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STACKED TOWNHOMES DEVELOPMENT

5858 DUNN STREET

NIAGARA FALLS, ONTARIO

STORMWATER MANAGEMENT REPORT

PREPARED FOR:

RPDS INTEGRATED DESIGN FIRM

PREPARED BY:

J.H. COHOON ENGINEERING LIMITED

440 HARDY ROAD UNIT 1

BRANTFORD, ONTARIO, N3T 5L8

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PROJECT NO. 16363 OCTOBER 10, 2023

Professional Engineers
Ontario

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1 Introduction

J.H. Cohoon Engineering Limited has been retained to prepare the following Stormwater Management (SWM) report in support of the proposed stacked townhomes development at 5858 Dunn Street in the City of Niagara Falls.

1.1 Site Description

The subject site consists of 0.73 ha of Residential Low Density Grouped Multiple Dwelling zone and Development Holding zone lands, which are currently vegetated and vacant. The site is bound by Dunn Street to the north, residentially zoned properties to the east, and parking lands for the Fallsview Tower Hotel to the south and west.

The proposed development consists of four residential stacked townhome buildings with 72 units and surface parking for 79 vehicles. Access to the proposed development will be provided via a driveway entrance to Dunn Street. Details of the proposed development have been provided on the attached Grading Plan (Drawing C-01) and Servicing Plan (Drawing C-02) in Appendix A.

1.2 Objectives

The purpose of this SWM report is to document the preliminary SWM strategy for the site, demonstrating the proposed development will not adversely affect local surface water conditions. The SWM report will evaluate the effect of the proposed development on local drainage conditions and where necessary, provide solutions to mitigate any adverse impacts.

1.3 Guidelines and Background Information

This report was prepared in accordance with the following municipal, provincial and agency guideline documents:

- The Ministry of Transportation Drainage Management Manual (1997)
- The Ministry of the Environment, Conservation and Parks (MECP, formerly known as the Ministry of Environment) SWM Practices Planning and Design Manual (2003);
- The CVC/TRCA Low Impact Development SWM Planning and Design Guide (2010); and
- Niagara Peninsula Conservation Authority Stormwater Management Guidelines (2010).

2 Pre-Development Conditions

Information regarding the existing topography, ground cover and drainage patterns was obtained through collection of detailed topographic survey data, record drawings / available plans and confirmed during site visits. Detailed topographic survey data was collected by The Larocque Group in July 2023.

Under pre-development conditions, the subject site consists of 0.73 ha of residential buildings and accessory structures, lawn cover and vegetation. The subject site slopes gently southwest at approximately 2% toward the west and south property lines (Outlet #1).

2.1 Pre-Development Conditions Hydrology

The Rational Method has been used to generate pre-development peak flow rates for the subject site based on the City of Niagara Falls IDF parameters. Online mapping and aerial photography were used to determine pre-development catchment parameters. The site has been modelled as one catchment (Catchment 1) totalling to 0.73 ha in area, with 9% imperviousness sloping at approximately 2% to Outlet #1, as shown on Pre-Development Drainage Plan attached.

For the purpose of determining peak flow rates, a runoff coefficient of 0.27 was assigned to Catchment 1 based on runoff coefficient values for corresponding land uses provided in the Niagara Peninsula Conservation Authority Stormwater Management and Policies and Guidelines. Peak flow rates have been assessed at Outlet #1.

Peak flow rates for the 2-year through 100-year storm events have been calculated and summarized in Table 1 below, while detailed calculations are provided in Appendix B.

Table 1: Pre-Development Peak Flow Rate Summary

Design Storm Event	Peak Flow Rate (m^3/s)
2-year	0.025
5-year	0.032
10-year	0.040
25-year	0.048
100-year	0.066

3 Proposed Stormwater Management Plan

The proposed SWM Plan has been developed to address any potential adverse impacts from the proposed development to local surface water features and surface water quality.

The majority of the subject site (0.61 ha) will be graded to drain to a combination of underground storm sewer, storm structures, and an underground StormTank module system to provide water quantity controls before discharging to the Dunn Street right of way. The 2-year through 100-year storm runoff will be collected, controlled and conveyed to the Royal Manor Drive storm sewer. An oil and grit separator unit will be implemented to provide quality controls.

The remaining 0.13 ha of the site is proposed to be released uncontrolled to the Dunn Street right of way and existing outlet.

While there is no information readily available with respect to the subject site's soil characteristics, it is understood that the City of Niagara Falls encourages the use of Low Impact Development (LID) practices where feasible to manage storm water and minimize the impact of development. The proposed SWM plan will incorporate LID practices to promote infiltration where feasible.

3.1 Design Criteria

This SWM report is subject to the review and approval of the City of Niagara Falls. Applicable SWM design criteria for the proposed development are presented below:

- Water Quantity Control – post-development peak flow rates must be controlled to pre-development rates for rainfall events to ensure no adverse impacts for downstream landowners;
- Water Quality Control – controls must be provided to satisfy the MECP SWM Practices Planning and Design Manual. Enhanced water quality control corresponding to 80% total suspended solids (TSS) removal is required; and
- Siltation and Erosion Control – recommendations for a siltation and erosion control strategy during construction are required.

3.2 Proposed Conditions Hydrology

Details of the proposed site grading and overall SWM plan are provided on the Grading Plan (Drawing C-01) and Servicing Plan (Drawing C-02) included in Appendix A. A Post-Development Drainage Plan is also enclosed for reference.

The Rational Method has been used to generate anticipated post-development peak flow rates for the subject site based on the City of Niagara Falls IDF parameters. The site has been modelled as three catchments (Catchment 201, Catchment 202 and Catchment 99) for the purpose of determining post-development peak flows as discussed below:

- Catchment 201 consists of the storm Catchments 2 through 10 shown on the Post-Development Drainage Plan, totalling to 0.61 ha in area with proposed imperviousness of

84%, and assigned a runoff coefficient of 0.83. Drainage from Catchment 201 will be collected in the site's internal storm sewer and controlled through on-site underground storage prior to discharging to the Dunn Street storm sewer;

- Catchment 202 consists of Catchments 98 and 99 shown on the Post-Development Drainage Plan, totalling to 0.03 ha in area, with proposed imperviousness of 25%, and assigned a runoff coefficient of 0.39. Drainage from Catchment 202 will be released overland and uncontrolled to the Dunn Street right of way.
- Catchment 99 is shown on the Post-Development Drainage plan, totalling to 0.10 ha in area with proposed imperviousness of 26% and an assigned runoff coefficient of 0.40. Drainage from Catchment 99 will be released overland to the existing site outlet at the south and west property site property lines.

All three post-development Catchments have been assessed using the same outlet (considered the property line), to be conservative.

3.3 Water Quantity Control

Water quantity controls for Catchment 201 will be provided via a combination of underground storm sewer, storm structures, and an underground StormTank module system. The total active storage volume provided is 249 m^3 through the stacked ST-2536 and ST-2524 StormTank modules, two 600 mm dia. storm sewers and maintenance hole structures ST-2 and ST-4. The combined underground storage will be controlled by a 100 mm dia. orifice plate at the elevation of 188.64 m in maintenance hole structure ST-2.

The Modified Rational Method was used to determine the required storage volumes in order to maintain post-development peak flow rates to pre-development rates. Operating characteristics of the proposed underground storage system including discharge rates, storage volumes and equivalent water surface elevations for the 2-year through 100-year design storm events are summarized in Table 2. Detailed supporting calculations and stage-storage-discharge tables are provided in Appendix B for reference.

Table 2: Underground Storage System Operating Characteristics

Design Storm Event	Peak Flow Rate (m^3/s)	Storage Volume Provided (m^3/s)	Water Elevation (m)
2-year	0.016	77.8	189.23
5-year	0.019	108.0	189.40
10-year	0.022	150.5	189.67
25-year	0.023	172.2	189.80
100-year	0.027	241.8	190.23

As shown, the maximum water surface elevation in the underground storage system is 190.23 m under the 100-year design storm condition, which corresponds to a depth of 0.65 m below the lower patio elevation of proposed Buildings 'A', 'B' and 'C'. Therefore, the lower patios of Buildings 'A', 'B' and 'C' will not experience ponding as a result of backwater conditions from the underground storage system.

The Rational Method calculations do not account for the anticipated infiltration from the StormTank module system, and therefore the peak flow rates summarized in Table 2 are expected to be conservative.

Post-Development peak flow rates incorporating the proposed SWM controls are summarized in Table 3. Detailed supporting calculations are provided in Appendix B.

Table 3: Post-Development Peak Flow Rate Summary (With Controls)

Design Storm Event	Pre-Development Peak Flow Rate (m^3/s)	Post-Development Peak Flow Rate (m^3/s)
2-year	0.025	0.025
5-year	0.032	0.030
10-year	0.040	0.036
25-year	0.048	0.040
100-year	0.066	0.050

As shown, post-development peak flows discharging from the property are anticipated to be controlled to the pre-development peak flow rates.

3.4 Major and Minor Flow Conveyance

Part of the internal storm sewer network has been sized to function as storage in combination with StormTank modules to provide water quantity controls for the proposed development. The system has been designed to collect and control the 100-year design storm event runoff from the proposed development under typical operating conditions.

Under emergency conditions, where catch basin grates or maintenance hole grates are blocked, or the Regional storm event occurs, rooftop and parking lot runoff will be safely conveyed to the municipal ROW via the Dunn Street driveway entrance. The overland flow route capacity was checked at this location, which represents the cross section where the greatest overland peak flow rate is expected to occur. This cross section conveys the 100-year uncontrolled peak flow of 0.23 m^3/s from the upstream area at the depth of 0.03 m, resulting in a maximum ponding depth of 0.28 m at upstream maintenance hole structure ST2. Therefore, safe access and egress is provided into the parking lot, as the maximum allowable depth for safe vehicle passage is 0.30 m.

Detailed storm sewer design sheet and overland flow route calculations are provided in Appendix B.

3.5 Water Quality Control

Enhanced Level water quality control corresponding to 80% TSS removal is required for the proposed development.

Water quality controls will be provided for the 0.61 ha drainage area contributing to the

underground SWM controls via a Canadian Environmental Verified Technology (CA ETV) certified oil and grit separator unit (Stormceptor EFO6 or approved equivalent), which has a corresponding TSS removal rate of up to 62% under the CA ETV particle distribution, and 92% under the fine particle distribution. Water quality controls will be provided for the remaining 0.13 ha area consisting of Catchment 203 and Catchment 99 in the form of grass filter strips, which have a corresponding TSS removal of 40% per the CVC/TRCA Low Impact Development SWM Planning and Design Guide (2010).

A weighted average of the removal rates has been calculated to ensure that 80% TSS removal is provided for the overall development, per the calculation below:

$$\frac{0.92 \times Controlled\ Area + \ 0.40 \times Uncontrolled\ Area}{Total\ Area} = \frac{0.92 \times 0.61 + \ 0.40 \times 0.13}{0.73}$$

$$= 84\%\ Overall\ TSS\ Removal$$

As shown, the overall TSS removal for the development area is 84%, and therefore, water quality requirements for the site are satisfied.

3.6 Siltation and Erosion Control

A construction erosion and sediment control plan shall be implemented on this site for all construction activities, including earthworks, material stockpiling, pavement construction and grading operations to ensure no impact on the adjacent lands and or municipal storm sewer. The erosion control measures proposed include:

- Heavy duty siltation control fences to prevent transport of sediment to adjacent properties;
- Stone mud mat at the construction entrance from Dunn Street; and
- Silt sacks installed in catch basin and maintenance hole structures to prevent sediment from entering the municipal storm sewer.

Regular inspection of control measures will be completed during construction and repairs made as necessary. Following the completion of construction, erosion control measures shall remain in place and maintained by the Contractor until vegetation cover is established.

Details of the siltation and erosion control plan are shown on the Siltation and Erosion Control Plan (Drawing C-05).

4 Summary

This SWM report demonstrates that the proposed development at 5858 Dunn Street, Niagara Falls will not adversely affect local surface water conditions.

Water quantity controls will be provided via a combination of underground storm sewer, storm structures, and a StormTank module system to provide water quantity controls before discharging to the Dunn Street right of way. The 2-year through 100-year storm runoff from the site will be controlled to pre-development peak flow rates. An oil and grit separator unit will be implemented to provide quality controls.

The proposed SWM plan demonstrates that the proposed development will not negatively impact landowners adjacent to or downstream of the subject site. Siltation and erosion controls will be provided to mitigate erosion and sedimentation impacts during construction.

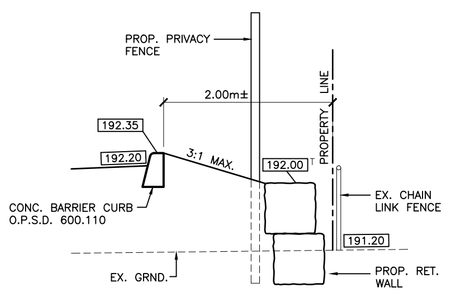
We trust this SWM report is sufficient to satisfy the requirements of the City of Niagara Falls.

Report prepared by:

J.H. COHOON ENGINEERING LIMITED

R.W. Phillips, P.Eng.

APPENDIX A: DRAWINGS



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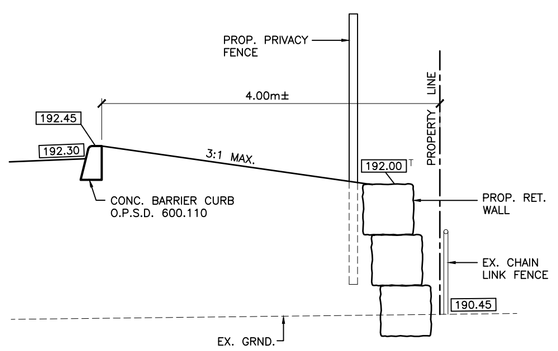

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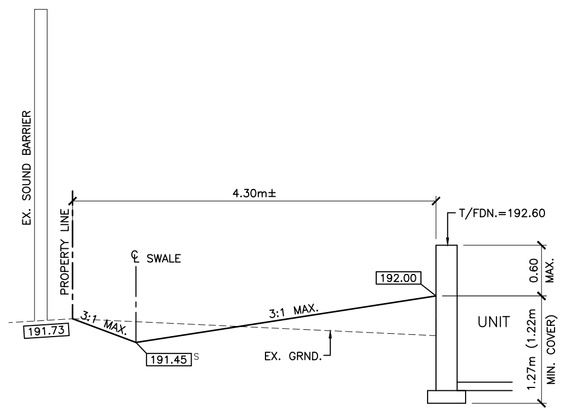

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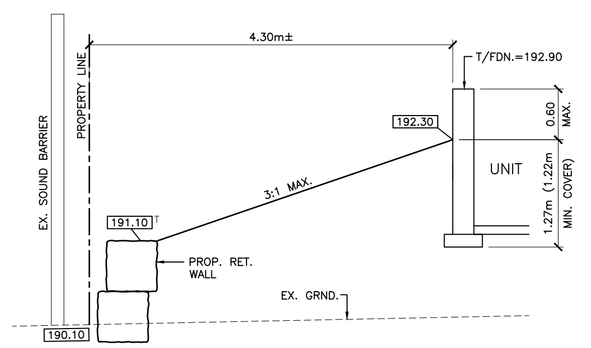

SECTION 4
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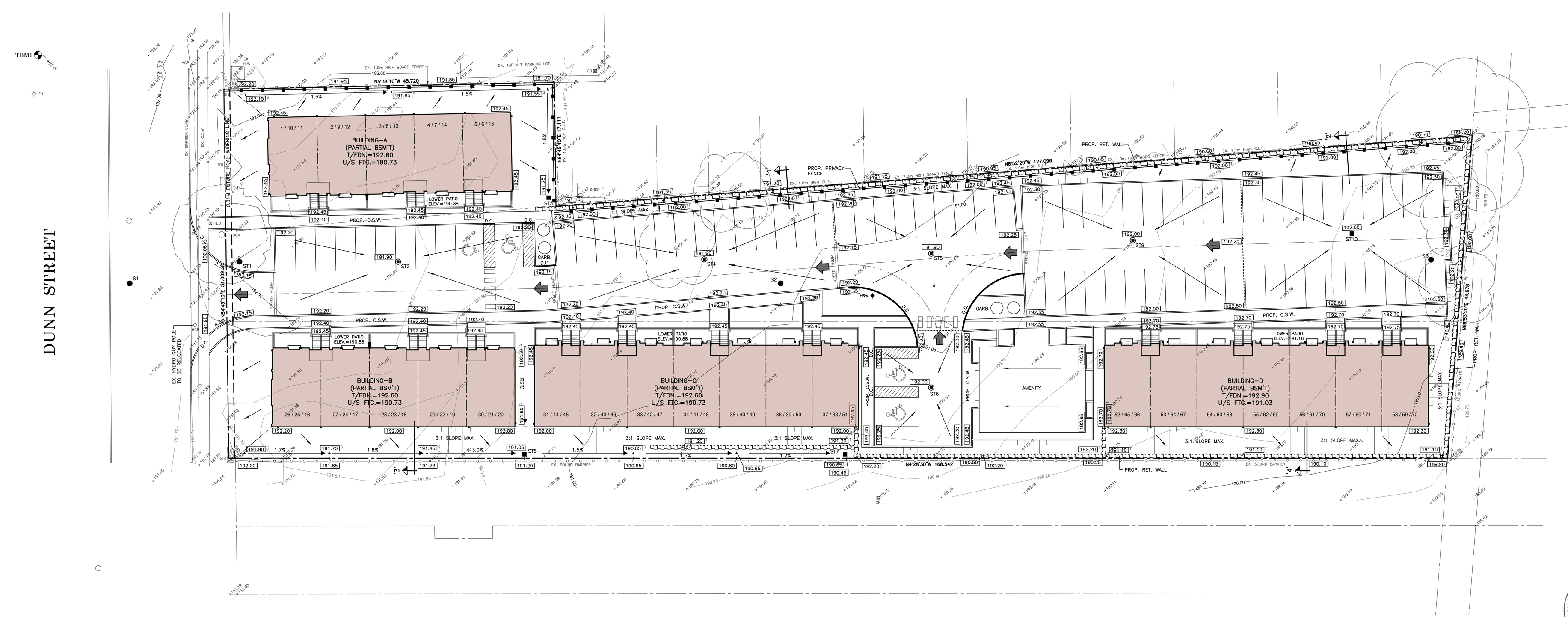
NOTES:

1. ALL ELEVATIONS SHOWN ARE METRIC.
2. BUILDER/OWNER TO VERIFY COMPLIANCE WITH ZONING BYLAWS (ie. SIDEYARDS, SETBACKS, REARYARDS ETC.)
3. BUILDER TO VERIFY LOCATION OF ABOVE GROUND STRUCTURES (i.e. TRANSFORMERS, STREET LIGHTS, HYDRANTS, PEDESTALS ETC.) DOES NOT CONFLICT WITH DRIVEWAY ENTRANCE LOCATION.
4. WEEPING TILE DRAINAGE AROUND BUILDING FOOTING TO BE DISCHARGED TO GRADE VIA A SUMP PUMP C/W A "GOOSE-NECK" STYLE DRAIN. ALL STORM OUTLETS TO BE DIRECTED TOWARDS LANEWAYS IN FRONT OF UNIT.
5. CONTRACTOR TO VERIFY LOCATION/ELEVATION OF EXISTING SEWERS PRIOR TO CONSTRUCTION.
6. THE BUILDER/CONTRACTOR IS TO ENSURE FOOTINGS ARE FOUNDED ON SOIL CAPABLE OF SUPPORTING THE ANTICIPATED LOADS.
7. BOUNDARY AND TOPO GRAPHIC SURVEY PROVIDED BY THE LAROCQUE GROUP (DWG FILE NS2022-065-02 DATED JULY 11, 2023)

T.B.M. No. 1 ELEV. = 193.10m (GEO)
TOP NUT OF FIRE HYDRANT ON THE NORTH SIDE OF DUNN STREET AS SHOWN (EASTERLY OF 2 HYDRANT CLOSE TOGETHER).

