

223 St. Andrew Street East, Fergus

Functional Servicing and Stormwater Management Report

Project Location: 223 St. Andrew Street East, Fergus, ON

Prepared for: MMDG Health Services Inc. 309 Daniel Crescent, Elora, ON

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

May 17, 2022

MTE File No.: 50389-100





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Functional Site Grading Plan MTE Drawing No. C2.1	Appended Separately
Functional Site Servicing Plan MTE Drawing No. C2.2	Appended Separately

1.0 Introduction

MTE Consultants Inc. was retained by MMDG Health Services Inc. to complete a Functional Servicing and Stormwater Management Report for a new mixed-use development to be constructed at 223 St. Andrew Street East (herein referred to as 'the Site') in the Township of Centre Wellington in support of the Zoning By-Law Amendment Application. The current zoning of the Site is C1 (Central Business District Commercial). The C1 zoning allows for residential units above ground floor commercial however, the new mixed-use building proposes one residential unit on the ground floor. Moreover, the allowable building height in the C1 zoning is 11m but the proposed building is approximately 15m. As a result, a Zoning By-Law Amendment is required.

The Site is legally described as all of lot 70, north side of north St. Andrew Street, registered plan 55 in the Township of Centre Wellington. The property is bounded to the north and east by existing commercial and residential properties, to the south by St. Andrew Street East, and to the west by Gowrie Street North. For the exact location of the Site refer to Figure 1.0.

The proposed development for the Site is the construction of a new 5-storey mixed-use residential building with commercial suites on the ground floor. The proposed development will have surface parking to the north side of the building and will also include a ground floor patio adjacent to St. Andrew Street East. To construct the proposed development, demolition of the existing dwelling and garage/workshop will be required.

The purpose of this study is to support the 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 property. Pending approval of the Amendment application, detailed design of the Site will commence and be submitted to the Township in support of Site Plan Approval.

2.0 Existing Conditions

2.1 Existing Topography

The Site encompasses an area of 0.10ha and currently comprises of a dwelling, a garage/workshop, two driveways connecting to Gowrie Street North, and green space. In the existing condition, there is a high point between the east walls of the existing buildings, with drainage at either side of the high point being directed towards the east and west. There is an elevation difference of approximately 0.8m between the north and south property line, and approximately 0.2m between the east and west property line. Currently, a retaining wall exists on the north side of the Site on the neighbouring property. The Site is approximately 33% impervious in the existing condition.



April 1, 2022 — 1:51 p.m. — Plotted By: SDu

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2.2 Existing Servicing

2.2.1 Water

There is an existing 300mm diameter municipal watermain along St. Andrew Street East, and an existing 200mm diameter municipal watermain along Gowrie Street North. The closest municipal fire hydrant is near the southwest corner of the Site in the boulevard north of St. Andrew Street East. The Site is currently serviced by an unknown diameter water service off the St. Andrew Street East watermain. There is also an existing 25mm water service off the Gowrie Street North watermain capped with a curb stop at the west property line of the Site. The existing water services off St. Andrew Street East and Gowrie Street North will be decommissioned and capped at the main as a part of the redevelopment of the Site.

2.2.2 Sanitary

There is an existing 450mm diameter sanitary sewer along St. Andrew Street East which drains toward the west. The closest existing manhole is located near the southwest corner of the Site in the northeast boulevard of the St. Andrew Street East and Gowrie Street North intersection. At this manhole, the sewer is approximately 2.3m below the top grate elevation. The Site is currently serviced by an unknown diameter pipe which connects to this St. Andrew Street East sanitary sewer. This service will be capped at the property line as a part of the redevelopment of the Site.

There is also an existing 200mm diameter sanitary sewer along Gowrie Street North which drains toward the south. The closest existing manhole is located near the northwest corner of the Site in the Gowrie Street North right-of-way. At this manhole, the sewer is approximately 2.5m below the top grate elevation. There is an existing 150mm diameter pipe extended to the Site which connects to this Gowrie Street North sanitary sewer and is plugged at the property line with a clean out.

The two sanitary sewers along St. Andrew Street East and Gowrie Street North converge at an existing manhole located in the intersection of the two streets, where a 525mm sanitary sewer continues to drain toward the west. At this manhole, the sewer is approximately 2.2m below the top grate elevation.

2.2.3 Storm

There is a 300mm diameter storm sewer along St. Andrew Street East that upsizes to a 375mm diameter storm sewer and drains toward the west. The closest existing manhole is located next to the drop curb on the south side of the St. Andrew Street East and Gowrie Street North intersection. At this manhole, the sewer is approximately 1.9m below the top grate elevation.

There is also an existing 250mm diameter storm sewer along Gowrie Street North that drains toward the south. The closest existing manhole is located near the west property line, next to the drop curb on the east side of Gowrie Street North right-of-way. At this manhole the sewer is approximately 1.2m below the top grate elevation.

Surface runoff from a majority of the Site is conveyed overland to the west, where it enters the Gowrie Street North storm sewer.

2.3 Existing Soils Information

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

2.4 Reviewing Agencies

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

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 Fryett Turner Architects Inc., dated March 29, 2022.

3.1 Proposed Grading

The proposed development will have 2 commercial units on the ground floor and 17 residential units between the remaining 4 stories. There will also be 11 above-ground parking spaces available to the north of the development. For more details on the building configuration, refer to the Architectural drawings.

The Site will be accessible through a driveway connecting to Gowrie Street North. Pedestrian access will also be available with a connection to the existing sidewalks on St. Andrew Street East and Gowrie Street North. The proposed grading strategy will respect the existing grades along the property line; however, re-grading a portion of Gowrie Street North boulevard will be required to construct the Site's driveway entrance. Due to the proposed and existing elevation differences along the east, south, and west property line, a retaining wall is proposed in addition to risers at connection to the existing sidewalk on St. Andrew Street East. All proposed elevations are subject to change during detailed design. The grading strategy has been developed to ensure water will flow away from the building with a major storm overland flow route towards Gowrie Street North.

3.2 Proposed Servicing

3.2.1 Water

A new connection to the 200mm diameter municipal watermain along Gowrie Street North will be required in order to service the proposed building. The required private water service size will be determined during detailed design, but will likely be 150mm diameter. The private water service will connect to the northwest corner of the proposed building.

3.2.2 Water Demands

Preliminary water demands were calculated for the proposed development and are included in Appendix A. The maximum day domestic water demand was determined to be 0.35L/s.

The proposed development was analyzed using both the OBC and FUS fire flow requirements. The fire flow requirement was determined to be 60L/s and 184L/s based on the OBC and FUS fire flow requirements, respectively.

Many municipalities in Ontario use both the OBC and the FUS fire flow requirements for assessing firefighting water supply requirements. Ideally, fire flow demands for new developments are calculated based on the FUS criteria; however, it is not reasonable to expect

that the existing municipal watermain infrastructure always has the operational capacity to supply water at the rates prescribed in the FUS guidelines. As a result, at no time shall the available fire flow be less than that required by the Ontario Building Code. The minimum allowable pressure permitted under fire fighting conditions is 140.0kPa per OBC 2012.

It is anticipated that the existing fire hydrant located near the southwest corner of the Site will be sufficient for the proposed building, as it is located approximately 8m from the proposed fire department connection at the southeast side of 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.

3.2.3 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 17 residential units, some commercial space, and a site area of 0.10ha, the resulting peak flow rate from the Site is expected to be 0.56L/s. Refer to Appendix B for sanitary flow calculations.

It is proposed that the Site will be serviced by a new 150mm diameter sanitary sewer connecting to the existing 150mm diameter sanitary plug and clean out located at the west property line. The existing 150mm diameter sanitary plug and clean out connects to the 200mm diameter municipal sewer in the Gowrie Street North right-of-way which has an approximated capacity of 46.4L/s. The proposed private sanitary sewer will connect to the existing sanitary plug and clean out. While the slope of the existing lateral is unknown, it is assumed to have a minimum slope of 2.0%, with a resulting capacity of 21.5L/s. The proposed private sanitary sewer should have an appropriate depth for servicing the building while maintaining adequate capacity. The service sizes and inverts are subject to change during detailed design.

