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www.envdesign.com

298 Pineapple Grove Way - Delray Beach, FL 33444
Florida Certificate of Authorization #6506

SURFACE WATER MANAGEMENT CALCULATIONS

FOR

HATCHER OFFICE BUILDING
20-26 NW 6TH AVE
DELRAY BEACH, FL

AUGUST 21, 2020

SITE AREA: AREA 0.44Ac

Certified by: _____

Joseph A. Pike, P.E.
FL Registration No. 42696
EnviroDesign Associates, Inc.
Certificate of Authorization #6506

JOSEPH PIKE LICENSE No 42696 STATE OF FLORIDA PROFESSIONAL ENGINEER

Joseph Pike

Digitally signed by Joseph Pike
DN: c=US, o=EnviroDesign Associates Inc, ou=A01427D0000016A55394DCE00000A54, cn=Joseph Pike
Date: 2020.08.21 11:25:54 -04'00'

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DRAINAGE CALCULATIONS

HATCHER OFFICE BUILDING - 20-26 NW 6TH AVE - Job #19108

WATER QUALITY VOLUME:

BASED ON F.A.C. CHAPTER 62-302 & SFWMD BASIS OF REVIEW

GIVEN:

TOTAL SITE AREA	19350 sf	
ROOF AREA	4429 sf	
WATER SURFACE AREA	0 sf	
PERMEABLE PAVER AREA	0 sf	
WATER QUALITY SITE AREA	14921 sf	(Total Site - water surface + roofs)
WATER QUALITY IMPERVIOUS AREA	12157 sf	(W.Q. Site Area - Pervious)
50% PERMEABLE PAVER CREDIT	0 sf	
NET WQ IMPERVIOUS AREA	12157 sf	(W.Q. Impervious Area - 50% Permeable Paver Credit)
WATER QUALITY PERVIOUS AREA	2764 sf	(W.Q. Site Area - Impervious)
WATER QUALITY % IMPERVIOUS	81.5 %	(Impervious / W.Q. Site Area)

REQUIRED STORAGE VOLUME: WET DETENTION VOLUME = 1" OVER TOTAL SITE AREA OR 2.5" OVER IMPERVIOUS AREA (IF SITE IS OVER 40% IMPERVIOUS, USE 2.5" OVER IMPERVIOUS)

→ **COMPUTE 1" OVER TOTAL SITE AREA:**

1in * 19350 = 1613 cf

→ **COMPUTE 2.5" OVER % IMPERVIOUS AREA:**

2.5in * 0.81 * 19350 = 3284 cf **(THIS METHOD CONTROLS)**

PER SFWMD SWERP APPLICANT'S HANDBOOK VOLUME II, 4.2.1

PROVIDE 100% FOR EXFILTRATION (exfil calcs includes 50% reduction & safety factor 2)

WATER QUALITY VOLUME = 3284 * 1 = 3284 cf

PRE- vs. POST-DEVELOPMENT 10-YEAR, 1-DAY RUN-OFF VOLUME:

GIVEN: REQUIRED STORAGE: 7.5" PER SFWMD TECHINICAL PUBLICATION EMA #390 FIGURE 9

		PRE	POST
	TOTAL SITE AREA	19350	19350
	IMPERVIOUS AREA	0	16586
	PERVIOUS AREA	19350	2764

USDA SCS RUNOFF EQUATION:

A = 19350 sf

Q = RUNOFF = (P-0.2S)^2 / (P+0.8S)

P = ACCUMULATED RAINFALL = 16.00

S = SOIL STORAGE * %PERVIOUS

AVERAGE PERVIOUS ELEVATION	=	14 ft	14.5 ft
WATER TABLE ELEVATION	=	8 ft	8 ft
DEPTH TO WATER TABLE	=	4 ft	4 ft
CUMULATIVE WATER STORAGE WITHIN SOIL STORAGE PER SFWMD BASIS OF 25% REDUCTION	=	10.90 in	10.90 in
	=	8.18 in	8.18 in
S	=	8.18 in	1.17 in
0.2S	=	1.64 in	0.23 in

