field exploration program included ten (10) SPT borings to a depth of 20 feet below the existing ground surface proposed throughout the site. The vegetation permit was denied for the proposed borings on the west side of the property so only the borings on the east side of the property were performed. The SPT borings were conducted using methods consistent with ASTM D-1586. The equipment and procedures used in the SPT borings are described in detail in **Appendix II**. Upon completion of the borings, the boreholes were backfilled with cement grout.

TEST LOCATIONS

The locations of the borings are shown in the attached **Figure 2 – Test Location Map**. They were located by using Google Earth Pro and a handheld Global Positioning System (GPS) device. Therefore, the locations indicated should be considered accurate only to the degree implied by the method of measurement used. If more precise locations of the borings and tests are desired, then we recommend that a registered land surveyor be employed to locate them on site.

LABORATORY TESTING PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our office for a geotechnical engineer to confirm soil classifications. Laboratory testing was performed on selected samples as deemed necessary to aid in soil classification and to further define the engineering properties of the soils. The laboratory tests performed included Atterberg Limits, Natural Moisture Content, Sieve Analysis, and Percent Finer than the U.S. No. 200 Sieve (percent silt and clay).

The test results are presented in the attached **Soil Boring Profiles** shown in **Figure 3** at the depths from which the samples were recovered. Test results from the sieve analyses are also presented in the attached Grain Size Distribution Curves in **Appendix I**. The soil descriptions shown on the soil boring profiles are based on visual-manual procedures following local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

GENERAL SUBSURFACE CONDITIONS

The general subsurface conditions encountered during the field exploration are shown on the attached soil borings profiles. Soil stratification is based on evaluation of recovered soil samples and interpretation of the field boring logs. The stratification lines represent the approximate boundaries between the soil types. The actual transitions may be gradual. Due to the large area of study, the soil profiles below are described in general terms. The attached Soil Boring Profiles should be reviewed for soil profile details.

The results of the borings can be summarized in the following generalized soil profile.

Depth Below Ground Surface (feet)		Description
From	To	
Ground Surface	12	Loose to medium slightly silty fine SAND (SP-SM), poorly graded SAND (SP), silty SAND (SM), trace of roots, slightly organic content, trace of gravel (limestone fragments). SILT (ML) was encountered at borings B-08 and B-09 at 8 feet in depth, and Soft Weathered Limestone was encountered in boring B-07 at an approximate depth of 9 feet below the ground surface.
12	20	Soft Weathered Limestone was encountered in most of the borings. Hard Limestone was encountered in boring B-06. Boring B-05 encountered loose to very loose clayey–silty SAND (SC-SM) and silty SAND (SM). Borings B-07 and B-08 encountered soft SILT (ML) and loose silty SAND (SM) at an approximate depth of 16½ feet below the ground surface.

The above soil profile is outlined in general terms only. Please refer to **Figure 3** for soil profile details.

GROUNDWATER LEVEL

Groundwater was encountered in the boreholes at depths ranging from the existing ground surface (standing water) to a depth of approximately 6 feet at the time of our field exploration (November 2023). The groundwater depths shown on the boring profiles represent the groundwater surface encountered on the date shown. Fluctuations in groundwater level should be anticipated throughout the year due to seasonal variations in rainfall, and other factors.

EVALUATION AND RECOMMENDATIONS

In view of our findings, subsurface soil conditions appear to be adequate to allow use of a shallow footing foundation system with slab-on-grade. <u>Compaction of the surface soils is recommended to increase the soil bearing capacity and minimize foundation settlement.</u>

Considering that the project is at an early stage and that architectural or structural plans were not available, the following are our general recommendations for overall site preparation and foundation design for the existing soil conditions. These recommendations are made as a guide for the design engineer and/or architect, parts of which should be incorporated into the project's general specifications.

<u>SITE PREPARATION:</u>

1. Each building area "footprint", plus a minimum margin of 5 feet, should be stripped and grubbed of all surface vegetation, debris or other deleterious material, as encountered. During the clearing and grubbing operation, roots with a diameter greater than 1-inch or small roots in high density should be completely removed. These materials should be disposed of in areas designated by the Owner.

2. The cleared surfaces in construction areas should be proof-rolled using the appropriate compaction equipment for site and soil conditions. Adjust the moisture content of the soil, as necessary, to aid compaction. Sufficient passes should be made to develop a minimum dry density of 95 percent of the Modified Proctor Maximum Dry Density (ASTM D-1557) to a depth of 12 inches below the compacted surface. Replace all material, if determined to be deleterious, in areas that "yield" during the proof-rolling operation and replace with suitable fill material conforming to that stated in Item 4.

3. After satisfactory proof-rolling of the cleared surface in accordance with the above, filling with suitable material may proceed. Fill material should conform to that stated in Item 4 below. The fill should be placed in level lifts not exceeding 12 inches in uncompacted thickness. Each lift should be compacted by repeated passes with appropriate compaction equipment to achieve at least 95 percent of the Modified Proctor Maximum Dry Density (ASTM D-1557). The filling and compaction operations should continue until the desired elevation(s) is achieved.

4. Fill material should preferably consist of clean to slightly silty fine sands (SP or SP-SM), free of organic or other deleterious materials, with less than 12 percent passing the U.S. Sieve No. 200.

