FUNCTIONAL SERVICING & STORMWATER MANAGEMENT REPORT 13290 NUNNVILLE ROAD

TOWN OF CALEDON

PREPARED FOR:

BOLTON SUMMIT DEVELOPMENTS INC.

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
2800 HIGH POINT DRIVE, SUITE 100
MILTON, ON L9T 6P4

MARCH 2023

CFCA FILE NO. 649-6278

CROZIER
CONSULTING ENGINEERS

Revision Number	Date	Comments
Rev 0	April 13, 2022	Issued for 1st Submission
Rev 1	March 6, 2023	Issued for 2nd Submission

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1.0 INTRODUCTION

C.F. Crozier & Associates Inc. (Crozier) was retained by Bolton Summit Developments Inc. (BSDI) to prepare a Functional Servicing and Stormwater Management Report in support of the Zoning By-Law Amendment and Official Plan Amendment for the proposed development located at 13290 Nunnville Road in the Town of Caledon.

This report demonstrates how the proposed development's functional servicing and stormwater management will integrate with the area's existing water, sanitary and stormwater infrastructure.

2.0 SITE DESCRIPTION

The proposed development is part of an established residential area in Bolton. The property is located at 13290 Nunnville Road. The site currently consists of one existing residential building adjacent to a forested area. The proposed development covers an area of approximately 0.86 ha. The developable area is proposed to include 15 townhouses comprised of 3 separate blocks, a private road, and associated landscaped areas. The remainder of the site is environmentally sensitive and is regulated by the Toronto and Region Conservation Authority (TRCA).

The subject property is bounded by:

- A TRCA Regulated Environmental Protection Area (EPA) to the north and west
- Nunnville Road to the east
- An Existing residential property to the south

3.0 WATER SERVICING

The Region of Peel is responsible for the operation and maintenance of the public water supply and treatment system in the Town of Caledon. Any local water supply system will connect to the existing or proposed Region's municipal water network.

3.1 Existing Water Servicing

According to Berkshire Homes Development as-constructed drawing 36209-D (A.M. Candaras Associates, May 2006), there is an existing 150 mm diameter PVC watermain along Nunnville Road with a plug and blowoff valve located at the northwest corner of Bateman Lane and Nunnville Road. An existing fire hydrant is also located at the northwest corner of Bateman Lane and Nunnville Road.

3.2 Design Water Demand

The population density, provided by the Region of Peel, was used to determine an equivalent population estimate for the proposed residential development. The results are provided in Table 1 and detailed calculations are provided in Appendix A.

Table 1: Equivalent Population Estimate

Number of Units	Persons/Unit	Total Persons
15	3.4	51

The Region of Peel Watermain Design Criteria (June 2010) was used to determine the maximum domestic water demand generated by the proposed development based on the equivalent population estimate for the site. Table 2 summarizes the estimated design water demand. Appendix A contains detailed calculations for the required water demand.

Table 2: Estimated Design Water Demand

Standard	Average Daily Demand (L/s)	Maximum Daily Demand (L/s)	Peak Hourly Demand (L/s)
Region of Peel Watermain Design Criteria (June 2010)	0.17	0.33	0.50

The domestic water service will be designed to convey a peak domestic design water demand of 0.50 L/s.

3.3 Fire Flow Demand

The Fire Underwriters Survey method (1999) was used to estimate the fire flow demand for the proposed development. Based on dwelling gross floor area and exposure distance (VA3 Design, February 2023), the preliminary fire demand using this method is 234 L/s for a minimum duration of 3 hours. Detailed calculations are provided in Appendix A. The calculation is based on the assumptions that the proposed building will be made from Type 5 wood frame construction, potential to contain rapid burning fire hazards, and will not have an automatic sprinkler system.

Hydrant flow testing was carried out on April 18, 2019, by Aquazition on the existing 150 mm diameter municipal watermain on Nunnville Road. Based on the hydrant test results, at 138 kPa (20 psi) residual pressure, a minimum of 242 L/s (3,839 US GPM) projected flow is available within the 150 mm diameter municipal watermain on Nunnville Road. Detailed results of the hydrant flow test and projected fire flows are provided in Appendix A.

The Region of Peel developed water modeling based on our Single Use Demand Table and determined there was not enough fire flow to support the required demand for the existing 150 mm watermain on Nunnville Road, when extended into the subject site. To support the required demand to the subject site, an agreement was made between the Region of Peel and the Owner to upgrade the 150mm diameter watermain on Nunnville Road to a 200mm diameter, at the Owner's expense. Correspondence dated January 12, 2023, is found in Appendix A.

3.4 Proposed Water Servicing

The proposed development will be serviced by a proposed upgraded 200mm diameter watermain commencing at the intersection of Allan Drive and Sant Farm Drive and then running north to Riverwood Terrace, then running east along Riverwood Terrace to Nunnville Road, then running north along Nunnville Road to the proposed development. The units will be serviced by 25 mm diameter domestic water services which will connect to the proposed watermain within the private road. Two (2) fire hydrants are also proposed to provide the required fire suppression coverage for the proposed development.

4.0 SANITARY SERVICING

The Region of Peel is responsible for the operation and maintenance of the public sewage collection and treatment system in the Town of Caledon. Any local sewage system will connect to the Region's municipal sanitary sewage network.

4.1 Existing Sanitary Servicing

According to Southridge Estates Phase 7 as-constructed drawing 25231-D (Falby Burnside & Associates, May 1997) there is an existing 250 mm diameter sanitary sewer flowing south on Nunnville Road. Additionally, according to the Nunnville Road issued for construction drawings 69958-D (Region of Peel, July 2018) there is a proposed 900 mm diameter trunk sanitary sewer flowing south on Nunnville Road which will connect to the existing trunk sanitary sewer on Albion-Vaughan Road. According to the issued for construction drawings, a 250 mm diameter sanitary sewer is proposed to provide sanitary service from the site to the trunk sewer.

4.2 Design Sanitary Flow

The Region of Peel Sanitary Design Criteria (March 2017) and the equivalent population estimate from Section 3.2, were used to determine the estimated design sanitary flow for the proposed development. Estimated design sanitary calculations are provided in Table 3, and detailed calculations are provided in Appendix B.

Table 3: Estimated Design Sanitary Demand

Standard	Average Day (L/s)	Peaking Factor	Infiltration Flow (L/s)	Total Flow (L/s)
Region of Peel Sanitary Design Criteria (March 2017)	0.18	4.00	0.08	0.80

The proposed sanitary service must convey a total design sanitary demand of 0.80L/s determined according to the Region of Peel Sanitary Design Criteria (March 2017).

4.3 Proposed Sanitary Servicing

The proposed development will be serviced by a 250 mm diameter sanitary sewer at a minimum slope of 1% which will connect to the future 250 mm diameter sanitary sewer (completed by others) within Nunnville Road.

5.0 DRAINAGE CONDITIONS

5.1 Existing Drainage Conditions

According to the topographic survey (R-PE Surveying Ltd., February 2022) the site slopes from south to north and existing stormwater flows are conveyed overland to the TRCA Environmental Protection Area (EPA) Regulated Lands and towards adjacent properties on Old King Road and Deer Hollow Court, ultimately to the Humber River.

- Catchment 101 (A = 0.77 ha; RC = 0.30) demonstrates drainage from the south of the site discharging uncontrolled to the TRCA EPA regulated land that surrounds the site on north, east and west.

- Catchment 102 (A = 0.08 ha; RC = 0.25) demonstrates drainage form the southeast corner of the site discharging uncontrolled minor flows towards a catch basin located on the southeast portion of the property. Flows are discharged to a headwall adjacent to the Nunnville Road pedestrian walkway towards Old King Road within the TRCA EPA regulated lands to the north, east and west. Major flows also drain to the TRCA EPA regulated land that surrounds the site.

Figure 1 illustrates the delineation of the drainage areas and existing drainage conditions.

5.2 Proposed Drainage Conditions

The developable area is proposed to include 15 townhouses comprised of 3 separate blocks, a private road, and associated landscaped areas. Stormwater flows within the total property area are considered for this analysis. Lands outside the development limit will maintain their existing drainage patterns.

The proposed development has been divided into two post-development stormwater catchment areas as shown on Figure 2 Post-Development Drainage Plan**.** The grading of the proposed development results in the following post-development drainage catchments:

- Catchment UC1 (A = 0.64 ha; RC = 0.36) discharges uncontrolled to the TRCA EPA regulated lands and adjacent properties on Old King Road and Deer Hollow Court, ultimately to the Humber River maintaining existing drainage patterns. Post-development uncontrolled peak flows will be equal to or less than pre-development peak flows.

- Catchment 201 (A = 0.18 ha; RC = 0.66) minor flows will be controlled using an orifice tube and an oversized concrete pipe for stormwater storage. Minor flows will be conveyed to the existing storm sewer system on Nunnville Road which discharge via a headwall to the existing concrete channel adjacent to the Nunnville Road walkway within the TRCA EPA regulated land, ultimately draining to Old King Road and then the Humber River. Major flows will be conveyed overland to same ditch on Nunnville Road.

- Catchment 202 (A = 0.02 ha; RC = 0.37) minor flows will be conveyed to the relocated existing catchbasin located in the southeast corner of the site (previously conveyed Catchment 102 minor flows) and major flows will be conveyed overland to a ditch on Nunnville Road within the TRCA EPA regulated land, ultimately draining to Old King Road and then the Humber River. The relocated catchbasin will continue to receive the existing flows from the pre-development condition.

In accordance with Town of Caledon standards, stormwater flows will be attenuated so the post-development peak flows for all storm events match or are less than the pre-development peak flows for all storm events. The controlled Catchment 201 will be controlled by a 44 mm diameter orifice tube downstream of a proposed 1200 mm diameter storm sewer superpipe which will be used to attenuate excess flows.

Emergency flows will be conveyed to TRCA EPA regulated land and the ditch along the Nunnville Road right-of-way, ultimately draining to Old King Road and then the Humber River. The overland flow route for an emergency flow scenario is outlined in the Preliminary Grading Plan C103 and Figure 2.

6.0 STORMWATER MANAGEMENT

The proposed stormwater management design must comply with the Town of Caledon Development Standards Manual (V5, 2019). Table 4 provides a summary of the stormwater management criteria based on the stormwater management design guidelines.

Table 4: Summary of Stormwater Management Criteria

Control Parameter	Catchment 202
Quantity Control	Post-development peak stormwater flows must be equal to or less than pre-development peak stormwater flows.
Quality Control	Achieve Ontario Ministry of the Environment, Conservation and Parks (MECP) Enhanced Level of protection (80% total suspended solids (TSS) removal).
Water Balance	Retain 5 mm rainfall event on-site.
Erosion and Sediment Controls	Provided during construction and until the site is stabilized.

6.1 Stormwater Quantity Control

The Modified Rational Method was used to determine the pre-development and post-development flow rates for the site using the Town's IDF rainfall data according to Town Standard Drawing No. 103. The peak flow rates were then used to determine if any stormwater quantity control was required for the proposed development. Detailed Modified Rational Method calculations are included in Appendix C.

The following section will consider two outlets, which is the TRCA EPA regulated lands. The outlet to the regulated lands includes pre-development Catchment 101 and 102, and post-development Catchments UC1, 201 and 202. Table 5 summarizes the pre-and post-development peak flows to the TRCA EPA regulated lands.

Table 5: TRCA EPA Regulated Lands

Storm Event (yr)	Flow Rates (L/s)		
	Pre-Development Flows		Post-Development Flows
	Uncontrolled Flows		Uncontrolled Flows
	Q_{101}	Q_{target}	Q_{UC1}
2	55.4	**55.4**	**55.2**
5	70.9	**70.9**	**70.7**
10	86.8	**86.8**	**86.5**
25	101.2	**101.2**	**100.9**
50	114.0	**114.0**	**113.6**
100	127.1	**127.1**	**126.7**

As presented in Table 5, the post-development peak flows to the regulated lands are less than the pre-development peak flows. Therefore, the stormwater quantity control criterion to this outlet is satisfied.

Controlled stormwater from Catchment 201 and will be conveyed to the existing 375 mm diameter storm sewer located on Nunnville Road. A 44 mm diameter orifice tube downstream of a 97 m long

1200 mm diameter concrete oversized pipe network which will restrict peak flow to achieve the quantity control criterion. The concrete oversized pipe will retain the attenuated peak flows from the 2-year to 100-year storm events. The 100-year high-water level will be contained within the pipe. A summary of the target peak flows and subsequent required storage volumes is presented in Table 6.

Table 6: Summary of Target Peak Flow Rates into Nunnville Sewer and Storage Volumes

Storm Event (yr)	Flow Rates (L/s)						Storage (m3)
	Pre-Development	Post-Development					
		Uncontrolled Flows		Target Control Flow	Controlled Flow	Total Flow	Required Storage
	Q_{102}	Q_{201}	Q_{202}	$Q_{201\text{-Target}} = Q_{102} - Q_{202}$	Q_{201}	Q_{outlet}	
2-yr	**4.8**	29.2	**2.7**	2.1	**2.1**	**4.8**	**29**
5-yr	**6.1**	37.3	**3.5**	2.6	**2.5**	**6.0**	**44**
10-yr	**7.5**	45.7	**4.3**	3.2	**3.2**	**7.5**	**52**
25-yr	**8.8**	53.3	**5.0**	3.8	**3.6**	**8.6**	**65**
50-yr	**9.9**	60.0	**5.6**	4.2	**3.8**	**9.5**	**75**
100-yr	**11.0**	66.9	**6.3**	4.7	**4.1**	**10.4**	**85**

As shown in Table 6, a 44 mm diameter orifice tube is required for Catchment 201 to control post-development peak flows to pre-development peak flows and meet the quantity control criteria.

6.2 Stormwater Quality Control

Stormwater quality controls for the site must incorporate measures to provide an Enhanced Level of Protection (Level 1) according to the MECP (March 2003) guidelines. Enhanced water quality protection involves the removal of at least 80% of total suspended solids (TSS) from 90% of the annual runoff volume. An area breakdown and associated TSS removal rate is provided in Table 7.

Table 7: Area Breakdown and Associated TSS Removal

Catchment		Area (m2)	% of Total Development Area	TSS Removal Efficiency	Total TSS Removal
Catchment UC1	Landscape and Rooftop	6410	75.4%	80%	60.3%
Catchment 201	Jellyfish Filter	1842	21.7%	89%	19.3%
Catchment 202	CB Shield	248	2.9%	57%	1.7%
Total Site		**8500**	**100.0%**	**-**	**81.3%**

Catchment UC1, which discharges uncontrolled to the TRCA EPA regulated lands, are landscaped areas that naturally achieve 80% TSS removal efficiency. A Jellyfish filter will be used to treat the controlled discharge from Catchment 201 and will apply 89% TSS Removal Efficiency. A CB Shield will be used within the relocated catchbasin to treat the discharge from Catchment 202 and will apply a 57% TSS Removal Efficiency. The resulting combined TSS removal efficiency for the site is 81.3%, therefore the quality control criterion is achieved.

