PROPOSED

THREE (3) STOREY APARTMENT BUILDING SITE

LOT 75

R-PLAN 263

370 ATHLONE AVENUE

CITY OF OTTAWA

STORM DRAINAGE REPORT

REPORT No. R-823-83

T.L. MAK ENGINEERING CONSULTANTS LTD.

MAY 2024

REFERENCE FILE NUMBER 823-83

Introduction

The proposed three (3) storey residential apartment building site is located on the west side of Athlone Avenue and situated south of Scott Street and north of Richmond Road. Its legal property description is Lot 75 Registered Plan 263 in City of Ottawa (Ward 15 Kitchissippi). Presently, the residential development site under consideration houses a 1-storey vinyl sided dwelling in which the house is located near the front of the lot. The municipal address of the property is referenced as 370 Athlone Avenue.

The lot area under consideration is approximately 508.38 square metres. This property is proposed for the development of a (3) storey residential apartment building plus a basement. The total gross floor area at each floor will cover an area of approximately 2,555 ft^2 (237.0 m) and for the proposed building is approximately 7,665.0 square feet (712.0 square metres) including basement level.

The building will house a total of 16 apartment units, including four (4) 2-bedroom units, eight (8) 1-bedroom units and four (4) bachelor units. The storm water outlet for this site is the existing 600mm diameter storm sewer located within the Athlone Avenue road right of way.

From storm-drainage criteria set by the staff at the City of Ottawa's Engineering Department, the allowable post-development runoff release rates shall not exceed the two (2)-year pre-development conditions because the existing storm pipe was built prior to 1970. The allowable pre-development runoff coefficient is the lesser of the calculated "C" existing value = 0.55 or C_{allow} = 0.5 maximum. If the uncontrolled storm-water runoff exceeds the specified requirements, then on-site storm-water management (SWM) control measures are necessary. The post-development runoff coefficient for this site is estimated at C = 0.79, which exceeds the calculated pre-development allowable C_{allow} = 0.5 criteria for the Athlone Avenue storm sewer without on-site SWM control. Therefore, SWM measures are required. Refer to the attached Drainage Area Plan (Figure 1) as detailed in Appendix A. For Pre and Post site development characteristics, refer also to the storm Drainage Area Plan Dwg. No. 823-83 D-1 for details.

This report will address and detail the grading, drainage, and storm-water management control measures required to develop this property. Based on the Proposed Site Grading and Servicing Plan (Dwg. No. 823-83 G-1), and on the Proposed Rooftop Storm-water Management Plan (Dwg. No. 823-83 SWM-1), the storm water of this lot will be controlled on site only by the building's flat rooftop.

The storm-water management calculations that follow will detail the extent of on-site SWM control to be implemented and the storage volume required on site to attain where possible the appropriate runoff release that will conform to the City's established drainage criteria and review requirements.

Because the site will be connecting to and outletting into the separated Athlone Avenue storm sewer, therefore, the approval exemption under Ontario Regulations 525/98 would apply since storm water discharges from this site will outlet flow into a downstream storm sewer. Thus, an Environmental Compliance Application (ECA) application will not be required to be submitted to the Ministry.

Site Data

1. Development Property Area

Post-Development Site Area Characteristics

Development Lot Area	=	508.38 m^2
Roof Surface Area	=	280.97 m^2
Concrete Area	=	37.26 m^2
Interlock Area	=	105.82 m^2
Grass Area	=	84.33 m^2

$$C = \frac{(280.97 \times 0.9) + (105.82 \times 0.9) + (37.26 \times 0.9) + (84.33 \times 0.2)}{508.38}$$

$$C = \frac{398.511}{508.38}$$

$$C = 0.7839$$

Say "C" $= 0.79$

Therefore, the average post-development "C" for this site is 0.79.

2. Controlled Area Data (NODE #1 and NODE #2)

Roof Surface Area	=	259.87 m^2
Total Storm-water Controlled Area	=	259.87 m^2

$$C = \frac{(259.87 \times 0.9)}{259.87}$$

$$C = \frac{233.883}{259.87}$$

$$C = 0.9$$

Say "C" $= 0.9$

Therefore, the post-development "C" for the controlled storm-water drainage area (roof top) is 0.90.

3. Uncontrolled Area Data (NODE #3)

PROPOSED SITE

Roof Area	=	21.10 m^2
Grass Area	=	84.33 m^2
Interlock Paver Area	=	105.82 m^2
Concrete Area	=	37.26 m^2
Total Storm-water Uncontrolled Area	=	248.51 m^2

$$C = \frac{(105.82 \times 0.9) + (84.33 \times 0.2) + (37.26 \times 0.9) + (21.10 \times 0.9)}{248.51}$$

$$C = \frac{164.628}{248.51}$$

$$C = 0.663$$

Say "C" = 0.66

Therefore, the average post-development "C" for the uncontrolled storm-water drainage area of 248.51 m^2 from this site is 0.66.

The total tributary area consisting of approximately 248.51 square metres will be out-letting off site uncontrolled from the residential apartment building site which is also the surface area draining to the front of the lot and outletting to the Athlone Avenue road right of way.

