SERVICING AND STORMWATER MANAGEMENT REPORT

Project No.: 0CP-18-0512
Project Name.: 200 Maple Creek Court – Storage Building

Prepared for:

NCM Hydrovac Services
200 Maple Creek Court
Carp, ON
K0A 1L0

Prepared by:

McIntosh Perry
115 Walgreen Road
Carp, ON
K0A 1L0

Rev 01 – May 28, 2019

Rev 02 – October 30, 2019

Rev 03 – February 07, 2020

McINTOSH PERRY

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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 200 Maple Creek Court within the City of Ottawa.

1.2 Site Description

The property is located at 200 Maple Creek Court within the approved Reis Road Industrial Park. It is described as Part 6 of Lot 7, Concession 2 within the geographic Township of Huntley, City of Ottawa. The land in question covers approximately 1.75 ha. See Appendix 'A' for Key Plan.

The existing site is currently developed with gravel parking, drive aisles, buildings, and two water storage depressions at the rear of the property.

The proposed development consists of a single-storey garage/truck storage building with an adjoining two-story building section consisting of office space. The total building footprint is approximately 1012.64m². Parking will be provided at the rear of the new building. The proposed development will take place at the front portion of the lot with the existing structures and gravel areas remaining unchanged at the rear of the site.

2.0 BACKGROUND STUDIES

Background studies that have been completed for the site include a review of a topographical survey of the site.

The topographic survey of the site was completed by Fairhall Moffatt & Woodland Limited, dated January 11, 2019 and can be found under separate cover.

The following reports have been reviewed and are available under separate cover:

- Geotechnical Report by McIntosh Perry.
- Hydrogeological Study by McIntosh Perry.
- Carp River Watershed/Subwatershed Study by Robinson Consultants Inc.

3.0 PRE-CONSULTATION SUMMARY

City of Ottawa Staff have been pre-consulted regarding the proposed development in person on October 2, 2018. Specific design parameters to be incorporated within this design include the following:

- Pre-development and post-development flows shall be calculated using a time of concentration (Tc) of 20 minutes and 10 minutes, respectively.

- Control 5 through 100-year post-development flows as outlined in the approved Reis Road Industrial Park Guidelines.
    - Sites in this industrial park can be developed without a requirement for on-site SWM if the combined C-value does not exceed 0.775.
    - It is important to note that the Reis Road Industrial Park Guidelines uses constant C-values for 5- and 100-year storm events. The City of Ottawa Sewer Design Guidelines stipulates a 25% increased C-value to a maximum of 1 for the 100-year storm event. The increased C-values will be used in this design.
- MVCA has also recommended an enhanced level of treatment (80% TSS removal).
- Per the Carp River Watershed / Subwatershed Study, a target infiltration rate of 104mm/yr is specified for moderate recharge areas.

Correspondence with the City can be found in Appendix 'B'.

4.0 EXISTING SERVICES

No underground water, storm, or sanitary mains exist within Maple Creek Court. There is an existing roadside ditch along Maple Creek Court fronting the site. The ditch appears to convey flow towards the northwest.

The site is currently serviced with an existing well. There is no known existing septic system onsite.

5.0 SERVICING PLAN

5.1 Proposed Servicing Overview

A new water line will be extended from the existing well. Fire tanks will be proposed onsite for fire fighting. A new septic system is proposed at the south side of the building. A storm network is proposed on the site to convey flows to the roadside ditch.

5.2 Proposed Water Design

A new water line will be connected to the existing well to provide the proposed building with domestic water supply (by others). For details refer to the Hydrogeological Study completed by McIntosh Perry.

The well will not provide fire protection for the site. Fire protection will be provided onsite via underground fire tank system which will be located at the south property corner. The tank system will hold 40,000 gallons. Calculations can be found in Appendix 'C'.

5.3 Proposed Sanitary Design

The proposed building will be serviced via septic system. The proposed septic system has been designed by Green Valley Environmental and can be found under a separate cover.

5.4 Proposed Storm Design (Conveyance and Management)

Stormwater runoff will be conveyed by way of overland sheet flow and into the proposed storm network which will be treated with a Stormceptor unit before discharging into the existing Maple Creek Court roadside ditch. The MVCA has recommended an enhanced level of treatment be implemented for the entire site (80% TSS removal). Ultimately the runoff from the site will reach Huntley Creek before outletting to the Carp River. The Carp River Watershed/Subwatershed study stipulates a target infiltration rate for the site. To achieve infiltration, a grassed portion of the site and half of the roof will outlet to a designated ponding area to allow for infiltration.

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 and into a new underground storm sewer system within the site. This SWM plan will not implement quantity control strategies as per the Reis Road Industrial Park Guidelines. The storm runoff will enter the pipe system through catch basins (CB) located within the northeast parking area and within the swale located at the southwest property line. The rear property will also be collected in the proposed storm network. The stormwater runoff will be directed to the existing Maple Creek Court roadside ditch; similarly, overland flow will be directed towards the Maple Creek Court right-of-way. The quantitative properties of the storm runoff for both the pre- and post-development flows are further detailed below.

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. The swale at the south west 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:

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

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-value 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.

The time of concentration (Tc) used for pre-development and post-development flows shall be 20 and 10 minutes, respectively.

6.2.1 Pre-Development Drainage

The existing site has been demonstrated as drainage areas A1 and A2. Drawing CP-18-0512 PRE (Appendix 'D') indicates the limits of the drainage areas. Please note, the development portion of the site has been labeled as A1 while the existing back portion of the site is labeled as A2. The existing site is currently developed with three buildings at the rear of the property. There are also two man made depressions located at the back of the site. The depression located at the southeast corner of the site is labeled as a lagoon on the plans. The depressions currently collect and store runoff. The remainder of the site consist of gravel and grassed areas. There are miscellaneous retaining walls, trailers, and structures on the site.

In its existing condition, the overland stormwater runoff flows from high points located across the northeast area of the property and draining southwest towards Maple Creek Court right-of-way (ROW). The rear portion of the site drains to two depressed gravel areas in place to collect runoff. The overflow of the gravel areas would ultimately flow northeast off the site. The rear portion of the site will remain unchanged with the exception of the addition of a storm pipe. 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	0.70	0.35	0.43	47.68	101.03
A2	1.05	0.65	0.77	133.70	270.48
Total	1.75			181.38	371.51

(See Appendix 'F' for Calculations)

6.2.2 Post-Development Drainage

The proposed drainage and overland flow directions are indicated on drawing CP-18-0512 POST (Appendix 'E'). Table 3 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	0.05	0.90	1.00	13.20	25.13
B2	0.17	0.20	0.25	10.07	21.56
B3	0.47	0.47	0.59	64.20	137.22
B4	0.24	0.45	0.56	30.77	65.91
B5	0.02	0.22	0.27	1.55	3.28
B6	0.57	0.78	0.89	128.65	252.84
B7	0.22	0.53	0.62	34.20	69.52
Total	**1.75**			282.63	575.47

(See Appendix 'F' for Calculations)

6.3 Quantity Control

As per the Reis Industrial Park stormwater management guidelines, sites having a combined C-value less than 0.775 can be developed without a requirement for stormwater management. The weighted average of the combined 100-year c-value for areas B1 to B7 is 0.66, therefore no stormwater management will be implemented onsite. See Appendix 'F' for calculations. An excerpt from the Reis Stormwater Management Study has been provided in Appendix 'B'.

Areas B1 and B2 are directed to a designated roof leader ponding area. Area B3 is directed to CB5, and area B4 is directed to CBMH3 and MH4. Area B5 is grassed area located at the front of the site and is directed towards the roadside ditch. Area B6 is located at the rear of the site and consists of existing buildings, a gravel area, and a depressed area for runoff storage. Area B6 will be collected in the new storm network and treated by the Stormceptor unit before discharging to the roadside ditch. Area B7 is also located at the rear portion of the site and consists of grass, gravel and mixed vegetation. The area also has a small depressed area for runoff storage that will not be conveyed to the new storm network. Areas B6 and B7 will remain unchanged with the exception of the addition of a new storm pipe to drain area B6. The onsite storm network has been sized to convey the 5-year storm event. See Appendix 'F' for sizing calculations.

