STORMWATER MANAGEMENT REPORT

MARGATE COLLISION CENTER

BUILDING ROOF ADDITION DRAINAGE SYSTEM MODIFICATION
5355 NW 24TH STREET
MARGATE, BROWARD COUNTY, FLORIDA 33063

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THE BETA JONES GROUP

A CIVIL ENGINEERING FIRM
EXPEDITING DEVELOPMENT

Luis A. Betalleluz, P.E., Florida License No. 65892

Date:
15 April 2019
Project Number:
18109

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INTRODUCTION

The subject property (Folio# 4842-19-28-0010), is located at 5355 NW 24th Street, within the City of Margate, Florida in Broward County. The 973,774 SF property has an existing commercial building with associated parking lot, lake, and infrastructure.

This project proposes the expansion of 2,642 SF of the existing Commercial Building with associated internal infrastructure to accommodate a manual car wash area with drainage for the entire car wash area to be handled exclusively through an oil / water separator before being dumped into the Sanitary Sewer System, Accordingly. Since the NET Impervious Area increase is 0 SF because the New Roof Drainage is currently parking pavement; and this site currently has a master stormwater drainage system which collects all surface water and treats and stores within an onsite Lake, Included in the development plans is the construction of a 72 ft long x 5ft wide Exfiltration Trench System to accommodate only the surface runoff created by the new 2,642 SF of Roof Area. As coordinated with the Broward County Surface Water Management License Department, since this site already has a permitted drainage system, this project only adds the exfiltration trench to treat and store the new surface runoff created by the new Roof Area.. Upon completion, the stormwater system will be able to treat and store the 5yr-1hr storm event plus the Water Quality Treatment Volume generated by the New Roof Area.

DESIGN METHODOLOGY

Stormwater Management Design

This study was prepared using methods contained in the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) Publication TR-55 "Urban Hydrology for Small Watersheds". Each method outlines procedures for calculating peak rates of runoff resulting from precipitation events. TR-55 outlines additional procedures for developing runoff hydrographs.

The TR-55 procedure simulates a watershed as a series of overland flows, channel flows, inflow and outflow structures for its contribution to runoff. A value for area, curve number (CN), and time of concentration (Tc) was calculated for each drainage area.

Referenced from the SCS maps for Broward County, Florida the soils within the project site were divided into hydrologic soil groups (A, B, C and D). The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the lowest runoff potential and "D" soils have the greatest runoff potential. Soil group designations within the project limits are primarily being classified as soils with group designation of D.

Soil and Water Features of the Soils for the USDA NRCS Soil Survey for Broward County identifies

the site soils as being fill material used in urban lands. Soil type described is Urban Soil.

The curve number is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. Based on the coverage of soil groups and land use in the area, a weighted CN was determined for each drainage area for proposed conditions. CN values for the property were determined from Soil Group A for purposes of this design.

The time of concentration is defined as the time for runoff to travel from the hydraulically most distant point of the drainage area to a point of interest. Values of the time of concentration were determined for proposed conditions based on land cover and slope of the flow path using methods described in TR-55.

The minimum design storm used to size the Exfiltration Trench Systems is the 5 Year- 1 Hour storm event. All excess Drainage Runoff was strictly calculated within the exfiltration trench as a Volume Required-Volume Needed direct relationship, as required by the Jurisdictional Agencies for Exfiltration trench systems. Rainfall depths were determined based on values provided in the South Florida Water Management District Regulations (See Appendix “A”).

EXISTING CONDITIONS

Existing Site Description

The subject property (Folio# 4842-19-28-0010), is located at 5355 NW 24th Street, within the City of Margate, Florida in Broward County. The 973,774 SF property has an existing commercial building with associated parking lot, lake, and infrastructure.

Existing Site Drainage Conditions

Topography elevations for the project site range from EL 12.00 NAVD at the drainage inlets, to EL 13.00 along the outside edges of the parking area. The published Broward County Office of Environmental Services Water management Division Water Table Map lists the Seasonal High-Water Line (SHWT) Elevation at +6.50 NAVD (See Figure 2)..

PROPOSED CONDITIONS

Proposed Development

This project proposes the expansion of 2,642 SF of the existing Commercial Building with associated internal infrastructure to accommodate a manual car wash area with drainage for the entire car wash area to be handled exclusively through an oil / water separator before being dumped into the Sanitary Sewer System, Accordingly.