The uncontrolled drainage area draining to the front of the lot is 248.51 m^2 and the controlled drainage area from the available flat roof top is 259.87 m^2 which totals to 508.38 m^2.

The SWM area to be controlled is 259.87 m^2. Refer to the attached "Drainage Area Plan" in Figure 1 of Appendix A for further details.

Pre-Development Flow Estimation

Maximum allowable off-site flow: two (2)-year storm

Node #101

Pre-Development Site Area Characteristics		
Development Lot Area	=	508.38 m^2
Asphalt Area	=	1.69 m^2
Concrete/Interlock Area	=	103.66 m^2
Roof Area	=	147.35 m^2
Grass Area	=	255.68 m^2

$$C_{2pre} = \frac{(147.35 \times 0.9) + (103.66 \times 0.9) + (1.69 \times 0.9) + (255.68 \times 0.2)}{508.38}$$

$$C_{2pre} = \frac{278.566}{508.38}$$

$$C_{2pre} = 0.548$$

Say $C_{2pre} = 0.55 > C_{2allow} = 0.5$

∴ Use C_{pre} = 0.50 allowable for redevelopment

T_c = D/V where D = 27.0m, ΔH = 0.94m, S = 3.5%, and V = 1.30 feet/second = 0.40 m/s

Therefore,

$T_c = \frac{27.0m}{0.40m/s}$

T_c = 1.13 minutes

Use T_c = 10 minutes

I_2 = 77.10 mm/hr [City of Ottawa, two (2)-year storm]

Using the Rational Method

Q = 2.78 (0.50) (77.10) (0.05084)

Q = 5.45 L/s

Therefore, the total allowable flow off-site is 5.45 L/s.

The pre-development flow of the two (2)-year and 100-year storm event draining off-site from the lot is as follows:

Where, Tc = 10 min.

$Q_{2pre} = 2.78\ CIA$

$$C_{2pre} = \frac{278.566}{508.38}$$

$$C_{2pre} = 0.548$$

Say, $C_{2pre} = 0.55$ all draining to the front of lot

$Q_{2pre} = 2.78\ (0.55)\ (77.10)\ (0.05084)$

$= 5.99\ L/s$

$$C_{100pre} = \frac{(147.35\times1.0)+(103.66\times1.0)+(1.69\times1.0)+(255.68 \times 0.2 \times 1.25)}{508.38}$$

$$C_{100pre} = \frac{316.62}{508.38}$$

$$C_{100pre} = 0.623$$

Say, $C_{100pre} = 0.62$ all draining to the front of lot

$$Q_{100pre} = 2.78\ (0.62)\ (178.6)\ (0.05084)$$

$$= 15.65\ L/s$$

Therefore under current site conditions the 2-year pre-development flow is estimated at 5.99 L/s and the 100 year pre-development flow is estimated at 15.65 L/s.

A coloured Google image and aerial photography of these current pre-development conditions of the site is provided in Appendix B of this report for reference.

Post-Development Flow Estimation

Uncontrolled Drainage Areas

The post-development flow of the two (2)-year and 100-year storm event draining off-site from the lot uncontrolled is as follows:

Where, Tc = 10 min.

Node #3

$Q_{2post} = 2.78\ CIA$

Post Development Area Draining to the **front** uncontrolled is:

Roof Area	=	21.10 m^2
Interlock Paver Area	=	105.82 m^2
Grass Area	=	84.33 m^2
Concrete Area	=	37.26 m^2

$A_{Total} = 248.51\ m^2$

$$C_{2post} = \frac{(105.82 \times 0.9) + (84.33 \times 0.2) + (37.26 \times 0.9) + (21.10 \times 0.9)}{248.51}$$

$$C_{2post} = \frac{164.628}{248.51}$$

$$C_{2post} = 0.663$$

Say, C_{2post}= 0.66 draining to the front of lot uncontrolled.

Q_{2post}= 2.78 (0.66) (77.10) (0.0249)

$= 3.52$ L/s

$$C_{100post} = \frac{(105.82 \times 1.0) + (84.33 \times 0.2 \times 1.25) + (37.26 \times 1.0) + (21.10 \times 1.0)}{248.51}$$

$$C_{100post} = \frac{185.26}{248.51}$$

$C_{100post} = 0.746$

Say, $C_{100post} = 0.75$ draining to the front of lot uncontrolled

$Q_{100post} = 2.78\ (0.75)\ (178.6)\ (0.0249)$

$= 9.27$ L/s

Therefore under post development condition, the 2-year uncontrolled flow off-site is estimated at 3.52 L/s and the 100 year uncontrolled flow is 9.27 L/s.

For this site, because 248.51 square meters of the site area is drained uncontrolled off site, the net allowable discharge for this site into the existing sewer system using the two (2)-year storm event criteria at C_{allow} = 0.5 is calculated as follow: Q = {2.78 (0.5) (77.10) (0.0508) - [2.78 (0.75) (178.6) (0.0249)]} = 5.45 L/s – 9.27 L/s = -3.82 L/s. Therefore, according to this approach, the maximum calculated allowable flow rate off site is 5.45 L/s and the net allowable controlled flow rate off-site is -3.82 L/s. Therefore, an exceedance of -3.82 L/s off-site is put forth for consideration to the City of Ottawa due to the small development lot size.

