tierra
SOUTH FLORIDA
GEOTECHNICAL ENGINEERING MATERIAL TESTING INSPECTION SERVICES

December 12, 2014

Kimley-Horn & Associates, Inc.
600 N. Pine Island Road, Suite 450
Plantation, Florida 33324

Attn: Mr. Stefano Viola, P.E.

Re: Geotechnical Engineering Services
Drainage Improvements at City Center
Margate, Florida
TSF File No. 7111-14-351

Dear Stefano:

TIERRA SOUTH FLORIDA, INC. (TSF) is pleased to transmit our Geotechnical Engineering Services Report for the referenced project. This report includes the results of field exploration and laboratory testing, geotechnical recommendations for soil parameters, as well as general site development.

We appreciate the opportunity to perform this Geotechnical Study and look forward to continued participation during the design and construction phases of this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,

TIERRA SOUTH FLORIDA, INC.

12/12/14

Ramakumar Vedula, P.E.
Principal Engineer
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Staff Engineer

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1.0 EXECUTIVE SUMMARY

A geotechnical exploration and evaluation of the subsurface conditions has been completed for the proposed drainage improvements at the City Center located at the intersection areas between Margate Boulevard and SR 7 in the City of Margate, Florida. In general, the borings performed at the site encountered silty sand with limerock fragments (fill) below about 6 inches of topsoil, followed by sandy limestone with occasional mix of silt, underlain by sand extending to the boring termination depths. The Standard Penetration N-Values indicated that the materials are generally in a loose to medium dense condition. The probes performed in the canal indicated the water depth varied from about 3 feet to 16 feet, and the soft sediments varied from about 1.5 feet to 3.5 feet.

The groundwater level at the time of drilling was between about 4 and 5 feet below existing grade.

The results of this exploration indicate that the subsurface conditions at the site are generally suitable for proposed improvements. Details related to site development, foundation design, and construction considerations are included in subsequent sections of this report.

The owner/designer should not rely solely on this Executive Summary and must read and evaluate the entire contents of this report prior to utilizing our preliminary engineering recommendations.

2.0 PROJECT INFORMATION

2.1 Project Authorization

TSF has completed a geotechnical exploration for the proposed drainage improvements at the City Center located at the intersection areas between Margate Boulevard and SR 7 in the City of Margate, Florida. This exploration was authorized by Kimley-Horn & Associates, Inc.

2.2 Project Description

Our understanding of the project is based on general information obtained from Kimley-Horn & Associates, Inc. as well as a site plan indicating the proposed development.

We understand that the proposed construction will consist of drainage improvements in the City Center areas, and constructing a Waterfront Promenade and a Waterfront Lawn along the existing canal. No other information regarding the proposed construction has been provided at this time.

The geotechnical recommendations presented in this report are based on the available project information, building location, and the subsurface materials described in this report. If any of the noted information is incorrect, please inform TSF in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. TSF will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

2.3 Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site for the proposed drainage improvements. This report briefly outlines the testing procedures, describes the site and subsurface conditions, and presents soil parameters and general site development.

Our scope of services included drilling a total of four (4) Standard Penetration Test (SPT) borings to a depth of 40 feet below the ground surface around the existing canal area, sediment probes at sixteen (16) locations in the canal to determine the sediment depths, and ten (10) Borehole permeability (BHP) tests, as well as the preparation of this geotechnical report. Geotechnical recommendations regarding the following items are presented herein:

- Soil parameters for lateral pressure calculations, and

- Comments regarding factors that may impact construction and performance of the proposed construction.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air on or below, or around this site. Any statement in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Prior to further development of this site, an environmental assessment is advisable.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Location and Description

The project site is located at the intersection areas between Margate Boulevard and SR 7 in the City of Margate, Florida. At the time of field exploration, the site was occupied by a canal, buildings, roadway pavement, and vegetation.

3.2 Subsurface Conditions

Review of the "Soil Survey of Broward County Area, Florida", prepared by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), indicates the site is mapped as Hallandale-Urban land complex, Margate fine sand, Udorthents, Urban land.

Subsurface conditions at the site were explored with a combination of four (4) Standard Penetration Test (SPT) borings to a depth of 40 feet below the ground surface around the existing canal area, and ten (10) Borehole permeability (BHP) tests located as shown on the Boring Location Plan, Sheet 1. The soil test boring profiles are also presented on Sheet 1. Additionally, sediment probes were performed in the canal pond at sixteen (16) locations. Approximate sediment probe locations and profile showing sediment depth and thickness is presented on Sheet 2. The SPT borings were drilled using a D-50 drill rig (equipped with a safety hammer). Samples of the in-place materials were recovered at frequent intervals using a standard split spoon driven with a 140-pound hammer freely falling 30 inches (the SPT after ASTM D 1586). Samples of the in-place soils were returned to our laboratory for classification by a geotechnical engineer, in general accordance with the Unified Soil Classification System (USCS).

The borings performed at the site, typically, encountered silty sand with limerock fragments (fill) below about 6 inches of topsoil, followed by sandy limestone with occasional mix of silt, underlain by sand extending to the boring termination depths. The Standard Penetration N-Values indicated that the materials are generally in a loose to medium dense condition. The probes performed in the canal indicated the water depth varied from about 3 to 6 feet at locations about 4 feet from the water edge along the bank and about 12 to 16 feet along the pond centerline, and the soft sediments varied from about 1.5 feet to 3.5 feet.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil boring profiles should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, and Standard Penetration resistances. The stratifications shown on the soil profiles represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these soil profiles. Samples collected for classification and laboratory testing will be retained for 30 days from the date of this report and then will be discarded.

