TATHAM ENGINEERING

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Sydenham Heights Centre

SERVICING FEASIBILITY STUDY

Thompson Centres

File 120242 | December 18, 2020

Document Control

File:	Prepared by:	Prepared for:
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Date: **December 18, 2020**		

Authored by:	Reviewed by:
	
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Issue	Date	Description
0	December 16, 2020	Draft for client review
1	December 18, 2020	Final

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1 Introduction

Tatham Engineering Limited (Tatham) was retained by Thompson Centres Inc. to prepare a Servicing Feasibility Study in support of the proposed commercial development at 1960 16th Street East in the City of Owen Sound. This Servicing Feasibility Report has been prepared in support of the Zoning By-law Amendment application process, required to facilitate the development.

1.1 OBJECTIVES

The purpose of this report is to review the servicing requirements of the site, evaluate the existing municipal and utility infrastructure surrounding the site and to outline a servicing strategy for the proposed development. Specifically, the watermain distribution, sanitary sewage servicing, stormwater management, transportation, and utility servicing.

1.2 GUIDELINES AND BACKGROUND INFORMATION

The servicing strategies recommended in this report reflect the details outlined in the "Owen Sound Pre-Consultation for Commercial Development at 1960 16th Street East" response. The site is currently zoned as Light Industrial (M1), in which restaurants and retail stores are not permitted. There is a permanent 7.5 m wide easement along the west edge of the property, which is used to connect the watermain, sanitary sewer, and an electrical duct bank from 16th Street East to 17th Street East.

2 Site Description

2.1 LOCATION AND TOPOGRAPHY

The 1.11 ha site is located at municipal address 1960 16th Street East within the eastern limits of the City of Owen Sound, on the north side of 16th Street (Hwy 26). The legal description of the site is RANGE 6 EGR PARK PT LOT 8 including RP 16R712 PART OF PART 1, RP 16R1883 PART OF PART 2, RP 16R1883 PART OF PART 1 and RP 16R1883 PARTS 3 & 4. The site is bounded by 16th Street East to the south, 17th Street East to the north, a commercial/industrial property to the west and a single-family residence to the east.

The site location is shown on Figure 1.

2.2 SITE CONDITIONS

The site was previously a single-family residence with a detached garage. Both structures have since been demolished, with the gravel driveway off of 16th Street East remaining. Currently the gravel driveway off of 16th Street East is the only access point for the property. The site is heavily treed at the northern end and is grassed with vegetation on the southwest side. The existing topography of the site slopes to the northwest of the site to the existing roadside drainage ditch along 17th Street East with an average slope of 4.6%.

2.3 SUBSURFACE CONDITIONS

Borehole logs from the geotechnical investigation conducted by Paterson Group, indicate that the groundwater levels are approximately 3-4 m below the existing ground surface, but may fluctuate seasonally. The report indicates that the site generally is covered with a layer of topsoil, over a layer of compact glacial till including cobbles and boulders. In accordance with the Ontario soil survey report for Grey County, the soil series associated with the site is Vincent, symbol Vsc and hydrological soil group C (Silty clay loam).

2.4 PROPOSED DEVELOPMENT

The proposed development features a service commercial centre with four detached buildings. The proposed structures will include two restaurants with drive-thru access, and commercial/retail stores. Site access will be provided off 17th Street East and the proposed extension of 20th Avenue East.

3 Water Supply and Distribution

3.1 EXISTING WATER INFRASTRUCTURE

There is existing water infrastructure fronting the site on 16th Street East, 17th Street East, and along the easement within the west side of the property. The watermain on 16th Street East is a 450 mm diameter PVC main. 17th Street East and the permanent easement feature a 457 mm diameter concrete pressure pipe watermain.

3.2 PROPOSED INFRASTRUCTURE

The commercial development will be serviced with municipally treated water. A single 200 mm connection will be made to the 457 mm diameter watermain on 17th Street East for both domestic and fire servicing. Drawing GS-1 appended to this report, illustrates the existing watermains and the proposed service for the site. An additional site fire hydrant will be required to meet OBC requirements.

3.3 WATER DEMANDS ASSESSMENT

Commercial Equivalent Population (CEP)	=	86 persons/ha
	=	86 persons/ha x 1.11 ha
	=	95.5 persons
Average Day Demand (ADD)	=	(CEP) x Average daily demand per person
	=	(95.5) persons x 450 L/day
	=	42,975 L/day
	=	42.98 m^3/day (0.50 L/s)
Peak Hour	=	ADD x Peak hourly factor
	=	42.98 m^3/day x 7.4(1)
	=	318.05 m^3/day (3.7 L/s)
Maximum Day Demand (MDD)	=	ADD x Maximum daily factor
	=	42.98 m^3/day x 4.9(1)
	=	210.60 m^3/day (2.4 L/s)
Fire Flow (FF)	=	67 L/s(3)

MDD + FF	=	2.4 L/s + 67 L/s
	=	69.4 L/s

[1] Taken from MOE (2008) Design Guidelines for Drinking Water Systems

[2] Taken from Owen Sound Engineering Standards (2016)

[3] Fire flow calculation completed per Fire Underwriter Survey (1999) Water Supply for Public Fire Protection. A detailed calculation is included in Appendix A of this report. Each proposed building was analyzed with Building 'D' resulting in the highest fire flow demand. Fire flow supply to be confirmed by the building's mechanical engineer at the time of detailed design. In addition, a hydrant flow test adjacent to the site is to be completed to ensure the fire flow is available within the City's watermain system.

3.3.1 Water Capacity

The proposed development will have an Average Day Demand (ADD) of 42.98 m^3/day and Maximum Day Demand (MDD) of 210.60 m^3/day based on a commercial equivalent population of 95.5 persons.

The City's existing water treatment plant has a capacity of 27,300 m^3/day and is operating at approximately 50% capacity, see City correspondence in Appendix F. Based on the operational capacity of the plant and the existing infrastructure available adjacent to the site, sufficient water supply to provide potable water to the proposed commercial development is available.

4 Sanitary Servicing

4.1 BACKGROUND / EXISTING INFRASTRUCTURE

There is an existing 450 mm diameter sanitary sewer draining from west to east along the north frontage of the property along the 17th Street East ROW. There is also a 450 mm diameter sanitary sewer draining east to west along the south frontage of the property within the 16th Street East ROW. In addition, an existing 450 mm diameter sanitary sewer in located within the 7.5 m easement draining south to north along the west side of the property, which connects the two above mentioned sanitary sewers.

4.2 SEWAGE DEMANDS

To estimate the peak flow, we have assumed the following:

Commercial Equivalent Population	=	100 persons/ha
(CEP)	=	100 persons/ha x 1.112 ha
	=	111.2 persons
Site Area	=	1.112ha
Average Flow (Q)	=	400 L/capita/day
Peak Extraneous Flows (I)	=	0.20 L/ha/s
Harmon Peaking Factor (M)	=	$1+14/(4+(CEP/1000)^{0.5})^{(1)}$
	=	$1+14/(4+((111.2)/1000)^{0.5})$
	=	4.23
Peak Flow	=	(M*Q*CEP/1000)/86.4 + IA
	=	(4.23 x 400 x (111.2/1000))/86.4 + 0.20 x 1.112
	=	2.4 L/s

[1] Taken from Owen Sound Engineering Standards (2016)

4.3 PROPOSED SANITARY SEWER / INFRASTRUCURE

A proposed 200 mm diameter sanitary sewer service will be installed connecting to the existing 450mm sanitary main along 17th Street East to service the development, with a control manhole

constructed along the property line. The proposed 200 mm sanitary service and connection point are shown on Drawing GS-1 appended to this report.

Sanitary drainage from the proposed development will ultimately drain to the Owen Sound Wastewater Treatment Plant located on the eastern shore of Georgian Bay on 3rd Avenue East.

The full flow capacity of the existing 450 mm sanitary main at 0.3% along 17th Street East for the proposed tie in location for the service is 156 L/s. Full flow capacity obtained through Manning's Equation, see below.

Manning's Roughness Coefficient (n)	=	0.013(1)
Area of Flow (A)	=	$\pi \times (r/2)^2$
	=	$\pi \times (0.45\ m/2)^2$
	=	$0.159\ m^2$
Wetted Perimeter (p_w)	=	$\pi \times r$
	=	$\pi \times 0.45\ m$
	=	0.414 m
Hydraulic Radius (R)	=	A/p
	=	$0.159\ m^2/1.414\ m$
	=	0.112 m
Energy Slope (S)	=	0.30 %
	=	0.003
Full Flow (Q)	=	$(1/n) \times A \times R^{(2/3)} \times S^{(1/2)}$
	=	$(1/0.013) \times 0.159\ m^2 \times (0.112\ m)^{2/3} \times (0.003)^{1/2}$
	=	$0.156\ m^3/s$ (156 L/s)

1 Taken from MTO Drainage Management Manual Table 2.01

The Owen Sound Wastewater Treatment Plant located on the eastern shore of Georgian Bay on 3rd Avenue East has a capacity of 24,545 m^3/day and has been confirmed to be operating at approximately 50% capacity, see City correspondence in Appendix F. Based on the operational capacity of the plant and the existing infrastructure available adjacent to the site, there is adequate capacity to service the proposed development.

5 Stormwater Management

5.1 EXISTING AND PROPOSED DRAINAGE CONDITIONS

Under existing conditions, the site drains via overland from the southeast corner to the northwest corner at an average gradient of 4.6%. Drainage from the site is collected in the roadside ditch on the south side of 17th Street East. The existing ditch continues to flow west along 17th Street East and eventually discharges to the Georgian Bay.

An existing conditions drainage plan (Drawing DP-1) is enclosed and shows the existing drainage pattern of the site.