3.2.4 Storm

A private storm sewer system will be installed on-site to collect rooftop runoff from the building and runoff from the common driveway and parking area. The runoff will enter a new catchbasin which will connect to a proposed 200mm diameter storm sewer directed to the OGS unit located at the main entrance of the Site. A new 200mm diameter storm sewer will connect the proposed OGS unit to the existing municipal storm sewer with a new manhole, at a slope of 1.0%. The proposed storm sewer will have a capacity of 32.8L/s and the resulting flow rate from the contributing area is expected to be 8.0L/s during the 5-year storm event with upstream attenuation. The upstream attenuation measures are discussed in more detail in Section 4.2. Refer to Appendix C for preliminary storm sewer sizing details.

4.0 Preliminary Storm Water Management Design

4.1 SWM Criteria

The stormwater management design criteria for the subject Site, established based on best management practices, are assumed to be as follows:

- i) Attenuation of the post-development peak flows for the 5- and 100-year storm event to the pre-development (existing) peak flow;
- ii) Implementation of Enhanced (Level 1) 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:

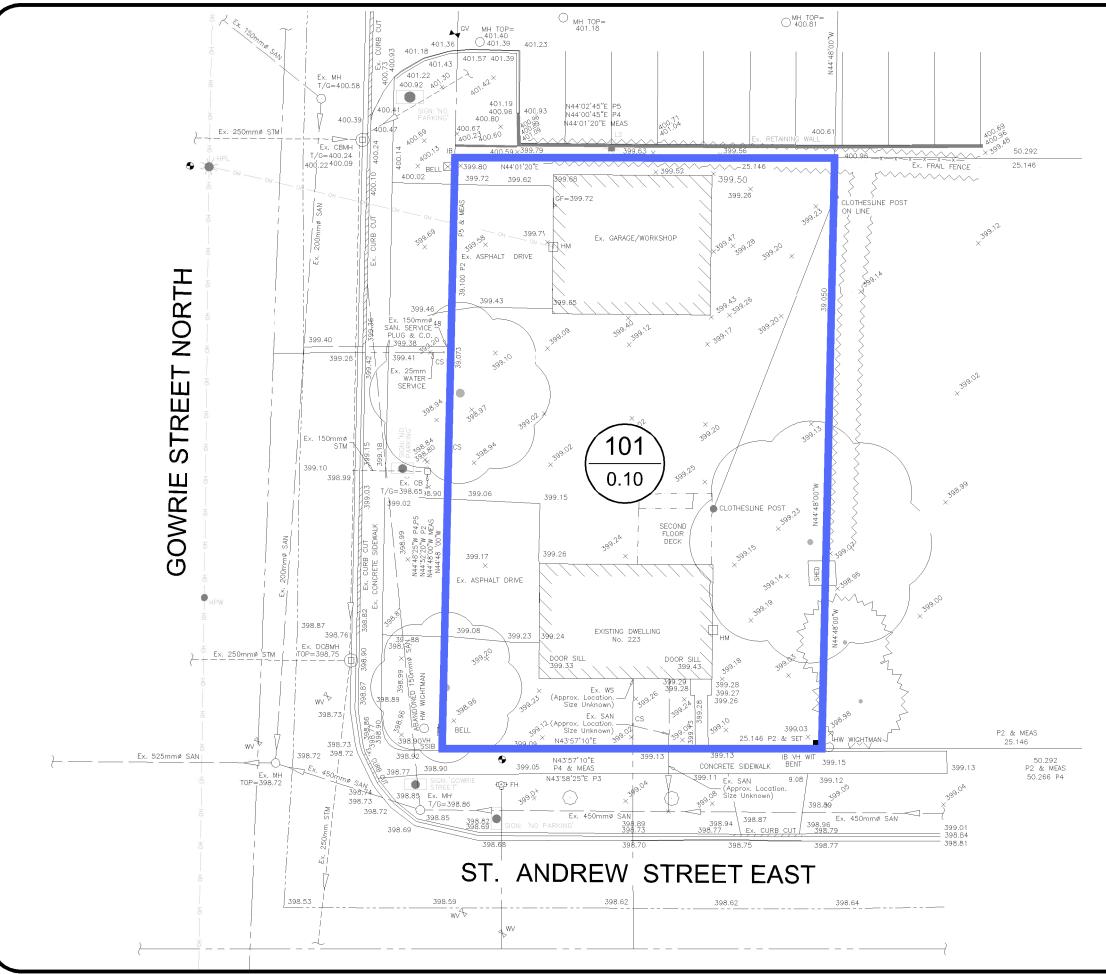
- i) Calculate the allowable runoff rates using MIDUSS NET;
- ii) Determine the percent impervious of the Site and catchment parameters for inclusion in MIDUSSS modeling; and,
- iii) Calculate post-development runoff hydrographs using MIDUSS NET.

The following table summarizes the catchments used in modeling of the Site. The post-development condition was separated into two catchment areas; the controlled area and the uncontrolled area. Figure 2.0 illustrates the limits of the pre-development catchment area. Figure 3.0 illustrates the limits of the post-development catchment areas.

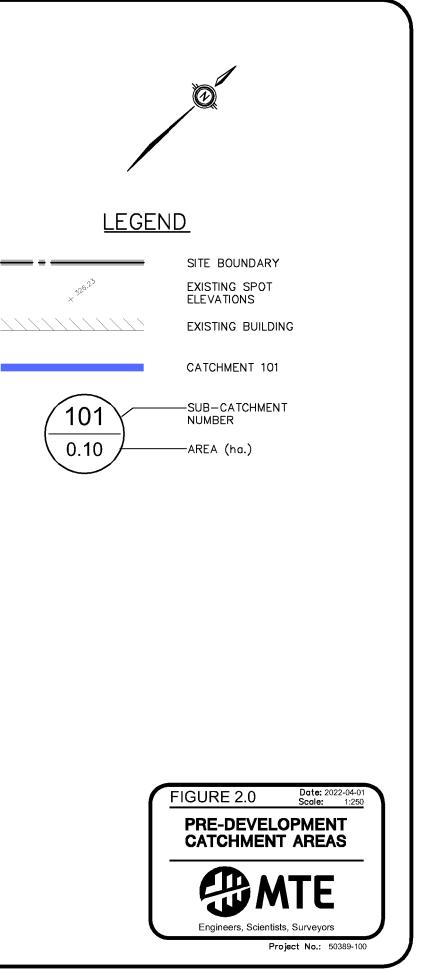
Table 4.1 – Catchment Parameters	Table 4.1 –	Catchment	Parameters
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#	Catchment	Area (ha)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)				
Pre-D	evelopment Catchme	ent Area									
101	Existing	0.10	32.7	78	98	2.0	8.0				
Post-Development Catchment Areas											
201	Rooftop Area	0.04	100.0	78	98	2.0	7.5				
202	Controlled Area	0.04	100.0	78	98	2.0	9.5				
203	Uncontrolled Area	0.02	40.1	78	98	4.5	2.0				