Proposed Drainage Conditions

Since the NET Impervious Area increase is 0 SF because the New Roof Drainage is currently parking pavement; and this site currently has a master stormwater drainage system which collects all surface water and treats and stores within an onsite Lake, Included in the development plans is the construction of a 72 ft long x 5ft wide Exfiltration Trench System to accommodate only the surface runoff created by the new 2,642 SF of Roof Area. As coordinated with the Broward County Surface Water Management License Department, since this site already has a permitted drainage system, this project only adds the exfiltration trench to treat and store the new surface runoff created by the new Roof Area. Upon completion, the stormwater system will be able to treat and store the 5yr-1hr storm event plus the Water Quality Treatment Volume generated by the New Roof Area..

Proposed Water Quality Design

Water quality measures are proposed to provide treatment for volumes generated from the greater of 1" of runoff over the drainage area or 2.5 inches of runoff times the proposed impervious percentage. This water quality volume will be captured and treated through the proposed exfiltration trench systems for the drainage well systems. Specific calculations showing these criteria are presented in Appendix A.

FIGURES

Property Id: 484219280010 **Please see map disclaimer

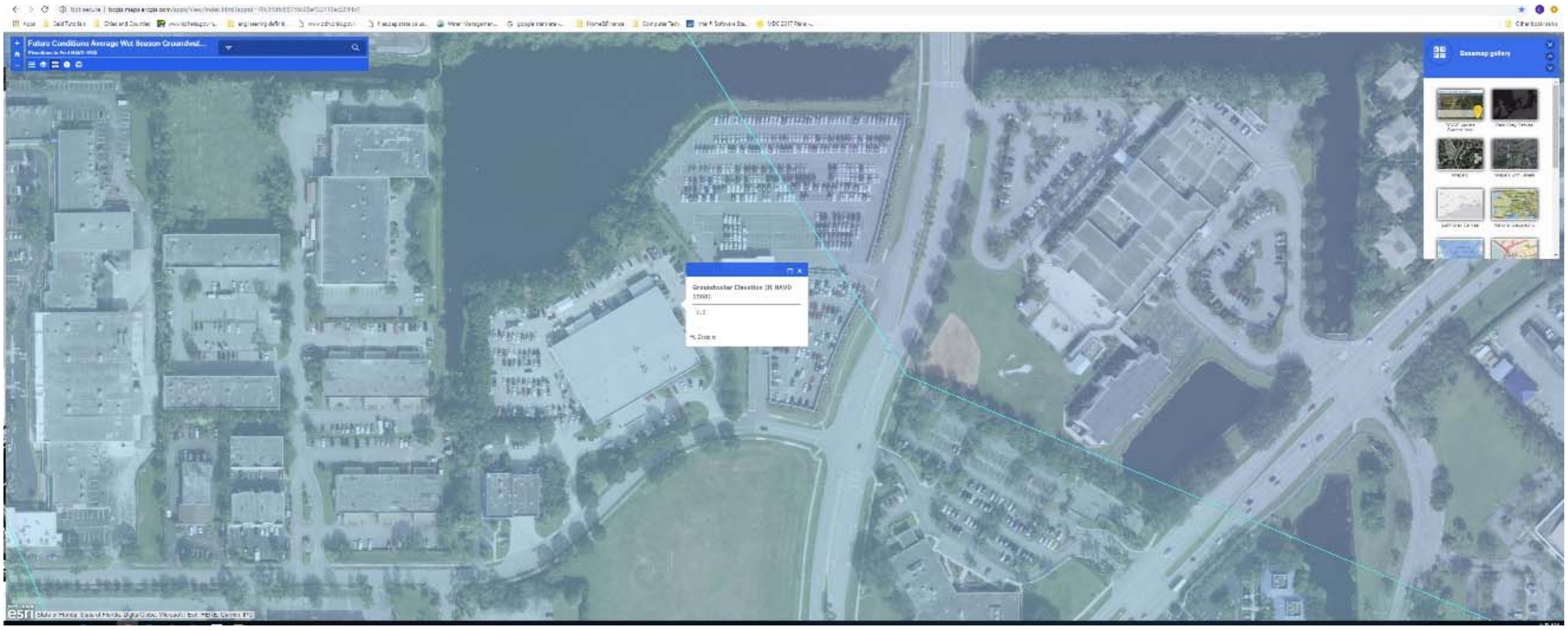
April 15, 2019

1:4,000

0 187.5 375 750 ft

0 55 110 220 m

Flight Date : Between Jan 2, 2019 and Jan 29, 2019 Broward County Property Appraiser


Future Conditions Average Wet Season Groundwat...
Basemap gallery
Groundwater Elevation (ft NAVD
esri

APPENDIX A

Design Storms & Stormwater Parameters

APPENDIX "A"
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DESIGN STORMS

The storm used for analysis is the South Florida Water Management District (SFWMD) 5 year – 1 hr, 5 year – 1 day, 25 year – 3 day, and 100 year – 3 day rainfall distribution

Therefore, the following design storms and precipitation values will be used.

