SERVICING AND STORMWATER MANAGEMENT REPORT

Project No.: 0CP-18-0217

Project Name.: 1171 Maple Avenue – Canada Post Office Addition

Prepared for:

CSV Consultants Inc.
1066 Somerset Street West
Ottawa, ON
K1Y 4T3

Prepared by:

McIntosh Perry
115 Walgreen Road
Carp, ON
K0A 1L0

June 2018; Revised June 22, 2018.

McINTOSH PERRY

Executive Summary

Developing a site within the City of Ottawa requires meeting a predefined set of requirements outlined in the City of Ottawa Sewer Design Guidelines (SDG) - 2012 along with meeting the local conservation authority requirements (Rideau Valley Conservation Authority - RVCA) and provincial requirements (Ministry of Environmental and Climate Change – MOECC). Site specific requirements are discussed and outlined in the pre-consultation meeting with the City of Ottawa before the detailed design process is initiated.

This report describes an innovative and cost-efficient design solution for the site servicing (water, sanitary, and storm) and stormwater management (SWM) requirements in order to develop this site. From correspondence with the Rideau Valley Conservation Authority the runoff from the new addition is considered clean, therefore no stormwater quality control is required.

Evaluation of the proposed site in addition to a review of the site grading was completed. Our review identified that rooftop storage is the optimal design solution to meet the SWM requirements. The rooftop storage will discharge onto grassed surfaces that will convey the runoff into the existing catchbasin located in the corner of the eastern parking area. No restriction to the stormwater aside from the roof is required.

The evaluation of the proposed development, existing site characteristics and surrounding municipal infrastructure suggests that the SWM design elements consisting of rooftop storage and quantity restriction will be sufficient solution to the site constraints. The existing sanitary and water services will be utilized and will support the additional flows from the proposed addition. Therefore, it is our professional opinion that this site located at 1171 Maple Avenue is able to be developed and fully serviced to support the proposed new building addition to the Canada Post Office location.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

1.0 PROJECT DESCRIPTION

1.1 Purpose

This report will address the servicing (water, sanitary, and storm) and stormwater management requirements associated with the proposed development of the property located at 1171 Maple Avenue within the City of Ottawa.

1.2 Site Description

The property is located at 1171 Maple Avenue. It is described as Part of Lot 2 Concession 'A' (Broken Front), Geographic Township of North Gower, City of Ottawa. The land in question covers approximately 0.21 ha and is located south of the intersection of Manotick Main Street and Maple Avenue.

The existing site is currently developed with a single storey Canada Post Office including parking on both sides of the building and two private approaches. It is assumed that the existing site has sanitary and water services. The existing services will be inspected to confirm serviceability and be used to service the new addition through the existing building.

The proposed development consists of a one-storey 315m² addition. The existing parking is to remain; only the northern portion of the site will be modified which consists of approximately 0.09 ha. The two existing private approaches as well as the catch basin located in the northeastern corner of the site will remain.

Figure 1: Key Map: 1171 Maple Avenue, Ottawa.

2.0 BACKGROUND STUDIES

Background studies that have been completed for the site include review of the City of Ottawa as-built drawings and a topographical survey of the site. McIntosh Perry is currently undertaking a geotechnical report.

As-built drawings of the existing services within the vicinity of the site were reviewed in order to determine proper servicing and stormwater management schemes for the site.

A topographic survey of the site was completed by McIntosh Perry Surveying Inc. dated June 07, 2018 and can be found under separate cover.

The following reports are currently being completed and will be available under separate cover:

- Geotechnical Investigation by McIntosh Perry.

3.0 PRE-CONSULTATION SUMMARY

City of Ottawa Staff have been pre-consulted regarding the proposed development in person on April 24, 2018. Further correspondence with City of Ottawa Staff outlined specific design parameters to be incorporated within this design including:

- The time of concentration shall be proven to be 10 minutes by calculation.
- Post-development flows shall be calculated using a time of concentration (Tc) of 10.
- Control 5 and 100-year post-development flows to the 5-year pre-development flows with a combined C value to a maximum of 0.50.
- C value to be calculated and proven to City Staff.

Correspondence with the City can be found in Appendix ‘A’.

4.0 EXISTING SERVICES

The existing water and sanitary services are extended from Maple Avenue and are to be inspected by CCTV for serviceability for the additional flows generated by the proposed addition as per the City of Ottawa Guidelines. The following subsection describes the existing services within the Maple Avenue right-of-way.

4.1 Maple Avenue

There is an existing 200 mm diameter sanitary main as well as a 600 mm diameter storm sewer located within Maple Avenue. The 600 mm diameter storm sewer ends approximately 23 m southwest of the northeastern property line. Both the sanitary and storm sewers flow northeastwards towards Manotick Main Street. There is also a 300 mm diameter watermain within the roadway. The watermain services the fire hydrant located across the street from the site.

Hydro, gas, cable and Bell service locations will need to be confirmed.

5.0 SERVICING PLAN

5.1 Proposed Servicing Overview

The overall servicing will be provided via the existing services for the site. The existing services are connected from the mains within Maple Avenue. The existing water service will be utilized which currently is extended from the 300mm diameter watermain. Similarly, the existing sanitary service will be utilized which is currently connected to the 200 mm diameter main.

5.2 Proposed Water Design

The existing 150 mm diameter PVC water lateral will remain to service the existing building as well as the addition. The existing lateral is extended from the 300 mm diameter water main within Maple Avenue.

The proposed addition will not be equipped with a sprinkler system. Following Part 3 of the Ontario Building Code (OBC), the required fire protection remains at 1,800 L/min with the inclusion of the proposed addition (See Appendix 'B' for calculation). The required fire protection from the Fire Underwriters Survey (FUS) increased from 3,000 L/min to 5,000 L/min (provided for information purposes only).

The water demands for the new building have been calculated as per the Ottawa Design Guidelines – Water Distribution. Due to the calculation being dependent on gross site area for demands, no changes to the demands are required due to the inclusion of the proposed addition. The demands are as follows: the average and maximum daily demands are 0.13 L/s and 0.20 L/s respectively. The maximum hourly demand was calculated as 0.35 L/s (Refer to Appendix 'B' for flow details).

Boundary conditions have been received from the City of Ottawa and a water model has been run to determine the available fire flows. The model determined that the hydrant has sufficient flow to accommodate the required fire flows. The boundary conditions as well as the fire flows report are available in Appendix 'B'.

5.3 Proposed Sanitary Design

The existing 200 mm diameter gravity sanitary service will remain to service the existing building as well as the addition. The existing lateral is extended from the 250 mm diameter sanitary main with Maple Avenue.

The peak design flow for the proposed site was determined to be 0.022 L/s. A 200 mm diameter pipe at the minimum slope of 0.32 percent slope has a capacity of 19.36 L/s, therefore the existing 200 mm diameter lateral has sufficient capacity to convey the flows (See Appendix 'C' for detailed calculations). It is anticipated that there will be no issues with capacity constraints within the proposed lateral or within the existing sanitary main within Maple Avenue as the amount of additional flow leaving the site is minimal.

5.4 Proposed Strom Design (Conveyance and Management)

Stormwater runoff will be restricted atop the proposed building addition's roof and discharged to the grassed surface. From there, the runoff will be conveyed by way of overland sheet flow from the development area to

the existing site that will remain in existing conditions. The existing site is equipped with a catch basin within the eastern parking area that will capture the flows from the western and northeastern sections of the site, while the southern portion of the site will be conveyed to the Maple Avenue right-of-way.

From discussions with the City of Ottawa and the Rideau Valley Conservation Authority (RVCA), quantity control will be provided. Quality control is not required due to the addition roof runoff is considered clean. Correspondence with the RVCA is available in Appendix 'A'. Further details and calculations pertaining to the quantity and quality of the stormwater management system are provided in Section 6.0.