NOTE: IF 0.2S IS > OR = P, THEN Q = 0

Q	=	9.15 in	14.68 in
V	=	14762 cf	23670 cf

100-YEAR, 3-DAY RUN-OFF VOLUME:

GIVEN: REQUIRED STORAGE: 7.5" PER SFWMD TECHINICAL PUBLICATION EMA #390 FIGURE 9

		POST
	TOTAL SITE AREA	19350
	IMPERVIOUS AREA	16586
	PERVIOUS AREA	2764

USDA SCS RUNOFF EQUATION:

A = 19350 sf

Q = RUNOFF = (P-0.2S)^2 / (P+0.8S)

P = ACCUMULATED RAINFALL = 16.00

S = SOIL STORAGE * %PERVIOUS

AVERAGE PERVIOUS ELEVATION	=	14.5 ft
WATER TABLE ELEVATION	=	8 ft
DEPTH TO WATER TABLE	=	4 ft
CUMULATIVE WATER STORAGE WITHIN SOIL STORAGE PER SFWMD BASIS OF 25% REDUCTION	=	10.90 in
	=	8.18 in
S	=	1.17 in
0.2S	=	0.23 in

NOTE: IF 0.2S IS > OR = P, THEN Q = 0

Q	=	14.68 in
V	=	23670 cf

TOTAL VOLUME REQUIRED:

WATER QUALITY VOLUME:

V = 3284 cf = 0.90

10-YR, ONE DAY PRE- VS. POST-DEVELOPMENT RUNOFF VOLUME:

V = 8908 cf = 2.45

100-YR, 3-DAY RUNOFF VOLUME:

V = 23670 cf = 6.52 **(THIS METHOD CONTROLS)**

REQUIRED VOLUME:

V = 8908 cf = 2.45 Ac-In

PROVIDED VOLUME:

V = 27402 cf = 7.55 Ac-In

see exfil calcs

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EXFILTRATION TRENCH CALCULATIONS

HATCHER OFFICE BUILDING - 20-26 NW 6TH AVE - Job #19108

L =	LENGTH OF TRENCH REQ'D (FT)			
V wq =	WTR QUALITY VOLUME TO BE TREATED (AC-IN)	=	0.90	
V add =	ADD'L VOLUME TO BE TREATED (AC-IN)		5.62	
W =	TRENCH WIDTH (FT)	=	6	
H =	DEPTH TO WATER TABLE (FT)	=	6	
Du =	NON-SATURATED TRENCH DEPTH (FT)	=	4	
Ds =	SATURATED TRENCH DEPTH (FT)	=	0	
FS=	SAFETY FACTOR NOT LESS THAN 2	=	2	
%WQ=	PERCENT REDUCTION IN WATER QUALITY		50	
K =	HYDRAULIC CONDUCTIVITY (CFS/FT^2-FT HEAD)	=	2.27 X 10 $^{-3}$	
OR K =		=	0.00227	

STANDARD FORMULA:

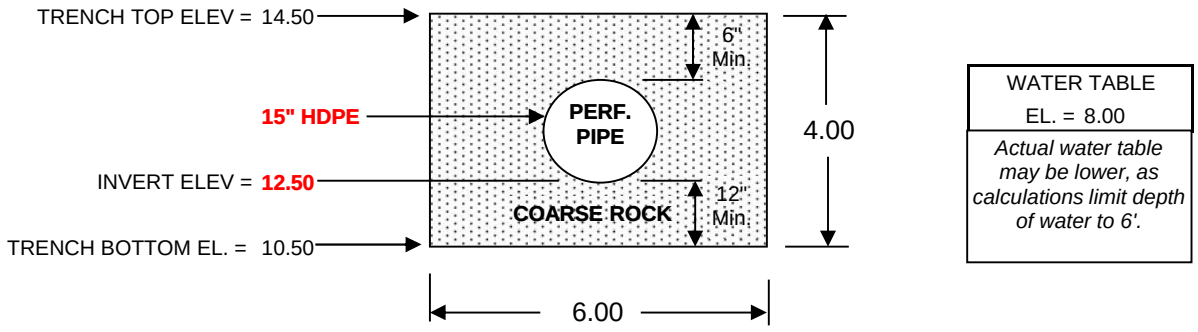
$$L = \frac{FS[(\%WQ)(V\ wq) + V\ add]}{K(HW+2HDu-Du^2 + 2HDs) + (1.39 \times 10^{-4})\ wDu} = \mathbf{76.96\ FEET}$$