3.3 Groundwater Information

Groundwater levels were measured in the borings upon completion of the drilling activities. The depths to the free water surface at the time of drilling the borings was found between about 4 and 5 feet below existing grade. We expect the groundwater to typically fluctuate within about 2 feet from where it was encountered during the drilling activities.

In general, the seasonal high groundwater level is not intended to define a limit or ensure that future seasonal fluctuations in groundwater levels will not exceed the estimated levels. Post-development groundwater levels could exceed the normal seasonal high groundwater level estimate as a result of a series of rainfall events, changed conditions at the site that alter surface water drainage characteristics, or variations in the duration, intensity, or total volume of rainfall. We recommend that the Contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on his or her construction procedures.

3.4 Borehole Permeability Test Result

Ten (10) BHP tests were performed using the usual open-hole, constant head methodology. The hole was 10 feet deep, and was drilled with a solid stem auger so that soil samples could be retrieved for visual classification by an engineer. The boring was completed as open well with gravel pack (6-20 silica sand). The well screen slot widths were 0.020 inches. Water from the drill rig tank was then pumped into the open well, and the amount of water required maintaining constant head was recorded.

The results of our field permeability tests are attached.

4.0 EVALUATION AND RECOMMENDATIONS

4.1 Geotechnical Discussion

The geotechnical study completed for the proposed development that the site is suitable for the planned construction when viewed from a soil mechanics and foundation engineering perspective. Subsurface conditions at the site are not expected to impose any major geotechnical constraints or limitations on the constructed project.

Recommendations for the geotechnical aspects of site preparation, canal backfilling, and pavement design and related construction are presented in the following sections of this report.

4.2 Canal Backfill Area

The canal areas may need to be partially filled up to construct the proposed development. The structural area within the canal fill portion will need to be appropriately treated to minimize settlement and differential settlement.

We recommend the sediment below the proposed fill area be cleaned and excavated in its entirety prior to starting to place fill material. The backfill material in the structural areas should consist of well-graded clean sand free from organics, trash, or other deleterious materials containing less than 8 percent passing the No. 200 sieve. #57 filter stone can be utilized to backfill below the water to about 6 inches above the water. Prior to placing sand/fill above the stone, we recommend a filter fabric be utilized as a separator. As alternate, the canal could be backfilled with clean sand (less than 3% passing the No. 200 sieve) to about 6 inches below the ground water and overlaid by about 1½ to 2 feet of compacted #57 stone. After compacting the #57 stone and prior to placing sand/fill above the stone, we recommend a filter fabric be utilized as a separator.

Once the canal is filled above the ground water level, the fill needs to be compacted in lifts. The structural fill should be placed in thin lifts (12-inch thick loose measure), near the optimum moisture content for compaction, and be compacted to at least 95 percent of maximum dry density (ASTM D 1557).

The side slope, if proposed in the development, of the backfill in the canal area should be 2H:1V or flatter. Due to the likely presence of few sediments, we expect settlement of the canal backfill area after raising grades. Although settlements are expected to be minimal, we recommend that grades in the canal area be raised to pavement subgrade levels and left in place for as long as possible to minimize the impact of settlements on the pavement. As an alternate, the area could be surcharged with about 3 feet of fill above finish grade for a period of about 3 weeks.

4.3 Soil Lateral Pressure

Based on the borings, the upper soils at the site consist primarily of sandy soil with loose to medium dense conditions. For drained loading conditions, lateral earth pressure coefficients may be taken as 0.5 at-rest, 0.33 for active pressure, and 3.0 for passive pressure. Assuming a soil unit weight of 125

pcf, an equivalent fluid pressure of 62.5 pcf, and 41.25 pcf may be used for the at-rest, and active earth pressure cases. This pressure does not include hydrostatic pressure and if there is a potential for build up of hydrostatic pressure, we recommend a drainage system be provided behind the walls to relieve hydrostatic pressure. A coefficient of sliding friction of 0.35 is recommended.

5.0 CONSTRUCTION CONSIDERATIONS

It is recommended that TSF be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project to verify subsurface conditions. TSF cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the foundation if not engaged to also provide construction observation and testing for this project.

5.1 Excavations

Above normal excavation efforts should be expected for excavations through limestone. We recommend that sides of excavations be sloped to 2H:1V or flatter or supported by temporary shoring.

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P." This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottoms. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. TSF does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available subsurface information obtained by TSF and design details furnished by Kimley-Horn & Associates, Inc. for the proposed project.

If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, TSF should be notified immediately to determine if changes in the preliminary foundation recommendations are required. If TSF is not retained to perform these functions, TSF will not be responsible for the impact of those conditions of the project.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. This geotechnical report has been prepared for the exclusive use of Kimley-Horn & Associates, Inc. for the specific application to the proposed drainage improvements at the City Center located at the intersection areas between Margate Boulevard and SR 7 in Margate, Florida.

