PROPOSED FREESTANDING PAD BUILDING
5150 INNES ROAD, ORLEANS, ON

STORM WATER MANAGEMENT DESIGN BRIEF

EXISTING DEVELOPMENT DRAINAGE SYSTEM

REV 1 – December 06, 2019

PREPARED BY:

HALLEX ENGINEERING LTD.

HALLEX PROJECT #190105

HALLEX NIAGARA
4999 VICTORIA AVENUE
NIAGARA FALLS, ON L2E 4C9

HALLEX HAMILTON
745 SOUTH SERVICE ROAD, UNIT 205
STONEY CREEK, ON L8E 5Z2

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1. PRE-DEVELOPMENT CONDITIONS

1.1 LOCATION

The proposed free-standing pad building is located in an existing commercial retail property at 5150 Innes Road in Orleans, Ontario. It is located at the south west corner of the Innes Road and Trim Road intersection. The subject area of the existing site consists of an asphalt parking lot which shall be redeveloped for the proposed 1 storey building complete with a drive through.

1.2 DRAINAGE PATTERN

The site currently drains via an existing storm sewer system within the asphalt parking lot. This storm sewer eventually discharges to the existing 525mm dia municipal storm sewer at Innes Road.

2. PROPOSED WORK

2.1 GRADING

The objective of the design is to utilize the existing design slope to achieve the minimum and maximum slopes in the grading of the new asphalt surface. This will ensure the asphalt surface not only drains as per the design but is not too steep. The grading of the site also ensures that the storm water will drain through the existing storm sewer system onsite for the five-year storm event as per the City of Ottawa intensity-duration-frequency curve.

2.2 DRAINAGE

As only a small portion of the property will be affected by the proposed development only the subject area of the site will be considered in this design brief. The proposed design consists of 25.7m of new sewer pipe, a new catch basin and a new catch basin manhole. The new catch basins will connect to the existing storm sewer system onsite. This sewer eventually discharges to the 525mm diameter municipal storm sewer at Innes Road.

3. DESIGN CONSIDERATIONS

3.1 SITE DRAINAGE

3.1.1 Pre-development

A. Peak Runoff

The total drainage area for the subject area of the site is 0.561 hectares with an existing runoff coefficient of 0.77 based on the existing asphalt and grass surface areas.

The time of concentration is determined to be 10 minutes to the start of the sewer as required by the City of Ottawa Municipal Standards.

Using the Rational Method, the peak flow rates are $Q = \frac{CiA}{360}$

Subcatchment	Description	Draining to	Area, ha	Tc, min
Sewer	Sewer flow	Innes Road	0.561	10
5-year Storm	A,ha	C	*i*,mm/h	Q, L/s
Sewer	0.561	0.77	97	115.5

Therefore, the total pre-development flow for the site is 115.5L/s for the five-year storm. The flows and other design information are contained in Exhibit #1 for the five-year storm.

B. Quantity

As per the Site Servicing Plan by J.L Richards & Associates Ltd., under Job # 12912-07, 20633 dated October 24, 2008, several inlet control devices were installed in 13 separate catchbasins throughout the site. One of these existing ICD's (ie a 75mm PVC plug type inlet control device) are located at the outlet pipe for a catchbasin within the subject area of the site that is to be altered by the development (ie XCBMH.2). This ICD allows for a maximum ponding of 300mm at the catchbasin and is designed to discharge a maximum allowable flow rate of 20L/s.

3.1.2 Post Development

A. Peak Runoff

The proposed development consists of the removal of existing asphalt surfaces and the construction of a coffee shop complete with a drive thru. The decrease in hard surface areas result in a post-development runoff coefficient of 0.76.

The subject area of the site will continue to drain to the existing storm sewer system on the property. This sewer eventually discharges to the 525mm dia municipal storm sewer at Innes Road.

Using the Rational Method, the peak flow rates are as follows:

Subcatchment	Description	Draining to	Area, ha	Tc, min
Sewer	Sewer flow	Innes Road	0.561	10
5-year Storm	A,ha	C	*i*,mm/h	Q, L/s
Sewer	0.561	0.76	97	111.2
100-year Storm	A,ha	C	*i*,mm/h	Q, L/s
Sewer	0.561	0.96*	97	257.1

* The runoff coefficient for the subject area of the site is increased by 25% for the 100-year storm as per the City of Ottawa Sewer Design Guidelines

The total post-development flow for the subject area of the site is 111.2L/s for the five-year storm and 257.1L/s for the one-hundred-year storm. The flows and other design information are contained in Exhibit #2 for the five-year storm and Exhibit #3 for the one-hundred -year storm.

