STORMWATER MANAGEMENT CALCULATIONS FOR Rooms To Go - Outdoor City of Stuart Martin County, Florida August 2018

PREPARED BY

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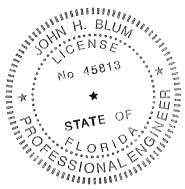
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This item has been electronically signed and sealed by **John H. Blum, P.E**. on **August 24, 2018** using a *SHA* authentication code.

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John H. Blum, P.E.
Florida Reg. No. 45813

DRAINAGE SYSTEM SUMMARY

Description of Stormwater System

The proposed project, located at the 1800 block of NW Federal Highway in Stuart, Florida, consists of the construction of a 9,000 square foot Rooms To Go Outdoor furniture store along with asphalt parking and drive aisles. A future phase will include the construction of retail buildings on the south portion of the property. The 2.57 acre parcel is currently undeveloped. Due to the uncertainty of future phase construction, the stormwater management system has been designed for 65% of the overall site to be impervious (maximum allowable per City of Stuart regulations).

The proposed system will collect runoff from the impervious surfaces and store it in the on-site dry retention area at the rear of the property. Once the required treatment volume is met within the dry retention pond, the system will overflow, via a control structure, into an FDOT drainage ditch parallel to the eastern property boundary. The boundary stages for this ditch have been estimated using engineering judgement and submittals from adjacent properties. In addition to providing stormwater treatment and recovery within 72 hours, the system has been designed to ensure the post development peak rate of discharge does not exceed the pre-development peak rate during the storm events listed below.

Water Quantity

A) Manage the runoff from a 10 Yr - 72 Hr event (9.2″) as follows:
   1. Post Development Peak Discharge ≤ Predevelopment peak discharge

B) Manage the runoff from a 25 Yr – 72 Hr event (11.0”) as follows:
   1. Post Development Peak Discharge ≤ Predevelopment peak discharge

C) Manage the runoff from a 100 Yr – 72 Hr event (13.0”) as follows:
   1. No off-site flooding to properties adjacent to or along the discharge path

The calculations which follow demonstrate that the proposed stormwater management system limits the post development peak discharge rate to less than the predevelopment.

Using the results of the Advanced Interconnect Channel and Pond Routing (adICPR Ver. 3.02) computer model, the peak runoff rates discharged from the site are presented in the following table.

STORM & CONDITION	10 YR – 72 Hr PEAK Q (CFS)	25 YR - 72 Hr PEAK Q (CFS)	100 YR – 72 Hr PEAK STAGE (NAVD’88)
Predevelopment	5.66	6.98	N/A
Post Development	4.98	5.13	11.46

1. ENGINEERING DRAWING FOR SITE PLAN REVIEW PURPOSES

See Site Plan.

2. TOPOGRAPHIC MAP

See Site Plan.

3. HYDROLOGIC DATA

A. Design Rainfall

A predevelopment versus post development comparison has been done using the 10 year frequency - 72 hour duration storm event (9.2 inches per SFWMD), the 25 year frequency – 72 hour duration storm event (11.0 inches per SFWMD), and the 100 year frequency - 72 hour duration storm event (13.0 inches per SFWMD).

B. Drainage Basin Areas
Project Basins: 2.57 Acres

C. Existing and Proposed Impervious Areas (Area of Dev.)

See the pre and post development drainage calculations

D. Soil Characteristics and Depth to G.W.T.
Soil characteristics were estimated by review of a geotechnical report done in the location of the proposed construction. A summary of the findings are on page 9. The full report is available in Appendix D.

E. Drainage Calculations
See attached sheets.

F. Stage vs Storage and Stage vs Discharge

See attached sheets.

4. EROSION AND SEDIMENT CONTROL PLANS

The swales and other previous areas of the property will be sodded solid or seeded and mulched to prevent erosion.

5. ASSUMPTIONS AND REFERENCES USED

A. S.C.S. Unit Hydrograph Method
B. SFWMD sfwmd72 Distribution
C. ICPR Computer Software for Flood Routing
D. MODRET
E. Other references and assumptions listed in the drainage calculations.

6. STORMWATER SYSTEM MAINTENANCE PLAN

The stormwater management system will be owned and maintained by the owners, Florida Patio Partners, LLC.

7. AGENCIES HAVING PERMIT JURISDICTION

A. South Florida Water Management District
B. City of Stuart
C. Florida Department of Transportation

PRE DEVELOPMENT DRAINAGE CALCULATIONS

A) Land Cover Calculations: Basin **B-PRE**

Basin Area	111,787 sf	2.57 ac
Impervious Area (CN 98)	0 sf	0.00 ac
Pervious Areas (CN 79)	111,787 sf	2.57 ac

B) Soil Characteristics

CN calculations from SCS TR-55, Table 2-2a
Cover Type: Urban Commercial and Business
Soil Type: Waveland & Immokalee Fine Sands - Group A/D* (Use D) - *USDA Web Soil Survey

Impervious = 98
Woods = 79 Fair

Weighted CN:

79 x 2.57 ac	= 202.74	
98 x 0.00 ac	= 0.00	
Sum	= 202.74	/ 2.57 ac

CN used = 79.00

C) Time of Concentration

Sheet Flow:

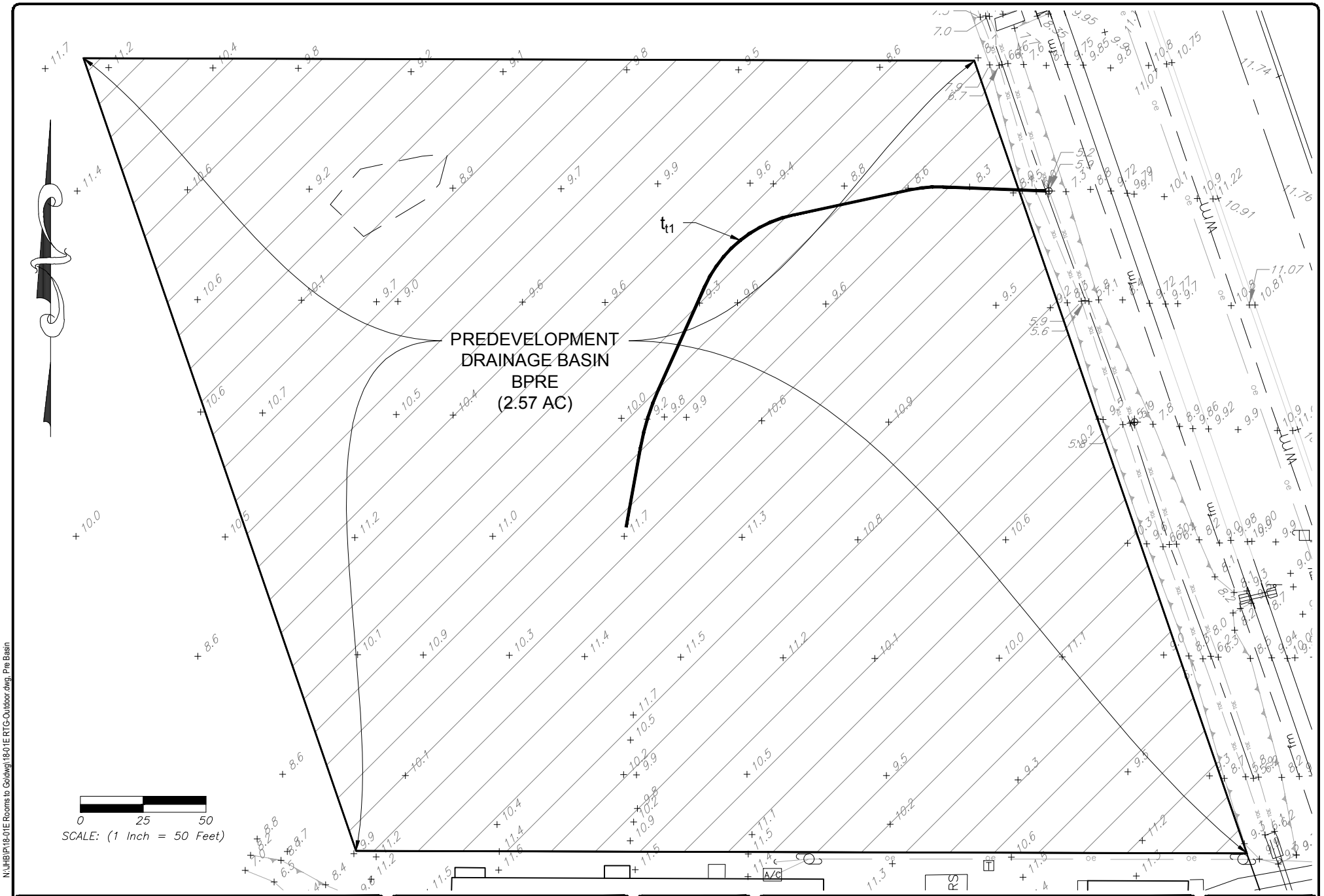
$$t_{t1} = \frac{.007(nL)^{0.8}}{P^{0.5}S^{0.4}}$$

where, n = 0.400
L = 250 ft. P = 5.7 in.
S = 0.026

t_{t1} = 0.503 hr = 31.0 min Use 31 min.

D) Stage - Storage: **Node N-Pre**

Elevation	Area (Ac)
7.50	0.000
8.00	0.010
8.50	0.030
9.00	0.130
9.50	0.330
10.00	0.810
10.50	1.280
11.00	1.720
11.50	1.910
11.70	1.960



N:\JHB\P\18-01E Rooms to Go\dwg\18-01E RTG-Outdoor.dwg, Pre Basin
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DATE

DATE	: 08/2018
PROJ. #	: 18-01E
DRAWN BY:	TNS
APPD. BY	: JHB
PLOT BY	: Tyler Spencer
REF. #	: -
F.B. & PG.	: -

ROOMS TO GO OUTDOOR
1850 NW FEDERAL HWY
STUART, FLORIDA
CPUD AMENDMENT
PREDEVELOPMENT BASIN MAP

SHEET
PRE
Dwg. #: - 6

POST DEVELOPMENT DRAINAGE CALCULATIONS

A) Land Cover Calculations: Basin **B-PST**

Basin Area	111,787 sf	2.57 ac	
Impervious Area (CN 98)	72,662 sf	1.67 ac	(65% Max. Impervious)
Pervious Areas (CN 49)	39,125 sf	0.90 ac	

B) Soil Characteristics

CN calculations from SCS TR-55, Table 2-2a
Soil Type: Waveland & Immokalee Fine Sands - Group A/D* (Use A) - *USDA Web Soil Survey

Open Space = 49
Impervious = 98

Weighted CN:

49 x 0.90 ac	= 44.01	
98 x 1.67 ac	= 163.47	
Sum	= 207.48	/ 2.57 ac

CN used = 80.85

C) Time of Concentration

Sheet Flow:

$$t_{t1} = \frac{.007(nL)^{0.8}}{P^{0.5}S^{0.4}}$$

where, n = 0.011, L = 120 ft., P = 5.7 in., S = 0.010

t_{t1} = 0.023 hr = 2.0 min Use 10 min.