The site has been designed such that in the event of a blockage in the storm network, the emergency overland flow route will direct flows offsite. Runoff from the rear of the site will pond to a maximum depth of 0.30m above CBMH5 spilling over at an elevation of 114.35m at the northwest side of the building. Flow is then

directed towards CBMH3. Water will pond to a maximum depth of 0.10m above CBMH3 and CBMH4 before spilling over at an elevation of 113.90m and directed towards the Maple Creek Court roadside ditch.

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 MVCA, 80% TSS removal is required for the site. Please refer to Appendix 'B' for correspondence with the MVCA and City of Ottawa. A Stormceptor unit has been proposed within MH4 Areas B3, B4, and B6 will be collected in the onsite storm network. The storm network conveys flows to the proposed Stormceptor unit before outletting to the roadside ditch. Runoff from areas B5 and B7 are unable to be conveyed to the storm network and therefore will not be treated prior to leaving the site. Area B5 consists mostly of grass with the fire tank hatches making up the impervious area, therefore runoff from this area is not a concern. Area B7 is located at the rear of the site and, as noted above, it consists of grass, gravel and mixed vegetation. The Stormceptor has been designed to provide TSS removal greater than 80% to counter the areas unable to be treated.

In addition, the Carp River Watershed/Subwatershed study indicates Subwatershed priorities for Huntley Creek:

- Infiltration target of 104mm/yr infiltration for moderate recharge areas. As per Figure 9.3, the site is located in a moderate recharge area. See Appendix 'B' for Figure 9.3 excerpt.
- Maintain and restore tolerant coldwater fish community (i.e. temperature control measures)

6.4.1 Roof Leader to Ponding Area

A ponding area has been designed in accordance with MECP 'Stormwater Management Planning and Design Manual', Section 4.5.5. The ponding area will accept runoff from drainage areas B1 and B2. B1 is half of the roof area which will be directed to downspout at the north corner of the building and into a trench drain to cross the gravel area and outlet to the grass swale. The swale will direct flow to the designated ponding area located at the northeast edge of the parking lot. Area B2 consist of the grass and ponding area that will contribute runoff to be infiltrated in the ponding area.

As per the Carp River Watershed / Subwatershed Study, 104mm/yr is required to be infiltrated. Therefore, taking the development area of 1.75ha by the required infiltration, 1820m^3/year is required to be infiltrated. 2017 Annual Rainfall data has been taken and derived from the Canada Weather Stats website. Storm events between the 5mm and 40mm were considered, which gives a total number of 63 events in 2017 with an average precipitation depth of 13.55mm yielding a total of volume of runoff of 1909.03m^3/yr to infiltrate (which exceeds the required volume noted above).

The ponding area has been designed to contain and infiltrate flows from a 40mm storm event. Taking the product of areas B1 and B2 by the 40mm storm event, a volume of 89.45m^3 is required to be held within the ponding area. The total available volume in the ponding area is 89.61m^3 with a maximum ponding depth of 0.20m. A percolation rate of 75mm/hr with an applied safety factor of 2 has been used for the site. The average retention time is 1.6 hours for a 40mm event. In the instance of a storm event exceeding the 40mm event, runoff from the ponding area will overflow to CB5. Refer to Appendix 'F' for calculations.

Table 4: Roof Leader to Ponding Area – MECP Requirements

No.	Design Element	Criteria	Proposed Works
1	Soils	Percolation rate >15mm/hr	A percolation rate of 75mm/hr with an applied safety of 2 has been used.
2	Storage Volume	Min. 5mm and Max. 20mm over the rooftop area.	The pond has been designed to fully contain the 20mm event.
3	Ponding Depth	Ponding should be a shallow depression with a max. depth of 100mm. An overflow path should be provided for depths greater than this amount.	The bottom of the pond is at an elevation of 114.10 with and overflow elevation of 114.30. The depth exceeds the recommended, however an overland flow route has been established.
4	Configuration	If possible, the length of the ponding should be maximized compared to width.	Pond length is 35m, width 11.5m.
5	Location	Ponding are should be at least 4m away from building foundations.	The pond is greater than 4m away from the building foundations.

6.4.2 Temperature Mitigation Measures

Parts of Huntley Creek have been designated as a cool water fish habitat. It is expected that stormwater measures designed to promote infiltration will aid in addressing the temperature mitigation targets. The development area of the site is primarily gravel area. A small amount of infiltration is expected within gravel areas, however, infiltration will primary be within the ponding area. The building rooftop is proposed to be light-coloured material to reduce radiant heat transfer to stormwater runoff from the roof area.

The majority of the heat transfer is expected to occur during the initial 10mm of a storm event. The ponding area will contain 22% of the 10mm rainfall event with the remainder being gravel, roof, and grassed area runoff. Considering the contained 22% volume with the gravel, grass, and light-coloured roof, it is expected that the design will provide sufficient temperature mitigation to satisfy the ecological balance within Huntley Creek.

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

- The proposed development consists of a single-storey garage/truck storage building with an adjoining two-story building section consisting of office space. The total building footprint is approximately 1012.64m².
- The proposed building will be serviced via septic system (designed by others).
- A new water line will be connected to the existing well to provide the proposed building with domestic water supply (by others).
- A new storm network will be installed onsite and will outlet to the existing Maple Creek Court roadside ditch.
- As per the Reis Industrial Park stormwater management guidelines, sites having a combined c-value less than 0.775 can be developed without a requirement for stormwater management. The weighted average of the combined 100-year c-value for areas B1 to B7 is 0.66, therefore no stormwater management will be implemented onsite
- The Carp River Watershed/Subwatershed study indicates Subwatershed priorities for Huntley Creek. Infiltration will be met through the use of a roof leader ponding area. Temperature mitigation measures will also be put in place to lessen the effects of development on the Huntely Creek coldwater fish community.

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 development located at 200 Maple Creek Court.

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
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E: r.kennedy@mcintoshperry.com

Charissa Hampel, EIT
Engineering Intern, Land Development
McIntosh Perry Consulting Engineers
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10.0 STATEMENT OF LIMITATIONS

This report was produced for the exclusive use of NCM Hydrovac Services. 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: KEY PLAN

APPENDIX B: CORRESPONDENCE

APPENDIX C: FIRE PROTECTION CALCULATIONS

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APPENDIX D: PRE-DEVELOPMENT DRAINAGE PLAN