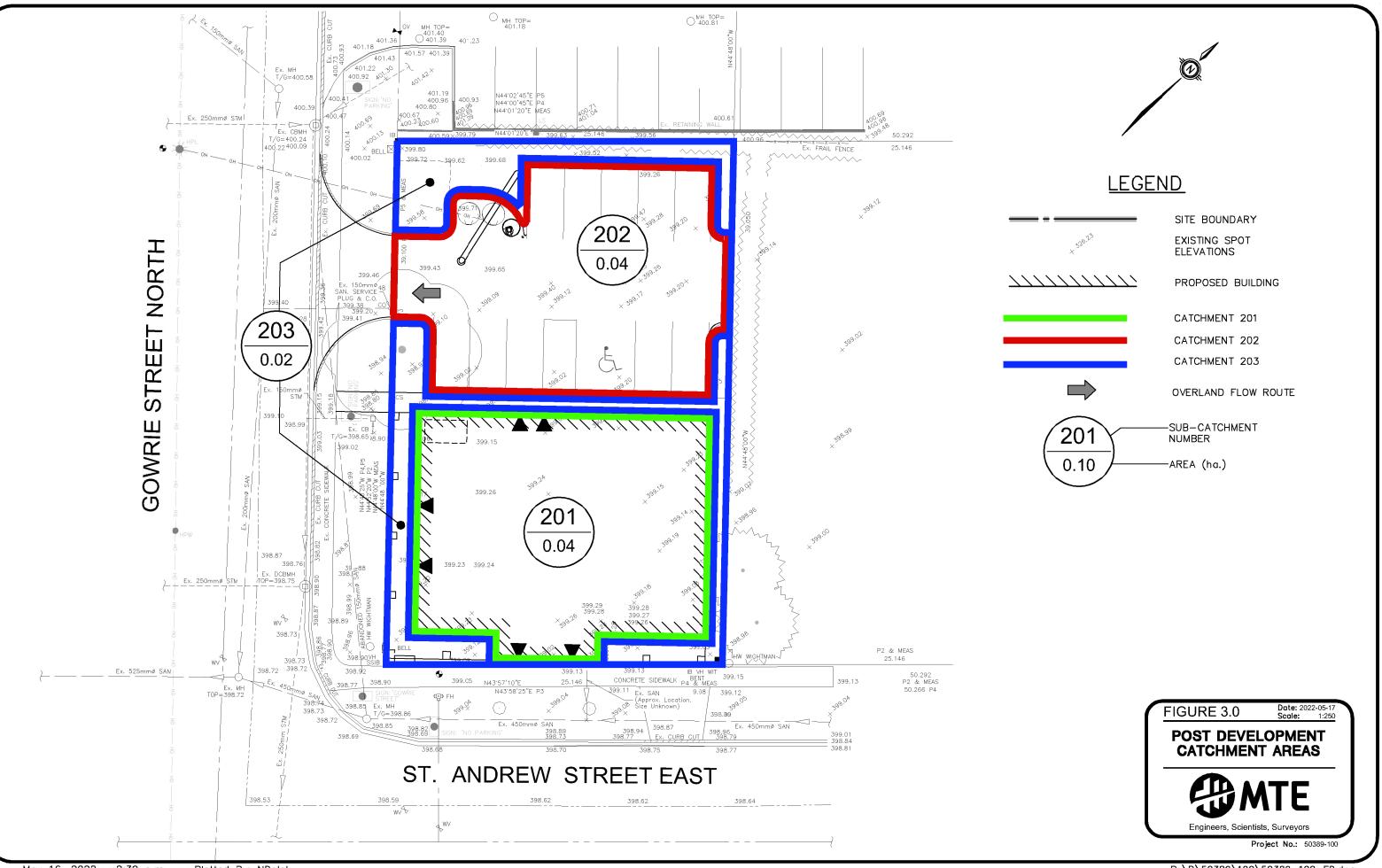
A geotechnical investigation was not available for this development at the time this report was published. Therefore, a conservative value of 78 was used for the pervious CN.



April 1, 2022 — 2:36 p.m. — Plotted By: SDu



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May 16, 2022 — 2:39 p.m. — Plotted By: NDalal

In order to achieve the stormwater management requirements for the Site, runoff generated from the parking areas will be controlled with a 60mm diameter orifice plate. Furthermore, runoff generated from the roof area will be controlled using two 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	5-Year Storm Event (m ³ /s)	100-Year Storm Event (m ³ /s)
Pre-Development	0.012	0.030
Post-Development	0.011	0.016

With the installation of the orifice plate and flow control roof drains, the post-development runoff from the controlled portion of the Site for the 5- and 100-year storm event is controlled to 0.008m³/s for both events. The maximum ponding depth on the rooftop as well as in the parking lot is 0.15m for the 100-year storm event. As above, the ponding values are subject to change at detailed design. Refer to Appendix D for the MIDUSS output.

4.3 Water Quality Control

A Stormceptor Model EFO4 will be installed on the storm sewer system to provide water quality control for the Site. The chosen unit is expected to provide Level 1 (Enhanced) water quality control. Refer to Appendix E 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 site preparation or demolition;
- ii) All erosion control measures are to be inspected and monitored by the contractor and repairs are to be completed as required;
- 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; and,
- iv) To minimize the amount of mud being tracked onto the roadway, a mud mat should be installed at the primary construction entrance.

5.0 Conclusions

Based on the foregoing analysis, it is concluded that:

- The proposed grading design will respect the existing grades along the property lines;
- Existing municipal infrastructure for water, sanitary, and storm is available along St. Andrew Street East and Gowrie Street North;
- Service connections for water, sanitary, and storm are proposed off of Gowrie Street North;
- The anticipated maximum day domestic water demand is 0.35L/s and the maximum fire flow demand is 60L/s based on OBC calculations. If required, a fire flow analysis will be completed during detailed design to confirm that the minimum residual pressure of 140kPa is achieved at the existing municipal hydrant;
- The proposed sanitary flow rate is expected to be 0.56L/s and the proposed piped stormwater flow rate is expected to be 8.0L/s during the 5-year storm event;
- Stormwater management quantity controls can be provided through two flow control roof drains and an on-line orifice plate; and,
- Stormwater quality control can be provided with the installation of a Stormceptor Model EFO4.

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

All of which is respectfully submitted,

MTE Consultants Inc.

DALLE

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Water Demand Calculation





223 St Andrew Street East

 FIRE FLOW DEMANDS

 Township of Centre Wellington, Ontario

 Project #:
 50389-100

 Date:
 March 25, 2022

 Date Printed:
 3/25/2022

 Design By:
 DXN

 Checked By:
 LEI

															l	Fire Fl	ow²								Domes	tic Flow ³	,4			
			Ontario Building Code							Fire Underwriters Survey																				
Node ID / Area ID / Building #		Description	# of Units	Population # of people	Bldg Area (1 st Floor)	Total Bldg Area	Volume	к	V	S _{tot}	Q	F L/min	F L/s	с	A	F L/min	(2) Occupancy Reduction	(3) Sprink l er Protection		F L/min	F L/s	Fire Flow (Max OBC/FUS)	MOE	ICI (Tri-City)	Total	Average Day ∠/s	Max Day	Peak Hour	Minimum Hour L/s	Max Day + Fire Flow
Prop. Bldg.	399.60	Mix-Use Residentia	17	# 01 people 30	368	3 2.39	1 6,53	5 10	6.535	2.00	130,694		60	0.80	<u>m²</u> 2,391		-15%	-30%	75%	11.000	183	183	0.078	0.048	0.126	0.126	0.348	0.522		184
		TOTALS FOR SITE	17	30	0 368	3 239	1 653	5			Max Fire	Flow =	60						Max Fir	e Flow =	183	183	0.08			0.13	0.35	0.52	0.05	184
																								Sum of	Maximum	Day Flow	s + OBC	Fire Flo	w (L/s) =	60
																								Sum of	Maximum	Day Flow	s + FUS	Fire Flo	ow (L/s) =	184

Assumptions:

1 The building area is based on the Site Plan by Fryett Turner Architects Inc. dated 2022-03-16. Assumed 1.77 persons per unit as per Region of Waterloo Water and Wastewater Monitoring Report 2017

2 The proposed building is assumed to be classified as occupancy group C (Residential Occupancy).

3 The proposed building will be non-combustible construction and be sprinklered.

4 Average Daily Demands for each building are based on "Tri City Water Distribution Master Plan Final Report" by AECOM, Dated May 2009:

Residential = 225 L/cap/day

5 Average Daily Demands for Industrial, Commercial, Institutional based on zone "WAT 4" in Table 3.12 of "Tri City Water Distribution Master Plan Final Report" by AECOM, Dated May 2009 and an assumption of 25 individuals: ICl= 166 L/cap/day x 25 cap / 24 / 60 /60

6 Peaking Factors based on "Design Guidelines for Drinking-Water Systems" (MOE, 2008):

Average Day =	1
Maximum Day =	2.75
Peak Hour =	4.13
Minimum Hour =	0.4



Sanitary Sewer Design Calculation



223 St Andrew	Street Ea	ist		ſ						Design Parameters										1									
Township of Cent	re Welling	on				RY SEW				•	Residenti	Average Daily Flow Mannings "n" 0.013 Residential 0.004 L/s/c Min. Velocity 0.6 m/sec Commercial 0.60 L/s/ha Max, Velocity 3.0 m/sec												-					
Project Number: Date: Design By: Checked By:	DXN LE	, 2022			Area Plan No:						Industrial	Industrial 0.50 L/s/ha Residential Harmon Peaking Factor (F) F = 1 + 14/(4 + P ^{0.5}) Inst. / School 2.50 L/s/ha Commercial Peaking Factor = 2.5 Residential Areas Infiltration 0.25 L/s/ha									MTE								
File:		9\100\Sanitary \$	Sewer Design	RESIDENTIAL AREAS AND POPULATION					SCHOOL, INSTITUTIONAL			INDUSTRIAL			INFILTRATION			DESIGN											
STREET	AREA NO.		HOLE TION TO MH	AREA	No. UNITS @ 1.76 PPU	No. UNITS @ PPU	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW		CUMUL	HECT. L/s/ha PEAK FLOW		CUMUL	L/s/ha	ZONING AREA			TOTALS- C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY
				ha			1000s	1000s		L/sec	ha	ha	L/sec	ha	ha	L/sec	ha	ha	L/sec	L/sec	ha	ha	L/sec	L/sec	т	%	тт	L/sec.	m/s
223 St Andrew St E		Bldg MH1A	MH1A Ex. Stub		17.00		0.030		4.354921 4.354921					0.01		0.0150 0.0150				0.0150 0.0150					7.8 6.5		150 150	21.5267 21.5267	1.219 1.219
Capacity Check		Ex. Stub	ROW																		0.10	0.10	0.0245	0.5852	9.7	2.00	200	46.3604	1.476