[**L wq =** **5.74** FT + **Ladd=** **71.22** FT]

CONSERVATIVE FORMULA: (NOT APPLICABLE - STANDARD FORMULA APPLIES)

$$L = \frac{V}{K(2HDu-Du^2 + 2HDs) + (1.39 \times 10^{-4})\ wDu} = \mathbf{N/A}$$

STANDARD TRENCH DETAIL - REFER TO ENGINEERING PLANS FOR ACTUAL SPECIFICATIONS



THEREFORE, MIN. TRENCH LENGTH REQUIRED	=	**77**	**FEET**
ACTUAL TRENCH LENGTH PROVIDED	=	**90**	**FEET**
ACTUAL TREATMENT VOLUME PROVIDED=7.55 AC-IN OR 0.63 AC-FT			
TRENCH DIMENSIONS: 6.00 FT. WIDE BY 4.00 FT. DEEP			

*PERCENTAGE OF EXFILTRATION VOLUME CREDITED TOWARD STAGE-STORAGE: **100 %**

O:\2019\19108-20-26 NW 6th Ave-Hatcher Construction\CASCADE\[19108-calcs.xlsm]EXFIL

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Geotechnical & Construction Materials
Engineering, Testing, & Inspection
Environmental Services

Offices throughout the state of Florida

www.nuttingengineers.com info@nuttingengineers.com

August 6, 2020

Mr. Jeff Hatcher
Hatcher Construction
710 West Atlantic Avenue
Delray Beach, Florida 33444

Subject: Report of Exfiltration Test
20 & 26 NW 6th Avenue
Delray Beach, Florida

Dear Mr. Hatcher:

Nutting Engineers of Florida, Inc. has performed an exfiltration test for the proposed drainage improvements at the above referenced location. This report presents a brief description of the field procedures, and the results of the exfiltration test.

One exfiltration test was performed to a depth of six feet below existing grade in accordance with South Florida Water Management District (SFWMD) criteria for 'Usual Open-Hole' conditions.

Prior to starting the test, a 6-inch diameter hole was augered to the test depth to determine the depth to groundwater and to examine subgrade soils. After establishing the above parameters, the hole was stabilized by a full-length perforated PVC pipe in accordance with South Florida Water Management District specifications. Water was then pumped into the hole maintaining a constant water level at the ground surface. The stabilized flow rates were recorded in one-minute intervals for a total of 10 minutes.

The exfiltration test revealed the hydraulic conductivity ('K'-value) of the soil was 2.27×10^{-3} cubic feet per second per square foot per foot of head. Soil descriptions and flow rates for the test are shown on the attached exfiltration summary sheet. We note that the water table was below a depth of 6 feet at the time of the test. This testing was performed to determine the hydraulic conductivity value only. Soil information shall not be used for other purposes.

We appreciate the opportunity to provide these services for you. Should you have any questions, or if we can be of further assistance, please feel free to contact us.

Respectfully Submitted:
NUTTING ENGINEERS OF FLORIDA, INC.