5.5 Site Utilities

All relevant utility companies (telephone/cable – Bell/Rogers, gas – Enbridge and hydro – Hydro One) will be contacted prior to construction in order to confirm adequate utility servicing for the site. Existing utilities are present along Maple Avenue. Utility services are anticipated to be fed from the existing utilities currently within the Maple Avenue right-of-way.

5.6 Service Locations

The existing services are to be used once deemed serviceable by a CCTV inspection. Hydro, cable, telephone and gas will be likely be extended internally from the existing building. This will be further detailed by the mechanical/electrical engineer.

6.0 PROPOSED STORMWATER MANAGEMENT

6.1 Design Criteria and Methodology

Stormwater management for this site will be maintained through positive drainage away from the proposed building addition and into the existing catchbasin within the northeastern parking lot of the site or off site after restriction from the rectangular concrete weir. This SWM plan will implement quantity control strategies by restricting and storing stormwater on the roof of the proposed addition as well as the runoff from the grassed area behind the addition. The restricted stormwater runoff will be directed to the existing sewer within Maple Avenue; similarly, overland flow, as in existing conditions, will be directed towards the Maple Avenue right-of-way. The quantitative properties of the storm runoff for both the pre- and post-development flows are further detailed below. No quality control will be implemented due to the addition flows generated by the proposed addition as the runoff is considered clean.

Stormwater Best Management Practices (SWM BMP's) will be implemented at the "Lot level", "Conveyance" and "End of Pipe" locations. To summarize, roof water will be directed to grass surfaces that in turn will be collected into the proposed swale. The swale will convey the runoff into the proposed storm network.

6.2 Runoff Calculations

Runoff calculations presented in this report are derived using the Rational Method, given as:

$$Q = 2.78CIA \quad \text{(L/s)}$$

Where C = Runoff coefficient

I = Rainfall intensity in mm/hr (City of Ottawa IDF curves)

A = Drainage area in hectares

It is recognized that the rational method tends to overestimate runoff rates. As a by-product of using extremely conservative prediction method, any facilities that are sized using these results are expected to function as intended in real world conditions.

The following coefficients were used to develop an average C for each area:

Table 1: Average Runoff Coefficients (C)

Surface	Avg. C
Roofs/Concrete/Asphalt	0.90
Gravel	0.60
Undeveloped and Grass	0.20

As per the City of Ottawa Sewer Design Guidelines, the 5-year balanced 'C' value must be increased by 25% for a 100-year storm event to a maximum of 1.0.

As per correspondence with City of Ottawa Staff the time of concentration (Tc) has been proven to be 10 minutes for the pre-development conditions as well as in post-development (calculations are available in Appendix 'F').

6.2.1 Pre-Development Drainage

The existing site has been demonstrated as drainage area A1. Drawing CP-18-0217 PRE (Appendix 'D') indicates the limits of the drainage area. Existing conditions have the overland stormwater runoff flowing from a high point located in the western corner of the site and draining to the southeast and northeast to either side of the existing Canada Post Office, then to Maple Avenue's right-of-way. Table 2 demonstrates the existing flow rates in pre-development conditions.

Table 2: Pre-Development Runoff Summary

Area ID	Drainage Area (ha)	Balanced Runoff Coefficient (C) 5-yr	Balanced Runoff Coefficient (C) 100-yr	5-Year Flow Rate (L/s)	100-Year Flow Rate (L/s)
A1	0.083	0.34	0.40	8.14	16.43
Total	0.083			8.14	16.43

(See Appendix 'F' for Calculations)

6.2.2 Post-Development Drainage

The post-development drainage plan was designed to retain runoff generated by a 100-year event onsite. Stormwater exceeding this amount is directed to the southeast corner of the property. The proposed drainage and overland flow directions are indicated on drawing CP-18-0118 POST (Appendix 'E'). Table 3 below displays the post-development runoff generated by the proposed site.

Table 3: Post-Development Runoff Summary

Area ID	Drainage Area (ha)	Balanced Runoff Coefficient (C) 5-yr	Balanced Runoff Coefficient (C) 100-yr	5-year Flow Rate (L/s)	100-year Flow Rate (L/s)
B1	0.032	0.90	1.00	8.32	15.84
B2	0.036	0.20	0.25	2.06	4.41
B3	0.013	0.56	0.64	2.11	4.11
B4	0.003	0.39	0.45	0.31	0.61
Total	0.083			12.80	24.97

(See Appendix 'F' for Calculations)

Runoff from area B1 will be restricted on the rooftop of the proposed addition before discharging to the grassed surface. Similarly, the runoff from area B2 will be restricted by a concrete rectangular channel that will restrict the 100-year storm event flows to 2.09 L/s. Areas B3 and B4 will flow unrestricted to the right-of-way of Maple Avenue. See Appendix 'F' for calculations. This restriction will be further detailed in Section 6.3.

6.3 Quantity Control

After discussing the stormwater management criteria for the site with City of Ottawa staff, the 100-year post-development runoff for this site will be restricted to match the 5-year pre-development flow rate with a maximum C value of 0.5 (See Appendix 'A' for correspondence). These values create the following allowable release rates and storage volumes for the development site.

Table 4: Allowable Release Rate

Area ID	Drainage Area (ha)	Balanced Runoff Coefficients (C) 5-yr	5-Year Flow Rate (l/s)
A1	0.09	0.34	8.14

(See Appendix 'F' for Calculations)

Reducing site flows will be achieved using flow restriction and will create the need for onsite storage. Runoff from areas B1 and B2 will be restricted as detailed in the Table 5 on the following page.

Table 5: Post-Development Restricted Runoff Calculations

Area ID	Post-Development Unrestricted (l/s)		Post-Development (Restricted) (l/s)		
	5-yr	100-yr	5-yr	100-yr	
B1	8.32	15.84	0.72	1.32	RESTRICTED
B2	2.06	4.41	1.29	2.09	RESTRICTED
B3	2.11	4.11	2.11	4.11	UNRESTRICTED
B4	0.31	0.61	0.31	0.61	UNRESTRICTED
Total	12.80	24.97	4.43	8.14	

(See Appendix 'F' for Calculations)

Runoff from Areas B1 will be restricted on top of the roof by a singular roof drain. This roof drain will restrict area B1 to 0.72 L/s and 1.32 L/s for the 5 and 100-year storm events respectively. The restriction creates water ponding on top of 75 percent of the rooftop. Table 6 below details the required and provided rooftop storage volumes for the development.

Table 6: Rooftop Storage Summary

Area	Depth of ponding (m) for 5-yr storm	5-year required storage (m^3)	5-yr available storage (m^3)	Depth of ponding (m) for 100-yr storm	100-year required storage (m^3)	100-year available storage (m^3)
B1	0.030	6.9	7.2	0.055	13.1	13.2

(See Appendix 'F' for Calculations)

Are B2 will be restricted by a concrete rectangular weir as detailed on drawing CP-18-0217 – C101 submitted along with this report. The restriction will create a water surface elevation (WSEL) or 90.33 for the 5-year storm and 90.37 for the 100-year storm event. Table 7 details the required storage before discharge into the municipal infrastructure within Maple Avenue.

Table 7: Site Storage Summary

Area	Depth of ponding (m) for 5-yr storm	5-year required storage (m^3)	5-yr available storage (m^3)	Depth of ponding (m) for 100-yr storm	100-year required storage (m^3)	100-year available storage (m^3)
B2	0.08	0.5	0.6	0.12	1.4	1.6

(See Appendix 'F' for Calculations)

6.4 Quality Control

The development of this lot will employ Best Management Practices (BMP's) wherever possible. The intent of implementing stormwater BMP's is to ensure that water quality and quantity concerns are addressed at all stages of development. Lot level BMP's typically include temporary retention of the lot runoff, minimizing

ground slopes and maximizing landscaped areas. Some of these BMP's cannot be provided for this site due to site constraints and development requirements.