LEGEND:

- 200.00 — EXISTING ELEVATIONS
- 200.00 — PROPOSED ELEVATIONS
- 200.00S — PROPOSED SWALE ELEVATIONS
- 200.00T — PROPOSED TOP OF RET. WALL ELEVATIONS
- PROPOSED SWALE
- GENERAL DRAINAGE
- PROPOSED RAINWATER LEADER
- DC — PROPOSED DEPRESSED CURB
- PROPOSED HYDRO TRANSFORMER
- PROPOSED LIGHT STANDARD
- PROPOSED OVERLAND FLOW ROUTE



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No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT

5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

GRADING PLAN

DRAWN BY: K.P.B. DATE: OCT. 10/23
CHECKED BY: R.W.P. SCALE: 1:250

PROJECT NO.: 16363
DRAWING NO.: C-01

LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PHILLIPS
PROVINCE OF ONTARIO

T.B.M. No. 1 ELEV. = 193.10m (GEO)
TOP NUT OF FIRE HYDRANT ON THE NORTH SIDE OF DUNN STREET AS SHOWN (EASTERLY OF 2 HYDRANT CLOSE TOGETHER).

WATERMAIN CROSSINGS

LOCATION	STM. INV.	STM. OBV.	SAN. INV.	SAN. OBV.	W/M INV. AT CROSSING ONLY	W/M OBV. AT CROSSING ONLY
1	189.05	189.25			190.30	190.45
2	189.14	189.34			190.30	190.45
3	188.90	189.10			190.30	190.45
4	189.35	189.55			190.55	190.70

* DENOTES LOCATION WHERE WATERMAIN IS TO BE LOWERED BELOW STORM SEWER (ONLY) OR SANITARY SEWER (ONLY) USING 45° VERT. BENDS (PROVIDE 0.50m MIN. CLEARANCE – WATERMAIN ELEVATIONS SHOWN ARE THE LOWERED ELEVATIONS AT INDICATED CROSSING LOCATIONS)

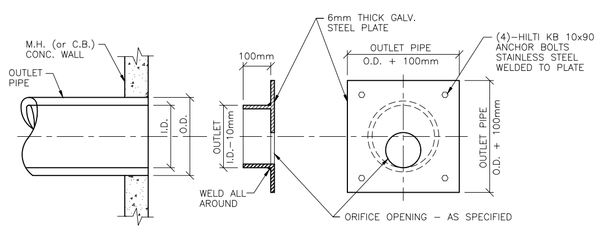
STORM SYSTEM

MH No.	DESCRIPTION	T/G	INVERTS
ST1	STORMCEPTOR MODEL EFO6	192.30	N 188.51 S 188.57
ST2	1.5mø P/C CB/MH	191.90	N 188.64 S 188.66 SE 189.00 W 188.80 E 188.80
ST3	0.6x0.6x1.98m P/C CB	191.25	NW 189.42
ST4	1.5mø P/C CB/MH	191.90	N 188.79 S 188.81 W 189.00
ST5	1.2mø P/C CB/MH	191.90	N 188.86 S 188.88 W 188.88
ST6	1.2mø P/C CB/MH	192.00	E 188.94 NW 188.96
ST7	0.6x0.6x1.67m P/C CB	190.45	SE 189.01 N 189.03
ST8	0.6x0.6x1.67m P/C CB	191.05	S 189.54
ST9	1.2mø P/C CB/MH	192.00	N 188.96 S 189.50 W 189.28
ST10	0.6x0.6x1.67m P/C CB	192.00	N 190.50

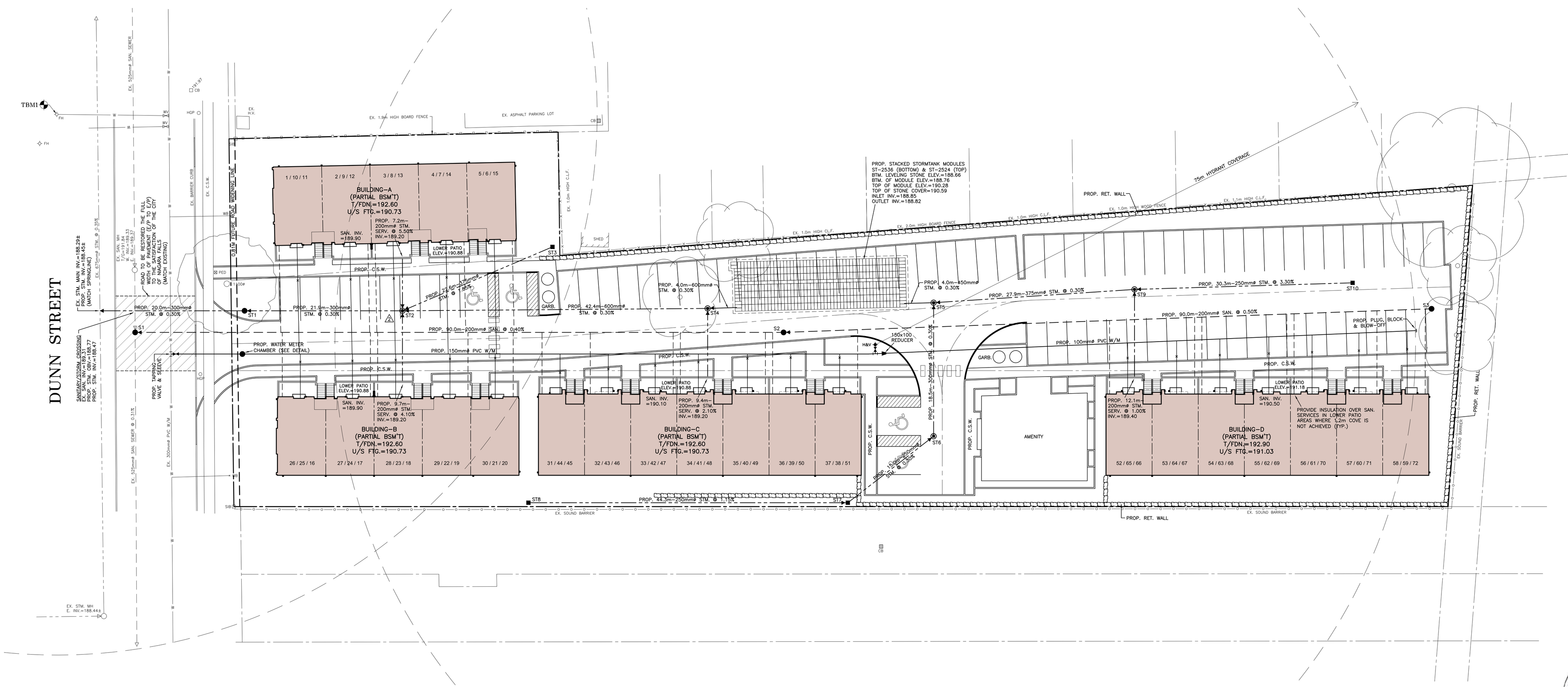
SANITARY SYSTEM

MH No.	DESCRIPTION	T/G	INVERTS
S1	1.2mø P/C MH	191.80	EX. 189.30 S 189.35
S2	1.2mø P/C MH	192.15	N 189.71 S 189.73
S3	1.2mø P/C MH	192.30	N 190.18

C.B. ORIFICE PLATE SIZING	
ORIFICE PLATE CONFIGURATION NUMBER	DIAMETER OF ORIFICE PLATE OPENING
1	100mm



FLOW CONTROL DEVICE
ORIFICE PLATE
N.T.S.



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No.	Date	Version	Dwn.

PROJECT:
TOWNHOMES DEVELOPMENT
5858 Dunn Street
City Of Niagara Falls
Canada

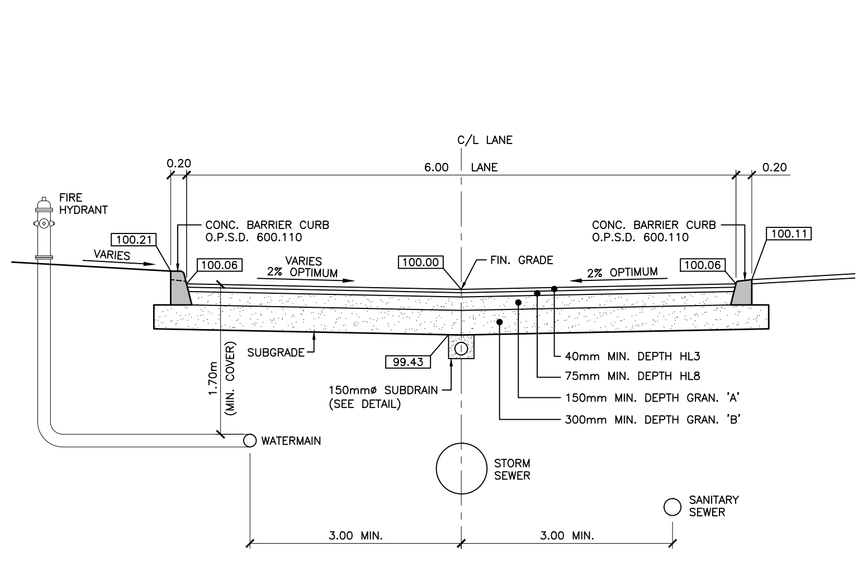
DRAWING TITLE:
SERVICING PLAN

DRAWN BY: K.P.B. DATE: OCT. 10/23
CHECKED BY: R.W.P. SCALE: 1:250

PROJECT NO.: 16363

DRAWING NO.: C-02

LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PHILLIPS
PROVINCE OF ONTARIO



TYPICAL LANE X-SECTION

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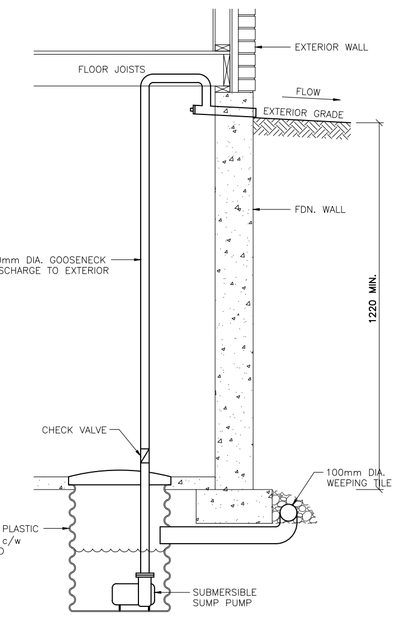
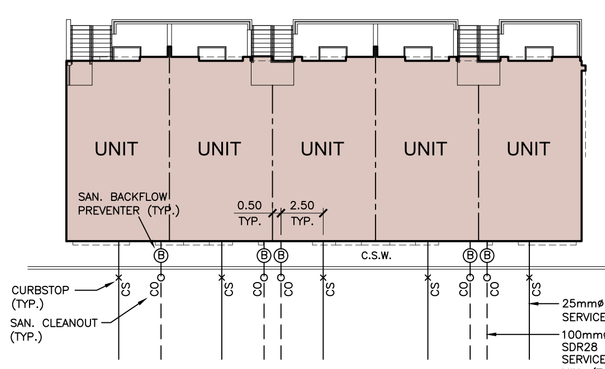


SUMP PUMP WITH GOOSE NECK DETAIL

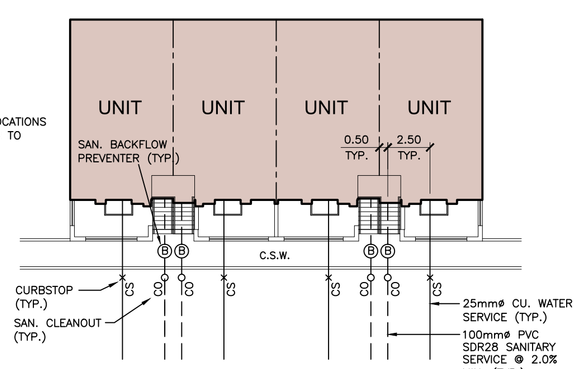
N.T.S.



NOTE: SOME SERVICE LOCATIONS MAY VARY (REFER TO SERVICING PLAN)

UNITS SERVICING (REAR OF BLDG.)

SCALE: 1:250



UNITS SERVICING (FRONT OF BLDG.)

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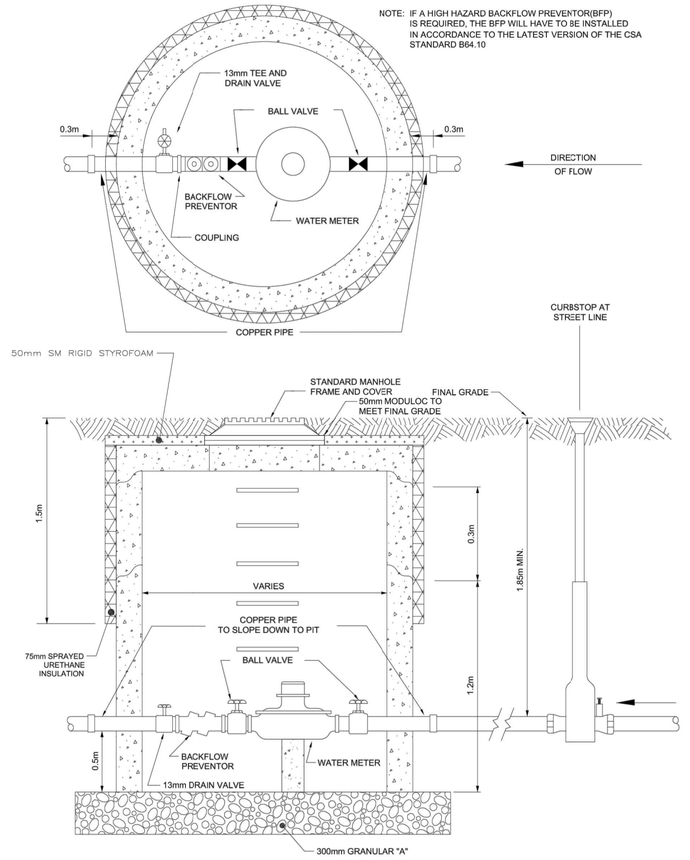


WATER METER CHAMBER DETAIL

(N.T.S.)

WATER METER CHAMBER NOTES:

1. NO BYPASS VALUE IS TO BE INCLUDED IN THE WATER METER CHAMBER.
2. THE WATER METER IS TO BE A NEPTUNE PRODUCT PURCHASED DIRECTLY FROM THE CITY OF WELLAND PUBLIC WORKS.
3. THE RADIO TRANSMITTER FOR THE WATER METER IS TO BE INSTALLED EXTERNAL TO THE CHAMBER, WITH THE WIRE PASSED THROUGH A 50mm GALVANIZED STEEL CONDUIT, CORED THROUGH THE CHAMBER WALL. THE CONDUIT SHOULD TERMINATE IN THE BOULEVARD DIRECTLY WEST AND AS CLOSE TO THE CHAMBER AS POSSIBLE, MOUNTED TO A 4x4 POST.

GENERAL LEGEND:

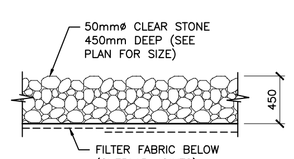
100.00	EXISTING ELEVATIONS
S1	EXISTING SANITARY MANHOLE
ST1	EXISTING STORM MANHOLE
CB	EXISTING CATCHBASIN
HGP	EXISTING HYDRO GUY POLE
LS	EXISTING LIGHT STANDARD
PED	EXISTING BELL PEDESTAL
FH	EXISTING FIRE HYDRANT
V&B	EXISTING VALVE & BOX
SIB	EXISTING STANDARD IRON BAR
MON	EXISTING MONUMENT
	EXISTING DITCH
x x	EXISTING CHAIN LINK FENCE
S1	PROPOSED SANITARY MANHOLE
ST1	PROPOSED STORM MANHOLE
ST1	PROPOSED CATCHBASIN MANHOLE
CB	PROPOSED CATCHBASIN
	PROPOSED RAIN WATER LEADER (CONNECT TO U/G BUILDING STORM SERVICE)
H&V	PROPOSED FIRE HYDRANT & VALVE
V&B	PROPOSED VALVE & BOX
	75m FIRE HYDRANT COVERAGE
	PROPOSED HYDRO TRANSFORMER
	PROPOSED LIGHT STANDARD

GENERAL NOTES:

1. CONSTRUCTION OF SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARDS OF THE CITY O NIAGARA FALLS, AND THE ONTARIO PROVINCIAL STANDARDS DRAWINGS (OPSD). THE CITY OF NIAGARA FALLS STANDARDS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS IS FURNISHED AS THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS THEY SEE FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR ITS ACCURACY AND/OR SUFFICIENCY.
3. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION AND HE SHALL REPORT ANY DISCREPANCIES IMMEDIATELY TO THE ENGINEER.
4. RELOCATION OF EXISTING SERVICES AND/OR UTILITIES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
5. THE CONTRACTOR SHALL OBTAIN ALL PERMITS FOR CONSTRUCTION.
6. FOR ALL SEWERS AND WATERMAIN IN FILL SECTIONS, THE COMPACTION SHALL BE VERIFIED PRIOR TO LAYING OF PIPE.
7. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE CITY OF NIAGARA FALLS OR THE ENGINEER.
8. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% S.P.D.
9. THE DEVELOPER AND/OR CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING (UNTIL ROAD CONSTRUCTION IS FINISHED) SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BY THE ENGINEER.
10. ALL WORKS SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE CITY OF NIAGARA FALLS STANDARDS AND IN AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS AND STANDARDS PRESCRIBED BY THE CITY OF NIAGARA FALLS.
11. ALL BOULEVARD AREAS TO BE RESTORED WITH #1 NURSERY SOD ON A MINIMUM 150mm OF TOPSOIL.
12. ALL TRENCH BACKFILL UNDER EXISTING ROADWAYS SHALL BE COMPACTED IN MINIMUM 230mm LIFTS TO 98% STANDARD PROCTOR DENSITY. A GEOTECHNICAL ENGINEER'S REPRESENTATIVE SHALL BE ON SITE DURING THE WORK TO VERIFY THE COMPACTION OF EACH LIFT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS OF RE-TESTING.

