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3210 Albion Road South, Ottawa, ON

Site Servicing and Stormwater Management Report

Date: October 30, 2025

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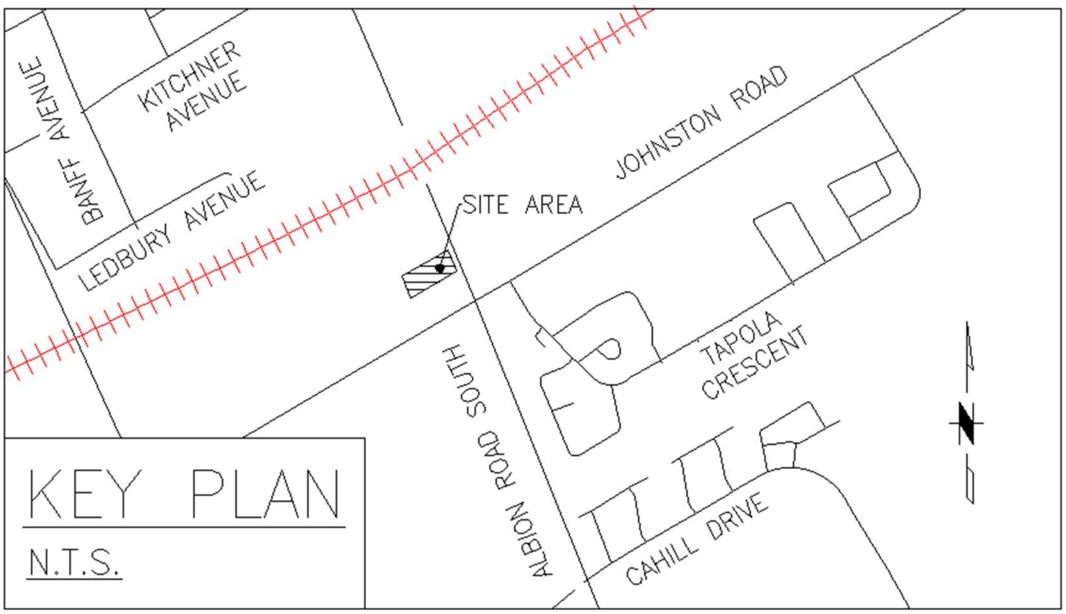
1 Introduction

Engineering for Industry (EFI) has been retained by Roof Maintenance Solutions Inc. (RMS) to complete a site servicing and stormwater management report for the property located at 3210 Albion Road South, Ottawa, ON. The site consists of one parcel with an area of 0.49 ha. The client is planning to develop the site into three light industrial warehouse units. The development consists of two buildings. Building A accommodates two units, and the building B has one unit. The site is bounded to the northeast by Albion Road South. The other sides are adjacent to commercial establishments. The overall key plan of the site is presented in **Figure 1** below.

Figure 1 – Key Plan



This report has been prepared regarding the functional servicing and water and storm water management (SWM) requirements set forth by the City of Ottawa; proposing a design which meets the requirements for the site. It is to be read in conjunction with the accompanying engineering drawings (drawings **C100** to **C108**) which are attached as **Appendix D**. The report and accompanying engineering drawings is to be submitted to the City of Ottawa in support of the site plan application for the above project.

2 Site Servicing

The objective of the site servicing design is to provide proper sanitary sewages servicing, a suitable domestic water supply and to ensure that appropriate fire protection is provided for the proposed development. The servicing criteria, the expected sewage flows, and the water demands are to conform to the requirements of the city of Ottawa's standards & design guidelines for Sewer and water distribution systems.

2.1 Sanitary Servicing

Per City of Ottawa's GIS (Geo-Ottawa) a 450mm sanitary main exists along the Albion Road South as shown in **Figure 2** below. The subject development will be serviced by a new 200mm lateral service which will be connected to the existing sanitary main.

Figure 2 – Site on City of Ottawa's GIS

Anticipated sanitary flows is calculated based on City of Ottawa's "Sewer Design Guidelines". The guideline requires that the sewers be designed for the sum of peak design flow and infiltration allowance. The average flow for light industrial usage is assumed to be 35,000 L/ha/day. This results in the following average daily flow for the proposed development:

$$Average\ Daily\ Flow\ = 35{,}000\ L/ha/day\ \times 0.49\ ha\ = 17{,}150\ L/day\ = 0.198\ L/s$$

The peaking factor applicable for sewage flows from industrial areas shall be based on the Appendix 4-B of the guidelines, which yields a peaking factor of 7.4 for proposed light industrial development and the following peak flow:

$$Peak\ Flow = 0.198\ L/s\ \times 7.4\ \approx 1.47\ L/s$$

Considering an infiltration allowance of 0.28 L/s/ha, the infiltration flow will be:

$$Inflitration\ Flow = 0.28\ L/s/ha\ \times 0.49\ ha\ \approx 0.137\ L/s$$

Hence, the sanitary sewer design flow will be:

$$Design\ Flow = 1.47\ L/s\ + 0.137\ L/s\ \approx 1.61\ L/s$$

The proposed sanitary service lateral is a 200 mm PVC pipe with a minimum slope of 1.5%. Two manholes (**SAN100** and **SAN101**) will be installed inside the property and near the property line for future maintenance and monitoring purposes. More details about the proposed sanitary lateral and manholes can be found in drawing **C103** (Site Servicing Plan).

The Sanitary Sewer Desing Sheet in **Appendix A** establishes the adequacy of the proposed service lateral. The following table summarizes the results of the calculation. It can bee seen that the velocities are between the minimum and maximum velocities of 0.6 m/s and 3.0 m/s.

Table 1: Sanitary Sewer Flows

From	To	Pipe Dia. (mm)	Pipe Slope (%)	Peak Flow (L/s)	Full Flow Capacity (L/s)	Full Flow Velocity (m/s)	Peak Flow Velocity (m/s)
Building	SAN100	200	1.57	1.48	41.1	1.31	0.62
SAN100	SAN101	200	1.5	1.60	40.2	1.28	0.62
SAN101	Main	200	1.96	1.61	45.9	1.46	0.69

2.2 Water Servicing

The site is planned to be serviced by a new ⌀ 150 mm water service off the existing ⌀ 152 mm watermain on Albion Road South. The water demand for the site includes the water required for fire protection and domestic water usage.

Water demands for the site are anticipated to meet the flows noted in the Ministry of Environment's Design Guidelines for Drinking Water Systems and the "Ottawa Design Guidelines - Water Distribution" (2010). The requirements, calculations and analysis are presented in the following subsections.

2.2.1 Calculation of Average Daily, Maximum Day and Maximum Hour Demands

Based on "Ottawa Design Guidelines - Water Distribution", the average day demand for the proposed light industrial development is taken to be 35,000 L/ha/day. The subject site has an area of about 0.49 ha. Thus, the average daily demand would be:

$$Average\ Day\ Demand\ = 35{,}000\ L/ha/day\ \times 0.49\ ha\ = 17{,}150\ L/day\ = 0.198\ L/s$$

The above guideline specifies that Table 3-3 of the MOE's "Design Guidelines for Drinking-Water Systems" (2008) to be used for maximum day and maximum hour peaking factors for sites with populations less than 500. The MOE Guidelines recommends that for determining the equivalent population for a commercial/industrial area, "the area occupied by the commercial/industrial complex be considered at an equivalent population density to the surrounding residential lands". Ottawa's guidelines set this density as 60 persons per gross hectare. This yields the following number for the population for the proposed development:

$$Population\ = 0.49\ ha\ \times 60\,\frac{person}{ha} = 29.4\ person$$

Alternatively, an estimation of the population can be made by using the occupancy load (OBC Table 3.1.17.1) for the proposed industrial development. The total floor area is 1,627 m^2, thus:

$$Occupancy\ Load\ = 1627\ sqm\ \div\ 46\,\frac{sqm}{person} = 35\ person$$

Based on the above estimations, a population of 30 is used to determine a conservative value for the peaking factors from Table 3-3 of "Design Guidelines for Drinking-Water Systems". This yields the following values for maximum day and peak hour demands:

$$Maximum\ Day\ Demand\ = 17{,}150\ L/day\ \times 9.5\ = 162{,}925\ L/day\ = 1.89\ L/s$$

$$Peak\ Hour\ Demand\ = 0.198\ L/s\ \times 14.3 = 2.84\ L/s$$

The following table summarizes the average daily, maximum day and maximum hour demands:

Table 2: Average Daily, Maximum Day and Maximum Hour Demands

Description	Demand Flow	
	L/day	L/s
Average Day Demand	17,150	0.198
Maximum Day Demand	16,925	1.89
Peak Hour Demand	-	2.84

2.2.2 Calculation of Fire Protection Water Supply Requirement

As required by the City of Ottawa during the pre-consultation phase, the Fire Underwriters Survey (FUS) was used to determine the fire protection water supply requirement.