B. Quantity

Stormwater quantity controls for the site will be maintained by utilizing the existing 75mm PVC plug type orifice at the outlet side of XCBMH.2 in order to maintain the existing stormwater management controls for the site. The orifice plate will ensure the post development runoff is

controlled to the 20L/s allowable flow rate for the one-hundred-year storm event.

The resulting 216 m^3 volume generated from the one-hundred-year storm event will be contained within the storm sewer system and temporary surface ponding. The storage within the pipes consist of only the static portion of the proposed sewer as the dynamic portion is required to remain in a state of flow as per the design. In addition, storage is provided within each node consisting of catchbasins and catchbasin manholes. The resulting storage volume for the one-hundred-year storm is calculated using EPA SWMM v5.1 software.

The orifice sizing and subsequent storage volume for the detained flow are indicated in Exhibit #4 for the one-hundred-year storm event.

C. Maintenance Recommendations

The storm sewer system includes pipes, catchbasins and catchbasin maintenance holes. It is important to regularly inspect the elements to ensure that storm water is flowing as originally designed. Debris and sediment commonly clog the system and reduce the overall effectiveness.

The following maintenance and inspection tasks should be done:

1. Inspect the inlet pipes and outlet pipes for structural integrity. (Annually) Check inlet/ outlet pipes for structural integrity to ensure they aren't crumbling or broken.

2. Conduct routine inspections for trash or other debris that may be blocking the inlet/ outlet pipes. (Monthly and after rain events) Remove all trash and debris.

3. Inspect and clean the storm sewer system (Every 5 years or as needed). Catchbasins to be inspected annually and debris removed when the debris reaches a depth of ½ from the bottom of the sump to the bottom of the pipe.

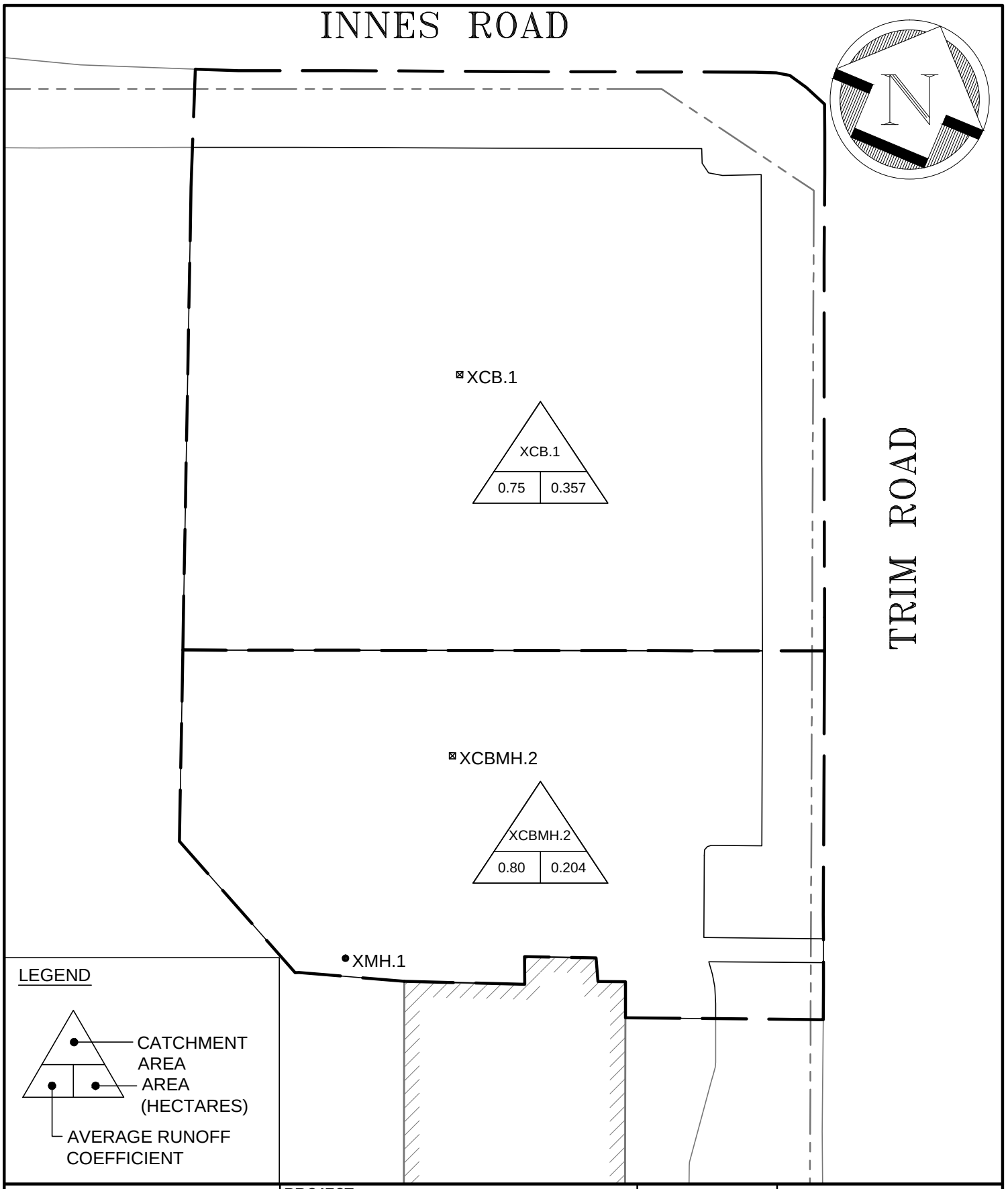
4. Inspect for sediment accumulation at pipes (Semi-annually and after rain events). It is important to clean out sediment that might be restricting water flow.