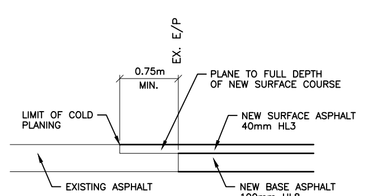
ROADWORKS:

1. ROADWAYS & RELATED WORKS SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE CITY OF NIAGARA FALLS STANDARDS AND IN ACCORDANCE WITH THE CURRENT GUIDELINES CODES, REGULATIONS AND STANDARDS PRESCRIBED BY THE CITY OF NIAGARA FALLS.
2. CATCH BASIN CONNECTIONS TO BE PVC SDR35 PIPE CSA B182.4
   SINGLE CATCH BASIN LEADS TO BE MIN. 250mm DIA.
   DOUBLE CATCH BASIN LEADS TO BE MIN. 300mm DIA.
   REAR LOT CATCHBASIN LEADS AND DITCH INLET LEADS TO BE CSA A257.1 EXTRA STRENGTH CL3 CONC. MIN 250mm DIA.
3. SINGLE CATCH BASINS AS PER OPSD 705.010
   FRAME AND COVER AS PER OPSD 400.010.
4. DOUBLE CATCH BASINS AS PER OPSD 705.020.
   FRAME AND COVER AS PER OPSD 400.010.
5. FINAL ROADWAY CROSSFALL TO BE 2.0%
6. VALVES, MANHOLES AND CATCH BASINS SHALL BE PLACED AT ASPHALT BINDER COURSE (HL4) ELEVATION AS DIRECTED BY THE ENGINEER.
7. AT SAG POINTS, CATCH BASIN ADJUSTMENT AND PAVING TO BE PLACED IN SUCH MANNER THAT WILL NOT OBSTRUCT DRAINAGE.
8. FINAL ASPHALT COURSE (HL3) SHALL BE PLACED IN ACCORDANCE WITH APPROVED CITY OF NIAGARA FALLS STANDARDS FOR TIMING, AS DIRECTED BY THE ENGINEER AND AS PER THE REQUIREMENTS STIPULATED BY THE CITY OF NIAGARA FALLS.
9. FOR MANHOLE AND CATCH BASIN TOP ADJUSTMENTS, ALL PERMANENT ADJUSTMENTS ARE TO BE POURED IN PLACE OR APPROVED EQUIVALENT (e.g. MODULOC).
10. ALL BEDDING AND BACKFILL MATERIAL, ROAD SUB-GRADES AND GRANULAR ROAD BASES SHALL BE COMPACTED TO MIN 100% SPD UNLESS OTHERWISE SPECIFIED.
11. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED ON THE SILTATION AND EROSION CONTROL PLAN.
12. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE CITY OF NIAGARA FALLS AND/OR THE ENGINEER.
13. ALL CATCHBASINS AND DOUBLE CATCHBASINS IN DEPRESSIONS TO BE INSTALLED WITH 150mm# PERFORATED PVC SUBDRAINS 6.0m LONG EACH WAY (MIN). ALL REMAINING CATCHBASINS WILL BE INSTALLED WITH 150mm# PERFORATED PVC SUBDRAINS 6.0m LONG UP GRADIENT (MIN.) OR AS DIRECTED BY ENGINEER.
14. SAWCUT, REMOVE AND REPLACE ANY EXISTING CURB FOR ANY NEW DRIVEWAYS OR ANY EXISTING DRIVEWAYS THAT ARE TO BE ABANDONED.
15. SITE SERVICING WITHIN THE ROAD ALLOWANCE MUST BE PERFORMED BY THE DEVELOPERS CONTRACTOR UNDER A ROAD OCCUPANCY PERMIT ISSUED BY THE ENGINEERING.
16. SITE SERVICING WITHIN THE ROAD ALLOWANCE MUST BE APPROVED BY THE CITY WITH THE ISSUANCE OF A ROAD OCCUPANCY PERMIT.



MUD MAT DETAIL

N.T.S.



ASPHALT MILLING DETAIL

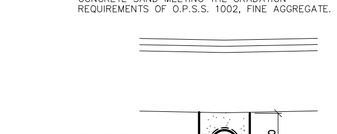
(N.T.S.)

WATERMAINS:

1. WATERMAINS AND RELATED APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH THE CITY OF NIAGARA FALLS STANDARD PRACTICES.
2. WATERMAINS TO BE INSTALLED WITH A MINIMUM DEPTH OF COVER OF 1.70m BELOW FINISHED GRADE.
3. WATERMAINS TO BE INSTALLED IN ACCORDANCE WITH OPSD 802.010 TYPE 2. TRENCH BEDDING TO BE BEDDING GRANULAR 'A' MATERIAL UNLESS OTHERWISE NOTED.
4. WATERMAINS TO BE PVC DR=18 IN ACCORDANCE WITH AWWA C900 CLASS 150. THE PIPE SHALL BE SHIPPED TO THE SITE WITH THE ENDS FACTORY CAPPED.
5. FOR PVC WATERMAIN DEFLECTION:
   - MAXIMUM ALLOWABLE DEFLECTION OF 1 DEGREE PER JOINT SHALL NOT BE EXCEEDED.
   - EACH JOINT SHALL BE DEFLECTED AN EQUAL AMOUNT.
6. ALL WATER MAINS TO BE SWABBED, TESTED, DISINFECTED AND FLUSHED UNDER THE SUPERVISION OF THE ENGINEER TO THE SATISFACTION OF THE CITY OF NIAGARA FALLS PRIOR TO CONNECTION TO THE EXISTING MUNICIPAL SYSTEM. REFER TO OPSS 701.07.25, AWWA C651 & CITY OF NIAGARA FALLS GENERAL WATERMAIN DISINFECTION PROCEDURES.
7. A REDUCED PRESSURE DOUBLE BACKFLOW PREVENTER AND WATER METER ARE REQUIRED ON THE TEMPORARY SUPPLY LINES USED FOR FILLING AND FLUSHING/SWABBING OF WATERMAINS.
8. UPON COMPLETION OF INSTALLATION, THE CONTRACTOR SHALL PERFORM A PRESSURE TEST ON THE WATERMAINS AS PER OPSS 701.07.24 AND CITY OF NIAGARA FALLS SPECIFICATIONS. WATERMAIN IS TO BE TESTED UNDER THE SUPERVISION OF THE ENGINEER PRIOR TO CONNECTION TO EXISTING WATERMAINS USING TEMPORARY CAPS OR PLUGS.
9. PIPE CLOSURES WHERE REQUIRED, ARE TO BE SUPPLIED BY THE CONTRACTOR. THE CONTRACTOR SHALL ALSO SUPPLY AND INSTALL ALL ADAPTOR PIECES IN ORDER TO CONNECT EXISTING WATERMAINS.
10. ALL WATER SERVICE CONNECTIONS 25mm DIA. ASTM B88 TYPE 'K' SOFT COPPER WITH SAND BEDDING.
11. WATER SERVICES TO BE LOCATED AS PER TYPICAL SERVICING DETAIL ON THIS SHEET WITH A "BALL TYPE" CURB STOP AS PER TYPICAL DETAIL CURB STOPS TO BE SUPPLIED WITH STAINLESS STEEL RODS AND COTTER PINS AND AN ELECTRICAL GROUNDING CLAMP.
12. ALL VALVE BOXES TO BE SET TO PROPOSED ASPHALT BINDER COURSE (HL4) ELEVATION. VALVE BOXES ARE TO BE ADJUSTED TO FINAL SURFACE ASPHALT ELEVATION WHEN FINAL ASPHALT COURSE IS PLACED.
13. ALL WATER VALVES TO BE CITY OF NIAGARA FALLS APPROVED.
14. ALL FIRE HYDRANTS TO BE CITY OF NIAGARA FALLS APPROVED. FIRE HYDRANTS TO BE INSTALLED AS PER CITY OF NIAGARA FALLS SPECIFICATIONS.
15. ANCHOR BLOCKS FOR WATERMAINS AS PER OPSD 1103.01 AND OPSD 1103.02. JOINT RESTRAINERS WITH A MINIMUM LENGTH OF 1.2m ON EACH SIDE OF 45° BENDS PERMITTED. JOINT RESTRAINERS TO BE MEGA-LUG FOR PVC SERIES 2000PV OR APPROVED EQUAL.
16. ALL FIRE HYDRANTS SHALL CONFORM TO THE AREA MUNICIPALITY FIRE DEPARTMENT'S REQUIREMENTS. ALL HYDRANTS WITHIN DEVELOPMENT SHALL BE OF LIKE MANUFACTURE.
17. TRACING WIRES TW#28 GAUGE TO BE TERMINATED 1' ACCESSIBLE AT A TEST BOX AT ALL HYDRANTS AND PLACED ALONG TOP OF WATERMAIN AND FASTENED WITH STRAPS AT 6.0m CENTRES. TRACING WIRE SHALL NOT BE LOOPED TO THE SURFACE AT MAINLINE VALVE BOXES.
18. CATHODIC PROTECTION TO BE PROVIDED AT ALL VALVES, BENDS AND FITTINGS WITH 11.0 KG ZINC ANODES ON AND ON ALL WATER SERVICE CONNECTIONS WITH 5.5 KG ZINC ANODES.
19. WATERMAIN INSULATION TO BE PROVIDED AT ALL LOCATIONS WHERE THE WATERMAIN IS LOCATED CLOSE TO CATCH BASINS (LESS THAN 0.9m) AND AT CONNECTIONS TO EXISTING WATERMAINS WHERE DEPTH OF COVER IS INSUFFICIENT (LESS THAN 1.70m).
20. THE WATERMAIN AND HYDRANT LEADS AT THE HIGH POINTS SHOULD BE CONSTRUCTED SO THAT THE HYDRANT LEADS SLOPE SLIGHTLY UPWARD FROM THE WATERMAIN TO THE HYDRANT TO OPTIMIZE THE HYDRANTS AS AIR RELIEF POINTS.
21. EVERY NEW WATER SERVICE SHALL BE SERVICED WITH A WATER METER IN ACCORDANCE WITH CITY OF NIAGARA FALLS SPECIFICATIONS. THE WATER METER FEE SHALL BE PAID BY THE OWNER PRIOR TO ISSUANCE OF THE BUILDING PERMIT. THE ROUGHING AND INSTALLATION OF THE METER SHALL CONFORM TO THE REQUIREMENTS OF THE CITY WATER AND PUBLIC WORKS DEPARTMENTS.
22. WATER SERVICES TO BE INSTALLED TO MAIN UTILIZING MAINSTOPS WITH SERVICE SADDLES.

SUBDRAIN NOTES:

1. PERFORATED CORRUGATED POLYETHYLENE DRAINAGE PIPE SHALL MEET THE REQUIREMENTS OF O.P.S.S. 1840.
2. PIPE FILTER FABRIC CONFORMING TO O.P.S.S. 1860 FOR GEOTEXTILE CLASS 1 WITH A FILTRATION OPENING SIZE OF 150 to 450 MICRONS SHALL BE SUPPLIED ON ALL SECTIONS OF PERFORATED PIPE.
3. LAY PERFORATED PIPE WITH PERFORATIONS DOWNWARD.
4. CAP OPEN UPSTREAM ENDS OF PIPES.
5. SUBDRAIN PIPES TO BE SET ON AT LEAST 0.5% GRADE DRAINING TO A POSITIVE FROST-FREE OUTLET.
6. BEDDING AND BACKFILL MATERIAL SHALL BE CONCRETE SAND MEETING THE GRADATION REQUIREMENTS OF O.P.S.S. 1002, FINE AGGREGATE.



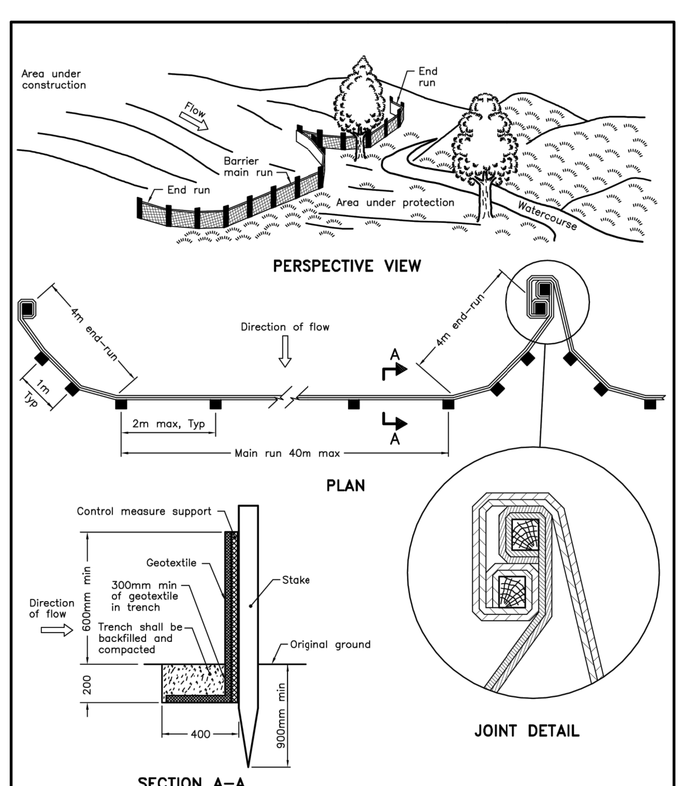
TYPICAL SUBDRAIN DETAIL

N.T.S.

SANITARY & STORM SEWERS:

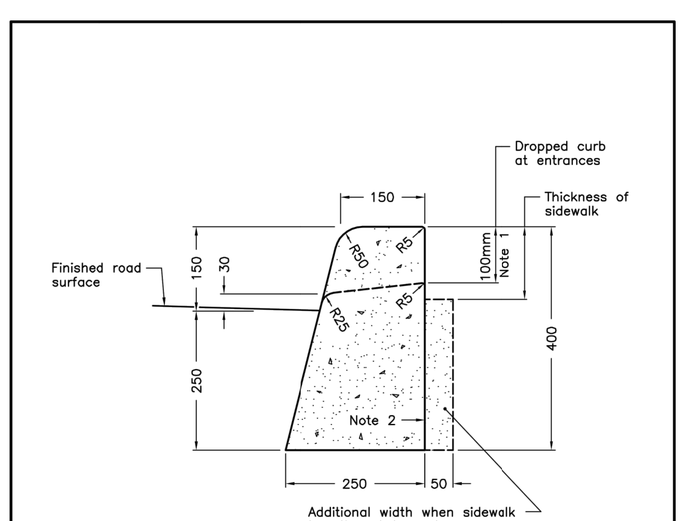
1. SANITARY & STORM SEWERS & RELATED APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO COMPLY WITH APPLICABLE LAW, TO BE CONSISTENT WITH THE CITY OF NIAGARA FALLS STANDARDS AND IN ACCORDANCE WITH CURRENT GUIDELINES, CODES, REGULATIONS, BEST PRACTICES AND STANDARDS PRESCRIBED BY THE CITY OF NIAGARA FALLS.
2. COVER AND BEDDING MATERIAL FOR CONCRETE PIPE AS PER OPSD 802.030 CLASS 'B' BEDDING TO BE BEDDING GRANULAR 'A' MATERIAL UNLESS OTHERWISE INDICATED.
3. COVER AND BEDDING MATERIAL FOR PVC PIPE AS PER OPSD 802.010 TYPE 2 TRENCH BEDDING SHALL BE GRANULAR 'A' MATERIAL UNLESS OTHERWISE INDICATED.
4. PVC PIPE WILL REQUIRE SPECIAL CONSTRUCTION PROCEDURES FOR LEAKAGE AND TESTING, PIPE DEFLECTION, ETC.
5. ALL SEWERS TO BE FLUSHED & VIDEOED PRIOR TO THE SUBMISSION OF THE FIRST INTERIM COMPLETION CERTIFICATE AND PRIOR TO THE FINAL COMPLETION CERTIFICATE.
6. ALTERNATE MATERIALS MAY BE ACCEPTABLE, PROVIDED APPROVAL HAS FIRST BEEN OBTAINED FROM THE CITY OF NIAGARA FALLS AND ENGINEER IN WRITING.
7. SAFETY PLATFORMS AS PER OPSD 404.020.
8. DROP STRUCTURES AS PER OPSD 1003.010.
9. ALL STORM MANHOLES AND CATCHBASINS TO BE PRECAST CONCRETE STRUCTURES MANUFACTURED IN PRE QUALIFIED PLANTS IN ACCORDANCE WITH THE LATEST APPLICABLE ONTARIO PROVINCIAL STANDARD (OPS) DRAWINGS AND SPECIFICATIONS.
10. ALL SEWER AND CULVERT INSTALLATIONS TO CONFORM WITH OPSD 802.031 TYPE 3 SOIL.
11. ALL STORM MANHOLE FRAMES AND COVERS TO CONFORM WITH OPSD 401.010 TYPE 'B' OPEN COVER.
12. ALL SANITARY MANHOLE FRAMES AND COVERS TO CONFORM WITH OPSD 401.010 TYPE 'A' CLOSED COVER.
13. MANHOLES SHALL BE SUPPLIED TO THE SITE PRE-BENCHED UNLESS OTHERWISE NOTED.
14. PRIVATE SANITARY DRAINS TO BE 100mm# DR28 PVC PIPE, CSA B182.1 M-1983, RUBBER GASKET JOINT.
15. BEDDING FOR PRIVATE SANITARY & STORM DRAINS AS PER OPSD 1006.02 TYPE 2 TRENCH WITH GRANULAR 'A' BEDDING AND COVER MATERIAL.
16. MINIMUM FALL FOR PRIVATE SANITARY & STORM DRAINS TO BE 2.0%
17. EXFILTRATION (INFILTRATION) TESTING AND AIR TESTING OF THE SANITARY SEWER IS TO BE PERFORMED BY THE CONTRACTOR.
18. SANITARY SEWERS:
    - MAINLINE SANITARY SEWERS TO BE CSA B182.2 DR35 P.V.C. PIPE

    STORM SEWERS:
    - MAINLINE STORM SEWERS UP TO AND INCLUDING 450mm# TO BE CSA B182.2 DR35 P.V.C. PIPE, OR CSA A257.2 65-D CONCRETE PIPE
    - 525mm# AND LARGER MAINLINE STORM SEWERS TO BE CSA A257.2 65-D CONCRETE PIPE
19. ALL RESIDENCES WILL REQUIRE SUMP PUMPS c/w "GOOSNECK" CONNECTIONS.
20. CONNECTION TO THE SANITARY OR STORM SEWER MAIN MUST BE WITH AN APPROVED PRE-FABRICATED TEE AND SLEEVES CUT IN TO THE MAIN.
21. CONNECTION TO THE SANITARY OR STORM SEWER MAIN MUST BE WITH AN APPROVED CORE AND INSERT TEE OR PRE-FABRICATED SADDLE ON THE MAIN.



