I. Project Description

The FLX Marine Boat Display Expansion project involves construction of additional asphalt pavement areas for display of boats offered for sale. While some of the proposed construction will disturb existing lawn areas, the majority of the work will be located within a sparsely vegetated field area. Following construction of the new pavement, all other disturbed ground areas will be seeded to lawn.

II. Required Drainage Improvements

Article V Drainage Improvements contained in the Town of Canandaigua Site Design and Development Criteria – September 2018, requires incorporation of water quality and water quantity measures in the design of projects creating 5,000 s.f. or more of cumulative parking area. Since the FLX Marine Boat Display Expansion project will create 10,210 s.f. of additional pavement, water quality treatment and evaluation of the impacts of the 10 year storm must be provided.

III. Drainage Improvement Analysis

The 0.40 acre project area, which was analyzed using USDA TR-55 Urban Hydrology for Small Watersheds methodology, will experience a peak 10 year storm runoff rate of 1.20 cfs under post development conditions, whereas a 10 year storm peak runoff rate of 0.80 cfs is currently occurring. The required stormwater storage to mitigate the impacts of the proposed development is 623 c.f. Calculations supporting this analysis are attached.

Water quality improvements should provide treatment from the increased pavement areas. Calculations supporting the determination of the 824 c.f. water quality volume and 238 c.f. minimum runoff reduction volume are attached.

IV. Proposed Drainage Improvements

A rain garden is proposed for water quality treatment and water quantity attenuation. The rain garden will provide 400 c.f. of storage, yielding 64% of the required storage to fully mitigate the impacts from a 10 year storm event, and exceeding the 238 c.f. minimum runoff reduction volume required to satisfy NYSDEC green infrastructure requirements.

The linear rain garden will be constructed parallel to the natural ground topography and if overtopped by a ten year or greater storm event, will discharge stormwater as sheet flow distributed onto the lower portion of the FLX Marine parcel.

GFT FLX Marine Expansion

Pre Development Conditions

Ontario County, New York

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
2.19	2.69	3.14	3.87	4.52	5.29	1.89

Storm Data Source: Ontario County, NY (NRCS)

Rainfall Distribution Type: Type II

Dimensionless Unit Hydrograph: <standard>

-

-

-

GFT FLX Marine Expansion

Pre Development Conditions

Ontario County, New York

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area (ac)	Curve Number
site	Woods - grass combination	(poor) C	.4	82
	Total Area / Weighted Curve Number		.4	82 RCN

== ==

-
-
-

GFT FLX Marine Expansion

Pre Development Conditions

Ontario County, New York

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period	
	2-Yr (cfs) (hr)	10-Yr (cfs) (hr)
SUBAREAS		
site	0.41 12.02	0.80 12.01
REACHES		
OUTLET	0.41	0.80

GFT FLX Marine Expansion

Post Development Conditions

Ontario County, New York

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use	Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
site	Open space; grass cover > 75% (good)	C	.17	74
	Paved parking lots, roofs, driveways	C	.23	98
	Total Area / Weighted Curve Number		.4	88 RCN

== ==

GFT FLX Marine Expansion

Post Development Conditions

Ontario County, New York

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period	
	2-Yr (cfs) (hr)	10-Yr (cfs) (hr)
SUBAREAS		
site	0.70 11.94	1.20 11.93
REACHES		
OUTLET	0.70	1.20

Version 1.8
Last Updated: 11/09/2015

Total Water Quality Volume Calculation
WQv(acre-feet) = [(P)(Rv)(A)] /12

Is this project subject to Chapter 10 of the NYS Design Manual (i.e. WQv is equal to post-development 1 year runoff volume)?.....	