6.3 Water Balance

The minimum volume requirement to promote water balance is the retention of a 5 mm rainfall event. The water balance retention volume was calculated considering initial abstraction of runoff based on various surface types.

Infiltration of runoff from the hard surfaces was considered. Based on the Geotechnical Investigation Report prepared by Soil Engineers Ltd. dated March 2022, the existing native soils have low permeability and less suitable for infiltration practices. Therefore, water balance for the proposed development will be achieved through an additional 150 mm topsoil layer (enhanced topsoil). The water balance deficit from the impervious areas will be provided by the total topsoil depth of 300mm per the Town of Caledon Development Standards Manual (V5, 2019). A storage volume of approximately 6.0 m^3 is required to achieve the water balance criteria (5mm x 0.12 ha of impervious area in Catchment 201 and 202).

The total water balance volume will be stored in the topsoil of the landscaped area in Catchment 201 and 202 (0.08 ha). Using typical topsoil parameters (soil porosity = 0.47; soil field capacity = 0.32), the first 150 mm of topsoil is available for initial abstraction and has approximately 18.0 m^3 of capacity for rainfall storage. Since the capacity of storage in the topsoil and the physical volume of rainfall exceed the required storage volume, we conclude that a total topsoil depth of 300 mm will successfully retain 6.0 m^3 of rainfall volume. Detailed calculations for the topsoil retention are included in Appendix C.

7.0 EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION

Erosion and sediment controls (ESC) will be installed prior to the start of any construction activities and will be maintained until the site is stabilized or as directed by the Site Engineer or the Town of Caledon. The contractor will inspect the ESC after each significant rainfall event to ensure they are maintained in proper working condition.

Sediment Control Fencing

Sediment control fencing in accordance with Town standard drawing 304 will be installed on the perimeter of the site to intercept sheet flow. Adjacent to the sensitive EPA lands, double silt fence with straw bales will be installed for additional protection. Based on field decisions, the Site Engineer and the Owner may add additional sediment control fencing prior to, during, and following construction.

Rock Mud Mat

A rock mud mat will be installed at the entrance to the construction zone in order to prevent mud tracking from the site onto the surrounding lands and perimeter roadway network. All construction traffic will be restricted to this access only.

Sediment Control for Catchbasins

Sediment control device will be installed in the existing nearby storm sewer catch basins. The sediment control device will provide sediment control to prevent silt and sediment from entering the stormwater system.

8.0 CONCLUSIONS & RECOMMENDATIONS

The proposed development can be serviced for water, sanitary, and stormwater in accordance with the Town of Caledon requirements and standards. Our conclusions and recommendations include:

1. Water demand for the proposed development will be provided using individual 25 mm domestic water services connected to the proposed 200 mm diameter PVC watermain within the private road. The proposed watermain will connect to the proposed 200mm diameter watermain on Nunnville Road.

2. Two (2) fire hydrants are proposed to provide fire suppression coverage for the development.

3. Sanitary servicing for the proposed development will be provided using a 250 mm diameter sanitary sewer, which connects to the future 250mm diameter sanitary sewer located on Nunnville Road.

4. Stormwater runoff from Catchment UC1 will flow uncontrolled to the TRCA EPA regulated lands outlet. Stormwater runoff from Catchment 201 will flow controlled to the existing storm sewer system located on Nunnville Road. Stormwater runoff from Catchment 202 will flow uncontrolled to the existing storm sewer system located on Nunnville Road via the relocate catchbasin.

5. Stormwater quantity control has been provided using a 44 mm diameter orifice tube and a 97 m long 1200 mm diameter storm concrete oversized pipe which is sized to contain the attenuated post-development peak flows up to the 100-year storm event.

6. A combination of landscaped areas and a Jellyfish filter will provide an enhanced level of protection (81.3% TSS removal for total site) for stormwater quality control for Catchment 201.

7. Water balance for the proposed development will be achieved using enhanced topsoil over the landscaped area in Catchment 201 and 202, providing 18.0 m^3 of storage.

8. Erosion and Sediment Controls will be implemented on-site during construction and will be maintained until the site is stabilized.

Based on the above conclusions we support the proposed development application from the perspective of water supply, sanitary servicing, and stormwater management.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.

Jayesh Boily, E.I.T.
Land Development

C.F. CROZIER & ASSOCIATES INC.

Peter Smuczak, P.Eng.
Project Engineer

JB/cj

I:\600\649 - Bolton Gateway Developments Inc\6278- 13290 Nunnville Rd\Reports\2nd Submission (Civil)\2023.03.06_(0649-6278)_ 13290 Nunnville Rd_FSRSWM.docx

APPENDIX A

Water Demand Calculations

Connection Demand Table

WATER CONNECTION

Connection point [3]			
Existing 150mm diameter watermain on Nunnville Road ID: WND6569890-WND6569891			
Pressure zone of connection point		6	
Total equivalent population to be serviced [1]		51 persons	
Total lands to be serviced		0.38 ha	
Hydrant flow test			
	Hydrant flow test location	Nunnville Road	
	Pressure (kPa)	Flow (in l/s)	Time
Minimum water pressure	379	92	
Maximum water pressure	448	55	

No.	**Water Demand**		
	Demand type	**Demand**	**Units**
1	Average day flow	0.17	l/s
2	Maximum day flow	0.33	l/s
3	Peak hour flow	0.50	l/s
4	Fire flow [2]	234.00	l/s
Analysis			
5	Maximum day plus fire flow	234.50	l/s

WASTEWATER CONNECTION

Phase 1

Connection point [4]	
Future 250mm diameter PVC sanitary sewer on Nunnville Road Wastewater Line ID: SMH6579831-SMH6579832	
Total equivalent population to be serviced	51 persons
Total lands to be serviced	0.38 ha
6 Wastewater sewer effluent (l/s)	0.80

[1] Please refer to design criteria for population equivalencies
[2] Please reference the Fire Underwriters Survey Document
[3] Please specify the connection point ID
[4] Please specify the connection point (wastewater line or manhole ID)
Also, the "total equivalent population to be serviced" and the "total lands to be serviced" should reference the connection point. (the FSR should contain one copy of Site Servicing Plan)

Please include the graphs associated with the hydrant flow test information table
Please provide Professional Engineer's signature and stamp on the demand table
All required calculations must be submitted with the demand table submission.

CROZIER
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Project: 13290 Nunnville Rd
Project No.: 649-6278
Prepared By: JL
Checked By: JB/PS
Date: 2022.03.30
Updated: 2023.02.15

WATER DEMAND CALCULATIONS

13290 Nunnville Road, Town of Caledon

Note: Based on Site Plan provided by VA3 Design Inc. dated February 1, 2023

			References
Population Density	3.4	persons/unit	Population density as per email corespondence with Iwona Frandsen from the Region of Peel.
Number of Units	15		
Total Population	51	persons	
Average Daily Demand	280	L/cap/day	Region of Peel Public Works Design, Specifications & Procedures Manual, Linear Infrastructure, Watermain Design Criteria, Table 1, Section 2.3 (Revised June 2010)
	14,280.00	L/day	
	0.17	**L/s**	
Maximum Daily Demand Peaking Factor	2.0		Region of Peel Public Works Design, Specifications & Procedures Manual, Linear Infrastructure, Watermain Design Criteria, Table 1, Section 2.3 (Revised June 2010)
Maximum Hourly Demand Peaking Factor	3.0		
Maximum Daily Flow	28,560.00	L/day	
	0.33	**L/s**	
Peak Hour Flow	42,840.00	L/day	
	0.50	**L/s**	

5-200 Connie Cres. Concord ON L4K 1M1 Phone 416-883-9777 Fax 905-303-6977

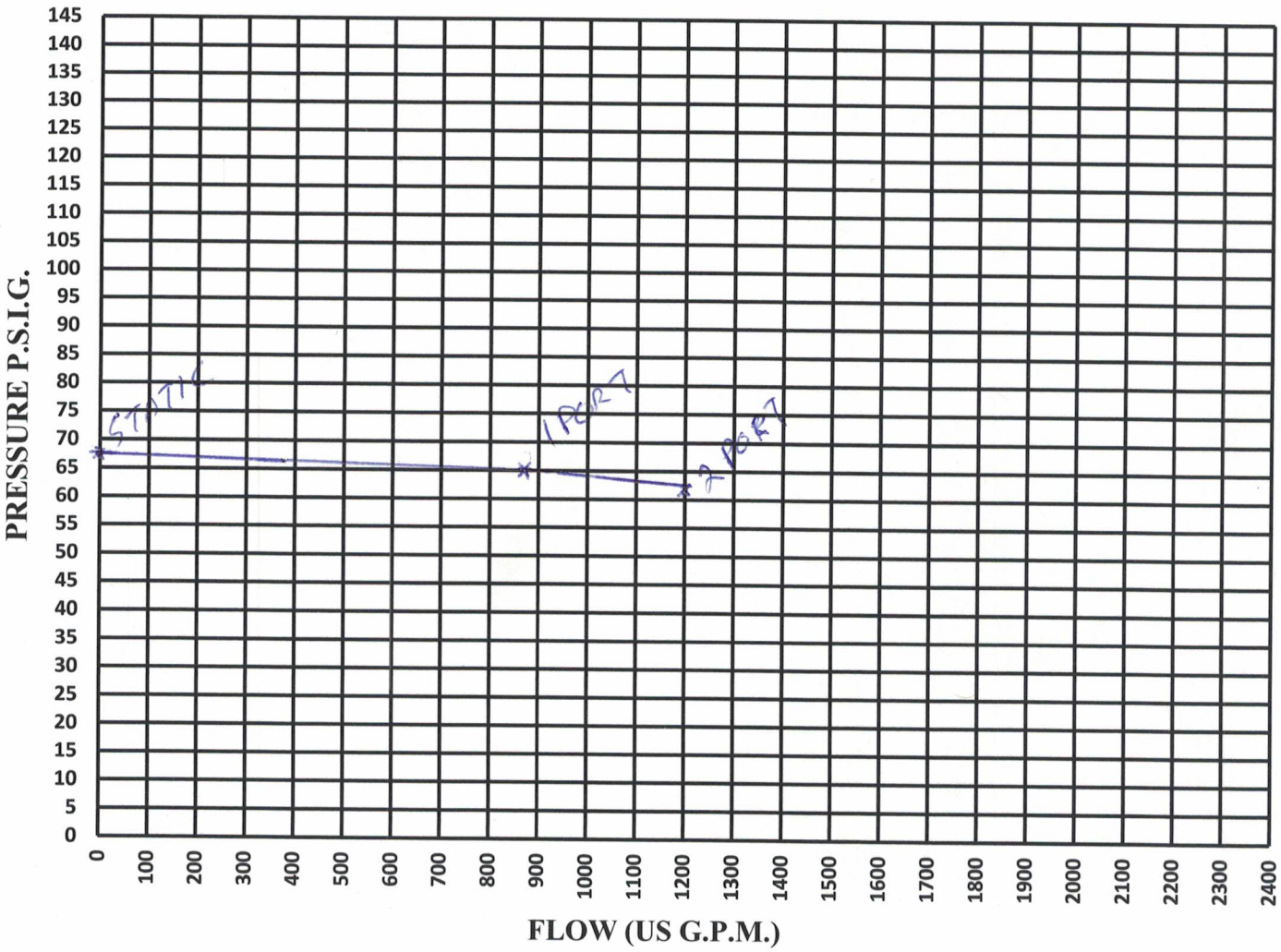
FLOW TEST REPORT

LOCATION OF RESIDUAL HYDRANT 13160 Nunnville Road

LOCATION OF FLOW HYDRANT 13259 Nunnville Road

TIME OF TEST 12:00 WATERMAIN SIZE 150mm STATIC PRESSURE 67

NUMBER OF OUTLETS	PITOT PRESSURE	FLOW (US G.P.M.)	RESIDUAL PRESSURE
One 2 ½" hydrant port	27	870	65
Two 2 ½" hydrant port	13	1207	62



PROJECT LOCATION Nunnville Road, Bolton DATE 04/18/19

COMPANY NAME SALV Inc. (PRINT NAME) AQUAZITION EMPLOYEE JASON WALING (PRINT NAME)

5-200 Connie Cres. Concord ON L4K 1M1 Phone 416-883-9777 Fax 905-303-6977

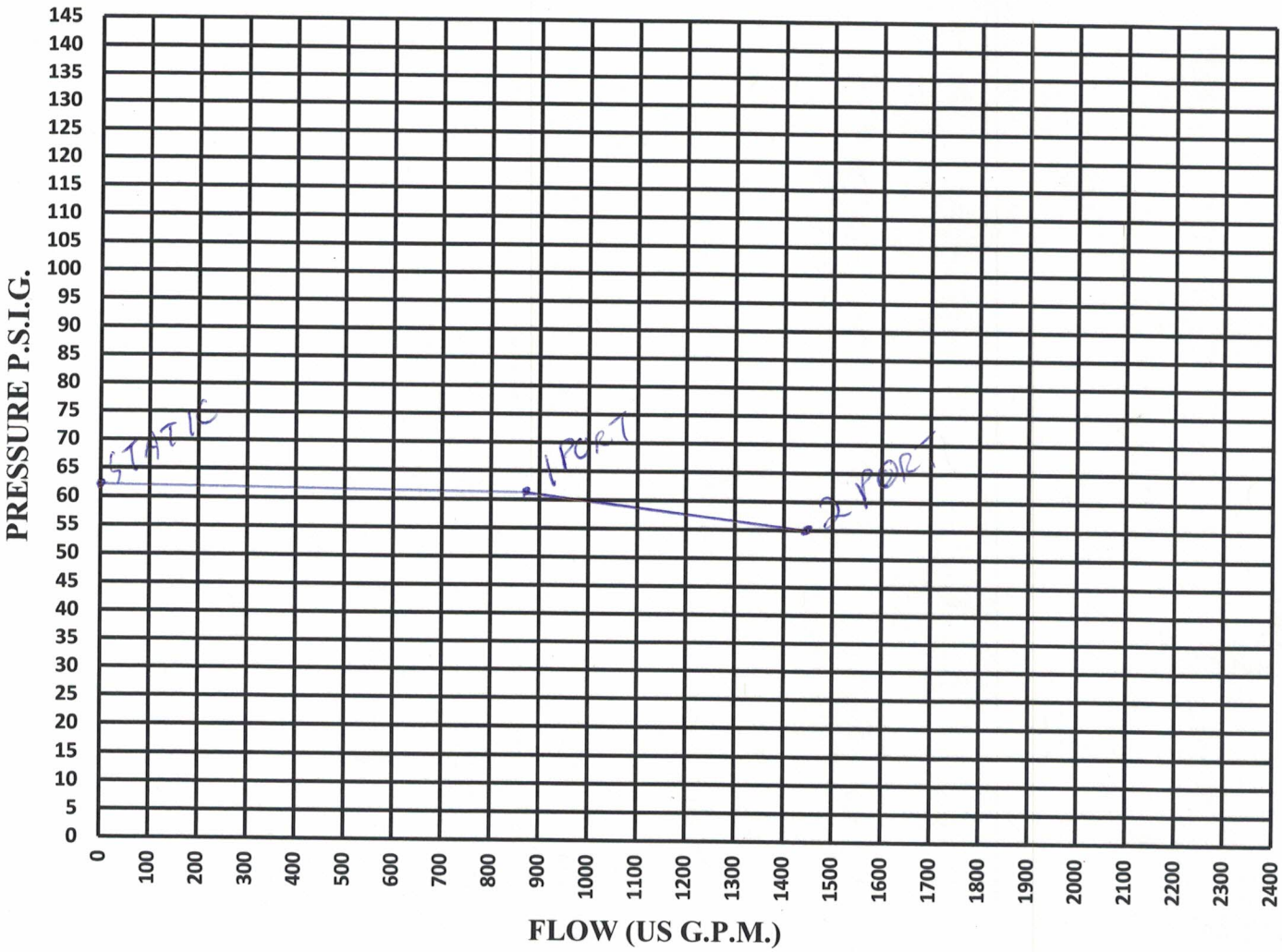
FLOW TEST REPORT

LOCATION OF RESIDUAL HYDRANT 13259 NUNNVILLE RD

LOCATION OF FLOW HYDRANT 13160 NUNNVILLE RD

TIME OF TEST 12:15 WATERMAIN SIZE 150 mm STATIC PRESSURE 62

NUMBER OF OUTLETS	PITOT PRESSURE	FLOW (US G.P.M.)	RESIDUAL PRESSURE
One 2 ½" hydrant port	27	870	61
Two 2 ½" hydrant port	19	1459	55