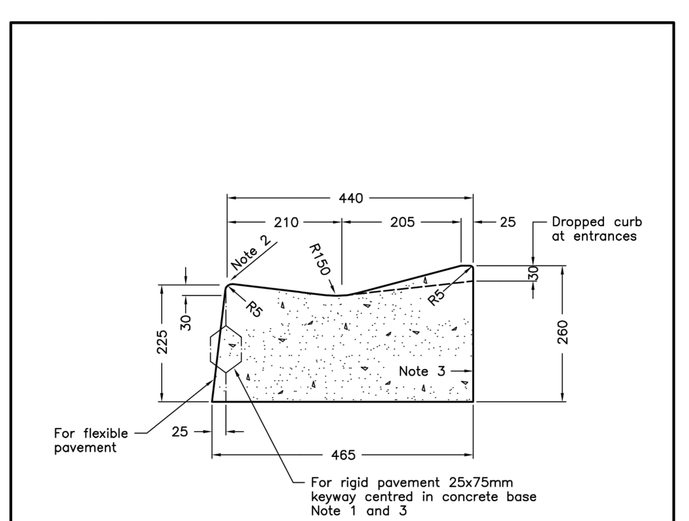
NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 2
HEAVY-DUTY SILT FENCE BARRIER		OPSD 219.130



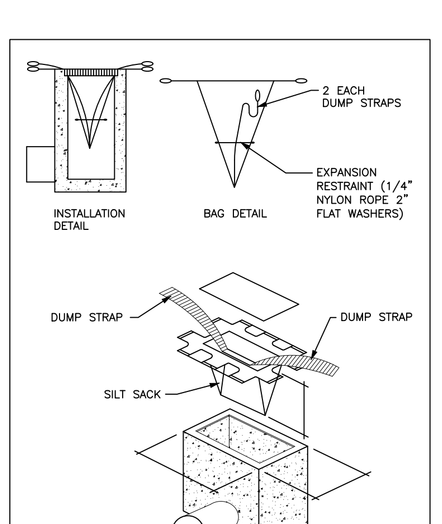
NOTES:
1 When sidewalk is continuously adjacent, the dropped curb at entrances shall be reduced to 75mm.
2 For slipforming procedure a 5% batter is acceptable.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE BARRIER CURB		OPSD 600.110



NOTES:
1 When curb and gutter is adjacent to concrete pavement or base, this drawing shall be used in conjunction with OPSD 552.010 and 552.020.
2 Flexible and composite pavement shall be placed 5mm above the adjacent edge of gutter.
3 For slipforming procedure a 5% batter is acceptable.
A Treatment at entrances shall be according to OPSD 351.010.
B Outlet treatment shall be according to the OPSD 610 Series.
C The transition from one curb type to another shall be a minimum length of 3.0m, except in conjunction with guide rail where it shall be according to the OPSD 900 Series.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2012	Rev 2
CONCRETE MOUNTABLE CURB WITH NARROW GUTTER		OPSD 600.100



SILT SACK DETAIL

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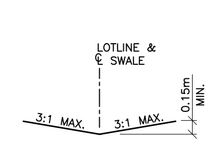

SWALE DETAIL

N.T.S.

PRIMARY CONSULTANT & PROJECT MANAGER

RPDS
INTEGRATED DESIGN FIRM
SUITE 203, 7895 TRANMERE DR., MISSISSAUGA, ON L5S 1V9
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ELECTRICAL CONSULTANT

CONSULTING CIVIL ENGINEERS

J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
440 HARDY ROAD , UNIT #1 , BRANTFORD - ONTARIO , N3T 5L8
TEL. (519) 753-2656 FAX. (519) 753-4263 www.cohooneng.com

No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT
5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

TYPICAL DETAILS AND NOTES

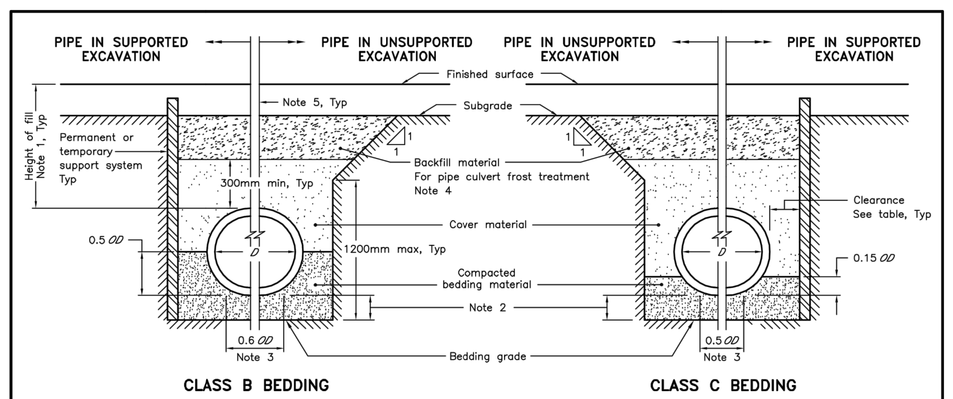
DRAWN BY: K.P.B. DATE: OCT. 10/23

CHECKED BY: R.W.P. SCALE: AS SHOWN

PROJECT NO.: **16363**

DRAWING NO.: **C-03**

LICENSED PROFESSIONAL ENGINEER
10/10/23
R.W. PHILLIPS
PROVINCE OF ONTARIO

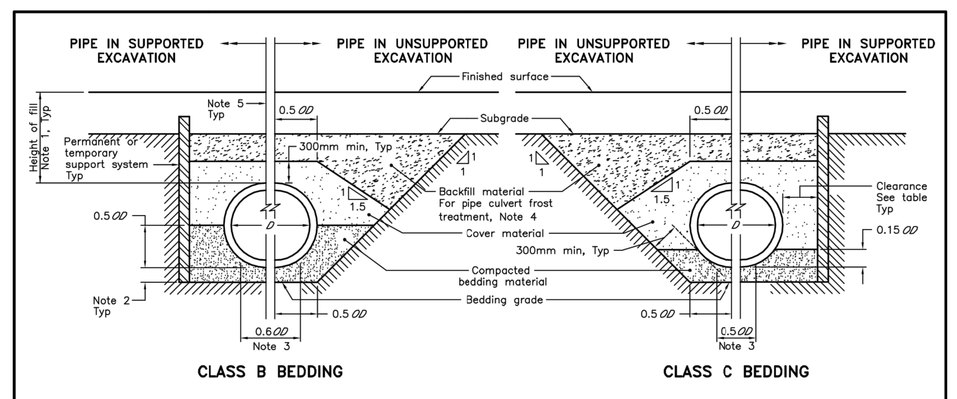


NOTES:
1 Height of fill is measured from the finished surface to top of pipe.
2 The minimum bedding depth below the pipe shall be 0.15Ø in no case shall this dimension be less than 150mm or greater than 300mm.
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.
A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
B All dimensions are in metres unless otherwise shown.

LEGEND:
D – Inside diameter
ØD– Outside diameter

CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 3
RIGID PIPE BEDDING, COVER, AND BACKFILL TYPE 1 OR 2 SOIL – EARTH EXCAVATION		OPSD 802.030



NOTES:
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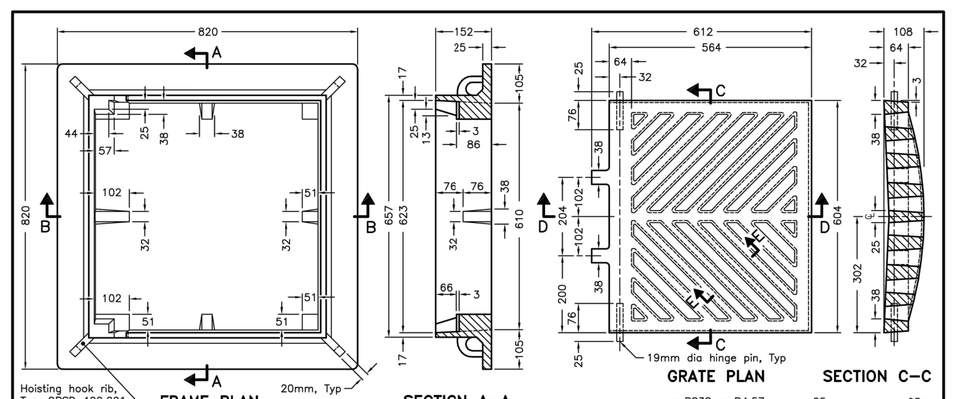
3 The pipe bed shall be compacted and shaped to receive the bottom of the pipe.
4 Pipe culvert frost treatment shall be according to OPSD 803.030 and 803.031.
5 Condition of excavation is symmetrical about centreline of pipe.
A Soil types as defined in the Occupational Health and Safety Act and Regulations for Construction Projects.
B All dimensions are in metres unless otherwise shown.

LEGEND:
D – Inside diameter
ØD– Outside diameter

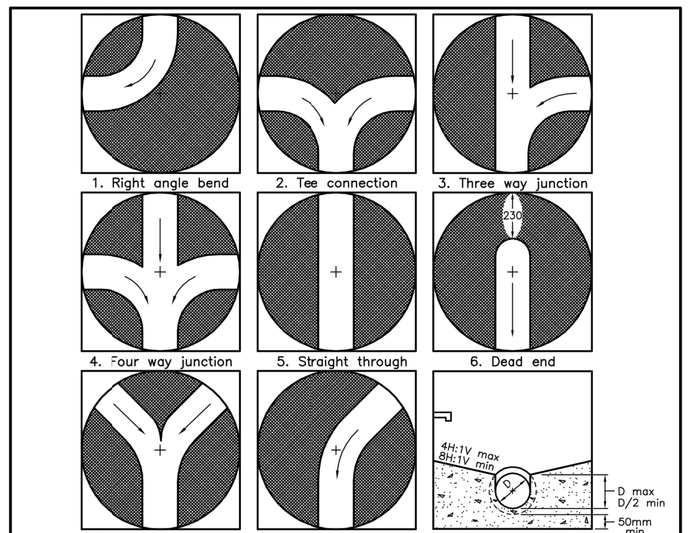
CLEARANCE TABLE	
Pipe Inside Diameter mm	Clearance mm
900 or less	300
Over 900	500

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2015	Rev 3
RIGID PIPE BEDDING, COVER, AND BACKFILL TYPE 3 SOIL – EARTH EXCAVATION		OPSD 802.031



NOTES:
A This OPSD shall be read in conjunction with OPSD 610.010 and 610.020.
B All dimensions are in millimetres unless otherwise shown.

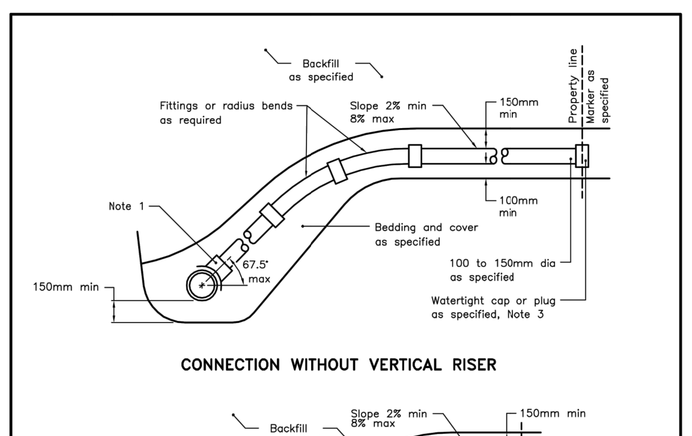
ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 2
CAST IRON, SQUARE FRAME WITH SQUARE OVERFLOW TYPE DISHED GRATE FOR CATCH BASINS, HERRING BONE OPENINGS		OPSD 400.010



MAXIMUM SIZE HOLE IN THE WALL IN PRECAST RISER SECTIONS					
Maintenance Hole Diameter	No. 1–4	No. 5 and 6	No. 8	No. 7	
				Inlet Hole	Outlet Hole
1200	700	860	780	700	860
1500	860	1220	960	860	1170
1800	1220	1485	1220	1220	1485
2400	1485	2020	1760	1485	2020
3000	1930	2450	2300	1930	2450
3600	2470	3085	2730	2470	3085

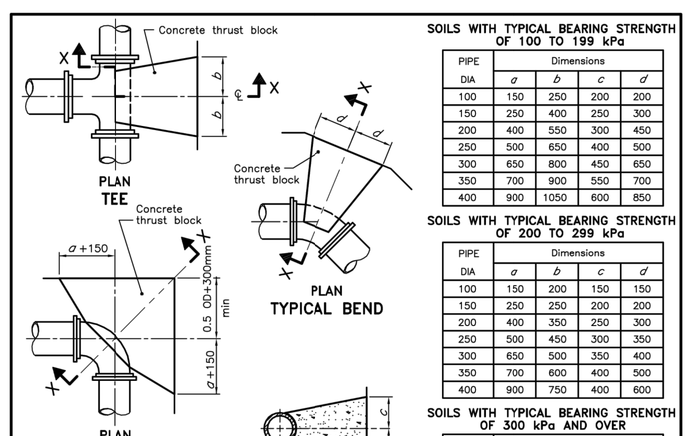
NOTES:
1 Slopes shall be maintained from the outlet hole opening for top of benching.
A Concrete for benching shall be 30MPa.
B When benching is hand–finished, it shall be given wood float finish, channel shall be given steel trowel finish.
C Benching slope and height shall be as specified.
D When specified, maintenance holes that are 1200mm in diameter with a uniform channel for 200 or 250mm pipe may be prebenched at the manufacturer with standardized benching slope and channel orientation.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 4
MAINTENANCE HOLE BENCHING AND PIPE OPENING ALTERNATIVES		OPSD 701.021



NOTES:
1 Sewer service connections to the main pipe sewer shall be made using factory made tees, strap–on–saddles, or other approved saddles.
2 Vertical risers shall be as specified.
3 Cap or plug at property line shall be adequately braced.
A Maintenance holes shall be used at the main sewer to connect service connections greater than or equal to 200mm.
B For new construction, saddles shall be installed on the main pipe before that pipe is laid.
C Approved cut–in tool shall be used for field made connections.
D All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2011	Rev 2
SEWER SERVICE CONNECTIONS FOR RIGID MAIN PIPE SEWER		OPSD 1006.010



SOILS WITH TYPICAL BEARING STRENGTH OF 100 TO 199 kPa

PIPE DIA	Dimensions a	b	c	d
100	150	250	200	200
150	250	400	250	300
200	400	550	300	450
250	500	650	400	500
300	650	800	450	650
350	700	900	550	700
400	900	1050	600	850

SOILS WITH TYPICAL BEARING STRENGTH OF 200 TO 299 kPa

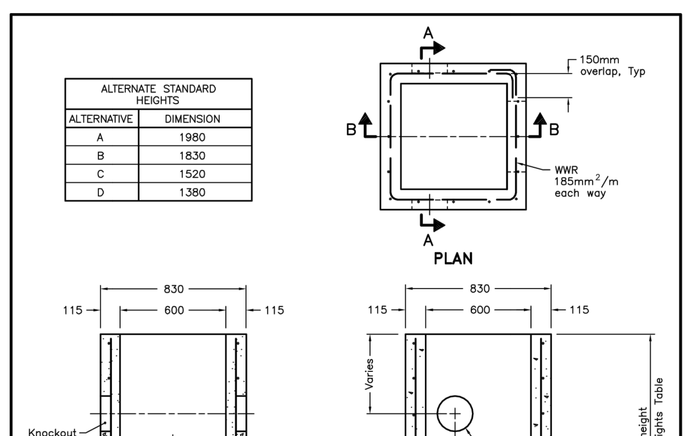
PIPE DIA	Dimensions a	b	c	d
100	150	200	150	150
150	250	250	200	200
200	400	350	250	300
250	500	450	300	350
300	650	500	350	400
350	700	600	400	500
400	900	750	400	600

SOILS WITH TYPICAL BEARING STRENGTH OF 300 kPa AND OVER

PIPE DIA	Dimensions a	b	c	d
100	150	150	150	150
150	250	200	200	200
200	400	300	200	250
250	500	400	250	300
300	650	450	300	300
350	700	550	350	350
400	900	650	350	450

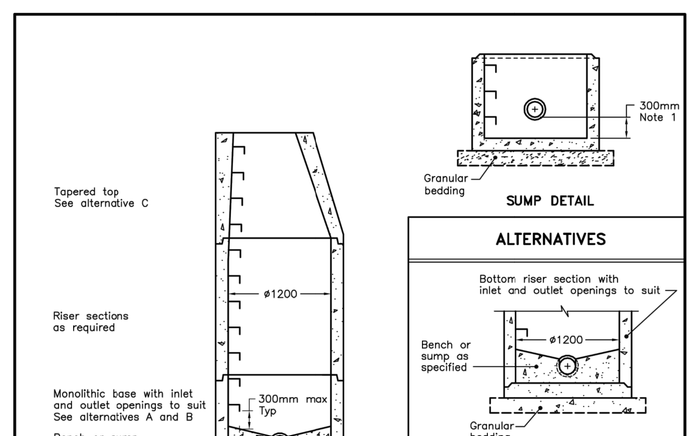
NOTES:
A Concrete shall be placed to within 50mm of the face of the bell.
B Bond breaker shall be used between concrete and fittings.
C The above thrust block dimensions meet or exceed the MOE Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit.
D The assumptions made for the above calculations are:
– Maximum operating pressure of 690 kPa,
– Maximum surge pressure with a flow velocity change of 0.6 m/s of 790 kPa for Class 52 DI pipe and 240 kPa for PVC pipe.
E The tables apply to both ductile iron and PVC pipe. When one length exceeded the other, the longer length was used.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2013	Rev 2
CONCRETE THRUST BLOCKS FOR TEES, PLUGS, AND HORIZONTAL BENDS		OPSD 1103.010



