

STORMWATER MANAGEMENT REPORT

Mutchmor Public School Addition
185 Fifth Avenue
Ottawa, Ontario

Report No. 12073-SWM

February 15, 2013



NOT VALID UNLESS
SIGNED & DATED

D. B. GRAY ENGINEERING INC.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

1052 Karsh Drive,
Ottawa, Ontario.
K1G 4N1

Tel: (613) 249-8044
Fax: (613) 249-9815
email: dbgray@rogers.com

Mutchmor Public School Addition
185 Fifth Avenue
Ottawa, Ontario

This report addresses the stormwater management requirements of a two storey addition to a public school located 185 Fifth Avenue (also having frontage on Fourth Avenue and Lyon Street).

This report forms part of the stormwater management design for the proposed development. Also refer to drawing SG-1 & SG-2 (Revision 2: Feb 15-13), prepared by D. B. Gray Engineering Inc.

WATER QUALITY:

Only the area of the proposed addition is being considered. Typically runoff from the roofs is considered clean, as such no permanent water quality measures are proposed.

During construction, an erosion and sediment control plan has been developed (see notes 2.1 to 2.4 on drawing SG-1). In summary: To filter out construction sediment: geotextile fabric will be placed between the grate and frame of all existing catch basins adjacent to the site and all new catch basins as they are installed.

WATER QUANTITY:

The stormwater quantity control measures detailed in this report are based on the criteria that the release rate, for post-development storm events, from the roof of the proposed addition is equal to or less than the flow produced by a five year storm using a runoff coefficient of 0.40 and a 20 minute time of concentration.

As recommended in City of Ottawa Technical Bulletin ISDTB-2012-1, the drainage system has been "stress tested" using design storms calculated on the basis of a 20% increase of the City's 1:100 year IDF curve rainfall values. The purpose of the stress test is to identify potential flooding of properties and, if necessary, to modify the proposed drainage system to prevent the flooding.

Calculations are based on the Rational Method. The runoff coefficients for the 100 year event were increased by 25% to maximum 1.00.

Stormwater will be stored within the development on the roof of the proposed addition. Each of two roof drains will be flow control type installed with a parabolic shaped slotted weir (1 slot per weir drain at 0.0124 l/s per mm per slot - 5 USgpm per inch per slot) causing the storm water to pond on the roof (Drainage Area I – 814 sq.m.). Stormwater released through the roof drains will drain to the existing storm drains in the existing building and will be conveyed off the site via an existing 150mm storm sewer connecting to a 450mm combined sewer in Fourth Avenue.

In the event that the 1:100 year IDF rainfall values are increased by 20%, the depth of the water stored on the roof will increase from 143mm depth at the roof drains to the maximum 150mm depth. Above this level stormwater will overflow out the scuppers and onto the adjacent grade where it will drain into a proposed storm sewer system. In such an event the maximum flowrate off the site will increase by about 41% from 3.55 to 4.99 l/s. The maximum volume of on-site storage will increase by about 15% from 32.81 to 37.14 cu.m.. There are no potential flooding issues and therefore the proposed drainage system does not need to be modified.

Since the stormwater management facility discharges to a combined sewer it is expected that Ministry of Environment Environmental Compliance Approval (ECA) will be required.

MAXIMUM ALLOWABLE RELEASE RATE:

The maximum permitted flow for the subject site is calculated as follows:

Area (A):	814 sq.m.
Time of Concentration (T):	20 minutes
Rainfall Intensity (Two Year Event) (i):	52 mm/hr
Runoff Coefficient (C):	0.40
Maximum Allowable Release Rate:	4.71 l/s

CONCLUSIONS:

WATER QUALITY:

Typically runoff from the roofs is considered clean, as such no permanent water quality measures are proposed.

An erosion and sediment control plan as been developed to be implemented during construction

WATER QUANTITY:

One Hundred Year Storm Event:

The maximum allowable release rate for the one hundred year storm event for the site is 4.71 l/s. The post-development release rate for the 100-year storm event is calculated to be 3.55 l/s. Therefore the maximum post development release rate for the 100-year storm event is less than the maximum permitted release rate. A maximum stored volume of 32.81 cu.m. is required to achieve the post development release rate.

