MIAMI-DADE BACK BAY
COASTAL STORM RISK STUDY

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GEOTECHNICAL SUB-APPENDIX

US Army Corps
of Engineers ®
Norfolk District

EXECUTIVE SUMMARY

This report presents the results of the geotechnical engineering evaluation of the area covered by the Miami-Dade Back Bay Coastal Storm Study. The purpose of this report is to document the existing geotechnical conditions of the study area and to provide geotechnical information in support of the final array of alternatives in the Feasibility Study. This report utilizes existing data gathered from a number of sources, including previous Miami-Dade County studies, USACE – Jacksonville District projects, USGS quadrangle mapping and Florida Department of Transportation (FDOT) projects.

Review of existing geotechnical investigations proximate to the proposed structural sites indicate typically shallow (less than ten feet) overburden depths consisting of light brown to gray fine sand with occasional various amounts of silt. Beneath the overburden materials, oolitic limestone, sandy and/or fossilferous limestone and occasional very loose to medium dense fine sand lenses/layers with or without limestone are typical. Limestone formations in the region are porous resulting in a highly transmissive groundwater network.

Floodwalls, surge barriers and pump stations were considered and evaluated as part of this study. Due to the local geology, design loads, congested working areas and rate of placement it is recommended that T-Walls be utilized supported by auger cast pile (ACP) foundations socketed into bedrock. The preliminary maximum T-Wall design is a 30-foot concrete wall stem on a 32-foot wide concrete footing with four piles; two vertical piles on the waterside of the footing and two battered piles underneath the wall stem and footing heel. Geotechnical engineering analyses completed for the T-walls include: axial capacity, lateral capacity, seepage analyses, and uplift pressure.

Critical geologic and geotechnical issues identified during the production of this report that will influence the performance of the proposed wall include: in-situ hydraulic conductivities of the bearing materials, temporal vertical distribution of surge waters on the waterside face of the structure during a storm event, and regional groundwater fluctuations from inland flooding. The vertical and horizontal hydraulic conductivities of the supporting bedrock used in the seepage analyses in this phase were determined from lab testing of rock cores obtained during a FDOT Port of Miami Tunnel Geotechnical investigation. It is critical that these values are confirmed with a site specific geotechnical investigation along the floodwall alignment. Also, for the purposes of this report, a transient hydraulic load was assumed for loading and unloading the wall structure to mimic the effects of tidal influence. The transient hydraulic load for the analyses assumed the tide would crest at the top of the floodwall after progressively increasing at a constant rate for 24-hours from the initial groundwater elevation and then would recede to the initial elevation at a constant rate within 24 hours. It is recommended that this temporaral distribution, as well as full steady-state seepage conditions, be evaluated during the design phase. Additionally, the models created for the seepage analyses do not take into account the effects of regional groundwater fluctuations due to inland flooding. The only loading accounted for are estimated static groundwater conditions prior to the storm event in combination with tidally influenced differential head between the upstream and downstream sides of the floodwall. Regional hydro-geologic models should be incorporated in subsequent phases to verify wall performance during inland flooding events.

In summary, from a geotechnical perspective, the incorporation of a floodwall as a flood mitigation strategy within the area of study is feasible to reduce, but not entirely eliminate, damages pre- and post-construction. Due to the unique geological conditions at the site, floodwall performance may only be effective at slowing down the rate of inundation during a storm surge event rather than eliminating it completely. The net effect of the floodwall will reduce flooding to an extent as determined by the critical issues described in the paragraph above by reducing the peak flood elevation on the protected side. The benefits of this reduction should be confirmed in subsequent study phases once these critical issues have been evaluated in detail.

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 1
1.1 INTRODUCTION 1
1.2 AREA DESCRIPTION 1
1.3 PREVIOUS GEOTECHNICAL STUDIES 2
CHAPTER 2 GEOLOGY, GROUNDWATER AND SEISMICITY 3
2.1 REGIONAL GEOLOGY 3
2.2 LOCAL GEOLOGY 3
2.3 REGIONAL GROUNDWATER 6
2.4 LOCAL GROUNDWATER 6
2.5 SEISMICITY 7
CHAPTER 3 EXISTING FLOOD RISK MANAGEMENT STRUCTURES 8
CHAPTER 4 STUDY STRUCTURAL MEASURES 9
4.1 GENERAL 9
4.2 MEASURE INFORMATION 9
CHAPTER 5 EXISTING GEOTECHNICAL INFORMATION 11
5.1 GENERAL 11
5.2 EDGEWATER 11
5.3 MIAMI RIVER 12
5.4 LITTLE RIVER 12
5.5 BISCAYNE CANAL 13
CHAPTER 6 GEOTECHNICAL ASPECTS OF FEASIBILITY STUDY MEASURES 14
6.1 GENERAL 14
6.2 T-WALL DESIGN 14
6.2.1 Pile Capacity – Axial and Lateral 14
6.2.2 Seepage Analysis 15
6.2.3 Uplift Pressure 16
6.2.4 Future Design Activity 17
6.3 STORM SURGE BARRIERS 17
6.3.1 Future Design Activity 18
6.4 PUMP STATIONS/GENERATORS 18

6.4.1 Future Design Activity 18

CHAPTER 7 CONSTRUCTABILITY 19

7.1 CONSTRUCTION ADJACENT TO EXISTING STRUCTURES AND INFRASTRUCTURE 19

7.2 MAN-MADE FILL MATERIALS 19

7.3 UNKNOWN SOIL CONTAMINATION 19

7.4 TRAFFIC IMPACTS 20

CHAPTER 8 REFERENCES 21

ENCLOSURES

Enclosure A: Subsurface Data and Locations

Enclosure B: Idealized Soil and Bedrock Profile for Axial and Lateral Capacity Analyses

Enclosure C: Preliminary ACP Axial Capacity Tables for Various Diameter and Length Piles

Enclosure D: Deflection Results from Lateral Pile Loading

Enclosure E: Seepage Analysis Results for T-Wall

LIST OF FIGURES

Figure 2-1: Generalized Miami Area Geology

Figure 2-2: Idealized East-West Cross Section of Miami Area

Figure 2-3: Two Percent Probability of Exceedance in 50 Years (2,500 Year Return Period) Map of Peak Ground Acceleration

Figure 3-1: L-31 East Levee System

LIST OF TABLES

Table 2-1: Estimated Groundwater Depths

Table 6-1: Estimated Seepage Rates at Floodwall

Table 6-2: Uplift Pressure on T-Wall Footing

CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

The Geotechnical Sub-Appendix presents the results of the geotechnical engineering evaluation of the area covered by the Miami-Dade County (MDC) Coastal Storm Risk Management (CSRM) study. The purpose of this sub-appendix is to document the existing geotechnical conditions of the study area and to provide geotechnical information in support of the final array of alternatives in the Feasibility Study.

Miami-Dade County is the non-Federal sponsor for the project. This sub-appendix utilizes existing data gathered from a number of sources, including previous Miami-Dade County studies, USACE – Jacksonville District projects and Florida Department of Transportation (FDOT) projects. The study authority is Public Law 84-71, June 15, 1955, which authorizes an examination and survey of the coastal and tidal areas of the eastern and southern United States, with particular reference to areas where severe damages have occurred from hurricane winds and tides.

The geotechnical aspects of this sub-appendix primarily focus on the feasibility of the proposed structural measures. The structural measures proposed include a combination of floodwalls, surge barriers/tide gates and pump stations at four locations including the Edgewater, Miami River, Little River and Biscayne Canal areas. A generalized layout of each location is available for review in Enclosure A of this sub-appendix. Maximum floodwall heights are not expected to exceed 30 feet from the top of footing elevation to the top of wall elevation producing resultant maximum vertical and lateral loads of 152 kips and 25 kips per pile, respectively.

1.2 AREA DESCRIPTION

The general area of study is within Miami-Dade County. The county is bordered by the Biscayne Bay and the Atlantic Ocean to the east, Monroe County to the south and west, Collier County to the northwest, and Broward County to the north. Portions of the county are Federal lands. The study will concentrate on recommendations for the urbanized portions of the county.

MDC is a highly urbanized, flat, tidal community with nearly the entire city between elevations five and 25 feet (North American Datum (NAVD) of 1988.) Miami-Dade County and its 34 municipalities, with approximately 2.7 million people, lie in a relatively low-lying and flat coastal area. The region has elevated risks of coastal flooding from hurricanes and tropical storms with projected sea level rise to increase these risks.

This Geotechnical Sub-Appendix will primarily focus on the proposed structural measures proximate to the Little River, Edgewater, Miami River and Biscayne Canal areas as shown in Enclosure A.

1.3 PREVIOUS GEOTECHNICAL STUDIES

Existing studies and data used for the analyses and recommendations in this sub-appendix are listed below. Approximate boring layouts and boring logs are located in Enclosure A. An idealized soil and bedrock profile was created based on review of the subsurface data listed below and is included in Enclosure B.

Edgewater and Miami River Areas (Enclosure A-1)

FDOT Biscayne Boulevard Reconstruction Borings B-7 through B-12, B-19 through B-24, and S1 through S-6
FDOT Port of Miami Tunnel Borings B1 through B-6
FDOT Seawall Replacement Borings RW 12 through 20
Miami River Greenway Streetscape Project Borings B-1 and 2, BP-1 and 2
FDOT SR US-1-Biscayne Boulevard Borings SS-5 and 6
FDOT CCTV 85 Boring

Little River and Biscayne Canal Areas (Enclosure A-2)

FDOT Biscayne Boulevard Reconstruction Borings B-25 through B-28
FDOT SR 907 Borings B-161 through B-170
FDOT SR-A1A Seawall Boring B-1
FDOT CCTV 88 and 89 Borings
FDOT Mast Arm SR 922 Boring MA-1
FDOT Mast Arms at SR 909 and 916 Borings MA-3 and MA-4

CHAPTER 2 GEOLOGY, GROUNDWATER AND SEISMICITY

2.1 REGIONAL GEOLOGY

South Florida lies within the southern zone of the coastal lowlands of the Coastal Plain physiographic province of the eastern United States. Most of this province originated from a combination of depositional and erosional processes associated with fluctuations in sea level during the late Pleistocene. The Florida peninsula sits atop the Florida Platform that consists of a porous plateau of karst limestone. The basement rocks of the Florida Platform include Precambrian-Cambrian igneous rocks, Ordovician-Devonian Sedimentary rocks and Triassic-Jurassic volcanic rocks. A thick sequence of mid-Jurassic to Holocence sediments lies unconformably upon the eroded surface of the basement rocks. In response to renewed uplift and erosion in the Appalachian highlands to the north and sea-level fluctuations, siliciclastic sediments began to encroach upon the carbonate-depositing environments of the Florida Platform. Deposition of siliciclastic-bearing carbonates and siliciclastic sediments predominated from mid-Oligocene to the Holocene over much of the platform. Numerous disconformities that formed in response to nondeposition and erosion resulting from sea-level fluctuations occur within the stratigraphic section.

Karst landscape features are typical in the region. Limestone Formations in the region are porous, allowing the acidic water to percolate through their strata, dissolving some limestone and carrying it away in solution. Over time, this persistent erosional process has created extensive underground voids and drainage systems in much of the carbonate rocks throughout the state. The limestones found in the Miami area are much softer than the hard rock formations found elsewhere in the U.S. Although the limestone in Miami can be very porous and have a sponge-like open interconnected network of vugs and small voids, large cavities prone to sinkhole activity are not generally found in the Miami area because the rock formations of South Florida are relatively young, as compared to those encountered in other parts of Florida.

2.2 LOCAL GEOLOGY

The generalized geologic map units in the project region are listed below with descriptions typically summarized from geologic quadrangle maps and literature review. Generalized geologic maps of Miami-Dade County are shown below. Review of existing geotechnical investigations proximate to the proposed structural sites indicate typically shallow (less than ten feet) overburden depths consisting of light brown to gray fine sand with occasional various amounts of silt. Overburden depths were much thicker, on the order of about 50 feet, in areas of fill for roadway embankment slopes. Beneath the overburden materials, oolitic limestone, sandy and/or fossilferous limestone and occasional very loose to medium dense fine sand lenses/layers with or without limestone are typical. Topography at the proposed structural measure sites are relatively flat with minimal grade changes based on review of available topographic mapping.

Miami Limestone (Qm), 92% of surface cover: Quaternary aged formation that is a grainstone to packstone, composed of ooids, pellets, skeletal grains and carbonate mud with a variable, but generally minor, quartz sand component. Induration varies from poor to good and the limestone is often recrystallized. The Miami Limestone occurs on the mainland and in the southern Florida Keys from Big Pine Key to the Marquesas Keys. The formation consists of two facies, an oolitic facies and a bryozoan facies. The oolitic facies consists of white to orangish gray, poorly to moderately indurated, sandy, oolitic limestone (grainstone) with scattered concentrations of fossils. The bryozoan facies consists of white to orangish gray, poorly to well indurated, sandy, fossiliferous limestone (grainstone and packstone). Beds of quartz sand are also present as unindurated sediments and indurated limey sandstones. Fossils present include mollusks, bryozoans and corals. Molds and casts of fossils are common. The highly porous and permeable Miami Limestone forms much of the Biscayne Aquifer system. Sand filled vertical joints and pinnacles are common where extensive weathering has occurred resulting in varied depths to rock surface below the surficial sediments.

Holocene Sediments (Qh), 7% of surface cover: Occur near the present coastline at elevations generally less than 5 feet. The sediments include quartz sands, carbonate sands and muds, and organics.

Shelly Sediments (TQsu), 1% of surface cover: Consists of Tertiary to Quaternary aged fossiliferous molluskbearing sediments. The sediments include quartz sands, carbonate sands and muds, and organics. The sediments are complex, varying from unconsolidated, variably calcareous and fossiliferous quartz sands to well indurated, sandy, fossiliferous limestones. Clayey sands and sandy clays are present.

Key Largo Limestone (Qk), 0.2% of surface cover: Quaternary aged coralling limestone composed of abundant specimens of small to large reef-forming corals, with the areas between the corals filled by reefal debris and numerous whole and fragmented fossils. The formation is exposed at the surface in the Florida Keys from Soldier Key on the northeast to Newfound Harbor Keys near Big Pine Key on the southwest. The Key Largo Limestone is a white to light gray, moderately to well indurated, fossiliferous, coralline limestone composed of coral heads encased in a calcarenitic matrix. Fossils present include corals, mollusks and bryozoans. It is highly porous and permeable and is part of the Biscayne Aquifer system.

Fort Thompson Formation Limestone (Qft), The Fort Thompson formation is composed of sand, marl, shell marl, sandstone, and limestone of fresh-water and marine origin. The occurrence of limestone in the Fort Thompson appears to be related to fluctuations of the water table accompanied by cementation with calcium carbonate.

FIGURE 2-1: GENERALIZED MIAMI AREA GEOLOGY

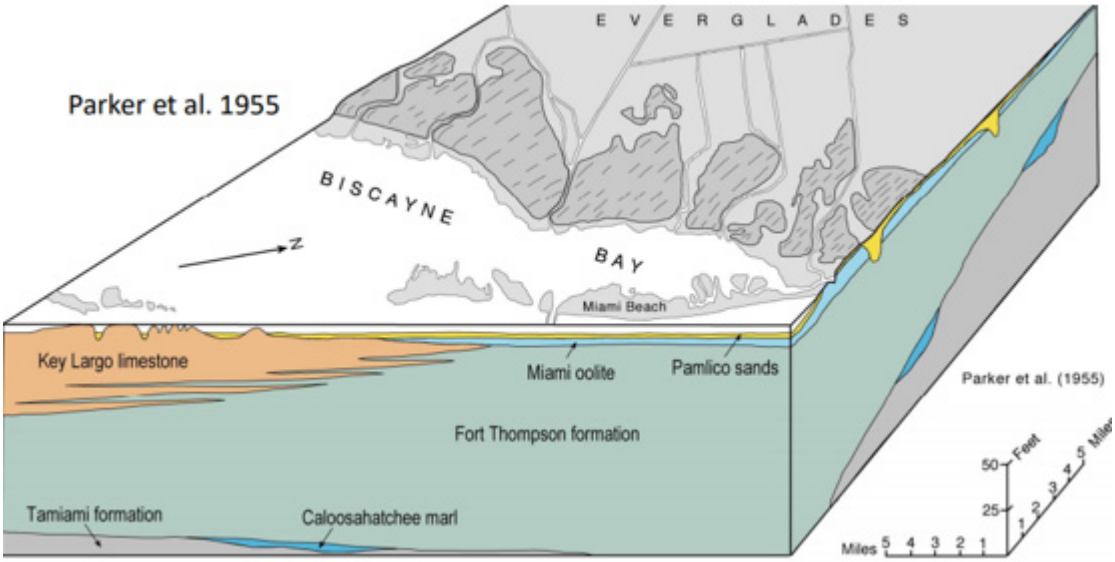
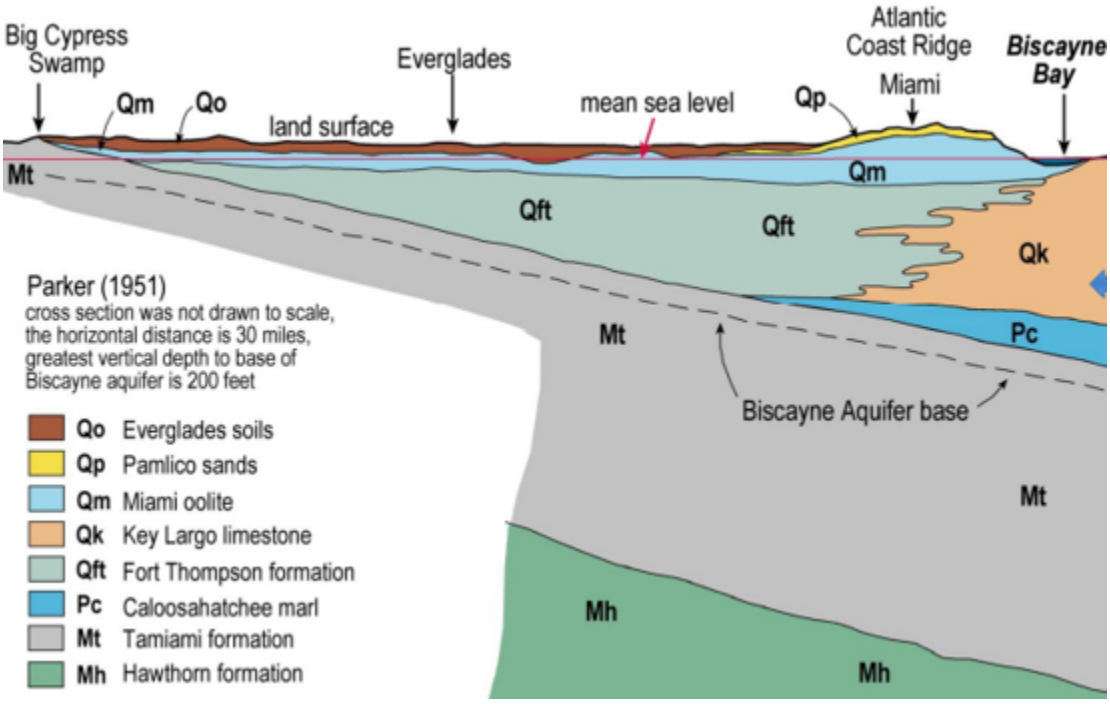


FIGURE 2-2: IDEALIZED EAST-WEST CROSS SECTION OF MIAMI AREA



2.3 REGIONAL GROUNDWATER

The Floridan aquifer system generally consists of an Upper Floridan aquifer and a Lower Floridan aquifer, separated by the middle confining unit. The Upper Floridan aquifer is a highly permeable unit that includes multiple different low permeability carbonate units that are referred to as the upper confining units. The Upper Floradan consists of two main zones that include the fluvial sand-and-gravel aquifer in the westernmost Florida panhandle and the Biscayne Aquifer in Broward, Miami-Dade, Monroe and Palm Beach Counties. The Lower Floridan aquifer is comparatively less known geologically and hydraulically than the Upper Floridan. Much of the Lower Floridan contains saline water. For this reason and because the Upper Floridan is so productive, there is little incentive to drill into the deeper Lower Floridan in most areas. The Upper and Lower Floridan aquifers are separated by a sequence of low-permeability carbonate rock of mostly middle Eocene age. This sequence, termed the middle confining unit, varies greatly in lithology, ranging from dense gypsiferous limestone in south-central Georgia to soft chalky limestone in the coastal strip from South Carolina to the Florida Keys.

2.4 LOCAL GROUNDWATER

Average groundwater depths at each of the proposed structural measure locations is shown in the table below. These depths were estimated from the graphical borings in Enclosure A. The short-term groundwater levels reported by drill crews are not generally indicative of the long-term groundwater levels. To accurately determine the long-term groundwater level, as well as the seasonal and precipitation induced fluctuations of the groundwater levels, it is necessary to install piezometer in the borings, and monitor them for an extended length of time. It is expected that groundwater will be encountered during construction of the foundation elements for the proposed structures.

Table 2-1: Estimated Groundwater Depths

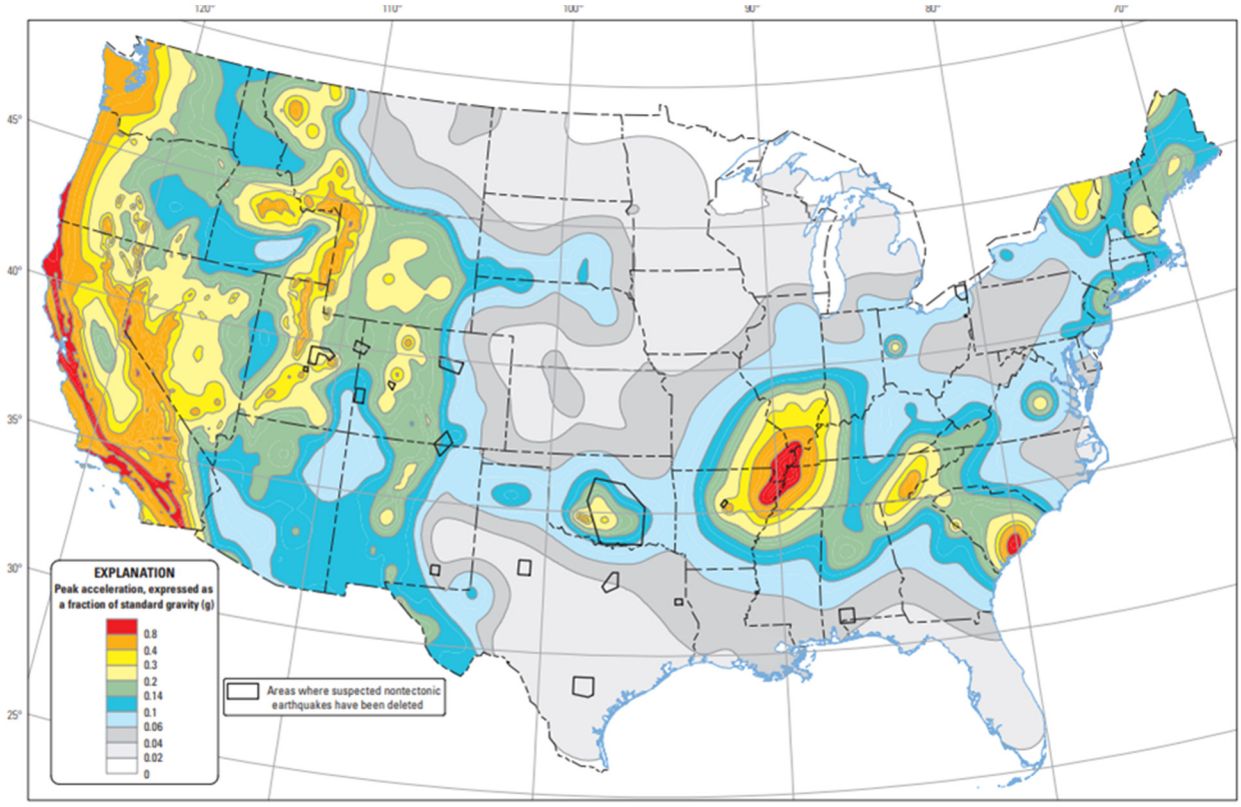
Structure Location	*Groundwater Average Depth Below Ground Surface Elevation, feet
Edgewater	6.0
Miami River	10.0
Little River	4.1
Biscayne Canal	4.0

*Based on review of Boring Data in Enclosure A

2.5 SEISMICITY

The seismic hazard in Miami-Dade County is low. Florida is not located near any tectonic plate boundaries resulting in rare occurrences of earthquakes. The largest earthquake in Florida since the development of seismographs occurred on January 28, 2020. The earthquake had a magnitude of 7.7 and the epicenter was located about 350 miles south of Miami, Florida between Cuba and Jamaica. There were no damages reported in Miami, Florida, however, building movement and voluntary evacuations were reported. The Florida Building Code (2017) and the International Building Code (2018) require seismic design considerations for structural designs. A map of the 2,500-year return period of peak ground acceleration of the continental United States is shown below.

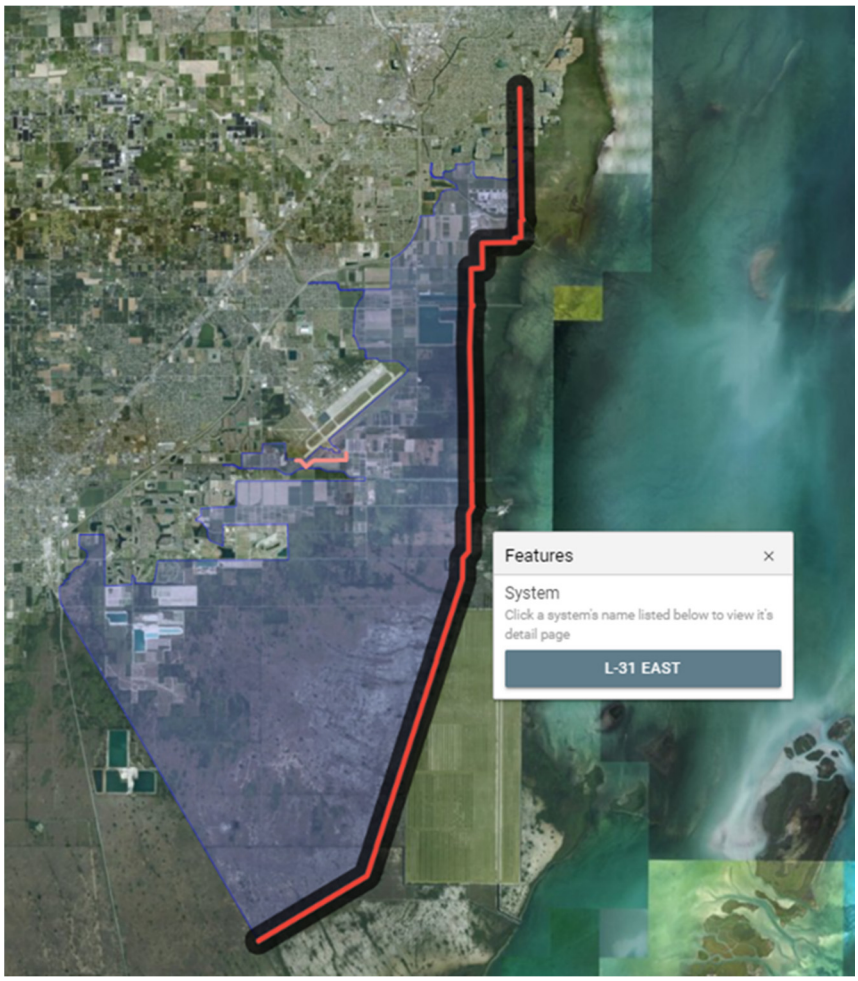
Figure 2-3: Two Percent Probability of Exceedance in 50 Years (2,500 Year Return Period) Map of Peak Ground Acceleration



CHAPTER 3 EXISTING FLOOD RISK MANAGEMENT STRUCTURES

The only mapped flood risk management structure in the National Levee Database, within MDC, designed to reduce the occurrence of tidal flooding is the L-31 East levee system. The L-31 East levee system is located in Miami-Dade County, Florida along the Biscayne Bay coastline. The levee was constructed to reduce the occurrence of tidal flooding and saltwater intrusion to areas west of the levee. The levee is approximately 7 feet high and 19 miles long. It was constructed by the U.S. Army Corps of Engineers (USACE) in 1968 and turned over to the South Florida Water Management District (SFWMD) who is responsible for operating and maintaining the levee and associated structural components. The leveed area is located generally south of the Miami metropolitan area and includes land use that is mostly undeveloped and rural. The leveed area extends to urban areas that include Homestead and Florida City. The system provides benefits to almost 4,000 people that work or live behind the levee, with $413 million in property value.

FIGURE 3-1: L-31 East Levee System



CHAPTER 4 STUDY STRUCTURAL MEASURES

4.1 GENERAL

Structural measures were considered and evaluated as part of this CSRM study. All measures considered and their evaluations are documented in the main report. Locations of the proposed structural measures are located in Enclosure A. The following measures were carried forward for alternative development:

- Floodwalls
- Surge Barriers
- Pump Stations

4.2 MEASURE INFORMATION

Due to the variable proposed floodwall heights along the proposed alignments, I-walls and T-walls were initially considered for foundation support of the structures. However, conventional I-walls were eliminated due to constructability concerns with driving sheet piling within areas of shallow bedrock. Additionally, I-walls were not considered in areas where wall heights were expected to exceed six feet, including the barrier islands, in accordance with EC 1110-2-6066, Design of I-Walls. An optional configuration of I-walls supported by rock socketed auger cast secant piles is presented as a concept in the Structural Sub-Appendix for walls less than six feet in height. The unit pile axial and lateral capacities for the secant pile configuration are expected to be similar or exceed the capacities discussed for single piles in Section 6.2.1 below but have not been analyzed in this phase of the study. For the purposes of this feasibility study, all floodwalls are considered to be T-Walls that consist of concrete walls with a shallow concrete footing.

Due to the local geology, design loads, congested working areas and rate of placement it is recommended that the T-Walls be supported by auger cast pile (ACP) foundations socketed into bedrock. Auger cast piles are consistent with deep foundation support systems in South Florida. They are constructed by rotating a hollow-stem continuous flight auger into the ground until the planned tip depth or termination criterion is achieved. At the termination depth, a grout with high fluidity is pumped under pressure into the hole through the hollow stem auger. As long as pressure is observed in the line, the auger is slowly withdrawn up the hole and the ACP is constructed. After the grout has been poured, the steel reinforcement is installed by lowering the steel to the required depth. The use of ACPs will reduce noise nuisance and vibration concerns normally associated with driven piles and drilled shafts. Additionally, ACPs can be typically installed a faster rate than conventional drilled shafts.

Where floodwall alignments cross roadways and waterways, articulating gate systems will be utilized. Gates will be open most of the time and would only be closed when flooding is forecast for that portion of the city. Surge barriers are proposed in areas of tidal and storm surges. Sector gates are proposed for crossing the navigation channels.

CHAPTER 5 EXISTING GEOTECHNICAL INFORMATION

5.1 GENERAL

This chapter provides an overview of the existing geotechnical information available for the locations where structural measures are proposed. The majority of the information was collected from existing Florida Department of Transportation (FDOT) projects proximate to the proposed structural measure locations including the Port of Miami Tunnel Project. Subsurface data is available for each location described below in Enclosure A. Enclosure A generally includes subsurface conditions encountered at nearby boring locations, including descriptions of the various strata and their depths and thicknesses. Geologic conditions do not vary significantly across the study area. Due to this, an idealized soil and rock profile using conservative parameters derived from soil/rock classification testing and SPT-N blow counts was developed for preliminary calculations for planning and estimating purposes. The idealized profile is in Enclosure B. Additionally, average permeability of recovered rock core from each bedrock layer is presented in Enclosure E. Site specific geotechnical investigations should be performed at each of the proposed structural locations during the design phase to support assumptions made during this phase of the study.

5.2 EDGEWATER

Three FDOT project locations were identified proximate to the proposed structural measure locations in the Edgewater area. These include the Port of Miami Tunnel, Seawall Replacement at I-395 and the Biscayne Boulevard Reconstruction. There were 27 borings between the three projects with depths ranging from about 25 feet to up to 150 feet below the existing ground surface elevation. Overburden depths in the Edgewater area are generally less than about ten feet in areas where man-made fill was not encountered. In areas with fill materials, such as at bridge approach embankments, overburden thicknesses could be over 40 feet. Native soils were typically described as fine to coarse sand, silty, dark brown to light brown and loose to dense in relative density. The fill materials can be described as light brown limerock (GP-GM), with silty fine sand, light brown in color and medium dense to dense in relative soil density. SPT-N values of the recovered soils samples ranged from two to 50 blows per foot, with an average of 17 blows per foot.

The recovered rock can typically be described as light brown to tan limestone, with fine sand, with interbedded light brown clean silty sand layers, weakly to strongly cemented, fossiliferous, oolitic, dolomitic and coquinoidal. The rock core recovery percentages ranged from 0 to 100 percent with most values between 16 and 80 percent, while Rock Quality Designation (RQD) percentages ranged from zero to 97 percent, with most values between zero and 41 percent, which is indicative of very poor to poor rock quality. Permeability of selected rock cores ranged from 6.2X10^ (-07) to 4.6X10^ (-04) feet per second (fps) vertically and 3.6X10^ (-07) to 7.9X10^

(-04) fps horizontally. Generally, permeability decreases with depth. Average groundwater depths based on the subsurface data in Enclosure A are summarized in Table 2-1 above.

5.3 MIAMI RIVER

Two FDOT projects and two Miami River Greenway projects were identified proximate to the proposed structural measure locations in the Miami River area. These include the FDOT SR 5/US 1/ Biscayne Boulevard roadway, FDOT CCTV 85 and 86, Miami Greenway and Miami Streetscape projects. There were six borings between the four projects with depths ranging from about 20 feet to up to 40 feet below the existing ground surface elevation. Overburden depths in the Miami River area are generally less than about ten feet in areas where man-made fill was not encountered. In areas with fill materials, such as at bridge approach and roadway embankments, overburden thicknesses could be over 20 feet. Native soils were typically described as fine sand (SM), silty, containing trace limerock, brown and medium dense to dense in relative density. The fill materials can be described as fine to medium sand (SP), with limerock fragments, brown and medium dense to dense in relative soil density. SPT-N values of the recovered soils samples ranged from two to 37 blows per foot, with an average of 21 blows per foot.

None of the projects in this area included rock coring. Recovered rock SPT-N samples in the Miami River can typically be described as light brown to tan limestone, with fine sand and interbedded light brown clean silty sand layers. SPT-N values in the rock in this area ranged from three to 25 blows per foot, excluding 50+ blow count samples, with an average of 16 blows per foot. Average groundwater depths based on the subsurface data in Enclosure A are summarized in Table 2-1 above.

5.4 LITTLE RIVER

Five FDOT projects were identified proximate to the proposed structural measure locations in the Little River area. These include the FDOT Biscayne Boulevard Reconstruction, FDOT CCTV-88 and -89, FDOT SR 907 and FDOT SR-A1A Sea Wall projects. There were 18 borings between the six projects with depths ranging from about 20 feet to 40 feet below the existing ground surface elevation. Overburden depths in the Little River area are generally less than about ten feet in areas where man-made fill was not encountered. In areas with fill materials, such as at bridge approach and roadway embankments, overburden thicknesses could be over 25 feet. Native soils were typically described as fine to coarse sand (SM/GM), silty, containing trace to some limerock, light brown to dark brown in color and loose to dense in relative soil density. The fill materials can be described as silty fine sand (SP/ SP-SM), with trace to some limerock fragments, light gray to light brown in color and loose to dense in relative soil density. Construction debris was also noted in the area proximate to the SR-A1A seawalls. SPT-N values of the recovered soils samples ranged from one to 50 blows per foot, excluding 50+ blow counts, with an average of 11 blows per foot.

None of the projects in this area included rock coring. Recovered rock SPT-N samples in the Little River can typically be described as light brown to tan limestone, with fine sand and interbedded light brown clean silty sand layers. SPT-N values in the rock in this area ranged from three to 50 blows per foot, excluding 50+ blow count samples, with an average of 25 blows per foot. Average groundwater depths based on the subsurface data in Enclosure A are summarized in Table 2-1 above.

5.5 BISCAYNE CANAL

Six FDOT projects were identified proximate to the proposed structural measure locations in the Little River area. These include the FDOT Mast Arm 1 at SR 922, FDOT Mast Arms at SR 916 and 909, FDOT CCTV-88 and -89, FDOT SR 907 and FDOT SR-A1A Sea Wall projects. There were 17 borings between the six projects with depths ranging from about 20 feet to 40 feet below the existing ground surface elevation. Overburden depths in the Biscayne area are generally less than about ten feet in areas where man-made fill was not encountered. In areas with fill materials, such as at bridge approach and roadway embankments, overburden thicknesses could be over 25 feet. Native soils were typically described as fine to coarse sand (SM/GM), silty, containing trace to some limerock, light brown to dark brown in color and loose to dense in relative soil density. The fill materials can be described as silty fine sand (SP/ SP-SM), with trace to some limerock fragments, light gray to light brown in color and loose to dense in relative soil density. SPT-N values of the recovered soils samples ranged from four to22 blows per foot with an average of 10 blows per foot. Construction debris was also noted in the area proximate to the SR-A1A seawalls.

None of the projects in this area included rock coring. Recovered rock SPT-N samples in the Biscayne Canal area can typically be described as light brown to tan limestone, with fine sand and interbedded light brown clean silty sand layers. SPT-N values in the rock in this area ranged from two to 50 blows per foot, excluding 50+ blow count samples, with an average of 21 blows per foot. Average groundwater depths based on the subsurface data in Enclosure A are summarized in Table 2-1 above.

CHAPTER 6 GEOTECHNICAL ASPECTS OF FEASIBILITY STUDY MEASURES

6.1 GENERAL

This chapter discusses the geotechnical design that was conducted for the measures recommended in the MDC CSRM Feasibility Study. The design level in this study is considered to be ten percent. This chapter also discusses the further data collection and analyses that would be required during the Planning, Engineering and Design (PED) phase of the project.

6.2 T-WALL DESIGN

The preliminary maximum T-Wall design is a 30-foot concrete wall stem on a 32-foot wide concrete footing with four piles; two vertical piles on the waterside of the footing and two battered piles underneath the wall stem and footing heel.

6.2.1 Pile Capacity – Axial and Lateral

Preliminary design loads (152 kips vertical, 25 kips lateral) were provided by the study Structural Engineer. Auger cast piles of various diameters were analyzed for skin friction and bearing capacities. Pile axial capacity tables are available for review in Enclosure C. Additionally, an idealized soil profile based on review of the existing geotechnical information was developed for use in the pile capacity tables and lateral capacity analyses. The idealized soil profile is in Enclosure B.

An allowable end bearing capacity of 2.3 kips per square foot (ksf) and an allowable skin friction capacity of 4.2 ksf can be utilized for the design of auger cast piles rock socketed into bedrock in accordance with the available geotechnical data and FHWA Geotechnical Engineering Circular No. 8 – "Design and Construction of Continuous Flight Auger Piles", 2007. Unit side shear for singular ACPs was derived from SPT correlations with shear resistance of the Miami Limestone Formation (Frizzi and Meyer, 2000, Enclosure C). End bearing was determined from procedures outlined in FHWA-NHI-10-016, "Drilled Shafts: Construction Procedures and LRFD Design Methods". A factor of safety of three was utilized for both shear resistance and end bearing.

Based on the axial capacity tables in Enclosure C, a minimum rock socket length of nine feet should be utilized for a 1 ½-foot diameter auger cast pile to provide the required axial capacity (153 kips) for the anticipated maximum axial loading (152 kips). If end bearing is neglected utilize a rock socket length of ten feet. Neglect end bearing if the bottom of the socket cannot be inspected and percussion or pilot test holes are not utilized to a minimum of ten feet below the bearing elevation. For estimating purposes, assume ten feet of overburden for a total auger cast pile length of 20 feet for the maximum wall section.

Lateral pile capacities were analyzed using L-Pile utilizing the maximum lateral load of 25 kips and the procedures outlined in EM 1110-2-2906, Design of Pile Foundations. Maximum pile

deflections were determined for a 1 ½-foot diameter by 20-feet long auger cast pile to verify deflections did not exceed one inch. Lateral load cases analyzed include: Fixed-end with and without axial loading; and Free-end with and without axial loading. Results from the lateral analysis in Enclosure D indicate that pile deflection does not exceed one inch for the loading conditions described above. As a result, it appears axial capacity requirements will govern pile lengths. If the pile lengths and diameters change and the anticipated lateral loads create excessive deformations, extend pile lengths as required to meet minimum deflection requirements.

6.2.2 Seepage Analysis

Due to the porous geology described and encountered in the study area, seepage analyses were completed to determine the amount of tidally influenced seepage flow at the proposed floodwalls. The analyses were performed only at the tallest wall section were seepage will be at a maximum. Graphical results of the analyses are included in Enclosure E. The models created for the seepage analyses do not take into account the effects of regional groundwater fluctuations due to inland flooding. The only loading accounted for are estimated static groundwater conditions prior to the storm event in combination with tidally influenced differential head between the upstream and downstream sides of the floodwall.

Geotechnical data, including permeability of recovered rock core, used to create the subsurface profile was generally derived from the Florida Department of Transportation Port of Miami Tunnel project. Both vertical and horizontal permeability for the rock core recovered from the tunnel project was determined from lab testing completed by the University of Colorado Mining Department (See Enclosure A for results). Permeability of the sand layers was determined from Table 6, Typical Values of Soil Index Values, in Naval Facilities Engineering Command Design Manual 7.01.

The maximum wall height provided by the project structural engineer of 30 feet was utilized for the analyses. Transient hydraulic loading was also utilized to mimic the effects of tidal loading. The transient hydraulic load for the analyses assumed the tide would crest at the top of the floodwall after progressively increasing at a constant rate for 24-hours from the initial groundwater elevation and then would recede to the initial elevation at a constant rate within 24 hours. Effects of the inclusion of a cement-bentonite cutoff wall were also modeled at depths of ten, 15 and 20 feet below the bottom of footing elevation. Results from the analyses are summarized in the tables below and include maximum seepage rates, maximum uplift pressures on the base of the footing and maximum exit gradients.

Using the geologic and hydraulic transient loading conditions described above, the peak estimated flow per linear foot of wall and approximate depth of water accumulating within the protected area were determined. Both of these parameters will vary dependent on the duration

of the hydraulic loading and site topography. The results of the analyses can be reviewed graphically in Enclosure E and in Table 6-1.

Table 6-1: Estimated Seepage Rates at Floodwall

Slurry Cutoff Wall Depth Below Footing, Feet	Max Seepage Rate per Linear Foot of Wall, Cubic Feet Per Second*	Maximum Exit Gradient*
0	0.0256	1.44
10	0.0064	0.38
15	0.0061	0.38
20	0.0057	0.34

*Estimated values based on geologic and hydraulic loading conditions described above.

The reported values above may vary significantly depending on the temporal distribution of the hydraulic loading on the floodwall structures. The design team should take into consideration the increased amount of flow into the protected area due to seepage when designing the pump station capacity and the associated economic impacts of potential additional damage.

6.2.3 Uplift Pressure

The uplift pressure on the T-wall footing was determined using Seep/W in general accordance with EM 1110-2-2502, Retaining and Floodwalls. Four conditions were evaluated; no waterside slurry cutoff wall, 10-foot deep waterside slurry wall, 15-foot deep waterside slurry wall, and 20-foot deep waterside slurry wall. All conditions were analyzed assuming a fully-loaded 30-foot tall floodwall. It is anticipated that a minimum of a 10-foot deep cutoff wall will be required at the waterside footing toe to reduce uplift pressure. The slurry wall backfill material will be Cement-Bentonite (CB), also known as self-hardening slurry. A trench is excavated through a slurry that consists of water, bentonite and cement. Rock removal will likely be required to reach the required slurry wall depths. The trench slurry hardens in place, typically overnight, and serves as a low-permeability cutoff wall. Results of the uplift analysis are in Enclosure E. Ideally, the slurry wall would extend through the oolitic Miami Formation and into the less permeable Fort Thompson Formation. However, depths to the Fort Thompson may be excessive and cannot be determined precisely until a site specific geotechnical investigation is completed.

Table 6-2: Uplift Pressure on T-Wall Footing

Condition	Maximum Uplift Pressure on Footing (PSF)
No Cutoff Wall	1,203
10-Foot Deep Cutoff Wall	630
15-Foot Deep Cutoff Wall	619
20-Foot Deep Cutoff Wall	609

6.2.4 Future Design Activity

During the PED phase, subsurface explorations will be conducted along the T-wall alignments to supplement existing information. Information from the subsurface explorations will be used to develop site-specific subsurface cross sections for axial and lateral load capacity, settlement, seepage and footing uplift pressure. The Structural Engineer may provide updated pile loadings (axial and lateral) based on more detailed structural analysis. At locations where fill exists, the effect of downdrag will be evaluated, if necessary. It is recommended that this temporaral distribution, as well as full steady-state seepage conditions, be evaluated during the design phase. In addition, during the PED phase, it is recommended that the New Orleans District developed Hurricane and Storm Damage Risk Reduction Guidelines be reviewed and implemented as necessary by the PED project geotechnical and structural engineers.

