TOWN OF CALEDON
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Dec 22, 2023

SERVICING & STORMWATER MANAGEMENT IMPLEMENTATION 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

DECEMBER 2023

CFCA FILE NO. 649-6278

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CROZIER
CONSULTING ENGINEERS

Revision Number	Date	Comments
Rev 0	April 13, 2022	Issued for 1st Submission (ZBA)
Rev 1	March 6, 2023	Issued for 2nd Submission (ZBA)
Rev 2	April 25, 2023	Issued for 1st Submission (SPA)
Rev 3	December 19, 2023	Issued for 2nd Submission (SPA)

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1.0 INTRODUCTION

C.F. Crozier & Associates Inc. (Crozier) was retained by Bolton Summit Developments Inc. (BSDI) to prepare a Servicing and Stormwater Management Implementation Report in support of the Site Plan Approval application for the proposed development located at 13290 Nunnville Road in the Town of Caledon.

This report demonstrates how the proposed development's 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 fifteen (15) townhouses comprised of three (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

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 150 mm diameter watermain on Nunnville Road to a 200mm diameter, at the Owner's expense. The upgrade to a 200 mm diameter watermain will provide an available fire flow of 124 L/s. according to the Region of Peel water modelling. Correspondence dated January 12, 2023, is found in Appendix A.

The Fire Underwriters Survey method (1999) was used to estimate the fire flow demand for the proposed development. Based on the dwelling gross floor area and exposure distance (VA3 Design, April 2023), the fire demand with a fire wall every unit is 100 L/s. Therefore the 100 L/s is less than the available fire flow of 124 L/s and meets the Region's requirements. 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 (wood framing will not be exposed), potential to contain rapid burning fire hazards (limited combustible) and will not have an automatic sprinkler system.

3.4 Proposed Water Servicing

The proposed development will be serviced by a proposed upgraded 200 mm 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 0.80 L/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 fifteen (15) townhouses comprised of three (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 three 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 a 70 mm Contech Vortex Valve (CEV225) and an oversized concrete pipe for stormwater storage (superpipe 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 a ditch on Nunnville Road within the TRCA EPA regulated land.

- Catchment 202 (A = 0.02 ha; RC = 0.46) 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 70 mm Contech Vortex Valve (CEV225) downstream of a proposed 1,050 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 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 conveyed to the TRCA EPA regulated lands. The outlets to the regulated lands include pre-development Catchments 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	55.44	**55.44**	**55.25**
5	70.94	**70.94**	**70.69**
10	86.78	**86.78**	**86.47**
25	101.21	**101.21**	**100.85**
50	113.96	**113.96**	**113.56**
100	127.12	**127.12**	**126.67**

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 will be conveyed to the existing 375 mm diameter storm sewer located on Nunnville Road. A 70 mm Contech Vortex Valve (CEV225) downstream of a 95 m long 1,050 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		Controlled Flow	Total Site Flow	Required Storage
	Q_{102} Total Site Target	Q_{201}	Q_{202}	Q_{201}	Q_{outlet} = $Q_{201(controlled)}$ + Q_{202}	
2-yr	**4.80**	29.18	**2.74**	**2.05**	**4.77**	**25.0**
5-yr	**6.14**	37.33	**3.50**	**2.40**	**5.88**	**37.5**
10-yr	**7.51**	45.67	**4.29**	**2.62**	**6.87**	**46.8**
25-yr	**8.76**	53.26	**5.00**	**2.91**	**7.87**	**59.1**
50-yr	**9.87**	59.98	**5.63**	**3.11**	**8.70**	**67.9**
100-yr	**11.01**	66.90	**6.28**	**3.33**	**9.56**	**77.3**

As shown in Table 6, a 70 mm Contech Vortex Valve (CEV190) is required for Catchment 201 to control post-development peak flows to pre-development peak flows and meet the quantity control criteria. The proposed superpipe will provide a maximum storage volume of 89.9 m^3 which will satisfy the required storage volume provided in Table 6. Detailed calculations are provided in Appendix C.

6.1.1 Total System Capture

As mentioned above in Section 6.0, post-development peak stormwater flows must be equal to or less than pre-development peak stormwater flows for all storm events (2-year to 100-year).

A total system capture analysis has been completed to ensure that the proposed catchbasin maintenance holes and catchbasins have sufficient capacity to capture the 100-year runoff generated by the proposed development. The analysis considered 50% blockage of the catchbasins and catchbasin maintenance holes. The results of the analysis determined that the catchbasin maintenance hole and catchbasins can capture the 100-year runoff generated by the proposed development.

The calculations for the total system capture analysis are provided in Appendix C. Figure 3 – Total System Capture Plan conveys the area captured by each catchbasin/catchbasin maintenance hole.