PROJECT LOCATION NUNNVILLE RD BOLTON DATE 04/18/19

COMPANY NAME SALV INC AQUAZITION EMPLOYEE J. MORGBIN

(PRINT NAME) (PRINT NAME)

CROZIER
CONSULTING ENGINEERS

PROJECT: Nunnville Road
PROJECT No.: 649-6278
DATE: 2019.04.23
UPDATE: 2022.04.13
DESIGN: JB
CHECK: PS

Projected Fire Flow Calculations - 1

Test	Hydrant Location / ID	Static Pressure	Residual Pressure during Test	Flow from Hydrant Test	Desired Residual Pressure*	Projected Fire Flow Available at 20 psi	
		Ps	Pt	Qt	Pr	Qr	
		(psi)	(psi)	(USGPM)	(psi)	(USGPM)	L/s
1	Nunnville Road	67	65	870	20	4,785	302
2			62	1207		4,048	255

$Q_r = Q_t \times ((P_s - P_r)/(P_s - P_t))^{0.54}$ Formula to determine available flow as per AWWA M17 (1989)

NOTE: Projected fire flows are calculated on the basis of hydrant tests carried out by Aqualization on April 18, 2019 at 12:15 pm.

Note Region of peel operation pressures 20-100 psi

CROZIER CONSULTING ENGINEERS

PROJECT: Nunnville Road
PROJECT No.: 649-6278
DATE: 2019.04.23
UPDATE: 2022.04.13
DESIGN: JB
CHECK: PS

Projected Fire Flow Calculations - 2

Test	Hydrant Location / ID	Static Pressure	Residual Pressure during Test	Flow from Hydrant Test	Desired Residual Pressure*	Projected Fire Flow Available at 20 psi	
		Ps	Pt	Qt	Pr	Qr	
		(psi)	(psi)	(USGPM)	(psi)	USGPM	L/s
1	Nunnville Road	62	61	870	20	6,547	413
2			55	1459		3,839	242

$Q_r = Q_t \times ((P_s - P_r)/(P_s - P_t))^{0.54}$ Formula to determine available flow as per AWWA M17 (1989)

NOTE: Projected fire flows are calculated on the basis of hydrant tests carried out by Aqualization on April 18, 2019 at 12:15 pm.

Note Region of peel operation pressures 20-100 psi

CROZIER CONSULTING ENGINEERS

13290 Nunnville Road, Town of Caledon
Fire Flow Calculation, North Block (6 Units)

Date: 2022.03.07
Designed By: JB
Checked By: MB
Updated: 2023.02.15

Water Supply for Public Fire Protection (2020)
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \sqrt{A}$$

where

F = the required fire flow in litres per minute

C = coefficient related to the type of construction:

=	1.5	for **Type V** Wood Frame Construction (all structure elements are constructed entirely or partially of wood or other materials)
=	0.8	for **Type IV-A** Encapsulated Mass Timber Construction (structure elements have a minimum 2-hour fire resistance rating and roof has a minimum 1-hour fire resistance rating, must also meet requirements set out within the 2020 National Building Code of Canada set out for Encapsulated Mass Timber Construction)
=	0.9	for **Type IV-B** Rated Mass Timber Construction (all structure elements have a minimum 1-hour fire resistance rating)
=	1.0	for **Type IV-C** Ordinary Mass Timber Construction (only exterior walls have a minimum 1-hour fire resistance rating, combustible floor and interior)
=	1.5	for **Type IV-D** Un-Rated Mass Timber Construction (exterior walls do not have a minimum 1-hour fire resistance rating, combustible floor and interior)
=	1.0	for **Type III** Odinary Construction (brick or other masonry walls with a minimum 1-hour fire resistnace rating, combustible floor and interior)
=	0.8	for **Type II** Non-Combustible Construction (all structure elements have a minimum 1-hour fire resistance rating and is entirely constructed with noncombustible materials)
=	0.6	for **Type I** Fire-Resistive Construction (all structure elements have a minimum 2-hour fire resistance rating and is entirely constructed with noncombustible materials)

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Refer to page 22 of the Water Supply for Public Fire Protection for details regarding Total Effective Area (A).

Proposed Buildings

GFA of 1 Unit: 190.45 sq.m

A = 1142.70 sq.m.
C = 1.5 **Type V Construction**

Based on correspondence with VA3 Design (Architect) dated October 21, 2022.

Therefore F = 11,155 L/min

No fire walls are assumed.

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	0% (No Change)		

*Refer to Table 3 in the Water Supply for Public Fire Protection for recommended occupancy charges.

Adjustment Factor: **Limited Combustible: -15%**

Reduction: -1,673 L/min
RFF: *9,482 L/min*

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduced by up to 50% for complete automatic sprinkler protection. The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards. 10% may be granted if the water supply is standard for both the system and fire departement hose lines required. Additional credit of up to 10% may be given for a fully supervised system.

Automatic Sprinkler System Design	Credit	
	With Complete Building Coverage	With Partial Building Coverage of X%
Automatic sprinkler protection designed and installed in accordance with NFPA 13	30%	30% x Percentage of Total Floor Area Serviced by Sprinkler System
Water supply is standard for both the system and Fire Department hose lines	10%	10% x Percentage of Total Floor Area Serviced by Sprinkler System
Fully supervised system	10%	10% x Percentage of Total Floor Area Serviced by Sprinkler System

Building will not have automatic sprinklers per NFPA 13 (typical 30% reduction)

Reduction: 0 L/min

13290 Nunnville Road, Town of Caledon
Fire Flow Calculation, North Block (6 Units)

Water Supply for Public Fire Protection (2020)
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	> 30 m	0%
10.1 to 20 m	15%		

Exposed buildings

Description	Distance		
Pr. East Block (3 Unit Block)	15.21 m	15%	1422.30
Pr. South Block (6 Unit Block)	19.28 m	15%	1422.30
			2,845 **L/min Surcharge**

Determine Required Fire Flow

No. 1	11,155		
No. 2	-1,673 reduction		
No. 3	0 reduction		
No. 4	2,845 surcharge		
Required Flow:	**12,327 L/min**		
Rounded to nearest 1000 L/min:	**13,000 L/min**	or	216.7 L/s 3,434 USGPM

Required Flow (L/s):	**217**
Duration (hr):	**2.75**

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	**2.5**
14,000	**3.0**
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

CROZIER CONSULTING ENGINEERS

13290 Nunnville Road, Town of Caledon
Fire Flow Calculation, East Block (3 Units)

Date: 2022.07
Designed By: JB
Checked By: MB
Updated: 2023.02.15

Water Supply for Public Fire Protection (2020)
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \sqrt{A}$$

where

F = the required fire flow in litres per minute

C = coefficient related to the type of construction:

=	1.5	for **Type V** Wood Frame Construction (all structure elements are constructed entirely or partially of wood or other materials)
=	0.8	for **Type IV-A** Encapsulated Mass Timber Construction (structure elements have a minimum 2-hour fire resistance rating and roof has a minimum 1-hour fire resistance rating, must meet requirements set out within the 2020 National Building Code of Canada set out for Encapsulated Mass Timber Construction)
=	0.9	for **Type IV-B** Rated Mass Timber Construction (all structure elements have a minimum 1-hour fire resistance rating)
=	1.0	for **Type IV-C** Ordinary Mass Timber Construction (only exterior walls have a minimum 1-hour fire resistance rating, combustible floor and interior)
=	1.5	for **Type IV-D** Un-Rated Mass Timber Construction (exterior walls do not have a minimum 1-hour fire resistance rating, combustible floor and interior)
=	1.0	for **Type III** Odinary Construction (brick or other masonry walls with a minimum 1-hour fire resistnace rating, combustible floor and interior)
=	0.8	for **Type II** Non-Combustible Construction (all structure elements have a minimum 1-hour fire resistance rating and is entirely constructed with noncombustible materials)
=	0.6	for **Type I** Fire-Resistive Construction (all structure elements have a minimum 2-hour fire resistance rating and is entirely constructed with noncombustible materials)

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Refer to page 22 of the Water Supply for Public Fire Protection for details regarding Total Effective Area (A).

Proposed Buildings

GFA of 1 Unit: 190.45 sq.m

A = 571.35 sq.m.
C = 1.5 **Type V Construction**

Based on correspondence with VA3 Design (Architect) dated February 1, 2023

Therefore F = 7,888 L/min

No fire walls are assumed.

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	0% (No Change)		

*Refer to Table 3 in the Water Supply for Public Fire Protection for recommended occupancy charges.

Adjustment Factor: **Limited Combustible: -15%**

Reduction: -1,183 L/min
RFF: 6,705 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduced by up to 50% for complete automatic sprinkler protection. The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards. 10% may be granted if the water supply is standard for both the system and fire departement hose lines required. Additional credit of up to 10% may be given for a fully supervised system.

Automatic Sprinkler System Design	Credit	
	With Complete Building Coverage	With Partial Building Coverage of X%
Automatic sprinkler protection designed and installed in accordance with NFPA 13	30%	30% x Percentage of Total Floor Area Serviced by Sprinkler System
Water supply is standard for both the system and Fire Department hose lines	10%	10% x Percentage of Total Floor Area Serviced by Sprinkler System
Fully supervised system	10%	10% x Percentage of Total Floor Area Serviced by Sprinkler System

Building will not have automatic sprinklers per NFPA 13 (typical 30% reduction)

Reduction: 0 L/min

13290 Nunnville Road, Town of Caledon
Fire Flow Calculation, East Block (3 Units)

Water Supply for Public Fire Protection (2020)
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	>30 m	0%
10.1 to 20 m	15%		

Exposed buildings

Description	Distance			
Pr. South Block (6 Unit Block)	24.29 m	10%	670.48	
Pr. North Block (6 Unit Block)	15.21 m	15%	1005.72	
Ex. Dwelling (13286 Nunnville Rd)	15.21 m	15%	1005.72	
			2,682	**L/min Surcharge**

Determine Required Fire Flow

No. 1	7,888		
No. 2	-1,183 reduction		
No. 3	0 reduction		
No. 4	2,682 surcharge		
Required Flow:	**9,387 L/min**		
Rounded to nearest 1000 L/min:	**10,000 L/min**	or	166.7 L/s
			2,642 USGPM

Required Flow (L/s):	**167**
Duration (hr):	**2.00**

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	**2.0**
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

CROZIER CONSULTING ENGINEERS

13290 Nunnville Road, Town of Caledon
Fire Flow Calculation, South Block (6 Units)

Date: 2022.07
Designed By: JB
Checked By: MB
Updated: 2023.02.15

Water Supply for Public Fire Protection (2020)
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

$$F = 220 * C * \sqrt{A}$$

where

F = the required fire flow in litres per minute

C = coefficient related to the type of construction:

=	1.5	for **Type V** Wood Frame Construction (all structure elements are constructed entirely or partially of wood or other materials)
=	0.8	for **Type IV-A** Encapsulated Mass Timber Construction (structure elements have a minimum 2-hour fire resistance rating and roof has a minimum 1-hour fire resistance rating, must meet requirements set out within the 2020 National Building Code of Canada set out for Encapsulated Mass Timber Construction)
=	0.9	for **Type IV-B** Rated Mass Timber Construction (all structure elements have a minimum 1-hour fire resistance rating)
=	1.0	for **Type IV-C** Ordinary Mass Timber Construction (only exterior walls have a minimum 1-hour fire resistance rating, combustible floor and interior)
=	1.5	for **Type IV-D** Un-Rated Mass Timber Construction (exterior walls do not have a minimum 1-hour fire resistance rating, combustible floor and interior)
=	1.0	for **Type III** Odinary Construction (brick or other masonry walls with a minimum 1-hour fire resistnace rating, combustible floor and interior)
=	0.8	for **Type II** Non-Combustible Construction (all structure elements have a minimum 1-hour fire resistance rating and is entirely constructed with noncombustible materials)
=	0.6	for **Type I** Fire-Resistive Construction (all structure elements have a minimum 2-hour fire resistance rating and is entirely constructed with noncombustible materials)

A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered.

Refer to page 22 of the Water Supply for Public Fire Protection for details regarding Total Effective Area (A).

Proposed Buildings

GFA of 1 Unit: 190.45 sq.m

A = 1142.70 sq.m.
C = 1.5 **Type V Construction**

Based on correspondence with VA3 Design (Architect) dated October 21, 2022.

Therefore F = 11,155 L/min

No fire walls are assumed.

Fire flow determined above shall not exceed:
30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

2. Values obtained in No. 1 may be reduced by as much as 25% for occupancies having low contents fire hazard or may be increased by up to 25% surcharge for occupancies having a high fire hazard.

Non-Combustible	-25%	Free Burning	15%
Limited Combustible	-15%	Rapid Burning	25%
Combustible	0% (No Change)		

*Refer to Table 3 in the Water Supply for Public Fire Protection for recommended occupancy charges.