6.3 STORM SURGE BARRIERS

Surge barriers are proposed at locations where tidal and storm surges impact the Miami River, Little River and Biscayne Canal areas. Approximate surge barrier locations are shown in Enclosure A. The Miami River area storm surge barrier and appurtenant structures are near the Brickell Avenue/ Miami River crossing. One surge barrier with associated floodwall and pump station is proposed upstream from the State Route 1/Little River crossing. Additionally, one surge barrier with associated floodwall and pump station is proposed between the State Route 1/Biscayne Canal crossing.

The surge barriers are anticipated to include, or consist of a combination of, sector gates (large openings), miter gates (small openings) and tide gates with associated floodwalls and pump stations. It is anticipated that the surge barriers and appurtenant structures will require an auger

cast pile foundation system for axial and lateral support. The sector structure will likely consist of two metal rotating sector gates attached to reinforced concrete abutments. Sector gates will be supported by an auger cast pile system socketed into bedrock. It is anticipated the sector gates will be left open most of the time to allow water exchange and small boat traffic and will only be closed during major storm events to prevent storm surge water. Miter gates may also be utilized at areas with smaller openings. Tide gates may be utilized where small creeks and storm drainage outlets cross the floodwall alignments.

6.3.1 Future Design Activity

During the PED phase, subsurface explorations will be conducted over water from a barge along the surge barrier alignments where needed to supplement existing data. Explorations for tide gate design will likely be conducted on land adjacent to the proposed gate location. All geotechnical explorations will be used to develop site-specific cross sections to design the barriers. It is anticipated that all piles will be auger cast-in-place type and be rock socketed. Pile design for sector gates will include evaluations of axial capacity, lateral load capacity and deflection, settlement and, where applicable, downdrag. The Structural Engineer will provide updated pile loads based on a more detailed structural analysis. The number and length of sector gate piles may change from what was assumed during this study. Pile length for the appurtenant structures (floodwalls and pump stations) may change based on the additional explorations. The axial capacity charts in Enclosure C can be used for appurtenant structures for estimating purposes.

6.4 PUMP STATIONS/GENERATORS

Pump stations with backup generators are proposed at several locations to pump interior drainage through the floodwalls. Backup generators alone are proposed for existing pump stations. The location of proposed pump stations is discussed in the Hydraulics, Hydrology, and Coastal Sub-Appendix. Depending on the size of the pump stations and the local foundation conditions, pump stations could be constructed with either shallow or deep foundations.

6.4.1 Future Design Activity

During the PED phase, subsurface explorations will be conducted at the locations of proposed pump stations. Geotechnical explorations will be used to develop site-specific cross sections to design the pump station foundations. It is anticipated that the structures will be supported by auger cast piles. Pile design will include evaluations of axial capacity, lateral load capacity and deflection, settlement and, where applicable, downdrag.

CHAPTER 7 CONSTRUCTABILITY

The primary constructability issues for the MDC CSRM project are expected to be construction adjacent to existing structures and infrastructure, man-made fill materials, unknown soil contamination, and traffic impacts. These issues are discussed individually in this chapter.

7.1 CONSTRUCTION ADJACENT TO EXISTING STRUCTURES AND INFRASTRUCTURE

Auger Cast-in-Place (ACIP) piles could be detrimental to the existing structures if installed in proximity to shallow foundations. The installation of ACIP piles tends to remove subsurface soil that could result in the undermining of the existing structure shallow foundations. The installation process of an ACIP pile causes loosening of the pile shaft sidewalls during augering; therefore, the installation of ACIP piles adjacent to existing shallow foundations bearing on granular soils may produce undesired settlements to nearby footings. To prevent unwanted damage to existing footings, preventive measures should be taken for ACIP piles installed within 15 feet of existing footings. Methods typically used to prevent damage to existing foundations include stabilization by means of jet grouting or chemical grouting, cutoff curtain walls around pile installation to contain ground softening caused by the augering process or underpinning of the existing shallow foundations. In either case, the existing structures and/or foundations shall be closely monitored for movement by the geotechnical engineer of record. Vibration monitoring will not be required because ACIP construction does not produce potentially damaging vibration levels.

Also, construction adjacent to existing structures also means that the temporary construction right-of-way must be minimized. Construction in tight quarters tends to take longer, which increases costs, and may be more dangerous for the workers.

7.2 MAN-MADE FILL MATERIALS

Significant amounts of man-made fill materials exist within the project footprint. Many of these fills were placed along the various waterways to raise grades and provide additional land for development. Older man-made fill materials are generally minimally compacted and consist of whatever material was available at the time, which can include trash and debris. Older man-made fills can cause excessive settlement of structures with shallow foundations due to inadequate compaction and large pieces of debris can make excavation and pile installation difficult. Project floodwalls will be on pile foundations. Obstructions encountered during pile installation will be evaluated on a case-by-case basis.

7.3 UNKNOWN SOIL CONTAMINATION

If contaminated soil is encountered during excavation, it must be separated from uncontaminated soil and characterized and disposed of in a landfill licensed to accept the material. This causes construction delays and increases construction disposal costs.

Contaminated soil is most likely to be encountered in areas with a history of industrial use. Construction debris was encountered in borings during the FDOT SR-A1A Sea Wall project and could indicate the possibility of encountering contaminated soils. During the PED phase, soil borings will be drilled along the floodwall alignments. This drilling may discover contamination, although contamination may exist between drilling locations that will not be discovered until construction.

7.4 TRAFFIC IMPACTS

Construction near and along/across roadways will negatively impact traffic and may require temporary street or lane closures and traffic monitors. The floodwall alignments of the MDC CSRM project cross numerous streets and parallel streets in some places. The construction contractor will need an extensive traffic control plan and will have to perform extensive coordination with the City to provide public notice of traffic impacts.

CHAPTER 8 REFERENCES

FDOT Report of Core Borings, Biscayne Boulevard Reconstruction from N.E. 14th Street to N.E. 38th Street, 2005

FDOT Report of Core Borings, Port of Miami Tunnel Project Preliminary Feasibility Study, 2005

FDOT Report of Core Borings, S.R. 836/I-395 Improvements, 2012

FDOT Report of Core Borings, CCTV-85 & CCTV 86

FDOT Report of Core Borings, SR 5/US-1/Biscayne Boulevard from SE 2nd Street to NE 11th Terrace, 2016

FDOT Report of Core Borings, CCTV-88 & CCTV 89

FDOT Soil Profiles, SR 907/Alton Road from 43rd Street to East of Allison Road

FDOT Report of Core Borings, SR-A1A Seawalls Between 23rd and 24th Street at NE 94th Street and Carlyle Avenue, 2004

FDOT Report of Core Borings, Mast Arm-1, Road No. 922, 2012

FDOT Report of Core Borings, Mast Arm-3 and -4, Road No. 916, 2013

FHWA GEC No. 8, Design and Constrution of Continuous Flight Auger Piles, 2007

FHWA Drilled Shafts: Construction Procedures and LRFD Design Methods, 2010

Frizzy, Meyer, Auger Cast Piles, South Florida Experience, 2000

Geosol, Inc Test Boring Record, Miami River Greenway Project, 2010

Geosol, Inc Test Boring Record, Miami River Greenway Streetscape Project, 2009

Naval Facilities Engineering Command (NAVFAC) DM 7.02, Foundations and Earth Structures, 1986

Parker, Generalized Miami Area Map, 1955

Parker, Idealized East-West Cross Section of Miami Area, 1951

USACE EM 1110-2-1901, Seepage Analysis and Control for Dams, 30 September 1986.

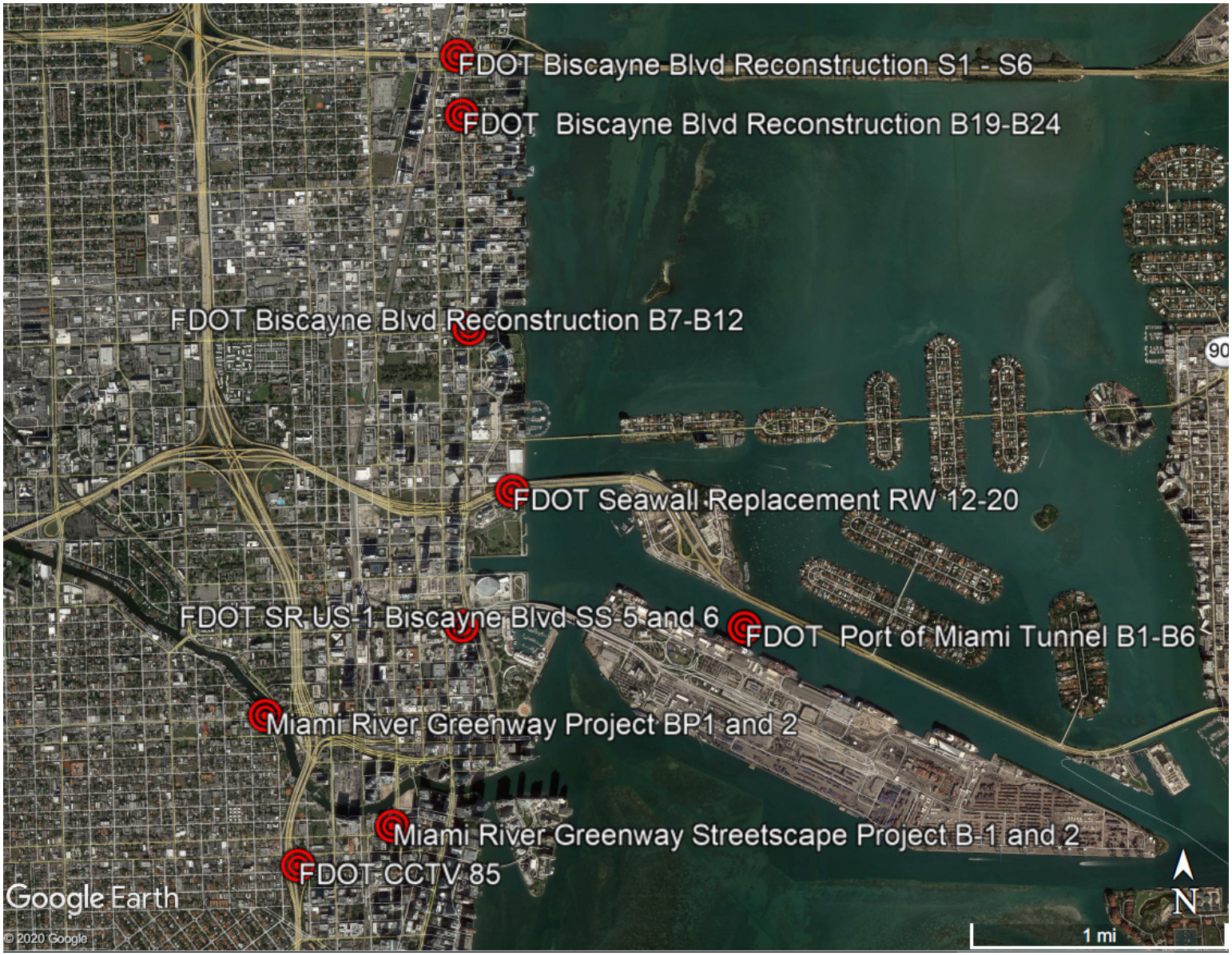
USACE EM 1110-2-2502, Design of Retaining and Flood Walls, 29 September 1989.

USACE EM 1110-2-1614, Design of Seawalls Coastal Revetments and Bulkheads, 30 June 1995

USACE EM 1110-2-2906, Design of Pile Foundations, 15 January 1991

ENCLOSURE A: SUBSURFACE DATA AND LOCATIONS

ENCLOSURE A-1 – PREVIOUS GEOTECHNICAL INFORMATION – EDGEWATER AND MIAMI RIVER AREAS



NOTE: EXACT LOCATIONS OF BORINGS NOT SHOWN. LOCATIONS ARE APPROXIMATE.

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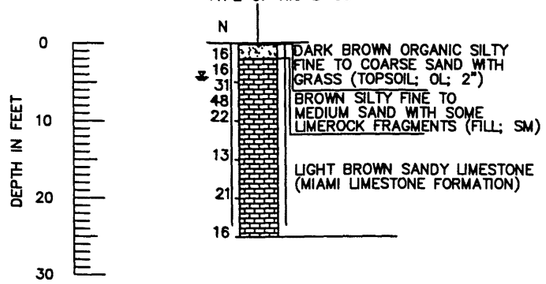

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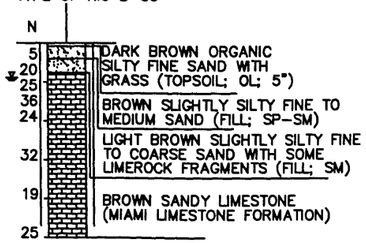

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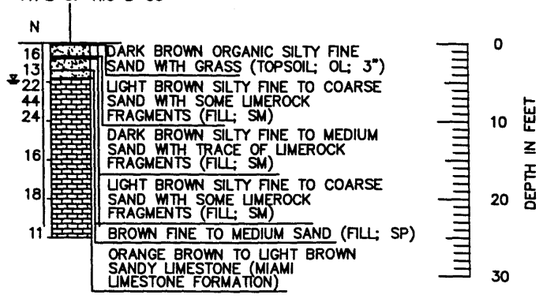

BORING TERMINATED @ DEPTH OF 25 FEET

0 10'
VERTICAL SCALE
HORIZONTAL N.T.S.

LEGEND

- DARK BROWN ORGANIC SILTY FINE SAND WITH GRASS (TOPSOIL)
- ASPHALT PAVEMENT
- BROWN CLEAN TO SILTY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (FILL; SP/SP-SM/SW-SM/SM)
- DARK BROWN ORGANIC SILTY FINE SAND (FILL; OL)
- BROWN AND GRAY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (SP/SW)
- LIGHT BROWN TO GRAY SANDY LIMESTONE (MIAMI LIMESTONE FORMATION)
- BROWN CLEAN TO SLIGHTLY SILTY FINE TO MEDIUM SAND WITH LITTLE LIMESTONE FRAGMENTS (FORT THOMPSON FORMATION SAND; SP/SP-SM)

NOTES:

- WATER TABLE AT TIME OF DRILLING
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION. (UNLESS OTHERWISE NOTED.)
- CASING USED
- -200 FINES PASSING NO. 200 SIEVE (%)
- NMC NATURAL MOISTURE CONTENT (%)
- OC ORGANIC CONTENT (%)

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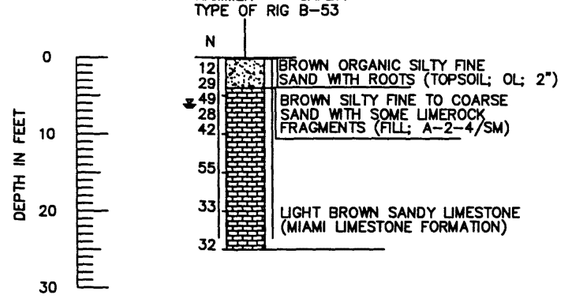

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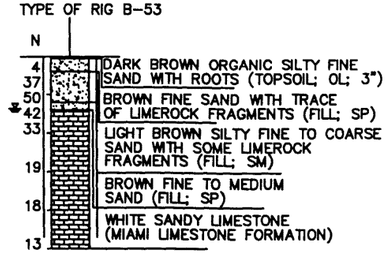

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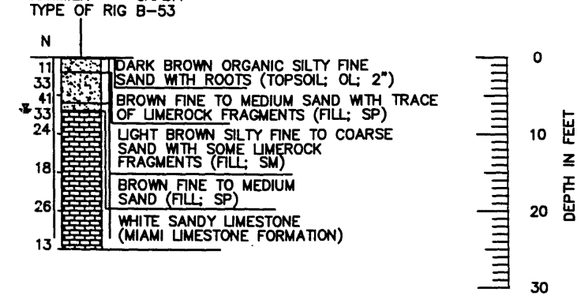

BORING TERMINATED @ DEPTH OF 25 FEET

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VERTICAL SCALE
HORIZONTAL N.T.S.

ENVIRONMENTAL CLASSIFICATION
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE
SUBSTRUCTURE: MODERATELY AGGRESSIVE

WATER:
pH: 7.35-7.49
CHLORIDE: 64.1-105 PPM
SULFATE: 36.4-66.8 PPM
RESISTIVITY: 1,200-1,500 OHM-CM

NOTES FOR DRILL SHAFT FOUNDATION CONSTRUCTION:

1. SUPER MUD OR POLYMER SLURRY ARE NOT ALLOWED.

2. THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION OF THE DRILL SHAFT.

3. IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THESE SHAFTS.

4. PRIOR TO PLACING CONCRETE, THE FLUID IN THE SHAFT EXCAVATION SHALL BE SAMPLED AND TESTED IN ACCORDANCE WITH SECTION 455-15.8.2 AND MUST MEET THE REQUIREMENTS SPECIFIED IN THIS SECTION.

GRANULAR MATERIALS-RELATIVE DENSITY	SPT (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50

SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	GREATER THAN 30

MAST ARMS

REVISIONS

Date	By	Description	Date	By	Description

	Names	Dates
Drawn by	ABR	3/05
Checked by	OR	3/05
Designed by		
Checked by	OR	3/05
Approved by	ORACIO RICCOBONO, P.E.	

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E. #49324
5795-A NW 151st STREET,
MIAMI LAKES, FL 33014
PHONE: (305)828-4367
CERTIFICATE OF AUTHORIZATION NO. 8530

FLORIDA DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
5	MIAMI-DADE	414624-1-52-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: BISCAYNE BOULEVARD RECONSTRUCTION FROM N.E. 14TH STREET TO N.E. 38TH STREET

SHEET NO. 17

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

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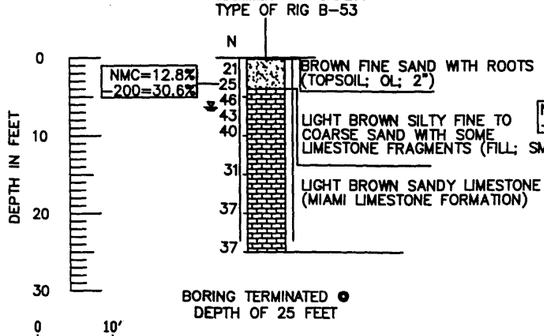

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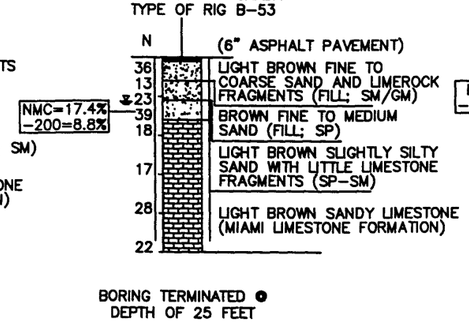

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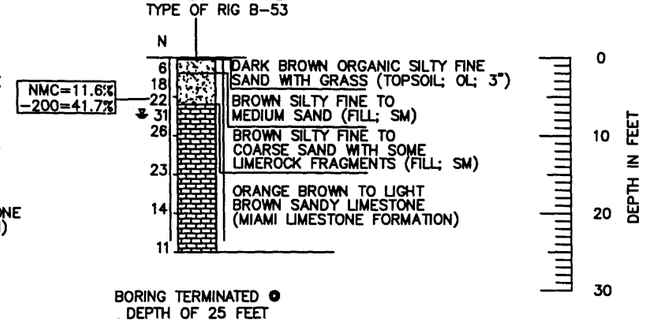

VERTICAL SCALE
HORIZONTAL N.T.S.

LEGEND

- DARK BROWN ORGANIC SILTY FINE SAND WITH GRASS (TOPSOIL)
- ASPHALT PAVEMENT
- BROWN CLEAN TO SILTY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (FILL;SP/SP-SM/SW-SM/SM)
- DARK BROWN ORGANIC SILTY FINE SAND (FILL; OL)
- BROWN AND GRAY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (SP/SW)
- LIGHT BROWN TO GRAY SANDY LIMESTONE (MIAMI LIMESTONE FORMATION)
- BROWN CLEAN TO SLIGHTLY SILTY FINE TO MEDIUM SAND WITH LITTLE LIMESTONE FRAGMENTS (FORT THOMPSON FORMATION SAND; SP/SP-SM)

NOTES:

WATER TABLE AT TIME OF DRILLING

N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION. (UNLESS OTHERWISE NOTED.)

|| || CASING USED

-200 FINES PASSING NO. 200 SIEVE (%)

NMC NATURAL MOISTURE CONTENT (%)

OC ORGANIC CONTENT (%)

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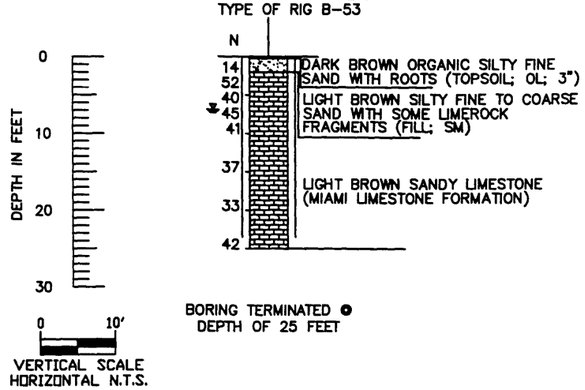

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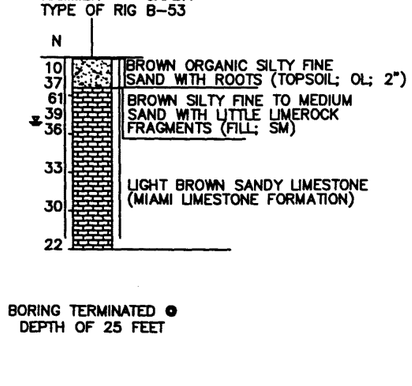

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DATE 4/6/05
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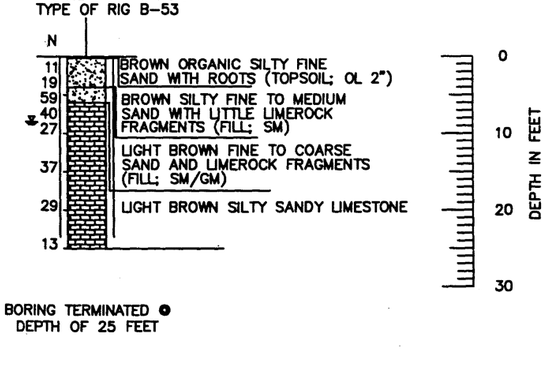
TYPE OF RIG B-53



VERTICAL SCALE
HORIZONTAL N.T.S.

ENVIRONMENTAL CLASSIFICATION
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE
SUBSTRUCTURE: MODERATELY AGGRESSIVE

WATER:
pH: 7.35-7.49
CHLORIDE: 64.1-105 PPM
SULFATE: 36.4-66.8 PPM
RESISTIVITY: 1,200-1,500 OHM-CM

NOTES FOR DRILL SHAFT FOUNDATION CONSTRUCTION:

1. SUPER MUD OR POLYMER SLURRY ARE NOT ALLOWED.

2. THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION OF THE DRILL SHAFT.

3. IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THESE SHAFTS.

4. PRIOR TO PLACING CONCRETE, THE FLUID IN THE SHAFT EXCAVATION SHALL BE SAMPLED AND TESTED IN ACCORDANCE WITH SECTION 455-15.8.2 AND MUST MEET THE REQUIREMENTS SPECIFIED IN THIS SECTION.

GRANULAR MATERIALS-RELATIVE DENSITY	SPT (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50

SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	GREATER THAN 30

MAST ARMS

REVISIONS

Date	By	Description	Date	By	Description

	Name	Date
Drawn by	ABR	3/05
Checked by	OR	3/05
Designed by		
Checked by	OR	3/05
Approved by	ORACIO RICCOBONO, P.E.	

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E. #49324
5795-A NW 151st STREET,
MIAMI LAKES, FL 33014
PHONE: (305)828-4367
CERTIFICATE OF AUTHORIZATION NO. 8530

FLORIDA DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
5	MIAMI-DADE	414624-1-52-01

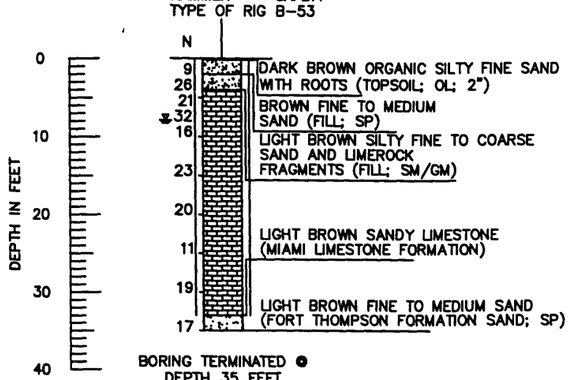
SHEET TITLE:
REPORT OF CORE BORINGS

PROJECT NAME:
BISCAYNE BOULEVARD RECONSTRUCTION
FROM N.E. 14TH STREET TO N.E. 38TH STREET

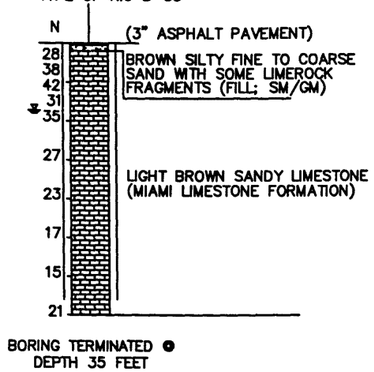
SHEET NO. 19

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

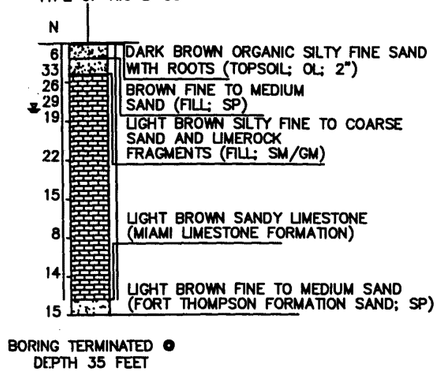
BORING NO. S-1
STATION 96+77
OFFSET 50 LT.
ELEV. N/A
NORTHING 537738.801
EASTING 922684.419
DATE 4/8/05
HAMMER SAFETY
TYPE OF RIG B-53

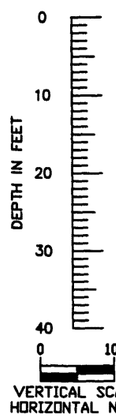


BORING NO. S-2
STATION 96+80
OFFSET 42 RT.
ELEV. N/A
NORTHING 537612.803
EASTING 922882.600
DATE 4/12/05
HAMMER SAFETY
TYPE OF RIG B-53



BORING NO. S-3
STATION 98+89
OFFSET 35 LT.
ELEV. N/A
NORTHING 537903.558
EASTING 922877.519
DATE 4/8/05
HAMMER SAFETY
TYPE OF RIG B-53





LEGEND

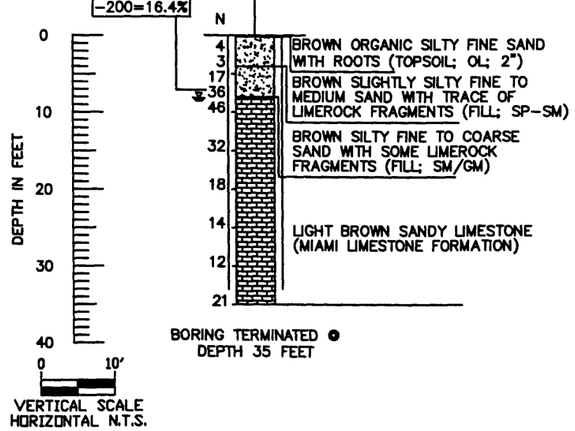
- DARK BROWN ORGANIC SILTY FINE SAND WITH GRASS (TOPSOIL)
- ASPHALT PAVEMENT
- BROWN CLEAN TO SILTY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (FILL; SP/SP-SM/SW-SM/SM)
- DARK BROWN ORGANIC SILTY FINE SAND (FILL; OL)
- BROWN AND GRAY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (SP/SW)
- LIGHT BROWN TO GRAY SANDY LIMESTONE (MIAMI LIMESTONE FORMATION)
- BROWN CLEAN TO SLIGHTLY SILTY FINE TO MEDIUM SAND WITH LITTLE LIMESTONE FRAGMENTS (FORT THOMPSON FORMATION SAND; SP/SP-SM)

NOTES:

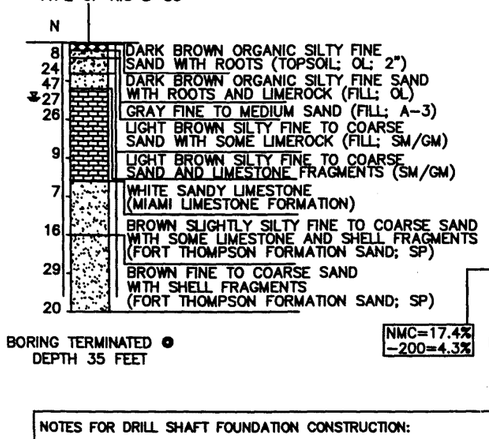
- WATER TABLE AT TIME OF DRILLING
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION. (UNLESS OTHERWISE NOTED.)
- CASING USED
- -200 FINES PASSING NO. 200 SIEVE (%)
- NMC NATURAL MOISTURE CONTENT (%)
- OC ORGANIC CONTENT (%)

BORING NO. S-4
STATION 104+17
OFFSET 57 RT.
ELEV. N/A
NORTHING 538252.832
EASTING 922931.297
DATE 4/7/05
HAMMER SAFETY
TYPE OF RIG B-53

NMC=9.7%
-200=16.4%

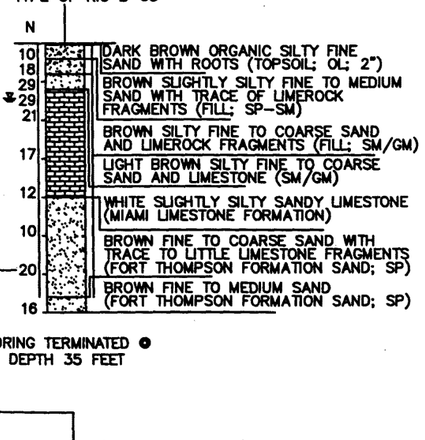


BORING NO. S-5
STATION 105+49
OFFSET 47 LT.
ELEV. N/A
NORTHING 538393.937
EASTING 922825.147
DATE 4/7/05
HAMMER SAFETY
TYPE OF RIG B-53



NMC=17.4%
-200=4.3%

BORING NO. S-6
STATION 105+42
OFFSET 44 RT.
ELEV. N/A
NORTHING 538572.239
EASTING 922856.948
DATE 4/7/05
HAMMER SAFETY
TYPE OF RIG B-53



ENVIRONMENTAL CLASSIFICATION
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE
SUBSTRUCTURE: MODERATELY AGGRESSIVE

WATER:
pH: 7.35-7.49
CHLORIDE: 64.1-105 PPM
SULFATE: 36.4-66.8 PPM
RESISTIVITY: 1,200-1,500 OHM-CM

NOTES FOR DRILL SHAFT FOUNDATION CONSTRUCTION:

1. SUPER MUD OR POLYMER SLURRY ARE NOT ALLOWED.

2. THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION OF THE DRILL SHAFT.

3. IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THESE SHAFTS.

4. PRIOR TO PLACING CONCRETE, THE FLUID IN THE SHAFT EXCAVATION SHALL BE SAMPLED AND TESTED IN ACCORDANCE WITH SECTION 455-15.8.2 AND MUST MEET THE REQUIREMENTS SPECIFIED IN THIS SECTION.

GRANULAR MATERIALS-RELATIVE DENSITY	SPT (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50

SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	GREATER THAN 30

SIGN STRUCTURES

REVISIONS

Date	By	Description	Date	By	Description

	Name	Date
Drawn by	ABR	3/05
Checked by	OR	3/05
Designed by		
Checked by	OR	3/05
Approved by	ORACIO RICCOBONO, P.E.	

ENGINEER OF RECORD: GEOSOL, INC.
ORACIO RICCOBONO, P.E. #49324
5795-A NW 151st STREET,
MIAMI LAKES, FL 33014
PHONE: (305)828-4367
CERTIFICATE OF AUTHORIZATION NO. 8530

FLORIDA DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
5	MIAMI-DADE	414624-1-52-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: BISCAYNE BOULEVARD RECONSTRUCTION FROM N.E. 14TH STREET TO N.E. 38TH STREET

SHEET NO. 21

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

GRANULAR MATERIALS– RELATIVE DENSITY	SAFETY HAMMER SPT–N (BLOWS/12 in)	AUTOMATIC HAMMER SPT–N (BLOWS/12 in)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4–10	3–7
MEDIUM	10–30	7–21
DENSE	30–50	21–35
VERY DENSE	GREATER THAN 50	GREATER THAN 35

SILTS AND CLAYS CONSISTENCY	SAFETY HAMMER SPT–N (BLOWS/12 in)	AUTOMATIC HAMMER SPT–N (BLOWS/12 in)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2–4	1–3
FIRM	4–8	3–6
STIFF	8–15	6–11
VERY STIFF	15–30	11–21
HARD	GREATER THAN 30	GREATER THAN 21

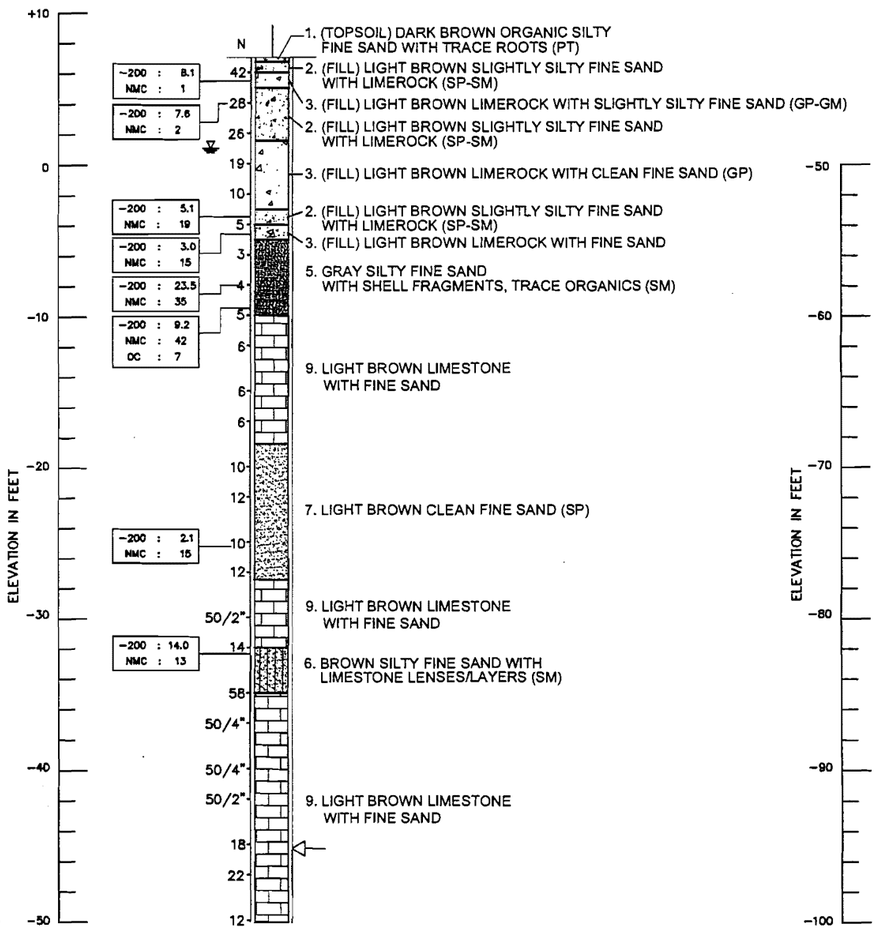
NOTES:

- WATER TABLE AT TIME OF DRILLING
- N — NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES PENETRATION. (UNLESS OTHERWISE NOTED.)
- CASING DEPTH
- NSR — NO SAMPLE RECOVERED
- LOSS OF CIRCULATION
- –200 — FINES PASSING NO. 200 SIEVE (%)
- NMC — NATURAL MOISTURE CONTENT (%)
- OC — ORGANIC CONTENT (%)
- W.O.H. — FELL UNDER THE WEIGHT OF THE HAMMER

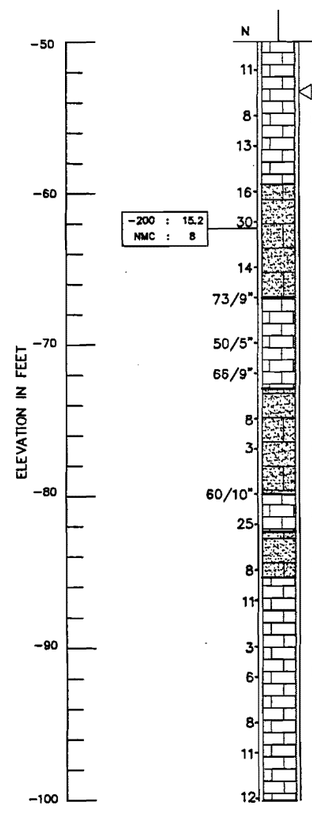
LEGEND

1. (TOPSOIL) DARK BROWN ORGANIC SILTY FINE SAND WITH TRACE ROOTS (PT)
1A. ASPHALTIC CONCRETE
2. (FILL) LIGHT BROWN SLIGHTLY SILTY FINE SAND WITH LIMEROCK (SP-SM)
3. (FILL) LIGHT BROWN LIMEROCK WITH CLEAN TO SLIGHTLY SILTY FINE SAND (GP,GP-GM)
4. (FILL) GRAY SILTY FINE SAND WITH SHELL FRAGMENTS, TRACE ORGANICS (SM)
5. GRAY SILTY FINE SAND WITH SHELL FRAGMENTS, TRACE ORGANICS (SM)
5A. GRAY SANDY SILT (ML)
6. BROWN SILTY FINE SAND WITH LIMESTONE LENSES/LAYERS (SM)
7. LIGHT BROWN CLEAN FINE SAND (SP)
8. LIGHT BROWN CLEAN TO SILTY FINE SAND WITH LIMESTONE LENSES/LAYERS (SP, SP-SM,SM)
9. LIGHT BROWN LIMESTONE WITH FINE SAND

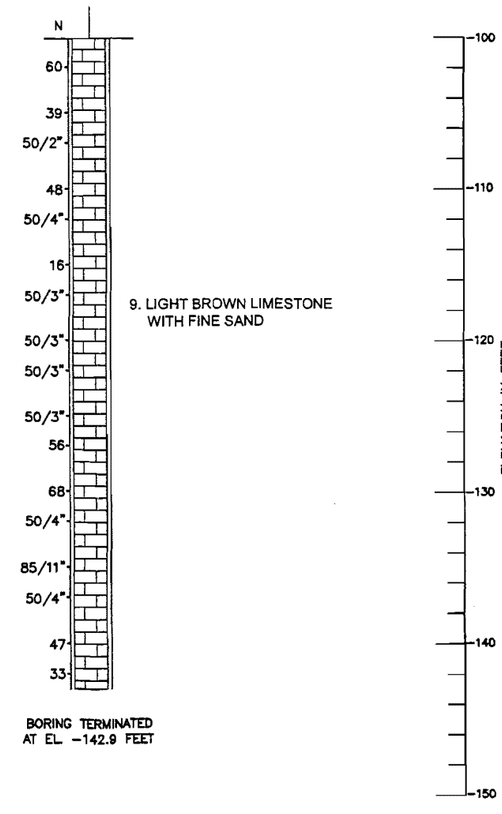
BORING No. B-1 SPT
NORTHING 527580.3
EASTING 927879.5
DATE 8/20/03 Through 8/22/03
ELEVATION +7.1'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-1 SPT
NORTHING 527580.3
EASTING 927879.5
DATE 8/20/03 Through 8/22/03
ELEVATION +7.1'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-1 SPT
NORTHING 527580.3
EASTING 927879.5
DATE 8/20/03 Through 8/22/03
ELEVATION +7.1'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

PSI ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
PROFESSIONAL SERVICE INDUSTRIES, INC.
7950 N.W. 64th STREET, MIAMI, FL 33166

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156–2	MIAMI–DADE	0010–801–R

SHEET TITLE: REPORT OF CORE BORING
PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY
SHEET NO. D–1

PSI PROJECT No. 397–35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

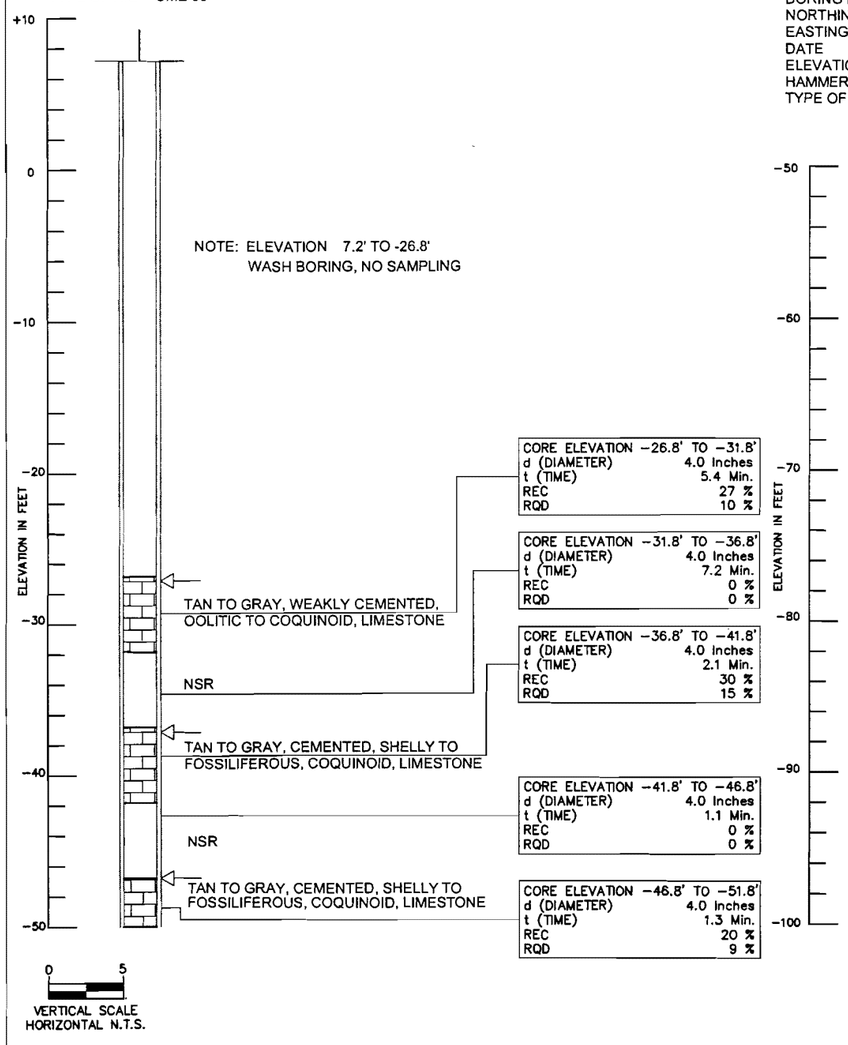
NOTES:

REC RECOVERY (%)
RQD ROCK QUALITY DESIGNATION (%)
CASING DEPTH
t TIME OF CORE RUN (MINUTES)
NSR NO SAMPLE RECOVERED
LOSS OF CIRCULATION

