PROPOSED FOUR STOREY LOW RISE RESIDENTIAL APARTMENT BUILDING SITE AT 4000 OLD RICHMOND ROAD AND PROPOSED 3 ½ STOREY STACKED DWELLING AT 572 MOODIE DRIVE CITY OF OTTAWA

STORM DRAINAGE REPORT

REPORT R-819-106

T.L. MAK ENGINEERING CONSULTANTS LTD.

OCTOBER 2021

REFERENCE FILE NUMBER 819-106

Introduction

For this site plan application, the proponent (Jami Omar Mosque) is proposing to develop an apartment building site identified as 4000 Old Richmond Road and re-develop the other site at 572 Moodie Drive which is currently the Imam's (priest's) residence.

At 4000 Old Richmond Road, a four (4) storey low-rise apartment building comprising of 59 units is proposed to be developed on this property. For the existing lot at 572 Moodie Drive, the existing Imam's residence will be re-developed to house a 3 ½ storey high stacked dwelling unit.

The site at 4000 Old Richmond Road is situated on the east side of Old Richmond Road, south of Seyton Drive and north of Sanibel Private.

The proposed re-development site at 572 Moodie Drive is abutting the properties of the existing Jami Omar Mosque complex. The existing 1 ½ storey residential building will be removed and a 3 ½ storey high stacked dwelling is proposed for this property. This ±0.0767 ha site is located on the west side of Moodie Drive, south of Arnold Drive and north of Songbird Private. Its legal property description is Part of Lots 32 and 33 Concession 5 (Rideau Front) Geographical Township of Nepean – City of Ottawa located in Ward #8 (College). See Site Plan details in Appendix A.

The proposed stacked building contains six 3-bedroom units. The total gross floor area is 1,184.0 m^2 (12,745 ft^2), equivalent to 296 m^2/floor (3186 ft^2/floor). Stormwater outlet for this site is the existing 750mm dia. storm sewer located within the Moodie Drive road right of way. Stormwater from this sewer is then routed north than west across the Mosque Complex and into the existing 750mm dia. storm sewer on Old Richmond Road.

The proposed building at the 4000 Old Richmond Road site is a 4 storey apartment building with an underground parking level. The building contains thirty-two bachelor units, twenty-four 1-bedroom and three 2-bedroom units. Each floor covers a gross floor area of 1,316 m^2/floor (14,165 ft^2/floor), and the underground parking occupies an area of 2,125 m^2 (22,873 ft^2). Stormwater outlet for this site is the existing 750mm dia. storm sewer located within the Old Richmond Road road right of way. Stormwater from this sewer is then routed west and then north to the existing 900mm dia. trunk storm sewer along Moodie Drive.

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 five (5) 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. Refer to the attached Drainage Area Plan (Figure 1 and 1A) for the two (2) proposed sites as detailed in Appendix B.

This report will address and detail the grading, drainage, and stormwater management control measures required where possible to develop the said properties. Based on the Proposed Site Grading and Servicing Plan (Dwg. No. 819-106, G-1 and G-2) and the Proposed Rooftop Stormwater Management

Plan – 4000 Old Richmond Road (Dwg. No. 819-106, SWM-1), the storm water of the low rise apartment building will be controlled on-site by means of building rooftop only. The 3 ½ stacked dwelling unit is designed with a pitched roof to meet Architectural consistency of the local neighbourhood and is without flat rooftop storage capability.

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 (2) sites will be connecting to and outletting into a separated storm sewer system, therefore, the approval exemption under Ontario Regulations 525/98 would apply since storm sewer 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. Refer to the Proposed Overall Site Servicing Plan (Dwg. No. 819-106 S-1) for details.

Site Data

4000 Old Richmond Road – Low Rise Apartment Building

The proposed 4 storey low rise apartment building at this site will incorporate a flat roof top for on-site Stormwater Management attenuation.

1. Development Property Area

Post-Development Site Area Characteristics

Development Lot Area	=	2,428.0 m^2
Roof Surface Area	=	1,374.86 m^2
Concrete/Interlock Area	=	252.24 m^2
Grass Area	=	589.27 m^2
Asphalt Area	=	211.63 m^2

$$C = \frac{(1{,}374.86 \times 0.9) + (252.24 \times 0.8) + (211.63 \times 0.9) + (589.27 \times 0.2)}{2{,}428.0}$$

$$C = \frac{1{,}747.487}{2{,}428.0}$$

$$C = 0.7197$$

Say "C" $= 0.72$

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

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

Roof Surface Area	=	1,374.86 m^2
Total Storm-water Controlled Area	=	1,374.86 m^2

$$C = \frac{(1,374.86 \times 0.9)}{1,374.86}$$

$$C = \frac{1,237.374}{1,374.86}$$

$$C = 0.9$$

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 #4)

PROPOSED SITE

Grass Area	=	589.27 m^2
Concrete/Interlock Area	=	252.24 m^2
Asphalt Area	=	211.63 m^2
Total Storm-water Uncontrolled Area	=	1,053.14 m^2

$$C = \frac{(211.63 \times 0.9) + (589.27 \times 0.2) + (252.24 \times 0.8)}{1,053.14}$$

$$C = \frac{510.113}{1,053.14}$$

$$C = 0.484$$

Say "C" = 0.49

Therefore, the average post-development "C" for the uncontrolled storm-water drainage area of 1,053.14 m^2 from this site is 0.49.

The total tributary area consisting of approximately 1,053.14 square metres will be out-letting off site uncontrolled from the 4 storey low rise residential apartment building site.

The uncontrolled drainage area draining to the front of the lot is 1,053.14 m^2 and the controlled drainage area from the available flat roof top is 1,374.86 m^2 which totals to 2,428.0 m^2.

The SWM area to be controlled is 1,374.86 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: five (5)-year storm

Node #101

Pre-Development Site Area Characteristics

Development Lot Area	=	2,428.0 m^2
Grass Area	=	1,375.12 m^2
Gravel Area	=	1,052.88 m^2

$$C_{5pre} = \frac{(1{,}375.12 \times 0.2) + (1{,}052.88 \times 0.8)}{2{,}428.0}$$

$$C_{5pre} = \frac{1{,}117.328}{2{,}428.0}$$

$$C_{5pre} = 0.4602$$

Say $C_{5pre} = 0.46$

Use C_{allow} = 0.46 allowable for redevelopment

T_c = D/V where D = 40.0 m, ΔH = 0.65 m, S = 1.6%, and V = 0.95 feet/second = 0.29 m/s

Therefore,

$$T_c = \frac{40.0\ m}{0.29 m/s}$$

T_c = 2.30 minutes

Use T_c = 10 minutes

I_5 = 104.20 mm/hr [City of Ottawa, five (5)-year storm]

Using the Rational Method

Q = 2.78 (0.46) (104.2) (0.2428)

Q = 32.35 L/s

Therefore, the total allowable flow off-site is 32.35 L/s.

The pre-development flow of the five (5)-year and 100-year storm event draining off-site is as follows:

Where, Tc = 10 min.

$$Q_{5pre} = 2.78\ CIA$$

$$C_{5pre} = \frac{1{,}117.328}{2{,}428.0}$$

$C_{5pre} = 0.4601$

Say, $C_{5pre} = 0.46$ all draining off-site

$Q_{5pre} = 2.78\ (0.46)\ (104.2)\ (0.2428)$

$= 32.35\ L/s$

$$C_{100pre} = \frac{(1{,}052.88 \times 1.0) + (1{,}375.12 \times 0.2 \times 1.25)}{2{,}428.0}$$

$$C_{100pre} = \frac{1{,}396.66}{2{,}428.0}$$

$C_{100pre} = 0.575$

Say, $C_{100pre} = 0.58$ all draining to the front of lot

$Q_{100pre} = 2.78\ (0.58)\ (178.6)\ (0.2428)$

$= 69.92\ L/s$

Therefore under current site conditions the 5 year pre-development flow is estimated at 32.35 L/s and the 100 year pre-development flow is estimated at 69.92 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 five (5)-year and 100-year storm event all draining to the existing road right of way uncontrolled is as follows:

Where, Tc = 10 min.