The development includes three units with light industrial usage. The units are separated by firewalls. Thus, they can be considered separate buildings for calculation of fire fighting water supply requirements. **Table 3** below presents a summary of the required fire flow for each building. For details of the fire flow calculation, please refer to **Appendix F**.

Table 3: Building Fire Flow Requirements

Building	Area	Flow Requirement	
	m^2	L/min	L/s
Unit 1	557	5,000	83.33
Unit 2	557	6,000	100.00
Unit 3	513	5,000	83.33

2.2.3 Water Boundary Conditions

Based on the computer model simulation by the City of Ottawa's Infrastructure and Water Services, the water supply boundary conditions at the location of the proposed connection for the site are shown in **Table 4**. Approximate elevation at the centreline of the Albion Road South at this location is 82.68 and the HGL at the flow of 100.3 L/s is 102.2 mH_2O. Consequently, the residual pressure at the fire flow rate is calculated to be 191 kPa.

Table 4: Water Servicing Boundary Conditions

Minimum HGL (mH2O)	Maximum HGL (mH2O)	Simulated Max. Day + Fire Flow (L/s)	Simulated Max. Day + Fire Flow HGL (mH2O)
125.0	131.5	100.3	102.2

For the email communication from the City and the location for the simulation, please see **Appendix B**.

2.2.4 Water Supply Flow Calculations Summary

As per City of Ottawa's "TECHNICAL BULLETIN ISTB-2018-02" (2018), the aggregate fire flow capacity of all contributing fire hydrants within 150 m of a building shall not be less the required fire flow. The proposed development will be serviced by an existing municipal Class AA hydrant (located near 3208 Albion Road South) and a proposed Class AA on-site private hydrant. Please refer to drawing C103 (Site Servicing Plan) for location of the existing Hydrant and proposed on site hydrant. The following table presents the maximum allowable contribution from each hydrant as per Table 1 of Appendix I of the technical bulletin:

Table 5: Contributing Hydrants

Hydrant	Class	Distance Range	Max. Allowable Contribution
Proposed On-Site	AA	≤ 75 m	5,700 L/min
Existing Municipal (Near 3208 Albion Rd S)	AA	≤ 150 m	3,800 L/min

As it can be seen in the above table, the maximum allowable flow from the two contributing hydrants is 9,500 L/min which is more than the required fire flow (RFF) of 6,000 L/min (100 L/s). The boundary condition provided by the City of Ottawa's Infrastructure and Water Services presented in section 2.2.3 and indicates that the RFF (100 L/s) can be supplied at the required 140 kPa minimum residual pressure at main (at the ground level). Consequently, the proposed 150 mm water service and on-site fire hydrant and existing fire hydrant can provide adequate water supply for fire fighting.

3 Stormwater Management

Based on Pre-Consultation Meeting's Feedback dated May 5, 2025, the following criteria, as established by the "Sawmill Creek Subwatershed Study Update" (May 2003), were considered to design the stormwater management system:

- **Quantity Control**: The post-development flows are to be controlled to the 2-year pre-development flowrate.
- **Quality Control**: The MOE Enhanced Protection Level (Level 1) quality control is to be achieved on site. (8"0% TSS removal and 90% run-off capture)
- **Run-off Detention**: Flows in excess of the 2-year storm release rate, up to and including the 100-year storm event, must be detained on site.
- **IDF Curves**: Intensity-Duration-Frequency (IDF) curves for design storm events for quantity and quality control are given by following equation:

$$i = \frac{a}{(t_d + b)^c}$$

where i is rainfall intensity (mm/hr.) and t_d is the rainfall duration (minutes). The regression constants a, b and c for the City of Ottawa, as well as the duration and depth of the design storms, are given in **Table 6** as per City of Ottawa's "Ottawa Sewer Design Guidelines" (October 2012). The regression constants are derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.

Table 6: Applicable IDF Curve Parameters

Rainfall Event	Parameters		
	a	b	c
2-year	732.951	6.199	0.810
5-year	998.071	6.053	0.814
10-year	1,174.184	6.014	0.816
100-year	1,735.688	6.014	0.820

3.1 Pre-Development Condition and allowable flow rate

The subject parcel currently does not have any connection to the city's storm sewer and water generated from the storm drains to Albion Road right-of-way/adjacent lands. Based on the pre-consultation comments, all post-development flows are to be controlled to the 2-year pre-development flowrate which here is considered as allowable flow rate.

City of Ottawa's "Ottawa Sewer Design Guidelines" (October 2012) allows the rational method to be used for calculating the flow rates in drainage areas less than 40 ha. The site has an area of approximately 0.49 ha. Consequently, the rational method will be used for stormwater management calculations.

As per the geotechnical report prepared by Cambium date 2025-09-25, in the predevelopment condition, the property is mainly covered by "a gravel lot, used as parking and storage." The remainder of the site is covered by a residential building, asphalt driveway and grass areas. The following table presents areas and run-off coefficients for different parts of the site based on "Ottawa Sewer Design Guidelines" recommendations:

Table 7: Pre-Development "C" Values

Area Description	Run-off Coefficient (C)	Area (ha)
Gravel	0.5	0.390
Grass/Lawn	0.1	0.072
Impervious (Roof & Asphalt)	0.9	0.028
Site	0.46	0.490

From above table, the overall pre-development run-off coefficient for the site is $C = 0.46$. Based on the pre-consultation comments by the City dated May 5, 2025, a maximum of 0.5 is allowed for the pre-development run-off coefficient. Hence, a value $C = 0.46$ will be used in the following calculations.

The 2-year pre-development flow rate will be used as the allowable discharge for the post-development conditions as per the pre-consultation comments.

The minimum time of concentration recommended by the City of Ottawa's guidelines and pre-consultation comments is 1 minutes. As the run-off coefficient for the post-development condition is greater than 0.40, the Bransby Williams formula may be used. The following equation is used to evaluate the time of concentration:

$$t_c = \max(\frac{0.057 \times L}{S^{0.2} \times A^{0.1}}, 10 \text{ min}) = \max(\frac{0.057 \times 45}{3^{0.2} \times 0.49^{0.1}}, 10 \text{ min}) = 10 \text{ min}$$

The design rainfall intensity is calculated based on the applicable IDF curves as follows:

$$i_{2yr} = \frac{a}{(t_d + b)^c} = \frac{732.951}{(10 + 6.199)^{0.810}} \approx 76.81\ mm/hr$$

The peak discharge (release rate) for the various storm events is calculated by using the rational method and is shown in **Table 8** below.

Table 8: Pre-Development Release Rates

Strom Return Period	Area (ha)	Run-off Coeff. (C)	T_c (min)	Rainfall Intensity (mm/hr)	Release Rate (L/s)
2 Year	0.49	0.46	10	76.81	48.1
5 Year	0.49	0.46	10	104.19	65.3
10 Year	0.49	0.46	10	122.14	76.5
100 Year	0.49	0.58	10	178.56	141.1

Please note that the run-off coefficient for the 100-year storm is increased by 25% in accordance with the MTO and City of Ottawa guidelines. Generally, for each return period, the post-development peak run-offs should be kept below the pre-development level. However, the pre-consultation comments recommend that 2-year pre-development release rate should be used as the allowable release rate for the storms up to 100-year return period. Hence, 48.1 L/s will be used as the allowable release rate for all storms.

3.2 Post-Development Condition

The proposed development consists of three light industrial units in two adjacent buildings. In the post development condition, the rest of the site is covered with asphalt parking spaces, asphalt driveway, landscaping and gravel driveway around the buildings. Units 1 and 2 will be constructed in one building and unit 3 will be constructed as a separate building. The storm water management system has been designed to achieve the quantity and quality control targets as set in **Section 3**. The following subsection describes the SWM system and measures implemented to achieve the quantity and quality control targets. The proposed system consists of two catch basins, seven catch basin manholes, underground storage tank with orifice plate at outlet, OGS and pipes. Details of the proposed SWM system can be found in drawing C103 “Site Servicing Plan”.

3.2.1 Quantity Control

For the purpose of quantity control, the site in the post-development condition is divided to 12 subcatchments (A-1 to A-12) as shown in drawing **C107** “Post-Development Condition Drainage Plan). Subcatchments A-1 to A-10 are controlled and a minor system is designed to collect the run-off generated in these subcatchments and release it to the existing 200 mm City storm sewer in the Albion Road South. Site grading has been designed such that there is positive draining towards the catch basins installed in controlled subcatchments. Details of site grading can be found in drawing **C104**. Subcatchments A-11 and A-12 are uncontrolled. **Table 9** summarizes the area and run-off coefficient for each subcatchments in the post-development condition. Using this table and averaging the run-off coefficient over the entire area of site, yields a value of C = 0.64 for post-development condition.