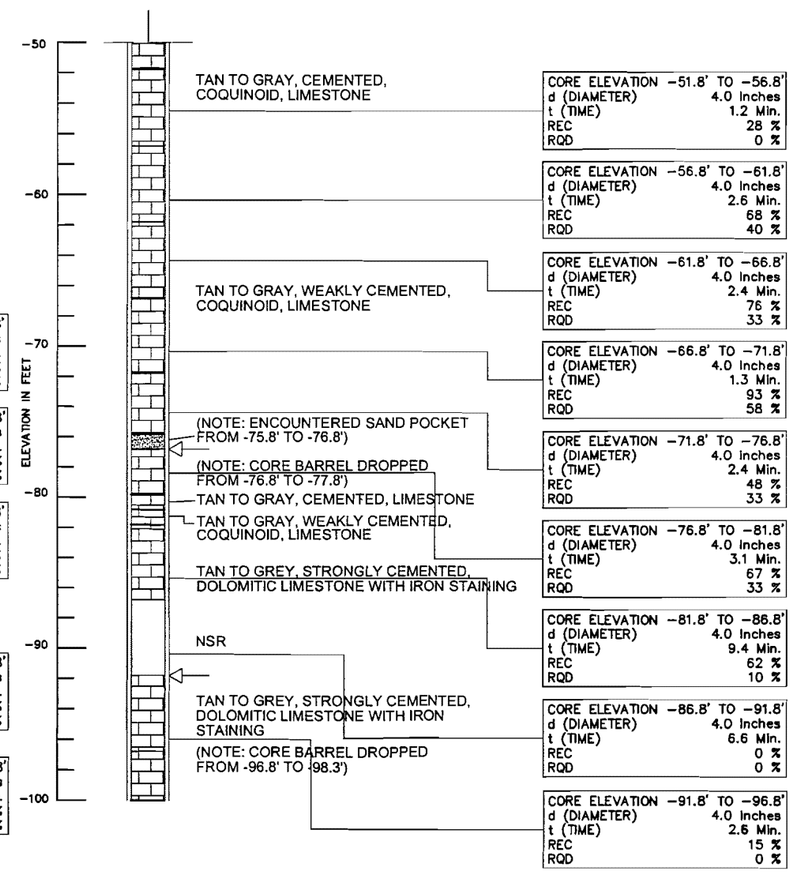
LEGEND

LIMESTONE
SAND

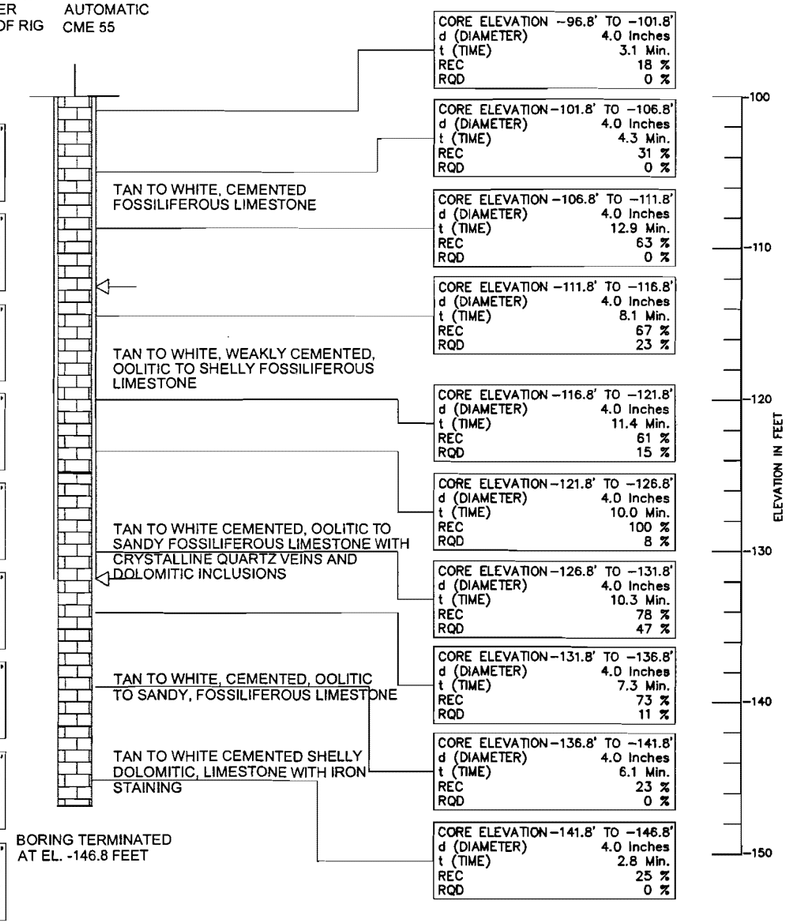
BORING No. B-1 RC
NORTHING 527579.9
EASTING 927883.1
DATE 9/3/03 Through 9/5/03
ELEVATION +7.2'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-1 RC
NORTHING 527579.9
EASTING 927883.1
DATE 9/3/03 Through 9/5/03
ELEVATION +7.2'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-1 RC
NORTHING 527579.9
EASTING 927883.1
DATE 9/3/03 Through 9/5/03
ELEVATION +7.2'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING
PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY
SHEET NO. D-2

PSI PROJECT No. 397-35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

NOTES:

REC RECOVERY (%)

RQD ROCK QUALITY DESIGNATION (%)

CASING DEPTH

t TIME OF CORE RUN (MINUTES)

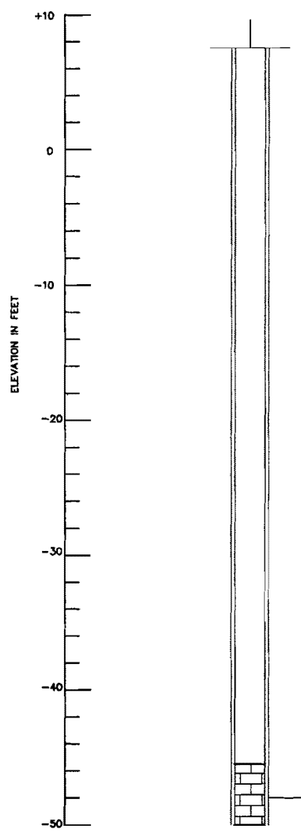
NSR NO SAMPLE RECOVERED

LOSS OF CIRCULATION

LEGEND

LIMESTONE

BORING No. B-1 (PACKER TEST)
NORTHING 527568.5
EASTING 927902.1
DATE 3/02/04 Through 3/03/04
ELEVATION +7.5'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



NOTE: ELEVATION +7.5' TO -45.5'
WASH BORING, NO SAMPLING

GREY, STRONGLY CEMENTED, LIMESTONE

CORE ELEVATION -45.5' TO -50.5'
d (DIAMETER) 4.0 inches
t (TIME) 4.3 Min.
REC 40 %
RQD 0 %

BORING No. B-1 (PACKER TEST)
NORTHING 527568.5
EASTING 927902.1
DATE 3/02/04 Through 3/03/04
ELEVATION +7.5'
HAMMER AUTOMATIC
TYPE OF RIG CME 55

GREY, STRONGLY CEMENTED, LIMESTONE

CORE ELEVATION -50.5' TO -55.5'
d (DIAMETER) 4.0 inches
t (TIME) 1.7 Min.
REC 42 %
RQD 8 %

CORE ELEVATION -55.5' TO -60.5'
d (DIAMETER) 4.0 inches
t (TIME) 2.1 Min.
REC 47 %
RQD 8 %

CORE ELEVATION -60.5' TO -65.5'
d (DIAMETER) 4.0 inches
t (TIME) 1.8 Min.
REC 50 %
RQD 10 %

TAN TO GREY, CEMENTED, COQUINOID LIMESTONE WITH IRON STAINING FROM EL. -80.5' TO -85.5'

CORE ELEVATION -65.5' TO -70.5'
d (DIAMETER) 4.0 inches
t (TIME) 2.1 Min.
REC 83 %
RQD 62 %

NOTE: 6" DIAMETER CASING DROPPED FROM EL. -75.5' TO -78.5'

CORE ELEVATION -70.5' TO -75.5'
d (DIAMETER) 4.0 inches
t (TIME) 1.9 Min.
REC 100 %
RQD 75 %

CORE ELEVATION -75.5' TO -80.5'
d (DIAMETER) 4.0 inches
t (TIME) 3.2 Min.
REC 6 %
RQD 0 %

CORE ELEVATION -80.5' TO -85.5'
d (DIAMETER) 4.0 inches
t (TIME) 7.1 Min.
REC 43 %
RQD 17 %

CORE ELEVATION -85.5' TO -90.5'
d (DIAMETER) 4.0 inches
t (TIME) 5.7 Min.
REC 23 %
RQD 0 %

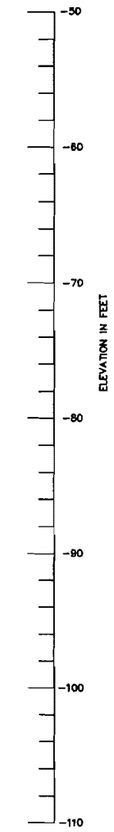
GREY TO WHITE, STRONGLY CEMENTED, FOSSILIFEROUS LIMESTONE

CORE ELEVATION -90.5' TO -95.5'
d (DIAMETER) 4.0 inches
t (TIME) 4.5 Min.
REC 23 %
RQD 0 %

CORE ELEVATION-95.5' TO -100.5'
d (DIAMETER) 4.0 inches
t (TIME) 4.5 Min.
REC 29 %
RQD 0 %

BORING TERMINATED AT EL. -105.5 FEET

CORE ELEVATION-100.5' TO -105.5'
d (DIAMETER) 4.0 inches
t (TIME) 5.5 Min.
REC 52 %
RQD 18 %



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:

HUGO E. SOTO, P.E.
FLA. REG. No. 36440

ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ✱ FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-3

PSI PROJECT No. 397-35115

GRANULAR MATERIALS– RELATIVE DENSITY	SAFETY HAMMER SPT–N (BLOWS/12 in)	AUTOMATIC HAMMER SPT–N (BLOWS/12 in)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4–10	3–7
MEDIUM	10–30	7–21
DENSE	30–50	21–35
VERY DENSE	GREATER THAN 50	GREATER THAN 35
SILTS AND CLAYS CONSISTENCY	**SAFETY HAMMER SPT–N (BLOWS/12 in)**	**AUTOMATIC HAMMER SPT–N (BLOWS/12 in)**
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2–4	1–3
FIRM	4–8	3–6
STIFF	8–15	6–11
VERY STIFF	15–30	11–21
HARD	GREATER THAN 30	GREATER THAN 21

RELATION OF RQD AND IN–SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

NOTES:

REC RECOVERY (%)

RQD ROCK QUALITY DESIGNATION (%)

CASING DEPTH

t TIME OF CORE RUN (MINUTES)

NSR NO SAMPLE RECOVERED

LOSS OF CIRCULATION

N NUMBERS TO THE LEFT OF BORING INDICATE SPT VALUE FOR 12 INCHES PENETRATION. (UNLESS OTHERWISE NOTED.)

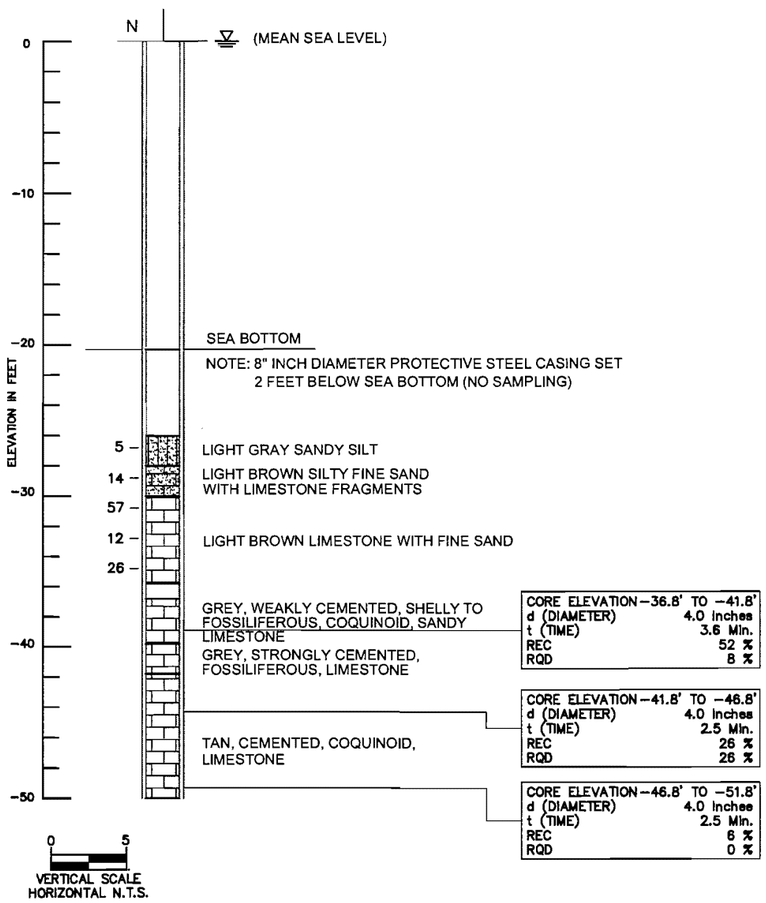
LEGEND

LIMESTONE

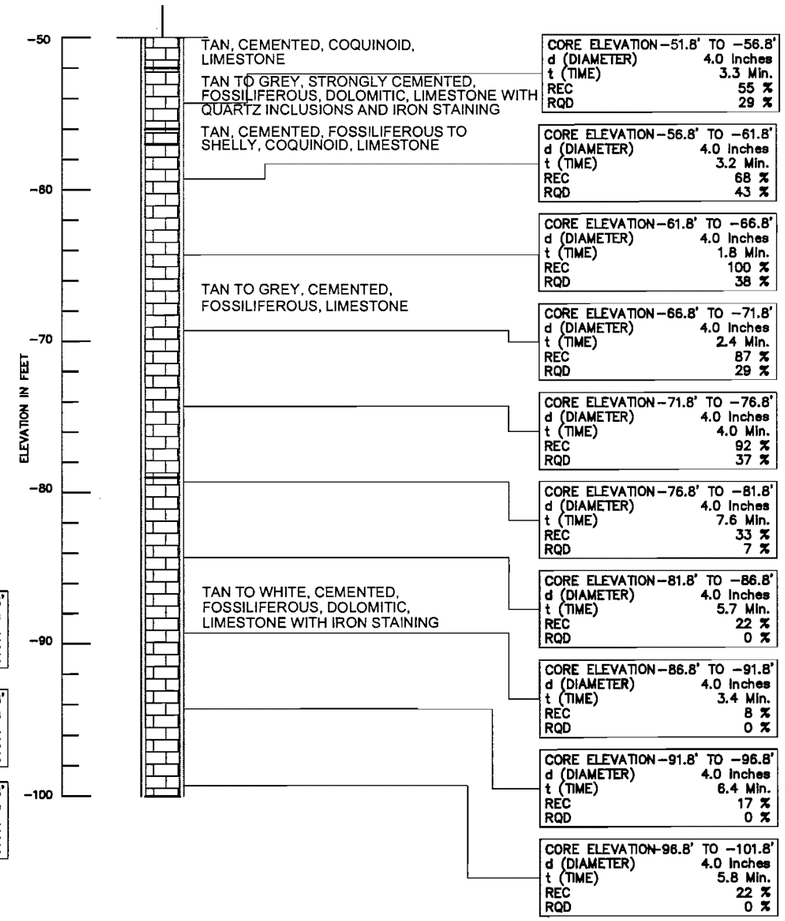
SILTY FINE SAND WITH LIMESTONE FRAGMENTS

SANDY SILT

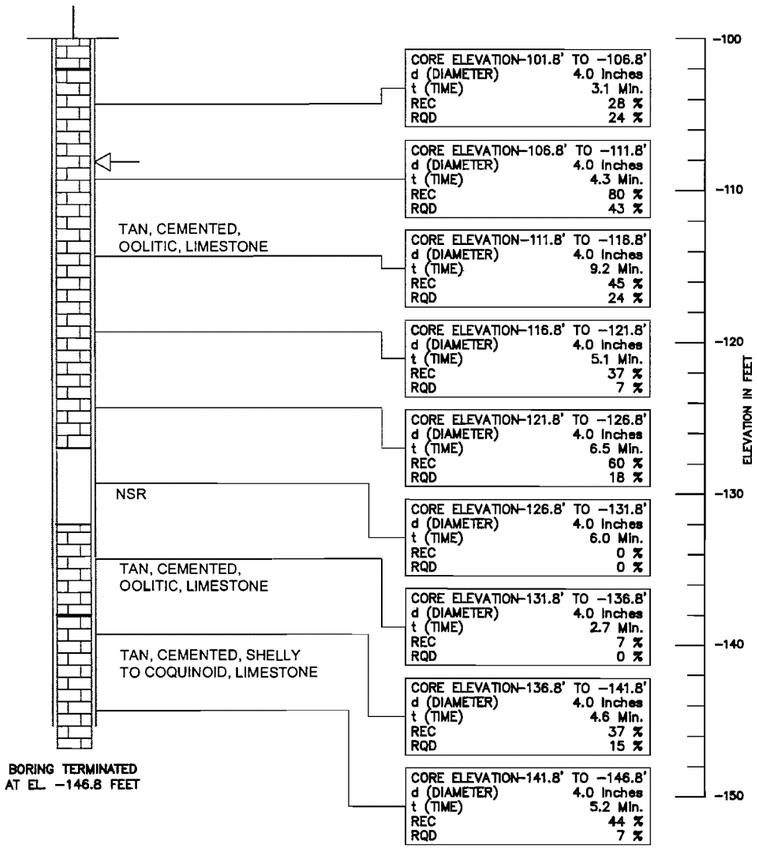
BORING No. B-2
NORTHING 527224.8
EASTING 927723.8
DATE 1/13/04 Through 1/16/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



BORING No. B-2
NORTHING 527224.8
EASTING 927723.8
DATE 1/13/04 Through 1/16/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



BORING No. B-2
NORTHING 527224.8
EASTING 927723.8
DATE 1/13/04 Through 1/16/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:

HUGO E. SOTO, P.E.
FLA. REG. No. 36440

ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156–2	MIAMI–DADE	0010–801–R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY

SHEET NO. D–4

PSI PROJECT No. 397–35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

NOTES:

REC RECOVERY (%)

RQD ROCK QUALITY DESIGNATION (%)

CASING DEPTH

t TIME OF CORE RUN (MINUTES)

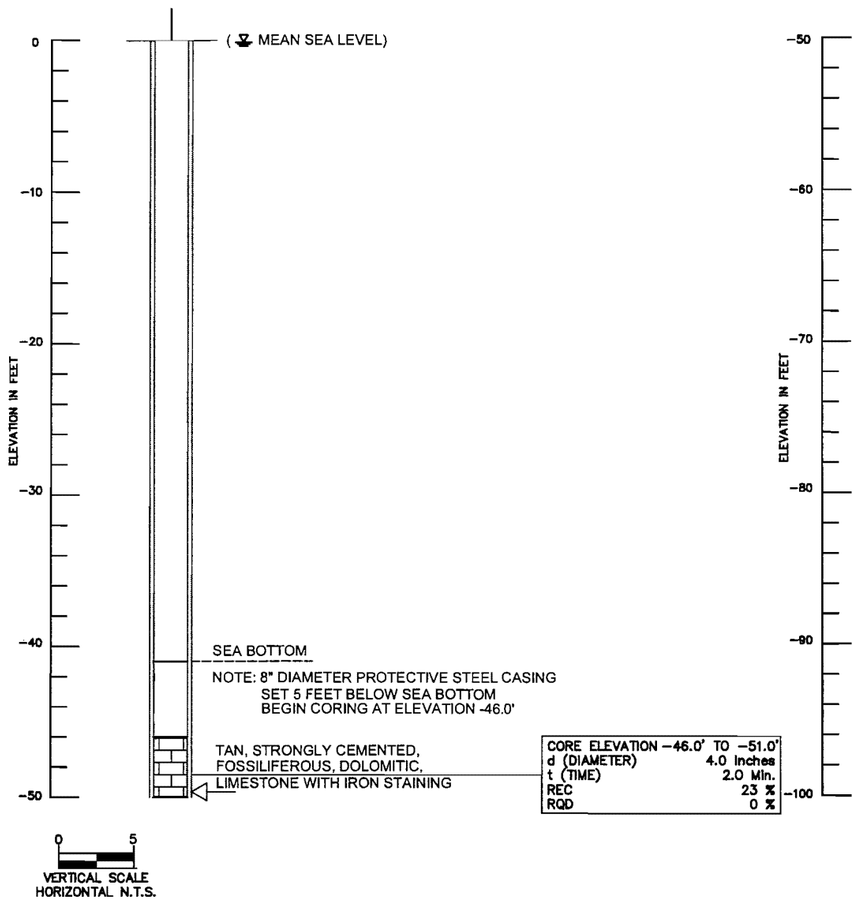
NSR NO SAMPLE RECOVERED

LOSS OF CIRCULATION

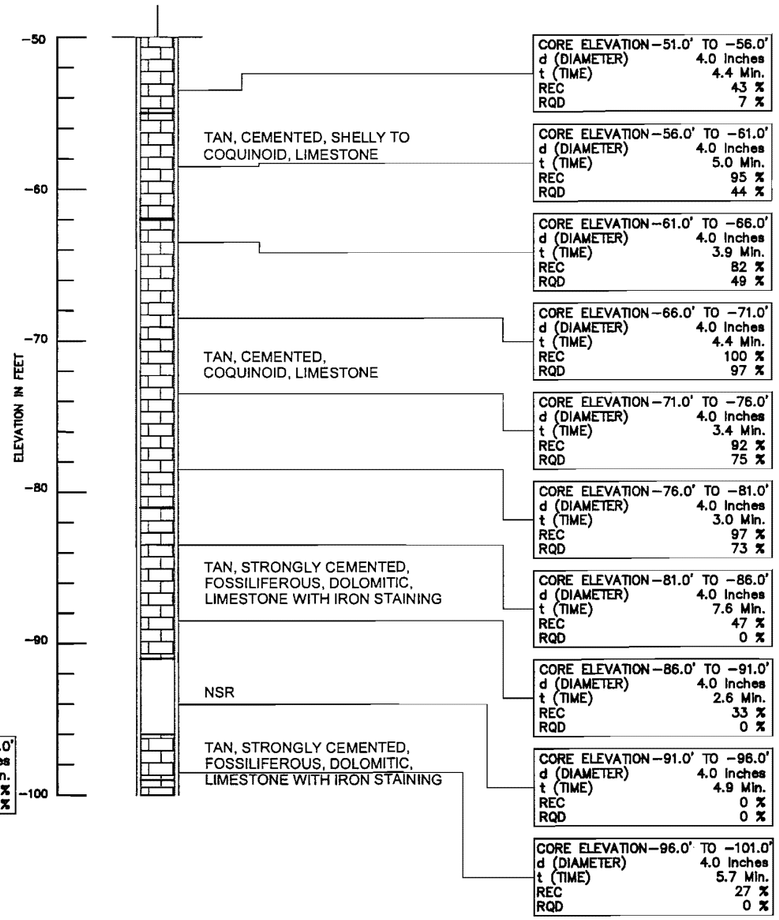
LEGEND

LIMESTONE

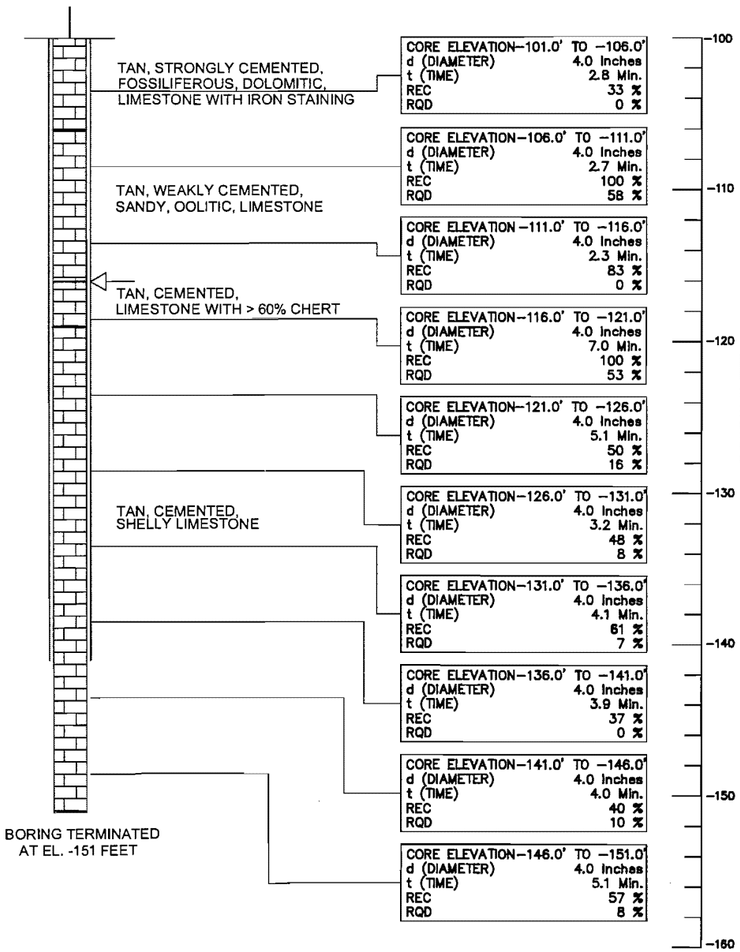
BORING No. B-3
NORTHING 526893.0
EASTING 927728.4
DATE 1/21/04 Through 1/23/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



BORING No. B-3
NORTHING 526893.0
EASTING 927728.4
DATE 1/21/04 Through 1/23/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



BORING No. B-3
NORTHING 526893.0
EASTING 927728.4
DATE 1/21/04 Through 1/23/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
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Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT
PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-5

PSI PROJECT No. 397-35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

NOTES:

REC RECOVERY (%)

RQD ROCK QUALITY DESIGNATION (%)

CASING DEPTH

t TIME OF CORE RUN (MINUTES)

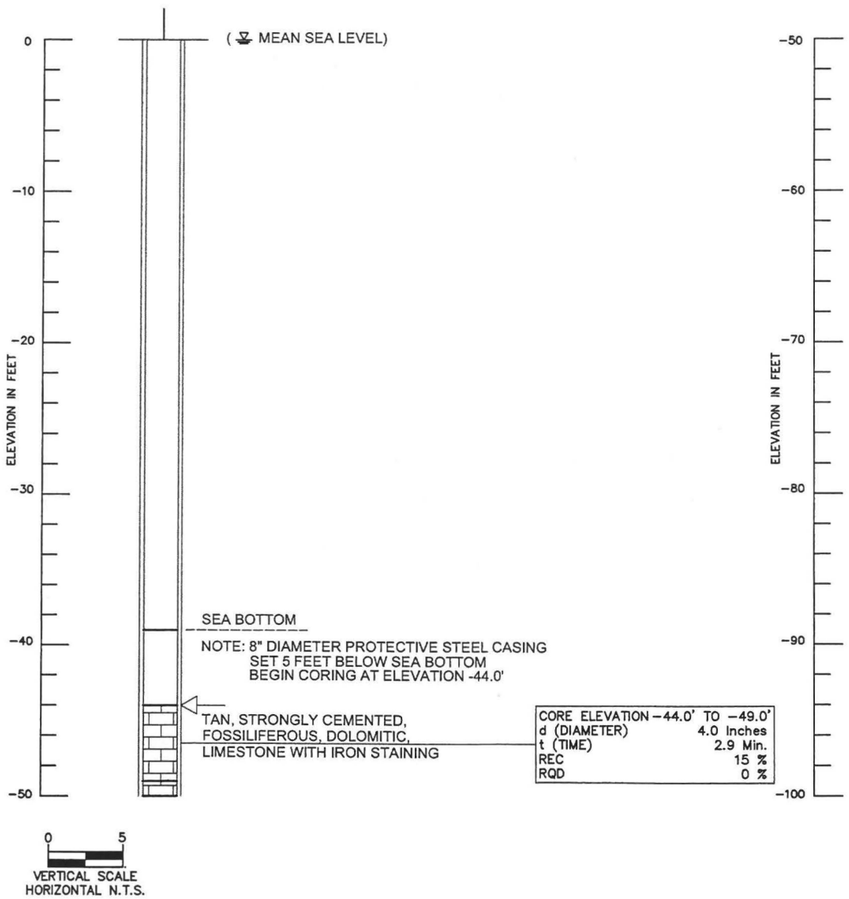
NSR NO SAMPLE RECOVERED

LOSS OF CIRCULATION

LEGEND

LIMESTONE

BORING No. B-4
NORTHING 526537.0
EASTING 927699.7
DATE 1/26/04 Through 1/29/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



BORING No. B-4
NORTHING 526537.0
EASTING 927699.7
DATE 1/26/04 Through 1/29/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75

CORE ELEVATION -49.0' TO -54.0'
d (DIAMETER) 4.0 Inches
t (TIME) 13.9 Min.
REC 17 %
RQD 0 %

CORE ELEVATION -54.0' TO -59.0'
d (DIAMETER) 4.0 Inches
t (TIME) 6.7 Min.
REC 98 %
RQD 62 %

CORE ELEVATION -59.0' TO -64.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.2 Min.
REC 82 %
RQD 33 %

CORE ELEVATION -64.0' TO -69.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.5 Min.
REC 100 %
RQD 39 %

CORE ELEVATION -69.0' TO -74.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.2 Min.
REC 92 %
RQD 55 %

CORE ELEVATION -74.0' TO -79.0'
d (DIAMETER) 4.0 Inches
t (TIME) 3.4 Min.
REC 100 %
RQD 70 %

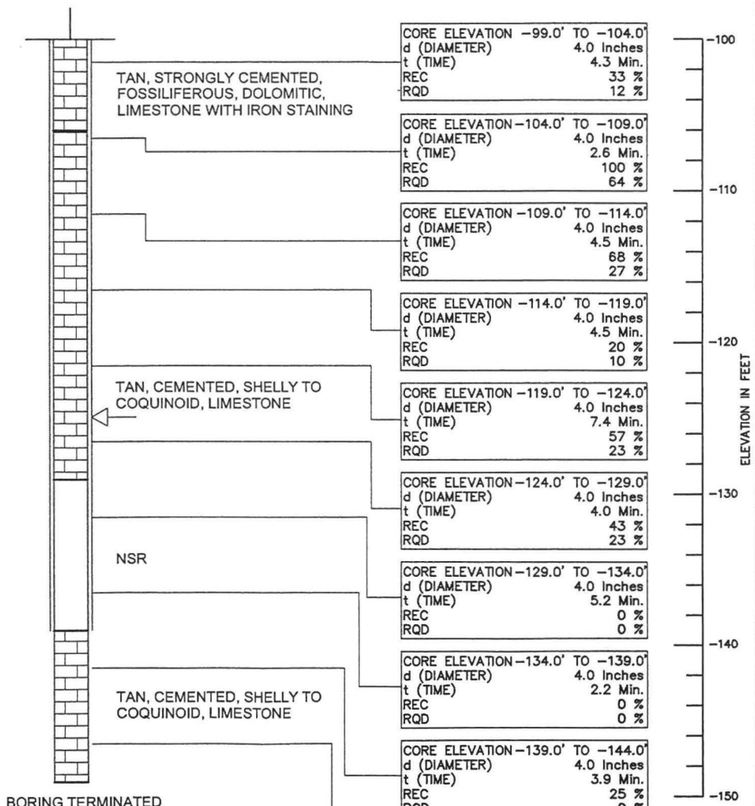
CORE ELEVATION -79.0'TO -84.0'
d (DIAMETER) 4.0 Inches
t (TIME) 6.4 Min.
REC 40 %
RQD 0 %

CORE ELEVATION -84.0' TO -89.0'
d (DIAMETER) 4.0 Inches
t (TIME) 3.1 Min.
REC 17 %
RQD 0 %

CORE ELEVATION -89.0' TO -94.0'
d (DIAMETER) 4.0 Inches
t (TIME) 2.5 Min.
REC 33 %
RQD 7 %

CORE ELEVATION -94.0' TO -99.0'
d (DIAMETER) 4.0 Inches
t (TIME) 5.8 Min.
REC 0 %
RQD 0 %

BORING No. B-4
NORTHING 526537.0
EASTING 927699.7
DATE 1/26/04 Through 1/29/04
ELEVATION 0.0'
HAMMER SAFETY
TYPE OF RIG CME 75



CORE ELEVATION -99.0' TO -104.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.3 Min.
REC 33 %
RQD 12 %

CORE ELEVATION -104.0' TO -109.0'
d (DIAMETER) 4.0 Inches
t (TIME) 2.6 Min.
REC 100 %
RQD 64 %

CORE ELEVATION -109.0' TO -114.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.5 Min.
REC 68 %
RQD 27 %

CORE ELEVATION -114.0' TO -119.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.5 Min.
REC 20 %
RQD 10 %

CORE ELEVATION -119.0' TO -124.0'
d (DIAMETER) 4.0 Inches
t (TIME) 7.4 Min.
REC 57 %
RQD 23 %

CORE ELEVATION -124.0' TO -129.0'
d (DIAMETER) 4.0 Inches
t (TIME) 4.0 Min.
REC 43 %
RQD 23 %

CORE ELEVATION -129.0' TO -134.0'
d (DIAMETER) 4.0 Inches
t (TIME) 5.2 Min.
REC 0 %
RQD 0 %

CORE ELEVATION -134.0' TO -139.0'
d (DIAMETER) 4.0 Inches
t (TIME) 2.2 Min.
REC 0 %
RQD 0 %

CORE ELEVATION -139.0' TO -144.0'
d (DIAMETER) 4.0 Inches
t (TIME) 3.9 Min.
REC 25 %
RQD 0 %

CORE ELEVATION -144.0' TO -149.0'
d (DIAMETER) 4.0 Inches
t (TIME) 3.9 Min.
REC 19 %
RQD 0 %

REVISIONS

Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
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Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT
PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-6

PSI PROJECT No. 397-35115

GRANULAR MATERIALS–RELATIVE DENSITY	SAFETY HAMMER SPT–N (BLOWS/12 in)	AUTOMATIC HAMMER SPT–N (BLOWS/12 in)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4–10	3–7
MEDIUM	10–30	7–21
DENSE	30–50	21–35
VERY DENSE	GREATER THAN 50	GREATER THAN 35

SILTS AND CLAYS CONSISTENCY	SAFETY HAMMER SPT–N (BLOWS/12 in)	AUTOMATIC HAMMER SPT–N (BLOWS/12 in)
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2–4	1–3
FIRM	4–8	3–6
STIFF	8–15	6–11
VERY STIFF	15–30	11–21
HARD	GREATER THAN 30	GREATER THAN 21

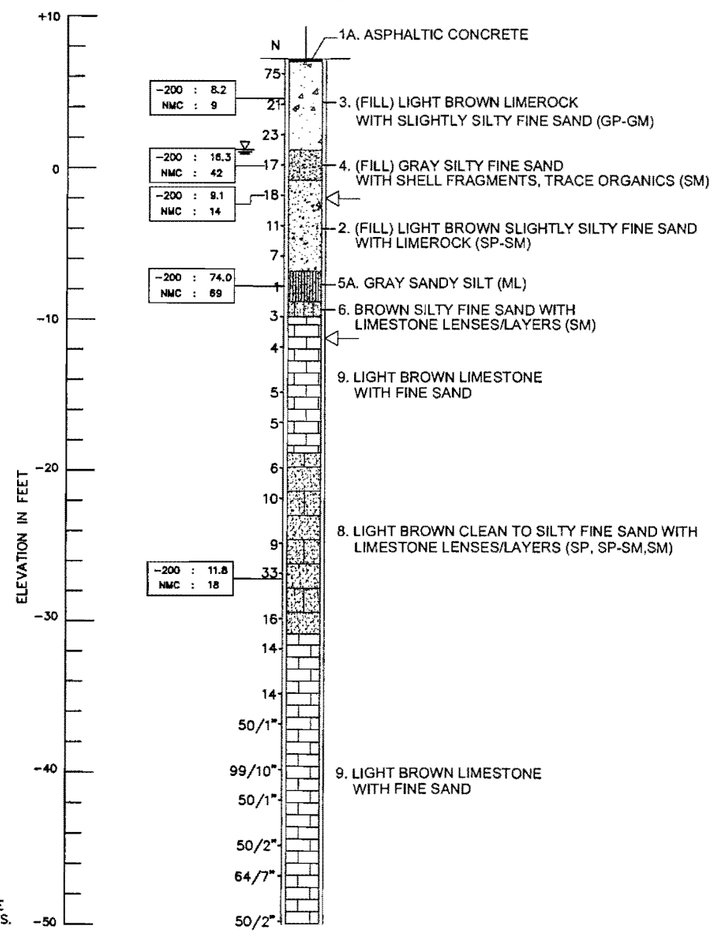
NOTES:

- WATER TABLE AT TIME OF DRILLING
- N — NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES PENETRATION. (UNLESS OTHERWISE NOTED.)
- CASING DEPTH
- NSR — NO SAMPLE RECOVERED
- LOSS OF CIRCULATION
- −200 — FINES PASSING NO. 200 SIEVE (%)
- NMC — NATURAL MOISTURE CONTENT (%)
- OC — ORGANIC CONTENT (%)
- W.O.H. — FELL UNDER THE WEIGHT OF THE HAMMER

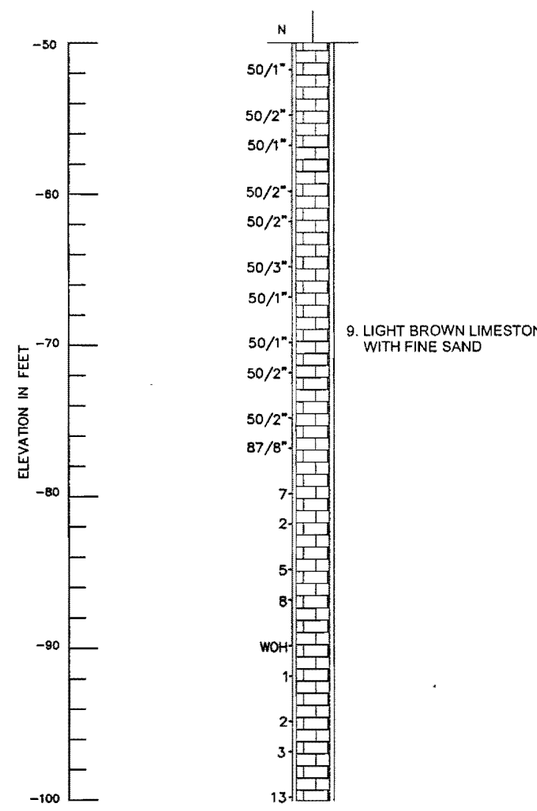
LEGEND

1. (TOPSOIL) DARK BROWN ORGANIC SILTY FINE SAND WITH TRACE ROOTS (PT)
1A. ASPHALTIC CONCRETE
2. (FILL) LIGHT BROWN SLIGHTLY SILTY FINE SAND WITH LIMEROCK (SP-SM)
3. (FILL) LIGHT BROWN LIMEROCK WITH CLEAN TO SLIGHTLY SILTY FINE SAND (GP,GP-GM)
4. (FILL) GRAY SILTY FINE SAND WITH SHELL FRAGMENTS, TRACE ORGANICS (SM)
5. GRAY SILTY FINE SAND WITH SHELL FRAGMENTS, TRACE ORGANICS (SM)
5A. GRAY SANDY SILT (ML)
6. BROWN SILTY FINE SAND WITH LIMESTONE LENSES/LAYERS (SM)
7. LIGHT BROWN CLEAN FINE SAND (SP)
8. LIGHT BROWN CLEAN TO SILTY FINE SAND WITH LIMESTONE LENSES/LAYERS (SP, SP-SM,SM)
9. LIGHT BROWN LIMESTONE WITH FINE SAND

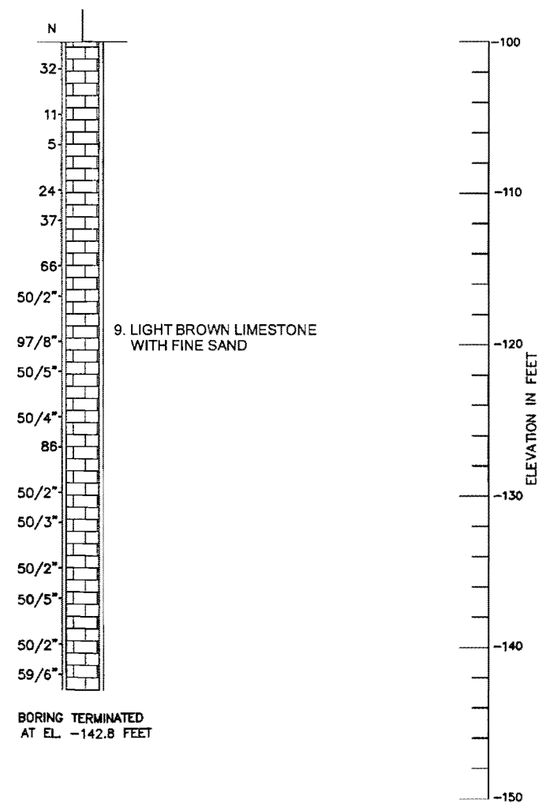
BORING No. B-5 SPT
NORTHING 526276.7
EASTING 927543.9
DATE 11/04/03 THROUGH 11/06/03
ELEVATION +7.2'
HAMMER AUTOMATIC
TYPE OF RIG CME 75



BORING No. B-5 SPT
NORTHING 526276.7
EASTING 927543.9
DATE 11/04/03 THROUGH 11/06/03
ELEVATION +7.2'
HAMMER AUTOMATIC
TYPE OF RIG CME 75



BORING No. B-5 SPT
NORTHING 526276.7
EASTING 927543.9
DATE 11/04/03 THROUGH 11/06/03
ELEVATION +7.2'
HAMMER AUTOMATIC
TYPE OF RIG CME 75



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
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FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING
PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY
SHEET NO. D-7

PSI PROJECT No. 397-35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

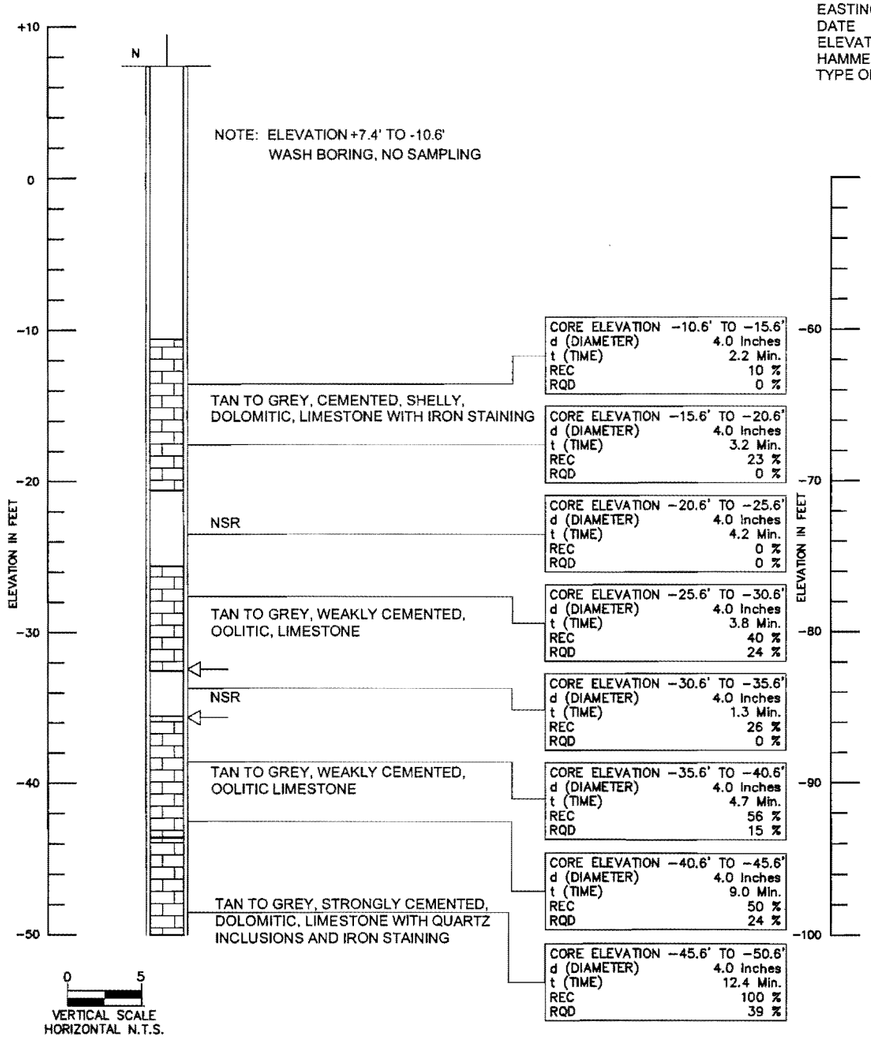
NOTES:

REC RECOVERY (%)
RQD ROCK QUALITY DESIGNATION (%)
CASING DEPTH
t TIME OF CORE RUN (MINUTES)
NSR NO SAMPLE RECOVERED
LOSS OF CIRCULATION

LEGEND

LIMESTONE

BORING No. B-5 RC
NORTHING 526270.6
EASTING 927539.9
DATE 11/17/03 Through 11/19/03
ELEVATION +7.4'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



CORE ELEVATION −10.6' TO −15.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	2.2 Min.
REC	10 %
RQD	0 %

CORE ELEVATION −15.6' TO −20.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	3.2 Min.
REC	23 %
RQD	0 %