The drainage patterns for the proposed development are shown on the enclosed post development drainage plan (Drawing DP-2). Drainage from the rooftop areas of the proposed buildings as well as the proposed parking areas will be directed to a storm sewer system including catchbasin and building connections. The post development flows are proposed to discharge to the 17th Street East roadside ditch as shown on Drawing GS-1. Preliminary stormwater management quantity controls have been modelled using Visual Otthymo (VO6) to calculate the required storage on site to reduce post development flows to existing. A quantity control manhole will be required on the downstream end of the storm sewer system to control the flows. The site was modelled using the minimum 100mm orifice as the control which generates approximately 600m^3 of storage requirement in the post development condition. The storage volume requirements will be provided with a combination of rooftop, surface and underground storage to be determined at the detailed stage of the project. Detailed storage volume and stage discharge calculations are included in Appendix C and summaries below in Section 5.2. In addition, an oil grit separator will be located downstream of the quantity control manhole to provide quality control prior to discharging to the 17th Street East roadside ditch as shown on Drawing GS-1. Sizing calculation are further discussed in Section 5.3 below.

5.2 STORMWATER QUANTITY CONTROL

The proposed development will increase the imperviousness of the property.

A Visual Otthymo (VO6) hydrologic model has been prepared to calculate existing condition peak flows from the site for the 2, 5, 25 and 100-year 4-hour Chicago design storm in accordance with the Owen Sound design criteria. Detailed calculations related to the hydrologic modeling parameters used and the VO6 output files are enclosed in Appendix B. For the purposes of this modeling, the site's outlet is the 17th Street East roadside ditch. Table 1 summarizes the results of the existing condition hydrologic modelling at the site's outlet.

Table 1: Existing Condition Hydrologic Modeling Results

STORM EVENT	4 HR CHICAGO PEAK FLOW (m^3/s)
2-year	0.016
5-year	0.030
25-year	0.059
100-year	0.087

A proposed condition hydrologic VO6 model was created for the site, output files from the model are included in Appendix D. Table 2 outlines the performance of the proposed underground stormwater facility and Table 3 summarizes the proposed condition controlled peak flows to the site's existing flows. As demonstrated in Table 3 the proposed underground stormwater facility will attenuate peak flows at the site's outlet to existing condition levels for the 2, 5, 25 and 100-year 4-hour Chicago design storm.

Table 2: SWM Facility Stage Storage Discharge Table

STORM EVENT	4 HR CHICAGO		
	PEAK FLOW (m^3/s)	STAGE (m)	STORAGE (m^3)
2-year	0.014	100.58	265
5-year	0.016	100.73	357
25-year	0.020	100.96	500
100-year	0.023	101.23	606

Table 3: Proposed Condition Hydrologic Modeling Results

STORM EVENT	4 HR CHICAGO PEAK FLOW (m^3/s)	
	EXISTING CONDITIONS	FUTURE CONDITIONS
2-year	0.016	0.014
5-year	0.030	0.016
25-year	0.59	0.02
100-year	0.087	0.023

5.3 STORMWATER QUALITY CONTROL

In accordance with the Owen Sound Engineering standards, an Enhanced Level (80% TSS removal) of water quality treatment is required and will be provided. A Stormceptor model EF-8 will treat flows and provide 83% TSS removal while treating 90% of the runoff volume. The Stormceptor will be located downstream of the quantity control manhole prior to discharging to the 17th Street East roadside ditch as shown on Drawing GS-1 .A detailed Stormceptor sizing output can be found in Appendix E.

5.4 WATER BUDGET

The proposed development will greatly increase the impervious area of the site compared to existing conditions. The increase in impervious area will decrease infiltration and increase runoff from the site.

Based on section 12.0 of the Owen Sound Engineering Design Standards 'Water Balance Management', the following the following calculations are provided.

Pre-Development Conditions

The site area is 1.11 ha with pasture type vegetation and wooded areas in silty clay loam with soil group C. The average annual site infiltration would be approximately 227 mm or approximately 2520 m^3 (227 mm × 1.11 ha).

Post-Development Conditions

With approximately 1.0 ha (90 %) of the site being converted to impervious area. The infiltration for this area would be 0 mm. The remaining 0.11 ha of the site (10 %) is assumed to be covered

with urban lawns (shallow rooted crops) with an average annual infiltration of 182 mm or approximately 200 m^3 (182 mm × 0.11 ha). There would be a net reduction in infiltration of 2320 m^3 (2520 m^3 – 200 m^3). At the detailed design stage an in-situ infiltration test will need to be performed at the proposed location of the infiltration gallery to determine if the underlying soils are conducive to infiltration. The intent will be to capture the 5 mm storm, which relates to 50% of all rainfall annually and. Volume to capture during a typical rainfall (5 mm) would be 50 m^3 (5 mm x 1.0 ha).

5.5 ALTERNATIVE SOLUTIONS

The above noted SWM plan demonstrates that the water quality and quantity objectives can be achieved. However, as this project evolves and transitions to detailed design, the opportunity to implement alternative SWM measures may arise. These may include but are not limited to rooftop and parking lot storage and low impact development features.

6 Transportation

The site is currently accessible from a gravel driveway off 16th Street East at the southwest corner of the site. Vehicular access to the proposed development will be provided off the proposed extension of 20th Avenue East and 17th Street East. Intersection improvements and the extension of 20th Avenue East north of 16th Street East will be required for providing vehicular access to the proposed site.

The existing tee intersection at 16th Street East and 20th Avenue East will be amended to allow 20th Avenue East to extend north, connecting to 17th Street East. The extension of 20th Avenue East will be constructed as part of this development. The length of road will extend from the existing intersection at 16th Street East to 17th Street East. The proposed length of road will be designed to the City of Owen Sound Standard drawing OSS-106C and will include 3 lanes.

In addition, 17th Street East fronting the site will also require upgrades as part of this development. The upgrades of 17th Street East will be designed per the City of Owen Sound Standard drawing OSS-107C, as a 2-lane rural road.

The proposed access from 20th Avenue East is located 83 m north of the existing intersection at 16th Street East and 20th Avenue. The proposed access from 17th Street East is located 75 m west of the proposed intersection of 20th Avenue East and 17th Street East.

A Traffic Impact Study (TIS) will be completed and submitted during the site plan application stage.

7 Utilities

7.1 HYDRO

Hydro supply for the site is available from the overhead distribution lines along 16th Street East.

An electrical duct bank is located in the permanent easement along the west side of the property.

7.2 GAS

From the survey conducted in 2004 by Dinsmore & England Ltd., there appears to be gas servicing on three sides of the property. There is servicing shown along the north side of 16th Street East within the ROW, along the east property line within the proposed 20th Avenue East ROW, as well as along 17th Street East on the south side of the road within the ROW.

Sizes and condition of the gas main in this area are currently unknown.

7.3 TELEPHONE & INTERNET

Bell has existing buried cable fronting the property along 16th Street East to service the development.

8 Summary

As outlined above, the property can be serviced, key findings are summarized below:

- Potable water will be supplied by connecting to the existing municipal watermain on 17th Street East. The existing City of Owen Sound water supply has sufficient capacity to supply the water demand.
- Sanitary sewage will be collected and conveyed to the existing sanitary sewer on 17th Street East. The existing Owen Sound Wastewater Treatment Plant has sufficient capacity to accommodate flows from the development.
- Stormwater drainage will be collected and controlled to provide quantity control by matching proposed flows to the existing condition level. A Stormceptor EF8 unit will provide water quality treatment to enhanced, Level 1, criteria.
- Site access will be provided from the proposed extension of 20th Avenue East, as well as 17th Street East. Construction of a portion of 20th Avenue East will be required to provide access to the site.
- Hydro, gas and bell have existing infrastructure fronting the site which can supply the site.

Figure 1: Site Location

17TH STREET EAST

16TH STREET EAST

20TH AVENUE EAST

EDGE OF ASPHALT

BOTTOM OF DITCH

LOCAL BENCHMARK

N80°55'20"E 219.60

219.00

220.00

221.00

222.00

223.00

224.00

225.00

226.00

227.00

226.20

144m @4.6%

100
1.11 | 14%

EXISTING GRAVEL DRIVEWAY

EXISTING ASPHALT ENTRANCE

(Reference Bearing)
N80°54'00"E

N80°51'50"E

N80°54'E

N80°54'00"E

N9°26'W

N9°27'W

TOP OF DITCH

BOTTOM OF DITCH

GUARD RAIL

EDGE OF ASPHALT

Utility Pole

Telephone Bell

Hydro Pad

LEGEND

PRE-DEVELOPMENT CATCHMENT BOUNDARY

A – CATCHMENT IDENTIFICATION NUMBER

B – CATCHMENT (AREA IN HECTARES)

C – IMPERVIOUSNESS (%)

EXISTING MINOR OVERLAND FLOW DIRECTION

EXISTING MAJOR OVERLAND FLOW DIRECTION

100
1.11 | 14%

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PRE-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-1**

SCALE: 1:750	DRAWN: AJO	DATE: DEC/20	JOB NO. 120242

Drawing Name: 120242-DP01.dwg, Plotted: Dec 15, 2020

17TH STREET EAST

16TH STREET EAST

20TH AVENUE EAST

STOP

LOCAL BENCHMARK

EDGE OF ASPHALT

BOTTOM OF DITCH

N80°55'20"E

219.00

220.00

221.00

222.00

223.00

225.00

226.00

227.00

228.00

229.00

SNOW STORAGE

10m SETBACK

3:1 SLOPE

UNIT 1 | UNIT 2 | UNIT 3 | UNIT 4 | UNIT 5

FUTURE BUILDING D
811.78 SM 8,738 SF
F.F.E. 224.00 22'-0" HIGH

B.F.