Table 9: Summery of Post-Development Subcatchments' Parameters

	A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	A-12
Area (ha)	0.021	0.032	0.037	0.037	0.036	0.163	0.040	0.034	0.026	0.031	0.016	0.018
C	0.45	0.84	0.80	0.57	0.57	0.90	0.45	0.43	0.43	0.38	0.10	0.10

Per City of Ottawa guidelines, the minor system sewers are designed for a 5-year storm event. Detailed calculation for sewer sizing and slope of the sewers is presented in the Storm Sewer Design Sheet (**Appendix C)**. As it can be seen from the table, all sewers have enough capacity for 5-year peak flows, and their full velocities are between minimum velocity (0.8 m/s) and maximum velocity (6.0 m/s) recommended by MECP and Ottawa's Guidelines.

To maintain the run-off release rate below the allowable value, a combination of an underground detention tank and an orifice is used. Modified rational method is used for evaluation of the maximum required tank volume for maintaining the released run-off below the allowable rate (48.1 L/s) in a 100-year storm event. The run-off coefficient for the 100-year storm is increased by 25% in accordance with the MTO and City of Ottawa guidelines and C = 0.80 is used. Please refer to **Appendix C** for a table of detailed calculations. It can be seen from the table, that the maximum required storage volume is estimated to be 98.98 m^3 for a storm with duration of 20 minutes. In the proposed SWM system, this volume is provided by installing an EZstorm$^+$ underground storage tank (V = 81.51 m^3) in the front yard. The total storage volume provided by the various components of the minor system is shown in **Table 10**.

Table 10: Storage Volume

Component	Storage Volume (m^3)	HGL Elevation (m)
Pipes	13.95	81.58
Storm Structures	4.01	81.58
Underground Tank	81.51	81.58
Total	**99.47**	**81.58**

Please note that in **Table 10**, the storage volume of the storm structures (manholes and catch basins) and pipes are calculated at the HGL = 81.58 which corresponds to the elevation at top of the proposed EZstorm+ underground tank. As it can be seen, at this elevation, the storage provided by the minor system (99.47 m^3) exceeds the required storge (98.98 m^3). The elevation on top of all structures is above this elevation. Hence, there will be no ponding over the storm structures when the underground tank reaches its maximum capacity.

To restrict the released rate below the allowable value, an orifice plate is placed in the outlet of the underground tank. The allowable release rate for post-development condition is 48.1 L/s. The uncontrolled subcatchments A-11 and A-12 (with a total area of 0.034 ha and covered by lawn) release the run-off at the following rate:

$$Uncontrolled\ Release = 2.78 \times C \times I \times A = 2.78 \times 0.1 \times 119.95 \times 0.034 \approx 1.13\ L/s$$

Hence, the release rate from the orifice shall be:

$$Orifice\ Release\ Rate = Allowable - Uncontrolled = 48.1 - 1.13 = 46.97\ L/s$$

An orifice plate with invert elevation of 80.92 and diameter of 172mm is used to ensure that release rate that does not exceeds the above value when the storage elevation reaches it highest value. Details of orifice calculations can be found in **Appendix C**.

3.2.2 Quality Control

To achieve the MOE Enhanced Protection Level (Level 1) quality control required by the City of Ottawa, an OGS device will be utilized. The OGS is required to provide at least 80% TSS removal and 90% run-off capture in order to meet the required suspended solids removal.

The proposed OGS device is a Stormceptor model EFO4 which satisfies the required criteria. The calculations by the software provided by the OGS manufacturer in **Appendix H** show that a Stormceptor model EFO4 can achieve the Enhanced Protection Level targets by providing 86% TSS removal and run-off capture of greater than 90%. The unit also meets the "ISO 14034 Environmental Management – Environmental Technology Verification (ETV)" requirements. Please see **Appendix I** for the verification statement. In addition, all the storm structures will have a minimum 600 mm sump.

The Stormceptor will require periodical inspection/maintenance to ensure it is operating properly. The required periodical inspection/maintenance of the unit should be performed by a qualified contractor hired by the owner per manufacturer's instructions and applicable regulations.

5. Erosion and Sediment Control

In order to minimize the amount of erosion and transport of construction sediments off the site during grading and construction, sediment control fencing will be installed. The sediment control fence (light duty silt fence) should be installed around the site and at the base of all stockpiles prior to construction. Please refer to the engineering drawing **C105** "Sediment and Erosion Control Plan" for more details.

Additionally, all catch-basins should be protected from entry of sediments by installing silt sack or double layer geotextile fabric during the construction.

Any sediment that is tracked onto the roadway during the course of construction should be cleaned by the contractor. To help minimize the amount of mud being tracked onto the roadway, a mud mat should be installed at the construction entrance.

4 CONCLUSIONS AND RECOMMENDATIONS

In conclusion, the site development will be provided with a complete storm drainage system, integrated site grading and improvement of the existing site surface elevations with following results:

1. The proposed stormwater management design provides adequate attenuation of all storm events up to the 1:100-year storm events to flows below the allowable and accounted for levels.
2. Upon completion of construction, the site conforms to the stormwater design criteria specified by the City of Ottawa.
3. The downstream facility is designed to provide MOE Enhanced Protection Level (Level 1) quality control required by the City of Ottawa.
4. Prior to construction, a sediment control perimeter fence will be installed, and all catch basins will be protected by appropriate geotextile filters. Silt fence at the base of all stockpiles and construction entrance mud mats will provide additional erosion control.

We have included stormwater management design calculations for this development. The existing and proposed conditions presented indicate the post-development conditions will be improved and the proposed development can safely be carried out.

The following are recommended:

1. All grading, servicing and erosion and sediment control are to be carried out according to the approved engineering drawings and specifications.
2. All engineering works are to be inspected during the construction.
3. It is required that after commissioning/occupancy, all water, sanitary and storm pipes and structures should be adequately maintained and inspected by their respective owners as per applicable municipal, regional and provincial regulations and standards.

Sincerely,
EFI ENGINEERING

2025.10.31 10:20:23-04'00'

Torben Ruddock, P. Eng.
Senior Water Resources Engineer
Project Manager

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Appendix A

Sanitary Design Sheet

3210 Albion Road South, Ottawa, ON

SANITARY SEWER DESIGN SHEET

PROJECT #: 25-7834
DATE: 2025-09-30
DESIGNED BY:
CHECKED BY:

Total Site Area (ha)	0.49			
n =	0.013			
Min. Full Velocity =	0.6	m/s		
Max. Full Velocity =	3	m/s		
Residential Peak Fac. =	Harmon Equation			
Commercial Peak Fac. =	1.5			
Institutional Peak Fac. =	1.5			
Light Indust. Peak Fac. =	7.4	Per appendix 4-B		
Heavy Indust. Peak Fac. =	N/A	Per appendix 4-B		

Average Daily Flow		
Residential:	350	L/c/d
Commercial:	0.5787	l/s/ha
Institutional:	0.5787	l/s/ha
Lifgt Industrial::	0.4051	l/s/ha
Heavy Industrial::	0.6366	l/s/ha
Infiltration:	0.28	l/s/ha

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Street	From	To	RESIDENTIAL AREA AND POPULATION							Commercial		Institutional		Industrial		C+I+I	Infiltration			Total	Pipe						Remarks
			Area (ha)	Pop. Density Zone	Pop. (p/unit)	Cumulative Area (ha)	Cumulative Pop.	Peak Fact.	Peak Flow (m^3/s)	Area (ha)	Cum. Area (ha)	Area (ha)	Cum. Area (ha)	Area (ha)	Cum. Area (ha)	Peak Flow (L/s)	Area (ha)	Cum. Area (ha)	Infilt. Flow (L/s)	Flow (L/s)	Length (m)	Dia. (mm)	Slope (%)	Cap. (Full) (L/s)	Vel. (Full) (m/s)	Vel. (Act.) (m/s)	
Driveway	Building	SAN100												0.49	0.49	1.47	0.049	0.049	0.014	1.48	10.85	200	1.57	41.10	1.31	0.62	OK
Driveway	SAN100	SAN101												0	0.49	1.47	0.402	0.451	0.126	1.60	89.16	200	1.50	40.17	1.28	0.62	OK
Driveway	SAN101	City MH												0	0.49	1.47	0.039	0.490	0.137	1.61	8.68	200	1.96	45.92	1.46	0.69	OK

Appendix B

Water Servicing Boundary Conditions

From: Cassidy, Tyler <tyler.cassidy@ottawa.ca>
Sent: Monday, August 18, 2025 10:36:30 AM
To: Torben Ruddock <truddock@efiengineering.com>
Subject: RE: Water Boundary Condition Request: 3210 Albion Rd Proposed Light Industrial (City File: PC2025-0114)

Hi Torben,

Please find below the revised boundary conditions for the site at 3210 Albion Road S.

The following are boundary conditions, HGL, for hydraulic analysis at 3210 Albion Road (zone 2W2C) assumed to be connected to the 152 mm watermain on Albion Road (see attached PDF for location).

Minimum HGL: 125.0 m

Maximum HGL: 131.5 m

Max Day + Fire Flow (100 L/s): 102.2 m

These are for current conditions and are based on computer model simulation.