CORE ELEVATION −20.6' TO −25.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	4.2 Min.
REC	0 %
RQD	0 %

CORE ELEVATION −25.6' TO −30.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	3.8 Min.
REC	40 %
RQD	24 %

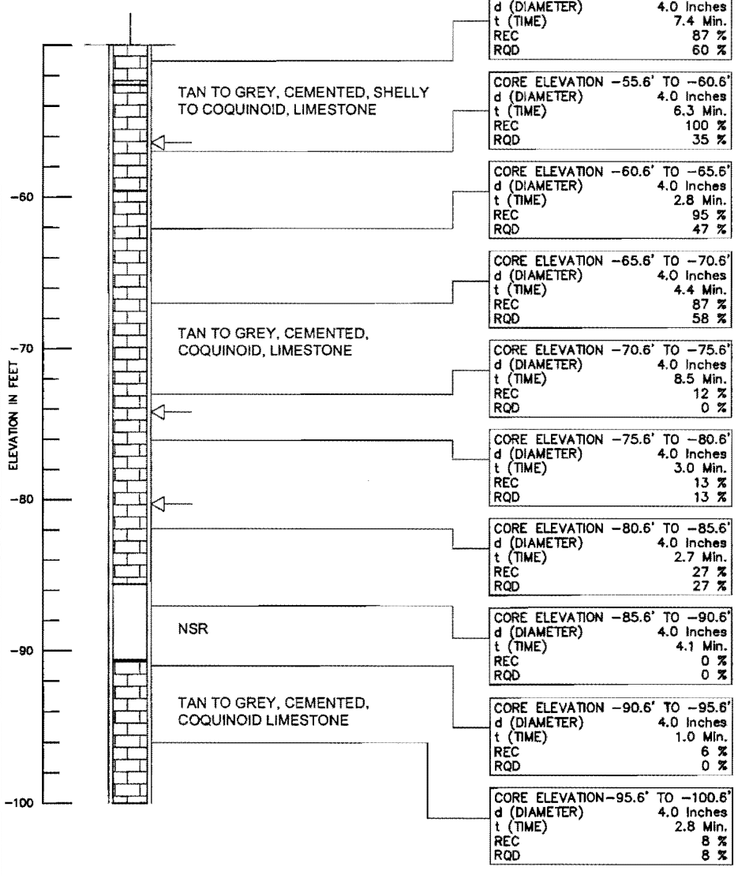
CORE ELEVATION −30.6' TO −35.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	1.3 Min.
REC	26 %
RQD	0 %

CORE ELEVATION −35.6' TO −40.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	4.7 Min.
REC	56 %
RQD	15 %

CORE ELEVATION −40.6' TO −45.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	9.0 Min.
REC	50 %
RQD	24 %

CORE ELEVATION −45.6' TO −50.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	12.4 Min.
REC	100 %
RQD	39 %

BORING No. B-5 RC
NORTHING 526270.6
EASTING 927539.9
DATE 11/17/03 Through 11/19/03
ELEVATION +7.4'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



CORE ELEVATION −50.6' TO −55.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	7.4 Min.
REC	87 %
RQD	60 %

CORE ELEVATION −55.6' TO −60.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	6.3 Min.
REC	100 %
RQD	35 %

CORE ELEVATION −60.6' TO −65.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	2.8 Min.
REC	95 %
RQD	47 %

CORE ELEVATION −65.6' TO −70.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	4.4 Min.
REC	87 %
RQD	58 %

CORE ELEVATION −70.6' TO −75.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	8.5 Min.
REC	12 %
RQD	0 %

CORE ELEVATION −75.6' TO −80.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	3.0 Min.
REC	13 %
RQD	13 %

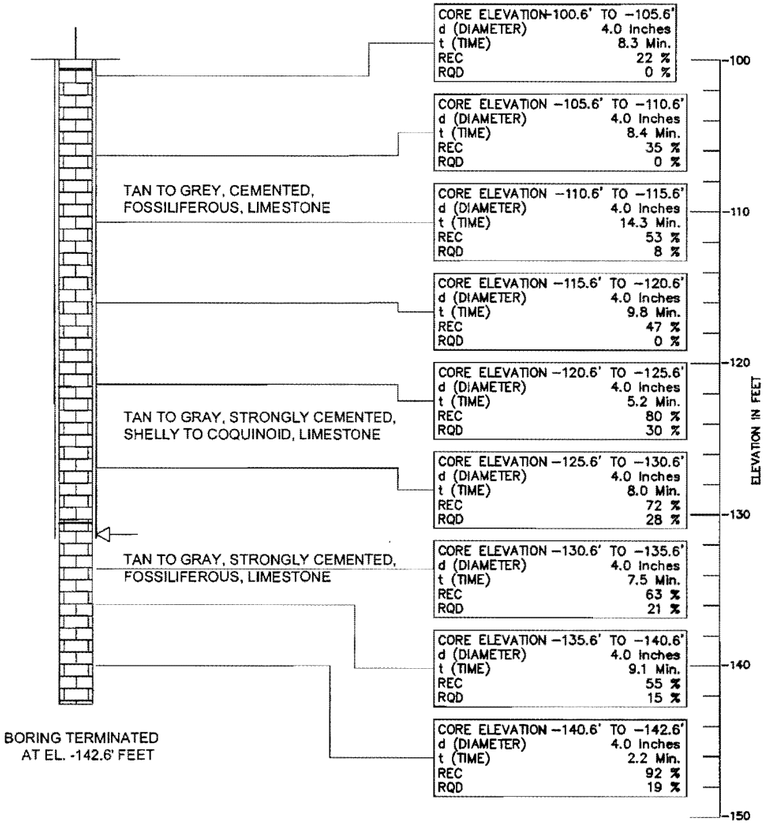
CORE ELEVATION −80.6' TO −85.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	2.7 Min.
REC	27 %
RQD	27 %

CORE ELEVATION −85.6' TO −90.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	4.1 Min.
REC	0 %
RQD	0 %

CORE ELEVATION −90.6' TO −95.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	1.0 Min.
REC	6 %
RQD	0 %

CORE ELEVATION−95.6' TO −100.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	2.8 Min.
REC	8 %
RQD	8 %

BORING No. B-5 RC
NORTHING 526270.6
EASTING 927539.9
DATE 11/17/03 Through 11/19/03
ELEVATION +7.4'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



CORE ELEVATION-100.6' TO −105.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	8.3 Min.
REC	22 %
RQD	0 %

CORE ELEVATION −105.6' TO −110.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	8.4 Min.
REC	35 %
RQD	0 %

CORE ELEVATION −110.6' TO −115.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	14.3 Min.
REC	53 %
RQD	8 %

CORE ELEVATION −115.6' TO −120.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	9.8 Min.
REC	47 %
RQD	0 %

CORE ELEVATION −120.6' TO −125.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	5.2 Min.
REC	80 %
RQD	30 %

CORE ELEVATION −125.6' TO −130.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	8.0 Min.
REC	72 %
RQD	28 %

CORE ELEVATION −130.6' TO −135.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	7.5 Min.
REC	63 %
RQD	21 %

CORE ELEVATION −135.6' TO −140.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	9.1 Min.
REC	55 %
RQD	15 %

CORE ELEVATION −140.6' TO −142.6'	
d (DIAMETER)	4.0 Inches
t (TIME)	2.2 Min.
REC	92 %
RQD	19 %

REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
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FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-8

PSI PROJECT No. 397-35115

GRANULAR MATERIALS– RELATIVE DENSITY	SAFETY HAMMER SPT–N (BLOWS/12 in)	AUTOMATIC HAMMER SPT–N (BLOWS/12 in)
VERY LOOSE	LESS THAN 4	LESS THAN 3
LOOSE	4–10	3–7
MEDIUM	10–30	7–21
DENSE	30–50	21–35
VERY DENSE	GREATER THAN 50	GREATER THAN 35
SILTS AND CLAYS CONSISTENCY	**SAFETY HAMMER SPT–N (BLOWS/12 in)**	**AUTOMATIC HAMMER SPT–N (BLOWS/12 in)**
VERY SOFT	LESS THAN 2	LESS THAN 1
SOFT	2–4	1–3
FIRM	4–8	3–6
STIFF	8–15	6–11
VERY STIFF	15–30	11–21
HARD	GREATER THAN 30	GREATER THAN 21

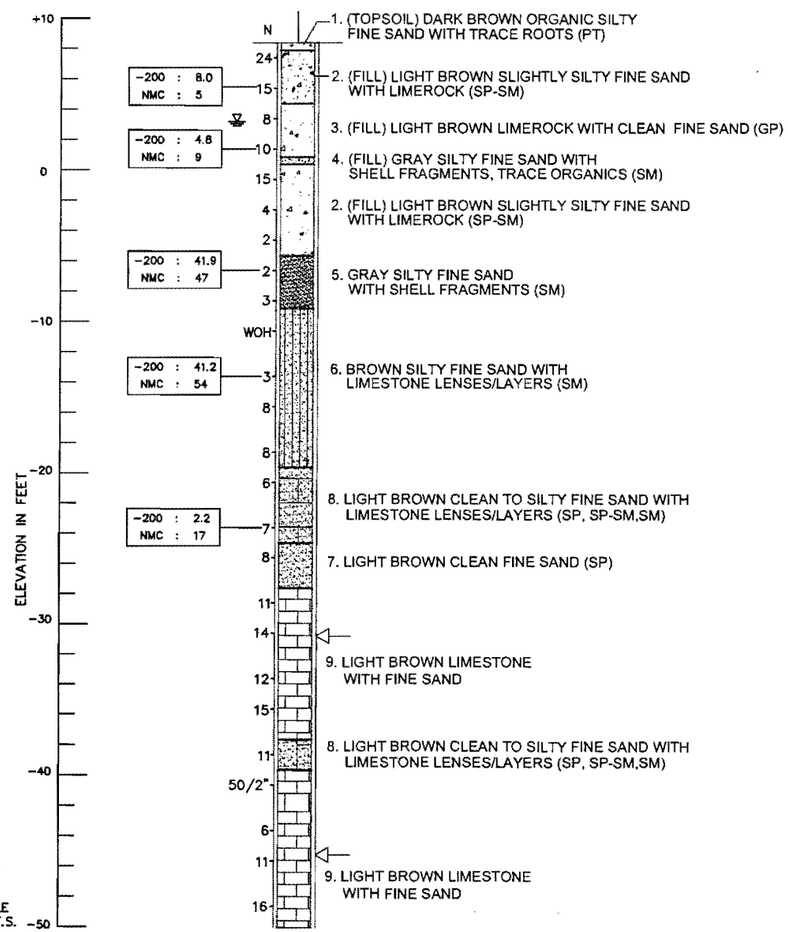
NOTES:

- WATER TABLE AT TIME OF DRILLING
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES PENETRATION. (UNLESS OTHERWISE NOTED.)
- CASING DEPTH
- NSR NO SAMPLE RECOVERED
- LOSS OF CIRCULATION
- –200 FINES PASSING NO. 200 SIEVE (%)
- NMC NATURAL MOISTURE CONTENT (%)
- OC ORGANIC CONTENT (%)
- W.O.H. FELL UNDER THE WEIGHT OF THE HAMMER

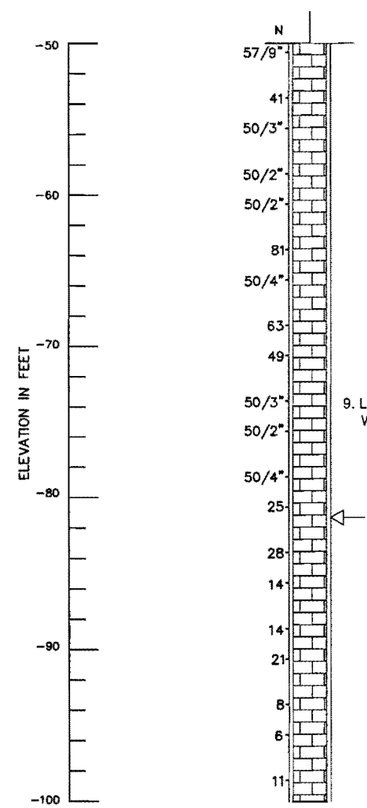
LEGEND

1. (TOPSOIL) DARK BROWN ORGANIC SILTY FINE SAND WITH TRACE ROOTS (PT)
1A. ASPHALTIC CONCRETE
2. (FILL) LIGHT BROWN SLIGHTLY SILTY FINE SAND WITH LIMEROCK (SP-SM)
3. (FILL) LIGHT BROWN LIMEROCK WITH CLEAN TO SLIGHTLY SILTY FINE SAND (GP,GP-GM)
4. (FILL) GRAY SILTY FINE SAND WITH SHELL FRAGMENTS, TRACE ORGANICS (SM)
5. GRAY SILTY FINE SAND WITH SHELL FRAGMENTS, TRACE ORGANICS (SM)
5A. GRAY SANDY SILT (ML)
6. BROWN SILTY FINE SAND WITH LIMESTONE LENSES/LAYERS (SM)
7. LIGHT BROWN CLEAN FINE SAND (SP)
8. LIGHT BROWN CLEAN TO SILTY FINE SAND WITH LIMESTONE LENSES/LAYERS (SP, SP-SM,SM)
9. LIGHT BROWN LIMESTONE WITH FINE SAND

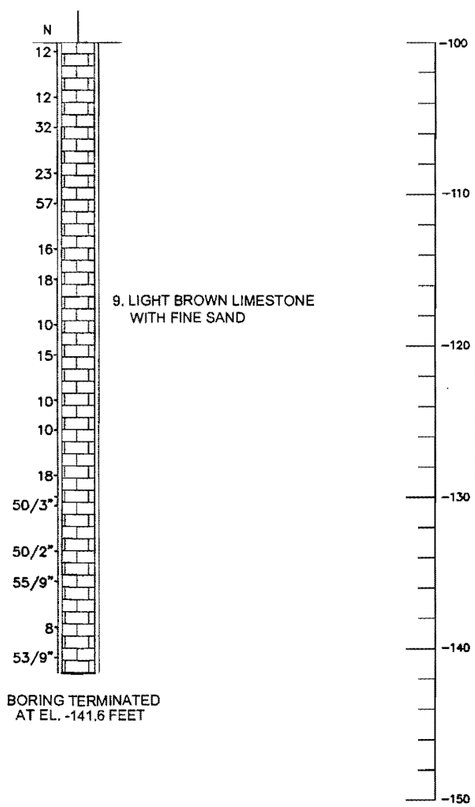
BORING No. B-6 SPT
NORTHING 525922.3
EASTING 927428.7
DATE 8/26/03 Through 8/27/03
ELEVATION +8.4'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-6 SPT
NORTHING 525922.3
EASTING 927428.7
DATE 8/26/03 Through 8/27/03
ELEVATION +8.4'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-6 SPT
NORTHING 525922.3
EASTING 927428.7
DATE 8/26/03 Through 8/27/03
ELEVATION +8.4'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-9

PSI PROJECT No. 397-35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

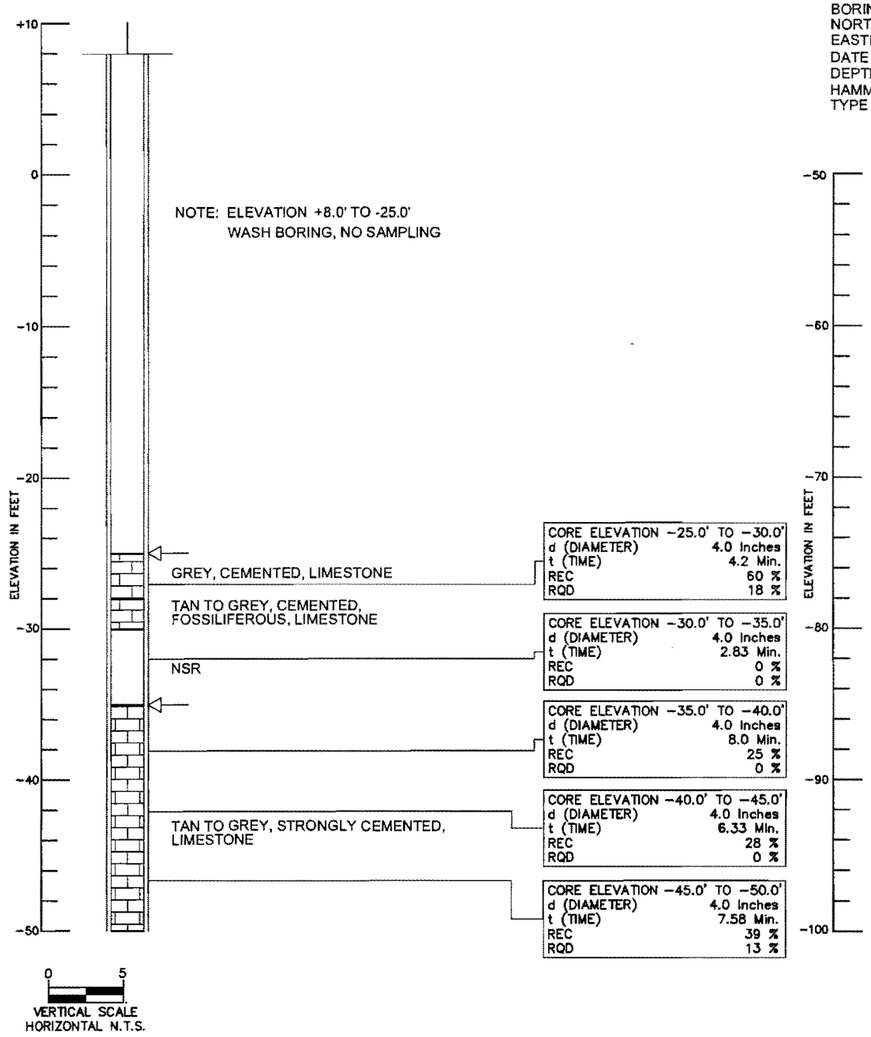
NOTES:

REC RECOVERY (%)
RQD ROCK QUALITY DESIGNATION (%)
CASING DEPTH
t TIME OF CORE RUN (MINUTES)
NSR NO SAMPLE RECOVERED
LOSS OF CIRCULATION

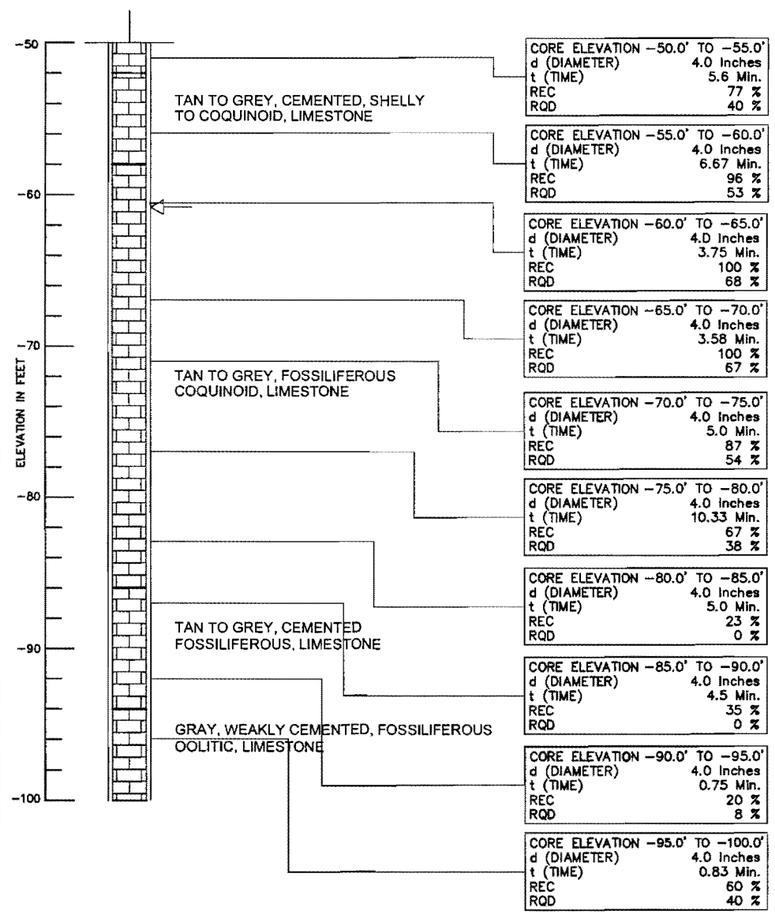
LEGEND

LIMESTONE
SILTY LIMESTONE

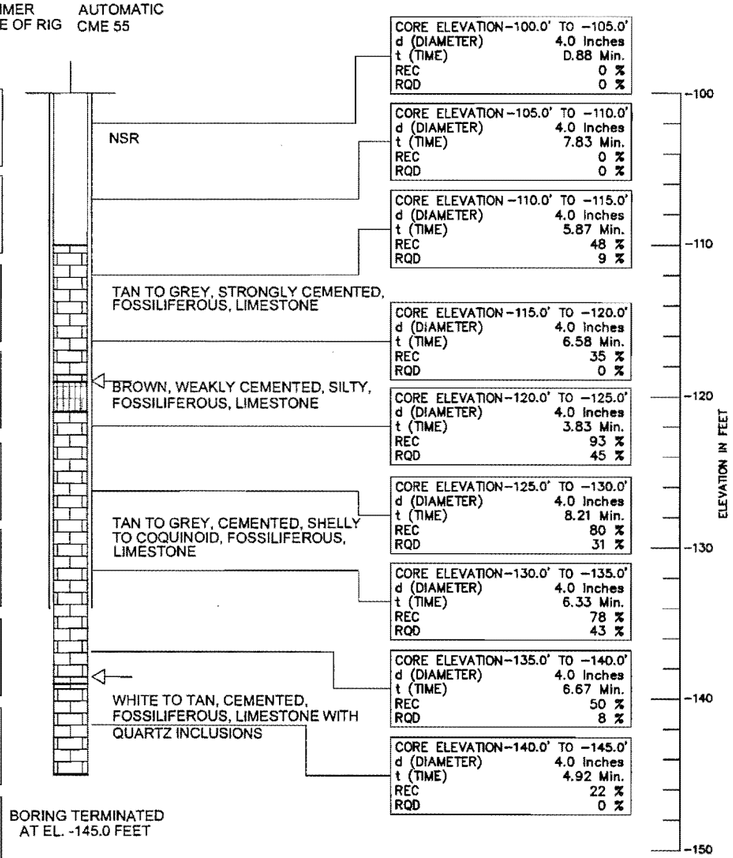
BORING No. B-6 RC
NORTHING 525917.8
EASTING 927425.7
DATE 9/9/03 Through 9/11/03
DEPTH +8.0'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-6 RC
NORTHING 525917.8
EASTING 927425.7
DATE 9/9/03 Through 9/11/03
DEPTH +8.0'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



BORING No. B-6 RC
NORTHING 525917.8
EASTING 927425.7
DATE 9/9/03 Through 9/11/03
DEPTH +8.0'
HAMMER AUTOMATIC
TYPE OF RIG CME 55



REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

PSI ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-10

PSI PROJECT No. 397-35115

RELATION OF RQD AND IN-SITU ROCK QUALITY	
RQD (%)	ROCK QUALITY
90–100	EXCELLENT
75–90	GOOD
50–75	FAIR
25–50	POOR
0–25	VERY POOR
AFTER DEERE, 1963	

NOTES:

REC RECOVERY (%)

RQD ROCK QUALITY DESIGNATION (%)

CASING DEPTH

t TIME OF CORE RUN (MINUTES)

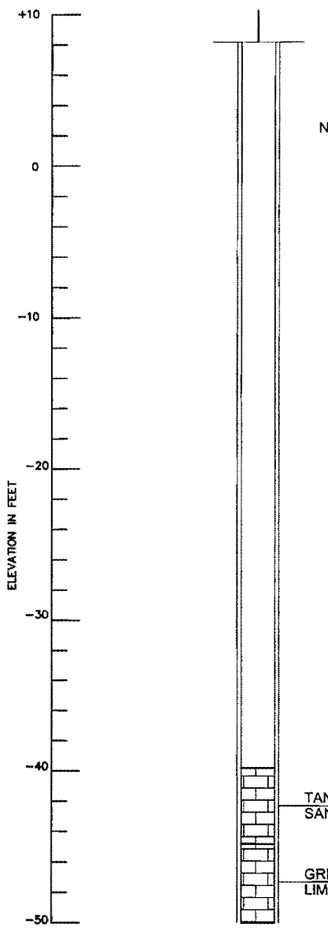
LOSS OF CIRCULATION

LEGEND

LIMESTONE

BORING No. B-6 (PACKER TEST)
NORTHING 525919.1
EASTING 927430.9
DATE 3/09/04 Through 3/10/04
ELEVATION +8.2
HAMMER AUTOMATIC
TYPE OF RIG CME 55

BORING No. B-6 (PACKER TEST)
NORTHING 525919.1
EASTING 927430.9
DATE 3/09/04 Through 3/10/04
ELEVATION +8.2
HAMMER AUTOMATIC
TYPE OF RIG CME 55



NOTE: ELEVATION +8.2' TO -39.8'
WASH BORING, NO SAMPLING

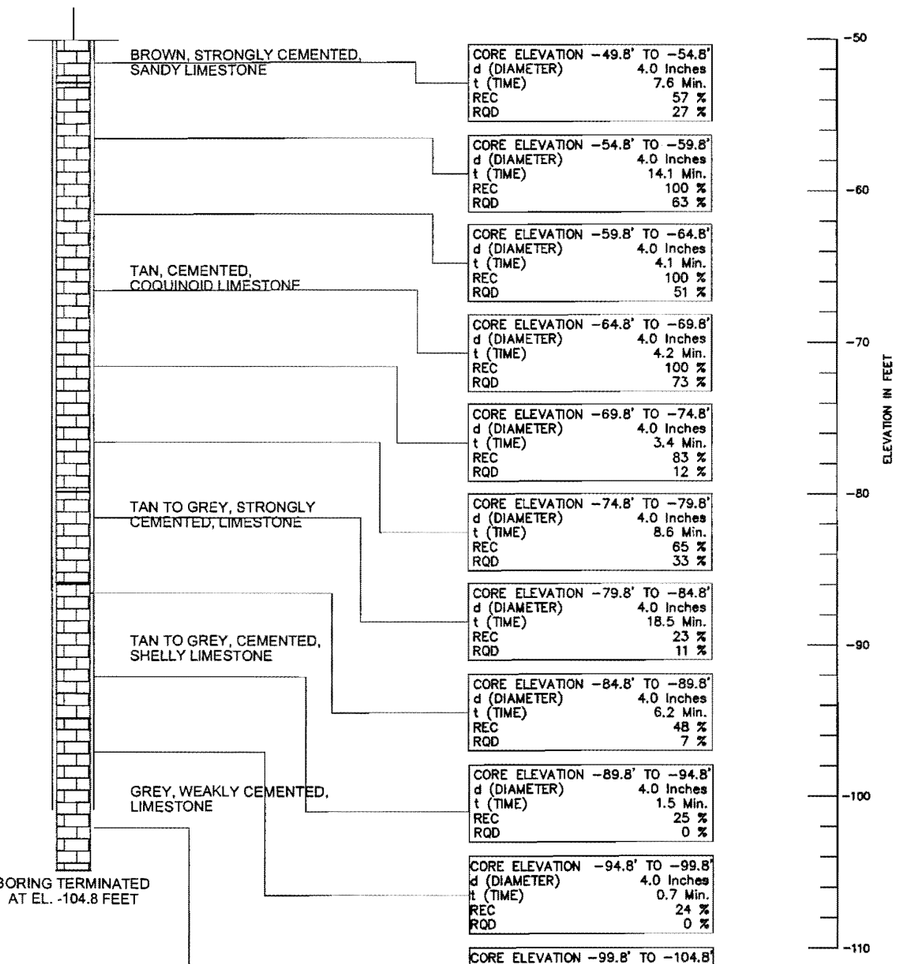
TAN TO GREY, STRONGLY CEMENTED, SANDY LIMESTONE

CORE ELEVATION -39.8' TO -44.8'
d (DIAMETER) 4.0 Inches
t (TIME) 5.4 Min.
REC 72 %
RQD 0 %

GREY, STRONGLY CEMENTED, LIMESTONE

CORE ELEVATION -44.8' TO -49.8'
d (DIAMETER) 4.0 Inches
t (TIME) 10.2 Min.
REC 42 %
RQD 8 %

0 5
VERTICAL SCALE
HORIZONTAL N.T.S.



BROWN, STRONGLY CEMENTED, SANDY LIMESTONE

CORE ELEVATION -49.8' TO -54.8'
d (DIAMETER) 4.0 Inches
t (TIME) 7.6 Min.
REC 57 %
RQD 27 %

CORE ELEVATION -54.8' TO -59.8'
d (DIAMETER) 4.0 Inches
t (TIME) 14.1 Min.
REC 100 %
RQD 63 %

TAN, CEMENTED, COQUINOID LIMESTONE

CORE ELEVATION -59.8' TO -64.8'
d (DIAMETER) 4.0 Inches
t (TIME) 4.1 Min.
REC 100 %
RQD 51 %

CORE ELEVATION -64.8' TO -69.8'
d (DIAMETER) 4.0 Inches
t (TIME) 4.2 Min.
REC 100 %
RQD 73 %

CORE ELEVATION -69.8' TO -74.8'
d (DIAMETER) 4.0 Inches
t (TIME) 3.4 Min.
REC 83 %
RQD 12 %

TAN TO GREY, STRONGLY CEMENTED, LIMESTONE

CORE ELEVATION -74.8' TO -79.8'
d (DIAMETER) 4.0 Inches
t (TIME) 8.6 Min.
REC 65 %
RQD 33 %

CORE ELEVATION -79.8' TO -84.8'
d (DIAMETER) 4.0 Inches
t (TIME) 18.5 Min.
REC 23 %
RQD 11 %

TAN TO GREY, CEMENTED, SHELLY LIMESTONE

CORE ELEVATION -84.8' TO -89.8'
d (DIAMETER) 4.0 Inches
t (TIME) 6.2 Min.
REC 48 %
RQD 7 %

GREY, WEAKLY CEMENTED, LIMESTONE

CORE ELEVATION -89.8' TO -94.8'
d (DIAMETER) 4.0 Inches
t (TIME) 1.5 Min.
REC 25 %
RQD 0 %

CORE ELEVATION -94.8' TO -99.8'
d (DIAMETER) 4.0 Inches
t (TIME) 0.7 Min.
REC 24 %
RQD 0 %

BORING TERMINATED AT EL. -104.8 FEET

CORE ELEVATION -99.8' TO -104.8'
d (DIAMETER) 4.0 Inches
t (TIME) 0.7 Min.
REC 0 %
RQD 0 %

REVISIONS

Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
LICENSE No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

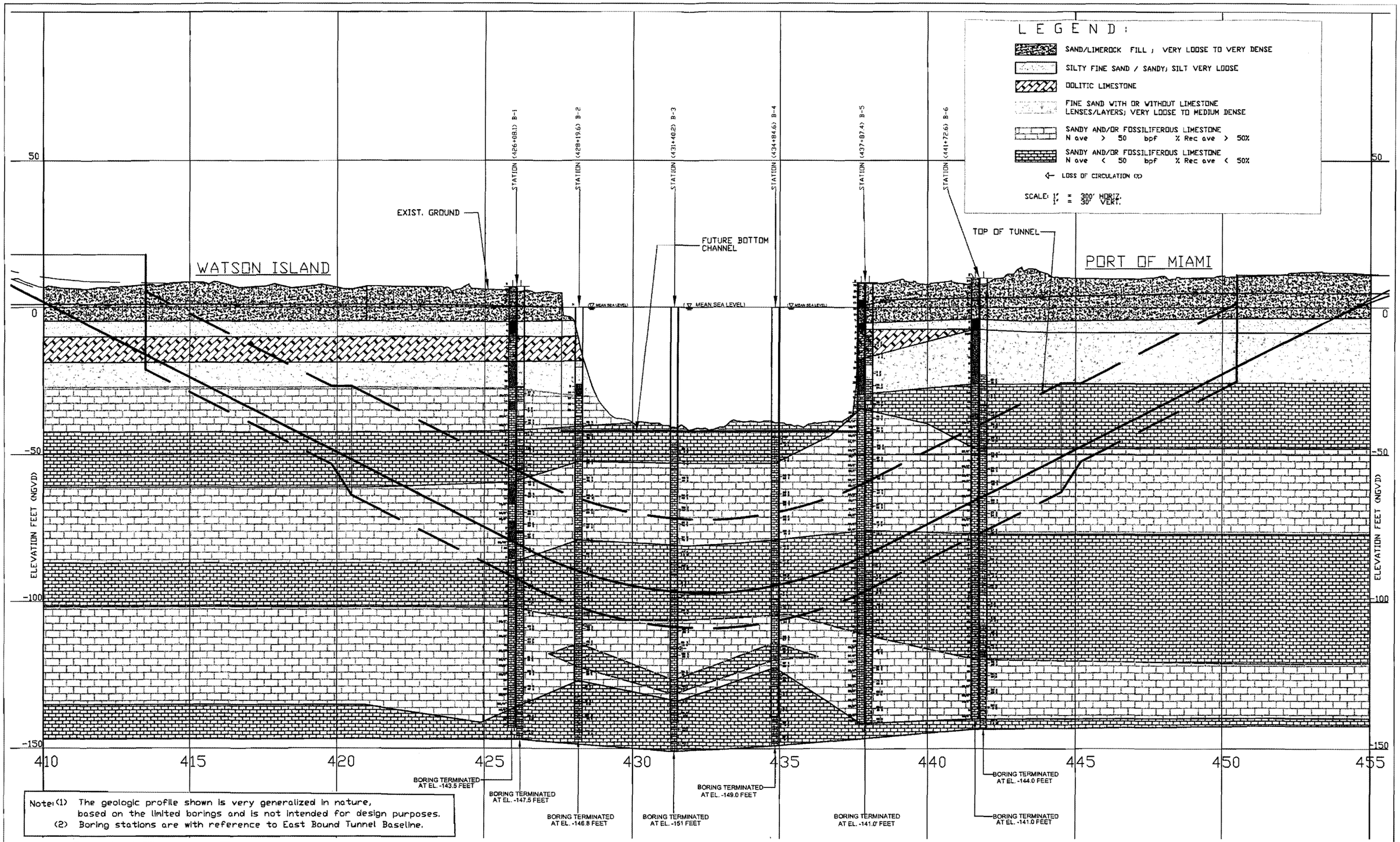
FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: REPORT OF CORE BORING

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT
PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-11

PSI PROJECT No. 397-35115



Note: (1) The geologic profile shown is very generalized in nature, based on the limited borings and is not intended for design purposes.
(2) Boring stations are with reference to East Bound Tunnel Baseline.

REVISIONS					
Date	By	Description	Date	By	Description

ENGINEER OF RECORD:
HUGO E. SOTO, P.E.
FLA. REG. No. 36440

PSI ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
CERTIFICATION OF AUTHORIZATION No. 3684
PROFESSIONAL SERVICE INDUSTRIES, INC.
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 * FAX (305) 593-1915

	Names	Dates
Drawn by	GG	08/05
Checked by	DB	08/05
Designed by		
Checked by		
Approved by	PAUL PASSE, P.E.	

FLORIDA'S TURNPIKE ENTERPRISE

FPID No.:	COUNTY	FEDERAL AID PROJECT No.
251156-2	MIAMI-DADE	0010-801-R

SHEET TITLE: GENERALIZED GEOLOGIC PROFILE

PROJECT NAME: PORT OF MIAMI TUNNEL PROJECT PRELIMINARY FEASIBILITY STUDY

SHEET NO. D-12

PSI PROJECT No. 397-35115

LABORATORY TEST DATA SUMMARY
PORT OF MIAMI TUNNEL PROJECT
PRELIMINARY FEASIBILITY STUDY
MIAMI-DADE COUNTY, FLORIDA
FPID: 251156-2
FEDERAL AID PROJECT NUMBER: 0010-801-R
PSI PROJECT NO. 397-35115

SIEVE ANALYSIS (PERCENT FINER BY WEIGHT)

BORING No.	SAMPLE DEPTH (ft.)	SAMPLE ELEVATION (ft.,NGVD)	NATURAL MOISTURE CONTENT (%)	SIEVE ANALYSIS (PERCENT FINER BY WEIGHT)							
				1½"	1"	¾"	3/8"	#4	#10	#40	#200
B-1 SPT	1.0-2.0	+6.1 to +5.1	1	100	100	80	61	45	37	28	8.1
B-1 SPT	2.0-4.0	+5.1 to +3.1	2	100	90	90	72	64	57	46	7.6
B-1 SPT	10.0-11.0	-2.9 to -3.9	19	100	100	100	91	82	75	67	5.1
B-1 SPT	11.0-12.0	-3.9 to -4.9	15	100	100	87	68	51	39	30	3.0
B-1 SPT	14.0-16.0	-6.9 to -8.9	35	100	100	100	100	99	98	80	23.5
B-1 SPT	16.0-17.5	-8.9 to -10.4	42	100	78	78	78	77	75	54	9.2
B-1 SPT	31.0-32.5	-23.9 to -25.4	15	100	100	100	100	100	100	85	2.1
B-1 SPT	38.5-40.0	-31.4 to -32.9	13	100	100	91	76	67	57	46	14.0
B-1 SPT	68.5-70.0	-61.4 to -62.9	8	100	100	94	93	85	72	49	15.2
B-5 SPT	2.0-4.0	+5.2 to +3.2	9	100	88	74	67	56	49	41	8.2
B-5 SPT	6.0-8.0	+1.2 to -0.8	42	100	100	100	100	99	97	75	16.3
B-5 SPT	8.0-10.0	-0.8 to -2.8	14	100	100	93	82	71	64	51	9.1
B-5 SPT	14.0-16.0	-6.8 to -8.8	69	100	100	100	100	100	100	92	74.0
B-5 SPT	33.5-35.0	-26.3 to -27.8	18	100	100	86	72	65	60	48	11.8
B-6 SPT	2.0-4.0	+6.4 to +4.4	5	100	88	78	73	61	51	36	8.0
B-6 SPT	6.0-7.5	+2.4 to +0.9	9	100	90	84	57	43	31	19	4.8
B-6 SPT	14.0-16.0	-5.6 to -7.6	47	100	100	100	100	100	100	84	41.9
B-6 SPT	21.0-22.5	-12.6 to -14.1	54	100	100	100	100	99	94	71	41.2
B-6 SPT	31.0-32.5	-22.6 to -24.1	17	100	100	100	98	94	93	85	2.2

LABORATORY TEST DATA SUMMARY
PORT OF MIAMI TUNNEL PROJECT
PRELIMINARY FEASIBILITY STUDY
MIAMI-DADE COUNTY, FLORIDA
FPID: 251156-2
FEDERAL AID PROJECT NUMBER: 0010-801-R
PSI PROJECT NO. 397-35115

ORGANIC CONTENT TEST

BORING NO.	SAMPLE DEPTH (ft.)	SAMPLE ELEVATION (ft.,NGVD)	NATURAL MOISTURE CONTENT (%)	ORGANIC CONTENT (%)
B-1 SPT	16.0-17.5	-8.9 to –10.4	42	7

CORROSION SERIES TEST RESULTS

BORING NO.	SAMPLE DEPTH (ft.)	SAMPLE ELEVATION (ft.,NGVD)	pH	RESISTIVITY (ohm-cm)	CHLORIDE (ppm)	SULFATE (ppm)	ENVIRONMENTAL CLASSIFICATION	
							STEEL	CONCRETE
B-4	Water Surface	-	8	49	3000	11,628	EA	EA

Notes: 1. **Water Sample was obtained from the Main Channel**
2. **EA-Extremely Aggressive**

Earth Mechanics Institute

Project: Port of Miami Tunnel

Location: Miami, FL

Client: PSI

Colorado School of Mines

Mining Engineering Department

Date: 04/15/04						
Bore Hole Number	Depth (ft)	Rock Type	Direction	Permeability (cm/s)	Porosity (%)	Notes
B-2	48.0-48.8	Coral	Vertical	1.4E-02	29.72	*
B-2	59.8-60.3	Coral	Vertical	7.3E-04	28.38	*
B-2	63.8-64.3	Coral	Vertical	3.0E-03	24.01	*
B-2	73.6-74.4	Coral	Vertical	1.0E-02	38.26	*
B-2	108.3-109.4	Coral	Vertical	6.1E-03	20.94	*
B-2	114.1-114.5	Coral	Vertical	9.1E-03	45.45	*
B-2	115.4-115.8	Coral	Vertical	7.9E-03	51.97	*
B-2	118.5-118.9	Coral	Vertical	1.9E-05	14.17	*
B-3	63.0-63.6	Coral	Vertical	3.8E-03	33.97	*
B-3	69.2-70.4	Coral	Vertical	6.2E-03	16.39	*
B-3	121.5-122.0	Coral	Vertical	2.9E-04	19.65	*
B-4	58.0-58.5	Coral	Vertical	2.1E-04	16.79	*
B-4	63.3-63.7	Coral	Vertical	2.8E-04	18.62	*
B-4	76.9-77.3	Coral	Vertical	8.2E-03	36.81	*
B-4	108.0-108.6	Coral	Vertical	9.1E-03	44.51	*
B-4	118.4-118.9	Coral	Vertical	4.9E-04	23.13	*
B-2	48.0-48.8	Coral	Horizontal	1.6E-02	27.03	
B-2	59.8-60.3	Coral	Horizontal	4.0E-03	25.25	
B-2	63.8-64.3	Coral	Horizontal	3.7E-03	29.06	
B-2	73.6-74.4	Coral	Horizontal	1.9E-02	22.83	
B-2	108.3-109.4	Coral	Horizontal	2.2E-05	8.46	
B-2	114.1-114.5	Coral	Horizontal	1.7E-02	51.24	
B-2	115.4-115.8	Coral	Horizontal	1.6E-02	43.61	
B-2	118.5-118.9	Coral	Horizontal	1.1E-04	8.36	
B-3	63.0-63.6	Coral	Horizontal	1.1E-02	27.74	
B-3	69.2-70.4	Coral	Horizontal	1.1E-02	13.55	
B-3	121.5-122.0	Coral	Horizontal	1.7E-03	13.14	
B-4	58.0-58.5	Coral	Horizontal	2.4E-04	9.67	
B-4	63.3-63.7	Coral	Horizontal	2.4E-04	17.79	
B-4	76.9-77.3	Coral	Horizontal	2.1E-02	25.37	
B-4	108.0-108.6	Coral	Horizontal	2.4E-02	53.35	
B-4	118.4-118.9	Coral	Horizontal	4.3E-03	18.27	

* Porosity calculations for the vertical samples were taken from the average specific gravity data and, as received bulk density data because specimens were not dried out in there entirety after test, in order to perform coring for the horizontal permeability test.

