164, 168 KING STREET SOUTH AND 8 GEORGE STREET DEVELOPMENT

Functional Servicing and Stormwater Management Report

Project Location:
164, 168 King Street South and 8 George Street
Waterloo, Ontario

Prepared for:
Your Neighbourhood Credit Union
168 King Street South
Waterloo, ON N2J 1P6

Prepared by:
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9

August 24, 2018
Revised: March 29, 2019

MTE File No.: 43070-101

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1.0 INTRODUCTION

MTE Consultants Inc. was retained by MHBC on behalf of Your Neighbourhood Credit Union to complete a Functional Servicing and Stormwater Management Report for a new mixed-use residential development to be constructed at 164, 168 King Street South and 8 George Street (herein referred to as 'the Site') in the City of Waterloo in support of the Official Plan Amendment and Zoning By-Law Amendment Application.

The Site is currently split zoned under Zoning By-law 1108 and split designated under the Official Plan. 164 and 168 King Street South are currently zoned as Commercial Two-12 (C2-12) and designated as Mixed Use Medium High Density Residential and is within the Uptown Complementary Transition Area of the Urban Growth Centre/Primary Node. 8 George Street is currently zoned as General Residence Two A (GR2A) and designated as Low Density Residential. The City of Waterloo is currently undertaking a comprehensive Zoning By-law Review. In the final draft of the Comprehensive Zoning By-law, the Site continues to be split zoned with 164 King Street South zoned as Residential Mixed Use-40 (RMU-40), 168 King Street South zoned as Residential Mixed Use-30 (RMU-30) and 8 George Street zoned as Residential Four (R4). The proposed development will require 8 George Street to be "upzoned" and "updesignated" to accommodate the proposed parking associated with a high density mixed use building on 168 King Street South.

The property is bounded to the north by an existing residential property fronting George Street and the William Street Pumping Station, to the east by George Street, to the south by King Street South, and to the west by Kuntz Lane and an existing dental office. For the exact location of the Site refer to the key plan on the enclosed engineering drawings.

The proposed development for the Site is the demolition of the existing buildings and construction of nine storey mixed use building with surface parking. The first and second floor of the proposed building will have office space for Your Neighbourhood Credit Union and covered parking, while the remaining storeys will have 36 residential units with amenity space on the top floor. There will be uncovered surface parking on the remainder of the property.

The purpose of this study is to support the Official Plan Amendment and Zoning By-Law Amendment Applications. This will be accomplished by reviewing the opportunities and constraints for the subject property with respect to servicing, grading, and stormwater management; reviewing the requirements of the reviewing agencies; describing the development concept; and demonstrating the functional serviceability of the Site. Pending approval of the Amendment Applications, detailed design of the Site will commence and be submitted to the City in support of Site Plan Approval.

2.0 EXISTING CONDITIONS

2.1 Existing Topography

The Site encompasses an area of 0.202 ha and currently comprises of an existing mixed use building with Your Neighbourhood Credit Union office space and residential units on 168 King Street South, a private parking lot on 164 King Street South and a residential dwelling on 8 George Street. There is a driveway access to 168 King from Kuntz Lane, an entrance across the entire frontage of the existing parking lot on 164 King Street South from Kuntz Lane and 8 George Street has two driveway accesses from George Street. In the existing condition, surface runoff from the Site drains from south to north. There is an elevation difference of approximately 2.5 metres between the sidewalk at the intersection of King Street South and George Street and the north corner of the Site. The Site is approximately 74% impervious under existing conditions.

2.2 Existing Servicing

2.2.1 Water

There is an existing 300 mm diameter municipal watermain along King Street South and a 150 mm diameter municipal watermain along George Street. The closest municipal fire hydrant is located at the intersection of King Street South and George Street. 168 King Street South and 8 George Street are currently serviced by water services of unknown size from the George Street watermain. All existing water services will be decommissioned and capped at the municipal watermain as part of the redevelopment of the Site. Based on the Infrastructure Assessment completed in 2011 by Stantec, the Site is located within Pressure Zone 4 Waterloo that generally operates with a hydraulic grade line target of 381 mASL. A hydrant flow test may be required to determine actual watermain pressures in the area but future projections showed no concerns.

2.2.2 Sanitary

There is an existing 200 mm diameter sanitary sewer along King Street South which drains westerly. The closest manhole is located at the intersection of King and George and is approximately 3.75 metres deep. There is an existing 200 mm diameter sanitary sewer along George Street. The closest manhole is located at the proposed driveway access on George Street and is a high point which drains both to the northeast and to the King Street sewer and is approximately 1.75 metres deep. Both 168 King Street South and 8 George Street are serviced from the George Street sewer by services on unknown size. All existing sanitary connections will be capped as part of the redevelopment of the Site.

2.2.3 Storm

There is a 300 mm diameter storm sewer along King Street South that drains westerly. The closest existing manhole is located at the intersection of King and George that is approximately 2.75 metres deep. There is also an existing catchbasin in the boulevard in the northwest corner of 168 King that conveys stormwater to the King Street South storm sewer through a 300 mm lead. The catchbasin is approximately 1.5 metres deep.

There is a 300 mm diameter storm sewer along George Street that drains towards the northeast. There is a catchbasin with a 150 mm lead near the proposed entrance and a double catchbasin manhole located adjacent to the northeast corner of the Site that is approximately 1.0 metre deep. The existing building on 168 King is serviced by a 150 mm diameter storm service that connects to the catchbasin.

There is an existing 300 mm diameter storm sewer on Kuntz Lane begins 20 metres west of the Site. The closest manhole is approximately 1.0 metre deep.

Surface runoff from a majority of the site is conveyed overland to the north where it enters the Kuntz Lane storm sewer or drains onto the William Street Pumping Station lands.

2.3 Existing Soils Information

Geotechnical information for the property is currently not available. A geotechnical investigation will be required during detailed building design to determine the condition of the native soils and recommend appropriate construction methods for the site development

2.4 Reviewing Agencies

Grading, servicing and stormwater management designs as well as this Functional Servicing and Stormwater Management Report will be required for submission to the City of Waterloo in support of the Official Plan Amendment, the Zoning By-Law Amendment and the Site Plan Applications. The City will also be responsible for the review and approval of site plans, site grading, servicing, stormwater management, lighting and landscape design and ultimately issuing building permits.