Storm Sewer Design Calculation



223 St Andrew	Street Eas	t								De	sign Parame	ters								
Township of Centre \	Vellington			ѕто	RM SEV	VER DE	SIGN SI	IEET	5 YEAR ST	ORM										
Project Number: Date: Design By: Checked By: File:	50389-100 April 1, 2022 DXN LEI Q:\50389\100\S		ign Sheet Kitcher	Drainage Are		<u>G AND PL</u>	JBLIC W	ORKS	Q=kAIC, k=(Intensity (I) = a = b = c =		Manning's "n" Min. Velocity Max. Velocity	0.013 0.800 6.000	m/s		B	T۸	Έ			
	LOCATION		•				STORMW	ATER FLO	w					DESIGN						
STREET	AREA NUMBER	MANHOLE FROM MH	LOCATION TO MH	AREA (A)	RUNOFF COEFF. (C)	AxC	CUMUL. A x C	TI TOTAL	ITRATION ME IN PIPE	RAIN INTENSITY (I)	(Q)	PIPE SIZE		SLOPE	CAPACITY	FULL FLOW VELOCITY	PIPE FULL			
				ha		ha	ha	min	min	mm/hr	L/s	mm	т	%	L/s	m/s	%			
223 St Andrew St E		Roof CBMH1 OGS2	CBMH1 OGS2 MH3	0.040 0.040 0.040				5-year flow	Laken from M Laken from M Laken from M	DUSS mode	8.00000		10.0 12.0 7.2	2.00 1.00 1.00	32.79844	1.2188 1.0440 1.0440	13.93 24.36 24.39			



MIDUSS Output



Pre-Development



			MIDUSS Output>"
			MIDUSS Version Version 2.25 rev. 473"
п			MIDUSS created Sunday, February 7, 2010"
		10	Units used: ie METRIC"
п		10	Job folder: Q:\50389\100\SWM\2022-04-01"
п			Output filename: 0. (30389 (100 (300) (2022-04-01))
п			Licensee name: A"
п			Company "
			Date & Time last used: 4/1/2022 at 1:56:29 PM"
п	31	т.	IME PARAMETERS"
п	71		Time Step"
		5.000 180.000	•
			Max. Storm length"
	32	1500.000	Max. Hydrograph"
п	52	1	TORM Chicago storm"
		1593.000	Chicago storm" Coefficient A"
		11.000	
			Constant B"
		0.879	Exponent C" Fraction R"
		0.400 180.000	Duration"
		1.000	
			Time step multiplier" aximum intensity 139.250 mm/hr"
			•
		6	
	33		005hyd Hydrograph extension used in this file" ATCHMENT 101"
	22	1	Triangular SCS"
п		1	Equal length"
		1	SCS method"
		101	Existing"
		32.700	-
п		0.100	% Impervious" Total Area"
п		8.000	Flow length"
		2.000	Overland Slope"
		0.067	Pervious Area"
п		8.000	Pervious length"
п		2.000	Pervious slope"
п		0.033	Impervious Area"
		8.000	Impervious length"
п		2.000	Impervious slope"
п		0.250	Pervious Manning 'n'"
		78.000	Pervious SCS Curve No."
			Pervious Runoff coefficient"
		0.303 0.100	Pervious Ia/S coefficient"
п		7.164	Pervious Initial abstraction"
		7.164 0.015	Impervious Manning 'n'"
		98.000	
		98.000	Impervious SCS Curve No." Impervious Runoff coefficient"
		0.855	Impervious Ia/S coefficient"
п		0.100	Impervious Initial abstraction"
		0.010	0.012 0.000 0.000 0.000 c.m/sec"
			0.012 0.000 0.000 0.000 C.M/Sec

"	Catchment 101	Pervious	Impervious	Total A	rea "
	Surface Area	0.067	0.033	0.100	hectare"
	Time of concentration	7.932	0.896	3.870	minutes"
	Time to Centroid	107.070	87.237	95.619	minutes"
	Rainfall depth	47.240	47.240	47.240	mm"
u –	Rainfall volume	31.79	15.45	47.24	c.m"
u –	Rainfall losses	32.903	6.933	24.411	mm"
н	Runoff depth	14.337	40.307	22.829	mm"
"	Runoff volume	9.65	13.18	22.83	c.m"
н	Runoff coefficient	0.303	0.853	0.483	п
"	Maximum flow	0.005	0.011	0.012	c.m/sec"
" 40	HYDROGRAPH Add Runoff	"			
н	4 Add Runoff "				
"	0.012 0.01	2 0.000	0.000"		
" 38	START/RE-START TOTALS	101"			
н	3 Runoff Totals on EX	IT"			
н	Total Catchment area		0	.100	hectare"
н	Total Impervious area		0	.033	hectare"
н	Total % impervious		32	.700"	
" 19	EXIT"				

 MIDUSS version Version 2.25 rev. 473" MIDUSS created Sunday, February 7, 2010" 10 Units used: ie METRIC" Job folder: Q:\503891100\SUM\2022-04-01" Licensee name: Company Date & Time last used: 4/1/2022 at 1:57:32 PM" TIME PARAMETERS" 5.000 Time Step" 1500.000 Max. Hydrograph" 32 STORM Chicago storm" 4688.000 Coefficient A" 17.000 Tonic step 0.400 France 0.400 France 0.400 France 0.400 France 0.600 Duration" 180.000 Duration" 1.0007 Time step multiplier" Maximum intensity 29.650 mm/hr" Total depth 87.263 mm" 6 100hyd Hydrograph extension used in this file" 33 CATCHMENT 101" 1000 Time step multiplier" 11 Tringular SCS" 1 Equal length" 32.700 % Impervious" 8.000 Flow length" 2.200 Vervious Service 0.633 Impervious Area" 8.000 Pervious Length" 0.633 Impervious Area" 8.000 Impervious Slope" 0.55 Pervious Scurve No." 0.482 Pervious Slope" 0.55 Pervious Scurve No." 0.482 Pervious Slope" 0.482 Pervious Manning 'n'' 7.500 Findervious Slope" 0.482 Pervious Manning 'n'' 98.000 Impervious Slope" 0.482 Pervious Manning 'n'' 98.000 Impervious Slope" 0.482 Pervious Runoff coefficient" 0.482 Pervious Manning 'n'				MIDUSS Output>"
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" 0.518 Impervious Initial abstraction"	"		0.100	•
			0.518	Impervious Initial abstraction"
" 0.030 0.000 0.000 0.000 c.m/sec"	"			0.030 0.000 0.000 0.000 c.m/sec"

"	Catchment 101	Pervious	Impervious	Total A	rea "
	Surface Area	0.067	0.033	0.100	hectare"
	Time of concentration	5.067	0.712	3.023	minutes"
	Time to Centroid	98.495	85.009	92.165	minutes"
	Rainfall depth	87.263	87.263	87.263	mm"
п	Rainfall volume	58.73	28.54	87.26	c.m"
"	Rainfall losses	45.221	10.722	33.940	mm"
"	Runoff depth	42.043	76.541	53.324	mm"
"	Runoff volume	28.29	25.03	53.32	c.m"
11	Runoff coefficient	0.482	0.877	0.611	п
"	Maximum flow	0.018	0.019	0.030	c.m/sec"
" 40	HYDROGRAPH Add Runoff	"			
"	4 Add Runoff "				
"	0.030 0.03	0.000	0.000"		
" 38	START/RE-START TOTALS	101"			
"	3 Runoff Totals on EX	IT"			
"	Total Catchment area		0	.100	hectare"
"	Total Impervious area		0	.033	hectare"
11	Total % impervious		32	.700"	
" 19	EXIT"				

