Stormwater Management Report and Servicing Brief

Benson Auto Parts
2020 Bantree Street
Ottawa, Ontario

Prepared for:

Benson Auto Parts
700 Education Road
Cornwall, Ontario
K6H 6B8

Attention: Mr. Marty Benson

LRL File No.: 180357.07

September 27, 2021

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1 INTRODUCTION

LRL Associates Ltd. (LRL) has been retained by De Saulniers Construction Ltd. (DSC) on behalf of Benson Auto Parts to prepare a Site Servicing and Stormwater Management Report in support of their Site Plan Control application for a proposed new auto parts building with a building footprint of approximately 1858 m^2. This report presents the proposed servicing plan for the proposed development regarding water and sanitary services, as well as stormwater management.

The subject property is located within the urban boundary of the City of Ottawa; Ward 18 Alta Vista, in the Industrial Park. As illustrated in Figure 1, the proposed new development will be part of the Benson Auto Parts property, located at 2020 Bantree Street; South of Bantree Street, and East of Edinburgh Place. The site is comprised of an existing auto service building, office and asphalt parking lot. The total area of the property measures approximately 2.043 ha whereas the watershed to be impacted by the proposed new development is 0.96 ha.

Figure 1: Aerial View of Proposed Site

The proposed development will include construction of a new building in the East side of property with a footprint area of approximately 1858 m^2.

This report has been prepared in consideration of the information above and survey carried out by Fairhall, Moffatt & Woodland Ltd. dated August 25th, 2021. Should there be any discrepancies in the existing infrastructure and/or connections to existing services, which may relate to site servicing and stormwater management, LRL should be advised in order to review

the report recommendations. This report should be read in conjunction with the Civil Plans prepared by LRL.

2 SCOPE OF WORK

As per applicable guidelines, the scope of work includes the following:

Water Services

- Calculate the expected water supply demand at average and peak conditions.
- Calculate the fire flow requirements as per the Fire Underwriter Survey (FUS) method.
- Describe the water distribution network.

Sanitary Services

- Calculate the allowable/anticipated sanitary release rate.
- Calculate peak flow rates from the development.
- Verify the capacity of the proposed sanitary system.

Stormwater Management

- Calculate the allowable stormwater release rate.
- Calculate the anticipated post-development stormwater release rates.
- Demonstrate how the target quality and quantity control objectives will be achieved.
- Verify the capacity of the proposed storm system.

3 WATER SUPPLY AND FIRE PROTECTION

3.1 Existing Water Supply Services

The site is currently being serviced by a 150 mm dia. water service that is connected to the existing 300 mm dia. watermain extending along Bantree Street. There are three existing fire hydrants nearby: (i) North of the site on Bantree Street, (ii) Northeast of the site on Bantree Street and (iii) on-site hydrant on the inside of the site's West property line off Edinburgh Place. See Appendix A for the location of fire hydrants surrounding the site.

3.2 Water Supply Demand

The water supply demands were calculated using the Ontario Building Code (OBC) and the City of Ottawa Design Guidelines. The demands were calculated only for the proposed new building. The average daily water demand was calculated to 1.67 L/s. A daily and hourly peak factor of 1.5 and 1.8 were applied; resulting in a maximum daily demand of 2.5 L/s, and a maximum hourly demand of 4.5 L/s. Refer to Appendix A for the water demand calculation sheet.

The fire flow demand was estimated in accordance with the Fire Underwriters Survey (FUS). This method is based on the floor area of the building to be protected, type and combustibility of the structural frame and the separation distances with adjoining buildings. The fire flow demand was calculated to be 150.0 L/s. Refer to Appendix A for the fire flow calculation sheet.

The City of Ottawa has provided boundary conditions to LRL for this project. Refer to Appendix G for the boundary conditions. The HGL provided (minimum, maximum and maximum day + fire flow pressures at the Bantree Street connection) correspond to a pressures of 430.17 kPa (62.39 psi), 516.50 (74.91 psi) and 371.31 kPa (53.85 psi) which show that adequate water supply/pressure is available and meets the City of Ottawa standards as per Section 4.2.2 of the Ottawa Design Guidelines – water distribution. Since the maximum pressure is less than 80 psi, a pressure reducing valve is not required.

Summary Table	
Average Water Demand	144,017 L/day
Total Fixture Units	32
Peak Factors	1.5 (max daily) & 1.8(max hourly)
Average Daily Demand	1.67 L/s
Maximum Daily Demand	2.5 L/s
Peak Hourly Demand	4.5 L/s
FUS Fire Flow Requirement	150 L/s
Maximum Daily + Fire Flow	152.5 L/s

3.3 Water Supply Servicing Design

The proposed new building will be serviced by a new 150mm dia. PVC pipe to be connected to the City water main on Bantree Street.

Fire flow protection is to be provided by the proposed sprinkler system, along with the existing fire hydrants on the North of site on Bantree Street which is located 67.2 m from the building's Siamese connection.

4 SANITARY DRAINAGE

4.1 Existing Sanitary Sewer Services

The site is currently being serviced by a 150mm dia. PVC service, located north of the existing building. The sewage is currently conveyed from this 150 mm dia. service easterly through a 300mm dia. sanitary sewer on Bantree Street which eventually reaches the Robert O. Pickard Environmental Centre located at 800 Greens Creek Drive in Gloucester.

4.2 Sanitary Sewer Servicing Design

The proposed new building will be serviced by a new 150 mm dia. PVC pipe to be connected to the City 300 mm dia. sanitary sewer on Bantree Street.

The parameters used to calculate the site's allowable sanitary flows are: Heavy industrial flow demand of 55,000 L/ha/day, an industrial peaking factor of 4.25 and an infiltration rate of 0.28 L/s/ha. Based on these parameters and the total site area of 0.96 ha (impacted by new building construction), the total allowable sanitary flow was estimated to be 2.91 L/s. Refer to Appendix B for the sanitary sewer design sheet.

5 STORMWATER MANAGEMENT

5.1 Existing Stormwater Infrastructure

The information below should be read in conjunction with LRL drawing C701.

Most of the stormwater runoff from EWS-01 appears to flow (uncontrolled) overland to the Southeast corner of the property, and some runoff from EWS-02 appears to flow (uncontrolled) overland onto the Bantree Street in the North.

5.2 Stormwater Management Concept

The information below should be read in conjunction with LRL drawings C401, C601, C701, C702 and Appendix C (Stormwater Management Design Sheets). The pervious and impervious runoff coefficients have been increased by 25% for the 100-year event; as per the Ottawa Sewer Design Guidelines.

The pre-development 5-year allowable release rate has been calculated using a C coefficient of 0.5, a time of concentration of 10 minutes as per City of Ottawa guidelines, and a calculated intensity of 104.2 mm/hr for an impacted site area of 0.96 ha. The allowable release rate was calculated to be 138.99 L/s.

The post-development conditions (100-year storm event) were designed using a restricted release flow of 129.91 L/s. The proposed storm system will restrict the flow using an Inlet Control Device (ICD) installed at CBMH04 outlet. During a major storm event (100-year), the ICD will not release more than 129.91 L/s (allowable flow).

As mentioned above, the 100-year storm runoff (from the proposed catchment areas WS-01, WS-02, WS-03 and WS-04) will be controlled at the proposed CBMH04. Runoff above the 100-year storm will back out of the proposed CBMHs and pond around each drainage structure until it flows overland, making its way to Bantree Street. Stormwater from the 5-year storm event will always remain contained.

The 100-year storage required for this site is 220.78 m^3. The 100-year storage provided is 229.92 m^3 which is a combination of the overland ponding storage around CBMH01, CBMH03 and CBMH04. Refer to LRL drawing C601 for 5-year and 100-year surface storage.

5.3 Design Criteria

The stormwater quantity control measure will take into account reduction of post-development stormwater runoff to an allowable pre-development level whereas the quality control objective will be met by installing an on-site water quality treatment unit.

5.3.1 Water Quality

A Stormceptor EFO6 oil/grit separator (OGS) is proposed as a part of this design. This unit will provide water quality treatment and meets the City's minimum requirement of 80% TSS removals. Refer to Appendix E for further details regarding the proposed treatment unit.

5.3.2 Water Quantity

All storm events up to and including the 100-year event will be controlled to the 5-year pre-development level. The site's major overland flow route has been designed to ensure that storm events beyond the 100-year design storm can be safely conveyed overland towards the Bantree Street right of way. The storm sewer within the site is sized to convey the 5-year storm event flows from the site to the municipal storm sewer on Bantree Street. Refer to Appendix C for the Storm Sewer Design Sheet.

5.4 Method of Analysis

The Rational Method was used to calculate the runoff from the development. The Intensity-Duration-Frequency (IDF) curve formulas of the MacDonald Cartier International Airport, City of Ottawa, were used to calculate the peak storm flows.

5.5 Allowable Release Rate

The pre-development 5-year allowable release rate has been calculated using a runoff coefficient (C) of 0.5, a time of concentration of 10 minutes as per City of Ottawa guidelines, and a calculated intensity of 104.2 mm/hr for a total site area of 0.96 ha impacted by the proposed new development. The allowable release rate was calculated to be 138.99 L/s.

6 Erosion and Sediment Control

During construction, erosion and sediment controls will be provided primarily via a sediment control fence to be erected along the perimeter of the site where runoff has the potential of leaving the site. Inlet sediment control devices are also to be provided in any catch basin and/or manhole in and around the site that may be impacted by the site during construction.

Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) # 577. Refer to LRL drawing C101 for erosion and sediment control details.

7 CONCLUSIONS

In accordance with the report objectives, the analyses of the proposed development can be summarized as follows:

Water Service

- The anticipated maximum hourly water demand of this site is 4.50 L/s.
- The maximum required fire flow was calculated at 150.00 L/s using the FUS method.
- For fire protection, there are three fire hydrants surrounding the subject site.
- The site will be serviced by a 150 mm dia. PVC pipe to be connected to the City's watermain along Bantree Street.

Sanitary Service

- The total sanitary peak flow is estimated to be 2.91 L/s.
- The site will be serviced by a 150 mm dia. PVC pipe to be connected to the City's sanitary sewer along Bantree Street.

Stormwater Management

- The 5-year and 100-year post-development stormwater runoff will be controlled to the 5-year pre-development level.
- Stormwater quantity control objectives will be met through on-site stormwater surface storage.
- Stormwater quality control objectives will be met using an on-site treatment unit (Stormceptor EFO6 oil/grit separator or approved equivalent).

8 LIMITATIONS AND USE OF REPORT

The report conclusions are applicable only to the project described in this report. Any changes require a review by LRL Associates Ltd. to ensure the compatibility with the recommendations contained in this report.

We trust that the information presented in this report meets your current requirements. Please do not hesitate to contact us should you have any questions or concerns.

Prepared by:

LRL Associates Ltd.

Maxime Longtin
Civil Engineering Technologist

Mohan Basnet, P.Eng.
Civil Engineer

APPENDIX A

Water Demand and Fire Flow Calculations

Water Service Calculations

LRL File No.: 180357
Project: 2020 Bantree St., Ottawa, ON
Date: February 26, 2020
Designed: M. Basnet
Checked: V. Johnson

Water Demand

Fixtures	Qty.	Fixture Units/Fixture (OBC Table 7.6.3.2.A)	Total
Water closets	4	5	20
Lavatories	6	2	12
		Total fixture units	**32**

Conversion of fixture units to equivalent gpm = 22 gpm (as per PS&D)

Average water demand = 144017.3 L / day
= **1.67** **L/s**

Maximum daily peak factor = 1.5
Maximum daily demand = 216026 L / day
= **2.50** **L / s**

Maximum hour peak factor = 1.8
Maximum hour demand = 388847 L / day
= **4.50** **L / s**

Fire Flow Calculations

LRL File No. : 180357
Project : 2020 Bantree St., Ottawa, ON
Date : February 26, 2020
Method : Fire Underwriters Survey (FUS), 1999
Designed: M. Basnet
Checked: V. Johnson

Step	Task	Term	Options	Multiplier	Choose	Value	Fire Flow	unit
Type of Construction								
1	Choose frame used for building	Coefficient C related to the type of construction	Wood frame construction (combustible)	1.5				
			Ordinary construction	1.0	Ordinary construction	1		
			Non-combustible construction	0.8				
			Fire resistive construction	0.6				
Floor Space Area								
2	Choose type of housing	Type of housing	Single family dwelling	0	Building - no. of units per floor	1		
			Townhouse - no. of units	0				
			Building - no. of units per floor	1				
3	Enter area of a unit	Enter floor space area of one unit (excluding basement)		1	1858.00			sq.m.
4	Determine required fire flow (F) to the nearest 1000 L/min, **$F = 220 \times C \times A^{0.5}$**						9,000	L/min
Reductions or Surcharge due to Occupancies								
5	Choose combustibility of contents	Occupancy hazard reduction or surcharge	Non-combustible	-0.25				
			Limited combustible	-0.15				
			Combustible	0	Combustible	0	**9,000**	**L/min**
			Free burning	0.15				
			Rapid burning	0.25				
6	Choose reduction for sprinklers	Sprinkler reduction	Sprinklers (NFPA13)	-0.30	True	-0.3	-2700	L/min
			Water supply is standard for both the system and fire department hose lines	-0.10	False	0		
			Fully supervised system	-0.10	False	0		
7	Choose separation	Exposure distance between units	North side	Over 45m	0	0.3	2700	L/min
			East side	10.1 to 20m	0.15			
			South side	20.1 to 30m	0.10			
			West side	30.1 to 45m	0.05			
Net Required Fire Flow								
8	Obtain fire flow and duration	Minimum required fire flow rate (rounded to nearest 1000)					**9,000**	**L/min**
		Minimum required fire flow rate					**150**	**L/s**
		Required duration of fire flow					**2**	**hr**

Note: The above calculations take into account only for the proposed new building

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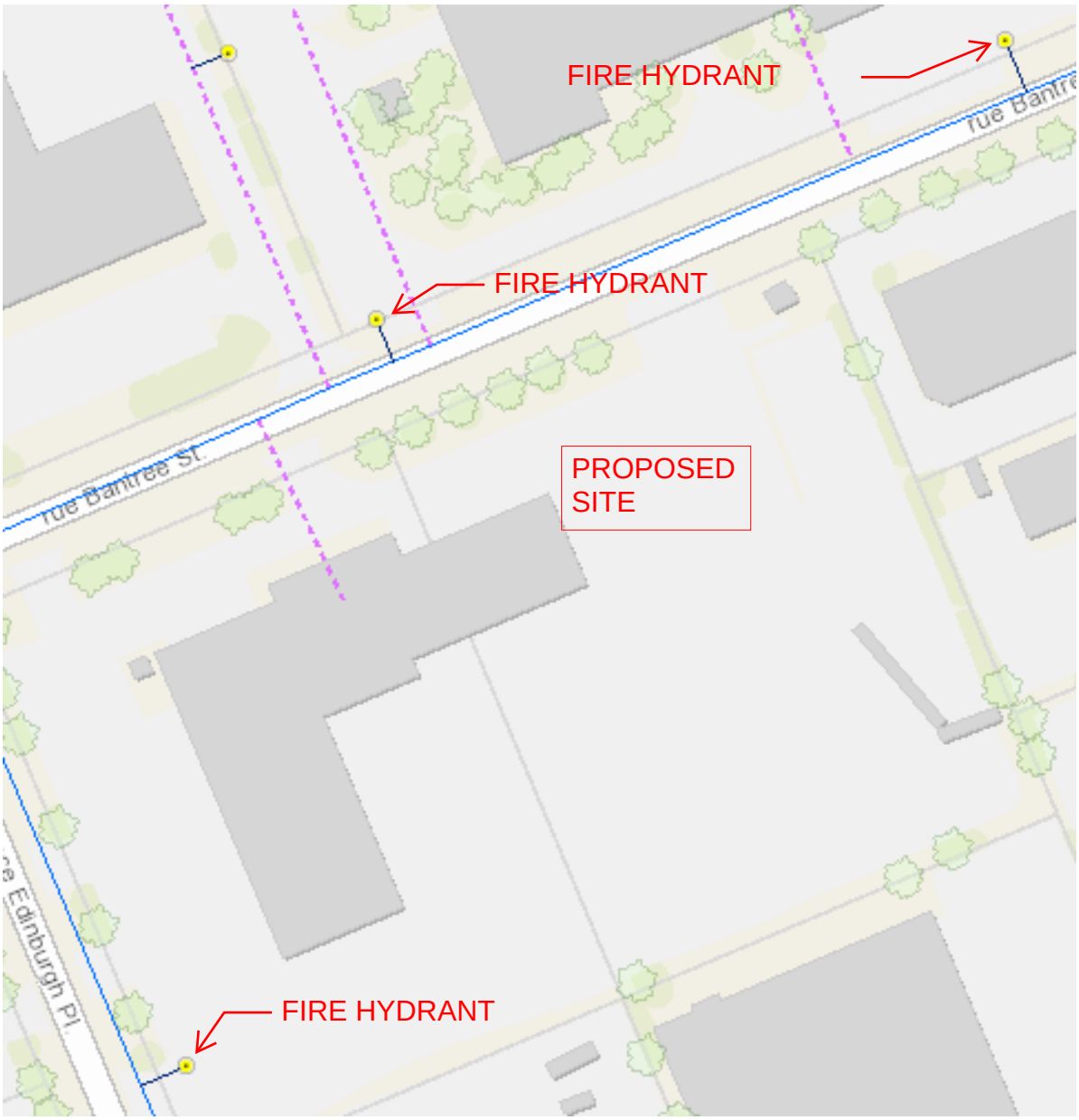
PROJECT

SITE PLAN CONTROL-AUTO PARTS BUILDING
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE

FIRE HYDRANT LOCATION

CLIENT	DATE	PROJECT
DE SAULNIERS CONSTRUCTION LTD.	MAY 11, 2020	180357



SCALE : N.T.S.

APPENDIX B

Sanitary Calculations

LRL Associates Ltd.
Sanitary Design Sheet

LRL File No.: 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: 2021-06-21
Designed: M. Basnet
Drawing Reference: C401

Design Parameters

Average Daily Flow =	280	L/capita/day
Commercial & Institutional Flow =	28000	L/ha/day
Light Industrial Flow =	35000	L/ha/day
Heavy Industrial Flow =	55000	L/ha/day
Maximum Residential Peak Factor =	4.0	
Commercial & Institutional Peak Factor =	1.5	
Industrial Peak Factor =	as per Appendix 4-B	

Extraneous Flow =	0.33 L/s/ha
Manning's Coefficient (n) =	0.013
Minimum Velocity =	0.6
Maximum Velocity =	3.0

Location			Residential						Commercial		Industrial			Institutional		C+I+I	Infiltration			Pipe					
Street/Site	From M.H.	To M.H.	Area (ha)	Pop.	Accu. Area (ha)	Pop.	Peak Factor	Peak Flow (L/s)	Area (ha)	Accu. Area (ha)	Area (ha)	Accu. Area (ha)	Peak Factor	Area (ha)	Accu. Area (ha)	Peak Flow (L/s)	Total Area (ha)	Accu. Area (ha)	Infilt. Flow (L/s)	Total Flow (L/s)	Length (m)	Dia. (mm)	Slope (%)	Full Capacity (L/s)	Velocity (Full) (m/s)
Site	BLDG	SAN MH01									0.960	0.960	4.25			2.60	0.960	0.960	0.32	2.91	15.1	150	2.00%	21.54	1.2
Site/Sreet	SAN MH01	Ex Sewer																		2.91	30.1	150	1.60%	19.26	1.1

APPENDIX C

Stormwater Management Design Sheets

LRL Associates Ltd.