200
1.11 | 0.90

RETAINING WALL 2.0m

2m SETBACK

BUILDING C
419.64 SM
4,517 SF

F.F.E. 225.2
24'-0" HIGH

F.F.E. 224.4
22'-0" HIGH
BUILDING A
221.65 SM
2,386 SF

BUILDING B
538.80 SM (5,800 SF)
F.F.E. 224.7 22'-0" HIGH

FLUSH MOUNT CURB

RETAINING WALL 1.0m

10m MTO SETBACK

RETAINING WALL 0.5m

FUTURE TRANSFORMER (LOCATION & SIZE T.B.D.)

EXISTING ASPHALT ENTRANCE

LP

LEGEND

MAJOR POST-DEVELOPMENT CATCHMENT BOUNDARY

A – CATCHMENT IDENTIFICATION NUMBER

B – CATCHMENT (AREA IN HECTARES)

C – RUNOFF COEFFICIENT

PROPOSED MINOR OVERLAND FLOW DIRECTION

PROPOSED MAJOR OVERLAND FLOW DIRECTION

200
1.11 | 0.9

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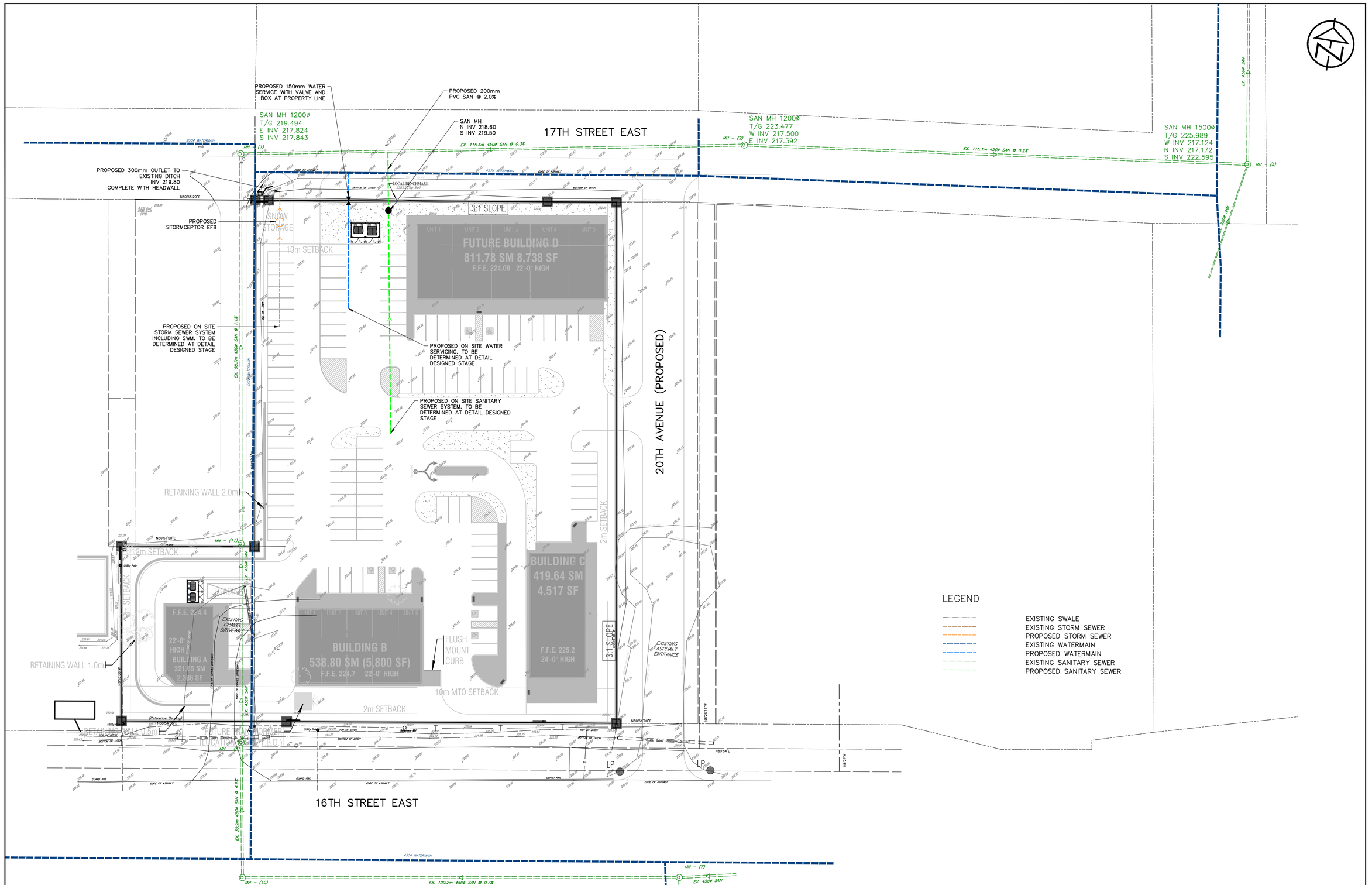
POST-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-2**

SCALE: 1:750 | DRAWN: AJO | DATE: DEC/20 | JOB NO. 120242

Drawing Name: 120242-DP02.dwg, Plotted: Dec 15, 2020



LEGEND

- EXISTING SWALE
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING WATERMAIN
- PROPOSED WATERMAIN
- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER

BENCHMARKS

NOTES

No.	REVISION DESCRIPTION	DATE

ENGINEER STAMP

1960 16TH STREET
CITY OF OWEN SOUND

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PRELIMINARY SERVICING PLAN

DESIGN: DESIGN	FILE: 120242	DWG: GS-1
DRAWN: AJO	DATE: DEC 2020	
CHECK: DC	SCALE: 1:400	

Drawing Name: 120242-GS01.dwg, Plotted: Jan 04, 2021

Appendix A:
Fire Flow Calculation

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Project:	1960 16th Street, Owen Sound	Date:	Dec. 14, 2020
File No.:	120242	Designed:	DC
Subject:	Fire Flow Calculations	Checked	
Revisions:			

FIRE UNDERWRITERS SURVEY FIRE FLOW CALCULATIONS
LONG METHOD

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options	Multiplier Associated with Option	Choose	Value Used	Unit	Total Fire Flow (L/min)	
1	Frame Use for Construction of Unit	**Framing Material**							
		Coefficient related to type of construction (C)	Wood Frame	1.5	Non-combustible construction	**0.8**	-		
			Ordinary Construction	1					
			Non-combustible construction	0.8					
			Fire resistive construction (< 2 hrs)	0.7					
			Fire resistive construction (> 2 hrs)	0.6					
2	Type of Building (if Townhouse, enter number of units per TH block)	**Floor Space Area**							
		Type of Housing	Single Family			0	Units		
			Townhouse / Apartment- inform # of units			0			
			Other (Comm. Ind., etc)			**1**			
2.1	Number of Stories	Number of Floors / Stories in the unit (do not include basement)				**1**	Stories		
3	Floor Area	Total Floor Area (A) - for all stories excluding basement					m^2		
		Measurement Units	Square Feet (ft2)		Square metres	812			
			Square Metres (m^2)	1					
			Hectares (ha)						
4	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (FF= 220 x C x $A^{0.5}$)					L/min		5,000
5	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**							
5.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Non- Combustible	-0.25	N/A	0	(1,250)
			Limited combustible	-0.15					
			Combustible	0.00					
			Free burning	0.15					
			Rapid burning	0.25					
5.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete automatic sprinkler protection	-0.3	None	0.0	N/A	0	-
			None	0					
5.3	Separation Distance Between Units	Exposure distance between units	North Side	0	0	0	N/A	0	-
			East Side	0	0				
			South Side	57	0				
			West Side	0	0				
					Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:			0	4,000
6	Required Fire Flow, Duration and Volume				**Total Required Fire Flow (above) in L/s:**			**0**	**67**
					Required Duration of Fire Flow of 4,000 L/min (hrs):			1.50	
					Required volume for Fire Flow of 4,000 L/min (m^3):			360	

Notes: - Assumed non-combustible construction as detailed design drawings are not yet available

REQUIRED DURATION OF FIRE FLOW

Fire Flow Required (L/min)		Duration (hours)
2,000	or less	1.00
3,000		1.25
4,000		1.50
5,000		1.75
6,000		2.00
8,000		2.00
10,000		2.00
12,000		2.50
14,000		3.00
16,000		3.50
18,000		4.00
20,000		4.50
22,000		5.00
24,000		5.50
26,000		6.00
28,000		6.50
30,000		7.00
32,000		7.50
34,000		8.00
36,000		8.50
38,000		9.00
40,000	and over	9.50

Appendix B:
Existing Condition Modeling

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Visual OTTHYMO Model Parameter Calculations (NasHYD)

Project Details

1960 16th Street	120242

Prepared By

Doris Casullo	Dec.14, 2020

Data Sources

Detailed Soil Survey Reports for Ontario, GSCA Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation (2010), MTO Drainage Management Manual (1997)

Pre-Development Condition

Watershed:	GSCA
Catchment ID:	100
Catchment Area (ha):	1.11
Impervious %:	14%

Average Curve Number (CN), Runoff Coefficient (C) and Initial Abstraction (IA)

Soil Symbol		**Vsc**											
Soil Series		Vincent											
Hydrologic Soils Group		C											
Soil Texture		Silty Clay Loam											
Runoff Coefficient Type		3											
Area (ha)		1.11											
Percentage of Catchment		100%											
Land Cover Category	**IA**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**
Impervious	2		100	0.95									
Gravel	3		89	0.38									
Woodland	10	0.67	73	0.35									
Pasture/Lawns	5	0.44	79	0.40									
Meadows	8		76	0.38									
Cultivated	7		82	0.55									
Waterbody	12		50	0.05									
Average CN		75.38											
Average C		0.37											
Average IA		8.02											