As per the discussions with the RVCA, no stormwater quality control is required for the proposed addition. Please refer to Appendix 'A' for correspondence with the RVCA and City of Ottawa. Due to the expectations outlined above no additional on-site quality treatment has been provided. The combination of the above BMP's and the proposed flow control measures will aid in the protection of the natural environment.

7.0 SEDIMENT EROSION CONTROL

The site-grading contractor is responsible for ensuring sediment control structures are installed in accordance with the Site Grading and Drainage Plan as indicated. Silt fences shall be installed on site before construction or earth-moving operations begin.

Geosock is to be installed under the grates of all existing structures along the frontage of the site and any new structures immediately upon installation. The Geosock is to be removed only after all areas have been paved and vegetation has been established. Care shall be taken at the removal stage to ensure that any silt that has accumulated is properly handled and disposed of. Removal of silt fences without prior removal of the sediments shall not be permitted.

At the discretion of the project manager, municipal staff or conservation authority, additional silt control devices shall be installed at designated locations.

8.0 SUMMARY

- A new 319 m^2 one-storey building addition will be constructed on the site located at 1171 Maple Avenue.
- The existing sanitary service lateral will be used if serviceability is confirmed by CCTV inspection.
- The existing water service lateral will be used for continued service.
- As discussed with City of Ottawa staff, the stormwater management design will ensure that the post-development flow rates are restricted to the 5-year pre-development flow rate calculated with a maximum C value of 0.5.
- Storage for the 100-year storm event will be provided on the proposed flat roof as well as within the grassed area behind the proposed addition.

9.0 RECOMMENDATIONS

Based on the information presented in this report, we recommend that City of Ottawa approve this Servicing and Stormwater Management Report in support of the proposed development located at 1171 Maple Avenue.

The sediment and erosion control plan outlined in Section 7.0 and detailed in the Grading and Drainage Plan notes are to be implemented by the contractor.

This report is respectfully being submitted for approval.

Ryan Kennedy, P.Eng.
Practice Area Lead, Land Development
McIntosh Perry Consulting Engineers
T: 613.836.2184 x 2243
E: r.kennedy@mcintoshperry.com

H:\01 PROJECT - PROPOSALS\2018 JOBS\CP\0CP-18-0217 CSV_CANADA POST_1171 MAPLE AVENUE\CIVIL\03 - SERVICING\REPORT\CP-18-0217_SERVICING REPORT_REV02.DOCX

10.0 STATEMENT OF LIMITATIONS

This report was produced for the exclusive use of CSV Consulting Inc. The purpose of the report is to assess the existing stormwater management system and provide recommendations and designs for the post-construction scenario that are in compliance with the guidelines and standards from the Ministry of the Environment and Climate Change, City of Ottawa and local approval agencies. McIntosh Perry reviewed the site information and background documents listed in Section 2.0 of this report. While the previous data was reviewed by McIntosh Perry and site visits were performed, no field verification/measures of any information were conducted.

Any use of this review by a third party, or any reliance on decisions made based on it, without a reliance report is the responsibility of such third parties. McIntosh Perry accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this review.

The findings, conclusions and/or recommendations of this report are only valid as of the date of this report. No assurance is made regarding any changes in conditions subsequent to this date. If additional information is discovered or becomes available at a future date, McIntosh Perry should be requested to re-evaluate the conclusions presented in this report, and provide amendments, if required.

APPENDIX A: CORRESPONDENCE

From: Bakhit, Reza <reza.bakhit@ottawa.ca>
Sent: June 12, 2018 12:33 PM
To: Tyler Ferguson; Sean Leflar
Cc: Whittaker, Damien; Wang, Anne
Subject: RE: 1171 Maple Avenue: SWM Criteria

Good afternoon Tyler,

In addition to providing SWM for B1 an B2, please demonstrate storm water control for the drainage area B3 by providing surface storage at the East parking area . (Please include storage calculation in your report)

Regards,

Reza Bakhit, E.I.T, C.E.T.
Engineering Intern
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Rural Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 19346, reza.bakhit@ottawa.ca

From: Tyler Ferguson <t.ferguson@mcintoshperry.com>
Sent: Tuesday, June 12, 2018 9:51 AM
To: Sean Leflar <s.leflar@mcintoshperry.com>; Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Whittaker, Damien <Damien.Whittaker@ottawa.ca>; Wang, Anne <anne.wang1@ottawa.ca>
Subject: RE: 1171 Maple Avenue: SWM Criteria

Hi Reza,

We have went ahead and provided some preliminary calculations for our site at 1171 Maple Avenue.

- Assuming the downstream infrastructure is sized for the 5-year flow;
- 'C' value for pre-development conditions was calculated to be over 0.5, so 0.5 has been used;
- A Tc of 9.22 min was calculated (as shown within the attached) for pre-development conditions so 10 min was used;

The issue for this site is the owner (Canada Post) is not planning any works on the existing parking lots, etc. However the 100-year flow for the non-development area is greater than the 5-year pre-development flow. This will be a challenge as they will now be required to do a significant amount of work that isn't planned. Can the requirement for the site be modified to just focus on the stormwater management controls within drainage areas B1/B2 only?

Any questions or concerns don't hesitate to contact me.

Thanks,

Tyler Ferguson, EIT
Engineering Intern
115 Walgreen Road, R.R. 3, Carp, ON K0A 1L0
T. 613.836.2184 (ext 2242) | **F.** 613.836.3742
t.ferguson@mcintoshperry.com | www.mcintoshperry.com
McINTOSH PERRY

From: Sean Leflar
Sent: June-08-18 7:55 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Whittaker, Damien <Damien.Whittaker@ottawa.ca>; Tyler Ferguson <t.ferguson@mcintoshperry.com>; Wang, Anne <anne.wang1@ottawa.ca>
Subject: RE: 1171 Maple Avenue: SWM Criteria

Good Morning,

Thank you for your response, I will move forward with the revised criteria provided.
I apologize for my delayed response, I have been absent from the office.

Thank you for your assistance in the matter.

Sean Leflar
Civil Engineering Technolgist
T. 613.836.2184 (ext 2252) | **F.** 613.836.3742

From: Bakhit, Reza <reza.bakhit@ottawa.ca>
Sent: June 6, 2018 1:40 PM
To: Sean Leflar <s.leflar@McIntoshPerry.com>
Cc: Whittaker, Damien <Damien.Whittaker@ottawa.ca>; Tyler Ferguson <t.ferguson@mcintoshperry.com>; Wang, Anne <anne.wang1@ottawa.ca>
Subject: 1171 Maple Avenue: SWM Criteria

Good afternoon Sean,

Please see the response below:

- Restrict the 5-year post development flows to the 5-year pre-development flow rate and the 100-year post to the 100-year pre-development flows.
  Since the capacity of the receiving sewer (On site CB located at North East of the site) is in Question , therefore as per SDG 8.3.7.3 all runoff must be controlled to the 2-year or 5-year pre-development level depending on the design return period of the receiving sewer, and all flow depth must be controlled on-site.

- Maximum calculated C value of 0.5.
  As per SDG 8.3.7.3 pre-development condition will be determined using the smaller of a runoff coefficient of 0.5 (0.4 in combined areas) or the actual existing site runoff coefficient. The consultant need to provide justification for using the 0.5 by providing calculation for the actual runoff coefficient value

- Time of concentration of 10 minutes for pre and post
  The consultant need to provide justification and calculation for using 10 minutes for pre and post

- We are also looking to only analyze the stormwater within the limit of development area as outlined in the attached plan. Can you confirm that this would be acceptable?
  Considering the site topography (apparently all of the run off would be directed towards the existing CB on site) and since there is no previous storm water management report for the site , the analyses should look into the entire site

Best regards,

Reza Bakhit, E.I.T, C.E.T.
Engineering Intern
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Rural Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 19346, reza.bakhit@ottawa.ca

'

'
'

This e-mail originates from the City of Ottawa e-mail system. Any distribution, use or copying of this e-mail or the information it contains by other than the intended recipient(s) is unauthorized. Thank you.