Storm Frequency (Year)	Storm Duration (Hours)	Rainfall* (Inches)
5	1	3.20
5	24	6.50
25	72	11.50
100	72	15.00

**Values obtained from South Florida Water Management District Regulations*

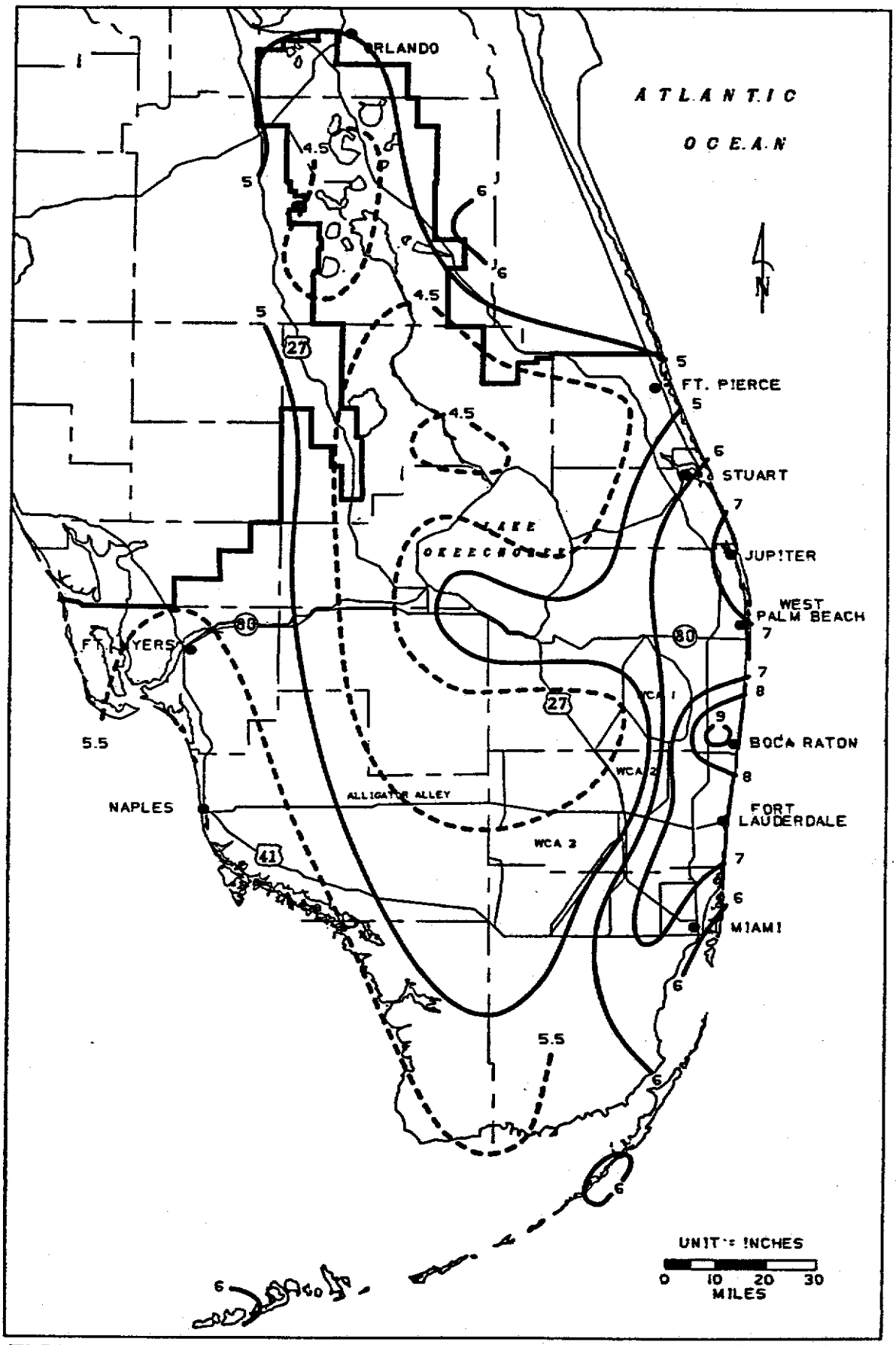

FIGURE C-3. 1-DAY RAINFALL: 5-YEAR RETURN PERIOD

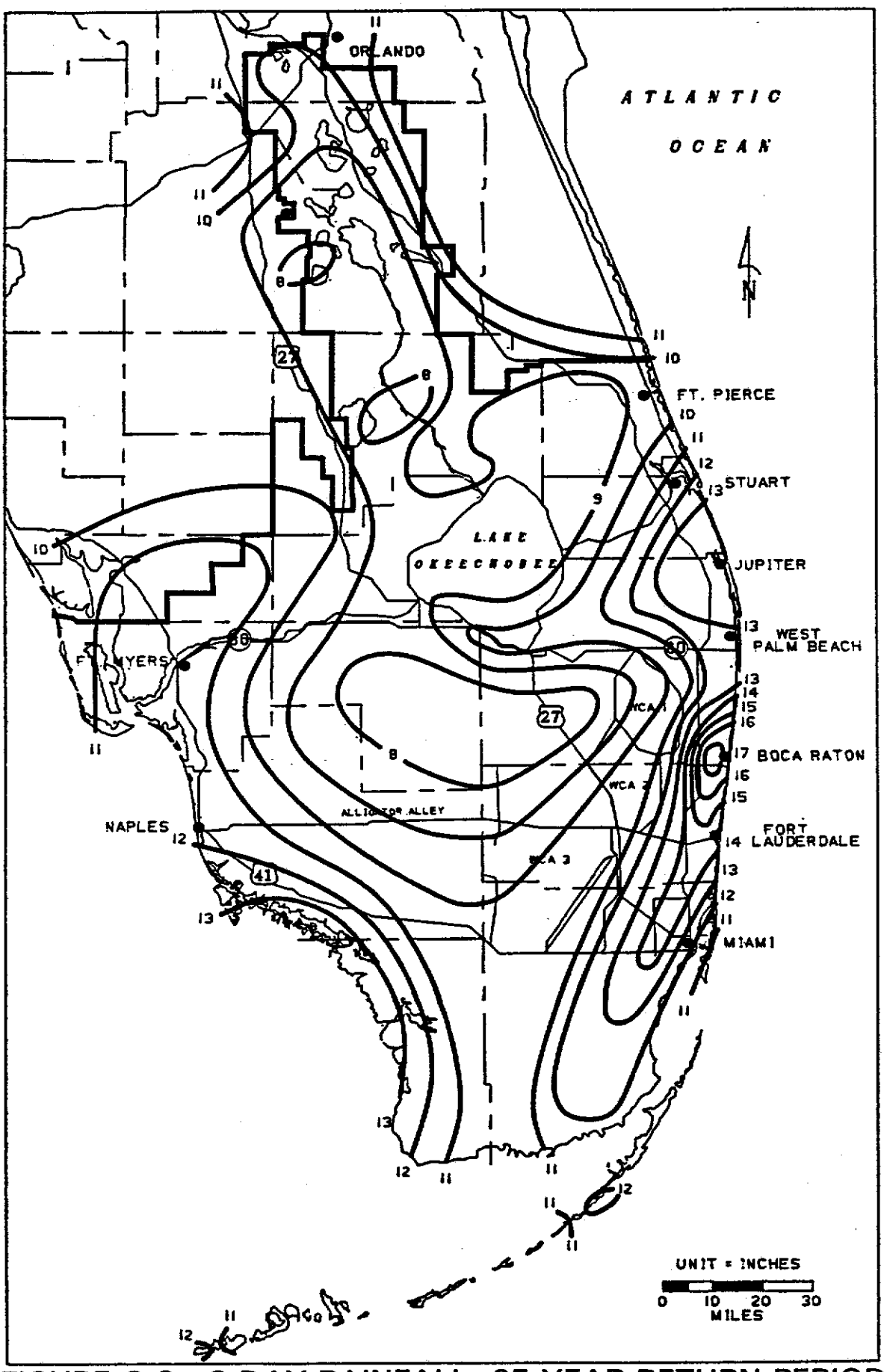

FIGURE C-8. 3-DAY RAINFALL: 25-YEAR RETURN PERIOD

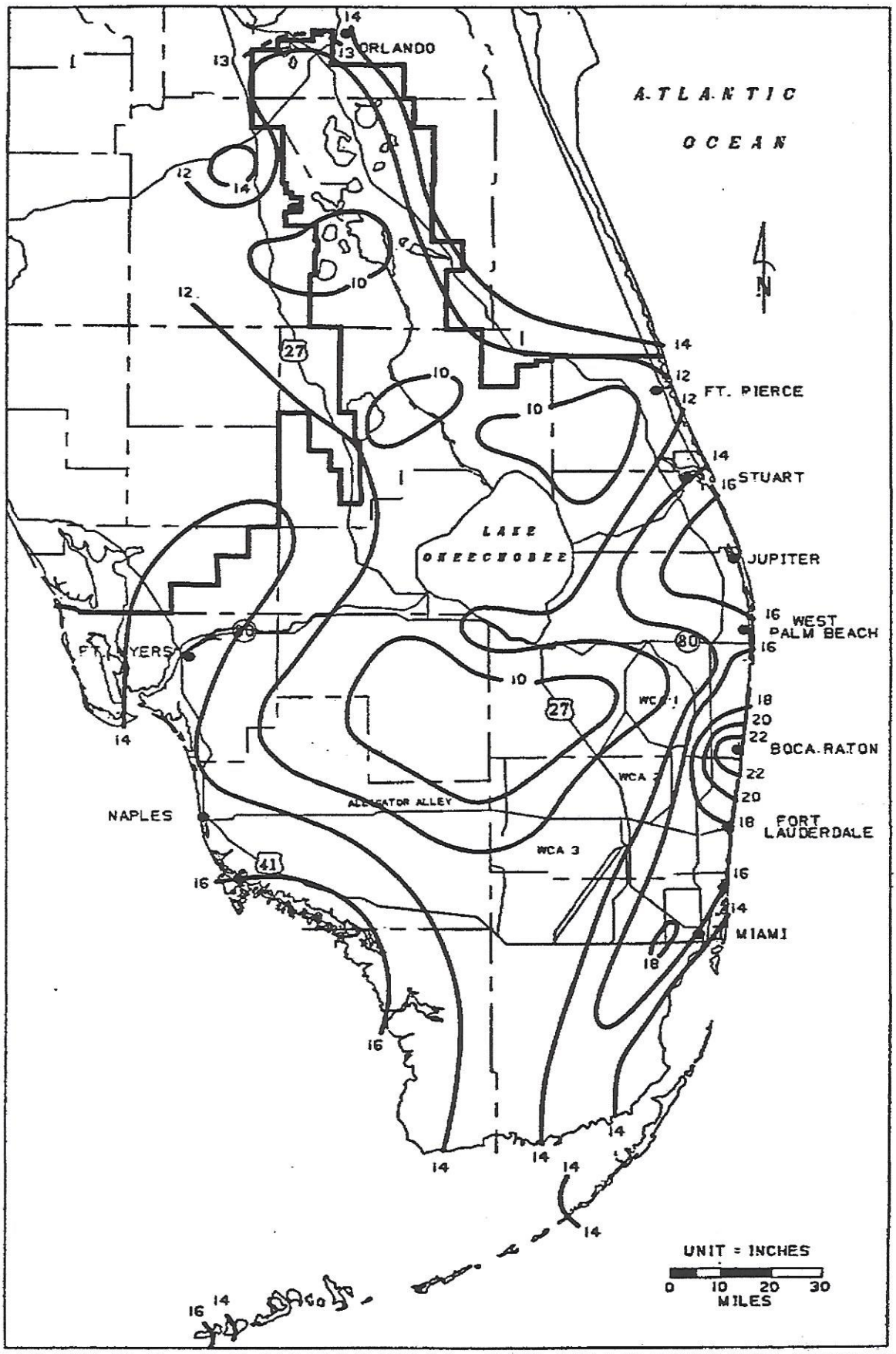

FIGURE C-9. 3-DAY RAINFALL: 100-YEAR RETURN PERIOD

Project Name:	MARGATE COLLISION CENTER ADDITION
Project No:	18109
Date:	4/15/19 12:34 AM
Description:	Post-Development CN and Tc