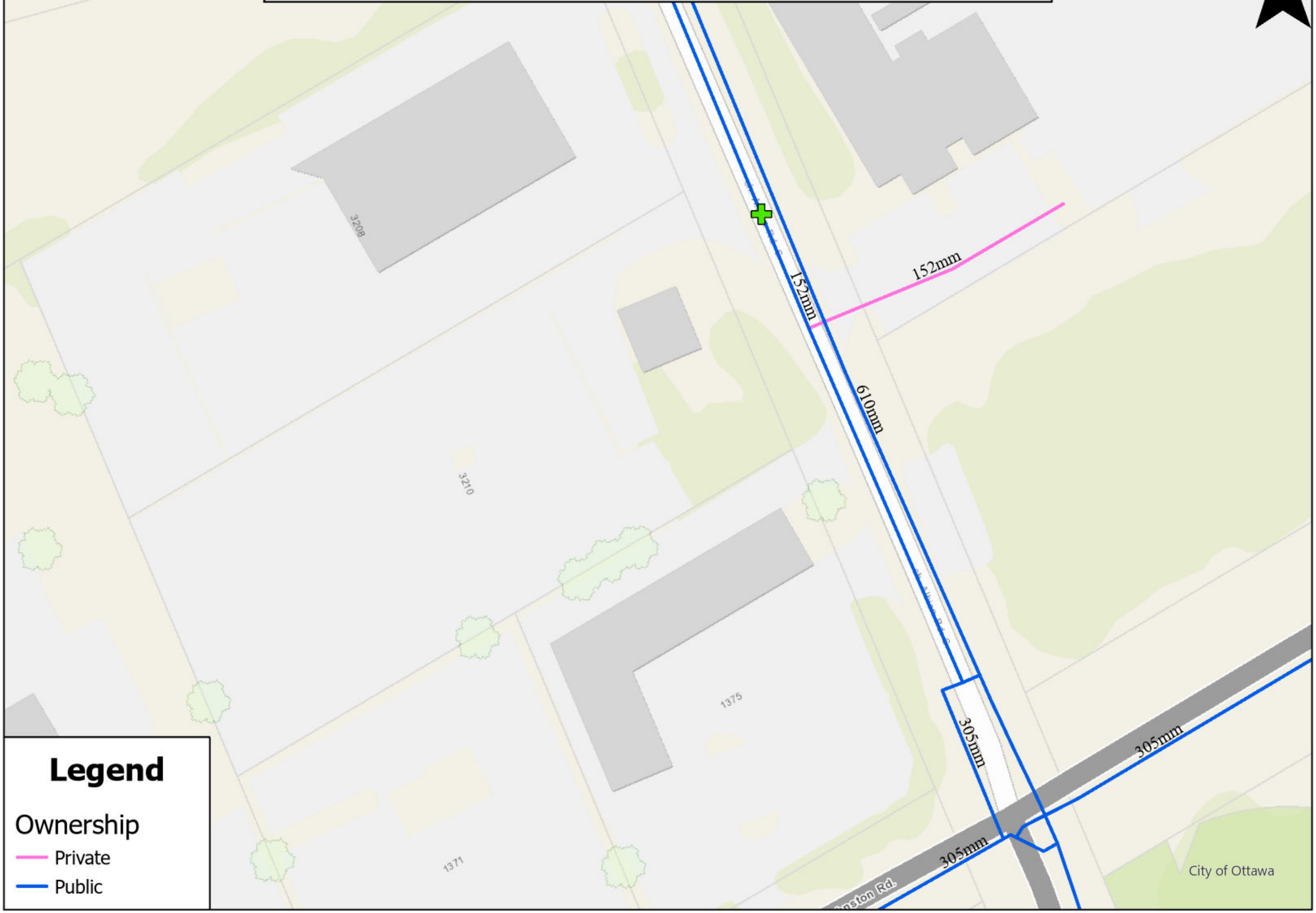
Disclaimer:

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

"The IWSD has recently updated their water modelling software. Any significant difference between previously received BC results and newly received BC results could be attributed to this update."

Tyler Cassidy, P.Eng
Infrastructure Project Manager,
Planning, Development and Building Services department (PDBS)/ Direction générale des services de la planification, de l'aménagement et du bâtiment (DGSPAB) - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 12977, Tyler.Cassidy@ottawa.ca

Boundary Condition for 3210 Albion Road



Appendix C

Storm Sewer Design Sheet

3210 Albion Road South, Ottawa, Ontario		STORM SEWER DESIGN SHEET	Design Parameters				EFI ENGINEERING
			5 YEAR STORM		OTHER PARAMETERS		
Project Number:	25-7834		Q=kAIR, k=0.00278		Manning's "n"	0.013	
Date:	2025-09-30		I = a/(tc+b)^c		Min. Full Velocity	0.8 m/s	
Design By:					Max. Full Velocity	6 m/s	
Checked By:			a=	998.071	Concentration Time	10	
			b=	6.053			
			c=	0.814			

LOCATION				STORMWATER FLOW								DESIGN				
STREET	AREA NUMBER	FROM MH	TO MH	AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME		RAIN INTENCITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY
				ha		ha	ha	min	min	mm/hr	L/sec	mm	m	%	L/sec	m/s
West Driveway	A-1, A-6	CB#1	CBMH#103	0.062	0.80	0.0496	0.0496	10.0	0.66	104.19	14.4	300	26.3	0.34	56.6	0.80
South Driveway	A-7, A-6	CBMH#103	CBMH#104	0.081	0.77	0.0624	0.1120	10.7	0.67	100.85	31.4	300	33.6	0.36	57.8	0.82
South Driveway	A-8	CBMH#104	CBMH#105	0.034	0.61	0.0207	0.1327	11.3	0.48	97.67	36.0	300	25.0	0.36	58.0	0.82
South Driveway	A-9	CBMH#105	CBMH#106	0.026	0.62	0.0161	0.1488	11.8	0.39	95.52	39.5	300	20.3	0.34	56.7	0.80
South Driveway	A-10, A-6	CBMH#106	CHAMBER	0.072	0.75	0.0540	0.2028	12.2	0.25	93.86	52.9	300	14.1	0.36	57.6	0.82
North Driveway	A-2	CB#2	CBMH#100	0.032	0.82	0.0262	0.0262	10.0	0.69	104.19	7.6	300	23.2	0.34	56.8	0.80
North Driveway	A-3	CBMH#100	CBMH#101	0.037	0.82	0.0303	0.0566	10.7	0.60	100.67	15.8	300	25.0	0.36	58.0	0.82
North Driveway	A-4	CBMH#101	CBMH#102	0.037	0.61	0.0226	0.0792	11.3	0.65	97.85	21.5	300	29.2	0.34	56.6	0.80
North Driveway	A-5, A-6	CBMH#102	CHAMBER	0.077	0.76	0.0585	0.1377	11.9	0.01	94.95	36.3	300	0.8	1.19	105.5	1.49

Storm Storage Calculation

	Post-Dev.	Allowable
Area (ha)	0.49	
Period	100 Y	2 Y
C	0.80	0.46
a	1,735.69	732.95
b	6.014	6.199
c	0.82	0.81
t_c (min)	-	10.00
i	-	76.81

T_c	Rainfal Intensity	Post-Dev. Q	Allowable Q	Storage Volume
min	mm/hr	m3/s	m3/s	m3
5	242.70	0.26	0.0481	64.84518
10	178.56	0.19	0.0481	87.7824
15	142.89	0.16	0.0481	96.72204
20	119.95	0.13	0.0481	98.98291
25	103.85	0.11	0.0481	97.42649
30	91.87	0.10	0.0481	93.43316
35	82.58	0.09	0.0481	87.76308
40	75.15	0.08	0.0481	80.8751
45	69.05	0.08	0.0481	73.06553
50	63.95	0.07	0.0481	64.53595
55	59.62	0.06	0.0481	55.42921
60	55.89	0.06	0.0481	45.84999

Orifice Flow Calculation

The proposed orifice has an invert elevation of 80.92 and a diameter of 172 mm. At the HGL elevation of 81.58 (top of underground storage tank), H_e would be 0.574 m. Using an orifice coefficient of 0.6, the maximum flow trough the orifice can be calculated using the orifice flow equation for a circular orifice:

$$Q = C_d \frac{\pi D^2}{4} \sqrt{2gH_e} = 0.6 \frac{\pi \times 0.172^2}{4} \sqrt{2 \times 9.81 \times 0.574} \approx 0.04676\, m^2/s \ = 46.76\, L/s$$

Appendix D
Engineering Drawings

Appendix E
References

- Ottawa Design Guidelines – Water Distribution, City of Ottawa (July 2010)
- Ottawa Sewer Design Guidelines, City of Ottawa (October 2012)
- Sawmill Creek Subwatershed Study Update, City of Ottawa (May 2003)
- TECHNICAL BULLETIN ISTB-2018-02: Revisions to Ottawa Design Guidelines – Water Distribution, City of Ottawa (March 2018)
- Water Supply for Public Water Protection: A Guide to Recommended Practice in Canada, Fire Underwriters Survey (2020)