Le présent courriel a été expédié par le système de courriels de la Ville d'Ottawa. Toute distribution, utilisation ou reproduction du courriel ou des renseignements qui s'y trouvent par une personne autre que son destinataire prévu est interdite. Je vous remercie de votre collaboration.

'

From: Eric Lalande <eric.lalande@rvca.ca>
Sent: June 11, 2018 9:19 AM
To: Sean Leflar
Subject: RE: 1171 Maple Avenue - Stormwater Quality Requirements

Hi Sean,

The one storey addition will result in new roof top collection, which is considered clean. The RVCA would look for best management practices to improve water quality from the site. The subject site appears to be overland draining towards the municipal system outletting to the Rideau <1 Km away. While the RVCA has no requirements for the addition, improved stormwater quality is encouraged and should be included if/when the storm system is extended to the site, to a standard of 80% TSS removal.

Thanks,

Eric Lalande, MCIP, RPP
Planner, Rideau Valley Conservation Authority
613-692-3571 x1137

From: Sean Leflar <s.leflar@mcintoshperry.com>
Sent: Sunday, June 10, 2018 11:25 AM
To: Eric Lalande <eric.lalande@rvca.ca>
Cc: Tyler Ferguson <t.ferguson@mcintoshperry.com>
Subject: 1171 Maple Avenue - Stormwater Quality Requirements

Good Morning Eric,

I have started up the civil design for a one-storey addition to the existing Canada Post Office located on 1171 Maple Avenue in Manotick. I have corresponded with the City and they are requiring Stormwater quantity control. When you have a moment could you review the information provided and let me know what kind of quality control the RVCA would require?

Thank you for your time,

Sean Leflar
Civil Engineering Technolgist
115 Walgreen Road, R.R. 3, Carp, ON K0A 1L0
T. 613.836.2184 (ext 2252) | **F.** 613.836.3742
s.leflar@mcintoshperry.com | www.mcintoshperry.com
McINTOSH PERRY

APPENDIX B: EXISTING WATERMAIN FLOW AND FIRE PROTECTION CALCULATIONS

McINTOSH PERRY

From: Bakhit, Reza <reza.bakhit@ottawa.ca>
Sent: June 21, 2018 12:38 PM
To: Sean Leflar
Cc: Whittaker, Damien; Wang, Anne; Tyler Ferguson
Subject: RE: 1171 Maple Avenue - Request for Boundary Conditions
Attachments: 1171 Maple ave.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Good afternoon Sean,

As requested , attached please see the boundary conditions for 1171 Maple.

Regards,

Reza Bakhit, E.I.T, C.E.T.
Engineering Intern
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - Rural Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 19346, reza.bakhit@ottawa.ca

From: Sean Leflar <s.leflar@mcintoshperry.com>
Sent: Monday, June 11, 2018 11:38 AM
To: Bakhit, Reza <reza.bakhit@ottawa.ca>
Cc: Whittaker, Damien <Damien.Whittaker@ottawa.ca>; Wang, Anne <anne.wang1@ottawa.ca>; Tyler Ferguson <t.ferguson@mcintoshperry.com>
Subject: 1171 Maple Avenue - Request for Boundary Conditions

Good Morning,

I would like to request boundary conditions for the new addition to the Canada Post Office located on Maple Avenue. The addition consists of a 315m^2 one-storey addition attached to the existing 230m^2 one-storey Canada Post Office. The addition will not be sprinklered and will be considered to be of ordinary construction. We are planning to use the existing water service to the service the new addition through the existing building. Since the water demands are calculated by gross area of the site, the water demands remain the same including the new addition. The fire flow has increased based on the additional building area.

Type of Development:	Commercial
Location of Service:	Existing Connection to Maple Avenue
Amount of Fire Flow Required:	5,000 L/min or 83.33 L/sec
Gross Site Area (ha):	0.21
Average Daily Demand (L/sec):	0.13
Maximum Daily Demand (L/sec):	0.20
Maximum Hourly Demand (L/sec):	0.35

If you require any further information, please feel free to contact me.

Thank you,

Sean Leflar
Civil Engineering Technolgist
115 Walgreen Road, R.R. 3, Carp, ON K0A 1L0
T. 613.836.2184 (ext 2252) | **F.** 613.836.3742
s.leflar@mcintoshperry.com | www.mcintoshperry.com
McINTOSH PERRY

BOUNDARY CONDITIONS

Boundary Conditions For: 1171 Maple Ave

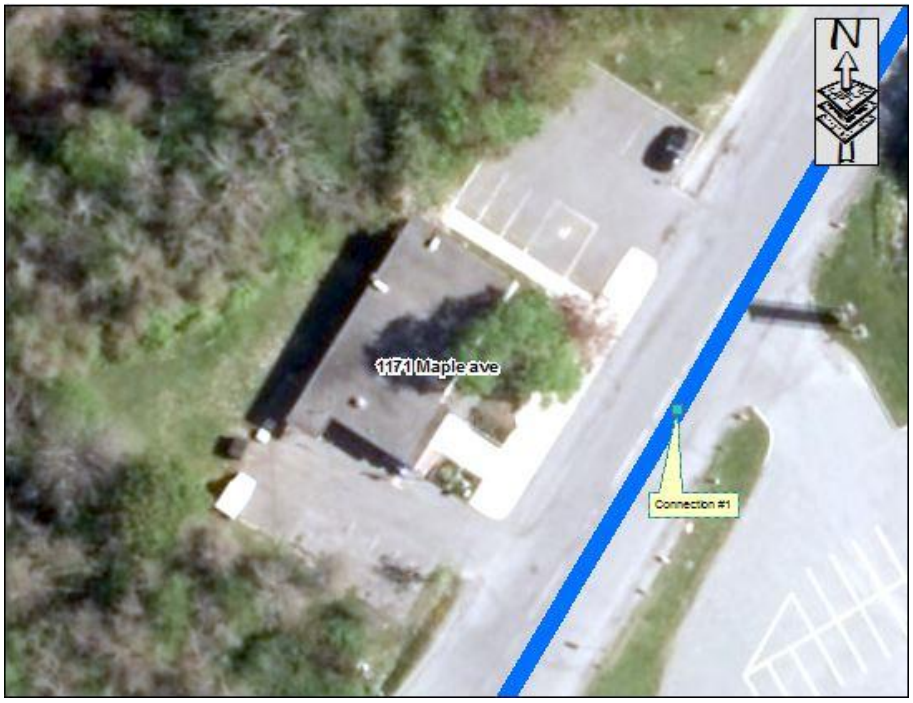
Date of Boundary Conditions: 2018-Jun-20

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	12.6	0.2
Maximum Daily Demand	7.8	0.1
Peak Hour	21	0.4
Fire Flow #1 Demand	5000	83.3

Number Of Connections: 1

Location:



BOUNDARY CONDITIONS

Results:

Pre

Connection #: 1

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	156.8	97.1
Peak Hour	142.1	73.2
Max Day Plus Fire (5,000) L/min	129.1	54.7

[1]Elevation: **90.57**

Post

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	147.7	81.2
Peak Hour	144.7	76.9
Max Day Plus Fire (5,000) L/min	139.0	68.8

[1]Elevation: **90.57**

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time,

as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Max Day plus Fire Flow

Label	Is Fire Flow Run Balanced?	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (L/min)	Fire Flow (Available) (L/min)	Pressure (psi)	Elevation (m)
H-3	True	True	5,000.00	10,000.00	71.68	88.50
TEE	False	False	5,000.00	(N/A)	71.54	88.60
BLDG	False	False	5,000.00	(N/A)	69.55	89.40