DRAINAGE AREA 1 PARAMETERS

PRE-DEVELOPMENT DATA

	Hydrologic Soil Group			
	A	B	C	D
Impervious	98	98	98	98
Open Space-Lawn (Good)	39	61	74	80
	Area (acres)			
Impervious	0.06			
Open Space-Lawn (Good)	0.00			
Curve Number Post	=	98		

Area Data		
Drainage Area	2,642.00	SF
	0.06065	Acres
Total Impervious Area Breakdown		
Building	-	SF
	0.00	Acres
Pavement	2,642.00	SF
	0.06	Acres
Sidewalks	-	SF
	0.00	Acres
Total	2,642.00	SF
	0.06	Acres
Open Area/Landscape Area		
Total Open Area	-	SF
	0.00	Acres

Time of Concentration

Manning's Coefficient	0.01		
Sheet Flow Length	300	(hrs.)	(min.)
2 Year-24Hour Depth (in)	5.00	0.0741	**4.44**
Highest Elevation (Sheet)	8.30	**Minimum Tc Used = 10 minutes**	
Lowest Elevation (Sheet)	7.10		

Project Name:	MARGATE COLLISION CENTER ADDITION
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Description:	Post-Development CN and Tc

DRAINAGE AREA 1 PARAMETERS

POST-DEVELOPMENT DATA

	Hydrologic Soil Group			
	A	B	C	D
Impervious	98	98	98	98
Open Space-Lawn (Good)	39	61	74	80
	Area (acres)			
Impervious	0.06			
Open Space-Lawn (Good)	0.00			
Curve Number Post	=	98		

Area Data		
Drainage Area	2,642.00	SF
	0.06065	Acres
Total Impervious Area Breakdown		
Building Addn.	2,642.00	SF
	0.06	Acres
Pavement		SF
	0.00	Acres
Sidewalks		SF
	0.00	Acres
Total	2,642.00	SF
	0.06	Acres
Open Area/Landscape Area		
Total Open Area	-	SF
	0.00	Acres

Time of Concentration

Manning's Coefficient	0.01		
Sheet Flow Length	300	(hrs.)	(min.)
2 Year-24Hour Depth (in)	5.00	0.1051	**6.31**
Highest Elevation (Sheet)	8.50	**Minimum Tc Used = 10 minutes**	
Lowest Elevation (Sheet)	8.00		

Project Name:	MARGATE COLLISION CENTER ADDITION
Project No:	18109
Date:	4/15/19 12:34 AM
Description:	Water Quality Treatment Volume-Drainage Area 1

Water Quality Treatment Volumes SFWMD

	(ft^2)	(ac)	
Total Drainage Area	2,642		0.06
Impervious Area Breakdown (Total Site - Water & Roof Areas)	0		0.00
WQTV Impervious Area Breakdown (Total Impervious - Open Area)	2,642		0.06
Percentange of Impervious Area	100.00%	Impervious	
Percentage Impervious to be Treated (%Imp x 2.5 inches)	2.50	Inches	
(Total Drainage Area) * (1.0 inches) =	220	ft^3	
or			
(Total Area - Water Surface Area) * (Imp. To be treated in inches) =	550	ft^3	
100% of Water Quality Treatment Volume =	550	ft^3	
	0.0126	ac-ft	

FINAL WQTV with Volume Reduction (100% for Wet Detention, 75% for Dry Detention, 50% for Retention)	**550 ft^3 0.0126 ac-ft**

*Exfiltration Trench has 0 Reduction in this formula since the SFWMD already accounts for this reduction in Trench Design Formula.

Commercial or Industrial Zoned Projects with a Wet Detention Drainage System Require 0.5 Inches of Pre-Treatment	**YES**	Commercial or Industrial?
	NO	Wet Detention System?