Storm Watershed Summary

LRL File No. 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: June 25, 2021
Designed: M. Longtin
Checked: M. Basnet
Drawing Reference: C701, C702

Pre-Development Catchments

Watershed	C = 0.20	C = 0.80	C = 0.90	Total Area (ha)	Combined C
EWS-01 (uncontrolled)	0.012	0.629	0.177	0.819	0.81
EWS-02(uncontrolled)	0.017	0.000	0.124	0.141	0.81
Total	**0.029**	**0.629**	**0.301**	**0.960**	**0.81**

Post-Development Catchments

Watershed	C = 0.20	C = 0.8	C = 0.90	Total Area (ha)	Combined C
WS-01 (controlled)	0.040	0.000	0.171	0.212	0.77
WS-02 (controlled)	0.031	0.075	0.063	0.169	0.73
WS-03 (controlled)	0.017	0.109	0.313	0.439	0.85
WS-04 (controlled)	0.006	0.000	0.116	0.122	0.87
WS-05 (uncontrolled)	0.000	0.000	0.018	0.018	0.90
Total	**0.095**	**0.184**	**0.681**	**0.960**	**0.81**

LRL File No. 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: June 25, 2021
Designed: M. Basnet
Drawing Ref.: C601

Stormwater Management Design Sheet

STORM - 100 YEAR

Runoff Equation

Q = 2.78CIA (L/s)
C = Runoff coefficient
I = Rainfall intensity (mm/hr) = A / (Td + C)^{B}
A = Area (ha)
T_c = Time of concentration (min)

Pre-Development Catchments within Development Area (East Catchments)

	Total Area =	**0.960**	**ha**	**∑R =**	**0.81**
Uncontrolled	EWS-01	0.819	ha	R =	0.81
	EWS-02	0.141	ha	R =	0.81
	Total Uncontrolled =	**0.960**	**ha**	**∑R =**	**0.81**

100 Year Pre-Development Release Rate

I_{100} = 1735.688 / (Td + 6.014)$^{0.820}$ **A = 1735.688** **B = 0.820** **C = 6.014**

C =	0.81	
I =	178.6	mm/hr
Tc =	10	min
A =	0.960	ha
100-year Release Rate =	**387.30**	**L/s**

Allowable Release Rate (Max C=0.5, 5-year Pre-Development Flow Rate)

I_5 = 998.071 / (Td + 6.053)$^{0.814}$ **A = 998.071** **B = 0.814** **C = 6.053**

C =	0.50	max of 0.5 as per City of Ottawa
I =	104.2	mm/hr
Tc =	10	min
A =	0.960	ha
Allowable Release Rate =	**138.99**	**L/s**

LRL File No. 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: June 25, 2021
Designed: M. Basnet
Drawing Ref.: C601

Stormwater Management Design Sheet

Post-development Stormwater Management

					$\sum R_5$	$\sum R_{100}$
	Total Site Area =	**0.960**	**ha**	**∑R =**	**0.79**	**0.99**
Controlled	WS-01 (controlled)	0.212	ha	R =	0.77	0.96
	WS-02 (controlled)	0.169	ha	R =	0.73	0.91
	WS-03 (controlled)	0.439	ha	R =	0.85	1.00
	WS-04 (controlled)	0.122	ha	R =	0.87	1.00
	Total Contolled =	**0.941**	**ha**	**∑R =**	**0.81**	**1.00**
Uncontrolled	WS-05 (uncontrolled)	0.018	ha	∑R =	0.90	1.00
	Total Uncontolled =	**0.018**	**ha**	**∑R =**	**0.90**	1.00

100 Year Post-development Stormwater Management

$I_{100} = 1735.688 / (Td + 6.014)^{0.820}$ **A = 1735.688** **B = 0.820** **C = 6.014**

Time (min)	Intensity (mm/hr)	Controlled Runoff (L/s)	Storage Volume (m^3)	Controlled Release Rate (L/s)	Uncontrolled Runoff (L/s)	Total Release Rate (L/s)
10	178.56	467.26	202.41	129.91	9.08	138.99
15	142.89	373.93	219.62	129.91	7.27	137.18
20	119.95	313.89	220.78	129.91	6.10	136.01
25	103.85	271.75	212.76	129.91	5.28	135.19
30	91.87	240.40	198.89	129.91	4.67	134.58
35	82.58	216.09	180.99	129.91	4.20	134.11
40	75.15	196.64	160.16	129.91	3.82	133.73
45	69.05	180.69	137.12	129.91	3.51	133.42
50	63.95	167.36	112.34	129.91	3.25	133.16
55	59.62	156.02	86.18	129.91	3.03	132.94
60	55.89	146.27	58.89	129.91	2.84	132.75
65	52.65	137.77	30.65	129.91	2.68	132.59
70	49.79	130.29	1.61	129.91	2.53	132.44
75	47.26	123.66	0.00	129.91	2.40	132.31
80	44.99	117.73	0.00	129.91	2.29	132.20
85	42.95	112.40	0.00	129.91	2.19	132.09
90	41.11	107.58	0.00	129.91	2.09	132.00

On-site Stormwater Retention

Total Storage Required =	**220.78**	**m^3**	
Storage Provided			
Available Roof Storage =	0.00	m^3	no roof storage has been considered
Pipe Storage =	0.00	m^3	no pipe storage has been considered
CB/MH Storage =	0.00	m^3	no CB/MH storage has been considered
Underground Storage =	0.00	m^3	no underground storage structures has been considered
Surface Storage =	229.92	m^3	refer to LRL Plan C601
Total Storage Provided =	**229.92**	**m^3**	

LRL File No. 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: June 25, 2021
Designed: M. Basnet
Drawing Ref.: C601

Stormwater Management Design Sheet

STORM - 5 YEAR

Runoff Equation

Q = 2.78CIA (L/s)

C = Runoff coefficient

I = Rainfall intensity (mm/hr) = $A / (Td + C)^B$

A = Area (ha)

T_c = Time of concentration (min)

Pre-Development Catchments within Development Area (East Catchments)

	Total Area =	**0.960**	**ha**	**∑R =**	**0.81**
Uncontrolled	EWS-01	0.819	ha	**R =**	0.81
	EWS-02	0.141	ha	**R =**	0.81
	Total Uncontrolled =	**0.960**	**ha**	**∑R =**	**0.81**

5 Year Pre-Development Release Rate

$I_5 = 998.071 / (Td + 6.053)^{0.814}$ **A = 998.071** **B = 0.814** **C = 6.053**

C =	0.81	
I =	104.2	mm/hr
Tc =	10	min
A =	0.960	ha
5-year Release Rate =	**226.00**	**L/s**

Allowable Release Rate (Max C=0.5, 5-year Pre-Development Flow Rate)

$I_5 = 998.071 / (Td + 6.053)^{0.814}$ **A = 998.071** **B = 0.814** **C = 6.053**

C =	0.50	max of 0.5 as per City of Ottawa
I =	104.2	mm/hr
Tc =	10	min
A =	0.960	ha
Allowable Release Rate =	**138.99**	**L/s**

LRL File No. 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: June 25, 2021
Designed: M. Basnet
Drawing Ref.: C601

Stormwater Management Design Sheet

Post-Development Stormwater Management

					$\sum R_5$	$\sum R_{100}$
	Total Site Area =	**0.960**	ha	**∑R =**	**0.81**	**1.00**
Controlled	WS-01	0.212	ha	R =	0.77	0.96
	WS-02	0.169	ha	R =	0.73	0.91
	WS-03	0.439	ha	R =	0.85	1.00
	WS-04	0.122	ha	R =	0.87	1.00
	Total Controlled =	**0.941**	**ha**	**∑R =**	**0.81**	**1.00**
Un-controlled	WS-05 (uncontrolled)	0.018	ha	R =	0.90	1.00
	Total Un-Controlled =	**0.018**	**ha**	**∑R =**	**0.90**	**1.00**

5 Year Post-development Stormwater Management

$I_5 = 998.071 / (Td + 6.053)^{0.814}$ **A = 998.071** **B = 0.814** **C = 6.053**

Time (min)	Intensity (mm/hr)	Controlled Runoff (L/s)	Storage Volume (m^3)	**Controlled Release Rate (L/s)	Uncontrolled Runoff (L/s)	Total Release Rate (L/s)
10	104.19	220.83	54.56	129.91	4.77	134.68
15	83.56	177.10	42.47	129.91	3.83	133.73
20	70.25	148.90	22.79	129.91	3.22	133.12
25	60.90	129.07	0.00	129.91	2.79	132.70
30	53.93	114.30	0.00	129.91	2.47	132.38
35	48.52	102.83	0.00	129.91	2.22	132.13
40	44.18	93.65	0.00	129.91	2.02	131.93
45	40.63	86.11	0.00	129.91	1.86	131.77
50	37.65	79.80	0.00	129.91	1.72	131.63
55	35.12	74.44	0.00	129.91	1.61	131.52
60	32.94	69.82	0.00	129.91	1.51	131.42
65	31.04	65.80	0.00	129.91	1.42	131.33
70	29.37	62.25	0.00	129.91	1.34	131.25
75	27.89	59.11	0.00	129.91	1.28	131.18
80	26.56	56.30	0.00	129.91	1.22	131.12
85	25.37	53.77	0.00	129.91	1.16	131.07
90	24.29	51.48	0.00	129.91	1.11	131.02

** 100-year control release rate

Onsite Stormwater Retention

Total Storage Required = 54.56 m^3

LRL Associates Ltd.
Storm Design Sheet

LRL File No. 180357
Project: Site Plan Control-Auto Parts Building
Location: 2020 Bantree St., Ottawa, ON
Date: September 23, 2021
Designed: M. Basnet
Dwg. Reference: C401,C702

Design Parameters

Rational Method
Q = 2.78CIA
Q = Peak flow (L/s)
A = Drainage area (ha)
C = Runoff coefficient
I = Rainfall intensity (mm/hr)

Runoff coefficient (C)
Grass = 0.2
Gravel = 0.8
Asphalt / rooftop = 0.9

IDF curve
Ottawa Macdonald-Cartier International Airport
Storm event: 5 Years
Intensity equation:
$I_5 = 998.071 / (Tc + 6.053)^{0.814}$ (mm/hr)
Minimum velocity = 0.80 m/s
Manning's "n" = 0.013

LOCATION			AREA (ha)									STORM SEWER							
WATERSHED / STREET	From MH	To MH	C = 0.20	C = 0.8	C = 0.9	Indiv. 2.78AC	Accum. 2.78AC	Time of Conc. (min.)	Rainfall Intensity (mm/hr)	Peak Flow Q (L/s)	Controlled Flow Q_{CONT} (L/s)	Pipe Diameter (mm)	Type	Slope (%)	Length (m)	Capacity Full Q_{FULL} (L/s)	Velocity Full (m/s)	Time of Flow (min)	Ratio Q/Q_{FULL}
WS-02	CB01	CBMH01	0.031	0.075	0.063	0.34	0.34	10.00	104.19	35.61		300	PVC	0.34%	48.4	56.39	0.80	1.01	0.63
WS-03	CBMH01	MH02	0.017	0.109	0.313	1.03	1.38	11.01	99.14	136.41		525	PVC	0.25%	45.0	215.03	0.99	0.76	0.63
	MH02	CBMH04					1.38	11.77	95.71	131.69		525	PVC	0.25%	27.6	215.03	0.99	0.46	0.61
WS-01	CBMH03	CBMH04	0.040	0.000	0.171	0.45	0.45	10.00	104.19	46.99		300	PVC	0.34%	23.7	56.39	0.80	0.50	0.83
WS-05	CB100	MH101	0.000	0.000	0.018	0.05	0.05	10.00	104.19	4.77		250	PVC	0.50%	72.0	42.05	0.86	1.40	0.11
	MH101	STM					0.05	11.40	97.33	4.46		250	PVC	2.72%	4.4	98.08	2.00	0.04	0.05
WS-04	*CBMH04	OGS	0.006	0.000	0.116	0.29	2.17	12.23	93.73	202.94	129.91	525	PVC	0.25%	10.9	215.03	0.99	0.18	0.94
	OGS	Ex STM					2.17	12.41	92.97	202.82	129.91	525	PVC	0.25%	7.7	215.03	0.99	0.13	0.94

Note
* Proposed ICD installed at CBMH04 will control flow at 129.91 L/s (H=2.19)

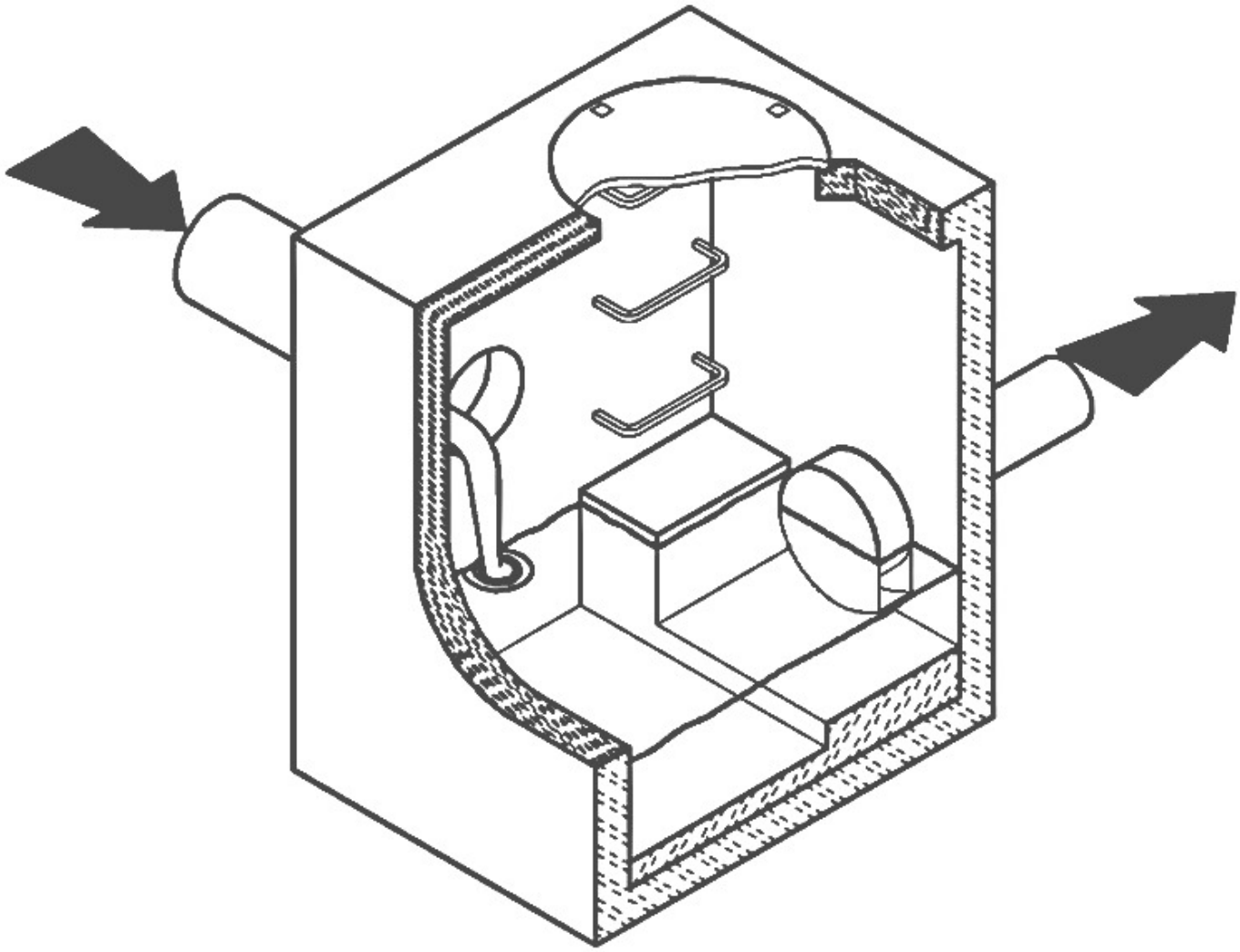
APPENDIX D

Inlet Control Device

CSO/STORMWATER MANAGEMENT

HYDROVEX® VHV / SVHV

Vertical Vortex Flow Regulator



JOHN MEUNIER

APPLICATIONS

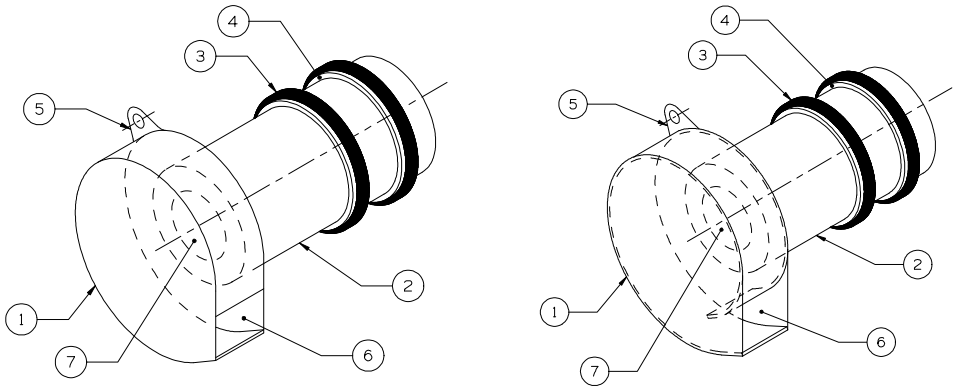
One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm, uncontrolled flows may overload the drainage system and cause flooding. Due to increased velocities, sewer pipe wear is increased dramatically and results in network deterioration. In a combined sewer system, the wastewater treatment plant may also experience significant increases in flows during storms, thereby losing its treatment efficiency.

A simple means of controlling excessive water runoff is by controlling excessive flows at their origin (manholes). **John Meunier Inc.** manufactures the **HYDROVEX® VHV / SVHV** line of vortex flow regulators to control stormwater flows in sewer networks, as well as manholes.

The vortex flow regulator design is based on the fluid mechanics principle of the forced vortex. This grants flow regulation without any moving parts, thus reducing maintenance. The operation of the regulator, depending on the upstream head and discharge, switches between orifice flow (gravity flow) and vortex flow. Although the concept is quite simple, over 12 years of research have been carried out in order to get a high performance.

The **HYDROVEX® VHV / SVHV** Vertical Vortex Flow Regulators **(refer to Figure 1)** are manufactured entirely of stainless steel, and consist of a hollow body (**1**) (in which flow control takes place) and an outlet orifice (**7**). Two rubber "O" rings (**3**) seal and retain the unit inside the outlet pipe. Two stainless steel retaining rings (**4**) are welded on the outlet sleeve to ensure that there is no shifting of the "O" rings during installation and use.

1. **BODY**
2. **SLEEVE**
3. **O-RING**
4. **RETAINING RINGS (SQUARE BAR)**
5. **ANCHOR PLATE**
6. **INLET**
7. **OUTLET ORIFICE**



VHV ***SVHV***

FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTREX FLOW REGULATORS

ADVANTAGES

- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Having no moving parts, they require minimal maintenance.
- The geometry of the **HYDROVEX® VHV / SVHV** flow regulators allows a control equal to an orifice plate, having a cross section area 4 to 6 times smaller. This decreases the chance of blockage of the regulator, due to sediments and debris found in stormwater flows. **Figure 2** illustrates the comparison between a regulator model 100 SVHV-2 and an equivalent orifice plate. One can see that for the same height of water, the regulator controls a flow approximately four times smaller than an equivalent orifice plate.
- Installation of the **HYDROVEX® VHV / SVHV** flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no special tools or equipment and may be carried out by any contractor.
- Installation may be carried out in existing structures.

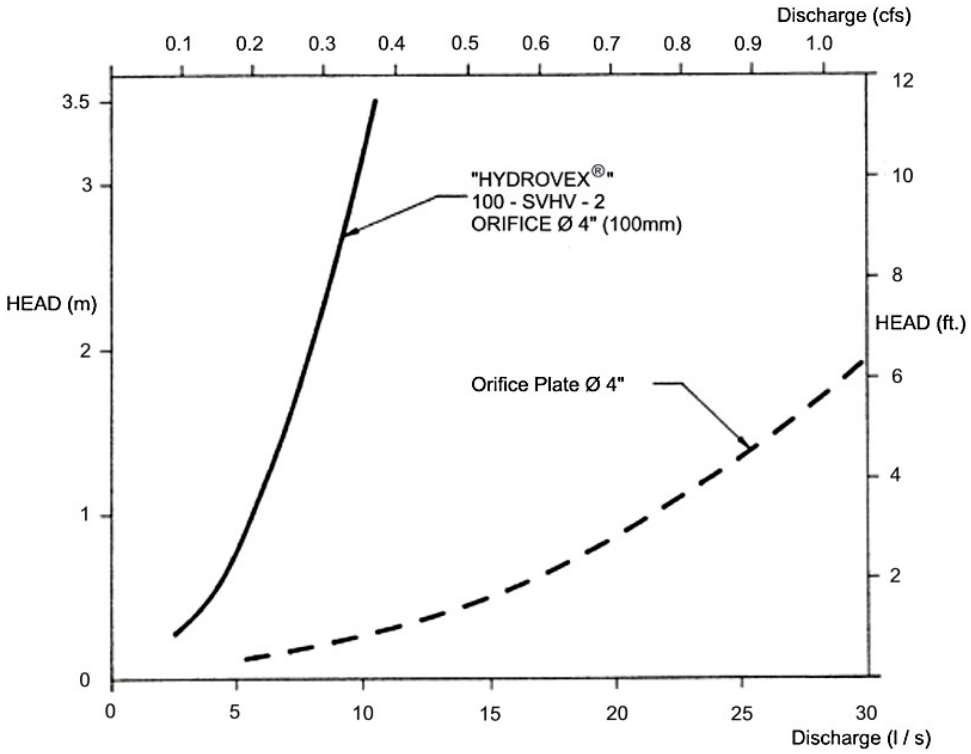


FIGURE 2: DISCHARGE CURVE SHOWING A HYDROVEX® FLOW REGULATOR VS AN ORIFICE PLATE

SELECTION

Selection of a **VHV or SVHV** regulator can be easily made using the selection charts found at the back of this brochure (see **Figure 3)**. These charts are a graphical representation of the maximum upstream water pressure (head) and the maximum discharge at the manhole outlet. The maximum design head is the difference between the maximum upstream water level and the invert of the outlet pipe. All selections should be verified by John Meunier Inc. personnel prior to fabrication.