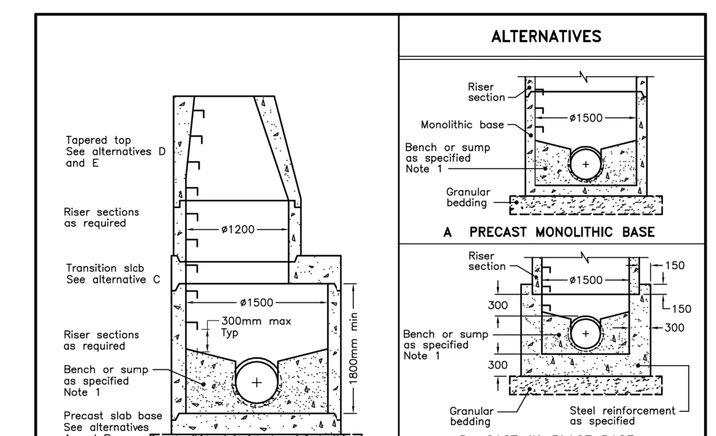
NOTES:
1 Outlet hole size 525mm diameter maximum, location as recuired.
2 200mm diameter knockout to accommodate subdrain. Knockout shall be 60mm deep.
A Centre reinforcing in base slab and walls ±20mm.
B Granular backfill shall be placed to a minimum thickness of 300mm all around the catch basin.
C Frame, grate, and adjustment units shall be installed according to OPSD 704.010.
D Pipe support shall be according to OPSD 708.020.
E All dimensions are nominal.
F All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 3
PRECAST CONCRETE CATCH BASIN 600x600mm		OPSD 705.010



NOTES:
1 The sump is measured from the lowest invert.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, or 701.032.
C Structure exceeding 5.0m in depth shall include safety platform according to OPSD 404.020.
D Pipe support according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 1200mm DIAMETER		OPSD 701.010



NOTES:
1 For sump detail, see OPSD 701.010.
A Granular backfill shall be placed to a minimum thickness of 300mm all around the maintenance hole.
B Precast concrete components shall be according to OPSD 701.030, 701.031, 701.040, 701.041, 703.011, 703.021, and 706.010.
C Structures exceeding 5.0m in depth shall include safety platform according to OPSD 404.020 or 404.021.
D Pipe support shall be according to OPSD 708.020.
E For benching and pipe opening details, see OPSD 701.021.
F For adjustment unit and frame installation, see OPSD 704.010.
G All dimensions are nominal.
H All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2014	Rev 5
PRECAST CONCRETE MAINTENANCE HOLE 1500mm DIAMETER		OPSD 701.011

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ELECTRICAL CONSULTANT

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J.H. COHOON ENGINEERING LIMITED
CONSULTING ENGINEERS
440 HARDY ROAD , UNIT #1 , BRANTFORD – ONTARIO , N3T 5L8
TEL. (519) 753–2656 FAX. (519) 753–4263 www.cohooneng.com

No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT

5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

TYPICAL DETAILS AND NOTES

DRAWN BY: K.P.B. DATE: OCT. 10/23

CHECKED BY: R.W.P. SCALE: AS SHOWN

PROJECT NO.: 16363

DRAWING NO.: C-04

LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PHILLIPS
PROVINCE OF ONTARIO

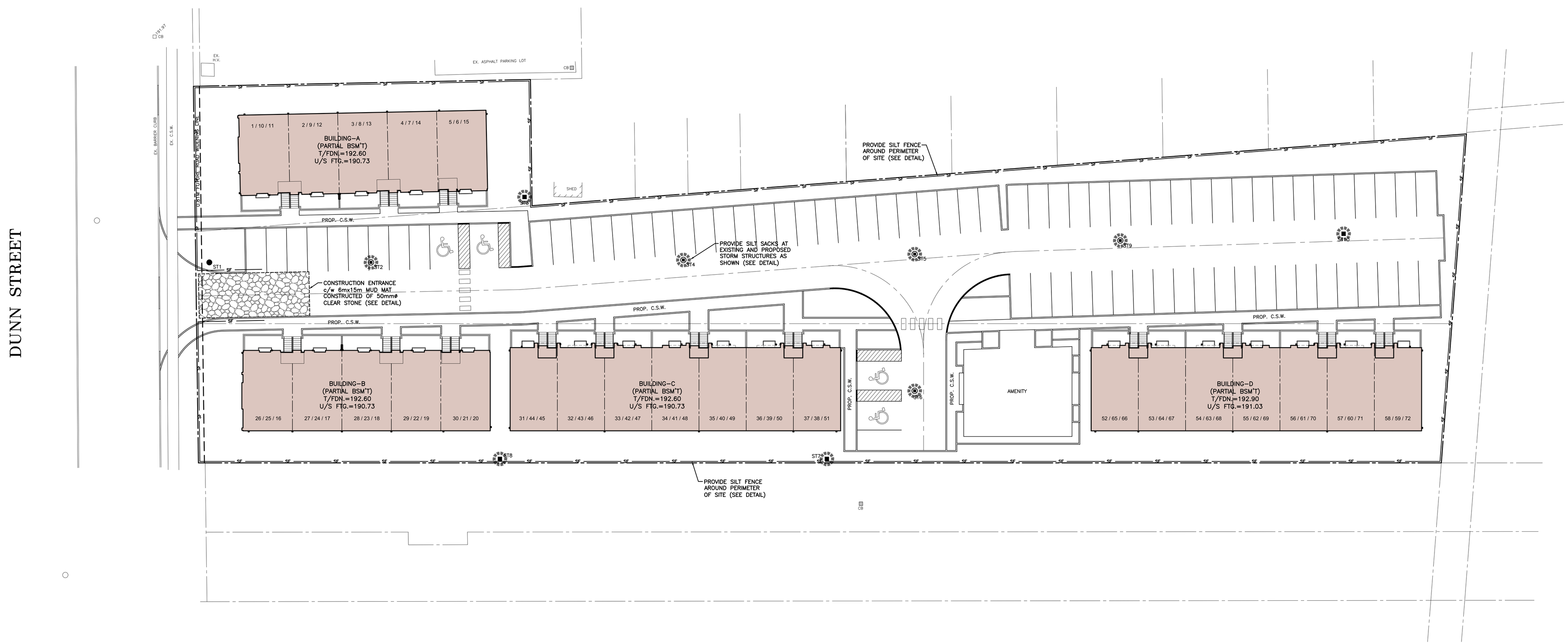
LEGEND:

—SF— SILTATION FENCE

SILT SACK AS SHOWN

NOTES:

1. ALL ELEVATIONS & DIMENSIONS SHOWN ARE METRIC.
2. ELEVATIONS MAY VARY PENDING ENGINEERS APPROVAL.
3. WHERE ONLY ONE ELEVATION IS SHOWN, EXISTING AND PROPOSED ELEVATIONS ARE THE SAME.
4. THE SILTATION & EROSION CONTROL (SEC) MEASURES ILLUSTRATED ON THIS PLAN ARE CONSIDERED TO BE THE MINIMUM REQUIREMENT. SITE CONDITIONS MAY REQUIRE ADDITIONAL MEASURES WHICH WILL BE IDENTIFIED BY THE ENGINEER DURING CONSTRUCTION.
5. ALL SEC MEASURES ARE TO BE IN PLACE PRIOR TO COMMENCEMENT OF CONSTRUCTION.
6. OWNER/CONTRACTOR TO MAINTAIN EROSION CONTROL MEASURES THROUGHOUT SITE UNTIL A COMPLETE GRASS/VEGETATION COVER IS ACHIEVED.
7. ONLY AT THE DIRECTION OF THE ENGINEER ARE THE SEC MEASURES TO BE REMOVED.
8. ALL RAINWATER LEADERS FROM EACH UNIT ARE TO BE DIRECTED TOWARDS LANEWAY WHERE POSSIBLE.
9. CONTRACTOR TO PROVIDE SILT SACKS ON TOP OF ALL EXISTING AND PROPOSED STORM STRUCTURES WITHIN THE INFLUENCE OF RUNOFF DURING CONSTRUCTION UNTIL ADEQUATE VEGETATIVE COVER IS ACHIEVED.
10. CONTRACTOR TO PROVIDE SILT FENCE AROUND PERIMETER OF ALL ON SITE STOCKPILES.



LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PAWLIPS
PROVINCE OF ONTARIO

PRIMARY CONSULTANT & PROJECT MANAGER

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No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT

5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

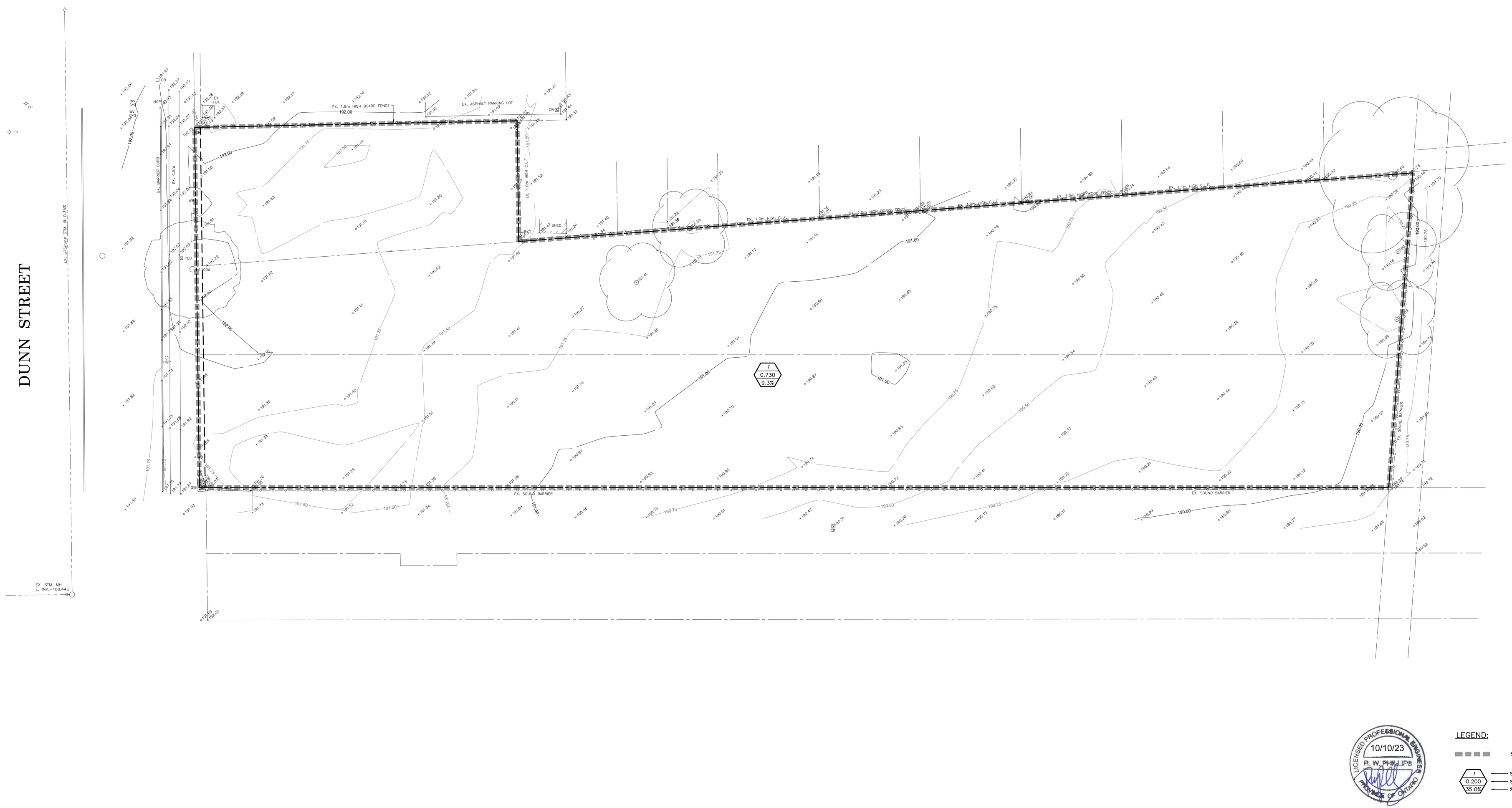
SILTATION AND EROSION CONTROL PLAN

DRAWN BY: K.P.B. DATE: OCT. 10/23

CHECKED BY: R.W.P. SCALE: 1:250

PROJECT NO.: **16363**

DRAWING NO.: **C-05**



LEGEND:

STORM DRAINAGE BOUNDARY

7 — STORM DRAINAGE NUMBER
0.200 — STORM AREA IN HECTARES
35.0% — % IMPERVIOUS

LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PHILLIPS
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No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT

5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

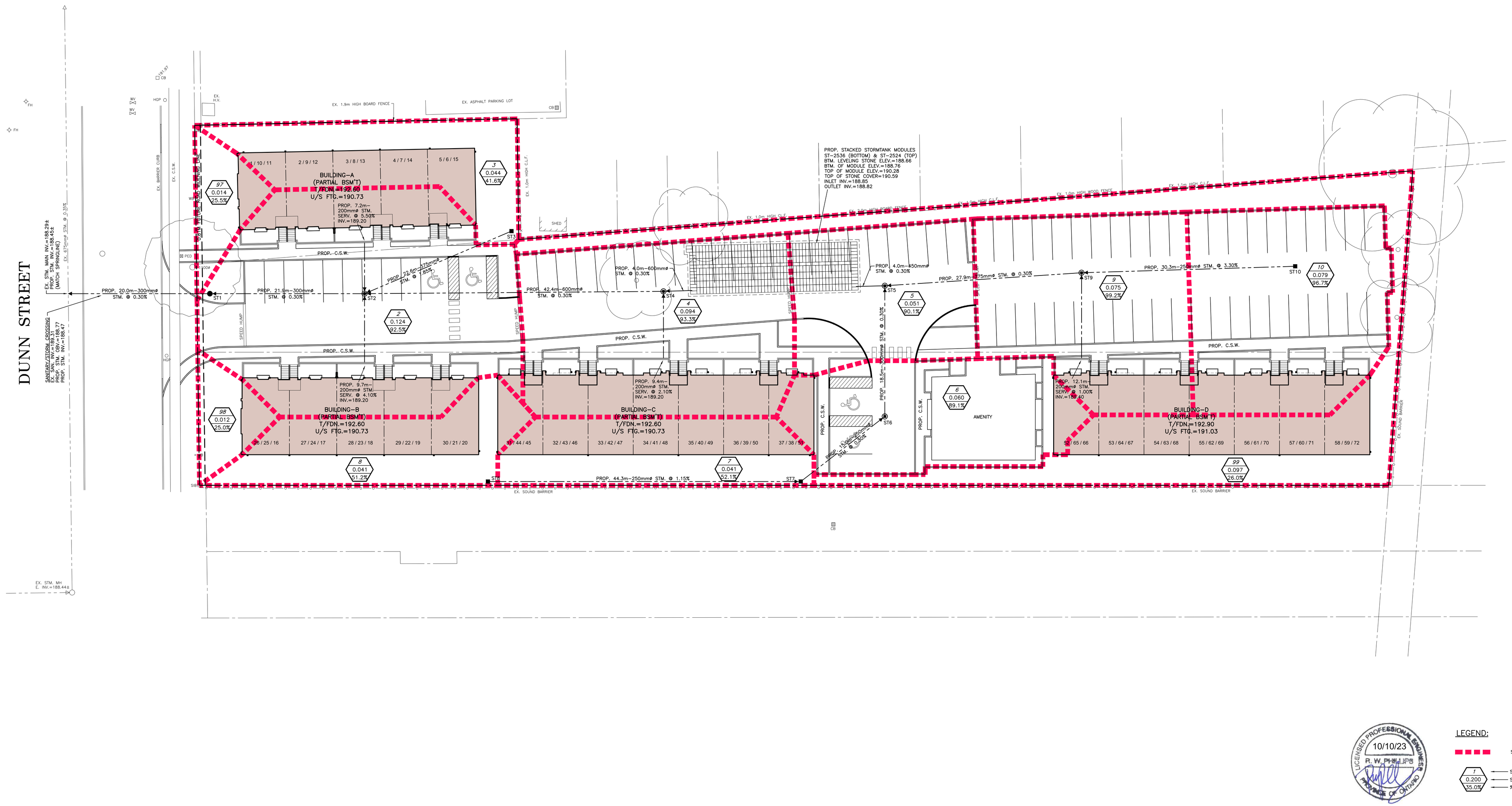
PRE DEVELOPMENT STORM DRAINAGE AREAS

DRAWN BY: K.P.B. DATE: OCT. 10/23

CHECKED BY: R.W.P. SCALE: 1:250

PROJECT NO.: 16363

DRAWING NO.: C-06



LEGEND:

STORM DRAINAGE BOUNDARY

1 / 0.200 / 35.0% — STORM DRAINAGE NUMBER / STORM AREA IN HECTARES / % IMPERVIOUS

LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PHILLIPS
PROVINCE OF ONTARIO

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No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT

5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

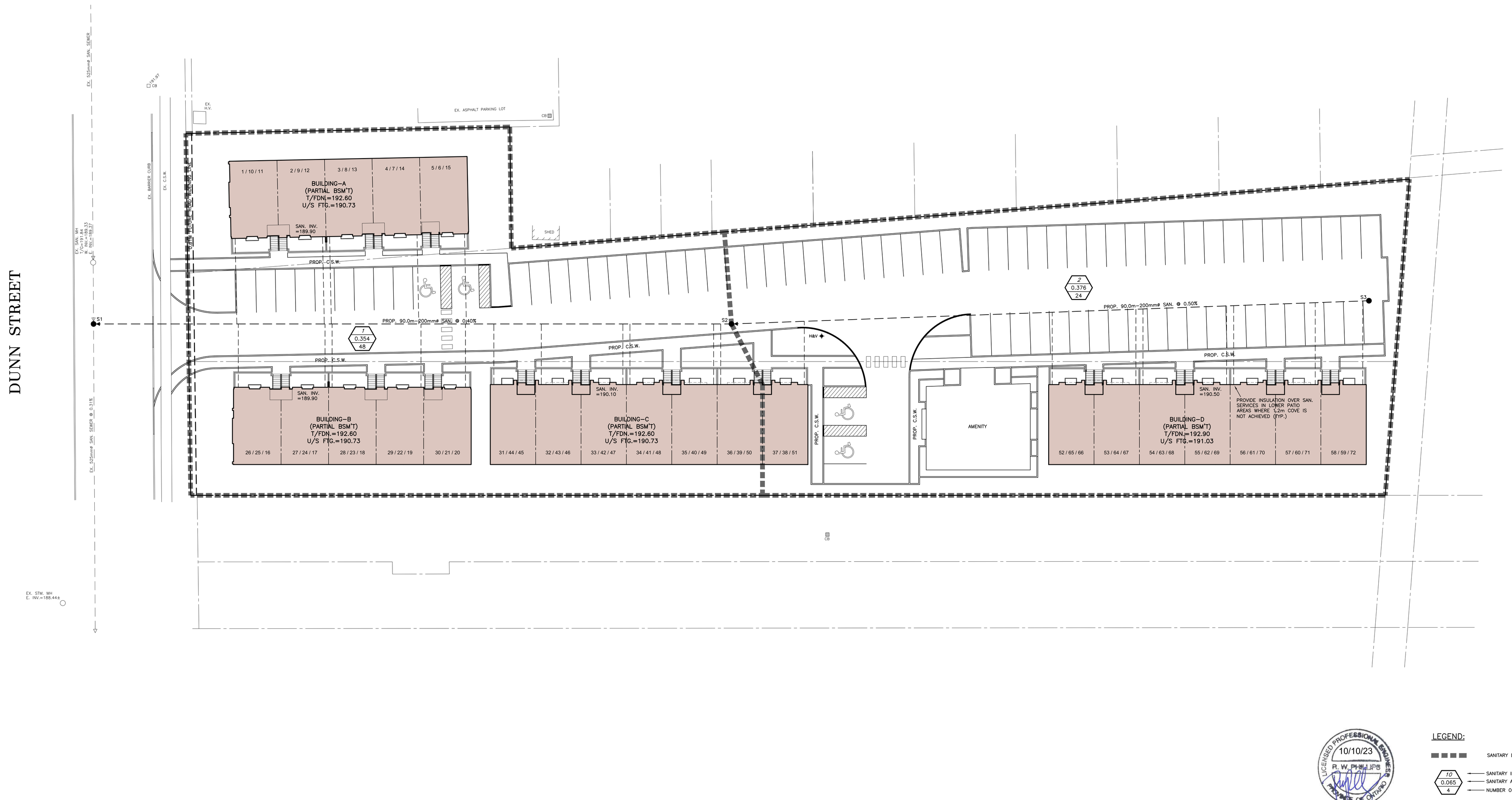
POST DEVELOPMENT STORM DRAINAGE AREAS

DRAWN BY: K.P.B. DATE: OCT. 10/23

CHECKED BY: R.W.P. SCALE: 1:250

PROJECT NO.: 16363

DRAWING NO.: C-07



LEGEND:

SANITARY DRAINAGE BOUNDARY

10 / 0.065 / 4 — SANITARY IDENTIFICATION; SANITARY AREA IN HECTARES; NUMBER OF UNITS

LICENSED PROFESSIONAL ENGINEER
10/10/23
R. W. PHILLIPS
PROVINCE OF ONTARIO

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No.	Date	Version	Dwn.