5. Do not dump any materials in the storm sewer system.

Yours truly,
HALLEX ENGINEERING LTD

Jim Halucha P.Eng
Civil/Structural Engineer

Jonathan Skinner, C.E.T., B.Tech
Civil Technologist



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PROJECT: PROPOSED FREESTANDING PAD BUILDING
5150 INNES ROAD, ORLEANS, ON

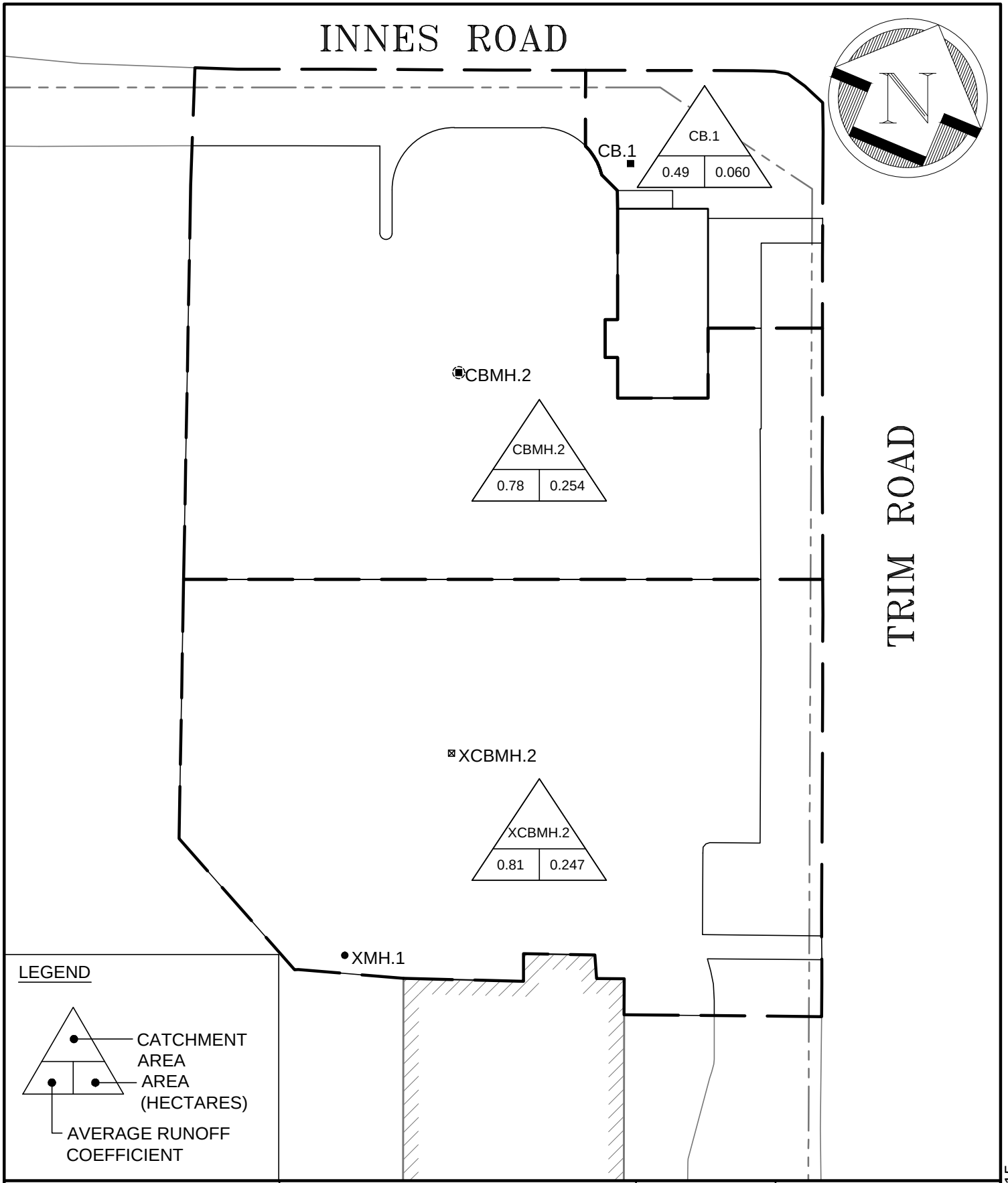
SHEET TITLE: PRE-DEVELOPMENT CATCHMENT AREA PLAN