8/6/2020

Christopher E. Gworek, P.E. #69947
Senior Engineer

NUTTING ENGINEERS OF FLORIDA, INC. ESTABLISHED 1967

Hatcher Construction
20 & 26 NW 6th Avenue
Delray Beach, Florida
ORDER NO. 16397.2

APPROXIMATE TEST LOCATION PLAN

GEOTECHNICAL EXPLORATION

FIG. 1

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Report of Exfiltration Test

Client:	Hatcher Construction	Order No	16397.20
Project:	20 & 26 NW 6th Avenue	Report No	1
Location:	20 & 26 NW 6th Avenue	Date:	8/5/20
	Delray Beach, Florida		
Test:	Usual Open Hole Exfiltration Test		
Surface Elevation:	Approx. @ Road Crown	Water table from ground surface:	>6'
Casing Diameter:	6"		
Tube Depth:	6'		

EXFIL NO. 1

Sample Location: Approx. as located on site plan.

Material:

0-6"	TOPSOIL
6"-1'	Gray fine SAND
1'-5'	Lt. gray fine SAND
5'-6'	Brown fine SAND

One Minute Increme	Pump Rate in Gal/Min
1	30.0
2	30.0
3	30.0
4	30.0
5	30.0
6	30.0
7	30.0
8	30.0
9	30.0
10	30.0

$K = 2.27 \times 10^{-3}$ cfs/ft^{2}ft.head

LIMITATIONS OF LIABLILITY

WARRANTY

We warranty that the services performed by Nutting Engineers of Florida, Inc. are conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession in our area currently practicing under similar conditions at the time our services were performed. ***No other warranties, expressed or implied, are made***. While the services of Nutting Engineers of Florida, Inc. are a valuable and integral part of the design and construction teams, we do not warrant, guarantee or insure the quality, completeness, or satisfactory performance of designs, construction plans, specifications we have not prepared, nor the ultimate performance of building site materials or assembly/construction.

SUBSURFACE EXPLORATION

Subsurface exploration is normally accomplished by test borings; test pits are sometimes employed. The method of determining the boring location and the surface elevation at the boring is noted in the report. This information is represented in the soil boring logs and/or a drawing. The location and elevation of the borings should be considered accurate only to the degree inherent with the method used and may be approximate.

The soil boring log includes sampling information, description of the materials recovered, approximate depths of boundaries between soil and rock strata as encountered and immediate depth to water data. The log represents conditions recorded specifically at the location where and when the boring was made. Site conditions may vary through time as will subsurface conditions. The boundaries between different soil strata as encountered are indicated at specific depths; however, these depths are in fact approximate and dependent upon the frequency of sampling, nature and consistency of the respective strata. Substantial variation between soil borings may commonly exist in subsurface conditions. Water level readings are made at the time and under conditions stated on the boring logs. Water levels change with time, precipitation, canal level, local well drawdown and other factors. Water level data provided on soil boring logs shall not be relied upon for groundwater based design or construction considerations.

LABORATORY AND FIELD TESTS

Tests are performed in *general* accordance with specific ASTM Standards unless otherwise indicated. All criteria included in a given ASTM Standard are not always required and performed. Each test boring report indicates the measurements and data developed at each specific test location.

ANALYSIS AND RECOMMENDATIONS

The geotechnical report is prepared primarily to aid in the design of site work and structural foundations. Although the information in the report is expected to be sufficient for these purposes, it shall not be utilized to determine the cost of construction nor to stand alone as a construction specification. Contractors shall verify subsurface conditions as may be appropriate prior to undertaking subsurface work.

Report recommendations are based primarily on data from test borings made at the locations shown on the test boring reports. Soil variations commonly exist between boring locations. Such variations may not become evident until construction. Test pits sometimes provide valuable supplemental information that derived from soil borings. If variations are then noted, the geotechnical engineer shall be contacted in writing immediately so that field conditions can be examined and recommendations revised if necessary.

The geotechnical report states our understanding as to the location, dimensions and structural features proposed for the site. ***Any significant changes of the site improvements or site conditions must be communicated in writing to the geotechnical engineer immediately*** so that the geotechnical analysis, conclusions, and recommendations can be reviewed and appropriately adjusted as necessary.