Storm-Water Management Analysis

Based on the above calculation from site information provided and given the small area size of the lot under consideration (508.38 m^2) therefore to limit the maximum allowable flow off-site to 5.45 L/s the City of Ottawa Engineering Department recognized that this is not achievable.

For this proposed development, the building flat roof top will be used to provide Stormwater Management (SWM) attenuation for this site. Two (2) controlled roof drains are proposed to regulate flow off-site for on-site SWM measures to be incorporated with this proposed development.

The roof drain flow rate proposed is set at 0.316 L/s (5.0 U.S. gal/min.) for Roof Drain #1 and for Roof Drain #2. Therefore, the total controlled roof drain flow off-site is 0.63 L/s (10.0 U.S. gal/min.).

Thus for this site, the 2-year maximum post development flow rate draining off-site is the uncontrolled flow from the lot plus controlled rooftop flow which equals to 4.15 L/s (3.52 L/s + 0.63 L/s) which is less than 5.45 L/s set by the SWM criteria for this site. During the 100 year event, the maximum post

development flow rate off-site is estimated at 9.90 L/s (9.27 L/s + 0.63 L/s) which exceeds the allowable site flow of 5.45 L/s by 4.45 L/s.

Therefore for this proposed development site, the total maximum allowable two (2) year release site of 5.45 L/s will not be exceeded since the estimated flow is 4.15 L/s. For storm events up to and including the 100 year event the total maximum allowable release rate of 5.45 L/s will be exceeded by 4.45 L/s (estimated at 9.90 L/s) where the flow exceedance is 4.45 L/s for this site.

However, in comparing the pre-development flow of the current site conditions to the post development flow, the SWM regulated flow plus uncontrolled flow from the proposed site under the post development conditions at the 2-year event = 4.15 L/s and the 100 year event = 9.90 L/s where both of the post development flow events are less than current pre-development flow estimate for the site at 2-Year $_{Pre}$ = 5.99 L/s and 100-Year $_{Pre}$ = 15.65 L/s. Therefore with this proposed development, stormwater flow is improved from that of the existing condition.

To the controlled drainage area (flat roof top of proposed building) the post-development inflow rate during the two (2)-year and 100-year storms for the (2) two flat rooftop areas can be calculated as follows.

Design Discharge Computation

Flat Rooftop Areas

To Calculate Roof Storage Requirements

The proposed flat roof of the apartment building on the property will incorporate two (2) roof drains to control flow off-site for this development property. The roof drain flow rate proposed is at 0.316 L/s (5.0 U.S. gal./min.) for roof drain #1 and for roof drain #2. The specified roof drain is the Watts "Adjustable Accutrol Weir" (Model # RD-100-A-ADJ) with weir opening in the closed position, which will allow a flow of 0.316 L/s under a head of 150 mm water above the drain for roof drain #1. At roof drain #2, the weir opening is also in the closed position which will allow a flow of 0.316 L/s under a head of 150 mm water above the drain. See Appendix C for Roof Drain details. Therefore, the storm-water flow that can be controlled from this rooftop and outletted off site is 0.316 L/s + 0.316 L/s = 0.63 L/s. Refer to the Proposed Rooftop Stormwater Management Plan Dwg. 823-83 SWM-1 for roof drain details.
C=0.9 will be used for sizing roof storage volume in this case.

Inflow rate (Q_A) = 2.78 CIA, where C = 0.9, A = surface area of roof, I = mm/hr

For Roof Area 1, Q_{A1} = 2.78 CIA (NODE #1)

Two (2)-Year Event
C_2 = 0.90
A = 129.86 m^2
I = mm/hr

Q_1 = 2.78 (0.90) (0.013 ha.) I = 0.03253 I

100-Year Event

$C_{100} = 1.0$

$A = 129.86\ m^2$

I = mm/hr

$Q_1 = 2.78\ (1.0)\ (0.013\ ha.)\ I = 0.03614\ I$

For Roof Area 2, Q = 2.78 CIA (NODE #2)

Two (2)-Year Event

$C_2 = 0.90$

$A = 130.01\ m^2$

I = mm/hr

$Q_2 = 2.78\ (0.90)\ (0.013\ ha.)\ I = 0.03253\ I$

100-Year Event

$C_{100} = 1.0$

$A = 130.01\ m^2$

I = mm/hr

$Q_2 = 2.78\ (1.0)\ (0.013\ ha.)\ I = 0.03614\ I$

The summary results of the calculated inflow and the storage volume of the site and building's flat rooftop to store the two (2)-year and 100-year storm events are shown in **Tables 1 to 4** inclusive.

Table 5 summarizes the post-development design flows from the building roof top area as well as the type of roof drains, the maximum anticipated ponding depths, storage volumes required, and storage volumes provided for the two (2)-year, and 100-year design events.

