

NEW FIRE STATION BUILDING  
SUBSURFACE SOIL EXPLORATION  
3451 SHOAL LINE BOULEVARD  
HERNANDO BEACH  
HERNANDO COUNTY, FLORIDA

CONDUCTED FOR

**HERNANDO BEACH FIRE DEPARTMENT**



**CENTRAL TESTING LABORATORY  
INVERNESS, FLORIDA**

MAY 28, 2009  
0981114.200

Engineering & Materials Testing

Reply to:  
Inverness

May 28, 2009

Hernando Beach Fire Department  
3451 Shoal Line Boulevard  
Hernando Beach, FL 34613  
(352) 540-6326  
Attn: Kathy Connell  
c/o Hernando County Public Works Department  
Engineering Division  
1525 E. Jefferson Street  
Brooksville, FL 34601  
(352) 754-4062  
(352) 754-4423 fax

Attn: Bob Carpenter

Subject: Subsurface Soil Exploration  
New Fire Station Building  
3451 Shoal Line Boulevard  
Hernando Beach, Hernando County, Florida  
CTL Project No. 0981114.200

Dear Mr. Wert:

Central Testing Laboratory (CTL) has completed a subsurface soil exploration for the above referenced project. The purposes of performing this exploration were to evaluate the general subsurface conditions within the proposed new building area and to provide recommendations for site preparation, foundation support and design. This report documents CTL's findings and presents our engineering recommendations.

The site of the proposed new building is located adjacent to the north side of the existing Fire Station building at 3451 Shoal Line Boulevard (Section 13, Township 23 south, Range 16 east) in Hernando Beach, Hernando County, Florida. The general site location is shown on the Hernando County, Florida, Street Atlas Map and is presented in Figure No. 1.

5400 S. Florida Avenue  
Inverness, FL 34450  
(352) 726-6447

130 Satellite Ct.  
Leesburg, FL 34748  
(352) 787-1268

Sumter County  
(352) 793-3110

1725 SW 17th Street  
Ocala, FL 34474  
(352) 622-1186



### **Proposed Construction**

It is CTL's understanding that the proposed new building consists of a 50 ft. x 50 ft. single story pre-engineered metal building. It has been assumed that maximum loading conditions for the proposed structure are on the order of 2 to 3 kips per linear foot (klf) for linear foundations and 40 kips for individual column foundations. If the actual loads exceed the maximum assumed loads, then the recommendations in this report may not be valid.

The grading plans are not complete at this time, therefore, it has been assumed that only minimal fill will be used to bring the new building area to about the same finished floor elevation as the existing fire station building.

### **Review of Soil Survey Maps**

Based on the 1977 Soil Survey for Hernando County, Florida as prepared by the U.S. Department of Agriculture, Soil Conservation Service, the predominant soil type at the site is identified as the "Udalfic Arents - Urban land complex" soil series. The "Udalfic Arents" soil series consists soil materials dug from canals, reworked and shaped into building sites. According to the Soil Survey, the seasonal high water table for this soil series is typically 3.5 to 5.0 feet below the natural ground surface.

### **Field Exploration Program**

The field exploration program consisted of performing four (4) Standard Penetration Test (SPT) borings. A site plan was not provided to CTL. Therefore, the locations of these borings are illustrated on a hand drawn Boring Location Plan presented in Figure No. 2. The boring locations were determined in the field based on measurements from the existing Fire Station building. The locations should be considered accurate only to the degree implied by the method of measurement used.

The SPT borings were performed at locations within the proposed new building area. The borings were advanced to a depth of 20.0 feet below the ground surface using the methodology outlined in ASTM D-1586. This field procedure is outlined in the methodology summary presented in Appendix I.

Samples recovered during performance of the SPT borings were visually classified in the field and representative portions of the samples were placed in containers and transported to our laboratory for further analysis.

The groundwater level at each of the boring locations was measured upon completion of drilling to document the water table conditions at the site.

### **Laboratory Testing Program**

Soil samples from the borings were classified in the field and transported to our laboratory for further testing and classification. The soil samples were visually classified in general accordance with the Unified Soil Classification System (ASTM D-2488) with the soil colors being determined from the

Munsell Soil Color Chart. Organic content (L.O.I.) tests were performed on selected samples to determine the engineering characteristics of the soils. The resulting soil descriptions and organic content test results are shown on the soil boring profiles presented in Appendix II.

### **Results of Field Exploration**

The results of the field exploration are graphically shown on the soil boring logs presented in Appendix II. These profiles represent our interpretation of the field boring logs and the results of the laboratory analysis of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual change may be more gradual than suggested.

The results of the borings indicate that the general soil profile consists of slightly clayey to clayey fine sands (Unified Soil Classifications - SP/SC and SC) from the surface to depths of 3.5 and 4.0 feet underlain with organic soils (Pt) and tree roots in borings B-1, B-2 and B-3. The limestone formation was encountered at depths of 4.0 and 6.0 feet and continued through completion depth of the borings. A loss of drilling fluid circulation was experienced in boring B-2 at a depth of 16.0 feet. It is not unusual to experience a loss of drilling fluid circulation within the upper limestone formation in this area of Florida.

The above soil profile is outlined in general terms only. Please refer to the boring logs in Appendix II for soil profile details.

The groundwater was encountered in the borings at a depth of 4.0 feet below the ground surface at the time of drilling. Changes in groundwater levels should be expected throughout the year due to seasonal differences in rainfall, tidal influences and other factors that may vary from the time the borings were conducted.

### **Typical Seasonal High Water Table**

The typical seasonal high water table each year is the water level in the August-September period at the end of the rainy season. The seasonal high water table is affected by a number of factors. The drainage characteristics of the soils, the land surface elevation, the presence and distance to relief points such as lakes, rivers, swamp areas, etc., are some important factors which have an influence on the seasonal high water table.