Post-Development



<pre>MIDUSS version Version 2.25 rev. 473" MIDUSS created Sunday, February 7, 2010 Job folder: 0:\50389\100\SWM\2022.04.01 Output filename: 0:\50389\100\SWM\2022.04.01 Company ACCOMPANY ACCOMPANY</pre>				MIDUSS Output>"
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100.000 % Impervious" 100.000 % Impervious" 0.040 Total Area" 7.500 Flow length" 2.000 Overland Slope" 0.000 Pervious Area" 7.500 Pervious length" 2.000 Pervious length" 2.000 Pervious length" 2.000 Pervious slope" 0.040 Impervious Area" 7.500 Pervious length" 2.000 Impervious length" 2.000 Impervious length" 9.000 Impervious Slope" 0.040 Impervious length" 2.000 Impervious Slope" 0.040 Impervious Slope" 0.250 Pervious Slope" 0.250 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.000 Pervious Ia/S coefficient" 0.100 Pervious Initial abstraction" 0.015 Impervious SCS Curve No." 98.000 Impervious SCS Curve No."				
<pre>0.000 % Impervious 0.040 Total Area" 7.500 Flow length" 2.000 Overland Slope" 0.000 Pervious Area" 7.500 Pervious length" 2.000 Pervious slope" 0.040 Impervious Area" 7.500 Impervious length" 2.000 Impervious length" 0.250 Pervious slope" 0.250 Pervious Manning 'n'" 78.000 Pervious SCS Curve No." 0.000 Pervious SCS Curve No." 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No."</pre>				•
<pre>" 7.500 Flow length" " 2.000 Overland Slope" " 0.000 Pervious Area" " 7.500 Pervious length" " 2.000 Pervious slope" " 0.040 Impervious Area" " 7.500 Impervious length" " 2.000 Impervious length" " 2.000 Impervious slope" " 0.250 Pervious Manning 'n'" " 78.000 Pervious SCS Curve No." " 0.000 Pervious SCS Curve No." " 0.100 Pervious Ia/S coefficient" " 7.164 Pervious Initial abstraction" " 0.015 Impervious Manning 'n'" " 98.000 Impervious SCS Curve No."</pre>				
<pre>" " " " " " " " " " " " " " " " " " "</pre>				
 0.000 Pervious Area" 7.500 Pervious length" 2.000 Pervious slope" 0.040 Impervious Area" 7.500 Impervious length" 2.000 Impervious slope" 0.250 Pervious Manning 'n'" 78.000 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious SCS Curve No." 				-
<pre>" 7.500 Pervious length" " 2.000 Pervious slope" " 0.040 Impervious Area" " 7.500 Impervious length" " 2.000 Impervious slope" " 0.250 Pervious Manning 'n'" " 78.000 Pervious SCS Curve No." " 0.000 Pervious Runoff coefficient" " 0.100 Pervious Runoff coefficient" " 7.164 Pervious Initial abstraction" " 0.015 Impervious Manning 'n'" " 98.000 Impervious SCS Curve No."</pre>				•
<pre>" 2.000 Pervious slope" " 0.040 Impervious Area" " 7.500 Impervious length" " 2.000 Impervious slope" " 0.250 Pervious Manning 'n'" " 78.000 Pervious SCS Curve No." " 0.000 Pervious Runoff coefficient" " 0.100 Pervious Runoff coefficient" " 7.164 Pervious Initial abstraction" " 0.015 Impervious Manning 'n'" " 98.000 Impervious SCS Curve No."</pre>				
 0.040 Impervious Area" 7.500 Impervious length" 2.000 Impervious slope" 0.250 Pervious Manning 'n'" 78.000 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 				5
 7.500 Impervious length" 2.000 Impervious slope" 0.250 Pervious Manning 'n'" 78.000 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 				•
 2.000 Impervious slope" 0.250 Pervious Manning 'n'" 78.000 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 				•
 0.250 Pervious Manning 'n'" 78.000 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 	п			
 78.000 Pervious SCS Curve No." 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 				
 0.000 Pervious Runoff coefficient" 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 				•
 0.100 Pervious Ia/S coefficient" 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 				
 7.164 Pervious Initial abstraction" 0.015 Impervious Manning 'n'" 98.000 Impervious SCS Curve No." 	п			
" 0.015 Impervious Manning 'n'" " 98.000 Impervious SCS Curve No."	"			
" 98.000 Impervious SCS Curve No."				
·	"			
" 0.850 Impervious Runott coetticient"	"		0.850	İmpervious Runoff coefficient"
" 0.100 Impervious Ia/S coefficient"	"			
" 0.518 Impervious Initial abstraction"	"		0.518	Impervious Initial abstraction"
" 0.013 0.000 0.000 0.000 c.m/sec"	"			0.013 0.000 0.000 0.000 c.m/sec"

	Surface Area Surface Area Time of concentration Rainfall depth Rainfall volume Rainfall losses	Pervious 0.000 7.630 106.692 47.240 0.00 32.916	0.040 0.862 87.203 47.240 18.90 7.065	Total Area 0.040 0.862 87.203 47.240 18.90 7.065	hectare" minutes" minutes" mm" c.m" mm"
	кипотт аерсп	14.324 0.00	40.175 16.07	40.175 16.07	mm" c.m"
		0.000	0.850	0.850	"
u		0.000	0.013	0.013	c.m/sec"
					,
"					
"		0.000	0.000"		
"	54 POND DESIGN"				
	0.013 Current peak flow	c.m/sec"			
	0.030 Tanget outtion C.	m/sec"			
	10.1 Hydrograph volume	c.m"			
	10. Number of stages	metre"			
		metre"			
u	0		= False"		
"		Volume"			
"	0.000 0.000	0.000"			
"	0.0100/ 0.00000	0.02316"			
"	0.03333 0.00100	0.1851"			
	0.00000 0.00100	0.6250"			
	0.0000/ 0.00200	1.482"			
	0.08333 0.00250	2.893"			
	0.1000 0.00300	5.000"			
	0.110/ 0.00350	7.947" 11.843"			
		16.716"			
		10.710			
u		a Area/dra	ain Drain f	flow Roof s	slope"
u					H:1V"
"		•		-	0.000"
"	" Using 2 roofdrains on r	oofstorage	area of 300		
U	-	0.00			
"	' Maximum level	0.10		1	
"	' Maximum storage	6.44	12 c.m"		
"	Centrolual lag	1.79			
"	0.013 0.013	0.003	0.000 c.m/	/sec"	
	40 IIIDROGRAFII NEXT IIIR				
	5 NEXT TINK	0 000	0.000"		
	0.013 0.003	0.003	0.000"		
	55 CATCHMENT 202				
	I Intaligutar SCS				
	T Ednat Telikrii				

	1	SCS method"				
	202	Controlled Area"				
	100.000	% Impervious"				
	0.040	Total Area"				
	9.500					
	2.000	Flow length" Overland Slope"				
	0.000	Pervious Area"				
	9.500	Pervious length"				
	2.000	Pervious slope"				
	0.040	Impervious Area"				
	9.500	Impervious length"				
	2.000	Impervious slope"				
	0.250	Pervious Manning 'n				
	78.000	Pervious SCS Curve				
	0.000	Pervious Runoff coe				
	0.100	Pervious Ia/S coeff				
	7.164	Pervious Initial ab				
	0.015	Impervious Manning				
	98.000	Impervious SCS Curv				
	0.860	Impervious Runoff c				
	0.100	Impervious Ia/S coe				
"	0.518	Impervious Initial		u		
"		0.013 0.00			c.m/sec"	
	(Catchment 202	Pervious	Impervious	Total Area	п
"	1	Surface Area	0.000	0.040	0.040	hectare"
"		Fime of concentration	8.793	0.993	0.993	minutes"
"		Γime to Centroid	108.104	87.366	87.366	minutes"
	I	Rainfall depth	47.240	47.240	47.240	mm"
"	I	Rainfall volume	0.00	18.90	18.90	c.m"
"	I	Rainfall losses	32.934	6.595	6.595	mm"
"	I	Runoff depth	14.306	40.645	40.645	mm"
"	I	Runoff volume	0.00	16.26	16.26	c.m"
"	I	Runoff coefficient	0.000	0.860	0.860	п
"		Aaximum flow	0.000	0.013	0.013	c.m/sec"
"	40 I	HYDROGRAPH Add Runoff				
"	4	Add Runoff "				
"		0.013 0.01	.5 0.003	0.000"		
"		POND DESIGN"	<i>.</i>			
	0.015	Current peak flow	c.m/sec"			
	0.030	8	.m/sec"			
	32.3	Hydrograph volume	c.m"			
	8.	Number of stages"				
	398.330	Minimum water level				
	399.500	Maximum water level				
	398.330 0	Starting water leve		- Ealco"		
	0	Keep Design Data: 1 Level Discharge	Volume"	- Faise		
п		398.330 0.000	0.000"			
п			1.01E-05"			
"		399.330 0.00773	0.7400"			
			0.7400			