Earth Mechanics Institute

Colorado School of Mines
Mining Engineering Department

Project : Port of Miami Tunnel
Client : PSI

Date : 11/24/2003				Uniaxial Compressive Strength Test						Notes	
Boring Number	Rock Core Number	Depth	Rock Type	Avg. Diameter	Length	Density		Strength			
		(ft)		(in)	(in)	(lb/ft^3)	(g/cm^3)	(psi)	(MPa)	*Sample Preparation*	*(UCS Failure Type)*
B-1	C-9	74.0 - 74.8	Sedimentary	2.003	4.373	101	1.61	199	1.4	Re-cored w/ 2" barrel	Non-structural
B-1	C-10	79.3 - 80.0	Sedimentary	N/A	N/A	N/A	N/A	N/A	N/A	Broken during re-coring	N/A
B-1	C-18	121.8 - 122.2	Sedimentary	1.243	2.973	150	2.41	3,334	23.0	Re-cored w/ 5/4" barrel	Non-structural
B-6	C-6	59.4 - 60.0	Sedimentary	1.242	2.661	142	2.28	2,781	19.2	Re-cored w/ 5/4" barrel	Non-structural
B-6	C-7	64.7 - 65.7	Sedimentary	N/A	N/A	N/A	N/A	N/A	N/A	Broken during grinding	N/A
B-6	C-8	70.1 - 70.7	Sedimentary	1.996	4.178	114	1.83	538	3.7	Re-cored w/ 2" barrel	Non-structural
B-6	C-9	76.1 - 76.8	Sedimentary	2.002	4.208	118	1.88	817	5.6	Re-cored w/ 2" barrel	Non-structural
B-6	C-10	81.6 - 82.2	Sedimentary	N/A	N/A	N/A	N/A	N/A	N/A	Broken during grinding	N/A
B-6	C-11	83.7 - 84.4	Sedimentary	N/A	N/A	N/A	N/A	N/A	N/A	Broken during re-coring	N/A
B-6	C-21	136.1 - 137.0	Sedimentary	2.005	4.067	138	2.21	2,215	15.3	Re-cored w/ 2" barrel	Non-structural
B-6	C-22	140.6 - 141.3	Sedimentary	2.004	4.123	148	2.38	4,470	30.8	Re-cored w/ 2" barrel	Non-structural

* Unable to perform static elastic constant tests due to porosity of samples in origin

Earth Mechanics Institute

Colorado School of Mines
Mining Engineering Department

Project : Port of Miami Tunnel
Client : PSI

Date : 11/24/2003				Brazilian (Indirect) Tensile Strength Test				
Boring Number	Rock Core Number	Depth (ft)	Rock Type	Avg. Diameter (in)	Avg. Length (in)	Strength (psi)	Strength (MPa)	Notes (BTS Failure Type)
B-1	C-1	34.5-35.0	Sedimentary	2.008	1.35	304	2.1	Non-structural
B-1	C-7	66.0-66.6	Sedimentary	2.002	1.40	144	1.0	Non-structural
B-1	C-8	69.5-70.0	Sedimentary	3.999	2.32	128	0.9	Non-structural
B-1	C-9	75.5-76.0	Sedimentary	4.003	2.38	160	1.1	Non-structural
B-1	C-10	80.4-81.0	Sedimentary	2.013	1.71	70	0.5	Non-structural
B-1	C-11	84.0-85.0	Sedimentary	3.945	2.20	84	0.6	Non-structural
B-1	C-18	120.5-121.0	Sedimentary	3.959	2.40	236	1.6	Non-structural
B-1	C-19	126.3-126.7	Sedimentary	3.974	2.38	463	3.2	Non-structural
B-1	C-21	135.5-136.0	Sedimentary	3.994	2.50	313	2.2	Non-structural
B-1	C-22	142.1-142.7	Sedimentary	3.999	2.38	347	2.4	Non-structural
B-6	C-1	33.7-34.1	Sedimentary	3.968	1.90	172	1.2	Non-structural
B-6	C-5	54.4-55.1	Sedimentary	4.078	2.05	231	1.6	Non-structural
B-6	C-6	59.0-59.4	Sedimentary	4.003	1.95	416	2.9	Non-structural
B-6	C-7	63.8-64.3	Sedimentary	4.006	2.15	162	1.1	Non-structural
B-6	C-8	69.2-69.8	Sedimentary	3.992	2.18	134	0.9	Non-structural
B-6	C-9	77.1-77.5	Sedimentary	4.004	2.10	162	1.1	Non-structural
B-6	C-10	82.2-82.4	Sedimentary	3.983	2.01	181	1.2	Non-structural
B-6	C-11	83.4-83.7	Sedimentary	3.982	1.76	171	1.2	Non-structural
B-6	C-13	93.9-94.3	Sedimentary	4.000	1.93	353	2.4	Non-structural
B-6	C-15	104.6-105.2	Sedimentary	2.062	1.78	20	0.1	Non-structural
B-6	C-18	119.9-120.4	Sedimentary	4.002	2.31	240	1.7	Non-structural
B-6	C-19	124.9-125.3	Sedimentary	4.006	2.02	366	2.5	Non-structural
B-6	C-20	128.0-128.7	Sedimentary	1.990	1.41	9	0.1	Non-structural
B-6	C-20	130.3-130.8	Sedimentary	4.009	2.34	213	1.5	Non-structural
B-6	C-21	135.6-136.1	Sedimentary	3.988	2.12	309	2.1	Non-structural
B-6	C-22	139.5-140.1	Sedimentary	3.998	2.35	292	2.0	Non-structural
B-6	C-23	143.3-143.8	Sedimentary	4.001	2.37	370	2.6	Non-structural
B-6	C-24	148.9-149.2	Sedimentary	2.002	1.42	601	4.1	Non-structural

Earth Mechanics Institute

Project : Port of Miami Tunnel

Location : Miami, FL

Client : PSI

Colorado School of Mines

Mining Engineering Department

Date :1/13/2004	Rock Core Number	Depth	Rock Type	Uniaxial Compressive Strength Test						Note
Boring Number				Avg. Diameter	Length	Density		Strength		
		(ft)		(in)	(in)	(lb/ft^3)	(g/cm^3)	(psi)	(MPa)	*(UCS Failure Type)*
B-5	C-8	53.9-54.9	Sedimentary	4.000	7.532	128	2.05	634	4.4	Non-structural
B-5	C-9	58.8-59.7	Sedimentary	4.005	8.574	136	2.18	2,482	17.1	Non-structural
B-5	C-10	65.3-66.2	Sedimentary	3.987	7.824	117	1.87	1,006	6.9	Non-structural
B-5	C-12	73.0-74.0	Sedimentary	3.988	8.243	134	2.15	357	2.5	Non-structural
B-5	C-15	88.0-89.3	Sedimentary	3.999	8.445	137	2.19	1,087	7.5	Non-structural

Date : 1/13/2004	Rock Core Number	Depth	Rock Type	Brazilian (Indirect) Tensile Strength Test				Notes
Boring Number				Avg. Diameter	Avg. Length	Strength		
		(ft)		(in)	(in)	(psi)	(MPa)	*(BTS Failure Type)*
B-5	C-7	49.2-50.0	Sedimentary	4.003	2.37	241	1.7	Non-structural
B-5	C-9	61.8-62.3	Sedimentary	4.003	2.42	230	1.6	Non-structural
B-5	C-10	66.2-66.9	Sedimentary	3.997	2.32	303	2.1	Non-structural
B-5	C-11	71.9-72.2	Sedimentary	3.981	2.18	153	1.1	Non-structural
B-5	C-15	88.0-89.3	Sedimentary	4.011	2.29	124	0.9	Non-structural
B-5	C-21	119.3-119.7	Sedimentary	3.985	2.33	273	1.9	Non-structural

* Unable to perform static elastic constant tests due to porosity of samples in origin

Earth Mechanics Institute

Project: Port of Miami Tunnel

Client: PSI

Location: Miami, Florida

Colorado School of Mines

Mining Engineering Department

Date : 02/12/2004

Boring Number	Rock Core Number	Sample Depth (ft)	Rock Type	Uniaxial Compressive Strength Test: Avg. Diameter (in)	Length (in)	Density (lb/ft^3)	Density (g/cm^3)	Strength (psi)	Strength (MPa)	Note (UCS Failure Type)
B-2	C-5	63.0-63.8	Sedimentary	3.994	8.036	122	1.95	682	5	Structural failure at the bottom
	C-8	78.7-79.6	Sedimentary	3.998	8.205	128	2.04	321	2	Structural failure at the top
B-3	C-5	70.4-71.8	Sedimentary	4.004	8.046	140	2.24	1,021	7	Non-Structural

Earth Mechanics Institute

Project: Port of Miami Tunnel

Client: PSI

Location: Miami, Florida

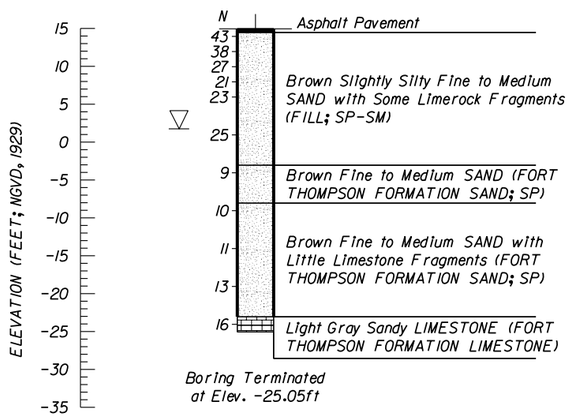
Colorado School of Mines

Mining Engineering Department

Date : 02/12/2004

Boring Number	Rock Core Number	Sample Depth (ft)	Rock Type	Brazilian(Indirect) Tensile Strength Test: Avg. Diameter (in)	Avg. Length (in)	Strength (psi)	Strength (MPa)	Cerchar Abrasivity Index (CAI)	Note (*BTS Failure Type*)
B-2	C-2	48.8-49.3	Sedimentary	3.933	2.23	232	1.6	1.0	Structural
	C-4	58.7-59.2	Sedimentary	4.036	2.21	382	2.6	1.1	Non-structural
	C-5	64.9-65.3	Sedimentary	4.048	2.06	363	2.5	1.0	Non-structural
	C-8	79.8-80.2	Sedimentary	3.993	2.33	53	0.4	1.2	Structural
	C-14	108.3-109.4	Sedimentary	4.009	2.18	425	2.9	1.0	Non-structural
	C-15	116.1-116.5	Sedimentary	4.027	2.13	242	1.7	N/A	Non-structural
	C-16	118.9-119.5	Sedimentary	4.008	2.26	564	3.9	1.1	Non-structural
B-3	C-3	58.5-58.9	Sedimentary	3.997	2.26	322	2.2	0.5	Structural
	C-5	70.4-71.8	Sedimentary	3.990	2.23	88	0.6	0.5	Non-structural
	C-13	111.8-112.4	Sedimentary	3.907	2.28	157	1.1	0.5	Non-structural
	C-15	122.0-122.5	Sedimentary	3.994	2.26	554	3.8	0.7	Non-structural
B-4	C-5	68.2-68.6	Sedimentary	3.965	2.07	283	1.9	1.1	Non-structural
	C-6	74.9-75.5	Sedimentary	3.990	2.21	200	1.4	1.3	Non-structural

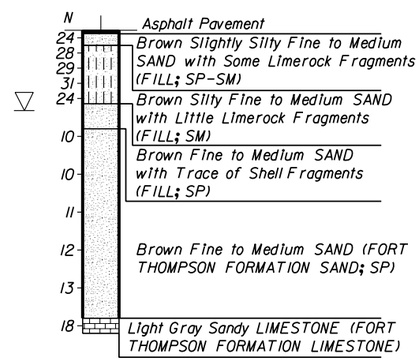
BOR # RW-18
ELEV. 14.95
DATE 1/30/2012
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529134.33
EASTING 923793.81



Boring Terminated at Elev. -25.05ft

Casing Length 38ft

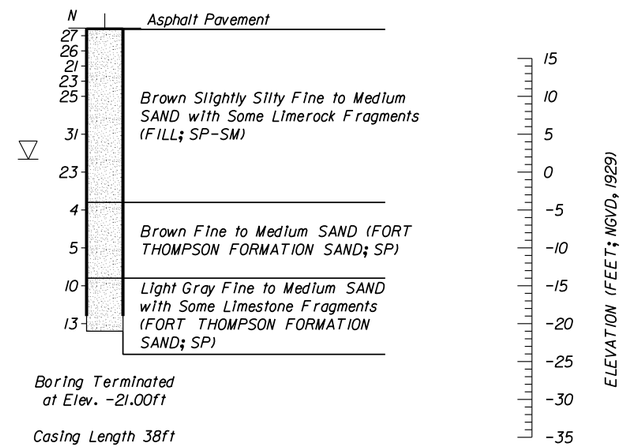
BOR # RW-19
ELEV. 12.38'
DATE 1/24/2012
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529042.02
EASTING 923970.33



Boring Terminated at Elev. -27.62ft

Casing Length 38ft

BOR # RW-20
ELEV. 19.00
DATE 1/30/2012
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529149.39
EASTING 924103.92



Boring Terminated at Elev. -21.00ft

Casing Length 38ft

LEGEND

- ASPHALT PAVEMENT
- TOPSOIL (OL)
- FILL (SP, SP-SM)
- SANDY GRAVEL (FILL; GP)
- SILTY SAND (FILL; SM)
- ORGANIC SAND (OL)
- MIAMI LIMESTONE FORMATION
- PAMLICO FORMATION SAND (SP)
- FORT THOMPSON FORMATION LIMESTONE
- FORT THOMPSON FORMATION SAND (SP/SP-SM)

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.

▽ WATER TABLE AT TIME OF DRILLING

CASING USED

N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).

NMC NATURAL MOISTURE CONTENT (%)

-200 FINES PASSING THE #200 SIEVE (%)

O.C. ORGANIC CONTENT (%)

WOH FELL UNDER WEIGHT OF HAMMER

ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE
STEEL SUBSTRUCTURE: EXTREMELY AGGRESSIVE
CONCRETE SUBSTRUCTURE: EXTREMELY AGGRESSIVE

WATER:

pH: 7.4-8.0
CHLORIDE: 15-3,430 PPM
SULFATE: 14-526 PPM
RESISTIVITY: 94-2,130 OHM-CM

GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC SPT HAMMER (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTANCY	**AUTOMATIC SPT HAMMER (BLOWS PER FOOT)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

0 5 20
Feet
Horizontal Scale
Vertical Scale N.T.S.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

DRAWN BY, S.B. 03-12
CHECKED BY, A.I. 03-12
DESIGNED BY, R.V. 03-12
CHECKED BY, O.R. 03-12

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
836	MIAMI-DADE	251688-1-32-01

SHEET TITLE, REPORT OF CORE BORINGS

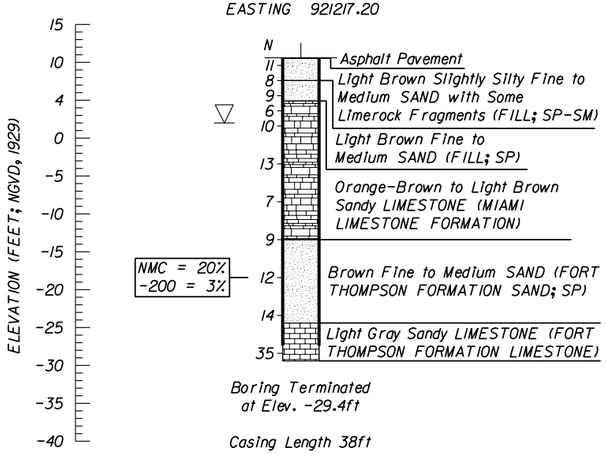
PROJECT NAME, S.R. 836 / I-395 IMPROVEMENTS

REF. DWG. NO.

SHEET NO. 42

Administrator 4/30/2012 3:00:22 PM \\navarro\v8\2011\211153\geotech\BORING26.dgn

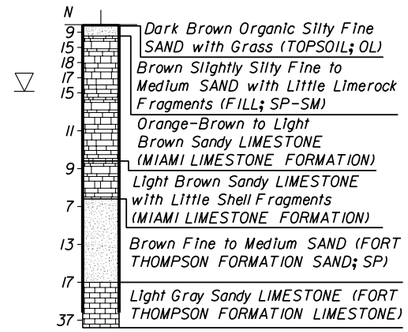
BOR # RW-12
ELEV. 10.60'
DATE 9/30/2011
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 528926.61
EASTING 921217.20



Boring Terminated at Elev. -29.4ft

Casing Length 38ft

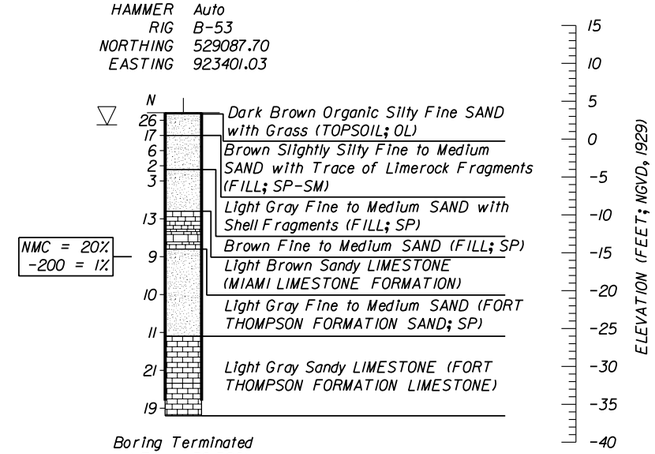
BOR # RW-13
ELEV. 10.75'
DATE 9/30/2011
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529027.62
EASTING 921754.66



Boring Terminated at Elev. -29.25ft

Casing Length 38ft

BOR # RW-14
ELEV. 3.48'
DATE 11/19/2011
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529087.70
EASTING 923401.03



Boring Terminated at Elev. -36.52ft

Casing Length 38ft

LEGEND

- ASPHALT PAVEMENT
- TOPSOIL (OL)
- FILL (SP, SP-SM)
- SANDY GRAVEL (FILL; GP)
- SILTY SAND (FILL; SM)
- ORGANIC SAND (OL)
- MIAMI LIMESTONE FORMATION
- PAMLICO FORMATION SAND (SP)
- FORT THOMPSON FORMATION LIMESTONE
- FORT THOMPSON FORMATION SAND (SP/SP-SM)

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.

▽ WATER TABLE AT TIME OF DRILLING

| | CASING USED

N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).

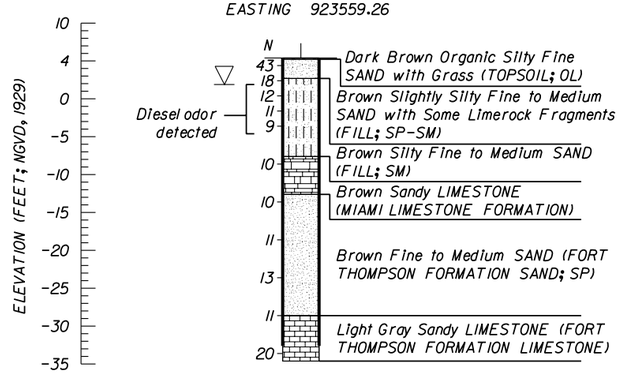
NMC NATURAL MOISTURE CONTENT (%)

-200 FINES PASSING THE #200 SIEVE (%)

O.C. ORGANIC CONTENT (%)

WOH FELL UNDER WEIGHT OF HAMMER

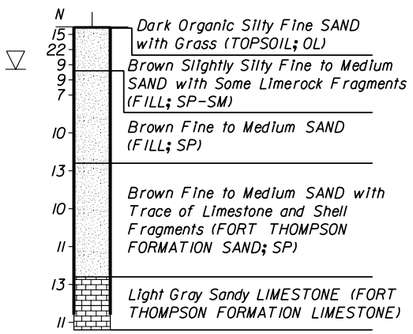
BOR # RW-15
ELEV. 5.39'
DATE 1/24/2012
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529087.17
EASTING 923559.26



Boring Terminated at Elev. -34.61ft

Casing Length 38ft

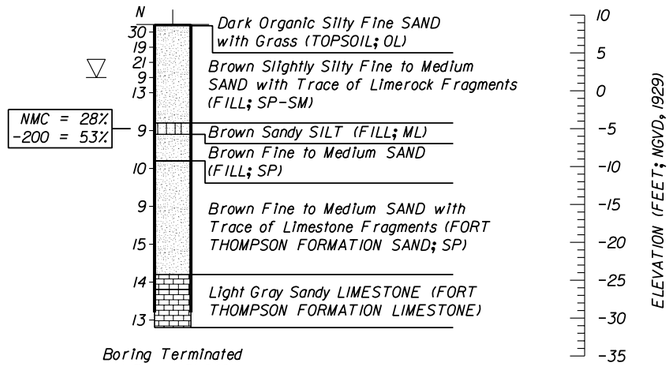
BOR # RW-16
ELEV. 7.39'
DATE 1/26/2012
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 528916.31
EASTING 923593.44



Boring Terminated at Elev. -32.61ft

Casing Length 38ft

BOR # RW-17
ELEV. 8.76'
DATE 1/27/2012
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 529015.72
EASTING 923799.89



Boring Terminated at Elev. -31.24ft

Casing Length 38ft

0 5 20
Feet
Horizontal Scale
Vertical Scale N.T.S.

ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE
STEEL SUBSTRUCTURE: EXTREMELY AGGRESSIVE
CONCRETE SUBSTRUCTURE: EXTREMELY AGGRESSIVE

WATER:

pH: 7.4-8.0
CHLORIDE: 15-3,430 PPM
SULFATE: 14-526 PPM
RESISTIVITY: 94-2,130 OHM-CM

GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC SPT HAMMER (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTANCY	**AUTOMATIC SPT HAMMER (BLOWS PER FOOT)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

DRAWN BY: S.B. 03-12
CHECKED BY: A.I. 03-12
DESIGNED BY: R.V. 03-12
CHECKED BY: O.R. 03-12

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
836	MIAMI-DADE	251688-1-32-01

SHEET TITLE: REPORT OF CORE BORINGS

PROJECT NAME: S.R. 836 / I-395 IMPROVEMENTS

REF. DWG. NO.

SHEET NO. 41

Administrator 4/30/2012 3:00:02 PM \\navarro\v8\2011\211153\geotech\BORING25.dgn

GEOSOL, Inc. MIAMI LAKES, FL	TEST BORING RECORD (ASTM D-1586)	BORING No. B-1

PROJECT NAME: MIAMI RIVER GREENWAY STREETSCAPE PROJECT — SHEET No. 1 OF 1

CLIENT: APCTE — STATION (FT): — OFFSET (FT):

BORING LOCATION: NORTHING: — EASTING: — ELEVATION (ft): — PROJECT No. 209135

GROUNDWATER (FEET): 3.1

DATE	TIME	DEPTH (ft)	CASING	TYPE	CASING	SAMPLE	CORE	TUBE		
				TYPE	NW	SS			DATUM (ft):	
			L (ft)	DIA.(in)	3	1 - 3/8 ID			DATE START:	10/6/2009
			23	WT.(lbs)		140			DATE FINISH:	10/6/2009
				FALL(in)		30			DRILLER:	R. Morales
									EQUIP./HAMMER:	B-53/ AUTOMATIC

DEPTH, ft	SAMPLE No.	STRATUM No.	BLOWS / 6"	N Value (bpf)	SYMBOL	MATERIAL DESCRIPTION	REMARKS
		1	-			0 to 6.5": Asphalt Pavement	
1	S-1	2	9	20		6.5" to 1.3': Brown Silty Fine to Medium SAND with Some Limerock Fragments (FILL, A-1-b / SM)	
			8				
2		4	12			1.3' to 1.8': Dark Brown Organic Silty Fine to Medium SAND (A-8 / OL)	
3	S-2		11	25			
			13				
			12				
4			14				
5	S-3		16	16			
			9				
			7				
6			7				
7	S-4		8	14			
			6				
			8				
8			7				
9	S-5		9	17			
			8				
			9				
10			8				
11							
12		5				1.8' to 25': Light Brown Sandy LIMESTONE (MIAMI LIMESTONE FORMATION)	
13							
14	S-6		6	15			
			8				
			7				
15			8				
16							
17							
18							
19	S-7		8	17			
			9				
			8				
20			10				
21							
22							
23							
24	S-8		4	13			BORING TERMINATED AT DEPTH OF 25 ft. BOREHOLE GROUTED
			6				
			7				
25			7				

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	
0-3	Very Loose	0-1	Very Soft	- H - Hand Auger	- FILL
3-8	Loose	1-3	Soft	- S - Split Spoon	- SAND
8-24	Medium Dense	3-6	Medium Stiff	- T - Thin Wall Tube	- ORGANIC SOILS / MUCK
24-40	Dense	6-12	Stiff	- U - Undisturbed Piston	- SILT
> 40	Very Dense	12-24	Very Stiff	- C - Diamond Core	- CLAY
		> 24	Hard	- W - Wash Sample	- LIMESTONE
					- SANDSTONE

GEOSOL, Inc. MIAMI LAKES, FL	TEST BORING RECORD (ASTM D-1586)	BORING No. B-2

PROJECT NAME: MIAMI RIVER GREENWAY STREETSCAPE PROJECT			SHEET No. 1 OF 1
CLIENT: APCTE	STATION (FT):	OFFSET (FT):	
BORING LOCATION: NORTHING:	EASTING:	ELEVATION (ft):	PROJECT No. 209135

GROUNDWATER (FEET): 4.0

DATE	TIME	DEPTH (ft)	CASING	TYPE	CASING	SAMPLE	CORE	TUBE	DATUM (ft):	
			L (ft)	DIA.(in)	NW	SS			DATE START:	10/6/2009
			23	WT.(lbs)	3	1 - 3/8 ID			DATE FINISH:	10/6/2009
				FALL(in)		140			DRILLER:	R. Morales
						30			EQUIP./HAMMER:	B-53/ AUTOMATIC

DEPTH, ft	SAMPLE No.	STRATUM No.	BLOWS / 6"	N Value (bpf)	SYMBOL	MATERIAL DESCRIPTION	REMARKS
		1	-			0 to 1.75": Asphalt Pavement	
1	S-1	2	12	21		1.75" to 2': Brown Silty Fine to Medium SAND with Some Limerock Fragments (FILL, A-1-b / SM)	
			10				
			11				
2		4	13			2' to 2.5': Dark Brown Organic Silty Fine to medium SAND (FILL, A-8 / OL)	
3	S-2		10	19			
			9				
4			11				
	S-3		13				
5			10	21			
			11				
6			10				
	S-4		9				
7			7	16			
			9				
8			10				
	S-5		11				
9			10	18			
			8				
10			10				
11							
12							
13		5	7			2.5' to 25': Light Brown Sandy LIMESTONE (MIAMI LIMESTONE FORMATION)	
14	S-6		9	17			
			8				
15			8				
16							
17							
18			9				
	S-7		10				
19			9	19			
			10				
20			10				
21							
22							
23							
	S-8		6				
24			8	14			BORING TERMINATED AT DEPTH OF 25 ft. BOREHOLE GROUTED
			6				
25			8				

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	
0-3	Very Loose	0-1	Very Soft	- H - Hand Auger	- FILL
3-8	Loose	1-3	Soft	- S - Split Spoon	- SAND
8-24	Medium Dense	3-6	Medium Stiff	- T - Thin Wall Tube	- ORGANIC SOILS / MUCK
24-40	Dense	6-12	Stiff	- U - Undisturbed Piston	- SILT
> 40	Very Dense	12-24	Very Stiff	- C - Diamond Core	- CLAY
		> 24	Hard	- W - Wash Sample	- LIMESTONE
					- SANDSTONE

GEOSOL, Inc. MIAMI LAKES, FL	TEST BORING RECORD (ASTM D-1586)	BORING No. BP-1
PROJECT NAME: MIAMI RIVER GREENWAY PROJECT		SHEET No. 1 OF 1
CLIENT: BCC ENGINEERING, INC.	STATION (FT): OFFSET (FT):	
BORING LOCATION: NORTHING:	EASTING: ELEVATION (ft):	PROJECT No. 210127

GROUNDWATER (FEET): 4					CASING	SAMPLE	CORE	TUBE	DATUM (ft):	N/A
DATE	TIME	DEPTH (ft)	CASING	TYPE	NW	SS			DATE START:	5/5/2010
			L (ft)	DIA.(in)	3	1 - 3/8 ID			DATE FINISH:	5/5/2010
			-	WT.(lbs)		140			DRILLER:	J. Gonzalez
				FALL(in)		30			EQUIP./HAMMER:	B-53/ AUTOMATIC

DEPTH, ft	SAMPLE No.	STRATUM No.	BLOWS / 6"	N Value (bpf)	SYMBOL	MATERIAL DESCRIPTION	REMARKS
		0	-			0 to 2.9": Asphalt Pavement	
1	S-1	1B	10	35		2.9" to 4.5': Brown Silty Fine to Medium SAND with Some Limerock Fragments (BASE/STABILIZED SUBGRADE; A-1-b/SM)	
			21				
			14				
2	S-2		9	13			
3			7				
			6				
4			7				
	S-3		5	14			
5		3	4			4.5' to 15': Light Brown Sandy LIMESTONE (MIAMI LIMESTONE FORMATION)	
			10				
6			9				
	S-4		11	17			
7			9				
			8				
8			9				
	S-5		7	13			
9			5				
			8				
10			10				
11							Terminated SPT. Advanced borehole with tri-cone bit to depth of 15 feet to perform percolation testing.
12							
13							
14							
15							
16							BORING TERMINATED AT DEPTH OF 15 FT. BOREHOLE GROUTED.
17							
18							
19							
20							
21							
22							
23							
24							
25							

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	
0-3	Very Loose	0-1	Very Soft	- H - Hand Auger	- FILL
3-8	Loose	1-3	Soft	- S - Split Spoon	- SAND
8-24	Medium Dense	3-6	Medium Stiff	- T - Thin Wall Tube	- ORGANIC SOILS / MUCK
24-40	Dense	6-12	Stiff	- U - Undisturbed Piston	- SILT
> 40	Very Dense	12-24	Very Stiff	- C - Diamond Core	- CLAY
		> 24	Hard	- W - Wash Sample	- LIMESTONE
					- SANDSTONE

GEOSOL, Inc.	TEST BORING RECORD	BORING No. BP-2
MIAMI LAKES, FL	(ASTM D-1586)	

PROJECT NAME: MIAMI RIVER GREENWAY PROJECT — SHEET No. 1 OF 2

CLIENT: BCC ENGINEERING, INC. — STATION (FT): — OFFSET (FT):

BORING LOCATION: NORTHING: — EASTING: — ELEVATION (ft):

PROJECT No. 210127

GROUNDWATER (FEET): 4.9

DATE	TIME	DEPTH (ft)	CASING	TYPE	CASING	SAMPLE	CORE	TUBE
					NW	SS		
			L (ft)	DIA.(in)	3	1 - 3/8 ID		
			28	WT.(lbs)		140		
				FALL(in)		30		

DATUM (ft):	N/A
DATE START:	5/5/2010
DATE FINISH:	5/5/2010
DRILLER:	R. Morales
EQUIP./HAMMER:	B-53/ AUTOMATIC

DEPTH, ft	SAMPLE No.	STRATUM No.	BLOWS / 6"	N Value (bpf)	SYMBOL	MATERIAL DESCRIPTION	REMARKS
		0	-			0 to 2.3": Asphalt Pavement	
1	S-1	1A	-			2.3" to 10.3": Concrete	
		1B	8, 11	19		10.3" to 2.5': Brown Silty Fine to Medium SAND with Some Limerock Fragments (BASE/STABILIZED SUBGRADE; A-1-b/SM)	
2	S-2		10				
3		2	14, 12	26		2.5' to 3.5': Brown Organic Stained Silty Fine to Medium SAND with Trace of Limerock Fragments (FILL; A-2-4 / SM)	
4		3	13			3.5' to 23': Light Brown Sandy LIMESTONE (MIAMI LIMESTONE FORMATION)	
5	S-3		11, 9, 10, 11	19			
6	S-4		8, 7, 9, 9	16			
7							
8	S-5		10, 13, 11, 9	24			
9							
10							
11							
12							
13	S-6		3, 5, 4, 5	9			
14							
15							
16							
17							
18	S-7		9, 4, 7, 8	11			
19							
20							
21							
22							
23	S-8	4	6, 8, 6, 9	14		23' to 30': Light Brown Sandy LIMESTONE (FORT THOMPSON FORMATION LIMESTONE)	
24							
25							

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	
0-3	Very Loose	0-1	Very Soft	- H - Hand Auger	- FILL
3-8	Loose	1-3	Soft	- S - Split Spoon	- SAND
8-24	Medium Dense	3-6	Medium Stiff	- T - Thin Wall Tube	- ORGANIC SOILS / MUCK
24-40	Dense	6-12	Stiff	- U - Undisturbed Piston	- SILT
> 40	Very Dense	12-24	Very Stiff	- C - Diamond Core	- CLAY
		> 24	Hard	- W - Wash Sample	- LIMESTONE
					- SANDSTONE

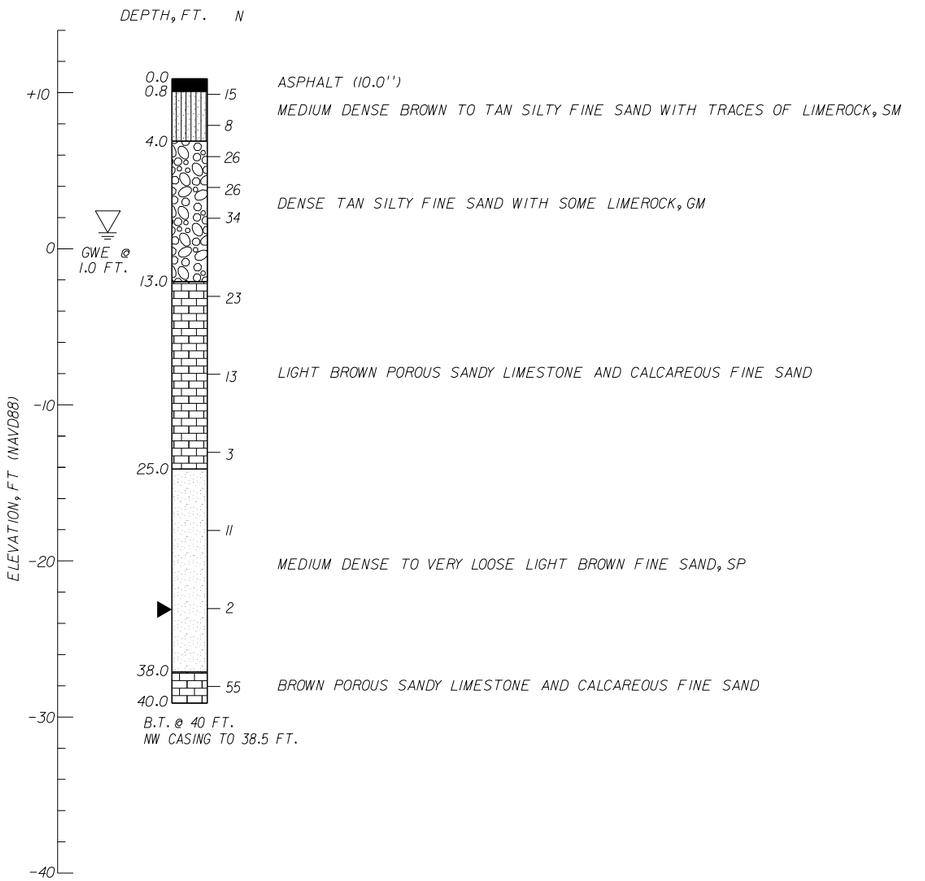
GEOSOL, Inc. MIAMI LAKES, FL	TEST BORING RECORD (ASTM D-1586)	Boring No. BP-2
PROJECT NAME: MIAMI RIVER GREENWAY PROJECT		SHEET No. 2 OF 2
CLIENT: BCC ENGINEERING, INC.		Project No. 210127

DEPTH, ft	SAMPLE No.	STRATUM No.	BLOWS / 6"	N Value (bpf)	SYMBOL	MATERIAL DESCRIPTION	REMARKS
26		4				23' to 30': Light Brown Sandy LIMESTONE (FORT THOMPSON FORMATION LIMESTONE)	
27							
28							
29	S-9		8 10 7 11	17			BORING TERMINATED AT DEPTH OF 30 ft. BOREHOLE GROUTED
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	SYMBOL
0-3	Very Loose	0-1	Very Soft	- H - Hand Auger	- FILL
3-8	Loose	1-3	Soft	- S - Split Spoon	- SAND
8-24	Medium Dense	3-6	Medium Stiff	- T - Thin Wall Tube	- ORGANIC SOILS / MUCK
24-40	Dense	6-12	Stiff	- U - Undisturbed Piston	- SILT
> 40	Very Dense	12-24	Very Stiff	- C - Diamond Core	- CLAY
		> 24	Hard	- W - Wash Sample	- LIMESTONE - SANDSTONE

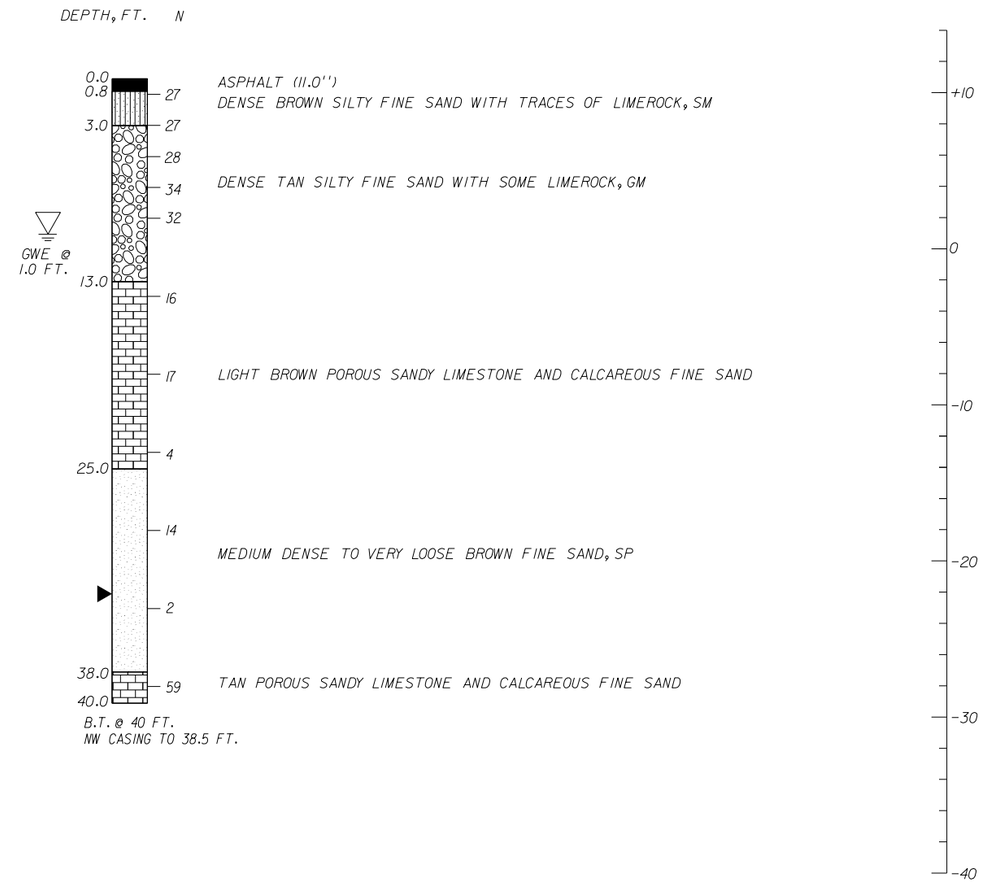
SS-5

LATITUDE: 25.77912
LONGITUDE: -80.18953
STATION: 4+83.68
OFFSET: 6.5' LT
ELEVATION: 11.0 FT.
DATE: 11/10/16



SS-6

LATITUDE: 25.77909
LONGITUDE: -80.18953
STATION: 4+83.68
OFFSET: 7.0' RT
ELEVATION: 11.0 FT.
DATE: 11/09/16



VERTICAL SCALE: 0 2 10
HORIZONTAL SCALE: N.T.S.
HRES PROJECTC No. HR16-1218R

LEGEND:

- ASPHALT
- SILTY SAND
- LIMEROCK FILL
- LIMESTONE WITH SOME FINE SAND OR AND FINE SAND
- FINE SAND

▶ WATER LOSS

GROUND WATER LEVEL AT BORING COMPLETION

B.T. BORING TERMINATED

W.C.: WATER CONTENT

O.C.: ORGANIC CONTENT

>200: PERCENT PASSING #200 SIEVE

N: SPT VALUE FOR A 12-INCH PENETRATION (AUTOMATIC HAMMER)

HAMMER WEIGHT = 140 LB

DROP HEIGHT = 30 IN

GRANULAR MATERIALS:

RELATIVE DENSITY	SPT N-VALUE (BLOWS/12 INCHES)
VERY LOOSE	<3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	>40

SILTS AND CLAYS:

CONSISTENCY	SPT N-VALUE (BLOWS/12 INCHES)
VERY SOFT	<1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	>24

ENVIRONMENTAL CLASSIFICATION

SUBSTRUCTURE:
CONCRETE: MODERATELY AGGRESSIVE
STEEL: EXTREMELY AGGRESSIVE
SUPERSTRUCTURE: EXTREMELY AGGRESSIVE

Resistivity Ohms-cm	pH	Sulfates ppm	Chlorides ppm
1,267-628	7.4-7.3	77-49	180-100

REVISIONS

DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

HR ENGINEERING SERVICES, INC.
Hernando R. Ramos
P.E. License No. 42045
7815 NW 72nd Avenue Medley, Florida 33166
Phone: (305) 888-8880 - Fax: (305) 888-8770
Certificate of Authorization No. 7991

DRAWN BY: ME 11-16
CHECKED BY: RAC 11-16
DESIGNED BY: RAC 11-16
CHECKED BY: HRR 11-16

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
SR 5	MIAMI-DADE	437915-1-52-01

SHEET TITLE: REPORT OF CORE BORINGS - LOCATION 1

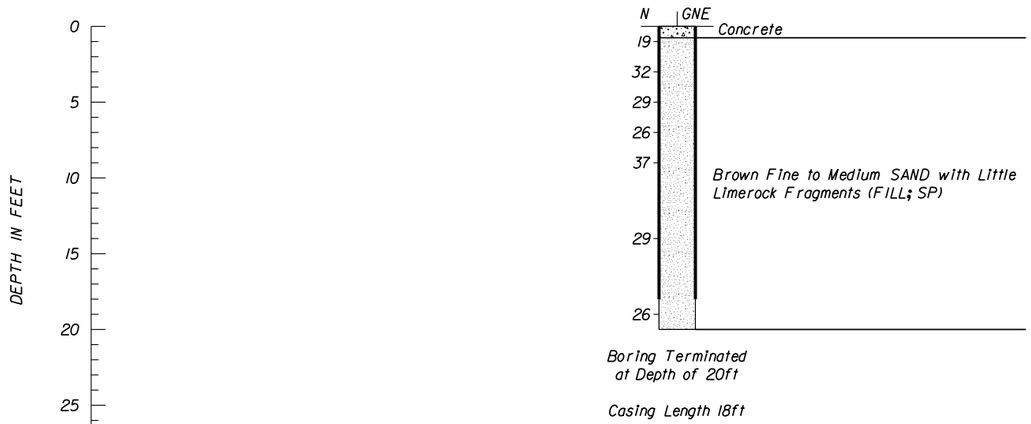
A-8

REF. DWG. NO.

PROJECT NAME: SR 5/US-1/BISCAYNE BOULEVARD FROM SE 2ND STREET TO NE 11TH TERRACE

SHEET NO.

BOR #	CCTV-85 & CCTV-86
STA.	N/A
OFF.	N/A
ELEV.	N/A
DATE	4/19/2012
DRILLER	R. MORALES - GEOSOL, Inc.
HAMMER	Auto
RIG	B-53
NORTHING	520175.24
EASTING	919625.47



LEGEND

CONCRETE

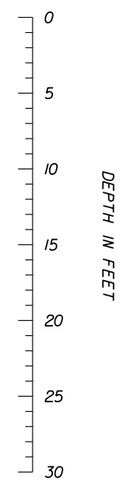
SAND (SP)

WATER TABLE AT TIME OF DRILLING

N — NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).

CASING USED

GNE — GROUNDWATER NOT ENCOUNTERED



VERTICAL SCALE
HORIZONTAL N.T.S.

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.

ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: EXTREMELY AGGRESSIVE
SUBSTRUCTURE: EXTREMELY AGGRESSIVE

WATER:

pH:	7.3-8.0
CHLORIDE:	202-250 PPM
SULFATE:	124-250 PPM
RESISTIVITY:	288-1,370 OHM-CM

NOTES:

1) THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE INSTALLATION OF THE POLE AND THAT TEMPORARY CASING MAY BE REQUIRED TO STABILIZE THE EXCAVATION FOR INSTALLATION OF THE POLE AND PLACEMENT OF THE CONCRETE.

2) THE CONTRACTOR IS ADVISED THAT VERY DENSE SOILS AND/OR A HARD TO VERY HARD LIMESTONE LAYER MAY BE ENCOUNTERED DURING THE EXCAVATION FOR THE INSTALLATION OF THE POLE. THESE MATERIALS MAY BE DIFFICULT TO DEWATER, EXCAVATE AND/OR PENETRATE AND MAY REQUIRE SPECIAL EQUIPMENT TO COMPLETE THE EXCAVATION AS REQUIRED.

3) IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION, THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THE POLE. TEMPORARY CASING CANNOT REMAIN IN THE GROUND UNLESS THE LENGTH OF THE POLE IS INCREASED TO OVERCOME THE EFFECT OF LEAVING THE CASING IN THE GROUND.

4) THE CONTRACTOR SHALL CLEAN THE INTERIOR OF THE EXCAVATED AND/OR PREDRILLED HOLE/CASING OF LOOSE MATERIALS AND DEBRIS TO THE BOTTOM OF THE HOLE PRIOR TO THE PLACEMENT OF THE POLE.

5) INSERT POLE IN CASING/PREDRILLED HOLE THEN FILL ANNULUS BETWEEN POLE AND PREDRILLED HOLE WITH CLASS NS CONCRETE TO THE GROUND SURFACE IN ACCORDANCE WITH FDOT STANDARD INDEX 18113.

6) THE CONTRACTOR IS RESPONSIBLE FOR SELECTING THE DIAMETER OF THE PREDRILLED HOLE AND/OR CASING.

GRANULAR MATERIALS-RELATIVE DENSITY	AUTOMATIC SPT (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTANCY	**AUTOMATIC SPT (BLOWS PER FOOT)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

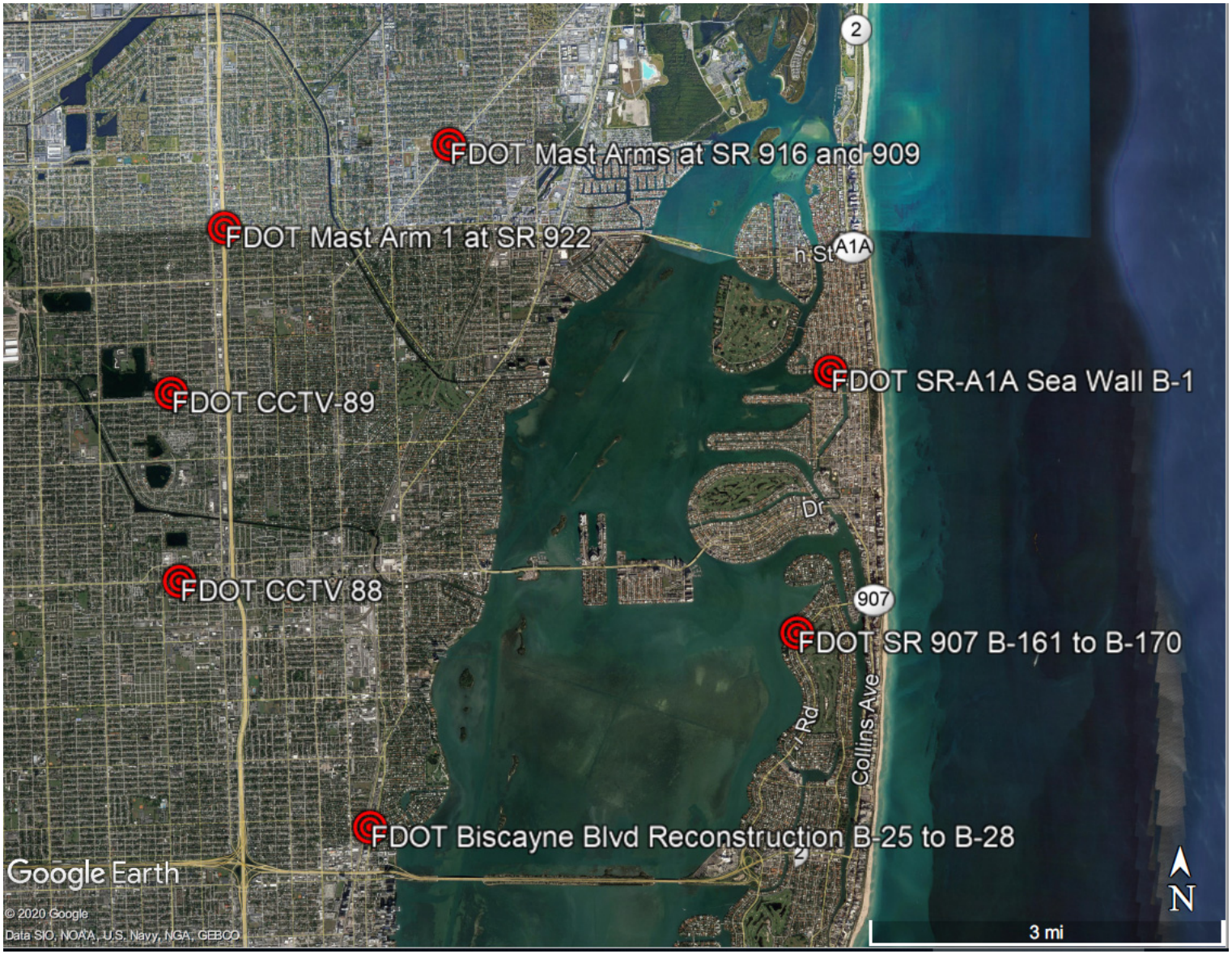
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
9A	MIAMI-DADE	417740-4-92-01

REPORT OF CORE BORINGS

SHEET NO. 11

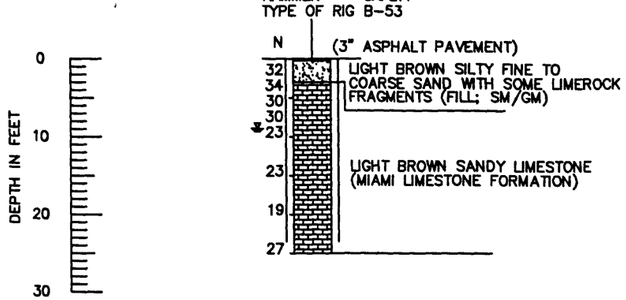
NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

ENCLOSURE A-2 – PREVIOUS GEOTECHNICAL INFORMATION – BISCAYNE CANAL AND LITTLE RIVER AREAS



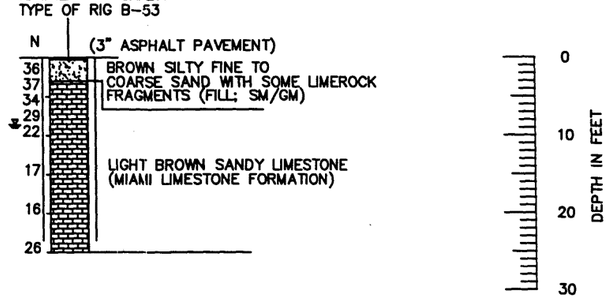
NOTE: EXACT LOCATIONS OF BORINGS NOT SHOWN. LOCATIONS ARE APPROXIMATE.

BORING NO. B-25
STATION 97+28
OFFSET 23 LT.
ELEV. N/A
NORTHING 537663.425
EASTING 922839.517
DATE 4/12/05
HAMMER SAFETY
TYPE OF RIG B-53



BORING TERMINATED @ DEPTH OF 25 FEET

BORING NO. B-26
STATION 98+72
OFFSET 32 RT.
ELEV. N/A
NORTHING 537787.146
EASTING 922861.786
DATE 4/12/05
HAMMER SAFETY
TYPE OF RIG B-53

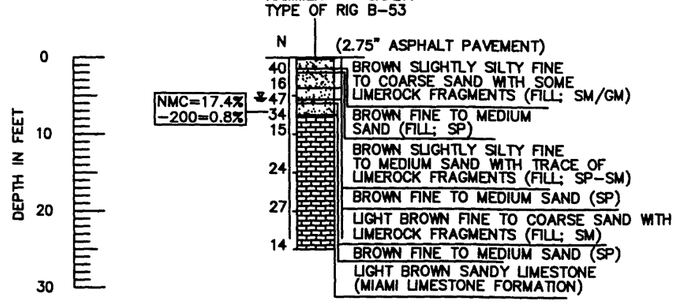


BORING TERMINATED @ DEPTH OF 25 FEET

DEPTH IN FEET: 0, 10, 20, 30

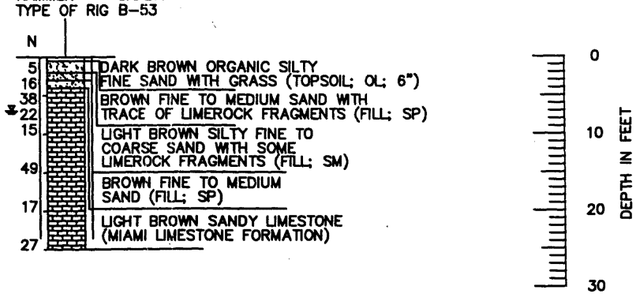
0 10'
VERTICAL SCALE
HORIZONTAL N.T.S.

BORING NO. B-27
STATION 104+82
OFFSET 23 LT.
ELEV. N/A
NORTHING 538372.027
EASTING 922808.832
DATE 4/6/05
HAMMER SAFETY
TYPE OF RIG B-53



BORING TERMINATED @ DEPTH OF 25 FEET

BORING NO. B-28
STATION 104+24
OFFSET 60 RT.
ELEV. N/A
NORTHING 538122.470
EASTING 923011.062
DATE 3/11/05
HAMMER SAFETY
TYPE OF RIG B-53



BORING TERMINATED @ DEPTH OF 25 FEET

DEPTH IN FEET: 0, 10, 20, 30

0 10'
VERTICAL SCALE
HORIZONTAL N.T.S.

LEGEND

- DARK BROWN ORGANIC SILTY FINE SAND WITH GRASS (TOPSOIL)
- ASPHALT PAVEMENT
- BROWN CLEAN TO SILTY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (FILL; SP/SP-SM/SW-SM/SM)
- DARK BROWN ORGANIC SILTY FINE SAND (FILL; OL)
- BROWN AND GRAY FINE TO COARSE SAND WITH TRACE TO SOME LIMEROCK FRAGMENTS (SP/SW)
- LIGHT BROWN TO GRAY SANDY LIMESTONE (MIAMI LIMESTONE FORMATION)
- BROWN CLEAN TO SLIGHTLY SILTY FINE TO MEDIUM SAND WITH LITTLE LIMESTONE FRAGMENTS (FORT THOMPSON FORMATION SAND; SP/SP-SM)

NOTES:
@ WATER TABLE AT TIME OF DRILLING
N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION. (UNLESS OTHERWISE NOTED.)
|| || CASING USED
-200 FINES PASSING NO. 200 SIEVE (%)
NMC NATURAL MOISTURE CONTENT (%)
OC ORGANIC CONTENT (%)

ENVIRONMENTAL CLASSIFICATION
SUPERSTRUCTURE: SLIGHTLY AGGRESSIVE
SUBSTRUCTURE: MODERATELY AGGRESSIVE
WATER:
pH: 7.35-7.49
CHLORIDE: 64.1-105 PPM
SULFATE: 36.4-66.8 PPM
RESISTIVITY: 1,200-1,500 OHM-CM

GRANULAR MATERIALS-RELATIVE DENSITY	SPT (BLOWS/FT.)
VERY LOOSE	LESS THAN 4
LOOSE	5-10
MEDIUM	11-30
DENSE	31-50
VERY DENSE	GREATER THAN 50

SILTS AND CLAYS CONSISTENCY	SPT (BLOWS/FT.)
VERY SOFT	LESS THAN 2
SOFT	3-4
FIRM	5-8
STIFF	9-15
VERY STIFF	16-30
HARD	GREATER THAN 30

NOTES FOR DRILL SHAFT FOUNDATION CONSTRUCTION:

1. SUPER MUD OR POLYMER SLURRY ARE NOT ALLOWED.

2. THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION OF THE DRILL SHAFT.

3. IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THESE SHAFTS.

4. PRIOR TO PLACING CONCRETE, THE FLUID IN THE SHAFT EXCAVATION SHALL BE SAMPLED AND TESTED IN ACCORDANCE WITH SECTION 455-15.8.2 AND MUST MEET THE REQUIREMENTS SPECIFIED IN THIS SECTION.

MAST ARMS

REVISIONS

Date	By	Description	Date	By	Description

	Names	Dates
Drawn by	ABR	3/05
Checked by	OR	3/05
Designed by		
Checked by	OR	3/05
Approved by	ORACIO RICCOBONO, P.E.	

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E. #49324
5795-A NW 151st STREET,
MIAMI LAKES, FL 33014
PHONE: (305)828-4367
CERTIFICATE OF AUTHORIZATION NO. 8530

FLORIDA DEPARTMENT OF TRANSPORTATION

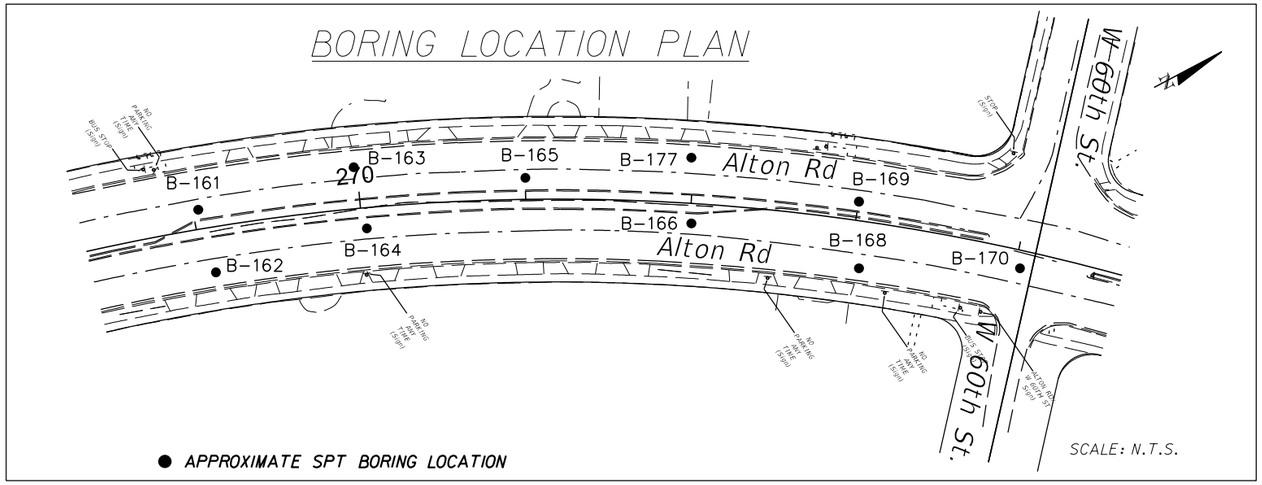
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
5	MIAMI-DADE	414624-1-52-01

SHEET TITLE: REPORT OF CORE BORINGS

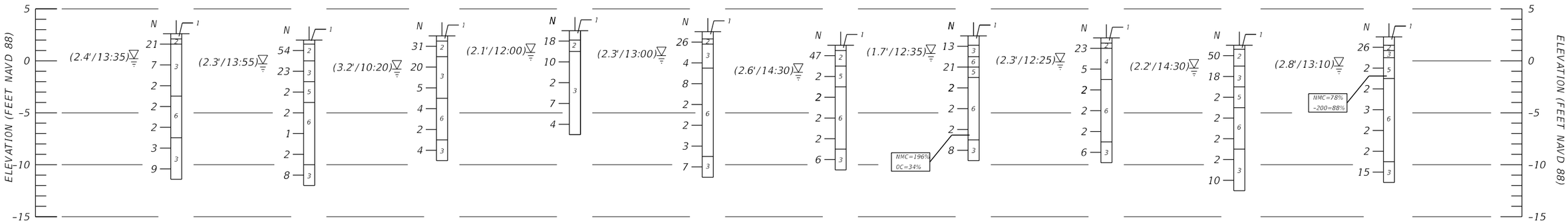
PROJECT NAME: BISCAYNE BOULEVARD RECONSTRUCTION FROM N.E. 14TH STREET TO N.E. 38TH STREET

SHEET NO. 20

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.



BORING No.	B-161	B-162	B-163	B-164	B-165	B-167	B-166	B-169	B-168	B-170	BORING No.
NORTHING	548613	548599	548704	548689	548785	548875	548851	548944	548919	549000	NORTHING
EASTING	942022	942062	942057	942091	942120	942169	942202	942247	942285	942337	EASTING
STATION	269+00	269+04	269+98	270+02	270+98	271+98	272+00	273+00	273+08	274+04	STATION
OFFSET	15' LT	28' RT	25' LT	12' RT	15' LT	28' LT	12' RT	14' LT	31' RT	9' RT	OFFSET
ELEVATION	2.6'	2.0'	2.4'	2.9'	2.8'	1.5'	2.4'	2.2'	1.5'	2.3'	ELEVATION
DATE	12/18/14	2/02/15	2/09/15	12/17/14	12/18/14	12/17/14	12/17/14	12/18/14	2/02/15	12/17/14	DATE



LEGEND

1. ASPHALT PAVEMENT
2. LIGHT BROWN/GRAY LIMEROCK WITH FEW TO LITTLE SILT AND SAND (A-1-a/A-1-b)
3. LIGHT BROWN/GRAY FINE SAND WITH FEW SILT, TRACE TO FEW LIMEROCK AND/OR TRACES OF SHELL FRAGMENTS (A-3)
4. LIGHT BROWN/GRAY SILTY FINE SAND WITH TRACE TO FEW LIMEROCK AND/OR TRACES OF SHELL FRAGMENTS (A-2-4)
5. BROWN/GRAY SANDY SILT TO SILT WITH TRACE TO FEW LIMEROCK AND/OR TRACES OF SHELL FRAGMENTS (A-4)
6. DARK BROWN ORGANIC SANDY SILT AND/OR SANDY PEAT AND/OR ORGANIC SILTY FINE SAND AND/OR WOOD FRAGMENTS (A-8)

NOTES

- BORING LOCATIONS WERE MARKED IN THE FIELD USING A HAND HELD GPS INSTRUMENT (GARMIN 62stc). THE INSTRUMENT HAS AN ACCURACY OF 15 FEET.
- STATION AND OFFSET DATA WAS INTERPRETED USING SURVEY INFORMATION PROVIDED BY LOCHNER AND THE VALUES ARE REFERENCED TO THE S.R. 907 BASELINE.

N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12 INCHES PENETRATION, UNLESS OTHERWISE INDICATED.

▽ GROUNDWATER LEVEL ON THE DATE OF DRILLING (WATER DEPTH/TIME OF MEASURMENT).

NMC NATURAL MOISTURE CONTENT (%)

-200 PERCENTAGE PASSING NO.200 SIEVE

OC ORGANIC CONTENT

W.O.H. WEIGHT OF HAMMER

DRILLED BY: LUIS RODRIGUEZ (PSI) AND IVAN DIAZ (PSI).

GRANULAR MATERIALS-RELATIVE DENSITY	AUTOMATIC HAMMER SPT-N (BLOWS/12-INCH)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	**AUTOMATIC HAMMER SPT-N (BLOWS/12-INCH)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

SPT NOTES

HAMMER WEIGHT	140 LBS.
HAMMER DROP HEIGHT	30 INCHES
TYPE OF HAMMER	AUTOMATIC
SPOON INSIDE DIAMETER	1.500 INCH
SPOON INSIDE DIAMETER (AT OPENING)	1.375 INCH
SPOON OUTSIDE DIAMETER	2.000 INCH
TYPE OF RIGS	CME-55 AND CME-75

S.R. 907/ALTON ROAD FROM 43RD STREET TO EAST OF ALLISON ROAD

PSI PROJECT No. 0397-695

THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

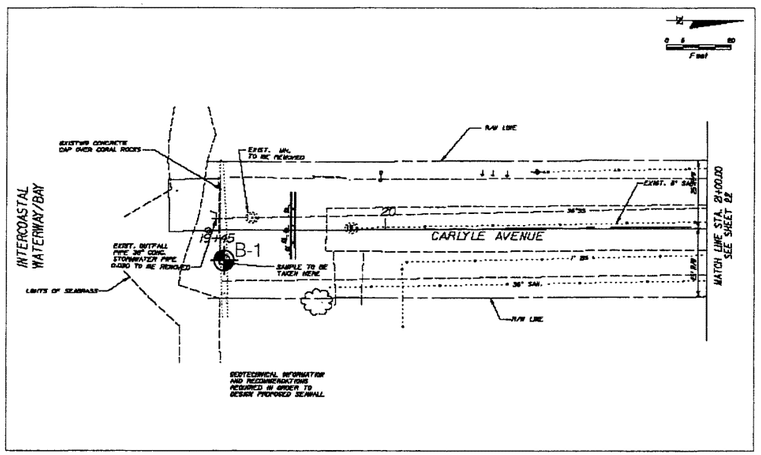
PROFESSIONAL SERVICE INDUSTRIES, INC. (PSI)
7950 N.W. 64TH STREET, MIAMI, FL 33166
PHONE: (305) 471-7725 - FAX: (305) 593-1915
CERTIFICATE OF AUTHORIZATION No. 3684
ENGINEER OF RECORD: PAUL D. PASSE, P.E. No. 34750

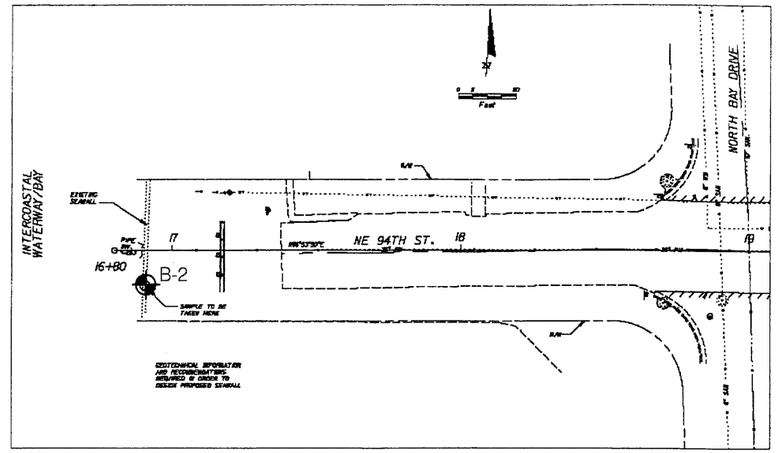
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
907	MIAMI-DADE	430444-1-52-01

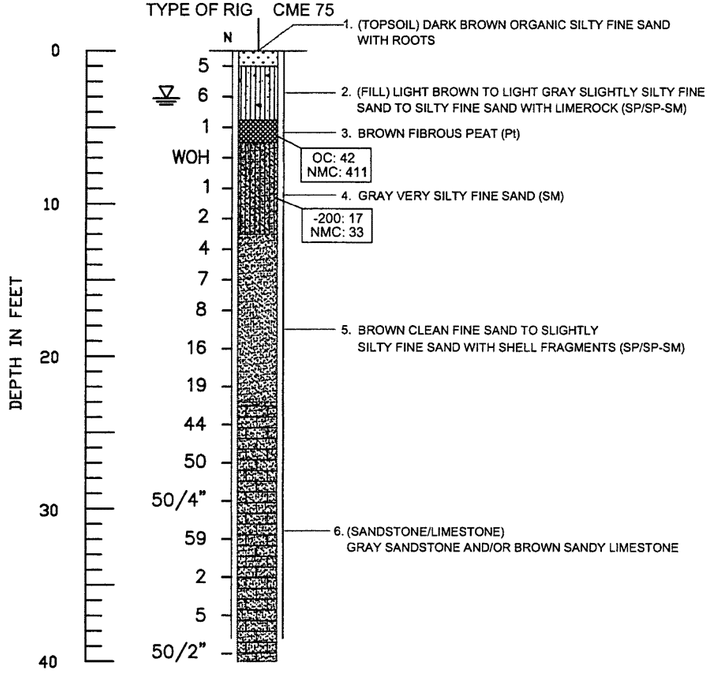
SOIL PROFILES

SHEET NO. GR-17



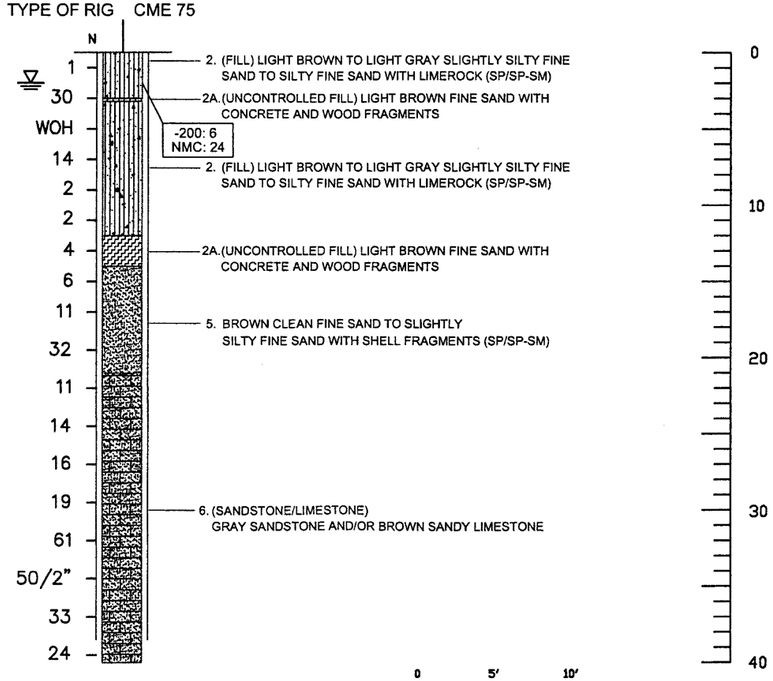


BORING NO.	B-1
NORTHING	560313.4
EASTING	943975.7
STATION	19+45
OFFSET	10' RT.
DATE	11/04/04
HAMMER	AUTOMATIC
TYPE OF RIG	CME 75



BORING TERMINATED @ DEPTH OF 40 FEET

BORING NO.	B-2
NORTHING	564196.9
EASTING	943098.2
STATION	16+80
OFFSET	12' LT.
DATE	11/04/04
HAMMER	AUTOMATIC
TYPE OF RIG	CME 75



BORING TERMINATED @ DEPTH OF 40 FEET

0 5' 10'
VERTICAL SCALE
HORIZONTAL N.T.S.

LEGEND

1. (TOPSOIL) DARK BROWN ORGANIC SILTY FINE SAND WITH ROOTS
2. (FILL) LIGHT BROWN TO LIGHT GRAY SLIGHTLY SILTY FINE SAND TO SILTY FINE SAND WITH LIMEROCK (SP/SP-SM)
2A. (UNCONTROLLED FILL) LIGHT BROWN FINE SAND WITH CONCRETE AND WOOD FRAGMENTS
3. BROWN FIBROUS PEAT (Pt)
4. GRAY VERY SILTY FINE SAND (SM)
5. BROWN CLEAN FINE SAND TO SLIGHTLY SILTY FINE SAND WITH SHELL FRAGMENTS (SP/SP-SM)
6. (SANDSTONE/LIMESTONE) GRAY SANDSTONE AND/OR BROWN SANDY LIMESTONE

NOTES:

WATER TABLE AT TIME OF DRILLING

N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).

-200: PERCENT PASSING THE No. 200 SIEVE

OC: PERCENT ORGANIC CONTENT

NMC: PERCENT NATURAL MOISTURE CONTENT

|| || CASING USED

WOH FELL UNDER THE WEIGHT OF THE HAMMER

DRILLED BY DANIEL CORREA (PSI)

STATIONS AN OFFSETS (IN FEET) ARE REFENCED TO THE CORRESPONDING STREET/AVENUE BASELINE

PLANE COORDINATES (NORTHING AND EASTING) WERE TAKE USING A HANDHELD GPS DEVICE AND ARE APPROXIMATE WITHIN 10 FEET.

ENVIRONMENTAL CLASSIFICATION: EXTREMELY AGGRESSIVE

GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC HAMMER SPT-N (BLOWS/12 In)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTENCY	**AUTOMATIC HAMMER SPT-N (BLOWS/12 In)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

THE CONTRACTOR SHOULD ANTICIPATE THAT THE LIMESTONE FORMATION WILL BE ENCOUNTERED AND THAT PRE-DRILLING MAY BE REQUIRED TO ASSIST IN OBTAINING THE REQUIRED PENETRATION. THIS MATERIAL IS ALSO DIFFICULT TO DEWATER DUE TO ITS HIGH POROSITY AND PERMEABILITY.

THESE DRAWINGS WERE PREPARED UNDER DISTRICT/AREAWIDE CONTRACT FM No. 250730-1-32-02

REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

ENGINEER OF RECORD

HUGO E. SOTO, P.E.
FLA. REG. No. 36440

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION
CERTIFICATE OF AUTHORIZATION No. 3684
7950 N.W. 64th STREET, MIAMI, FL 33166
PHONE (305) 471-7725 ■ FAX (305) 593-1915

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
AIA	MIAMI-DADE	249561-2-52-01

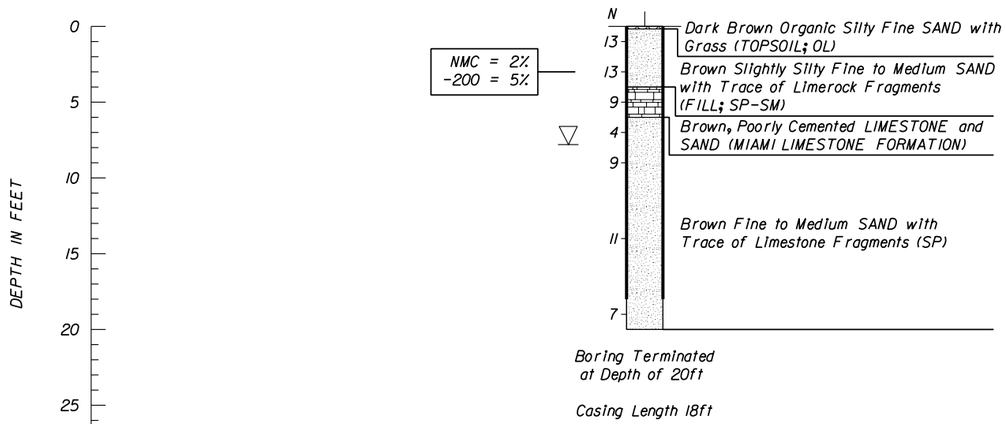
REPORT OF CORE BORINGS

SR-AIA SEAWALLS
BETWEEN 23rd AND 24th STREET
AT NE 94th STREET AND CARLYLE AVENUE

SHEET NO.

PSI PROJECT No. 397-45138
SHEET No. 2

BOR #	CCTV-88
STA.	N/A
OFF.	N/A
ELEV.	N/A
DATE	4/9/2012
DRILLER	R. MORALES - GEOSOL, Inc.
HAMMER	Auto
RIG	B-53
NORTHING	550874.2
EASTING	915305.39

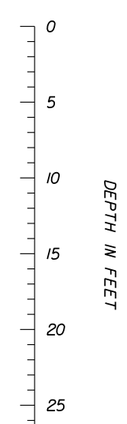


LEGEND

- TOPSOIL (OL)
- SAND (SP/SP-SM)
- MIAMI LIMESTONE FORMATION
- ▽ WATER TABLE AT TIME OF DRILLING
- N — NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).
- | | CASING USED
- NMC — NATURAL MOISTURE CONTENT (%)
- -200 — FINES PASSING THE #200 SIEVE (%)

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.



0 10
Feet
VERTICAL SCALE
HORIZONTAL N.T.S.

ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: EXTREMELY AGGRESSIVE
SUBSTRUCTURE: EXTREMELY AGGRESSIVE

WATER:

pH:	7.3-8.0
CHLORIDE:	202-250 PPM
SULFATE:	124-250 PPM
RESISTIVITY:	288-1,370 OHM-CM

NOTES:

1) THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE INSTALLATION OF THE POLE AND THAT TEMPORARY CASING MAY BE REQUIRED TO STABILIZE THE EXCAVATION FOR INSTALLATION OF THE POLE AND PLACEMENT OF THE CONCRETE.

2) THE CONTRACTOR IS ADVISED THAT VERY DENSE SOILS AND/OR A HARD TO VERY HARD LIMESTONE LAYER MAY BE ENCOUNTERED DURING THE EXCAVATION FOR THE INSTALLATION OF THE POLE. THESE MATERIALS MAY BE DIFFICULT TO DEWATER, EXCAVATE AND/OR PENETRATE AND MAY REQUIRE SPECIAL EQUIPMENT TO COMPLETE THE EXCAVATION AS REQUIRED.

3) IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION, THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THE POLE. TEMPORARY CASING CANNOT REMAIN IN THE GROUND UNLESS THE LENGTH OF THE POLE IS INCREASED TO OVERCOME THE EFFECT OF LEAVING THE CASING IN THE GROUND.

4) THE CONTRACTOR SHALL CLEAN THE INTERIOR OF THE EXCAVATED AND/OR PREDRILLED HOLE/CASING OF LOOSE MATERIALS AND DEBRIS TO THE BOTTOM OF THE HOLE PRIOR TO THE PLACEMENT OF THE POLE.

5) INSERT POLE IN CASING/PREDRILLED HOLE THEN FILL ANNULUS BETWEEN POLE AND PREDRILLED HOLE WITH CLASS NS CONCRETE TO THE GROUND SURFACE IN ACCORDANCE WITH FDOT STANDARD INDEX 18113.

6) THE CONTRACTOR IS RESPONSIBLE FOR SELECTING THE DIAMETER OF THE PREDRILLED HOLE AND/OR CASING.

GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC SPT (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS CONSISTANCY	AUTOMATIC SPT (BLOWS PER FOOT)
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

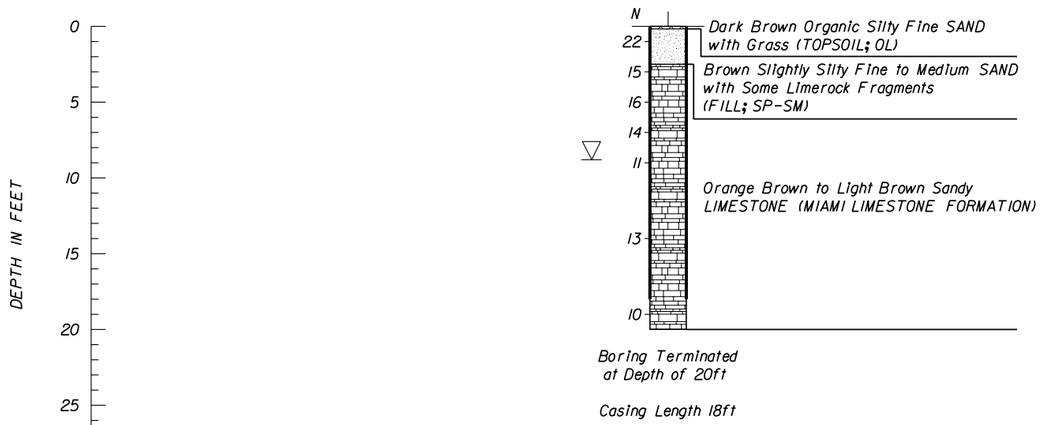
ROAD NO.	COUNTY	FINANCIAL PROJECT ID
934	MIAMI-DADE	417740-4-92-01

REPORT OF CORE BORINGS

SHEET NO. 13

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

BOR #	CCTV-89
STA.	N/A
OFF.	N/A
ELEV.	N/A
DATE	4/9/2012
DRILLER	R. MORALES - GEOSOL, Inc.
HAMMER	Auto
RIG	B-53
NORTHING	558854.2
EASTING	914227.91

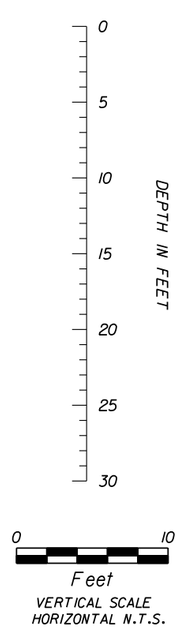


LEGEND

- TOPSOIL (OL)
- SAND (SP-SM)
- MIAMI LIMESTONE FORMATION
- WATER TABLE AT TIME OF DRILLING
- N — NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).
- CASING USED

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.



ENVIRONMENTAL CLASSIFICATION:

SUPERSTRUCTURE: EXTREMELY AGGRESSIVE
SUBSTRUCTURE: EXTREMELY AGGRESSIVE

WATER:

pH:	7.3-8.0
CHLORIDE:	202-250 PPM
SULFATE:	124-250 PPM
RESISTIVITY:	288-1,370 OHM-CM

NOTES:

1) THE CONTRACTOR IS ADVISED THAT CAVING SOILS MAY BE ENCOUNTERED DURING THE INSTALLATION OF THE POLE AND THAT TEMPORARY CASING MAY BE REQUIRED TO STABILIZE THE EXCAVATION FOR INSTALLATION OF THE POLE AND PLACEMENT OF THE CONCRETE.

2) THE CONTRACTOR IS ADVISED THAT VERY DENSE SOILS AND/OR A HARD TO VERY HARD LIMESTONE LAYER MAY BE ENCOUNTERED DURING THE EXCAVATION FOR THE INSTALLATION OF THE POLE. THESE MATERIALS MAY BE DIFFICULT TO DEWATER, EXCAVATE AND/OR PENETRATE AND MAY REQUIRE SPECIAL EQUIPMENT TO COMPLETE THE EXCAVATION AS REQUIRED.

3) IF CASING IS REQUIRED TO STABILIZE THE EXCAVATION, THE CONTRACTOR SHALL FURNISH CASING AND PROPER EQUIPMENT TO INSTALL IT AND REMOVE IT. CORRUGATED CASING SHALL NOT BE ALLOWED FOR THE CONSTRUCTION OF THE POLE. TEMPORARY CASING CANNOT REMAIN IN THE GROUND UNLESS THE LENGTH OF THE POLE IS INCREASED TO OVERCOME THE EFFECT OF LEAVING THE CASING IN THE GROUND.

4) THE CONTRACTOR SHALL CLEAN THE INTERIOR OF THE EXCAVATED AND/OR PREDRILLED HOLE/CASING OF LOOSE MATERIALS AND DEBRIS TO THE BOTTOM OF THE HOLE PRIOR TO THE PLACEMENT OF THE POLE.

5) INSERT POLE IN CASING/PREDRILLED HOLE THEN FILL ANNULUS BETWEEN POLE AND PREDRILLED HOLE WITH CLASS NS CONCRETE TO THE GROUND SURFACE IN ACCORDANCE WITH FDOT STANDARD INDEX 18113.

6) THE CONTRACTOR IS RESPONSIBLE FOR SELECTING THE DIAMETER OF THE PREDRILLED HOLE AND/OR CASING.

GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC SPT (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40

SILTS AND CLAYS CONSISTANCY	AUTOMATIC SPT (BLOWS PER FOOT)
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

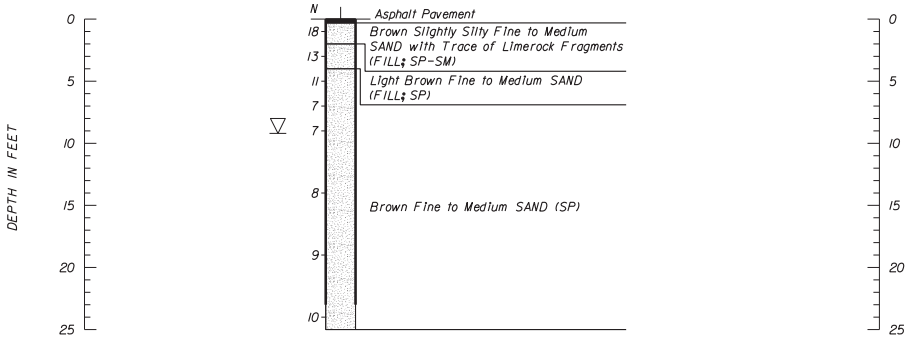
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
932	MIAMI-DADE	417740-4-92-01

REPORT OF CORE BORINGS

SHEET NO. 14

BOR #	MA-1
STA.	37+43 B/L SURVEY SR 922
OFF.	19' RT
ELEV.	N/A
DATE	4/24/2012
DRILLER	R. Morales - GEOSOL, Inc.
HAMMER	Auto
RIG	B-53
NORTHING	566216.6
EASTING	916360.1



Boring Terminated at Depth of 25ft

Casing Length 23ft

LEGEND

- Asphalt Pavement
- SAND (FILL; SP, SP-SM)
- SAND (SP)

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.

NOTE FOR DRILLED SHAFT CONSTRUCTION:

1) THE CONTRACTOR IS ADVISED THAT CAVING SOILS AND/OR DENSE TO VERY DENSE SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION FOR THE INSTALLATION OF THE DRILLED SHAFTS.

▽ WATER TABLE AT TIME OF DRILLING

| | CASING USED

N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED).

GRANULAR MATERIALS-RELATIVE DENSITY	AUTOMATIC SPT HAMMER (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTANCY	**AUTOMATIC SPT HAMMER (BLOWS PER FOOT)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

0 2 10
Feet
VERTICAL SCALE
HORIZONTAL N.T.S.

NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
P.E. LICENSE NO. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

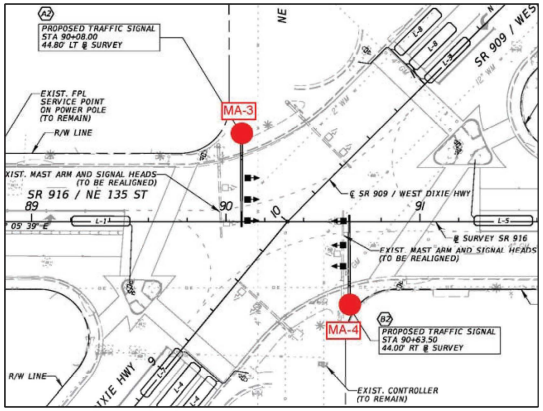
STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
922	MIAMI-DADE	429022-1-52-01

REPORT OF CORE BORINGS

SHEET NO. 16

Santiago 5/24/2012 3:50:01 PM Y:\2012\212123\Geotech\BORING01.DGN



BORING LOCATION PLAN

LEGEND

- TOPSOIL (OL)
- SAND (FILL; SP, SP-SM)
- SILTY SAND (FILL; SM)
- MIAMI LIMESTONE FORMATION
- SAND (SP)

NOTES:

1) SPT BORINGS PERFORMED PER ASTM D-1586 WITH A HAMMER WEIGHT OF 140 LBS FALLING 30 INCHES.

▽ WATER TABLE AT TIME OF DRILLING

| | CASING USED

● APPROXIMATE SPT BORING LOCATION

N NUMBERS TO THE LEFT OF BORING INDICATE SPT VALUE FOR 12" PENETRATION (UNLESS OTHERWISE NOTED)

NMC NATURAL MOISTURE CONTENT (%)

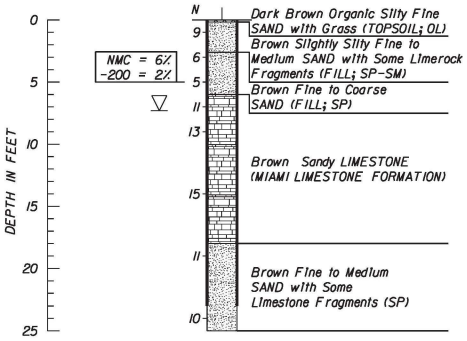
-200 PERCENT PASSING #200 SIEVE (%)

NOTE FOR DRILLED SHAFT CONSTRUCTION:

1) THE CONTRACTOR IS ADVISED THAT CAVING SOILS AND/OR DENSE TO VERY DENSE SOILS MAY BE ENCOUNTERED DURING THE EXCAVATION FOR THE INSTALLATION OF THE DRILLED SHAFTS.

2) THE CONTRACTOR IS ADVISED THAT A STRONG NATURAL LIMESTONE LAYER MAY BE ENCOUNTERED DURING THE EXCAVATION FOR THE INSTALLATION OF THE DRILLED SHAFTS WHICH MAY REQUIRE SPECIAL EQUIPMENT TO DO SO.

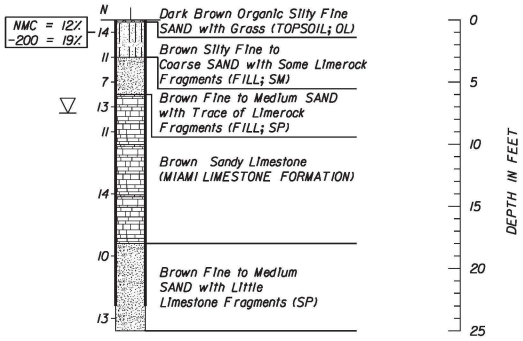
BOR # MA-3
STA. 90+08.00 B/L SURVEY SR 916
OFF. 44.80' LT
ELEV. N/A
DATE 10/24/2013
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 570168.3
EASTING 903506.9



Boring Terminated at Elev. -25ft

Casing Length 23ft

BOR # MA-4
STA. 90+63.50 B/L SURVEY SR 916
OFF. 44.00' RT
ELEV. N/A
DATE 10/24/2013
DRILLER R. Morales - GEOSOL, Inc.
HAMMER Auto
RIG B-53
NORTHING 570049.4
EASTING 926117.2



Boring Terminated at Elev. -25ft

Casing Length 23ft

0 2 10
Feet
Vertifcal Scale
Horizontal N.T.S.

GRANULAR MATERIALS- RELATIVE DENSITY	AUTOMATIC SPT HAMMER (BLOWS PER FOOT)
VERY LOOSE	LESS THAN 3
LOOSE	3-8
MEDIUM DENSE	8-24
DENSE	24-40
VERY DENSE	GREATER THAN 40
SILTS AND CLAYS CONSISTANCY	**AUTOMATIC SPT HAMMER (BLOWS PER FOOT)**
VERY SOFT	LESS THAN 1
SOFT	1-3
FIRM	3-6
STIFF	6-12
VERY STIFF	12-24
HARD	GREATER THAN 24

MAST ARMS AT SR 916 AND SR 909

REVISIONS			
DATE	DESCRIPTION	DATE	DESCRIPTION

ENGINEER OF RECORD:
GEOSOL, INC.
ORACIO RICCOBONO, P.E.
PE LICENSE No. 49324
5795-A NW 151ST STREET
MIAMI LAKES, FL 33014
PHONE: (305) 828-4367
CERTIFICATE OF AUTHORIZATION 8530

STATE OF FLORIDA
DEPARTMENT OF TRANSPORTATION

ROAD NO.	COUNTY	FINANCIAL PROJECT ID
916	MIAMI-DADE	429346-2-52-01

REPORT OF CORE BORINGS

SHEET NO. 5

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NOTICE: THE OFFICIAL RECORD OF THIS SHEET IS THE ELECTRONIC FILE SIGNED AND SEALED UNDER RULE 61G15-23.003, F.A.C.