Adjustment Factor: **Limited Combustible: -15%**

Reduction: -1,673 L/min
RFF: *9,482* *L/min*

Note: Flow determined shall not be less than 2,000 L/min

3. Sprinklers - The value obtained in No. 2 above maybe reduced by up to 50% for complete automatic sprinkler protection. The credit for the system will be a maximum of 30% for an adequately designed system conforming to NFPA 13 and other NFPA sprinkler standards. 10% may be granted if the water supply is standard for both the system and fire departement hose lines required. Additional credit of up to 10% may be given for a fully supervised system.

Automatic Sprinkler System Design	Credit	
	With Complete Building Coverage	With Partial Building Coverage of X%
Automatic sprinkler protection designed and installed in accordance with NFPA 13	30%	30% x Percentage of Total Floor Area Serviced by Sprinkler System
Water supply is standard for both the system and Fire Department hose lines	10%	10% x Percentage of Total Floor Area Serviced by Sprinkler System
Fully supervised system	10%	10% x Percentage of Total Floor Area Serviced by Sprinkler System

Building will not have automatic sprinklers per NFPA 13 (typical 30% reduction)

Reduction: 0 L/min

Water Supply for Public Fire Protection (2020)
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure - To the value obtained in No. 2, a percentage should be added for structures exposed within 45 metres by the fire area under consideration. The percentage shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length and height of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s) and the effect of hillside locations on the possible spread of fire.

Separation	Charge	Separation	Charge
0 to 3 m	25%	20.1 to 30 m	10%
3.1 to 10 m	20%	> 30 m	0%
10.1 to 20 m	15%		

Exposed buildings

Description	Distance			
Pr. North Block (6 Units)	19.28 m	15%	1422.30	
Pr. East Block (3 Units)	24.29 m	10%	948.20	
Ex. Dwelling (13286 Nunnville Rd)	9.34 m	20%	1896.40	
			4,267	**L/min Surcharge**

Determine Required Fire Flow

No. 1	11,155		
No. 2	-1,673 reduction		
No. 3	0 reduction		
No. 4	4,267 surcharge		
Required Flow:	**13,749 L/min**		
Rounded to nearest 1000 L/min:	**14,000 L/min**	or	233.3 L/s 3,698 USGPM

Required Flow (L/s):	**234**
Duration (hr):	**3.00**

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	**3.0**
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

CROZIER
CONSULTING ENGINEERS

13290 Nunnville Road, Town of Caledon
Fire Flow Calculation, Summary
Scenario #0 : No Fire Walls

Date: 2022.03.07
Designed By: JB
Checked By: MB
Updated: 2023.02.15

Fire Underwriters Survey Summary		
Block	**Required Fire Flow** (L/s)	**Duration** (hr)
North	217	2.75
East	167	2.00
South	234	3.00

Peter Smuczak

From: Sam Morra <sammorra@bell.net>
Sent: January 12, 2023 12:11 PM
To: Amaral, Patrick
Cc: Prowse, Dylan; Miriam Polga; Masley, Aleksander; Elizabeth Trent; Peter Smuczak; aclarke@mhbcplan.com
Subject: Re: 13290 Nunnville road, Caledon - Fire flow meeting - POPA 2022-0003 & RZ 2022-0004, 21T-22003C & 21CDM-22003C

Follow Up Flag: Follow up
Flag Status: Flagged

Good afternoon Patrick

Happy New Year!

Hope all is well.

Further to a meeting I had this morning with the Region attended by Miriam Polga, Alex Masley, and Josh Ashurst, Josh was good enough to explain the concepts involved from a Hydrant Flow Test and Water Modeling perspective to attain accurate fire flow values for my development at 13290 Nunnville Rd. Together, Miriam, Josh Alex and I agreed on a desired servicing option. The solution is to tie into the existing 200mm diameter watermain at the corner of Allan Drive and Sant Farm Drive and install a 200mm watermain north on Sant Farm Drive to the north leg of Riverwood Terrace and then proceed east along Riverwood Terrace to Nunnville Rd. and then north along Nunnville Road to my development. Is my understanding that the Region has already performed the modeling for this scenario and it works for my development. I also understand and agree that this improvement to the Watermain system will be 100% at my cost. We will do the design and perform the work as we would normally do for a subdivision with external servicing. I will contact Crozier and get them going on the design as soon as possible so we can coordinate any necessary approvals to run in parallel with the Development Planning Approvals.

I'd like to thank Miriam, Alex and Josh for working with me to arrive at this solution.

Respectfully yours,
Sam Morra, P. Eng.
President
Bolton Summit Developments Inc.
CasaMorra Homes

Sent from my iPhone

APPENDIX B

Sanitary Demand Calculations

CROZIER
CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Prepared By: OS
Checked By: JB
Date: 2022.03.30
Updated: 2023-02-15

SANITARY FLOW CALCULATIONS
13290 Nunnville Road, Town of Caledon

Note: Based on Site Plan provided by VA3 Design Inc. dated February 1, 2023

Total Site Area	0.41	ha	
Population Density	3.4	persons/unit	Population density as per email corespondence with Iwona Frandsen from the Region of Peel.
Number of Units	15		
Total Population	51	persons	
Average daily demand	302.8	L/person/day	Region of Peel 2013 Water and Wastewater Master Plan for the Lake-Based System, Volume IV - Wastewater master Plan, Table 4.1, Section 2.1.1. (March 31, 2014)
Harmon Peaking Factor (M) M = 1+(14/(4+p^0.5))	4.00	(Max Harmon Peaking Factor of 4.00)	Region of Peel Public Works Design, Specifications & Procedures Manual, Linear Infrastructure, Sanitary Sewer Design Criteria, Sectin 2.2 (Modified March 2017).
Average Daily Flow	15,442.80	L/day	
	0.18	**L/s**	
Peak Flow	61,771.20	L/day	
	0.71	**L/s**	
Infiltration	0.20	L/s/ha	Region of Peel 2013 Water and Wastewater Master Plan for the Lake-Based System, Volume IV - Wastewater master Plan, Section 2.1.3. (March 31, 2014)
	0.08	**L/s**	
Total Sanitary Flow	**0.80**	**L/s**	

APPENDIX C

Stormwater Design Calculations

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Modified Rational Calculations - Input Parameters
13290 Nunnville Road, Town of Caledon

Storm Data: Caledon

Time of Concentration: T_c = 10 **min** (per Town of Caledon standards)

Return Period	A	B	C	I (mm/hr)
2 yr	1070	8	0.8759	85.72
5 yr	1593	11	0.8789	109.68
10 yr	2221	12	0.9080	134.16
25 yr	3158	15	0.9335	156.47
50 yr	3886	16	0.9495	176.19
100 yr	4688	17	0.9624	196.54

Pre - Development Conditions			
Catchment ID	**Area** (ha)	**Area** (m^2)	**Weighted Average C**
101	0.77	7,700	0.30
102	0.08	800	0.25
Total Site	**0.85**	8,500	**0.30**

Post- Development Conditions			
Catchment ID	**Area** (ha)	**Area** (m^2)	**Weighted Average C**
UC1	0.64	6,410	0.36
201	0.18	1,842	0.66
202	0.02	248	0.46
Total Site	**0.85**	8,500	

Equations:

Peak Flow
$$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet A$$

Intensity
$$i(T_d) = A / (T + B)^{\wedge}C$$

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Target Flow Rates Summary

NUNNVILLE SEWER FLOW RATES

Storm Event (yr)	Flow Rates (L/s)						Storage (m3)	
	Pre-Development Flows	Post-Development Flows						
		Uncontrolled Flows		Target Control Flow	Controlled Flow	Total Flow		
	Q_{102}	Q_{202}	Q_{201}	$Q_{201}=Q_{102}-Q_{202}$	Q_{201}	Q_{outlet}	Required Storage	Provided Storage
2	**4.8**	2.7	29.2	**2.1**	**2.1**	**4.8**	**29**	**110**
5	**6.1**	3.5	37.3	**2.6**	**2.5**	**6.0**	**44**	
10	**7.5**	4.3	45.7	**3.2**	**3.2**	**7.5**	**52**	
25	**8.8**	5.0	53.3	**3.8**	**3.6**	**8.6**	**65**	
50	**9.9**	5.6	60.0	**4.2**	**3.8**	**9.5**	**75**	
100	**11.0**	6.3	66.9	**4.7**	**4.1**	**10.4**	**85**	

TRCA EPA REGULATED LANDS

Storm Event (yr)	Flow Rates (L/s)		
	Pre-Development Flows		Post-Development Flows
	Uncontrolled Flows		Uncontrolled Flows
	Q_{101}	Q_{target}	Q_{UC1}
2	55.4	**55.4**	**55.2**
5	70.9	**70.9**	**70.7**
10	86.8	**86.8**	**86.5**
25	101.2	**101.2**	**100.9**
50	114.0	**114.0**	**113.6**
100	127.1	**127.1**	**126.7**

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Modified Rational Calculations - 2 -Year Storm Event

Control Criteria

2 yr: Uncontrolled Post-Development Flow:

Q_{201} = 29.2 L/s

Q_{202} = 2.7 L/s

2 yr: Target Flow Rate:

Q_{102} = 4.8 L/s

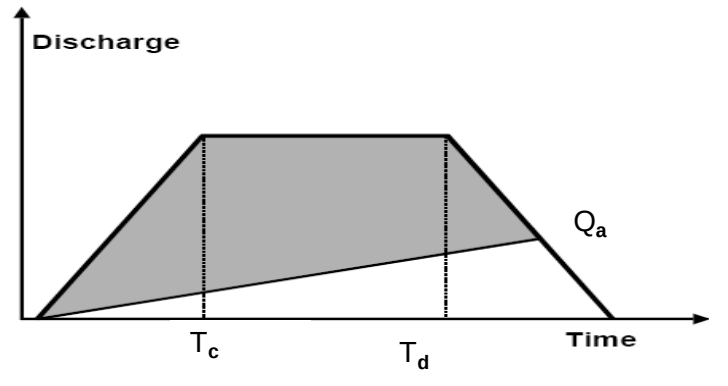
$Q_{Target\ 201}$ = 2.1 L/s

$Q_{orifice\ 201}$ = 2.1 L/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Post} (m^3/s)	S_d (m^3)
10	85.72	600	0.029	16.3
20	58.06	1200	0.020	21.9
30	44.38	1800	0.015	24.7
40	36.14	2400	0.012	26.4
50	30.60	3000	0.010	27.5
60	26.62	3600	0.009	28.3
70	23.60	4200	0.008	28.8
80	21.23	4800	0.007	29.1
90	19.31	5400	0.007	29.3
100	17.74	6000	0.006	29.4
110	16.41	6600	0.006	29.5
120	15.28	7200	0.005	29.4
130	14.30	7800	0.005	29.3
140	13.45	8400	0.005	29.2
150	12.70	9000	0.004	29.0
160	12.04	9600	0.004	28.8
Required Storage Volume:				**29.5**

Peak Flow
$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet$

Storage
$S_d = Q_{post} \bullet T_d - Q_{target} (T_d + T_c) / 2$



Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Modified Rational Calculations - 5 -Year Storm Event

Control Criteria

5 yr: Uncontrolled Post-Development Flow:

Q_{201} = 37.3 L/s

5 yr: Target Flow Rate:

Q_{102} = 6.1 L/s

$Q_{orifice\ 202}$ = 2.5 L/s

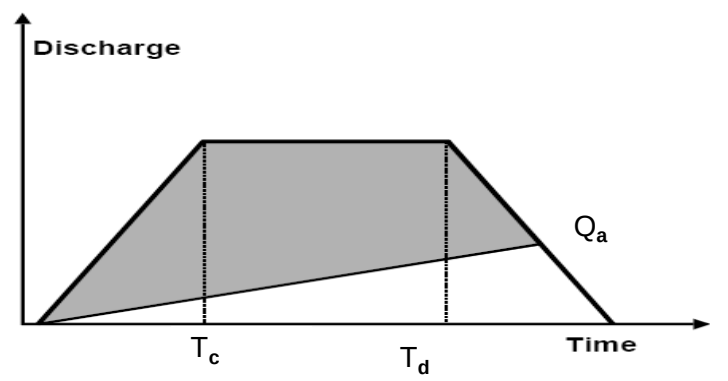
Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Post} (m^3/s)	S_d (m^3)
10	109.68	600	0.037	20.9
20	77.89	1200	0.027	29.6
30	60.92	1800	0.021	34.3
40	50.28	2400	0.017	37.3
50	42.96	3000	0.015	39.4
60	37.60	3600	0.013	40.8
70	33.48	4200	0.011	41.9
80	30.23	4800	0.010	42.6
90	27.58	5400	0.009	43.2
100	25.39	6000	0.009	43.6
110	23.53	6600	0.008	43.8
120	21.95	7200	0.007	44.0
130	20.57	7800	0.007	44.1
140	19.37	8400	0.007	44.1
150	18.31	9000	0.006	44.1
160	17.36	9600	0.006	44.0
Required Storage Volume:				**44.1**

Peak Flow

$$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet$$

Storage

$$S_d = Q_{post} \bullet T_d - Q_{target} (T_d + T_c) / 2$$



Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.08
Updated: 2023.03.02

Modified Rational Calculations - 10 -Year Storm Event

Control Criteria

10 yr: Uncontrolled Post-Development Flow:

Q_{201} = 45.7 L/s

10 yr: Target Flow Rate:

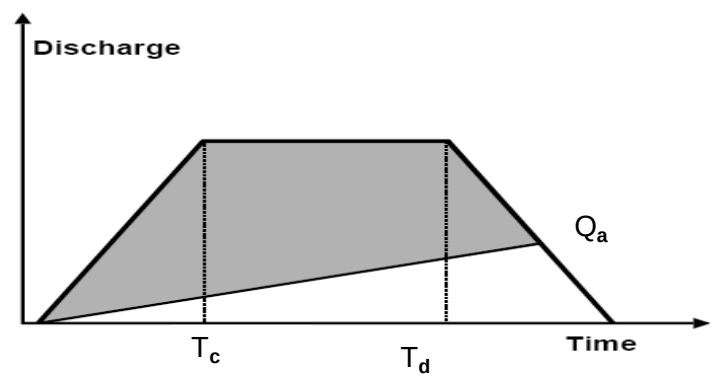
Q_{102} = 7.5 L/s

$Q_{orifice\ 202}$ = 3.2 L/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Post} (m^3/s)	S_d (m^3)
10	134.16	600	0.046	25.5
20	95.47	1200	0.032	36.1
30	74.58	1800	0.025	41.9
40	61.44	2400	0.021	45.4
50	52.37	3000	0.018	47.7
60	45.72	3600	0.016	49.3
70	40.63	4200	0.014	50.4
80	36.60	4800	0.012	51.2
90	33.32	5400	0.011	51.7
100	30.61	6000	0.010	52.0
110	28.32	6600	0.010	52.1
120	26.37	7200	0.009	52.2
130	24.68	7800	0.008	52.1
140	23.20	8400	0.008	52.0
150	21.89	9000	0.007	51.7
160	20.73	9600	0.007	51.5
Required Storage Volume:				**52.2**