"			399.380 0.00793	4.310"	
"			399.430 0.00812 1	.3.240"	
"			399.480 0.00831 2	6.810"	
"			399.500 0.00839 3	2.970"	
"			399.550 0.00857 4	9.750"	
"		1.	ORIFICES"		
			Orifice Orifice Or	ifice Number	of"
"			invert coefficie dia	meter orifi	ces"
"			398.330 0.630 0	.0600 1.0	300"
"		Pe	ak outflow	0.008	c.m/sec"
		Ма	ximum level	399.365	metre"
"		Ма	ximum storage	3.260	c.m"
"		Ce	ntroidal lag	1.665	hours"
"			0.013 0.015	0.008 0.0	000 c.m/sec"
"	40	HY	DROGRAPH Combine 1		
"		6	Combine "		
"		1	Node #"		
"			Total Site"		
"		Ма	ximum flow	0.008	c.m/sec"
"		Ну	drograph volume	31.993	c.m"
"			0.013 0.015	0.008	0.008"
"	40	HY	DROGRAPH Start - New Tr	'ibutary"	
"		2	Start - New Tributary"	1	
"			0.013 0.000	0.008	0.008"
"	33	CA	TCHMENT 203"		
"		1	Triangular SCS"		
"		1	Equal length"		
"		1	SCS method"		
"		203			
"		40.100	•		
"		0.020	Total Area"		
"		2.000	Flow length"		
"		4.500	Overland Slope"		
"		0.012	Pervious Area"		
"		2.000	Pervious length"		
"		4.500	Pervious slope"		
"		0.008	Impervious Area"		
"		2.000	Impervious length"		
"		4.500	Impervious slope"		
"		0.250	Pervious Manning 'n'"		
"		78.000	Pervious SCS Curve No.		
		0.299	Pervious Runoff coeffi		
		0.100	Pervious Ia/S coeffici		
		7.164	Pervious Initial abstr		
		0.015	Impervious Manning 'n'		
"		98.000	Impervious SCS Curve N		
"		0.773	Impervious Runoff coef		
		0.100	Impervious Ia/S coeffi		
		0.518	Impervious Initial abs		
"			0.003 0.000	0.008	0.008 c.m/sec"

	40	Surf Time Rain Rain Rain Runo Runo Maxi HYDR	chment 203 ace Area of conce to Centr fall dept fall loss off depth off volume off coeff mum flow ROGRAPH Ac	entratio roid th ume ses e icient dd Runof		Pervi 0.012 2.707 100.4 47.24 5.66 33.13 14.10 1.69 0.299 0.001	2 7 148 10 37 32	Impe 0.00 0.30 86.4 47.2 3.79 10.7 36.5 2.93 0.77 0.00	8 6 99 40 16 24 3	Total / 0.020 1.184 91.601 47.240 9.45 24.147 23.093 4.62 0.489 0.003		<pre>" hectare" minutes" minutes" mm" c.m" mm" c.m" " c.m/sec"</pre>
		4 A	dd Runof									
			0.003				0.008		0.008"			
	40		ROGRAPH Co		ut	flow"						
		8 C	Copy to Ou		~~'	-						
	40	חסעוו	0.003 ROGRAPH	3 0. Combine	60:	3 1"	0.003		0.008"			
	40		Combine "	COMDITIE		T						
			lode #"									
			otal Site	"								
"			mum flow	-			0.01	11	c.m/se	ec"		
"		Hydr	rograph vo	olume			36.61	12	c.m"			
п		-	0.00		00	3	0.003		0.011"			
"	38	STAR	RT/RE-STAF	RT TOTAL	s :	203"						
"		3 R	Runoff Tot	als on	EX:	IT"						
"			al Catchme							.100		tare"
"			al Impervi		а					.088	hect	tare"
"			al % imper	rvious					88.	.020"		
"	19	EXIT	- 11									

			MIDUSS Output>"
			MIDUSS version Version 2.25 rev. 473"
п			MIDUSS created Sunday, February 7, 2010"
		10	Units used: ie METRIC"
		10	Job folder: Q:\50389\100\SWM\2022-04-01"
			Output filename: 100 Year Post.out"
п			Licensee name: A"
			Company "
			Date & Time last used: 4/1/2022 at 1:40:35 PM"
	31	T	IME PARAMETERS"
п		5.000	Time Step"
		180.000	Max. Storm length"
		1500.000	Max. Hydrograph"
"	32		TORM Chicago storm"
		1	Chicago storm"
		4688.000	Coefficient A"
		17.000	Constant B"
"		0.962	Exponent C"
"		0.400	Fraction R"
"		180.000	Duration"
		1.000	Time step multiplier"
"		Ma	aximum intensity 239.650 mm/hr"
"		Т	otal depth 87.263 mm"
		6	100hyd Hydrograph extension used in this file"
	33	C	ATCHMENT 201"
		1	Triangular SCS"
		1	Equal length"
		1	SCS method"
		201	Rooftop Area"
		100.000	% Impervious"
		0.040	Total Area"
		7.500	Flow length"
		2.000	Overland Slope"
		0.000	Pervious Area"
		7.500	Pervious length"
		2.000	Pervious slope"
		0.040	Impervious Area"
		7.500	Impervious length"
		2.000	Impervious slope"
		0.250 78.000	Pervious Manning 'n'" Pervious SCS Curve No."
		0.000	Pervious Runoff coefficient"
		0.000	Pervious Ia/S coefficient"
		7.164	Pervious Initial abstraction"
		0.015	Impervious Manning 'n'"
		98.000	Impervious SCS Curve No."
		0.873	Impervious Runoff coefficient"
		0.100	Impervious Ia/S coefficient"
		0.518	Impervious Initial abstraction"
		0.010	0.023 0.000 0.000 0.000 c.m/sec"

	Surface Area Time of concentration Time to Centroid Rainfall depth Rainfall volume Rainfall losses	98.249 87.263 0.00 45.246	0.040 0.685 85.004 87.263 34.91 11.072	Total Area 0.040 0.685 85.004 87.263 34.91 11.072	hectare" minutes" minutes" mm" c.m" mm"
	кипотт аерсп	42.017	76.191	76.191	mm"
	RUNOTT VOLUME	0.00	30.48	30.48	c.m" "
	RUNOTT COETTICIENC	0.000 0.000	0.873 0.023	0.873 0.023	c.m/sec"
			0.025	0.025	C.III/SEC
"		3 0.000	0.000"		
		0.000	0.000		
"		c.m/sec"			
"	•	.m/sec"			
"	30.5 Hydrograph volume	c.m"			
"	10. Number of stages"				
"	0.000 MINIMUM Water level				
	0.150 Maximum water ievei				
	0.000 Starting water ieve.		- 1 "		
	Ø Keep Design Data: I	-	= False"		
	Level Discharge	Volume"			
	0.000 0.000	0.000" 0.02316"			
		0.1851"			
		0.6250"			
		1.482"			
"		2.893"			
"		5.000"			
	0.1167 0.00350	7.947"			
"	0.1333 0.00400	11.843"			
"	0.1500 0.00450	16.716"			
"	I. RUUFTUP				
	Roof area Store are				-
	nectare necta			-	H:1V"
	0.040 0.03				9.000"
	Using 2 roofdrains on a	-			etre"
	PEAK OULTIOW	0.00 0.14			
	Maximum ievei Maximum storage	15.14			
	Centroidal lag	2.0			
	6	0.004	0.000 c.m	/sec"	
		0.001	0.000 0.00	See	
"					
"		4 0.004	0.000"		
"					
"	1 Triangular SCS"				
"	1 Equal length"				