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

Controlled Catchments		Area (m2)	% of Total Controlled Area	TSS Removal Efficiency	Total TSS Removal
Catchment 201	Jellyfish Filter	1842	88%	89%	78%
Catchment 202	CB Shield	248	12%	57%	7%
Controlled Total Area		**2090**	**100.0%**	**-**	**85%**

Catchment UC1 consist of rooftop and rear yard drainage which is considered clean and would not require TSS removal treatment. A Jellyfish filter (JF4) will be used to treat the controlled discharge from Catchment 201 and will apply 89% TSS Removal Efficiency. A manual for the Jellyfish is provided in Appendix C. 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 85%, therefore the quality control criterion is achieved.

6.3 Proposed Storm Servicing

The proposed development will be serviced by 300 mm diameter storm sewer and 1,050 mm diameter storm sewer superpipe at a minimum slope of 0.4% which will connect to the existing 375 mm diameter storm sewer within Nunnville Road. Each unit will consist of a foundation connection per Region of Peel Standard Drawing 2-4-4 with no sump pumps required. Per Town standards, A minimum of 1m cover is required between the obvert of the storm sewer and the basement floor elevation (BFE). In the most restrictive section, the proposed storm sewer will have a minimum cover of 4.25 m from obvert of pipe to the BFE, therefore a Hydraulic Grade Analysis (HGL) is not required.

6.4 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 are less suitable for infiltration practices. Therefore, in a best effort to achieve water balance to pre-development conditions, we have proposed the use of 150mm of enhanced topsoil to retain the runoff onsite. The water balance deficit from the impervious areas will be provided by the total topsoil depth of 300 mm 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 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 200 mm 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 relocated catchbasin.

5. Stormwater quantity control has been provided using a 70 mm Contech Vortex Valve (CEV225) and a 95 m long 1,050 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 (85% 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 Manager

MJB/cj;rl

I:\600\649 - Bolton Gateway Developments Inc\6278- 13290 Nunnville Rd\Reports\2nd Submission (Civil - SPA)\2023.12.15 (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 CONSULTING ENGINEERS

Project: 13290 Nunnville Rd
Project No.: 649-6278
Prepared By: JL
Checked By: JB/PS
Date: 2022.03.30
Updated: 2023.11.23

WATER DEMAND CALCULATIONS

13290 Nunnville Road, Town of Caledon

Note: Based on Site Plan provided by VA3 Design Inc. dated November 17, 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