POST DEVELOPMENT TREATMENT VOLUME REQUIREMENTS

A) Treatment Volume Requirement

Basin Area		111,787 sf	2.57 ac
Impervious Area:		72,662 sf	1.67 ac
1)	1.25 inches times the impervious area …		
	$\frac{1.25 \text{ in} \times 1.0 \text{ ft} \times 72{,}662 \text{ sf}}{12.0 \text{ in}} =$	7,569 cf	0.174 ac-ft
2)	0.5 inches times the drainage basin …		
	$\frac{0.5 \text{ in} \times 1.0 \text{ ft} \times 111{,}787 \text{ sf}}{12.0 \text{ in}} =$	4,658 cf	0.107 ac-ft
	Dry Retention Treatment Volume (V_1) =	7,569 cf	0.174 ac-ft
	Additional 50% required for discharge into Impaired Water Body =	4,658 cf	0.107 ac-ft
	Total Dry Retention Treatment Volume Required =	12,227 cf	0.281 ac-ft

B) Pollutant Loading Analysis (See Appendix B for BMPTrains Model Calculations)

Required Total Nitrogen Treatement Efficiency	78%	
Required Total Phosphorus Treatement Efficiency	86%	
Required Retention Depth over Watershed to Meet Required Efficiencie	1.60 in	0.342 ac-ft

C) Stage vs. Storage:

Dry Retention Provided

Description	Stage (feet)	Area (sq.ft.)	Area (acres)	Incremental Volume (cf)	Total Volume (cf)	Total Volume (ac-ft)
Bottom	8.50	5,987	0.137	0.00	0.00	0.000
	9.00	6,859	0.157	3211.50	3211.50	0.074
	10.00	8,679	0.199	7769.00	10980.50	0.252
Weir	10.45	9,531	0.219	4097.25	15077.75	0.346
	11.00	10,600	0.243	5536.03	20613.78	0.473
Top of Bank	11.50	11,598	0.266	5549.50	26163.28	0.601

D) Minimum Overflow Elevation:

1) Treatment Volume Elevation:

Minimum overflow weir elevation =	10.43		
Set Weir Elevation =	10.45		
	Treatment Volume Required =	14,905 cf	0.342 ac-ft
	Treatment Volume Provided =	15,078 cf	0.346 ac-ft

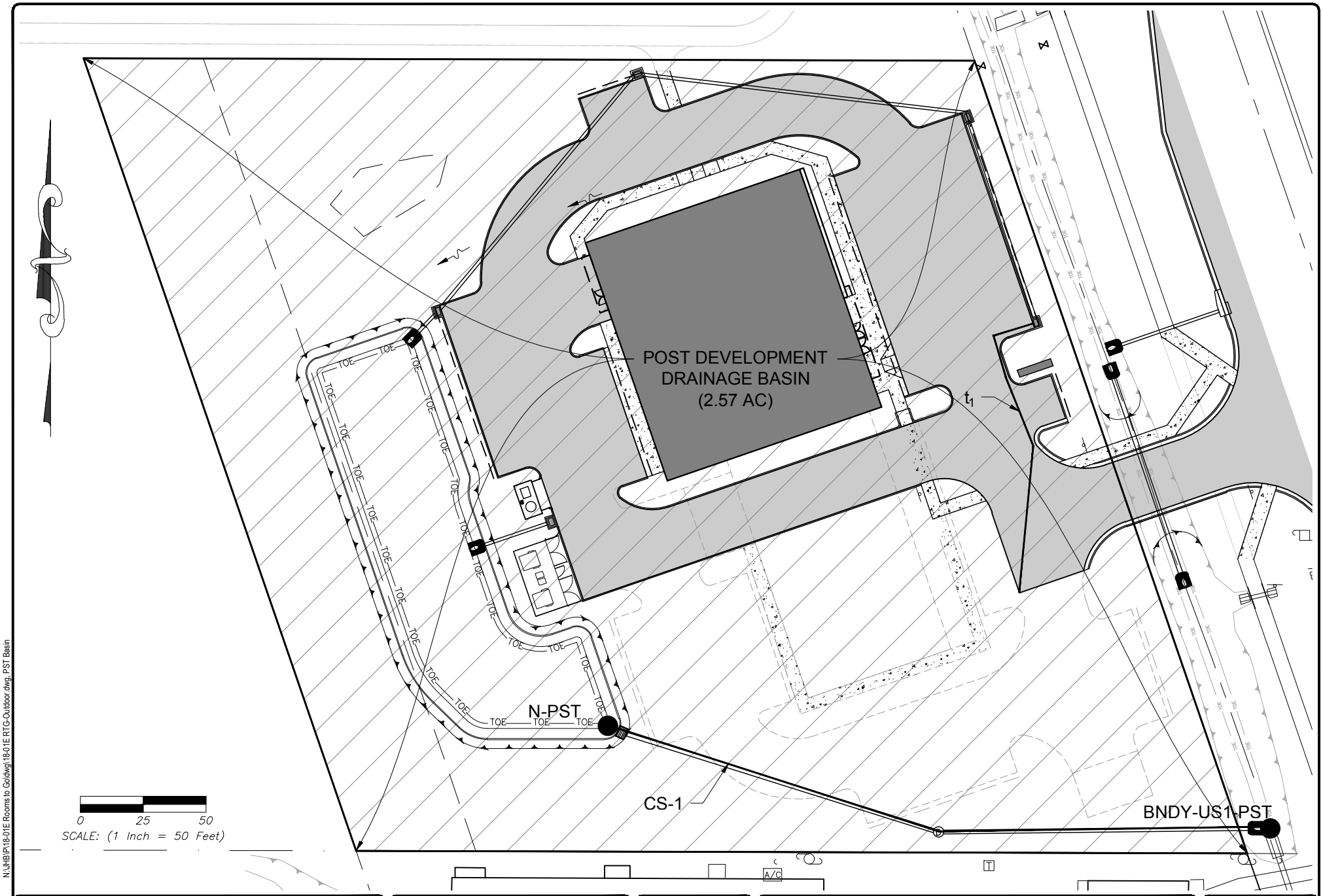
NORMAL WET SEASON WATER TABLE

The Normal Wet Season Water Table is assumed to be 6.5 NAVD'88. Soil borings taken by Professional Service Industries, Inc. on April 23, 2018 indicate that the observed water level was 4.5 to 5 feet below existing ground in the location of the proposed dry retention pond. SFWMD daily historical rainfall data shows that the site received approximately 3" of rainfall in the 72 hours leading up to the borings. Approximately one foot was added to the observed water levels to accommodate for the wet season. Please see Appendix D for the complete soils report.

Test Hole	Est. Ground Elevation	Observed Depth to Water Table (ft)	Observed Water Table Elev.	Est. Wet Season Water Table Elev.
B-9	10.0	4.6' Below Grade	5.4 NAVD'88	6.5 NAVD'88
B-10	10.0	5.2' Below Grade	4.8 NAVD'88	6.5 NAVD'88

HYDRAULIC CONDUCTIVITY TEST RESULTS

The hydraulic conductivity was calculated by Professional Service Industries, Inc. A "Usual Condition Constant Head" percolation test was performed in the location of the proposed dry retention ponds (B-9 borehole). The value obtained from the test (26.7 feet/day) was input into MODRET to perform a recovery analysis. The results of the analysis indicated that the treatment volume will recover in approximately 61 hours. The obtained infiltration rates were also modeled into the overall ICPR model. A summary of the test results can be found in the complete soils report (Appendix D).