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APPENDIX E: POST-DEVELOPMENT DRAINAGE PLAN

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APPENDIX F: STORMWATER MANAGEMENT CALCULATIONS

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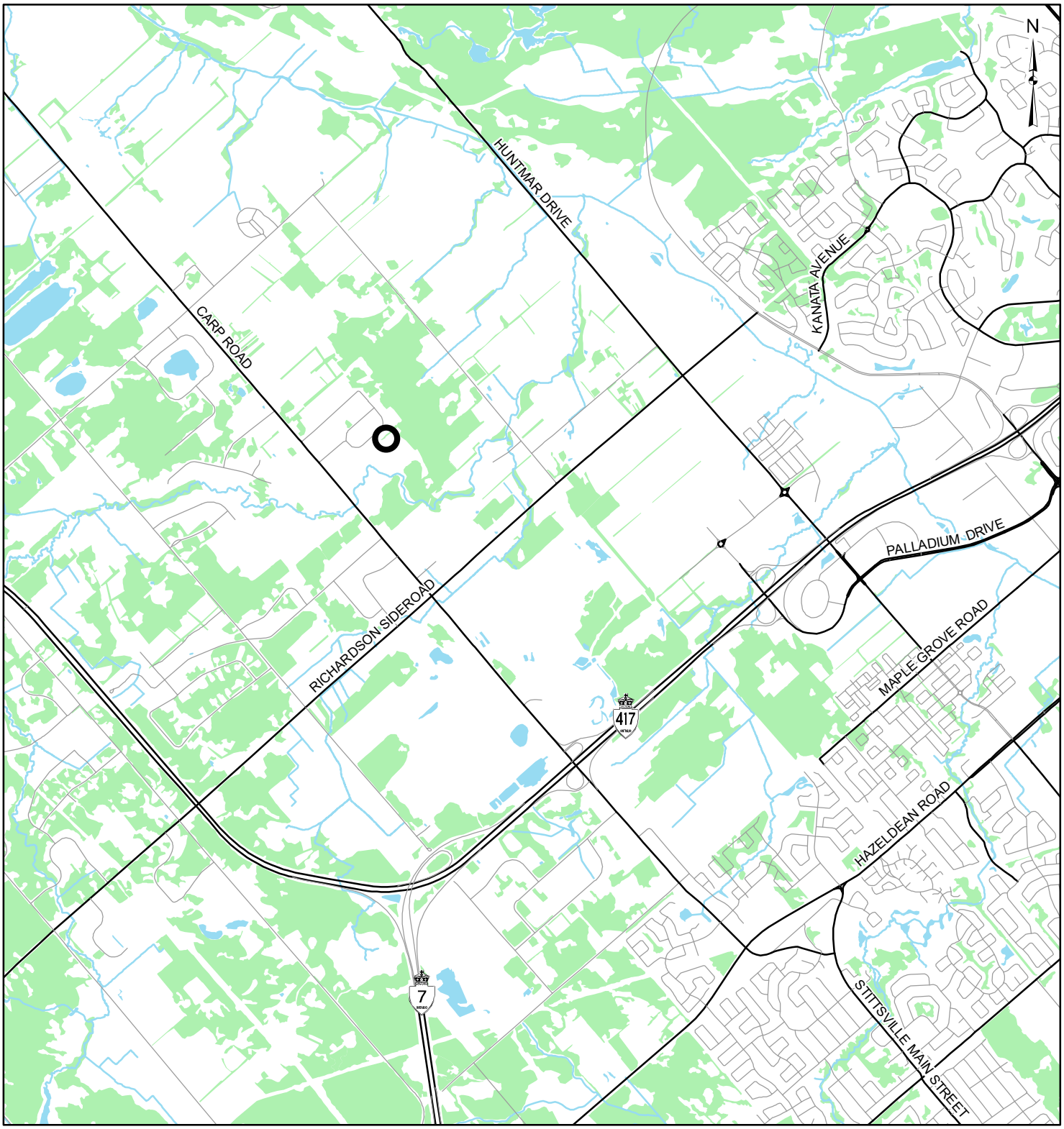
APPENDIX A: KEY PLAN



1,300 650 0 1,300

Scale 1:44,000 Metres

LEGEND

- Site Location
- Local Road
- Major Road
- Watercourse
- Wooded Area
- Waterbody

REFERENCE

GIS data provided by the Ontario Ministry of Natural Resources and Forestry, 2019 and the City of Ottawa, 2019.

CLIENT: NCM HYDROVAC SERVI CES

PROJECT: PROPOSED STORAGE BUILDING
200 MAPLE CREEK COURT

TITLE: SITE LOCATION

McINTOSH PERRY
115 Walgreen Road, RR3, Carp, ON K0A1L0
Tel: 613-836-2184 Fax: 613-836-3742
www.mcintoshperry.com

PROJECT NO:	CP-18-0512
Date	Mar., 25, 2019
GIS	LC
Checked By	MG

FIGURE: 1

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APPENDIX B: CORRESPONDENCE

From: Julie Carrara <carrara@fotenn.com>
Sent: October 29, 2018 4:28 PM
To: Curtis Melanson
Subject: NCM Hydrovac- 200 Maple Creek (Carp Road Corridor)

Hi Curtis,

As we discussed, could you please prepare a proposal for services to undertake the following reports in support of a Site Plan Control application for NCM Hydrovac's property at 200 Maple Creek Court in the Carp Road Corridor?

- Geotechnical/Slope Stability Study
- Site Servicing Plan
- Grade Control and Drainage Plan
- Stormwater Management Report
- Assessment of Adequacy of Public Services/Site Servicing Study/Brief
- Erosion and Sediment Control Plan/Brief
- Hydro geological and Terrain Analysis

NCM is proposing a new, 10,000 ft^2 pre-fabricated building on a foundation which will be used to store their trucks. They are also proposing a fueling station. The existing ponds on the property are not proposed to be altered at this time.

Please address the proposal to:

Kris Norris and Dana Norris
NCM Hydrovac Services
200 Maple Creek Court
Carp, ON K0A 1L0

The pre-application consultation notes (from a September 2018 meeting) state:

Engineering Comments (Provided by Brian Morgan)

- Please identify if there will be an oil and grit separator used/required.
- Please identify on the Site Plan where the well is located.
- Fire tanks will likely be required.

Hydrogeology Comments (Provided by Tessa Di Iorio)

- The report will need to confirm the well water yield requirements for the development, i.e. will well water be used to wash the trucks on site, or if the trucks will be washed off site.
- Although a well has been established on site already, an 8 hour pump test demonstrating the quality and quantity of water is required (as per MECP Guideline D-5-5). The well record must also be submitted with hydrogeological report.
- The site is within the Carp Road Corridor and policies of the Carp Road Corridor CDP are applicable. The site is located in an area identified as high recharge in the CDP and water (infiltration) should be maintained onsite. Please discuss how water will be managed on site. This can be presented as a pre- and post- water budget.
- A Septic (Nitrate) Impact Assessment will also be required with the hydrogeological report (as per MECP Guideline D-5-4). This should include an assessment of the septic flow required for the site. Note that a modified methodology for the septic impact assessment within the Carp Road Corridor has been developed for the City (see memo dated Sept. 27, 2016).
- It is highly recommended that your hydrogeological consultant do a technical pre-consultation prior to an application submission. Please get your consultant to contact Tessa Di Iorio (x17658).

Additional Comments from the MVCA (Provided by Niall Oddie):

- The preliminary site plan provided indicates that a small portion of the site will be developed with a structure, septic system and associated parking.
- Stormwater from this site would go to Huntley Creek, which is a cold water/ diverse warm water fishery community and is sensitive to changes in water quality and temperature. MVCA recommends enhanced treatment (80% TSS removal).
- Additional information on the stormwater management proposal is required, however thermal controls may be recommended. MVCA notes that the Carp River Watershed/Subwatershed Study recommends infiltration targets for this area.

Engineering and Hydrogeology Comments:

- An ECA will be required for the proposed stromwater pond to be located on the site.
- Please consider Fire Trucks and Fire Truck Routes. Will there be enough room to accommodate fire trucks? Will a fire route interfere with car parking? Please note that as per the Guide to Preparing Studies and Plans, a fire route is required and must be identified on all site plans.
- Lot located within a Groundwater Recharge Area.
- The proposed fueling station seems very close to the proposed new septic field.

Feel free to contact me with any questions.