CONSTRUCTION OBSERVATION

Construction observation and testing is an important element of geotechnical services. The geotechnical engineer's field representative (G.E.F.R.) is the "owner's representative" observing the work of the contractor, performing tests and reporting data from such tests and observations. ***The geotechnical engineer's field representative does not direct the contractor's construction means, methods, operations or personnel.*** The G.E.F.R. does not interfere with the relationship between the owner and the contractor and, except as an observer, does not become a substitute owner on site. The G.E.F.R. is responsible for his/her safety, but has no responsibility for the safety of other personnel at the site. The G.E.F.R. is an important member of a team whose responsibility is to observe and test the work being done and report to the owner whether that work is being carried out in general conformance with the plans and specifications. The enclosed report may be relied upon solely by the named client.

SOIL AND ROCK CLASSIFICATION CRITERIA

SAND/SILT

N-VALUE (bpf)	RELATIVE DENSITY
0 – 4	Very Loose
5 – 10	Loose
11 – 29	Medium
30 – 49	Dense
>50	Very dense
100	Refusal

CLAY/SILTY CLAY

N-VALUE (bpf)	UNCONFINED COMP. STRENGTH (tsf)	CONSISTENCY
<2	<0.25	v. Soft
2 – 4	0.25 – 0.50	Soft
5 – 8	0.50 – 1.00	Medium
9 – 15	1.00 – 2.00	Stiff
16 – 30	2.00 – 4.00	v. Stiff
>30	>4.00	Hard

ROCK

N-VALUE (bpf)	RELATIVE HARDNESS	ROCK CHARACTERISTICS
N≥ 100	Hard to v. hard	Local rock formations vary in hardness from soft to very hard within short vertical and horizontal distances and often contain vertical solution holes of 3 to 36 inch diameter to varying depths and horizontal solution features. Rock may be brittle to split spoon impact, but more resistant to excavation.
25≤ N ≤ 100	Medium hard to hard	
5≤ N ≤ 25	Soft to medium hard	

PARTICLE SIZE

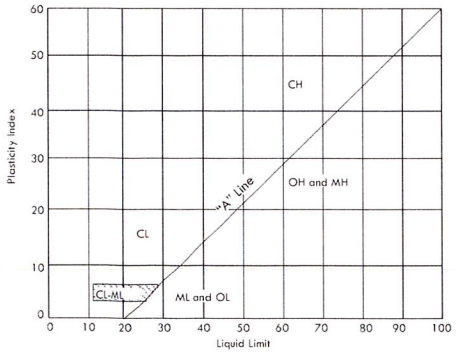
Boulder	>12 in.
Cobble	3 to 12 in.
Gravel	4.76 mm to 3 in.
Sand	0.074 mm to 4.76 mm
Silt	0.005 mm to 0.074 mm
Clay	<0.005 mm

DESCRIPTION MODIFIERS

0 – 5%	Slight trace
6 – 10%	Trace
11 – 20%	Little
21 – 35%	Some
>35%	And

Major Divisions			Group Symbols	Typical names	Laboratory classification criteria
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gavels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_z = \frac{(D_{30})^2}{D_{10} x D_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GW* d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / Atterberg limits above "A" line with P.I. greater than 7 — Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_z = \frac{(D_{30})^2}{D_{10} x D_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM* d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / Atterberg limits above "A" line with P.I. more than 7 — Limits plotting in hatched zone with P.I. between 4 and 7 are *borderline* cases requiring use of dual system.
			SC	Clayey sands, sand-clay mixtures	
Fine-grained soils (More than half of material is *smaller* than No. 200 sieve size)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy, clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
			CH	Inorganic clays or high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
	Highly organic soils		PT	Peat and other highly organic soils	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:
Less than five percent.....GW, GP, SW, SP
More than 12 percent.....GM, GC, SM, SC
5 to 12 percent.....*Borderline* cases requiring dual systems**



Plasticity Chart

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