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F.B. & PG.	: -

ROOMS TO GO OUTDOOR

1850 NW FEDERAL HWY
STUART, FLORIDA
CPUD AMENDMENT

POST DEVELOPMENT BASIN MAP

SHEET
POST
Dwg. #: - 10

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APPENDIX A

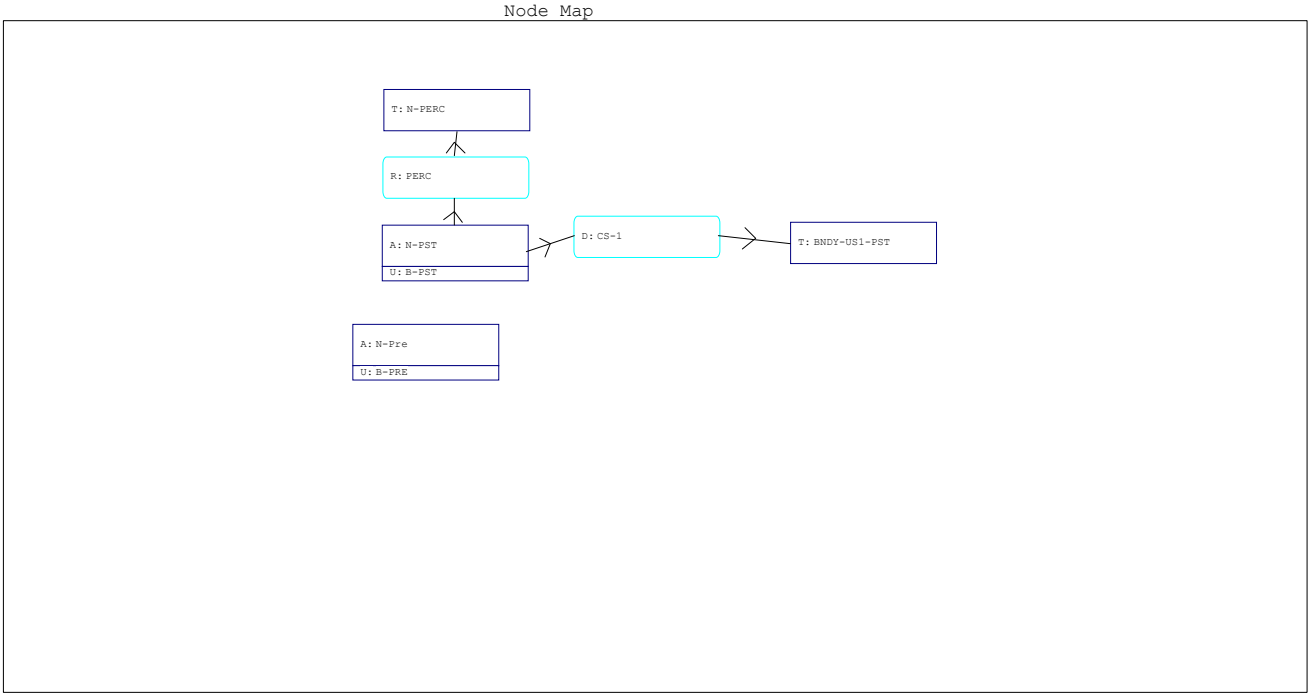
– ICPR HYDROGRAPH, FLOOD ROUTE RESULTS, AND INPUT DATA

Rooms To Go Outdoor
Node Map

Nodes
A Stage/Area
V Stage/Volume
T Time/Stage
M Manhole

Basins
O Overland Flow
U SCS Unit CN
S SBUH CN
Y SCS Unit GA
Z SBUH GA

Links
P Pipe
W Weir
C Channel
D Drop Structure
B Bridge
R Rating Curve
H Breach
E Percolation
F Filter
X Exfil Trench



```
            Basin Name: B-PRE
            Group Name: PRE
            Simulation: 10 YR - 72 Hr
             Node Name: N-Pre
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh256
          Peaking Fator: 256.0
    Spec Time Inc (min): 4.13
    Comp Time Inc (min): 4.13
         Rainfall File: Sfwmd72
   Rainfall Amount (in): 9.200
   Storm Duration (hrs): 72.00
                 Status: Onsite
     Time of Conc (min): 31.00
       Time Shift (hrs): 0.00
              Area (ac): 2.570
   Vol of Unit Hyd (in): 1.000
          Curve Number: 79.000
              DCIA (%): 0.000

        Time Max (hrs): 60.21
        Flow Max (cfs): 5.66
     Runoff Volume (in): 6.631
    Runoff Volume (ft3): 61859


--------------------------------------------------------------------------------

            Basin Name: B-PST
            Group Name: POST
            Simulation: 10 YR - 72 Hr
             Node Name: N-PST
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh323
          Peaking Fator: 323.0
    Spec Time Inc (min): 1.33
    Comp Time Inc (min): 1.33
         Rainfall File: Sfwmd72
   Rainfall Amount (in): 9.200
   Storm Duration (hrs): 72.00
                 Status: Onsite
     Time of Conc (min): 10.00
       Time Shift (hrs): 0.00
              Area (ac): 2.570
   Vol of Unit Hyd (in): 1.001
          Curve Number: 80.850
              DCIA (%): 0.000

        Time Max (hrs): 60.00
        Flow Max (cfs): 10.28
     Runoff Volume (in): 6.866
    Runoff Volume (ft3): 64055


--------------------------------------------------------------------------------

            Basin Name: B-PRE
            Group Name: PRE
            Simulation: 100 YR - 72 Hr
             Node Name: N-Pre
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh256
          Peaking Fator: 256.0
    Spec Time Inc (min): 4.13
    Comp Time Inc (min): 4.13
         Rainfall File: Sfwmd72
   Rainfall Amount (in): 13.000
   Storm Duration (hrs): 72.00
                 Status: Onsite
     Time of Conc (min): 31.00
       Time Shift (hrs): 0.00
              Area (ac): 2.570
   Vol of Unit Hyd (in): 1.000
          Curve Number: 79.000
              DCIA (%): 0.000

        Time Max (hrs): 60.21
        Flow Max (cfs): 8.43
     Runoff Volume (in): 10.272
    Runoff Volume (ft3): 95833


--------------------------------------------------------------------------------

            Basin Name: B-PST
```

```
            Group Name: POST
            Simulation: 100 YR - 72 Hr
             Node Name: N-PST
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh323
          Peaking Fator: 323.0
   Spec Time Inc (min): 1.33
   Comp Time Inc (min): 1.33
          Rainfall File: Sfwmd72
  Rainfall Amount (in): 13.000
  Storm Duration (hrs): 72.00
                Status: Onsite
    Time of Conc (min): 10.00
      Time Shift (hrs): 0.00
             Area (ac): 2.570
  Vol of Unit Hyd (in): 1.001
          Curve Number: 80.850
              DCIA (%): 0.000

         Time Max (hrs): 60.00
        Flow Max (cfs): 15.13
    Runoff Volume (in): 10.539
   Runoff Volume (ft3): 98317


--------------------------------------------------------------------------------

            Basin Name: B-PRE
            Group Name: PRE
            Simulation: 25 YR - 72 Hr
             Node Name: N-Pre
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh256
          Peaking Fator: 256.0
   Spec Time Inc (min): 4.13
   Comp Time Inc (min): 4.13
          Rainfall File: Sfwmd72
  Rainfall Amount (in): 11.000
  Storm Duration (hrs): 72.00
                Status: Onsite
    Time of Conc (min): 31.00
      Time Shift (hrs): 0.00
             Area (ac): 2.570
  Vol of Unit Hyd (in): 1.000
          Curve Number: 79.000
              DCIA (%): 0.000

         Time Max (hrs): 60.21
        Flow Max (cfs): 6.98
    Runoff Volume (in): 8.344
   Runoff Volume (ft3): 77846


--------------------------------------------------------------------------------

            Basin Name: B-PST
            Group Name: POST
            Simulation: 25 YR - 72 Hr
             Node Name: N-PST
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh323
          Peaking Fator: 323.0
   Spec Time Inc (min): 1.33
   Comp Time Inc (min): 1.33
          Rainfall File: Sfwmd72
  Rainfall Amount (in): 11.000
  Storm Duration (hrs): 72.00
                Status: Onsite
    Time of Conc (min): 10.00
      Time Shift (hrs): 0.00
             Area (ac): 2.570
  Vol of Unit Hyd (in): 1.001
          Curve Number: 80.850
              DCIA (%): 0.000

         Time Max (hrs): 60.00
        Flow Max (cfs): 12.58
    Runoff Volume (in): 8.596
   Runoff Volume (ft3): 80196
```

Rooms To Go Outdoor
Node Max Report

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
BNDY-US1-PST	POST	10 YR - 72 Hr	65.00	9.80	12.00	0.0033	0	60.20	4.98	0.00	0.00
N-PERC	PERC	10 YR - 72 Hr	0.00	6.50	10.00	0.0000	0	57.57	0.36	0.00	0.00
N-PST	POST	10 YR - 72 Hr	60.22	11.12	11.50	0.0050	17471	60.00	10.27	60.20	5.34
BNDY-US1-PST	POST	100 YR - 72 Hr	65.00	10.90	12.00	0.0047	0	60.19	5.42	0.00	0.00
N-PERC	PERC	100 YR - 72 Hr	0.00	6.50	10.00	0.0000	0	55.00	0.36	0.00	0.00
N-PST	POST	100 YR - 72 Hr	60.33	11.46	11.50	0.0050	37153	60.00	15.12	60.19	5.77
BNDY-US1-PST	POST	25 YR - 72 Hr	65.00	10.10	12.00	0.0018	0	60.23	5.13	0.00	0.00
N-PERC	PERC	25 YR - 72 Hr	0.00	6.50	10.00	0.0000	0	56.20	0.36	0.00	0.00
N-PST	POST	25 YR - 72 Hr	60.27	11.33	11.50	0.0050	29415	60.00	12.57	60.23	5.49

==========
==== Basins ==========
==========

Name: B-PRE Node: N-Pre Status: Onsite
Group: PRE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
Rainfall File: Sfwmd72 Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 31.00
Area(ac): 2.570 Time Shift(hrs): 0.00
Curve Number: 79.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: B-PST Node: N-PST Status: Onsite
Group: POST Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh323 Peaking Factor: 323.0
Rainfall File: Sfwmd72 Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 10.00
Area(ac): 2.570 Time Shift(hrs): 0.00
Curve Number: 80.85 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

==========
==== Nodes ==========
==========

Name: BNDY-US1-PST Base Flow(cfs): 0.000 Init Stage(ft): 6.500
Group: POST Warn Stage(ft): 12.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	6.500
120.00	6.500

Name: N-PERC Base Flow(cfs): 0.000 Init Stage(ft): 6.500
Group: PERC Warn Stage(ft): 10.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	6.500
120.00	6.500

Name: N-Pre Base Flow(cfs): 0.000 Init Stage(ft): 7.500
Group: PRE Warn Stage(ft): 15.000
Type: Stage/Area

Stage(ft)	Area(ac)
7.500	0.0000
8.000	0.0100
9.000	0.1300
9.500	0.3300
10.000	0.8100
10.500	1.2800
11.000	1.7200
11.500	1.9100
11.700	1.9600

Name: N-PST Base Flow(cfs): 0.000 Init Stage(ft): 8.500
Group: POST Warn Stage(ft): 11.500
Type: Stage/Area

Storage Provided in parking lot for elevations 11.5 and greater

Stage(ft)	Area(ac)
8.500	0.1370
9.000	0.1570
10.000	0.1990

10.100	0.2040
11.000	0.2430
11.500	0.9000
12.000	1.0000

Operating Tables

Name: PERC Group: PERC
Type: Rating Curve
Function: US Stage vs. Discharge

US Stage(ft)	Discharge(cfs)
8.500	0.02
8.567	0.02
8.658	0.02
8.764	0.03
8.891	0.04
9.054	0.05
9.283	0.08
9.675	0.36

Drop Structures

Name: CS-1 From Node: N-PST Length(ft): 261.00
Group: POST To Node: BNDY-US1-PST Count: 1

	UPSTREAM	DOWNSTREAM		
Geometry:	Circular	Circular	Friction Equation:	Automatic
Span(in):	15.00	15.00	Solution Algorithm:	Most Restrictive
Rise(in):	15.00	15.00	Flow:	Both
Invert(ft):	7.700	6.500	Entrance Loss Coef:	0.000
Manning's N:	0.012000	0.012000	Exit Loss Coef:	1.000
Top Clip(in):	0.000	0.000	Outlet Ctrl Spec:	Use dc or tw
Bot Clip(in):	0.000	0.000	Inlet Ctrl Spec:	Use dc
			Solution Incs:	10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

*** Weir 1 of 1 for Drop Structure CS-1 ***

TABLE

Count: 1 Bottom Clip(in): 0.000
Type: Horizontal Top Clip(in): 0.000
Flow: Both Weir Disc Coef: 3.200
Geometry: Rectangular Orifice Disc Coef: 0.600

Span(in): 36.00 Invert(ft): 10.450
Rise(in): 54.00 Control Elev(ft): 10.450

Rating Curves

Name: PERC From Node: N-PST Count: 1
Group: PERC To Node: N-PERC Flow: Both

	TABLE	ELEV ON(ft)	ELEV OFF(ft)
#1:	PERC	8.510	8.500
#2:		0.000	0.000
#3:		0.000	0.000
#4:		0.000	0.000

Hydrology Simulations

Name: 10 YR - 72 Hr
Filename: N:\JHB\P\18-01E Rooms to Go\Calcs\Storm-ICPR\10 YR - 72 Hr.R32

Override Defaults: Yes
Storm Duration(hrs): 72.00
Rainfall File: Sfwmd72
Rainfall Amount(in): 9.20

Time(hrs)	Print Inc(min)
72.000	5.00

Name: 100 YR - 72 Hr
Filename: N:\JHB\P\18-01E Rooms to Go\Calcs\Storm-ICPR\100 YR - 72 Hr.R32

Override Defaults: Yes
Storm Duration(hrs): 72.00
Rainfall File: Sfwmd72
Rainfall Amount(in): 13.00

Time(hrs)	Print Inc(min)
72.000	5.00

Name: 25 YR - 72 Hr
Filename: N:\JHB\P\18-01E Rooms to Go\Calcs\Storm-ICPR\25 YR - 72 Hr.R32

Override Defaults: Yes
Storm Duration(hrs): 72.00
Rainfall File: Sfwmd72
Rainfall Amount(in): 11.00

Time(hrs)	Print Inc(min)
72.000	5.00

==========
==== Routing Simulations ==========
==========

Name: 10 YR - 72 Hr Hydrology Sim: 10 YR - 72 Hr
Filename: N:\JHB\P\18-01E Rooms to Go\Calcs\Storm-ICPR\10 YR - 72 Hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 120.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: 10 YR - 72 Hr Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes
PERC	Yes
POST	Yes
PRE	Yes