Time to Peak Calculations

Max. Catchment Elev. (m):	226.20
Min. Catchment Elev. (m):	219.60
Catchment Length (m):	144
Catchment Slope (%):	4.58%
Method: Airport Method	
Time of Concentration (mins):	17.28

Summary

Catchment CN:	75.4
Catchment C:	0.37
Catchment IA (mm):	8.02
Time of Concentration (hrs):	0.29
Catchment Time to Peak (hrs):	0.19
Catchment Time Step (mins):	2.30

TATHAM ENGINEERING

PROJECT	1960 16th Street, Owen Sound	FILE	120242
		DATE	Dec.14, 2020
SUBJECT	Exisitng Condition Otthymo Schematic	NAME	Doris Casullo
		PAGE	1 OF 1

100

NASHYD

ROUTE PIPE

DUHYD

STANDHYD

ROUTE CHANNEL

DIVERT HYD

ADDHYD

ROUTE RESERVOIR

Pre - Development

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       V    V   I    SSSSS  U   U    A    L             (v 6.0.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U A   A  L
         VV     I    SSSSS  UUUUU A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                *****  D E T A I L E D   O U T P U T *****


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35211-8d56-4171-a8e8-e625b51b7458\sce


DATE: 12-14-2020                          TIME: 02:31:44

USER:



COMMENTS: _____________________________________________________________


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  ***********************************************
  ** SIMULATION : 1.Chicago Design Storm-2yr    **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 854.100
| Ptotal= 33.22 mm |                          B=   7.781
--------------------                          C=   0.830
```