APPENDIX

BHP Test Results
Boring Location Plan and Soil Profiles – Sheet 1
Sediment Probe Location and Sediment Thickness – Sheet 2

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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P1	Date:	11/20/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		1.10
2		1.00
3		1.00
4		0.90
5		0.80
6		0.80
7		0.90
8		0.80
9		0.90
10		0.80
Constant Flow Rate (gpm)		0.90

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

k	=	3.97E-05	$CF/S/Ft^2$ - Ft Head
H_2	=	8.00	Ft Hydraulic Head
Ds	=	2	ft
d	=	0.33	ft

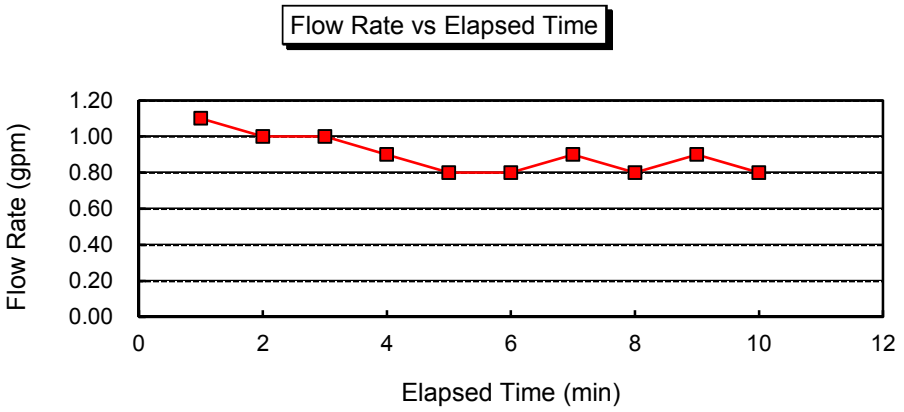
Soil profile:
0-0.25' ASPHALT
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
6'-10' LIGHT BROWN LIMESTONE

Depth of GWT (FT)= 8.00

Where:

Hydraulic Conductivity

K= 3.97E-05 $CF/S/Ft^2$ - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P2	Date:	11/19/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		0.90
2		0.80
3		0.70
4		0.70
5		0.80
6		0.60
7		0.70
8		0.80
9		0.80
10		0.70
Constant Flow Rate (gpm)		0.75

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

Soil profile:
0-0.25' ASPHALT
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
2'-10' LIGHT BROWN LIMESTONE

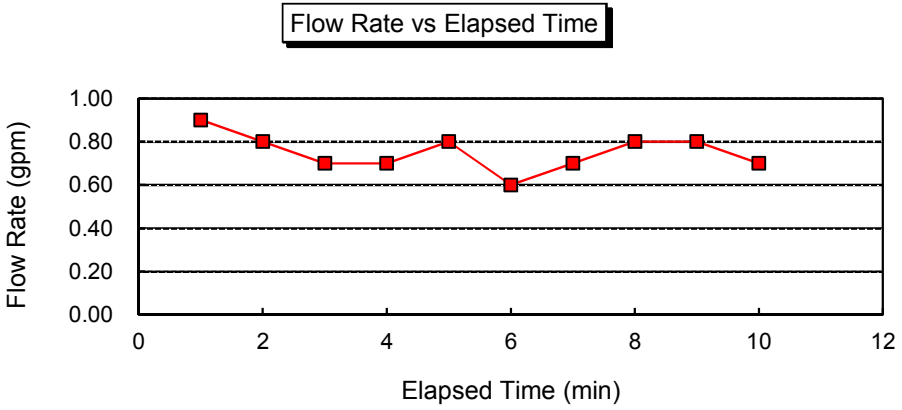
k = 3.21E-05 CF/S/Ft^2 - Ft Head
H_2 = 9.00 Ft Hydraulic Head
Ds = 1 ft
d = 0.33 ft

Depth of GWT (FT)= 9.00

Where:

Hydraulic Conductivity

K= 3.21E-05 CF/S/Ft^2 - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P3	Date:	11/19/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		0.90
2		0.90
3		0.80
4		0.80
5		0.70
6		0.60
7		0.70
8		0.80
9		0.90
10		0.90
Constant Flow Rate (gpm)		0.80

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

k	=	3.62E-05	CF/S/Ft^2 - Ft Head
H_2	=	7.50	Ft Hydraulic Head
Ds	=	2.5	ft
d	=	0.33	ft

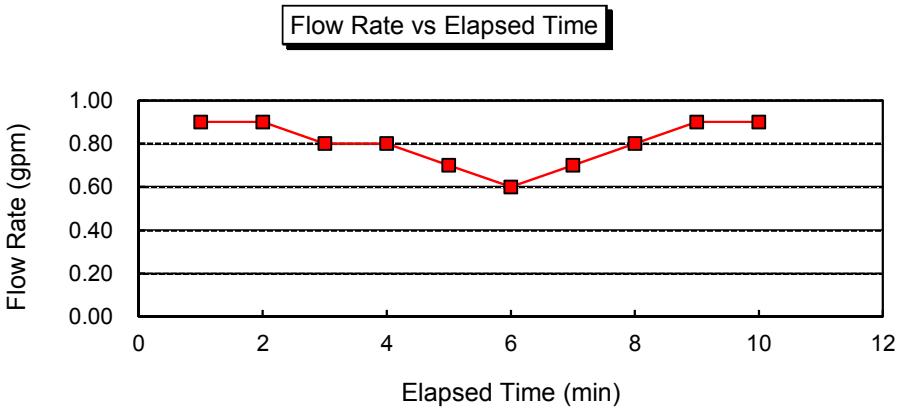
Depth of GWT (FT)= 7.50

Soil profile:
0-0.25' TOPSOIL
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
2'-10' LIGHT BROWN LIMESTONE

Where:

Hydraulic Conductivity

K= 3.62E-05 CF/S/Ft^2 - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P4	Date:	11/20/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		1.00
2		0.80
3		0.70
4		0.70
5		0.70
6		0.80
7		0.80
8		0.80
9		0.90
10		0.80
Constant Flow Rate (gpm)		0.80