Node #4

Q_{5post} = 2.78 CIA

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

Concrete Area	=	252.24 m^2
Grass Area	=	589.27 m^2
Asphalt Area	=	211.63 m^2

A_{Total} = 1,053.14 m^2

$$C_{5post} = \frac{(252.24 \times 0.8) + (589.27 \times 0.2) + (211.63 \times 0.9)}{1{,}053.14}$$

$$C_{5post} = \frac{510.113}{1{,}053.14}$$

$$C_{5post} = 0.484$$

Say, $C_{5post} = 0.49$ draining to the Old Richmond Road road right of way uncontrolled.

$$Q_{5post} = 2.78\ (0.49)\ (104.2)\ (0.1053)$$

$$= 14.95\ L/s$$

$$C_{100post} = \frac{(211.63 \times 1.0) + (589.27 \times 0.2 \times 1.25) + (252.24 \times 1.0)}{1{,}053.14}$$

$$C_{100post} = \frac{611.19}{1{,}053.14}$$

$$C_{100post} = 0.5803$$

Say, $C_{100post} = 0.58$ draining off-site uncontrolled

$$Q_{100post} = 2.78\ (0.58)\ (178.6)\ (0.1053)$$

$$= 30.32\ L/s$$

Therefore under post development condition, the 5 year uncontrolled flow off-site is estimated at 14.95 L/s and the 100 year uncontrolled flow is 30.32 L/s.

For this site, because 1,053.14 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 five (5)-year storm event criteria at C_{allow} = 0.46 is calculated as follow: Q = {2.78 (0.46) (104.2) (0.2428) – [2.78 (0.58) (178.6) (0.1053)]} = 32.35 L/s – 30.32 L/s = 2.03 L/s. Therefore, according to this approach, the maximum allowable flow rate off site is 32.35 L/s and the new allowable controlled flow rate off-site from the 4th floor roof drains is 2.03 L/s.

Storm-Water Management Analysis

For this proposed development, the building flat roof top will be used to provide Stormwater Management (SWM) attenuation for this site. Three (3) controlled roof drains are proposed to regulate flow off-site for on-site SWM measures to be incorporated with this proposed development. There are landscaped drains proposed over the parking garage level but will not be controlled for SWM.

The roof drain flow rate proposed is the Watts Roof Drain Model RD-100-A-ADJ (1/2 Opening Exposed) set at 1.26 L/s (20.0 U.S. gal/min.) for Roof Drain #1, for Roof Drain #2 and for Roof Drain #3 under a head of approximately 150mm at the drain for the 100-Year event. For the 5-Year event the roof drain flow rate is set at 1.10 L/s (17.50 US Gal/min.) for Roof Drain #1, #2, and #3 inclusive under a head of 120 mm. Therefore, the maixmum total controlled roof drain flow off-site is 3.78 L/s (60.0 U.S. gal/min.).

Thus for this site, the 5 year maximum post development flow rate draining off-site is the uncontrolled flow from the lot plus controlled rooftop flow which equals to 18.25 L/s (14.95 L/s + 3.30 L/s) which is less than the 32.35 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 34.10 L/s (30.32 L/s + 3.78 L/s) which exceeds the allowable site flow of 32.35 L/s by 1.75 L/s due to the practical selection of the flat roof top controlled drains. For the (3) roof areas involved, selecting a smaller roof drain size would exceed the ±150mm height of water at each drain.

Therefore for this proposed development site, the total maximum allowable five (5) year release rate of 18.25 L/s is less than the 5-year post development flow of 32.35 L/s by approximately 14.10 L/s.

For storm events up to and including the 100 year event the total maximum allowable release rate of 32.35 L/s will be exceeded by 1.75 L/s (estimated at 34.10 L/s) where the flow exceedance is less than 2.0 L/s for this site at the 100-Year event level. During the 5-Year event, the post development flow of 18.25 L/s is less than the maximum allowable release rate of 32.35 L/s.

To the controlled drainage area (flat roof top of proposed building) the post-development inflow rate during the five (5)-year and 100-year storms for the (3) three 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 three (3) roof drains to control flow off-site for this development property. The roof drain flow rate proposed is at 1.26 L/s (20.0 U.S. gal./min.) for roof drain #1, for roof drain #2 and for roof drain #3. The specified roof drain is the Watts "Adjustable Accutrol Weir" (Model # RD-100-A-ADJ) with weir opening in the ½ open position, which will allow a maximum flow of 1.26 L/s under a head of 150 mm water above the drain for each of roof drain #1, roof drain #2 and roof drain #3. See Appendix D for Roof Drain details. Therefore, the storm-water flow that can be controlled from this rooftop and outletted off site is (1.26 L/s x 3) = 3.78 L/s. Refer to the Proposed Rooftop Stormwater Management Plan Dwg. 819-106 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)

Five (5)-Year Event
C_5 = 0.90
A = 428.0 m^2
I = mm/hr

Q_1 = 2.78 (0.90) (0.0428 ha.) I = 0.1071 I

100-Year Event
C_{100} = 1.0
A = 428.0 m^2
I = mm/hr

Q_1 = 2.78 (1.0) (0.0428 ha.) I = 0.119 I

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

Five (5)-Year Event
C_5 = 0.90
A = 492.53 m^2
I = mm/hr

Q_2 = 2.78 (0.90) (0.0493 ha.) I = 0.1234 I

100-Year Event
C_{100} = 1.0
A = 492.53 m^2
I = mm/hr

Q_2 = 2.78 (1.0) (0.0493 ha.) I = 0.1371 I

For Roof Area 3, Q = 2.78 CIA (NODE #3)

Five (5)-Year Event
C_5 = 0.90
A = 454.33 m^2
I = mm/hr

Q_3 = 2.78 (0.90) (0.0454 ha.) I = 0.1137 I

100-Year Event
$C_{100} = 1.0$
$A = 454.33\ m^2$
$I =$ mm/hr

$Q_3 = 2.78\ (1.0)\ (0.0454\ ha.)\ I = 0.1263\ I$

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 6 inclusive.

Table 7 summarizes the post-development design flows from the building 4th floor 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 five (5)-year, and 100-year design events.

Table 7: 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)
			5 YR	100 YR	5 YR	100 YR	5 YR	100 YR	
RD-1 (0.0428 ha)	1	RD-100-A-ADJ (1/2 OPENING EXPOSED)	1.10	1.26	0.12	0.156	8.82	19.635	19.64
RD-2 (0.0493 ha)	1	RD-100-A-ADJ (1/2 OPENING EXPOSED)	1.10	1.26	0.12	0.152	10.66	23.60	24.78
RD-3 (0.0454 ha)	1	RD-100-A-ADJ (1/2 OPENING EXPOSED)	1.10	1.26	0.12	0.152	9.57	21.22	22.56
Total Roof (0.1375 ha)	3	-	**3.30**	**3.78**	-	-	**29.05**	**64.46**	**66.98**

572 Moodie Drive – 3 ½ Storey Stacked Dwelling

The proposed 3 ½ storey stacked dwelling at this site was architecturally designed with pitch roofs to comply with City's planning requirement and meeting the Architectural consistency of the immediate neighbourhood. Therefore, no flat roof top storage is available with this building on a small lot of $767.04\ m^2$.

1. Development Property Area

Post-Development Site Area Characteristics

Development Lot Area	=	$767.04\ m^2$
Roof Surface Area	=	$393.61\ m^2$
Concrete Area	=	$45.43\ m^2$
Grass Area	=	$202.17\ m^2$
Asphalt Area	=	$125.83\ m^2$

$$C = \frac{(393.61 \times 0.9) + (125.83 \times 0.9) + (45.43 \times 0.8) + (202.17 \times 0.2)}{767.04}$$

$$C = \frac{544.274}{767.04}$$

$$C = 0.7096$$

Say "C" $= 0.71$

Therefore, the average post-development "C" for this site is 0.71.

Pre-Development Flow Estimation

Node #102 (See Dwg. No. 819-106 D-2)

Pre-Development Site Area Characteristics

Development Lot Area	=	767.04 m^2
Asphalt Area	=	122.79 m^2
Concrete Area	=	11.66 m^2
Roof Area	=	261.26 m^2
Grass Area	=	343.0 m^2
Interlock Area	=	28.33 m^2

$$C_{pre} = \frac{(261.26 \times 0.9) + (122.79 \times 0.9) + (11.66 \times 0.8) + (343.0 \times 0.2) + (28.33 \times 0.8)}{767.04}$$

$$C_{pre} = \frac{446.237}{767.04}$$

$$C_{pre} = 0.581$$

Say $C_{pre} = 0.58$

T_c = D/V where D = 26.0 m, ΔH = 0.35 m, S = 1.35%, and V = 0.85 feet/second = 0.26 m/s

Therefore,

$$T_c = \frac{26.0\ m}{0.25 m/s}$$

T_c = 1.73 minutes

Use T_c = 10 minutes

I_5 = 104.20 mm/hr [City of Ottawa, five (5)-year storm]

Using the Rational Method

Q = 2.78 (0.58) (104.2) (0.0767)

Q = 12.89 L/s

Therefore, the total allowable flow off-site is 12.89 L/s.