Table 5: Design Flow and Roof Drain Table

Roof Drain ID & Drainage Area (ha)	Number of Roof Drains	Watts Roof Drain Model ID (Weir Opening)	Controlled Flow per Drain (L/s)		Approximate Ponding Depth Above Drains (m)		Storage Volume Required (m^3)		Max. Storage Available (m^3)
			2 YR	100 YR	2 YR	100 YR	2 YR	100 YR	
RD-1 (0.013 ha)	1	RD-100-A-ADJ (CLOSED)	0.316	0.316	0.11	0.15	1.81	6.33	6.39
RD-2 (0.013 ha)	1	RD-100-A-ADJ (CLOSED)	0.316	0.316	0.11	0.15	1.81	6.33	6.40
Total Roof (0.026 ha)	2	-	**0.63**	**0.63**	-	-	**3.62**	**12.66**	**12.79**

Erosion and Sediment Control

The contractor shall implement Best Management Practices to provide for protection of the receiving storm sewer during construction activities. These practices are required to ensure no sediment and/or associated pollutants are released to the receiving watercourse. These practices include installation of a "siltsack" catch basin sediment control device or equal in catch basins as recommended by manufacturer on-site and off-site within the Athlone Avenue road right of way adjacent to this property.

Siltsack shall be inspected every 2 to 3 weeks and after every major storm. The deposits will be disposed of as per the requirements of the contract. See Dwg. #823-83 ESC-1 for details.

Conclusion

At this proposed residential site and to develop this lot to house a 16 unit apartment building on a 0.0508 ha. parcel of land, the estimated allowable flow off-site is calculated at 5.45 L/s based on City of Ottawa Drainage and Stormwater Management (SWM) criteria of 2-year pre-development flow at C_{allow} = 0.50. For on-site SWM attenuation, the flat roof top of the proposed apartment building will be utilized and (2) controlled roof drains are incorporated each with a controlled release rate of 0.316 L/s (5.0 U.S. gal/min.). The controlled flow from this site totals to 0.63 L/s for the post development condition. The uncontrolled 2-year post development flow from the remainder of the site is estimated at 3.52 L/s and 9.27 L/s for the 100-year event respectively.

During the two (2)-year storm event for the flat rooftop storage, the ponding depth of rooftop area 1 and 2 is estimated at 110 mm at the drain and 0mm at the roof perimeter, assuming a 1.9% minimum roof pitch to the drain. The rooftop storage available at Roof Area 1 is 2.46 m^3 and the rooftop storage available at Roof Area 2 is 2.48 m^3, for a total of 4.94 m^3, which is greater than the required volume of 3.62 m^3.

During the 100-year storm event for the flat rooftop storage, the ponding depth of Roof Area 1 and 2 is estimated at 150 mm at the drain and 0mm at the roof perimeter, assuming a 1.9% minimum roof pitch to the drain. The rooftop storage available at Roof Area 1 is 6.39 m^3 and the rooftop storage available at Roof Area 2 is 6.40 m^3, for a total of 12.79 m^3, which is greater than the required volume of 12.66 m^3.

Therefore, by means of flat building rooftop storage and grading the site to the proposed grades as shown on the Proposed Grading and Servicing Plan and Proposed Rooftop Stormwater Management Plan Dwg. 823-83 G-1 and 823-83 SWM-1 respectively, the desirable two (2)-year storm and 100-year storm event detention volume of 4.94 m^3 and 12.79 m^3 respectively will be available on site. Refer to Appendix D for detailed calculations of available storage volumes.

Thus for this development site, the 2-year maximum post development flow draining off-site is the controlled roof top flow plus the uncontrolled flow from the remainder of the site totals to 4.15 L/s (0.63 L/s + 3.52 L /s) which is less than the allowable 5.45 L/s. For event up to and including 100 year, the estimated maximum post development flow draining off-site is 9.90 L/s (0.63 L/s + 9.27 L/s) which exceeds the site allowable of 5.45 L/s by 4.45 L/s for this site.

In comparing the pre-development flow of the current site conditions to the post development flow, the SWM regulated flow plus uncontrolled flow from the proposed site under the post development conditions at the 2-year event = 4.15 L/s and the 100 year event = 9.90 L/s where both of the post development flow events are less than current pre-development flow estimate for the site at 2-Year $_{Pre}$ = 5.99 L/s and 100-Year $_{Pre}$ = 15.65 L/s. Therefore with this proposed development, stormwater flow is improved from that of the existing condition.

The building weeping tile drainage will outlet via its separate 150mm diameter PVC storm lateral. The roof drains will be outletted also via a separate 150mm PVC storm lateral from the apartment building which "wye" into the proposed 150mm dia. weeping tile storm lateral, whereupon both laterals are outletting to the existing Athlone Avenue 600mm diameter storm sewer with only one (1) connection. The City of Ottawa recommends that pressurized drain pipe material be used in the building for the roof drain leader pipe in the event of surcharging on the City storm sewer system. Refer to the proposed site grading and servicing plan Dwg. 823-83 G-1 for details.

PREPARED BY T.L. MAK ENGINEERING CONSULTANTS LTD.