Example:

✓ Maximum design head	2m (6.56 ft.)
✓ Maximum discharge	6 L/s (0.2 cfs)
✓ Using **Figure 3** - VHV	model required is a **75 VHV-1**

INSTALLATION REQUIREMENTS

All **HYDROVEX® VHV / SVHV** flow regulators can be installed in circular or square manholes. **Figure 4** gives the various minimum dimensions required for a given regulator. ***It is imperative to respect the minimum clearances shown to ensure easy installation and proper functioning of the regulator.***

SPECIFICATIONS

In order to specify a **HYDROVEX®** regulator, the following parameters must be defined:

- The model number (ex: 75-VHV-1)
- The diameter and type of outlet pipe (ex: 6" diam. SDR 35)
- The desired discharge (ex: 6 l/s or 0.21 CFS)
- The upstream head (ex: 2 m or 6.56 ft.) *
- The manhole diameter (ex: 36" diam.)
- The minimum clearance "H" (ex: 10 inches)
- The material type (ex: 304 s/s, 11 Ga. standard)

* ***Upstream head is defined as the difference in elevation between the maximum upstream water level and the invert of the outlet pipe where the HYDROVEX® flow regulator is to be installed.***

PLEASE NOTE THAT WHEN REQUESTING A PROPOSAL, WE SIMPLY REQUIRE THAT YOU PROVIDE US WITH THE FOLLOWING:

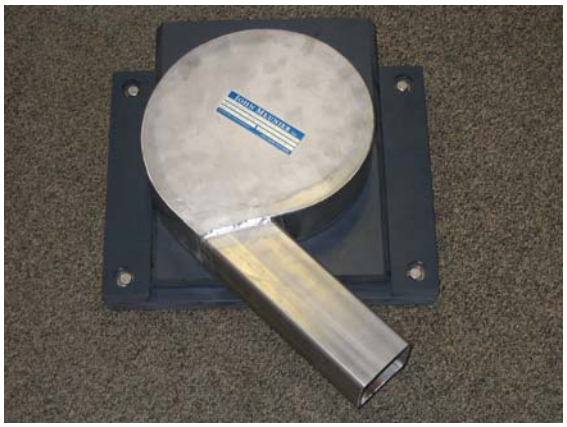
- ***project design flow rate***
- ***pressure head***
- ***chamber's outlet pipe diameter and type***

Typical VHV model in factory

OPTIONS

FV – SVHV (mounted on sliding plate)

VHV-1-O (standard model with odour control inlet)



FV – VHV-O (mounted on sliding plate with odour control inlet)

VHV with Gooseneck assembly in existing chamber without minimum release at the bottom

VHV with air vent for minimal slopes

HYDROVEX®

VHV Vertical Vortex Flow Regulator

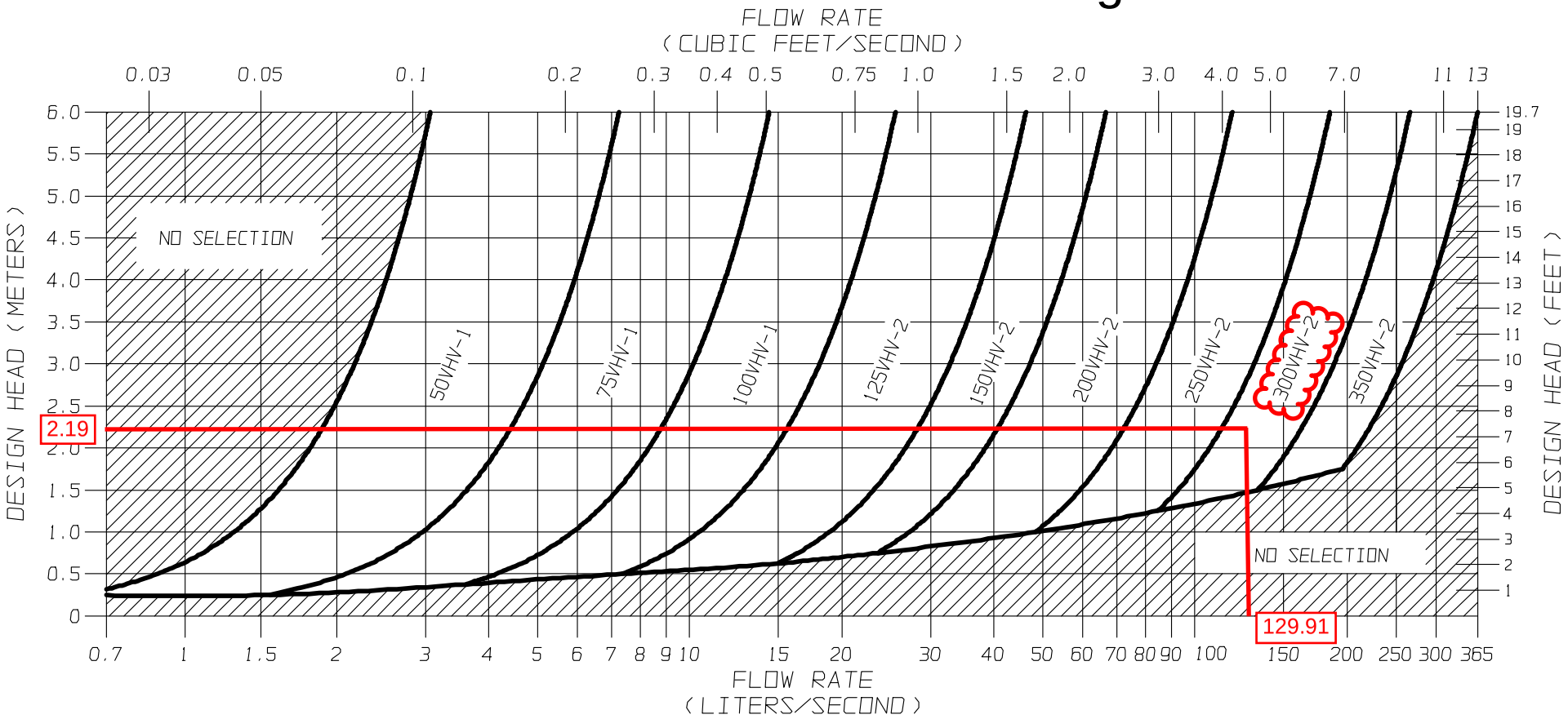
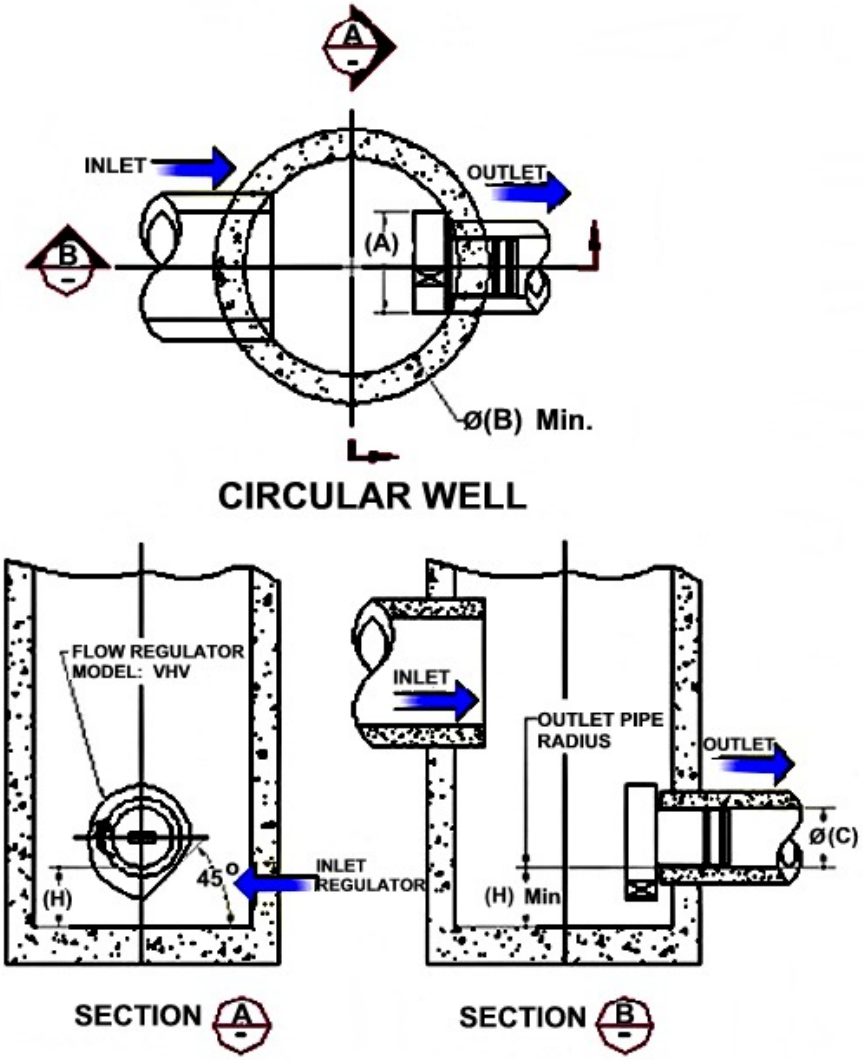


FIGURE 3 - VHV

JOHN MEUNIER

FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL VHV)

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	**A** (in.)	**B** (mm)	**B** (in.)	**C** (mm)	**C** (in.)	**H** (mm)	**H** (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	900	36	150	6	200	8
125VHV-2	275	11	900	36	150	6	200	8
150VHV-2	350	14	900	36	150	6	225	9
200VHV-2	450	18	1200	48	200	8	300	12
250VHV-2	575	23	1200	48	250	10	350	14
300VHV-2	675	27	1600	64	250	10	400	16
350VHV-2	800	32	1800	72	300	12	500	20



INSTALLATION

The installation of a **HYDROVEX®** regulator may be undertaken once the manhole and piping is in place. Installation consists of simply fitting the regulator into the outlet pipe of the manhole. **John Meunier Inc.** recommends the use of a lubricant on the outlet pipe, in order to facilitate the insertion and orientation of the flow controller.

MAINTENANCE

HYDROVEX® regulators are manufactured in such a way as to be maintenance free; however, a periodic inspection (every 3-6 months) is suggested in order to ensure that neither the inlet nor the outlet has become blocked with debris. The manhole should undergo periodically, particularly after major storms, inspection and cleaning as established by the municipality

GUARANTY

The **HYDROVEX®** line of **VHV / SVHV** regulators are guaranteed against both design and manufacturing defects for a period of 5 years. Should a unit be defective, **John Meunier Inc.** is solely responsible for either modification or replacement of the unit.

John Meunier Inc.
ISO 9001 : 2008

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Revised: 2011-05-03

APPENDIX E

Stormwater Treatment Unit

Stormceptor®

FORTERRA

Stormceptor® EF Sizing Report

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION STORMCEPTOR®

05/06/2020

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA MACDONALD-CARTIER INT'L AP
NCDC Rainfall Station Id:	6000
Years of Rainfall Data:	37

Site Name:	2020 Bantree St.

Drainage Area (ha):	0.96
Runoff Coefficient 'c':	0.79

Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.0

Require Hydrocarbon Spill Capture?	Yes
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	

Project Name:	2020 Bantree St.
Project Number:	180357
Designer Name:	Brandon O'Leary
Designer Company:	Forterra
Designer Email:	brandon.oleary@forterrabp.com
Designer Phone:	(905) 630-0359
EOR Name:	Guillaume Courtois
EOR Company:	LRL Associates Ltd.
EOR Email/Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	71
EFO6	80
EFO8	85
EFO10	88
EFO12	89

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 80

Water Quality Runoff Volume Capture (%): > 90

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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

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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	51.3	51.3	2.11	127.0	48.0	93	47.7	47.7
2	8.7	60.0	4.22	253.0	96.0	88	7.6	55.4
3	5.8	65.8	6.33	380.0	144.0	83	4.8	60.1
4	4.6	70.4	8.43	506.0	192.0	77	3.5	63.7
5	4.2	74.6	10.54	633.0	240.0	72	3.0	66.7
6	3.2	77.8	12.65	759.0	289.0	69	2.2	68.9
7	2.6	80.4	14.76	886.0	337.0	64	1.7	70.6
8	2.4	82.8	16.87	1012.0	385.0	60	1.4	72.0
9	1.9	84.7	18.98	1139.0	433.0	57	1.1	73.1
10	1.6	86.3	21.08	1265.0	481.0	56	0.9	74.0
11	1.3	87.6	23.19	1392.0	529.0	54	0.7	74.7
12	1.1	88.7	25.30	1518.0	577.0	53	0.6	75.3
13	1.3	90.0	27.41	1645.0	625.0	52	0.7	76.0
14	1.1	91.1	29.52	1771.0	673.0	52	0.6	76.5
15	0.6	91.7	31.63	1898.0	721.0	51	0.3	76.8
16	0.8	92.5	33.73	2024.0	770.0	51	0.4	77.3
17	0.7	93.2	35.84	2151.0	818.0	51	0.4	77.6
18	0.5	93.7	37.95	2277.0	866.0	51	0.3	77.9
19	0.6	94.3	40.06	2404.0	914.0	50	0.3	78.2
20	0.5	94.8	42.17	2530.0	962.0	50	0.3	78.4
21	0.2	95.0	44.28	2657.0	1010.0	50	0.1	78.5
22	0.4	95.4	46.38	2783.0	1058.0	50	0.2	78.7
23	0.5	95.9	48.49	2910.0	1106.0	49	0.2	79.0
24	0.4	96.3	50.60	3036.0	1154.0	49	0.2	79.2
25	0.1	96.4	52.71	3163.0	1202.0	48	0.0	79.2

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	96.7	54.82	3289.0	1251.0	48	0.1	79.3
27	0.4	97.1	56.93	3416.0	1299.0	47	0.2	79.5
28	0.2	97.3	59.03	3542.0	1347.0	47	0.1	79.6
29	0.2	97.5	61.14	3669.0	1395.0	46	0.1	79.7
30	0.2	97.7	63.25	3795.0	1443.0	45	0.1	79.8
31	0.1	97.8	65.36	3922.0	1491.0	43	0.0	79.9
32	0.2	98.0	67.47	4048.0	1539.0	42	0.1	79.9
33	0.1	98.1	69.58	4175.0	1587.0	41	0.0	80.0
34	0.1	98.2	71.68	4301.0	1635.0	40	0.0	80.0
35	0.1	98.3	73.79	4428.0	1683.0	38	0.0	80.1
36	0.2	98.5	75.90	4554.0	1732.0	37	0.1	80.1
37	0.0	98.5	78.01	4681.0	1780.0	36	0.0	80.1
38	0.1	98.6	80.12	4807.0	1828.0	35	0.0	80.2
39	0.1	98.7	82.23	4934.0	1876.0	34	0.0	80.2
40	0.1	98.8	84.33	5060.0	1924.0	34	0.0	80.2
41	0.1	98.9	86.44	5187.0	1972.0	33	0.0	80.3
42	0.1	99.0	88.55	5313.0	2020.0	32	0.0	80.3
43	0.2	99.2	90.66	5440.0	2068.0	31	0.1	80.4
44	0.1	99.3	92.77	5566.0	2116.0	31	0.0	80.4
45	0.1	99.4	94.88	5693.0	2164.0	30	0.0	80.4
46	0.0	99.4	96.98	5819.0	2213.0	29	0.0	80.4
47	0.1	99.5	99.09	5946.0	2261.0	28	0.0	80.5
48	0.0	99.5	101.20	6072.0	2309.0	28	0.0	80.5
49	0.0	99.5	103.31	6199.0	2357.0	27	0.0	80.5
50	0.0	99.5	105.42	6325.0	2405.0	27	0.0	80.5
Estimated Net Annual Sediment (TSS) Load Reduction =								**80 %**

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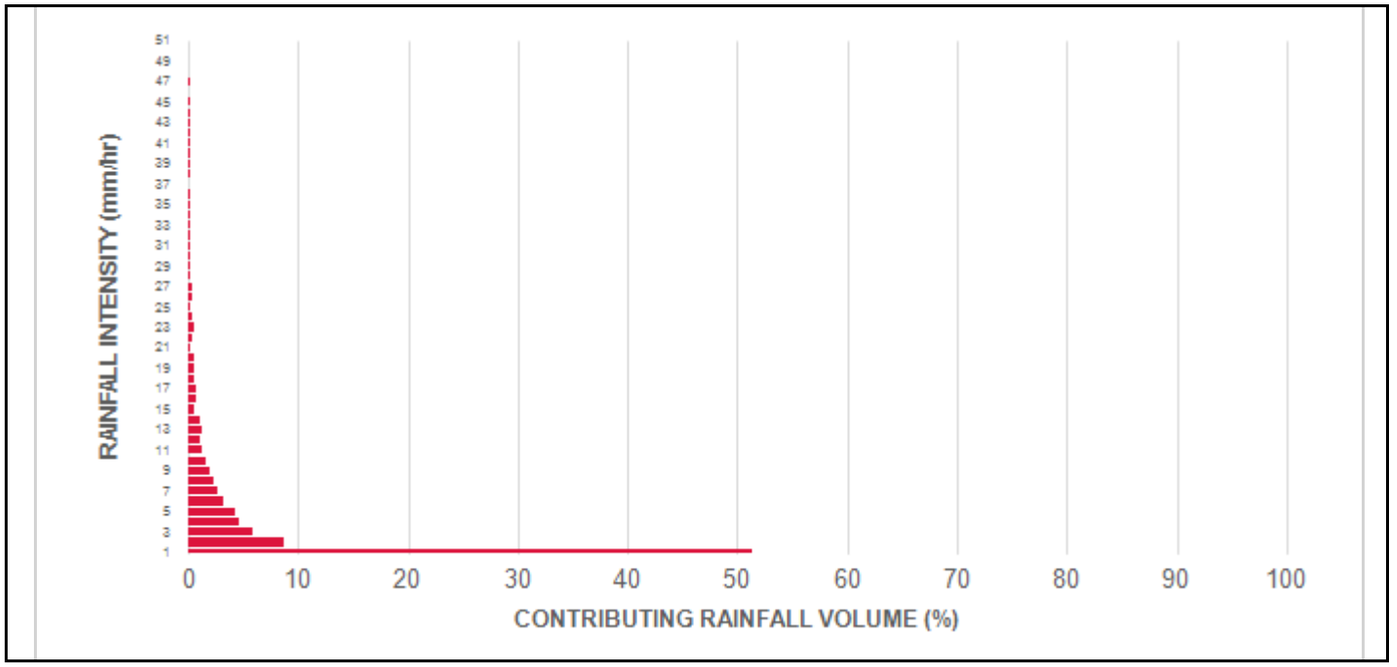
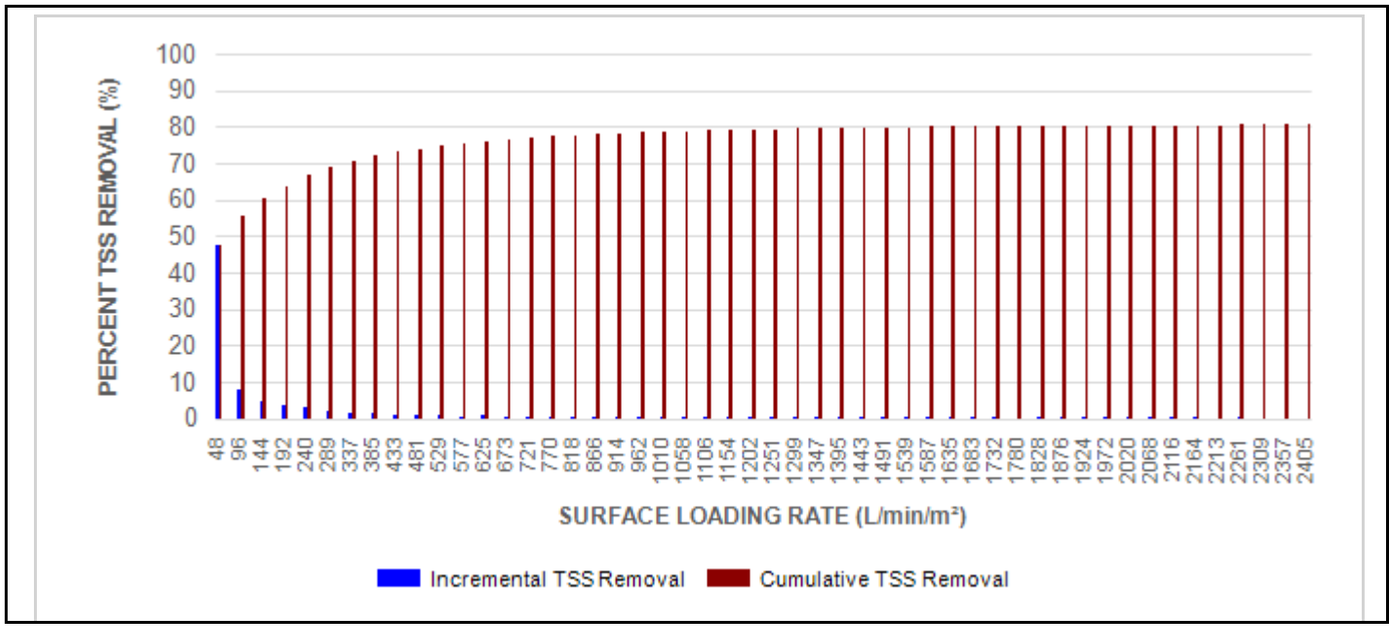
RAINFALL DATA FROM OTTAWA MACDONALD-CARTIER INT'L AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



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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

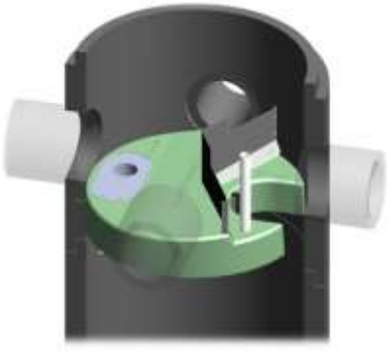
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

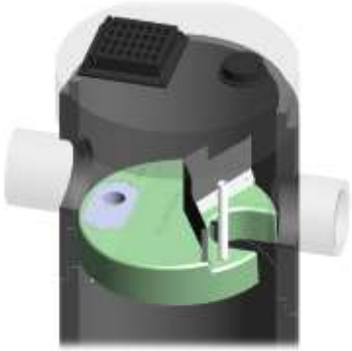
DESIGN FLEXIBILITY

►**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.

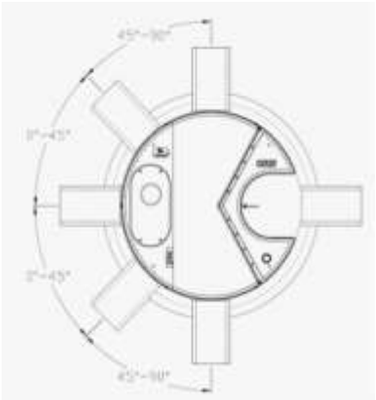
OIL CAPTURE AND RETENTION

►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.





imbrium



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	197	52	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	348	92	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	545	144	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	874	231	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	1219	322	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

imbrium

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** 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
	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.

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

PART 1 – GENERAL

1.1 WORK INCLUDED

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APPENDIX F

Civil Plans

PROPOSED AUTO PARTS BUILDING
2020 BANTREE ST, OTTAWA, ON

REVISION 02

KEY PLAN (N.T.S.)