Based on CTL's interpretation of the site conditions using our boring logs, it is anticipated that the seasonal high water table will be at a depth of approximately 3.0 feet below the existing ground surface.

### **Evaluations and Recommendations**

The primary geotechnical concerns for this site are the organic soils and root material found between the depths of 3.5 to 6.0 feet in borings B-1, B-2 and B-3 along with the anticipated shallow seasonal high water table at 3.0 feet. Organic soils and root debris of the type encountered in the borings decay over time and consolidate when subjected to new building and fill loads leading to a potential for damaging differential settlement to occur.

CTL has evaluated the existing soil conditions, depth of water table, thickness of organic/root materials, depth to the limestone formation, and presence of the existing Fire Station building. Based on this evaluation CTL would recommend the following two (2) options for support of the new foundation system.

- Small diameter, cased, drilled shafts socketed into the limestone formation, and
- Excavation of the organic/root materials and backfilling with suitable soils.

For this geotechnical report CTL is recommending the latter option of excavation and backfilling. Therefore, with proper excavation, backfilling and site preparation as recommended in this report, the soils at final grade will be suitable for supporting the new structure on conventional shallow foundations such as linear foundations or individual column foundations.

Recommendations for foundation site preparation which in CTL's opinion are best suited for the proposed new building and existing soil conditions are presented below. The recommendations are made as a guide for the contractor, design engineer and/or architect. Parts of these recommendations should be incorporated into the project's specifications.

### **Recommended Site Preparation**

#### **Stripping and Grubbing**

The "footprints" of the proposed building, plus an additional horizontal margin of 5 feet, should be stripped of all vegetation, stumps, surface debris, or other deleterious materials, as encountered. The actual depth(s) of stripping and grubbing must be determined by visual observation and judgment during the earthwork operation.

#### **Excavation**

After stripping and grubbing excavate the top two (2) feet of the clayey soils for the entire building footprint plus five (5) additional feet in the north, west and east sides. **Do not excavate at anytime beyond the new building footprint along the south side adjacent to the existing Fire Station building.** Continue with excavation of the organic soils, root debris and organics mixed with other materials. The limits and extent of this unsuitable materials are not known and excavation will need to explore and follow the pockets and layers of unsuitable soils for complete removal. Where excavation extends below the water table, materials excavated from the top two (2) feet may need to be mixed with the organic soils to facilitate removal. Based on the boring data it should be anticipated that excavation depths will range between 2.0 and 6.0 feet below existing site grade.

Backfilling with compacted suitable soils should immediately proceed after the unsuitable soils have been excavated.

### Suitable Backfill and Fill Material and the Compaction of Soils

The backfill and fill materials should be free of organics such as roots and/or vegetation. CTL recommends using soils with less than 10 percent by dry weight of material passing the U.S. Standard No. 200 sieve size. Soils with greater than 10 percent passing the No. 200 sieve will be difficult to compact due to their inherent nature to retain soil moisture. To achieve the recommended soil density, thinner lifts and/or moisture adjustments may be needed with soils having more than 10 percent passing the No. 200 sieve, or if light compaction equipment is used in the compaction process.

To avoid damaging neighboring structures while compaction is underway and prior to initiating the compaction operation, existing conditions (i.e. cracks) of the structures should be documented with photographs and/or survey if necessary. Compaction should cease if deemed harmful to adjacent structures. **Heavy vibratory compactors should not be used on this site.** Central Testing Laboratory should be notified immediately if such a situation exists.

Suitable soils should be placed in level lifts not thicker than 12 inches (uncompacted). Each lift should be compacted to at least 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value. If hand-held or light compaction equipment is used, reduce the uncompacted lift thickness to 6 inches. The backfilling and compaction operation should continue in lifts until the desired elevation is attained.

Compaction of the backfill should begin at one (1) foot above the bottom of the excavation or two (2) feet above the water table.

### Foundation Support

After excavation, backfilling, filling and compaction, excavate the foundations to the proposed bottom of the footing elevations and verify the in-place compaction for a depth of one (1) foot below the footing bottoms. If necessary, recompact the bottoms of the footing excavations to achieve a minimum dry density equivalent to 95 percent of the modified Proctor maximum dry density (ASTM D-1557) value for a depth of one (1) foot below the footing bottoms. **The bottom of the foundation footings should not be deeper than 30 inches below existing ground elevation.**

Based on the existing soil conditions, and assuming the above outlined excavation, backfilling, filling, compaction and depth of footing criteria is implemented, an allowable soil bearing pressure of 2,500 pounds per square foot (p.s.f.) may be used in the foundation design. This bearing pressure should result in foundation settlements within tolerable limits (i.e., 1 inch or less).

All bearing wall foundations should be a minimum of 16 inches wide and column foundations 30 inches wide. A minimum soil coverage of **18** inches should be maintained from the bottom of the exterior foundations to the adjacent outside finished grades.

Compaction beneath the floor slab should be verified for a depth of 12-inches and meet the 95 percent criteria (modified Proctor, ASTM D-1557). **The floor slab should be structurally sufficient to support the heavy fire fighting equipment used at this Station.**

Moisture entry from the underlying subgrade soils should be minimized. An impervious membrane placed between the subgrade soils and floor slab will help to accomplish this. A polyethylene film (6 mil) is commonly used for this purpose. Care should be used so that the membrane is not punctured when placing reinforcing steel (or mesh) and concrete.

If columns are used, expansion joints should be used around columns if they are to be isolated from the floor slab. The expansion joints should be sealed with a water-proof sealant.