Name: 100 YR - 72 Hr Hydrology Sim: 100 YR - 72 Hr
Filename: N:\JHB\P\18-01E Rooms to Go\Calcs\Storm-ICPR\100 YR - 72 Hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 120.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: 100 YR - 72 Hr Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes
PERC	Yes
POST	Yes
PRE	Yes

Name: 25 YR - 72 Hr Hydrology Sim: 25 YR - 72 Hr
Filename: N:\JHB\P\18-01E Rooms to Go\Calcs\Storm-ICPR\25 YR - 72 Hr.I32

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 120.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: 25 YR - 72 Hr Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	60.000

Group	Run
BASE	Yes
PERC	Yes
POST	Yes
PRE	Yes

Boundary Conditions

Name: 10 YR - 72 Hr Node: BNDY-US1-PST Type: Stage

Time(hrs)	Stage(ft)
0.000	6.500
10.000	6.600
20.000	6.800
30.000	7.000
40.000	7.200
50.000	7.500
60.000	9.500
65.000	9.800
70.000	9.400
80.000	8.500
90.000	8.000
100.000	7.500
110.000	7.000
120.000	6.500

Name: 25 YR - 72 Hr Node: BNDY-US1-PST Type: Stage

Time(hrs)	Stage(ft)
0.000	6.500
10.000	6.700
20.000	6.900
30.000	7.200
40.000	7.500
50.000	8.500
60.000	9.600
65.000	10.100
70.000	9.800
80.000	9.200
90.000	8.500
100.000	8.000
110.000	7.500
120.000	7.000

Name: 100 YR - 72 Hr Node: BNDY-US1-PST Type: Stage

Time(hrs)	Stage(ft)
0.000	6.500
10.000	6.800
20.000	7.200
30.000	7.500
40.000	8.000
50.000	8.500
60.000	9.500
65.000	10.900
70.000	10.500
80.000	9.800
90.000	9.000
100.000	8.500
110.000	8.000
120.000	7.500

APPENDIX B

– POLLUTANT LOADING ANALYSIS – BMPTRAINS MODEL

WATERSHED CHARACTERISTICS V 8.6

GO TO STORMWATER TREATMENT ANALYSIS

Blue Numbers = Input data | Red Numbers = Calculated | LAND USES/EMC

SELECT CATCHMENT CONFIGURATION 8/24/2018

CLICK ON CELL BELOW TO SELECT CONFIGURATION: A - Single Catchment

VIEW CATCHMENT CONFIGURATION

COMINGLING | MULTI-LAND USE

GO TO GENERAL SITE INFORMATION PAGE

For comingling, the off-site catchment must be upstream. The delay is only for retention BMPs and must be used in hours as measured by the time of concentration at a one inch/hour rain

VIEW AVERAGE ANNUAL

VIEW EMC & FLUCCS

GO TO GIS LANDUSE DATA

CATCHMENT NO.1

Delay [hrs] | CATCHMENT NO.1 NAME: Basin 1

max delay = 15 hrs.

Pre-development land use:	CLICK ON CELL BELOW TO SELECT: Undeveloped - Ruderal/Upland Pine: TN=1.694 TP=0.162
with default EMCs	
Post-development land use:	CLICK ON CELL BELOW TO SELECT: High-Intensity Commercial: TN=2.40 TP=0.345
with default EMCs	

Total pre-development catchment area:	2.570	AC
Total post-development catchment or for BMP analysis:	2.570	AC
Pre-development Non DCIA CN:	79.00	
Pre-development DCIA percentage:	0.00	%
Post-development Non DCIA CN:	49.00	
Post-development DCIA percentage:	65.00	%
Estimated BMP Area (No loading from this area)	0.243	AC

OVERWRITE DEFAULT CONCENTRATIONS USING:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

Average annual pre runoff volume:	1.826	ac-ft/year
Average annual post runoff volume (note no BMP area):	5.929	ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**	3.815	kg/year
Pre-development Annual Mass Loading - **Phosphorus:**	0.365	kg/year
Post-development Annual Mass Loading - **Nitrogen:**	17.549	kg/year
Post-development Annual Mass Loading - **Phosphorus:**	2.523	kg/year

CATCHMENT NO.2

CATCHMENT NO.2 NAME:

Pre-development land use:	CLICK ON CELL BELOW TO SELECT
with default EMCs	
Post-development land use:	CLICK ON CELL BELOW TO SELECT
with default EMCs	

Total pre-development catchment area:		AC
Total post-development catchment or BMP analysis area:		AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:		
Post-development DCIA percentage:		%
Estimated BMP Area (No loading from this area)		AC

OVERWRITE DEFAULT CONCENTRATIONS:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):		ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**		kg/year
Post-development Annual Mass Loading - **Phosphorus:**		kg/year

CATCHMENT NO.3

CATCHMENT NO.3 NAME:

Pre-development land use:	CLICK ON CELL BELOW TO SELECT
with default EMCs	
Post-development land use:	CLICK ON CELL BELOW TO SELECT
with default EMCs	

Total pre-development catchment area:		AC
Total post-development catchment or BMP analysis area:		AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:		
Post-development DCIA percentage:		%
Estimated BMP Area (no loading from this area)		AC

OVERWRITE DEFAULT CONCENTRATIONS:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):		ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**		kg/year
Post-development Annual Mass Loading - **Phosphorus:**		kg/year

CATCHMENT NO.4

CATCHMENT NO.4 NAME:

Pre-development land use:	CLICK ON CELL BELOW TO SELECT
with default EMCs	
Post-development land use:	CLICK ON CELL BELOW TO SELECT
with default EMCs	

Total pre-development catchment area:		AC
Total post-development catchment or BMP analysis area:		AC
Pre-development Non DCIA CN:		
Pre-development DCIA percentage:		%
Post-development Non DCIA CN:		
Post-development DCIA percentage:		%
Estimated BMP Area (no loading from this area)		AC

OVERWRITE DEFAULT CONCENTRATIONS:

	PRE:		POST:	
EMC(N):		mg/L		mg/L
EMC(P):		mg/L		mg/L

USE DEFAULT CONCENTRATIONS

Average annual pre runoff volume:		ac-ft/year
Average annual post runoff volume (note no BMP area):		ac-ft/year
Pre-development Annual Mass Loading - **Nitrogen:**		kg/year
Pre-development Annual Mass Loading - **Phosphorus:**		kg/year
Post-development Annual Mass Loading - **Nitrogen:**		kg/year
Post-development Annual Mass Loading - **Phosphorus:**		kg/year

RETENTION BASIN: 8/24/2018 V 8.6

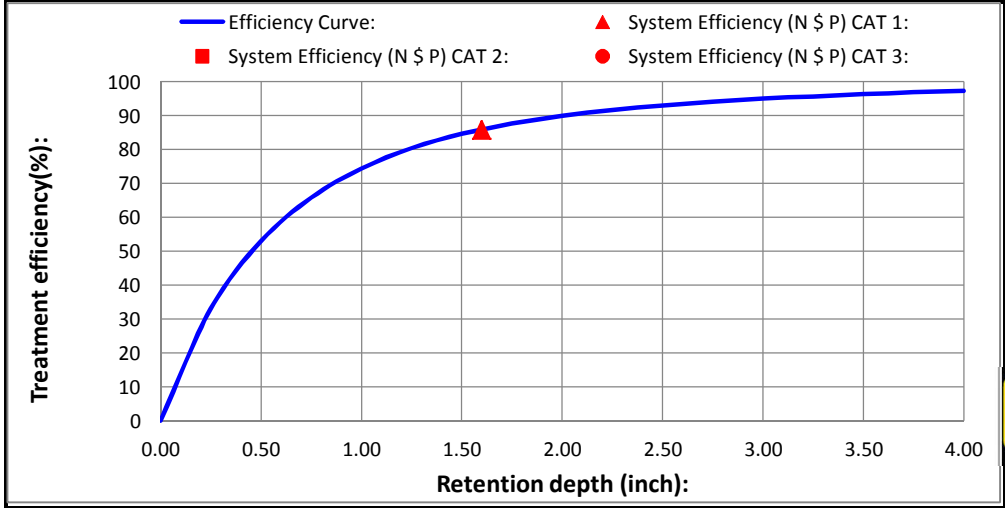
RETENTION BASIN SERVING: Rooms To Go

Loadings from BMP area are contained by the BMP, thus no BMP area load.

	Basin 1	Catchment 2	Catchment 3	Catchment 4	
Watershed area cotributing to basin:	2.327	0.000	0.000	0.000	ac
Required Treatment Eff (**Nitrogen**):	78.259				%
Required Treatment Eff (**Phosphorus**):	85.536				%
Required retention depth over the watershed to meet required efficiency:	1.588	0.000	0.000	0.000	in
Required water quality retention volume:	0.308	0.000	0.000	0.000	ac-ft

RETENTION BASIN FOR MULTIPLE TREATMENT SYSTEMS (if there is a need for additional removal efficiencies in a series of BMPs):

Retention volume based on retention depth and Total area - BMP area	0.310	0.000	0.000	0.000	ac-ft
Provided retention depth (0.1-3.99 inches over the watershed)	1.600				in
Provided treatment efficiency (**Nitrogen**):	85.680	0.000	0.000	0.000	%
Provided treatment efficiency (**Phosphorus**):	85.680	0.000	0.000	0.000	%
Remaining treatment efficiency (**Nitrogen**):	0.000				%
Remaining treatment efficiency (**Phosphorus**):	0.000				%
Remaining retention depth needed:	0.000	0.000	0.000	0.000	in



NOTE FOR TREATMENT EFFICIENCY GRAPH:

The purpose of this graph is to help illustrate the treatment efficiency of the retention system as the function of retention depth **for a single BMP and in a single catchment**. The graph illustrates that there is a diminished return as the retention depth is increased. Thus evaluations of other alternatives in "treatment trains" and compensatory treatment should be considered. **NOTE:** the retention volume can not exceed 3.99 inches to be within the range of data used to determine effectiveness.