DRAWING INDEX	
TITLE PAGE	
SEDIMENT AND EROSION CONTROL PLAN	C101
DEMOLITION PLAN	C102
SITE DEVELOPMENT PLAN	C201
GRADING AND DRAINAGE PLAN	C301
SERVICING PLAN	C401
STORMWATER MANAGEMENT PLAN	C601
PRE-DEVELOPMENT WATERSHED PLAN	C701
POST-DEVELOPMENT WATERSHED PLAN	C702
CONSTRUCTION DETAIL PLAN	C901

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

PROPOSED AUTO PARTS BUILDING
2020 BANTREE ST., OTTAWA, ON
REV.02 - ISSUED FOR APPROVAL - SEPTEMBER 2021
LRL PROJECT no: 180357

LICENSED PROFESSIONAL ENGINEER
M. BASNET
100501996
2021-09-27
PROVINCE OF ONTARIO

NOT AUTHENTIC UNLESS SIGNED AND DATED

EROSION AND SEDIMENT CONTROL MEASURES:

** CONTRACTOR IS RESPONSIBLE FOR ALL INSTALLATION, MONITORING, REPAIR AND REMOVAL OF ALL EROSION AND SEDIMENT CONTROL FEATURES **

1. PRIOR TO START OF CONSTRUCTION:

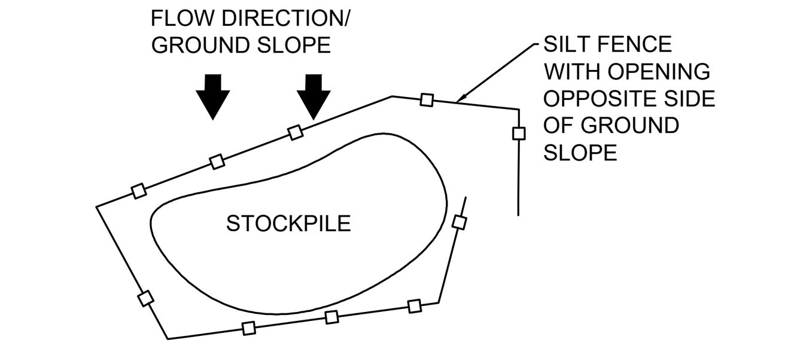
- PRIOR TO THE REMOVAL OF ANY VEGETATIVE COVER, MOVING OF SOIL AND CONSTRUCTION:
- INSTALL SILT FENCE IMMEDIATELY DOWNSTREAM FROM AREAS TO BE DISTURBED (SEE PLAN FOR LOCATION).
- INSTALL GEOSOCK INSERTS WITH AN OVERFLOW IN ALL THE DOWNSTREAM CATCHBASINS AND MANHOLES
- INSTALL SILTSACK FILTERS IN ALL CONCRETE CATCH BASINS STRUCTURES
- INSPECT MEASURES IMMEDIATELY AFTER INSTALLATION.

2. DURING CONSTRUCTION:

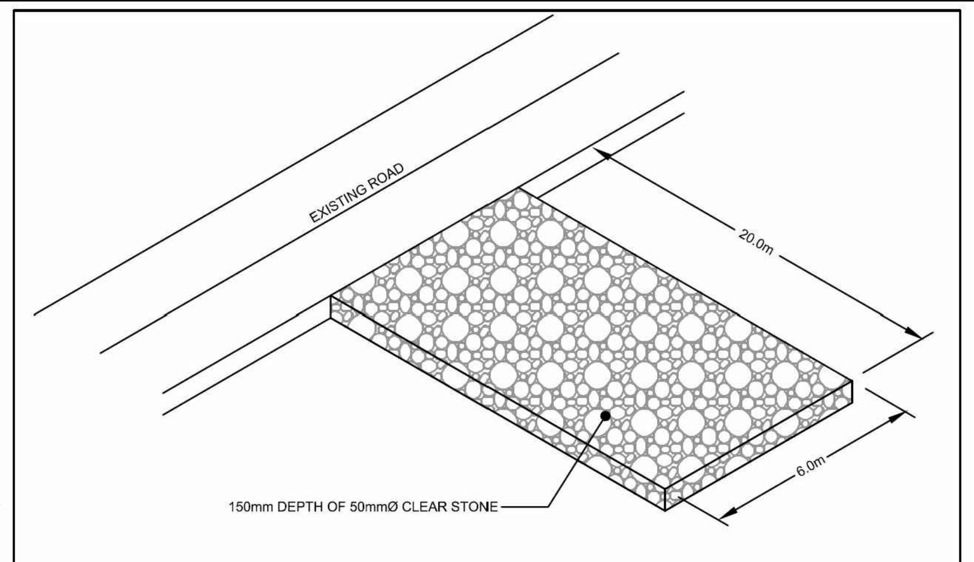
- WORK TO BE DONE IN THE VICINITY OF MAJOR WATERWAYS TO BE CARRIED OUT FROM JULY TO SEPTEMBER ONLY.
- MINIMIZE THE EXTENT OF DISTURBED AREAS AND THE DURATION OF EXPOSURE.
- PROTECT DISTURBED AREAS FROM RUNOFF.
- PROVIDE TEMPORARY COVER SUCH AS SEEDING OR MULCHING IF DISTURBED AREA WILL NOT BE REHABILITATED WITHIN 30 DAYS.
- INSPECT SILT FENCES, FILTER CLOTHS AND CATCH BASIN SUMPS WEEKLY AND AFTER EVERY MAJOR STORM EVENT. CLEAN AND REPAIR WHEN NECESSARY.
- CONSTRUCT SWALES AS PER DETAIL.
- PLAN TO BE REVIEWED AND REVISED AS REQUIRED DURING CONSTRUCTION
- EROSION CONTROL FENCING TO BE ALSO INSTALLED AROUND THE BASE OF ALL STOCKPILES.
- DO NOT LOCATE TOPSOIL PILES AND EXCAVATION MATERIAL CLOSER THAN 2.5m FROM ANY PAVED SURFACE, OR ONE WHICH IS TO BE PAVED BEFORE THE PILE IS REMOVED. ALL TOPSOIL PILES ARE TO BE SEEDED IF THEY ARE TO REMAIN ON SITE LONG ENOUGH FOR SEEDS TO GROW (LONGER THAN 30 DAYS).
- CONTROL WIND-BLOWN DUST OFF SITE TO ACCEPTABLE LEVELS BY SEEDING TOPSOIL PILES AND OTHER AREAS TEMPORARILY (PROVIDE WATERING AS REQUIRED).
- ALL EROSION CONTROL STRUCTURE TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
- NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THIS CONSULTING ENGINEER AND THE CITY DEPARTMENT OF PUBLIC WORKS.
- CONTRACTOR RESPONSIBLE FOR CITY ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENT FROM VEHICULAR TRACKING ETC. AT THE END OF EACH WORK DAY.
- PROVIDE GRAVEL ENTRANCE WHEREVER EQUIPMENT LEAVES THE SITE TO PREVENT MUD TRACKING ONTO PAVED SURFACES. GRAVEL BED SHALL BE A MINIMUM OF 15m LONG, 4M WIDE AND 0.3m DEEP AND SHALL CONSIST OF COARSE (50mm CRUSHERT-RUN LIMESTONE) MATERIAL. MAINTAIN GRAVEL ENTRANCE IN CLEAN CONDITION.
- DURING WET CONDITIONS, TIRES OF ALL VEHICLES/EQUIPMENT LEAVING THE SITE ARE TO BE SCRAPED.
- ANY MUD/MATERIAL TRACKED ONTO THE ROAD SHALL BE REMOVED IMMEDIATELY BY HAND OR RUBBER TIRE LOADER.
- TAKE ALL NECESSARY STEPS TO PREVENT BUILDING MATERIAL, CONSTRUCTION DEBRIS OR WASTE BEING SPILLED OR TRACKED ONTO ABUTTING PROPERTIES OR PUBLIC STREETS DURING CONSTRUCTION AND PROCEED IMMEDIATELY TO CLEAN UP ANY AREAS SO AFFECTED.

3. AFTER CONSTRUCTION:

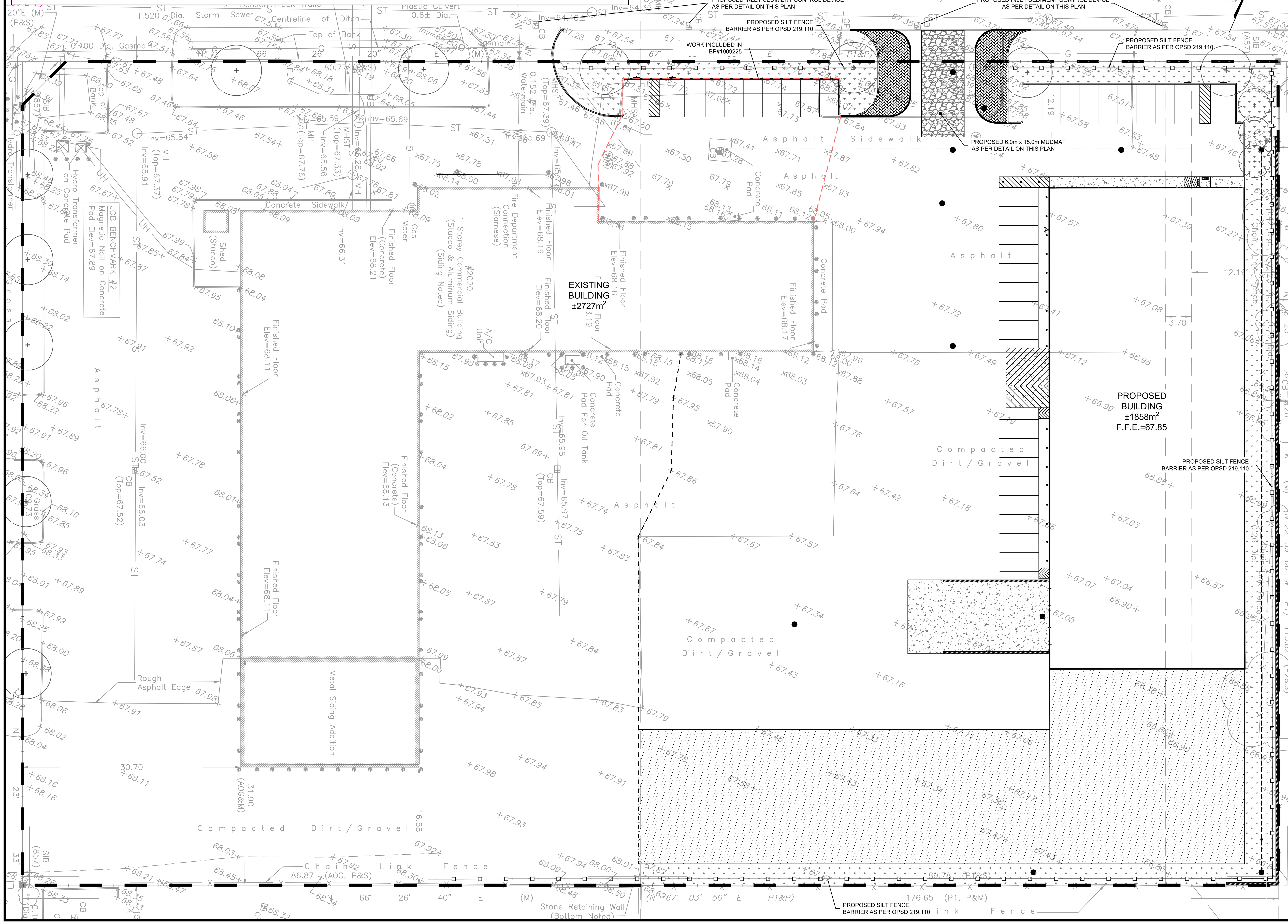
- PROVIDE PERMANENT COVER CONSISTING OF TOPSOIL AND SEED TO DISTURBED AREAS.
- REMOVE STRAW BALE FLOW CHECK DAMS, SILT FENCES AND FILTER CLOTHS ON CATCH BASINS AND MANHOLE COVERS AFTER DISTURBED AREAS HAVE BEEN REHABILITATED AND STABILIZED.
- INSPECT AND CLEAN CATCH BASIN SUMPS AND STORM SEWERS.



STOCKPILE EROSION PROTECTION
N.T.S.

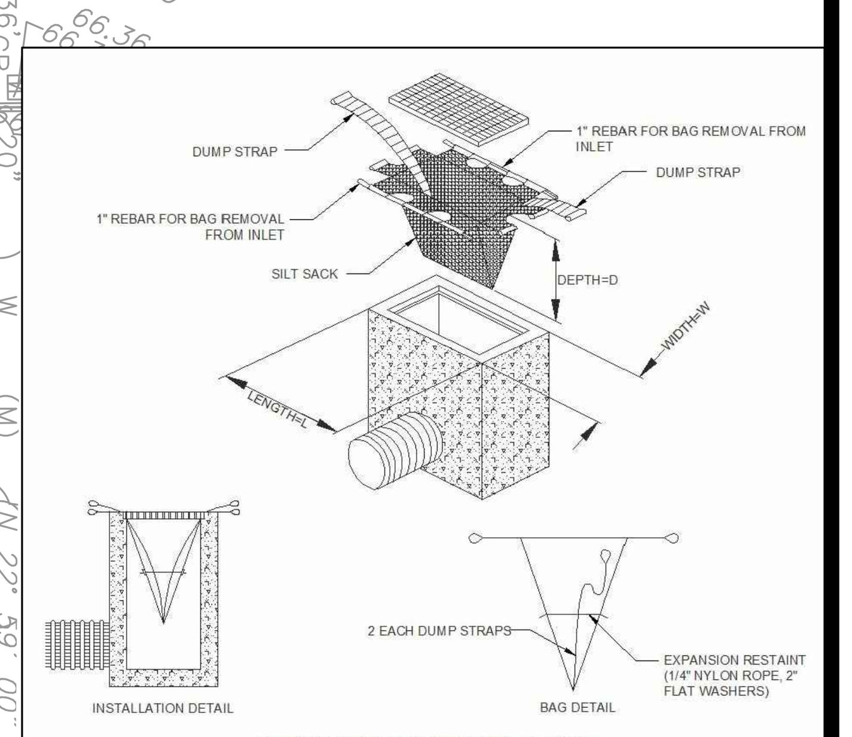


MUD MAT - CONSTRUCTION ACCESS
NTS

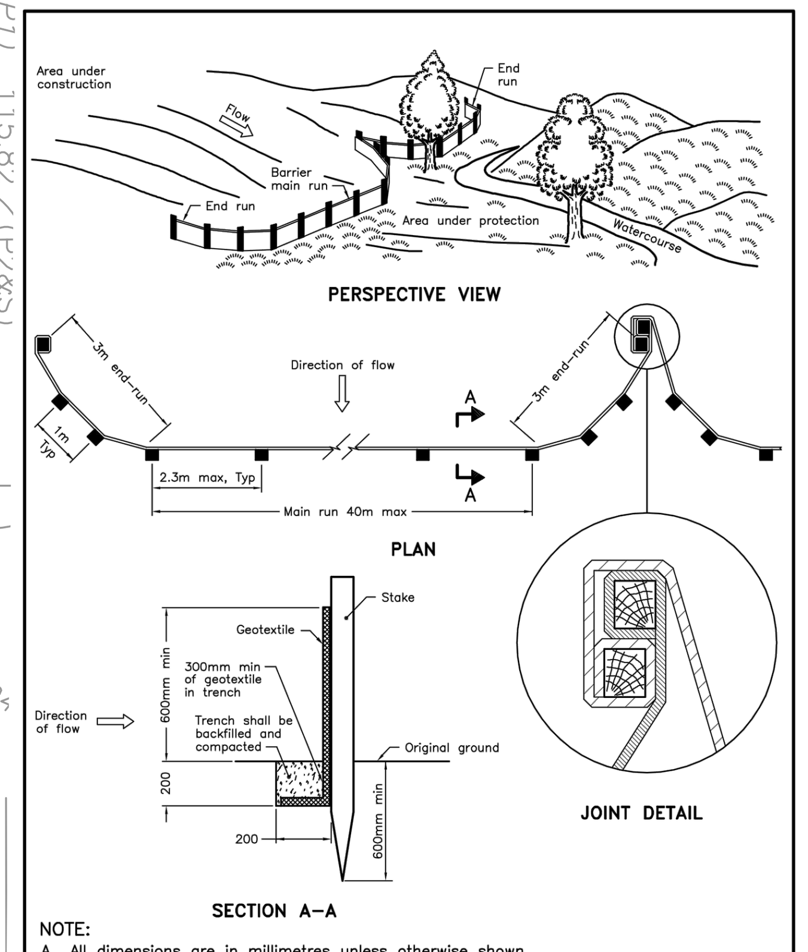


LEGEND:

- EXISTING PROPERTY LINE TO REMAIN
- PROPOSED CURB
- PROPOSED DEPRESSED CURB
- PROPOSED TERRACING (3:1 MIN.)
- PROPOSED SILT FENCE AS PER OPSD 219.110
- PROPOSED FENCE
- PROPOSED DOOR ENTRANCE/EXIT
- PROPOSED GRASS AREA (100mm TOP SOIL & SOD)
- PROPOSED CONCRETE FEATURES/SLAB
- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED GRAVEL
- PROPOSED RIP RAP
- ×50.00 PROPOSED ELEVATION
- ×50.00HP PROPOSED HIGH POINT ELEVATION
- ×50.00S PROPOSED SWALE ELEVATION
- ×50.00BC PROPOSED BOTTOM OF CURB ELEVATION
- ×50.00TC PROPOSED TOP OF CURB ELEVATION
- ×50.00EX MATCH INTO EXISTING ELEVATION
- EXISTING ELEVATION
- PROPOSED OVERLAND MAJOR FLOW ROUTE
- SUB PROPOSED 100mmØ PERFORATED SUBDRAIN
- STM PROPOSED STORM SEWER
- SAN PROPOSED SANITARY SEWER
- WTR PROPOSED WATERMAIN
- STM EXISTING STORM SEWER
- SAN EXISTING SANITARY SEWER
- WTR EXISTING WATERMAIN
- GAS EXISTING GAS LINE
- EXISTING MANHOLE
- EXISTING CATCHBASIN
- PROPOSED CATCHBASIN / CATCHBASIN-MANHOLE /
- PROPOSED STC300
- PROPOSED CURB STOP
- PROPOSED PIPE INSULATION
- PROPOSED 100 YEAR HIGH WATER LEVEL
- STORM WATERSHED EXTENT
- WS-XX WATERSHED NAME
- CONTROLLED RUNOFF COEFFICIENT
- AREA AREA IN HECTARES



INLET SEDIMENT CONTROL DEVICE
N.T.S.



NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 2
LIGHT-DUTY SILT FENCE BARRIER
OPSD 219.110

USE AND INTERPRETATION OF DRAWINGS

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION ARE PART OF THE CONTRACT DOCUMENTS AND DESCRIBE USE AND INTENT OF THE DRAWING. THE CONTRACT DOCUMENTS INCLUDE NOT ONLY THE DRAWINGS, BUT ALSO THE OWNER-CONTRACTOR AGREEMENTS, CONDITIONS OF THE CONTRACT, THE SPECIFICATIONS, ADDENDA, AND MODIFICATIONS ISSUED AFTER EXECUTION OF THE CONTRACT. THESE CONTRACT DOCUMENTS ARE COMPLEMENTARY, AND WHAT IS REQUIRED BY ANY ONE SHALL BE BINDING AS IF REQUIRED BY ALL. WORK NOT COMPLETELY DELINEATED HEREON SHALL BE CONSTRUCTED OF THE SAME MATERIALS AND DETAILED SIMILARLY AS WORK SHOWN MORE COMPLETELY ELSEWHERE IN THE CONTRACT DOCUMENTS.

BY USE OF THE DRAWINGS FOR CONSTRUCTION OF THE PROJECT, THE OWNER CONFIRMS THAT HE HAS REVIEWED AND APPROVED THE DRAWINGS. THE CONTRACTOR CONFIRMS THAT HE HAS VISITED THE SITE, FAMILIARIZED HIMSELF WITH THE LOCAL CONDITIONS, VERIFIED FIELD DIMENSIONS AND CORRELATED HIS OBSERVATIONS WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

AS INSTRUMENTS OF SERVICE, ALL DRAWINGS, SPECIFICATIONS, CADD FILES OR OTHER ELECTRONIC MEDIA AND COPIED THERE OF FURNISHED BY THE ENGINEER ARE HIS PROPERTY. THEY ARE TO BE USED ONLY FOR THIS PROJECT AND ARE NOT TO BE USED ON ANY OTHER PROJECT, INCLUDING REPEATS OF THE PROJECT. CHANGES TO THE DRAWINGS MAY ONLY BE MADE BY THE ENGINEER.

UNLESS THE REVISION TITLE IS "ISSUED FOR CONSTRUCTION", THESE DRAWINGS SHALL BE CONSIDERED PRELIMINARY AND SHALL NOT BE USED AS A CONSTRUCTION DOCUMENT.

THESE DRAWINGS ILLUSTRATES THE WORK TO BE DONE. THE ENGINEER IS NOT RESPONSIBLE FOR THE MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES USED TO DO THE WORK, OR THE SAFETY ASPECTS OF CONSTRUCTION, AND NOTHING ON THESE DRAWINGS EXPRESSED OR IMPLIED CHANGES THIS CONDITION. CONTRACTOR SHALL DETERMINE ALL CONDITIONS AT THE SITE AND SHALL BE RESPONSIBLE FOR KNOWING HOW THEY AFFECT THE WORK. SUBMITTAL OF A BID TO PERFORM THIS WORK IS ACKNOWLEDGEMENT OF THE RESPONSIBILITIES, AND THAT THEY HAVE BEEN FULLY CONSIDERED IN PLANNING OF THE WORK, AND THE BID PRICE. NO CLAIMS FOR EXTRA CHARGES DUE TO THESE CONDITIONS WILL BE FORTHCOMING.

UNAUTHORIZED CHANGES:

IN THE EVENT THE CLIENT, THE CLIENT'S CONTRACTORS OR SUBCONTRACTORS, OR ANYONE FOR WHOM THE CLIENT IS LEGALLY LIABLE MAKES OR PERMITS TO BE MADE ANY CHANGES TO ANY REPORTS, PLANS, SPECIFICATIONS OR OTHER CONSTRUCTION DOCUMENTS PREPARED BY LRL ASSOCIATES LTD. (LRL) WITHOUT OBTAINING LRL'S PRIOR WRITTEN CONSENT, THE CLIENT SHALL ASSUME FULL RESPONSIBILITY FOR THE RESULTS OF SUCH CHANGES. THEREFORE THE CLIENT AGREES TO WAIVE ANY CLAIM AGAINST LRL AND TO RELEASE LRL FROM ANY LIABILITY ARISING DIRECTLY OR INDIRECTLY FROM SUCH UNAUTHORIZED CHANGES.

IN ADDITION, THE CLIENT AGREES, TO THE FULLEST EXTENT PERMITTED BY LAW, TO INDEMNIFY AND HOLD HARMLESS LRL FROM ANY DAMAGES, LIABILITIES OR COST, INCLUDING REASONABLE ATTORNEY'S FEES AND COST OF DEFENSE, ARISING FROM SUCH CHANGES.