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PROPOSED 370 ATHLONE AVENUE THREE STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 1

TWO (2)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME

ROOF DRAIN No. 1

t_c **TIME** (minutes)	I **2-YEAR** (mm/hr)	Q **ACTUAL** (L/s)	Q **ALLOW** (L/s)	Q **STORED** (L/s)	**VOLUME STORED** (m^3)
5	102.80	3.344	0.316	3.028	0.91
10	77.10	2.508	0.316	2.192	1.32
15	63.30	2.059	0.316	1.743	1.57
20	52.03	1.693	0.316	1.377	1.65
25	45.15	1.469	0.316	1.153	1.73
30	39.90	1.298	0.316	0.982	1.77
35	36.06	1.173	0.316	0.857	1.80
40	32.87	1.069	0.316	0.753	1.81
45	30.24	0.984	0.316	0.669	1.806
50	28.04	0.912	0.316	0.596	1.79

Therefore, the required rooftop storage volume is 1.81 m^3.

PROPOSED 370 ATHLONE AVENUE THREE STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 2

TWO (2)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME

ROOF DRAIN No. 2

t_c **TIME** (minutes)	**I 2-YEAR** (mm/hr)	**Q ACTUAL** (L/s)	**Q ALLOW** (L/s)	**Q STORED** (L/s)	**VOLUME STORED** (m^3)
5	102.80	3.344	0.316	3.028	0.91
10	77.10	2.508	0.316	2.192	1.32
15	63.30	2.059	0.316	1.743	1.57
20	52.03	1.693	0.316	1.377	1.65
25	45.15	1.469	0.316	1.153	1.73
30	39.90	1.298	0.316	0.982	1.77
35	36.06	1.173	0.316	0.857	1.80
40	32.87	1.069	0.316	0.753	1.81
45	30.24	0.984	0.316	0.669	1.806
50	28.04	0.912	0.316	0.596	1.79

Therefore, the required storage volume is 1.81 m^3.

PROPOSED 370 ATHLONE AVENUE THREE STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 3

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME

ROOF DRAIN No. 1

t_c **TIME** (minutes)	I **100-YEAR** (mm/hr)	Q **ACTUAL** (L/s)	Q **ALLOW** (L/s)	Q **STORED** (L/s)	**VOLUME STORED** (m^3)
10	178.6	6.455	0.316	6.139	3.68
15	142.9	5.164	0.316	4.848	4.36
20	120.0	4.337	0.316	4.021	4.83
25	103.9	3.755	0.316	3.439	5.16
30	91.9	3.321	0.316	3.005	5.41
35	82.6	2.985	0.316	2.669	5.61
40	75.1	2.714	0.316	2.398	5.76
45	69.1	2.497	0.316	2.181	5.89
50	63.9	2.309	0.316	1.993	5.98
55	59.6	2.154	0.316	1.838	6.07
60	55.9	2.020	0.316	1.704	6.13
65	52.6	1.901	0.316	1.585	6.18
70	49.8	1.800	0.316	1.484	6.23
75	47.3	1.709	0.316	1.393	6.27
80	44.99	1.626	0.316	1.310	6.29
85	42.95	1.552	0.316	1.236	6.30
90	41.10	1.485	0.316	1.169	6.31
95	39.44	1.425	0.316	1.109	6.321
100	37.90	1.370	0.316	1.054	6.33
105	36.50	1.319	0.316	1.003	6.319
110	35.20	1.272	0.316	0.956	6.31

Therefore, the required storage volume is 6.33 m^3.

PROPOSED 370 ATHLONE AVENUE THREE STOREY APARTMENT

BUILDING DEVELOPMENT SITE

TABLE 4

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME

ROOF DRAIN No. 2

t_c **TIME** (minutes)	I **100-YEAR** (mm/hr)	Q **ACTUAL** (L/s)	Q **ALLOW** (L/s)	Q **STORED** (L/s)	**VOLUME STORED** (m^3)
10	178.6	6.455	0.316	6.139	3.68
15	142.9	5.164	0.316	4.848	4.36
20	120.0	4.337	0.316	4.021	4.83
25	103.9	3.755	0.316	3.439	5.16
30	91.9	3.321	0.316	3.005	5.41
35	82.6	2.985	0.316	2.669	5.61
40	75.1	2.714	0.316	2.398	5.76
45	69.1	2.497	0.316	2.181	5.89
50	63.9	2.309	0.316	1.993	5.98
55	59.6	2.154	0.316	1.838	6.07
60	55.9	2.020	0.316	1.704	6.13
65	52.6	1.901	0.316	1.585	6.18
70	49.8	1.800	0.316	1.484	6.23
75	47.3	1.709	0.316	1.393	6.27
80	44.99	1.626	0.316	1.310	6.29
85	42.95	1.552	0.316	1.236	6.30
90	41.10	1.485	0.316	1.169	6.31
95	39.44	1.425	0.316	1.109	6.321
100	37.90	1.370	0.316	1.054	6.33
105	36.50	1.319	0.316	1.003	6.319
110	35.20	1.272	0.316	0.956	6.31

Therefore, the required rooftop storage volume is 6.33 m^3.