Design Point:		
P=	1.00	*inch*

Breakdown of Subcatchments

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious %	Rv	WQv *(ft^3)*	Description
1	0.40	0.23	58%	0.57	824	
2						
3						
4						
5						
6						
7						
8						
9						
10						
Subtotal (1-30)	0.40	0.23	58%	0.57	**824**	**Subtotal 1**
Total	0.40	0.23	58%	0.57	**824**	**Initial WQv**

Identify Runoff Reduction Techniques By Area

Technique	Total Contributing Area *(Acre)*	Contributing Impervious Area *(Acre)*	Notes
Conservation of Natural Areas	0.00	0.00	*minimum 10,000 sf*
Riparian Buffers	0.00	0.00	*maximum contributing length 75 feet to 150 feet*
Filter Strips	0.00	0.00	
Tree Planting	0.00	0.00	*Up to 100 sf directly connected impervious area may be subtracted per tree*
Total	**0.00**	**0.00**	

Recalculate WQv after application of Area Reduction Techniques

	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious %	Runoff Coefficient Rv	WQv *(ft^3)*
"<<Initial WQv"	0.40	0.23	58%	0.57	824
Subtract Area	0.00	0.00			
WQv adjusted after Area Reductions	**0.40**	**0.23**	58%	0.57	824
Disconnection of Rooftops		0.00			
Adjusted WQv after Area Reduction and Rooftop Disconnect	0.40	0.23	58%	0.57	**824**
WQv reduced by Area Reduction techniques					0

Rain Garden Worksheet

WQv ≤ VSM + VDL + (DP x ARG)
VSM = ARG x DSM x nSM
VDL (optional) = ARG x DDL x nDL

Design Point:							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	0.40	0.23	0.58	0.57	824.01	1.00	
Enter Impervious Area Reduced by Disconnection of		0.00	58%	0.57	824	<<WQv after adjusting for Disconnected Rooftops	

Soil Information			
Soil Group	B		
Using Underdrains	*No*	*Okay*	
Infiltration Rate	1.00	*in/hour*	*Okay*

Rain Garden Parameters				
Enter number of Rain Gardens		1		
Enter area of each Rain Garden		400		
Enter Rain Garden Surface area	ARG	400	*sf*	
Enter depth of Soil Media	DSM	1.50	*ft*	*1 to 1.50*
Enter depth of drainage layer	DDL	0.50	*ft*	*≥ 0.50 ft*
Enter ponding depth above surface	DP	0.50	*ft*	*≤ 0.50*
Enter porosity of Soil Media	nSM	0.20		*≥20%, enter as a decimal*
Enter porosity of Drainage Layer	nDL	0.40		*≥ 40%, enter as a decimal*
Volume Provided In Soil Media	VSM	120	ft^3	
Volume Provided in Drainage Layer	VDL	80	ft^3	
Volume Provided In Ponding Area		200	ft^3	
Total Volume Provided		400	ft^3	

Determine Runoff Reduction			
Percent Reduction	100%		
Runoff Reduction	**824**	ft^3	
WQv ≤ VSM + VDL + (DP x ARG) √	ERROR		

CLIENT

FLX MARINE BOAT DISPLAY EXP.

PROJECT

THORNTON ENGINEERING LLP

SUBJECT	MADE	CHK	REV	JOB NO.
DRAINAGE				SHEET NO.