As the Site falls within GRCA Regulation limit, the site engineering design will also be submitted to the GRCA for their review and approval. A 'Fill Permit' will be required.

King Street South is a Regional Road (Regional Road 15) and the Site is located adjacent to the Regionally- owned William Street Reservoir and Wells Site. As such, the Region of Waterloo will be circulated on the Site Plan Application submission and will need to approve the site grading, servicing and stormwater management design.

3.0 PROPOSED GRADING AND SERVICING STRATEGY

Preliminary grading and servicing strategies for the proposed development have been developed based on the topographic survey, plan and profile information, and Conceptual Site Plan prepared by MHBC dated March 11, 2019.

3.1 Proposed Grading

The proposed development will have a single nine storey building on 168 King Street South with office space and covered parking on the first and second floor and uncovered surface

parking of the remainder of the Site (164 King and 8 George). There will be a driveway access from George Street to the covered parking and driveway access from Kuntz Lane, to the covered parking and to the exposed surface parking on 164 King Street South. It is proposed that new sidewalk be installed across the frontage of 164 and 168 King Street South and along the west property line on Kuntz Lane to connect to the existing William Street Pumping Station located north of the Site. The new concrete sidewalk will match into the existing sidewalk west of the driveway access on Kuntz Lane and north of the George Street driveway access. A retaining wall will be required along the perimeter of the parking lot on 164 King Street South.

3.2 Proposed Servicing

3.2.1 Water

A new connection to the 150 mm diameter municipal watermain along George Street will be required in order to service the proposed buildings. The required private water service size will be determined during detailed design, but will likely be 150 mm diameter. It is anticipated that the existing fire hydrant located across George Street will be sufficient to service the proposed building. If required, a fire flow analysis will be completed at the detailed design stage to ensure that adequate flow and pressure will be available at the existing hydrant.

3.2.2 Sanitary

A sanitary flow design sheet has been prepared to determine the flows anticipated to be generated by the proposed development. With the proposed building having 36 apartment units and commercial space on the ground floor, the resulting flow is expected to be 1.92 L/s from the site. See Appendix A for details.

It is proposed that the Site will be serviced by a new 200 mm diameter sanitary sewer that connects to the existing municipal manhole on George Street. The 200 mm diameter sanitary sewer will enter the proposed building's east face. The private sanitary sewer is to be installed at a slope that provides depth for the servicing of the building while maintaining adequate capacity. The service sizes and inverts will be confirmed at detailed design. All proposed sanitary connections will be constructed in accordance with the Region's Source Protection Guidance Document (May 2018) 'Enhanced Construction for Sewers in Wellhead Protection Areas.

3.2.3 Storm

A private storm sewer system will be installed on-site to collect rooftop runoff from the building and parking areas. The runoff collected in the storm sewers will be directed to the OGS unit and ultimately to the municipal storm sewer in the George Street right-of-way. All proposed stormwater infrastructure is to be constructed to enhance standards and will minimize stormwater leakages into the subsurface. Runoff from the driveway accesses, sidewalk and landscaped frontage will be directed overland to the closest municipal right-of-way.

4.0 PRELIMINARY STORM WATER MANAGEMENT DESIGN

4.1 SWM Criteria

The stormwater management design criteria for the Site, as established by the City of Waterloo, are as follows:

i) Attenuation of the post-development peak flows for the 2, 5 and 100 year storm event to the pre-development (existing) peak flow;

ii) Implementation of Normal (level 2) water quality controls; and

iii) Implementation of Erosion and Sediment Control measures.

4.2 Water Quantity Control

In order to successfully complete the preliminary stormwater management design for the site, the following specific tasks were undertaken:

i) Calculate the allowable runoff rates using MIDUSS NET;

ii) Determine the percent impervious of the site and catchment parameters for inclusion in MIDUSSS modeling; and

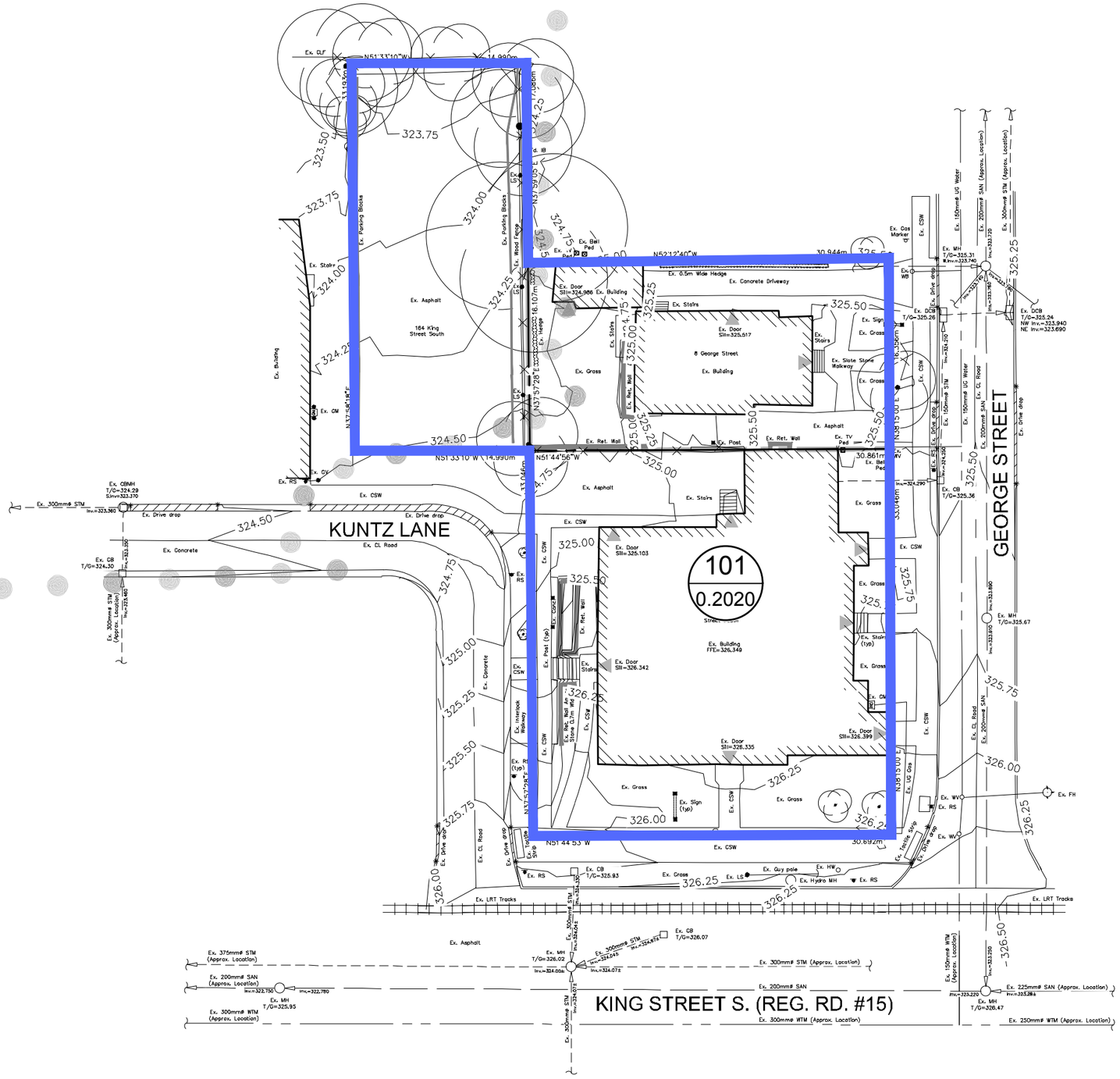
iii) Calculate post-development runoff hydrographs using MIDUSS NET.