McINTOSH PERRY

CP-18-0217 - 1171 MAPLE AVENUE - Water Demands

Project:	1171 MAPLE AVENUE
Project No.:	CP-18-0217
Designed By:	SVL
Checked By:	RPK
Date:	06/05/2018
Site Area:	0.21 gross ha

AVERAGE DAILY DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	350	L/c/d
Industrial - Light	35,000	L/gross ha/d
Industrial - Heavy	55,000	L/gross ha/d
Shopping Centres	2,500	L/(1000m² /d
Hospital	900	L/(bed/day)
Schools	70	L/(Student/d)
Trailer Parks no Hook-Ups	340	L/(space/d)
Trailer Park with Hook-Ups	800	L/(space/d)
Campgrounds	225	L/(campsite/d)
Mobile Home Parks	1,000	L/(Space/d)
Motels	150	L/(bed-space/d)
Hotels	225	L/(bed-space/d)
Tourist Commercial	28,000	L/gross ha/d
Other Commercial	***28,000***	***L/gross ha/d***
AVERAGE DAILY DEMAND	**0.13**	**L/s**

MAXIMUM DAILY DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	2.5 x avg. day	L/c/d
Industrial	1.5 x avg. day	L/gross ha/d
Commercial	***1.5 x avg. day***	***L/gross ha/d***
Institutional	1.5 x avg. day	L/gross ha/d
MAXIMUM DAILY DEMAND	**0.20**	**L/s**

MAXIMUM HOUR DEMAND

DEMAND TYPE	AMOUNT	UNITS
Residential	2.2 x max. day	L/c/d
Industrial	1.8 x max. day	L/gross ha/d
Commercial	***1.8 x max. day***	***L/gross ha/d***
Institutional	1.8 x max. day	L/gross ha/d
MAXIMUM HOUR DEMAND	**0.35**	**L/s**

WATER DEMAND DESIGN FLOWS PER UNIT COUNT
CITY OF OTTAWA - WATER DISTRIBUTION GUIDELINES, JULY 2010

McINTOSH PERRY

CP-18-0217 - 1171 MAPLE AVENUE - OBC Fire Calculations

Project:	1171 MAPLE AVENUE
Project No.:	CP-18-0217
Designed By:	SVL
Checked By:	RPK
Date:	06/05/2018

Ontario 2006 Building Code Compendium (Div. B - Part 3)

***Water Supply for Fire-Fighting* - Store/Office & Warhouse Building**

Building is classified as Group : F2 (from table 3.2.2.55)

Building is of combustible construction with fire separations and fire resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.

From Div. B A-3.2.5.7. of the Ontario Building Code - 3. Building On-Site Water Supply:

(a) Q = K x V x Stot

where:

Q = minimum supply of water in litres

K = water supply coefficient from Table 1

V = total building volume in cubic metres

Stot = total of spatial coefficient values from the property line exposures on all sides as obtained from the formula:

Stot = 1.0 + [Sside1+Sside2+Sside3+...etc.]

K	**21**	(from Table 1 pg A-31) (Worst case occupancy {E / F2} 'K' value used)
V	**1,063**	(Total building volume in m^3.)
Stot	**1.0**	(From figure 1 pg A-32)
Q =	**22,316.70 L**	

→

			From Figure 1 (A-32)
Snorth	over 10	m	0.0
Seast	over 10	m	0.0
Ssouth	over 10	m	0.0
Swest	over 10	m	0.0

*approximate distances

From Table 2: Required Minimum Water Supply Flow Rate (L/s)

1800 L/min (if building is one storey not exceeding 600m^2)

476 gpm

McINTOSH PERRY

CP-18-0217 - 1171 MAPLE AVENUE - Fire Underwriters Survey (FUS) Fire Calculations

Project:	1171 MAPLE AVENUE
Project No.:	CP-18-0217
Designed By:	SVL
Checked By:	RPK
Date:	06/05/2018

From the Fire Underwriters Survey (1999)

From Part II – Guide for Determination of Required Fire Flow Copyright I.S.O.:

F = 220 x C x √A Where:

F = Required fire flow in liters per minute

C = Coefficient related to the type of construction.

A = The total floor area in square meters (including all storey's, but excluding basements at least 50 percent below grade) in the building being considered.

A. Determine The Coefficient Related To The Type Of Construction

The building is considered to be of ordinary construction type. Therefore,

C = 1.00

B. Determine Ground Floor Area

As provided by the Architect:

Floor Area (One Floor) = 545.00 m^2

A = 545.00 m^2

This floor area represents the final build-out of the development; as outlined on the Site Plan drawing.

C. Determine Height in Storeys

From Architectural Drawings:

Number of Storeys = 1.00

D. Calculate Required Fire Flow

F = 220 x C x √A

F = 220.00 X 1.00 X √ 545.00

F = 5,135.95 L/min.

F = 5,000.00 L/min.

E. Determine Increase or Decrease Based on Occupancy

From note 2, Page 18 of the Fire Underwriter Survey:

Combustible - Post Office Storage

No Change

Occupancy Decrease = 0.00 L/min.

F = 5,000.00 L/min.

CP-18-0217 - 1171 MAPLE AVENUE - Fire Underwriters Survey (FUS) Fire Calculations

F. Determine the Decrease, if any for Sprinkler Protection

From note 3, Page 18 of the Fire Underwriter Survey:

- The flow requirement may be reduced by up to 50% for complete automatic sprinkler protection depending upon adequacy of the system.
- The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards.
- Additional credit of 10% if water supply is standard for both the system and fire department hose lines
- If sprinkler system is fully supervised system, an additional 10% credit is granted
- The entire building will be installed with a fully automated, standardized with the City of Ottawa Fire Department and fully supervised.
- Therefore the value obtained in Step E is reduced by 0% (The building is not sprinklered)

Reduction = 5,000.00 L/min. X 0%

Reduction = 0.00 L/min.

G. Determine the Total Increase for Exposures

From note 4, Page 18 of the Fire Underwriter Survey:

- There are no existing buildings surrounding the site that are within 45m.
- Therefore the charge for exposure is 0% of the value obtained in Step E.

Increase = 5,000.00 L/min. X 0%

Increase = 0.00 L/min.

H. Determine the Total Fire Demand

- To the answer obtained in E, substract the value obtained in F and add the value obtained in G
- Fire flow should be no less than 2,000L/min. and the maximum value shoul not exceed 45,000L/min.

F = 5,000.00 L/min. - 0.00 L/min. + 0.00 L/min.
F = 5,000.00 L/min.

Therefore, after rounding to the nearest 1,000 L/min, the total required fire flow for the development is 5000 L/min (1321 GPM).