Five Year Storm Event:

The maximum allowable release rate for the five year storm event for the site is 4.71 l/s. The post-development release rate for the 5-year storm event is calculated to be 2.63 l/s. Therefore the maximum post development release rate for the 5-year storm event is less than the maximum permitted release rate. A maximum stored volume of 15.29 cu.m. is required to achieve the post development release rate.

Stress Test:

Increasing the 1:100 year IDF rainfall values by 20% does not identify any potential flooding issues and therefore the proposed drainage system does not need to be modified.

Summary Tables

ONE HUNDRED YEAR EVENT				
Drainage Area	Maximum Release Rate l/s	Maximum Allowable Release Rate l/s	Maximum Volume Stored cu.m.	Maximum Volume Required cu.m.
AREA I (Roof)	3.55	4.71	32.81	32.81

FIVE YEAR EVENT				
Drainage Area	Maximum Release Rate l/s	Maximum Allowable Release Rate l/s	Maximum Volume Stored cu.m.	Maximum Volume Required cu.m.
AREA I (Roof)	2.63	4.71	15.29	15.29

STRESS TEST - 20% INCREASE TO ONE HUNDRED YEAR EVENT RAINFALL				
Drainage Area	Maximum Release Rate l/s	Maximum Allowable Release Rate l/s	Maximum Volume Stored cu.m.	Maximum Volume Required cu.m.
AREA I (Roof)	4.99	-	37.14	37.14

STORMWATER MANAGEMENT CALCULATIONS

Flow control roof drain calculations are based on the following formula:

$$Q = N \times S \times d \times F$$

where:

Q = flowrate in litres per second

N = number of roof drains

S = slots per weir

d = pond depth at roof drain in mm

F = flowrate through each slot

0.0124 litres per second per mm pond depth (5 USgpm per inch)

Storage calculations for the roof are based on the following formula for volume of a prismoidal shape (the formula is accurate if both length and width are changing proportionally):

$$V = (A_{\text{top}} + A_{\text{bottom}} + (A_{\text{top}} \times A_{\text{bottom}})^{0.5}) / 3 \times d$$

where:

V = volume in cu.m.

A_{top} = area of pond in sq.m.

A_{bottom} = area of bottom of depressed area

d = ponding depth in meters

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STORM WATER MANAGEMENT CALCULATIONS
Rational Method

ONE HUNDRED YEAR EVENT

Maximum Allowable Release Rate

Area (A):	814	sq.m.
Time of Concentration:	20	min.
Rainfall Intensity (i):	52	mm/hr (2 year event)
Runoff Coefficient (C):	0.40	

Maximum Allowable Release Rate: 4.71 l/s

DRAINAGE AREA I (Roof):

(ONE HUNDRED YEAR EVENT)

				C
Roof Area:	814	sq.m.	1.00	
Paved Area:	0	sq.m.	1.00	
Landscaped Areas:	0	sq.m.	0.25	
Total Catchment Area	814	Ave. C	1.00	
No. of Roof Drains:	2			
Slots per Wier:	1	0.0124 l/s/mm/slot (5 USgpm/in/slot)		
Depth at Roof Drain:	143	mm		
Maximum Release Rate	3.55	l/s	Pond Area:	603 sq.m.
			Achieved Vol:	32.81 cu.m.
			Max. Vol. Required:	32.81 cu.m.