The following table summarizes the catchments used in modeling of the site. The post development condition was separated into three catchment areas; the rooftop area, parking area and the uncontrolled area. Figure 1.0 illustrates the limits of the pre-development catchment area. Figure 2.0 illustrates the limits of the post-development catchment areas.

TABLE 4.1 - CATCHMENT PARAMETERS

#	Catchment	Area (ha)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Pre-Development Catchment Area							
101	Pre-Development	0.2020	74	75	98	2.5	60
Post-Development Catchment Areas							
201	Rooftop	0.0595	100	75	98	1.5	10
202	Parking	0.0673	100	75	98	1.5	10
203	Uncontrolled	0.0752	37	75	98	4.5	5

A geotechnical investigation was not available for this development at the time this report was published. Therefore, a conservative value of 75 was used for the pervious CN.



LEGEND

CATCHMENT 101

101 — SUB-CATCHMENT NUMBER

0.131 — AREA (ha.)

FIGURE 1.0

Date: AUG.23/18

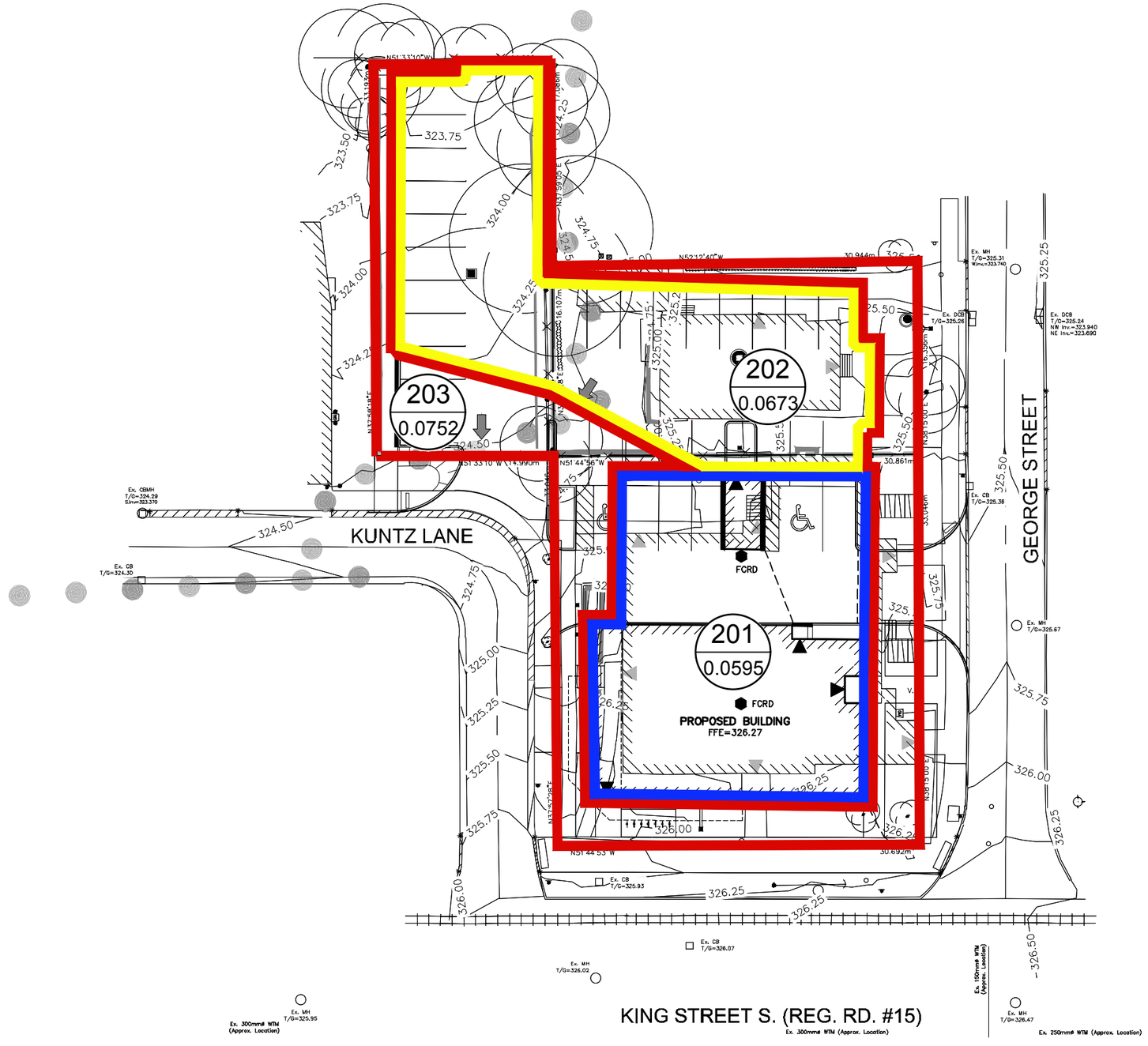
Scale: 1:400

PRE-DEVELOPMENT CATCHMENT AREA

MTE

Engineers | Scientists | Surveyors

Project No.: 43070-101



LEGEND

- CATCHMENT 201
- CATCHMENT 202
- CATCHMENT 203

201 / 0.131 — SUB-CATCHMENT NUMBER / AREA (ha.)