Thanks,

Julie

Julie Carrara, MCIP RPP
Senior Planner

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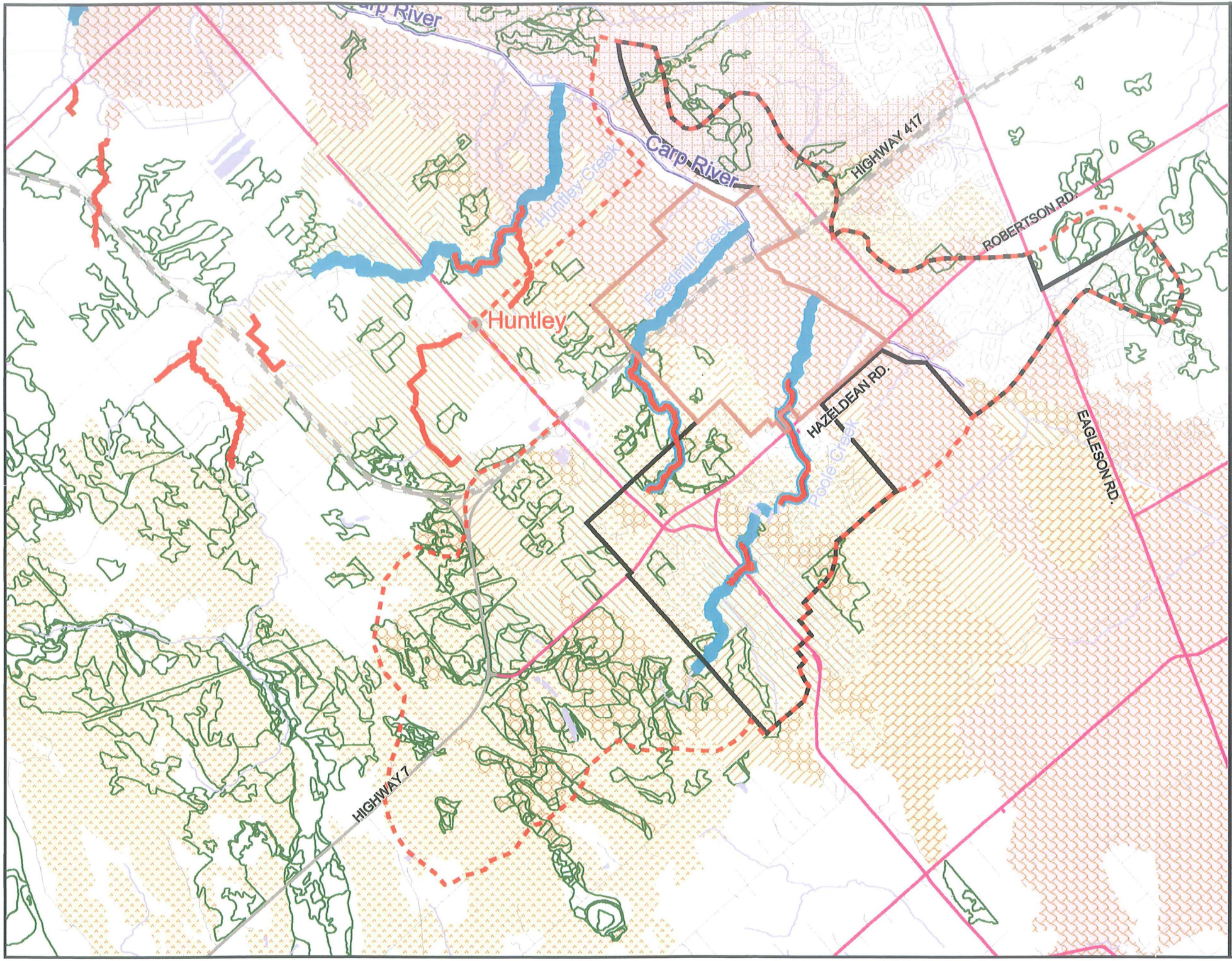
Stormwater Management – The allowable runoff rate from sites within the Reis Industrial Park is governed by the design assumptions used in the approved Engineering Report contained in Schedule "H" of the subdivision agreement. If the resulting runoff from the proposed site will be less than the allowable rate, no on-site SWM will be required. The design parameters used in the approved subdivision Engineering Report are as follows:

- The design of the internal drainage for the subdivision was based on site developments that would be: 50% building (C=1.0), 25% parking (C=0.9) and 25% undeveloped (C=0.2). By my interpretation of design assumptions in the subdivision Engineering Report, sites in this subdivision can be developed without a requirement for on-site SWM as long as the combined C-value does not exceed 0.775.

It is important to note that the subdivision design used constant C-values, while the City of Ottawa Sewer Design Guidelines now stipulate a 25% increase during the 100-year event. Accordingly, I would ask that you use the City's 100-year runoff coefficients when determining the combined C-value for the site. If this is below 0.775, no on-site SWM will be required. If SWM is required, the allowable release will be based on the 5-year flow, with a C-value of 0.775

Carp River Watershed Study

Subwatershed Studies Groundwater Component Figure 9.3



LEGEND:

- Subwatershed Study Area
- Carp River Drainage
- Town
- Planning Area
- Kanata West Planning Area

Roads

- Secondary
- 4 Lane Highway
- Highway
- Main
- Rail Road

Potential Discharge Indicators

- High Quality Fishery
- Seasonal Discharge Area

Natural Runoff Detention Areas

- Woodlands / Woodland

Type	Recharge
Sand And Gravel	High
Fine Sand	Moderate
Peat	Moderate
Till	Moderate
Paleozoic Bedrock	Moderate
Precambrian Bedrock	Low
Clay	Low

N

500 0 500 1000 1500 Meters

CARP RIVER WATERSHED

Ottawa

Robinson Consultants

Aquafor Beech Limited

APPENDIX C: FIRE PROTECTION CALCULATIONS

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May 24, 2019

NCM Hydrovac Services
200 Maple Creek Court
Carp, Ontario
K0A 1L0

Re: Rural Fire Protection Tank Calculations

1.0 BUILDING OCCUPANCY

From Table 3.1.2.1. Volume 1 of the National Building Code – Major Occupancy Classification:

- Group F Division 3

2.0 BUILDINGS REQUIRING ON-SITE WATER SUPPLY

From Div. B A-3.2.5.7. Volume 2 of the National Building Code – 3."Buildings Requiring On-Site Water Supply"

- Q=K*V*Stot Where:
  K = 19 (from Table 1 in Appendix A pg. 34)
  V = 6,075 m^3

  S_{tot} = 1.00 (from Figure 1 in Appendix A pg. 35)

- Therefore, Q = (19) * (6,075 m3) * (1.00) = 115,425 L (~30,492 gal)

3.0 MINIMUM REQUIRED WATER SUPPLY

From Div. B A-3.2.5.7., Table 2, Volume 2 of the National Building Code – Required Minimum Water Supply Flow Rate (L/min)

- 3600 L/min (if Q > 108,000 and ≤ 135,000 L)

  From 3. (c) 3600 L/min for 30 min = 135,000 L (~35,663 gal)

Therefore, the number of proposed underground fire protection tanks will be 4 – 37,854 L (10,000 gal) tanks.

115 Walgreen Road, R.R.3. Carp, ON K0A 1L0 | T. 613-836-2184 | F. 613-836-3742
info@mcintoshperry.com | www.mcintoshperry.com

Fire Tank Design Sheet

Project: NCM Storage Building
Project No.: CP-18-0512
Designed By: C.D.H.
Checked By: R.P.K.
Date: May 24, 2019

McINTOSH PERRY

113.75	m	Existing Top of Grade
114.00	m	Proposed Top of Grade
0.15	m	Groundwater Depth
6.10	m	Length
3.16	m	Height
3.05	m	Width
2400.00	Kg/m^3	Density of Concrete
1600.00	Kg/m^3	Density of Soil
1000.00	Kg/m^3	Density of water
0.90	m	depth of tank

Tank Size (10,000 L)

Mac Gregor Concrete

= 20`X 10`X 10`4 1/2"

= 6.1m X 3.05m X 3.16m

Volume

	Length		Height		Width
Exterior					
$V_{EXTERIOR}$ =	(6.10)	X	(3.155)	X	(3.05)
=	58.79 m^3				
Interior					
$V_{INTERIOR}$ =	(5.8)	X	(2.75)	X	(2.86)
=	45.62 m^3				
Total					
V_{TOTAL} =	(58.79)	-	(45.62)		
=	13.17 m^3				

Force Down

	Length		Heigtht		Width
Tank					
F_{TANK} =	(13.17)	X	(2400)	X	(9.81)
=	310.19 kN ↓				
Soil					
V_{SOIL} =	(6.095)	X	(3.05)	X	(0.9)
=	16.73 m^3				
F_{SOIL} =	(16.73)	X	(1600.00)	X	(9.81)
=	262.61 kN ↓				
Total					
F_{TOTAL} =	(310.19)	+	(262.61)		
=	572.79 kN ↓				

Force Up

	T/G			Width	* Without 1' Concrete Slab
Tank Bottom					
=	(114.00)	-	(0.9)	- (3.05)	
=	110.05 m				
Ground Water Elevation	EX T/G				
=	(113.75)	-	(0.15)		* AS PER AME FOUNDATION REPORT
=	113.60 m				
Depth of Water					
=	(113.60)	-	(110.05)		
=	3.55 m				
Volume					
=	(3.55)	X	(3.05)	X (6.10)	
=	65.99 m^3				
Force Up					
=	(65.99)	X	(1000)	X (9.81)	
=	647.40 kN ↑				
=	(647.40)	X	(1.5)	Safety Factor	
=	971.10 kN ↑				

