

**1842 King Street
City of Hamilton**

Storm Water Management Report

September 2021



Lamarre Consulting Group Inc.
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1.0 INTRODUCTION

Lamarre Consulting Group Inc. has been retained by LanHack Consultants Inc. to assess the storm water management requirements relating to the proposed re-development of the former Brock University property located at 1842 King Street East in the City of Hamilton. The property is approximately 2.682 ha in size and is located between Kenilworth Avenue South and Rosedale Avenue abutting King Street East to the north and Lawrence Road to the south.



Figure 1 – Site Location Map

The site was previously the Hamilton Campus of Brock University. The site consisted of a large single building with associated parking. The coverage of the site under existing conditions is approximately 62.1%. It is proposed to develop the property with six multi-storey buildings. It is noted however that in order to receive LEED certification for this development it is proposed to use green roof technology on the buildings and to utilize permeable pavement on much of the parking and walkway areas. With the use of green roof technology the total impervious coverage of the site will be reduced to approximately 31.2% impervious coverage. This report will review the recommended storm water management strategy used to develop the proposed site in accordance with City of Hamilton storm water management criteria.

2.0 STORMWATER MANAGEMENT

The following section will describe the proposed stormwater management (SWM) plan for the existing and proposed development conditions.

2.1 Stormwater Management Criteria

There is a 450mm combined sewer and a 900mm storm relief sewer along Lawrence Road, and a 375/450mm combined sewer along King Street. Existing and proposed drainage boundaries are shown on the Drainage Area Plans provided in **Appendix E**. According to City GIS mapping, the existing site is mostly accommodated within the storm relief sewer along Lawrence Road. Based on the City of Hamilton standard conditions the following stormwater management (SWM) criteria will be applied to the site:

Stormwater Quantity Control

The 100yr post-development peak flow should be controlled to the lesser of the 2-year pre-development flow or the free flow capacity of the existing storm lateral.

Stormwater Quality Control

Water quality control requirement is to provide Level 1 (enhanced) treatment levels for the proposed site works as per the MOECC SWM Practices Planning and Design Manual (2003).

2.2 Existing/Proposed Conditions

The existing and proposed conditions were assessed using the SWMHYMO Hydrologic Modeling and the 2-year and 100-year IDF parameters for the City of Hamilton design storms.

King Street Outlet

Under existing conditions only a small grassed area and a portion of the west driveway drain out to the King Street East combined sewer. The total area draining to King Street is currently 0.483ha (6.8% impervious). There is an existing 150mm service connection to the King Street combined sewer (150mm @ 12.0% - 0.118m³/s capacity). The 2yr pre-development peak flow from the site to this sewer is estimated at **0.014m³/s** and would be the governing criteria to meet. The 100yr pre-development flow from the site to this sewer is estimated at 0.101m³/s.

Under proposed conditions the area draining to King Street will be reduced such that only the narrow setback strip between the proposed building face and roadway right of way will continue to drain to King Street. This will reduce the total area draining to King Street from 0.483ha to 0.096ha (28.4% impervious) or approximately 20% of the current drainage area to this outlet. As it is not

feasible to construct quantity controls within this narrow 185m long strip, no further reduction of flows to this system is feasible. The 100yr peak flow from the site to King Street will be reduced from $0.101\text{m}^3/\text{s}$ to **$0.017\text{m}^3/\text{s}$** , just slightly in excess of the 2yr pre-development peak flow of $0.014\text{m}^3/\text{s}$.

Lawrence Road Outlet

Under existing conditions the majority of the site drains to Lawrence Road. The area draining to Lawrence Road is estimated at 2.199ha with 61.2% impervious coverage. There is an existing 375mm service connection to the Lawrence Road sewer (375mm @ 2.0% - $0.259\text{m}^3/\text{s}$ capacity). The 2yr pre-development peak flow from the site to this sewer is estimated at **$0.220\text{m}^3/\text{s}$** and would be the governing criteria to meet. The 100yr pre-development flow from the site to this sewer is estimated at $0.737\text{m}^3/\text{s}$.

Under proposed conditions the area draining to Lawrence Road will be increased as recommended by City of Hamilton staff. The total area draining to Lawrence Road will increase from 2.199ha at 61.2% impervious to 2.586ha at 31.2% impervious coverage. The reduced impervious coverage is due largely to the use of green roof technology on a large portion of the proposed buildings (4354m^2). Site runoff, except for the narrow setback area between the buildings and the Lawrence Road right of way, will be collected into a storm water tank located on the first level of underground parking in order to allow for a gravity connection to the storm relief sewer on Lawrence Road. The tank footprint of **250m^2** and will hold a total volume of **500m^3** prior to spill. It is proposed to control the outlet rate from this tank using a **260mm orifice plate**. The depth of water in the SWM tank under a 100-year storm event will be approximately 1.95m (488m^3). The total peak flow to the Lawrence Road storm sewer would be controlled to **$0.210\text{m}^3/\text{s}$** , less than the 2yr pre-development peak flow rate ($0.220\text{m}^3/\text{s}$). This modeling conservatively assumes that the permeable pavement areas function as standard pavement with respect to storm water runoff. In addition, as part of the LEED certification it is proposed to harvest site runoff for use in irrigation on-site. This too has been omitted from the hydrologic modeling. Hence the tank sizing represents a very conservative estimate of the sizing required to achieve the City of Hamilton runoff criteria.

See SWMHYMO model analysis in **Appendix B** for more detail. Table 2.1 summarizes the stage-storage-discharge characteristics for the underground SWM tank.

Table 2.1: Stage-Storage-Discharge Relationship for Stormwater (SWM) Storage Tank

<p style="text-align: center;">Stage Storage Discharge King Street Hamilton</p>								
Input Data:		Orifice Diameter	260 mm					
		Orifice Elevation	102.57	Invert	102.7	Center		
		Pipe Diameter	250 mm		Overflow Pipe			
		Pipe Elevation	104.57	Invert	104.695	Center		
		C Co-efficient	0.65					
Design to Control to 2yr Pre-Development Flow Rate (0.220cms)								
Stage Storage Discharge								
	Incr.	Area		Total		Orifice	Orifice	Total
Elev.	Elev.	Tank	Depth	Volume		Outlet	Outlet	Outflow
(m)	(m)	(m2)	(m)	(m3)		(m3/s)	(m3/s)	(m3/s)
102.57	0.00	250	0	0		0.000		0.000
102.82	0.25	250	0.25	63		0.053		0.053
103.07	0.25	250	0.50	125		0.093		0.093
103.32	0.25	250	0.75	188		0.120		0.120
103.57	0.25	250	1.00	250		0.143		0.143
103.82	0.25	250	1.25	313		0.162		0.162
104.07	0.25	250	1.50	375		0.179		0.179
104.32	0.25	250	1.75	438		0.195		0.195
104.57	0.25	250	2.00	500		0.209	0.000	0.209
104.82	0.25	250	2.25	563		0.223	0.000	0.223

Table 2.2 Hydrologic modelling results.

	2yr (m ³ /s)	100yr (m ³ /s)
Pre-Development		
To King Street (m ³ /s)	0.014	0.101
To Lawrence Road (m ³ /s)	0.220	0.737
Post- Development		
To King Street (m ³ /s)		0.017
Site to Tank (m ³ /s)		0.511
Storage Volume (m ³)		488
Depth (m)		1.95
Outlet Rate (m ³ /s)		0.206
Total to Lawrence Road (m ³ /s)		0.210

From these results, it can be concluded that the 100yr post development peak flows from the site are controlled to less than the existing 2yr rate into the Lawrence Road storm sewer. The 100yr peak flow from this site into the King Street combined sewer will be reduced from 0.101m³/s to 0.017m³/s, slightly exceeding the 2yr peak flow rate.

Stormwater Quality Control

Level 1 enhanced quality control for the proposed site works is required. It is proposed to install a single OGS unit downstream of the storage tank. This unit will be a Hydro First Defence HC model FD-5HC to treat runoff prior to entering the municipal storm sewer system. Based on the DJDEP/ETV distribution, this unit is sized to provide enhanced treatment for the new paved surfaces, excluding the buildings. The installation of an OGS unit on this site will significantly improve storm runoff quality from the property as the existing institutional use currently has no water quality treatment measures in place. See Servicing Plan for the FD-5HC location and refer to the detailed Hydro First Defence sizing report prepared by Hydro International in **Appendix C** for further detail.

2.3 Sediment and Erosion Control

During development of the site, it is important that sediment disturbed by the construction operations are controlled and maintained throughout the construction period. Sediment and erosion control measures will be implemented on site during construction and will conform to the Erosion & Sediment Control Guideline for Urban Construction (Ref 6) and City of Hamilton Standards.

Sediment and erosion control measures will include:


- Installation of silt control fencing at strategic locations around the perimeter of the site where feasible;
- Preventing silt or sediment laden water from entering inlets (existing catch basins/catch basin manholes) by wrapping their tops with filter fabric or installing silt sacks, where feasible;
- Maintaining sediment and erosion control structures in good repair (including periodic cleaning as required) until such time that the Engineer or Town of Milton approves their removal. Erosion control measures to be inspected daily and after any rainfall event.
- Should excess mud-tracking occur during construction, mud-mats shall be installed to assist with mud-tracking control; where feasible.

2.5 Conclusions and Recommendations

Based on the information provided herein, we conclude that:

- The peak runoff rate from this site into the Lawrence Road storm sewer will effectively be controlled to less than the existing 2yr peak rate. This is achieved through the installation of a single 500m³ storage tank with a 260mm orifice plate to restrict the outlet rate.
- The peak runoff rate from this site into the King Street combined sewer will be effectively controlled to slightly greater than the 2yr peak rate. This is achieved through the reduction in contributing drainage area to this system.
- Quality of site storm water runoff from the paved areas will be to MOECC enhanced levels through the installation of a Hydro First Defense model FD-5HC unit downstream of the stormwater management tank outlet.
- Erosion and sediment controls be installed as described in section 2.4 of this report.

Respectfully submitted,
Lanhack Consultants Inc.

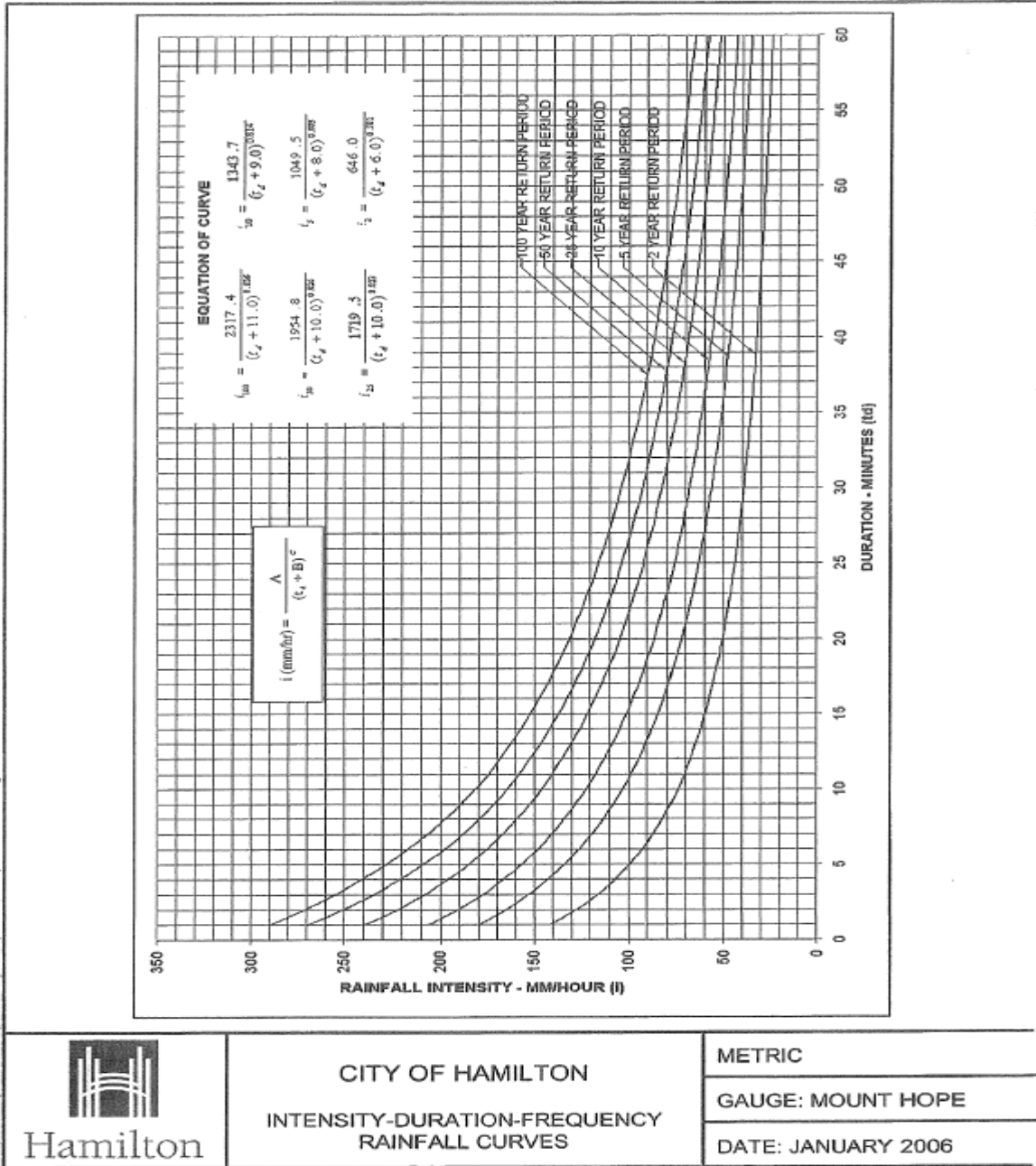


John Lamarre, P.Eng.
Lamarre Consulting Group Inc.



APPENDIX A: Stormwater Management Information

The rainfall intensities used in the SWMHYMO Modeling Program were taken from the IDF Curve from the City of Hamilton design guidelines.



G:\WORK\1D1078A\WATER\DWG\JAN2006\MINTHOPE.dwg

Design storm information used in the hydrologic modeling was based on Chicago Storm Distribution Intensity-Duration Frequency (IDF) equations for the City of Hamilton in the form:

$$i = \frac{A}{(t+B)^C}$$

- i = rainfall intensity (mm/hour)
- t = time of concentration in minutes (10 minutes)
- A , B and C = constant (see above)

APPENDIX B: SWMHYMO Input and Output

2

START 0.0

*#*****

*# 1842 King Street - City of Hamilton

*# LAMARRE CONSULTING GROUP

*# September 1 2021

*#*****

*#*****

*#

*# 2yr EVENT

*#

*#*****

CHICAGO STORM IUNITS=2 TD=4hrs TPRAT=.40 CSDT=10 min

ICASEcs=1 A=646 B=6 C=.791

*#*****

PRE DEVELOPMENT

*#*****

*#

*# TO KING STREET

*#

CALIB NASHYD NHYD=1 NHYD=100 DT=10min, AREA=0.447ha DWF=0.0cms

CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD ID=2 NHYD=100 DT=10min AREA=0.036ha

XIMP=0.99 TIMP=0.99 DWF (cms)=0 LOSS=2 CN=76

Ia =5.0mm SLPP (%)=2.0 LGP (m)=30 MNP=0.25 SCP (hr)=0

DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=30 MNI=0.015 SCI (hr)=0 -1

ADD HYD ID=3 NHY=100 ID=1,2

*#

*# TO LAWRENCE ROAD

*#

CALIB STANDHYD ID=4 NHYD=200 DT=10min AREA=2.199ha

XIMP=0.50 TIMP=0.612 DWF (cms)=0 LOSS=2 CN=76

Ia =5.0mm SLPP (%)=2.0 LGP (m)=120 MNP=0.25 SCP (hr)=0

DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=120 MNI=0.015 SCI (hr)=0 -1

*#*****

*#

*# 100yr EVENT

*#

*#*****

CHICAGO STORM IUNITS=2 TD=4hrs TPRAT=.40 CSDT=10 min

ICASEcs=1 A=2317.4 B=11 C=.836

*#*****

PRE-DEVELOPMENT

*#*****

*#

*# TO KING STREET

*#

CALIB NASHYD NHYD=1 NHYD=100 DT=10min, AREA=0.447ha DWF=0.0cms

CN=76 IA=10.0mm N=3 TP=0.12hrs -1

CALIB STANDHYD ID=2 NHYD=100 DT=10min AREA=0.036ha

XIMP=0.99 TIMP=0.99 DWF (cms)=0 LOSS=2 CN=76

la =5.0mm SLPP (%)=2.0 LGP (m)=30 MNP=0.25 SCP (hr)=0
DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=30 MNI=0.015 SCI (hr)=0 -1

ADD HYD ID=3 NHY=100 ID=1,2

*#

*# TO LAWRENCE ROAD

*#

CALIB STANDHYD ID=4 NHYD=200 DT=10min AREA=2.199ha
XIMP=0.50 TIMP=0.612 DWF (cms)=0 LOSS=2 CN=76
la =5.0mm SLPP (%)=2.0 LGP (m)=120 MNP=0.25 SCP (hr)=0
DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=120 MNI=0.015 SCI (hr)=0 -1

*#*****

POST DEVELOPMENT

*#*****

*#

*# TO KING STREET

*#

CALIB STANDHYD ID=1 NHYD=401 DT=10min AREA=.096ha
XIMP=0.001 TIMP=0.284 DWF (cms)=0 LOSS=2 CN=76
la =5.0mm SLPP (%)=2.0 LGP (m)=120 MNP=0.25 SCP (hr)=0
DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=120 MNI=0.015 SCI (hr)=0 -1

*#

*# TO LAWRENCE ROAD (CONTROL TO 2yr PRE-DEVELOPMENT 0.220cms)

*#

CALIB STANDHYD ID=3 NHYD=401 DT=10min AREA=2.545ha
XIMP=0.312 TIMP=0.312 DWF (cms)=0 LOSS=2 CN=76
la =5.0mm SLPP (%)=2.0 LGP (m)=120 MNP=0.25 SCP (hr)=0
DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=120 MNI=0.015 SCI (hr)=0 -1

*# STORAGE TANK

ROUTE RESERVOIR ID=4 NHYD=401 IDIN=3 DT=5min
OUTFLOW (cms) STORAGE (ham)

0	0
0.053	0.0063
0.093	0.0125
0.120	0.0188
0.143	0.0250
0.162	0.0313
0.179	0.0375
0.195	0.0438
0.209	0.0500
0.223	0.0563 -1 -1

*# SOUTH BLVD UNCONTROLLED TO LAWRENCE ROAD

CALIB STANDHYD ID=5 NHYD=401 DT=10min AREA=0.041ha
XIMP=0.001 TIMP=0.420 DWF (cms)=0 LOSS=2 CN=76
la =5.0mm SLPP (%)=2.0 LGP (m)=120 MNP=0.25 SCP (hr)=0
DPSI =1.0mm SLPI (%)= 2.0 LGI (m)=120 MNI=0.015 SCI (hr)=0 -1

*# TOTAL FLOW TO LAWRENCE ROAD

ADD HYD ID=6 NHYD=401 ID=4,5

FINISH

```

***** SUMMARY OUTPUT *****
*****
*      RUN DATE: 2021-09-29   TIME: 13:51:35   RUN COUNTER: 000001      *
*****
* Input file: D:\WORK FILES\2020 Projects\2014 - 1842 King Street Hamilton\KingSt1.dat *
* Output file: D:\WORK FILES\2020 Projects\2014 - 1842 King Street Hamilton\KingSt1.out *
* Summary file: D:\WORK FILES\2020 Projects\2014 - 1842 King Street Hamilton\KingSt1.sum *
* User comments:
* 1: _____*
* 2: _____*
* 3: _____*
*****

```

```

RUN#:COMMAND#
R0001:C00001-----
START
[TZERO = .00 hrs on 0]
[METOUT= 2 (1=imperial, 2=metric output)]
[NSTORM= 0]
[NRUN = 0001]

```

```

#*****
#      1842 King Street - City of Hamilton
#
#      LAMARRE CONSULTING GROUP
#
#      September1 2021
#*****
#*****

```

```

#
# 2yr EVENT
#
#*****

```

```

R0001:C00002-----
CHICAGO STORM
[SDT=10.00:SDUR= 4.00:PTOT= 33.19]
[A/B/C= 646.000/ 6.000/ .791]

```

```

#*****
#* PRE DEVELOPMENT
#*****

```

```

#
# TO KING STREET
#

```

```

R0001:C00003-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm---RVmm-R.C.---DWFcms
* CALIB NASHYD 10.0 01: 100 .45 .007 No_date 1:50 5.20 .157 .000
[CN= 76.0: N= 3.00: Tp= .12]
R0001:C00004-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm---RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 02: 100 .04 .007 No_date 1:40 31.94 .962 .000
[XIMP=.99:TIMP=.99]
[LOSS= 2 :CN= 76.0]
[Pervious area: IAper= 5.00:SLPP=2.00:LGP= 30.:MNP=.250:SCP= .0]
[Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 30.:MNI=.015:SCI= .0]
R0001:C00005-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm---RVmm-R.C.---DWFcms
ADD HYD 10.0 01: 100 .45 .007 No_date 1:50 5.20 n/a .000
+ 10.0 02: 100 .04 .007 No_date 1:40 31.94 n/a .000

```

```

SUM= 10.0 03: 100 .48 .014 No_date 1:40 7.20 n/a .000
#
# TO LAWRENCE ROAD
#
R0001:C00006-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 04: 200 2.20 .220 No_date 1:40 20.79.626 .000
[XIMP=.50:TIMP=.61]
[LOSS= 2 :CN= 76.0]
[Pervious area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP= .0]
[Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI= .0]
#*****

#
# 100yr EVENT
#
#*****

R0001:C00007-----
CHICAGO STORM
[SDT=10.00:SDUR= 4.00:PTOT= 91.39]
[A/B/C=2317.400/ 11.000/ .836]
#*****

#* PRE-DEVELOPMENT
#*****

#
# TO KING STREET
#
R0001:C00008-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB NASHYD 10.0 01: 100 .45 .082 No_date 1:40 41.00.449 .000
[CN= 76.0: N= 3.00: Tp= .12]
R0001:C00009-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 02: 100 .04 .018 No_date 1:40 89.94.984 .000
[XIMP=.99:TIMP=.99]
[LOSS= 2 :CN= 76.0]
[Pervious area: IAper= 5.00:SLPP=2.00:LGP= 30.:MNP=.250:SCP= .0]
[Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 30.:MNI=.015:SCI= .0]
R0001:C00010-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
ADD HYD 10.0 01: 100 .45 .082 No_date 1:40 41.00 n/a .000
+ 10.0 02: 100 .04 .018 No_date 1:40 89.94 n/a .000
SUM= 10.0 03: 100 .48 .101 No_date 1:40 44.64 n/a .000
#
# TO LAWRENCE ROAD
#
R0001:C00011-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 04: 200 2.20 .737 No_date 1:40 70.77.774 .000
[XIMP=.50:TIMP=.61]
[LOSS= 2 :CN= 76.0]
[Pervious area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP= .0]
[Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI= .0]
#*****

#* POST DEVELOPMENT
#*****

#
# TO KING STREET
#

```

```

R0001:C00012-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 01: 401 .10 .017 No_date 1:40 53.09 .581 .000
  [XIMP=.00:TIMP=.28]
  [LOSS= 2 :CN= 76.0]
  [Pervious area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP= .0]
  [Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI= .0]
#
# TO LAWRENCE ROAD (CONTROL TO 2yr PRE-DEVELOPMENT 0.220cms)
#
R0001:C00013-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 03: 401 2.55 .511 No_date 1:40 59.03 .646 .000
  [XIMP=.31:TIMP=.31]
  [LOSS= 2 :CN= 76.0]
  [Pervious area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP= .0]
  [Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI= .0]
# STORAGE TANK

R0001:C00014-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
ROUTE RESERVOIR -> 10.0 03: 401 2.55 .511 No_date 1:40 59.03 n/a .000
  out <= 5.0 04: 401 2.55 .206 No_date 2:10 59.03 n/a .000
  {MxStoUsed=.4877E-01 m3}
# SOUTH BLVD UNCONTROLLED TO LAWRENCE ROAD

R0001:C00015-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
* CALIB STANDHYD 10.0 05: 401 .04 .009 No_date 1:40 58.00 .635 .000
  [XIMP=.00:TIMP=.42]
  [LOSS= 2 :CN= 76.0]
  [Pervious area: IAper= 5.00:SLPP=2.00:LGP= 120.:MNP=.250:SCP= .0]
  [Impervious area: IAimp= 1.00:SLPI=2.00:LGI= 120.:MNI=.015:SCI= .0]
# TOTAL FLOW TO LAWRENCE ROAD

R0001:C00016-----DTmin-ID:NHYD-----AREAha-QPEAKcms-TpeakDate_hh:mm----RVmm-R.C.---DWFcms
ADD HYD 5.0 04: 401 2.55 .206 No_date 2:10 59.03 n/a .000
  + 10.0 05: 401 .04 .009 No_date 1:40 58.00 n/a .000
  SUM= 5.0 06: 401 2.59 .210 No_date 2:10 59.01 n/a .000
R0001:C00017-----
FINISH
-----

```



APPENDIX C: Hydro First Defence HD-5HC Sizing



Hydro First Defense® - HC				Hydro International			
Net Annual Water Quality Worksheet				Net Annual Removal Model: FD-5HC			
Rev. 9.8		Project Name: 1842 King Street		Report Date: 2020-12-04		Paste	
Street:		City: Hamilton		Intensity ⁽¹⁾	Fraction of Rainfall ⁽¹⁾	FD-5HC Removal Efficiency ⁽²⁾	Weighted Net Annual Efficiency
Province: Ontario		Country:		(mm/hr)	(%)	(%)	(%)
Designer:		email:		0.50	0.4%	100.0%	0.4%
Treatment Parameters:				RESULTS SUMMARY			
Structure ID:		TSS Goal: 80 % Removal		Model	TSS	Volume	
TSS Particle Size: NJDEP / ETV		Area: 0.304 ha		FD-3HC	70.2%	99.7%	
Percent Impervious: 100%		Rational C value: 0.90 Calc. On		FD-4HC	80.4%	100.0%	
Rainfall Station: Hamilton, ON MAP		Peak Storm Flow: 416 L/s		FD-5HC	81.5%	99.9%	
				FD-6HC	85.4%	99.9%	
				FD-8HC	90.6%	99.9%	
Model Specification:				5.00	4.7%	77.6%	3.6%
Model: FD-5HC		Diameter: 1500 mm		6.00	4.2%	75.6%	3.1%
Peak Flow Capacity: 566.00 L/s		Sediment Storage: 0.84 m ³		7.00	4.2%	73.9%	3.1%
Oil Storage: 1136.00 L				8.00	3.2%	72.5%	2.3%
Installation Configuration:				9.00	1.9%	71.2%	1.4%
Placement: Online		Outlet Pipe Size: mm OK		10.00	2.6%	70.1%	1.8%
Outlet Pipe 1 Size: mm OK		Inlet Pipe 1 Size: mm OK		20.00	9.2%	62.6%	5.8%
Outlet Pipe 2 Size: mm OK		Inlet Pipe 2 Size: mm OK		30.00	2.3%	58.2%	1.3%
Outlet Pipe 3 Size: mm OK		Rim Level: m Calc Invs.		40.00	1.1%	55.1%	0.6%
		Outlet Pipe Invert: m		50.00	0.5%	52.7%	0.3%
		Invert Pipe 1: m OK!		100.00	0.6%	45.2%	0.3%
		Invert Pipe 2: m		150.00	0.1%	40.8%	0.0%
		Invert Pipe 3: m		200.00	0.0%	37.7%	0.0%
Designer Notes				Total Net Annual Removal Efficiency: 81.5%			
				Total Annual Runoff Volume Treated: 99.9%			
				1. Rainfall Data: 1970:2007, HLY03, Hamilton, ON, 6153194.			
				2. Based in NJDEP / Canada ETV PSD.			
				3. Rainfall adjusted to 5 min peak intensity based on hourly average.			