FIGURE 2.0

Date: AUG.23/18
Scale: 1:400

POST DEVELOPMENT CATCHMENT AREAS

MTE
Engineers | Scientists | Surveyors

Project No.: 43070-101

March 28, 2019 10:26 a.m. Plotted By: jshearer

P:\P\43070\101\43070-101-F1.dwg

In order to achieve the stormwater management requirements for the Site, runoff generated from the rooftop area will be controlled with flow control roof drains. The following table summarizes the expected flows that will be generated by the whole site. Please note that these flows are subject to change at the detailed design stage.

TABLE 4.2 - SUMMARY OF FLOWS

Modeling Condition	2 year Storm Event (m^3/s)	5 year Storm Event (m^3/s)	100 year Storm Event (m^3/s)
Pre-Development	0.029	0.042	0.083
Post-Development	0.024	0.033	0.067

With the installation of the flow control roof drains, the post development runoff from the Site for the 2-year storm event is controlled to 0.024 m^3/s. The post-development runoff from the Site for the 5-year storm event is controlled to 0.033 m^3/s with a maximum ponding depth of 10.6 cm on the rooftop. The post-development runoff from the Site for the 100-year storm event is controlled to 0.067 m^3/s with a maximum ponding depth of 14.5 cm on the rooftop. The ponding values are subject to change at the detailed design stage. Refer to Appendix B for the MIDUSS output.

4.3 Water Quality Control

A Stormceptor Model STC 300 will be installed on the storm sewer system to provide water quality control for the Site. The chosen unit is expected to provide Level 2 water quality control. (Refer to Appendix C for the sizing output from the Stormceptor Expert program.) The Stormceptor will require regular annual maintenance to ensure it is operating properly. The owner may be required to enter into a maintenance agreement with a suitable contractor to complete this work. In addition, all the storm structures will have a 600mm sump.

4.4 Erosion & Sediment Control

Precautions will need to be taken during construction to limit erosion and sedimentation. Typically, the following measures are recommended during construction for erosion and sedimentation control:

i) Erosion and sedimentation facilities are to be installed prior to any area grading operations;

ii) All erosion control measures are to be inspected and monitored by the contractor and repairs are to be completed as required; and

iii) All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance from leaving the Site.

5.0 CONCLUSIONS

Based on the foregoing analysis, it is concluded that:

- The proposed grading design will respect the natural topography of the Site;
- Existing municipal infrastructure for water, sanitary and storm is available along George Street; and
- The SWM criteria can be satisfied with the implementation of onsite controls for water quantity and water quality.

Additional grading, servicing and stormwater management details will be provided during detailed design.

All of which is respectfully submitted,

MTE CONSULTANTS INC.

Kathryn Morris, E.I.T.
Designer

Jeff Lerch, P.Eng.
Design Engineer

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APPENDIX A

DESIGN SHEETS

168 King Street South
CITY OF
WATERLOO, Ontario

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 43070-100
Date: March 28, 2019
Design By: KXM
Checked By: JPL
File: Q:\43070\101\43070-101 Sanitary Sewer Design Sheet Waterloo.xls

Design Parameters

Average Daily Flow
Residential 0.003 L/s/c
3.25 ppu for detatched dwellings
1.77 ppu for apartment

Commercial 0.95 L/s/ha
Industrial 0.40 L/s/ha
Inst. / School 0.25 L/s/ha

Mannings "*n*" 0.0130
Min. Velocity 0.6 m/sec
Max. Velocity 3.0 m/sec
Residential Harmon Peaking Factor (F)

Residential Areas Infiltration 0.25 L/s/ha

LOCATION				RESIDENTIAL AREAS and POPULATION						SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN					
										HECTARES AND FLOW OF EACH ZONING																	
										0.25 *L/s/ha*			0.95 *L/s/ha*			0.40 *L/s/ha*											
STREET	AREA NO.	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA	DENSITY	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	TOTALS-C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY
				ha	*ppha*	*1000s*	*1000s*		*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*m*	*%*	*mm*	*L/sec.*	*m/s*
Current Zoning				**0.05**		**0.003**	**0.003**	**4.450818**	**0.0460**				**0.15**	**0.15**	**0.9500**				**0.9500**	**1.32**	**1.32**	**0.3300**	**1.3260**	**13.5**	**2.00**	**200**	**46.3604**	**1.476**
Proposed Zoning				**0.20**		**0.064**	**0.064**	**4.292237**	**0.8705**				**0.20**	**0.20**	**0.9500**				**0.9500**	**0.40**	**0.40**	**0.1010**	**1.9215**	**13.5**	**2.00**	**200**	**46.3604**	**1.476**

168 King Street South

CITY OF WATERLOO, Ontario

STORM SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 43070-100
Date:
Design By: mmj
Checked By: XXX
File: Q:\43070\101\Storm Sewer Design Sheet Waterloo(SSMS)_Rev5.xlsx

Drainage Area Plan No: xxxx-xxxx

Design Parameters

5 YEAR STORM

Q=kAIR, k=0.00278
Intensity (I) = a/(tc+b)^{c}
a = 1755
b = 12.3
c = 0.895

Manning's "n" 0.013
Min. Velocity 0.600 m/s
Max. Velocity 6.000 m/s

LOCATION				STORMWATER FLOW 5 YEAR STORM								DESIGN					
STREET	AREA NUMBER	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME TOTAL	CONCENTRATION TIME IN PIPE	RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL
				ha		*ha*	*ha*	*min*	*min*	*mm/hr*	*L/s*	*mm*	*m*	*%*	*L/s*	*m/s*	*%*
		CB	CBMH	0.025	1.00	0.0252	0.0252	10.0000	0.6507	108.82431	7.62380	200	23.8	0.40	20.74355	0.6603	36.75
		CBMH	OGS	0.042	0.40	0.0168	0.0420	10.6507	0.3566	106.06419	12.38405	300	14.5	0.40	61.15893	0.8652	20.25