```
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33

      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
      0.08    2.50 |  0.83   16.07 |  1.58    7.71 |  2.33    3.33
      0.17    2.74 |  0.92   37.77 |  1.67    6.71 |  2.42    3.14
      0.25    3.05 |  1.00  103.05 |  1.75    5.94 |  2.50    2.97
      0.33    3.44 |  1.08   48.38 |  1.83    5.34 |  2.58    2.82
      0.42    3.94 |  1.17   27.20 |  1.92    4.84 |  2.67    2.68
      0.50    4.63 |  1.25   18.42 |  2.00    4.44 |  2.75    2.56
      0.58    5.63 |  1.33   13.76 |  2.08    4.09 |  2.83    2.44
      0.67    7.20 |  1.42   10.93 |  2.17    3.80 |  2.92    2.34
      0.75    9.97 |  1.50    9.04 |  2.25    3.55 |  3.00    2.25
```

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   1.11   Curve Number   (CN)= 75.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.02   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

     Unit Hyd Qpeak  (cms)=   0.146

     PEAK FLOW       (cms)=   0.016 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=   5.869
     TOTAL RAINFALL   (mm)=  33.223
     RUNOFF COEFFICIENT   =   0.177

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L             (v 6.0.2006)
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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U A   A  L
         VV     I    SSSSS  UUUUU A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

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DATE: 12-14-2020 TIME: 02:31:44

USER:

COMMENTS: _____

****
** SIMULATION : 2.Chicago Design Storm-5yr **
****

| CHICAGO STORM | Ptotal= 42.92 mm |

IDF curve parameters: A=1234.576
B= 8.297
C= 0.851
used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.96	0.83	20.90	1.58	9.70	2.33	4.01
0.17	3.27	0.92	50.20	1.67	8.38	2.42	3.76
0.25	3.65	1.00	136.52	1.75	7.38	2.50	3.55
0.33	4.14	1.08	64.50	1.83	6.59	2.58	3.36
0.42	4.79	1.17	35.96	1.92	5.95	2.67	3.19
0.50	5.67	1.25	24.07	2.00	5.42	2.75	3.03
0.58	6.97	1.33	17.79	2.08	4.98	2.83	2.89
0.67	9.03	1.42	13.99	2.17	4.61	2.92	2.77
0.75	12.71	1.50	11.47	2.25	4.28	3.00	2.65

CALIB NASHYD (0100) ID= 1 DT= 5.0 min	Area (ha)= 1.11	Curve Number (CN)= 75.4	Ia (mm)= 8.02	# of Linear Res.(N)= 3.00	U.H. Tp(hrs)= 0.29

Unit Hyd Qpeak (cms)= 0.146

PEAK FLOW (cms)= 0.030 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 10.331
TOTAL RAINFALL (mm)= 42.923
RUNOFF COEFFICIENT = 0.241

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

V V I SSSSS U U A L (v 6.0.2006)
V V I SS U U A A L
V V I SS U U AAAAA L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

OOO TTTTT TTTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
OOO T T H H Y M M OOO

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***** D E T A I L E D O U T P U T *****

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DATE: 12-14-2020                          TIME: 02:31:44

USER:



COMMENTS: _____________________________________________________________


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  ***********************************************
  ** SIMULATION : 3.Chicago Design Storm-25yr   **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1750.276
| Ptotal= 60.35 mm |                          B=   8.303
--------------------                          C=   0.862
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.08    2.71 |  1.08   16.72 |  2.08    9.57 |  3.08    3.84
                0.17    2.91 |  1.17   27.82 |  2.17    8.52 |  3.17    3.66
                0.25    3.14 |  1.25   68.08 |  2.25    7.67 |  3.25    3.50
                0.33    3.42 |  1.33  188.05 |  2.33    6.97 |  3.33    3.35
                0.42    3.75 |  1.42   87.82 |  2.42    6.39 |  3.42    3.21
                0.50    4.15 |  1.50   48.42 |  2.50    5.90 |  3.50    3.09
                0.58    4.65 |  1.58   32.14 |  2.58    5.48 |  3.58    2.97
                0.67    5.29 |  1.67   23.59 |  2.67    5.11 |  3.67    2.86
                0.75    6.13 |  1.75   18.44 |  2.75    4.79 |  3.75    2.76
                0.83    7.31 |  1.83   15.05 |  2.83    4.51 |  3.83    2.67
                0.92    9.03 |  1.92   12.66 |  2.92    4.26 |  3.92    2.59
                1.00   11.77 |  2.00   10.91 |  3.00    4.04 |  4.00    2.51


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0100)|   Area    (ha)=   1.11   Curve Number   (CN)= 75.4
|ID= 1 DT= 5.0 min |   Ia      (mm)=   8.02   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.29

     Unit Hyd Qpeak  (cms)=   0.146

     PEAK FLOW       (cms)=   0.059 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  20.230
     TOTAL RAINFALL   (mm)=  60.348
     RUNOFF COEFFICIENT   =   0.335

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.0.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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7213c-42ad-4e38-a10e-30e4be0949ed\sce


DATE: 12-14-2020                          TIME: 02:31:44

USER:
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COMMENTS: _____

  ****
  ** SIMULATION : 4.Chicago Design Storm-100yr **
  ****

| CHICAGO STORM |
| Ptotal= 72.84 mm |

IDF curve parameters: A=2171.754
B= 8.303
C= 0.867
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.18	1.08	20.04	2.08	11.39	3.08	4.53
0.17	3.42	1.17	33.54	2.17	10.12	3.17	4.31
0.25	3.70	1.25	82.78	2.25	9.10	3.25	4.12
0.33	4.02	1.33	230.33	2.33	8.27	3.33	3.94
0.42	4.41	1.42	106.99	2.42	7.57	3.42	3.78
0.50	4.89	1.50	58.68	2.50	6.98	3.50	3.63
0.58	5.49	1.58	38.79	2.58	6.48	3.58	3.49
0.67	6.25	1.67	28.38	2.67	6.04	3.67	3.36
0.75	7.27	1.75	22.13	2.75	5.66	3.75	3.24
0.83	8.67	1.83	18.01	2.83	5.33	3.83	3.13
0.92	10.74	1.92	15.13	2.92	5.03	3.92	3.03
1.00	14.05	2.00	13.01	3.00	4.76	4.00	2.94

| CALIB |
| NASHYD (0100)|
|ID= 1 DT= 5.0 min |

Area (ha)= 1.11 Curve Number (CN)= 75.4
Ia (mm)= 8.02 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.29

Unit Hyd Qpeak (cms)= 0.146

PEAK FLOW (cms)= 0.087 (i)
TIME TO PEAK (hrs)= 1.667
RUNOFF VOLUME (mm)= 28.421
TOTAL RAINFALL (mm)= 72.844
RUNOFF COEFFICIENT = 0.390

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

FINISH
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Appendix C: Underground Retention Facility Calculations

TATHAM ENGINEERING

Project:	1960 16th Street
Date:	December 14, 2020
File No.:	120242
Designed By:	DC
Checked By:	
Subject:	Storage Volume

UNDERGROUND RETENTION SWM FACILITY STAGE-VOLUME TABLE

	Cell 1
Bottom Elev.	100.00
Top of Facility	101.35
Stage	0.05
Void Space of Underground Storage	0.955
Void Space of Stone	0.4

	Elev.	**Cell 1**		**Avg. Area**	**Volume**			
		Depth	**Area**		**Dead**	**Accum. Dead**	**Live**	**Accum. Live**
	(m)	**(m)**	**(m^2)**	**(m^2)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
Bottom Of Base Stone	**100.00**	**0**	**650**	**0**	**0**	**0**	**0**	**0**
	100.05	0.05	650	650	13	13	0	0
	100.10	0.10	650	650	13	26	0	0
Top of Base Stone/ Bottom of Infiltration Basin	100.15	0.15	650	650	13	39	0	0
	100.25	0.25	650	650	0	39	62	62
	100.35	0.35	650	650	0	39	62	124
	100.45	0.45	650	650	0	39	62	186
	100.55	0.55	650	650	0	39	62	248
	100.65	0.65	650	650	0	39	62	310
	100.75	0.75	650	650	0	39	62	372
	100.85	0.85	650	650	0	39	62	435
	100.95	0.95	650	650	0	39	62	497
Top of Infiltraiton Basin/ Bottom of Backfill Stone	101.05	1.05	650	650	0	39	62	559
	101.10	1.10	650	650	0	39	13	572
	101.15	1.15	650	650	0	39	13	585
	101.20	1.20	650	650	0	39	13	598
	101.25	1.25	650	650	0	39	13	611
	101.30	1.30	650	650	0	39	13	624
Top of Backfill Stone	**101.35**	**1.35**	**650**	**650**	**0**	**39**	**13**	**637**

TATHAM ENGINEERING

Project:	1960 16th Street
Date:	December 14, 2020
File No.:	120242
Designed By:	DC
Checked By:	
Subject:	Stage Discharge

UNDERGROUND RETENTION FACILITY STAGE-DISCHARGE TABLE

ORIFICE CONTROL

	Minor
Orifice/Pipe Size (mm)	100
Cross-sectional Area (sq.m)	0.00785
Orifice Coefficient	0.63
Invert Elevation (m)	100.15

CONTROL STRUCTURE CONFIGURATION

	Outlet Structure		Total Discharge
	Minor Orifice		
Water Level	1		
	Head	Discharge	
(m)	(m)	(cms)	(cms)
100.15	0.000	0.0000	0.0000
100.25	0.100	0.0069	0.0069
100.35	0.200	0.0098	0.0098
100.45	0.300	0.0120	0.0120
100.55	0.400	0.0139	0.0139
100.65	0.500	0.0155	0.0155
100.75	0.600	0.0170	0.0170
100.85	0.700	0.0183	0.0183
100.95	0.800	0.0196	0.0196
101.05	0.900	0.0208	0.0208
101.10	0.950	0.0214	0.0214
101.15	1.000	0.0219	0.0219
101.20	1.050	0.0224	0.0224
101.25	1.100	0.0230	0.0230
101.30	1.150	0.0235	0.0235
101.35	1.200	0.0240	0.0240

TATHAM ENGINEERING

Project:	1960 16th Street
Date:	December 14, 2020
File No.:	120242
Designed By:	DC
Checked By:	
Subject:	Stage Storage Discharge

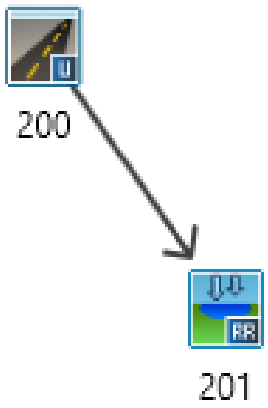
UNDERGROUND RETENTION SWM FACILITY STAGE-STORAGE-DISCHARGE TABLE

Bottom Elev.	100.00
Top of Storage	101.35
Stage	0.05

Water Level	Minor Orifice Discharge	Total Discharge	Volume		
			Dead	Live	Total
(m)	(m^3/s)	(m^3/s)	(m^3)	(m^3)	(m^3)
100.00	0.000	0.000	0	0	0
100.05	0.000	0.000	13	0	13
100.10	0.000	0.000	26	0	26
100.15	0.000	0.000	39	0	39
100.25	0.007	0.007	39	62	101
100.35	0.010	0.010	39	124	163
100.45	0.012	0.012	39	186	225
100.55	0.014	0.014	39	248	287
100.65	0.015	0.015	39	310	349
100.75	0.017	0.017	39	372	411
100.85	0.018	0.018	39	435	474
100.95	0.020	0.020	39	497	536
101.05	0.021	0.021	39	559	598
101.10	0.021	0.021	39	572	611
101.15	0.022	0.022	39	585	624
101.20	0.022	0.022	39	598	637
101.25	0.023	0.023	39	611	650
101.30	0.023	0.023	39	624	663
101.35	0.024	0.024	39	637	676

Appendix D:
Proposed Condition Modeling

PROJECT	1960 16th Street, Owen Sound	FILE	120242
		DATE	Dec.14, 2020
SUBJECT	Post Condition Otthymo Schematic	NAME	Doris Casullo
		PAGE	1 OF 1



NASHYD

ROUTE PIPE

DUHYD

STANDHYD

ROUTE CHANNEL

DIVERT HYD

ADDHYD

ROUTE RESERVOIR

Post - Development

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       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                *****  D E T A I L E D   O U T P U T *****


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DATE: 12-15-2020                          TIME: 10:24:32

USER:



COMMENTS: _____________________________________________________________


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  ***********************************************
  ** SIMULATION : Run 01        2-year      **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 854.100
| Ptotal= 33.22 mm |                          B=   7.781
--------------------                          C=   0.830
                                  used in:   INTENSITY =  A / (t + B)^C

                                  Duration of storm  =  3.00 hrs
                                  Storm time step    =  5.00 min
                                  Time to peak ratio =  0.33

      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
      0.08    2.50 |  0.83   16.07 |  1.58    7.71 |  2.33    3.33
      0.17    2.74 |  0.92   37.77 |  1.67    6.71 |  2.42    3.14
      0.25    3.05 |  1.00  103.05 |  1.75    5.94 |  2.50    2.97
      0.33    3.44 |  1.08   48.38 |  1.83    5.34 |  2.58    2.82
      0.42    3.94 |  1.17   27.20 |  1.92    4.84 |  2.67    2.68
      0.50    4.63 |  1.25   18.42 |  2.00    4.44 |  2.75    2.56
      0.58    5.63 |  1.33   13.76 |  2.08    4.09 |  2.83    2.44
      0.67    7.20 |  1.42   10.93 |  2.17    3.80 |  2.92    2.34
      0.75    9.97 |  1.50    9.04 |  2.25    3.55 |  3.00    2.25

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.10          0.01
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      86.02         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=     103.05         29.49
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       2.31 (ii)     3.42 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.30          0.26
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.29          0.00          0.292 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.00           1.00
     RUNOFF VOLUME    (mm)=      32.22         13.15          32.03
     TOTAL RAINFALL   (mm)=      33.22         33.22          33.22
     RUNOFF COEFFICIENT   =       0.97          0.40           0.96

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0201)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0200      0.0497
                          0.0070     0.0062   |   0.0210      0.0559
                          0.0100     0.0124   |   0.0210      0.0572
                          0.0120     0.0186   |   0.0220      0.0585
                          0.0140     0.0248   |   0.0220      0.0598
                          0.0150     0.0310   |   0.0230      0.0611
                          0.0170     0.0372   |   0.0230      0.0624
                          0.0180     0.0435   |   0.0240      0.0637

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      1.110      0.292      1.00      32.03
   OUTFLOW: ID= 1 (  0201)      1.110      0.014      2.00      31.83

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.89
                  TIME SHIFT OF PEAK FLOW         (min)= 60.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0265

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========================

       V    V   I    SSSSS  U   U    A    L             (v 6.0.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.0\VO2\voin.dat
  Output  filename:
C:\Users\DCasullo\AppData\Local\Civica\VH5\e89ea26c-672c-48f5-9006-c9a00153c6c7\9e4
0218d-ec10-4f1a-b591-b051e2786ac2\sce
  Summary filename:
C:\Users\DCasullo\AppData\Local\Civica\VH5\e89ea26c-672c-48f5-9006-c9a00153c6c7\9e4
0218d-ec10-4f1a-b591-b051e2786ac2\sce

DATE: 12-15-2020                          TIME: 10:24:32

USER:


COMMENTS: _____________________________________________________________

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------------------------
  ************************************************
  ** SIMULATION : Run 02        5-year          **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1234.576
| Ptotal= 42.92 mm |                          B=   8.297
--------------------                          C=   0.851
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  3.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.08    2.96 |  0.83   20.90 |  1.58    9.70 |  2.33    4.01
                0.17    3.27 |  0.92   50.20 |  1.67    8.38 |  2.42    3.76
                0.25    3.65 |  1.00  136.52 |  1.75    7.38 |  2.50    3.55
                0.33    4.14 |  1.08   64.50 |  1.83    6.59 |  2.58    3.36
                0.42    4.79 |  1.17   35.96 |  1.92    5.95 |  2.67    3.19
                0.50    5.67 |  1.25   24.07 |  2.00    5.42 |  2.75    3.03
                0.58    6.97 |  1.33   17.79 |  2.08    4.98 |  2.83    2.89
                0.67    9.03 |  1.42   13.99 |  2.17    4.61 |  2.92    2.77
                0.75   12.71 |  1.50   11.47 |  2.25    4.28 |  3.00    2.65

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   1.11
```

```
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.10         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.02        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     136.52        47.10
                 over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.06 (ii)    3.05 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.31         0.27
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.39         0.00          0.394 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      41.92        19.89          41.70
     TOTAL RAINFALL   (mm)=      42.92        42.92          42.92
     RUNOFF COEFFICIENT   =       0.98         0.46           0.97

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0201)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0200     0.0497
                          0.0070     0.0062   |   0.0210     0.0559
                          0.0100     0.0124   |   0.0210     0.0572
                          0.0120     0.0186   |   0.0220     0.0585
                          0.0140     0.0248   |   0.0220     0.0598
                          0.0150     0.0310   |   0.0230     0.0611
                          0.0170     0.0372   |   0.0230     0.0624
                          0.0180     0.0435   |   0.0240     0.0637

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)     1.110      0.394      1.00      41.70
   OUTFLOW: ID= 1 (  0201)     1.110      0.016      2.00      41.51

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  4.18

                  TIME SHIFT OF PEAK FLOW         (min)= 60.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0357

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      V    V   I    SSSSS  U   U    A    L              (v 6.0.2006)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.0\VO2\voin.dat

  Output  filename:
C:\Users\DCasullo\AppData\Local\Civica\VH5\e89ea26c-672c-48f5-9006-c9a00153c6c7\fff
045fb-c934-403f-9a27-2347556ba9e2\sce
  Summary filename:
C:\Users\DCasullo\AppData\Local\Civica\VH5\e89ea26c-672c-48f5-9006-c9a00153c6c7\fff
045fb-c934-403f-9a27-2347556ba9e2\sce


DATE: 12-15-2020                          TIME: 10:24:33

USER:



COMMENTS: _____________________________________________________

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  **********************************************
  ** SIMULATION : Run 03        25-year     **
  **********************************************
```