REDUCE POST DEVELOPMENT 10 YR. STORM PEAK DISCHARGE TO PRE DEVELOPMENT RATE

q_o = PRE DEVELOPMENT PEAK DISCHARGE = 0.80CFS

q_i = POST DEVELOPMENT PEAK DISCHARGE = 1.20CFS

$q_o/q_i = 0.80/1.20 = 0.67$

$V_s/V_r = 0.22$

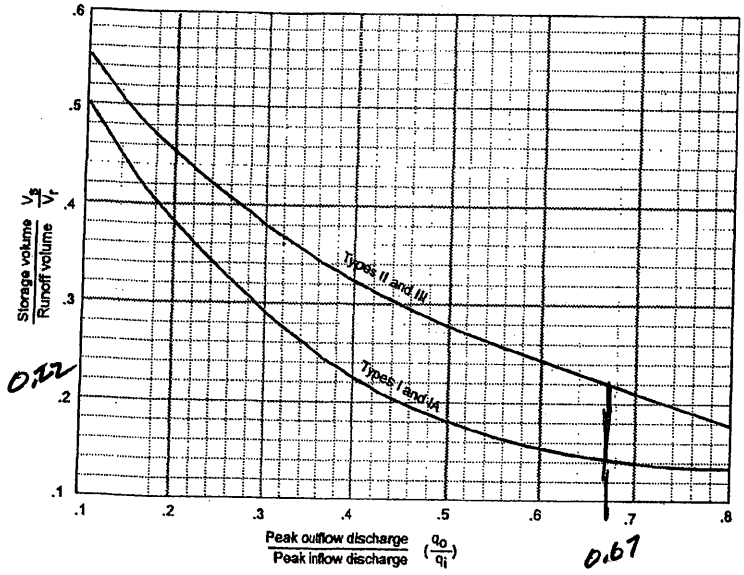
$P_{10} = 3.14$ IN

RCN = 88

$Q_{10} = 1.95$ IN.

A = 0.40 AC

Figure B.2 Approximate Detention Basin Routing For Rainfall Types I, IA, II, and III (Source: NRCS, 1986)



REQUIRED STORAGE = $\frac{(V_s/V_r)(Q_{10})(A)}{12} = \frac{0.22(1.95)(0.40)}{12} = 623$ CF

Table 2-1 Runoff depth for selected CN's and rainfall amounts 1/

Rainfall	Runoff depth for curve number of—												
	40	45	50	55	60	65	70	75	80	85	90	95	98
	inches												
1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.17	0.32	0.56	0.79
1.2	.00	.00	.00	.00	.00	.00	.03	.07	.10	5.27	.46	.74	.99
1.4	.00	.00	.00	.00	.00	.02	.06	.13	.24	.39	.61	.92	1.18
1.6	.00	.00	.00	.00	.01	.05	.11	.20	.34	.52	.76	1.11	1.38
1.8	.00	.00	.00	.00	.03	.09	.17	.29	.44	.65	.93	1.29	1.58
2.0	.00	.00	.00	.02	.06	.14	.24	.38	.56	.80	1.09	1.48	1.77
2.5	.00	.00	.02	.08	.17	.30	.46	.65	.89	1.18	1.53	1.96	2.27
3.0	.00	.02	.09	.19	.33	.51	.71	.96	1.25	1.59	1.98	2.45	2.77
3.5	.02	.08	.20	.35	.53	.75	1.01	1.30	1.64	2.02	2.45	2.94	3.27
4.0	.06	.18	.33	.53	.76	1.03	1.33	1.67	2.04	2.46	2.92	3.43	3.77
4.5	.14	.30	.50	.74	1.02	1.33	1.67	2.05	2.46	2.91	3.40	3.92	4.26
5.0	.24	.44	.69	.98	1.30	1.65	2.04	2.45	2.89	3.37	3.88	4.42	4.76
6.0	.50	.80	1.14	1.52	1.92	2.35	2.81	3.28	3.78	4.30	4.85	5.41	5.76
7.0	.84	1.24	1.68	2.12	2.60	3.10	3.62	4.15	4.69	5.25	5.82	6.41	6.76
8.0	1.25	1.74	2.25	2.78	3.33	3.89	4.46	5.04	5.63	6.21	6.81	7.40	7.76
9.0	1.71	2.29	2.88	3.49	4.10	4.72	5.33	5.95	6.57	7.18	7.79	8.40	8.76
10.0	2.23	2.89	3.56	4.23	4.90	5.56	6.22	6.88	7.52	8.16	8.78	9.40	9.76
11.0	2.78	3.52	4.26	5.00	5.72	6.43	7.13	7.81	8.48	9.13	9.77	10.39	10.76
12.0	3.38	4.19	5.00	5.79	6.56	7.32	8.05	8.76	9.45	10.11	10.76	11.39	11.76
13.0	4.00	4.89	5.76	6.61	7.42	8.21	8.98	9.71	10.42	11.10	11.76	12.39	12.76
14.0	4.65	5.62	6.55	7.44	8.30	9.12	9.91	10.67	11.39	12.08	12.75	13.39	13.76
15.0	5.33	6.36	7.35	8.29	9.19	10.04	10.85	11.63	12.37	13.07	13.74	14.39	14.76

1/ Interpolate the values shown to obtain runoff depths for CN's or rainfall amounts not shown.