IN ADDITION, THE CLIENT AGREES TO INCLUDE IN ANY CONTRACTS FOR CONSTRUCTION APPROPRIATE LANGUAGE THAT PROHIBITS THE CONTRACTOR OR ANY SUBCONTRACTORS OF ANY TIER FROM MAKING ANY CHANGES OR MODIFICATIONS TO LRL'S CONSTRUCTION DOCUMENTS WITHOUT THE PRIOR WRITTEN APPROVAL OF LRL AND THAT FURTHER REQUIRES THE CONTRACTOR TO INDEMNIFY BOTH LRL AND THE CLIENT FROM ANY LIABILITY OR COST ARISING FROM SUCH CHANGES MADE WITHOUT SUCH PROPER AUTHORIZATION.

GENERAL NOTES:

EXISTING SERVICES AND UTILITIES SHOWN ON THESE DRAWINGS ARE TAKEN FROM THE BEST AVAILABLE RECORDS, BUT MAY NOT BE COMPLETE OR TO DATE. CONTRACTOR SHALL VERIFY IN FIELD FOR LOCATION AND ELEVATION OF PIPES AND CHECK WITH THE UTILITY COMPANIES BEFORE DIGGING OR PERFORMING WORK.

CONTRACTOR IS ADVISED TO COLLECT INFORMATION ON SOIL CONDITIONS BEFORE START OF CONSTRUCTION.

THE ENGINEER WAIVES ANY AND ALL RESPONSIBILITY AND LIABILITY FOR PROBLEMS WHICH ARISE FROM FAILURE TO FOLLOW THESE PLANS, SPECIFICATIONS AND THE DESIGN INTENT THEY CONVEY, OR FOR PROBLEMS WHICH ARISE FROM OTHERS' FAILURE TO OBTAIN AND/OR FOLLOW THE ENGINEER'S GUIDANCE WITH RESPECT TO ANY ERRORS, OMISSIONS, INCONSISTENCIES AMBIGUITIES OR CONFLICTS WHICH ARE ALLEGED.

CONTRACTOR TO VERIFY ALL DIMENSIONS AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES BEFORE WORK COMMENCES. DO NOT SCALE DRAWINGS.

5m 2 0 5 10m

SCALE: 1:300

No.	REVISIONS	BY	DATE
02	ISSUED FOR APPROVAL	M.L.	27 SEP 2021
01	ISSUED FOR APPROVAL	M.L.	23 JUN 2021

LICENSED PROFESSIONAL ENGINEER
M. BASNET
100501996
2021-09-27
PROVINCE OF ONTARIO

NOT AUTHENTIC UNLESS SIGNED AND DATED

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
DE SAULNIERS CONSTRUCTION LTD.

DESIGNED BY:	DRAWN BY:	APPROVED BY:
M.L.	M.L.	M.B.

PROJECT
BENSON AUTO PARTS
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE
EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.
180357

DATE
APRIL 2021

C101

DETAILS OF DEVELOPMENT

DATA		REQUIRED	PROVIDED
ZONING		IH	
SETBACKS	FY	7.5m	17.7m
	RY	7.5m	30.4m
	INT.SY	7.5m	4.8m
	EXT.SY	7.5m	N/A
NET LOT AREA (sqm)		20,434 sqm	
BUILDING COVERAGE		65% (MAX)	22.4 %
BUILDING HEIGHT		18m (MAX)	8.2 m
GROSS FLOOR AREA		1858 sqm	
No. of UNITS		1	
LOADING SPACES		1	2
PARKING: WAREHOUSE: 0.8/100sqm 1659sqm = 14PARKING SPOT OFFICE : 2.4/100sqm 200sqm = 5 PARKING SPOT		17 + 2 HC	24 + 2 HC
No. OF STOREYS			1
OTHER:			

LEGEND:

- EXISTING PROPERTY LINE TO REMAIN
- PROPOSED CURB
- PROPOSED DEPRESSED CURB
- PROPOSED TERRACING (3:1 MIN.)
- PROPOSED SILT FENCE AS PER OPSD 219.110
- PROPOSED FENCE
- PROPOSED DOOR ENTRANCE/EXIT
- PROPOSED GRASS AREA (100mm TOP SOIL & SOD)
- PROPOSED CONCRETE FEATURES/SLAB
- PROPOSED HEAVY DUTY ASPHALT
- PROPOSED GRAVEL
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- EXISTING CATCHBASIN
- PROPOSED CATCHBASIN / CATCHBASIN-MANHOLE /
- PROPOSED STC300
- PROPOSED CURB STOP
- PROPOSED PIPE INSULATION
- PROPOSED 100 YEAR HIGH WATER LEVEL
- STORM WATERSHED EXTENT
- WS-XX CONTROLLED AREA RUNOFF — WATERSHED NAME / RUNOFF COEFFICIENT / AREA IN HECTARES

SITE PLAN NOTES:

1. EXISTING BUILDING
2. PROPOSED BUILDING
3. PROPOSED CONCRETE BARRIER CURB AS PER DETAIL SC1.1 ON PLAN C901
4. PROPOSED HANDICAP PARKING
5. PROPOSED PARKING (TYP.)
6. PROPOSED LIGHT DUTY PAVEMENT AREA (SEE PAVEMENT STRUCTURE ON PLAN C301)
7. PROPOSED HEAVY TRAFFIC PAVEMENT AREA (SEE PAVEMENT STRUCTURE ON PLAN C301)
8. PROPOSED FIRE ROUTE
9. PROPOSED 100mm TOPSOIL & SOD
10. PROPOSED 30 x 45 cm "DISABLED PARKING PERMIT" SIGN (Rb-93) AS PER MTO BOOK 5 AND AS PER SECTION 11 OF THE ONTARIO REGULATION 581/90. SIGN TO BE MOUNTED ON STAINLESS STEEL POST.
11. PROPOSED 1.8m HIGH CHAIN LINK FENCE AS PER DETAIL ON PLAN C901
12. PROPOSED BOLLARD (TYP.) AS PER DETAIL ON C901
13. PROPOSED SEMI-DEPRESSED PAVERS FOR TRANSPORT TRUCK MANEUVERABILITY
14. PROPOSED CONCRETE CHEVRONS AS PER DETAIL ON C901
15. PROPOSED CONCRETE SIDEWALK / FEATURE
16. PROPOSED BOLLARD SPACED AT 2.7m C/C AS PER DETAIL ON C901
17. PROPOSED SNOW STORAGE AREA
18. PROPOSED TACTILE ATTENTION INDICATOR. DEPTH SHALL BE NOT LESS THAN 300mm AND NOT MORE THAN 610mm. SHALL CONFORM TO CLAUSES 4.1.1. AND 4.1.2. OF ISO 23599, "ASSISTIVE PRODUCTS FOR BLIND AND VISION-IMPAIRED PERSONS - TACTILE WALKING SURFACE INDICATORS".

USE AND INTERPRETATION OF DRAWINGS

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5m 2 0 5 10m
SCALE: 1:300

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01	ISSUED FOR APPROVAL	M.L.	23 JUN 2021

LICENSED PROFESSIONAL ENGINEER
M. BASNET
100501996
2021-09-27
PROVINCE OF ONTARIO
NOT AUTHENTIC UNLESS SIGNED AND DATED

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road I Ottawa, ON, K1J 9G2
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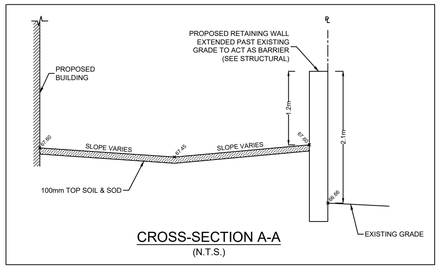
DRAWING TITLE
SITE DEVELOPMENT PLAN

PROJECT NO.
180357
DATE
APRIL 2021

C201

NOTE:

1. CONTRACTOR TO ENSURE EXISTING GRANULAR BASE IS AS PER PAVEMENT STRUCTURE SPECIFIED.
2. ADDITIONAL DEPTH OF GRANULAR A MAY BE REQUIRED TO ENSURE GRANULAR PAVEMENT STRUCTURE IS IN ACCEPTABLE CONDITION PRIOR TO PLACEMENT OF ASPHALT.
3. REFER TO GEOTECHNICAL REPORT PREPARED BY LRL ENGINEERING DATED FEBRUARY 2021



CROSS-SECTION A-A
(N.T.S.)

PAVEMENT STRUCTURE

COURSE	MATERIAL	THICKNESS (mm) HEAVY DUTY ASPHALT
SURFACE	HL 3 A/C (PG 58-28)	40
BINDER	HL 8 A/C (PG 58-28)	50
BASECOURSE	GRANULAR "A"	150
SUBBASE	GRANULAR "B" TYPE II	450

NOTE:
THE SUBGRADE IS TO BE SHAPED AS PER DESIGN TO PROMOTE DRAINAGE OF THE SITE AS PER THE GRADING PLAN. BASECOURSE CONDITION AND THICKNESS TO BE VERIFIED PRIOR TO PAVEMENT SURFACE COURSE BEING INSTALLED.

THE PAVEMENT STRUCTURE AS PER THE GEOTECHNICAL REPORT PREPARED BY LRL ENGINEERING, DATED FEBRUARY 2021.

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LICENSED PROFESSIONAL ENGINEER
M. BASNET
100501996
2021-09-27
PROVINCE OF ONTARIO

NOT AUTHENTIC UNLESS SIGNED AND DATED

LRJ
ENGINEERING | INGÉNIERIE
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www.lrl.ca I (613) 842-3434

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PROJECT
BENSON AUTO PARTS
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE
GRADING AND DRAINAGE PLAN

PROJECT NO.
180357

DATE
APRIL 2021

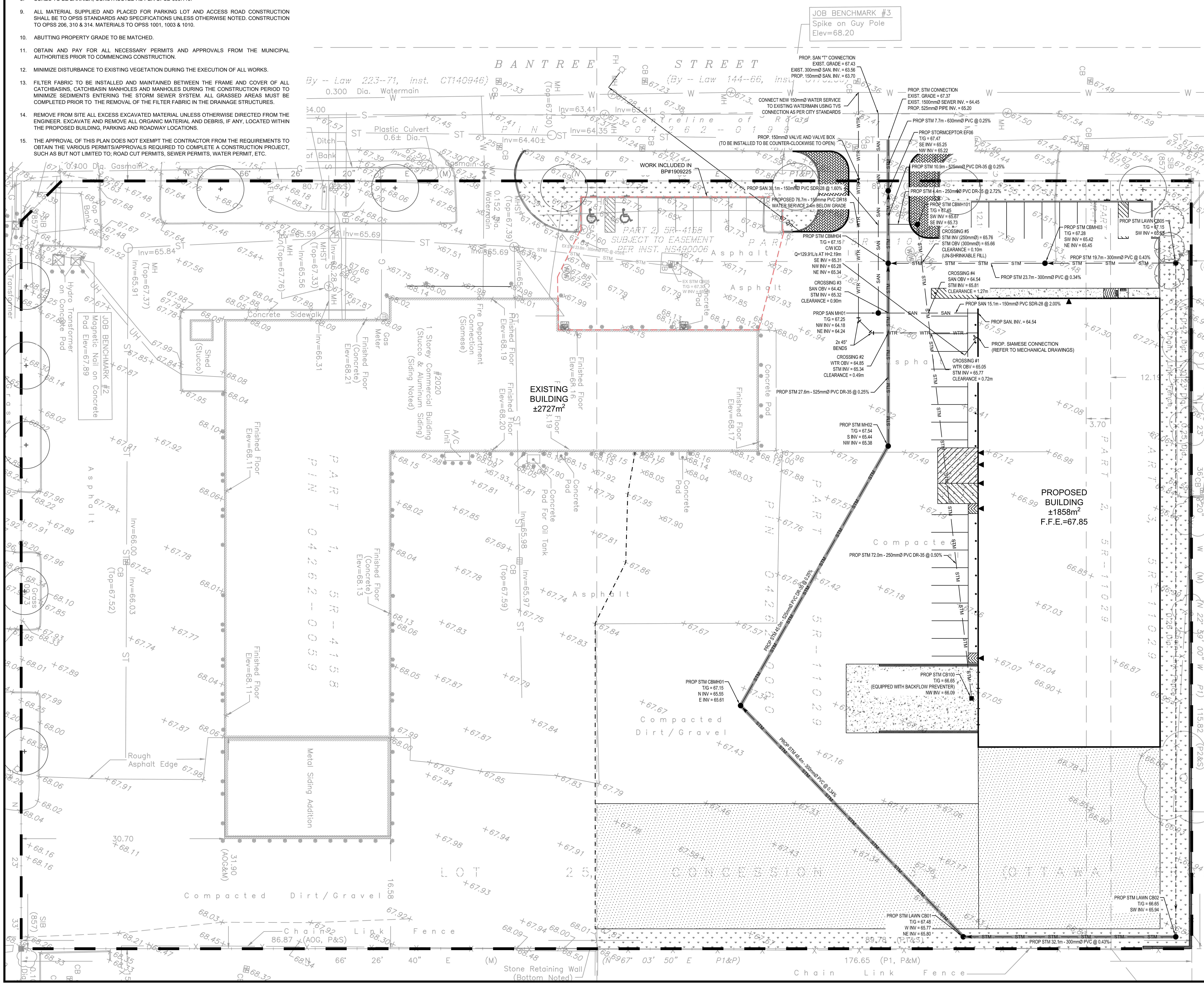
C301

NOTES: GENERAL

1. CONTRACTOR IS RESPONSIBLE FOR ALL LAYOUT FOR CONSTRUCTION PURPOSES.
2. ALL ELEVATIONS ARE GEODETIC AND UTILIZE METRIC UNITS.
3. JOB BENCH MARK - CONFIRM WITH LRL PRIOR TO UTILIZATION.
4. ALL GROUND SURFACES SHALL BE EVENLY GRADED WITHOUT PONDING AREAS AND WITHOUT LOW POINTS EXCEPT WHERE APPROVED SWALE, CATCH BASIN OUTLETS AND/OR STORM DETENTION AREAS ARE PROVIDED.
5. STRIP AND REMOVE ALL TOPSOIL FROM IMPROVED AREAS.
6. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
7. ALL EDGES OF DISTURBED PAVEMENT SHALL BE SAW CUT TO FORM A CLEAN STRAIGHT LINE PRIOR TO PLACING NEW PAVEMENT. PAVEMENT REINSTATEMENT SHALL BE WITH STEP JOINTS OF 500mm WIDTH MINIMUM.
8. CURBS TO BE BARRIER, CONSTRUCTED AS PER OPSD 600.110.
9. ALL MATERIAL SUPPLIED AND PLACED FOR PARKING LOT AND ACCESS ROAD CONSTRUCTION SHALL BE TO OPSS STANDARDS AND SPECIFICATIONS UNLESS OTHERWISE NOTED. CONSTRUCTION TO OPSS 206, 310 & 314. MATERIALS TO OPSS 1001, 1003 & 1010.
10. ABUTTING PROPERTY GRADE TO BE MATCHED.
11. OBTAIN AND PAY FOR ALL NECESSARY PERMITS AND APPROVALS FROM THE MUNICIPAL AUTHORITIES PRIOR TO COMMENCING CONSTRUCTION.
12. MINIMIZE DISTURBANCE TO EXISTING VEGETATION DURING THE EXECUTION OF ALL WORKS.
13. FILTER FABRIC TO BE INSTALLED AND MAINTAINED BETWEEN THE FRAME AND COVER OF ALL CATCHBASINS, CATCHBASIN MANHOLES AND MANHOLES DURING THE CONSTRUCTION PERIOD TO MINIMIZE SEDIMENTS ENTERING THE STORM SEWER SYSTEM. ALL GRASSED AREAS MUST BE COMPLETED PRIOR TO THE REMOVAL OF THE FILTER FABRIC IN THE DRAINAGE STRUCTURES.
14. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL UNLESS OTHERWISE DIRECTED FROM THE ENGINEER. EXCAVATE AND REMOVE ALL ORGANIC MATERIAL AND DEBRIS, IF ANY, LOCATED WITHIN THE PROPOSED BUILDING, PARKING AND ROADWAY LOCATIONS.
15. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS BUT NOT LIMITED TO; ROAD CUT PERMITS, SEWER PERMITS, WATER PERMIT, ETC.
16. AT PROPOSED UTILITY CONNECTION POINTS AND CROSSINGS (I.E. STORM SEWER, SANITARY SEWER, WATER, ETC.) THE CONTRACTOR SHALL DETERMINE THE PRECISE LOCATION AND DEPTH OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES OR CONFLICTS TO THE ENGINEER BEFORE COMMENCING WORK.
17. ALL SIDEWALK CONSTRUCTION TO BE AS PER OPSD 310.010 & OPSD 310.050.

NOTES: SEWERS

1. SEWER BEDDING AS PER PIPE TRENCH DETAIL WITH GRANULAR 'A' BEDDING COMPACTED TO 95% OF ITS SPMDD.
2. ALL WORK SHALL BE PERFORMED, AS APPLICABLE IN ACCORDANCE WITH OPSS 407, AND 410.
3. CONTRACTOR TO CONFIRM ELEVATION OF EXISTING SEWERS AT PROPOSED CONNECTION POINTS AND REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE COMMENCING ANY WORK.
4. ALL SEWERS WITH LESS THAN 2.0m OF COVER ARE SUBJECT TO INSULATION DETAIL.



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5m 2 0 5 10m

SCALE: 1:300

No.	REVISIONS	BY	DATE
02	ISSUED FOR APPROVAL	M.L.	27 SEP 2021
01	ISSUED FOR APPROVAL	M.L.	23 JUN 2021

LICENSED PROFESSIONAL ENGINEER
M. BASNET
100501996
2021-09-27
PROVINCE OF ONTARIO

NOT AUTHENTIC UNLESS SIGNED AND DATED

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DESIGNED BY:	DRAWN BY:	APPROVED BY:
M.L.	M.L.	M.B.

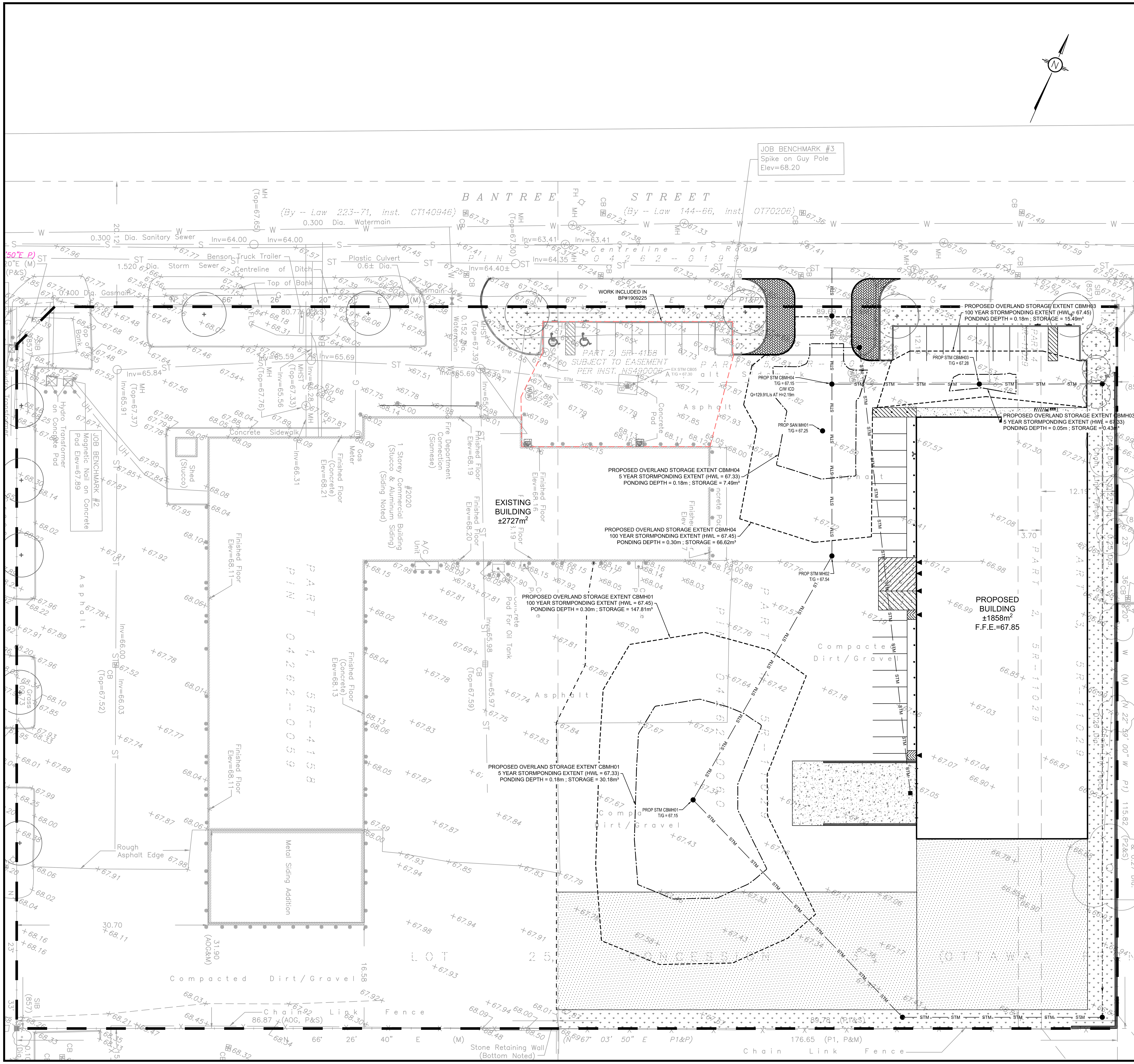
PROJECT
BENSON AUTO PARTS
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE
SERVICING PLAN