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--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1750.276
| Ptotal= 60.35 mm |                          B=   8.303
--------------------                          C=   0.862
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.08    2.71 |  1.08   16.72 |  2.08    9.57 |  3.08    3.84
                0.17    2.91 |  1.17   27.82 |  2.17    8.52 |  3.17    3.66
                0.25    3.14 |  1.25   68.08 |  2.25    7.67 |  3.25    3.50
                0.33    3.42 |  1.33  188.05 |  2.33    6.97 |  3.33    3.35
                0.42    3.75 |  1.42   87.82 |  2.42    6.39 |  3.42    3.21
                0.50    4.15 |  1.50   48.42 |  2.50    5.90 |  3.50    3.09
                0.58    4.65 |  1.58   32.14 |  2.58    5.48 |  3.58    2.97
                0.67    5.29 |  1.67   23.59 |  2.67    5.11 |  3.67    2.86
                0.75    6.13 |  1.75   18.44 |  2.75    4.79 |  3.75    2.76
                0.83    7.31 |  1.83   15.05 |  2.83    4.51 |  3.83    2.67
                0.92    9.03 |  1.92   12.66 |  2.92    4.26 |  3.92    2.59
                1.00   11.77 |  2.00   10.91 |  3.00    4.04 |  4.00    2.51


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0200)|   Area    (ha)=   1.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.10         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      86.02        40.00
     Mannings n           =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     188.05        79.05
               over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.81 (ii)    2.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.32         0.29
                                                        *TOTALS*
     PEAK FLOW       (cms)=       0.55         0.00          0.553 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      59.35        33.40          59.09
     TOTAL RAINFALL   (mm)=      60.35        60.35          60.35
     RUNOFF COEFFICIENT   =       0.98         0.55           0.98

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0201)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  0.0200      0.0497
                          0.0070     0.0062   |  0.0210      0.0559
                          0.0100     0.0124   |  0.0210      0.0572
                          0.0120     0.0186   |  0.0220      0.0585
                          0.0140     0.0248   |  0.0220      0.0598
                          0.0150     0.0310   |  0.0230      0.0611
                          0.0170     0.0372   |  0.0230      0.0624
                          0.0180     0.0435   |  0.0240      0.0637

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      1.110     0.553      1.33      59.09
   OUTFLOW: ID= 1 (  0201)      1.110     0.020      2.42      58.89

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.63
                TIME SHIFT OF PEAK FLOW         (min)= 65.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0500

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 FINISH
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       V    V   I    SSSSS  U   U    A    L              (v 6.0.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
```

```
       O   O    T     T    H   H    Y    M   M  O   O
        OOO     T     T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.0\VO2\voin.dat

Output filename:
C:\Users\DCasullo\AppData\Local\Civica\VH5\e89ea26c-672c-48f5-9006-c9a00153c6c7\9d3a4142-eb22-4c1f-b719-f40ab2d6295e\sce
Summary filename:
C:\Users\DCasullo\AppData\Local\Civica\VH5\e89ea26c-672c-48f5-9006-c9a00153c6c7\9d3a4142-eb22-4c1f-b719-f40ab2d6295e\sce

DATE: 12-15-2020 TIME: 10:24:32

USER:

COMMENTS: _____

** SIMULATION : Run 04 100-year **

CHICAGO STORM	Ptotal= 72.84 mm

IDF curve parameters: A=2171.754
B= 8.303
C= 0.867
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.18	1.08	20.04	2.08	11.39	3.08	4.53
0.17	3.42	1.17	33.54	2.17	10.12	3.17	4.31
0.25	3.70	1.25	82.78	2.25	9.10	3.25	4.12
0.33	4.02	1.33	230.33	2.33	8.27	3.33	3.94
0.42	4.41	1.42	106.99	2.42	7.57	3.42	3.78
0.50	4.89	1.50	58.68	2.50	6.98	3.50	3.63
0.58	5.49	1.58	38.79	2.58	6.48	3.58	3.49
0.67	6.25	1.67	28.38	2.67	6.04	3.67	3.36
0.75	7.27	1.75	22.13	2.75	5.66	3.75	3.24
0.83	8.67	1.83	18.01	2.83	5.33	3.83	3.13
0.92	10.74	1.92	15.13	2.92	5.03	3.92	3.03
1.00	14.05	2.00	13.01	3.00	4.76	4.00	2.94

CALIB STANDHYD (0200) ID= 1 DT= 5.0 min	Area (ha)= 1.11 Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	1.10	0.01
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	86.02	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.(mm/hr)=		230.33	106.36
over (min)		5.00	5.00
Storage Coeff. (min)=		1.67 (ii)	2.48 (ii)
Unit Hyd. Tpeak (min)=		5.00	5.00
Unit Hyd. peak (cms)=		0.32	0.29

		TOTALS
PEAK FLOW	(cms)=	0.68	0.00	0.684 (iii)
TIME TO PEAK	(hrs)=	1.33	1.33	1.33
RUNOFF VOLUME	(mm)=	71.84	43.82	71.56
TOTAL RAINFALL	(mm)=	72.84	72.84	72.84
RUNOFF COEFFICIENT	=	0.99	0.60	0.98

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

RESERVOIR(0201) IN= 2---> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)

```
                        0.0000     0.0000   |   0.0200      0.0497
                        0.0070     0.0062   |   0.0210      0.0559
                        0.0100     0.0124   |   0.0210      0.0572
                        0.0120     0.0186   |   0.0220      0.0585
                        0.0140     0.0248   |   0.0220      0.0598
                        0.0150     0.0310   |   0.0230      0.0611
                        0.0170     0.0372   |   0.0230      0.0624
                        0.0180     0.0435   |   0.0240      0.0637

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0200)      1.110      0.684      1.33      71.56
   OUTFLOW: ID= 1 (  0201)      1.110      0.023      2.25      71.37

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.36
                  TIME SHIFT OF PEAK FLOW         (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0606

--------------------------------------------------------------------------------
```

Appendix E:
Stormceptor Sizing Output

Stormceptor®

Stormceptor® EF Sizing Report

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

12/15/2020

Province:	Ontario
City:	Owen Sound
Nearest Rainfall Station:	OWEN SOUND MOE
NCDC Rainfall Station Id:	6132
Years of Rainfall Data:	40

Site Name:	Thompson Centres

Drainage Area (ha):	1.11
Runoff Coefficient 'c':	0.90

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	34.39
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	1960 16th Street
Project Number:	120242
Designer Name:	Doris Casullo
Designer Company:	Tatham Engineering
Designer Email:	dcasullo@tathameng.com
Designer Phone:	705-444-2565
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	67
EFO6	78
EFO8	83
EFO10	86
EFO12	88

Recommended Stormceptor EFO Model: EFO8

Estimated Net Annual Sediment (TSS) Load Reduction (%): 83

Water Quality Runoff Volume Capture (%): > 90

imbrium

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 waterwavs.

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.

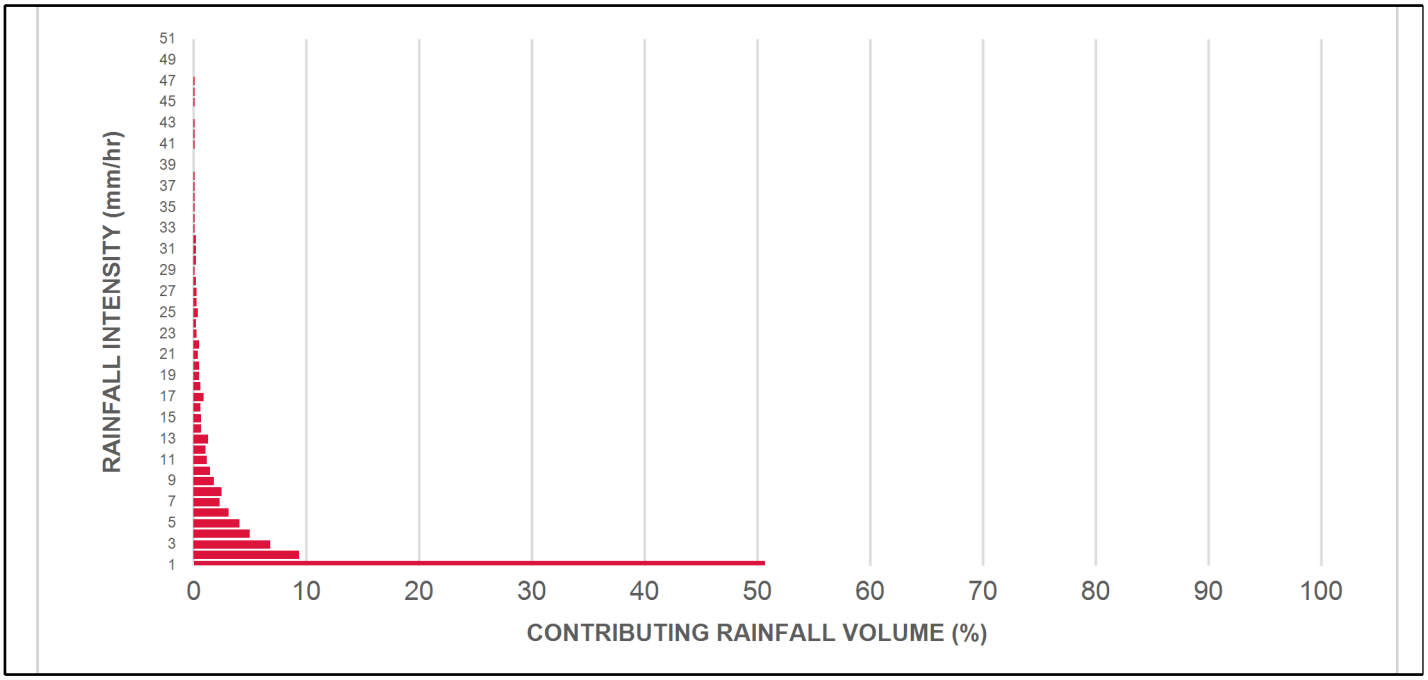
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Stormceptor® EF Sizing Report