APPENDIX B

MIDUSS OUTPUT

PRE-DEVELOPMENT

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40 "        0.250   Pervious Manning 'n'"
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42 "        0.163   Pervious Runoff coefficient"
43 "        0.100   Pervious Ia/S coefficient"
44 "        8.467   Pervious Initial abstraction"
45 "        0.015   Impervious Manning 'n'"
46 "       98.000   Impervious SCS Curve No."
47 "        0.831   Impervious Runoff coefficient"
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49 "        0.518   Impervious Initial abstraction"
50 "                     0.029     0.000     0.000     0.000 c.m/sec"
51 "             Catchment 101          Pervious   Impervious Total Area "
52 "             Surface Area           0.053      0.149      0.202      hectare"
53 "             Time of concentration  39.705     3.185      5.535      minutes"
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56 "             Rainfall volume        17.02      48.43      65.45      c.m"
57 "             Rainfall losses        27.127     5.460      11.093     mm"
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59 "             Runoff volume          2.77       40.27      43.04      c.m"
60 "             Runoff coefficient     0.163      0.831      0.658      "
61 "             Maximum flow           0.001      0.029      0.029      c.m/sec"
62 " 40          HYDROGRAPH Add Runoff "
63 "            4   Add Runoff "
64 "                     0.029     0.029     0.000     0.000"
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69 "             Total % impervious                        74.000"
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29 "          101   PRE"
30 "       74.000   % Impervious"
31 "        0.202   Total Area"
32 "       60.000   Flow length"
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34 "        0.053   Pervious Area"
35 "       60.000   Pervious length"
36 "        2.500   Pervious slope"
37 "        0.149   Impervious Area"
38 "       60.000   Impervious length"
39 "        2.500   Impervious slope"
40 "        0.250   Pervious Manning 'n'"
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42 "        0.259   Pervious Runoff coefficient"
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56 "             Rainfall volume        24.97      71.08      96.05      c.m"
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14 " 32          STORM Chicago storm"
15 "           1   Chicago storm"
16 "    4692.000   Coefficient A"
17 "      17.437   Constant B"
18 "       0.956   Exponent C"
19 "       0.400   Fraction R"
20 "     180.000   Duration"
21 "       1.000   Time step multiplier"
22 "            Maximum intensity          239.793    mm/hr"
23 "            Total depth                 89.960    mm"
24 "           6   100hyd   Hydrograph extension used in this file"
25 " 33          CATCHMENT 101"
26 "           1   Triangular SCS"
27 "           1   Equal length"
28 "           1   SCS method"
29 "         101   PRE"
30 "      74.000   % Impervious"
31 "       0.202   Total Area"
32 "      60.000   Flow length"
33 "       2.500   Overland Slope"
34 "       0.053   Pervious Area"
35 "      60.000   Pervious length"
36 "       2.500   Pervious slope"
37 "       0.149   Impervious Area"
38 "      60.000   Impervious length"
39 "       2.500   Impervious slope"
40 "       0.250   Pervious Manning 'n'"
41 "      75.000   Pervious SCS Curve No."
42 "       0.443   Pervious Runoff coefficient"
43 "       0.100   Pervious Ia/S coefficient"
44 "       8.467   Pervious Initial abstraction"
45 "       0.015   Impervious Manning 'n'"
46 "      98.000   Impervious SCS Curve No."
47 "       0.925   Impervious Runoff coefficient"
48 "       0.100   Impervious Ia/S coefficient"
49 "       0.518   Impervious Initial abstraction"
50 "                    0.083     0.000     0.000     0.000 c.m/sec"
51 "            Catchment 101          Pervious   Impervious Total Area "
52 "            Surface Area           0.053      0.149      0.202      hectare"
53 "            Time of concentration  16.560     2.230      4.295      minutes"
54 "            Time to Centroid       113.903    87.136     90.992     minutes"
55 "            Rainfall depth         89.960     89.960     89.960     mm"
56 "            Rainfall volume        47.25      134.47     181.72     c.m"
57 "            Rainfall losses        50.099     6.743      18.016     mm"
58 "            Runoff depth           39.861     83.217     71.944     mm"
59 "            Runoff volume          20.93      124.39     145.33     c.m"
60 "            Runoff coefficient     0.443      0.925      0.800      "
61 "            Maximum flow           0.008      0.082      0.083      c.m/sec"
62 " 40          HYDROGRAPH Add Runoff "
63 "           4   Add Runoff "
64 "                    0.083     0.083     0.000     0.000"
65 " 38          START/RE-START TOTALS 101"
66 "           3   Runoff Totals on EXIT"
67 "            Total Catchment area                      0.202    hectare"
68 "            Total Impervious area                     0.149    hectare"
69 "            Total % impervious                       74.000"
70 " 19          EXIT"
```

POST-DEVELOPMENT

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                          Version 2.25  rev. 473"
"                MIDUSS created                       Sunday, February 07, 2010"
"           10   Units used:                                        ie METRIC"
"                Job folder:                                  Q:\43070\101\SWM"
"                Output filename:                       43070-101_2yr post.out"
"                Licensee name:                                          admin"
"                Company                                             Microsoft"
"                Date & Time last used:                3/28/2019 at 10:11:59 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1101.000   Coefficient A"
"        9.258   Constant B"
"        0.882   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          105.659    mm/hr"
"             Total depth                 32.400    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Rooftops"
"      100.000   % Impervious"
"        0.060   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.059   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.829   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.014     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.059      0.060      hectare"
"             Time of concentration  15.795     1.267      1.267      minutes"
"             Time to Centroid       118.648    88.230     88.230     minutes"
"             Rainfall depth         32.400     32.400     32.400     mm"
"             Rainfall volume        0.00       19.28      19.28      c.m"
"             Rainfall losses        27.148     5.527      5.527      mm"
"             Runoff depth           5.252      26.873     26.873     mm"
"             Runoff volume          0.00       15.99      15.99      c.m"
"             Runoff coefficient     0.000      0.829      0.829      "
"             Maximum flow           0.000      0.014      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.014     0.014     0.000     0.000"
" 54          POND DESIGN"
"        0.014   Current peak flow    c.m/sec"
"        0.017   Target outflow    c.m/sec"
"         16.0   Hydrograph volume    c.m"
"          11.   Number of stages"
"        0.000   Minimum water level    metre"
"        0.250   Maximum water level    metre"
```



```
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000     0.000"
"                0.02500   0.00075    0.1653"
"                0.05000   0.00150     1.322"
"                0.07500   0.00225     4.463"
"                 0.1000   0.00300    10.578"
"                 0.1250   0.00375    20.502"
"                 0.1500   0.00450    31.658"
"                 0.1750   0.00525    42.815"
"                 0.2000   0.00600    53.971"
"                 0.2250   0.00675    65.127"
"                 0.2500   0.00750    76.283"
"          1.   ROOFTOP"
"               Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                 hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                   0.060       0.045     250.000      22.500      66.667"
"           Using 2 roofdrains on roofstorage area of 446. square metre"
"           Peak outflow                   0.003    c.m/sec"
"           Maximum level                  0.089    metre"
"           Maximum storage                7.840    c.m"
"           Centroidal lag                 2.007   hours"
"                0.014     0.014     0.003     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.014     0.003     0.003     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Controlled Parking"
"      100.000   % Impervious"
"        0.067   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.067   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.829   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.015     0.003     0.003     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.067      0.067      hectare"
"             Time of concentration  15.795     1.267      1.267      minutes"
"             Time to Centroid       118.648    88.230     88.230     minutes"
"             Rainfall depth         32.400     32.400     32.400     mm"
"             Rainfall volume        0.00       21.81      21.81      c.m"
"             Rainfall losses        27.148     5.527      5.527      mm"
"             Runoff depth           5.252      26.873     26.873     mm"
"             Runoff volume          0.00       18.09      18.09      c.m"