The pre-development flow of the five (5)-year and 100-year storm event draining to the Moodie Drive road right of way is as follows:

Where, Tc = 10 min.

$Q_{5pre} = 2.78\ CIA$

$$C_{5pre} = \frac{446.237}{767.04}$$

$C_{5pre} = 0.581$

Say, $C_{5pre} = 0.58$

$Q_{5pre} = 2.78\ (0.58)\ (104.2)\ (0.0767)$

$= 12.89\ L/s$

$$C_{100pre} = \frac{(261.26 \times 1.0)+(122.79 \times 1.0)+(11.66 \times 1.0)+(28.33 \times 1.0)+(343.0 \times 0.2 \times 1.25)}{767.04}$$

$$C_{100pre} = \frac{464.79}{767.04}$$

$C_{100pre} = 0.606$

Say, $C_{100pre} = 0.61$

$Q_{100pre} = 2.78\ (0.61)\ (178.6)\ (0.0767)$

$= 23.23\ L/s$

Therefore under current site conditions the 5 year pre-development flow is estimated at 12.89 L/s and the 100 year pre-development flow is estimated at 23.23 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

Node #10 (See Dwg. No. 819-106 D-1)

The post-development flow of the five (5)-year and 100-year storm event all draining to the existing Moodie Drive road right of way uncontrolled is as follows:

5-Year Storm Event

Where, Tc = 10 min.

Node #10

$Q_{5post} = 2.78$ CIA

$C_{5post} = 0.7096$

Say, $C_{5post} = 0.71$

$Q_{5post} = 2.78\ (0.71)\ (104.2)\ (0.0767)$

$= 15.78\ \text{L/s}$

100-Year Storm Event

$$C_{100post} = \frac{(393.61 \times 1.0) + (202.17 \times 0.2 \times 1.25) + (125.83 \times 1.0) + (45.43 \times 1.0)}{767.04}$$

$$C_{100post} = \frac{615.41}{767.04}$$

$C_{100post} = 0.802$

Say, $C_{100post} = 0.80$

$Q_{100post} = 2.78\ (0.80)\ (178.6)\ (0.0767)$

$= 30.47\ \text{L/s}$

Therefore under post development condition, the 5 year uncontrolled flow off-site is estimated at 15.78 L/s and the 100 year uncontrolled flow is 30.47 L/s.

The said site at 572 Moodie Drive is proposed to house a 3 ½ storey stacked dwelling unit with pitch roofs. No flat rooftop is available for on-site stormwater management. Discussions were held with the City Engineering Department and it was agreed that softening the site as much as possible and thereby mitigating the post development 5 Year and 100 Year flow impact to be within a reasonable range of increase from that of the pre-development 5 Year to 100 Year flow level.

The **5 Year event** post development flow is estimated at 15.78 L/s with pre-development flow calculated at 12.89 L/s which is an increase of 2.89 L/s to the Moodie Drive roadway ditch system and 750mm large diameter storm sewer.

The **100 Year event** post development flow is estimated at 30.47 L/s with pre-development flow calculated at 23.23 L/s which is an increase of 7.24 L/s to the city 750 mm large diameter storm sewer and roadway ditch system at Moodie Drive.

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 Moodie Drive and Old Richmond Road 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. #819-106 ESC-1 for details.

Conclusion

4000 Old Richmond Road

At this proposed residential site and to develop this lot to house a 59 unit apartment building on a 0.2428 ha. parcel of land, the estimated allowable flow off-site is calculated at 32.35 L/s based on City of Ottawa drainage and Stormwater Management (SWM) criteria. For on-site SWM attenuation, the flat roof top of the proposed apartment building will be utilized and (3) controlled roof drains are incorporated each with a maximum controlled release rate of 1.26 L/s (20.0 U.S. gal/min.). The estimated net allowable controlled flow from the rooftop of this site totals to 2.03 L/s for the post development condition. Given the limiting roof drain model required to drain the roof areas within a certain height and within a reasonable time period, the model selected will exceed the estimated allowable flow by 1.75 L/s for the 100 Year post development storm event. The 5 Year post development flow of 18.25 L/s will be less than the allowable of 32.35 L/s.

During the five (5)-year storm event for the flat rooftop storage, the ponding depth of rooftop area 1, 2 and 3 is estimated at 120 mm at the drain and 0mm at the roof perimeter, assuming a 1.0% minimum roof pitch to the drain. The rooftop storage available at Roof Area 1 is 9.00 m^3, at Roof Area 2 is 10.79 m^3 and the rooftop storage available at Roof Area 3 is 11.41 m^3, for a total of 31.20 m^3, which is greater than the required volume of 29.05 m^3.

During the 100-year storm event for the flat rooftop storage, the ponding depth of Roof Area 1 is estimated at 156 mm at the drain and 0mm at the roof perimeter and the ponding depth at Roof Area 2 and 3 is estimated at 152 mm at the drain and 0 mm at the roof perimeter, assuming a 1.0% minimum roof pitch to the drain. The rooftop storage available at Roof Area 1 is 19.64 m^3, Roof Area 2 is 24.78 m^3 and the rooftop storage available at Roof Area 3 is 22.56 m^3, for a total of 66.98 m^3, which is greater than the required volume of 64.46 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. 819-106 G-1 and 819-106 SWM-1 respectively, the desirable five (5)-year storm and 100-year storm event rooftop detention volume of 31.20 m^3 and 66.98 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 its separate 150mm diameter PVC storm lateral. The main building roof drains as well as the landscaped drains at the rooftop of the underground parking level at the amenity area will be outletted also via a separate 150mm PVC storm lateral, where upon both laterals are connected directly to the existing Old Richmond Road 750mm diameter 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. 819-106 G-1 for details. The proposed reversed sloped down ramp to the underground garage parking level will have a trench drain with a 150mm diameter internal building storm pipe to drain the ramp area. Stormwater outlet for this reversed slope ramp area is the existing 250mm diameter Old Richmond Road sanitary sewer via the building's sanitary sewage pit and pumping system. Stormwater from the ramp drain cannot be connected to and outlet into the existing Old Richmond Road storm pipe due to potential oil content in the ramp area storm water collected.

572 Moodie Drive

For this site of ±0.0767 ha. parcel of land with a 3 ½ storey pitch roof stack dwelling proposed on this lot no flat roof top is available for on-site stormwater management attenuation. A comparison of post development flow to pre-development level is provided for City of Ottawa Engineering review.

In comparing the magnitude of the 5 Year and 100 Year pre and post development flow, the 5 Year post development flow of 15.78 L/s is slightly higher than the 5 Year pre-development flow of 12.89 L/s. As for the 100 Year post development flow of 30.47 L/s, it is 7.24 L/s greater than the 100 Year pre-development flow of 23.23 L/s. Therefore, drainage from this proposed site development without roof top SWM attenuation will increase the 5 Year flow by ±22.0% for the 5 Year event and ±31.0% for the 100 Year event in comparison to the current stormwater loading to the existing municipal storm sewer system.

The building weeping tile drainage will outlet via its separate 125mm diameter PVC storm lateral for each of the (3) separate stacked units, where upon the (3) laterals are connected directly to the existing Moodie Drive 750mm diameter storm sewer. Refer to the Proposed Site Grading and Servicing Plan (Dwg. 819-106 G-2) for details.

PREPARED BY T.L. MAK ENGINEERING CONSULTANTS LTD.

TONY L. MAK, P.ENG.

LICENSED PROFESSIONAL ENGINEER
12/14/21
TONY L-M. MAK
PROVINCE OF ONTARIO

PROPOSED 4000 OLD RICHMOND ROAD FOUR STOREY

LOW-RISE APARTMENT BUILDING DEVELOPMENT SITE

TABLE 1

FIVE (5)-YEAR EVENT

REQUIRED BUILDING ROOF AREA 1 STORAGE VOLUME (NODE #1)

t_c **TIME** (minutes)	**I** **5-YEAR** (mm/hr)	**Q** **ACTUAL** (L/s)	**Q** **ALLOW** (L/s)	**Q** **STORED** (L/s)	**VOLUME** **STORED** (m^3)
5	141.20	15.12	1.10	14.02	4.21
10	104.20	11.16	1.10	10.06	6.04
15	83.50	8.94	1.10	7.84	7.06
20	70.30	7.53	1.10	6.43	7.72
25	60.90	6.52	1.10	5.42	8.13
30	53.93	5.78	1.10	4.68	8.42
35	48.50	5.19	1.10	4.09	8.59
40	44.20	4.73	1.10	3.63	8.71
45	40.60	4.35	1.10	3.25	8.78
50	37.70	4.04	1.10	2.94	8.82
55	35.12	3.76	1.10	2.66	8.78
60	32.94	3.53	1.10	2.43	8.75

Therefore, the required rooftop storage volume is 8.82 m^3.