Force Comparison

= 971.10 kN ↑ - 572.79 kN ↓

= 398.30 kN ↑

= -398.30 kN ↓

Therefore a concrete pad is required to resist the bouyant forces

Force Required

= ↓ 398.30 kN ↑ (MIN) let T_M represent the thickness required

= (6.10) X (3.05) X (T_M) X (2400) X (9.81) ≥ 398.30

= (398.30) / (9.81) X (2400) X (6.095) X (3.05)

= 0.910 m

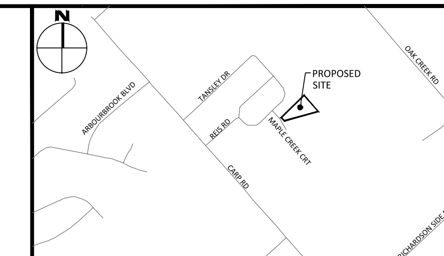
= 2.99 feet

= 35.83 inches

Therefore a concrete slab 36" in depth is sufficient to provide the required force down

APPENDIX D: PRE-DEVELOPMENT DRAINAGE PLAN

McINTOSH PERRY



LOCATION PLAN

LEGEND

AREA NAME — A1 | 0.25 — AREA (Ha)
0.90
1.00 — 5yr & 100yr COEFFICIENT

OVERLAND DRAINAGE FLOW

FOR REVIEW ONLY
NOT FOR CONSTRUCTION

No.	Revisions	Date
2	REVISED AS PER COMMENTS	OCT. 24, 2019
1	ISSUED FOR SITE PLAN CONTROL	MAY 23, 2019

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

SCALE 1 : 400
0 10 20 30 40 Metres

McINTOSH PERRY
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Stamp:

Client:
NCM HYDROVAC SERVICES
200 MAPLE CREEK COURT
CARP, ON K0A 1L0

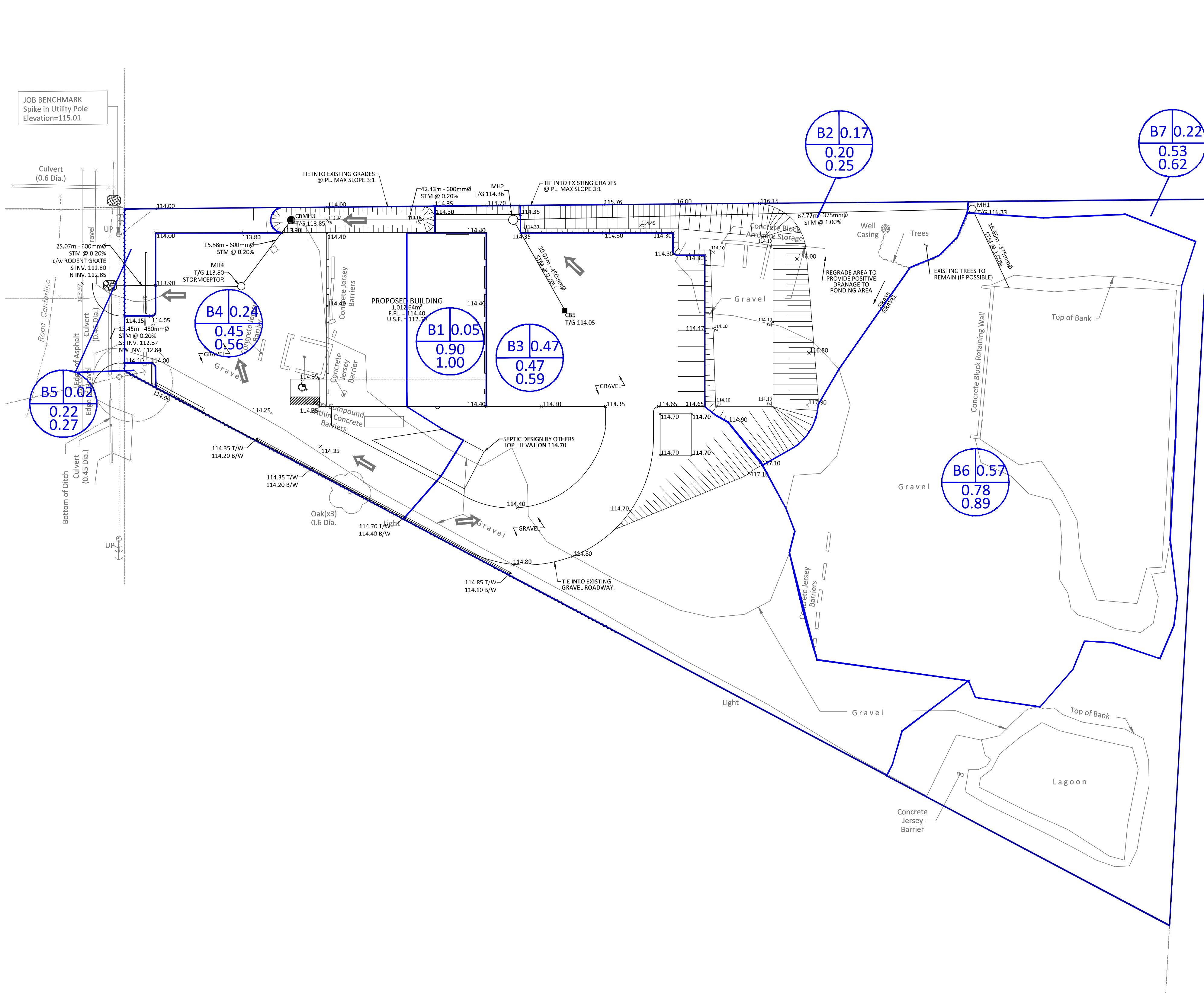
Project:
STORAGE BUILDING
200 MAPLE CREEK COURT
CARP, ON K0A 1L0

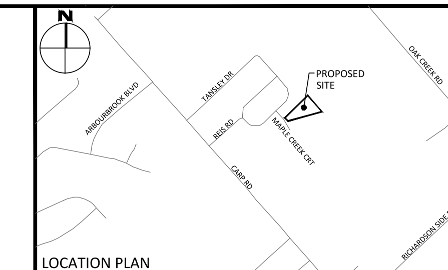
Drawing Title:
SITE SERVICING PLAN

Scale:	1:400	Project Number:	CP-18-0512
Drawn By:	C.D.H.		
Checked By:	R.P.K.	Drawing Number:	PRE
Designed By:	C.D.H.		

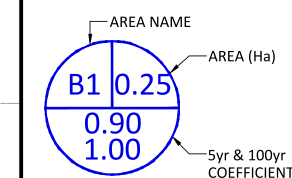
APPENDIX E: POST-DEVELOPMENT DRAINAGE PLAN

McINTOSH PERRY





LEGEND



FOR REVIEW ONLY
NOT FOR CONSTRUCTION

No.	Revisions	Date
2	REVISED AS PER COMMNETS	OCT 24, 2019
1	ISSUED FOR SITE PLAN CONTROL	MAY 23, 2019

Check and verify all dimensions before proceeding with the work

Do not scale drawings

SCALE 1 : 400

0 10 20 30 40 Metres

McINTOSH PERRY
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Stamp:

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CARP, ON K0A 1L0

Project:
STORAGE BUILDING
200 MAPLE CREEK COURT
CARP, ON K0A 1L0

Drawing Title:
SITE SERVICING PLAN

Scale:	1:400	Project Number: CP-18-0512
Drawn By:	C.D.H.	
Checked By:	R.P.K.	Drawing Number: POST
Designed By:	C.D.H.	