Peak Flow
$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet$

Storage
$S_d = Q_{post} \bullet T_d - Q_{target} (T_d + T_c) / 2$



Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Modified Rational Calculations - 25 -Year Storm Event

Control Criteria

25 yr: Uncontrolled Post-Development Flow:

Q_{201} = 53.3 L/s

25 yr: Target Flow Rate:

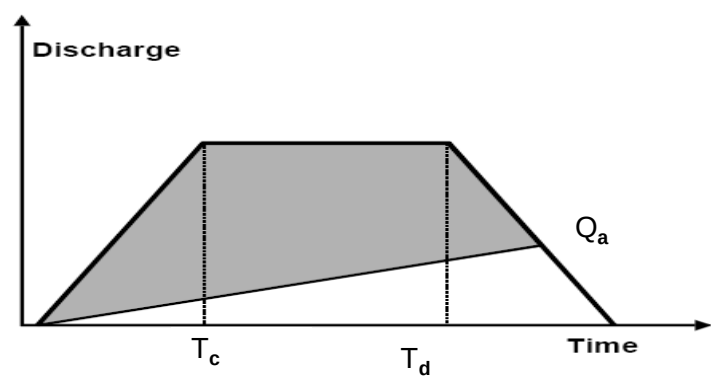
Q_{102} = 8.8 L/s

$Q_{orifice\ 202}$ = 3.6 L/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Post} (m^3/s)	S_d (m^3)
10	156.47	600	0.053	29.8
20	114.29	1200	0.039	43.5
30	90.39	1800	0.031	51.1
40	74.95	2400	0.026	55.8
50	64.13	3000	0.022	59.0
60	56.11	3600	0.019	61.2
70	49.92	4200	0.017	62.8
80	45.00	4800	0.015	63.8
90	40.99	5400	0.014	64.6
100	37.65	6000	0.013	65.0
110	34.83	6600	0.012	65.3
120	32.41	7200	0.011	65.4
130	30.32	7800	0.010	65.4
140	28.49	8400	0.010	65.3
150	26.88	9000	0.009	65.1
160	25.44	9600	0.009	64.8
Required Storage Volume:				**65.4**

Peak Flow
$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet$

Storage
$S_d = Q_{post} \bullet T_d - Q_{target} (T_d + T_c) / 2$



Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Modified Rational Calculations - 50 -Year Storm Event

Control Criteria

50 yr: Uncontrolled Post-Development Flow:

Q_{201} = 60.0 L/s

50 yr: Target Flow Rate:

Q_{102} = 9.9 L/s

$Q_{orifice\ 202}$ = 3.8 L/s

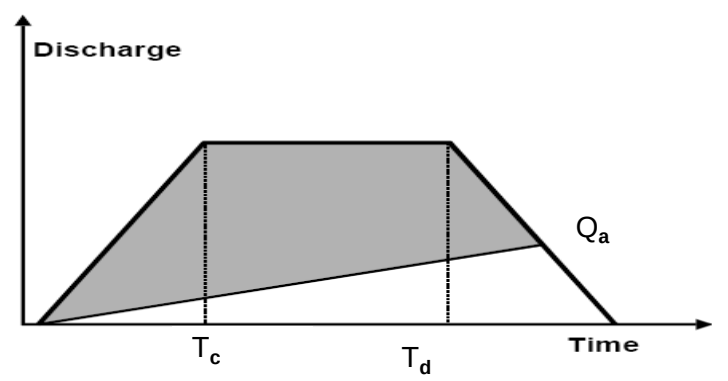
Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Post} (m^3/s)	S_d (m^3)
10	176.19	600	0.060	33.7
20	129.36	1200	0.044	49.4
30	102.50	1800	0.035	58.2
40	85.04	2400	0.029	63.7
50	72.75	3000	0.025	67.4
60	63.63	3600	0.022	69.9
70	56.58	4200	0.019	71.7
80	50.97	4800	0.017	72.9
90	46.40	5400	0.016	73.7
100	42.59	6000	0.014	74.3
110	39.37	6600	0.013	74.6
120	36.62	7200	0.012	74.8
130	34.23	7800	0.012	74.7
140	32.15	8400	0.011	74.6
150	30.30	9000	0.010	74.4
160	28.67	9600	0.010	74.1
Required Storage Volume:				**74.8**

Peak Flow

$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet$

Storage

$S_d = Q_{post} \bullet T_d - Q_{target} (T_d + T_c) / 2$



Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Modified Rational Calculations - 100 -Year Storm Event

Control Criteria

100 yr: Uncontrolled Post-Development Flow:

Q_{201} = 66.9 L/s

Q_{202} = 6.3 L/s

100 yr: Target Flow Rate:

Q_{102} = 11.0 L/s

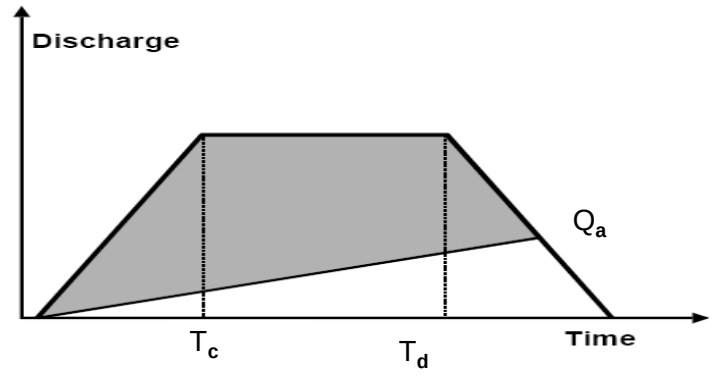
$Q_{Target\ 201}$ = 4.7 L/s

$Q_{orifice\ 201}$ = 4.1 L/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Post} (m^3/s)	S_d (m^3)
10	196.54	600	0.067	37.7
20	145.13	1200	0.049	55.6
30	115.28	1800	0.039	65.7
40	95.75	2400	0.033	72.1
50	81.95	3000	0.028	76.3
60	71.69	3600	0.024	79.2
70	63.74	4200	0.022	81.3
80	57.40	4800	0.020	82.7
90	52.23	5400	0.018	83.7
100	47.93	6000	0.016	84.3
110	44.29	6600	0.015	84.7
120	41.17	7200	0.014	84.9
130	38.47	7800	0.013	84.9
140	36.11	8400	0.012	84.8
150	34.03	9000	0.012	84.5
160	32.18	9600	0.011	84.2
Required Storage Volume:				**84.9**

Peak Flow
$Q_{post} = 0.0028 \bullet C_{post} \bullet i(T_d) \bullet$

Storage
$S_d = Q_{post} \bullet T_d - Q_{target} (T_d + T_c) / 2$



Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Orifice Design Summary - 2 Year Storm Event

Orifice Type =	Plate	
Invert Elevation =	241.08	m
Diameter of Orifice =	44	mm
Area of Orifice (A) =	0.0015	sq.m
Orifice Coefficient (Cd) =	0.640	

Calculation of Head

Centroid Elevation =	241.10	m
Water Elevation =	241.33	m
Upstream Head*, (h) =	0.23	m

Qa =	**(Cd)(A)(2gh)^0.5**	
Actual Controlled Discharge, Qa =	0.00206	cms
Qa =	**2.06**	**L/s**

*Head is based upon orifice area @ orifice face not Vena Contracta

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Orifice Design Summary - 5 Year Storm Event

Orifice Type =	Plate	
Invert Elevation =	241.08	m
Diameter of Orifice =	44	mm
Area of Orifice (A) =	0.0015	sq.m
Orifice Coefficient (Cd) =	0.640	

Calculation of Head

Centroid Elevation =	241.10	m
Water Elevation =	241.44	m
Upstream Head*, (h) =	0.34	m

Qa =	**(Cd)(A)(2gh)^0.5**	
Actual Controlled Discharge, Qa =	0.00251	cms
Qa =	**2.51**	**L/s**

*Head is based upon orifice area @ orifice face not Vena Contracta

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Orifice Design Summary - 10 Year Storm Event

Orifice Type =	Plate	
Invert Elevation =	241.08	m
Diameter of Orifice =	44	mm
Area of Orifice (A) =	0.0015	sq.m
Orifice Coefficient (Cd) =	0.640	

Calculation of Head

Centroid Elevation =	241.10	m
Water Elevation =	241.65	m
Upstream Head*, (h) =	0.55	m

Qa =	**(Cd)(A)(2gh)^0.5**	
Actual Controlled Discharge, Qa =	0.00319	cms
Qa =	**3.19**	**L/s**

*Head is based upon orifice area @ orifice face not Vena Contracta

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Orifice Design Summary - 25 Year Storm Event

Orifice Type	=	Plate	
Invert Elevation	=	241.08	m
Diameter of Orifice	=	44	mm
Area of Orifice (A)	=	0.0015	sq.m
Orifice Coefficient (Cd)	=	0.640	

Calculation of Head

Centroid Elevation	=	241.10	m
Water Elevation	=	241.80	m
Upstream Head*, (h)	=	0.69	m

Qa	**=**	**(Cd)(A)(2gh)^0.5**	
Actual Controlled Discharge, Qa	**=**	0.00359	cms
Qa	**=**	**3.59**	**L/s**

*Head is based upon orifice area @ orifice face not Vena Contracta

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Orifice Design Summary - 50 Year Storm Event

Orifice Type =	Plate	
Invert Elevation =	241.08	m
Diameter of Orifice =	44	mm
Area of Orifice (A) =	0.0015	sq.m
Orifice Coefficient (Cd) =	0.640	

Calculation of Head

Centroid Elevation =	241.10	m
Water Elevation =	241.90	m
Upstream Head*, (h) =	0.80	m

Qa =	**(Cd)(A)(2gh)^0.5**	
Actual Controlled Discharge, Qa =	0.00384	cms
Qa =	**3.84**	**L/s**

*Head is based upon orifice area @ orifice face not Vena Contracta

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Orifice Design Summary - 100 Year Storm Event

Orifice Type =	Plate	
Invert Elevation =	241.08	m
Diameter of Orifice =	44	mm
Area of Orifice (A) =	0.0015	sq.m
Orifice Coefficient (Cd) =	0.640	

Calculation of Head

Centroid Elevation =	241.10	m
Water Elevation =	242.01	m
Upstream Head*, (h) =	0.91	m

Qa =	**(Cd)(A)(2gh)^0.5**	
Actual Controlled Discharge, Qa =	0.00410	cms
Qa =	**4.10**	**L/s**

*Head is based upon orifice area @ orifice face not Vena Contracta

Project: 13290 Nunnville Road
Project No.: 649-6278
Created By: JB
Reviewed By: PS
Date: 2022.03.09
Updated: 2023.03.02

Provided Storage			
Diameter of Pipe (mm)	**Length of Pipe** (m)	**Cross Sectional Area of Pipe** (m^2)	**Provided Storage** (m^3)
1200	97	1.13	109.7

Super Pipe Summary				
Storm Event (yr)	**Storage Required (m3)**	**Storage Provided (m3)**	**Percent Full**	**HWL (m)**
2	29.46	109.70	27%	241.33
5	44.11	109.70	40%	241.44
10	52.17	109.70	48%	241.65
25	65.44	109.70	60%	241.80
50	74.75	109.70	68%	241.90
100	84.91	109.70	77%	242.01

CROZIER CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 0649-6278

Date: 2022.03.28
Designed By: JL
Checked By: JB/PS
Updated: 2023.02.08

Enhanced Topsoil Design

Storage Required	Total Area of Additional Topsoil	Extra Topsoil Depth[1]	Soil Volume	Soil Porosity	Soil Field Capacity	Avalable Storage Volume[2]
m3	ha	mm	m3			m3
6.00	0.08	150.00	120.00	0.47	0.32	18.00

1. Topsoil depth in addition to the 150mm minimum covering the site, total topsoil depth = 300mm (150mm + 150mm = 300mm topsoil)
2. Water volume that can be stored for a given soil = (soil volume) x (soil porosity – soil field capacity)

Total Contributing Impervious Area 0.12 ha

Allowable Infiltration Rainfall Depth: 5 mm

Available Runoff Volume to be infiltrated: 6.00 m3

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Sunday, February 19, 2023
Project Name	13290 Nunnville Rd.
Project Number	
Location	Caledon

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-1-1 is recommended to meet the water quality objective by treating a flow of 7.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 85 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	7.6	85

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

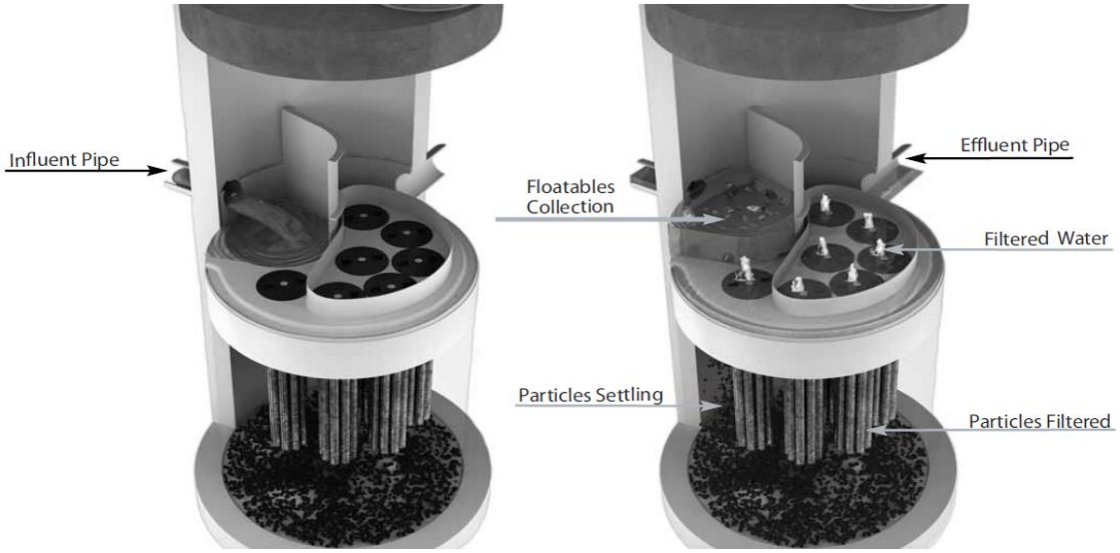
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 77%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Jellyfish® Filter

Project Information

Date:	Sunday, February 19, 2023
Project Name:	13290 Nunnville Rd.
Project Number:	
Location:	Caledon

Designer Information

Company:	C.F. Crozier & Associates Inc.
Contact:	Owen Salvucci
Phone #:	

Notes

Rainfall

Name:	TORONTO CENTRAL
State:	ON
ID:	100
Record:	1982 to 1999
Co-ords:	45°30'N, 90°30'W