PROPOSED 4000 OLD RICHMOND ROAD FOUR STOREY

LOW-RISE APARTMENT BUILDING DEVELOPMENT SITE

TABLE 2

FIVE (5)-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)
5	141.20	17.40	1.10	16.30	4.89
10	104.20	12.84	1.10	11.74	7.04
15	83.50	10.29	1.10	9.19	8.27
20	70.30	8.66	1.10	7.56	9.07
25	60.90	7.51	1.10	6.41	9.62
30	53.93	6.65	1.10	5.55	9.99
35	48.50	5.98	1.10	4.88	10.25
40	44.20	5.45	1.10	4.35	10.44
45	40.60	5.00	1.10	3.90	10.53
50	37.70	4.65	1.10	3.55	10.65
55	35.12	4.33	1.10	3.23	10.66
60	32.94	4.06	1.10	2.96	10.656
65	31.04	3.83	1.10	2.73	10.65
70	29.40	3.62	1.10	2.52	10.58

Therefore, the required storage volume is 10.66 m^3.

PROPOSED 4000 OLD RICHMOND ROAD FOUR STOREY

LOW-RISE APARTMENT BUILDING DEVELOPMENT SITE

TABLE 3

FIVE (5)-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)
5	141.20	16.05	1.10	14.95	4.49
10	104.20	11.84	1.10	10.75	6.45
15	83.50	9.49	1.10	8.39	7.55
20	70.30	7.99	1.10	6.89	8.27
25	60.90	6.92	1.10	5.82	8.73
30	53.93	6.13	1.10	5.03	9.05
35	48.50	5.52	1.10	4.42	9.28
40	44.20	5.03	1.10	3.93	9.43
45	40.60	4.62	1.10	3.52	9.50
50	37.70	4.29	1.10	3.19	9.57
55	35.12	3.99	1.10	2.89	9.537
60	32.94	3.75	1.10	2.65	9.54
65	31.04	3.53	1.10	2.43	9.48

Therefore, the required storage volume is 9.57 m^3.

PROPOSED 4000 OLD RICHMOND ROAD FOUR STOREY

LOW-RISE APARTMENT BUILDING DEVELOPMENT SITE

TABLE 4

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	178.60	21.25	1.26	19.99	11.99
15	142.90	17.01	1.26	15.75	14.18
20	120.00	14.28	1.26	13.02	15.62
25	103.90	12.36	1.26	11.10	16.65
30	91.90	10.94	1.26	9.68	17.42
35	82.60	9.83	1.26	8.57	18.00
40	75.10	8.94	1.26	7.68	18.43
45	69.10	8.22	1.26	6.96	18.79
50	63.90	7.60	1.26	6.34	19.02
55	59.60	7.10	1.26	5.84	19.27
60	55.90	6.65	1.26	5.39	19.40
65	52.60	6.27	1.26	5.01	19.54
70	49.80	5.93	1.26	4.67	19.61
80	44.99	5.35	1.26	4.09	19.63
85	42.95	5.11	1.26	3.85	19.635
90	41.10	4.89	1.26	3.63	19.60
100	37.90	4.51	1.26	3.25	19.50

Therefore, the required storage volume is 19.635 m^3.

PROPOSED 4000 OLD RICHMOND ROAD FOUR STOREY

LOW-RISE APARTMENT BUILDING DEVELOPMENT SITE

TABLE 5

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	178.60	24.45	1.26	23.19	13.91
15	142.90	19.57	1.26	18.31	16.48
20	120.00	16.43	1.26	15.17	18.20
25	103.90	14.23	1.26	12.97	19.46
30	91.90	12.58	1.26	11.32	20.38
35	82.60	11.31	1.26	10.05	21.11
40	75.10	10.28	1.26	9.02	21.65
45	69.10	9.46	1.26	8.20	22.14
50	63.90	8.75	1.26	7.49	22.47
55	59.60	8.16	1.26	6.90	22.77
60	55.90	7.65	1.26	6.39	23.00
65	52.60	7.20	1.26	5.94	23.17
70	49.80	6.82	1.26	5.56	23.35
80	44.99	6.16	1.26	4.90	23.52
90	41.10	5.63	1.26	4.37	23.598
95	39.44	5.40	1.26	4.14	<u>23.60</u>
100	37.90	5.19	1.26	3.93	23.58
110	35.20	4.82	1.26	3.56	23.50

Therefore, the required rooftop storage volume is 23.60 m^3.

PROPOSED 4000 OLD RICHMOND ROAD FOUR STOREY

LOW-RISE APARTMENT BUILDING DEVELOPMENT SITE

TABLE 6

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	178.60	22.56	1.26	21.30	12.78
15	142.90	18.05	1.26	16.79	15.11
20	120.00	15.16	1.26	13.90	16.68
25	103.90	13.12	1.26	11.86	17.79
30	91.90	11.61	1.26	10.35	18.63
35	82.60	10.43	1.26	9.17	19.26
40	75.10	9.49	1.26	8.23	19.75
45	69.10	8.73	1.26	7.47	20.17
50	63.90	8.07	1.26	6.81	20.43
55	59.60	7.53	1.26	6.27	20.69
60	55.90	7.06	1.26	5.80	20.88
65	52.60	6.64	1.26	5.38	20.98
70	49.80	6.29	1.26	5.03	21.13
80	44.99	5.68	1.26	4.42	21.216
90	41.10	5.19	1.26	3.93	<u>21.22</u>
95	39.44	4.98	1.26	3.72	21.20
100	37.90	4.79	1.26	3.53	21.18
110	35.20	4.45	1.26	3.19	21.05

Therefore, the required rooftop storage volume is 21.22 m^3.

PROPOSED FOUR STOREY LOW RISE

RESIDENTIAL APARTMENT BUILDING SITE AT

4000 OLD RICHMOND ROAD

AND

PROPOSED 3 ½ STOREY STACKED DWELLING AT

572 MOODIE DRIVE

CITY OF OTTAWA

APPENDIX A

SITE PLAN

DWG. No. SP

.\zoning\zoning map.PNG

0 SP ZONING MAP
Scale: NTS

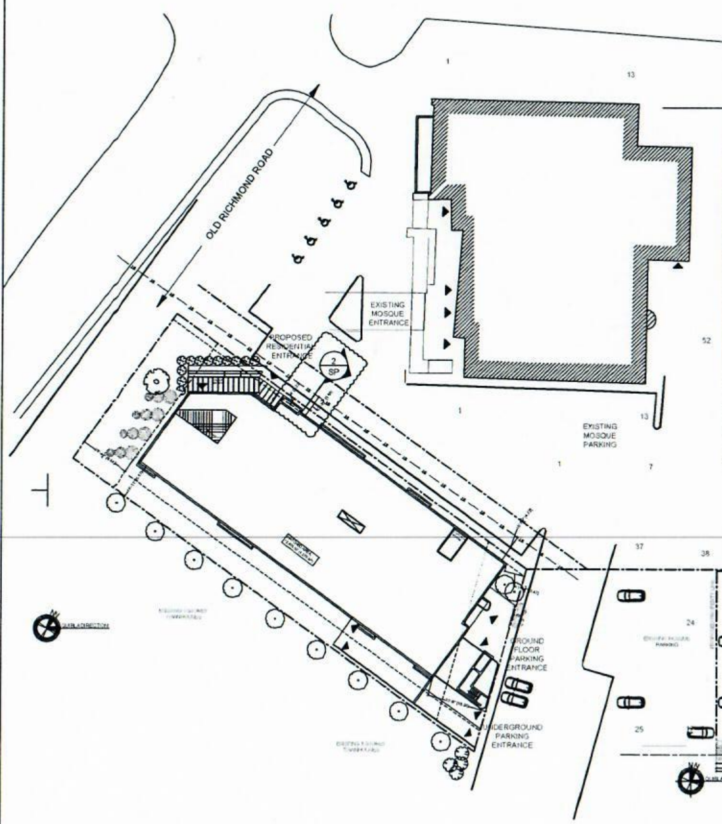
GROSS FLOOR AREA		
USE	GFA (M²)	UNITS
ASSISTED LIVING/ APARTMENT BUILDING	1,316	60
GROUND FLOOR PARKING	139	9
BASEMENT PARKING	2,125	64 SPACES
STACKED DWELLING	1,184	6
TOTAL	4,764	60+6 UNITS
EXISTING MOSQUE	4,404	