STM STRUCTURE TABLE

APPENDIX F: STORMWATER MANAGEMENT CALCULATIONS

McINTOSH PERRY

CP-18-0512 - 200 Maple Creek Avenue - Runoff Calculations

Pre-Development Runoff Coefficient

Drainage Area	Area (ha)	Impervious Area (m^2)	C	Gravel Area (m^2)	C	Pervious Area (m^2)	C	C_{AVG} 2&5-Year	C_{AVG} 100-Year
A1	0.70	176.65	0.90	2,284.54	0.60	4,558.56	0.20	0.35	0.43
A2	1.05	3,566.70	0.90	5,635.10	0.60	1,273.00	0.20	0.65	0.77

Pre-Development Runoff Calculations

Drainage Area	Area (ha)	C 2&5-Year	C 100-Year	Tc (min)	I (mm/hr)			Q (L/s)		
					2-Year	5-Year	100-Year	2-Year	5-Year	100-Year
A1	0.70	0.35	0.43	20	52.0	70.3	120.0	35.31	47.68	101.03
A2	1.05	0.65	0.77	20	52.0	70.3	120.0	99.02	133.70	270.48
Total	1.75							134.34	181.38	371.51

Post-Development Runoff Coefficient

Drainage Area	Area (ha)	Impervious Area (m^2)	C	Gravel Area (m^2)	C	Pervious Area (m^2)	C	C_{AVG} 2&5-Year	C_{AVG} 100-Year	
B1	0.05	506.32	0.90	0.00	0.60	0.00	0.20	0.90	1.00	Roof
B2	0.17	0.00	0.90	0.00	0.60	1,737.50	0.20	0.20	0.25	Roof Ponding Area
B3	0.47	48.31	0.90	3,106.58	0.60	1,544.16	0.20	0.47	0.59	CB5
B4	0.24	0.00	0.90	1,477.93	0.60	877.68	0.20	0.45	0.56	CBMH3
B5	0.02	6.00	0.90	0.00	0.60	240.36	0.20	0.22	0.27	
B6	0.57	3,665.60	0.90	1,835.29	0.60	206.00	0.20	0.78	0.89	
B7	0.22	603.45	0.90	772.88	0.60	869.69	0.20	0.53	0.62	

1.75

Post-Development Runoff Calculations

Drainage Area	Area (ha)	C 2&5-Year	C 100-Year	Tc (min)	I (mm/hr)			Q (L/s)		
					2-Year	5-Year	100-Year	2-Year	5-Year	100-Year
B1	0.05	0.90	1.00	10	76.8	104.2	178.6	9.73	13.20	25.13
B2	0.17	0.20	0.25	10	76.8	104.2	178.6	7.42	10.07	21.56
B3	0.47	0.47	0.59	10	76.8	104.2	178.6	47.32	64.20	137.22
B4	0.24	0.45	0.56	10	76.8	104.2	178.6	22.68	30.77	65.91
B5	0.02	0.22	0.27	10	76.8	104.2	178.6	1.14	1.55	3.28
B6	0.57	0.78	0.89	10	76.8	104.2	178.6	94.83	128.65	252.84
B7	0.22	0.53	0.62	10	76.8	104.2	178.6	25.21	34.20	69.52
Total	1.75							208.34	282.63	575.47
	Weighted Average		0.66							

ROOF LEADER PONDING INFILTRATION CALCULATION

Volume Reqruied to be Infiltrated			
Required Infiltration Rate:	104	mm/yr	(Moderate Recharge Area per Figure 9.3 - Carp River Watershed / Subwatershed Study)
Site Area:	1.75	ha	
Required Infiltration:	1820	m^3/yr	(Required Infiltration X Site Area)

Annual Rainfall Data (Up to 40mm Storm Event)			
Number of events/yr 5mm<x<40mm:	63		
Average Days Between Events:	5.7		
Average Depth 5mm<x<40mm:	13.55	mm	
Area B1 and B2	2236.32	m^2	
Cummulative Rainfall Depth 5mm<x<40mm:	853.65	mm/yr	(Number of Events X Average Depth)
Volume of Runoff per year to Infiltrate:	1909.03	m^3/yr	(Area X Cummulative Rainfall Depth)

Requried Storage Volume (40mm Event)			
Required Storage Volume:	89.45	m^3	(Area x 40mm)
Assumed Porosity (n):	-		
Clearstone Volume:	-	m^3	(Storage Volume/n)

Ponding Aea Volume			
Depth of Pond Area:	0.20	m	
Area:	518.00	m^2	*calculated from AutoCAD
Volume:	89.61	m^3	*calculated from AutoCAD

Infiltration Rate Through Soil			
Percolation Rate:	75.0	mm/hr	Geotechnical Assumption, Conductivity (0.001 cm/s)
Percolation Rate:	37.5	mm/hr	Applied Safety Factor of 2
Infiltration Rate:	5.40	L/s	(Percolation Rate X Area of Ponding)

Retention Time Average (13.55 mm event)			
Volume of Water during the 13.55mm event:	30.30	m^3	
Depth:	0.07	m	*calculated from AutoCAD
Time:	1.6	hr	(Volume / Infiltration Rate)
	0.06	days	

Retention Time (20 mm event)			
Volume of Water during the 40mm event:	89.45	m^3	
Depth of Ponding Area:	0.20	m	
Time:	4.6	hr	(Volume / Infiltration Rate)
	0.19	days	

STORM SEWER DESIGN SHEET

PROJECT: 200 MAPLE CREEK AVENUE
LOCATION: OTTAWA, ONTARIO
CLIENT: NCM

McINTOSH PERRY

LOCATION				CONTRIBUTING AREA (ha)								RATIONAL DESIGN FLOW											SEWER DATA								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
STREET	AREA ID	FROM MH	TO MH	AREA			C-VALUE			INDIV AC	CUMUL AC	INLET (min)	TIME IN PIPE	TOTAL (min)	i (5) (mm/hr)	i (10) (mm/hr)	i (100) (mm/hr)	5yr PEAK FLOW (L/s)	10yr PEAK FLOW (L/s)	100yr PEAK FLOW (L/s)	FIXED FLOW (L/s)	DESIGN FLOW (L/s)	CAPACITY (L/s)	LENGTH (m)	PIPE SIZE (mm)			SLOPE (%)	VELOCITY (m/s)	AVAIL CAP (5yr)	
																									DIA	W	H			(L/s)	(%)
	B6	Inlet	MH1	0.57			0.78			0.44	0.44	10.00	0.17	10.17	104.19	122.14	178.56	128.78				128.78	182.91	16.65	375			1.00	1.604	54.13	29.59%
		MH2	CBMH3							0.00	0.44	10.17	0.91	11.08	103.29	121.08	176.99	127.66				127.66	182.91	87.77	375			1.00	1.604	55.25	30.20%
	B1-B3	CB5	MH2	0.69			0.43			0.30	0.30	10.00	0.41	10.41	104.19	122.14	178.56	85.94				85.94	133.02	20.01	450			0.20	0.810	47.08	35.39%
		MH2	CBMH3							0.00	0.74	11.08	0.72	11.81	98.79	115.78	169.22	203.59				203.59	286.47	42.43	600			0.20	0.982	82.87	28.93%
	B4	CBMH3	MH4	0.24			0.45			0.11	0.85	11.81	0.27	12.07	95.54	111.95	163.58	225.56				225.56	286.47	15.88	600			0.20	0.982	60.90	21.26%
		MH4	OUTLET							0.00	0.85	12.07	0.43	12.50	94.38	110.58	161.58	222.83				222.83	286.47	25.07	600			0.20	0.982	63.64	22.21%

Definitions:
Q = 2.78CiA, where:
Q = Peak Flow in Litres per Second (L/s)
A = Area in Hectares (ha)
i = Rainfall intensity in millimeters per hour (mm/hr)
[i = 998.071 / (TC+6.053)^0.814] 5 YEAR
[i = 1174.184 / (TC+6.014)^0.816] 10 YEAR
[i = 1735.688 / (TC+6.014)^0.820] 100 YEAR

Notes:
1. Mannings coefficient (n) = 0.013

Designed: C.D.H.
Checked: R.P.K.
Project No.: CP-18-0512

No.	Revision	Date
1.	ISSUED FOR SITE PLAN CONTROL	2019-05-24

Sheet No: 1 of 1

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

ESTIMATED NET ANNNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

Province:	Ontario
City:	Carp
Nearest Rainfall Station:	OTTAWA MACDONALD-CARTIER INT'L AP
NCDC Rainfall Station Id:	6000
Years of Rainfall Data:	37

Site Name:	McIntosh Perry

Drainage Area (ha):	1.33
Runoff Coefficient 'c':	0.62

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.0

Require Hydrocarbon Spill Capture?	Yes
Upstream Flow Control?	No
Estimated Water Quality Flow Rate (L/s):	29.80
Peak Conveyance (maximum) Flow Rate (L/s):	