Table 1					
WATER SUPPLY COEFFICIENT - K					
TYPE OF CONSTRUCTION	Classification by Group or Division in Accordance with Table 3.1.2.1. of the Building Code				
	A-2 B-1 B-2 B-3 C D	A-4 F-3	A-1 A-3	E F-2	F-1
Building is of noncombustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches.	10	12	14	17	23
Building is of noncombustible construction or of heavy timber construction conforming to Article 3.1.4.6. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	16	19	22	27	37
Building is of combustible construction with fire separations and fire-resistance ratings provided in accordance with Subsection 3.2.2., including loadbearing walls, columns and arches. Noncombustible construction may be used in lieu of fire-resistance rating where permitted in Subsection 3.2.2.	18	22	25	31	41
Building is of combustible construction. Floor assemblies are fire separations but with no fire-resistance rating. Roof assemblies, mezzanines, loadbearing walls, columns and arches do not have a fire-resistance rating.	23	28	32	39	53
Column 1	2	3	4	5	6

Table 3.2.2.55.
Maximum Building Area, Group D, up to 2 Storeys
Forming Part of Sentence 3.2.2.55.(1)

No. of *Storeys*	Maximum Area, m^2		
	Facing 1 *Street*	Facing 2 *Streets*	Facing 3 *Streets*
1 2	1 000 800	1 250 1 000	1 500 1 200
Column 1	2	3	4

Table 2	
OBC Part 3 Buildings	Required Minimum Water Supply Flow Rate (L/min)
One-storey building with building area not exceeding 600 m^2	1800
All other buildings	2700 (if Q ≤ 108,000 L)(1) 3600 (if Q > 108,000 L and ≤ 135,000 L)(1) 4500 (if Q > 135,000 L and ≤ 162,000 L)(1) 5400 (if Q > 162,000 L and ≤ 190,000 L)(1) 6300 (if Q > 190,000 L and ≤ 270,000 L)(1) 9000 (if Q > 270,000 L)(1)

Note to Table 2:
(1) $Q = KVS_{To}$, as referenced in Paragraph 3(a)

APPENDIX C: SANITARY SEWER CALCULATIONS

McINTOSH PERRY

Project:	CP-18-0217 – 1171 Maple Avenue
Designed By:	SVL
Checked By:	RPK
Date:	June 11, 2018

Re: Sanitary Flow Calculations

1. Building Occupancy

The maximum number of employees will be 25 persons as per correspondence with the Architects.

2. Daily Volume in Litres

As per the extract of the City of Ottawa Sewer Design Guidelines, Appendix 4-A; Daily Sewage Flow for Employees – Various Locations;

- Various buildings and places of Employment – e.g. store employees, Office workers – depends of facilities.

  = 75 Liters/Person/Day

3. Peak Flow (Q/p)

- Q(p) = F x P Where:

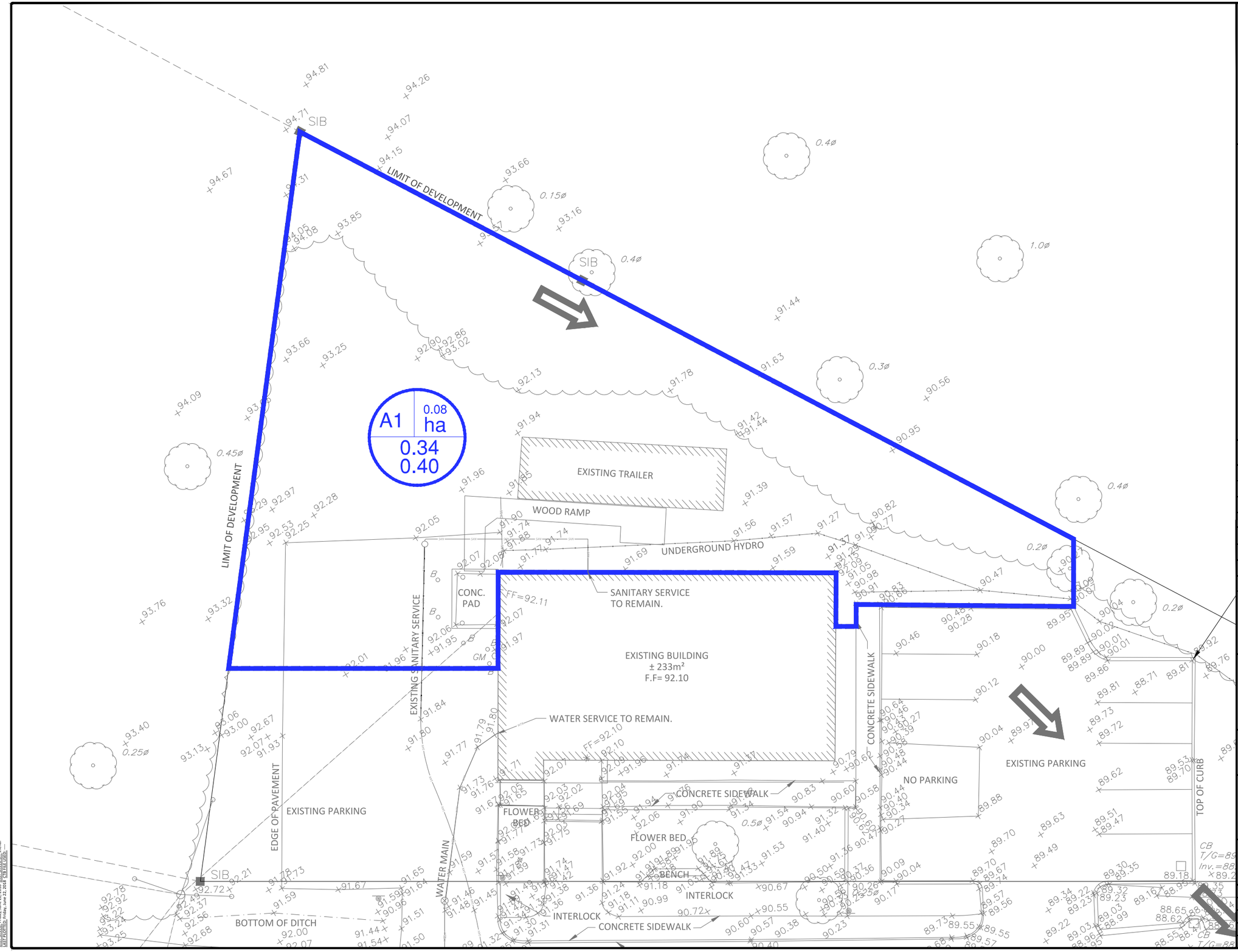
  F = 75 Litres/Person/Day (as per City of Ottawa Sewer Design Guidelines)

  P = 25 Persons (as per Correspondence with the Architects)
- Therefore, $Q_{TOTAL}(p) = 75 \times 25 =$ 1,875 L/Day (0.022 L/sec)

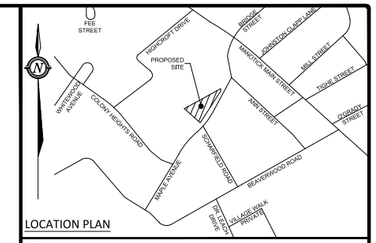
It is anticipated that the existing 200 mm sanitary service lateral will have suitable capacity to accept the development flows due to the capacity of a 200 mm pipe at a minimum slope of 0.32% has the available capacity of 19.36 L/sec. It is also expected that the 200 mm diameter sanitary main within Maple Avenue will be able to accept the development flows due to the size and 6.20% as-built slope has a capacity of 85.20 L/sec.

APPENDIX D: PRE-DEVELOPMENT DRAINAGE PLAN

McINTOSH PERRY



LOCATION PLAN



LEGEND

- BARRIER CURB (GUTTERLINE & TOP OF CURB)
- MOUNTABLE CURB (GUTTERLINE)
- EASEMENT
- MH7 — STORM MANHOLE
- CB6 DI6 — CATCHBASIN OR DITCH INLET
- MH7A — SANITARY MANHOLE
- PERFORATED PIPE IN SWALES
- WATER VAVLE/CHAMBER
- HYD — FIRE HYDRANT
- CENTRELINE OF SWALE
- SLOPING AT 3:1 (UNLESS SPECIFIED)
- 101.50 / 99.85 — PROPOSED ELEVATION / EXISTING ELEVATION
- 101.35 (S) — SWALE ELEVATION
- SILT FENCE (AS PER OPSD 219.130)
- STRAW BALE CHECK DAM (AS PER OPSD 219.180)
- EMERGENCY OVERLAND FLOW ROUTE
- 5-YR PONDING LIMIT
- 100-YR PONDING LIMIT

FOR REVIEW ONLY
NOT FOR CONSTRUCTION

SCALE 1 : 200
0 10 20 Metres

No.	Revision/Issue	Date
02	ISSUED FOR SITE PLAN CONTROL	JUN. 22, 2018
01	ISSUED FOR REVIEW	JUN. 14, 2018

Check and verify all dimensions before proceeding with the work. Do not scale drawings.