DATE: 12/06/2019
SCALE: 1:400
DR. BY: AB
CH. BY: JS/JH

JOB No.: 190105
DWG. CSK1
REV. 1

D07-12-19-0115

DWG#CSK1



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PROJECT: PROPOSED FREESTANDING PAD BUILDING
5150 INNES ROAD, ORLEANS, ON

SHEET TITLE: POST-DEVELOPMENT CATCHMENT AREA PLAN

DATE: 12/06/2019
SCALE: 1:400
DR. BY: AB
CH. BY: JS/JH

JOB No.: 190105
DWG. CSK2
REV. 1

D07-12-19-0115

DWG#CSK2

HALLEX ENGINEERING LTD.

5150 Innes Road, Orleans
Exhibit #1 - 5 Year Pre - Development Calculations

12/6/2019
Job: 190105

Ottawa - 5 Year Storm

manning's n = 0.013 Conc Pipe
0.013 PVC Pipe
0.024 Corr. Stl Pipe

Rainfall Intensity Values = A= 998.000
B= 6.100
C= 0.840

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Sewer Design				Invert Elevations	
Pipe	From Node	To Node		Increment	Cum Total	To Upper	In Sectio			Cum Flow	Cum Flow	Slope	Capacity Full	Velocity Full	Diameter	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
1	**XCB.1**	**XCBMH.2**	**36.7**	**0.357**	**0.357**	**10.00**	**0.60**	**97**	**67299**	**6189.2**	**0.0716**	**0.0071**	**0.0501**	**1.0208**	**0.250**	**86.00**	**85.74**
Paved	-	-	-	0.279	-	-	-	-	20885.8	5827.1	-	-	-	-	-	-	-
Grass	-	-	-	0.078	-	-	-	-	4641.3	362.0	-	-	-	-	-	-	-
2	**XCBMH.2**	**XMH.1**	**21.9**	**0.204**	**0.204**	**10.00**	**0.31**	**97**	**67299**	**9978.8**	**0.1155**	**0.0055**	**0.1300**	**1.1773**	**0.375**	**85.62**	**85.50**
Paved	-	-	-	0.175	-	-	-	-	20885.8	3655.0	-	-	-	-	-	-	-
Grass	-	-	-	0.029	-	-	-	-	4641.3	134.6	-	-	-	-	-	-	-

Run-off Coefficients Used:

Roof Structure	C =	0.90
Paved Surface	C =	0.90
Grass Surface	C =	0.20
Gravel Surface	C =	0.60
Perm. Paver	C =	0.30

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration = 10 min

HALLEX ENGINEERING LTD.