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

k	=	3.42E-05	CF/S/Ft^2 - Ft Head
H_2	=	9.00	Ft Hydraulic Head
Ds	=	1	ft
d	=	0.33	ft

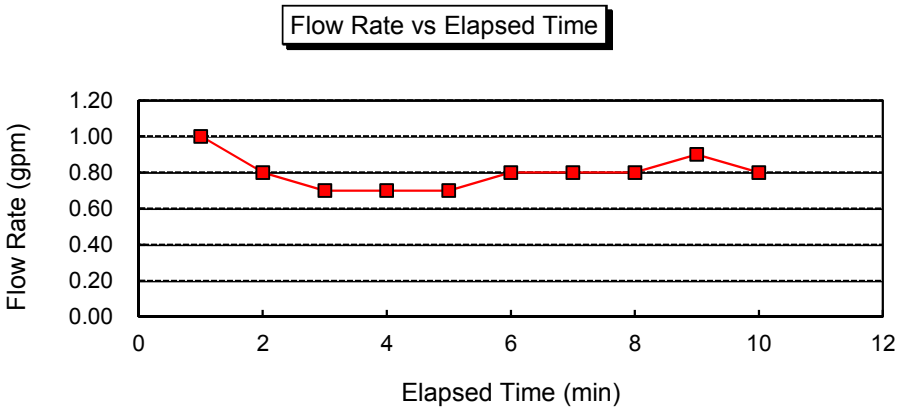
Depth of GWT (FT)= 9.00

Soil profile:
0-0.25' TOPSOIL
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
2'-10' LIGHT BROWN LIMESTONE

Where:

Hydraulic Conductivity

K= 3.42E-05 CF/S/Ft^2 - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P5	Date:	11/20/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		0.80
2		0.80
3		0.70
4		0.80
5		0.70
6		0.70
7		0.60
8		0.70
9		0.70
10		0.70
Constant Flow Rate (gpm)		0.72

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

Soil profile:
0-0.25' TOPSOIL
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
2'-10' LIGHT BROWN LIMESTONE

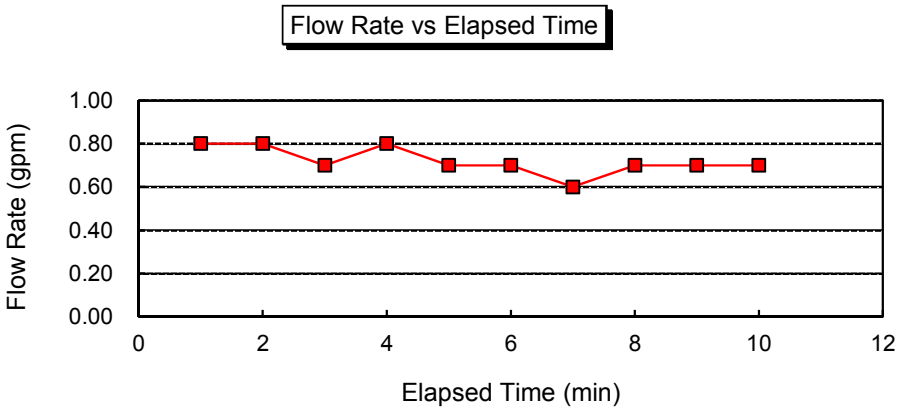
k = 3.26E-05 CF/S/Ft^2 - Ft Head
H_2 = 7.50 Ft Hydraulic Head
Ds = 2.5 ft
d = 0.33 ft

Depth of GWT (FT)= 7.50

Where:

Hydraulic Conductivity

K= 3.26E-05 CF/S/Ft^2 - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P6	Date:	11/20/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		1.30
2		1.30
3		1.20
4		1.10
5		1.00
6		1.20
7		1.20
8		1.20
9		1.30
10		1.20
Constant Flow Rate (gpm)		1.20

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

Soil profile:
0-0.25' TOPSOIL
0.25"-10' LIGHT BROWN LIMESTONE

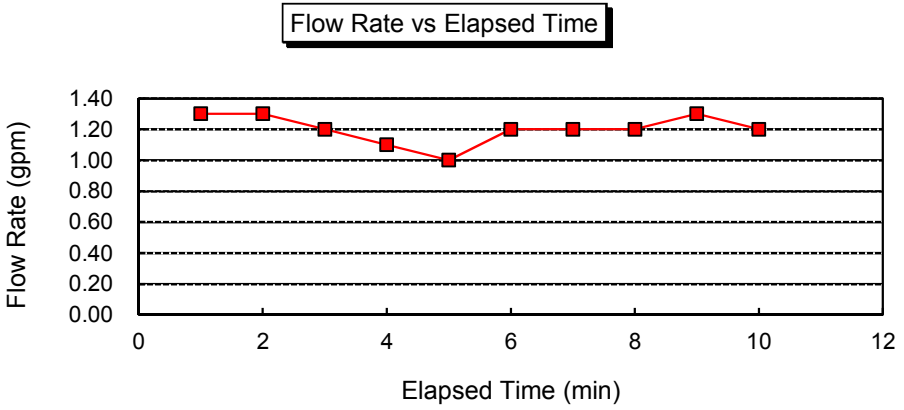
k = 5.13E-05 CF/S/Ft^2 - Ft Head
H_2 = 9.00 Ft Hydraulic Head
Ds = 1 ft
d = 0.33 ft

Depth of GWT (FT)= 9.00

Where:

Hydraulic Conductivity

K= 5.13E-05 CF/S/Ft^2 - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P7	Date:	11/21/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		1.00
2		1.00
3		1.20
4		1.00
5		0.90
6		0.80
7		0.80
8		0.90
9		0.80
10		0.80
Constant Flow Rate (gpm)		0.92