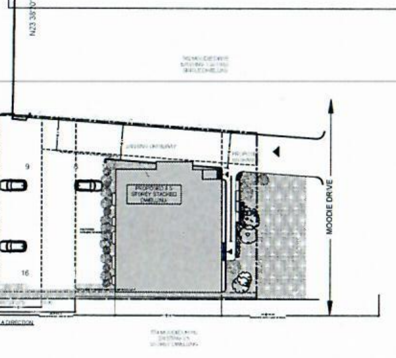
BICYCLE PARKING REQUIREMENTS			
BICYCLE PARKING	RATE	REQUIRED	PROPOSED
BUILDING "A"	/UNIT	30	30
STACKED DWELLING	0.5 /UNIT	3	3
TOTAL		30 + 3	30 + 3

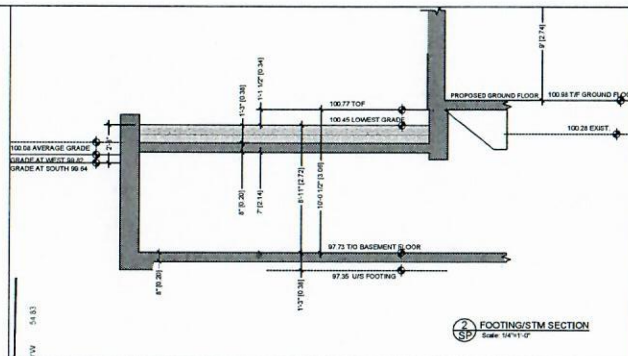
PARKING DIMENSIONS		
PARKING	DIMENSIONS	PROPOSED
BARRIER FREE TYPE A	3.4 M x 5.2 M W/ 1.5 M AISLE	1
BARRIER FREE YPE B	2.4 M x 5.2 M W/ 1.5 M AISLE	2
PARKING SPACE	2.6 M x 5.2 M	70
SMALL PARKING SPACE	2.4 M x 5.2 M	3

PARKING REQUIREMENTS			
PARKING	RATE	REQUIRED	PROPOSED
EXISTING (MOSQUE)		165	181 EXISTING
ACCESIBLE PARKING			5 EXISTING
NUMBER OF REMOVED PARKING SPACES			11 REMOVED
TOTAL			175 REMAINED
ASSISTED LIVING-BUILDING "A"	(1.2 + 0.25)/2=0.725/UNIT, 1.2-APARTMENT BLDG, 0.25-RETIREMENT HOME	0.725x60=43.5	
GROUND FLOOR LEVEL			9
BASEMENT LEVEL			64
ACCESIBLE PARKING	N/A	N/A	3
TOTAL			73
STACKED DWELLING	1.2/UNIT	7.2	7.2
VISITOR PARKING	RATE	REQUIRED	PROPOSED
VISITOR PARKING (BUILDING "A")	0.2/UNIT	12	12
VISITOR PARKING (STACKED DWELLING)	0.2/UNIT	1.2	1.2
SUBTOTAL		13.2	13
EXTERIOR			0 NEW PARKING SPACES
INDOOR (GROUND FLOOR + BASEMENT)			73 NEW
TOTAL			73 NEW PARKING SPACES
LANDSCAPE BUFFER	RATE	REQUIRED	PROPOSED
BUILDING "A"	N/A	N/A	N/A
STACKED DWELLING	NOT ABUTTING A STREET	1.5 M	1.5 M
STACKED DWELLING	15% OF THE AREA OF ANY PARKING LOT	EXISTING	EXISTING+42.6 M²

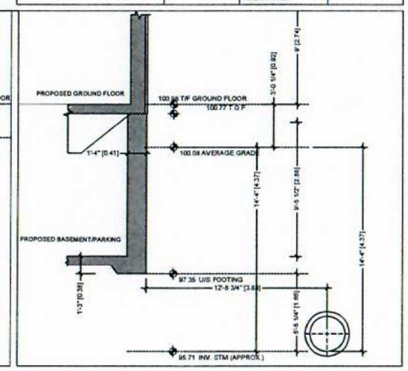
ZONING REQUIREMENTS			
LOW-RISE APARTMENT BUILDING	EXISTING REQUIREMENT FOR R1FF	REQUIREMENT FOR R4Z	PROPOSED
MINIMUM LOT WIDTH	19.5 M	18 M	30.37 M
MINIMUM LOT AREA	600 M²	450 M²	2,396 M²
MINIMUM FRONT YARD SETBACK	6 M	3 M	9.14 M
MINIMUM REAR YARD SETBACK	30% OF LOT DEPTH=23.76 M	THE MINIMUM REQUIRED REAR YARD SETBACK IS 6 METRES. NOTWITHSTANDING THE FOREGOING, WHERE THE REAR LOT LINE ABUTS THE INTERIOR SIDE LOT LINE OF AN ABUTTING LOT, THE MINIMUM REQUIRED REAR YARD SETBACK IS EQUAL TO THE MINIMUM REQUIRED INTERIOR SIDE YARD SETBACK OF THE ABUTTING LOT ALONG EACH POINT OF THE SHARED LOT LINE.	3.39 M - 10.15 M
MINIMUM INTERIOR SIDE YARD SETBACK	MIN. TOTAL IS 2.1 M, ONE SIDE NO LESS THAN 0.9 M	1.5 M (FOR HEIGHT LESS THAN 11 M), 3 M FOR HEIGHT GREATER THAN 11), OTHERWISE 6M	5.9 M & 1.22 M
MINIMUM CORNER SIDE YARD SETBACK	4.5 M	N/A	N/A
MAXIMUM HEIGHT	9.5 M	14.5 M	12 M
CONDITIONAL USE	N/A	N/A	N/A
PERMITTED PROJECTIONS INTO REQUIRED YARDS - BALCONIES, MAX. PROJECTION		2 METRES, BUT NO CLOSER THAN 1 METRE FROM ANY LOT LINE	0.6 M
		1.8 M INTO AN INTERIOR SIDE YARD, BUT NOT CLOSER THAN 0.6 M TO A SIDE LOT LINE	0.6 M
PERMITTED PROJECTIONS INTO REQUIRED YARDS - CANOPIES AND AWNINGS		A DISTANCE EQUAL TO ½ THE DEPTH OF A FRONT, REAR OR CORNER SIDE YARD BUT NOT CLOSER THAN 0.6 M TO A LOT LINE.	0.6 M
AMENITY AREA	N/A	6 M² PER DWELLING UNIT = 360 M² COMMUNAL AMENITY AREA -A MINIMUM OF 50% OF THE REQUIRED TOTAL AMENITY AREA	261 M² (50% COMMUNAL)







2 SP FOOTING/STM SECTION
Scale: 1/4"=1'-0"



1 SP SECTION AT GARAGE
Scale: 1/32"=1'-0"

LOW-RISE APARTMENT BUILDING
3990 OLD RICHMOND ROAD

STACKED DWELLING
572 MOODIE DRIVE

NO	REVISION	DATE
10		
09		
08		
07		
06		
05	REISSUED FOR BUILDING PERMIT	
04	ISSUED FOR BUILDING PERMIT	
03	ISSUED FOR ZONING AMENDMENT	
02	REISSUED FOR COORDINATION	11/05/2021
01	ISSUED FOR PRELIMINARY DESIGN REVIEW	10/22/2020

NOTE:
1. All dimensions are to be checked onsite. Discrepancies or ambiguities should be reported prior to work on site or ordering materials.
2. All work to comply with Ontario Building Code.
3. All dimensions include thickness of gypsum board on stud walls.
4. Drawings to be read in conjuction with structural drawings.

SUSAN D. SMITH ARCHITECT
941 MERIVALE RD,
OTTAWA, ON, K1Z 6A1
613 722 5327
s.smith@sdsarch.ca

PROJECT TITLE:
ZONING AMENDMENT
3990 OLD RICHMOND ROAD &
572 MOODIE DRIVE

DRAWING TITLE:

PROJECT START DATE: APRIL, 2019
DRAWN BY: ZK
SCALE: 3/16" = 1'-0"
REVIEWED BY:
SHEET No.