5150 Innes Road, Orleans
Exhibit #2 - 5 Year Post - Development Calculations

12/6/2019
Job: 190105

Ottawa - 5 Year Storm

Rainfall Intensity Values =
A= 998.000
B= 6.100
C= 0.840

manning's n =
0.013 PVC Pipe
0.013 Conc Pipe
0.024 Corr. Stl Pipe
0.035 Grass Swale

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Sewer Design				Invert Elevations	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow	Slope	Capacity Full	Velocity Full	Dia-meter	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
1	**CB. 1**	**CBMH. 2**	**25.7**	**0.060**	**0.060**	**10.00**	**0.36**	**97**	**46413**	**684.6**	**0.0079**	**0.0100**	**0.0595**	**1.2115**	**0.250**	**86.29**	**86.03**
Roof	-	-	-	0.017	-	-	-	-	20885.8	355.1	-	-	-	-	-	-	-
Paved	-	-	-	0.008	-	-	-	-	20885.8	167.1	-	-	-	-	-	-	-
Grass	-	-	-	0.035	-	-	-	-	4641.3	162.4	-	-	-	-	-	-	-
2	**CBMH. 2**	**XCBMH. 2**	**36.7**	**0.254**	**0.314**	**10.36**	**0.60**	**95**	**25057**	**5206.3**	**0.0603**	**0.0071**	**0.0501**	**1.0208**	**0.250**	**86.00**	**85.74**
Paved	-	-	-	0.211	-	-	-	-	20501.4	4325.8	-	-	-	-	-	-	-
Grass	-	-	-	0.043	-	-	-	-	4555.9	195.9	-	-	-	-	-	-	-
3	**XCBMH. 2**	**XMH. 1**	**21.9**	**0.247**	**0.561**	**10.96**	**0.32**	**92**	**24315**	**9609.5**	**0.1112**	**0.0055**	**0.1300**	**1.1773**	**0.375**	**85.62**	**85.50**
Paved	-	-	-	0.214	-	-	-	-	19894.0	4257.3	-	-	-	-	-	-	-
Grass	-	-	-	0.033	-	-	-	-	4420.9	145.9	-	-	-	-	-	-	-

Run-off Coefficients Used:

Roof Structure C = 0.90
Paved Surface C = 0.90
Grass Surface C = 0.20

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

5150 Innes Road, Orleans
Exhibit #3 - 100 Year Post - Development Calculations

Ottawa - 100 Year Storm

Rainfall Intensity Values =

A= 1736.000
B= 6.000
C= 0.820

manning's n =

0.013 PVC Pipe
0.013 Conc Pipe
0.024 Corr. Stl Pipe
0.035 Grass Swale

Location			Length of Pipe	Area		Flow Time		Rainfall Intensity	Unit rate of Runoff	Design Flows		Flow Control	Sewer Design				Invert Elevations	
Pipe	From Node	To Node		Incre-ment	Cum Total	To Upper	In Section			Cum Flow	Cum Flow		Slope	Capacity Full	Velocity Full	Dia-meter	Up-stream	Down-stream
			(m)	(ha)	(ha)	(min)	(min)	mm/hr	m^3/ha*day	(m^3/d)	(m^3/s)	(m^3/s)	(m/m)	(m^3/s)	(m/s)	(m)	(m)	(m)
1	**CB. 1**	**CBMH. 2**	**25.7**	**0.060**	**0.060**	**10.00**	**0.36**	**179**	**107232**	**1581.7**	**0.0183**	**0.0183**	**0.0100**	**0.0595**	**1.2115**	**0.250**	**86.29**	**86.03**
Roof	-	-	-	0.017	-	-	-	-	48254.2	820.3	-	-	-	-	-	-	-	-
Paved	-	-	-	0.008	-	-	-	-	48254.2	386.0	-	-	-	-	-	-	-	-
Grass	-	-	-	0.035	-	-	-	-	10723.2	375.3	-	-	-	-	-	-	-	-
2	**CBMH. 2**	**XCBMH. 2**	**36.7**	**0.254**	**0.314**	**10.36**	**0.60**	**175**	**57911**	**12032.0**	**0.1393**	**0.1393**	**0.0071**	**0.0501**	**1.0208**	**0.250**	**86.00**	**85.74**
Paved	-	-	-	0.211	-	-	-	-	47381.8	9997.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.043	-	-	-	-	10529.3	452.8	-	-	-	-	-	-	-	-
3	**XCBMH. 2**	**XMH. 1**	**21.9**	**0.247**	**0.561**	**10.96**	**0.32**	**170**	**56226**	**22213.9**	**0.2571**	**0.0188**	**0.0055**	**0.1300**	**1.1773**	**0.375**	**85.62**	**85.50**
Paved	-	-	-	0.214	-	-	-	-	46002.8	9844.6	-	-	-	-	-	-	-	-
Grass	-	-	-	0.033	-	-	-	-	10222.8	337.4	-	-	-	-	-	-	-	-