IF BOTH YES, THEN PROCEED:

0.5 Inches of Pre-Treatment (0.5 Inches x Total Area - Surface Water)	~~1,321~~	~~0.03~~

Refers back to Stormwater Water Quality criteria. Part 4.2.1 - SFWMD ERP Applicant Handbook Volume 2 and Example I n Part III Section W (Pages W-1 thur W-5)

Project Name:	MARGATE COLLISION CENTER ADDITION
Project No:	18109
Date:	4/15/19 12:34 AM
Description:	Water Storage Requirements - Drainage Area 1

Water Storage - 5Yr-1Hr Storm

3 Year-1 Hour Depth (in)	3.20		
Curve Number (Pre)	98		
Curve Number (Post)	98		
Drainage Area (ft^2)	2,642.00		
Runoff (Q-Pre)			2.97 inches
Runoff (Q-Post)			2.97 inches
Delta Q			0.00 inches
	(ft^3)	(Ac-ft)	
Post Water Storage Volume	653.34	**0.015**	
Delta (Post - Pre) Water Volume	0.00	**0.000**	

Water Storage - 5Yr-24Hr Storm

5 Year-24Hour Depth (in)	6.50		
Curve Number (Pre)	98		
Curve Number (Post)	98		
Drainage Area (ft^2)	2,642.00		
Runoff (Q-Pre)			6.26 inches
Runoff (Q-Post)			6.26 inches
Delta Q			0.00 inches
	(ft^3)	(Ac-ft)	
Post Water Storage Volume	1378.54	**0.032**	
Delta (Post - Pre) Water Volume	0.00	**0.000**	

Water Storage - 25Yr-72Hr Storm

25 Year-72Hour Depth (in)	11.50		
Curve Number (Pre)	98		
Curve Number (Post)	98		
Drainage Area (ft^2)	2,642.00		
Runoff (Q-Pre)			11.26 inches
Runoff (Q-Post)			11.26 inches
Delta Q			0.00 inches
	(ft^3)	(Ac-ft)	
Post Water Storage Volume	2478.78	**0.057**	
Delta (Post - Pre) Water Volume	0.00	**0.000**	

Water Storage - 100Yr-72Hr Storm

100 Year-72Hour Depth (in)	15.00		
Curve Number (Pre)	98		
Curve Number (Post)	98		
Drainage Area (ft^2)	2,642.00		
Runoff (Q-Pre)			14.76 inches
Runoff (Q-Post)			14.76 inches
Delta Q			0.00 inches
	(ft^3)	(Ac-ft)	
Delta (Post - Pre) Water Volume	0.00	**0.000**	
Pre Water Storage Volume	3249.19	**0.075**	
Post Water Storage Volume	3249.19	**0.075**	

Project Name:	MARGATE COLLISION CENTER ADDITION
Project No:	18109
Date:	10/18/15 8:59 AM
Description:	Drainage Area 1 Post-Development Exfiltration Trench Calculations
EXFILTRATION TRENCH CALCULATIONS - 5 YR 1HR STORM	

SITE PARAMETERS - MARGATE BLDG. ADDITION

From Initial Storage Calculations

TOTAL DRAINAGE AREA (A)	=	0.061	Acres
WEIGHTED CURVE NUMBER (C)	=	98	
TIME OF CONCENTRATION (t_c)	=	10.00	MIN
Water Volume Required to retain the Delta Post Development - Pre-Development 5YR-1HR Storm	=	0.0150	Ac-ft

CALCULATIONS

Assumption that the first 1" of runoff is completely polluted.

TIME TO GENERATE 1-INCH RUNOFF (t_1)	=	**8.99**	**MIN**
DESIGN FREQUENCY (F)	=	10	YR

$$t_1 = \frac{2940F^{-0.11}}{308.5C - 60.5(0.5895 + F^{-0.67})}$$

* Formula developed by FDOT Disctric VI

POLLUTED RUNOFF DURATION (T_T)

$$T_T = t_C + t_1$$

TIME OF CONCENTRATION (t_c)	=	10.00	MIN
TIME TO GENERATE 1-INCH RUNOFF (t_1)	=	8.99	MIN.
TOTAL STORM DURATION (T_T)	=	18.99	MIN

STORM INTENSITY FORMULA

$$i = \frac{308.5}{48.6 * F^{-0.11} + T_T(0.5895 + F^{-0.67})}$$

STORM INTENSITY (i)	=	5.82	INCH/HR

PEAK DISCHARGE

$$Q = CiA$$

PEAK DISCHARGE (Q)	=	0	CFS

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Description:	Drainage Area 1 Post-Development Exfiltration Trench Calculations
EXFILTRATION TRENCH CALCULATIONS - 5 YR 1HR STORM	