PROPOSED

THREE (3) STOREY APARTMENT BUILDING SITE

LOT 75

R-PLAN 263

370 ATHLONE AVENUE

CITY OF OTTAWA

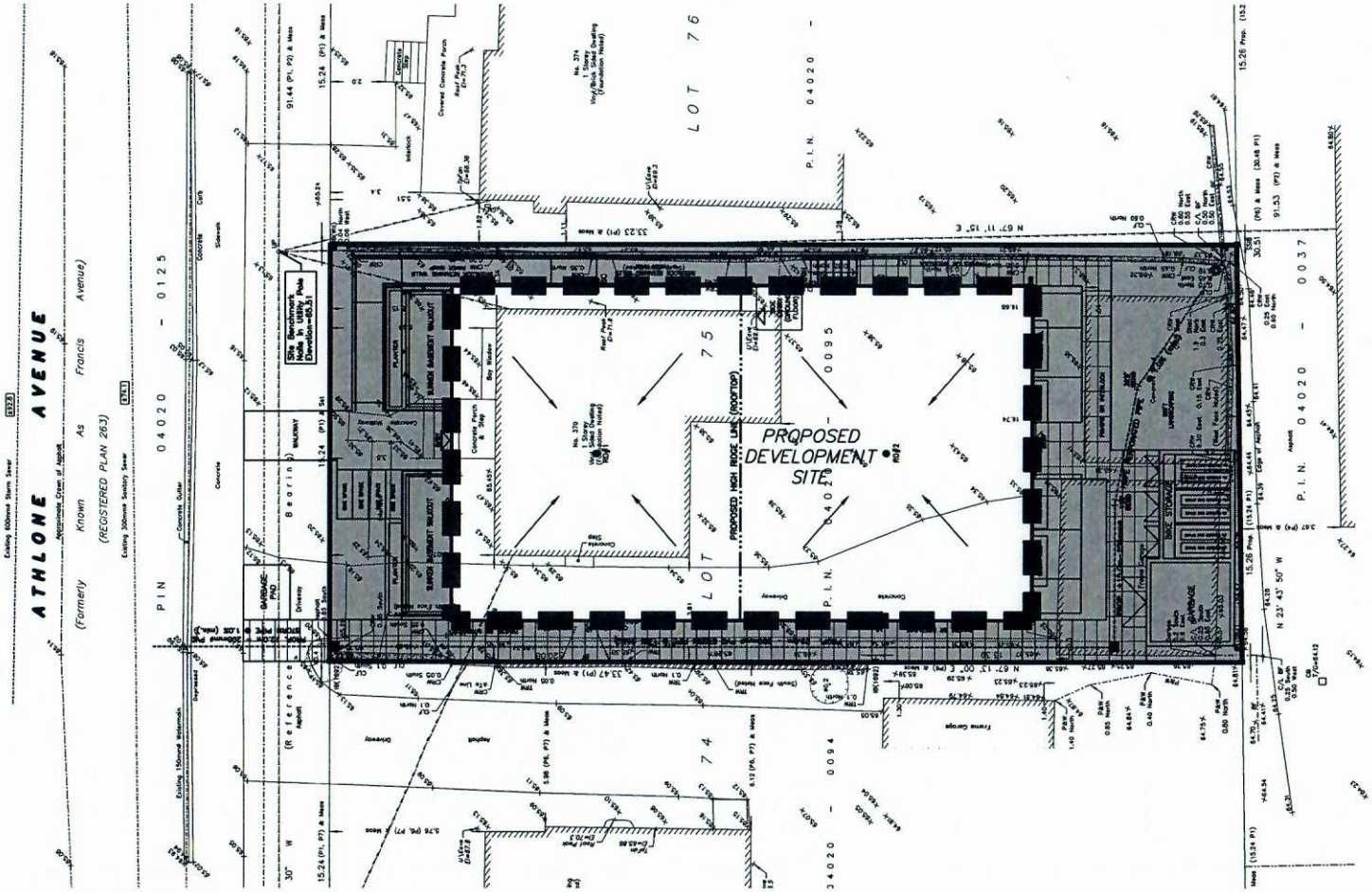
APPENDIX A

STORM DRAINAGE AREA PLAN

FIGURE 1

PROPOSED 370 ATHLONE AVENUE
SITE DEVELOPMENT
DRAINAGE AREA PLAN

N.T.S.