PROJECT:

TOWNHOMES DEVELOPMENT

5858 Dunn Street
City Of Niagara Falls
Canada

DRAWING TITLE:

SANITARY DRAINAGE AREAS

DRAWN BY: K.P.B. DATE: OCT. 10/23

CHECKED BY: R.W.P. SCALE: 1:250

PROJECT NO.: 16363

DRAWING NO.: C-08

APPENDIX B: STORMWATER MANAGEMENT CALCULATIONS

J.H. COHOON ENGINEERING LIMITED
PRE-DEVELOPMENT CATCHMENTS
LAND USE BREAKDOWN

PROJECT: 5858 Dunn Street
PROJECT #: 16363
DATE: October 10, 2023

Area Description	Runoff Coefficient	Land Use Areas (ha)
		1
Parks/Open Space	0.20	0.662
Low Density Residential	0.50	
Medium Density Residential	0.65	
High Density Residential	0.75	
Institutional	0.75	
Industrial	0.75	
Commercial	0.90	
Paved Areas	0.95	0.068
Total Area (ha)		0.730
Composite Runoff Coefficient		**0.27**

Runoff Coefficient vaules per Niagara Peninsula Conservation Authority Stormwater Management Policies and Gudelines

Time of Concentration Calculation Parameters	101
Calculation Method	Airport
Catchment Area (ha)	0.73
Catchment Length (m)	76.71
Slope (%)	2%
Time of Concentration (min)	19.35

J.H. COHOON ENGINEERING LIMITED
POST-DEVELOPMENT CATCHMENTS
LAND USE BREAKDOWN

PROJECT: 5858 Dunn Street
PROJECT #: 16363
DATE: October 10, 2023

From Post-Development Drainage Plan:

Catchment ID	2	3	4	5	6	7	8	9	10	97	98	99
Area	0.124	0.044	0.094	0.051	0.06	0.041	0.041	0.075	0.079	0.014	0.012	0.097
% Impervious	93%	42%	93%	90%	89%	52%	51%	99%	97%	26%	25%	26%

To simplify the analysis, Catchments 2, 3, 4, 5, 6, 7, 8, 9, and 10 have been combined and defined as Catchment 201 for the purpose of determining major peak flows and required SWM Controls. Catchments 97 and 98 have been combined and defined as Catchment 202.

Area Description	**Runoff Coefficient**	**Land Use Areas**			
		201	**202**	**99**	
Parks/Open Space	0.20	0.096	0.019	0.072	
Low Density Residential	0.50				
Medium Density Residential	0.65				
High Density Residential	0.75				
Institutional	0.75				
Industrial	0.75				
Commercial	0.90				
Paved Areas	0.95	0.513	0.007	0.025	
Total Area (ha)		0.609	0.026	0.097	
Composite Runoff Coefficient		**0.83**	**0.39**	**0.40**	

Runoff Coefficient vaules per Niagara Peninsula Conservation Authority Stormwater Management Policies and Gudelines

J.H. COHOON ENGINEERING LIMITED
MODIFIED RATIONAL CALCULATION

PROJECT: 5858 Dunn Street
PROJECT #: 16363
DATE: 10-Oct-23

CITY OF NIAGARA FALLS IDF PARAMETERS

Design Storm	2YR	5YR	10YR	25YR	100YR
A	521.97	719.5	577.93	1020.69	1264.57
B	5.280	6.340	2.483	7.290	7.720
C	0.7588	0.7687	0.669	0.779	0.7814

PRE-DEVELOPMENT ANALYSIS

Catchment ID:	100
Catchment Area (ha):	0.73
Runoff Coefficient:	0.27
Time of Concentration (min):	19.3

RATIONAL METHOD CALCULATION (Q = CIA/360)

	i (mm/hr)	C	Q (m^3/s)
2YR	45.90	0.27	0.025
5YR	59.35	0.27	0.032
10YR	73.46	0.27	0.040
25YR	79.15	0.30	0.048
100YR	96.08	0.34	0.066

POST-DEVELOPMENT ANALYSIS

Controlled to Dunn Street

Catchment ID:	201
Catchment Area (ha):	0.61
Runoff Coefficient:	0.83
Time of Concentration (min):	10

RATIONAL METHOD CALCULATION (Q = CIA/360)

	i (mm/hr)	C	Q (m^3/s)
2YR	65.94	0.83	0.093
5YR	84.02	0.83	0.118
10YR	106.77	0.83	0.150
25YR	110.83	0.92	0.172
100YR	133.78	1.00	0.226

Uncontrolled to Dunn Street

Catchment ID:	202
Catchment Area (ha):	0.03
Runoff Coefficient:	0.39
Time of Concentration (min):	10

	i (mm/hr)	C	Q (m^3/s)
2YR	65.94	0.39	0.002
5YR	84.02	0.39	0.002
10YR	106.77	0.39	0.003
25YR	110.83	0.43	0.003
100YR	133.78	0.49	0.005

Uncontrolled to South P/L

Catchment ID:	203
Catchment Area (ha):	0.10
Runoff Coefficient:	0.40
Time of Concentration (min):	10

	i (mm/hr)	C	Q (m^3/s)
2YR	65.94	0.40	0.007
5YR	84.02	0.40	0.009
10YR	106.77	0.40	0.011
25YR	110.83	0.43	0.013
100YR	133.78	0.49	0.018

PEAK RUNOFF RATE SUMMARY

Storm	$Q_{EXISTING}$	$Q_{NO\ CONTROLS}$	$Q_{UNCONTROLLED}$	$Q_{CONTROLLED}$	Q_{TOTAL}	
2YR	0.025	0.102	0.009	**0.016**	0.025	m^3/s
5YR	0.032	0.130	0.011	**0.019**	0.030	m^3/s
10YR	0.040	0.165	0.014	**0.022**	0.036	m^3/s
25YR	0.048	0.188	0.016	**0.023**	0.039	m^3/s
100YR	0.066	0.249	0.023	**0.027**	0.050	m^3/s

REQUIRED STORAGE VOLUMES (m^3) - MODIFIED RATIONAL METHOD CALCULATION
($V_p = Q_p \times D - Q_o \times ((D + Tc)/2)$)

Dur (min)	2YR	5YR	10YR	25YR	100YR
60	77.4	106.2	138.8	165.9	228.4
70	**77.8**	107.5	142.7	169.1	233.8
80	77.6	**108.0**	145.6	171.0	237.5
90	76.9	107.8	147.6	172.0	239.9
100	75.9	107.1	149.1	**172.2**	241.3
110	74.5	106.1	150.0	171.8	**241.8**
120	72.9	104.6	150.5	170.9	241.6
130	71.1	102.9	**150.5**	169.5	240.8
140	69.0	101.0	150.3	167.8	239.6

J.H. COHOON ENGINEERING LIMITED
SWM FACILITY VOLUME TABLES

PROJECT: 5858 Dunn Street, Niagara Falls
PROJECT #: 16363
DATE: 10-Oct-23

STORMTANK MODULE ST-36 & ST-24

Leveling Stone Bottom Elev (m)	188.6500	Outlet Elevation (m)	188.82
ST-36 Module Invert (m)	188.7560	Clear Stone Void Ratio	0.40
Top of ST-36 Module Elev (m)	189.6700	ST-36 Module Void Ratio	0.97
ST-24 Module Invert (m)	189.6700	ST-24 Module Void Ratio	0.96
Top of ST-24 Module Elev (m)	190.2800	Stone Area (m^2)	182.800
Top of Stone Backfill (m)	190.5848	Module Area (m^2)	163.463

STORM SEWERS

ID	TANK-ST4	ST4-ST2
DIA. (m)	0.600	0.600
U/S INV	188.82	188.79
D/S INV	188.81	188.66
AVG INV	188.82	188.73
Length (m)	4.0	42.4

STRUCTURES

ID	ST4	ST2
T/G	191.90	191.90
INV	188.79	188.64
DIA. (m)	1.5	1.5
Area (m^2)	1.77	1.77

Elevation	Depth	STORMTANK MODULE ST-36 & ST-24						SEWER & STRUCTURES				TOTAL ACTIVE STORAGE
		Stone Area	Module Area	Incremental Stone Vol.	Incremental Module Vol.	Accum. Stone Vol.	Accum. Module Vol.	TANK-ST4	ST4-ST2	ST4	ST2	
m	m	m^2	m^2	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3	m^3
188.64	0.00	182.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
188.76	0.12	182.80	163.46	8.48	0.00	8.48	0.00	0.00	0.41	0.00	0.20	0.61
188.82	0.18	19.34	163.46	0.50	10.15	8.98	10.15	0.01	1.25	0.05	0.32	1.62
188.92	0.28	19.34	163.46	0.77	15.86	9.75	26.00	0.22	4.26	0.23	0.49	21.06
189.02	0.38	19.34	163.46	0.77	15.86	10.52	41.86	0.48	7.36	0.41	0.67	40.64
189.12	0.48	19.34	163.46	0.77	15.86	11.30	57.72	0.72	9.86	0.58	0.85	59.58
189.22	0.58	19.34	163.46	0.77	15.86	12.07	73.57	0.83	10.81	0.76	1.02	76.86
189.32	0.68	19.34	163.46	0.77	15.86	12.84	89.43	1.01	11.99	0.94	1.20	94.41
189.42	0.78	19.34	163.46	0.77	15.86	13.62	105.28	1.13	11.99	1.11	1.38	110.75
189.52	0.88	19.34	163.46	0.77	15.86	14.39	121.14	1.13	11.99	1.29	1.56	126.96
189.62	0.98	19.34	163.46	0.77	15.86	15.16	137.00	1.13	11.99	1.47	1.73	143.17
189.67	1.03	19.34	163.46	0.39	7.93	15.55	144.92	1.13	11.99	1.56	1.82	151.27
189.72	1.08	19.34	163.46	0.39	7.85	15.94	152.77	1.13	11.99	1.64	1.91	159.29
189.82	1.18	19.34	163.46	0.77	15.69	16.71	168.46	1.13	11.99	1.82	2.09	175.34
189.92	1.28	19.34	163.46	0.77	15.69	17.49	184.15	1.13	11.99	2.00	2.26	191.38
190.02	1.38	19.34	163.46	0.77	15.69	18.26	199.85	1.13	11.99	2.17	2.44	207.43
190.12	1.48	19.34	163.46	0.77	15.69	19.03	215.54	1.13	11.99	2.35	2.62	223.48
190.22	1.58	19.34	163.46	0.77	15.69	19.81	231.23	1.13	11.99	2.53	2.79	239.52
190.28	1.64	19.34	163.46	0.46	9.42	20.27	240.65	1.13	11.99	2.63	2.90	249.15
190.38	1.74	182.80	0.00	7.31	0.00	27.58	240.65	1.13	11.99	2.81	3.07	249.50
190.48	1.84	182.80	0.00	7.31	0.00	34.89	240.65	1.13	11.99	2.99	3.25	249.86
190.58	1.94	182.80	0.00	7.66	0.00	42.56	240.65	1.13	11.99	3.17	3.44	250.23

Note: Total Active Storage Volume does not include stone storage to be conservative.

J.H. COHOON ENGINEERING LIMITED
SWM FACILITY DISCHARGE TABLE

PROJECT: 5858 Dunn Street, Niagara Falls
PROJECT #: 16363
DATE: 10-Oct-23

OUTLET #1		
100 mm Orifice Plate		
Diameter =	100	mm
Area =	0.008	m^2
Orifice C =	0.63	
Invert =	188.64	m

Orifice Equation

Q = C x A x (2gH)^0.5

where

Q = flow rate (m^3/s)

C = constant

A = area of opening (m^2)

H = net head on the orifice

g = acceleration due to gravity (9.81 m/s^2)

Elevation	**OUTLET #1**		**TOTAL DISCHARGE**
	Head	**Discharge**	
m	**m**	**m^3/s**	**m^3/s**
188.64	0.00	0.0000	0.0000
188.76	0.07	0.0056	0.0056
188.82	0.13	0.0079	0.0079
188.92	0.23	0.0105	0.0105
189.02	0.33	0.0126	0.0126
189.12	0.43	0.0144	0.0144
189.22	0.53	0.0160	0.0160
189.32	0.63	0.0174	0.0174
189.42	0.73	0.0187	0.0187
189.52	0.83	0.0200	0.0200
189.62	0.93	0.0211	0.0211
189.72	1.03	0.0222	0.0222
189.82	1.13	0.0233	0.0233
189.92	1.23	0.0243	0.0243
190.02	1.33	0.0253	0.0253
190.12	1.43	0.0262	0.0262
190.22	1.53	0.0271	0.0271
190.28	1.59	0.0276	0.0276
190.38	1.69	0.0285	0.0285
190.48	1.79	0.0293	0.0293
190.58	1.89	0.0302	0.0302

J.H. COHOON ENGINEERING LIMITED
SWM FACILITY SUMMARY TABLES

PROJECT: 5858 Dunn Street, Niagara Falls
PROJECT #: 16363
DATE: 10-Oct-23

STAGE STORAGE DISCHARGE TABLE

Elevation m	Active Depth m	Total Discharge m^3/s	Active Storage Volume m^3
188.64	0.00	0.0000	0.00
188.76	0.12	0.0056	0.61
188.82	0.18	0.0079	1.62
188.92	0.28	0.0105	21.06
189.02	0.38	0.0126	40.64
189.12	0.48	0.0144	59.58
189.22	0.58	0.0160	76.86
189.32	0.68	0.0174	94.41
189.42	0.78	0.0187	110.75
189.52	0.88	0.0200	126.96
189.62	0.98	0.0211	143.17
189.72	1.08	0.0222	159.29
189.82	1.18	0.0233	175.34
189.92	1.28	0.0243	191.38
190.02	1.38	0.0253	207.43
190.12	1.48	0.0262	223.48
190.22	1.58	0.0271	239.52
190.28	1.64	0.0276	249.15
190.38	1.74	0.0285	249.50
190.48	1.84	0.0293	249.86
190.58	1.94	0.0302	250.23

SWMF OPERATION CHARACTERISTICS

Storm Event	Peak Flow m^3/s	Storage Provided m^3	Elevation m
2-year	0.016	77.8	189.23
5-year	0.019	108.0	189.40
10-year	0.022	150.5	189.67
25-year	0.023	172.2	189.80
100-year	0.027	241.8	190.23

J.H. COHOON ENGINEERING LIMITED
STORM SEWER DESIGN SHEET

PROJECT: 5858 Dunn Street, Niagara Falls
PROJECT #: 16363
DATE: October 10, 2023

Municipality

City of Niagara Falls

Runoff Coefficient Adjustment

Year	Adj. Factor
10	1
25	1.1
50	1.2
100	1.25

Manning's Coefficient

Pipe	Value
CSP	0.024
Concrete	0.013
PVC	0.013

Time of Concentration

10 mins

IDF Curve Coefficients

Year	A	B	C
2	521.970	5.280	0.759
5	719.500	6.340	0.769
10	577.930	2.483	0.669
25	1020.690	7.290	0.779
50			
100	1264.570	7.720	0.781

Rainfall Intensity: $i = \frac{A}{(tc+B)^C}$

Peak Flow: $Q = \frac{CiA}{360}$

STREET NAME	AREA ID	FROM MAINTENANCE HOLE	TO MAINTENANCE HOLE	AREA (ha)	5-YEAR RUNOFF COEFFICIENT	DESIGN STORM (YEAR)	ADJUSTED RUNOFF COEFFICIENT	AREA x RUNOFF COEFFICIENT	CUMULATIVE AREA (ha)	CUMULATIVE AREA x ADJUSTED RUNOFF COEFFICIENT	TIME OF CONCENTRATION (min)	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (m^3/s)	MANNING'S ROUGHNESS COEFFICIENT	SEWER LENGTH (m)	SEWER SLOPE (%)	ACTUAL SEWER DIAMETER (mm)	FULL FLOW VELOCITY (m/s)	FULL FLOW CAPACITY (m^3/s)	ACTUAL VELOCITY (m/s)	TRAVEL TIME (min)	CALCULATED PIPE DIAMETER (mm)	PERCENTAGE OF FULL FLOW CAPACITY (%)	TOTAL TRAVEL TIME (min)
5858 Dunn Street	10	ST10	ST9	0.08	0.93	100	1.00	0.08	0.079	0.08	10.00	133.78	0.029	0.013	30.3	3.3%	250	2.20	0.108	1.76	0.29	153	27%	10.29
5858 Dunn Street	9	ST9	ST5	0.08	0.94	100	1.00	0.08	0.15	0.15	10.29	132.11	0.057	0.013	27.9	0.3%	375	0.87	0.096	0.85	0.55	307	59%	10.84
5858 Dunn Street	8	ST8	ST7	0.04	0.58	100	0.73	0.03	0.04	0.03	10.00	133.78	0.011	0.013	44.3	1.2%	250	1.30	0.064	0.91	0.81	129	17%	10.81
5858 Dunn Street	7	ST7	ST6	0.04	0.59	100	0.74	0.03	0.08	0.06	10.81	129.20	0.022	0.013	15.0	0.3%	250	0.70	0.034	0.69	0.36	210	63%	11.17
5858 Dunn Street	6	ST6	ST5	0.06	0.87	100	1.00	0.06	0.14	0.12	11.17	127.25	0.042	0.013	18.5	0.3%	300	0.75	0.053	0.75	0.41	276	80%	11.58
5858 Dunn Street	5	ST5	TANK	0.05	0.88	100	1.00	0.05	0.35	0.32	10.84	129.04	0.116	0.013	4.0	0.3%	450	0.98	0.156	0.98	0.07	403	75%	10.91
5859 Dunn Street	N/A	TANK	ST4	0.00	0.95	100	1.00	0.00	0.35	0.33	10.91	128.67	0.116	0.013	4.0	0.3%	600	1.19	0.336	1.00	0.07	403	35%	10.97
5858 Dunn Street	4	ST4	ST3	0.09	0.90	100	1.00	0.09	0.44	0.42	10.97	128.31	0.149	0.013	42.4	0.3%	600	1.19	0.336	1.07	0.66	442	44%	11.63
5858 Dunn Street	3	ST3	ST2	0.04	0.51	100	0.64	0.03	0.49	0.45	11.63	124.89	0.155	0.013	22.6	1.9%	375	2.16	0.238	2.16	0.17	319	65%	11.80
5858 Dunn Street	2	ST2	ST1	0.12	0.89	100	1.00	0.12	0.61	0.57	11.80	124.02	0.197											