PROJECT NO.
180357

DATE
APRIL 2021

C401



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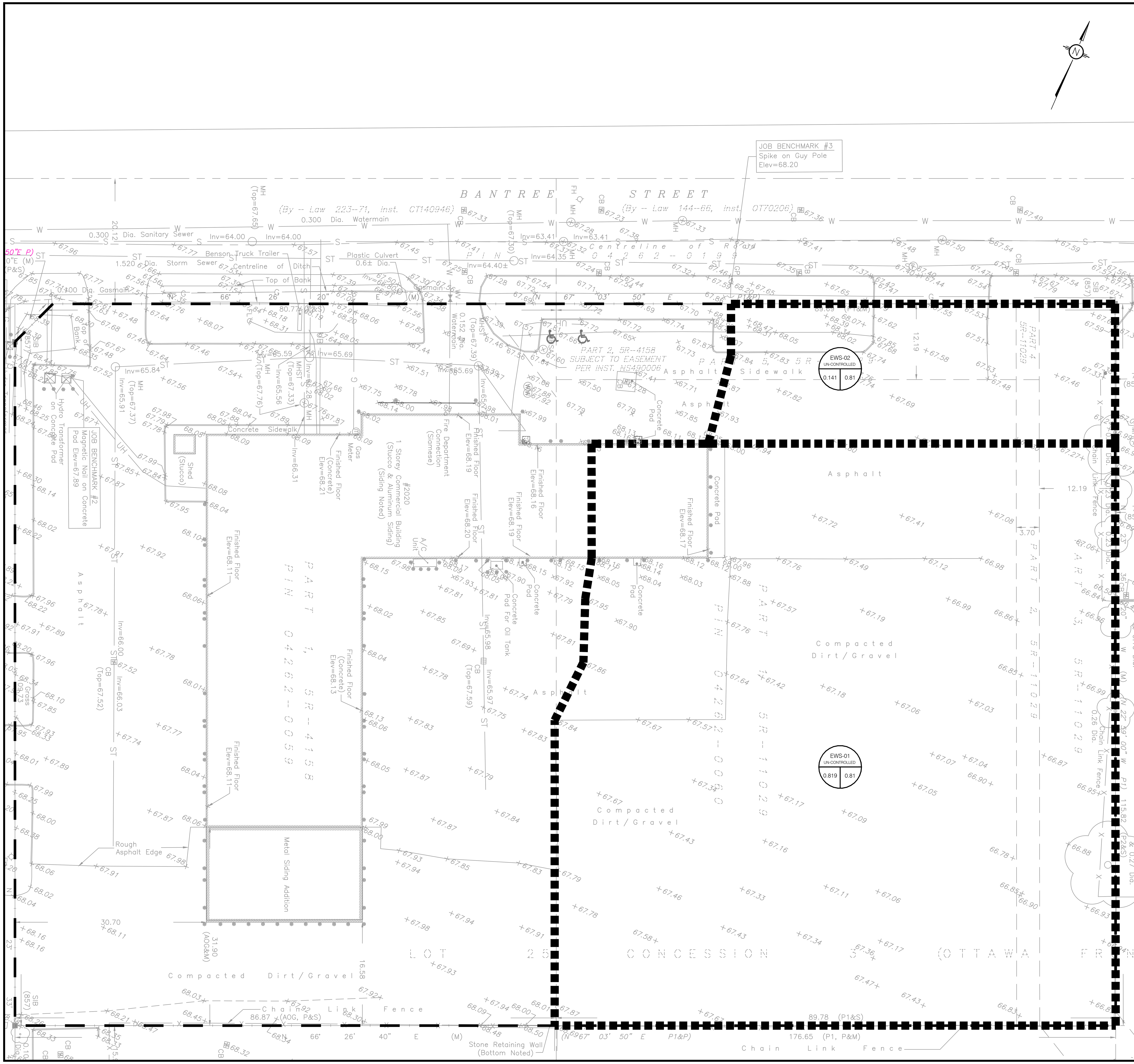
PROJECT
BENSON AUTO PARTS
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE
STORMWATER MANAGEMENT PLAN

PROJECT NO.
180357

DATE
APRIL 2021

C601



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DESIGNED BY:	DRAWN BY:	APPROVED BY:
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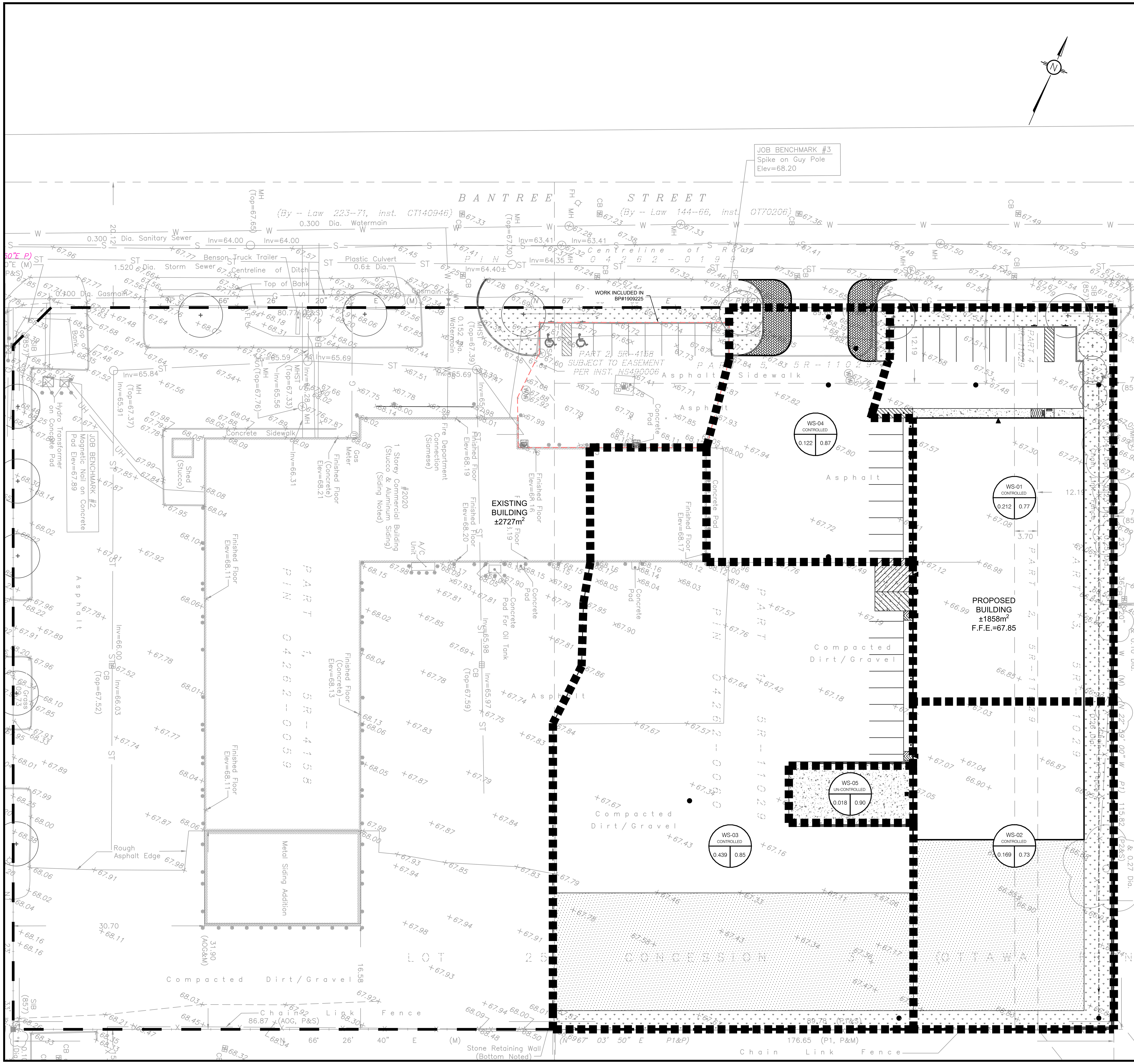
PROJECT
BENSON AUTO PARTS
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE
PRE-DEVELOPMENT
WATERSHED PLAN

PROJECT NO.
180357

DATE
APRIL 2021

C701



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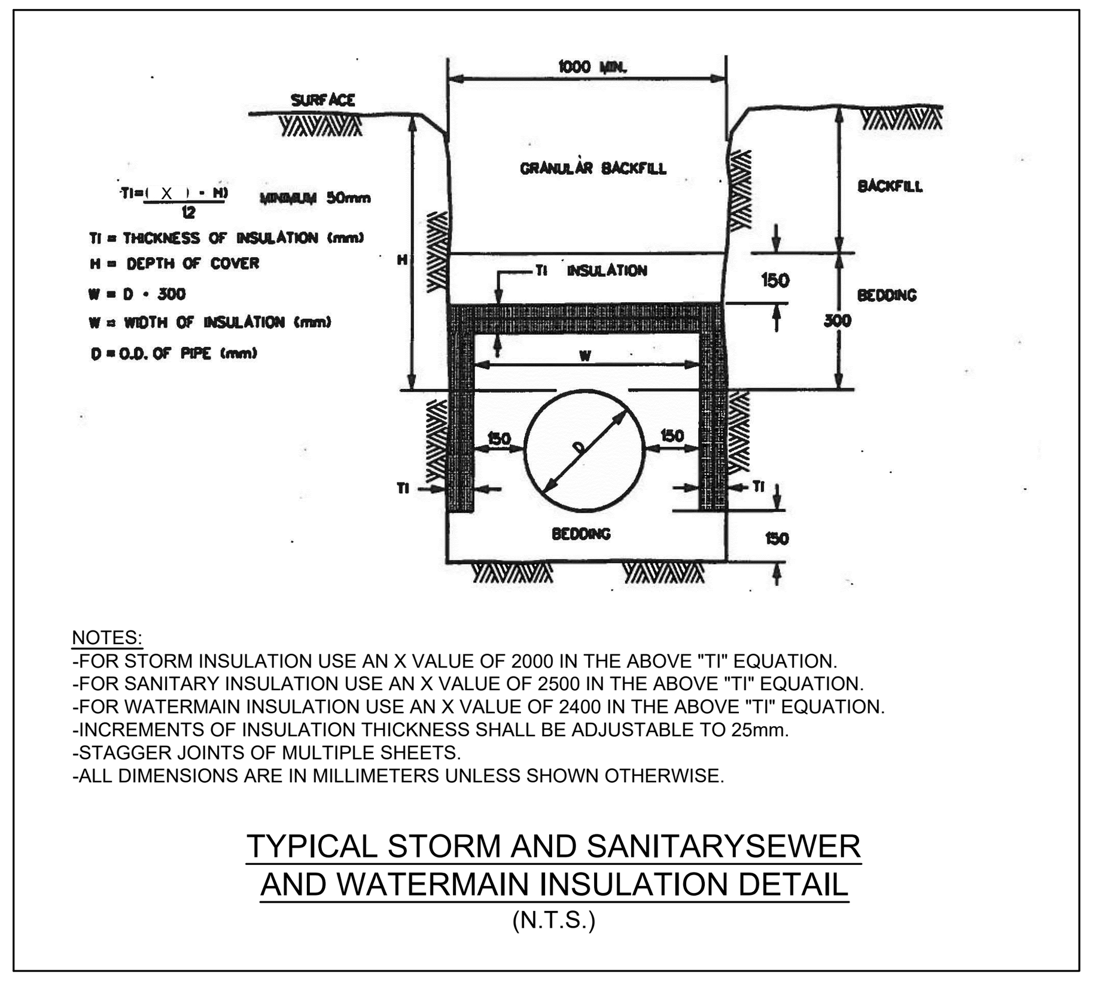
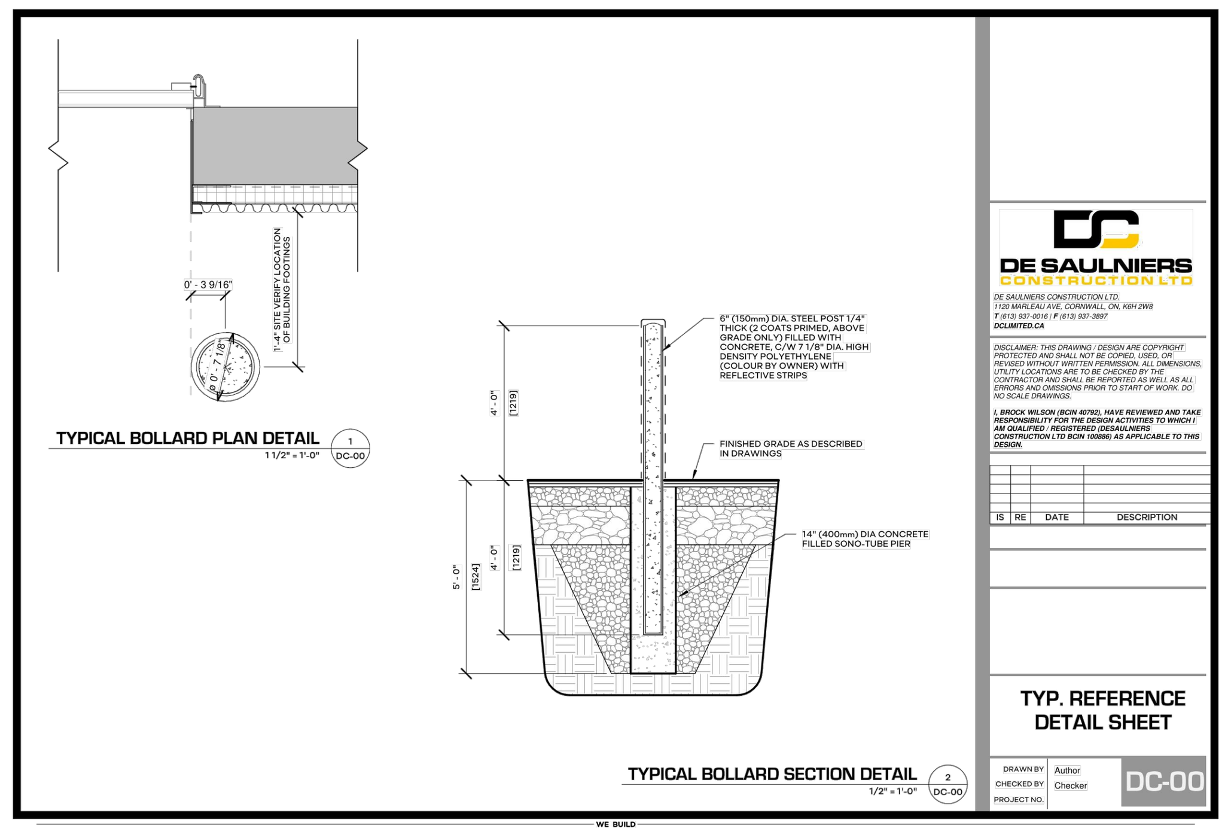
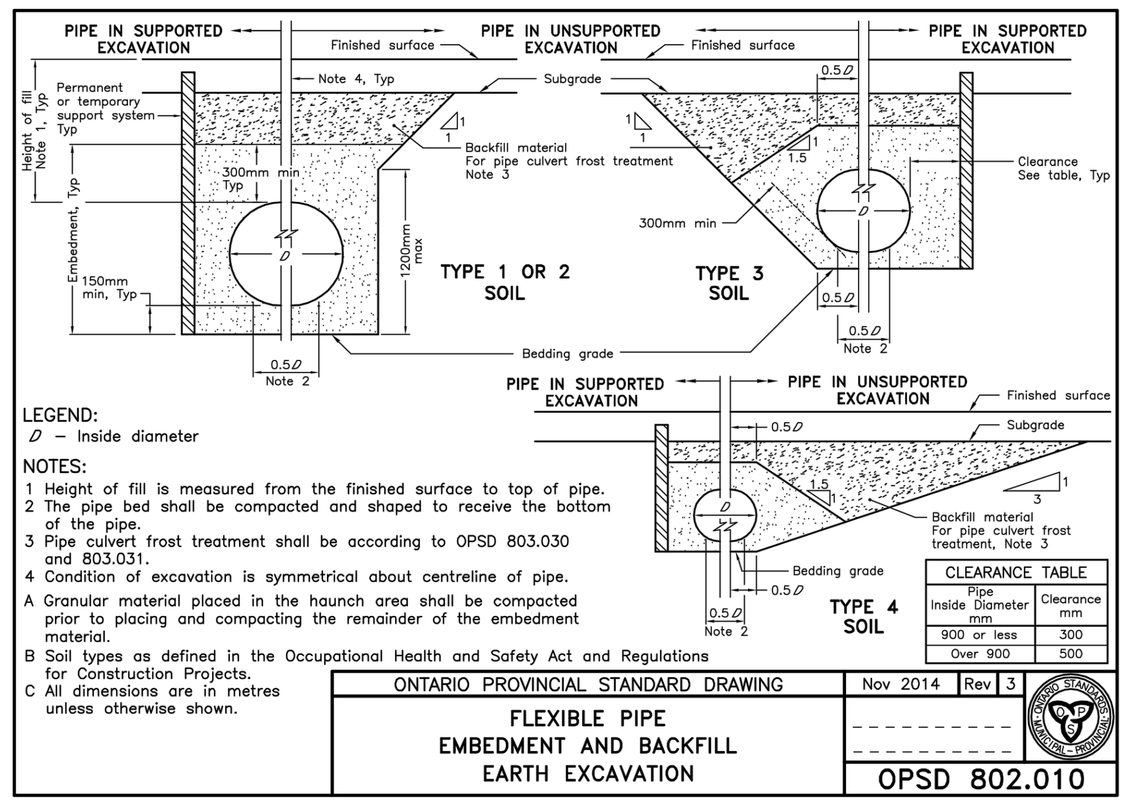
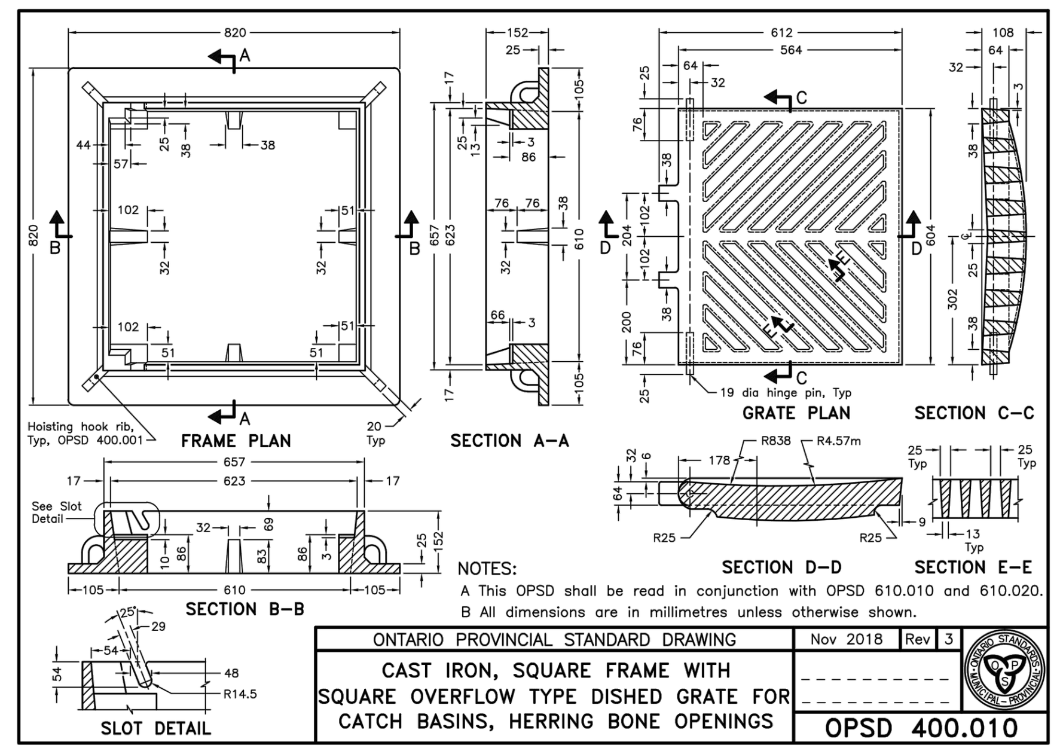
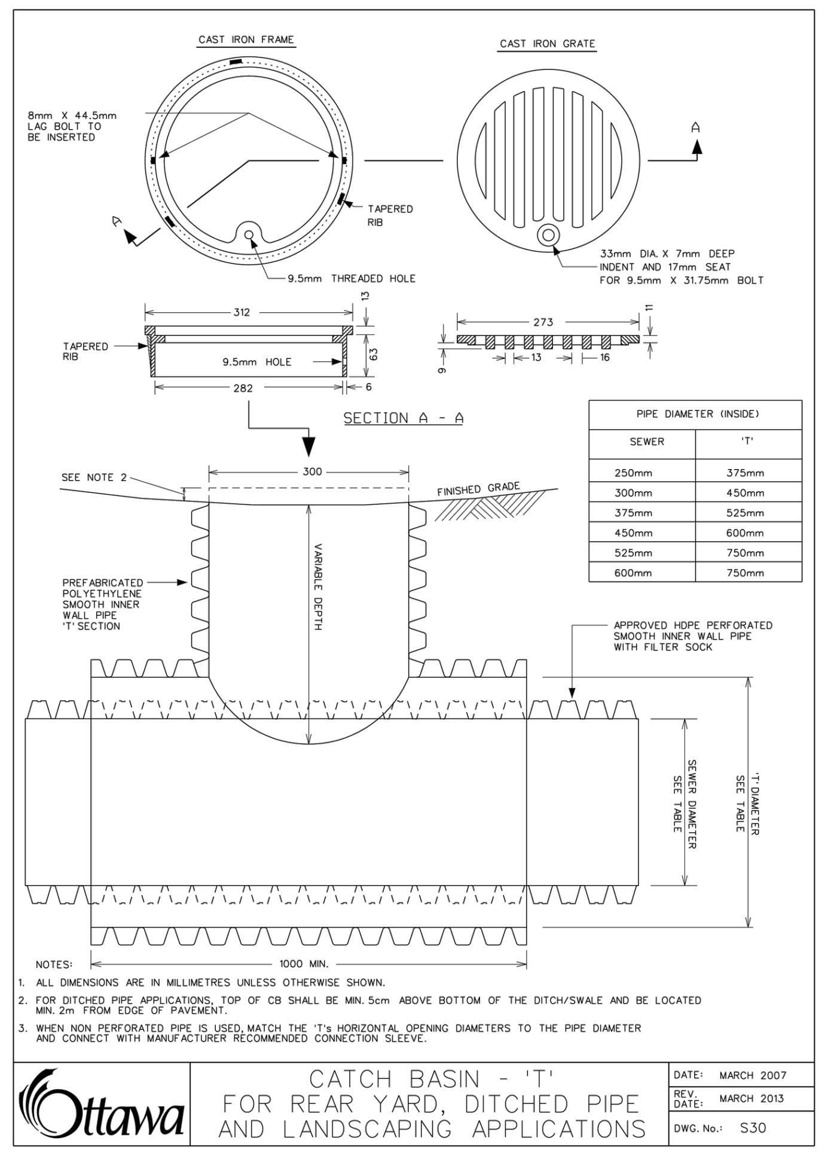
C702