Project Name:	200 Maple Creek Crt.
Project Number:	CP-18-0512
Designer Name:	Brandon O'Leary
Designer Company:	Forterra
Designer Email:	brandon.oleary@forterrabp.com
Designer Phone:	(905) 630-0359
EOR Name:	Charissa Hampel
EOR Company:	McIntosh Perry
EOR Email/Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	69
EFO6	79
EFO8	84
EFO10	87
EFO12	89

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 84

Water Quality Runoff Volume Capture (%): > 90

imbrium

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	51.3	51.3	2.29	138.0	29.0	93	47.7	47.7
2	8.7	60.0	4.58	275.0	59.0	92	8.0	55.7
3	5.8	65.8	6.88	413.0	88.0	89	5.2	60.9
4	4.6	70.4	9.17	550.0	117.0	86	3.9	64.8
5	4.2	74.6	11.46	688.0	146.0	83	3.5	68.3
6	3.2	77.8	13.75	825.0	176.0	79	2.5	70.8
7	2.6	80.4	16.05	963.0	205.0	76	2.0	72.8
8	2.4	82.8	18.34	1100.0	234.0	73	1.8	74.6
9	1.9	84.7	20.63	1238.0	263.0	71	1.3	75.9
10	1.6	86.3	22.92	1375.0	293.0	68	1.1	77.0
11	1.3	87.6	25.22	1513.0	322.0	65	0.8	77.8
12	1.1	88.7	27.51	1651.0	351.0	63	0.7	78.5
13	1.3	90.0	29.80	1788.0	380.0	60	0.8	79.3
14	1.1	91.1	32.09	1926.0	410.0	58	0.6	79.9
15	0.6	91.7	34.39	2063.0	439.0	57	0.3	80.3
16	0.8	92.5	36.68	2201.0	468.0	56	0.5	80.7
17	0.7	93.2	38.97	2338.0	497.0	55	0.4	81.1
18	0.5	93.7	41.26	2476.0	527.0	54	0.3	81.4
19	0.6	94.3	43.56	2613.0	556.0	54	0.3	81.7
20	0.5	94.8	45.85	2751.0	585.0	53	0.3	82.0
21	0.2	95.0	48.14	2888.0	615.0	52	0.1	82.1
22	0.4	95.4	50.43	3026.0	644.0	52	0.2	82.3
23	0.5	95.9	52.72	3163.0	673.0	52	0.3	82.5
24	0.4	96.3	55.02	3301.0	702.0	52	0.2	82.7
25	0.1	96.4	57.31	3439.0	732.0	51	0.1	82.8

Stormceptor® EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.3	96.7	59.60	3576.0	761.0	51	0.2	82.9
27	0.4	97.1	61.89	3714.0	790.0	51	0.2	83.2
28	0.2	97.3	64.19	3851.0	819.0	51	0.1	83.3
29	0.2	97.5	66.48	3989.0	849.0	51	0.1	83.4
30	0.2	97.7	68.77	4126.0	878.0	51	0.1	83.5
31	0.1	97.8	71.06	4264.0	907.0	51	0.1	83.5
32	0.2	98.0	73.36	4401.0	936.0	50	0.1	83.6
33	0.1	98.1	75.65	4539.0	966.0	50	0.1	83.7
34	0.1	98.2	77.94	4676.0	995.0	50	0.1	83.7
35	0.1	98.3	80.23	4814.0	1024.0	50	0.1	83.8
36	0.2	98.5	82.53	4952.0	1054.0	50	0.1	83.9
37	0.0	98.5	84.82	5089.0	1083.0	49	0.0	83.9
38	0.1	98.6	87.11	5227.0	1112.0	49	0.0	83.9
39	0.1	98.7	89.40	5364.0	1141.0	49	0.0	84.0
40	0.1	98.8	91.70	5502.0	1171.0	48	0.0	84.0
41	0.1	98.9	93.99	5639.0	1200.0	48	0.0	84.0
42	0.1	99.0	96.28	5777.0	1229.0	48	0.0	84.1
43	0.2	99.2	98.57	5914.0	1258.0	48	0.1	84.2
44	0.1	99.3	100.87	6052.0	1288.0	47	0.0	84.2
45	0.1	99.4	103.16	6189.0	1317.0	47	0.0	84.3
46	0.0	99.4	105.45	6327.0	1346.0	47	0.0	84.3
47	0.1	99.5	107.74	6465.0	1375.0	46	0.0	84.3
48	0.0	99.5	110.03	6602.0	1405.0	46	0.0	84.3
49	0.0	99.5	112.33	6740.0	1434.0	45	0.0	84.3
50	0.0	99.5	114.62	6877.0	1463.0	44	0.0	84.3
Estimated Net Annual Sediment (TSS) Load Reduction =								**84 %**

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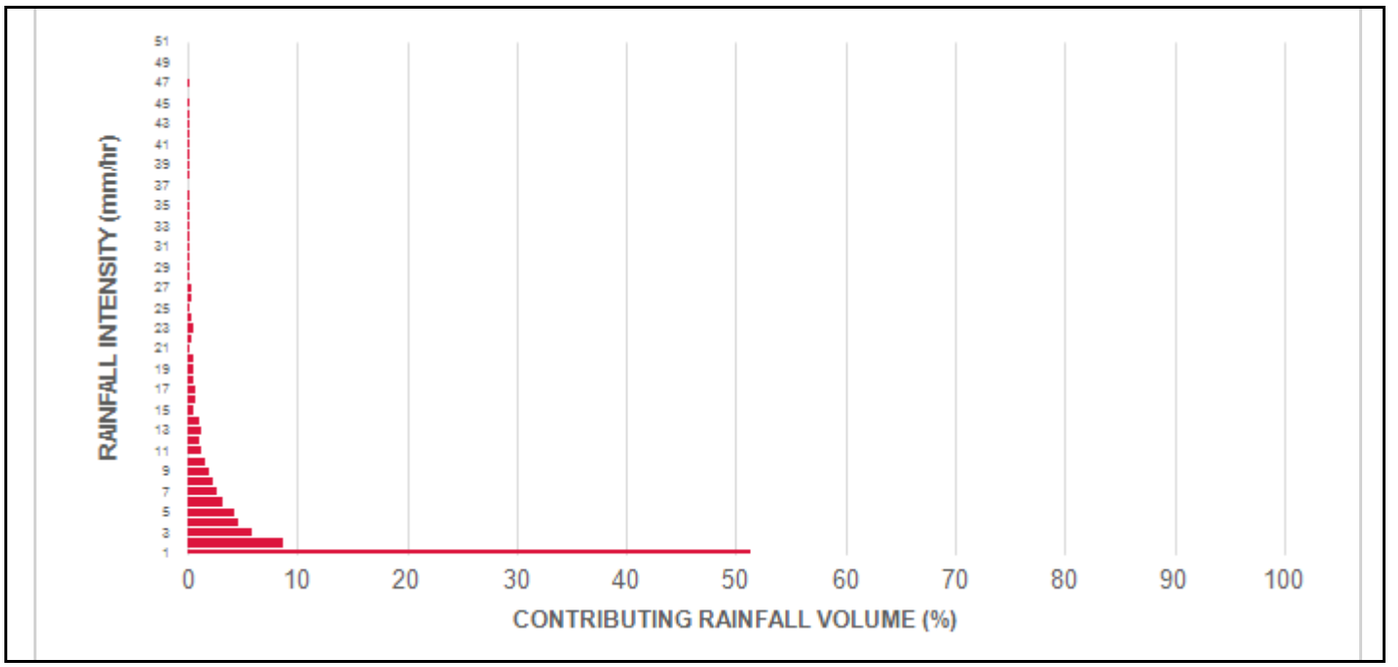
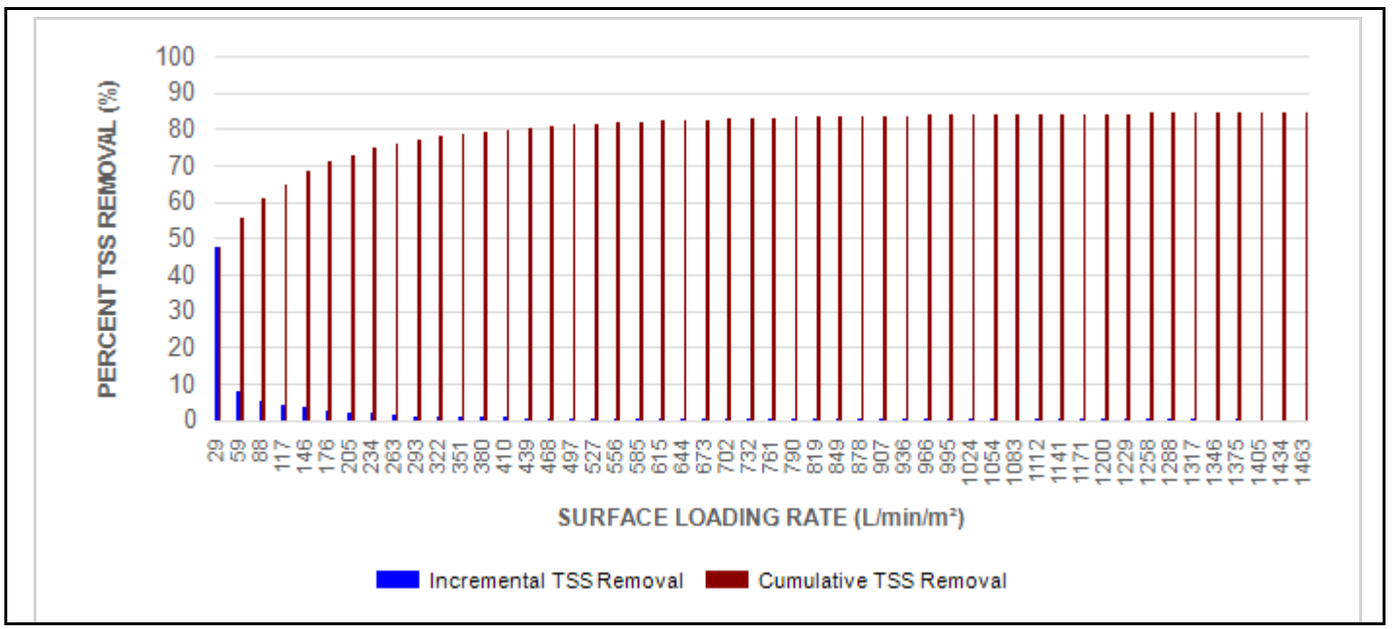
RAINFALL DATA FROM OTTAWA MACDONALD-CARTIER INT'L AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