Drainage Area

Total Area:	0.21 ha
Runoff Coefficient:	0.63

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 18 years of TORONTO CENTRAL rainfall data:	**3.9 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 775 m³, with a suspended sediment concentration of 60 mg/L.	**47 kg**

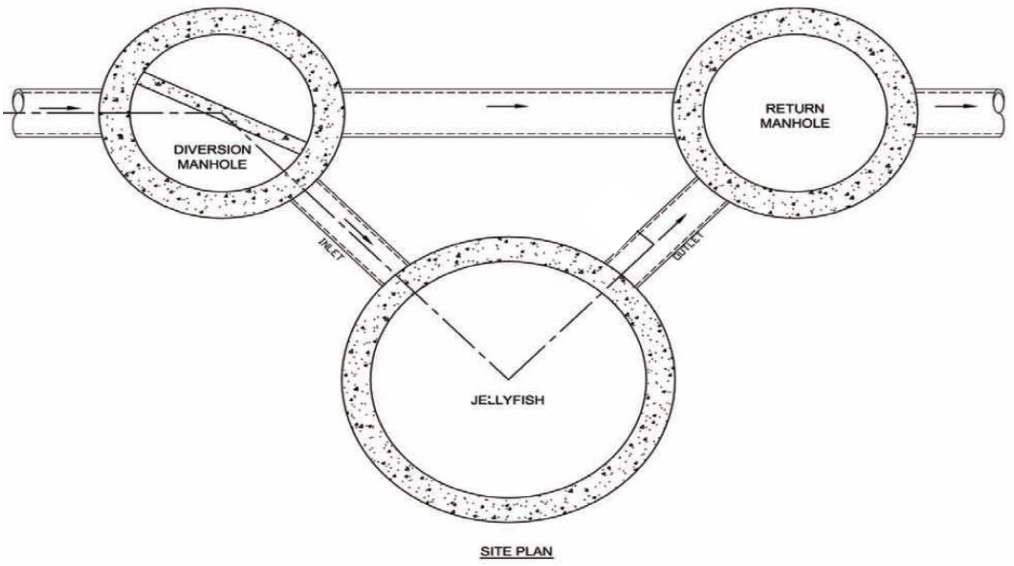
Recommendation

The Jellyfish Filter model JF4-1-1 is recommended to meet the water quality objective by treating a flow of 7.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 85 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	**1**	**1**	**1.2**	**2313**	**0.34**	**379**	**7.6**	**85**
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	**62º**	**150**	**200**
1.8	59º	200	250
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

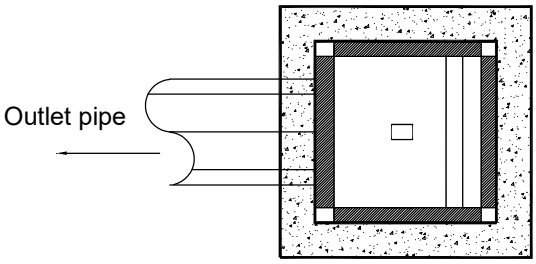
5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

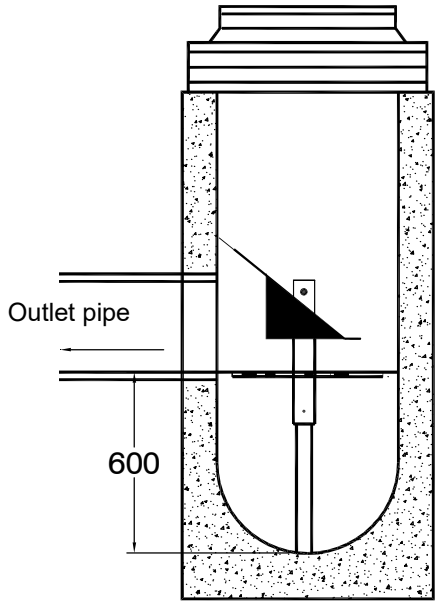
Notes

1 Recommended depth t/g - invert = 1.2m
Maximum depth t/g - invert = 2.4m

1. CB Shield to be installed in non frozen conditions.
2. The frame and cover should be well aligned with the catchbasin.
3. The sump must be clean before installation
4. The grate is at the same elevation as pipe invert.
5. Pipes must be cut flush with inside walls



Top view



Profile view

600 x 600 CB
CB Shield (600mm Sump)

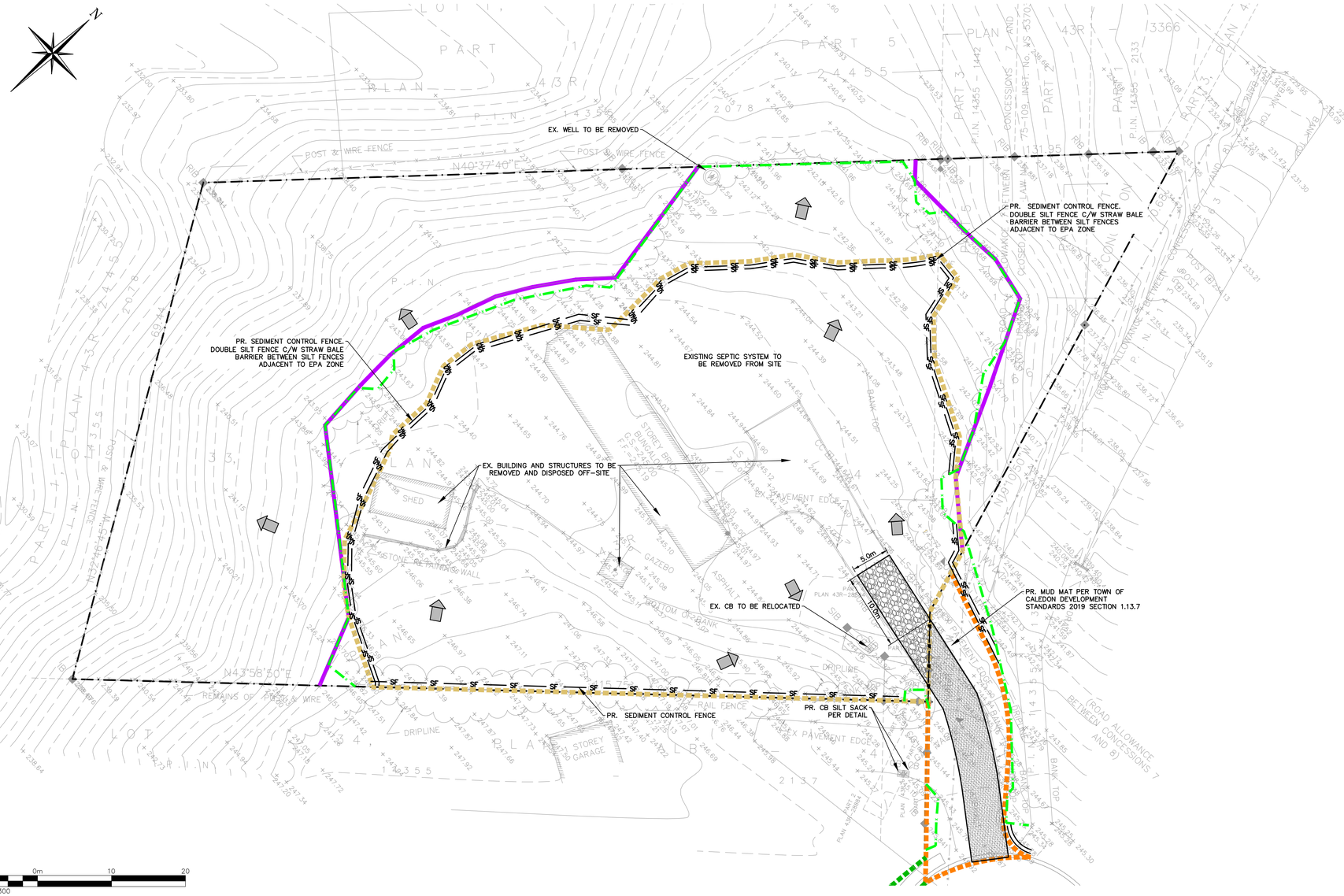
Average Annual Sediment Removal Rates (%) using a CB Shield (based on ETV Sediment - 1 to 1000 micron Particle Size Distribution)

Area to CB (ha)	Imperviousness[1] (%)					
	20%	35%	50%	65%	80%	100%
0.02	57%	57%	57%	57%	56%	56%
0.05	56%	56%	56%	55%	55%	54%
0.10	56%	55%	54%	53%	52%	51%
0.20	54%	53%	51%	49%	48%	46%
0.30	53%	50%	48%	46%	45%	43%
0.40	51%	48%	46%	44%	42%	40%
0.50	50%	47%	44%	42%	40%	38%
0.60	49%	45%	43%	40%	39%	36%

Notes:

1. Runoff Coefficient 'C' is approximately equal to 0.05 + 0.9*Impervious Fraction.
2. Above chart is based on long term continuous hydrologic analysis of Toronto, Ontario (Bloor St) rainfall data.
3. Assumes 0.6 m sump in CB and that maintenance is performed (i.e. CB cleaning) when required by sediment/pollutant build-up or otherwise.
4. See accompanying chart for suggested maintenance scheduling - AND - get CB Shield Inc. to monitor it for you in field.
5. Sediment/Pollutant removal rates based on third party certified laboratory testing using ETV sediment (PSD analysis available on request).
6. See additional discussion regarding scour protection from CB Shield during more infrequent runoff events.

DRAWINGS AND FIGURES



10 0m 10 20
SCALE: 1:300

KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING GRADE
- MUD-MAT; SEE DETAIL
- SILT FENCE
- EXISTING FENCE
- LONG TERM STABLE TOP OF SLOPE
- TREE PRESERVATION LINE & FENCE (KUNTZ FORESTRY, FEBRUARY 2023)
- INTERNAL DEVELOPMENT LIMIT
- EXTERNAL ENTRANCE CIVIL WORKS LIMIT

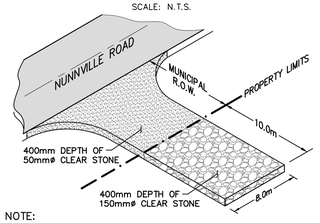
SITE REMOVAL NOTE:

1. REMOVE ALL EXISTING SURFACE MATERIALS AS REQUIRED TO COMPLETE THE SITE WORKS AND DISPOSE OF OFF SITE
2. STRIP AND REMOVE ALL TOPSOIL
3. REMOVE ALL SURFACE INFRASTRUCTURE ON TOWN PROPERTY AS REQUIRED TO ACCOMODATE NEW CONSTRUCTION

EROSION & SEDIMENT CONTROL NOTES:

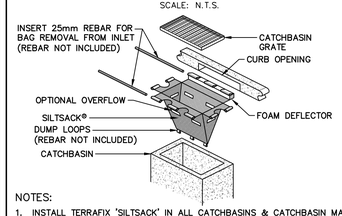
1. EROSION & SEDIMENT CONTROL MEASURES MUST BE INSTALLED PRIOR TO THE COMMENCEMENT OF SITE WORKS.
2. EROSION & SEDIMENT CONTROLS MUST BE INSPECTED ON A REGULAR BASIS AND AFTER EVERY RAIN FALL EVENT, AND MUST BE MAINTAINED AND REPAIRED IN A TIMELY MANNER TO PREVENT SEDIMENT FROM LEAVING THE SITE.
3. EXISTING AND PROPOSED CATCHBASINS ARE TO BE PROTECTED WITH FILTER CLOTH AND 150mm DEPTH OF 50mm DIA. STONE COVER DURING CONSTRUCTION.
4. IT IS REQUIRED TO STABILIZE ALL AREAS THAT WILL REMAIN DISTURBED FOR MORE THAN 30 DAYS.
5. MUD MAT, SILT FENCE, AND CATCHBASIN PROTECTION ARE NOT TO BE REMOVED UNTIL COMPLETION OF CONSTRUCTION.
6. ALL SILT FENCES SHOWN ARE OFFSET FROM PROPERTY LINE FOR CLARITY ONLY. INSTALL SILT FENCE IN SUITABLE LOCATION FOR THE DURATION OF THE PROJECT.
7. SEDIMENT AND EROSION CONTROL MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.
8. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO PREVENT SEDIMENT RELEASES TO THE NATURAL ENVIRONMENT. THE TRCA ENFORCEMENT OFFICER SHOULD BE IMMEDIATELY CONTACTED SHOULD THE EROSION AND SEDIMENT CONTROL PLANS CHANGE FROM THE APPROVED PLANS.
9. ALL EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE INSPECTED WEEKLY, AFTER EVERY RAINFALL AND SIGNIFICANT SNOW MELT EVENT, AND DAILY DURING PERIODS OF EXTENDED RAIN OR SNOW MELT.
10. ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE REPAIRED AND/OR REPLACED WITHIN 48 HOURS OF THE INSPECTION.
11. ALL DISTURBED AREAS WILL BE STABILIZED AND RESTORED WITH NATIVE/NON-INVASIVE SPECIES UPON COMPLETION OF THE WORK.
12. A REHABILITATION PLAN IS TO BE IMPLEMENTED TO RESTORE THE CONSTRUCTION SITE BACK TO ITS PRE-CONSTRUCTION STATE, OR BETTER.
13. THE CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE OF THE ONSET OF THE PROJECT TO ENSURE THAT THE WORKS WILL BE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS.

MUD MAT DETAIL
SCALE: N.T.S.



NOTE:
GEOTEXTILE (TERRAFIX 270R OR APPROVED EQUAL) TO BE PLACED AS SEPARATION BARRIER BETWEEN EXISTING GROUND AND CLEAR STONE.

'SILTSACK' DETAIL
SCALE: N.T.S.



NOTES:

1. INSTALL TERRAFIX 'SILTSACK' IN ALL CATCHBASINS & CATCHBASIN MANHOLES AFFECTED BY CONSTRUCTION.
2. INSTALL TERRAFIX 'SILTSACK' IN ALL NEW CATCHBASINS & CATCHBASIN MANHOLES.

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION	2022/APR/13

ELEVATION NOTE:

ELEVATIONS ARE GEODETIC IN ORIGIN AND ARE REFERRED TO FIRST ORDER BENCHMARK No.00819758057 HAVING AN ORTHOMETRIC ELEVATION OF 251.929 METRES. ELEVATIONS ARE REFERENCED TO THE CANADIAN GEODETIC VERTICAL DATUM OF 1928, 1978 ADJUSTMENT (CGVD-1928:1978)

SURVEY NOTES:

SKETCH FOR ENGINEER'S USE COMPLETED BY R-PE SURVEYING LTD. ON THE 23RD DAY OF FEBRUARY, 2022.
JOB No. 21-434

SITE PLAN NOTES:

DESIGN ELEMENTS SHOWN ARE BASED ON SITE PLAN PREPARED BY VAJ DESIGN.
PROJECT NUMBER: 22008 (2023/MAR/06)

DRAWING NOTES:

THIS DRAWING IS THE EXCLUSIVE PROPERTY OF C.F. CROZIER & ASSOCIATES INC. AND THE REPRODUCTION OF ANY PART OF IT WITHOUT PRIOR WRITTEN CONSENT OF THIS OFFICE IS STRICTLY PROHIBITED.