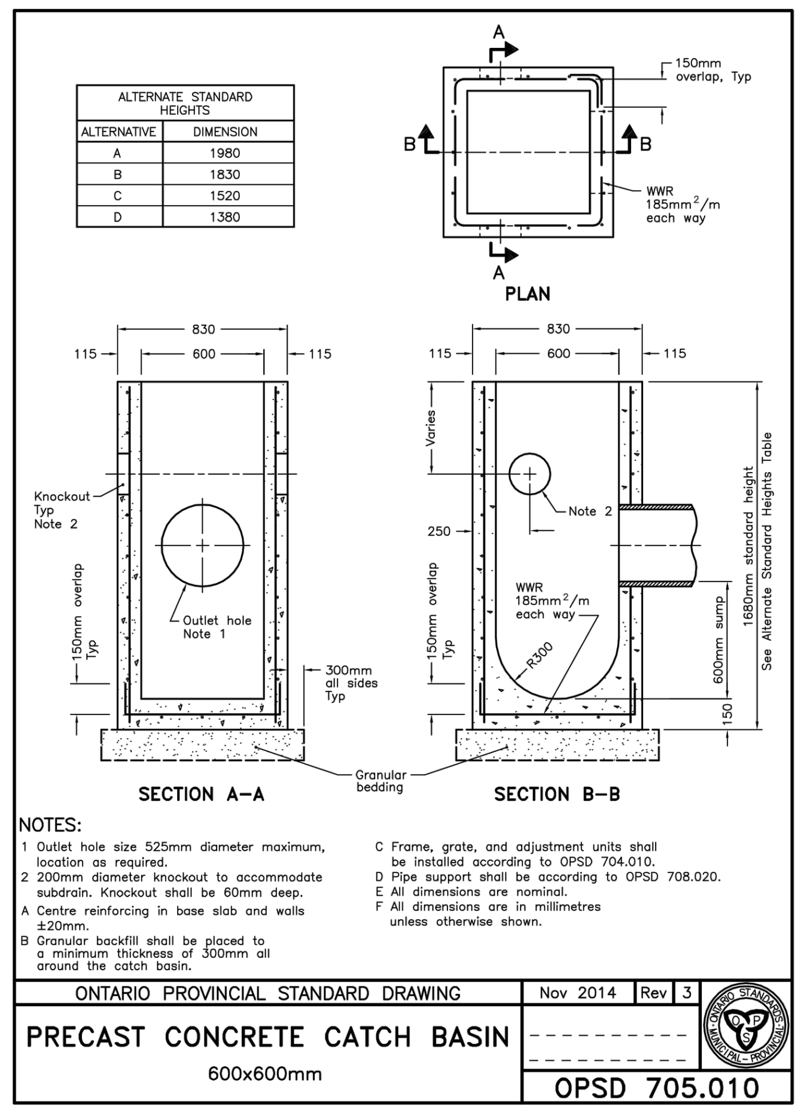


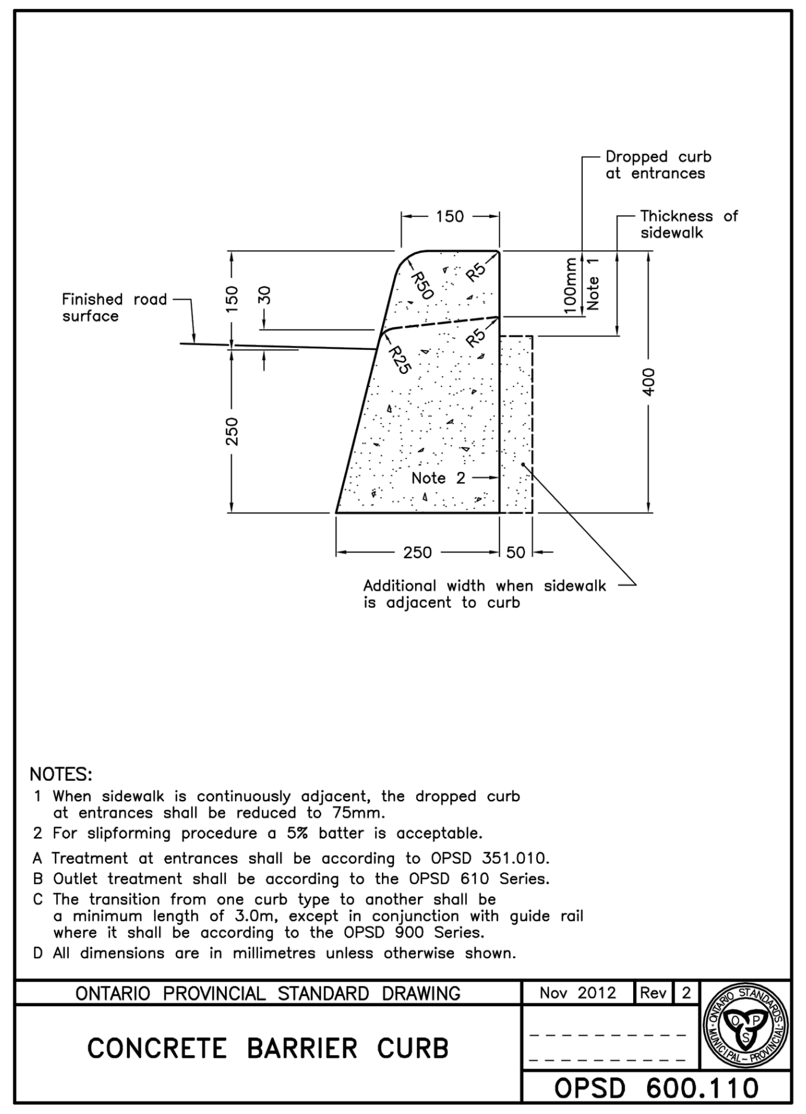


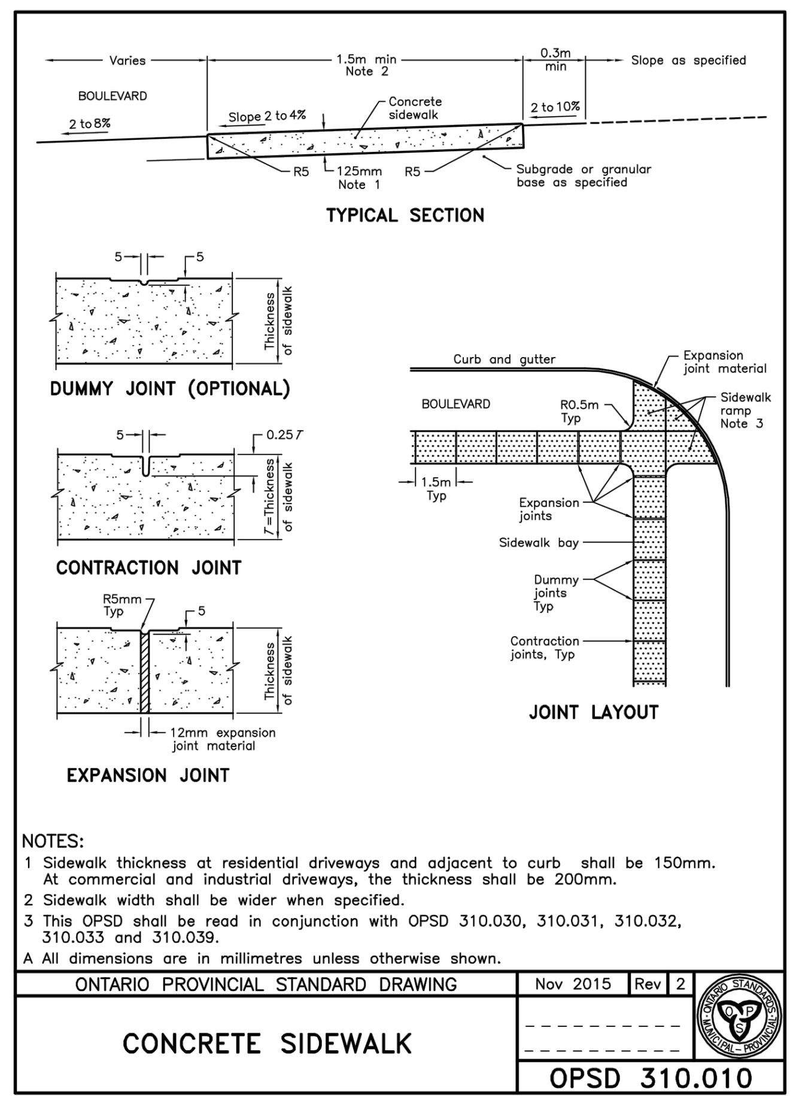


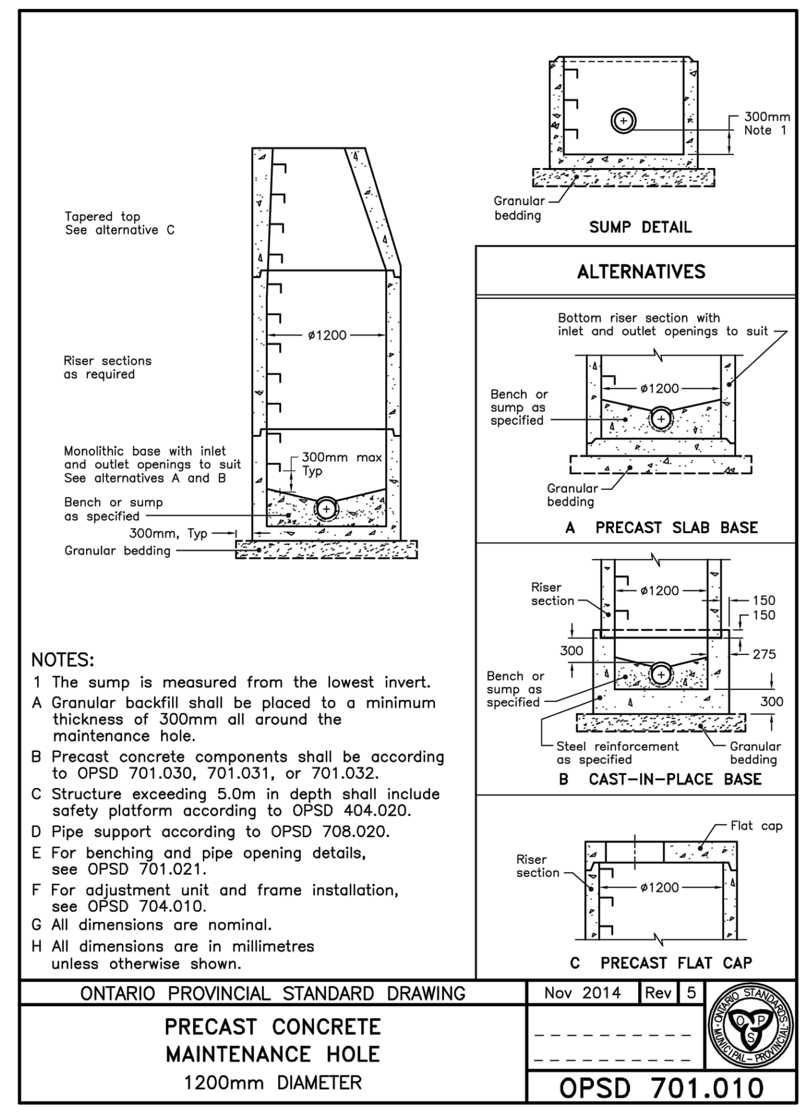


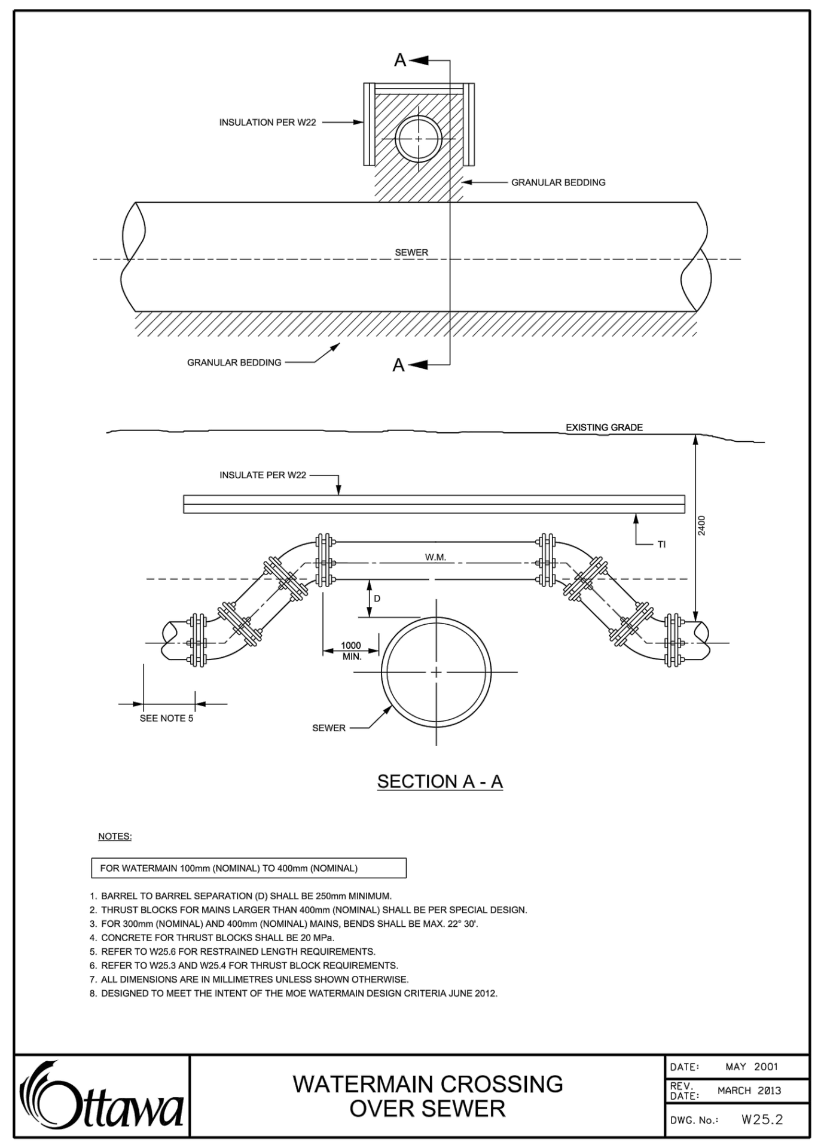


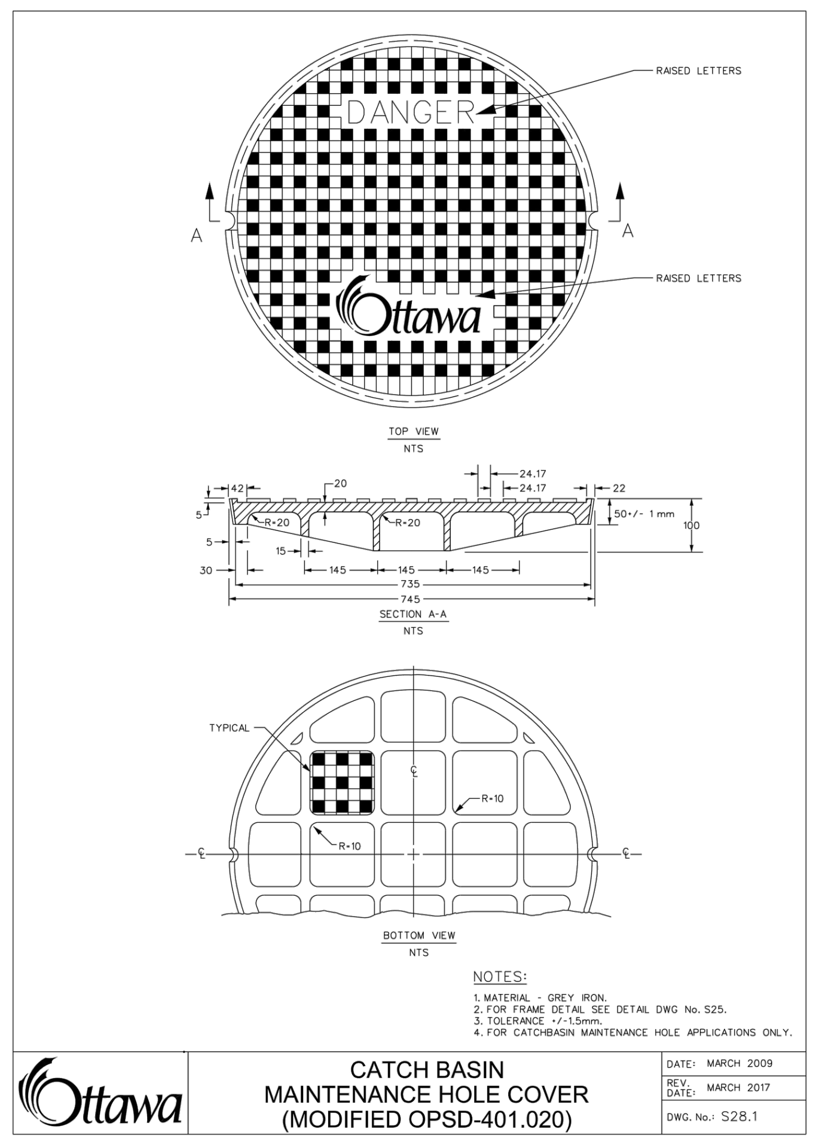


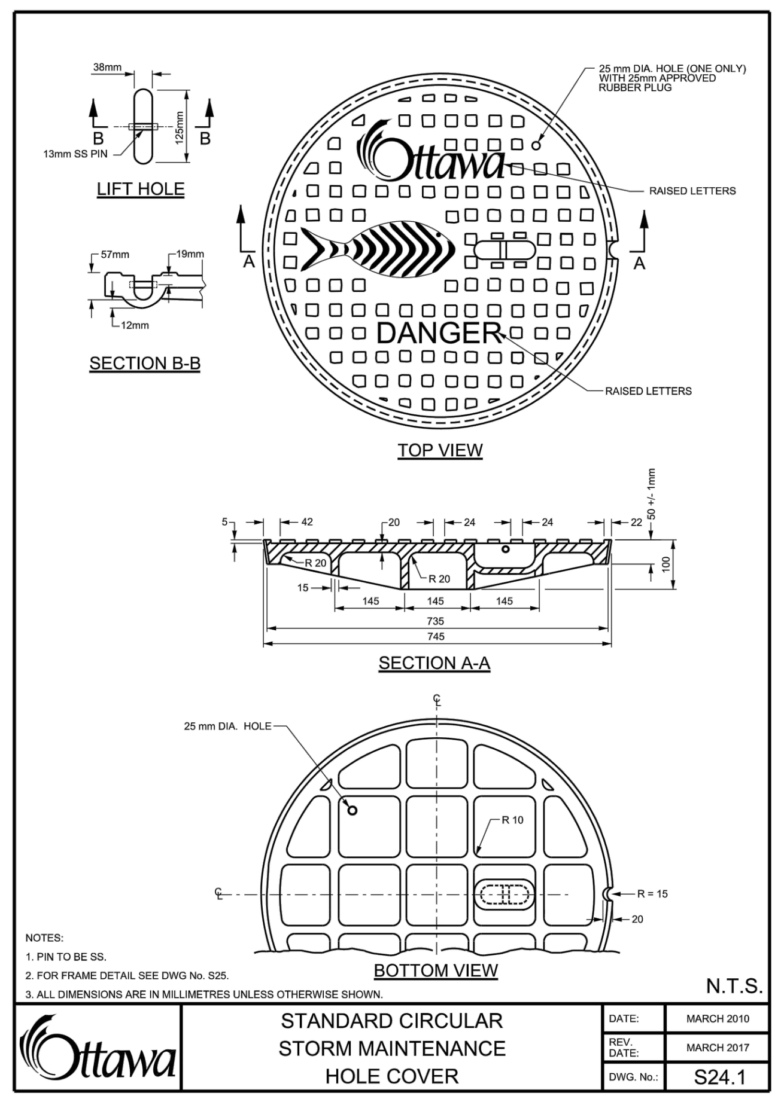


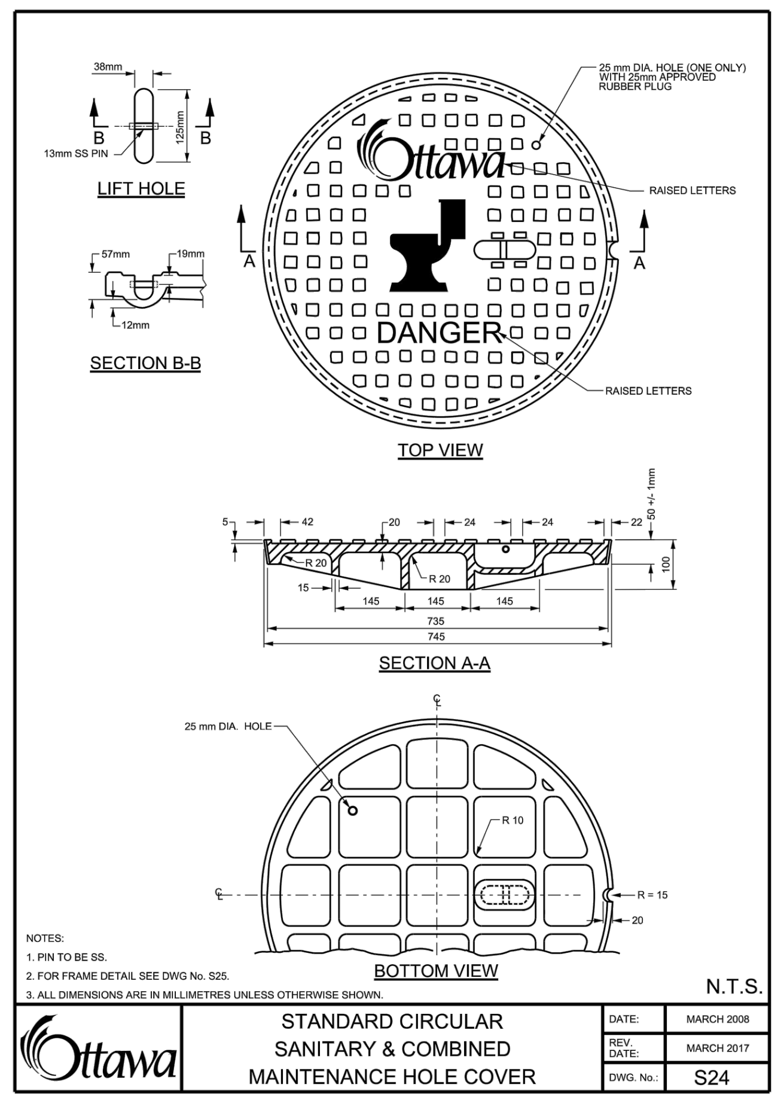


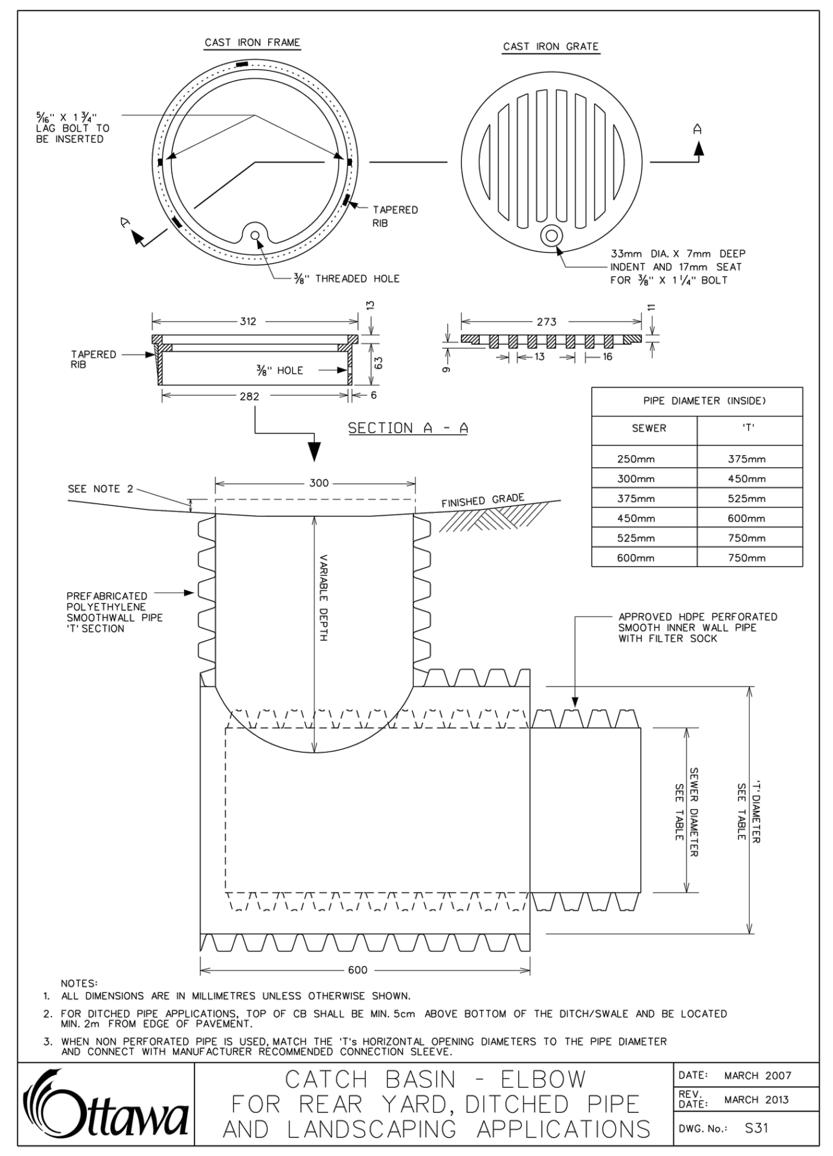


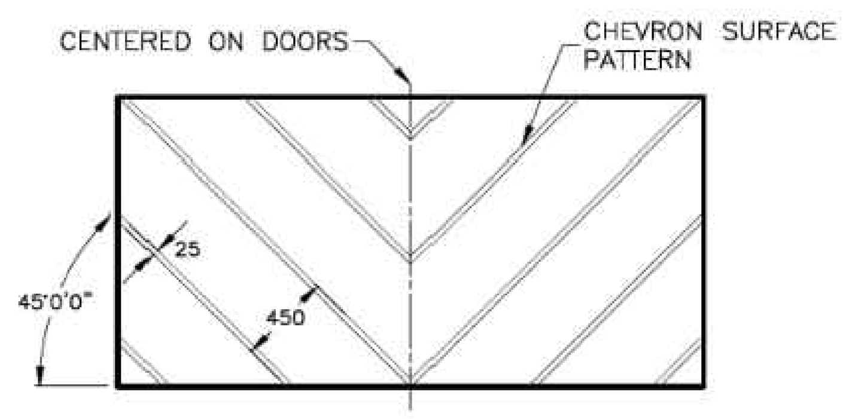












CONCRETE PAD CHEVRON SURFACE PATTERN

N.T.S.

NOTES

- CHEVRON SURFACE PATTERN TO HAVE 5mm DEPTH.

USE AND INTERPRETATION OF DRAWINGS

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION ARE PART OF THE CONTRACT DOCUMENTS AND DESCRIBE USE AND INTENT OF THE DRAWING. THE CONTRACT DOCUMENTS INCLUDE NOT ONLY THE DRAWINGS, BUT ALSO THE OWNER-CONTRACTOR AGREEMENTS, CONDITIONS OF THE CONTRACT, THE SPECIFICATIONS, ADDENDA, AND MODIFICATIONS ISSUED AFTER EXECUTION OF THE CONTRACT. THESE CONTRACT DOCUMENTS ARE COMPLEMENTARY, AND WHAT IS REQUIRED BY ANY ONE SHALL BE BINDING AS IF REQUIRED BY ALL. WORK NOT COMPLETELY DELINEATED HEREON SHALL BE CONSTRUCTED OF THE SAME MATERIALS AND DETAILED SIMILARLY AS WORK SHOWN MORE COMPLETELY ELSEWHERE IN THE CONTRACT DOCUMENTS.

BY USE OF THE DRAWINGS FOR CONSTRUCTION OF THE PROJECT, THE OWNER CONFIRMS THAT HE HAS REVIEWED AND APPROVED THE DRAWINGS. THE CONTRACTOR CONFIRMS THAT HE HAS VISITED THE SITE, FAMILIARIZED HIMSELF WITH THE LOCAL CONDITIONS, VERIFIED FIELD DIMENSIONS AND CORRELATED HIS OBSERVATIONS WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS.

AS INSTRUMENTS OF SERVICE, ALL DRAWINGS, SPECIFICATIONS, CADD FILES OR OTHER ELECTRONIC MEDIA AND COPIED THERE OF FURNISHED BY THE ENGINEER ARE HIS PROPERTY. THEY ARE TO BE USED ONLY FOR THIS PROJECT AND ARE NOT TO BE USED ON ANY OTHER PROJECT, INCLUDING REPEATS OF THE PROJECT. CHANGES TO THE DRAWINGS MAY ONLY BE MADE BY THE ENGINEER.

UNLESS THE REVISION TITLE IS "ISSUED FOR CONSTRUCTION", THESE DRAWINGS SHALL BE CONSIDERED PRELIMINARY AND SHALL NOT BE USED AS A CONSTRUCTION DOCUMENT.

THESE DRAWINGS ILLUSTRATES THE WORK TO BE DONE. THE ENGINEER IS NOT RESPONSIBLE FOR THE MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES USED TO DO THE WORK, OR THE SAFETY ASPECTS OF CONSTRUCTION, AND NOTHING ON THESE DRAWINGS EXPRESSED OR IMPLIED CHANGES THIS CONDITION. CONTRACTOR SHALL DETERMINE ALL CONDITIONS AT THE SITE AND SHALL BE RESPONSIBLE FOR KNOWING HOW THEY AFFECT THE WORK. SUBMITTAL OF A BID TO PERFORM THIS WORK IS ACKNOWLEDGEMENT OF THE RESPONSIBILITIES, AND THAT THEY HAVE BEEN FULLY CONSIDERED IN PLANNING OF THE WORK, AND THE BID PRICE. NO CLAIMS FOR EXTRA CHARGES DUE TO THESE CONDITIONS WILL BE FORTHCOMING.

UNAUTHORIZED CHANGES:

IN THE EVENT THE CLIENT, THE CLIENT'S CONTRACTORS OR SUBCONTRACTORS, OR ANYONE FOR WHOM THE CLIENT IS LEGALLY LIABLE MAKES OR PERMITS TO BE MADE ANY CHANGES TO ANY REPORTS, PLANS, SPECIFICATIONS OR OTHER CONSTRUCTION DOCUMENTS PREPARED BY LRL ASSOCIATES LTD. (LRL) WITHOUT OBTAINING LRL'S PRIOR WRITTEN CONSENT, THE CLIENT SHALL ASSUME FULL RESPONSIBILITY FOR THE RESULTS OF SUCH CHANGES. THEREFORE THE CLIENT AGREES TO WAIVE ANY CLAIM AGAINST LRL AND TO RELEASE LRL FROM ANY LIABILITY ARISING DIRECTLY OR INDIRECTLY FROM SUCH UNAUTHORIZED CHANGES.

IN ADDITION, THE CLIENT AGREES, TO THE FULLEST EXTENT PERMITTED BY LAW, TO INDEMNIFY AND HOLD HARMLESS LRL FROM ANY DAMAGES, LIABILITIES OR COST, INCLUDING REASONABLE ATTORNEY'S FEES AND COST OF DEFENSE, ARISING FROM SUCH CHANGES.

IN ADDITION, THE CLIENT AGREES TO INCLUDE IN ANY CONTRACTS FOR CONSTRUCTION APPROPRIATE LANGUAGE THAT PROHIBITS THE CONTRACTOR OR ANY SUBCONTRACTORS OF ANY TIER FROM MAKING ANY CHANGES OR MODIFICATIONS TO LRL'S CONSTRUCTION DOCUMENTS WITHOUT THE PRIOR WRITTEN APPROVAL OF LRL AND THAT FURTHER REQUIRES THE CONTRACTOR TO INDEMNIFY BOTH LRL AND THE CLIENT FROM ANY LIABILITY OR COST ARISING FROM SUCH CHANGES MADE WITHOUT SUCH PROPER AUTHORIZATION.

GENERAL NOTES:

EXISTING SERVICES AND UTILITIES SHOWN ON THESE DRAWINGS ARE TAKEN FROM THE BEST AVAILABLE RECORDS, BUT MAY NOT BE COMPLETE OR TO DATE. CONTRACTOR SHALL VERIFY IN FIELD FOR LOCATION AND ELEVATION OF PIPES AND CHECK WITH THE UTILITY COMPANIES BEFORE DIGGING OR PERFORMING WORK.

CONTRACTOR IS ADVISED TO COLLECT INFORMATION ON SOIL CONDITIONS BEFORE START OF CONSTRUCTION.

THE ENGINEER WAIVES ANY AND ALL RESPONSIBILITY AND LIABILITY FOR PROBLEMS WHICH ARISE FROM FAILURE TO FOLLOW THESE PLANS, SPECIFICATIONS AND THE DESIGN INTENT THEY CONVEY, OR FOR PROBLEMS WHICH ARISE FROM OTHERS' FAILURE TO OBTAIN AND/OR FOLLOW THE ENGINEER'S GUIDANCE WITH RESPECT TO ANY ERRORS, OMISSIONS, INCONSISTENCIES AMBIGUITIES OR CONFLICTS WHICH ARE ALLEGED.

CONTRACTOR TO VERIFY ALL DIMENSIONS AND NOTIFY THE ENGINEER OF ANY DISCREPANCIES BEFORE WORK COMMENCES. DO NOT SCALE DRAWINGS.

No.	REVISIONS	BY	DATE
02	ISSUED FOR APPROVAL	M.L.	27 SEP 2021
01	ISSUED FOR APPROVAL	M.L.	23 JUN 2021

NOT AUTHENTIC UNLESS SIGNED AND DATED

LRL
ENGINEERING | INGÉNIERIE
5430 Canotek Road | Ottawa, ON, K1J 9G2
www.lrl.ca | (613) 842-3434

CLIENT
DE SAULNIERS CONSTRUCTION LTD.

DESIGNED BY:	DRAWN BY:	APPROVED BY:
M.L.	M.L.	M.B.

PROJECT
BENSON AUTO PARTS
2020 BANTREE ST, OTTAWA, ON

DRAWING TITLE
CONSTRUCTION DETAIL PLAN

PROJECT NO.
180357

DATE
APRIL 2021

C901

APPENDIX G

Boundary Conditions

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: March 23, 2020 2:26 PM
To: Maxime Longtin
Cc: Mohan Basnet; Virginia Johnson
Subject: RE: 180357 - 2020 Bantree Street - Boundary Conditions