ENCLOSURE B:

IDEALIZED SOIL AND BEDROCK PROFILE FOR AXIAL AND LATERAL CAPACITY ANALYSES

IDEALIZED SOIL AND BEDROCK PROFILE FOR AXIAL AND LATERAL LOAD ANALYSES

MIAMI-DADE COUNTY CSRM T-FLOODWALLS

Approximate Depth (ft)		DESCRIPTION
0.0	Ground Surface	
6.0	Groundwater Depth	
		SILTY FINE SAND/SANDY SILT (SM, ML)
10.0	Top of Rock	
		MIAMI LIMESTONE FORMATION
30.0	Bottom of ACP	

Rock Parameters for Lateral Load Analysis

Rock Parameter	Value
Rock Unit Weight	130 pcf
Unconfined Compressive Strength (Rock)	208.3 psi
Allowable End Bearing Capacity (unit)	2.3 ksf
Allowable Skin Friction Capacity (unit)	4.2 ksf
Cohesion	104.2 psi

NEGLECT OVERBURDEN FOR AXIAL SUPPORT

Not to Scale

ENCLOSURE C:

PRELIMINARY ACP AXIAL CAPACITY TABLES FOR VARIOUS DIAMETER AND LENGTH PILES

Rock Socket Diameter =	1.5 feet	Nominal Unit Side Shear (ksf) =	12.6
Rock Socket Diameter =	18 inches	Nominal Unit End Bearing (ksf) =	6.9
		Nominal Unit Uplift Resistance (ksf) =	4.8

Depth Below Top of Rock (ft.)	Nominal Side Resistance (kips)	Nominal End Bearing Resistance (kips)	Nominal Uplift Resistance (kips)	Factored Side Resistance (kips)	Factored End Bearing Resistance (kips)	Total Factored Axial Resistance (kips)	Total Factored Uplift Resistance (kips)
0.0	-	-	-	-	-	-	-
1.0	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-
3.0	89	12.2	62	30	4	34	21
4.0	148	12.2	104	49	4	54	35
5.0	208	12.2	145	69	4	73	48
6.0	267	12.2	187	89	4	93	62
7.0	327	12.2	229	109	4	113	76
8.0	386	12.2	270	129	4	133	90
9.0	445	12.2	312	148	4	153	104
10.0	505	12.2	353	168	4	172	118
11.0	564	12.2	395	188	4	192	132
12.0	623	12.2	436	208	4	212	145
13.0	683	12.2	478	228	4	232	159
14.0	742	12.2	520	247	4	251	173
15.0	802	12.2	561	267	4	271	187
16.0	861	12.2	603	287	4	291	201
17.0	920	12.2	644	307	4	311	215
18.0	980	12.2	686	327	4	331	229
19.0	1039	12.2	727	346	4	350	242
20.0	1098	12.2	769	366	4	370	256

FACTORS OF SAFETY = 3.0

*Minimum Socket Length = 1.5 x Dia. = 2.25 feet

Neglect contribution of upper one diameter of shaft for axial resistance (already accounted for in table)

FHWA - Geotechncial Engineering Circular (GEC) No. 8 - "Design and Construction of Continuous Flight Auger Piles", 2007

Frizzi, Meyer, Auger Cast Piles - "South Florida Experience", 2000

Lateral Loads may govern ACP depths

Designer should consider neglecting end bearing if bottom of shaft can not be inspected

Rock Socket Diameter =	2.0 feet	Nominal Unit Side Shear (ksf) =	12.6
Rock Socket Diameter =	24 inches	Nominal Unit End Bearing (ksf) =	6.9
		Nominal Unit Uplift Resistance (ksf) =	4.8

Depth Below Top of Rock (ft.)	Nominal Side Resistance (kips)	Nominal End Bearing Resistance (kips)	Nominal Uplift Resistance (kips)	Factored Side Resistance (kips)	Factored End Bearing Resistance (kips)	Total Factored Axial Resistance (kips)	Total Factored Uplift Resistance (kips)
0.0	-	-	-	-	-	-	-
1.0	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-
3.0	79	21.7	55	26	7	34	18
4.0	158	21.7	111	53	7	60	37
5.0	238	21.7	166	79	7	86	55
6.0	317	21.7	222	106	7	113	74
7.0	396	21.7	277	132	7	139	92
8.0	475	21.7	333	158	7	166	111
9.0	554	21.7	388	185	7	192	129
10.0	633	21.7	443	211	7	218	148
11.0	713	21.7	499	238	7	245	166
12.0	792	21.7	554	264	7	271	185
13.0	871	21.7	610	290	7	298	203
14.0	950	21.7	665	317	7	324	222
15.0	1029	21.7	720	343	7	350	240
16.0	1108	21.7	776	369	7	377	259
17.0	1188	21.7	831	396	7	403	277
18.0	1267	21.7	887	422	7	429	296
19.0	1346	21.7	942	449	7	456	314
20.0	1425	21.7	998	475	7	482	333

FACTORS OF SAFETY = 3.0

*Minimum Socket Length = 1.5 x Dia. = 3 feet

Neglect contribution of upper one diameter of shaft for axial resistance (already accounted for in table)

FHWA - Geotechncial Engineering Circular (GEC) No. 8 - "Design and Construction of Continuous Flight Auger Piles", 2007

Frizzi, Meyer, Auger Cast Piles - "South Florida Experience", 2000

Lateral Loads may govern ACP depths

Designer should consider neglecting end bearing if bottom of shaft can not be inspected

Rock Socket Diameter =	2.5 feet	Nominal Unit Side Shear (ksf) =	12.6
Rock Socket Diameter =	30 inches	Nominal Unit End Bearing (ksf) =	6.9
		Nominal Unit Uplift Resistance (ksf) =	4.8

Depth Below Top of Rock (ft.)	Nominal Side Resistance (kips)	Nominal End Bearing Resistance (kips)	Nominal Uplift Resistance (kips)	Factored Side Resistance (kips)	Factored End Bearing Resistance (kips)	Total Factored Axial Resistance (kips)	Total Factored Uplift Resistance (kips)
0.0	-	-	-	-	-	-	-
1.0	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-
3.0	-	-	-	-	-	-	-
4.0	148	33.9	104	49	11	61	35
5.0	247	33.9	173	82	11	94	58
6.0	346	33.9	242	115	11	127	81
7.0	445	33.9	312	148	11	160	104
8.0	544	33.9	381	181	11	193	127
9.0	643	33.9	450	214	11	226	150
10.0	742	33.9	520	247	11	259	173
11.0	841	33.9	589	280	11	292	196
12.0	940	33.9	658	313	11	325	219
13.0	1039	33.9	727	346	11	358	242
14.0	1138	33.9	797	379	11	391	266
15.0	1237	33.9	866	412	11	424	289
16.0	1336	33.9	935	445	11	457	312
17.0	1435	33.9	1004	478	11	490	335
18.0	1534	33.9	1074	511	11	523	358
19.0	1633	33.9	1143	544	11	556	381
20.0	1732	33.9	1212	577	11	589	404

FACTORS OF SAFETY = 3.0

*Minimum Socket Length = 1.5 x Dia. = 3.75 feet

Neglect contribution of upper one diameter of shaft for axial resistance (already accounted for in table)

FHWA - Geotechncial Engineering Circular (GEC) No. 8 - "Design and Construction of Continuous Flight Auger Piles", 2007

Frizzi, Meyer, Auger Cast Piles - "South Florida Experience", 2000

Lateral Loads may govern ACP depths

Designer should consider neglecting end bearing if bottom of shaft can not be inspected

Rock Socket Diameter =	3.0 feet	Nominal Unit Side Shear (ksf) =	12.6
Rock Socket Diameter =	36 inches	Nominal Unit End Bearing (ksf) =	6.9
		Nominal Unit Uplift Resistance (ksf) =	4.8

Depth Below Top of Rock (ft.)	Nominal Side Resistance (kips)	Nominal End Bearing Resistance (kips)	Nominal Uplift Resistance (kips)	Factored Side Resistance (kips)	Factored End Bearing Resistance (kips)	Total Factored Axial Resistance (kips)	Total Factored Uplift Resistance (kips)
0.0	-	-	-	-	-	-	-
1.0	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-
3.0	-	-	-	-	-	-	-
4.0	-	-	-	-	-	-	-
5.0	238	48.8	166	79	16	95	55
6.0	356	48.8	249	119	16	135	83
7.0	475	48.8	333	158	16	175	111
8.0	594	48.8	416	198	16	214	139
9.0	713	48.8	499	238	16	254	166
10.0	831	48.8	582	277	16	293	194
11.0	950	48.8	665	317	16	333	222
12.0	1069	48.8	748	356	16	373	249
13.0	1188	48.8	831	396	16	412	277
14.0	1306	48.8	914	435	16	452	305
15.0	1425	48.8	998	475	16	491	333
16.0	1544	48.8	1081	515	16	531	360
17.0	1663	48.8	1164	554	16	570	388
18.0	1781	48.8	1247	594	16	610	416
19.0	1900	48.8	1330	633	16	650	443
20.0	2019	48.8	1413	673	16	689	471

FACTORS OF SAFETY = 3.0

*Minimum Socket Length = 1.5 x Dia. = 4.5 feet

Neglect contribution of upper one diameter of shaft for axial resistance (already accounted for in table)

FHWA - Geotechncial Engineering Circular (GEC) No. 8 - "Design and Construction of Continuous Flight Auger Piles", 2007

Frizzi, Meyer, Auger Cast Piles - "South Florida Experience", 2000

Lateral Loads may govern ACP depths

Designer should consider neglecting end bearing if bottom of shaft can not be inspected

Rock Socket Diameter =	3.5 feet	Nominal Unit Side Shear (ksf) =	12.6
Rock Socket Diameter =	42 inches	Nominal Unit End Bearing (ksf) =	6.9
		Nominal Unit Uplift Resistance (ksf) =	4.8

Depth Below Top of Rock (ft.)	Nominal Side Resistance (kips)	Nominal End Bearing Resistance (kips)	Nominal Uplift Resistance (kips)	Factored Side Resistance (kips)	Factored End Bearing Resistance (kips)	Total Factored Axial Resistance (kips)	Total Factored Uplift Resistance (kips)
0.0	-	-	-	-	-	-	-
1.0	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-
3.0	-	-	-	-	-	-	-
4.0	-	-	-	-	-	-	-
5.0	-	-	-	-	-	-	-
6.0	346	66.4	242	115	22	138	81
7.0	485	66.4	339	162	22	184	113
8.0	623	66.4	436	208	22	230	145
9.0	762	66.4	533	254	22	276	178
10.0	901	66.4	630	300	22	322	210
11.0	1039	66.4	727	346	22	368	242
12.0	1178	66.4	824	393	22	415	275
13.0	1316	66.4	921	439	22	461	307
14.0	1455	66.4	1018	485	22	507	339
15.0	1593	66.4	1115	531	22	553	372
16.0	1732	66.4	1212	577	22	599	404
17.0	1870	66.4	1309	623	22	646	436
18.0	2009	66.4	1406	670	22	692	469
19.0	2147	66.4	1503	716	22	738	501
20.0	2286	66.4	1600	762	22	784	533

FACTORS OF SAFETY = 3.0

*Minimum Socket Length = 1.5 x Dia. = 5.25 feet

Neglect contribution of upper one diameter of shaft for axial resistance (already accounted for in table)

FHWA - Geotechncial Engineering Circular (GEC) No. 8 - "Design and Construction of Continuous Flight Auger Piles", 2007

Frizzi, Meyer, Auger Cast Piles - "South Florida Experience", 2000

Lateral Loads may govern ACP depths

Designer should consider neglecting end bearing if bottom of shaft can not be inspected

Rock Socket Diameter =	4.0 feet	Nominal Unit Side Shear (ksf) =	12.6
Rock Socket Diameter =	48 inches	Nominal Unit End Bearing (ksf) =	6.9
		Nominal Unit Uplift Resistance (ksf) =	4.8

Depth Below Top of Rock (ft.)	Nominal Side Resistance (kips)	Nominal End Bearing Resistance (kips)	Nominal Uplift Resistance (kips)	Factored Side Resistance (kips)	Factored End Bearing Resistance (kips)	Total Factored Axial Resistance (kips)	Total Factored Uplift Resistance (kips)
0.0	-	-	-	-	-	-	-
1.0	-	-	-	-	-	-	-
2.0	-	-	-	-	-	-	-
3.0	-	-	-	-	-	-	-
4.0	-	-	-	-	-	-	-
5.0	-	-	-	-	-	-	-
6.0	317	86.7	222	106	29	134	74
7.0	475	86.7	333	158	29	187	111
8.0	633	86.7	443	211	29	240	148
9.0	792	86.7	554	264	29	293	185
10.0	950	86.7	665	317	29	346	222
11.0	1108	86.7	776	369	29	398	259
12.0	1267	86.7	887	422	29	451	296
13.0	1425	86.7	998	475	29	504	333
14.0	1583	86.7	1108	528	29	557	369
15.0	1742	86.7	1219	581	29	609	406
16.0	1900	86.7	1330	633	29	662	443
17.0	2058	86.7	1441	686	29	715	480
18.0	2217	86.7	1552	739	29	768	517
19.0	2375	86.7	1663	792	29	821	554
20.0	2533	86.7	1773	844	29	873	591

FACTORS OF SAFETY = 3.0

*Minimum Socket Length = 1.5 x Dia. = 6 feet

Neglect contribution of upper one diameter of shaft for axial resistance (already accounted for in table)

FHWA - Geotechncial Engineering Circular (GEC) No. 8 - "Design and Construction of Continuous Flight Auger Piles", 2007

Frizzi, Meyer, Auger Cast Piles - "South Florida Experience", 2000

Lateral Loads may govern ACP depths

Designer should consider neglecting end bearing if bottom of shaft can not be inspected

US Army Corps of Engineers
Norfolk District

JOB: _____

CALCULATED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____

SHEET NO. _____ OF _____

TYPICAL SUB SURFACE PROFILE FOR FLOOD WALL - MIAMI

USE SAME PROFILE FOR ALL STRUCTURES (MIAMI RIVER, EDGE WATER & LITTLE RIVER)

NOTE: OVERBURDEN MAY BE SUBSTANTIAL NEAR BRIDGES AT 836 (PORT BLVD) AND MACARTHUR CSWY 40'-50'

IDEALIZED PROFILE

GROUND SURFACE ELEVATION

10'

OVERBURDEN SOILS 10' M. DENSE TO LOOSE SAND
AVG BLOW COUNT = 10 BPF (FAIRLY CONSERVATIVE)

FINAL DEPTH OF AUG

MIAMI LIME STONE - VUGGY

SPT-N RANGES FROM A MINIMUM OF 11 TO 55 BPF

W/ MOST VALUES BETWEEN 13 AND 33

USE AN AVERAGE OF 23 BPF FOR DESIGN OF AUGER CAST PILES

NOTE: GROUND WATER ELEV. VARY REGIONAL BUT ARE GENERALLY NEAR THE BEDROCK INTERFACE

Form LMT - 01, 1 APR 91

Previous editions obsolete

US Army Corps of Engineers
Norfolk District

JOB: _____

CALCULATED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____

SHEET NO. _____ OF _____

SIDE RESISTANCE OF AUGER CAST PILE

- USE FRIZZI AND MEYER (2000) AS DISCUSSED IN FHWA "DESIGN AND CONSTRUCTION OF CONTINUOUS FLIGHT AUGER PILES" - TGSC No. 8
- USE IDEALIZED SOIL PROFILE DEVELOPED FOR THIS PROJECT
- NEGLECT CONTRIBUTION OF OVER BURDEN (IT WONT ACTUATE)
- FROM ATTACHED FIGURE (RELATIVE HARDNESS AND SIDE SHEAR DATA FOR AUGER CAST PILES)

ASSUMING SPT N = 23 BPF

ULTIMATE SIDE SHEAR = 6.3 TSF

= 12.6 KSF

= 12,600 PSF

UTILIZE FOS OF 3 FOR DESIGN

= 12,600 PSF / FOS = 3.0

= 4,200 PSF

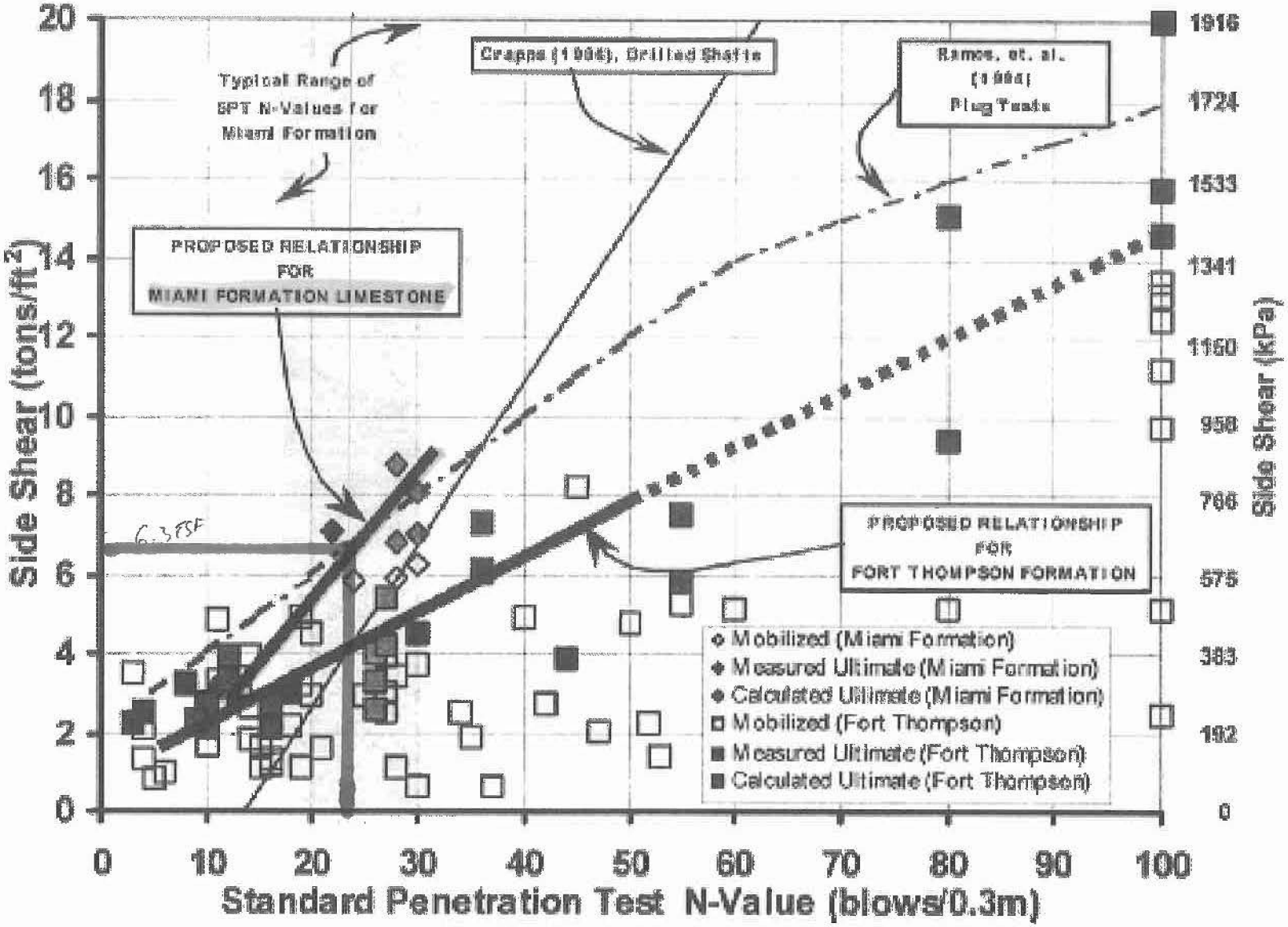


Figure 5. Relative Hardness and Side Shear Data for Augercast Piles

US Army Corps of Engineers
Norfolk District

JOB: _____

CALCULATED BY: _____ DATE: _____

CHECKED BY: _____ DATE: _____

SHEET NO. _____ OF _____

END BEARING FOR ACP - MIAMI

- USE FHWA METHOD FOR DRILLED SHAFTS AS RECOMMENDED IN GSC-8 (FHWA)

→ MODEL AS COHESIONLESS SOIL (SPT-N < 50 BPF)

USE $Q_{MAX} = (0.60)\, N_{SPT}$ TSF $\leq$ 30 TSF

EQN: 11.46 → FHWA: DRILLED SHAFTS CONSTRUCTION & DESIGN METHODS

⇒ USE AVG SPT-N = 23 FROM REVIEW OF ALL BORINGS PROXIMATE TO SITE

$$Q_{max} = (0.60)(23) \times \frac{0.5\ \text{KSF}}{1\ \text{TSF}} = 6.9\ \text{KSF}$$

⇒ USE FACTOR OF SAFETY OF 3 FOR ASD

⇒ ALLOWABLE $Q_{MAX} = \frac{6.9\ \text{KSF}}{3} = \underline{\underline{2.3\ \text{KSF}}}$

⇒ FOR UPLIFT RESISTANCE: $F_{MAX} = \psi\, F_{MAX}$ (COMPRESSION)
FHWA EQN 11.30

WHERE ψ = 0.7 FOR I6M
0.75 FOR COHESIONLESS SOIL
} USE MOST CONSERVATIVE

UPLIFT CAPACITY = (2.3 KSF)(0.70) = 1.61 KSF

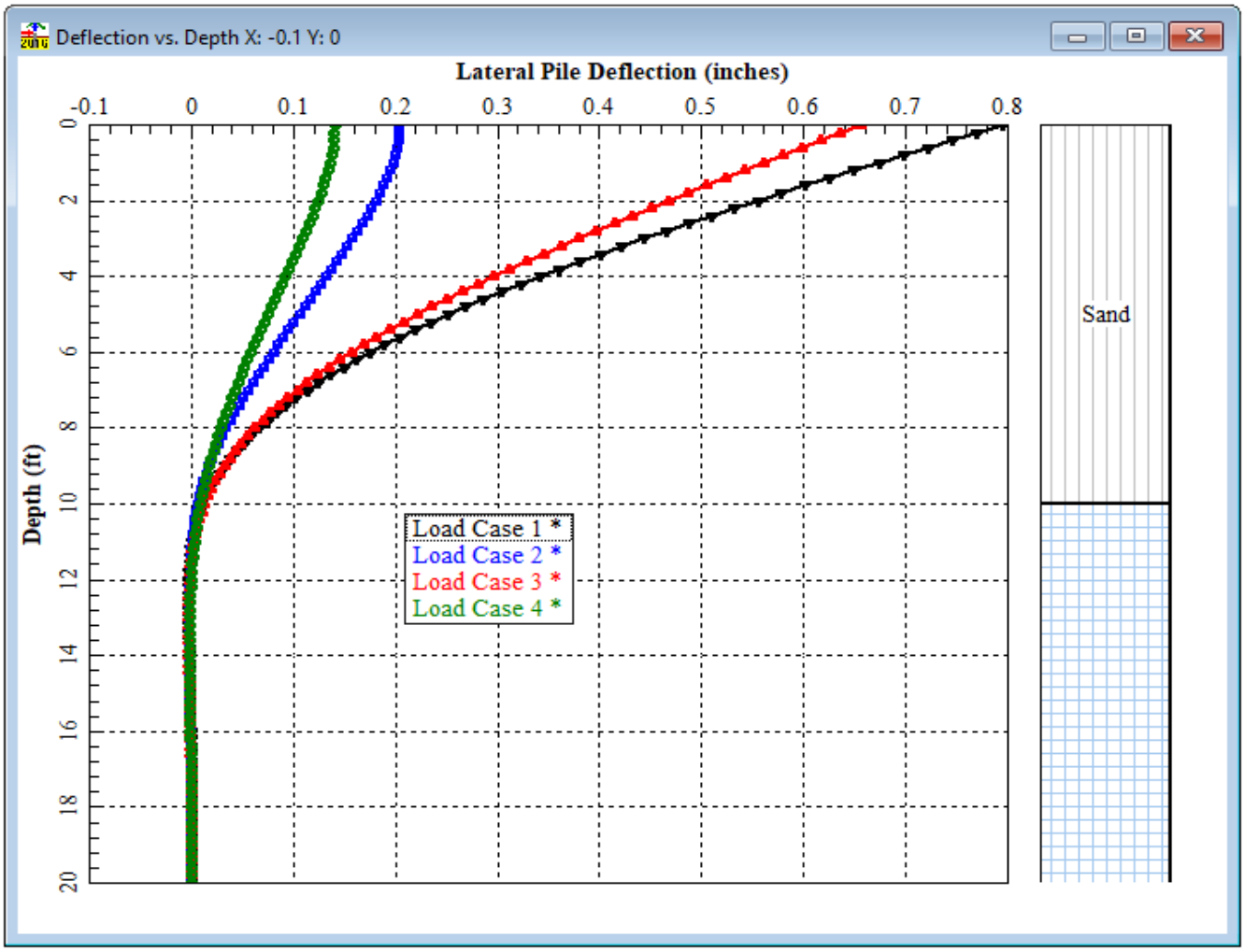
ENCLOSURE D:

DEFLECTION RESULTS FROM LATERAL PILE LOADING

LATERAL PILE DEFLECTION - AUGER CAST PILE

PILE DIAMETER = 18 INCHES, PILE LENGTH = 20 FEET

SUBSURFACE CONDITIONS FROM IDEALIZED SOIL PROFILE (APPENDIX B)



LOAD CASE 1: **No Axial Load, Free End, 25 kip lateral load**

LOAD CASE 2: **No Axial Load, Fixed End, 25 kip lateral load**

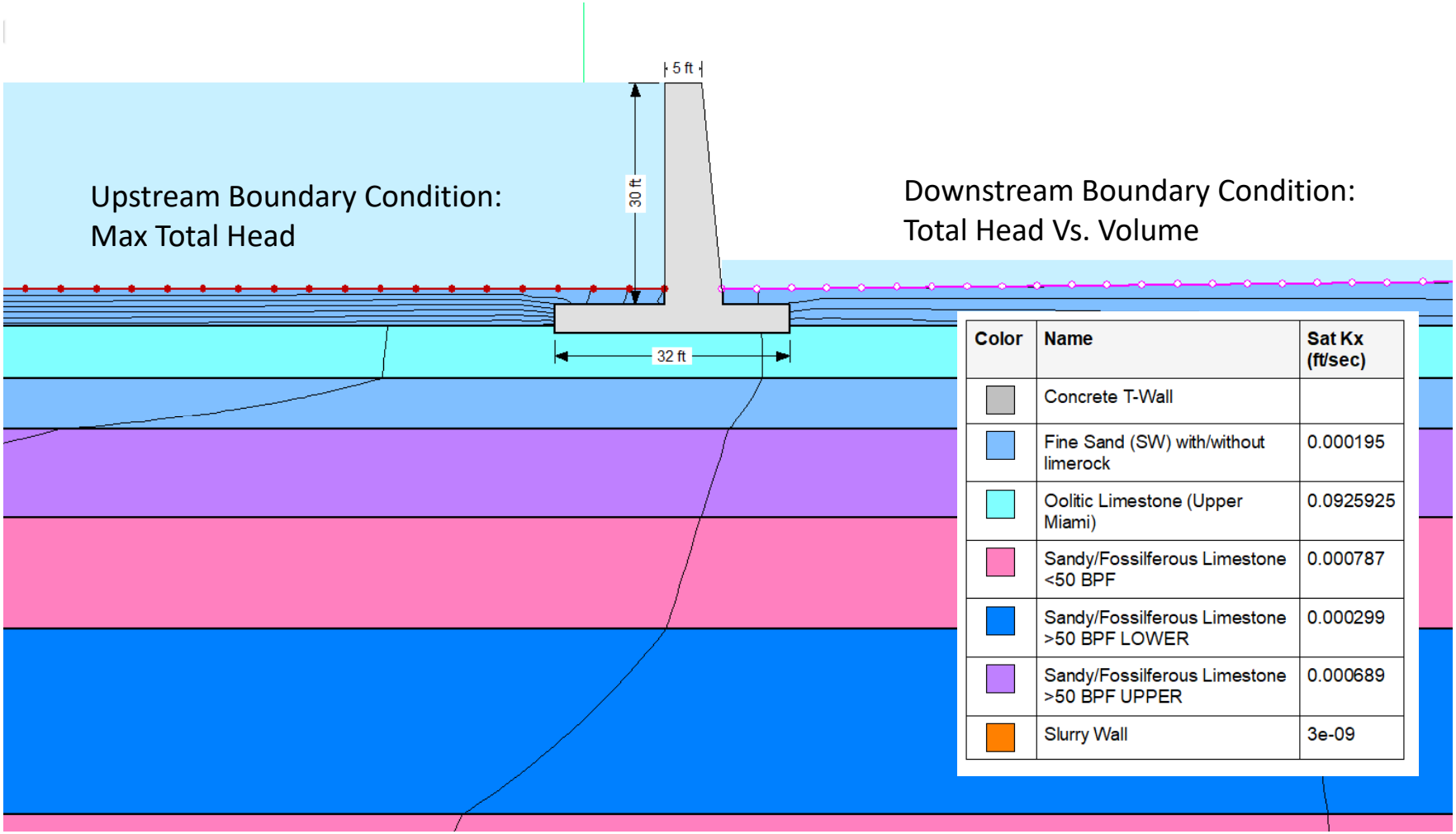
LOAD CASE 3: **152 kip Axial Load, Free End, 25 kip lateral load**

LOAD CASE 4: **152 kip Axial Load, Fixed End, 25 kip lateral load**

ENCLOSURE E:

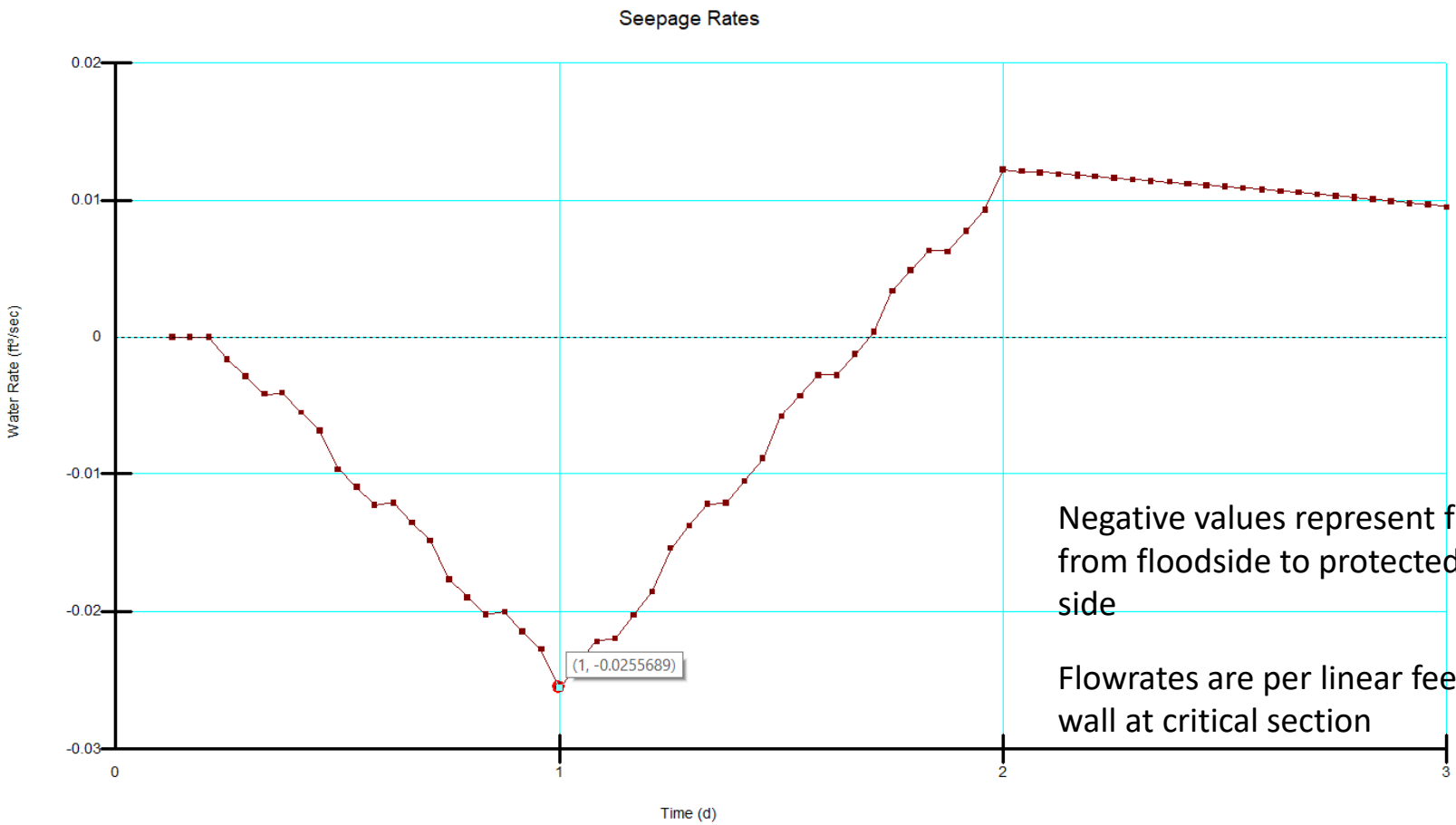
SEEPAGE ANALYSIS RESULTS FOR T-WALL

No Slurry Cutoff Wall – Typical Section



Color	Name	Sat Kx (ft/sec)
	Concrete T-Wall	
	Fine Sand (SW) with/without limerock	0.000195
	Oolitic Limestone (Upper Miami)	0.0925925
	Sandy/Fossilferous Limestone <50 BPF	0.000787
	Sandy/Fossilferous Limestone >50 BPF LOWER	0.000299
	Sandy/Fossilferous Limestone >50 BPF UPPER	0.000689
	Slurry Wall	3e-09

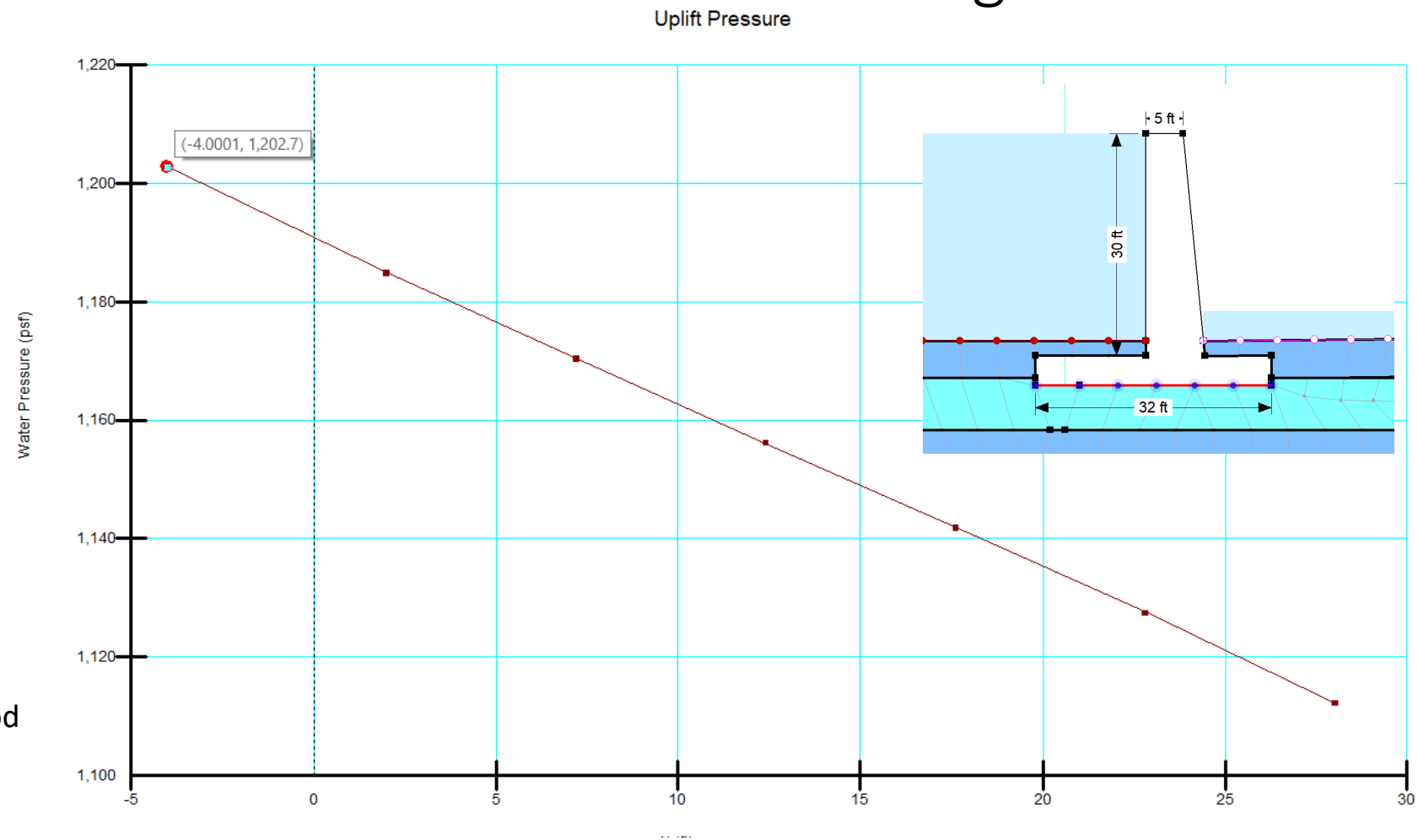
No Slurry Cutoff Wall – Peak Seepage Rate



Negative values represent flow from floodside to protected side

Flowrates are per linear feet of wall at critical section

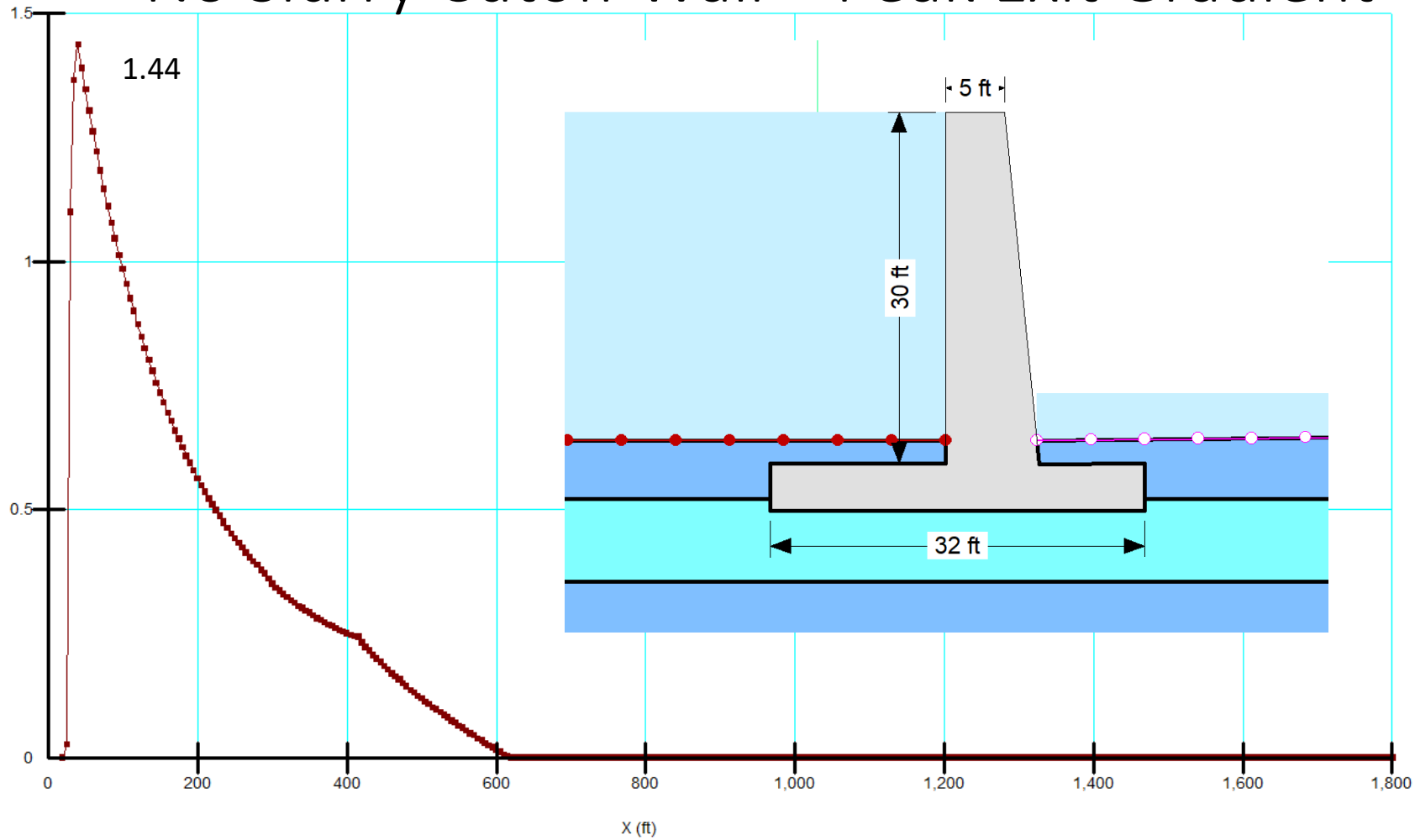
No Slurry Cutoff Wall – Peak Uplift Pressure on Bottom of Footing