Note: All Storm pipes upstream of ST2 have been sized to collect and convey the 100-year storm event in order to provide SWM Controls for the subject site. Maintenance hole structure ST2 is fitted with a 100 mm dia. orifice plate to control peak flow rates to pre-development levels.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 10 2023

16363 - Overland Flow at Dunn Street Driveway Entrance

Rectangular

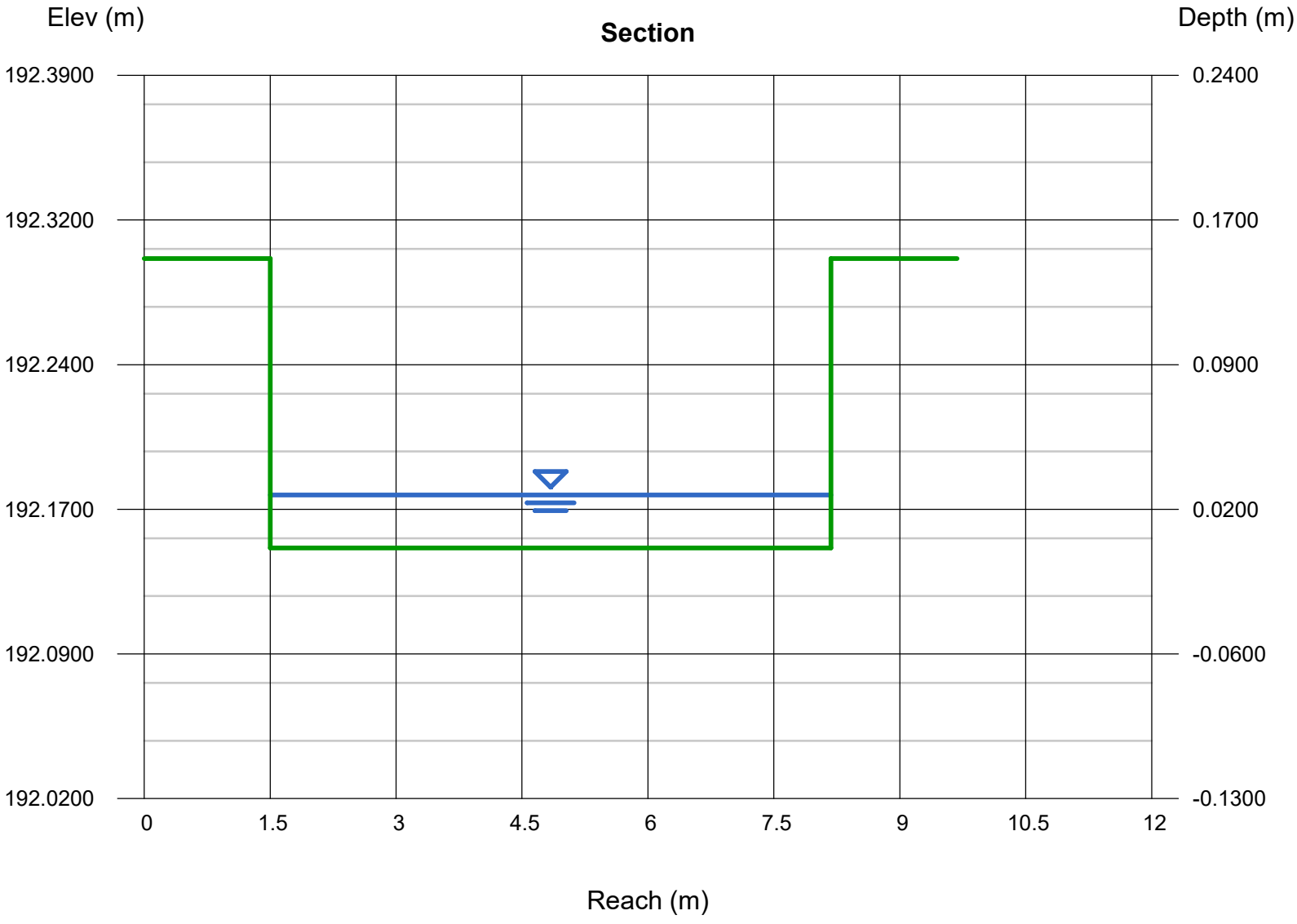
Bottom Width (m)	= 6.6800
Total Depth (m)	= 0.1500
Invert Elev (m)	= 192.1500
Slope (%)	= 3.4000
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cms)	= 0.2260

Highlighted

Depth (m)	= 0.0274
Q (cms)	= 0.226
Area (sqm)	= 0.1832
Velocity (m/s)	= 1.2333
Wetted Perim (m)	= 6.7349
Crit Depth, Yc (m)	= 0.0518
Top Width (m)	= 6.6800
EGL (m)	= 0.1050



APPENDIX C: OIL AND GRIT SEPARATOR SIZING

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

10/05/2023

Province:	Ontario
City:	City of Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
Climate Station Id:	6137287
Years of Rainfall Data:	33

Site Name:	5858 Dunn Street

Drainage Area (ha):	0.61
Runoff Coefficient 'c':	0.83

Particle Size Distribution:	CA ETV
Target TSS Removal (%):	60.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	15.74
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	31.00
Peak Conveyance (maximum) Flow Rate (L/s):	31.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	453
Estimated Average Annual Sediment Volume (L/yr):	369

Project Name:	5858 Dunn Street
Project Number:	16363
Designer Name:	Nicole Foris
Designer Company:	J.H. Cohoon Engineering Limited
Designer Email:	nforis@cohooneng.com
Designer Phone:	519-753-2656
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	55
EFO6	62
EFO8	65
EFO10	68
EFO12	69

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 62

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 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

Upstream Flow Controlled Results

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.2	9.2	0.70	42.0	16.0	70	6.5	6.5
1.00	20.5	29.7	1.41	84.0	32.0	70	14.4	20.9
2.00	16.5	46.2	2.82	169.0	64.0	67	11.1	32.0
3.00	11.3	57.5	4.22	253.0	96.0	63	7.2	39.2
4.00	9.1	66.7	5.63	338.0	128.0	61	5.5	44.7
5.00	5.5	72.2	7.04	422.0	161.0	57	3.2	47.8
6.00	4.5	76.7	8.45	507.0	193.0	55	2.5	50.3
7.00	4.2	80.9	9.85	591.0	225.0	53	2.3	52.6
8.00	3.5	84.4	11.26	676.0	257.0	53	1.8	54.4
9.00	2.0	86.5	12.67	760.0	289.0	52	1.1	55.5
10.00	1.5	88.0	14.08	845.0	321.0	50	0.7	56.2
11.00	1.8	89.8	15.48	929.0	353.0	50	0.9	57.1
12.00	1.1	90.9	16.89	1013.0	385.0	49	0.5	57.7
13.00	1.1	92.0	18.30	1098.0	417.0	48	0.5	58.2
14.00	1.4	93.4	19.71	1182.0	450.0	47	0.7	58.9
15.00	0.8	94.2	21.11	1267.0	482.0	46	0.4	59.2
16.00	0.6	94.8	22.52	1351.0	514.0	45	0.3	59.5
17.00	0.5	95.3	23.93	1436.0	546.0	44	0.2	59.7
18.00	0.3	95.6	25.34	1520.0	578.0	43	0.1	59.9
19.00	0.2	95.9	26.74	1605.0	610.0	42	0.1	59.9
20.00	0.2	96.1	28.15	1689.0	642.0	42	0.1	60.0
21.00	0.5	96.6	29.56	1773.0	674.0	42	0.2	60.3
22.00	3.4	100.0	30.97	1858.0	706.0	42	1.4	61.7
23.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
24.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
25.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
30.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
35.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
40.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
45.00	0.0	100.0	31.00	1860.0	707.0	42	0.0	61.7
Estimated Net Annual Sediment (TSS) Load Reduction =								**62 %**

Climate Station ID: 6137287 *Years of Rainfall Data*: 33

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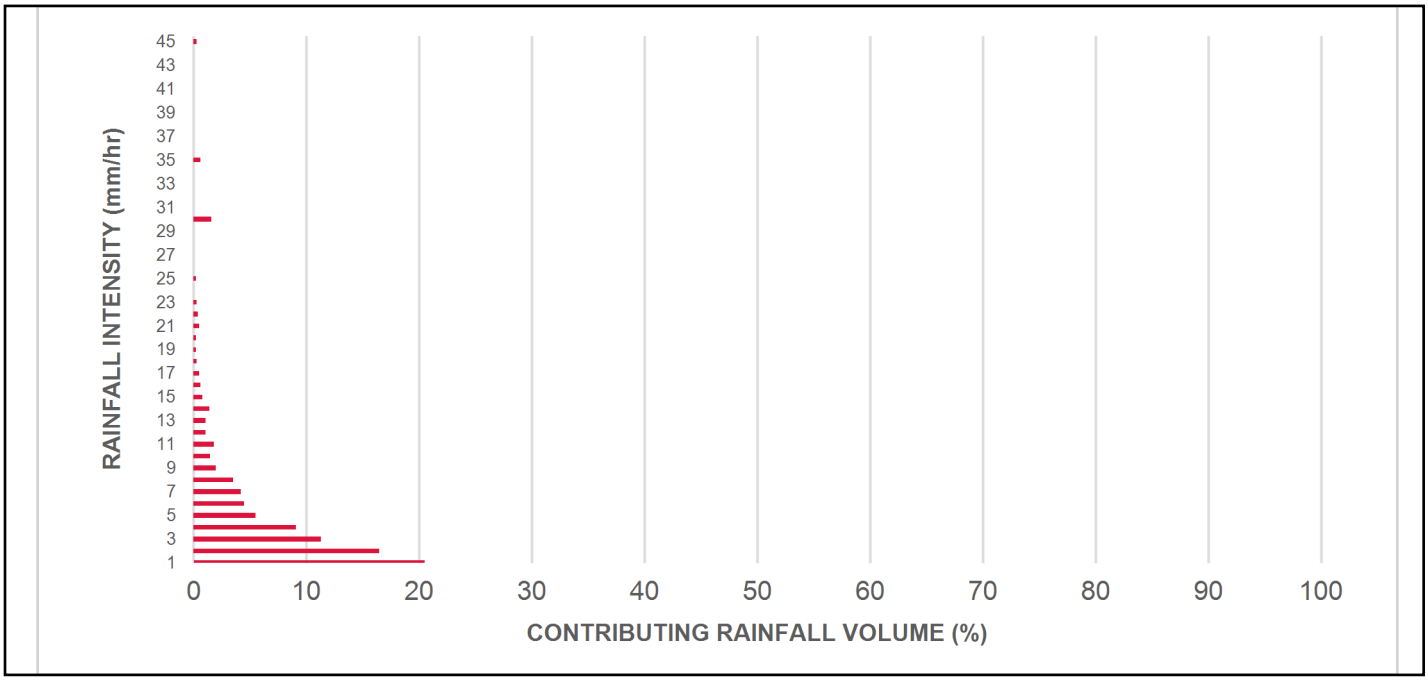
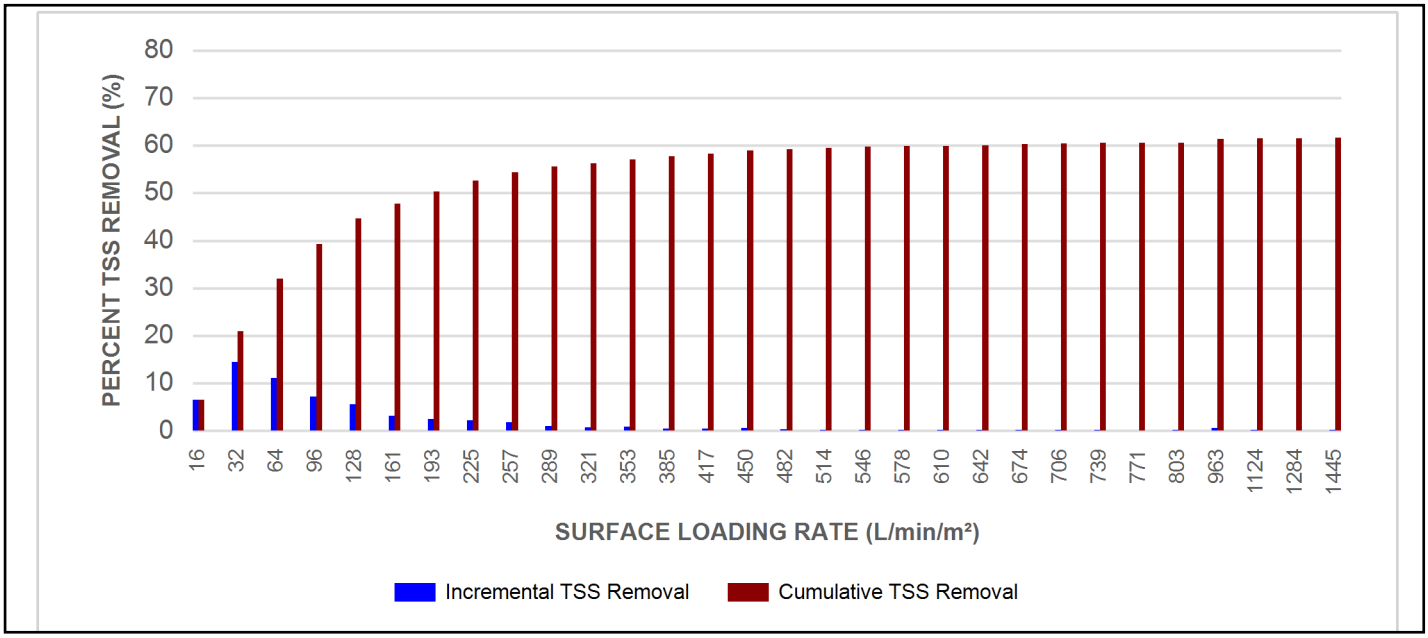
RAINFALL DATA FROM ST CATHARINES AP RAINFALL STATION



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

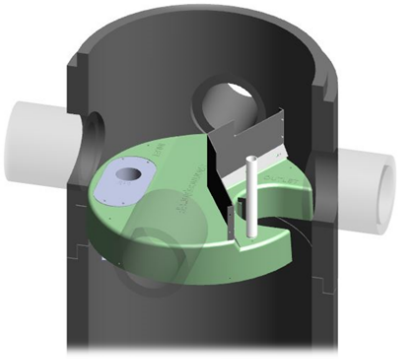
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

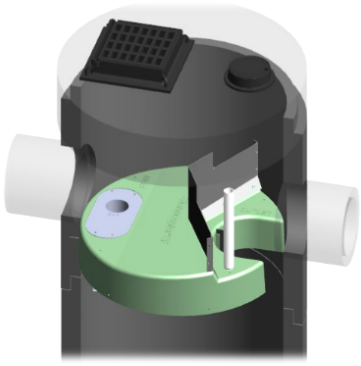
DESIGN FLEXIBILITY

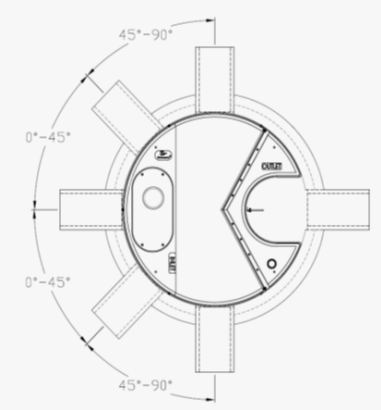
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend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







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

Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results
Stormceptor® EFO

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	42	1320	35	1980	24
30	70	690	42	1350	35	2010	24
60	67	720	41	1380	34	2040	23
90	63	750	41	1410	34	2070	23
120	61	780	41	1440	33	2100	23
150	58	810	41	1470	32	2130	22
180	56	840	41	1500	32	2160	22
210	54	870	41	1530	31	2190	22
240	53	900	41	1560	31	2220	21
270	52	930	40	1590	30	2250	21
300	51	960	40	1620	29	2280	21
330	50	990	40	1650	29	2310	21
360	49	1020	40	1680	28	2340	20
390	48	1050	39	1710	28	2370	20
420	47	1080	39	1740	27	2400	20
450	47	1110	38	1770	27	2430	20
480	46	1140	38	1800	26	2460	19
510	45	1170	37	1830	26	2490	19
540	44	1200	37	1860	26	2520	19
570	43	1230	37	1890	25	2550	19
600	42	1260	36	1920	25	2580	18
630	42	1290	36	1950	24	2600	26

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 of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

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

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

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

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

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

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Stormceptor®

Rinker MATERIALS™

Stormceptor® EF Sizing Report

Imbrium® Systems
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

10/05/2023

Province:	Ontario
City:	City of Niagara Falls
Nearest Rainfall Station:	ST CATHARINES AP
Climate Station Id:	6137287
Years of Rainfall Data:	33

Project Name:	5858 Dunn Street
Project Number:	16363
Designer Name:	Nicole Foris
Designer Company:	J.H. Cohoon Engineering Limited
Designer Email:	nforis@cohooneng.com
Designer Phone:	519-753-2656
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Site Name:	5858 Dunn Street (Fine)
Drainage Area (ha):	0.61
Runoff Coefficient 'c':	0.83
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	15.74
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	31.00
Peak Conveyance (maximum) Flow Rate (L/s):	31.00
Influent TSS Concentration (mg/L):	200
Estimated Average Annual Sediment Load (kg/yr):	607
Estimated Average Annual Sediment Volume (L/yr):	493

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	83
EFO6	92
EFO8	96
EFO10	98
EFO12	99

Recommended Stormceptor EFO Model: EFO4

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.