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A 1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

Stamp:

Client:
CSV CONSULTANTS INC.
1066 SOMERSET STREET WEST, OTTAWA, ON K1Y 4T3

Project:
1171 MAPLE AVENUE
CANADA POST OFFICE ADDITION
OTTAWA ON

Drawing Title:
PRE-DEVELOPMENT DRAINAGE AREA PLAN

Scale:	1:100
Drawn by:	S.V.L.
Checked By:	R.P.K.
Designed By:	S.V.L.
Date:	MAY/31/18

Project Number: CP-18-0217

Drawing Number: PRE

SHEET 1of 2

FILENAME: H:\01 Project - Proposals\2018 Jobs\CP\OP-18-0217 CSV_Canada Post_1171 Maple Avenue\Civil\12 - Drawings\OP-18-10017 - Presentation.dwg
LAST SAVED: Friday, June 22, 2018 LAST SAVED By: s.leflar
LAST PLOTTED: Friday, June 22, 2018 BY: S.LEFLAR

APPENDIX E: POST-DEVELOPMENT DRAINAGE PLAN

McINTOSH PERRY

LIMIT OF DEVELOPMENT

B2 0.0356 ha 0.20 0.25

B1 0.0319 ha 0.90 1.00

B3 0.0130 ha 0.56 0.64

B4 0.0027 ha 0.39 0.45

PROPOSED ADDITION
± 319m²
F.F = 92.10

EXISTING BUILDING
± 233m²
F.F= 92.10

EXISTING SANITARY CLEANOUT TO REMAIN.

EXISTING TRAILER

WOOD RAMP

UNDERGROUND HYDRO

SANITARY SERVICE TO REMAIN.

CONC. PAD

FF=92.11

REMOVE AND REPLACE CANOPY.
(REFER TO ARCHITECTURAL)

NEW BOLLARDS
(REFER TO SITE PLAN)

WATER SERVICE TO REMAIN.

NEW GARBAGE ENCLOSURE
(REFER TO SITE PLAN)

SCISSOR LIFT.
(REFER TO SITE PLAN)

TIE INTO EXISTING ASPHALT GRADES.

EXISTING SANITARY SERVICE

EDGE OF PAVEMENT

EXISTING PARKING

WATER MAIN

BOTTOM OF DITCH

FLOWER BED

BENCH

INTERLOCK

CONCRETE SIDEWALK

ROOF DISCHARGE
INV 91.32

100-YR
90.37
D= 0.12m
A= 33.37m²
V= 1.60m³

5-YR
90.33
D= 0.08m
A= 25.34m²
V= 0.57m³

RECTANGULAR OUTLET WEIR AS PER DETAIL BELOW.

PROPOSED STAIRS

CONCRETE SIDEWALK

TIE INTO EXISTING SIDEWALK GRADES.

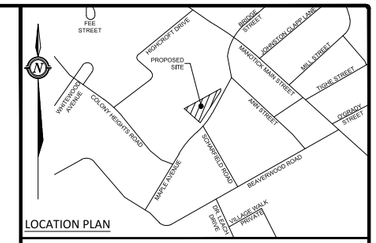
EXISTING PARKING

NO PARKING

TOP OF CURB

CB
T/G=89.1
Inv.=88.4

LOCATION PLAN



LEGEND

- BARRIER CURB (GUTTERLINE & TOP OF CURB)
- MOUNTABLE CURB (GUTTERLINE)
- EASEMENT
- MH7 STORM MANHOLE
- CB6 DI6 CATCHBASIN OR DITCH INLET
- MH7A SANITARY MANHOLE
- PERFORATED PIPE IN SWALES
- WATER VAVLE/CHAMBER
- HYD FIRE HYDRANT
- CENTRELINE OF SWALE
- SLOPING AT 3:1 (UNLESS SPECIFIED)
- 101.50 99.85 PROPOSED ELEVATION EXISTING ELEVATION
- 101.35 (s) SWALE ELEVATION
- SILT FENCE (AS PER OPSD 219.130)
- STRAW BALE CHECK DAM (AS PER OPSD 219.180)
- EMERGENCY OVERLAND FLOW ROUTE
- 5-YR PONDING LIMIT
- 100-YR PONDING LIMIT

FOR REVIEW ONLY
NOT FOR CONSTRUCTION

SCALE 1 : 200
0 10 20 Metres

No.	Revision/Issue	Date
02	ISSUED FOR SITE PLAN CONTROL	JUN. 22, 2018
01	ISSUED FOR REVIEW	JUN. 14, 2018

Check and verify all dimensions before proceeding with the work — Do not scale drawings

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A 1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

Stamp:

Client:
CSV CONSULTANTS INC.
1066 SOMERSET STREET WEST, OTTAWA, ON K1Y 4T3

Project:
1171 MAPLE AVENUE
CANADA POST OFFICE ADDITION
OTTAWA ON

Drawing Title:
POST-DEVELOPMENT DRAINAGE AREA PLAN

Scale:	1:100
Drawn by:	S.V.L.
Checked By:	R.P.K.
Designed By:	S.V.L.
Date:	MAY/31/18

Project Number: CP-18-0217

Drawing Number: SHEET 2of 2 POST

FILENAME: H:\01 Project - Proposals\2018 Jobs\CP\CP-18-0217 CSV_Canada Post_1171 Maple Avenue\Civil\12 - Drawings\DCP-18-02017 - Presentation.dwg
LAST SAVED: Friday, June 22, 2018 LAST SAVED BY: S.Laffar
LAST PLOTTED: Friday, June 22, 2018 STYLE USED:

APPENDIX F: STORMWATER MANAGEMENT CALCULATIONS

McINTOSH PERRY

CP-18-0217 - 1171 MAPLE AVENUE - RUNOFF CALCULATION

Pre-Development Runoff Coefficient

Drainage Area	Area (ha)	Impervious Area (m^2)	C	Gravel Area (m^2)	C	Pervious Area (m^2)	C	Average C (5-Year)	Average C (100-Year)
A1	0.08	164.10	0.90	0.00	0.60	667.36	0.20	0.34	0.40

Pre-Development Runoff Calculations

Drainage Area	Area (ha)	C (5-yr)	C (100-yr)	Tc (min)	I (mm/hr)		Q (L/s)	
					5-Year	100-Year	5-Year	100-Year
A1	0.08	0.34	0.40	10	104.2	178.6	8.14	16.43
Total	**0.08**						**8.14**	**16.43**

Post-Development Runoff Coefficient

Drainage Area	Area (ha)	Impervious Area (m^2)	C	Gravel Area (m^2)	C	Pervious Area (m^2)	C	Average C (5-Year)	Average C (100-Year)
B1	0.03	319.00	0.90	0.00	0.60	0.00	0.20	0.90	1.00
B2	0.04	0.00	0.90	0.00	0.60	355.52	0.20	0.20	0.25
B3	0.01	67.23	0.90	0.00	0.60	62.43	0.20	0.56	0.64
B4	0.00	7.40	0.90	0.00	0.60	19.85	0.20	0.39	0.45

Post-Development Runoff Calculations

Drainage Area	Area (ha)	C (5-yr)	C (100-yr)	Tc (min)	I (mm/hr)		Q (L/s)	
					5-Year	100-Year	5-Year	100-Year
B1	0.0319	0.90	1.00	10	104.2	178.6	8.32	15.84
B2	0.0356	0.20	0.25	10	104.2	178.6	2.06	4.41
B3	0.0130	0.56	0.64	10	104.2	178.6	2.11	4.11
B4	0.0027	0.39	0.45	10	104.2	178.6	0.31	0.61
Total	**0.0831**						**12.80**	**24.97**