"             Runoff coefficient     0.000      0.829      0.829      "
"             Maximum flow           0.000      0.015      0.015      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.015     0.017     0.003     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.015     0.017     0.017     0.000"
" 40          HYDROGRAPH Next link "
```

```
143 "            5   Next link "
144 "                    0.015     0.017     0.017     0.000"
145 " 33          CATCHMENT 203"
146 "            1   Triangular SCS"
147 "            1   Equal length"
148 "            1   SCS method"
149 "          203   Uncontrolled "
150 "       36.600   % Impervious"
151 "        0.075   Total Area"
152 "        5.000   Flow length"
153 "        4.500   Overland Slope"
154 "        0.048   Pervious Area"
155 "        5.000   Pervious length"
156 "        4.500   Pervious slope"
157 "        0.028   Impervious Area"
158 "        5.000   Impervious length"
159 "        4.500   Impervious slope"
160 "        0.250   Pervious Manning 'n'"
161 "       75.000   Pervious SCS Curve No."
162 "        0.162   Pervious Runoff coefficient"
163 "        0.100   Pervious Ia/S coefficient"
164 "        8.467   Pervious Initial abstraction"
165 "        0.015   Impervious Manning 'n'"
166 "       98.000   Impervious SCS Curve No."
167 "        0.778   Impervious Runoff coefficient"
168 "        0.100   Impervious Ia/S coefficient"
169 "        0.518   Impervious Initial abstraction"
170 "                    0.007     0.017     0.017     0.000 c.m/sec"
171 "             Catchment 203          Pervious   Impervious Total Area "
172 "             Surface Area           0.048      0.028      0.075      hectare"
173 "             Time of concentration  7.495      0.601      2.429      minutes"
174 "             Time to Centroid       108.982    87.726     93.362     minutes"
175 "             Rainfall depth         32.400     32.400     32.400     mm"
176 "             Rainfall volume        15.45      8.92       24.36      c.m"
177 "             Rainfall losses        27.152     7.206      19.852     mm"
178 "             Runoff depth           5.248      25.194     12.548     mm"
179 "             Runoff volume          2.50       6.93       9.44       c.m"
180 "             Runoff coefficient     0.162      0.778      0.387      "
181 "             Maximum flow           0.001      0.006      0.007      c.m/sec"
182 " 40          HYDROGRAPH Add Runoff "
183 "            4   Add Runoff "
184 "                    0.007     0.024     0.017     0.000"
185 " 38          START/RE-START TOTALS 203"
186 "            3   Runoff Totals on EXIT"
187 "             Total Catchment area                      0.202    hectare"
188 "             Total Impervious area                     0.154    hectare"
189 "             Total % impervious                       76.398"
190 " 19          EXIT"
```

```
" MIDUSS Output ------------------------------------------------->"
" MIDUSS version                          Version 2.25  rev. 473"
" MIDUSS created                       Sunday, February 07, 2010"
"          10   Units used:                                ie METRIC"
" MIDUSS created                                  Q:\43070\101\SWM"
" Output filename:                          43070-101_5yr post.out"
" Licensee name:                                           admin"
" Company                                                Microsoft"
" Date & Time last used:                  3/28/2019 at 10:17:13 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    1755.000   Coefficient A"
"      12.347   Constant B"
"       0.895   Exponent C"
"       0.400   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          136.512    mm/hr"
"            Total depth                 47.549    mm"
"           6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         201   Rooftops"
"     100.000   % Impervious"
"       0.060   Total Area"
"      10.000   Flow length"
"       1.500   Overland Slope"
"       0.000   Pervious Area"
"      10.000   Pervious length"
"       1.500   Pervious slope"
"       0.060   Impervious Area"
"      10.000   Impervious length"
"       1.500   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious SCS Curve No."
"       0.000   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.467   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.869   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.019     0.000     0.000     0.000 c.m/sec"
"            Catchment 201          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.060      0.060      hectare"
"            Time of concentration  10.845     1.126      1.126      minutes"
"            Time to Centroid       111.105    87.419     87.419     minutes"
"            Rainfall depth         47.549     47.549     47.549     mm"
"            Rainfall volume        0.00       28.53      28.53      c.m"
"            Rainfall losses        35.232     6.249      6.249      mm"
"            Runoff depth           12.317     41.300     41.300     mm"
"            Runoff volume          0.00       24.78      24.78      c.m"
"            Runoff coefficient     0.000      0.869      0.869      "
"            Maximum flow           0.000      0.019      0.019      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.019     0.019     0.000     0.000"
" 54          POND DESIGN"
"       0.019   Current peak flow    c.m/sec"
"       0.017   Target outflow    c.m/sec"
"        24.8   Hydrograph volume    c.m"
"         11.   Number of stages"
"       0.000   Minimum water level    metre"
"       0.250   Maximum water level    metre"
```



```
"       0.000   Starting water level    metre"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                   0.000     0.000     0.000"
"               0.02500   0.00075    0.1667"
"               0.05000   0.00150     1.333"
"               0.07500   0.00225     4.500"
"                0.1000   0.00300    10.667"
"                0.1250   0.00375    20.674"
"                0.1500   0.00450    31.924"
"                0.1750   0.00525    43.174"
"                0.2000   0.00600    54.424"
"                0.2250   0.00675    65.674"
"                0.2500   0.00750    76.924"
"          1.   ROOFTOP"
"               Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                 hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                   0.060       0.045     250.000      22.500      66.667"
"           Using 2 roofdrains on roofstorage area of 450. square metre"
"           Peak outflow                   0.003    c.m/sec"
"           Maximum level                  0.106    metre"
"           Maximum storage               13.077    c.m"
"           Centroidal lag                 2.221   hours"
"                0.019     0.019     0.003     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                   0.019     0.003     0.003     0.000"
" 33          CATCHMENT 202"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"         202   Controlled Parking"
"     100.000   % Impervious"
"       0.067   Total Area"
"      10.000   Flow length"
"       1.500   Overland Slope"
"       0.000   Pervious Area"
"      10.000   Pervious length"
"       1.500   Pervious slope"
"       0.067   Impervious Area"
"      10.000   Impervious length"
"       1.500   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      75.000   Pervious SCS Curve No."
"       0.000   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       8.467   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.869   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.021     0.003     0.003     0.000 c.m/sec"
"            Catchment 202          Pervious   Impervious Total Area "
"            Surface Area           0.000      0.067      0.067      hectare"
"            Time of concentration  10.845     1.126      1.126      minutes"
"            Time to Centroid       111.105    87.419     87.419     minutes"
"            Rainfall depth         47.549     47.549     47.549     mm"
"            Rainfall volume        0.00       31.86      31.86      c.m"
"            Rainfall losses        35.232     6.249      6.249      mm"
"            Runoff depth           12.317     41.300     41.300     mm"
"            Runoff volume          0.00       27.67      27.67      c.m"
"            Runoff coefficient     0.000      0.869      0.869      "
"            Maximum flow           0.000      0.021      0.021      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.021     0.023     0.003     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"           8   Copy to Outflow"
"                   0.021     0.023     0.023     0.000"
" 40          HYDROGRAPH Next link "
```

```
143 "            5   Next link "
144 "                    0.021     0.023     0.023     0.000"
145 " 33          CATCHMENT 203"
146 "            1   Triangular SCS"
147 "            1   Equal length"
148 "            1   SCS method"
149 "          203   Uncontrolled "
150 "       36.600   % Impervious"
151 "        0.075   Total Area"
152 "        5.000   Flow length"
153 "        4.500   Overland Slope"
154 "        0.048   Pervious Area"
155 "        5.000   Pervious length"
156 "        4.500   Pervious slope"
157 "        0.027   Impervious Area"
158 "        5.000   Impervious length"
159 "        4.500   Impervious slope"
160 "        0.250   Pervious Manning 'n'"
161 "       75.000   Pervious SCS Curve No."
162 "        0.258   Pervious Runoff coefficient"
163 "        0.100   Pervious Ia/S coefficient"
164 "        8.467   Pervious Initial abstraction"
165 "        0.015   Impervious Manning 'n'"
166 "       98.000   Impervious SCS Curve No."