Appendix F

Fire Flow Calculation (FUS)

Fire Flow Calculation (FUS)

Calculation of Exposure Adjustment Charges (EAC's)

Face	Building A		Building B		Building C	
	Distance	Charge	Distance	Charge	Distance	Charge
North	10.1 to 20	15%	20.1 to 30	10%	20.1 to 30	10%
South	20.1 to 30	10%	20.1 to 30	10%	20.1 to 30	10%
East	Firewall (max.)	10%	Firewall (max.)	10%	Over 30	0%
West	Over 30	0%	Firewall (max.)	10%	Firewall (max.)	10%
	Total	**35%**	**Total**	**40%**	**Total**	**30%**

Calculation of Required Fire Flows (RFF's)

	FUS Procedure	Phase			Notes & Equations
		One		Two	
		Building A	Building B	Building C	
B	Gross Floor Area (m^2)	557	557	513	$RFF = 220C\sqrt{A}$ RFF: Required Fire Flow (LPM) C: Construction Coefficient A: Total Effective Area (m^2)
	Largest Floor Area (m^2)	557	557	513	
	Total Effective Area (m^2)	557	557	513	
	Total Effective Area (ha)	0.0557	0.0557	0.0513	
A	Construction Coefficient	0.8	0.8	0.8	
C	Base Fire Flow (LPM)	4000	4000	4000	
D	Occupancy & Contents Adjustment (%)	0%	0%	0%	Absolute Value Cannot Exceed 25%
	Adjustment for OCAF - RFF (LPM)	0.00	0	0	-
E	Sprinkler Adjustment Percentage	0%	0%	0%	
	Sprinkler Adjustment (LPM)	0.00	0.00	0.00	
F	Exposure Adjustment Charge (%) [EAC]	35%	40%	30%	Cannot Exceed 75%
	Adjustment for EAC (LPM)	1400.00	1600.00	1200.00	-
G	Required Fire Flow (LPM)	5000.00	**6000.00**	5000.00	
	Required Fire Flow (LPS)	83.33	**100.00**	83.33	

Appendix G

Geotechnical Report

SUBMITTED UNDER SEPARATE COVER

Appendix H

OGS Sizing Report

Stormceptor EF Sizing Report

Imbrium® Systems

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

10/01/2025

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20

Project Name:	3210 Albion Road South
Project Number:	25-7834
Designer Name:	Borz Fariborzi
Designer Company:	EFI
Designer Email:	akeyhani@EFIengineering.com
Designer Phone:	226-929-9764
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	

Drainage Area (ha):	0.49
% Imperviousness:	80.00

Runoff Coefficient 'c': 0.78

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	12.34
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Influent TSS Concentration (mg/L):	
Estimated Average Annual Sediment Volume (L/yr):	373

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	86
EFO5	91
EFO6	94
EFO8	97
EFO10	99
EFO12	100

Recommended Stormceptor EFO Model: **EFO4**

Estimated Net Annual Sediment (TSS) Load Reduction (%): **86**

Water Quality Runoff Volume Capture (%): **> 90**

THIRD-PARTY TESTING AND VERIFICATION

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

PERFORMANCE

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

PARTICLE SIZE DISTRIBUTION (PSD)

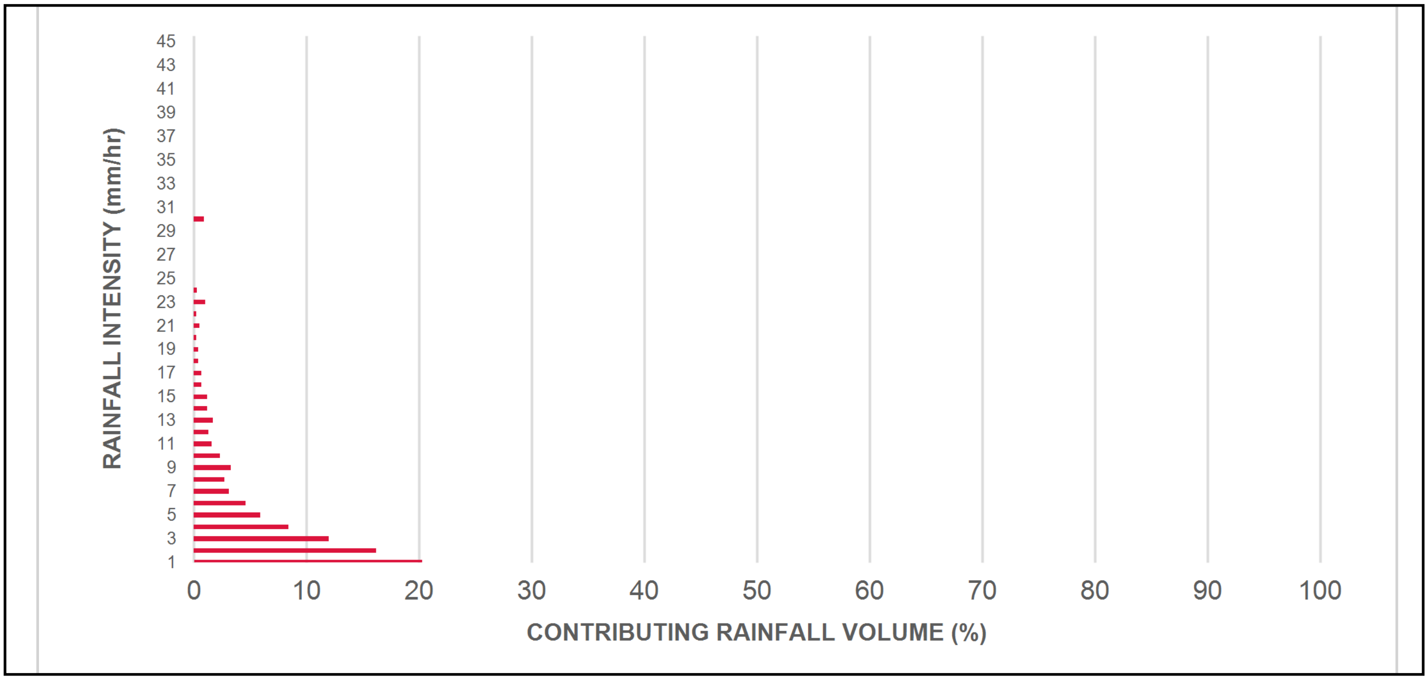
►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a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