HELP - EXAMPLE PROBLEM 3

View Media Mixes

Estimate of groundwater impacts	Catchment 1	Catchment 2	Catchment 3	Catchment 4
Use only down flow media mix before water enters the ground, specify type				
Nitrogen mass reduction in groundwater discharge (%)				
Phosphorus mass reduction in groundwater discharge (%)				

CATCHMENTS AND TREATMENT SURFACE DISCHARGE SUMMARY V 8.6

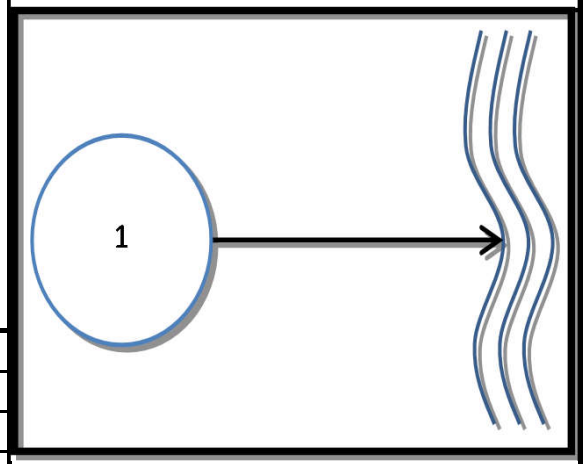
CALCULATION METHODS:

1. The effectiveness of each BMP in a single catchment is converted to an equivalent capture volume.
2. Certain BMP treatment train combinations have not been evaluated and in practice they are at this time not used, an example is a greenroof following a tree well.
3. Wet detention is last when used in a single catchment with other BMPs, except when followed by filtration

PROJECT TITLE	Rooms To Go	Optional Identification		
	Basin 1	Catchment 2	Catchment 3	Catchment 4
BMP Name	Retention Basin			
BMP Name				
BMP Name				

Surface Water Discharge Summary Performance of Entire Watershed

Catchment Configuration	A - Single Catchment		8/24/2018
Nitrogen Pre Load (kg/yr)	3.82	Treatment Objectives or Target for TN MET TP MET	BMPTRAINS MODEL
Phosphorus Pre Load (kg/yr)	0.36		
Nitrogen Post Load (kg/yr)	17.55		
Phosphorus Post Load (kg/yr)	2.52		
Target Load Reduction (N) %	78		
Target Load Reduction (P) %	86		
Target Discharge Load, N (kg/yr)	3.86		
Target Discharge Load, P (kg/yr)	0.35		
Provided Overall Efficiency, N (%):	86		
Provided Overall Efficiency, P (%):	86		
Discharged Load, N (kg/yr & lb/yr):	2.51	5.54	
Discharged Load, P (kg/yr & lb/yr):	0.36	0.80	
Load Removed, N (kg/yr & lb/yr):	15.04	33.12	
Load Removed, P (kg/yr & lb/yr):	2.16	4.76	



APPENDIX C
– MODRET INPUT DATA AND RESULTS

MODRET

SUMMARY OF UNSATURATED & SATURATED INPUT PARAMETERS

PROJECT NAME : Rooms To Go Outdoor
POLLUTION VOLUME RUNOFF DATA USED
UNSATURATED ANALYSIS INCLUDED

Pond Bottom Area	5,987.00 ft²
Pond Volume between Bottom & DHWL	15,078.00 ft³
Pond Length to Width Ratio (L/W)	3.20
Elevation of Effective Aquifer Base	2.50 ft
Elevation of Seasonal High Groundwater Table	6.50 ft
Elevation of Starting Water Level	8.50 ft
Elevation of Pond Bottom	8.50 ft
Design High Water Level Elevation	10.45 ft
Avg. Effective Storage Coefficient of Soil for Unsaturated Analysis	0.20
Unsaturated Vertical Hydraulic Conductivity	17.80 ft/d
Factor of Safety	2.00
Saturated Horizontal Hydraulic Conductivity	26.70 ft/d
Avg. Effective Storage Coefficient of Soil for Saturated Analysis	0.20
Avg. Effective Storage Coefficient of Pond/Exfiltration Trench	1.00

Hydraulic Control Features:

	Top	Bottom	Left	Right
Groundwater Control Features - Y/N	N	N	N	N
Distance to Edge of Pond	0.00	0.00	0.00	0.00
Elevation of Water Level	0.00	0.00	0.00	0.00
Impervious Barrier - Y/N	N	N	N	N
Elevation of Barrier Bottom	0.00	0.00	0.00	0.00

MODRET

TIME - RUNOFF INPUT DATA

PROJECT NAME: ROOMS TO GO OUTDOOR

STRESS PERIOD NUMBER	INCREMENT OF TIME (hrs)	VOLUME OF RUNOFF (ft^3)
Unsat	1.08	2,394.80
1	1.00	9,832.20
2	8.74	0.00
3	8.74	0.00
4	8.74	0.00
5	8.74	0.00
6	8.74	0.00
7	8.74	0.00
8	8.74	0.00
9	8.74	0.00

MODRET

SUMMARY OF RESULTS

PROJECT NAME : Rooms To Go Outdoor

CUMULATIVE TIME (hrs)	WATER ELEVATION (feet)	INSTANTANEOUS INFILTRATION RATE (cfs)	AVERAGE INFILTRATION RATE (cfs)	CUMULATIVE OVERFLOW (ft^3)
00.00 - 0.00	6.500	0.000 *		
			0.00000	
0.00	6.500	0.48184		
			0.41970	
2.08	9.675	0.35757		0.00
			0.09632	
10.82	9.283	0.07631		0.00
			0.05630	
19.56	9.054	0.04815		0.00
			0.04000	
28.30	8.891	0.03569		0.00
			0.03139	
37.04	8.764	0.02870		0.00
			0.02601	
45.78	8.658	0.02415		0.00
			0.02229	
54.52	8.567	0.02091		0.00
			0.01953	
61.89	8.500	0.01847		0.00
			0.01740	
72.00	8.417			0.00

Maximum Water Elevation: 9.675 feet @ 2.08 hours Recovery @ 61.894 hours

* Time increment when there is no runoff

Maximum Infiltration Rate: 4.690 ft/day

APPENDIX D
– SOIL REPORT

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

For:

PROPOSED ROOMS TO GO STORE
1850 NW FEDERAL HIGHWAY
STUART, FLORIDA

Prepared for:

SEAMAN DEVELOPMENT CORPORATION
400 PERIMETER CENTER TER
SUITE 800
ATLANTA, GEORGIA 30346

Prepared by:

PROFESSIONAL SERVICE INDUSTRIES, INC.
2000 AVENUE P, SUITE 16
RIVIERA BEACH, FLORIDA, 33404

PSI PROJECT NO. 0772-803

April 25, 2018

2000 Avenue P, Suite 16
Riviera Beach, FL 33404
phone: 561.844.2404
fax: 561.844.2474
intertek.com/building
psiusa.com

April 25, 2018

SEAMAN DEVELOPMENT CORPORATION
400 Perimeter Center Terrace, Suite 800
Atlanta, GA 30346

Attention: Mr. Jeffrey Finkel
Senior Vice President

Re: Report of Geotechnical Engineering Services
Proposed Rooms to Go Store
1850 NW Federal Highway
Stuart, Florida | PSI Project No.: 0772-803

Dear Mr. Finkel:

Professional Service Industries, Inc. (PSI), an Intertek Company, has completed a geotechnical engineering study in connection with the above-referenced project. Our services were provided in general accordance with PSI Proposal No. 0772-238147, dated March 8, 2018. This report provides an overview of the work completed by us in connection with the study and recommendations for use in site preparation, foundation design and pavement design.

We trust this report is adequate for your current needs; however, should you have any questions or should additional information be required, please do not hesitate to contact our office at (561) 844-2404.

Respectfully Submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Certificate of Authorization No. 3684



Morgan Dickinson, P.E.
Regional Engineer/Principal Consultant
FL License No. 37557

Jonathan D. Klevan, EI
Branch Manager

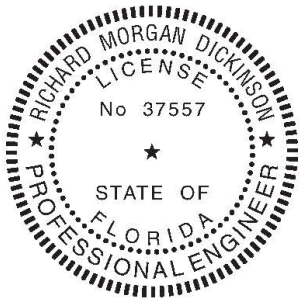


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APPENDIX

Figure 1: Site Vicinity Map
Figure 2: Boring Location Plan
Boring Logs

1.0 PROJECT INFORMATION

1.1 GENERAL

The proposed project consists of the design and construction of a single-story furniture store at 1850 NW Federal Highway in Stuart, Florida.

The scope of services for this project included the completion of a subsurface investigation, laboratory testing program and geotechnical engineering analysis. This report summarizes the results of the work performed and provides updated recommendations regarding foundation design, soil strength conditions and general site preparation criteria.

1.2 SITE DESCRIPTION

The proposed project site is located in an area with a mix of residential and commercial developments, specifically at 1850 NW Federal Highway in Stuart, Florida. At the time of our subsurface investigation of April 2018, the property was undeveloped, densely vegetated and with generally flat topography. Overhead power lines run in a general northwest-southeast direction along Northwest Federal Highway. A site vicinity map identifying the project location with respect to existing streets and features is presented as **Figure 1** of the **Appendix.** The boring locations were accessible with a truck mounted rig after clearing a path for the rig.

1.3 PROPOSED CONSTRUCTION

Based on the information provided, we understand the proposed single-story furniture store will be approximately 14,000 square feet in plan dimension. Associated paved parking/driveway areas will also be part of the project. We assume the proposed structure will consist of slab-on-grade construction with column and wall loads not exceeding 75 kips and 3 kips per lineal feet, respectively. We also assume that site grades will not change by more than 2 feet.

If any of the noted information is incorrect or has changed, please notify PSI so that we may amend the recommendations presented in this report, if appropriate.

2.0 FIELD EXPLORATION AND SUBSURFACE CONDITIONS

2.1 STANDARD PENETRATION TEST (SPT) BORINGS

To evaluate the soil conditions within the subject property, we drilled and sampled a total of ten (10) Standard Penetration Test (SPT) borings; five (5) to depths of approximately 30 feet and five (5) to depths of approximately 10 feet. Please note all boring depths refer to depths below existing site grades at the time of our subsurface investigation. The approximate locations at which the SPT borings were drilled are shown on **Figure 2** of the **Appendix**.

After seating the sample spoon six inches, the number of successive blows required to drive the sampler twelve inches into the soil constitutes the test result commonly referred to as the "N" value. The “N” value has been empirically correlated with various soil properties and is considered to be indicative of the relative density of cohesionless soils and the consistency of cohesive materials. The SPT borings were performed using a CME-55 truck mounted drill rig, which was equipped with an automatic hammer. The recovered split spoon samples were visually classified in the field and transported to the laboratory for further review. Following completion of our field services, the boreholes were backfilled with excavated soil.

2.2 SUBSURFACE CONDITIONS

Our interpretation of the subsurface conditions is based upon ten (10) SPT borings drilled in April 2018 at the approximate locations shown on **Figure 2** of the **Appendix**. The following discussion is general; for more specific information, please refer to the boring logs in the **Appendix.** It should be noted that the stratification lines shown on the boring logs indicate approximate transitions between soil types based on visual observation of the recovered soil samples and the interpretation of the field logs by a geotechnical engineer. In situ stratification changes could occur gradually or at different depths. Included with the logs are the N-values and groundwater levels measured at the time the borings were drilled. Please note that all SPT boring depths discussed below refer to depths below site grades at the time of our field exploration of April 2018.

The SPT borings were drilled in areas with exposed granular soils. In general, a stratum of gray, very loose to loose fine to medium grained sand (SP) with roots extends from the ground surface to depths of about 2 to 3 feet. Dark brown to brown, medium dense to very loose, fine to medium grained sand (SP), with scattered slightly silty (SM) zones was encountered below the upper sandy stratum and extends to depths of approximately 12 feet. Various shades of brown and/or gray, loose to medium dense, fine to medium grained sand (SP) was generally encountered below depths of approximately 12 feet and extends to the maximum boring termination depths of approximately 30 feet.