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

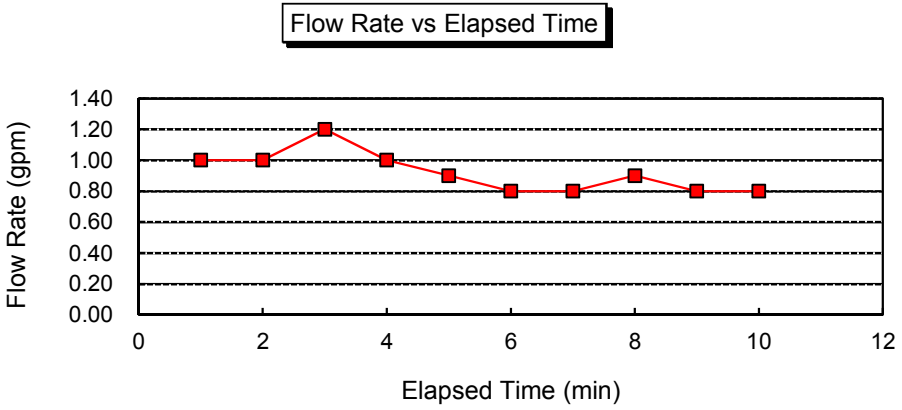
Soil profile:
0-0.25' TOPSOIL
0.25'-2.5' LIGHT BROWN SILTY LIMEROCK (SM)
2.5'-5.5' DARK BROWN SILTY SAND (SM)
5.5'-10' LIGHT BROWN LIMESTONE

k = 4.06E-05 CF/S/Ft^2 - Ft Head
H_2 = 8.00 Ft Hydraulic Head
Ds = 2 ft
d = 0.33 ft
Depth of GWT (FT)= 8.00

Where:

Hydraulic Conductivity

K= 4.06E-05 CF/S/Ft^2 - Ft Head



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USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P8	Date:	11/19/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		2.30
2		2.50
3		2.30
4		2.20
5		2.10
6		2.00
7		2.00
8		2.20
9		2.10
10		2.30
Constant Flow Rate (gpm)		2.20

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

k = 9.72E-05 CF/S/Ft^2 - Ft Head
H_2 = 8.00 Ft Hydraulic Head
Ds = 2 ft
d = 0.33 ft

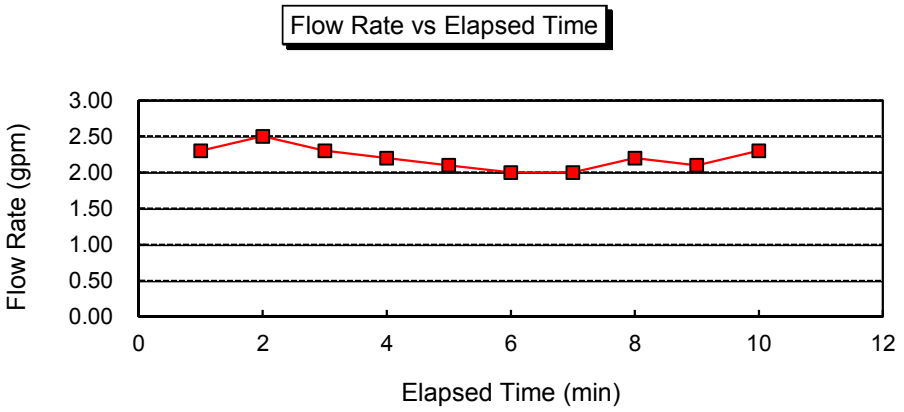
Depth of GWT (FT)= 8.00

Soil profile:
0-0.25' TOPSOIL
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
5'-10' LIGHT BROWN LIMESTONE

Where:

Hydraulic Conductivity

K= 9.72E-05 CF/S/Ft^2 - Ft Head



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GEOTECHNICAL ENGINEERING / MATERIAL TESTING / INSPECTION SERVICES

USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P9	Date:	11/19/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		2.30
2		2.50
3		2.30
4		2.20
5		2.10
6		2.00
7		2.00
8		2.20
9		2.10
10		2.30
Constant Flow Rate (gpm)		2.20

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

k = 9.72E-05 CF/S/Ft^2 - Ft Head
H_2 = 8.00 Ft Hydraulic Head
Ds = 2 ft
d = 0.33 ft

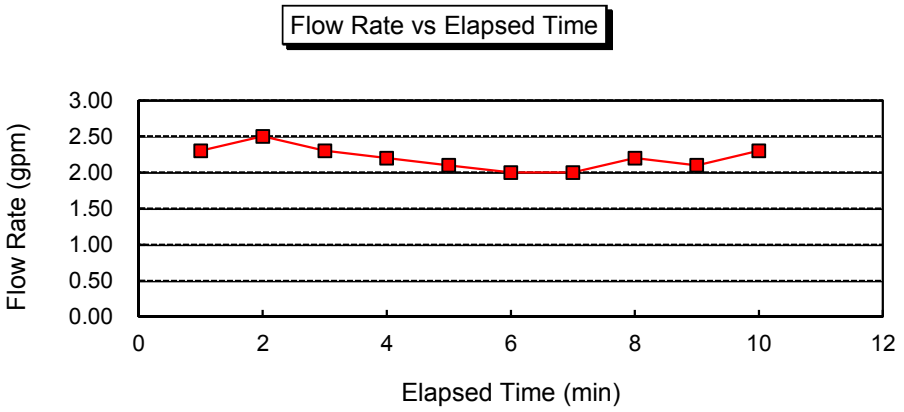
Depth of GWT (FT)= 8.00

Soil profile:
0-0.25' TOPSOIL
0.25'-2' LIGHT BROWN SILTY LIMEROCK (SM)
5'-10' LIGHT BROWN LIMESTONE

Where:

Hydraulic Conductivity

K= 9.72E-05 CF/S/Ft^2 - Ft Head



tierra SOUTH FLORIDA
GEOTECHNICAL ENGINEERING / MATERIAL TESTING / INSPECTION SERVICES

USUAL OPEN - HOLE TEST EVALUATION
SOUTH FLORIDA WATER MANAGEMENT METHOD

Client:	KHA	Test No.:	P10	Date:	11/20/14
Project:	City Center Margate	Well Depth:	10.0 Feet	Analyst:	MP
Job No.:	7111-14-351	Location:	Margate, Florida		

Elapsed Time (min)		Flow Rate (gpm)
0		0.00
1		0.90
2		1.00
3		0.80
4		0.70
5		0.80
6		0.80
7		0.70
8		0.70
9		0.80
10		0.80
Constant Flow Rate (gpm)		0.80

Equation for K Value: $\frac{4Q}{\pi * d(2H_2^2 + 4H_2D_s + H_2d)}$

Soil profile:
0-0.25' TOPSOIL
0.25'-4' LIGHT BROWN SILTY LIMEROCK (SM)
4'-10' LIGHT BROWN LIMESTONE

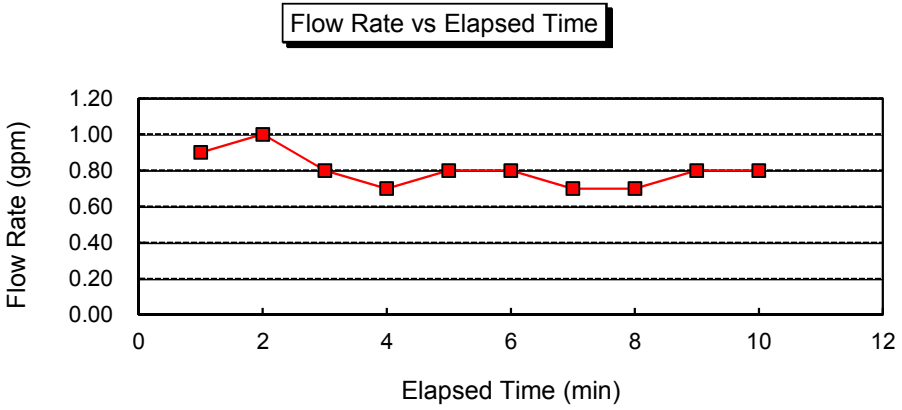
k = 3.47E-05 CF/S/Ft^2 - Ft Head
H_2 = 8.50 Ft Hydraulic Head
Ds = 1.5 ft
d = 0.33 ft