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

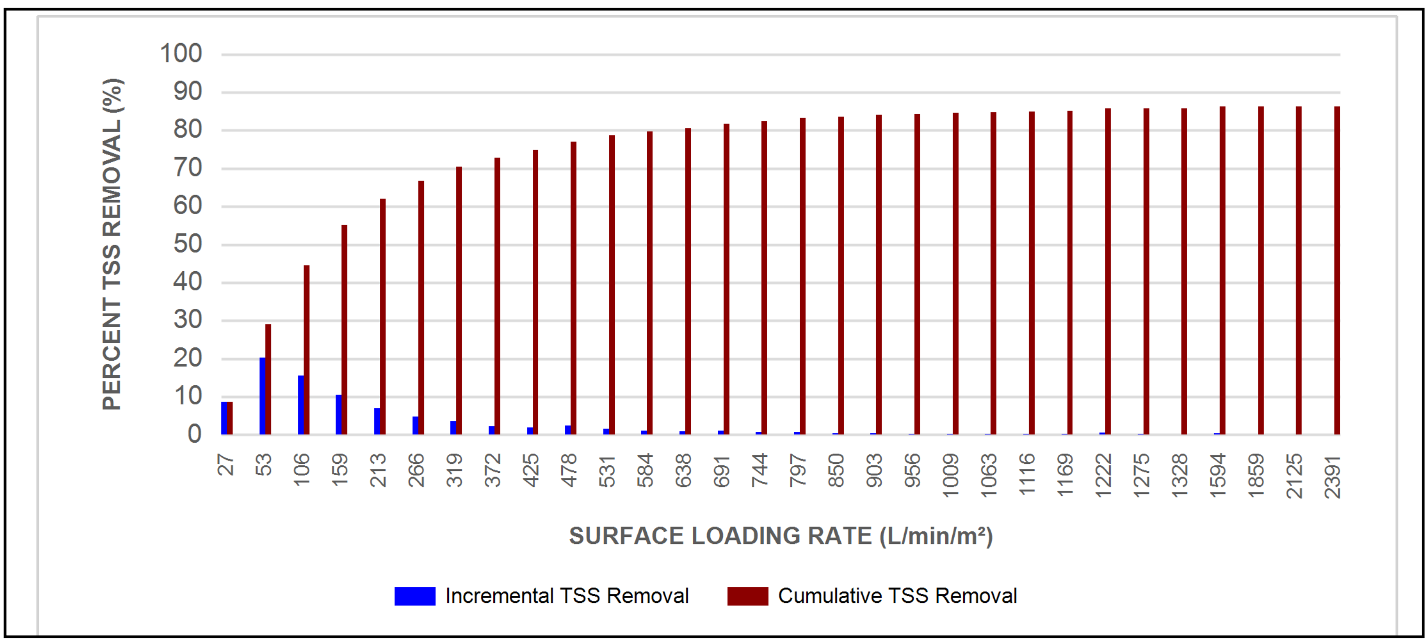
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	8.6	8.6	0.53	32.0	27.0	100	8.6	8.6
1.00	20.3	29.0	1.06	64.0	53.0	100	20.3	29.0
2.00	16.2	45.2	2.13	128.0	106.0	96	15.6	44.5
3.00	12.0	57.2	3.19	191.0	159.0	88	10.6	55.1
4.00	8.4	65.6	4.25	255.0	213.0	83	7.0	62.1
5.00	5.9	71.6	5.31	319.0	266.0	80	4.8	66.8
6.00	4.6	76.2	6.38	383.0	319.0	78	3.6	70.5
7.00	3.1	79.3	7.44	446.0	372.0	75	2.3	72.8
8.00	2.7	82.0	8.50	510.0	425.0	73	2.0	74.8
9.00	3.3	85.3	9.56	574.0	478.0	71	2.4	77.1
10.00	2.3	87.6	10.63	638.0	531.0	68	1.6	78.7
11.00	1.6	89.2	11.69	701.0	584.0	66	1.0	79.7
12.00	1.3	90.5	12.75	765.0	638.0	64	0.8	80.5
13.00	1.7	92.2	13.81	829.0	691.0	64	1.1	81.7
14.00	1.2	93.5	14.88	893.0	744.0	64	0.8	82.4
15.00	1.2	94.6	15.94	956.0	797.0	63	0.7	83.2
16.00	0.7	95.3	17.00	1020.0	850.0	63	0.4	83.6
17.00	0.7	96.1	18.06	1084.0	903.0	62	0.5	84.1
18.00	0.4	96.5	19.13	1148.0	956.0	62	0.2	84.3
19.00	0.4	96.9	20.19	1211.0	1009.0	61	0.3	84.6
20.00	0.2	97.1	21.25	1275.0	1063.0	60	0.1	84.7
21.00	0.5	97.5	22.31	1339.0	1116.0	59	0.3	85.0
22.00	0.2	97.8	23.38	1403.0	1169.0	58	0.1	85.1
23.00	1.0	98.8	24.44	1466.0	1222.0	56	0.6	85.7
24.00	0.3	99.1	25.50	1530.0	1275.0	55	0.1	85.8
25.00	0.0	99.1	26.56	1594.0	1328.0	54	0.0	85.8
30.00	0.9	100.0	31.88	1913.0	1594.0	46	0.4	86.2
35.00	0.0	100.0	37.19	2231.0	1859.0	39	0.0	86.2
40.00	0.0	100.0	42.50	2550.0	2125.0	35	0.0	86.2
45.00	0.0	100.0	47.81	2869.0	2391.0	31	0.0	86.2
Estimated Net Annual Sediment (TSS) Load Reduction =								**86 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF5 / EFO5	1.5	5	90	762	30	762	30	710	25
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

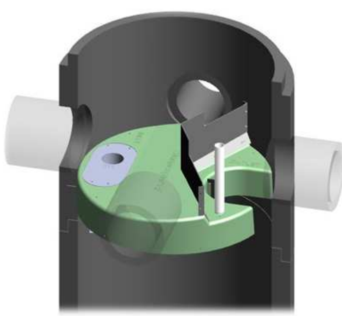
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

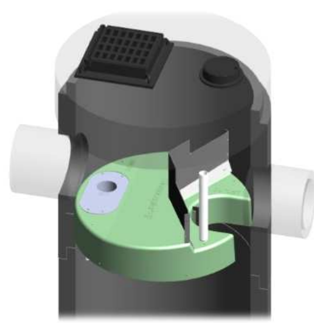
DESIGN FLEXIBILITY

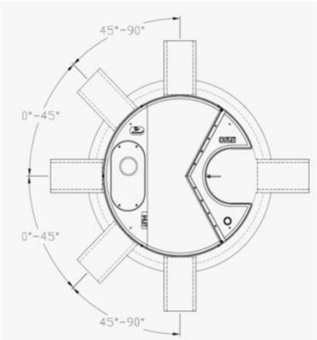
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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

OIL CAPTURE AND RETENTION

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







INLET-TO-OUTLET DROP

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

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

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

HEAD LOSS

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

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft^3)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF5 / EFO5	1.5	5	1.62	5.3	420	111	305	10	2124	75	2612	5758
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 / EFO12	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 kg/L (100 lb/ft^3)

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

STANDARD STORMCEPTOR EF/EFO DRAWINGS

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

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

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

STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREAMENT 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** S**eparators**

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:	1.19 m^3 sediment / 265 L oil
	5 ft (1524 mm) Diameter OGS Units:	1.95 m^3 sediment / 420 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

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. 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/m^2 to 1400 L/min/m^2, 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/m^2 and 1400 L/min/m^2 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/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 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/m^2.

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/m^2.

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 re-entrainment 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/m^2 to 2600 L/min/m^2) 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.

Appendix I

ETV Verification Statement for the OGS

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Stormceptor® EF4 and EFO4 Oil-Grit Separators

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

In accordance with

ISO 14034:2016

Environmental management —
Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

November 10, 2017
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
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Technology description and application

The Stormceptor® EF4 and EFO4 are treatment devices designed to remove oil, sediment, trash, debris, and pollutants attached to particulates from Stormwater and snowmelt runoff. The device takes the place of a conventional manhole within a storm drain system and offers design flexibility that works with various site constraints. The EFO4 is designed with a shorter bypass weir height, which accepts lower surface loading rate into the sump, thereby reducing re-entrainment of captured free floating light liquids.

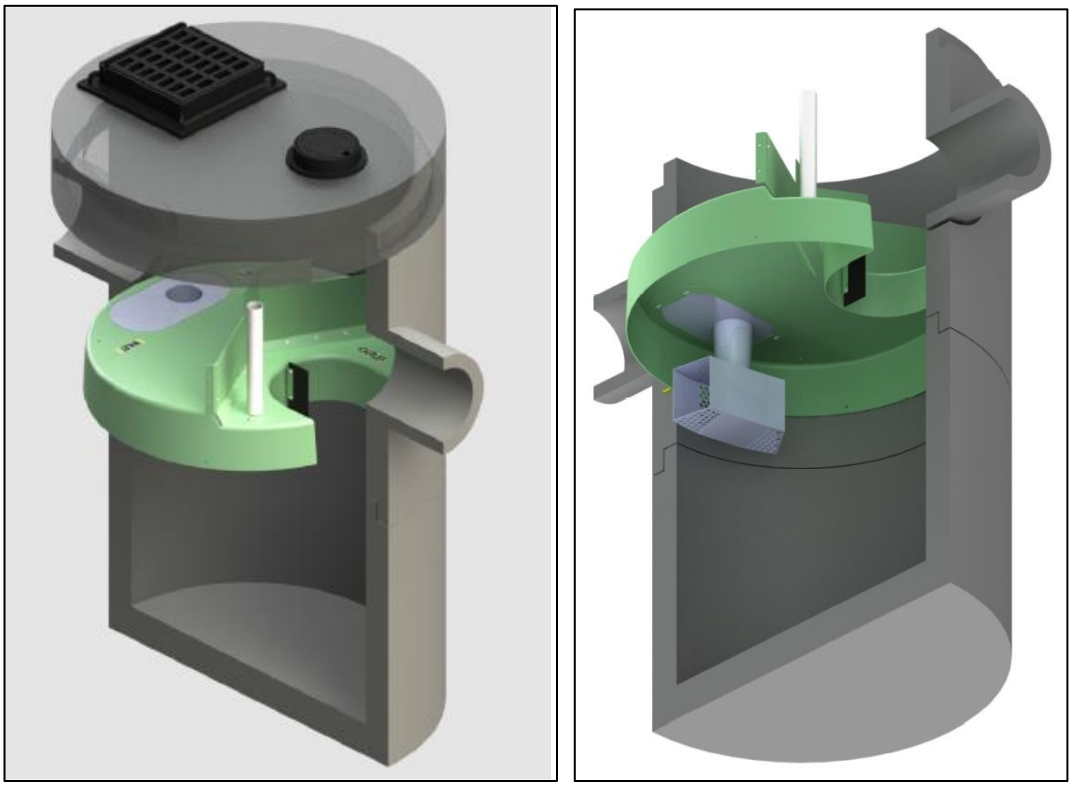

Figure 1. Graphic of typical inline Stormceptor® unit and core components.