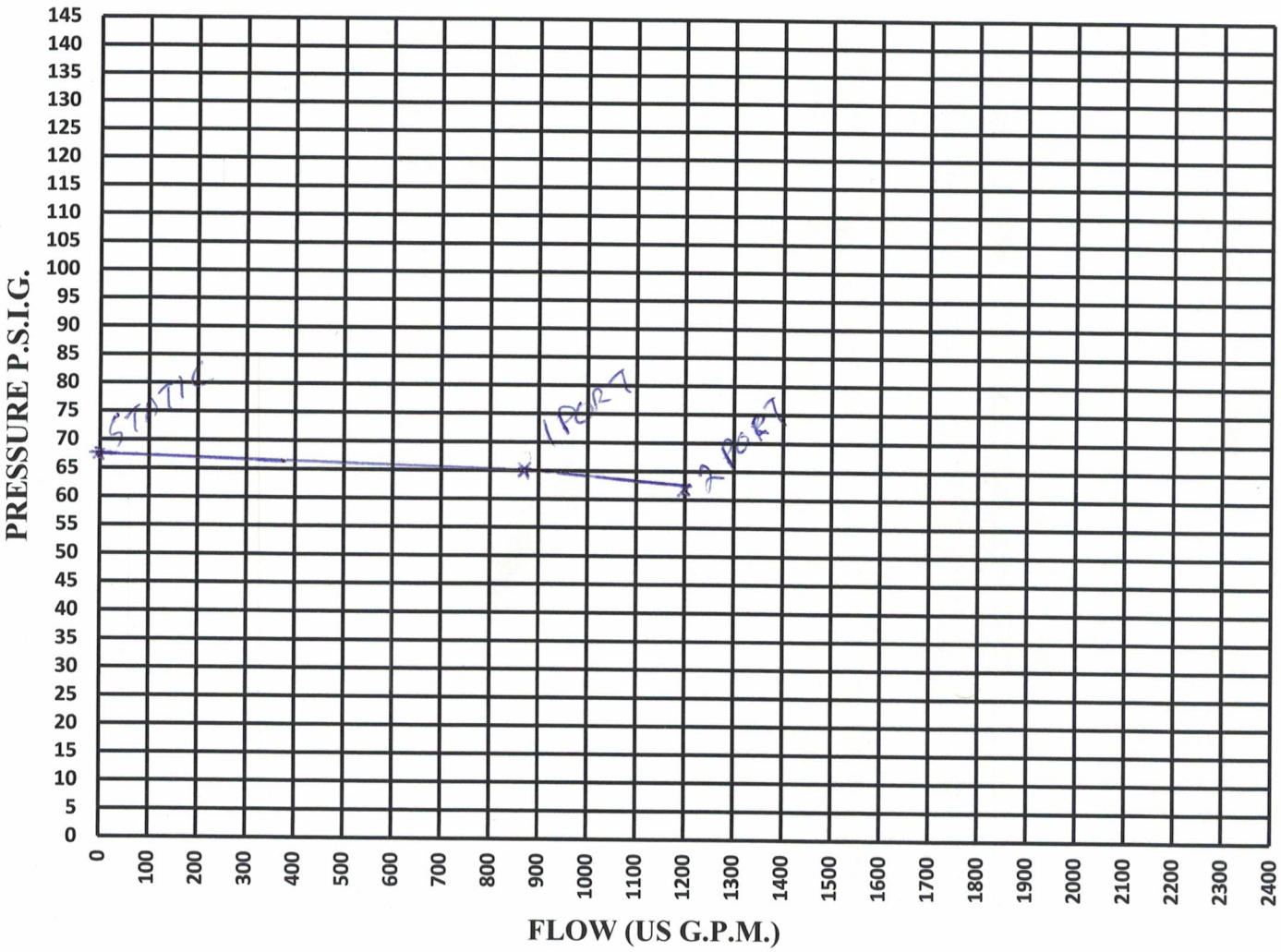
FLOW TEST REPORT

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

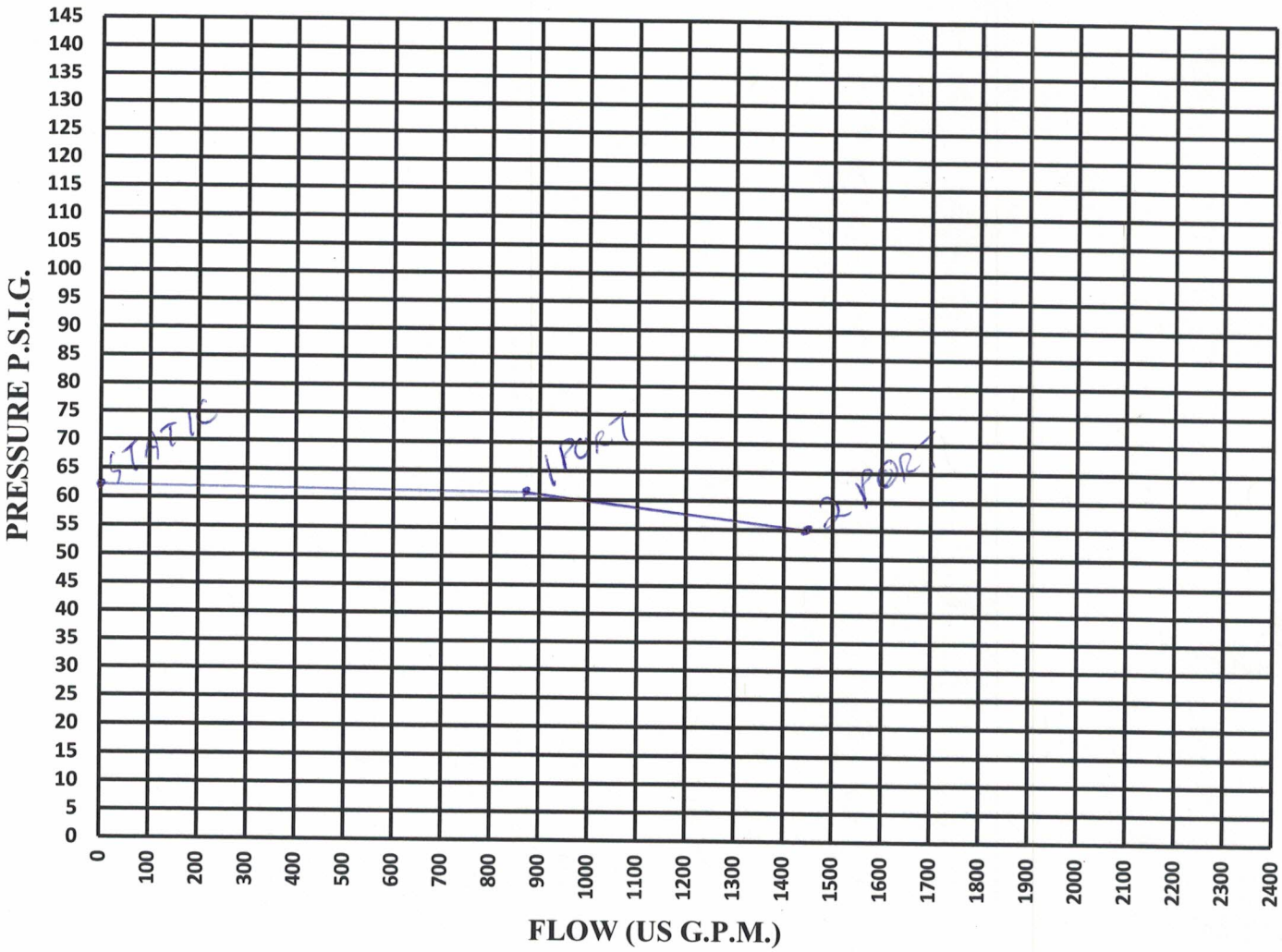
FLOW TEST REPORT

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)
Scenario #3: Fire Wall Every Unit

Date: 2022.03.07
Designed By: JB
Checked By: MB
Updated: 2022.10.31

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 = 190.45 sq.m.
C = 1.5 **Type V Construction**

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

Therefore F = 4,554 L/min

Fire walls are assumed every unit.

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: -683 L/min
RFF: *3,871* *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. East Block (3 Unit Block)	15.21 m	15%	580.65	
Pr. South Block (6 Unit Block)	19.28 m	15%	580.65	
			1,161	**L/min Surcharge**

Determine Required Fire Flow

No. 1	4,554			
No. 2	-683	reduction		
No. 3	0	reduction		
No. 4	1,161	surcharge		
Required Flow:	**5,032**	**L/min**		
Rounded to nearest 1000 L/min:	**6,000**	**L/min**	or	100.0 L/s
				1,585 USGPM

Required Flow (L/s):	**100**
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, East Block (3 Units)
Scenario #3: Fire Wall Every Unit

Date: 2022.03.07
Designed By: JB
Checked By: MB
Updated: 2022.10.31

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 = 190.45 sq.m.
C = 1.5 **Type V Construction**

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

Therefore F = 4,554 L/min

Fire walls are assumed every unit.

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: -683 L/min
RFF: 3,871 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%	387.10	
Pr. North Block (6 Unit Block)	15.21 m	15%	580.65	
Ex. Dwelling (13286 Nunnville Rd)	15.21 m	15%	580.65	
			1,548	**L/min Surcharge**

Determine Required Fire Flow

No. 1	4,554		
No. 2	-683	reduction	
No. 3	0	reduction	
No. 4	1,548	surcharge	
Required Flow:	**5,419**	**L/min**	
Rounded to nearest 1000 L/min:	**6,000**	**L/min**	or 100.0 L/s 1,585 USGPM