Time	i	2.78AiC	Release	Stored	Stored
min.	mm/hr	l/s	Rate	Rate	Volume
			l/s	l/s	cu.m.
5	243	54.92	3.55	51.37	15.41
10	179	40.41	3.55	36.86	22.11
15	143	32.34	3.55	28.79	25.91
20	120	27.14	3.55	23.59	28.31
25	104	23.50	3.55	19.95	29.93
30	92	20.79	3.55	17.24	31.03
35	83	18.69	3.55	15.14	31.79
40	75	17.00	3.55	13.46	32.29
45	69	15.63	3.55	12.08	32.61
50	64	14.47	3.55	10.92	32.77
55	60	13.49	3.55	9.94	32.81
60	56	12.65	3.55	9.10	32.76
65	53	11.91	3.55	8.36	32.62
70	50	11.27	3.55	7.72	32.42
75	47	10.69	3.55	7.14	32.15
80	45	10.18	3.55	6.63	31.83
85	43	9.72	3.55	6.17	31.47
90	41	9.30	3.55	5.75	31.07
95	39	8.92	3.55	5.37	30.64
100	38	8.58	3.55	5.03	30.17
105	36	8.26	3.55	4.71	29.67
110	35	7.97	3.55	4.42	29.15
115	34	7.70	3.55	4.15	28.61
120	33	7.44	3.55	3.89	28.04
125	32	7.21	3.55	3.66	27.46
130	31	6.99	3.55	3.44	26.86
135	30	6.79	3.55	3.24	26.24
140	29	6.60	3.55	3.05	25.60
145	28	6.42	3.55	2.87	24.95
150	28	6.25	3.55	2.70	24.29
180	24	5.41	3.55	1.86	20.09
210	21	4.78	3.55	1.24	15.57
240	19	4.30	3.55	0.75	10.83
270	17	3.91	3.55	0.36	5.91
300	16	3.60	3.55	0.05	0.85

FIVE YEAR EVENT

Maximum Allowable Release Rate

Area (A): 814 sq.m.
 Time of Concentration: 20 min.
 Rainfall Intensity (i): 52 mm/hr (2 year event)
 Runoff Coefficient (C): 0.40

Maximum Allowable Release Rate: 4.71 l/s

DRAINAGE AREA I (Roof):

(FIVE YEAR EVENT)

			C	
Roof Area:	814	sq.m.	0.90	
Paved Area:	0	sq.m.	0.90	
Landscaped Areas:	0	sq.m.	0.20	
Total Catchment Area		814	Ave. C	0.90
No. of Roof Drains:	2			
Slots per Wier:	1	0.0124 l/s/mm/slot (5 USgpm/in/slot)		
Depth at Roof Drain:	106	mm		
Maximum Release Rate	2.63	l/s	Pond Area:	365 sq.m.
			Achieved Vol:	15.29 cu.m.
			Max. Vol. Required:	15.29 cu.m.

Time	i	2.78AiC	Release	Stored	Stored
min.	mm/hr	l/s	Rate	Rate	Volume
			l/s	l/s	cu.m.
5	141	28.75	2.63	26.13	7.84
10	104	21.22	2.63	18.59	11.16
15	84	17.02	2.63	14.39	12.95
20	70	14.31	2.63	11.68	14.02
25	61	12.40	2.63	9.78	14.66
30	54	10.98	2.63	8.36	15.04
35	49	9.88	2.63	7.25	15.23
40	44	9.00	2.63	6.37	15.29
45	41	8.27	2.63	5.65	15.25
50	38	7.67	2.63	5.04	15.12
55	35	7.15	2.63	4.53	14.94
60	33	6.71	2.63	4.08	14.70
65	31	6.32	2.63	3.70	14.41
70	29	5.98	2.63	3.35	14.09
75	28	5.68	2.63	3.05	13.74
80	27	5.41	2.63	2.78	13.36
85	25	5.17	2.63	2.54	12.95
90	24	4.95	2.63	2.32	12.53
95	23	4.75	2.63	2.12	12.08
100	22	4.56	2.63	1.94	11.62
105	22	4.40	2.63	1.77	11.14
110	21	4.24	2.63	1.61	10.65
115	20	4.10	2.63	1.47	10.15
120	19	3.96	2.63	1.34	9.63
125	19	3.84	2.63	1.21	9.11
130	18	3.73	2.63	1.10	8.57
135	18	3.62	2.63	0.99	8.03
140	17	3.52	2.63	0.89	7.47
145	17	3.42	2.63	0.79	6.91
150	16	3.33	2.63	0.71	6.35
180	14	2.89	2.63	0.26	2.82
210	13	2.56	2.56	0.00	0.00
240	11	2.30	2.30	0.00	0.00
270	10	2.09	2.09	0.00	0.00
300	9	1.93	1.93	0.00	0.00
330	9	0.00	0.00	0.00	0.00
360	8	0.00	0.00	0.00	0.00