Run-off Coefficients Used:

Roof Structure C = 1.13
Paved Surface C = 1.13
Grass Surface C = 0.25

Velocity Range:

Minimum Velocity = 0.80 m/s
Maximum Velocity = 6.00 m/s

Time of Concentration:

Time of Concentration = 10 min

5150 Innes Road, Orleans
Exhibit #4 - 100 Year Orifice Plate and Storage Volume Calcs

12/6/2019
Job: 190105

Site Data

Site Discharge	Flow	Total Storm Volume
	(m^3/s)	(m^3)
Allowable Flow	0.0200	
Post - Develop.	0.2571	216.0

Control Node Data

Outlet Pipe	Storm Control Node	Outlet Pipe Size	Outlet Invert Elev.	Elev. @ Orifice
		(m)	(m)	(m)
3	CBMH. 2	0.375	85.62	85.66

* Calculated using using EPA SWMM 5.1 modelling software

Head Height 2.41 m **Storm Retention Elev. Check** **88.07 m**

Pipe Storage

Pipes	From Node	To Node	Pipe Length	Design Flow	Storage Pipe Size	Pipe Capacity	Dynamic	Static	Static Volume	Volume Part. Full	Inv. El @ Upper	Inv. El @ Lower
			(m)	(m^3/s)	(m)	(m^3/s)	(Pipe %)	(Pipe %)	(m^3)	(m^3)	(m)	(m)
1	CB. 1	CBMH. 2	25.7	0.0183	0.250	0.0595	30.78%	69.22%	0.87	0.87	86.29	86.03
2	CBMH. 2	CBMH. 2	36.7	0.1393	0.250	0.0501	100.00%	0.00%	0	0	86.00	85.74
Total			**62.4**						**0.87**	**0.87**		

Node Storage

Outlet Pipe	Node	Lid Elevation	Utility Dimensions		Storage Volume
			Size	Area	
		(m)	(m)	(m^2)	(m^3)
1	CB. 1	87.86	0.600	0.36	0.56
2	CBMH. 2	87.77	1.200	1.13	2.00
3	XCBMH. 2	87.77	1.200	1.13	2.38
Total					**4.94**

Surface Water Storage

Outlet Pipe	Node	Lid Elevation	Surface Ponding		Storage Volume
			Area	Elevation	
		(m)	(m^2)	(m)	(m^3)
1	CB. 1	87.86	13.80	88.07	1.45
2	CBMH. 2	87.77	652.70	88.07	97.90
3	XCBMH. 2	87.77	755.20	88.07	113.28
Total					**212.63**

Total Storage = 218.44 m^3 **Required Storage Achieved**

Orifice Diameter Calculation (A=Q/(Cd*sqrt(2*g*h)))

Coefficient of Discharge	Cd =	0.62	(sharp)	0.62	Sharp Orifice coefficient of discharge
Allowable Flow Rate	Q =	0.0200	m^3/s	0.80	Tube coefficient of discharge
Force of Gravity	g =	9.81	m/s/s		
Head Height	h =	2.41	m		
Dia of Max. Orifice	dia =	77.28	mm	Use -	75 mm

Flow Rate for Actual Size of Hole (Q=Cd*A*sqrt(2*g*h))

Area of Orifice	A =	0.0044	m^2
Flow Rate through Orifice	Q =	0.0188	m^3/s