PRELIMINARY

SP

PROPOSED FOUR STOREY LOW RISE

RESIDENTIAL APARTMENT BUILDING SITE AT

4000 OLD RICHMOND ROAD

AND

PROPOSED 3 ½ STOREY STACKED DWELLING AT

572 MOODIE DRIVE

CITY OF OTTAWA

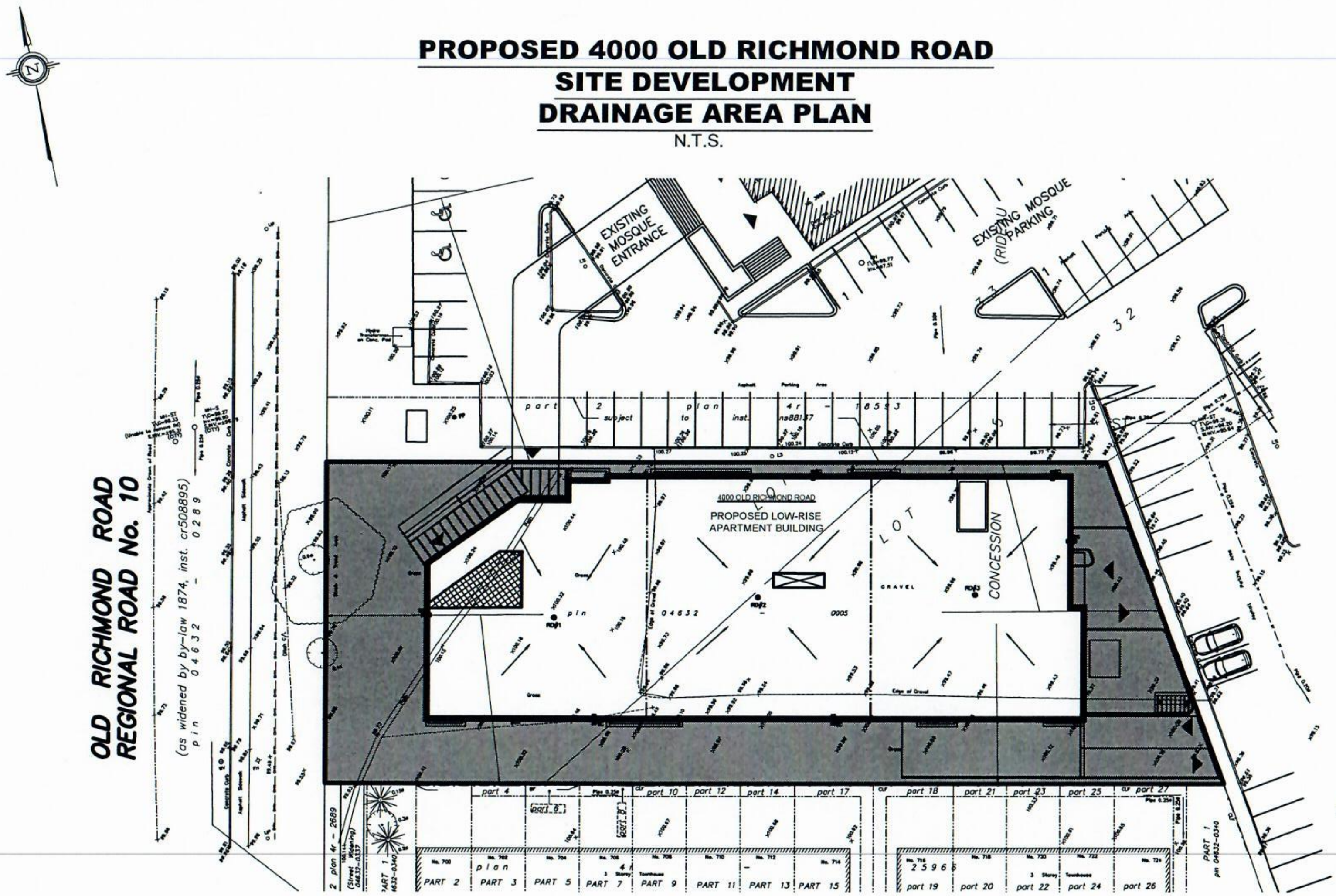
APPENDIX B

STORM DRAINAGE AREA PLAN

FIGURE 1 AND FIGURE 1A

PROPOSED 4000 OLD RICHMOND ROAD
SITE DEVELOPMENT
DRAINAGE AREA PLAN

N.T.S.



LEGEND

LIMIT OF CONTROLLED STORM
DRAINAGE AREA = 1,374.86 SQ. M

UNCONTROLLED STORM
DRAINAGE AREA = 1,053.14 SQ. M

TOTAL AREA = 2,428.0 SQ. M

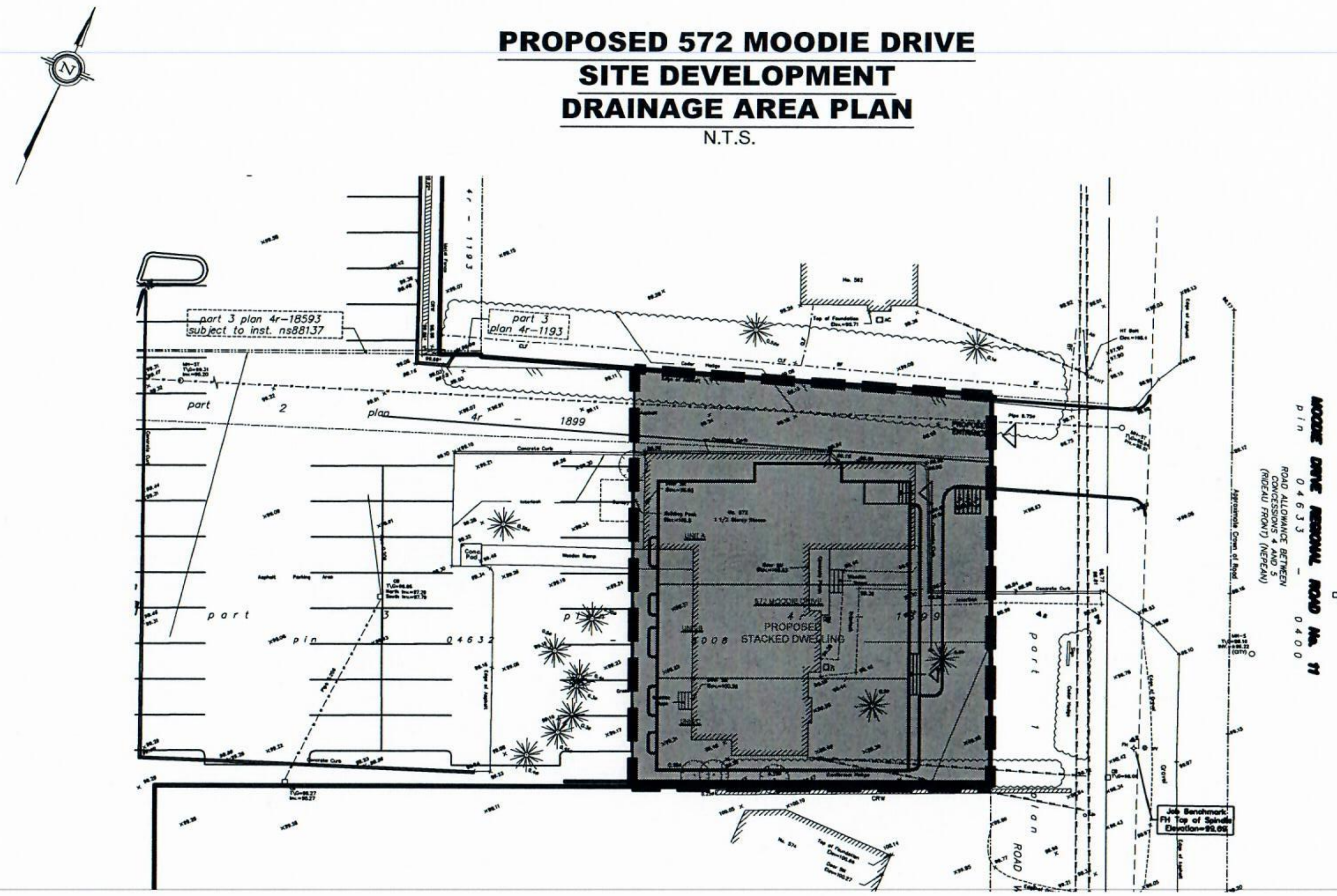
POST-DEVELOPMENT SITE
AVERAGE "C" = 0.72

T.L. MAK ENGINEERING CONSULTANTS LTD.
CONSULTING ENGINEERS

PROJECT No.	DATE	DRAWING No.
819-106	OCTOBER 2021	FIGURE 1

PROPOSED 572 MOODIE DRIVE
SITE DEVELOPMENT
DRAINAGE AREA PLAN

N.T.S.