Attachments: 2020_Bantree MArch 2020.pdf

Hi Maxime,

Please find below and attached water boundary conditions –

The following are boundary conditions, HGL, for hydraulic analysis at 2020 Bantree (zone 1E) assumed to be connected to the 305mm on Bantree (see attached PDF for location).

Minimum HGL = 109.0m

Maximum HGL = 117.8.0m

MaxDay + FireFlow (150 L/s) = 103.0m

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.

I'll follow-up with the contact list of senior engineers areas in a separate email.

Thanks,
Adam

From: Maxime Longtin <mlongtin@lrl.ca>
Sent: March 23, 2020 8:03 AM
To: Baker, Adam <adam.baker@ottawa.ca>
Cc: Mohan Basnet <mbasnet@lrl.ca>; Virginia Johnson <vjohnson@lrl.ca>
Subject: RE: 180357 - 2020 Bantree Street - Boundary Conditions

Hi Adam,

I hope that you are staying safe and healthy.

Just wanted to follow-up on the email below.

Let us know if you need anything else,

Maxime Longtin

Civil Engineering Technologist
LRL Associates Ltd.
5430 Canotek Road
Ottawa, Ontario K1J 9G2
T (613) 842-3434 or (877) 632-5664 ext 256
C (613) 915-8043
F (613) 842-4338
E mlongtin@lrl.ca
W www.lrl.ca

Given the current COVID-19 situation, please be aware that LRL has implemented alternative working conditions for our team.
Many of us have now transitioned to working from home; however, communication and workability remains one of our top priorities.
We will continue to be reachable by cell phone or by calling LRL at 613-842-3434 which will prompt you to enter the extension of the person you are trying to reach.
In addition, we will continue to have access to all e-mail correspondence and do our best to return all inquiries in a timely manner.

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: March 16, 2020 11:41 AM
To: Maxime Longtin <mlongtin@lrl.ca>
Cc: Mohan Basnet <mbasnet@lrl.ca>; Virginia Johnson <vjohnson@lrl.ca>
Subject: RE: 180357 - 2020 Bantree Street - Boundary Conditions

Great thank you. I'll follow-up as soon as I get the boundary results from our modelling group.

For each project you can go directly to the project manager or whoever provided the engineering follow-up comments for the pre-consultation meeting. If you don't have that info you can go to the senior engineer for the area – I will find the list of the ward areas for each senior engineer and follow-up with you on that.

Thanks,
Adam

From: Maxime Longtin <mlongtin@lrl.ca>
Sent: March 16, 2020 11:31 AM
To: Baker, Adam <adam.baker@ottawa.ca>
Cc: Mohan Basnet <mbasnet@lrl.ca>; Virginia Johnson <vjohnson@lrl.ca>
Subject: RE: 180357 - 2020 Bantree Street - Boundary Conditions

Thanks for getting back to us. I'm attaching the email that was sent by my colleague previously.

Also, would it be possible to have a ward map with who to contact in which sector? This would help LRL a lot when it comes times to request some information for other project down the road.

LRL
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Thanks, and have yourself a great day.
Maxime Longtin
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LRL Associates Ltd.
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C (613) 915-8043
F (613) 842-4338
E mlongtin@lrl.ca
W www.lrl.ca

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: Monday, March 16, 2020 10:48 AM
To: Maxime Longtin <mlongtin@lrl.ca>
Cc: Mohan Basnet <mbasnet@lrl.ca>; Virginia Johnson <vjohnson@lrl.ca>
Subject: RE: 180357 - 2020 Bantree Street - Boundary Conditions

Hi Maxime,

Hope you're doing well. I will handle this boundary request. Could you please send me the attachments which Mohan had mentioned in the original email (water supply and FUS calculations).

Thank you,
Adam

Adam Baker, EIT
Engineering Intern
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - 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 26552, Adam.Baker@ottawa.ca

From: Maxime Longtin <mlongtin@lrl.ca>
Sent: March 11, 2020 12:55 PM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Virginia Johnson <vjohnson@lrl.ca>; Mohan Basnet <mbasnet@lrl.ca>
Subject: RE: 180357 - 2020 Bantree Street - Boundary Conditions

Hope everything is well with you.
Could you see the email from my colleague below and advise?

Thanks so much

Maxime Longtin
Civil Engineering Technologist
LRL Associates Ltd.
5430 Canotek Road
Ottawa, Ontario K1J 9G2
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C (613) 915-8043
F (613) 842-4338
E mlongtin@lrl.ca
W www.lrl.ca

From: Mohan Basnet <mbasnet@lrl.ca>
Sent: Wednesday, February 26, 2020 3:05 PM
To: John.Wu@ottawa.ca
Cc: Virginia Johnson <vjohnson@lrl.ca>; Maxime Longtin <mlongtin@lrl.ca>
Subject: 180357 - 2020 Bantree Street - Boundary Conditions

Hello John,

We are currently working on a serviceability report for 2020 Bantree Street, and require the boundary conditions at the site to proceed.

Please use the following data to provide the require boundary conditions:

- Average Daily Demand = 1.67 L/s
- Maximum Daily Demand = 2.50 L/s
- Maximum Hourly Demand = 4.50 L/s
- Required Fire Flow = 150.00 L/s

For your reference, I have included copies of the Water Supply Calculations & FUS Fire Flow Calculations along with this email.

Thank you,

Mohan

Mohan Basnet, P.Eng.

Civil Engineering Services
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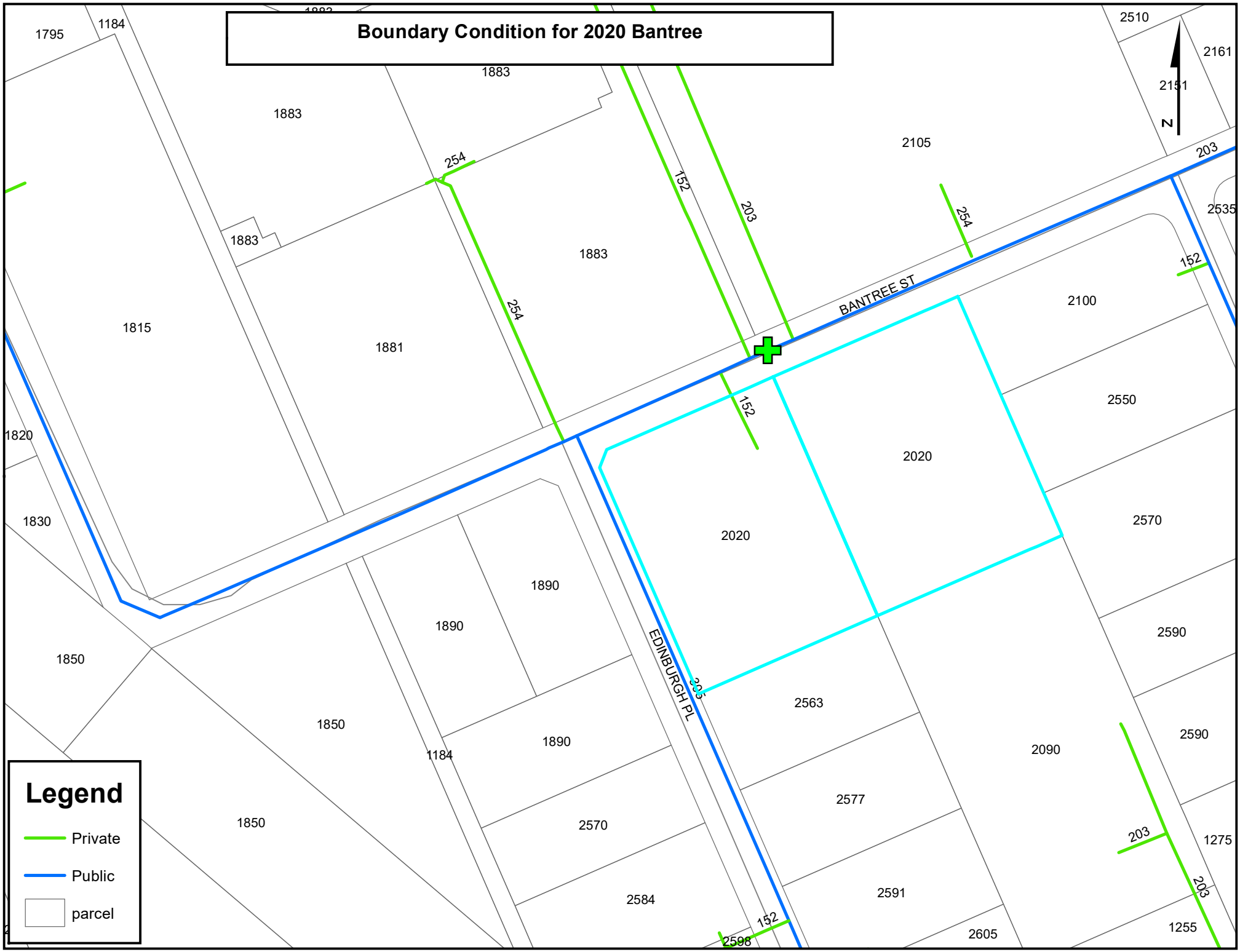
Boundary Condition for 2020 Bantree
1795
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1850
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Legend
Private
Public
parcel