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

REMOVALS, EROSION & SEDIMENT CONTROL PLAN

NOT FOR CONSTRUCTION

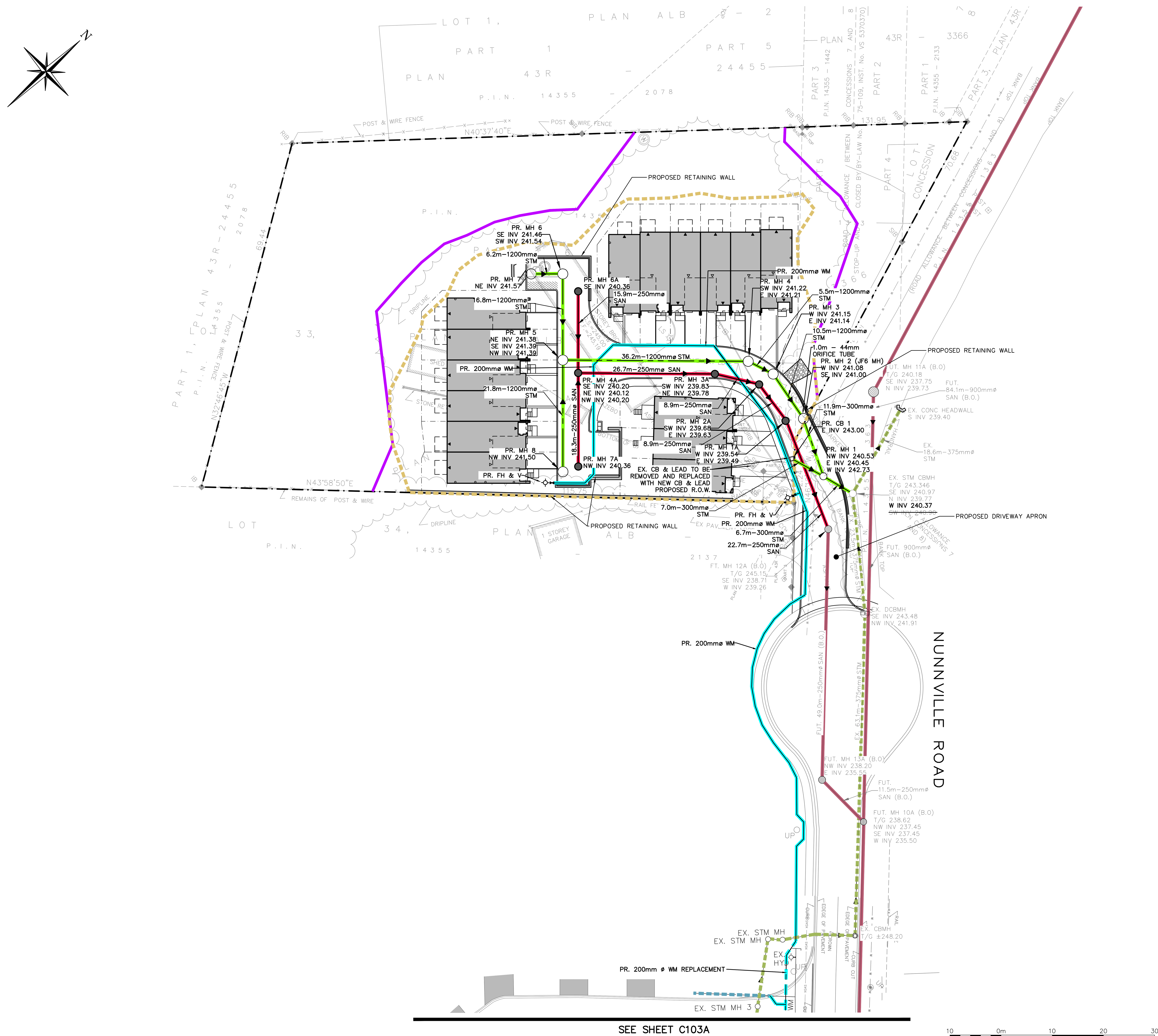
Engineer

Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905875-0026 T
905875-4915 F
WWW.CFCROZIER.CA

Drawn	Design	Project No.	
P.S./J.B.	P.S./J.B.		649-6278
Check	Check	Scale	Dwg.
P.S.	P.S./N.C.	1:300	C101



SEE SHEET C103A

KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING WATERMAIN & GATE VALVE
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- PROPOSED WATERMAIN & GATE VALVE TO SERVICE 13290 NUNNVILLE
- PROPOSED EXTERNAL WATERMAIN REPLACEMENT
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE CATCHBASIN
- PROPOSED SANITARY SEWER & MANHOLE
- FUTURE SANITARY SEWER & MANHOLE
- INTERNAL DEVELOPMENT LIMIT
- EXTERNAL ENTRANCE CIVIL WORKS LIMIT
- LONG TERM STABLE TOP OF SLOPE

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION	2022/APR/13

ELEVATION NOTE:

ELEVATIONS ARE GEODETIC IN ORIGIN AND ARE REFERRED TO FIRST ORDER BENCHMARK No.00819758057 HAVING AN ORTHOMETRIC ELEVATION OF 251.929 METRES. ELEVATIONS ARE REFERENCED TO THE CANADIAN GEODETIC VERTICAL DATUM OF 1928, 1978 ADJUSTMENT (CGVD–1928:1978)

SURVEY NOTES:

SKETCH FOR ENGINEER'S USE COMPLETED BY R–PE SURVEYING LTD. ON THE 23RD DAY OF FEBRUARY, 2022.
JOB No. 21–434

SITE PLAN NOTES:

DESIGN ELEMENTS SHOWN ARE BASED ON SITE PLAN PREPARED BY VA3 DESIGN. PROJECT NUMBER: 22008 (2023/MAR/06)

DRAWING NOTES:

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

PRELIMINARY
SITE SERVICING PLAN

NOT FOR CONSTRUCTION

Engineer | Engineer

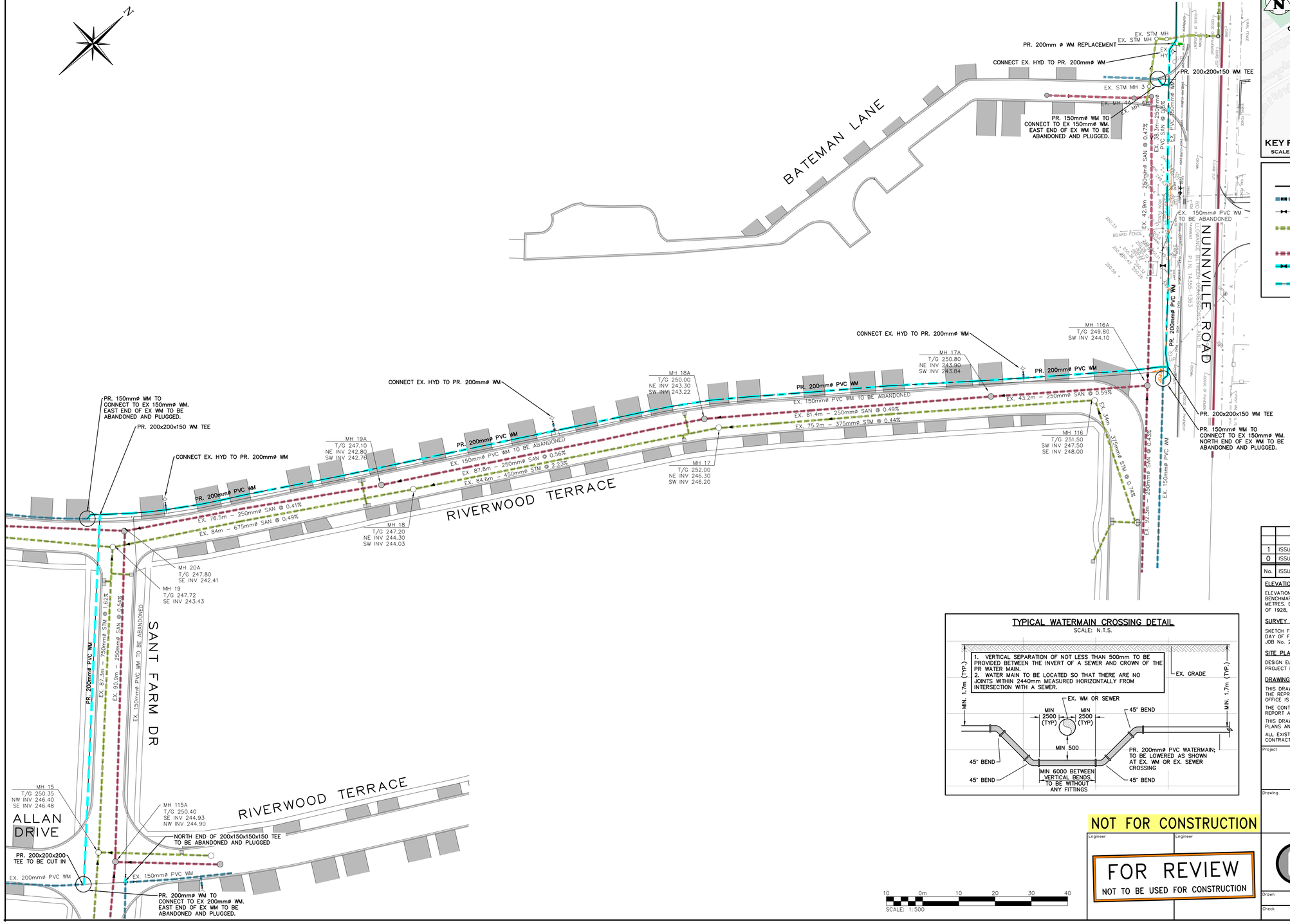
FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	P.S/J.B..	Design	P.S./J.B.	Project No.	649–6278
Check	P.S.	Check	P.S./N.C.	Scale 1:400	Dwg. C102A

SCALE: 1:400 (0 10 20 30)

SEE SHEET C103A



LEGEND

- PROPERTY LINE
- EXISTING WATERMAIN & GATE VALVE
- EXISTING WATERMAIN & GATE VALVE TO BE ABANDONED
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE / DOUBLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- PROPOSED WATERMAIN & GATE VALVE TO SERVICE 13290 NUNNVILLE
- PROPOSED EXTERNAL WATERMAIN REPLACEMENT

TYPICAL WATERMAIN CROSSING DETAIL

SCALE: N.T.S.

NOT FOR CONSTRUCTION

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

10 0m 10 20 30 40
SCALE: 1:500

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION	2022/APR/13

ELEVATION NOTE:

ELEVATIONS ARE GEODETIC IN ORIGIN AND ARE REFERRED TO FIRST ORDER BENCHMARK No.00819758057 HAVING AN ORTHOMETRIC ELEVATION OF 251.929 METRES. ELEVATIONS ARE REFERENCED TO THE CANADIAN GEODETIC VERTICAL DATUM OF 1928, 1978 ADJUSTMENT (CGVD-1928:1978)

SURVEY NOTES:

SKETCH FOR ENGINEER'S USE COMPLETED BY R-PE SURVEYING LTD. ON THE 23RD DAY OF FEBRUARY, 2022.
JOB No. 21-434

SITE PLAN NOTES:

DESIGN ELEMENTS SHOWN ARE BASED ON SITE PLAN PREPARED BY VAJ DESIGN.
PROJECT NUMBER: 22008 (2023/MAR/06)

DRAWING NOTES:

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ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