167 "        0.805   Impervious Runoff coefficient"
168 "        0.100   Impervious Ia/S coefficient"
169 "        0.518   Impervious Initial abstraction"
170 "                    0.010     0.023     0.023     0.000 c.m/sec"
171 "             Catchment 203          Pervious   Impervious Total Area "
172 "             Surface Area           0.048      0.027      0.075      hectare"
173 "             Time of concentration  5.146      0.534      2.180      minutes"
174 "             Time to Centroid       104.182    87.087     93.188     minutes"
175 "             Rainfall depth         47.549     47.549     47.549     mm"
176 "             Rainfall volume        22.61      13.05      35.66      c.m"
177 "             Rainfall losses        35.279     9.253      25.753     mm"
178 "             Runoff depth           12.270     38.296     21.796     mm"
179 "             Runoff volume          5.83       10.51      16.35      c.m"
180 "             Runoff coefficient     0.258      0.805      0.458      "
181 "             Maximum flow           0.003      0.009      0.010      c.m/sec"
182 " 40          HYDROGRAPH Add Runoff "
183 "            4   Add Runoff "
184 "                    0.010     0.033     0.023     0.000"
185 " 38          START/RE-START TOTALS 203"
186 "            3   Runoff Totals on EXIT"
187 "             Total Catchment area                      0.202    hectare"
188 "             Total Impervious area                     0.154    hectare"
189 "             Total % impervious                       76.460"
190 " 19          EXIT"
```

```
" MIDUSS Output ------------------------------------------------->"
" MIDUSS version                          Version 2.25  rev. 473"
" MIDUSS created                       Sunday, February 07, 2010"
"          10   Units used:                                ie METRIC"
" MIDUSS created                       Sunday, February 07, 2010"
" Units used:                                          ie METRIC"
" Job folder:                                  Q:\43070\101\SWM"
" Output filename:                      43070-101_100yr post.out"
" Licensee name:                                          admin"
" Company                                              Microsoft"
" Date & Time last used:                3/28/2019 at 10:19:00 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     4692.000   Coefficient A"
"       17.437   Constant B"
"        0.956   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          239.793    mm/hr"
"             Total depth                 89.960    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 201"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          201   Rooftops"
"      100.000   % Impervious"
"        0.060   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.060   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.900   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.035     0.000     0.000     0.000 c.m/sec"
"             Catchment 201          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.060      0.060      hectare"
"             Time of concentration  6.587      0.887      0.887      minutes"
"             Time to Centroid       101.523    85.335     85.335     minutes"
"             Rainfall depth         89.960     89.960     89.960     mm"
"             Rainfall volume        0.00       53.98      53.98      c.m"
"             Rainfall losses        50.405     9.010      9.010      mm"
"             Runoff depth           39.556     80.950     80.950     mm"
"             Runoff volume          0.00       48.57      48.57      c.m"
"             Runoff coefficient     0.000      0.900      0.900      "
"             Maximum flow           0.000      0.035      0.035      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.035     0.035     0.000     0.000"
" 54          POND DESIGN"
"        0.035   Current peak flow    c.m/sec"
"        0.017   Target outflow    c.m/sec"
"         48.6   Hydrograph volume    c.m"
"          11.   Number of stages"
"        0.000   Minimum water level    metre"
"        0.250   Maximum water level    metre"
```



```
"        0.000   Starting water level    metre"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                    0.000     0.000     0.000"
"                  0.02500   0.00075    0.1667"
"                  0.05000   0.00150     1.333"
"                  0.07500   0.00225     4.500"
"                   0.1000   0.00300    10.667"
"                   0.1250   0.00375    20.674"
"                   0.1500   0.00450    31.924"
"                   0.1750   0.00525    43.174"
"                   0.2000   0.00600    54.424"
"                   0.2250   0.00675    65.674"
"                   0.2500   0.00750    76.924"
"           1.   ROOFTOP"
"                Roof area  Store area  Area/drain  Drain flow  Roof slope"
"                  hectare     hectare    sq.metre  L/min/25mm      g H:1V"
"                    0.060       0.045     250.000      22.500      66.667"
"             Using 2 roofdrains on roofstorage area of 450. square metre"
"             Peak outflow                   0.004    c.m/sec"
"             Maximum level                  0.145    metre"
"             Maximum storage               29.827    c.m"
"             Centroidal lag                 2.720   hours"
"                  0.035     0.035     0.004     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.035     0.004     0.004     0.000"
" 33          CATCHMENT 202"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          202   Controlled Parking"
"      100.000   % Impervious"
"        0.067   Total Area"
"       10.000   Flow length"
"        1.500   Overland Slope"
"        0.000   Pervious Area"
"       10.000   Pervious length"
"        1.500   Pervious slope"
"        0.067   Impervious Area"
"       10.000   Impervious length"
"        1.500   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.000   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.900   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.039     0.004     0.004     0.000 c.m/sec"
"             Catchment 202          Pervious   Impervious Total Area "
"             Surface Area           0.000      0.067      0.067      hectare"
"             Time of concentration  6.587      0.887      0.887      minutes"
"             Time to Centroid       101.523    85.335     85.335     minutes"
"             Rainfall depth         89.960     89.960     89.960     mm"
"             Rainfall volume        0.00       60.27      60.27      c.m"
"             Rainfall losses        50.405     9.010      9.010      mm"
"             Runoff depth           39.556     80.950     80.950     mm"
"             Runoff volume          0.00       54.24      54.24      c.m"
"             Runoff coefficient     0.000      0.900      0.900      "
"             Maximum flow           0.000      0.039      0.039      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.039     0.042     0.004     0.000"
" 40          HYDROGRAPH Copy to Outflow"
"            8   Copy to Outflow"
"                    0.039     0.042     0.042     0.000"
" 40          HYDROGRAPH Next link "
```

```
143 "            5   Next link "
144 "                    0.039     0.042     0.042     0.000"
145 " 33          CATCHMENT 203"
146 "            1   Triangular SCS"
147 "            1   Equal length"
148 "            1   SCS method"
149 "          203   Uncontrolled "
150 "       36.600   % Impervious"
151 "        0.075   Total Area"
152 "        5.000   Flow length"
153 "        4.500   Overland Slope"
154 "        0.048   Pervious Area"
155 "        5.000   Pervious length"
156 "        4.500   Pervious slope"
157 "        0.027   Impervious Area"
158 "        5.000   Impervious length"
159 "        4.500   Impervious slope"
160 "        0.250   Pervious Manning 'n'"
161 "       75.000   Pervious SCS Curve No."
162 "        0.434   Pervious Runoff coefficient"
163 "        0.100   Pervious Ia/S coefficient"
164 "        8.467   Pervious Initial abstraction"
165 "        0.015   Impervious Manning 'n'"
166 "       98.000   Impervious SCS Curve No."
167 "        0.825   Impervious Runoff coefficient"
168 "        0.100   Impervious Ia/S coefficient"
169 "        0.518   Impervious Initial abstraction"
170 "                    0.025     0.042     0.042     0.000 c.m/sec"
171 "             Catchment 203          Pervious   Impervious Total Area "
172 "             Surface Area           0.048      0.027      0.075      hectare"
173 "             Time of concentration  3.126      0.421      1.711      minutes"
174 "             Time to Centroid       97.145     84.937     90.758     minutes"
175 "             Rainfall depth         89.960     89.960     89.960     mm"
176 "             Rainfall volume        42.78      24.69      67.47      c.m"
177 "             Rainfall losses        50.886     15.708     38.011     mm"
178 "             Runoff depth           39.074     74.252     51.949     mm"
179 "             Runoff volume          18.58      20.38      38.96      c.m"
180 "             Runoff coefficient     0.434      0.825      0.577      "
181 "             Maximum flow           0.012      0.015      0.025      c.m/sec"
182 " 40          HYDROGRAPH Add Runoff "
183 "            4   Add Runoff "
184 "                    0.025     0.067     0.042     0.000"
185 " 38          START/RE-START TOTALS 203"
186 "            3   Runoff Totals on EXIT"
187 "             Total Catchment area                      0.202    hectare"
188 "             Total Impervious area                     0.154    hectare"
189 "             Total % impervious                       76.460"
190 " 19          EXIT"
```