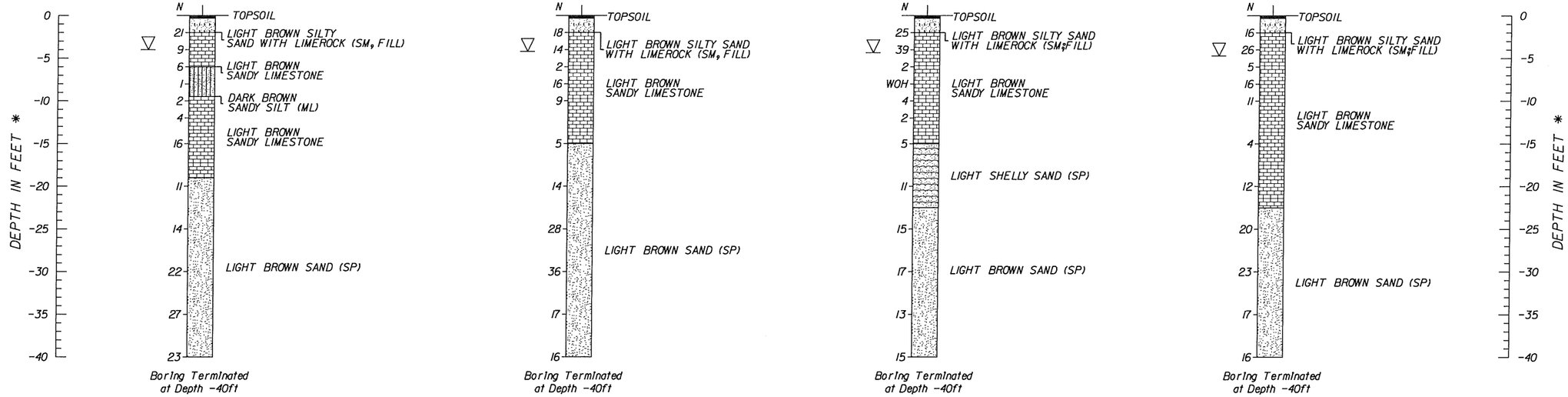
Depth of GWT (FT)= 8.50

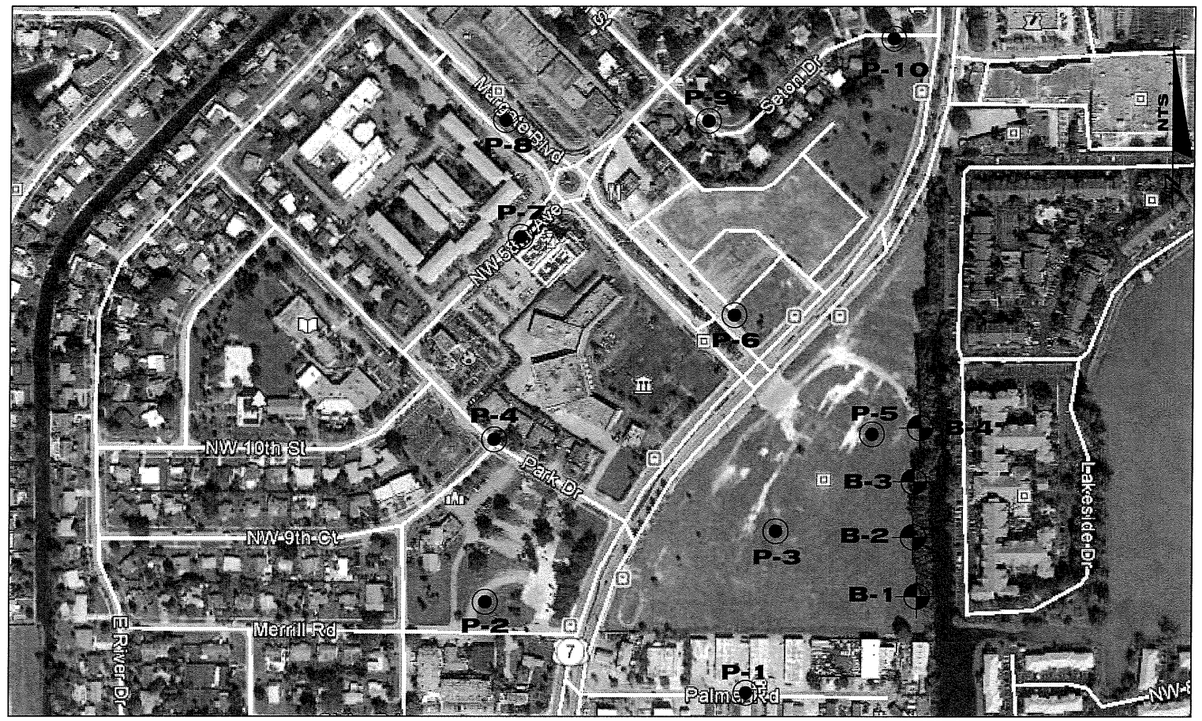
Where:

Hydraulic Conductivity

K= 3.47E-05 CF/S/Ft^2 - Ft Head







BORINGS LOCATION PLAN

- Approximate Location of SPT Borings
- Approximate Location of Percolation Borings

NOTES

- ▽ ENCOUNTERED GROUNDWATER TABLE
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION AND THEY WERE OBTAINED USING AN AUTOMATIC HAMMER. (UNLESS OTHERWISE NOTED.)
- WOH WEIGHT OF HAMMER
- * DENOTES DEPTH IN FEET FROM EXISTING GROUND SURFACE

Topsoil
Silty Sand
Limestone
Sandy Silt
Sand
Shelly Sand

DRAWN BY: NG CHECKED BY: FT	APPROVED BY: RK DATE: 12-01-2014	ENGINEER OF RECORD: RAJ KRISHNASAMY, P.E. FLORIDA LICENSE NO.: 53567	RAJ KRISHNASAMY, P.E. P.E. LICENSE NUMBER 53567 TIERRA SOUTH FLORIDA 2765 VISTA PARKWAY, S-10 WEST PALM BEACH, FL 33411 CERTIFICATE OF AUTHORIZATION 28073	SCALE: NTS	PROJECT NUMBER: 7111-14-351	BORING LOCATION PLAN AND PROFILE CITY CENTER MARGATE, FLORIDA	Sheet: 1