**STRESS TEST - 20% INCREASE TO ONE HUNDRED
YEAR RAINFALL EVENT**

DRAINAGE AREA I (Roof):

(ONE HUNDRED YEAR EVENT)

Roof Area:	814	sq.m.		1.00		
Paved Area:	0	sq.m.		1.00		
Landscaped Areas:	0	sq.m.		0.25		
Total Catchment Area	814	Ave. C		1.00		
No. of Roof Drains:	2					
Slots per Wier:	1	0.0124 l/s/mm/slot (5 USgpm/in/slot)				
Depth at Roof Drain:	150	mm				
Max. Roof Drain Release Rate	3.72	l/s		Pond Area:	654	sq.m.
Max. Scupper Release Rate	1.27	l/s		Achieved Vol:	37.14	cu.m.
Maximum Release Rate	4.99	l/s		Max. Vol. Required:	37.14	cu.m.

Time min.	i mm/hr	2.78AiC l/s	Roof Drain Release Rate l/s	Scupper Release Rate l/s	Total Release Rate l/s	Stored Rate l/s	Stored Volume cu.m.
5	291	65.91	3.72	0.00	3.72	62.19	18.66
10	214	48.49	3.72	0.00	3.72	44.77	26.86
15	171	38.80	3.72	0.00	3.72	35.08	31.57
20	144	32.57	3.72	0.00	3.72	28.85	34.62
25	125	28.20	3.72	0.00	3.72	24.48	36.72
30	110	24.95	3.72	0.59	4.31	20.64	37.14
35	99	22.42	3.72	1.02	4.74	17.69	37.14
40	90	20.41	3.72	1.21	4.93	15.48	37.14
45	83	18.75	3.72	1.27	4.99	13.76	37.14
50	77	17.37	3.72	1.27	4.99	12.38	37.14
55	72	16.19	3.72	1.22	4.94	11.26	37.14
60	67	15.18	3.72	1.14	4.86	10.32	37.14
65	63	14.30	3.72	1.05	4.77	9.52	37.14
70	60	13.52	3.72	0.96	4.68	8.84	37.14
75	57	12.83	3.72	0.86	4.58	8.25	37.14
80	54	12.22	3.72	0.76	4.48	7.74	37.14
85	52	11.66	3.72	0.66	4.38	7.28	37.14
90	49	11.16	3.72	0.57	4.29	6.88	37.14
95	47	10.71	3.72	0.47	4.19	6.52	37.14
100	45	10.29	3.72	0.38	4.10	6.19	37.14
105	44	9.91	3.72	0.30	4.02	5.90	37.14
110	42	9.56	3.72	0.21	3.93	5.63	37.14
115	41	9.23	3.72	0.13	3.85	5.38	37.14
120	39	8.93	3.72	0.05	3.77	5.16	37.14
125	38	8.65	3.72	0.00	3.72	4.93	36.99
130	37	8.39	3.72	0.00	3.72	4.67	36.43
135	36	8.15	3.72	0.00	3.72	4.43	35.85
140	35	7.92	3.72	0.00	3.72	4.20	35.25
145	34	7.70	3.72	0.00	3.72	3.98	34.63
150	33	7.50	3.72	0.00	3.72	3.78	34.00
180	29	6.49	3.72	0.00	3.72	2.77	29.92
210	25	5.74	3.72	0.00	3.72	2.02	25.47
240	23	5.16	3.72	0.00	3.72	1.44	20.75
270	21	4.70	3.72	0.00	3.72	0.98	15.82
300	19	4.32	3.72	0.00	3.72	0.60	10.72