Based on the groundwater conditions encountered, dewatering should not be required to achieve the necessary stripping and ensuing excavation, backfilling, and compaction requirements presented in this report.

### **Quality Control**

CTL recommends establishing a comprehensive quality control program to insure that site preparation and foundation construction is conducted according to plans and specifications. The materials testing and inspection services should be provided by Central Testing Laboratory.

An engineering technician should be on-site to monitor all stripping and excavation to verify that all deleterious materials have been removed. Density testing should be performed during backfilling and below all footings and the floor slab to check the required density. Field density values should be compared to laboratory Proctor moisture-density results for each different natural and fill soil encountered.

Inspection and testing of the construction materials for the foundations and other structural components are also recommended.

### **Closure**

The analyses and recommendations stated within this report are based upon the data obtained from the soil borings in Appendix II and the maximum assumed loading conditions. Variations may be present adjacent to or between the borings which were not apparent in the boring logs. If variations are encountered during construction, it may be necessary to reevaluate the recommendations made in this report.

Generally accepted soil and foundation engineering practices were employed in the preparation of this report. CTL should review the conclusions and recommendations made in this report if changes occur in the design of the proposed project.

Hernando Beach Fire Department  
New Fire Station Building, Hernando Beach  
CTL Project No. 0981114.200

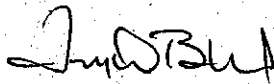
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Page No. 7

**Should it be desired to install the small diameter, cased, drilled shaft option for support of the foundation system, CTL will be pleased to provide recommendations under cover of a separate report.**

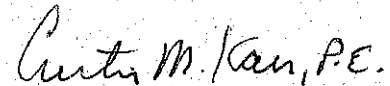
In Appendix III, CTL has provided a copy of "Your Geotechnical Report - Uses and Limitations." This document outlines important information as to the uses and limitations of this geotechnical report.

CTL appreciates the opportunity to provide our services on this project. Should you have any question concerning this report please do not hesitate to contact our engineering office in Inverness at (352) 726-6447, by fax at (352) 726-6385 or by e-mail at [ctlinverness@tampabay.rr.com](mailto:ctlinverness@tampabay.rr.com).

Respectfully submitted,  
CENTRAL TESTING LABORATORY, INC.