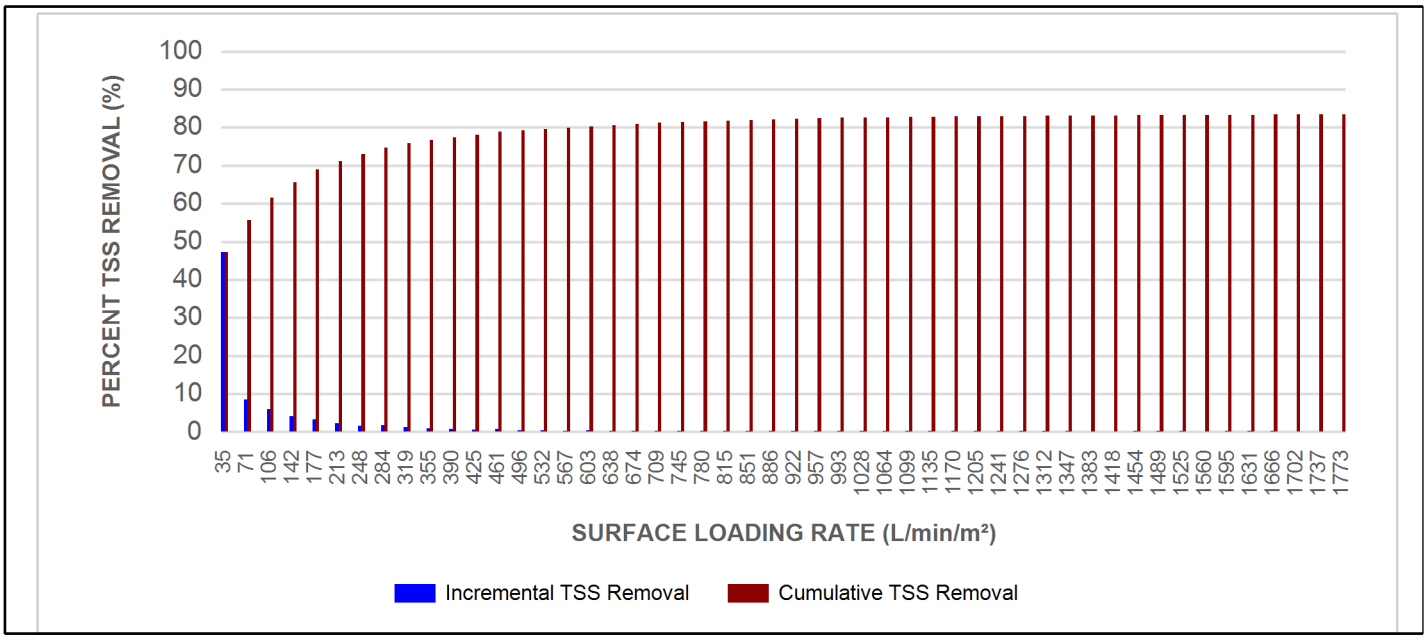
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	50.7	50.7	2.78	167.0	35.0	93	47.2	47.2
2	9.4	60.1	5.55	333.0	71.0	90	8.5	55.6
3	6.8	66.9	8.33	500.0	106.0	87	5.9	61.5
4	5.0	71.9	11.11	667.0	142.0	83	4.1	65.6
5	4.1	76.0	13.89	833.0	177.0	79	3.2	68.9
6	3.1	79.1	16.66	1000.0	213.0	75	2.3	71.2
7	2.3	81.4	19.44	1166.0	248.0	72	1.7	72.9
8	2.5	83.9	22.22	1333.0	284.0	69	1.7	74.6
9	1.8	85.7	24.99	1500.0	319.0	65	1.2	75.8
10	1.5	87.2	27.77	1666.0	355.0	63	0.9	76.7
11	1.2	88.4	30.55	1833.0	390.0	59	0.7	77.4
12	1.1	89.5	33.33	2000.0	425.0	57	0.6	78.1
13	1.3	90.8	36.10	2166.0	461.0	56	0.7	78.8
14	0.7	91.5	38.88	2333.0	496.0	55	0.4	79.2
15	0.7	92.2	41.66	2499.0	532.0	54	0.4	79.5
16	0.6	92.8	44.44	2666.0	567.0	53	0.3	79.9
17	0.9	93.7	47.21	2833.0	603.0	52	0.5	80.3
18	0.6	94.3	49.99	2999.0	638.0	52	0.3	80.6
19	0.5	94.8	52.77	3166.0	674.0	52	0.3	80.9
20	0.5	95.3	55.54	3333.0	709.0	51	0.3	81.2
21	0.4	95.7	58.32	3499.0	745.0	51	0.2	81.4
22	0.5	96.2	61.10	3666.0	780.0	51	0.3	81.6
23	0.3	96.5	63.88	3833.0	815.0	51	0.2	81.8
24	0.2	96.7	66.65	3999.0	851.0	51	0.1	81.9
25	0.4	97.1	69.43	4166.0	886.0	51	0.2	82.1

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 (%)
26	0.3	97.4	72.21	4332.0	922.0	50	0.2	82.2
27	0.3	97.7	74.98	4499.0	957.0	50	0.2	82.4
28	0.2	97.9	77.76	4666.0	993.0	50	0.1	82.5
29	0.1	98.0	80.54	4832.0	1028.0	50	0.1	82.5
30	0.2	98.2	83.32	4999.0	1064.0	49	0.1	82.6
31	0.2	98.4	86.09	5166.0	1099.0	49	0.1	82.7
32	0.2	98.6	88.87	5332.0	1135.0	49	0.1	82.8
33	0.1	98.7	91.65	5499.0	1170.0	48	0.0	82.9
34	0.1	98.8	94.43	5666.0	1205.0	48	0.0	82.9
35	0.1	98.9	97.20	5832.0	1241.0	48	0.0	83.0
36	0.1	99.0	99.98	5999.0	1276.0	47	0.0	83.0
37	0.1	99.1	102.76	6165.0	1312.0	47	0.0	83.1
38	0.1	99.2	105.53	6332.0	1347.0	47	0.0	83.1
39	0.0	99.2	108.31	6499.0	1383.0	46	0.0	83.1
40	0.0	99.2	111.09	6665.0	1418.0	46	0.0	83.1
41	0.1	99.3	113.87	6832.0	1454.0	44	0.0	83.2
42	0.1	99.4	116.64	6999.0	1489.0	43	0.0	83.2
43	0.1	99.5	119.42	7165.0	1525.0	42	0.0	83.2
44	0.0	99.5	122.20	7332.0	1560.0	41	0.0	83.2
45	0.1	99.6	124.97	7498.0	1595.0	41	0.0	83.3
46	0.1	99.7	127.75	7665.0	1631.0	40	0.0	83.3
47	0.1	99.8	130.53	7832.0	1666.0	39	0.0	83.4
48	0.0	99.8	133.31	7998.0	1702.0	38	0.0	83.4
49	0.0	99.8	136.08	8165.0	1737.0	37	0.0	83.4
50	0.0	99.8	138.86	8332.0	1773.0	36	0.0	83.4
						Estimated Net Annual Sediment (TSS) Load Reduction =		**83 %**

RAINFALL DATA FROM OWEN SOUND MOE 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
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

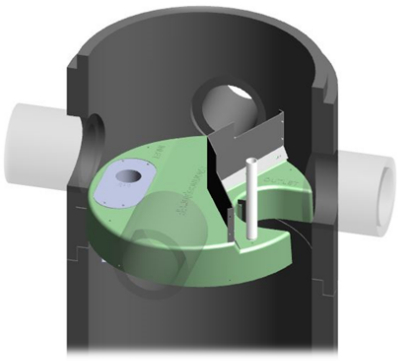
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test 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.

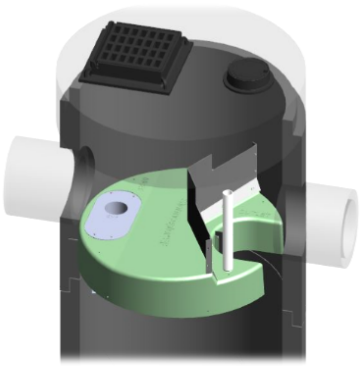
DESIGN FLEXIBILITY

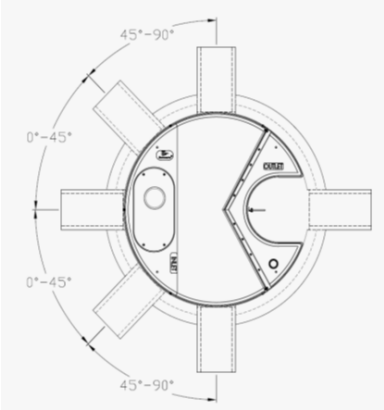
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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
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 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:	1.19 m^3 sediment / 265 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 shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. 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.**