MAXIMUM POLLUTED (TREATMENT) VOLUME $V' = 60QT_T$

MAXIMUM POLLUTED VOLUME (V')	=	394 0.0091	CF Ac-ft
VOLUME OF 5YR-1HR STORM	=	0.0150	Ac-ft
VOLUME OF STORAGE (Vatt)	=	0.0150	Ac-ft
VOLUME WATER QUALITY (Vwq)	=	0.0126	Ac-ft
VOLUME TO BE RETAINED ON TRENCH (Vtotal)	=	0.0276	Ac-ft
Max VOLUME TO BE RETAINED ON TRENCH within Formula (Vformula)	=	0.0166	Ac-ft
Excess VOLUME TO BE RETAINED ON TRENCH (Vexcess)	=	0.011	Ac-ft

DETERMINING TRENCH STORAGE

AVERAGE GROUND ELEVATION	=	12.00	FT
SEASONAL HIGH WATER TABLE (SWHT)	=	6.50	FT
EXFILTRATION TRENCH PIPE	=	24	INCHES
PIPE INVERT ELEVATION	=	6.50	FT
PIPE AREA ABOVE SHWT (A_{PIPE})	=	12.56	SF

TRENCH TOP ELEVATION	=	9.50	FT
HEIGHT OF TRENCH ABOVE SHWT (D_u)	=	3.00	FT
HEIGHT OF TRENCH BELOW SHWT (D_S)	=	6.00	FT
WIDTH OF TRENCH	=	5.00	FT
EXIFILTRATION TRENCH AGGREGATE POROSITY (f)	=	0.30	

Project Name:	MARGATE COLLISION CENTER ADDITION
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Description:	Drainage Area 1 Post-Development Exfiltration Trench Calculations
EXFILTRATION TRENCH CALCULATIONS - 5 YR 1HR STORM	

$$A_{trench} = f(W * D_u - A_{pipe})$$

EXIFILTRATION TRENCH STORAGE AREA (A_{TRENCH})	=	0.73	SF

$$S = A_{trench} + A_{pipe}$$

STORAGE IN TRENCH (S)	=	13.29	FT^3/FT

DETERMINING LENGTH OF EXFILTRATION TRENCH

FDOT DISTRICT VI METHOD

$$E_T = 2K_{10}\left(\frac{D_U}{2} + D_S\right)H_2 + 2K_{15}d_2H_2 + 2K_{20}d_3H_2$$

$$L = \frac{V_T}{S + 60 * E_T T_T}$$

FDOT EMPIRICAL METHOD

Eq. 1

$$L = \frac{FS[(\%WQ)(Vwq) + Vadd]}{K(H_2 \times W + 2 \times H_2 \times D_U - {D_U}^2 + 2 \times H_2 \times D_S) + 1.39 \times 10^{-4} \times W \times D_U}$$

Eq. 2. Use Eq.2 if trench width is twice the depth of exfiltration trench or if saturated depth(D_s) is greater than non-saturated trench depth (D_u).

$$L = \frac{FS[(\%WQ)(Vwq) + Vadd]}{K(2 \times H_2 \times D_U - {D_U}^2 + 2 \times H_2 \times D_S) + 1.39 \times 10^{-4} \times W \times D_U}$$

Project Name:	MARGATE COLLISION CENTER ADDITION
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EXFILTRATION TRENCH CALCULATIONS - 5 YR 1HR STORM	

Using Eq. 2

AVG HYDRAULIC CONDUCTIVITY (K)	=	1.02E-04	CFS-/FT^2-FT
HEIGHT OF TRENCH BELOW SHWT (D_S)	=	6.00	FT
HEIGHT OF TRENCH ABOVE SHWT (D_u)	=	3.00	FT

AVERAGE GROUND ELEVATION	=	12.00	FT
SEASONAL HIGH WATER TABLE (SWHT)	=	6.50	FT
CURRENT HEAD (H_2)	=	5.50	FT
VOLUME TO BE RETAINED IN TRENCH under Formula (V_T)	=	0.20	Acre-in
STORAGE IN TRENCH (S)	=	13.29	FT^3/FT
WIDTH OF TRENCH (W)	=	5.00	FT

REQUIRED LENGTH OF TRENCH (L)	=	17.66	FT

SAFETY FACTOR (SF)	=	2.00	

PROPOSED LENGTH OF TRENCH based on Formula (Lformula)	**=**	**35.32**	**FT**
PROPOSED LENGTH OF TRENCH based on Excess Volume (Lexcess)	**=**	**36.88**	**FT**
PROPOSED LENGTH OF TRENCH (L)	**=**	**72**	**FT**