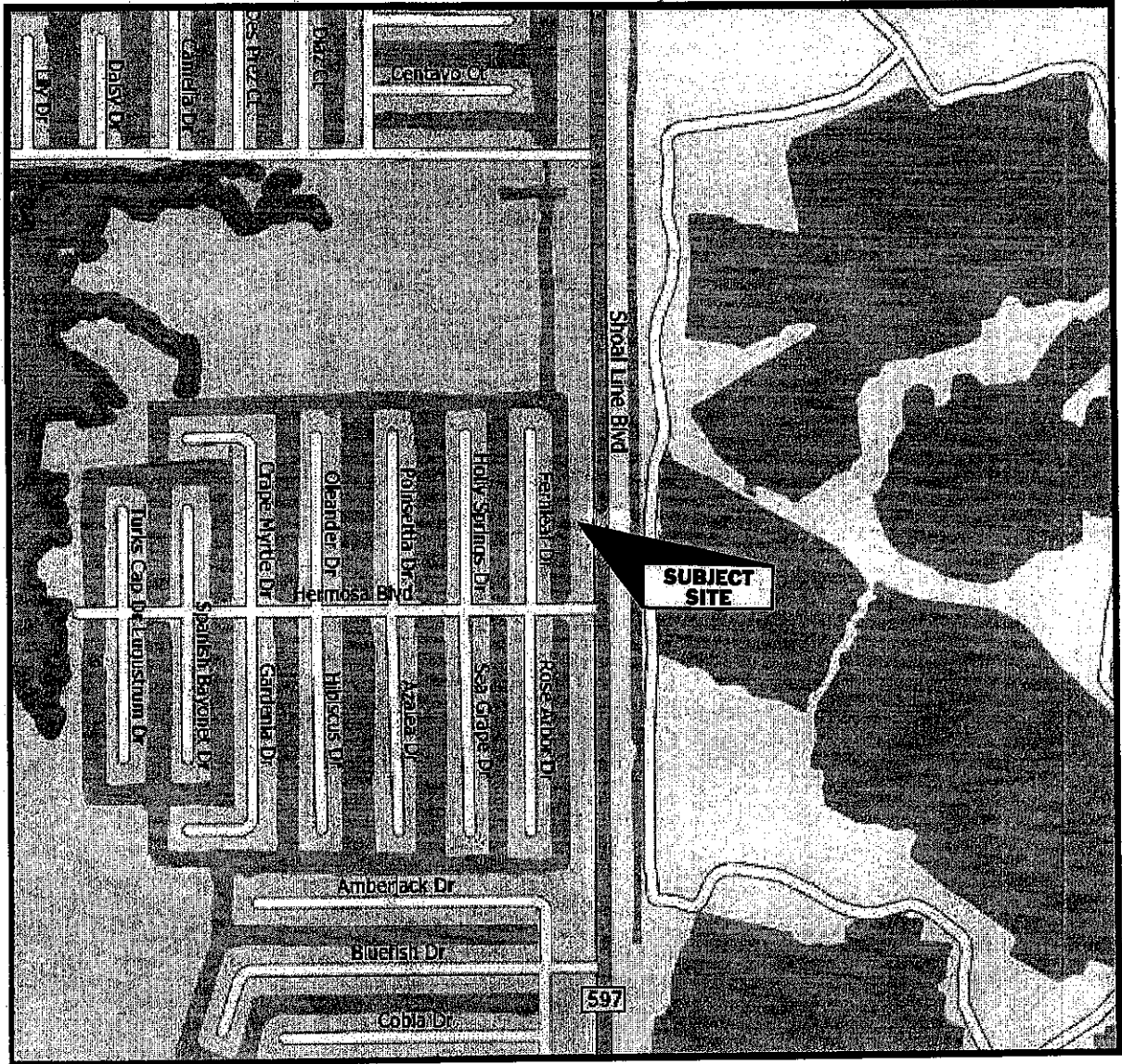
Terry D. Bland  
Branch Manager



Curtis M. Karr, P.E. 5-28-09  
Project Engineer  
Florida Registration No. 48173

cc: File

CMK/tap



Not to Scale



**Central Testing Laboratory  
Engineering & Materials**

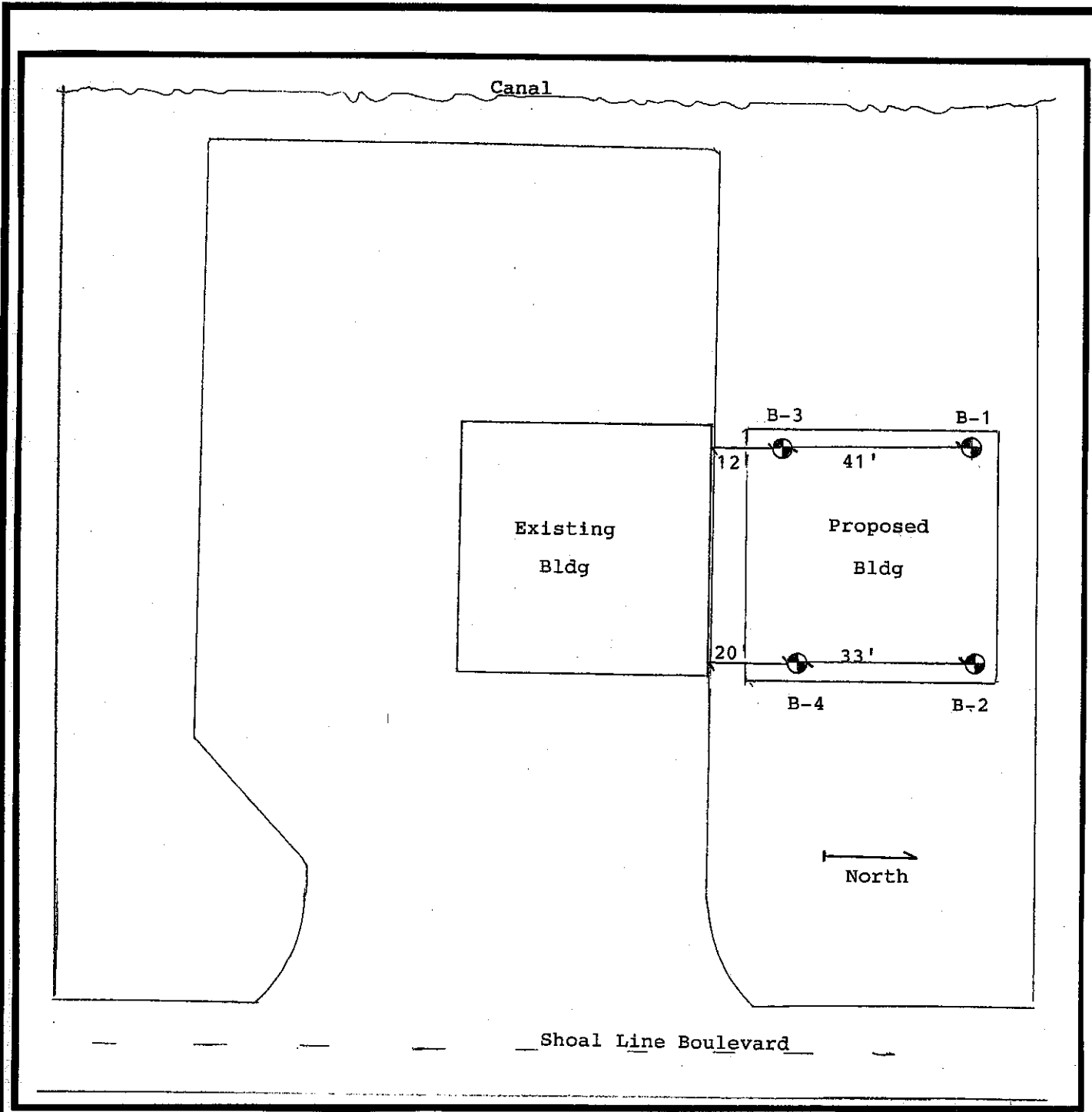
5400 South Florida Avenue  
Inverness, FL 34450

50 x 50 Metal Building  
**SITE LOCATION PLAN**  
Hernando Beach Fire Department  
3451 Shoal Line Boulevard  
Hernando Beach, FL 34613

Drawn by: TAP  
Checked by: CMK

CTL Project No.: 0981114.200  
3451 Shoal Line Boulevard  
Hernando Beach, Hernando County, Florida

Figure No. 1



Not to Scale



**Central Testing Laboratory  
Engineering & Materials**

5400 South Florida Avenue.  
Inverness, FL 34450

50 x 50 Metal Building  
**SITE LOCATION PLAN**  
Hernando Beach Fire Department  
3451 Shoal Line Boulevard  
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Drawn by: TAP  
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CTL Project No.: 0981114.200  
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Hernando Beach, Hernando County, Florida

Figure No. 2

# APPENDIX I

# CENTRAL TESTING LABORATORY

ENGINEERING - MATERIALS TESTING - QUALITY CONTROL

LEESBURG - INVERNESS - OCALA



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## THE STANDARD PENETRATION TEST ASTM D 1586

The Standard Penetration Test, commonly called a soil boring, provides small soil samples and standard penetration resistances (blow counts) from selected depth intervals. The samples are used for soil classification and the penetration resistances provide a general indication of soil strength and density. All of this data is used to estimate soil bearing capacity and settlements.

The borings are advanced to the desired test depth by a dry rotary drilling process using a flight auger. When it becomes necessary, drilling mud is used. Drilling mud, in this application, is a mixture of clay and water with a specific gravity of 1.05 to 1.10. Drilling mud is heavier than water; consequently, the drilling mud prevents ground water from entering the bore and provides support to the walls of the bore, minimizing wall collapse.

The sampler is driven into the bottom of the boring with a 140 pound hammer dropping thirty (30) inches. The blows are counted for three (3) consecutive six (6) inch increments for a total of eighteen (18) inches. The first six (6) inches are to assure that the sampler is in undisturbed soil. The number of blows for the remaining twelve (12) inches is recorded and is termed the N value or blow counts. This is performed in each soil stratum, but at maximum intervals of five (5) feet.

This procedure give a minimally disturbed sample that is classified by a technician, packaged in suitable containment, and transported to the laboratory. The samples are examined by an engineer or geologist to verify the field classifications.

The boring data are shown as soil classifications and penetration resistances in blow counts. The symbols used to show the various soils encountered are explained in the legend accompanying the Boring Logs. The blow counts are shown as blow count(s) per six (6) inches of penetration, i.e. 22/6. The color of the soil is determined by using the Munsell Soil Color Charts and is given in code such as 10YR 6/3. This information is used to prepare Boring Logs as necessary.

**MEMBER OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS**

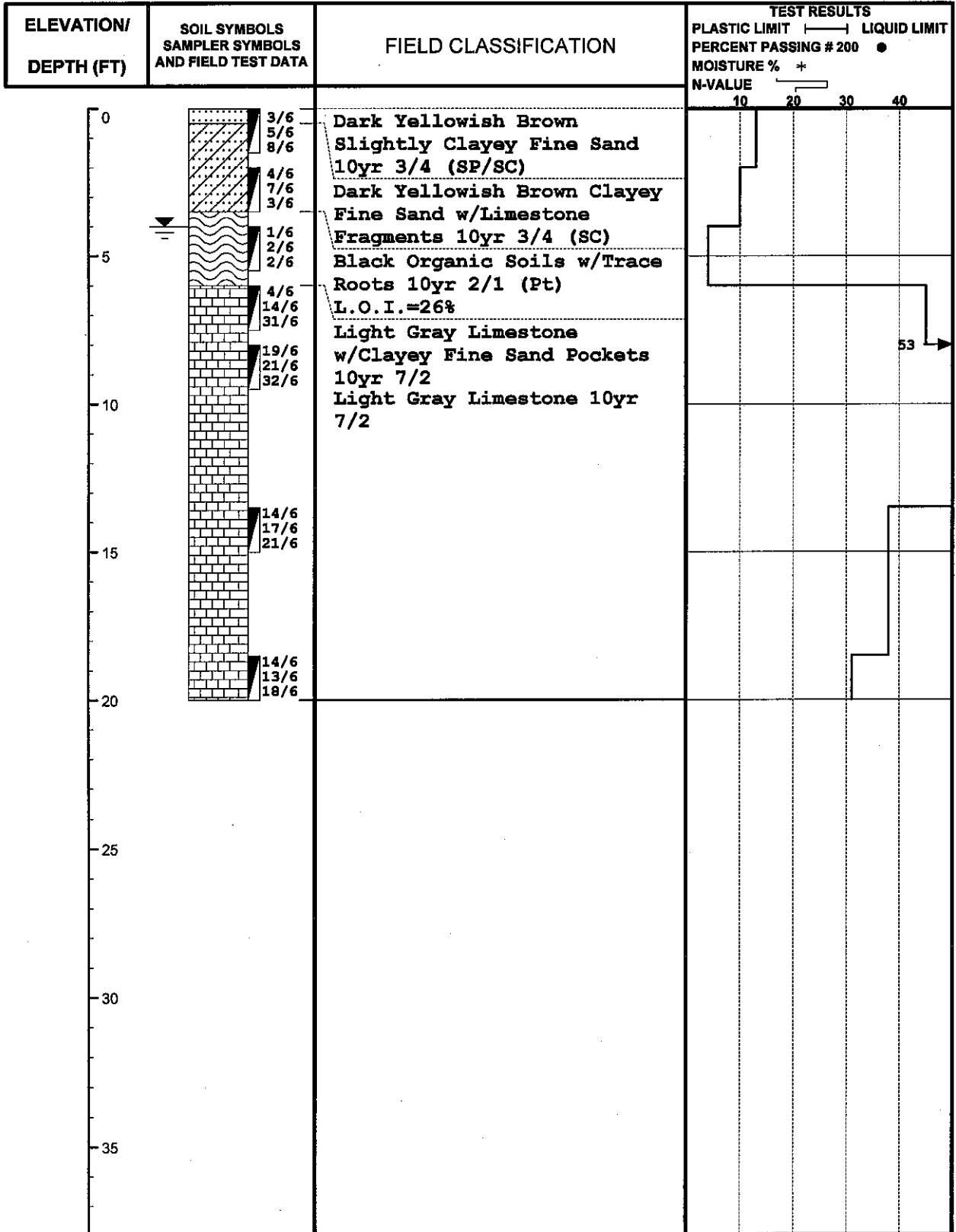
**APPENDIX II**

# BORING LOG

BORING NO. B-1

PROJECT: 50 x 50 Metal Building  
 BORING LOCATION: see Figure No. 2  
 BORING METHOD: SPT (ASTM D-1586)  
 CLIENT: Hernando Beach Fire Department  
 DEPTH TO - Water: 4.0'