LEGEND

- LIMIT OF CONTROLLED STORM DRAINAGE AREA = 259.87 SQ. M
- UNCONTROLLED STORM DRAINAGE AREA = 248.51 SQ. M

TOTAL AREA = 508.38 SQ. M

POST-DEVELOPMENT SITE
AVERAGE "C" = 0.79

T.L. MAK ENGINEERING CONSULTANTS LTD.
CONSULTING ENGINEERS

PROJECT No.	DATE	DRAWING No.
823-83	MAY 2024	FIGURE 1

PROPOSED

THREE (3) STOREY APARTMENT BUILDING SITE

LOT 75

R-PLAN 263

370 ATHLONE AVENUE

CITY OF OTTAWA

APPENDIX B

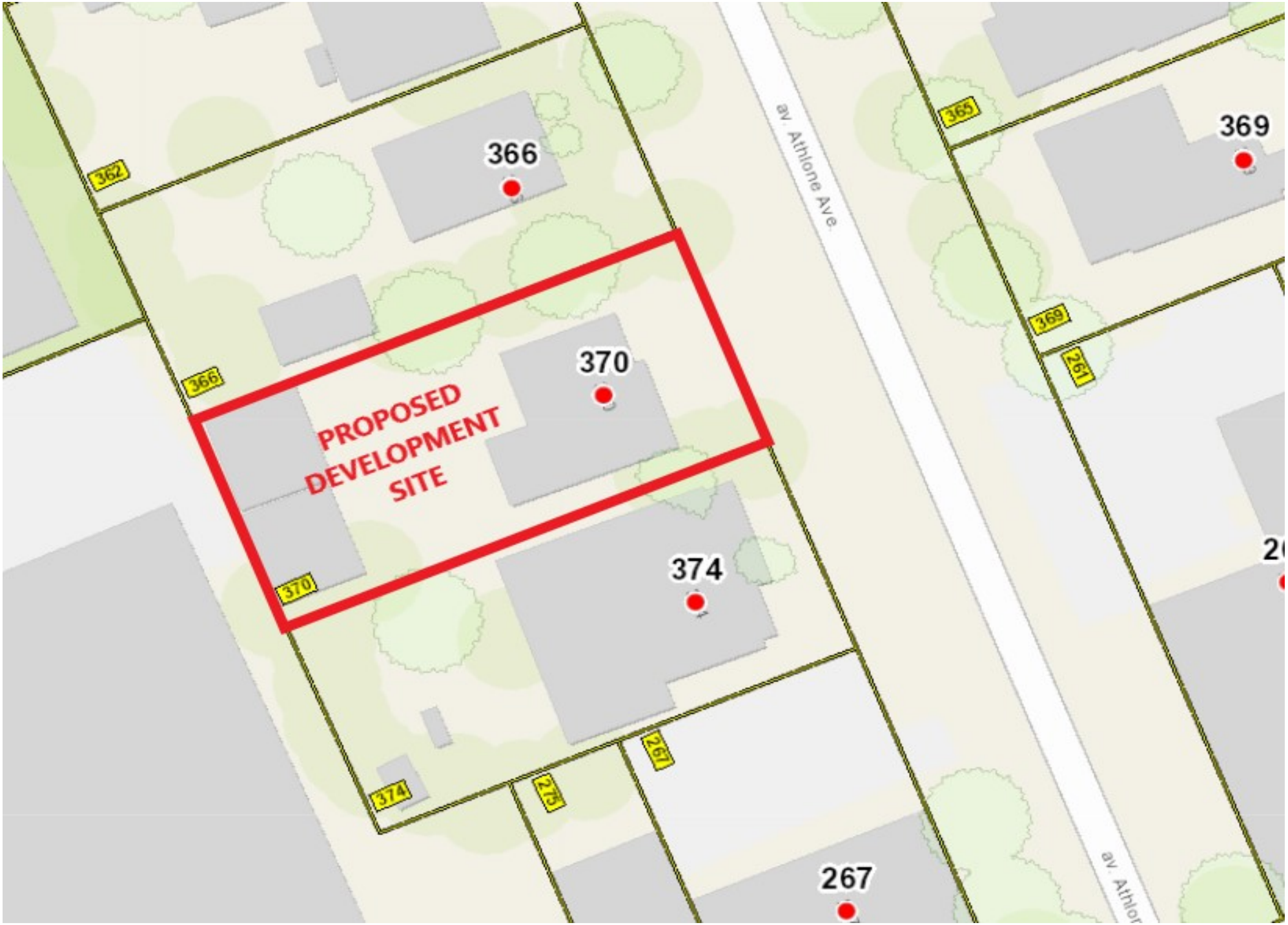
SITE PRE-DEVELOPMENT CONDITION

GOOGLE IMAGE 2020

AND

AERIAL PHOTOGRAPHY 2022 (GEOOTTAWA)

2020


366
369
370
374
267
PROPOSED
DEVELOPMENT
SITE
av. Athlone Ave.
362
365
369
261
366
370
374
275
267

2022


366
369
370
374
267
362
365
366
369
261
370
374
275
267
PROPOSED
DEVELOPMENT
SITE
av. Athlone Ave.

2022

PROPOSED

THREE (3) STOREY APARTMENT BUILDING SITE

LOT 75

R-PLAN 263

370 ATHLONE AVENUE

CITY OF OTTAWA

APPENDIX C

PROPOSED ROOF DRAIN

DETAILS

WATTS®	Adjustable Accutrol Weir Tag: _____	Adjustable Flow Control for Roof Drains

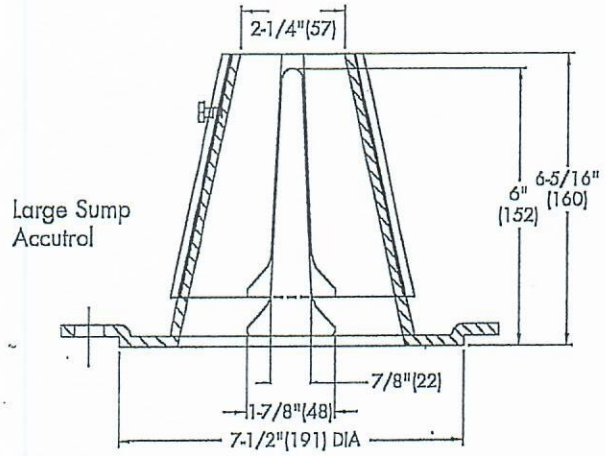
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