LEGEND

LIMIT OF DEVELOPMENT SITE
AREA = 767.04 SQ. M

UNCONTROLLED STORM
DRAINAGE AREA = 767.04 SQ. M

TOTAL AREA = 767.04 SQ. M

POST-DEVELOPMENT SITE
AVERAGE "C" = 0.71

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CONSULTING ENGINEERS

PROJECT No.	DATE	DRAWING No.
819-106	OCTOBER 2021	FIGURE 1A

PROPOSED FOUR STOREY LOW RISE

RESIDENTIAL APARTMENT BUILDING SITE AT

4000 OLD RICHMOND ROAD

AND

PROPOSED 3 ½ STOREY STACKED DWELLING AT

572 MOODIE DRIVE

CITY OF OTTAWA

APPENDIX C

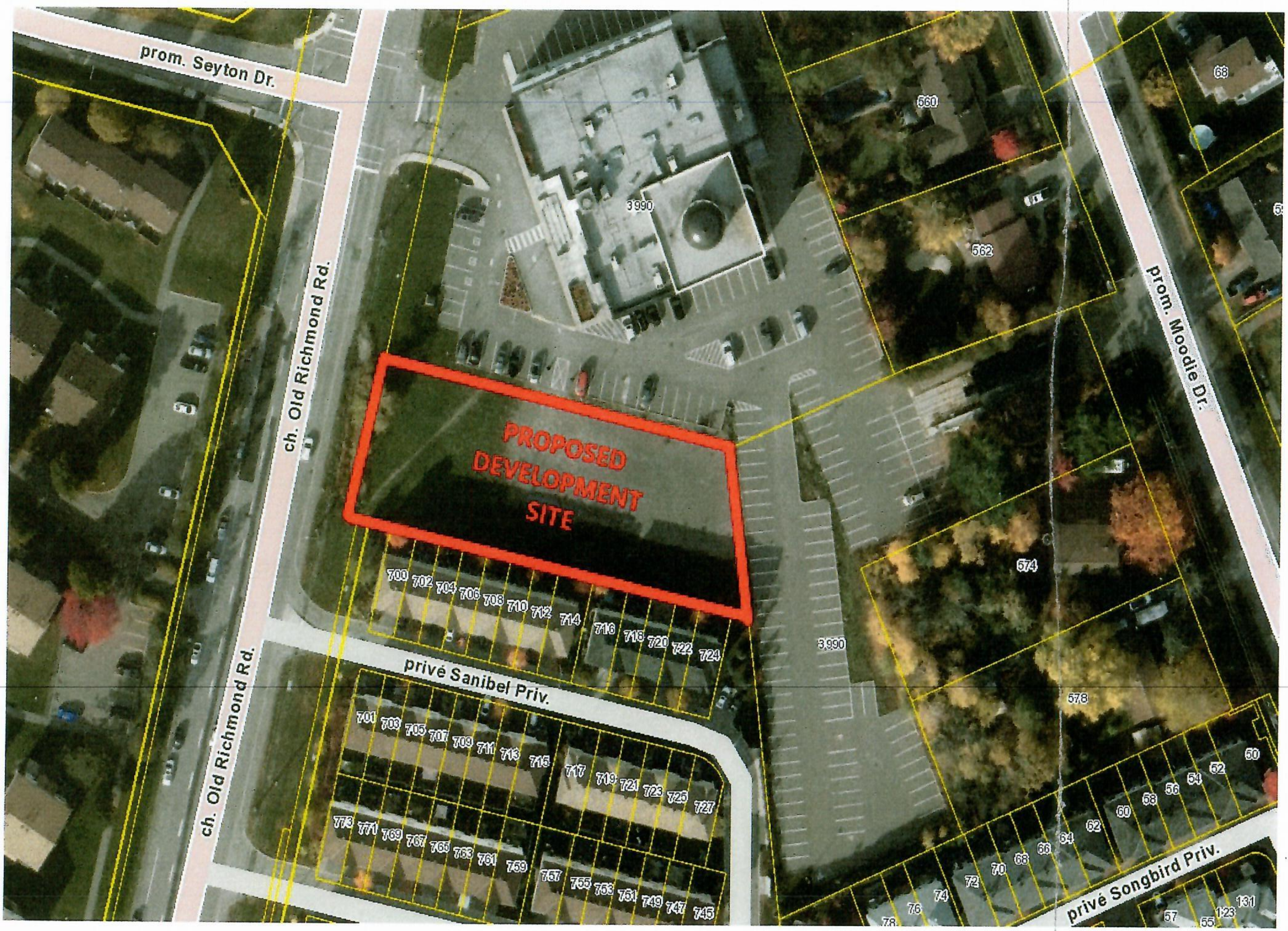
SITE PRE-DEVELOPMENT CONDITION

GOOGLE IMAGE 2019

AND

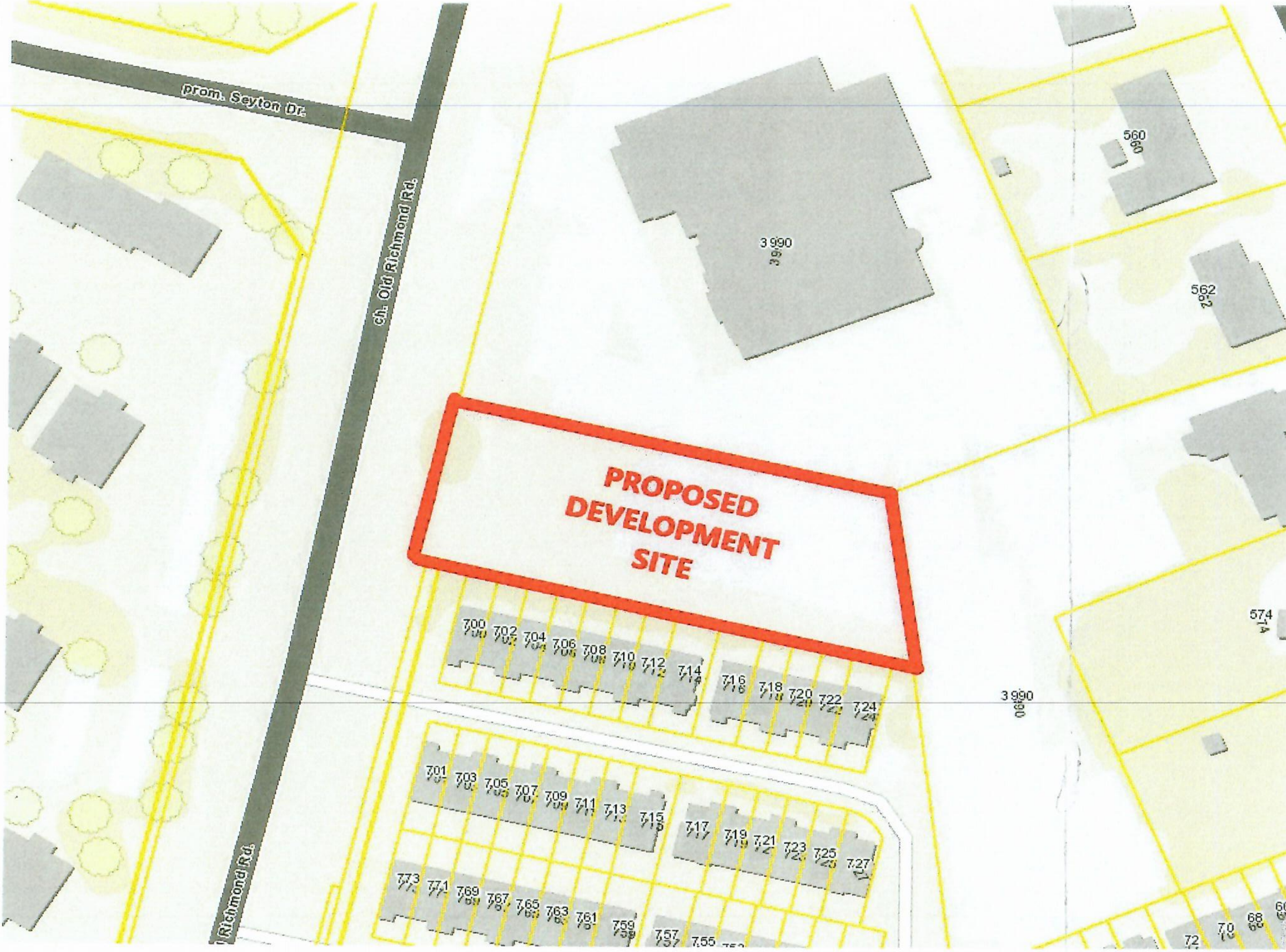
AERIAL PHOTOGRAPHY 2019 (GEOOTTAWA)

2019



prom. Seyton Dr.
ch. Old Richmond Rd.
ch. Old Richmond Rd.
PROPOSED DEVELOPMENT SITE
3990
3990
660
562
574
578
prom. Moodie Dr.
68
privé Sanibel Priv.
privé Songbird Priv.