DATE: 5-21-09  
 ELEVATION: N/A  
 DRILLER: JS/JS  
 DEPTH OF COLLAPSE: N/A



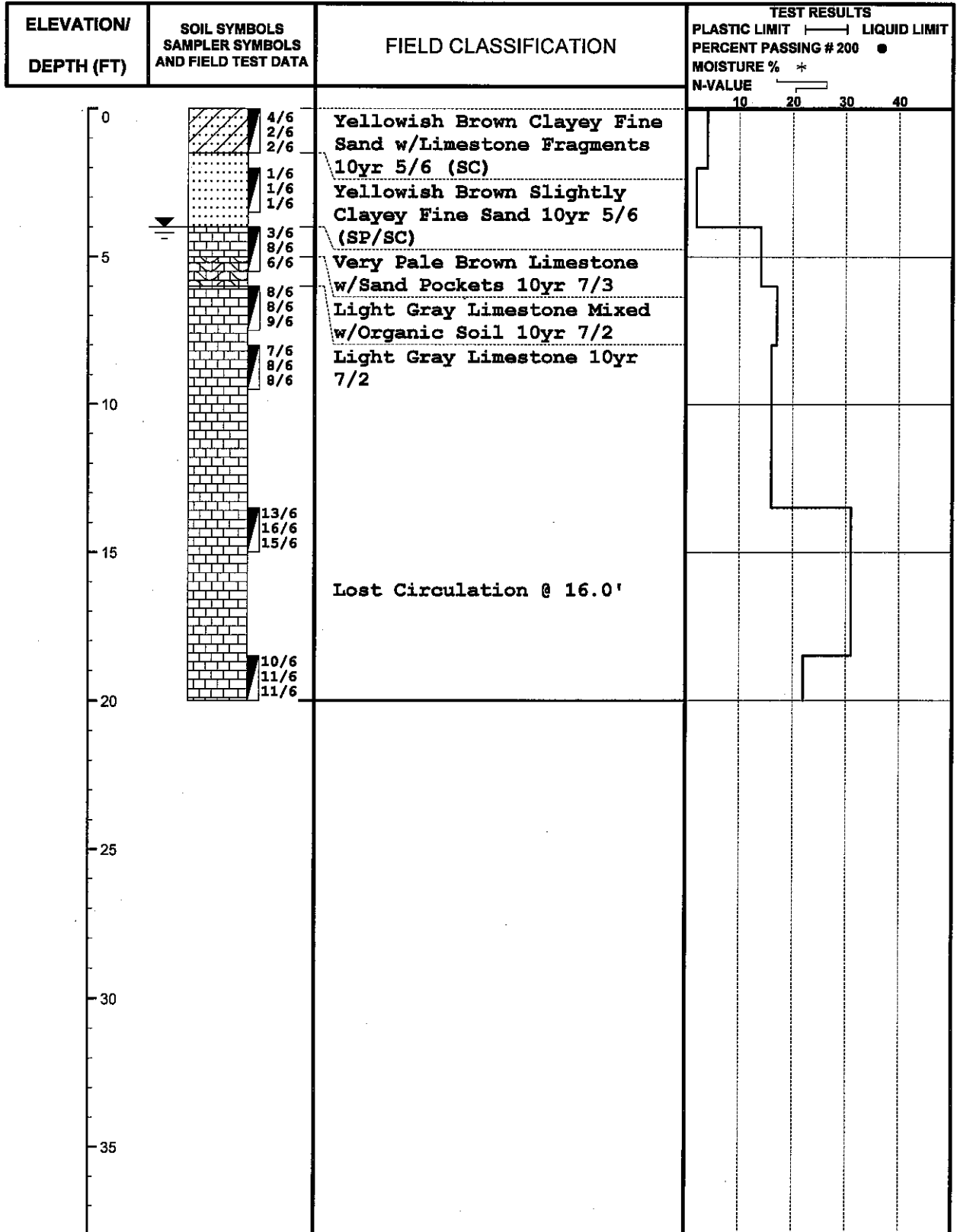
Notes:

# BORING LOG

BORING NO. B-2

PROJECT: 50 x 50 Metal Building  
 BORING LOCATION: see Figure No. 2  
 BORING METHOD: SPT (ASTM D-1586)  
 CLIENT: Hernando Beach Fire Department  
 DEPTH TO - Water: 4.0'