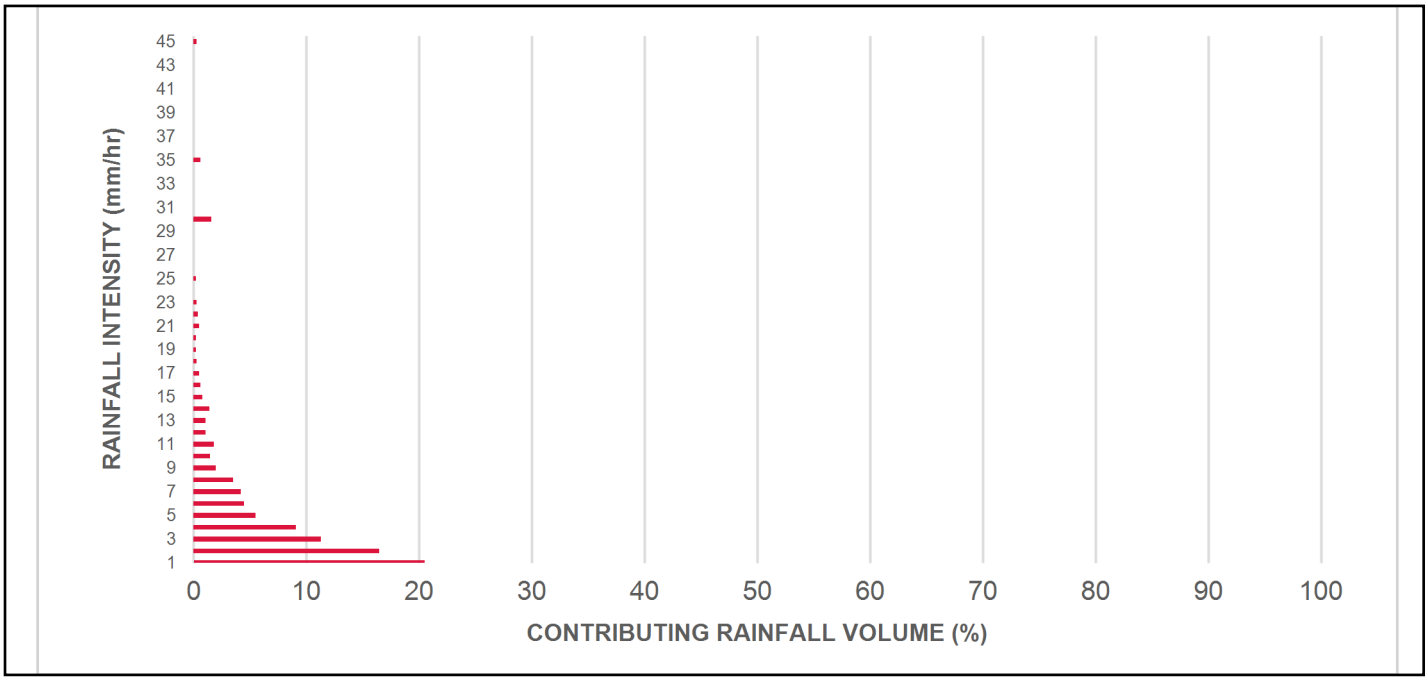
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Upstream Flow Controlled Results

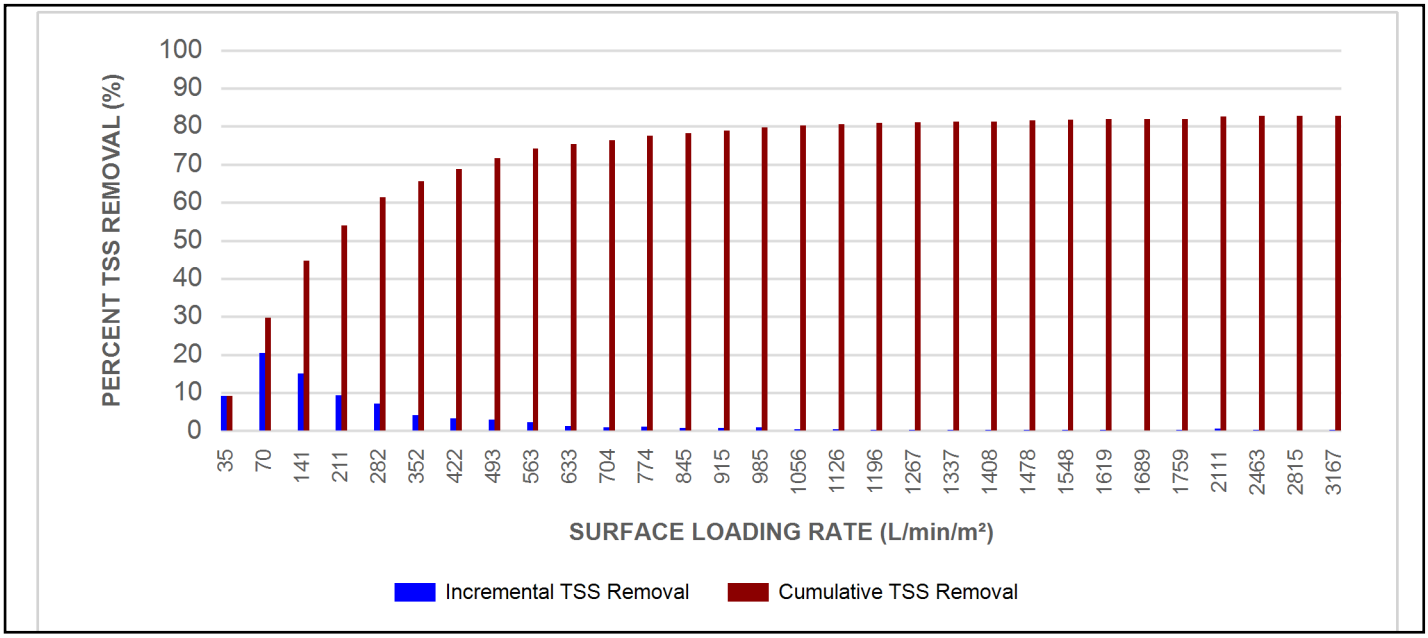
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
0.50	9.2	9.2	0.70	42.0	35.0	100	9.2	9.2
1.00	20.5	29.7	1.41	84.0	70.0	100	20.5	29.7
2.00	16.5	46.2	2.82	169.0	141.0	91	15.0	44.7
3.00	11.3	57.5	4.22	253.0	211.0	83	9.4	54.0
4.00	9.1	66.7	5.63	338.0	282.0	79	7.2	61.3
5.00	5.5	72.2	7.04	422.0	352.0	76	4.2	65.5
6.00	4.5	76.7	8.45	507.0	422.0	73	3.3	68.8
7.00	4.2	80.9	9.85	591.0	493.0	70	3.0	71.7
8.00	3.5	84.4	11.26	676.0	563.0	66	2.3	74.1
9.00	2.0	86.5	12.67	760.0	633.0	64	1.3	75.4
10.00	1.5	88.0	14.08	845.0	704.0	64	0.9	76.3
11.00	1.8	89.8	15.48	929.0	774.0	63	1.2	77.5
12.00	1.1	90.9	16.89	1013.0	845.0	63	0.7	78.2
13.00	1.1	92.0	18.30	1098.0	915.0	62	0.7	78.8
14.00	1.4	93.4	19.71	1182.0	985.0	62	0.9	79.7
15.00	0.8	94.2	21.11	1267.0	1056.0	60	0.5	80.2
16.00	0.6	94.8	22.52	1351.0	1126.0	59	0.3	80.6
17.00	0.5	95.3	23.93	1436.0	1196.0	57	0.3	80.9
18.00	0.3	95.6	25.34	1520.0	1267.0	56	0.2	81.0
19.00	0.2	95.9	26.74	1605.0	1337.0	54	0.1	81.2
20.00	0.2	96.1	28.15	1689.0	1408.0	52	0.1	81.3
21.00	0.5	96.6	29.56	1773.0	1478.0	50	0.3	81.5
22.00	3.4	100.0	30.97	1858.0	1548.0	48	1.6	83.1
23.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
24.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
25.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
30.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
35.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
40.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
45.00	0.0	100.0	31.00	1860.0	1550.0	47	0.0	83.1
Estimated Net Annual Sediment (TSS) Load Reduction =								**83 %**

Climate Station ID: 6137287 *Years of Rainfall Data*: 33

RAINFALL DATA FROM ST CATHARINES AP 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

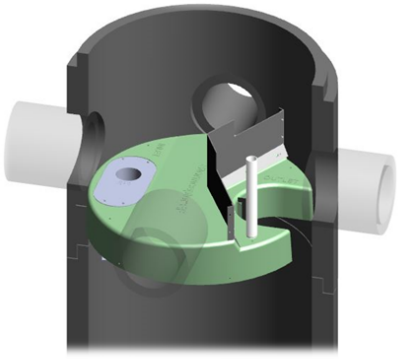
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test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

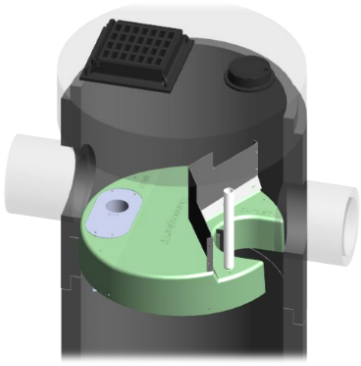
DESIGN FLEXIBILITY

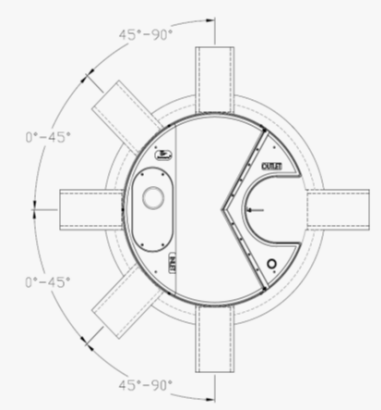
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend 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 of the OGS shall be determined by use of a minimum ten (10) years of local historical rainfall data provided by Environment Canada. Sizing shall also be determined by use of the sediment removal performance data derived from the ISO 14034 ETV third-party verified laboratory testing data from testing conducted in accordance with the Canadian ETV protocol Procedure for Laboratory Testing of Oil-Grit Separators, as follows:

3.2.1 Sediment removal efficiency for a given surface loading rate and its associated flow rate shall be based on sediment removal efficiency demonstrated at the seven (7) tested surface loading rates specified in the protocol, ranging 40 L/min/m^2 to 1400 L/min/m^2, and as stated in the ISO 14034 ETV Verification Statement for the OGS device.

3.2.2 Sediment removal efficiency for surface loading rates between 40 L/min/m^2 and 1400 L/min/m^2 shall be based on linear interpolation of data between consecutive tested surface loading rates.

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

3.2.4 Sediment removal efficiency for surface loading rates greater than the highest tested surface loading rate of 1400 L/min/m^2 shall assume zero sediment removal for the portion of flow that exceeds 1400 L/min/m^2, and shall be calculated using a simple proportioning formula, with 1400 L/min/m^2 in the numerator and the higher surface loading rate in the denominator, and multiplying the resulting fraction times the sediment removal efficiency at 1400 L/min/m^2.

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

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

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

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

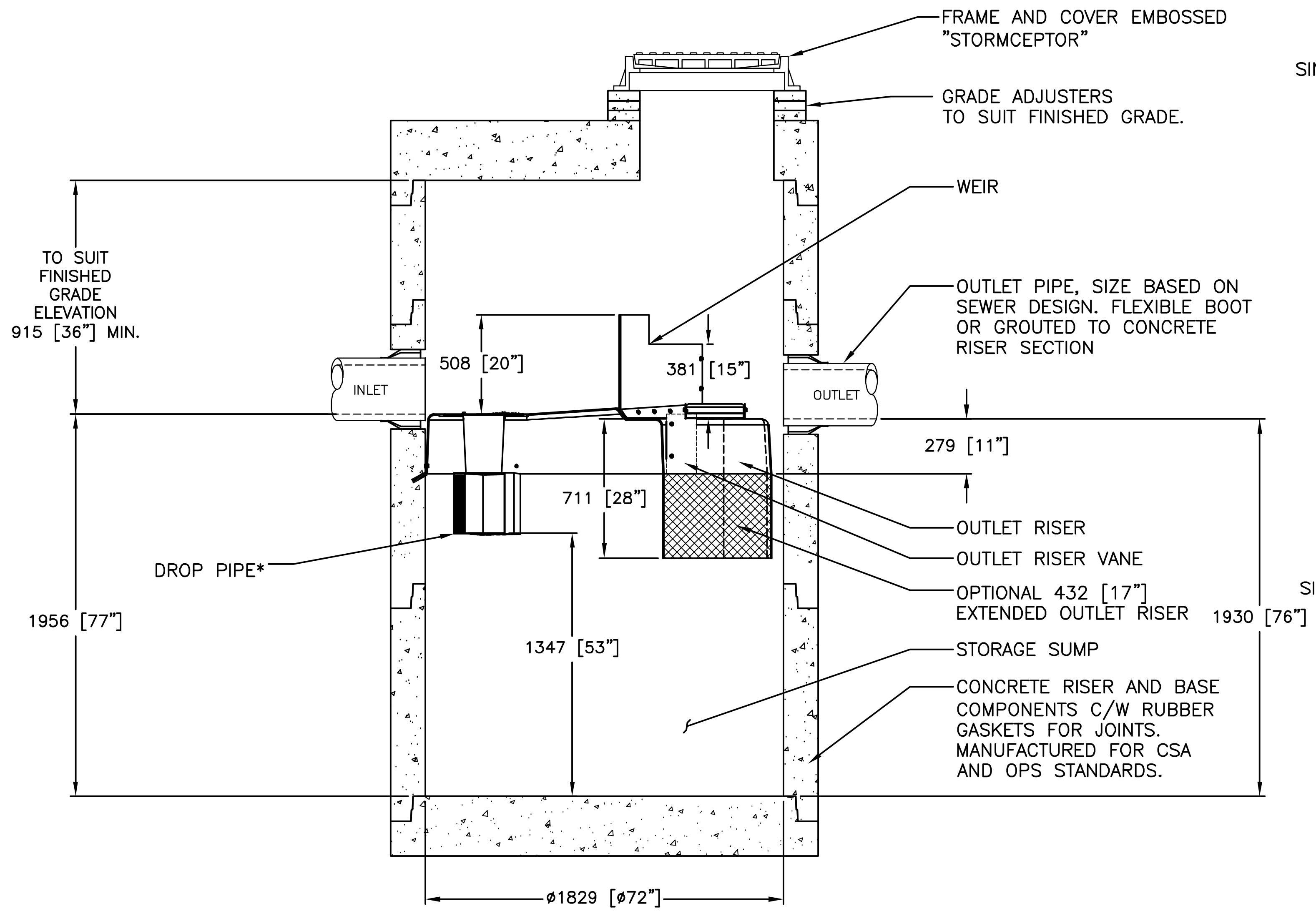
3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to

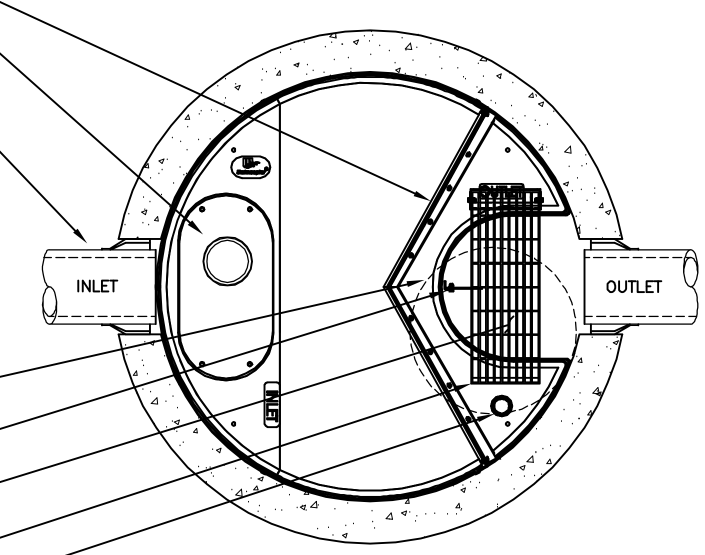
assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m^2 to 2600 L/min/m^2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

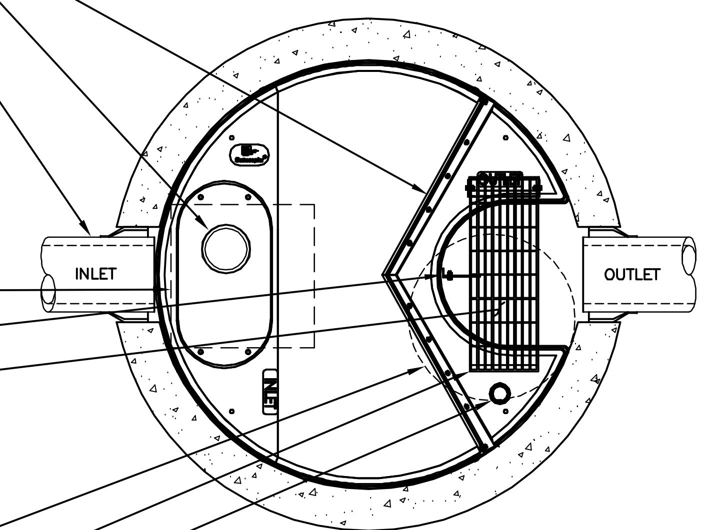
DRAWING NOT TO BE USED FOR CONSTRUCTION



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 EF6 AND 535 L/min/m^2 (13.1 gpm/ft^2) FOR STORMCEPTOR EFO6 (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.

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).

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.

STANDARD DETAIL
NOT FOR CONSTRUCTION

SITE SPECIFIC DATA REQUIREMENTS

STORMCEPTOR MODEL	EFO6				
STRUCTURE ID					*
HYDROCARBON STORAGE REQ'D (L)					*
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	05/26/17	INITIAL RELEASE	JSK

Stormceptor® EF

SCALE = NTS

imbrium

DATE: 10/13/2017	
DESIGNED: JSK	DRAWN: JSK
CHECKED: BSF	APPROVED: SP
PROJECT No.: EFO6	SEQUENCE No.: *
SHEET: 1 OF 1	

I:\IMBRIUM\PRODUCTS\STORMCEPTOR EF\40 DRAWINGS & DETAILS\STANDARD DETAILS\EFO STANDARD DETAILS\EFO6-DETAIL.DWG 4/12/2019 11:05 AM