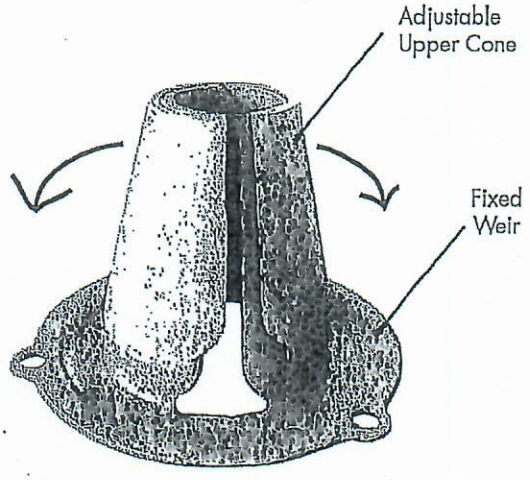
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name _____ Contractor _____

Job Location _____ Contractor's P.O. No. _____

Engineer _____ Representative _____

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

WATTS®
A Watts Water Technologies Company

PROPOSED

THREE (3) STOREY APARTMENT BUILDING SITE

LOT 75

R-PLAN 263

370 ATHLONE AVENUE

CITY OF OTTAWA

APPENDIX D

DETAILED CALCULATIONS

FOR TWO (2)-YEAR AND 100-YEAR

AVAILABLE STORAGE VOLUME

AVAILABLE STORAGE VOLUME CALCULATIONS

Two (2)-Year Event

Roof Storage at Flat Roof Building

The flat Roof Area 1 and Roof Area 2 will be used for storm-water detention. Each roof area will be drained by a controlled drain designed for a release rate of 5.0 U.S. gal./min. or 0.316 L/s. Refer to Dwg. 823-83 SWM-1 for roof drain details.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 129.86 m^2, C = 0.9, @roof slope of 1.9% minimum or 110mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.11\text{m})[68.11 + 4(46.53) + 0]}{6}$$

$$V = \frac{(0.11)(134.23)}{6}$$

$$V = 2.46\ m^3$$

The available Roof Area 1 storage volume of 2.46 m^3 > required two (2)-year storage volume of 1.81 m^3 from Table 1.

Roof Storage Area 2 (NODE No.2)

Available flat roof area for storage = 130.01 m^2, C = 0.9, @roof slope of 1.9% minimum or 110mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.11\text{m})[67.82 + 4(16.97) + 0]}{6}$$

$$V = \frac{(0.11)(135.70)}{6}$$

$$V = 2.48\ m^3$$

The available Roof Area 2 storage volume of 2.49 m^3 > required two (2)-year storage volume of 1.81 m^3 from Table 2.

Therefore, the ponding depth at the Roof Drain 1 and 2 locations is approximately 0.11m (110mm), and the two (2)-year level is estimated not to reach the roof perimeter of the building.

Hence, Roof Area 1 and Roof Area 2 of the proposed residential building flat rooftop storage are adequate to store the minimum required two (2)-year storm event volume of 3.62 m^3 given it can store up to 4.94 m^3.

AVAILABLE STORAGE VOLUME CALCULATIONS

100-Year Event

Roof Storage at Flat Roof Building

The flat Roof Area 1 to Roof Area 2 will be used for storm-water detention. Each roof area will be drained by a controlled drain designed for a release rate of 5.0 U.S. gal./min. or 0.316 L/s. refer to Dwg. 823-83 SWM-1 for roof drain details.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 129.86 m^2, C = 1.0, @roof slope of 1.9% minimum or 150mm of fall from roof perimeter to roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[129.86 + 4(31.46) + 0]}{6}$$

$$V = \frac{(0.15)(255.70)}{6}$$

$$V = 6.39\ m^3$$

The available Roof Area 1 storage volume of 6.39 m^3 > required 100-year storage volume of 6.33 m^3 from Table 3.

Roof Storage Area 2 (NODE No. 2)

Available flat roof area for storage = 130.01 m^2, C = 1.0, @roof slope of 1.9% minimum or 150mm of fall from roof perimeter to roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.15\text{m})[130.01 + 4(31.54) + 0]}{6}$$

$$V = \frac{(0.15)(256.17)}{6}$$

$$V = 6.40\ m^3$$

The available Roof Area 2 storage volume of 6.40 m^3 > required 100-year storage volume of 6.33 m^3 from Table 4.

Hence, Roof Area 1 and Roof Area 2 of the proposed residential building flat rooftop storage are adequate to store the minimum required 100-year storm event volume of 12.66 m^3 given it can store up to 12.79 m^3.

Therefore, the ponding depth at the Roof Drain 1 and 2 locations is approximately 0.15m (150mm), and at the perimeter of the flat roof area is 0mm above the roof perimeter surface. Accordingly, it is recommended that four (4) roof scuppers as shown on Dwg. 823-83 G-1 and 823-83 SWM-1 and the architect's roof plan be installed at the perimeter height of the rooftop for emergency overflow purposes in case of blockage from debris build up at the roof drain.