	1	SCS method"				
	202	Controlled Area"				
	100.000	% Impervious"				
	0.040	Total Area"				
	9.500	Flow length"				
	2.000	Overland Slope"				
	0.000	Pervious Area"				
	9.500	Pervious length"				
	2.000	Pervious slope"				
	0.040	Impervious Area"				
	9.500	Impervious length"				
	2.000	Impervious slope"				
	0.250	Pervious Manning 'n				
	78.000	Pervious SCS Curve				
	0.000	Pervious Runoff coe				
	0.100	Pervious Ia/S coeff				
	7.164	Pervious Initial ab				
	0.015	Impervious Manning				
	98.000	Impervious SCS Curv				
	0.887	Impervious Runoff c				
	0.100	Impervious Ia/S coe Impervious Initial		u .		
	0.518	0.023 0.00			c.m/sec"	
	c	atchment 202	Pervious		Total Area	п
		urface Area	0.000	0.040	0.040	hectare"
		ime of concentration		0.790	0.790	minutes"
		ime to Centroid	99.197	85.061	85.061	minutes"
		ainfall depth	87.263	87.263	87.263	mm"
		ainfall volume	0.00	34.91	34.91	c.m"
		ainfall losses	45.262	9.829	9.829	mm"
		unoff depth	42.001	77.434	77.434	mm"
		unoff volume	0.00	30.97	30.97	c.m"
		unoff coefficient	0.000	0.887	0.887	"
		aximum flow	0.000	0.023	0.023	c.m/sec"
		YDROGRAPH Add Runoff		0.025	0.025	com/ Sec
п	4	Add Runoff "				
		0.023 0.02	6 0.004	0.000"		
	54 P	OND DESIGN"	0.004	0.000		
	0.026	Current peak flow	c.m/sec"			
п	0.030	•	.m/sec"			
	61.5	Hydrograph volume	c.m"			
	8.	Number of stages"	C T			
	398.330	Minimum water level	metre"			
	399.500	Maximum water level				
	398.330	Starting water leve				
	0	Keep Design Data: 1		= False"		
"	-	Level Discharge	Volume"			
"		398.330 0.000	0.000"			
"			1.01E-05"			
		399.330 0.00773	0.7400"			

"Maximum level 399.428 mer "Maximum storage 12.961 c.m "Centroidal lag 1.968 hour 0.023 0.026 0.008 0.000 "40 HYDROGRAPH Combine 1" "6 Combine " " 6 "10 Node #" " 1 Node #" " Total Site" 0.008 c.m "40 Hydrograph volume 61.825 c.m "40 HYDROGRAPH Start - New Tributary" 2	
<pre>" 399.430 0.00812 13.240" " 399.480 0.00831 26.810" 399.500 0.00839 32.970" 399.550 0.00857 49.750" " 0rifice Orifice Orifice Number of" " 0rifice Orifice Orifice Number of" " 0rifice Orifice Orifice Number of" " 1. ORIFICES" " 0rifice Orifice Orifice Number of" " 1. ORIFICES" " 0rifice Orifice 0.008 c.1 " 0.023 0.026 0.008 0.000 0 " 40 HYDROGRAPH Combine 1" " 6 Combine " " 1 Node #" " Total Site" " Maximum flow 0.008 c.1 Hydrograph volume 61.825 c.1 0.023 0.026 0.008 0.000 " 40 HYDROGRAPH Start - New Tributary" " 2 Start - New Tributary"</pre>	tre" n" rs" c.m/sec"
<pre>" 399.480 0.00831 26.810" 399.500 0.00839 32.970" 399.550 0.00857 49.750" " 1. ORIFICES" " Orifice Orifice Orifice Number of" invert coefficie diameter orifices" 398.330 0.630 0.0600 1.000" " Peak outflow 0.008 c.1 " Maximum level 399.428 me Maximum storage 12.961 c.1 " Maximum storage 12.961 c.1 " Centroidal lag 1.968 hou 0.023 0.026 0.008 0.000 0 " 40 HYDROGRAPH Combine 1" " 6 Combine " " 1 Node #" " Total Site" " Maximum flow 0.008 c.1 Hydrograph volume 61.825 c.1 0.023 0.026 0.008 0.000 " 40 HYDROGRAPH Start - New Tributary" " 2 Start - New Tributary"</pre>	tre" n" rs" c.m/sec"
<pre>" 399.500 0.00839 32.970" 399.550 0.00857 49.750" " 1. ORIFICES" " Orifice Orifice Orifice Number of" invert coefficie diameter orifices" 398.330 0.630 0.0600 1.000" " Peak outflow 0.008 c.n " Maximum level 399.428 me Maximum storage 12.961 c.n Centroidal lag 1.968 hour 0.023 0.026 0.008 0.000 " 40 HYDROGRAPH Combine 1" " 6 Combine " " 1 Node #" " Total Site" " Maximum flow 0.008 c.n Hydrograph volume 61.825 c.n 0.023 0.026 0.008 0.00 " 40 HYDROGRAPH Start - New Tributary" " 2 Start - New Tributary"</pre>	tre" n" rs" c.m/sec"
<pre>" 399.550 0.00857 49.750" " 1. ORIFICES" " Orifice Orifice Orifice Number of"</pre>	tre" n" rs" c.m/sec"
1. ORIFICES" Orifice Orifice Orifice Number of" invert coefficie diameter orifices" 398.330 0.630 0.0600 1.000" Peak outflow 0.008 C.1 Maximum level 399.428 mer Maximum storage 12.961 C.1 Centroidal lag 1.968 hour 0.023 0.026 0.008 0.000 40 HYDROGRAPH Combine 1" 6 Combine " 1 Node #" " Total Site" 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00 " 0.023 0.026 0.008 0.00	tre" n" rs" c.m/sec"
" Orifice Orifice Orifice Number of" " invert coefficie diameter orifices" " 398.330 0.630 0.0600 1.000" " Peak outflow 0.0600 1.000" " Peak outflow 0.0600 1.000" " Peak outflow 0.0600 1.000" " Maximum level 399.428 mer " Maximum storage 12.961 c.1 " Maximum storage 12.961 c.1 " Centroidal lag 1.968 hour 0.023 0.026 0.008 0.000 " 40 HYDROGRAPH Combine 1 " Total Site"	tre" n" rs" c.m/sec"
<pre>invert coefficie diameter orifices" 398.330 0.630 0.0600 1.000" Peak outflow 0.008 c.n Maximum level 399.428 mee Maximum storage 12.961 c.n Centroidal lag 1.968 hour 0.023 0.026 0.008 0.000 40 HYDROGRAPH Combine 1" 6 Combine " 1 Node #" Total Site" Maximum flow 0.008 c.n Hydrograph volume 61.825 c.n 0.023 0.026 0.008 0.00 40 HYDROGRAPH Start - New Tributary" 2 Start - New Tributary"</pre>	tre" n" rs" c.m/sec"
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" 1 Triangular SCS"	
" 1 Equal length"	
" 1 SCS method"	
" 203 Uncontrolled Area"	
" 40.100 % Impervious"	
" 0.020 Total Area"	
" 2.000 Flow length"	
" 4.500 Overland Slope"	
" 0.012 Pervious Area"	
" 2.000 Pervious length"	
" 4.500 Pervious slope"	
" 0.008 Impervious Area"	
" 0.008 Impervious Area" " 2.000 Impervious length"	
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		Catchment 20 Surface Area Time of conc Time to Cent Rainfall dep Rainfall vol Rainfall los Runoff depth Runoff volum Runoff coeff Maximum flow	entration roid th ume ses e ficient	Pervi 0.012 1.729 93.99 87.26 10.45 45.48 41.77 5.00 0.479 0.003	2 9 5 5 3 8 7 5 9	Impervious 0.008 0.243 83.941 87.263 7.00 16.798 70.466 5.65 0.808 0.005	Total / 0.020 0.941 88.663 87.263 17.45 33.983 53.280 10.66 0.611 0.008	hectare" minutes" minutes" c.m" mm"
"	40	HYDROGRAPH A						- · ··· ,
"		4 Add Runof	f "					
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	40	HYDROGRAPH	Combine	1"				
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		1 Node #" Total Sit	~"					
		Maximum flow			0.03	L6 c.m/se	د"	
п		Hydrograph v			72.48			
п		0.00		8	0.008	0.016"		
	38	START/RE-STA		-		0.010		
"			tals on EX					
"		Total Catchm	ent area			0	.100	hectare"
u		Total Imperv	ious area			0	.088	hectare"
"		Total % impe	rvious			88	.020"	
"	19	EXIT"						