Post-Development Restricted Runoff Calculations

Drainage Area	Unrestricted Flow (L/s)		Restricted Flow (L/s)		Storage Required (m^3)		Storage Provided (m^3)		
	5-Year	100-Year	5-Year	100-Year	5-Year	100-Year	5-Year	100-Year	
B1	8.32	15.84	0.72	1.32	6.88	13.09	7.18	13.16	*RESTRICTED*
B2	2.06	4.41	1.29	2.09	0.46	1.39	0.57	1.60	*RESTRICTED*
B3	2.11	4.11	2.11	4.11	-	-	-	-	*UNRESTRICTED*
B4	0.31	0.61	0.31	0.61	-	-	-	-	*UNRESTRICTED*
Total	**12.80**	**24.97**	**4.43**	**8.14**	**7.34**	**14.49**	**7.75**	**14.76**	

CP-18-0217 - 1171 MAPLE AVENUE - STORAGE REQUIREMENTS

Storage Requirements for Area B1

5-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s)	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
40	44.2	3.53	0.72	2.81	6.74
45	40.6	3.24	0.72	2.52	6.81
50	37.7	3.01	0.72	2.29	6.86
55	35.1	2.80	0.72	2.08	6.88
60	32.9	2.63	0.72	1.91	6.87
65	31.0	2.48	0.72	1.76	6.86
70	29.4	2.34	0.72	1.62	6.82

Maximum Storage Required 5-Year (m^3) =	6.88

100-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s)	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
40	75.1	6.66	1.32	5.34	12.82
45	69.1	6.13	1.32	4.81	12.98
50	64.0	5.68	1.32	4.36	13.07
55	59.6	5.29	1.32	3.97	13.09
60	55.9	4.96	1.32	3.64	13.09
65	52.6	4.66	1.32	3.34	13.04
70	49.8	4.42	1.32	3.10	13.00

Maximum Storage Required 100-Year (m^3) =	13.09

Storage Occupied In Area B1

5-Year Storm Event

Water Elevation (m) =				75% of Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
Structure	T/G	Pipe dia.	INV. (out)				
ROOF	-	-	-	239.3	0.030	-	7.2

Storage Available (m^3) =	7.2
Storage Required (m^3) =	6.9

100-YEAR STORM EVENT

Water Elevation (m) =				75% of Area (m^2)	Depth (m)	Head (m)	Volume (m^3)
Structure	T/G	Pipe dia.	INV. (out)				
ROOF	-	-	-	239.3	0.055	-	13.2

Storage Available (m^3) =	13.2
Storage Required (m^3) =	13.1

CP-18-0217 - 1171 MAPLE AVENUE - STORAGE REQUIREMENTS

Storage Requirements for Area B6

5-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s)	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	104.2	2.06	1.29	0.77	0.46
15	83.6	1.65	1.29	0.36	0.33
20	70.3	1.39	1.29	0.10	0.12
25	60.9	1.20	1.29	-0.09	-0.13
30	53.9	1.07	1.29	-0.22	-0.40
35	48.5	0.96	1.29	-0.33	-0.70
40	44.2	0.87	1.29	-0.42	-1.00

Maximum Storage Required 5-Year (m^3) =	0.46

100-Year Storm Event

Tc (min)	I (mm/hr)	Runoff (L/s)	Allowable Outflow (L/s)	Runoff to be Stored (L/s)	Storage Required (m^3)
10	178.6	4.41	2.09	2.32	1.39
15	142.9	3.53	2.09	1.44	1.30
20	120.0	2.97	2.09	0.88	1.05
25	103.8	2.56	2.09	0.47	0.71
30	91.9	2.27	2.09	0.18	0.33
35	82.6	2.04	2.09	-0.05	-0.10
40	75.1	1.86	2.09	-0.23	-0.56

Maximum Storage Required 100-Year (m^3) =	1.39

CP-18-0217 - 1171 MAPLE AVENUE - STAGE-STORAGE-DISCHARGE B2

Discharge through Outlet Structure

For Weir Flow, C =	0.013

	Rectangular Concrete
Invert Elevation	90.25
Orifice Width/Weir Length	0.043 m

	Rip-Rap Lined Earth Weir		Total
Elevation (m)	H [m]	Q [l/s]	Q [l/s]
90.25	x	x	**x**
90.31	0.06	0.90	**0.90**
90.33	0.08	1.29	**1.29**
90.37	0.12	2.09	**2.09**
90.43	0.18	4.41	**4.41**
90.49	0.24	4.41	**4.41**

Notes:

1. *Weir flow calculated in Bentley's FlowMaster - Rectangular Channel at 0.1%, Vertical side slopes, roughness coeff. of 0.013.*

Reference: Urban Hydrology, Hydraulics and Stormwater Quality: engineering application and computer modeling / A. Akan, Robert J. Houghtalen, 2003.

Stage-Storage-Discharge -

Water Level (m)	Depth (m)	Storage Volume (m^3)	Discharge (L/s)	
90.25	0.00	0.00	x	
90.31	0.06	0.39	0.90	
90.33	0.08	0.57	1.29	5-year
90.37	0.12	1.60	2.09	100-year
90.43	0.18	1.60	4.41	
90.49	0.24	1.60	4.41	

5-Year Storm Event Storage Summary

Water Elev. (m) =		90.33	
INV. (out)	Area (m^2)	Depth (m)	Volume (m^3)
90.25	17.6	0.08	0.6

Storage Available (m^3) =	0.6
Storage Required (m^3) =	0.5

100-Year Storm Event Storage Sumamry

Water Elev. (m) =		90.37	
INV. (out)	Area (m^2)	Depth (m)	Volume (m^3)
90.25	24.9	0.12	1.6

Storage Available (m^3) =	1.6
Storage Required (m^3) =	1.4

CP-18-0217 - 1171 MAPLE AVENUE - RUNOFF CALCULATION

Roof Drain Flow For Flat Roof B1

Flow Rate Vs. Build-Up (One Weir)	
Depth (mm)	Flow (L/s)
15	0.18
20	0.24
25	0.30
30	0.36
35	**0.42**
40	0.48
45	0.54
50	0.60
55	**0.66**

*Roof Drain model to be Accutrol Weirs, See attached sheets
*Roof Drain Flow information taken from Watts Drainage website

CALCULATING ROOF FLOW EXAMPLES

1 roof drain during a 5 year storm
elevation of water = 25mm
Flow leaving 1 roof drain = (1 x 0.30 L/s) = 0.30 L/s

1 roof drain during a 100 year storm
elevation of water = 50mm
Flow leaving 1 roof drain = (1 x 0.60 L/s) = 0.60 L/s

4 roof drains during a 5 year storm
elevation of water = 25mm
Flow leaving 4 roof drains = (4 x 0.30 L/s) = 1.20 L/s

4 roof drains during a 100 year storm
elevation of water = 50mm
Flow leaving 4 roof drains = (4 x 0.60 L/s) = 2.40 L/s

2 Roof Drains

	Roof Drain Flow		
	Flow (L/s)	Storage Depth (mm)	Total Flow (L/s)
	0.18	15	0.36
	0.24	20	0.48
	0.30	25	0.60
5-Yr	**0.36**	**30**	**0.72**
	0.42	35	0.84
	0.48	40	0.96
	0.54	45	1.08
	0.60	50	1.20
100-Yr	**0.66**	**55**	**1.32**
	0.72	60	1.44
	0.78	65	1.56
	0.84	70	1.68
	0.90	75	1.80
	0.96	80	1.92
	1.02	85	2.04
	1.08	90	2.16
	1.14	95	2.28
	1.20	100	2.40
	1.26	105	2.52
	1.32	110	2.64
	1.38	115	2.76
	1.44	120	2.88
	1.50	125	3.00
	1.56	130	3.12
	1.62	135	3.24
	1.68	140	3.36
	1.74	145	3.48
	1.80	150	3.60

Note: The flow leaving through a restricted roof drain is based on flow vs. head information