2019



PROPOSED
DEVELOPMENT
SITE
prom. Seyton Dr.
ch. Old Richmond Rd.
3 990
560
562
574
700
702
704
706
708
710
712
714
716
718
720
722
724
701
703
705
707
709
711
713
715
717
719
721
723
725
727
773
771
769
767
765
763
761
759
757
755
72
70
68

2019

2019

2019


591
562
PROPOSED DEVELOPEMENT SITE
prom. Moodie Dr.
prom. Moodie Dr.
574

2019

PROPOSED FOUR STOREY LOW RISE

RESIDENTIAL APARTMENT BUILDING SITE AT

4000 OLD RICHMOND ROAD

CITY OF OTTAWA

APPENDIX D

PROPOSED ROOF DRAIN

DETAILS

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

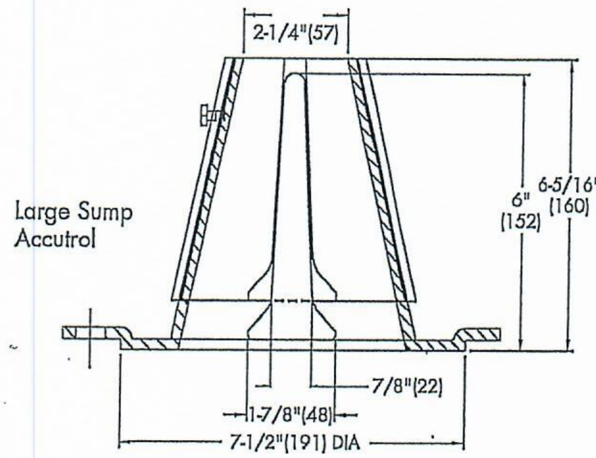
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

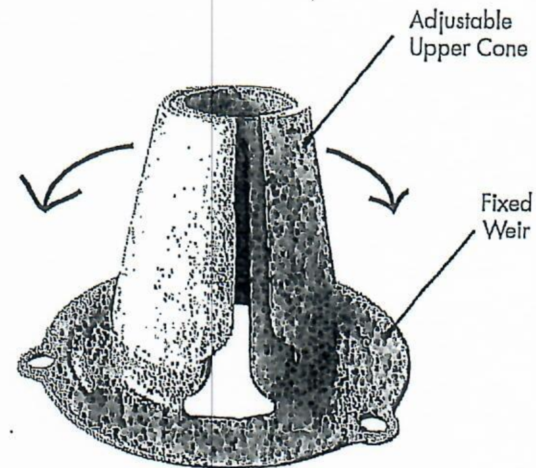
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the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

Watts product specifications in U.S. customary units and metric are approximate and are provided for reference only. For precise measurements, please contact Watts Technical Service. Watts reserves the right to change or modify product design, construction, specifications, or materials without prior notice and without incurring any obligation to make such changes and modifications on Watts products previously or subsequently sold.

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Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

PROPOSED FOUR STOREY LOW RISE

RESIDENTIAL APARTMENT BUILDING SITE AT

4000 OLD RICHMOND ROAD

AND

PROPOSED 3 ½ STOREY STACKED DWELLING AT

572 MOODIE DRIVE

CITY OF OTTAWA

APPENDIX E

DETAILED CALCULATIONS

FOR FIVE (5)-YEAR AND 100-YEAR

AVAILABLE STORAGE VOLUME

AVAILABLE STORAGE VOLUME CALCULATIONS

Five (5)-Year Event

Roof Storage at Flat Roof Building

The flat Roof Area 1, Roof Area 2 and Roof Area 3 will be used for storm-water detention. Each roof area will be drained by a controlled drain designed for a release rate of 17.50 U.S. gal./min. or 1.10 L/s at a height of 120mm above the drain. Refer to Dwg. 819-106 SWM-1 for roof drain details.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 395.12 m^2, C = 0.9, @roof slope of 1.0% minimum or 120mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[223.47 + 4(56.66) + 0]}{6}$$
$$V = \frac{(0.12)(450.11)}{6}$$
$$V = 9.00\ \text{m}^3$$

The available Roof Area 1 storage volume of 9.00 m^3 > required five (5)-year storage volume of 8.82 m^3 from Table 1.

Roof Storage Area 2 (NODE No.2)

Available flat roof area for storage = 485.43 m^2, C = 0.9, @roof slope of 1.0% minimum or 120mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[280.17 + 4(64.88) + 0]}{6}$$
$$V = \frac{(0.12)(539.69)}{6}$$
$$V = 10.79\ \text{m}^3$$

The available Roof Area 2 storage volume of 10.79 m^3 > required five (5)-year storage volume of 10.66 m^3 from Table 2.

Roof Storage Area 3 (NODE No.3)

Available flat roof area for storage = 438.68 m^2, C = 0.9, @roof slope of 1.0% minimum or 120mm of water height above the roof drain. Therefore, the available roof area will store a volume as shown below using the reservoir volume equation.

$$V = \frac{(0.12\text{m})[275.35 + 4(73.81) + 0]}{6}$$

$$V = \frac{(0.12)(570.59)}{6}$$

$$V = 11.43\ m^3$$

The available Roof Area 3 storage volume of 11.41 m^3 > required five (5)-year storage volume of 9.57 m^3 from Table 3.

Therefore, the ponding depth at the Roof Drain #1, #2 and #3 locations is approximately 0.12 m (120 mm), and the five (5)-year level is estimated not to reach the roof perimeter of the building.

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 five (5)-year storm event volume of 29.05 m^3 given it can store up to 31.20 m^3.

AVAILABLE STORAGE VOLUME CALCULATIONS

100-Year Event

Roof Storage at Flat Roof Building

The flat Roof Area 1, Roof Area 2, and Roof Area 3 will be used for storm-water detention. Each roof area will be drained by a controlled drain designed for a release rate of 20.0 U.S. gal./min. or 1.26 L/s at a height of 156mm above the drain at Roof Drain #1 and 152mm above the drain at Roof Drain #2 and #3. Refer to Dwg. 819-106 SWM-1 for roof drain details.

Roof Storage Area 1 (NODE No. 1)

Available flat roof area for storage = 395.12 m^2, C = 1.0, @roof slope of 1.0% minimum or 156mm 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.

$$V = \frac{(0.156\text{m})[395.12 + 4(90.10) + 0]}{6}$$

$$V = \frac{(0.156)(755.52)}{6}$$

$$V = 19.64\ \text{m}^3$$

The available Roof Area 1 storage volume of 19.64 m^3 > required 100-year storage volume of 19.635 m^3 from Table 4.

Roof Storage Area 2 (NODE No. 2)

Available flat roof area for storage = 478.26 m^2, C = 1.0, @roof slope of 1.0% minimum or 152mm 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.

$$V = \frac{(0.152\text{m})[478.26 + 4(124.94) + 0]}{6}$$

$$V = \frac{(0.152)(978.02)}{6}$$

$$V = 24.78\ \text{m}^3$$

The available Roof Area 2 storage volume of 24.78 m^3 > required 100-year storage volume of 23.60 m^3 from Table 5.

Roof Storage Area 3 (NODE No. 3)

Available flat roof area for storage = 438.68 m^2, C = 1.0, @roof slope of 1.0% minimum or 152mm 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.

$$V = \frac{(0.152\text{m})[438.68 + 4(112.97) + 0]}{6}$$

$$V = \frac{(0.152)(890.56)}{6}$$

$$V = 22.56\ m^3$$

The available Roof Area 3 storage volume of 22.56 m^3 > required 100-year storage volume of 21.22 m^3 from Table 6.

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 64.46 m^3 given it can store up to 66.98 m^3.

Therefore, the ponding depth at the Roof Drain #1 location is approximately 0.156m (156mm), and at the perimeter of the flat roof area is 0mm above the roof perimeter surface. The ponding depth at Roof Drain #2 and #3 location is approximately 0.152m (152mm), and at the perimeter of the flat roof area is 0 mm above the roof perimeter surface. Accordingly, it is recommended that six (6) roof scuppers as shown on Dwg. 819-106 G-1 and 819-106 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.