Project

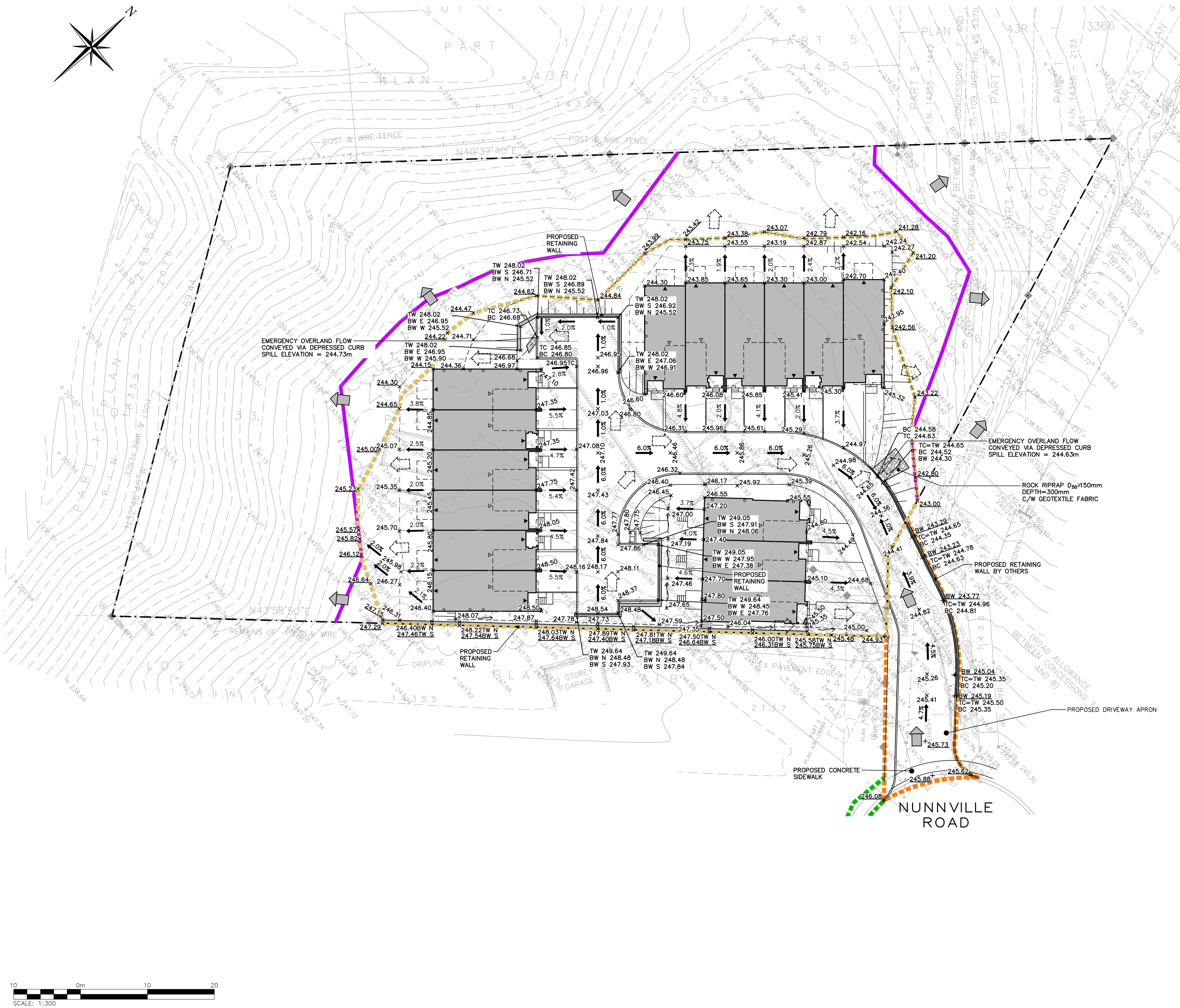
13290 NUNNVILLE RD
TOWN OF CALEDON

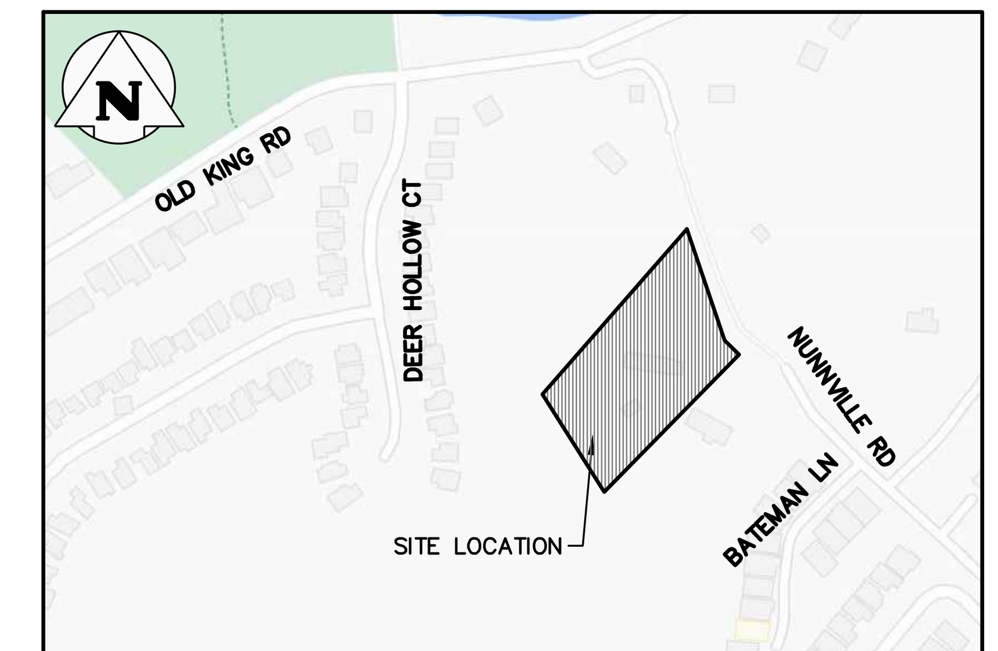
Drawing

EXTERNAL SERVICING PLAN

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905875-0026 T
905875-4915 F
WWW.CFCROZIER.CA

Drawn	Design	Project No.
P.S./J.B.	P.S./J.B.	649-6278
Check	**Check**	**Scale** / **Dwg.**
P.S.	P.S./N.C.	1:500 / C102B





KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING FENCE
- EXISTING STORM SEWER & MANHOLE
- EXISTING SANITARY SEWER & MANHOLE
- 215.00 EXISTING GRADE
- 215.00 PROPOSED GRADE
- 215.00 PROPOSED GRADE (TO MATCH EXISTING)
- 2.0% PROPOSED MINOR FLOW DIRECTION
- 2.0% PROPOSED GRASSED SWALE
- PROPOSED SLOPE (3:1 MAX.)
- PROPOSED MAJOR OVERLAND FLOW DIRECTION
- EXISTING MAJOR OVERLAND FLOW DIRECTION
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED STORM MANHOLE
- PROPOSED SANITARY SEWER & MANHOLE
- PROPOSED SINGLE / DOUBLE CATCHBASIN
- DEVELOPMENT LIMIT
- EXTERNAL ENTRANCE CIVIL WORKS LIMIT
- LONG TERM STABLE TOP OF SLOPE

No.	ISSUE / REVISION	YYYY/MMM/DD
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SURVEY NOTES:

SKETCH FOR ENGINEER'S USE COMPLETED BY R-PE SURVEYING LTD. ON THE 23RD DAY OF FEBRUARY, 2022.
JOB No. 21-434

SITE PLAN NOTES:

DESIGN ELEMENTS SHOWN ARE BASED ON SITE PLAN PREPARED BY VA3 DESIGN. PROJECT NUMBER: 22008 (2023/MAR/06)

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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

PRELIMINARY SITE GRADING PLAN

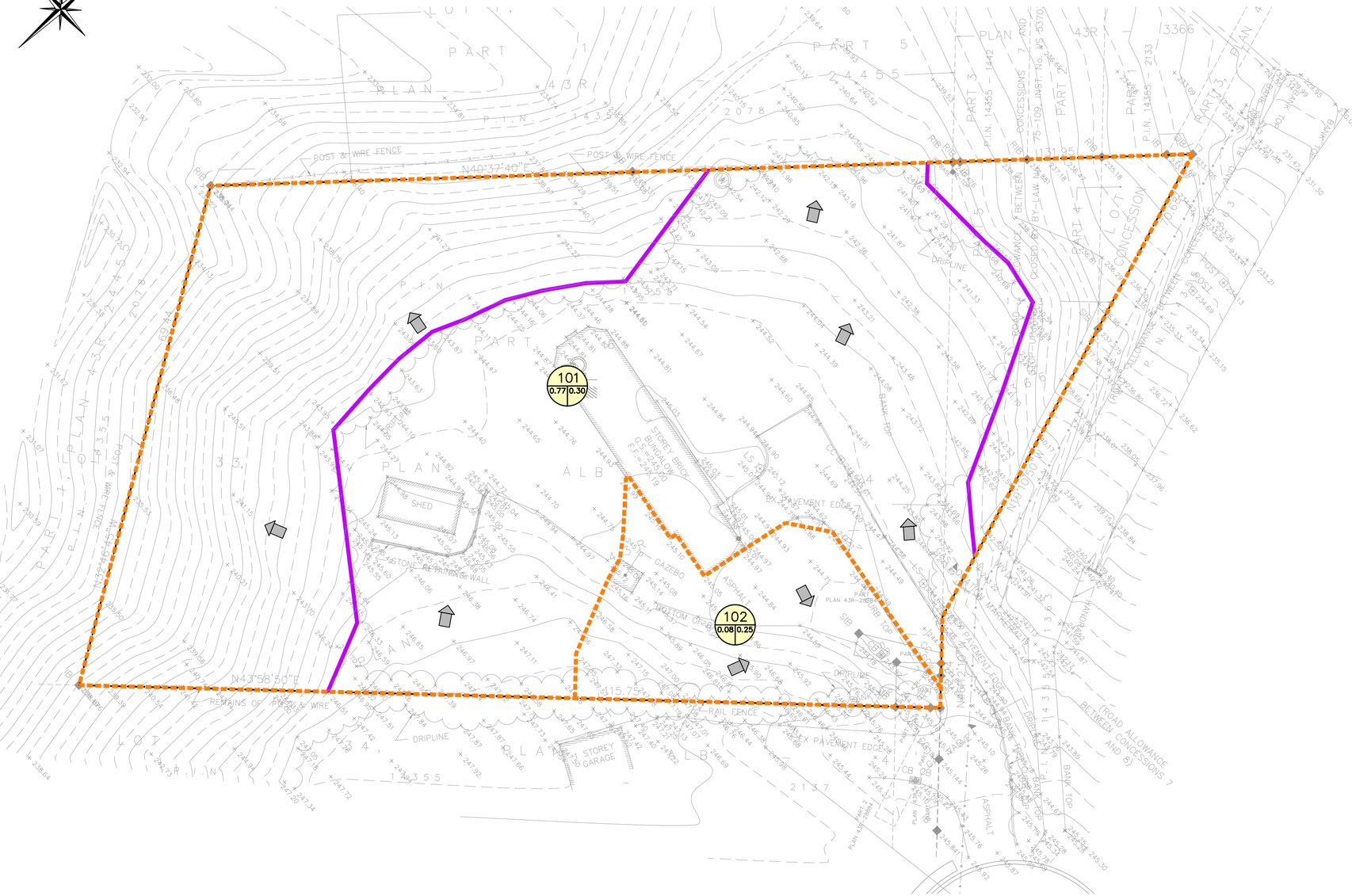
NOT FOR CONSTRUCTION

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	Design	Project No.	
P.S/J.B..	P.S./J.B.	649-6278	
Check P.S.	Check P.S./N.C.	Scale 1:300	Dwg. C103



KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- STORM DRAINAGE CATCHMENT
- EXISTING OVERLAND FLOW DIRECTION
- ID / AREA (ha) | RUNOFF COEFFICIENT — CATCHMENT I.D.
- LONG TERM STABLE TOP OF SLOPE

10 0m 10 20
SCALE: 1: 300

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION	2023/MAR/06
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SURVEY NOTES:

SKETCH FOR ENGINEER'S USE COMPLETED BY R-PE SURVEYING LTD. ON THE 23RD DAY OF FEBRUARY, 2022.
JOB No. 21-434

SITE PLAN NOTES:

DESIGN ELEMENTS SHOWN ARE BASED ON SITE PLAN PREPARED BY VAJ DESIGN.
PROJECT NUMBER: 22008 (2023/MAR/06)

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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

PRE-DEVELOPMENT DRAINAGE PLAN

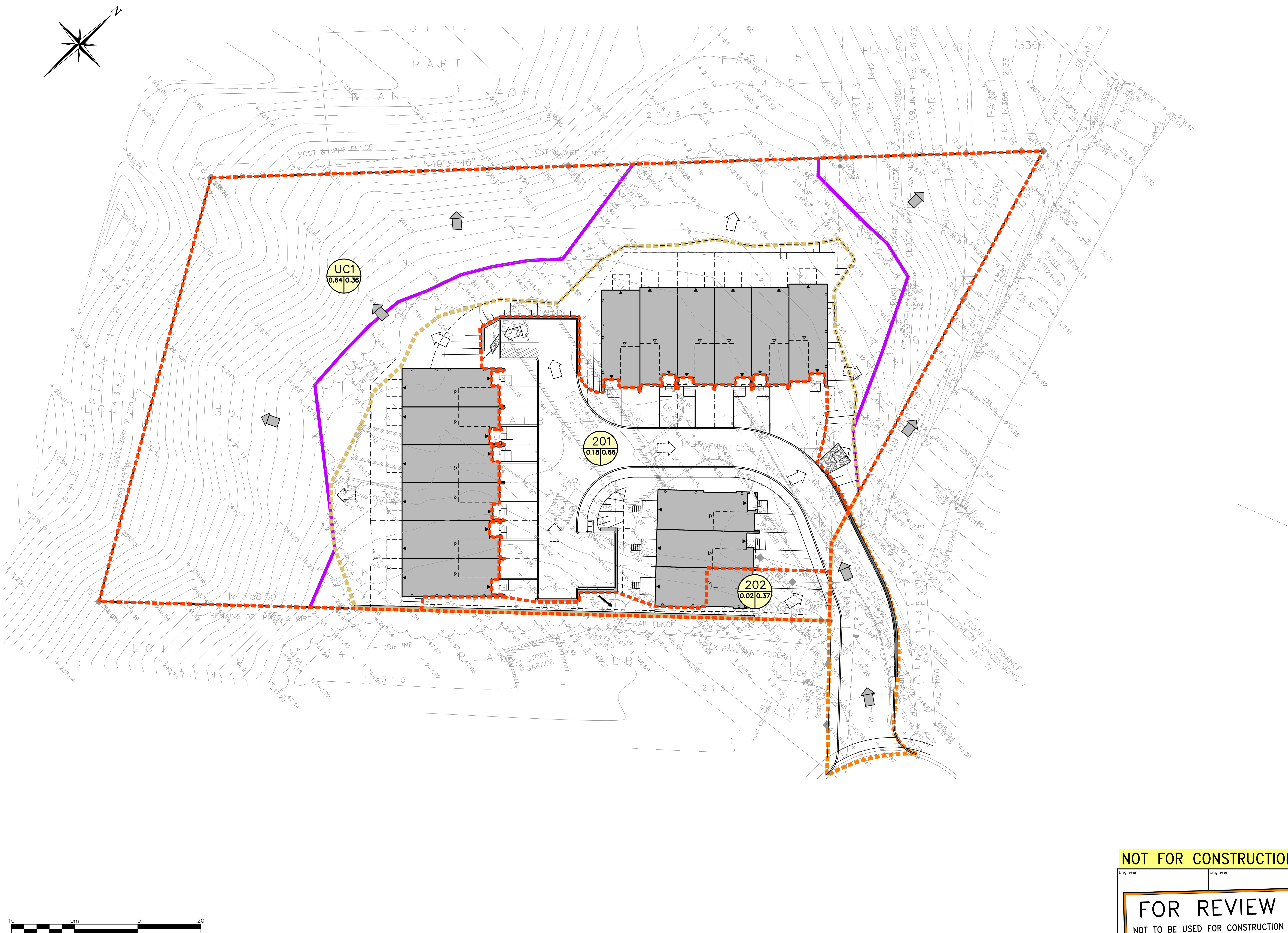
NOT FOR CONSTRUCTION

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905875-0026 T
905875-4915 F
WWW.CFCROZIER.CA

Drawn	Design	Project No.	
P.S./J.B..	P.S./J.B.		649-6278
Check	Check	Scale	Dwg.
P.S.	P.S./N.C.	1: 300	FIG1



KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- STORM DRAINAGE CATCHMENT
- EXISTING OVERLAND FLOW DIRECTION
- PROPOSED OVERLAND FLOW DIRECTION
- ID / A | RC — CATCHMENT I.D. / AREA (ha) | RUNOFF COEFFICIENT
- LONG TERM STABLE TOP OF SLOPE
- INTERNAL DEVELOPMENT LIMIT

No.	ISSUE / REVISION	YYYY/MMM/DD
1	ISSUED FOR SECOND SUBMISSION	2023/MAR/06
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SURVEY NOTES:

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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

POST-DEVELOPMENT DRAINAGE PLAN

NOT FOR CONSTRUCTION

Engineer | Engineer

FOR REVIEW
NOT TO BE USED FOR CONSTRUCTION

CROZIER
CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905-875-0026 T
905-875-4915 F
WWW.CFCROZIER.CA

Drawn	P.S/J.B..	Design	P.S./J.B.	Project No.	649-6278
Check	P.S.	Check	P.S./N.C.	Scale 1:300	Dwg. FIG2