APPENDIX C

STORMCEPTOR SIZING OUTPUT

Brief Stormceptor Sizing Report - 168 King St. S

Project Information & Location			
Project Name	168 King St. S	**Project Number**	43070-101
City	Waterloo	**State/ Province**	Ontario
Country	Canada	**Date**	8/21/2018
Designer Information		**EOR Information (optional)**	
Name	Maisy Jefferson	**Name**	
Company	MTE Consulting	**Company**	
Phone #	519-743-6500	**Phone #**	
Email	mjefferson@mte85.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	168 King St. S
Target TSS Removal (%)	70
TSS Removal (%) Provided	80
Recommended Stormceptor Model	STC 300

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	80
STC 750	87
STC 1000	88
STC 1500	89
STC 2000	91
STC 3000	92
STC 4000	94
STC 5000	94
STC 6000	95
STC 9000	97
STC 10000	97
STC 14000	98
StormceptorMAX	Custom

Stormceptor®

FORTERRA

Sizing Details

Drainage Area	
Total Area (ha)	0.202
Imperviousness %	84.0

Rainfall	
Station Name	WATERLOO WELLINGTON A
State/Province	Ontario
Station ID #	9387
Years of Records	34
Latitude	43°27'N
Longitude	80°23'W

Water Quality Objective	
TSS Removal (%)	70.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications