PROPOSED FOUR STOREY

RESIDENTIAL APARTMENT BUILDING SITE

LOT 23 (SOUTH MURRAY STREET)

R-PLAN 42482

168 – 174 MURRAY STREET

CITY OF OTTAWA

STORM DRAINAGE REPORT

REPORT R-822-43 (REV. #1)

DECEMBER 2023

T.L. MAK ENGINEERING CONSULTANTS LTD.

JUNE 2023

REFERENCE FILE NUMBER 822-43

Introduction

The proposed apartment building located at 168-174 Murray Street is a 4-storey residential building with a basement. A portion of the existing buildings at 168-174 Murray Street will be kept while the remaining will be demolished and be replaced by new construction.

The said re-development properties are an amalgamation of (2) lots known as 168 and 174 Murray Street. The total area of the site is 654.09 m^2 or 0.0654 ha. Presently, there are (2) dwellings occupying the site, one is a two-storey vinyl sided dwelling and the other is a two-storey brick and vinyl sided dwelling.

The properties under consideration are situated on south side of Murray Street, east of Dalhousie Street and west of Cumberland Street adjacent to the Byward Market. Its legal property description is Lot 23 (South of Murray Street) Registered Plan 42482 City of Ottawa in Ward 12 (Rideau-Vanier).

The proposed building contains twenty (20) residential units, comprising thirteen (13) 1-bedroom units and seven (7) 2-bedroom units. The total gross floor area of the proposed building is approximately 1,292 m^2, excluding the basement. See Site Plan details in **Appendix A**.

Storm water outlet for this site is the existing 675mm diameter Murray Street storm sewer located within the Murray Street road right of way. Storm water from this site is then routed east to the existing 1050mm diameter storm sewer on Cumberland Street which in turn further routes flow to the north and into the existing 1800mm diameter storm sewer on Bolton Street.

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. The allowable pre-development runoff coefficient is the lesser of the calculated "C" existing value or C = 0.5 maximum. If the uncontrolled stormwater runoff exceeds the specified requirements, the on-site stormwater management (SWM) control measures are necessary. The post-development runoff coefficient for this site is estimated at C = 0.72, which exceeds the pre-development allowable C_{allow} = 0.50 (max) criteria for the Murray Street 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 B**.

This report will address and detail the grading, drainage, and stormwater management control measures required to develop this property. Based on the Proposed Site Grading and Servicing Plan (Dwg. No. 822-43 G-1) and the Proposed Rooftop Stormwater Management Plan (Dwg. No. 822-43 SWM-1), the stormwater of this lot will be controlled on-site by means of building rooftop only.

The stormwater 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 the appropriate runoff release that will conform to the City's established drainage criteria.

Because the site will be connecting to and outletting into the separated Murray Street 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	=	654.09 m^2	
Roof Surface Area	=	373.30 m^2	, (C = 0.9)
Concrete/Interlock Area	=	88.12 m^2	, (C = 0.9)
Grass Area	=	166.11 m^2	, (C = 0.2)
Clearstone Area	=	26.56 m^2	, (C = 0.7)

$$C = \frac{(373.3 \times 0.9) + (88.12 \times 0.9) + (26.56 \times 0.7) + (166.11 \times 0.2)}{654.09}$$

$$C = \frac{467.092}{654.09}$$

$$C = 0.714$$

Say "C" $= 0.72$

Therefore, the average post-development "C" for this site is 0.72.

2. Controlled Area Data (NODE #1, NODE #2, NODE #3 and NODE #4)

Roof Surface Area	=	313.70 m^2
Total Storm-water Controlled Area	=	313.70 m^2

$$C = \frac{(313.70 \times 0.9)}{313.70}$$

$$C = \frac{282.33}{313.70}$$

$$C = 0.9$$

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 #5)

PROPOSED SITE

Roof Area	=	59.60 m^2	, (C = 0.9)
Grass Area	=	166.11 m^2	, (C = 0.2)
Concrete/Interlock Area	=	88.12 m^2	, (C = 0.9)
Clearstone Area	=	26.56 m^2	, (C = 0.7)
Total Storm-water Uncontrolled Area	=	340.39 m^2	

$$C = \frac{(88.12 \times 0.9) + (166.11 \times 0.2) + (26.56 \times 0.7) + (59.60 \times 0.9)}{340.39}$$

$$C = \frac{184.762}{340.39}$$

$$C = 0.543$$

$$\text{Say "C"} = 0.54$$

Therefore, the average post-development "C" for the uncontrolled storm-water drainage area of 340.39 m^2 from this site is 0.54.

The total tributary area consisting of approximately 340.39 square metres will be out-letting off site uncontrolled from the residential apartment building site which is also the surface area draining away from the building and subsequently outletting by surface flow to the Murray Street road right of way.

The uncontrolled drainage area draining to the front of the lot is 340.39 m^2 and the controlled drainage area from the available flat roof top is 313.70 m^2 which totals to 654.09 m^2.

The SWM area to be controlled is 313.70 m^2. Refer to the attached "Drainage Area Plan" in Figure 1 of **Appendix B** 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	=	654.09 m^2	
Asphalt Area	=	4.83 m^2	, (C = 0.9)
Concrete / Interlock Area	=	43.75 m^2	, (C = 0.9)
Roof Area	=	214.23 m^2	, (C = 0.9)
Grass Area	=	293.65 m^2	, (C = 0.2)
Gravel Area	=	97.63 m^2	, (C = 0.8)

$$C_{2pre} = \frac{(214.23 \times 0.9) + (43.75 \times 0.9) + (4.83 \times 0.9) + (293.65 \times 0.2) + (97.63 \times 0.8)}{654.09}$$

$$C_{2pre} = \frac{373.363}{654.09}$$

$$C_{2pre} = 0.571$$

Say $C_{2pre} = 0.57$

Use C_{allow} = 0.5 (max) for redevelopment

T_c = D/V where D = 32.0 m, ΔH = 0.67 m, S = 2.1%, and V = 1.1 feet/second = 0.34 m/s
Therefore,

$$T_c = \frac{32.0\ m}{0.34 m/s}$$

T_c = 1.57 minutes
Use T_c = 10 minutes
I_2 = 77.10 mm/hr [City of Ottawa, two (2)-year storm]

Using the Rational Method

Q_{2pre} = 2.78 (0.5) (77.10) (0.0654)

Q_{2pre} = 7.01 L/s

Therefore, the total allowable flow off-site is 7.01 L/s.

The pre-development flow of the two (2)-year and up to the 100-year storm event are draining away from the proposed apartment building and outletting to the Murray road right of way are as follows:

Where, Tc = 10 min.

$$Q_{2pre} = 2.78\ CIA$$

$$C_{2pre} = \frac{373.363}{654.09}$$

$$C_{2pre} = 0.571$$

$$Q_{2pre} = 2.78\ (0.57)\ (77.10)\ (0.0654)$$

$$= 7.99\ L/s$$

$$C_{100pre} = \frac{(214.23 \times 1.0)+(43.75 \times 1.0)+(4.83 \times 1.0)+(293.65 \times 0.2 \times 1.25) +(97.63 \times 0.8 \times 1.25)}{654.09}$$

$$C_{100pre} = \frac{433.85}{654.09}$$

$C_{100pre} = 0.663$

Say, $C_{100pre} = 0.66$ all draining to the City road right of way at Murray Street

$Q_{100pre} = 2.78\ (0.66)\ (178.6)\ (0.0654)$

$= 21.43\ L/s$

Therefore under current site conditions the 2 year pre-development flow is estimated at 7.99 L/s and the 100 year pre-development flow is estimated at 21.43 L/s.

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

Post-Development Flow Estimation

Uncontrolled Drainage Areas

The post-development flow of the two (2)-year and up to the 100-year storm event all draining to the existing road right of way uncontrolled is as follows:

Where, Tc = 10 min.

Node #5

$Q_{2post} = 2.78$ CIA

Post Development Area Draining to the City road right of way uncontrolled is:

Roof Area	=	59.60 m^2	, (C = 0.9)
Concrete/Interlock Area	=	88.12 m^2	, (C = 0.9)
Grass Area	=	166.11 m^2	, (C = 0.2)
Clearstone Area	=	26.56 m^2	, (C = 0.7)

$A_{Total} = 340.39\ m^2$

$$C_{2post} = \frac{(26.56 \times 0.7) + (166.11 \times 0.2) + (88.12 \times 0.9) + (59.60 \times 0.9)}{340.39}$$

$$C_{2post} = \frac{184.762}{340.39}$$

$C_{2post} = 0.543$

Say, $C_{2post} = 0.54$ draining to the City of Ottawa road right of way uncontrolled.

$Q_{2post} = 2.78\ (0.54)\ (77.10)\ (0.034)$

$= 3.94\ L/s$

$$C_{100post} = \frac{(59.60 \times 1.0) + (166.11 \times 0.2 \times 1.25) + (88.12 \times 1.0) + (26.56 \times 0.7 \times 1.25)}{340.39}$$

$$C_{100post} = \frac{212.49}{340.39}$$

$$C_{100post} = 0.624$$

Say, $C_{100post} = 0.62$ draining to the City of Ottawa road right of way uncontrolled

$$Q_{100post} = 2.78\ (0.62)\ (178.6)\ (0.034)$$

$$= 10.47\ L/s$$

Therefore under post development condition, the 2 year uncontrolled flow off-site is estimated at 3.94 L/s and the 100 year uncontrolled flow is 10.47 L/s.

For this site, because 340.39 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} = 0.50 is calculated as follow: ($Q_{NetAllow} = Q_{2pre(site)} - Q_{100post(uncontrolled)}$) Q = {2.78 (0.5) (77.10) (0.0654) – [2.78 (0.62) (178.6) (0.034)]} = 7.01 L/s – 10.47 L/s = -3.46 L/s. Therefore, according to this approach, the new allowable controlled flow rate off-site is -3.46 L/s.

Storm-Water Management Analysis

Based on the above calculation from site information provided and given the small area size of the lot under consideration (654.09 m^2) an assessment of the 2-Year and 100-Year pre and post development flow will be carried out at this site with implementation of on-site stormwater management (SWM) control by use of flat rooftop storage and controlled roof drains.

For this proposed development, the building flat roof top will be used to provide Stormwater Management (SWM) attenuation for this site. Four (4) 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 maximum flow rate proposed is set at 0.32 L/s (5.0 U.S. gal/min.) for Roof Drain #1, for Roof Drain #2 for Roof Drain #3 and for Roof Drain #4 under a head of 150mm at the drain. Therefore, the total controlled roof drain flow off-site is 1.28 L/s (20.0 U.S. gal/min.). The selected roof drains shall conform to Ontario Building Code Section 7.4.10.4. A roof drain controlled letter will be issued to the City by the owner's mechanical/structural engineers prior to site plan approval.

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 5.22 L/s (3.94 L/s + 1.28 L/s) which is less than the 2-Year pre-development flow of 7.99 L/s for the site. During the 100 year event, the maximum post development flow rate off-site is estimated at 11.75 L/s (10.47 L/s + 1.28 L/s) which is also less than the 100-Year pre-development flow of 21.43 L/s.

Therefore for this proposed development site, the total two (2) year post development release rate of 5.22 L/s is less than the 2-year pre development flow of 7.99 L/s.

For storm events up to and including the 100 year event the total 100-Year post development release rate of 11.75 L/s is less than the 100-Year pre-development flow of 21.43 L/s.

In comparing the pre and post development of the 2-Year and up to the 100-Year storm event and implementation of controlled roof drains on flat rooftop of the building, we can see that the proposed development with SWM measure has improved the current site stormwater flow 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 (4) four 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 four (4) roof drains to control flow off-site for this development property. The roof drain selected has a maximum flow rate of 0.32 L/s (5.0 U.S. gal./min.) under the head of 150mm at the drain for roof drain #1, for roof drain #2, for roof drain #3 and for roof drain #4 for storm events up to the 100-Year level. 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 0.32 L/s under a head of 100mm water above the drain for each of roof drain #1, roof drain #2, roof drain #3 and roof drain #4 for storm events up to the 2-Year level. See Watts "Adjustable Accutrol Weir" in **Appendix D** for further details. Therefore, the maximum stormwater flow to be controlled from this building's rooftop and outletted off site into the existing Murray Street city storm sewer is (0.32 L/s x 4) = 1.28 L/s. Refer to the Proposed Rooftop Stormwater Management Plan Dwg. 822-43 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

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

Two (2)-Year Event
C_2 = 0.90
A_1 = 75.40 m^2
I = mm/hr

Q_1 = 2.78 (0.90) (0.0075 ha.) I = 0.0189 I

100-Year Event

$C_{100} = 1.0$

$A_1 = 75.40\ m^2$

I = mm/hr

$Q_1 = 2.78\ (1.0)\ (0.0075\ ha.)\ I = 0.021\ I$

<u>For Roof Area 2, Q = 2.78 CIA (NODE #2)</u>

Two (2)-Year Event

$C_2 = 0.90$

$A_2 = 92.44\ m^2$

I = mm/hr

$Q_2 = 2.78\ (0.90)\ (0.0092\ ha.)\ I = 0.0231\ I$

100-Year Event

$C_{100} = 1.0$

$A_2 = 92.44\ m^2$

I = mm/hr

$Q_2 = 2.78\ (1.0)\ (0.0092\ ha.)\ I = 0.0257\ I$

<u>For Roof Area 3, Q = 2.78 CIA (NODE #3)</u>

Two (2)-Year Event

$C_2 = 0.90$

$A_3 = 97.91\ m^2$

I = mm/hr

$Q_3 = 2.78\ (0.90)\ (0.0098\ ha.)\ I = 0.0245\ I$

100-Year Event

$C_{100} = 1.0$

$A_3 = 97.91\ m^2$

I = mm/hr

$Q_3 = 2.78\ (1.0)\ (0.0098\ ha.)\ I = 0.0272\ I$

<u>For Roof Area 4, Q = 2.78 CIA (NODE #4)</u>

Two (2)-Year Event

$C_2 = 0.90$

$A_4 = 47.95\ m^2$

I = mm/hr

$Q_4 = 2.78\ (0.90)\ (0.0048\ ha.)\ I = 0.012\ I$

100-Year Event

$C_{100} = 1.0$

$A_4 = 47.45\ m^2$

I = mm/hr

$Q_4 = 2.78\ (1.0)\ (0.0048\ ha.)\ I = 0.0133\ I$

The summary results of the calculated inflow and the storage volume of the site and building's flat rooftop to store the five (5)-year and 100-year storm events are shown in **Tables 1 to 8** inclusive. Refer to **Appendix E** for details.

Table 9 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 9: 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 (0.0075 ha)	1	RD-100-A-ADJ (CLOSED)	0.32	0.32	0.10	0.15	0.80	3.07	3.65
RD-2 (0.0092 ha)	1	RD-100-A-ADJ (CLOSED)	0.32	0.32	0.10	0.15	1.10	4.05	4.55
RD-3 (0.0098 ha)	1	RD-100-A-ADJ (CLOSED)	0.32	0.32	0.10	0.15	1.19	4.37	5.00
RD-4 (0.0048 ha)	1	RD-100-A-ADJ (CLOSED)	0.32	0.32	0.10	0.15	0.40	1.64	2.46
Total Roof (0.0313 ha)	**4**	-	**1.28**	**1.28**	-	-	**3.49**	**13.13**	**15.66**

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 City approved "siltsack" or equivalent catch basin sediment control device or equal in catch basins as recommended by manufacturer on-site and off-site within the Murray Street 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. #822-43 ESC-1 for details.

Conclusion

In assessing the 2-Year storm event up to the 100-Year storm events under pre-development conditions to that of the same storm events under post-development conditions with implementation of the proposed on-site SWM measures (flat rooftop storage with (4) specified controlled drains) it was determined that post-development release rates has been improved for the site compared with the current existing flow rates.

The pre-development flow at the 2-Year storm event is 7.99 L/s and 21.43 L/s for the 100-Year event. Based on the proposed development and by incorporating the proposed SWM attenuation measures the post-development 2-Year flow is estimated at 5.22 L/s and the 100-Year flow is estimated at 11.75 L/s.

Therefore for this proposed development site, the two (2) year post development release rate of 5.22 L/s is less than the 2-Year pre-development flow rate of 7.99 L/s. For storm events up to and including the 100-Year event, the total 100-Year post-development release rate of 11.75 L/s is less than the 100-Year pre-development flow of 21.43 L/s.

At this proposed residential site and to develop the amalgamated properties to house a 20 unit apartment building on a 0.0654 ha. parcel of land, on-site SWM attenuation will be incorporated by means of the flat rooftop storage at the proposed apartment building. Four (4) controlled roof drains are incorporated and each drainage controlled to a release rate of 0.32 L/s (5.0 U.S. gal/min.). The maximum controlled flow from this site (4 roof drains at 0.32 L/s per drain) totals to 1.28 L/s for the post development condition.

During the two (2)-year storm event for the flat rooftop storage, the ponding depth of rooftop area 1, 2, 3 and 4 is estimated at 100mm at the drain and 0mm at the roof perimeter, assuming a 1.6% minimum roof pitch to the drain and controlling the flow rate at 0.32 L/s per drain. The rooftop storage available at Roof Area 1 is 1.12 m^3, rooftop storage available at Roof Area 2 is 1.35 m^3, rooftop storage available at Roof Area 3 is 1.40 m^3 and the rooftop storage available at Roof Area 4 is 0.70 m^3, for a total storage volume of 4.57 m^3, which is greater than the required volume of 3.49 m^3.

During the 100-year storm event for the flat rooftop storage, the ponding depth of Roof Area 1, 2, 3 and 4 is estimated at 150 mm at the drain and 0mm at the roof perimeter, assuming a 1.6% minimum roof pitch to the drain and controlling the flow rate at 0.32 L/s per drain. The rooftop storage available at Roof Area 1 is 3.65 m^3, rooftop storage available at Roof Area 2 is 4.55 m^3, rooftop storage available at Roof Area 3 is 5.0 m^3 and the rooftop storage available at Roof Area 4 is 2.46 m^3, for a total storage volume of 15.66 m^3, which is greater than the required volume of 13.13 m^3.

Therefore, by means of flat building rooftop storage as shown on the Proposed Rooftop Stormwater Management Plan and grading the site to the proposed grades as shown on the Proposed Grading and Servicing Plan Dwg. 822-43 SWM-1 and 822-43 G-1 respectively, the desirable two (2)-year storm and 100-year storm event detention volume of 4.57 m^3 and 15.66 m^3 respectively will be available on site. Refer to **Appendix E** for detailed calculations of available storage volumes.

The building weeping tile drainage will outlet via a proposed 150mm dia. PVC storm lateral. The roof drains will also be outletted via a separate 150mm dia. PVC lateral from the building which is then wyed into the proposed 150mm dia. storm lateral on private property and connected to the existing Murray Street 675mm dia. storm sewer. 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 in the City Storm sewer system. Refer to the proposed site grading and servicing plan Dwg. 822-43 G-1 for details.

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12/05/23
TONY L-M. MAK
PROVINCE OF ONTARIO

PROPOSED FOUR STOREY

RESIDENTIAL APARTMENT BUILDING SITE

LOT 23 (SOUTH MURRAY STREET)

R-PLAN 42482

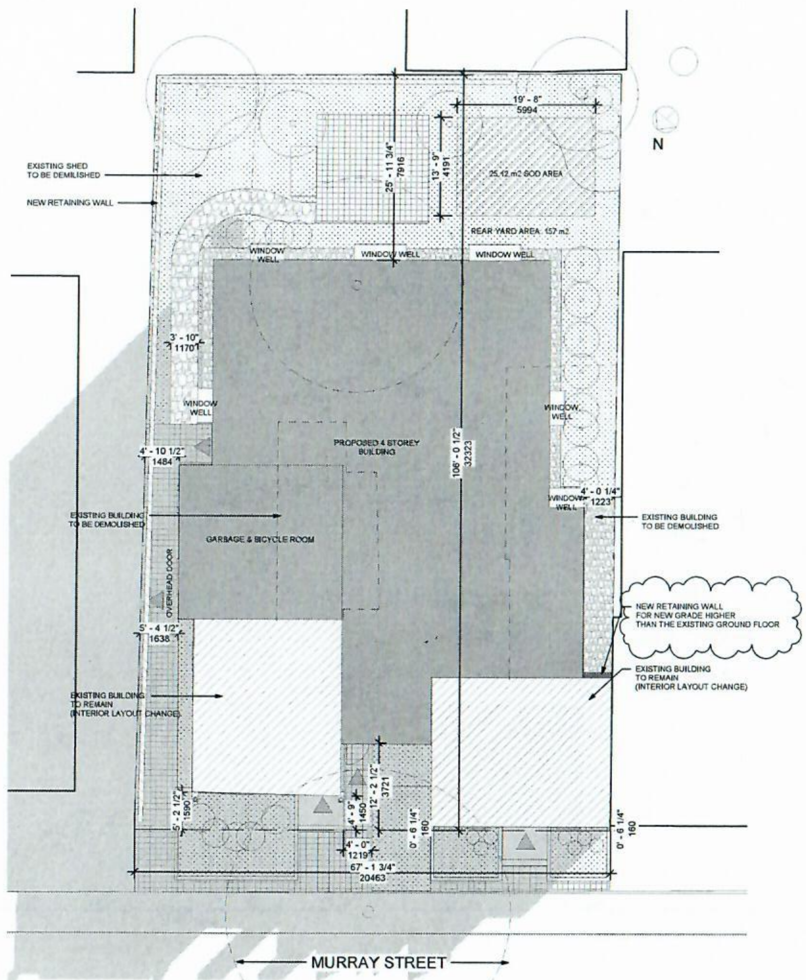
168 – 174 MURRAY STREET

CITY OF OTTAWA

APPENDIX A

SITE PLAN

DWG. No. A0



1 SITE PLAN
SCALE:1/100

168-174 MURRAY ST.			
SITE PLAN OF SURVEY LOT 23 REGISTERED PLAN 42482, CITY OF OTTAWA	SURVEY INFO TAKEN FROM LOT 23 REGISTERED PLAN 42482 CITY OF OTTAWA PREPARED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD. COMPLETED on JANUARY 7th, 2021		
R4UD[952] S74- RESIDENTIAL FOURTH DENSITY ZONE (SEC. 161-162) CITY OF OTTAWA, DWELLING TYPE: 4 STOREY LOW RISE RESIDENTIAL BUILDING			
ZONING MECHANISMS	**REQUIREMENT**	**PROVIDED**	**NOTES**
A) MINIMUM LOT AREA	450 m²	654.2 m²	
B) MINIMUM LOT WIDTH	15 m	20.46 m	
C) MINIMUM LOT DEPTH	N/A	32.32 m	
D) MINIMUM FRONT YARD SET BACK (AVERAGE SETBACK OF NEIGHBOURS)	0.2 m+ 1.63 m / 2 = 0.915 m	EXISTING BUILDING & 3.721 m	
E) MINIMUM INTERIOR SIDE YARD SETBACK	1.5 m	1.22 m	MINOR VARIANCE
F) MINIMUM REAR YARD SET BACK	Min. 9.69 m & must be 163.5 m2 in area	7.916 m & 158.77 m2 in area	MINOR VARIANCE
G) MAXIMUM BUILDING HEIGHT	168 Murray 5.8 metres (to a depth of 9.14 m from front lot line) 9.3 metres (rear) 174 Murray 7.0 metres (to a depth of 9.14 m from front lot line) 10.5 metres (rear)	13.36 m	
H) VEHICULE PARKING (RESIDENTS)	0	0	
VEHICULE PARKING (VISITOR)	20-12 = 8 units x 0.1=0.8 (1)	0	MINOR VARIANCE
VEHICULE PARKING (TOTAL)	0	0	
K) BIKE SPACES	20x0.5=10	22 (STACKED) INDOOR	
L) AMENITY AREA	6.0 x 20 units = 120m² 50% of 120m² = 60m² required as communal	157 m² @ BACK	
M) FRONT YARD, SOFTSCAPING PERCENTAGE	40%	28.8%	MINOR VARIANCE
N) REAR YARD, SOFTSCAPING PERCENTAGE	50%	75.7%	

BUILDING AREAS			
BASEMENT BUILDING AREA (NEW) 280 m²	**PROPOSED SITE DEVELOPMENT INFO.**		**GARBAGE REQUIREMENT** GARBAGE, RECYCLING AND COMPOSTING ARE TO BE STORED IN THE BASEMENT AND REMOVED PRIVATELY DURING COLLECTION
GROUND FLOOR BUILDING AREA (NEW) 280 m² BUILDING AREA (EXISTING) 97 m²	PROPOSED STOREYS	4	
	LOT COVERAGE	57.3%	
SECOND FLOOR BUILDING AREA (NEW) 280 m² BUILDING AREA (EXISTING) 97 m²	SOFT LANDSCAPING	25.6%	
	HARD LANDSCAPING	16.6%	**SNOW REMOVAL REQUIREMENT**
THIRD FLOOR BUILDING AREA (NEW) 269 m²	STAIR & LANDING	0.5%	
FOURTH FLOOR BUILDING AREA (NEW) 269 m²			

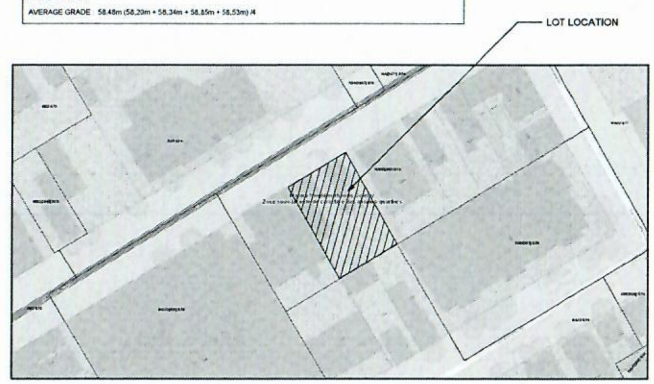
	1 BED	2 BED	3 BED	TOTAL
EXISTING BUILDING (RENOVATED)	0	0	2	2
PROPOSED ADDITION	13	5	0	18
TOTAL	13	5	2	20
REQUIRED 2+ BEDROOM		5	5	
PROPOSED 2+ BEDROOM		5	5	

AVERAGE GRADE

CALCULATED FROM EXISTING ELEVATION POINTS AT A DISTANCE EQUAL TO THE MINIMUM FRONT YARD & REAR YARD SETBACKS, AT THE INTERIOR SIDE PROPERTY LINES

AVERAGE GRADE : 58.48m (58.20m + 58.34m + 58.85m + 58.53m) /4

LEGEND
- NEW TREE
- EX. TREE TO BE REMOVED
- PROPOSED BUILDING
- EXISTING BUILDING TO REMAIN
- PROPOSED / EXISTING ENTRY / EXIT
- PROPERTY LINE
- DENOTES HARD LANDSCAPING
- DENOTES SOFT LANDSCAPING



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www.redlinearchitecture.ca

RESPONSIBILITIES:
DO NOT SCALE DRAWINGS
ALL DESIGN AND CONSTRUCTION TO BE IN ACCORDANCE WITH THE ONTARIO BUILDING CODE 2012
ALL CONTRACTORS MUST WORK IN ACCORDANCE WITH ALL LAWS, REGULATIONS AND BYLAWS HAVING JURISDICTION
IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECT/DESIGNER
THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT

GENERAL NOTES

ONTARIO ASSOCIATION OF ARCHITECTS
LEVENT TATAR
LICENCE
8842

168-174 MURRAY ST.
4 STOREY ADDITION TO EXISTING TWO STOREY BUILDINGS

CONSULTANTS
STRUCTURAL -
MECHANICAL -
ELECTRICAL -

NO.	REVISION/ISSUE	DATE
9		
8		
7		
6		
5		
4		
3		
2		
1	ISSUED FOR SPA	[illegible]

PROJECT
168-174 MURRAY ST.
4 STOREY ADDITION TO EXISTING TWO STOREY BUILDINGS
168-174 MURRAY ST.
OTTAWA, ON

SITE PLAN

DRAWN BY:
DATE: MAY 11, 2021
SCALE: AS NOTED
SHEET
A0

PROPOSED FOUR STOREY

RESIDENTIAL APARTMENT BUILDING SITE

LOT 23 (SOUTH MURRAY STREET)

R-PLAN 42482

168 – 174 MURRAY STREET

CITY OF OTTAWA

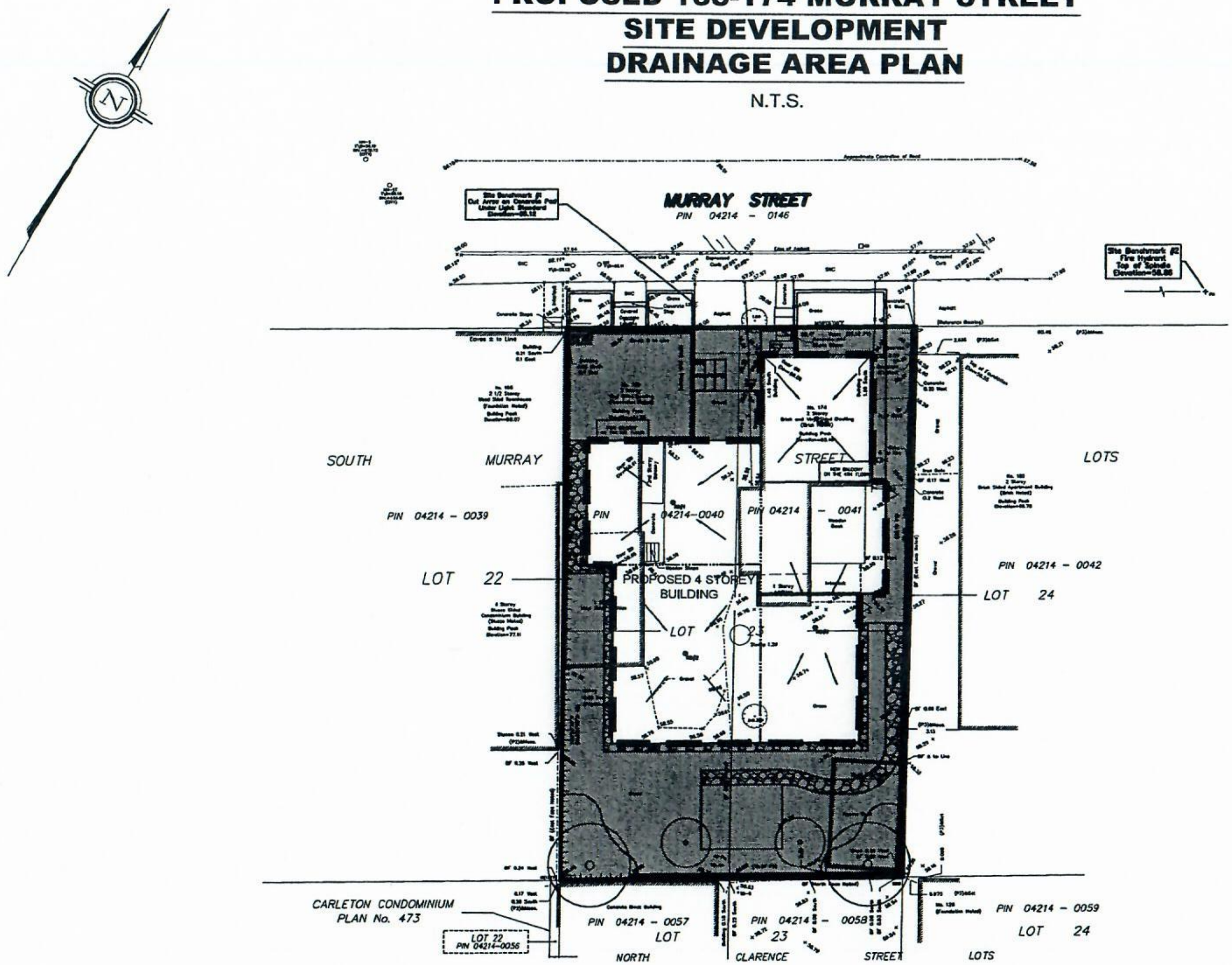
APPENDIX B

STORM DRAINAGE AREA PLAN

FIGURE 1

PROPOSED 168-174 MURRAY STREET
SITE DEVELOPMENT
DRAINAGE AREA PLAN

N.T.S.



LEGEND

LIMIT OF CONTROLLED STORM DRAINAGE AREA = 313.70 sq.m

UNCONTROLLED STORM DRAINAGE AREA = 340.39 sq.m

TOTAL AREA = 654.09 SQ. M

POST-DEVELOPMENT SITE AVERAGE "C" = 0.72

T.L. MAK ENGINEERING CONSULTANTS LTD.
CONSULTING ENGINEERS

PROJECT No.	DATE	DRAWING No.
822-43	JUNE 2023	FIGURE 1

PROPOSED FOUR STOREY

RESIDENTIAL APARTMENT BUILDING SITE

LOT 23 (SOUTH MURRAY STREET)

R-PLAN 42482

168 – 174 MURRAY STREET

CITY OF OTTAWA

APPENDIX C

SITE PRE-DEVELOPMENT CONDITION

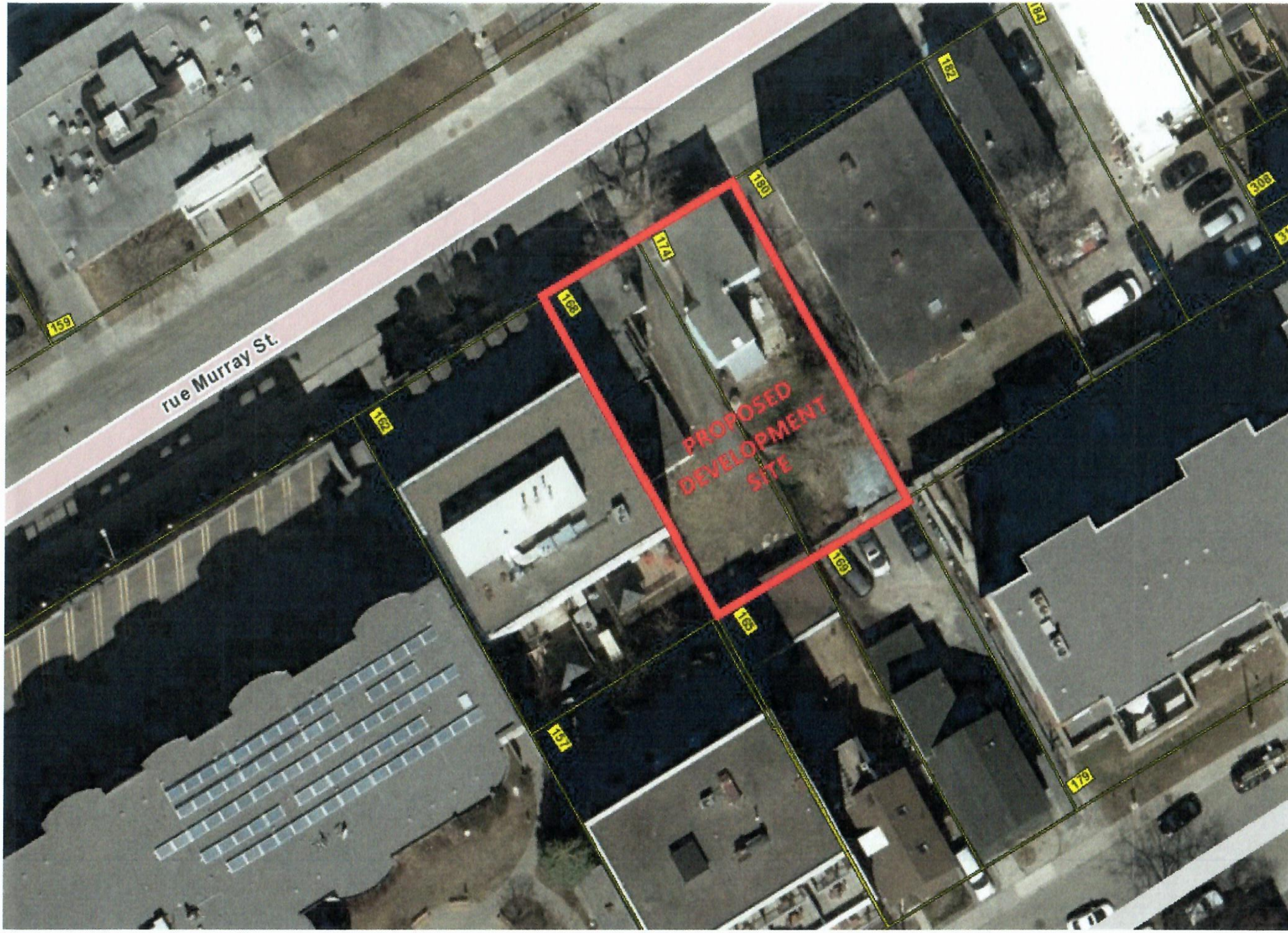
GOOGLE IMAGE 2021

AND

AERIAL PHOTOGRAPHY 2021 (GEOOTTAWA)


rue Murray St.
PROPOSED DEVELOPMENT SITE
174
168
162
180
182
184
192
194
308
310
159
179
169
165
157
145

2021



rue Murray St.
PROPOSED DEVELOPMENT SITE
159
168
174
180
182
184
308
310
162
157
165
169
179

2021

2021

PROPOSED FOUR STOREY

RESIDENTIAL APARTMENT BUILDING SITE

LOT 23 (SOUTH MURRAY STREET)

R-PLAN 42482

168 – 174 MURRAY STREET

CITY OF OTTAWA

APPENDIX D

PROPOSED ROOF DRAIN

DETAILS

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

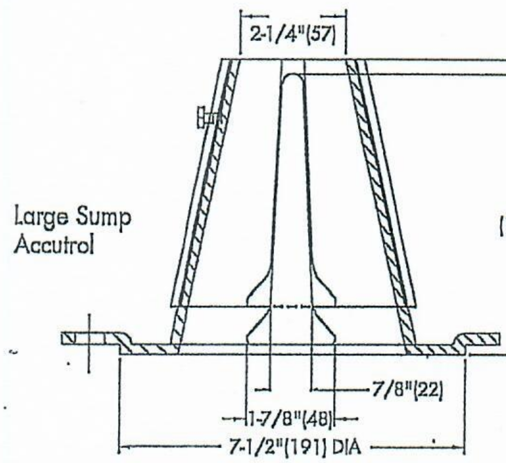
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

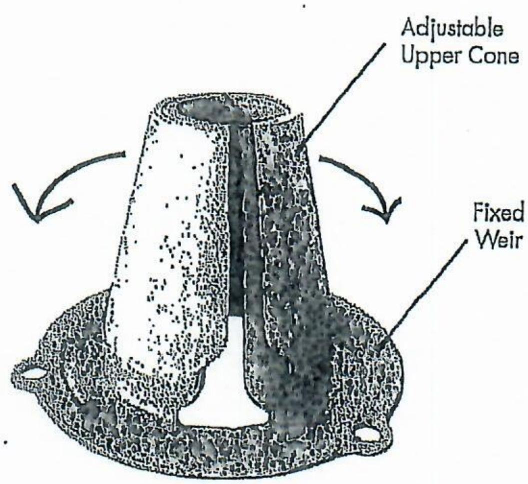
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the 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 ____________

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PROPOSED FOUR STOREY

RESIDENTIAL APARTMENT BUILDING SITE

LOT 23 (SOUTH MURRAY STREET)

R-PLAN 42482

168 – 174 MURRAY STREET

CITY OF OTTAWA

APPENDIX E

TABLES 1 TO 8 INCLUSIVE

DETAILED CALCULATIONS

FOR TW0 (2)-YEAR AND 100-YEAR

AVAILABLE STORAGE VOLUME

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 1

TWO (2)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME (NODE #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	1.94	0.32	1.62	0.49
10	77.10	1.46	0.32	1.14	0.68
15	63.30	1.20	0.32	0.88	0.79
20	52.03	0.98	0.32	0.66	0.80
25	45.17	0.85	0.32	0.53	0.795
30	40.04	0.757	0.32	0.437	0.787
35	36.06	0.68	0.32	0.36	0.76
40	32.86	0.62	0.32	0.30	0.72

Therefore, the required rooftop storage volume is 0.80 m^3.

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 2

TWO (2)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME (NODE #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	2.38	0.32	2.06	0.62
10	77.10	1.78	0.32	1.46	0.88
15	63.30	1.46	0.32	1.14	1.03
20	52.03	1.20	0.32	0.88	1.06
25	45.17	1.04	0.32	0.72	1.08
30	40.04	0.93	0.32	0.61	1.10
35	36.06	0.83	0.32	0.51	1.07
40	32.86	0.76	0.32	0.44	1.06
45	30.24	0.70	0.32	0.38	1.03
50	28.04	0.65	0.32	0.33	0.99
55	26.14	0.60	0.32	0.28	0.92

Therefore, the required rooftop storage volume is 1.10 m^3.

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 3

TWO (2)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 3 STORAGE VOLUME (NODE #3)

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	2.52	0.32	2.20	0.66
10	77.10	1.89	0.32	1.57	0.94
15	63.30	1.55	0.32	1.23	1.11
20	52.03	1.28	0.32	0.96	1.15
25	45.15	1.11	0.32	0.79	1.185
30	40.04	0.98	0.32	0.66	1.19
35	36.06	0.88	0.32	0.56	1.18
40	32.86	0.81	0.32	0.49	1.176
45	30.24	0.74	0.32	0.42	1.13

Therefore, the required rooftop storage volume is 1.19 m^3.

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 4

TWO (2)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 4 STORAGE VOLUME (NODE #4)

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	1.23	0.32	0.91	0.27
10	77.10	0.93	0.32	0.61	0.37
15	63.30	0.76	0.32	0.44	0.40
20	52.03	0.624	0.32	0.305	0.37
25	45.17	0.542	0.32	0.222	0.33
30	40.04	0.48	0.32	0.16	0.29

Therefore, the required rooftop storage volume is 0.40 m^3.

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 5

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME (NODE #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	3.75	0.32	3.43	2.06
15	142.9	3.00	0.32	2.68	2.41
20	120.0	2.52	0.32	2.20	2.64
25	103.9	2.18	0.32	1.86	2.79
30	91.9	1.93	0.32	1.61	2.90
35	82.6	1.74	0.32	1.42	2.98
40	75.1	1.58	0.32	1.26	3.02
45	69.1	1.45	0.32	1.13	3.05
50	63.9	1.34	0.32	1.02	3.06
55	59.6	1.25	0.32	0.93	3.07
60	55.9	1.17	0.32	0.85	3.06
65	52.6	1.10	0.32	0.78	3.04
70	49.8	1.04	0.32	0.72	3.02
75	47.26	0.99	0.32	0.67	3.015

Therefore, the required storage volume is 3.07 m^3.

TABLE 6

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 2 STORAGE VOLUME (NODE #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	4.59	0.32	4.27	2.56
15	142.9	3.67	0.32	3.35	3.02
20	120.0	3.08	0.32	2.76	3.31
25	103.9	2.67	0.32	2.35	3.53
30	91.9	2.36	0.32	2.04	3.67
35	82.6	2.12	0.32	1.80	3.78
40	75.1	1.93	0.32	1.61	3.86
45	69.1	1.78	0.32	1.46	3.94
50	63.9	1.64	0.32	1.32	3.96
55	59.6	1.53	0.32	1.21	3.99
60	55.9	1.44	0.32	1.117	4.01
65	52.6	1.35	0.32	1.03	4.02
70	49.8	1.28	0.32	0.96	4.03
75	47.26	1.22	0.32	0.90	4.05
80	45.0	1.157	0.32	0.837	4.02
85	42.95	1.104	0.32	0.784	3.99
90	41.1	1.056	0.32	0.736	3.97

Therefore, the required rooftop storage volume is 4.05 m^3.

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 7

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 3 STORAGE VOLUME (NODE #3)

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	4.86	0.32	4.54	2.72
15	142.9	3.89	0.32	3.57	3.21
20	120.0	3.26	0.32	2.94	3.53
25	103.9	2.83	0.32	2.51	3.77
30	91.9	2.50	0.32	2.18	3.92
35	82.6	2.25	0.32	1.93	4.05
40	75.1	2.04	0.32	1.72	4.13
45	69.1	1.88	0.32	1.56	4.21
50	63.9	1.74	0.32	1.42	4.26
55	59.6	1.62	0.32	1.30	4.29
60	55.90	1.52	0.32	1.20	4.32
65	52.6	1.43	0.32	1.11	4.33
70	49.8	1.36	0.32	1.04	4.368
75	47.26	1.29	0.32	0.97	4.37
80	45.0	1.224	0.32	0.904	4.34
85	42.95	1.168	0.32	0.848	4.33
90	41.10	1.118	0.32	0.798	4.31

Therefore, the required rooftop storage volume is 4.37 m^3.

PROPOSED 168-174 MURRAY STREET FOUR STOREY APARTMENT BUILDING

DEVELOPMENT SITE

TABLE 8

100-YEAR EVENT

REQUIRED BUILDING ROOF AREA 4 STORAGE VOLUME (NODE #4)

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	2.38	0.32	2.06	1.24
15	142.9	1.90	0.32	1.58	1.42
20	120.0	1.60	0.32	1.28	1.54
25	103.9	1.38	0.32	1.06	1.59
30	91.9	1.22	0.32	0.90	1.62
35	82.6	1.10	0.32	0.78	1.64
40	75.1	1.00	0.32	0.68	1.63
45	69.1	0.92	0.32	0.60	1.62
50	63.9	0.85	0.32	0.53	1.59
55	59.6	0.793	0.32	0.473	1.56
60	55.90	0.744	0.32	0.424	1.53

Therefore, the required rooftop storage volume is 1.64 m^3.

AVAILABLE STORAGE VOLUME CALCULATIONS

Two (2)-Year Event

Roof Storage at Flat Roof Building

The flat Roof Area 1, Roof Area 2, Roof Area 3 and Roof Area 4 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 0.32 L/s at a height of 100mm above the drain. Refer to Dwg. 822-43 SWM-1 for roof drain details.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 75.40 m^2, C = 0.9, @ roof slope of 2.0% minimum or 100mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.10\text{m})[33.39 + 4(8.48) + 0]}{6}$$

$$V = \frac{(0.10)(67.31)}{6}$$

$$V = 1.12\ \text{m}^3$$

The available Roof Area 1 storage volume of 1.12 m^3 > required two (2)-year storage volume of 0.80 m^3 from Table 1.

Roof Storage Area 2 (NODE No.2)

Available flat roof area for storage = 92.44 m^2, C = 0.9, @ roof slope of 2.0% minimum or 100mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.10\text{m})[40.17 + 4(10.27) + 0]}{6}$$

$$V = \frac{(0.10)(81.25)}{6}$$

$$V = 1.35\ \text{m}^3$$

The available Roof Area 2 storage volume of 1.35 m^3 > required two (2)-year storage volume of 1.10 m^3 from Table 2.

Roof Storage Area 3 (NODE No.3)

Available flat roof area for storage = 97.91 m^2, C = 0.9, @ roof slope of 1.6% minimum or 100mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.10\text{m})[42.86 + 4(10.26) + 0]}{6}$$

$$V = \frac{(0.10)(83.90)}{6}$$

$$V = 1.40\ \text{m}^3$$

The available Roof Area 3 storage volume of 1.40 m^3 > required two (2)-year storage volume of 1.19 m^3 from Table 3.

Roof Storage Area 4 (NODE No.4)

Available flat roof area for storage = 47.95 m^2, C = 0.9, @ roof slope of 2.0% minimum or 100mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.10\text{m})[21.0 + 4(5.23) + 0]}{6}$$

$$V = \frac{(0.10)(41.92)}{6}$$

$$V = 0.70 \text{ m}^3$$

The available Roof Area 4 storage volume of 0.70 m^3 > required two (2)-year storage volume of 0.40 m^3 from Table 4.

Therefore, the ponding depth at the Roof Drain 1, 2, 3 and 4 location is approximately 0.10 m (100 mm), and the two (2)-year level is estimated not to reach the roof perimeter of the building.

Hence, Roof Area 1, Roof Area 2, Roof Area 3 and Roof Area 4 of the proposed residential building flat rooftop storage are adequate to store the minimum required two (2)-year storm event volume of 3.49 m^3 given it can store up to 4.57 m^3.

AVAILABLE STORAGE VOLUME CALCULATIONS

100-Year Event

Roof Storage at Flat Roof Building

The flat Roof Area 1, Roof Area 2, Roof Area 3 and Roof Area 4 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 0.32 L/s at a height of 150mm above the drain. Refer to Dwg. 822-43 SWM-1 for roof drain details.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 75.40 m^2, C = 1.0, @ roof slope of 2.0% 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.

$$V = \frac{(0.15\text{m})[75.40 + 4(17.69) + 0]}{6}$$

$$V = \frac{(0.15)(146.16)}{6}$$

$$V = 3.65\ \text{m}^3$$

The available Roof Area 1 storage volume of 3.65 m^3 > required 100-year storage volume of 3.07 m^3 from Table 5.

Roof Storage Area 2 (NODE No. 2)

Available flat roof area for storage = 92.44 m^2, C = 1.0, @ roof slope of 2.0% 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.

$$V = \frac{(0.15\text{m})[92.44 + 4(22.40) + 0]}{6}$$

$$V = \frac{(0.15)(182.04)}{6}$$

$$V = 4.55\ \text{m}^3$$

The available Roof Area 2 storage volume of 4.55 m^3 > required 100-year storage volume of 4.05 m^3 from Table 6.

Roof Storage Area 3 (NODE No. 3)

Available flat roof area for storage = 97.91 m^2, C = 1.0, @ roof slope of 1.6% 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.

$$V = \frac{(0.15\text{m})[97.91 + 4(25.51) + 0]}{6}$$

$$V = \frac{(0.15)(199.95)}{6}$$

$$V = 5.0\ \text{m}^3$$

The available Roof Area 3 storage volume of 5.0 m^3 > required 100-year storage volume of 4.37 m^3 from Table 7.

Roof Storage Area 4 (NODE No. 4)

Available flat roof area for storage = 47.95 m^2, C = 1.0, @ roof slope of 2.0% 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.

$$V = \frac{(0.15\text{m})[47.95 + 4(12.64) + 0]}{6}$$

$$V = \frac{(0.15)(98.51)}{6}$$

$$V = 2.46\ \text{m}^3$$

The available Roof Area 4 storage volume of 2.46 m^3 > required 100-year storage volume of 1.64 m^3 from Table 8.

Hence, Roof Area 1, Roof Area 2 and Roof Area 3 of the proposed residential building flat rooftop storage are adequate to store the minimum required 100-year storm event volume of 13.13 m^3 given it can store up to 15.66 m^3.

Therefore, the ponding depth at the Roof Drain 1, 2, 3 and 4 location 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 eight (8) roof scuppers as shown on Dwg. 822-43 G-1 and 822-43 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.