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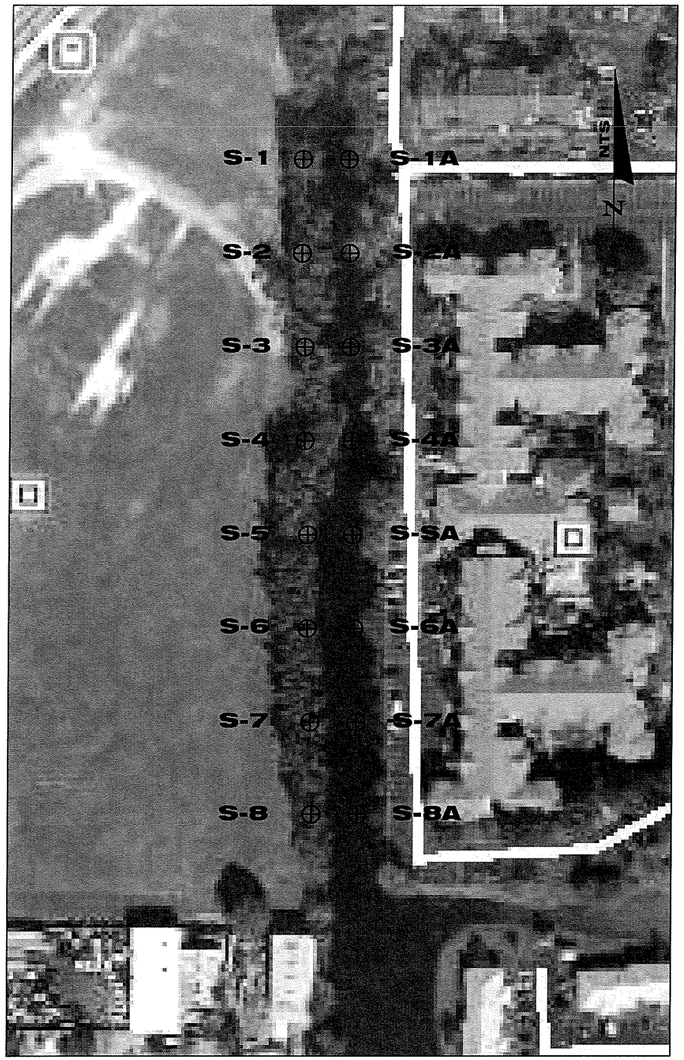
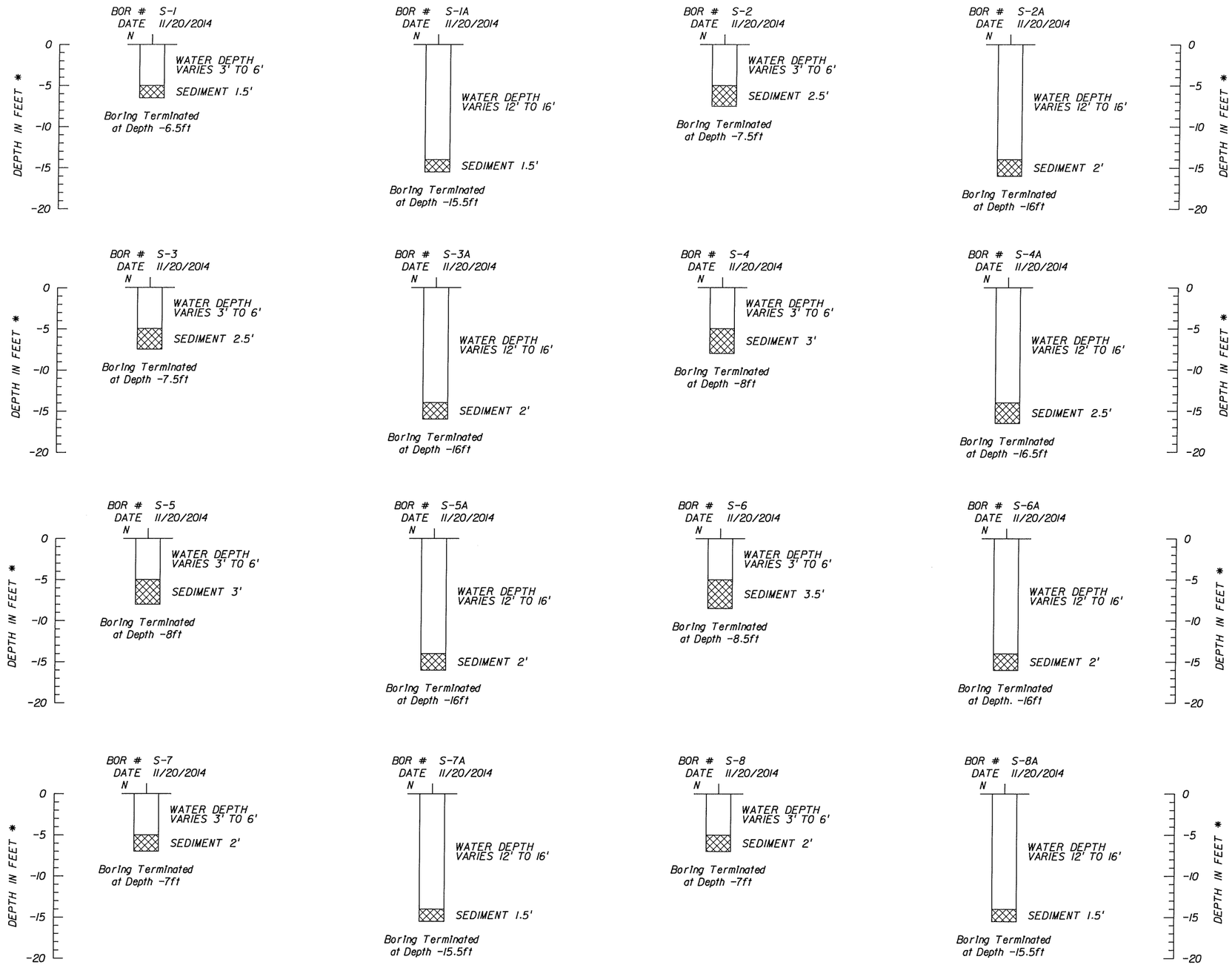


BORINGS LOCATION PLAN

⊕ Approximate Location of Sediments Borings



NOTES

- ▽ ENCOUNTERED GROUNDWATER TABLE
- N NUMBERS TO THE LEFT OF BORINGS INDICATE SPT VALUE FOR 12" PENETRATION AND THEY WERE OBTAINED USING AN AUTOMATIC HAMMER. (UNLESS OTHERWISE NOTED.)
- * DENOTES DEPTH IN FEET FROM EXISTING GROUND SURFACE

LEGEND

- Water
- Sediment

DRAWN BY: NG	APPROVED BY: RK	ENGINEER OF RECORD: RAJ KRISHNASAMY, P.E.	RAJ KRISHNASAMY, P.E. P.E. LICENSE NUMBER 53567 TIERRA SOUTH FLORIDA 2765 VISTA PARKWAY, S-10 WEST PALM BEACH, FL 33411 CERTIFICATE OF AUTHORIZATION 28073	SCALE: NTS	PROJECT NUMBER: 7111-14-351	SEDIMENT PROBE LOCATION PLAN AND THICKNESS CITY CENTER MARGATE, FLORIDA	Sheet: 2
CHECKED BY: FT	DATE: 12-01-2014	FLORIDA LICENSE NO.: 53567					