2.3 GROUNDWATER CONDITIONS

The groundwater table was observed in all SPT borings at depths ranging from approximately 2.7 to 7.3 feet below existing grade at the time of drilling (April 2018). It should be noted that groundwater levels fluctuate seasonally in response to rainfall and the infiltration rate of the soil. Therefore, at a time of year different from the time of drilling, there is a possibility of a change in the recorded levels.

We recommend that the contractor determine the actual groundwater levels at the time of construction to assess groundwater impact on the construction procedure. Please refer to the individual boring logs presented in the **Appendix** for details on the groundwater conditions observed at the specific exploration locations.

3.0 LABORATORY TESTING

The soil samples recovered from the borings were visually reviewed in the laboratory by a geotechnical engineer to confirm the field classifications. The samples were classified using the Unified Soil Classification System (USCS) in general accordance with the American Society of Testing and Materials (ASTM) test designation D2487. The soil classification was based on visual observations.

4.0 FOUNDATION RECOMMENDATIONS

4.1 SHALLOW FOUNDATIONS

Provided that the site preparation procedures noted in **Section 5.0** of this report are followed, the proposed structure can be supported on shallow foundations that are designed using a maximum net allowable bearing pressure of 2,500 pounds per square foot (psf) bearing on compacted structural fill or on compacted existing granular soils.

The bottom of the footings should be at least 12 inches below the finished exterior grade in accordance with the Florida Building Code (FBC). We further recommend that the footings supporting isolated columns have a minimum width of 36 inches and that continuous footings have a minimum width of at least 18 inches, even if those dimensions produce a bearing pressure less than the allowable. The purpose of limiting the minimum footing size is to prevent a "punching" shear failure and to reduce the possibility of bearing on an isolated weak zone.

Foundations subject to transient lateral loads will resist these forces through a combination of base shearing resistance mobilized at the footing-subgrade interface and earth pressure acting on the vertical faces of the footings at right angles to the direction of applied load. Base shearing resistance may be determined using a friction factor of 0.55.

Passive earth pressure resistance should be computed using an equivalent fluid pressure of 180 pounds per square foot per foot of depth, for granular backfill material. Resistance to sliding determined in accordance with the noted parameters should be considered ultimate resistance. Accordingly, the design for sliding resistance should include a factor of safety. We recommend that a factor of safety of at least 1.5 be used.

To calculate the resistance of a footing to uplift forces, a prismatic failure block with vertical faces should be assumed above the footing base. The resisting forces will be provided by the combination of footing weight, overburden soil weight in the failure block, and shearing resistance along the faces of the soil block. The weight of the soil above the water table should be taken as 105 pounds per cubic foot (pcf). For submerged soil, a buoyant weight of 43 pcf should be used. The factor of safety against uplift should not be less than 1.5.

The amount of settlement of a structure founded on top of granular soils is primarily governed by the elastic compressibility of the material, the size and depth of its foundations, and the pressure imposed on the supporting materials by the foundations. Based on the field test data obtained, our experience with similar structures and empirical relationships for bearing capacity and settlement, we have estimated that the maximum total settlement of the foundations will be less than one inch. Differential settlement, between adjacent foundations, should be approximately one-half of the total settlement movement.

The compacted natural granular soils or compacted structural fill material that will provide support to the foundations have very low compressibility characteristics and any settlement due to pressure applied by the foundations is likely to occur almost immediately upon application of the loads. In this case, nearly all of the settlement of the structure foundations due to dead loads is expected to take place during construction. The portion of the settlement due to the live load of the building will generally take place soon after the first application of this load. Our settlement estimates are contingent upon subgrade preparation being carried out as recommended herein.

Total and differential settlements of the noted magnitudes are usually considered tolerable for the anticipated construction; however, the tolerance of the proposed structure to the predicted total and differential settlements should be confirmed by the structural engineer/architect. Additionally, our settlement estimates are based on the foundation loads being on the order of magnitude noted earlier in **Section 1.0** of this report.

4.2 GROUND FLOOR SLAB

Slab-on-grade construction may be employed for the floor of the proposed building. We recommend that the procedures described in **Section 5.0** of this report be used to prepare the floor slab subgrade. Ground floor slabs can bear directly on top of compacted structural fill material. A modulus of subgrade reaction value of 150 pounds per cubic inch (pci) may be used for design.

To avoid potential moisture problems, we recommend that floor slab subgrade soils be covered with a vapor barrier (such as visqueen, normally 6 mil thick) prior to constructing the slab-on-grade floors. The floor slabs should be reinforced to make them as rigid as practical. Proper joints should be provided at the junctions of the slabs and foundation system so that a small amount of independent movement can occur without causing structural damage. An ultimate friction factor of 0.21 should be used for the vapor barrier-soil interface with an appropriate factor of safety.

5.0 SITE PREPARATION

5.1 GENERAL

Based on the results of our field exploration, we anticipate site preparation procedures to include the steps listed below. All work should be carried out in accordance with current regulatory criteria. The earthwork and testing required herein should be performed under the supervision of PSI personnel.

1. Site preparation for the proposed development should include the clearing and stripping of the site. All existing trees and associated root mass should be completely removed from the footprint of the proposed structure prior to construction. All unwanted ground cover or other unsuitable materials should be completely removed from the site and properly disposed of.

2. The location of any existing conflicting underground utility lines within the construction area should be established. Provisions should be made to relocate any interfering utility lines within the construction area. Abandoned utilities should be removed or grouted to reduce the possibility of subsurface erosion that could result in future settlement.

3. The cleared exposed subgrade should be densified as specified in **Section 5.2.** Densification of the soils should be performed within the proposed development areas plus a 5-foot wide perimeter extending beyond the outside edges, where practical. Densification operations should continue until the subgrade soils are firm and unyielding.

4. Any fill required to raise grades should conform to the recommendations in **Section 5.3** of the report.

5. It is mandated by federal regulations that all excavations, whether they be utility trenches, footings/pile caps excavations, be constructed in accordance with the 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.

5.2 IN-SITU DENSIFICATION

Following initial site preparation and clearing activities, in-situ densification of the subgrade soils should be performed in the proposed development areas plus a five-foot-wide perimeter extending beyond the outside edges of the construction areas, where practical. Densification should be accomplished with a self-propelled vibratory roller which imparts a dynamic force of not less than 40,000 pounds. To minimize the effects of compaction induced vibrations on adjacent existing structures, the compaction operations should be limited to a distance not closer than 25 feet from existing structures (subject to field adjustment as necessary).

The maximum drum roller weight to be used between 5 to 25 feet from existing structures should be limited to 4 tons. For distances of less than 5 feet, a walk behind vibratory sled or roller should be used. Compaction of the bearing surface using this equipment should continue until no further vertical settlement of that surface is visually discernible. Any area of the exposed surface that deflects excessively under the weight of the compaction equipment should be excavated approximately 24 inches and replaced with compacted structural fill.

Density control should be exercised in the upper 12 inches of the compacted subgrade. Soils in this interval should be compacted to at least 95 percent of the Modified Proctor maximum dry density determined per ASTM D-1557. Frequent wetting of the subgrade may be necessary during the rolling operations to prevent drying and loosening of the upper 6 to 12 inches of soil.

5.3 STRUCTURAL FILL AND BACKFILL

Structural fill should be free of organic matter and consist of granular material containing less than 12 percent passing by dry weight the U.S. Standard No. 200 mesh sieve. The fill material may be composed of either clean sands and/or limerock. The fill material should have no particle size in excess of three inches and have a Unified Soil Classification System (USCS) designation of GP, GW, GP-GM, GW-GM, SP, SW, SP-SM or SW-SM.

Structural fill should be placed in level lifts not exceeding 12 inches in loose thickness. Each lift should be compacted to at least 95 percent of the Modified Proctor maximum dry density near the optimum moisture content as determined by ASTM D-1557. Fill to be compacted with a vibratory plate tamper or a small walk behind vibratory roller should be placed in lifts not exceeding six inches in loose thickness.

In place density tests should be performed by a qualified soils technician working under the supervision of a geotechnical engineer in accordance with appropriate ASTM procedures. Any fill indicating less than the recommended relative compaction should be recompacted until the required density is obtained prior to the placement of subsequent fill lifts or pouring concrete for substructures.

Structural fill or backfill placed below the water table and to a height of one foot above it should consist of a combination of FDOT No. 57 Stone and structural fill material mixed in an approximate 50% proportion by volume. Density testing will not be required within this layer; however, the subgrade preparation work should be observed by a representative from our office to confirm that the material is in a stable and unyielding condition.

The use of a commercially available fill material by the name “Cyclone Sand” should not be permitted for the project. Cyclone sand contains large amounts of fines and is therefore very sensitive to moisture. The moisture sensitivity of the material makes it difficult to compact and achieve the desired densities.

5.4 GROUNDWATER CONTROL

Groundwater control may be required for construction excavations at this site for either excavation dewatering or removal of temporarily perched water from a rain event, such water can be controlled by pumping from sumps located in ditches or pits. Groundwater should be maintained at the following levels:

1. At least one foot below the bottom of any excavation made during construction operations and
2. At least two feet below the surface of any vibratory compaction operations.

Dewatering with well points might be used for deeper excavations or when required to facilitate construction. Dewatering systems should be designed and operated so as not to impact adjacent construction. Additionally, the discharge from dewatering systems should be handled in accordance with current regulatory criteria as related to the same. The dewatering systems shall be evaluated and designed by a specialty dewatering contractor.

5.5 FOUNDATION CONSTRUCTION FOR SHALLOW FOOTINGS

1. Very loose to loose soils were encountered at the expected footing bearing elevations. If encountered during construction, we recommend that very loose soils be undercut and replaced with FDOT No. 57 Stone compacted to at least 95 percent of the Modified Proctor maximum dry density.

2. Soils exposed at the bottom of the footing excavations should be compacted to at least 95 percent of the Modified Proctor maximum dry density just before pouring concrete. If the footing bearing materials become disturbed due to surface water resulting from precipitation and runoff, the disturbed soils should be overexcavated and replaced with compacted limerock which is densified to at least 95 percent of the materials Modified Proctor maximum dry density as determined by ASTM designation D-1557.

3. If groundwater impacts the replacement filling procedures at the footing locations, then we recommend that the fill material used both below the water table and to a height of one foot above it consist of a combination of FDOT No. 57 Stone and structural fill material mixed in an approximate 50% proportion by weight. Density testing will not be required within this layer, however the subgrade preparation work should be observed by a representative from our office to confirm that it is in a stable and unyielding condition.

4. All open foundation excavations should be observed and approved by a licensed geotechnical engineer or his representative prior to pouring concrete.

5.6 PIPE BEDDING MATERIAL RECOMMENDATIONS

We assume that the invert elevations of the proposed utility pipelines will range between approximately 3 to 10 feet below grade. The granular soils encountered between these depths are expected to provide adequate support for utility pipelines without the need for bedding when the invert elevations are at least 24 inches above groundwater levels (natural or pre-drained by dewatering). In the event that very loose sands, organics and/or other deleterious materials be encountered at or below the pipe invert elevations, these materials should be undercut and replaced with well compacted structural fill material conforming to the specification of **Section 5.3** of this report. The bedding surface should be uniformly compacted to at least 95 percent of the Modified Proctor maximum dry density determined per ASTM D-1557.