Stormwater and snowmelt runoff enters the Stormceptor® EF/EFO's upper chamber through the inlet pipe(s) or a surface inlet grate. An insert divides the unit into lower and upper chambers and incorporates a weir to reduce influent velocity and separate influent (untreated) from effluent (treated) flows. Influent water ponds upstream of the insert's weir providing driving head for the water flowing downwards into the drop pipe where a vortex pulls the water into the lower chamber. The water diffuses at lower velocities in multiple directions through the drop pipe outlet openings. Oil and other floatables rise up and are trapped beneath the insert, while sediments undergo gravitational settling to the sump's bottom. Water from the sump can exit by flowing upward to the outlet riser onto the top side of the insert and downstream of the weir, where it discharges through the outlet pipe.

Maximum flow rate into the lower chamber is a function of weir height and drop pipe orifice diameter. The Stormceptor® EF and EFO are designed to allow a surface loading rate of 1135 L/min/m^2 (27.9 gal/min/ft^2) and 535 L/min/m^2 (13.1 gal/min/ft^2) into the lower chamber, respectively. When prescribed surface loading rates are exceeded, ponding water can overtop the weir height and bypass the lower treatment chamber, exiting directly through the outlet pipe. Hydraulic testing and scour testing demonstrate that the internal bypass effectively prevents scour at all bypass flow rates. Increasing the bypass flow rate does not increase the orifice-controlled flow rate into the lower treatment chamber where sediment is stored. This internal bypass feature allows for in-line installation, avoiding the cost of additional bypass structures. During bypass, treatment continues in the lower chamber at the maximum flow rate. The Stormceptor® EFO's lower design surface loading rate is favorable for minimizing re-entrainment and washout of captured light liquids. Inspection of Stormceptor® EF and EFO devices is performed from grade by inserting a sediment probe through the outlet riser and an oil dipstick through the oil inspection pipe. The unit can be maintained by using a vacuum hose through the outlet riser.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Imbrium Systems Inc.'s Stormceptor® OGS device, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test [a]:

During the capture test, the Stormceptor® EF OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 46, 44, and 49 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Stormceptor® EFO, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 42, 40, and 34 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test [a]:

During the scour test, the Stormceptor® EF and Stormceptor® EFO OGS devices, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, generate corrected effluent concentrations of 4.6, 0.7, 0, 0.2, and 0.4 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[a]:

During the light liquid re-entrainment test, the Stormceptor® EFO OGS device with surrogate low-density polyethylene beads preloaded within the lower chamber oil collection zone, representing a floating light liquid volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.5, 99.8, 99.8, and 99.9 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2.

[a] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

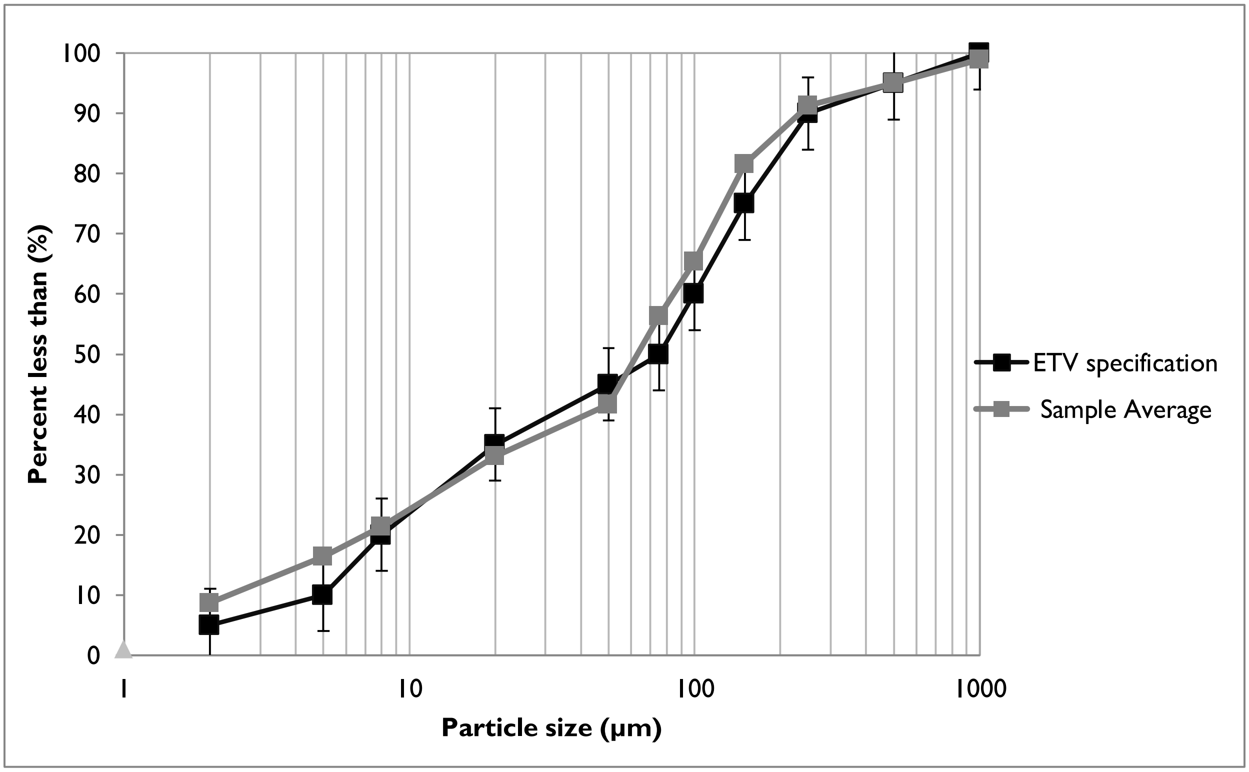

Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1). Since the EF and EFO models are identical except for the weir height, which bypasses flows from the EFO model at a surface loading rate of 535 L/min/m² (13.1 gpm/ft²), sediment capture tests at surface loading rates from 40 to 400 L/min/m² were only performed on the EF unit. Surface loading rates of 600, 1000, and 1400 L/min/m² were tested on both units separately. Results for the EFO model at these higher flow rates are presented in Table 2.

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and may be attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" (see Table 1 and 2) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) of the EF4 at specified surface loading rates

Particle size fraction (µm)	Surface loading rate (L/min/m^2)						
	40	80	200	400	600	1000	1400
>500	90	58	58	100*	86	72	100*
250 - 500	100*	100*	100	100*	100*	100*	100*
150 - 250	90	82	26	100*	100*	67	90
105 - 150	100*	100*	100*	100*	100*	100*	100
75 - 105	100*	92	74	82	77	68	76
53 - 75	Undefined [a]	56	100*	72	69	50	80
20 - 53	54	100*	54	33	36	40	31
8 - 20	67	52	25	21	17	20	20
5 – 8	33	29	11	12	9	7	19
<5	13	0	0	0	0	0	4
All particle sizes by mass balance	**70.4**	**63.8**	**53.9**	**47.5**	**46.0**	**43.7**	**49.0**

[a] An outlier in the feed sample sieve data resulted in a negative removal efficiency for this size fraction.
* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 171% (average 128%). See text and Bulletin # CETV 2016-11-0001 for more information.

Table 2. Removal efficiencies (%) of the EFO4 at surface loading rates above the bypass rate of 535 L/min/m^2

Particle size fraction (µm)	Surface loading rate (L/min/m^2)		
	600	1000	1400
>500	89	83	100*
250 - 500	90	100*	92
150 - 250	90	67	100*
105 - 150	85	92	77
75 - 105	80	71	65
53 - 75	60	31	36
20 - 53	33	43	23
8 - 20	17	23	15
5 – 8	10	3	3
<5	0	0	0
All particle sizes by mass balance	**41.7**	**39.7**	**34.2**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 103 and 111% (average 107%). See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the EF4 at each of the tested surface loading rates. Figure 4 shows the same graph for the EFO4 unit at surface loading rates above the bypass rate of 535 L/min/m^2.

As expected, the capture efficiency for fine particles in both units was generally found to decrease as surface loading rates increased.