Province:	Ontario		Project Name:	223 St. Andrew	
City:	Fergus		Project Number:	50389-100	
Nearest Rainfall Station:	WATERLOO WELLINGTON A	P	Designer Name:	Dain Na	
Climate Station Id:	6149387		Designer Company:	MTE Consultants Ir	าс.
Years of Rainfall Data:	34		Designer Email:	dna@mte85.com	
			Designer Phone:	519-743-6500	
Site Name:			EOR Name:		
Drainage Area (ha):	0.08		EOR Company:		
% Imperviousness:	100.00	-	EOR Email:		
•	efficient 'c': 0.90		EOR Phone:		
Target TSS Removal (%): Required Water Quality Runo	80.0 off Volume Capture (%):	90.00			Reduction ummary
Estimated Water Quality Flor		2.87		Stormceptor Model	TSS Removal Provided (%)
Oil / Fuel Spill Risk Site?		Yes		EFO4	95
Upstream Flow Control?		No		EFO6	99
Peak Conveyance (maximum) Flow Rate (L/s):			EFO8	100
Site Sediment Transport Rate	(kg/ha/yr):			EFO10	100
I				EFO12	100
	Estimated	d Net An	Recommended Si nual Sediment (Ti ater Quality Runc	SS) Load Reduct	ion (%): 9



Forterra





THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

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

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





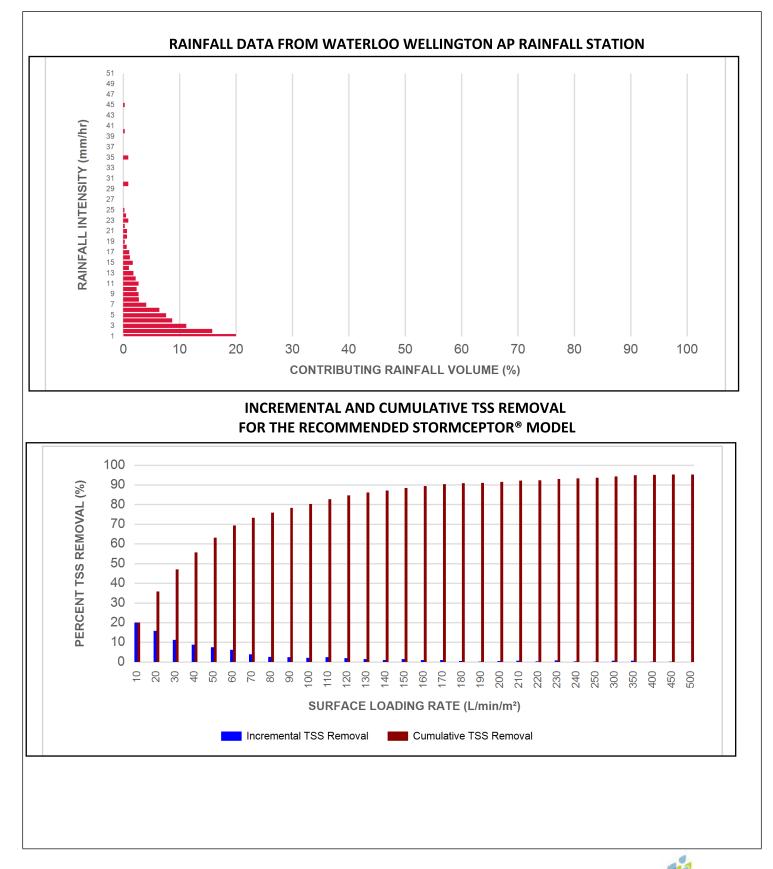


Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.0	20.0	0.20	12.0	10.0	100	20.0	20.0
2	15.8	35.8	35.8 0.40 24.0 20.0		100	15.8	35.8	
3	11.2	47.0	0.60	36.0	30.0	100	11.2	47.0
4	8.7	55.7	0.80	48.0	40.0	100	8.7	55.7
5	7.6	63.3	1.00	60.0	50.0	98	7.4	63.1
6	6.4	69.7	1.20	72.0	60.0	96	6.2	69.3
7	4.1	73.8	1.40	84.0	70.0	94	3.9	73.2
8	2.8	76.7	1.60	96.0	80.0	91	2.6	75.8
9	2.7	79.4	1.80	108.0	90.0	90	2.4	78.2
10	2.4	81.7	2.00	120.0	100.0	89	2.1	80.3
11	2.7	84.5	2.20	132.0	110.0	88	2.4	82.7
12	2.2	86.7	2.40	144.0	120.0	87	1.9	84.6
13	1.8	88.4	2.60	156.0	130.0	85	1.5	86.1
14	1.0	89.5	2.80	168.0	140.0	84	0.9	87.0
15	1.7	91.2	3.00	180.0	150.0	83	1.4	88.4
16	1.2	92.3	3.20	192.0	160.0	82	1.0	89.4
17	1.1	93.5	3.40	204.0	170.0	81	0.9	90.3
18	0.6	94.1	3.60	216.0	180.0	80	0.5	90.8
19	0.3	94.3	3.80	228.0	190.0	78	0.2	91.0
20	0.7	95.0	4.00	240.0	200.0	77	0.5	91.5
21	0.7	95.7	4.20	252.0	210.0	77	0.5	92.1
22	0.3	96.0	4.40	264.0	220.0	76	0.2	92.3
23	0.9	96.9	4.60	276.0	230.0	76	0.7	93.0
24	0.5	97.4	4.80	288.0	240.0	75	0.4	93.3
25	0.2	97.6	5.00	300.0	250.0	75	0.1	93.5
30	0.9	98.5	6.00	360.0	300.0	73	0.7	94.2
35	0.9	99.4	7.01	420.0	350.0	71	0.6	94.8
40	0.3	99.7	8.01	480.0	400.0	69	0.2	95.0
45	0.3	100.0	9.01	540.0	450.0	66	0.2	95.2
50	0.0	100.0	10.01	600.0	500.0	64	0.0	95.2
	•		Es	timated Ne	t Annual Sedim	ent (TSS) Loa	d Reduction =	95 %

Climate Station ID: 6149387 Years of Rainfall Data: 34









FORTERRA





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

SCOUR PREVENTION AND ONLINE CONFIGURATION

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

DESIGN FLEXIBILITY

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

OIL CAPTURE AND RETENTION

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



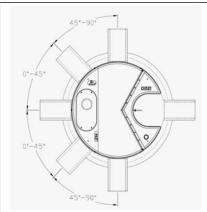












INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

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

					Poll	utant C	apacity					
Stormceptor EF / EFO	Moo Diam		Pipe In	(Outlet vert to Floor)	Oil Vo	lume	Sedi	mended ment nce Depth *	Maxiı Sediment ^v		Maxin Sediment	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EF012	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = $1.6 \text{ kg/L} (100 \text{ lb/ft}^3)$

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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





Stormceptor[®]EF Sizing Report

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1 4 ft (1219 mm) Diameter OGS Units:
6 ft (1829 mm) Diameter OGS Units:
8 ft (2438 mm) Diameter OGS Units:
10 ft (3048 mm) Diameter OGS Units:
12 ft (3657 mm) Diameter OGS Units:

 $\begin{array}{l} 1.19 \ m^{3} \ sediment \ / \ 265 \ L \ oil \\ 3.48 \ m^{3} \ sediment \ / \ 609 \ L \ oil \\ 8.78 \ m^{3} \ sediment \ / \ 1,071 \ L \ oil \\ 17.78 \ m^{3} \ sediment \ / \ 1,673 \ L \ oil \\ 31.23 \ m^{3} \ sediment \ / \ 2,476 \ L \ oil \\ \end{array}$

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall







remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada, and only rainfall intensities greater than 0.5 mm/hr shall be included in sizing calculations. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m² to 1400 L/min/m², and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m² and 1400 L/min/m² shall be based on linear interpolation of data between consecutive tested surface loading rates.

3.2.3 Sediment removal efficiency for surface loading rates less than the lowest tested surface loading rate of 40 $L/min/m^2$ shall be assumed to be identical to the sediment removal efficiency at 40 $L/min/m^2$. No extrapolation shall be allowed that results in a sediment removal efficiency that is greater than that demonstrated at 40 $L/min/m^2$.

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m² shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m², and shall be calculated using a simple proportioning formula, with 1400 L/min/m² in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m².

The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m².

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This reentrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a







surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m² to 2600 L/min/m²) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