5. Excavate the continuous wall footing lines and/or column footings to the proposed bottom of footing elevations and, thereafter, verify the in-place compaction. If necessary, compact the bottom of the excavations to achieve a minimum dry density of 95 percent of the Modified Proctor Maximum Dry Density (ASTM D-1557). This density should be developed to a minimum depth of 12 inches below the bottom of the footings. Over-excavate and recompact, as necessary, to fulfill the above compaction criteria. The moisture content of the foundation soils must be controlled during the compaction procedure to aid compaction.

6. Ardaman should be employed by the Owner to observe and test all prepared and compacted areas to document that all unsuitable soils are removed and that the natural foundation and fill soils are prepared and compacted in accordance with the above recommendations.

FOUNDATION DESIGN:

Foundation soils prepared in accordance with the above recommendations should be suitable for supporting the proposed structures on an economical and conventionally designed shallow foundation system. The foundations may be designed for an allowable net soil contact pressure of 2,000 pounds per square foot (psf) or less, provided the above site preparation recommendations are followed.

Minimum soil coverage of 12 inches should be maintained from the bottom of the exterior foundations to the adjacent outside finished grades.

DEWATERING

If the control of groundwater is required to achieve the necessary stripping, excavation, proof-rolling, filling, compaction, and any other earthwork, sitework, and/or foundation subgrade preparation operations required for the project, the actual method(s) of dewatering should be determined by the contractor. Dewatering should be performed to lower the groundwater level to depths that are adequately below excavations and compaction surfaces. Adequate groundwater level depths below excavations and compaction surfaces vary depending on soil type and construction method and are usually 2 feet or more. Dewatering solely with sump pumps may not achieve the desired results

UTILITY EXCAVATION

Sands with less than 12% fines, consisting of fine sand (SP), slightly silty fine sand (SP-SM), and slightly clayey fine sand (SP-SC), were encountered in the soil profiles at varying thicknesses and depths within the upper 10 feet. These soil types are suitable as pipe bedding material and for reuse as backfill. Roots as well as any other organic material or unsuitable materials should be removed prior to placement of any fill. In addition to these soil types, silty fine sand (SM) and silts (SM) were also encountered in the upper 10 feet. These materials are not suitable for use as utility support or pipe backfill. If encountered at pipe bedding elevation(s), these materials should be over-excavated and replaced with at least 6 inches of gravel such as FDOT No. 89 Stone.

REUSE OF ENCOUNTERED MATERIALS IN THE TEST BORINGS:

Fine Sand (SP)
Slightly Clayey Fine Sand (SP-SC)
Slightly Silty Fine Sand (SP-SM)

These sands contain less than 12 percent fines. Sands excavated below the water table should be stockpiled to drain excess moisture.

After removal of the surficial root-laden sands, these soil types are suitable as unprocessed fill for use as structural fill. They are also suitable for use in roadway and parking lot embankments and subgrades as well as general landscaping fill. Drainage or permeability characteristics of SP materials are good.

Silty Fine Sand (SM)

This soil type is generally considered to be poorer quality fill soil due to its relatively high fines content, with soil with higher fines content being less suitable than the lower fines content soil. It may be used as structural fill and in roadway and parking lot embankments; however, it will be difficult to compact and should only be used above the existing groundwater level at the time of construction. Extensive moisture conditioning will likely be required. If used, we recommend soils with less than 35 percent fines content.

Clayey Fine Sand (SC), Silty Clayey Fine Sand (SC-SM), and Silts (ML)

These soils are not suitable for reuse as structural fill, nor may they be used under roadway or parking lot embankments. Reuse will be limited to non-structural areas as berms. Due to the high fines content and plasticity, these materials will be very difficult to work and compact.

Limestone

Limestone is suitable for use in roadway/parking lot embankments and subgrades. Cobble and boulder-size fragments should be expected throughout the stratum, which will require crushing to reduce the particle sizes if used for fill material. Typically, we recommend no individual pieces larger than 3½ inches in the upper foot, 6 inches between 1 and 2 feet and 12 inches below a depth of 2 feet. Soft limestone (N-Values less than or equal to 50 blows per foot) can typically be excavated with an excavator. Hard weathered limestone (N-values greater than 50 blows per foot) may require use of hoe rams or hydraulic hammers to excavate the rock when encountered.

CLOSURE

The discussions in this report are based on the data obtained from six (6) soil borings performed at the approximate locations indicated on the attached **Figure 2 – Test Location Map**.

The general recommendations provided above are based on a due diligence requirement. This report does not reflect any variations that may occur between the borings or tests. The nature and extent of variations may not become evident until during the final subsurface soil exploration program and/or construction. If variations then appear evident, it will be necessary for a re-evaluation of the discussions in this report.

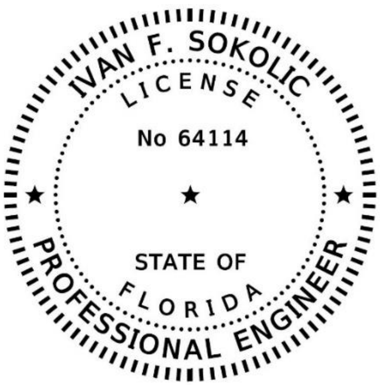
While the borings and tests are representative of subsurface conditions at their respective locations and for their respective vertical reaches, local variations characteristic of the subsurface materials of the region are anticipated and may be encountered. The boring profiles and related information are based on the driller's logs and visual evaluation of selected sample in the laboratory. The delineation between soil types shown on the profiles is approximate and the description represents our interpretation of subsurface conditions at the designated boring locations and on the particular date drilled.

This study does not include an evaluation of the environmental (ecological or hazardous/toxic material related) conditions of the site and subsurface. If you have any questions about this report, please contact this office.

Very truly yours,

ARDAMAN & ASSOCIATES, INC.

Julian Coronel
Senior Engineer



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Ivan Sokolic Digitally signed by Ivan Sokolic
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on the date adjacent to the seal.

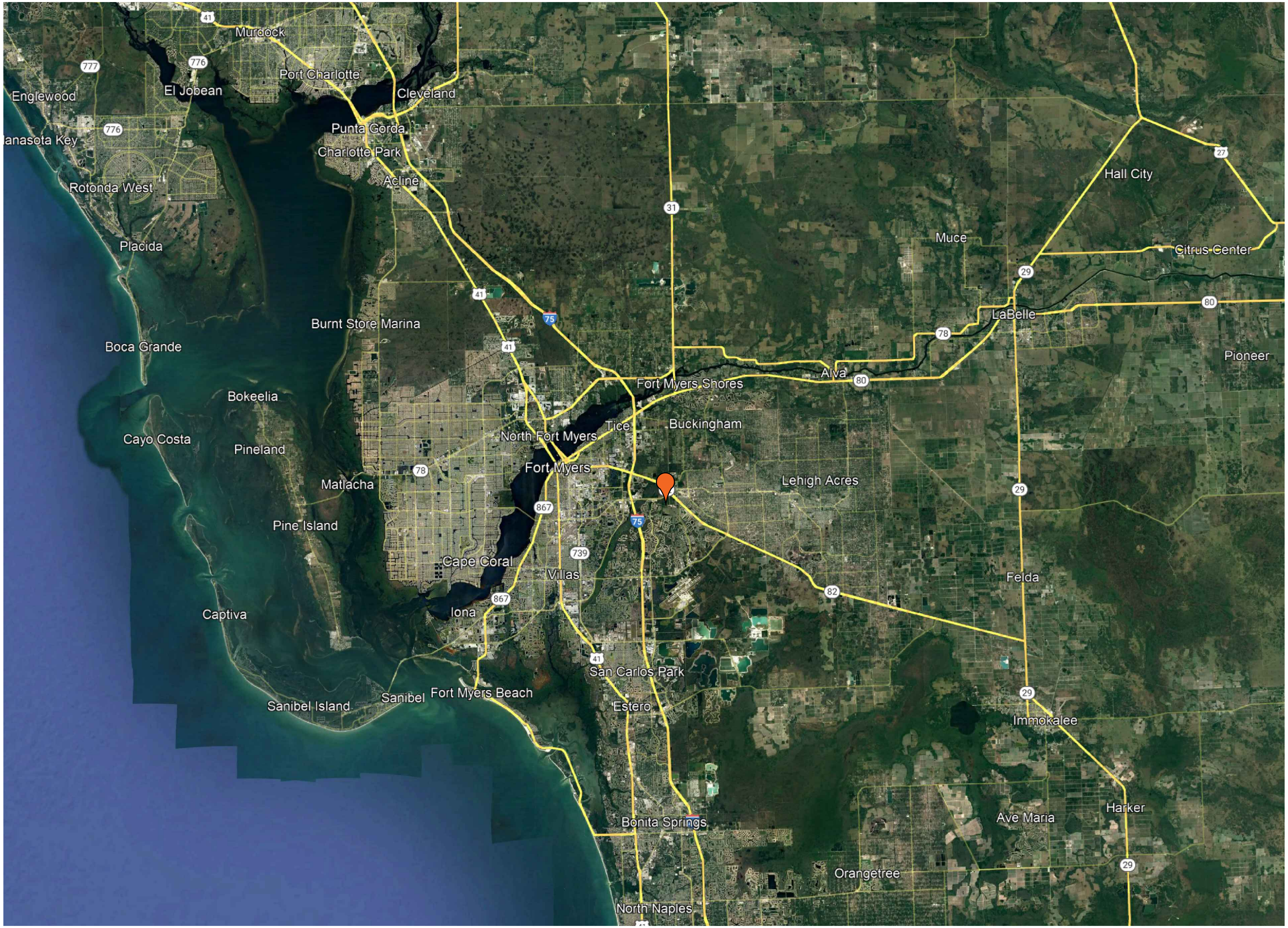
Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Ivan F. Sokolic, P.E. No.64114
Senior Engineer / Branch Manager

Attachments:	Figure 1 –	Site Location Map
	Figure 2 –	Test Location Map
	Figure 3 –	Soil Boring Profiles
	Appendix I –	Grain Size Distribution Curves
	Appendix II -	Soil Boring, Sampling and Testing Methods Project Soil Description Procedure Unified Soil Classification System (USCS)

FIGURES

SITE LOCATION MAP
BORING LOCATION MAP
SOIL BORING PROFILES



LEGEND

APPROXIMATE SITE LOCATION

APPROXIMATE SCALE

0mi 5 10

REFERENCE: GOOGLE EARTH PRO 2021, IMAGERY DATED 1/2021

SITE LOCATION MAP

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

LEE COUNTY SOLID WASTE
MATERIALS RECOVERY
LEE COUNTY, FLORIDA

DRAWN BY: KM	CHECKED BY: JC	DATE: 12/15/2023
FILE NO. 23-33-4545	APPROVED BY: IS	FIGURE: 1

G:\GEO\PROJECTS\2023\23-33-4545 RRT - LEE CO SOLIDWASTE MATLS RECOV FACILTY, LEE CO\05 DOCUMENTS\PREPARED DRAWINGS AND PLANS\SOLID WASTE.DWG

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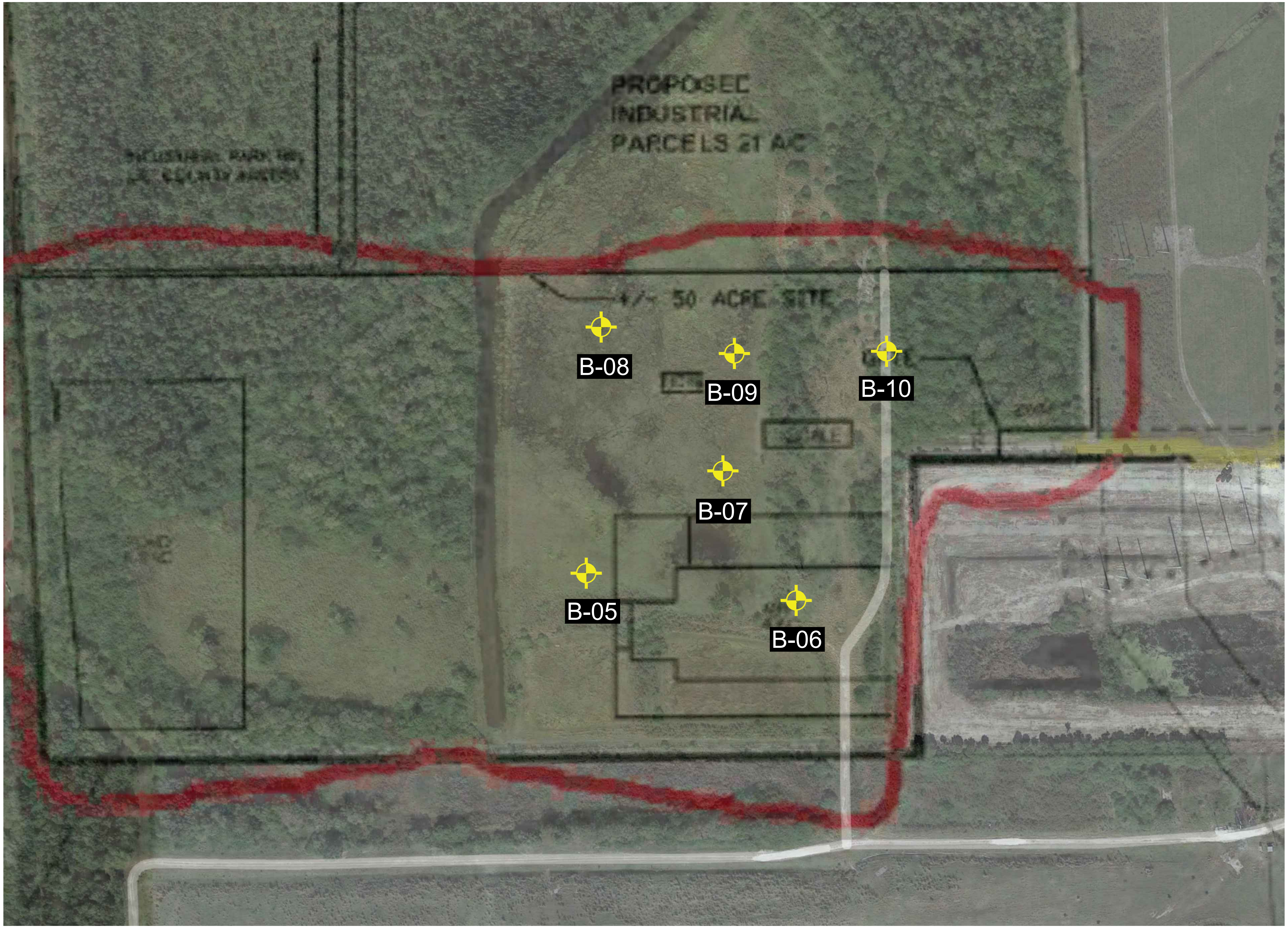

LEGEND

APPROXIMATE LOCATION OF SPT BORINGS

N

APPROXIMATE SCALE

0ft 200 400

REFERENCE: GOOGLE EARTH PRO 2021, IMAGERY DATED 1/2021

BORING LOCATION MAP

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

LEE COUNTY SOLID WASTE
MATERIALS RECOVERY
LEE COUNTY, FLORIDA

DRAWN BY:	CHECKED BY:	DATE:
KM	JC	12/15/2023

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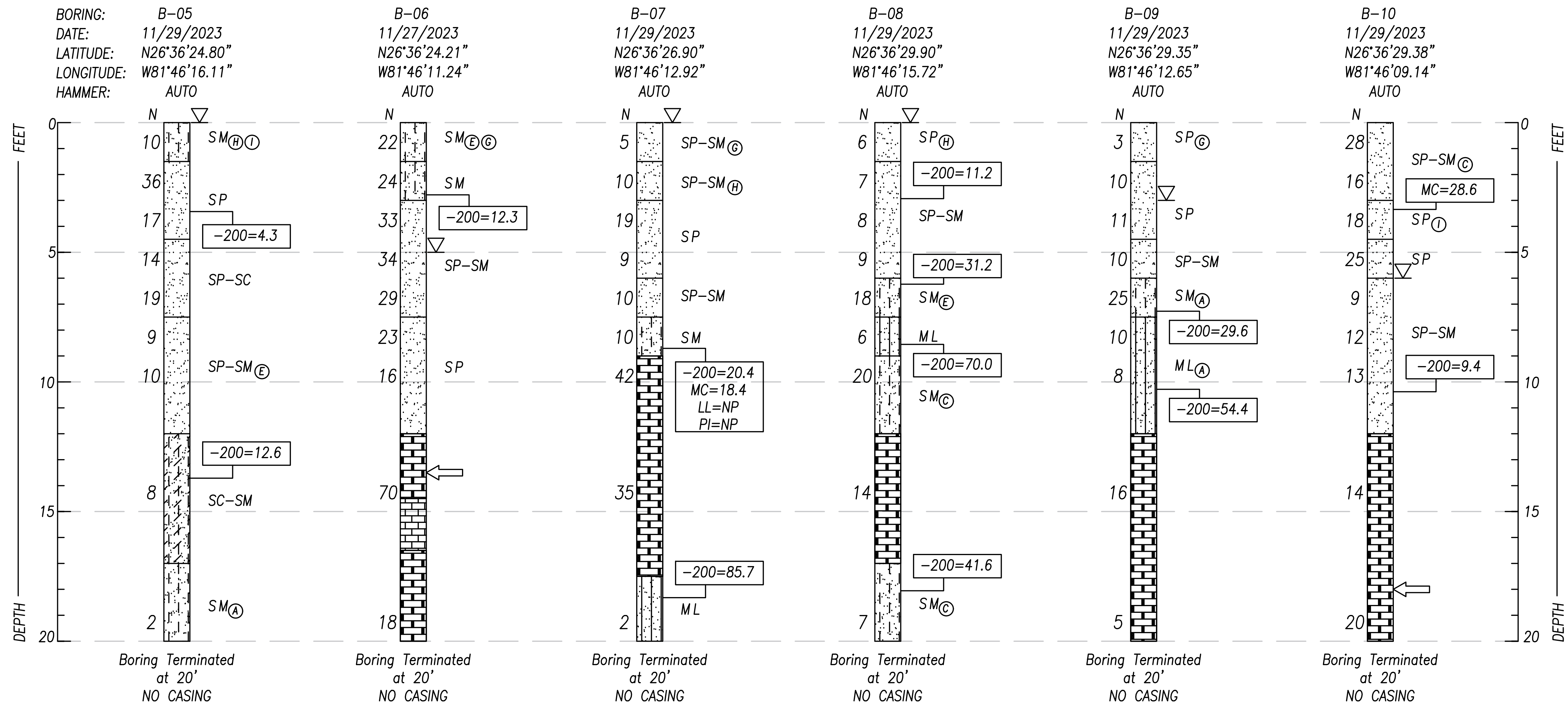


LEGEND

- SAND: Sand with ≤ 12% fines
- Silty SAND: Sand with 12% to 50% Silt
- Sandy SILT: Sand/Silt mixture with > 50% Silt
- Clayey Silty SAND: Sand with 12% to 50% Clay and Silt
- SOFT LIMESTONE: Limestone with N ≤ 50
- HARD LIMESTONE: Limestone with N > 50

ADDITIONAL SOIL COMPONENTS

- (A) Trace of Rock
- (B) Trace of Shell
- (C) Some Rock
- (D) Some Shell
- (E) Gravelly
- (F) Organic
- (G) Slightly Organic
- (H) Tree Roots
- (I) Wood Fragments
- (J) Debris

SPT	STANDARD PENETRATION TEST
SM	UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) GROUP SYMBOL
(A)	SUBSCRIPT INDICATING ADDITIONAL COMPONENTS OF SOIL SAMPLE
N	SPT N-VALUE IN BLOWS PER FOOT
▽	GROUNDWATER LEVEL MEASURED ON DATE DRILLED
MC	NATURAL MOISTURE CONTENT (%)
-200	% PASSING #200 SIEVE
LL	LIQUID LIMIT (%)
PI	PLASTICITY INDEX (%)
⇦	LOSS OF DRILLING FLUID CIRCULATION

SOIL BORING PROFILES

Ardaman & Associates, Inc.
Geotechnical, Environmental and Materials Consultants

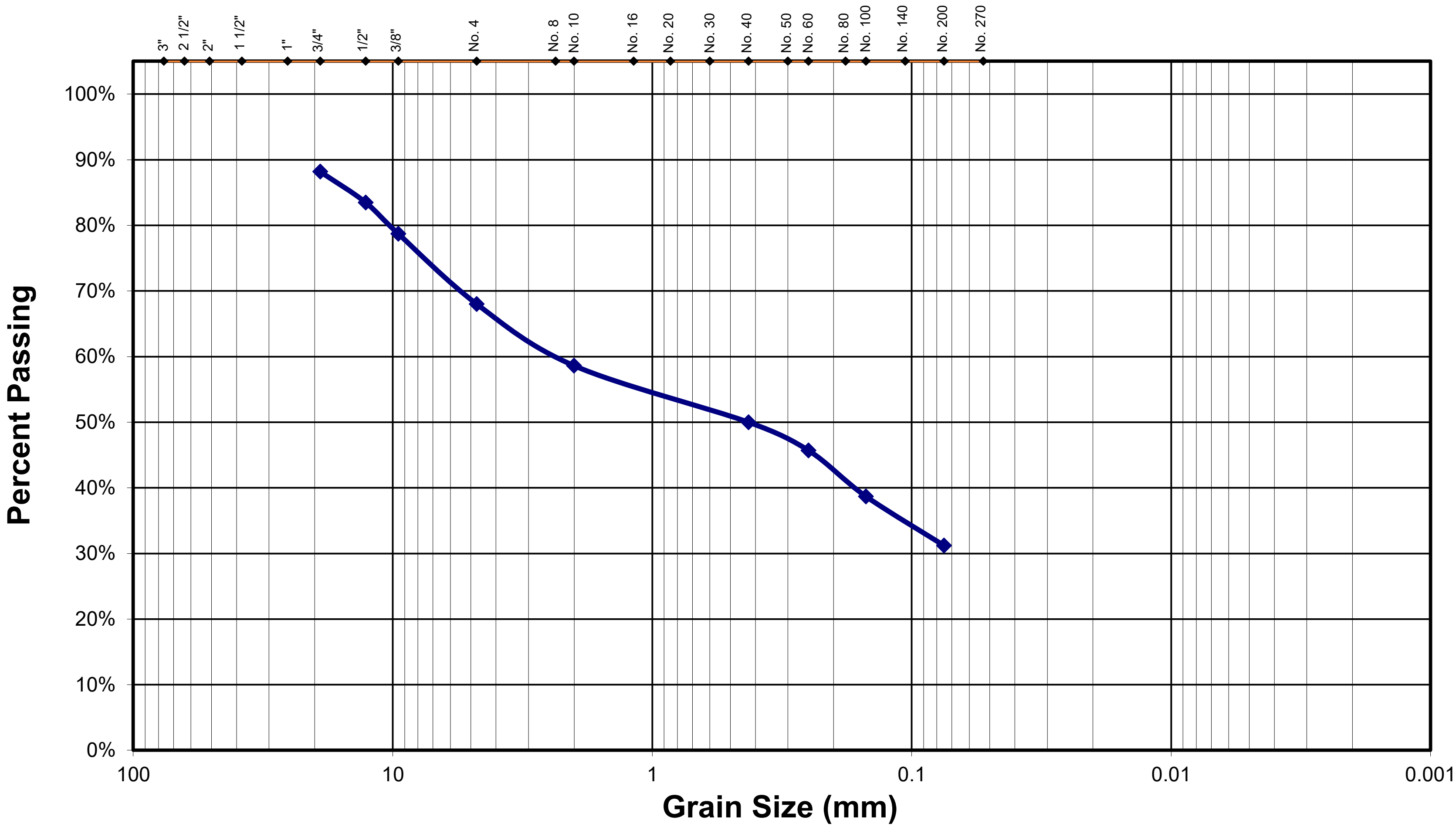
LEE COUNTY SOLID WASTE
MATERIALS RECOVERY
LEE COUNTY, FLORIDA

DRAWN BY: KM	CHECKED BY: JC	DATE: 12/15/2023
FILE NO. 23-33-4545	APPROVED BY: IS	FIGURE: 3

APPENDIX I

GRAIN SIZE DISTRIBUTION CURVES

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL	SAND		SILT	CLAY
	Coarse to Medium	Fine		

Project Name: 50-Acre Solid Waste Materials Recovery Facility

Project Location: Lehigh Acres, Florida, Lee County

Client Name: RRT Design & Construction

Graph Number: 1

Sample Depth (ft): 6.0'-7.5'

Boring Number: B-08

Sample Description: Silty SAND (SM)

Percent Passing No. 200 Sieve = 31.2%

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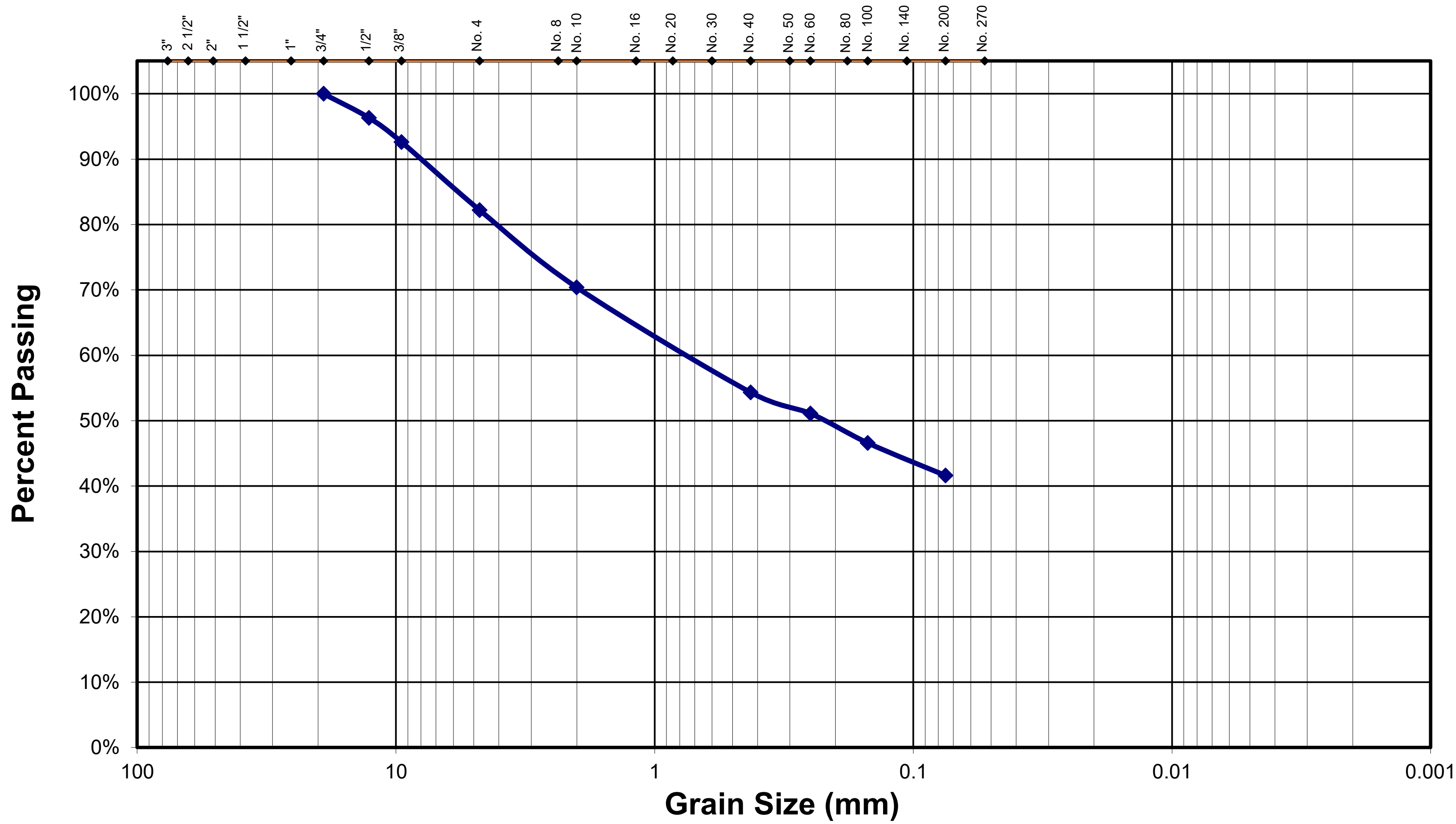
GRAIN SIZE DISTRIBUTION CURVE



GRAVEL	SAND		SILT	CLAY
	Coarse to Medium	Fine		

Project Name: 50-Acre Solid Waste Materials Recovery Facility

Project Location: Lehigh Acres, Florida, Lee County

Client Name: RRT Design & Construction

Graph Number: 2

Sample Depth (ft): 18.5'-20.0'

Boring Number: B-08

Sample Description: Silty SAND (SM)

Percent Passing No. 200 Sieve = 41.6%

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APPENDIX II

SOIL BORING, SAMPLING AND TESTING METHODS
PROJECT SOIL DESCRIPTION PROCEDURE – UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

SOIL BORING, SAMPLING AND TESTING METHODS

STANDARD PENETRATION TEST

The Standard Penetration Test (SPT) is a widely accepted method of in-situ testing of foundation soils (ASTM D-1586). A 2 ft (0.6 m) long, 2 in (50 mm) O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 in (0.45 m) into the ground by successive blows of a 140 lb (63.5 Kg) hammer freely dropping 30 in (0.76 m). The number of blows needed for each 6 in (0.15 m) of penetration is recorded. The sum of the blows required for penetration of the second and third 6 in (0.15 m) increments penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual description of the retained soil sample. The N-value has been empirically correlated with various soil properties allowing a conservative estimate of the behavior of soils under load. The following tables relate N-values to a qualitative description of soil density and, for cohesive soils, an approximate unconfined compressive strength (Q_u):

Cohesionless Soils:	N-Value Safety Hammer	N-Value Auto Hammer	Description	Relative Density
	< 4	< 3	Very loose	0 - 15%
	4 - 10	3 - 8	Loose	>15% - 35%
	11 - 30	9 - 24	Medium	>35% - 65%
	31 - 50	25 - 40	Dense	>65% - 85%
	> 50	> 40	Very dense	>85% - 100%

Cohesive Soils:	N-Value Safety Hammer	N-Value Auto Hammer	Description	Unconfined Compressive Strength, Q_u
	< 2	< 1	Very soft	< 0.25 tsf (25 kPa)
	2 - 4	1 - 3	Soft	0.25 - 0.50 tsf (25 - 50 kPa)
	5 - 8	4 - 6	Firm	>0.50 - 1.0 tsf (50 - 100 kPa)
	9 - 15	7 - 12	Stiff	>1.0 - 2.0 tsf (100 - 200 kPa)
	16 - 30	13 - 24	Very stiff	>2.0 - 4.0 tsf (200 - 400 kPa)
	> 30	> 24	Hard	> 4.0 tsf (400 kPa)

The tests are usually performed at 5 ft (1.5 m) intervals. However, more frequent or continuous testing is done by our firm through depths where a more accurate definition of the soils is required. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid. After completion of a test boring, the hole is kept open until a steady state groundwater level is recorded. The hole is then sealed by backfilling with neat cement.
Representative split-spoon samples from each sampling interval and from different strata are brought to our laboratory in air-tight jars for classification and testing, if necessary. Afterwards, the samples are discarded unless prior arrangements have been made.

HAND AUGER BORINGS

Hand auger borings are used, if soil conditions are favorable, when the soil strata are to be determined within a shallow (approximately 5 ft [1.5 m]) depth or when access is not available to power drilling equipment. A 3 in (75 mm) diameter hand bucket auger with a cutting head is simultaneously turned and pressed into the ground. The bucket auger is retrieved at approximately 6 in (0.15 m) intervals and its contents emptied for inspection. Sometimes post-hole diggers are used, especially in the upper 3 ft (1 m) or so. The soil sample obtained is described and representative samples put in bags or jars and transported to the laboratory for classification and testing, if necessary.

POWER AUGER BORINGS

Auger borings are used when a relatively large, continuous sampling of soil strata close to the ground surface is desired. A 4 in (100 mm) diameter, continuous flight, helical auger with a cutting head at its end is screwed into the ground in 5 ft (1.5 m) sections. It is powered by the rotary drill rig. The sample is recovered by withdrawing the auger out of the ground without rotating it. The soil sample so obtained, is described and representative samples put in bags or jars and returned to the laboratory for classification and testing, if necessary.

LABORATORY TEST METHODS

Soil samples returned to our laboratory are looked at again by a geotechnical engineer or geotechnician to obtain more accurate descriptions of the soil strata. Laboratory testing is performed on selected samples as deemed necessary to aid in soil classification and to help define engineering properties of the soils. The test results are presented on the soil boring logs at the depths at which the respective sample was recovered, except that grain-size distributions or selected other test results may be presented on separate tables, figures or plates as discussed in this report, the results of which will be located in an Appendix. The soil descriptions shown on the logs are based upon visual-manual procedures in accordance with local practice. Soil classification is in general accordance with the Unified Soil Classification System (ASTM D-2487) and is also based on visual-manual procedures.

THE PROJECT SOIL DESCRIPTION PROCEDURE FOR SOUTHWEST FLORIDA (1)

For use with the ASTM D-2487 Unified Soil Classification System

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

BOULDERS (>12 in [300 mm]) and COBBLES (3 in [75 mm] to 12 in [300 mm]):

GRAVEL:

Coarse Gravel: ¾ in (19 mm) to 3 in (75 mm)
Fine Gravel: No. 4 (4.75 mm) Sieve to ¾ in (19 mm)

Descriptive Adjectives:

0 – 5%	---	no mention of gravel in description
>5% – 15%	---	trace
>15% – 30%	---	some
>30% – 50%	---	gravelly (shell, limerock, cemented sands)

SANDS:

Coarse Sand: No. 10 (2 mm) Sieve to No. 4 (4.75 mm) Sieve
Medium sand: No. 40 (425 μm) Sieve to No. 10 (2 mm) Sieve
Fine sand: No. 200 (75 μm) Sieve to No. 40 (425 μm) Sieve

Descriptive Adjectives:

0 – 5%	---	no mention of sand in description
>5% – 15%	---	trace
>15% – 30%	---	some
>30% – 50%	---	sandy

SILT/CLAY: <#200 (75 μm) Sieve

Silty or Silt: PI < 4
Silty Clayey or Silty Clay: 4 ≤ PI ≤ 7
Clayey or Clay: PI > 7

Descriptive Adjectives:

0 – 5%	---	clean (no mention of silt or clay in description)
>5% – 12%	---	slightly
>12% – 30%	---	clayey, silty, or silty clayey
>30% – 50%	---	very

ORGANIC SOILS:

Organic Content	Descriptive Adjectives:	Classification:
0 – 2.5%	no mention of organics in description	see above
2.6 – 5%	slightly organic	see above
>5 – 20%	organic	add "with organic fines" to group name
>20-75%	highly organic sand or muck sandy peat	Peat (PT)
>75%	fibrous peat	Peat (PT)

STRATIFICATION AND STRUCTURE:

Descriptive Term:	Thickness:
seam:	less than ½ in (13 mm) thick
layer:	½ to 12 in (13 to 300 mm) thick
stratum:	more than 12 in (300 mm) thick
pocket:	small, erratic deposit, usually less than 1 ft
occasional:	1 or less per ft of thickness

Descriptive Term:	Thickness:
frequent:	more than 1 per ft of thickness
calcareous:	containing calcium carbonate (reaction to diluted HCL)
hardpan:	spodic horizon usually medium dense
marl:	mixture of carbonate clays, silts, shells and sands.

ROCK CLASSIFICATION:

Description:
Hard Limestone or Caprock: N-values >50 bpf
Soft Weathered Limestone: N-values ≤ 50 bpf

(1) This soil description procedure was developed specifically for projects in southwest Florida because it is believed that the terminology will be better understood as a result of local practice. It is not intended to supplant other visual-manual classification procedures for description and identification of soils such as ASTM D-2488.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

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]	$C_u > 4$ and $1 < C_c < 3$[E]	GW	Well graded gravel[F]
			$C_u < 4$ and/or $1 > C_c > 3$[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]	$C_u \geq 6$ and $1 \leq C_c \leq 3$[E]	SW	Well graded sand[I]
			$C_u < 6$ and/or $1 > C_c > 3$[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:	Liquid limit - oven dried (< 0.75)	OL	Organic clay[K,L,M,N]
			Liquid limit - not dried (< 0.75)	OL	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:	Liquid limit - oven dried (< 0.75)	OH	Organic clay[K,L,M,P]
			Liquid limit - not dried (< 0.75)	OH	Organic clay[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-in (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] $C_u = D_{60}/D_{10}$ $C_C = D_{30}^2/(D_{10} x D_{60})$

[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.