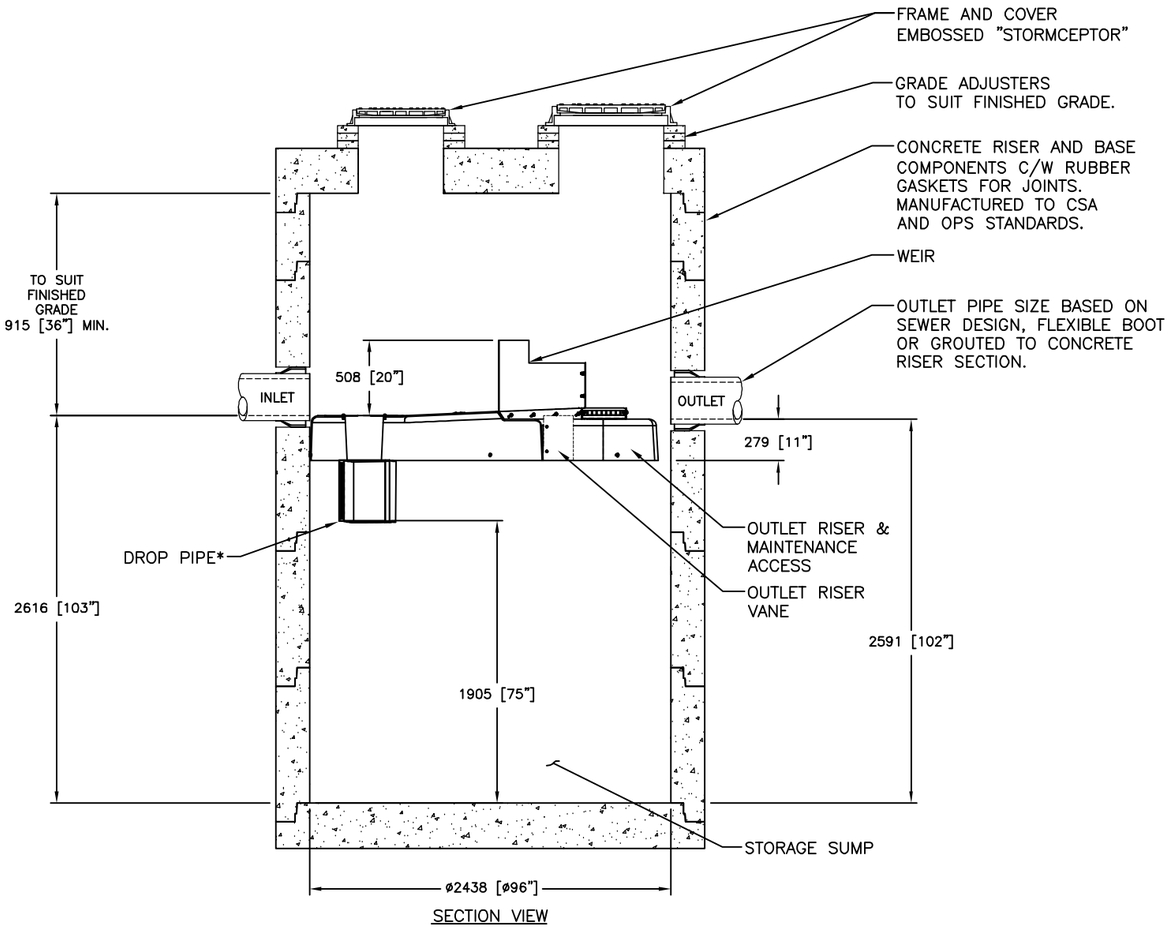
3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

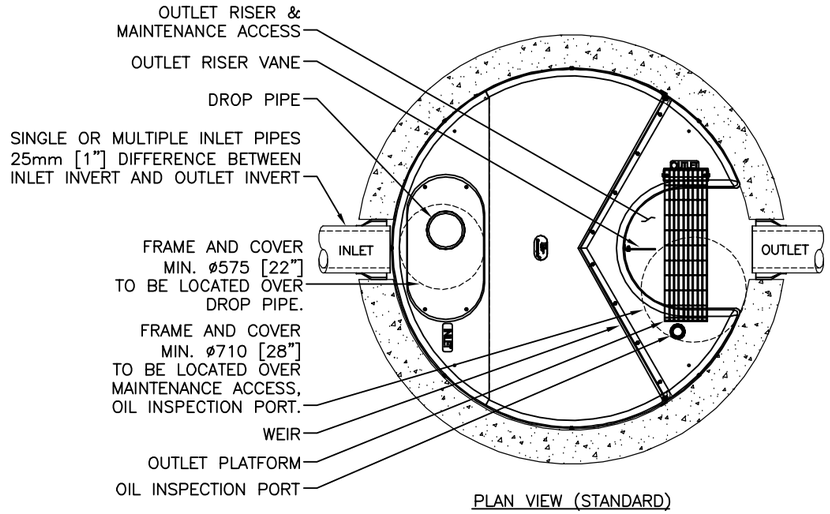
The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 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/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.

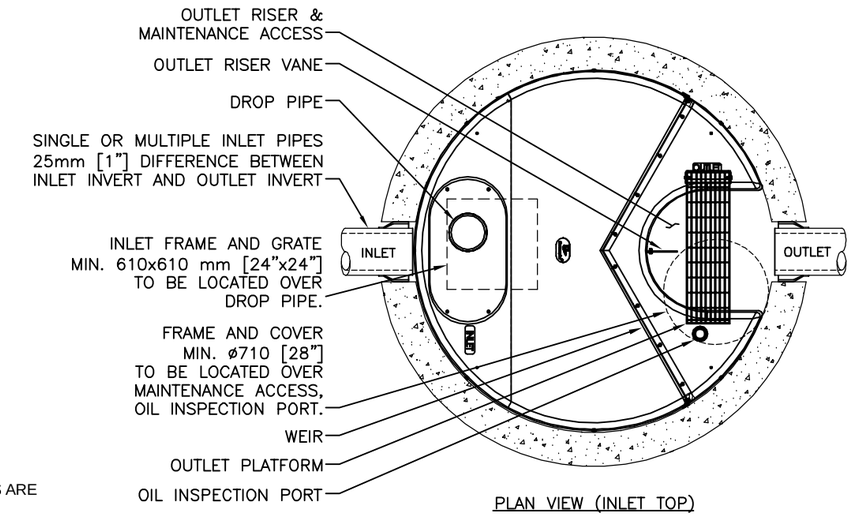
DRAWING NOT TO BE USED FOR CONSTRUCTION



SECTION VIEW



PLAN VIEW (STANDARD)



PLAN VIEW (INLET TOP)

GENERAL NOTES:

* MAXIMUM SURFACE LOADING RATE (SLR) INTO LOWER CHAMBER THROUGH DROP PIPE IS 1135 L/min/m^2 (27.9 gpm/ft^2) FOR STORMCEPTOR EF8 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO8 (OIL CAPTURE CONFIGURATION).

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. STORMCEPTOR STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE STORMCEPTOR SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT THE DEVICE FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. DEVICE ACTIVATION, BY CONTRACTOR, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE STORMCEPTOR UNIT IS CLEAN AND FREE OF DEBRIS.

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL STORMCEPTOR REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE (IF REQUIRED).

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EF8				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
DRAINAGE AREA (HA)					*
DRAINAGE AREA IMPERVIOUSNESS (%)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	REVISION DESCRIPTION	BY
1	6/8/18	OUTLET PLATFORM	JSK
0	5/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium®
407 FAIRVIEW DRIVE, WHITBY, ON, L1N 9A9
TF 800-565-4501 CA 416-665-9600 INTL +1-416-665-9600

DATE:	5/26/2017
DESIGNED:	JSK
DRAWN:	JSK
CHECKED:	BSF
APPROVED:	*
PROJECT No.:	EF8
SEQUENCE No.:	*
SHEET:	1 OF 1

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EF8-DETAIL.DWG 4/12/2019 10:53 AM

Appendix F: Water and Wastewater Capacity Correspondence

Alexandra O'Donnell

From: Goetz, Dana <dgoetz@owensound.ca>
Sent: December 17, 2020 2:30 PM
To: Alexandra O'Donnell
Subject: RE: 1960 16th Street East - Servicing Questions

Hi Alexandra;

The Rated Capacities are defined in the Drinking Water Works Permit (DWWP) for the Water Plant, and in the Environmental Compliance Approval (ECA) for the wastewater plant.

The WTP Capacity is 27,300 Cubic Metres per Day. (CMD)

The WWTP Capacity is 24,545 Cubic Metres per Day. (CMD)

Both are operating at approximately 50% capacity.

Dana M. Goetz, C.E.T.
Engineering Technologist III
ENGINEERING SERVICES DIVISION
PUBLIC WORKS & ENGINEERING DEPARTMENT
CITY OF OWEN SOUND
808 2nd Avenue East, Owen Sound, ON N4K 2H4
Telephone: [519] 376-4440 ext. 3308 | Fax: [519] 372-1209

Please consider the environment before printing this e-mail

From: Alexandra O'Donnell <aodonnell@tathameng.com>
Sent: December-17-20 2:03 PM
To: Goetz, Dana <dgoetz@owensound.ca>
Subject: FW: 1960 16th Street East - Servicing Questions

Hello Dana,

I was just advised that you might have more information on the questions I had asked Spencer. I am looking to verify capacity of the water and wastewater treatment plants. Please see email below.

Thank you,

Alex O'Donnell B.E.Sc., EIT
Intern Engineer

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
T 705-444-2565 x2113 | **C** 705-606-0224| aodonnell@tathameng.com | tathameng.com

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From: Alexandra O'Donnell
Sent: December 17, 2020 1:17 PM
To: shammill@owensound.ca
Subject: 1960 16th Street East - Servicing Questions

Hello Spencer,

I am working with Doris Casullo on the servicing feasibility study for the site at 1960 16th Street East.

I am hoping to verify capacity of the water and wastewater plants in Owen Sound for our report. Is there an updated water/wastewater assessment available? Any help would be appreciated.
If you have any questions please feel free to call.

Thank you,

Alex O'Donnell B.E.Sc., EIT
Intern Engineer

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
T 705-444-2565 x2113 | **C** 705-606-0224| aodonnell@tathameng.com | tathameng.com