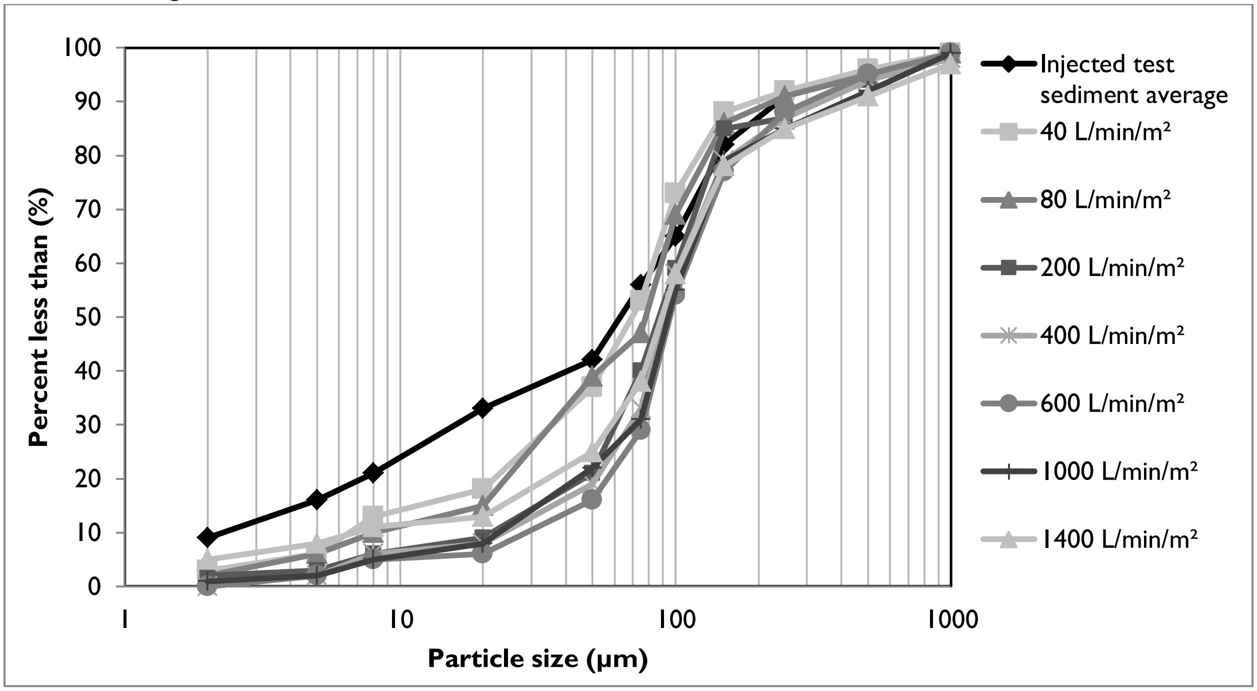

Figure 3. Particle size distribution of sediment retained in the EF4 in relation to the injected test sediment average.

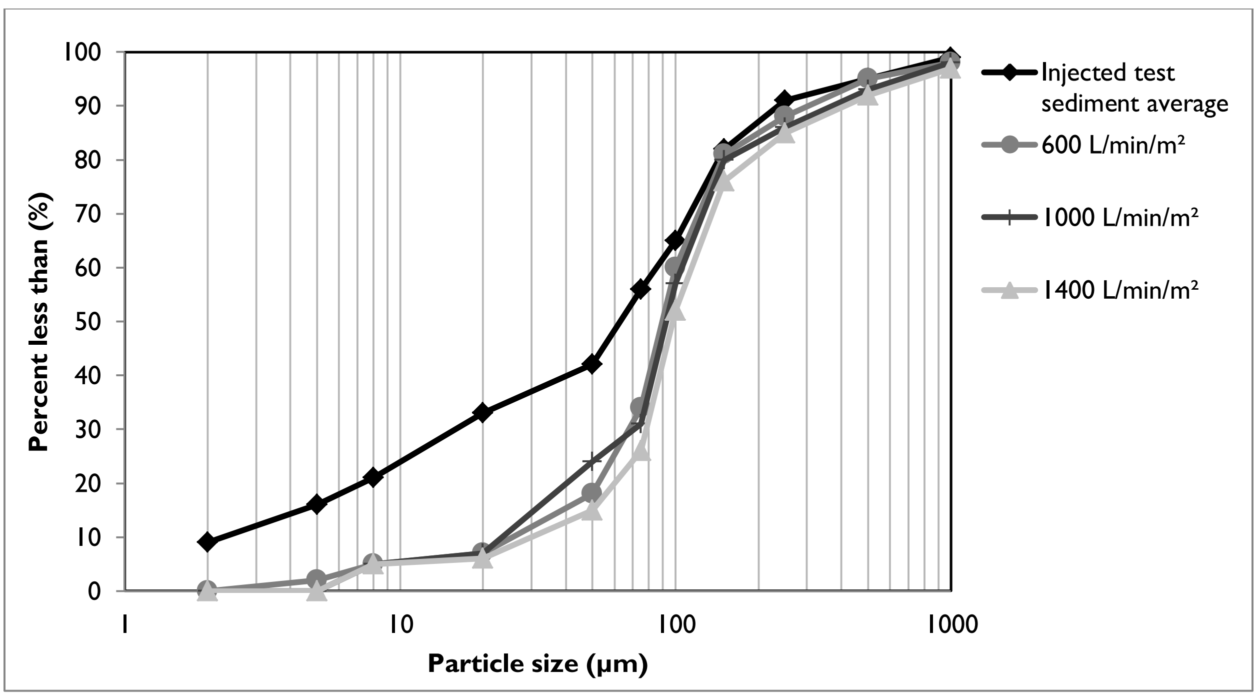

Figure 4. Particle size distribution of sediment retained in the EFO4 in relation to the injected test sediment average at surface loading rates above the bypass rate of 535 L/min/m²

Table 4 shows the results of the sediment scour and re-suspension test for the EF4 unit. The EFO4 was not tested as it was reasonably assumed that scour rates would be lower given that flow bypass occurs at a lower surface loading rate. The scour test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. Typically, the smallest 5% of particles captured during the 40 L/min/m² sediment capture test is also used to adjust the concentration, as per the method described in Bulletin # CETV 2016-09-0001. However, since the composites of effluent concentrations were below the Reporting Detection Limit of the Laser Diffraction PSD methodology, this adjustment was not made. Results showed average adjusted effluent sediment concentrations below 5 mg/L at all tested surface loading rates.

It should be noted that the EF4 starts to internally bypass water at 1135 L/min/m², potentially resulting in the dilution of effluent concentrations, which would not normally occur under typical field conditions because the field influent concentration would contain a much higher sediment concentration than during the lab test. Recalculation of effluent concentrations to account for dilution at surface loading rates above the bypass rate showed sediment effluent concentrations to be below 1.6 mg/L.

Table 4. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m²)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L) [a]	Average (mg/L)
1	200	1:00	<RDL	11.9	4.6
		2:00		7.0	
		3:00		4.4	
		4:00		2.2	
		5:00		1.0	
		6:00		1.2	
2	800	7:00	<RDL	1.1	0.7
		8:00		0.9	
		9:00		0.6	
		10:00		1.4	
		11:00		0.1	
		12:00		0	
3	1400	13:00	<RDL	0	0
		14:00		0.1	
		15:00		0	
		16:00		0	
		17:00		0	
		18:00		0	
4	2000	19:00	1.2	0.2	0.2
		20:00		0	
		21:00		0	
		22:00		0.7	
		23:00		0	

		24:00		0.4	
5	2600	25:00	1.6	0.3	0.4
		26:00		0.4	
		27:00		0.7	
		28:00		0.4	
		29:00		0.2	
		30:00		0.4	

[a] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 5. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device continuously at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2). Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 5. Light liquid re-entrainment test results for the EFO4.

Surface Loading Rate (L/min/m2)	Time Stamp	Amount of Beads Re-entrained			
		Mass (g)	Volume (L)[a]	% of Pre-loaded Mass Re-entrained	% of Pre-loaded Mass Retained
200	62	0	0	0.00	100
800	247	168.45	0.3	0.52	99.48
1400	432	51.88	0.09	0.16	99.83
2000	617	55.54	0.1	0.17	99.84
2600	802	19.73	0.035	0.06	99.94
Total Re-entrained		295.60	0.525	0.91	--
Total Retained		32403	57.78	--	99.09
Total Loaded		32699	58.3	--	--

[a] Determined from bead bulk density of 0.56074 g/cm^3

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. During the capture test, the 40 L/min/m^2 and 80 L/min/m^2 surface loading rates were evaluated over 3 and 2 days respectively due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit at these lower flow rates. Pumps were shut down at the end of each intermediate day, and turned on again the following morning. The target flow rate was re-established within 30 seconds of switching on the pump. This procedure may have allowed sediments to be captured that otherwise may have exited the unit if the test was

continuous. On the basis of practical considerations, this variance was approved by the verifier prior to testing.

2. During the scour test, the coefficient of variation (COV) for the lowest flow rate tested (200 L/min/m^2) was 0.07, which exceeded the specified limit of 0.04 target specified in the OGS Procedure. A pump capable of attaining the highest flow rate of 3036 L/min had difficulty maintaining the lowest flow of 234 L/min but still remained within +/- 10% of the target flow and is viewed as having very little impact on the observed results. Similarly, for the light liquid re-entrainment test the COV for the flow rate of the 200 L/min/m^2 run was 0.049, exceeding the limit of 0.04, but is believed to introduce negligible bias.

3. Due to pressure build up in the filters, the runs at 1000 L/min/m^2 for the Stormceptor® EF4 and 1000 and 1400 L/min/m^2 for the Stormceptor® EFO4 were slightly shorter than the target. The run times were 54, 59 and 43 minutes respectively, versus targets of 60 and 50 minutes. The final feed samples were timed to coincide with the end of the run. Since >25 lbs of sediment was fed, the shortened time did not invalidate the runs.

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems Inc. to support the performance claim included the following: Performance test report prepared by Good Harbour Laboratories, and dated September 8, 2017; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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