Alternatively, 6 to 12 inches of FDOT No. 57 Stone (gravel) may be placed below the pipe invert elevations as bedding material. When utilizing FDOT No. 57 stone for pipe bedding, sufficient sand should be used to fill the voids created by the gravel material.

6.0 PAVEMENT SECTION RECOMMENDATIONS

As previously stated in **Section 2.2** of this report, very loose soils were encountered at shallow depths. If encountered during the construction of pavements, we recommend that very loose soils be undercut at least 2 feet and replaced with well compacted structural fill following the recommendations and procedures described in **Section 5.0** of this report. Flexible pavement sections in this geographic area typically consist of an asphaltic concrete wearing course, a limerock base course and a stabilized subgrade (sub-base). Based on the expected traffic loading and our experience in the area, the typical pavement section thicknesses noted in **Table A** should be acceptable.

TABLE A: TYPICAL PAVEMENT SECTION SUGGESTIONS

Type of Pavement	Layer	Material Description	Layer Thickness (inches)	
			Light Duty	Medium Duty
Flexible	(A)	Florida DOT Asphalt Type S	1.5	2.5
	(B)	Crushed limerock with minimum LBR of 100, compacted to 98% of the Modified Proctor maximum dry density	6.0	8.0
	(SB)	Stabilized sub-grade (sub-base) fill with a minimum LBR of 40 compacted to 95% of the Modified Proctor maximum dry density	12.0	12.0
Rigid	(C)	Florida DOT Portland Cement Concrete	5.0	6.0
	(SB)	Stabilized sub-base compacted to 95% of the Modified Proctor maximum dry density	12.0	12.0
(A) = Asphaltic Concrete, (B) = Base Course, (SB) = Stabilized Sub-grade (Sub-base) (C) = Concrete				

The base course materials in the pavements should consist of crushed limerock having a minimum Limerock Bearing Ratio (LBR) of 100. Base materials should meet the requirements presented in the latest revisions of the Florida Department of Transportation "Specifications for Road and Bridge Construction", Section 911 (limestone). The base course should be compacted to at least 98 percent of the material's maximum dry density (ASTM D-1557). The subgrade should be stabilized to a depth of 12 inches to achieve a minimum LBR of 40. This can be obtained by blending base material (limerock) with the existing subgrade soils. The required mixing ratio should be determined by laboratory testing. The stabilized subgrade should be compacted to at least 95 percent of the maximum dry density (ASTM D-1557). The LBR requirement for the subgrade soils is only required for the "flexible" pavement section.

Where dumpsters are to be parked on the pavement, so that considerable load is transferred from relatively small steel supports, it is recommended that rigid concrete pavement be constructed. In addition, the area utilized for unloading the dumpsters by heavy duty-trucks should also be provided with a rigid pavement. A minimum Portland cement concrete pavement thickness of 5 inches should be used in parking areas (light duty) and 6 inches in loading areas (medium duty), if rigid pavements are to be employed. The subgrade soils below concrete pavements should be compacted to a minimum density of 95% of the modified Proctor maximum dry density (ASTM D-1557). Fill that may be required to raise grades in pavement areas should be compacted to at least 95 percent of the material's maximum dry density (ASTM D-1557).

Actual pavement section thicknesses and the reinforcement details for the rigid pavement section should be provided by the Design Civil Engineer based on traffic loads, volume, and the owner's design life requirements. The noted sections represent minimum thicknesses for typical local construction practices and, as such, periodic maintenance should be anticipated. All pavement materials and construction procedures should conform to FDOT, American Concrete Institute (ACI), or appropriate city/county requirements.

7.0 REPORT LIMITATIONS

Our professional services have been performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices at the time of this report. This company is not responsible for the conclusions, opinions or recommendations made by others based on this data. No other warranties are implied or expressed. After the plans and specifications are complete, it is recommended that PSI be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and foundation recommendations are properly interpreted and implemented. At that time, it may be necessary to submit supplemental recommendations.

The scope of investigation was intended to evaluate soil conditions within the influence of the proposed foundations and pavements. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If any subsoil variations become evident during the course of this project, a re-evaluation of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature or location of the proposed development.

The scope of our services did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil and groundwater. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our client.

This report has been prepared for the exclusive use of Seaman Development Corporation and their design consultants, for the specific application to the design and construction of the proposed single-story furniture store at 1850 NW Federal Highway in Stuart, Florida.

APPENDIX

SITE VICINITY MAP



FIGURE NO.:	1
DRAWN BY:	DG
CHECKED BY:	MD

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED ROOMS TO GO STORE
1850 NW FEDERAL HIGHWAY
STUART, FLORIDA
PSI PROJECT No.: 0772-803
DATE: 4/23/2018

intertek psi

BORING LOCATION PLAN



Approximate SPT Boring Test Location

FIGURE NO.:	2
DRAWN BY:	DG
CHECKED BY:	MD

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED ROOMS TO GO STORE
1850 NW FEDERAL HIGHWAY
STUART, FLORIDA
PSI PROJECT No.: 0772-803
DATE: 4/23/2018

intertek psi

BORING B-1

DATE STARTED:	4/10/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/10/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION:	N/A **OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	2.9 feet
	Upon Completion	2.9 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0										
				1		Dark Gray/Gray, Loose to Medium Dense, Fine to Medium Grained SAND	SP	1-2-3-4 N=5			
				2				4-4-4-6 N=8			
	5			3		Dark Brown, Medium Dense to Very Loose, Fine to Medium Grained SAND		5-5-6-4 N=11			
				4			SP	4-3-3-3 N=6			
				5				2-1-1-3 N=2			
	10										

intertek psi
Professional Service Industries, Inc.
7950 N.W. 64th Street
Miami, FL 33166
Telephone: (305) 471-7725

PROJECT NO.: 0772-803
PROJECT: Proposed Rooms To Go Store
LOCATION: 1850 NW Federal Highway
Stuart, FL

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-2

DATE STARTED:	4/11/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/11/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	30.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	4.5 feet
	Upon Completion	4.5 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Depth, (feet)	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)
0	1	Dark Gray/Gray, Loose, Fine to Medium Grained SAND	SP	1-1-2-3 N=3
	2			2-4-5-5 N=9
5	3	Dark Brown/Brown/Gray, Medium Dense, Silty Fine Grained SAND with Roots (Hardpan)	SM	4-5-3-3 N=8
	4			2-3-1-1 N=4
	5	Light Gray/Light Brown, Very Loose to Medium Dense, Fine to Medium Grained SAND	SP	1-1-1-1 N=2
10				
	6			2-2-3 N=5
15				
	7			3-4-5 N=9
20				
	8			4-5-6 N=11
25				
	9			4-8-8 N=16
30				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50
STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

Moisture, %

Additional Remarks

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Stuart, FL

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BORING B-3

DATE STARTED:	4/11/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/11/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	30.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION:	N/A **OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water

While Drilling	4.9	feet
Upon Completion	4.9	feet
Delay	N/A	

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0			1		Dark Gray/Gray, Very Loose, Fine to Medium Grained SAND with Roots	SP	1-1-2-2 N=3			
				2		Light Gray, Loose, Fine to Medium Grained SAND	SP	2-3-3-4 N=6			
	5			3		Gray/Dark Brown, Medium Dense to Very Loose, Fine to Medium Grained SAND		45-4-5 N=9			
				4				3-2-2-1 N=4			
				5			SP	1-2-3-2 N=5			
	10										
				6		Brown/Light Brown, Loose to Medium Dense, Fine to Medium Grained SAND		3-3-3 N=6			
	15										
				7			SP	3-3-4 N=7			
	20										
				8				5-5-5 N=10			
	25										
				9		Dark Gray, Medium Dense, Fine to Medium Grained SAND	SP	4-6-6 N=12			
	30										

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PROJECT NO.: 0772-803
PROJECT: Proposed Rooms To Go Store
LOCATION: 1850 NW Federal Highway, Stuart, FL

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-4

DATE STARTED:	4/11/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/11/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	30.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION:	N/A **OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	4.4 feet
	Upon Completion	4.4 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Depth, (feet)	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)
0	1	Light Gray, Very Loose to Loose, Fine to Medium Grained SAND	SP	1-1-2-2 N=3
	2			3-3-4-5 N=7
5	3	Dark Brown/Brown/Gray, Medium Dense, Silty Fine Grained SAND with Roots (Hardpan)	SM	4-5-3-4 N=8
	4	Dark Brown, Very Loose, Fine to Medium Grained SAND		3-2-1-1 N=3
	5		SP	1-2--1-2 N=3
10				
15	6	Brown/Light Brown/Gray, Loose to Medium Dense, Fine to Medium Grained SAND		2-3-3 N=6
20	7		SP	4-4-4 N=8
25	8			4-5-7 N=12
30	9			3-5-9 N=14

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50
STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

Moisture, %

Additional Remarks

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PROJECT NO.: 0772-803
PROJECT: Proposed Rooms To Go Store
LOCATION: 1850 NW Federal Highway
Stuart, FL

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-5

DATE STARTED:	4/11/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/11/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	30.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water

While Drilling	6.2 feet
Upon Completion	6.2 feet
Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					Gray/Light Gray, Loose, Fine to Medium Grained SAND with Roots					
				1			SP	1-1-3-4 N=4			
				2				3-3-4-7 N=7			
	5			3		Dark Brown/Brown, Loose to Medium Dense, Silty Fine Grained SAND with Roots		5-5-6-5 N=11			
				4				4-4-3-4 N=7			
				5			SM	4-6-12-16 N=18			
	10										
						Light Gray, Loose to Medium Dense, Fine to Medium Grained SAND					
	15			6				3-3-4 N=7			
				7			SP	5-5-7 N=12			
	20										
				8				5-6-7 N=13			
	25										
						Dark Gray, Medium Dense, Fine to Medium Grained SAND					
				9			SP	3-5-5 N=10			
	30										

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PROJECT: Proposed Rooms To Go Store
LOCATION: 1850 NW Federal Highway, Stuart, FL

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-6

DATE STARTED:	4/11/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/11/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	30.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	7.3 feet
	Upon Completion	7.3 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Depth, (feet)	Sample No.	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)
0	1	Gray/Light Gray, Very Loose to Loose, Fine to Medium Grained SAND with Roots	SP	1-1-2-2 N=3
2	2			3-6-6-7 N=12
5	3	Dark Brown/Brown, Loose to Medium Dense, Silty Fine Grained SAND with Roots	SM	5-5-5-7 N=10
4	4			3-3-4-5 N=7
	5			5-7-13-18 N=20
10		Light Gray/Light Brown, Loose to Medium Dense, Fine to Medium Grained SAND	SP	
15	6			3-3-5 N=8
20	7			5-6-7 N=13
25	8			5-5-7 N=12
30	9			4-5-6 N=11

Moisture, %

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0

Additional Remarks

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PROJECT NO.: 0772-803
PROJECT: Proposed Rooms To Go Store
LOCATION: 1850 NW Federal Highway
Stuart, FL

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-7

DATE STARTED:	4/10/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/10/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water