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Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

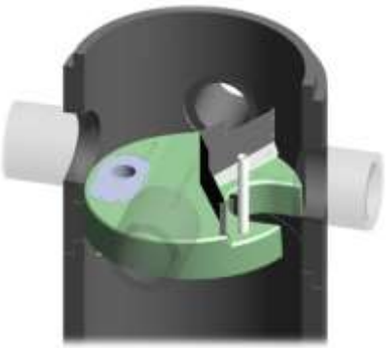
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

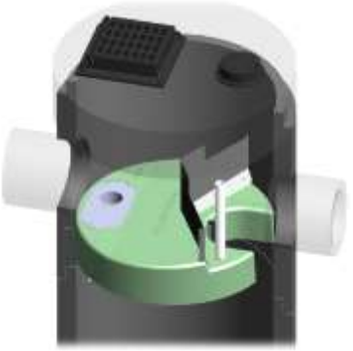
DESIGN FLEXIBILITY

►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.





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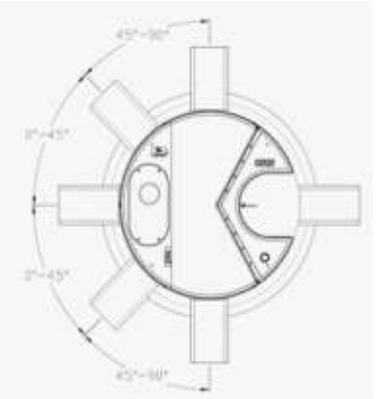

INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.
0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.
45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity
** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft^3)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

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APPENDIX G
CITY OF OTTAWA DESIGN CHECKLIST

McINTOSH PERRY

City of Ottawa

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

Criteria	Location (if applicable)
• Executive Summary (for larger reports only).	N/A
• Date and revision number of the report.	On Cover
• Location map and plan showing municipal address, boundary, and layout of proposed development.	Appendix 'A'
• Plan showing the site and location of all existing services.	Site Servicing Plan
• Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	1.1 Purpose 1.2 Site Description 6.0 Stormwater Management
• Summary of Pre-consultation Meetings with City and other approval agencies.	Appendix 'B'
• Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	1.1 Purpose 1.2 Site Description 6.0 Stormwater Management
• Statement of objectives and servicing criteria.	3.0 Pre-Consultation Summary

• Identification of existing and proposed infrastructure available in the immediate area.	N/A
• Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	Lot Grading, Drainage Plan, Sediment and Erosion Control Plan
• Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Lot Grading, Drainage Plan, Sediment and Erosion Control Plan
• Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	N/A
• Proposed phasing of the development, if applicable.	N/A
• Reference to geotechnical studies and recommendations concerning servicing.	See Geotech
• All preliminary and formal site plan submissions should have the following information: o Metric scale o North arrow (including construction North) o Key plan o Name and contact information of applicant and property owner o Property limits including bearings and dimensions o Existing and proposed structures and parking areas o Easements, road widening and rights-of-way o Adjacent street names	Lot Grading, Drainage Plan, Sediment and Erosion Control Plan

4.2 Development Servicing Report: Water

Criteria	Location (if applicable)
• Confirm consistency with Master Servicing Study, if available	N/A
• Availability of public infrastructure to service proposed development	N/A
• Identification of system constraints	N/A
• Identify boundary conditions	N/A
• Confirmation of adequate domestic supply and pressure	N/A
• Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Appendix 'C'
• Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	N/A
• Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	N/A
• Address reliability requirements such as appropriate location of shut-off valves	N/A
• Check on the necessity of a pressure zone boundary modification.	N/A
• Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range	N/A

• Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	N/A
• Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	N/A
• Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	N/A
• Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N/A

4.3 Development Servicing Report: Wastewater

Criteria	Location (if applicable)
• Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	N/A
• Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A
• Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N/A
• Description of existing sanitary sewer available for discharge of wastewater from proposed development.	5.2 Sanitary Servicing

• Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	N/A
• Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	N/A
• Description of proposed sewer network including sewers, pumping stations, and forcemains.	5.2 Sanitary Servicing
• Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	N/A
• Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A
• Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A
• Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A
• Special considerations such as contamination, corrosive environment etc.	N/A

4.4 Development Servicing Report: Stormwater Checklist

Criteria	Location (if applicable)
• Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	6.0 Stormwater Management
• Analysis of available capacity in existing public infrastructure.	N/A
• A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Pre- and Post-Development Plans
• Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	6.0 Stormwater Management
• Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	6.0 Stormwater Management
• Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	6.0 Stormwater Management
• Set-back from private sewage disposal systems.	N/A
• Watercourse and hazard lands setbacks.	N/A
• Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N/A
• Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A

• Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Appendix 'F'
• Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Sediment and Erosion Control Plan
• Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	6.0 Stormwater Management, Appendix 'F'
• Any proposed diversion of drainage catchment areas from one outlet to another.	6.0 Stormwater Management
• Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	6.0 Stormwater Management
• If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100 year return period storm event.	N/A
• Identification of potential impacts to receiving watercourses	N/A
• Identification of municipal drains and related approval requirements.	N/A
• Descriptions of how the conveyance and storage capacity will be achieved for the development.	6.0 Stormwater Management
• 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Lot Grading, Drainage Plan & sediment Control Plan
• Inclusion of hydraulic analysis including hydraulic grade line elevations.	N/A

• Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	7.0 Sediment and Erosion Control
• Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	N/A
• Identification of fill constraints related to floodplain and geotechnical investigation.	N/A

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

Criteria	Location (if applicable)
• Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	N/A
• Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	N/A
• Changes to Municipal Drains.	N/A
• Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	N/A

4.6 Conclusion Checklist

Criteria	Location (if applicable)
• Clearly stated conclusions and recommendations	8.0 Summary 9.0 Recommendations
• Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	All are stamped
• All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	All are stamped