DATE: 5-21-09  
 ELEVATION: N/A  
 DRILLER: JS/JS  
 DEPTH OF COLLAPSE: N/A

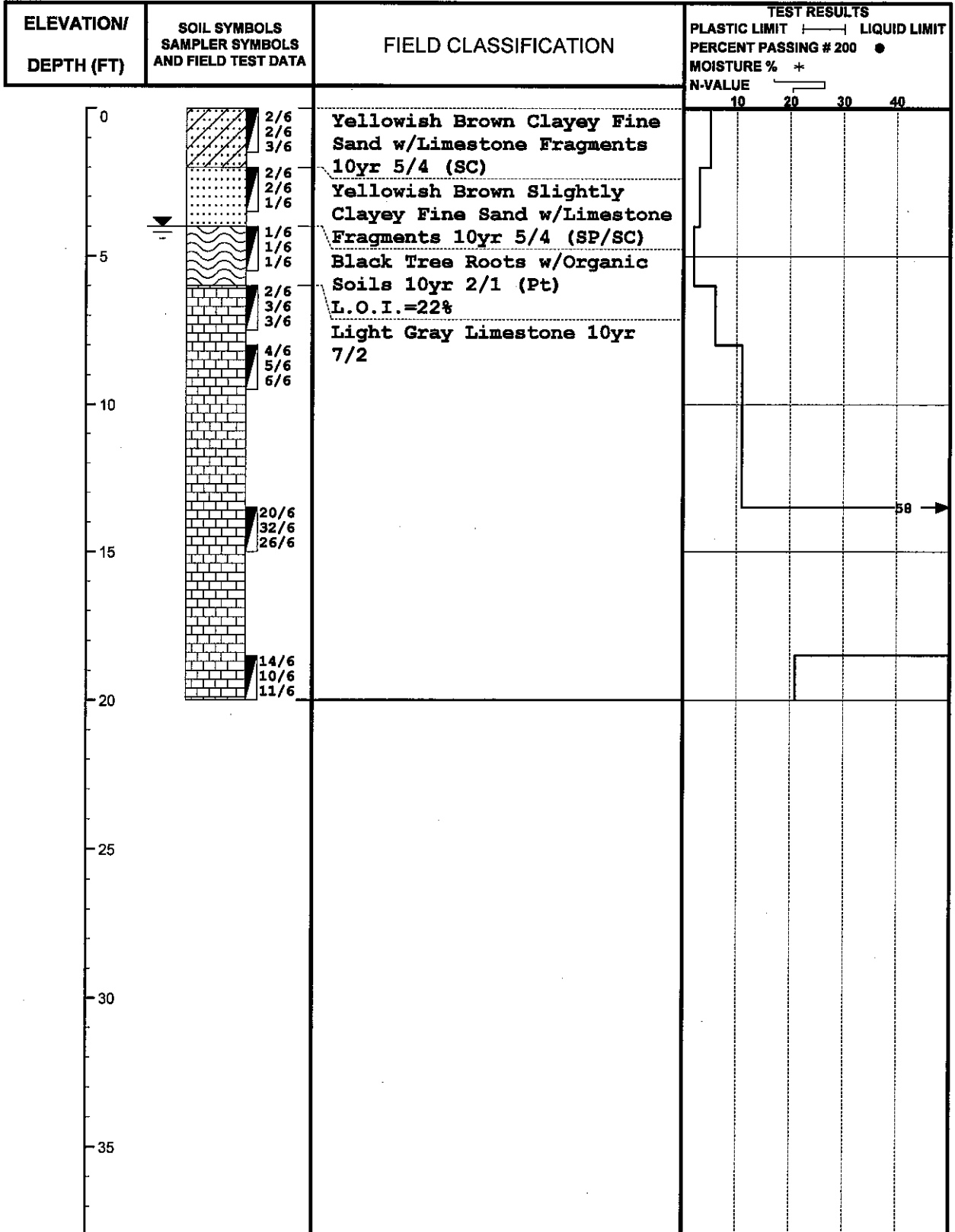


# BORING LOG

BORING NO. B-3

PROJECT: 50 x 50 Metal Building  
 BORING LOCATION: see Figure No. 2  
 BORING METHOD: SPT (ASTM D-1586)  
 CLIENT: Hernando Beach Fire Department  
 DEPTH TO - Water: 4.0'

DATE: 5-21-09  
 ELEVATION: N/A  
 DRILLER: JS/JS  
 DEPTH OF COLLAPSE: N/A



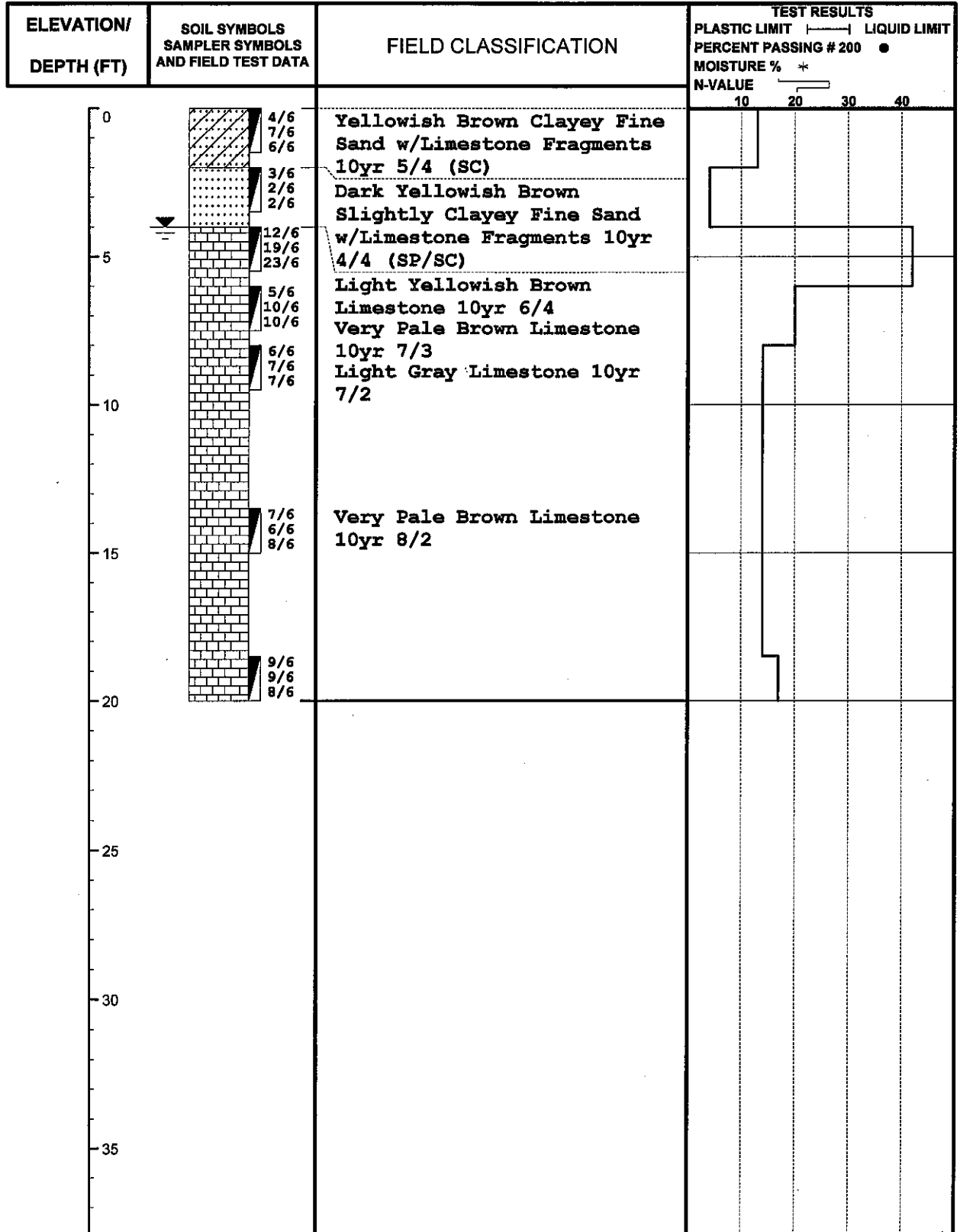
Notes:

# BORING LOG

BORING NO. B-4

PROJECT: 50 x 50 Metal Building  
 BORING LOCATION: see Figure No. 2  
 BORING METHOD: SPT (ASTM D-1586)  
 CLIENT: Hernando Beach Fire Department  
 DEPTH TO - Water: 4.0'

DATE: 5-21-09  
 ELEVATION: N/A  
 DRILLER: JS/JS  
 DEPTH OF COLLAPSE: N/A



Notes:

# KEY TO SYMBOLS

## Symbol Description

### Strata symbols



POORLY GRADED SANDS  
OR GRAVELLY SANDS  
LITTLE OR NO FINES



CLAYEY SANDS  
SAND-CLAY MIXES



PEAT/MUCK



LIMEROCK



LIMEROCK W/PEAT

### Misc. Symbols



Water table at  
boring completion

### Soil Samplers



Standard penetration test

### Notes:

1. ELEVATIONS REPORTED ON LOGS PROVIDED BY CLIENT.
2. THESE LOGS ARE SUBJECT TO THE LIMITATIONS, CONCLUSIONS, AND RECOMMENDATIONS IN THIS REPORT. DUE TO POSSIBLE VARIANCES IN THE SUBSURFACE BETWEEN THE LOCATIONS OF THE BORINGS, AND THE VARYING DEGREE OF DISTURBANCE, THE DESCRIPTIONS GIVEN ARE GOOD ONLY FOR THE MATERIALS REMOVED DURING THE CONSTRICTION OF EACH BORING.
3. RELATIVE DENSITY (sand-silt)

VERY LOOSE - Less than 4 blows/ft.	LOOSE - 4 to 10 blows/ft.
MEDIUM - 10 to 30 blows/ft.	DENSE - 30 to 50 blows/ft.
VERY DENSE - More than 50 blows/ft.	
4. CONSISTENCY (clay)

VERY SOFT - Less than 2 blows/ft.	SOFT - 2 to 4 blows/ft.
MEDIUM - 4 to 8 blows/ft.	STIFF - 8 to 15 blows/ft.
VERY STIFF - 15 to 30 blows/ft.	
HARD - More than 30 blows/ft.	
5. COLORS ARE DETERMINED BY USING THE MUNSELL SOIL COLOR CHART AND THE VALUES ARE GIVEN IN CODE SUCH AS 10YR 3/4.
6. L.O.I. - LOSS OF ORGANICS UPON IGNITION - ORGANIC CONTENT.

**APPENDIX III**

# **Your Geotechnical Report - Uses & Limitations**

## **(I) Your Geotechnical Report**

This geotechnical report has been prepared for the proposed construction on the referenced site and for the clients exclusive use.

The analyses, evaluations and recommendations presented in this report are for the specific site and based solely on the proposed construction and results of the soil borings performed at the approximate locations shown on the Boring Location Plan.

The boring log data represents the subsurface soil conditions at the specific boring location only. Subsurface conditions may change, or man-placed objects may be buried between the specific boring locations that were not apparent or known at the time of drilling. If these conditions are encountered during construction, the owner and Central Testing Laboratory should be immediately notified.

Central Testing Laboratory should be notified if natural or man-made changes alter the existing site grades, or if changes occur to the proposed construction. These changes may require re-evaluation of the recommendations presented in your geotechnical report.

## **(II) Use Limitations**

Your geotechnical report should not be used for another site or construction project. Unless specifically authorized within the report text, your geotechnical report should not be used for bidding purposes. Your geotechnical report is prepared to assist in the design of your project and may affect actual construction operations. Bidders should be responsible for obtaining their own soils data that will assist them with construction decisions and operations.

Should your geotechnical report be provided to others for their use and information, the geotechnical report should be provided in its entirety. Providing separated parts of the report may be misleading to the recipient.

## **(III) Limitations**

Central Testing Laboratory is not responsible for conclusions or recommendations presented by others based on the data presented in your geotechnical report as prepared by Central Testing Laboratory.

Central Testing Laboratory is not responsible for geoenvironmental conditions that may or may not be present at the site.

Central Testing Laboratory is not responsible for any subsurface conditions or buried objects found between the boring locations during construction.

Central Testing Laboratory is not responsible to certify that site preparation was performed in accordance with the geotechnical report recommendations and project specifications unless Central Testing Laboratory provides full time inspection services during site preparation processes.