While Drilling	4.7 feet
Upon Completion	4.7 feet
Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0			1		Light Gray/Gray, Very Loose to Loose, Fine to Medium Grained SAND	SP	1-1-1-3 N=2			
				2				2-4-4-7 N=8			
	5			3		▼ Light Gray/Dark Brown, Medium Dense to Dense, Fine to Medium Grained SAND		5-6-7-9 N=13			
				4			SP	11-11-14-22 N=25			
				5				12-14-14-15 N=28			
	10										

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PROJECT: Proposed Rooms To Go Store
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Stuart, FL

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BORING B-8

DATE STARTED:	4/10/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/10/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	2.7 feet
	Upon Completion	2.7 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0			1		Light Gray/Gray, Very Loose to Loose, Fine to Medium Grained SAND	SP	1-1-2-3 N=3			
				2				4-4--4-5 N=8			
	5			3		Dark Brown, Medium Dense to Loose, Fine to Medium Grained SAND		4-4-5-7 N=9			
				4			SP	4-4-3-3 N=7			
				5				3-2-2-2 N=4			
	10										

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BORING B-9

DATE STARTED:	4/10/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/10/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION:	N/A **OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	4.6 feet
	Upon Completion	4.6 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					Light Gray/Gray, Loose to Medium Dense, Fine to Medium Grained SAND					
				1				1-2-2-2 N=4			
				2			SP	2-2-3-4 N=5			
	5			3				4-6-7-8 N=13			
						Dark Brown, Medium Dense to Loose, Silty Fine Grained SAND					
				4			SM	9-11-12-12 N=23			
				5				10-15-12-10 N=27			
	10										

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PROJECT NO.: 0772-803
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Stuart, FL

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BORING B-10

DATE STARTED:	4/10/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/10/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION: N/A	**OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	5.2 feet
	Upon Completion	5.2 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ Moisture PL LL (0, 25, 50) STRENGTH, tsf Qu Qp (0, 2.0, 4.0)	Additional Remarks
	0					Light Gray, Very Loose to Medium Dense, Fine to Medium Grained SAND	SP	1-1-2-2 N=3			
				1							
				2				2-3-3-5 N=6			
	5			3		Dark Brown, Medium Dense to Dense, Fine Grained SAND	SP	3-7-8-10 N=15			
				4				15-15-16-18 N=31			
				5		Dark Brown, Dense, Silty Fine Grained SAND	SM	15-14-11-12 N=25			
	10										

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PROJECT NO.: 0772-803
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July 9, 2018

SEAMAN DEVELOPMENT CORPORATION
400 Perimeter Center Terrace, Suite 800
Atlanta, GA 30346

Attention: Mr. Jeffrey Finkel
Senior Vice President

Re: Addendum Letter – Percolation Testing
Proposed Rooms to Go Store
1850 NW Federal Highway
Stuart, Florida | PSI Project No.: 0772-803

Dear Mr. Finkel:

Professional Service Industries, Inc. (PSI), an Intertek Company, has completed requested percolation testing in connection with the geotechnical engineering study performed for the above-referenced project. Our services were provided in general accordance with PSI Proposal No. 0772-238147, dated March 8, 2018. This letter shall serve as an addendum to our original geotechnical engineering report (PSI Project No.; 0772-803), dated April 29, 2018.

A site vicinity map identifying the project location with respect to existing streets and features is presented as **Figure 1** of the **Appendix.** The approximate locations at which the Standard Penetration Test borings were drilled for this project are shown on **Figure 2** of the **Appendix**. Also included with this letter are the results of the percolation test performed on April 10, 2018.

The percolation test was performed at a depth of approximate 10 feet below grade within boring B-9. The percolation test was performed in general accordance with the South Florida Water Management District (SFWMD) procedures for the "Usual Condition Constant Head" Percolation Test.

Please note that the B-9 borehole was advanced using an 8-inch diameter casing. A 4-inch diameter perforated PVC pipe was placed in the borehole prior to retrieving the casing. Water was then pumped into the borehole in order to raise the water level as close to the ground surface as possible. Once the inflow equalized with the outflow rate, the average pumping rate and level of the water for the stabilized flow rate was recorded.

The hydraulic conductivity value estimated from the percolation test is presented in the attached **Table 1**. This value is expressed in units of cubic feet of flow per second, per square foot of seepage area, per foot of head (cfs/ft2-ft). It should be recognized that the results expressed in **Table 1** are ultimate values; therefore, an appropriate factor of safety should be applied when using these values for drainage design calculations.

We trust this report is adequate for your current needs; however, should you have any questions or should additional information be required, please do not hesitate to contact our office at (561) 844-2404.

Respectfully Submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.
Certificate of Authorization No. 3684



Morgan Dickinson, P.E.
Regional Engineer/Principal Consultant
FL License No. 37557

Jonathan D. Klevan, EI
Branch Manager

APPENDIX

SITE VICINITY MAP



FIGURE NO.:	1
DRAWN BY:	DG
CHECKED BY:	MD

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED ROOMS TO GO STORE
1850 NW FEDERAL HIGHWAY
STUART, FLORIDA
PSI PROJECT No.: 0772-803
DATE: 4/23/2018

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BORING LOCATION PLAN



Approximate SPT Boring Test Location

FIGURE NO.:	2
DRAWN BY:	DG
CHECKED BY:	MD

GEOTECHNICAL ENGINEERING SERVICES
PROPOSED ROOMS TO GO STORE
1850 NW FEDERAL HIGHWAY
STUART, FLORIDA
PSI PROJECT No.: 0772-803
DATE: 4/23/2018

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BORING B-9

DATE STARTED:	4/10/18	**DRILL COMPANY:**	Serco Drilling, Inc
DATE COMPLETED:	4/10/18	**DRILLER:**	**LOGGED BY:** S.C.
COMPLETION DEPTH	10.0 ft	**DRILL RIG:**	CME-55
BENCHMARK:	N/A	**DRILLING METHOD:**	Rotary Drilling
ELEVATION:	N/A	**SAMPLING METHOD:**	SS
LATITUDE:		**HAMMER TYPE:**	Automatic
LONGITUDE:		**EFFICIENCY**	N/A
STATION:	N/A **OFFSET:** N/A	**REVIEWED BY:**	M.D.

REMARKS:

Water		
	While Drilling	4.6 feet
	Upon Completion	4.6 feet
	Delay	N/A

BORING LOCATION:
Refer to Figure 2

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ◎ × Moisture ◪ PL ✚ LL (0, 25, 50) STRENGTH, tsf ▲ Qu ✳ Qp (0, 2.0, 4.0)	Additional Remarks
	0					Light Gray/Gray, Loose to Medium Dense, Fine to Medium Grained SAND					
				1				1-2-2-2 N=4			
				2			SP	2-2-3-4 N=5			
	5			3				4-6-7-8 N=13			
						Dark Brown, Medium Dense to Loose, Silty Fine Grained SAND					
				4			SM	9-11-12-12 N=23			
				5				10-15-12-10 N=27			
	10										

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PROJECT: Proposed Rooms To Go Store
LOCATION: 1850 NW Federal Highway
Stuart, FL

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TABLE 1
SUMMARY OF PERCOLATION TEST RESULTS
PROPOSED ROOMS TO GO STORE
1850 NW FEDERAL HIGHWAY
STUART, FLORIDA
PSI PROJECT No.: 0772-803

BORING	DATE	CASING DIAMETER	PERFORATED PVC DIAMETER	DEPTH OF HOLE	DEPTH TO GROUNDWATER LEVEL BELOW GROUND SURFACE (feet)		HYDRAULIC HEAD	SATURATED HOLE DEPTH,	AVERAGE FLOW RATE,	HYDRAULIC CONDUCTIVITY,
NO.	PERFORMED	(inches)	(inches)	(feet)	PRIOR TO TEST	DURING TEST	H_2 (feet)	D_S (feet)	Q (gpm)	K (cfs/ft^2-ft)
B-9	4/10/2018	6	4	10.0	4.6	0.0	4.6	5.4	5.2	3.09E-04

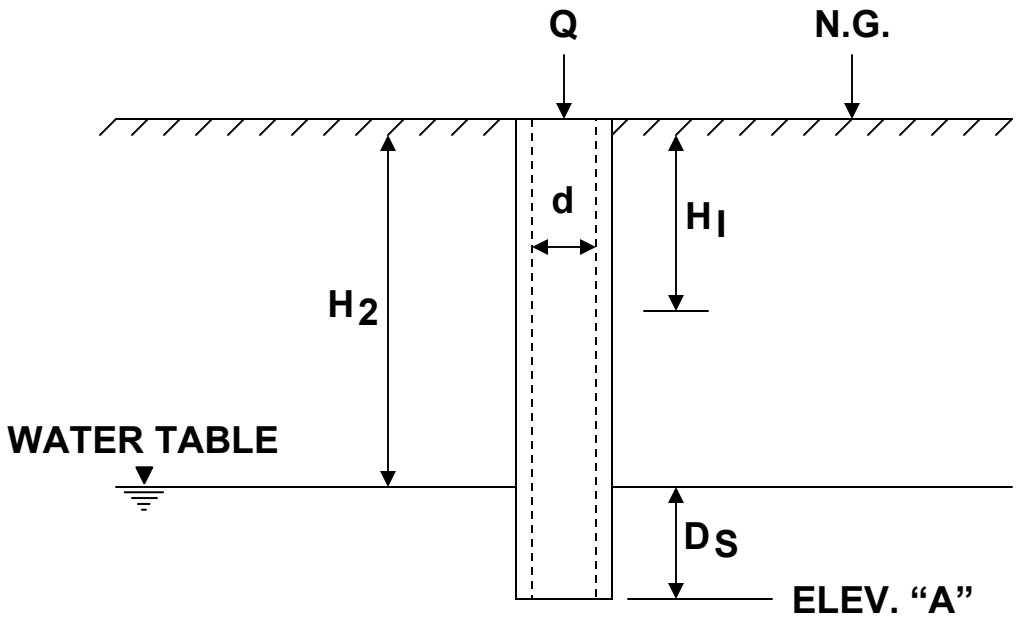
NOTES:

(1) The above hydraulic conductivity values are for a french drain installed to the same depth as the borehole tests. The values represent an ultimate value. The designer should apply the appropriate factor of safety.

(2) The hydraulic conductivity values were calculated based on the South Florida Water Management District's USUAL OPEN HOLE CONSTANT HEAD percolation test procedure as shown on the following page.

(3) A hole diameter of four inches was used in the computation of the Hydraulic Conductivity values presented in the above table.

USUAL OPEN – HOLE TEST



$$K = \frac{4Q}{\pi d (2H_2^2 + 4H_2D_S + H_2d)}$$

K= HYDRAULIC CONDUCTIVITY (CFS/FT.^{2} - FT.HEAD)

Q= "STABILIZED" FLOW RATE (CFS)

d= DIAMETER OF TEST HOLE (FEET)

H_2 = DEPTH TO WATER TABLE (FEET)

D_S = SATURATED HOLE DEPTH (FEET)

ELEV. "A"= PROPOSED TRENCH BOTTOM ELEV.

H_I = AVERAGE HEAD ON UNSATURATED HOLE SURFACE (FT.HEAD)

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