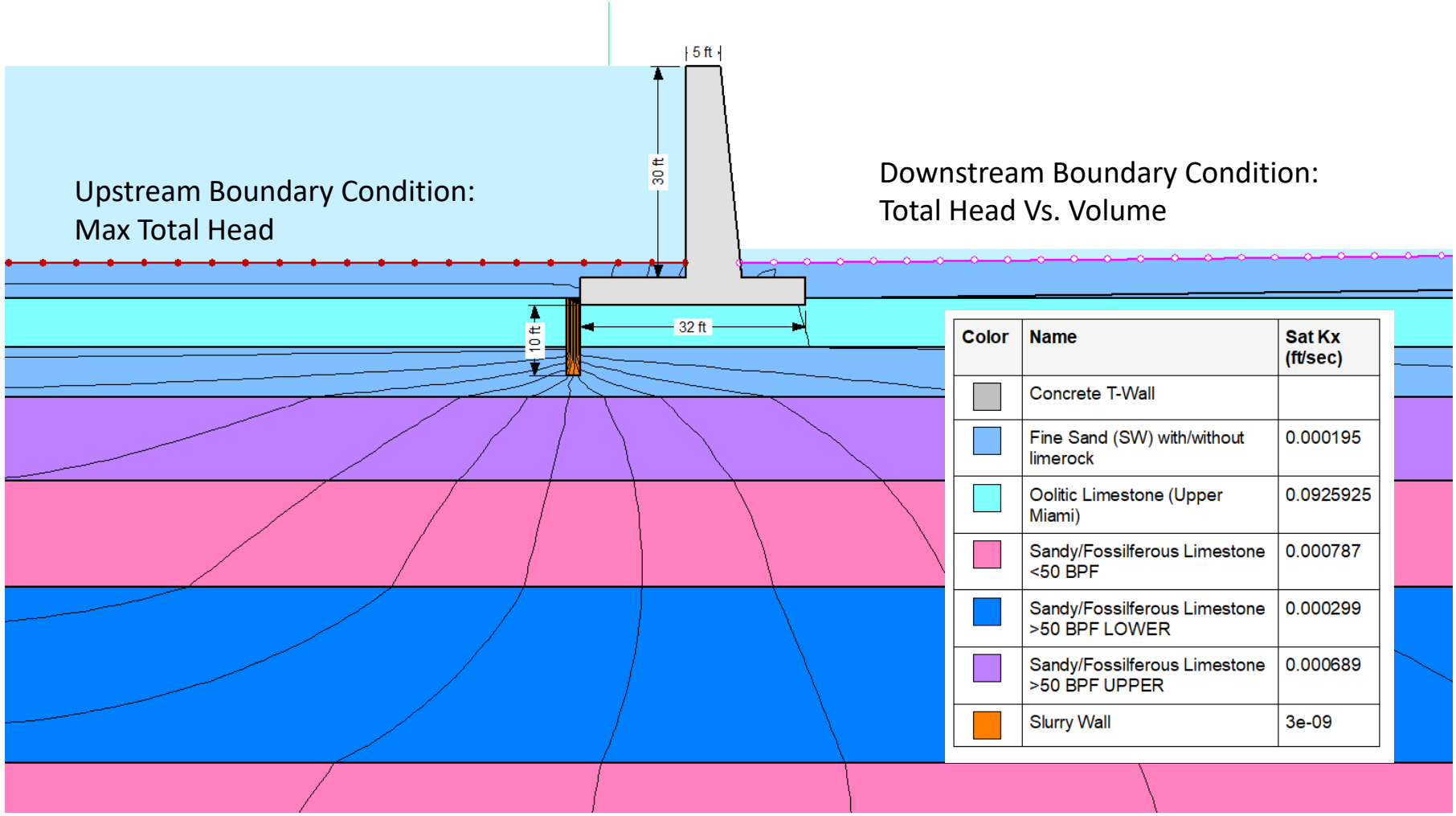
Flood Side

Protected Side

No Slurry Cutoff Wall – Peak Exit Gradient

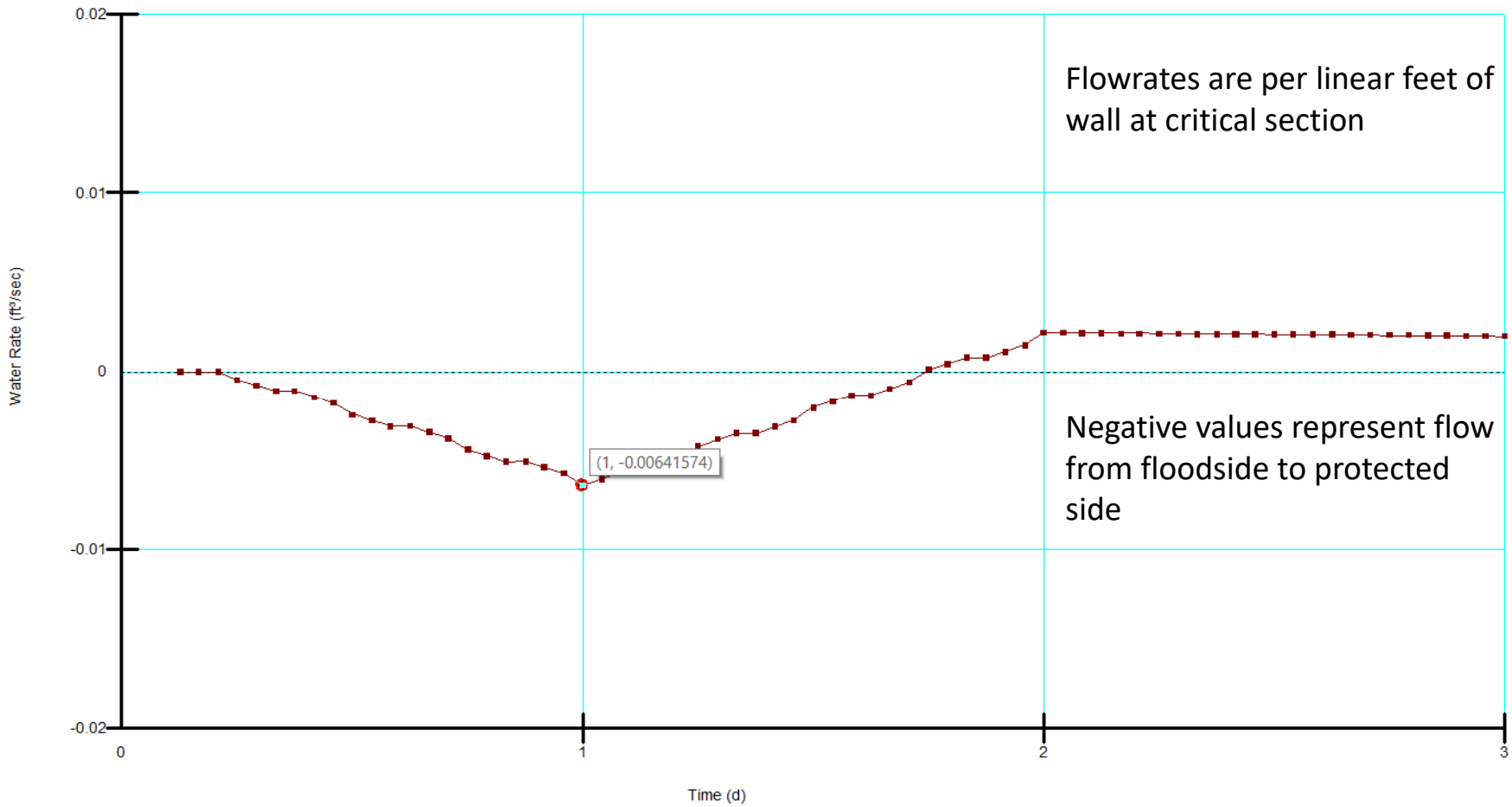


10 FT Slurry Cutoff Wall – Typical Section

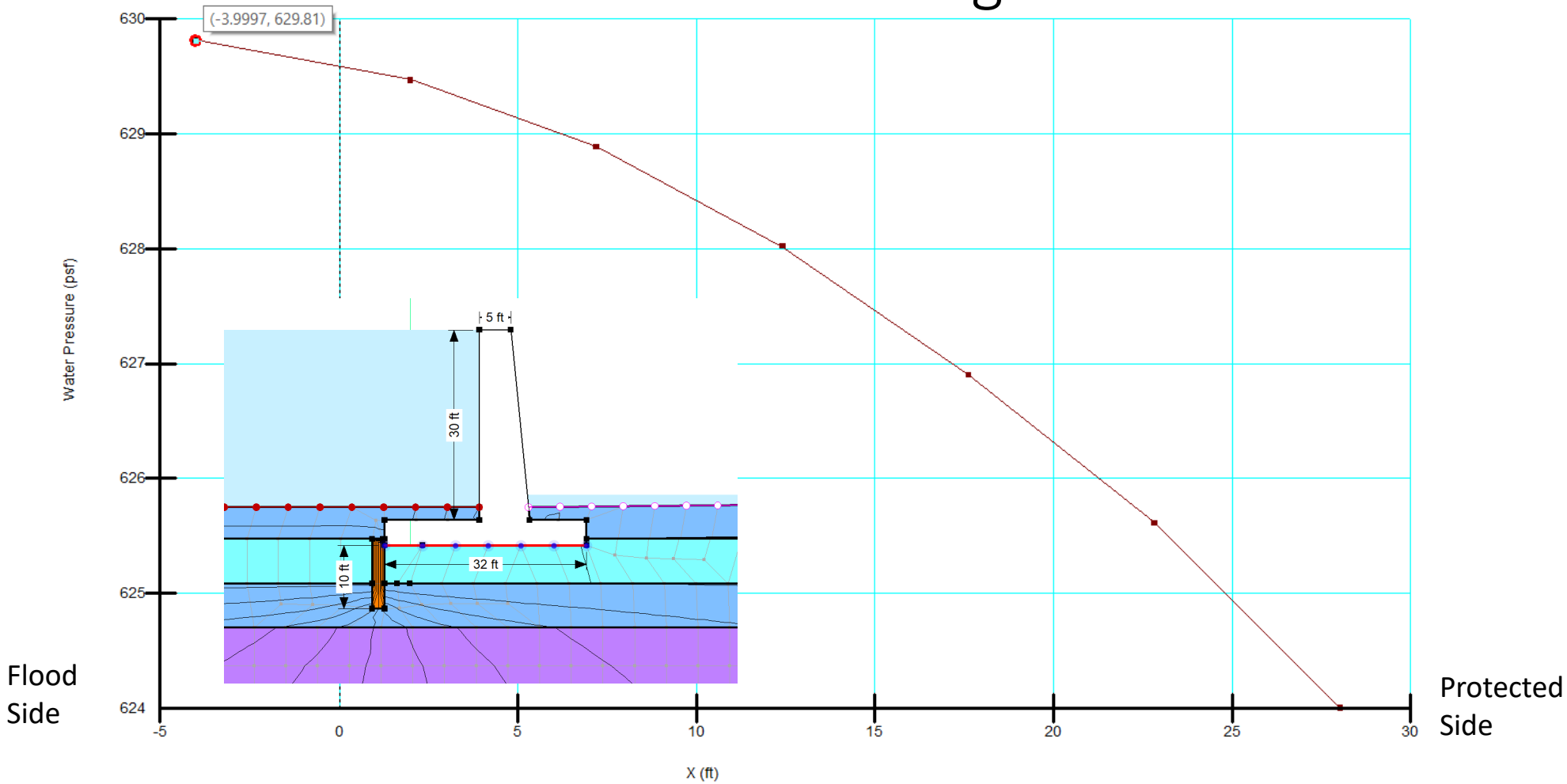


Color	Name	Sat Kx (ft/sec)
	Concrete T-Wall	
	Fine Sand (SW) with/without limerock	0.000195
	Oolitic Limestone (Upper Miami)	0.0925925
	Sandy/Fossilferous Limestone <50 BPF	0.000787
	Sandy/Fossilferous Limestone >50 BPF LOWER	0.000299
	Sandy/Fossilferous Limestone >50 BPF UPPER	0.000689
	Slurry Wall	3e-09

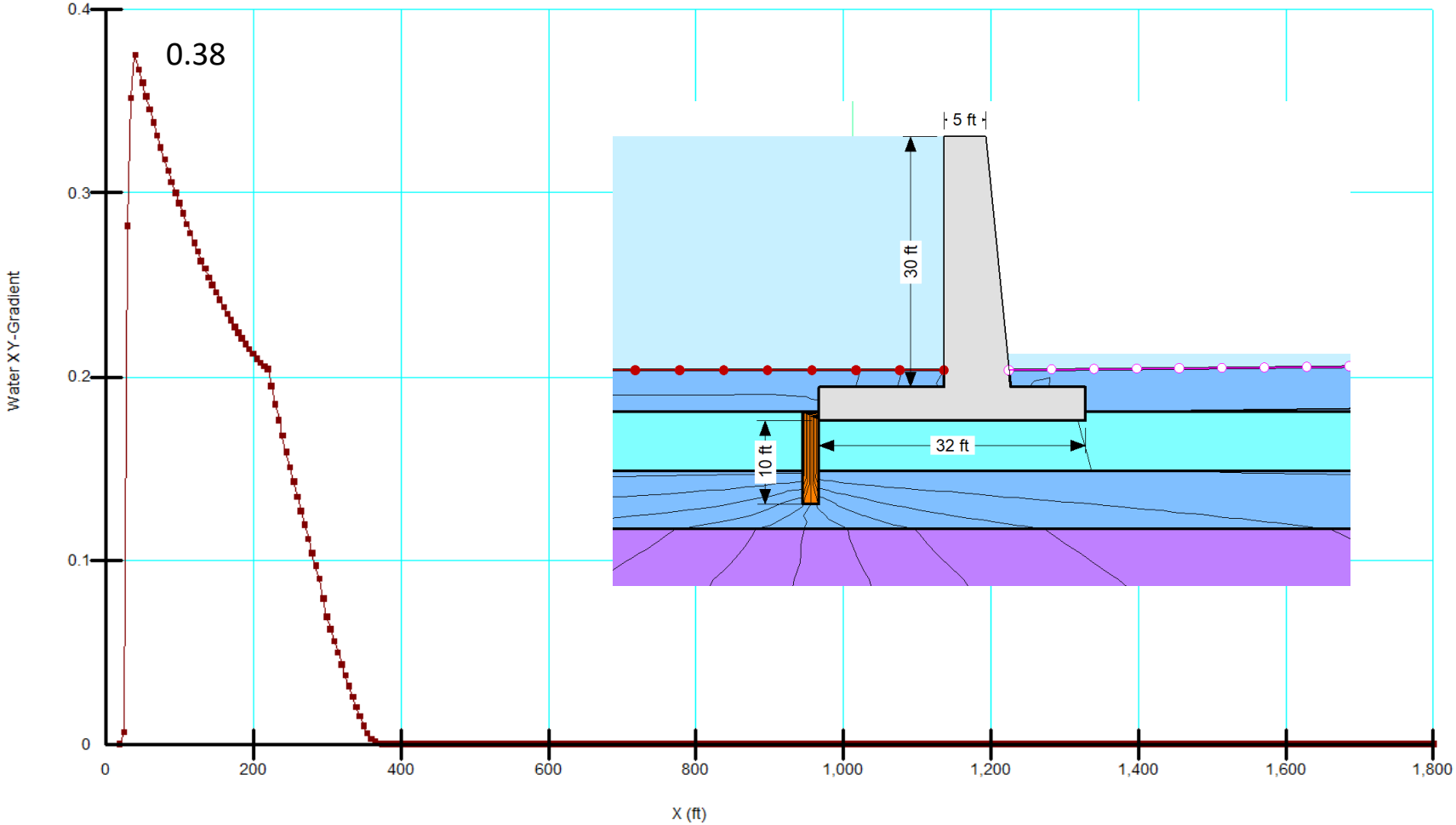
10 FT Slurry Cutoff Wall – Peak Seepage Rate



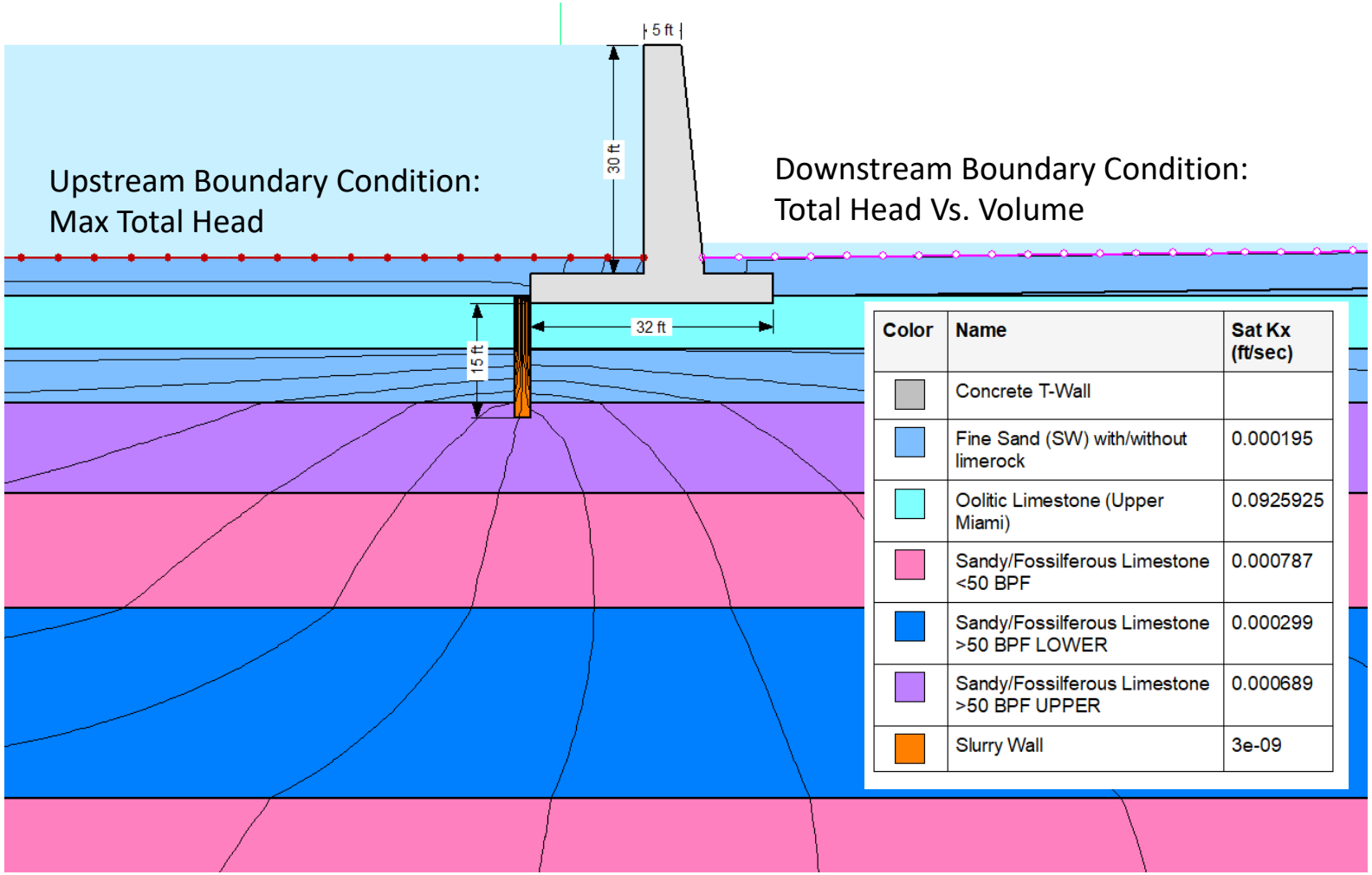
10 FT Slurry Cutoff Wall – Peak Uplift Pressure on Bottom of Footing



10 Foot Cutoff Wall – Peak Exit Gradient

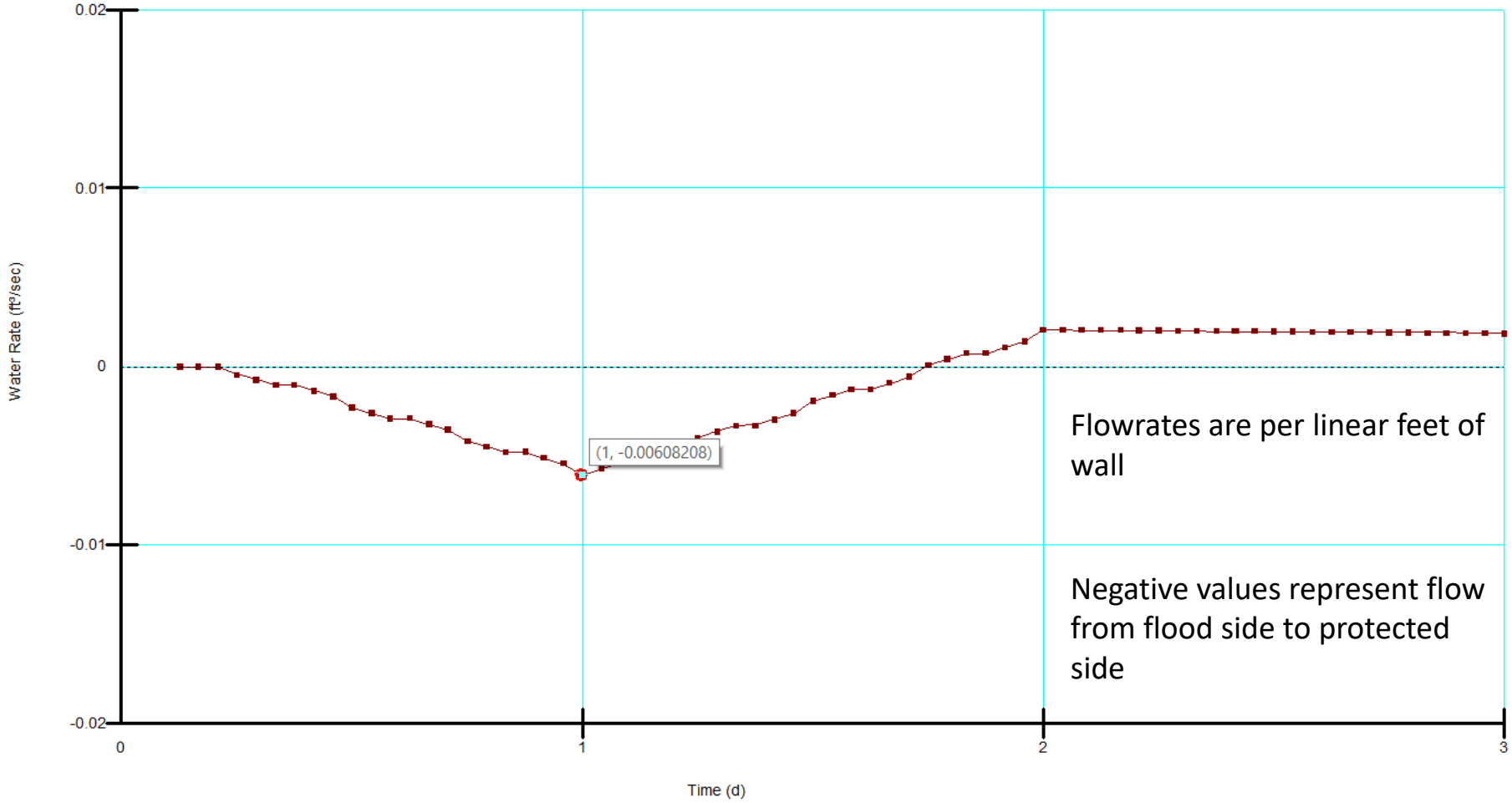


15 FT Slurry Cutoff Wall – Typical Section



Color	Name	Sat Kx (ft/sec)
	Concrete T-Wall	
	Fine Sand (SW) with/without limerock	0.000195
	Oolitic Limestone (Upper Miami)	0.0925925
	Sandy/Fossilferous Limestone <50 BPF	0.000787
	Sandy/Fossilferous Limestone >50 BPF LOWER	0.000299
	Sandy/Fossilferous Limestone >50 BPF UPPER	0.000689
	Slurry Wall	3e-09

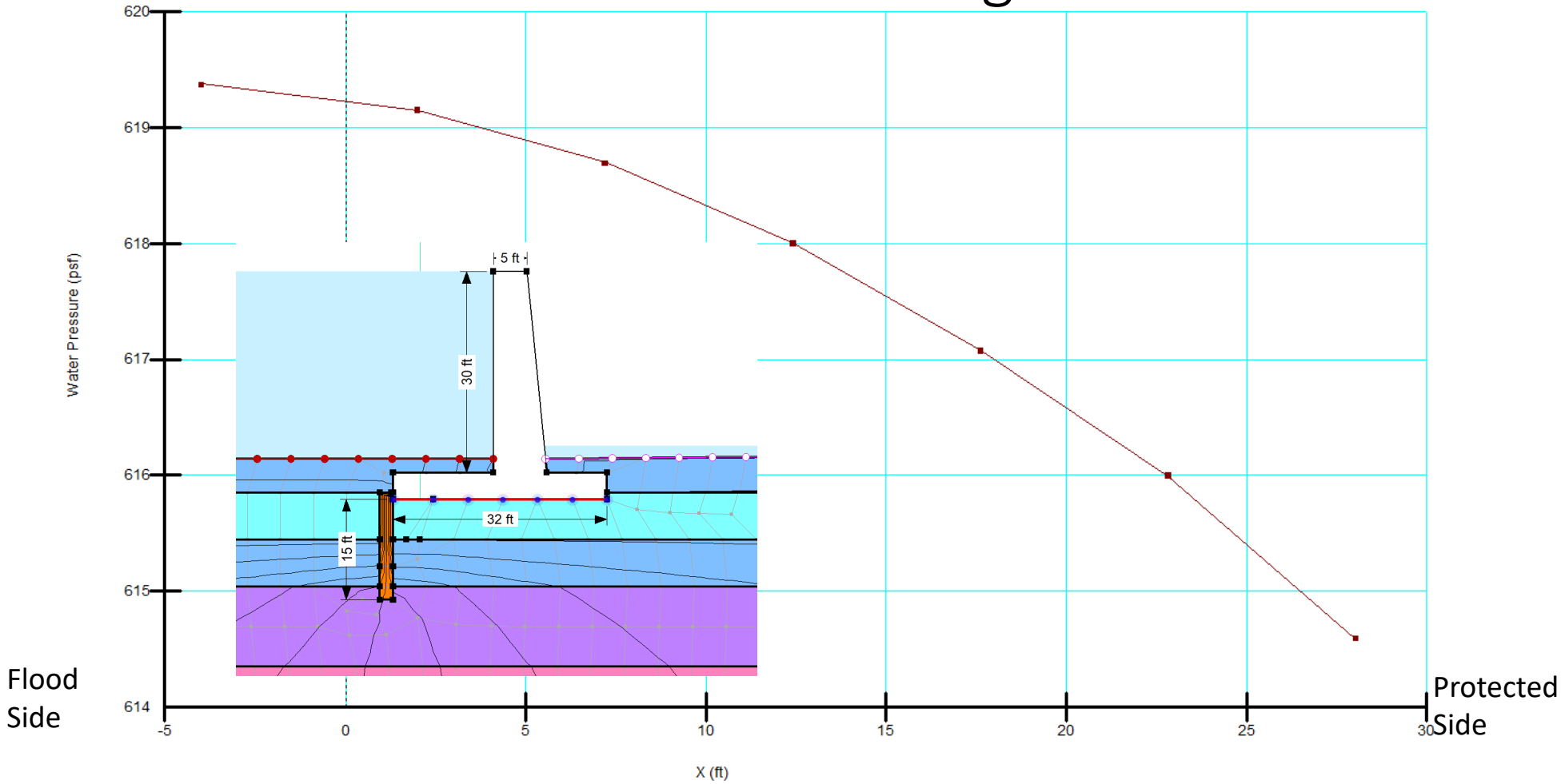
15 FT Slurry Cutoff Wall – Peak Seepage Rate



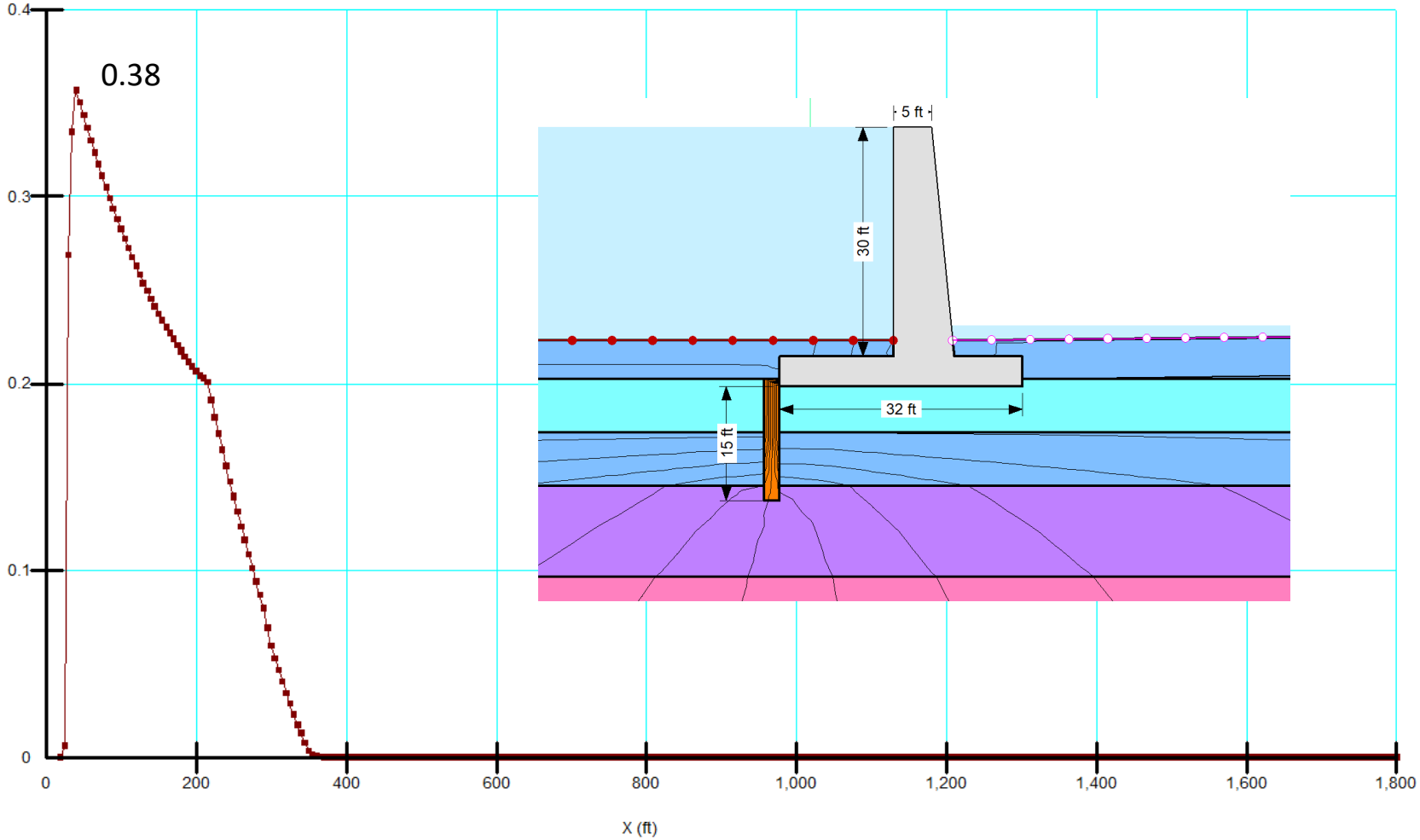
Flowrates are per linear feet of wall

Negative values represent flow from flood side to protected side

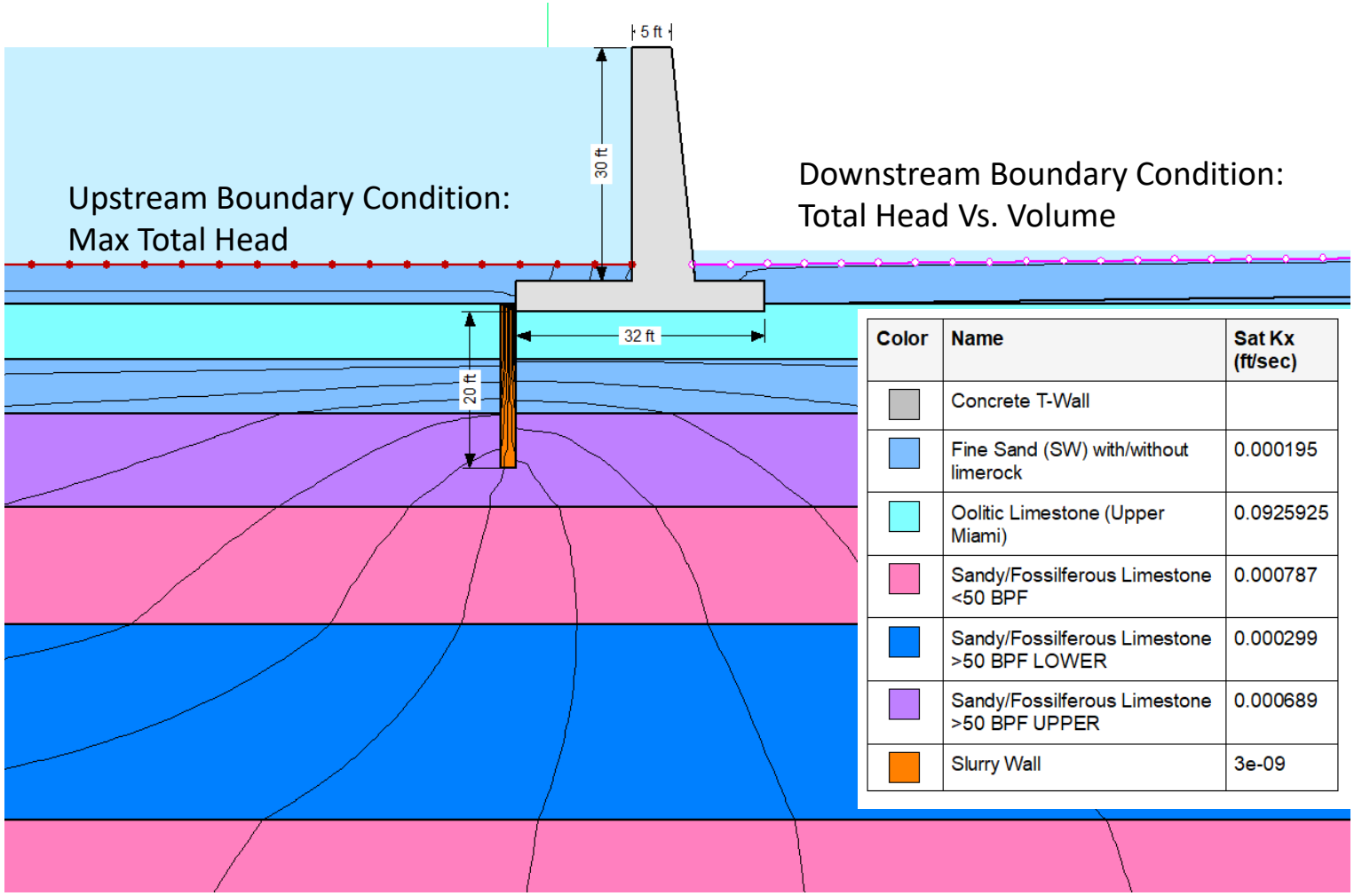
15 FT Slurry Cutoff Wall – Peak Uplift Pressure on Bottom of Footing



15 Foot Cutoff Wall – Peak Exit Gradient

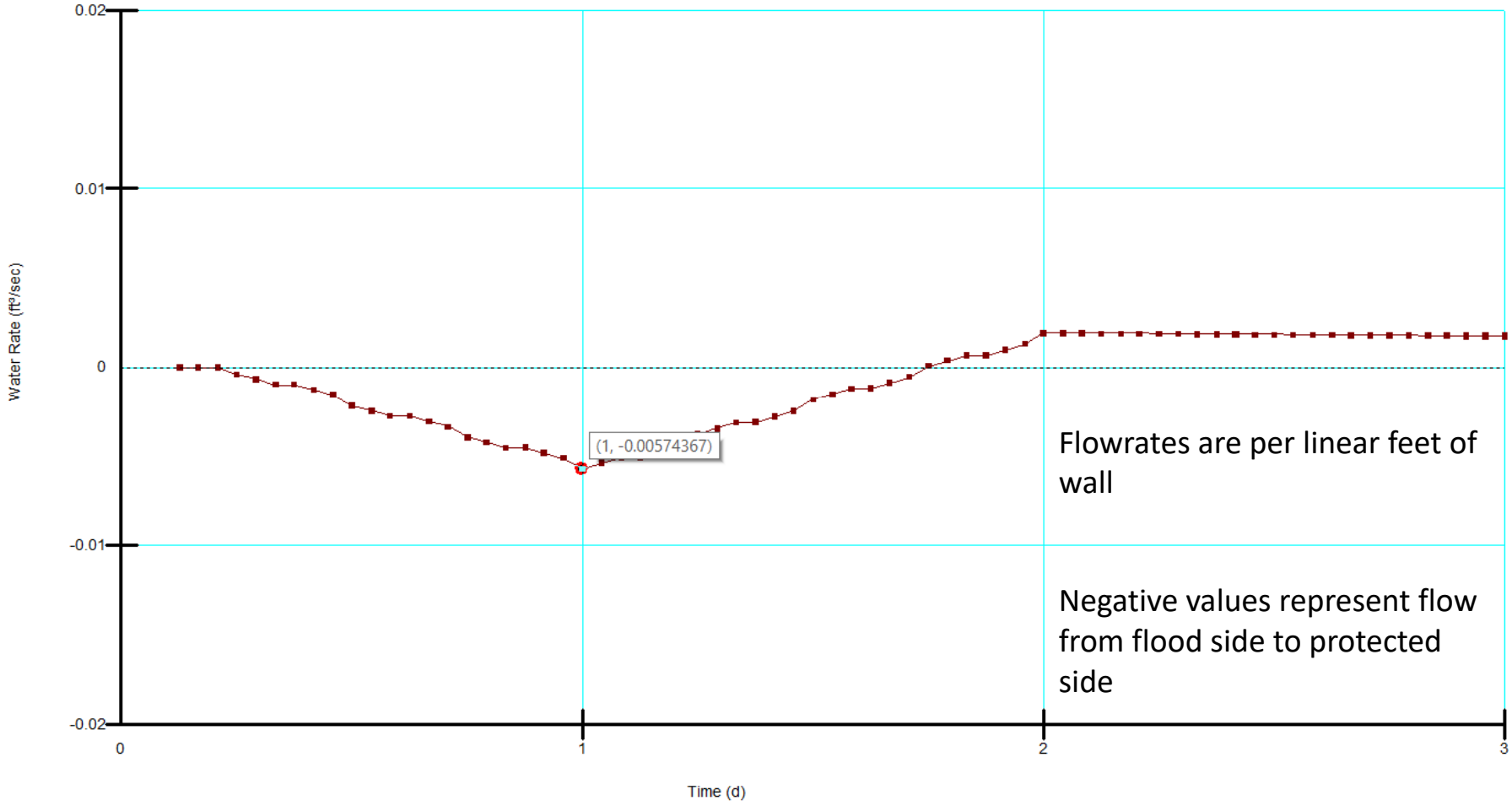


20 FT Slurry Cutoff Wall – Typical Section



Color	Name	Sat Kx (ft/sec)
	Concrete T-Wall	
	Fine Sand (SW) with/without limerock	0.000195
	Oolitic Limestone (Upper Miami)	0.0925925
	Sandy/Fossilferous Limestone <50 BPF	0.000787
	Sandy/Fossilferous Limestone >50 BPF LOWER	0.000299
	Sandy/Fossilferous Limestone >50 BPF UPPER	0.000689
	Slurry Wall	3e-09

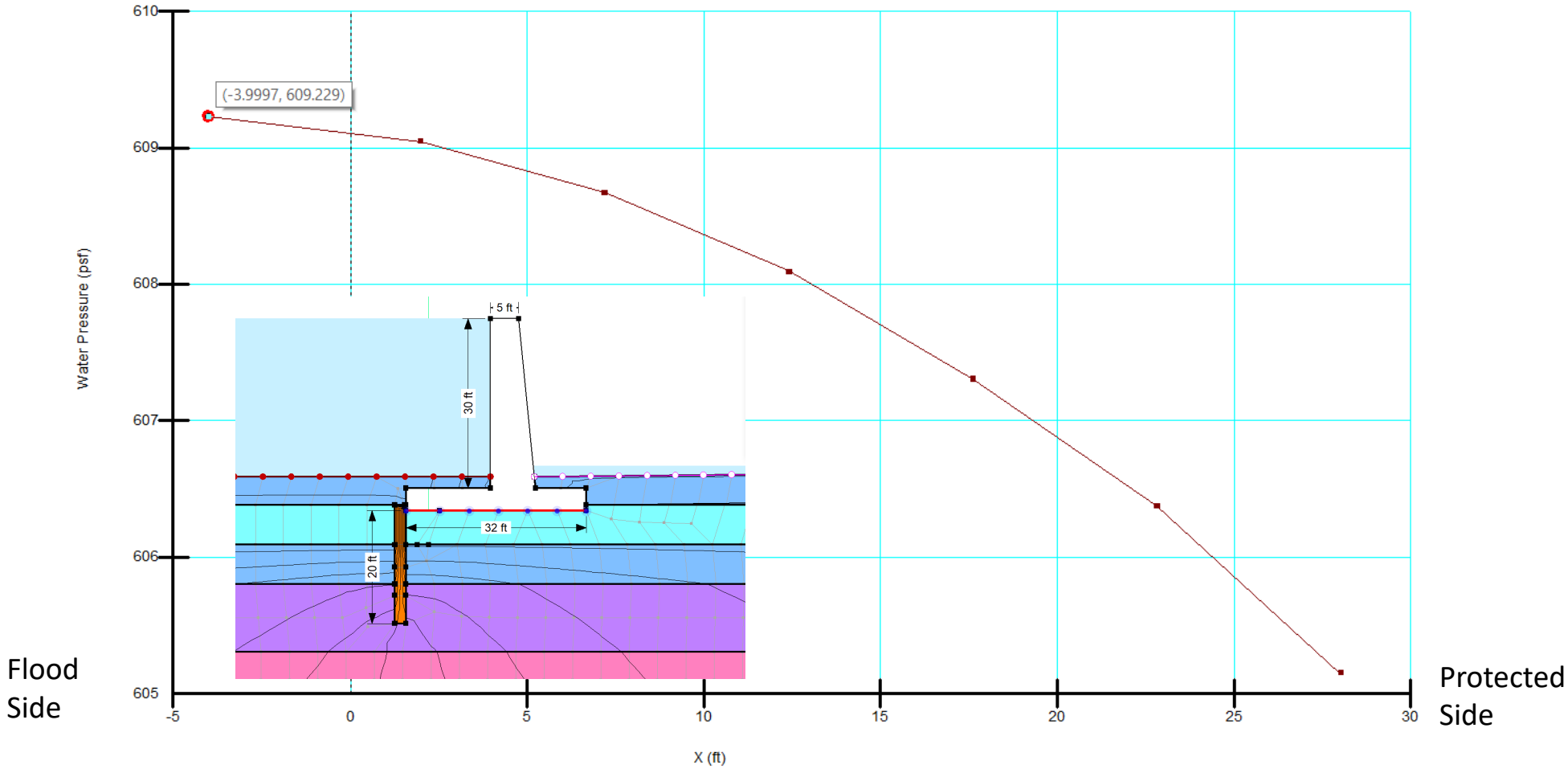
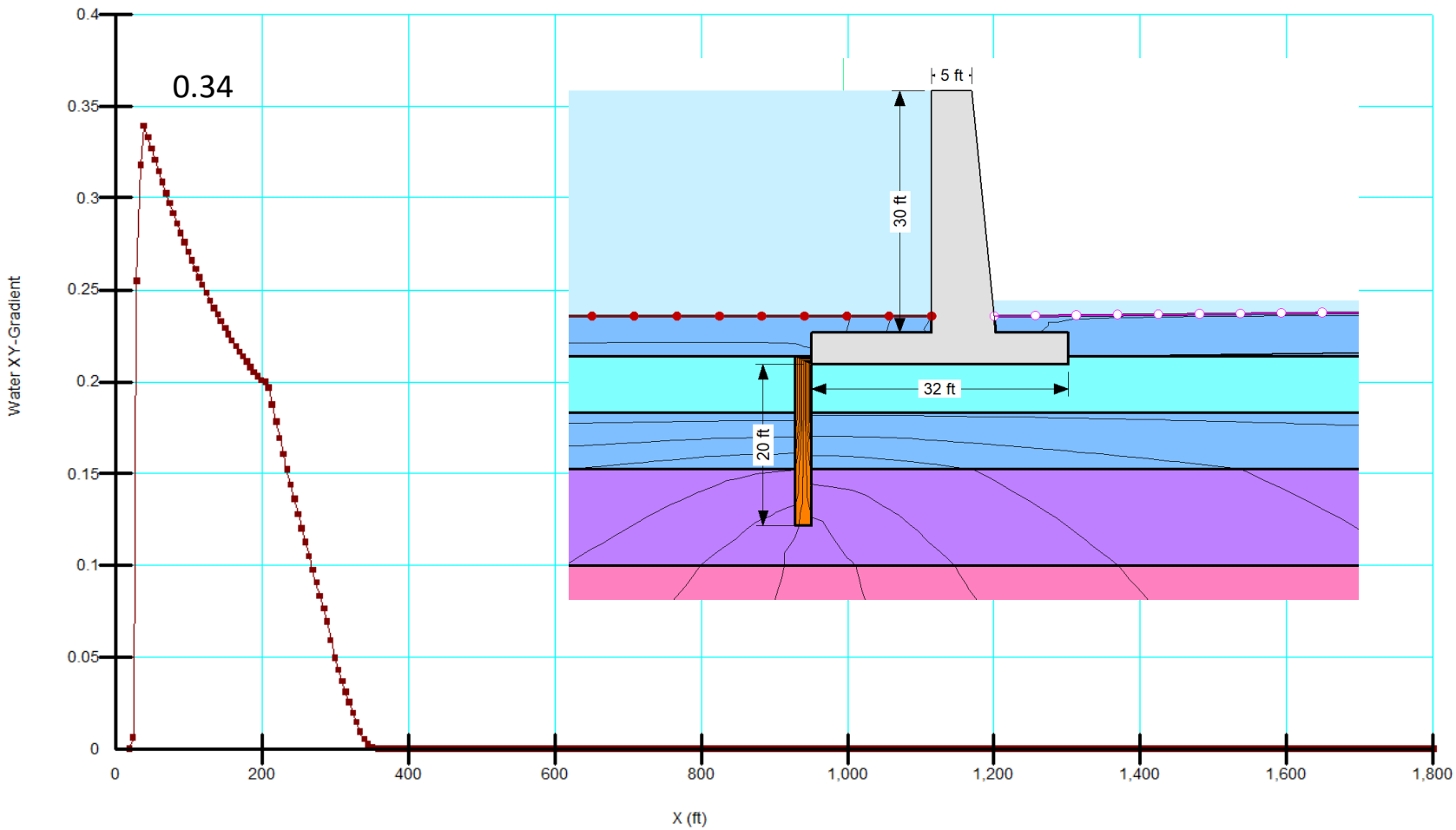
20 FT Slurry Cutoff Wall – Peak Seepage Rate



Flowrates are per linear feet of wall

Negative values represent flow from flood side to protected side

20 FT Slurry Cutoff Wall – Peak Uplift Pressure on Bottom of Footing



20 Foot Cutoff Wall – Peak Exit Gradient