STORMWATER MANAGEMENT REPORT

192 Cambridge Avenue

Proposed Construction of a new 3 Story – Multi-Family Building
With 3 Residential Units and Ground Floor Parking
Block 2203, Lot 2.01
Jersey City, New Jersey

November 8, 2022

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Jeffrey V. Lewis, RA

Date: 8-Nov-22

Project: 192 Cambridge Avenue
Jersey City, NJ

Stormwater Detention System Sizing:

Part A: Initial System Sizing Estimate

1. Design Parameters:
    1. System is to be designed to limit peak flow to 50% of undeveloped condition for 2 year storm, 75% of 10 year storm . and 80% of 100 year storm
    2. System is to be designed to store the difference between inflow and allowable outflow.
    3. Rational Method shall be used to calculate peak flows.
    4. Modified Rational Method shall be used to calculate storm volumes, with trapezoidal hydrograph for post-development inflow.
    5. As site is small and distances from site areas to drainage structures are short, a minimum of 10 minutes will be used for Tc.
    6. Inflow hydrographs will be increase from zero to Qpeak from t=0 to t=tc, stay at peak to t= duration, then decrease to zero over period of time equal again to tc.
    7. Outflow hydrograph depends on outflow structure geometry. With a round orifice design, outflow is dependent on the square of the depth of water in the basin. As the basin is a series of round pipes, the depth changes more rapidly at the top and bottom (as the volume is not directly proportional to the depth due to the round section). For purposes of initial system selection, this part of the analysis will assume a straight line outflow hydrograph that begins at zero and increases to Qall. Where it crosses the inflow hydrograph (as it is not permitted to exceed this for the particular design storm.

2. Site Areas:

	Pre Development		Post Development	
	Area (sf)	Area (acres)	Area (sf)	Area (acres)
1 Building	1,200	0.028	2,110	0.048
2 Paving	2,709	0.062	992	0.023
3 Landscape	0	0.000	807	0.019
Total Site	3,909	0.090	3,909	0.090

Difference between Pre and Post Development Impervious Coverage = -807 sf

3. "C" Values

Building	0.95
Paving	0.90
Landscape	0.20

4. Equivalent "C" Values: $C_{eq.} = (C_1A_1+C_2A_2+C_3A_3)/A_{total}$

Pre Development	$C_{eq.}$ =	0.92
Post Development	$C_{eq.}$ =	0.78

5. Rainfall Intensity: From the NJ curves, the following rainfall intensity values will be used to analyze various storm durations to find the critical storm.

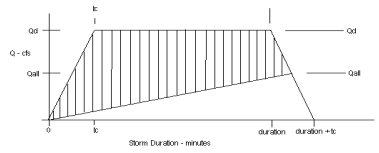
	Rainfall Intensity in inches/hour		
Duration (min)	2 Year Storm	10 Year Storm	100 Year Storm
10	4.60	5.80	8.00
15	3.80	4.90	6.90

20	3.30	4.10	5.70
30	2.50	3.30	4.60
45	1.90	2.50	3.70
60	1.50	2.00	2.90
90	1.10	1.50	2.25
120	0.90	1.25	1.80
240	0.50	0.75	1.10

6. Allowable Outflow = Q_{und} x Red. Factor at t = tc.

		C	i in/hr.	A (acres)	Factor	Qall (cfs)
Q_{und2} =	CiA x 0.50 =	0.92	4.60	0.090	0.50	0.19
Q_{und10} =	CiA x 0.75 =	0.92	5.80	0.090	0.75	0.36
Q_{und100} =	CiA x 0.75 =	0.92	8.00	0.090	0.80	0.53

7. Storage Volume Calculation: Using Modified Rational Method for inflow and straight line approximation for outflow from controlled orifice, required storage volume is area above outflow curve as follows:



Calculation for this volume is as follows:

Volume = $((Q_{dev}. X duration) - (Q_{al}l x (duration+ t_c)/2)) x 60sec/min$

2 year storm

duration (min.)	Qdev (cfs)	Max. Qall (cfs)	Volume (cf)
10	0.32	0.19	80
15	0.27	0.19	98
20	0.23	0.19	108
30	0.18	0.19	89
45	0.13	0.19	48
60	0.11	0.19	-18
90	0.08	0.19	-150
120	0.06	0.19	-282
240	0.04	0.19	-911

Critical Volume = 108

Qact	Vol Ratio
0.69054	-0.62462

Height Ratio
0.66

10 year storm

duration (min.)	Qdev (cfs)	Qall (cfs)	Volume (cf)	Qout 2 (cfs)	Volume (cf)	Qact	Vol. Ratio
10	0.41	0.36	30	0.55	-86	0.36062	0.495169
15	0.34	0.36	42	0.55	-103		
20	0.29	0.36	24	0.55	-150		
30	0.23	0.36	-12	0.55	-243		
45	0.18	0.36	-116	0.55	-434		
60	0.14	0.36	-245	0.55	-649		
90	0.11	0.36	-503	0.55	-1081		
120	0.09	0.36	-762	0.55	-1513		
240	0.05	0.36	-1922	0.55	-3367		

Height Ratio
0.18

Critical Volume = 42 -86

100 year storm

duration (min.)	Qdev (cfs)	Max. Qall (cfs)	Volume (cf)	Qout 2 (cfs)	Volume (cf)	Orifice Ht. (ft.)	Orifice Area (sf)
10	0.56	0.53	22	0.85	-173	1.67	0.126097

15	0.48	0.53	42	0.85	-201
20	0.40	0.53	7	0.85	-285
30	0.32	0.53	-49	0.85	-439
45	0.26	0.53	-166	0.85	-701
60	0.20	0.53	-371	0.85	-1052
90	0.16	0.53	-724	0.85	-1697
120	0.13	0.53	-1140	0.85	-2405
240	0.08	0.53	-2831	0.85	-5263
		Critical Volume =	**42**		-173

Notes: Initial estimate has 2 year storm with max. storage volume, but at low Qall.
This low storage volume will be achieved with permeable pavers and required piping.
All other storms require negative storage, as site impermeability is greatly increased.

8. Storage System Design:

A. All roof drainage will be directed to the parking lot drainage system. This parking lot drainage will include sections of 6" diameter pvc pipes in stone beds as part of permeable paver system.
The stormwater discharges to the public main storm line.

B. Storage provided for min. 108 cf:

1.	Pipe: 150 LF 6" PVC pipe x 0.20cf/lf				=	30.00	cf
2.	Stone [(1'-6" x 1'-6")-(1 x 0.2 sf)] x 0.40 (void ratio of stone) x 150ft.				=	123.00	cf
3.	Controlled Outflow Chamber: n/a				=	-	cf
4.	Inlet Chamber: n/a				=	-	cf
						153.00	cf
	Total Storage Provided:	153.00 cf	>	108 cf	:		OK

C. Roof drainage will be directly tied to the system.

D. Summary
It is our intention in these calculations to provide ground water recharge for the storm water. This has been shown to provide adequate storage, more than adequate reduction of off-site runoff, and dispersal of the water collected. The impervious coverage of the site is being greatly reduced and stormwater is being managed using permeable paver system in the front and rear yards which feed perforated pipe in a gravel bed.

END