Required Flow (L/s):	**100**
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)
Scenario #3: Fire Wall Every Unit

Date: 2022.03.07
Designed By: JB
Checked By: MB
Updated: 2022.10.31

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 = 190.45 sq.m.
C = 1.5 **Type V Construction**

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

Therefore F = 4,554 L/min

Fire walls are assumed every unit.

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: -683 L/min
RFF: *3,871* *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.

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	With Complete Building Coverage	With Partial Building Coverage of X%
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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%	580.65	
Pr. East Block (3 Units)	24.29 m	10%	387.10	
Ex. Dwelling (13286 Nunnville Rd)	9.34 m	20%	774.20	
			1,742	**L/min Surcharge**

Determine Required Fire Flow

No. 1	4,554		
No. 2	-683	reduction	
No. 3	0	reduction	
No. 4	1,742	surcharge	
Required Flow:	**5,613 L/min**		
Rounded to nearest 1000 L/min:	**6,000 L/min**	or	100.0 L/s
			1,585 USGPM

Required Flow (L/s):	**100**
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, Summary
Scenario #3: Fire Wall Every Unit

Date: 2022.03.07
Designed By: JB
Checked By: MB
Updated: 2022.10.31

Fire Underwriters Survey Summary		
Block	**Required Fire Flow** (L/s)	**Duration** (hr)
North	100	2.00
East	100	2.00
South	100	2.00

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: 2023-11-23

SANITARY FLOW CALCULATIONS
13290 Nunnville Road, Town of Caledon

Note: Based on Site Plan provided by VA3 Design Inc. dated November 17, 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

CROZIER
CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

Modified Rational Method - Input Data

Storm Data: City of Hamilton

Time of Concentration: 10 min = 0.17 hours
= 600 sec

Return Period	A	B	C	i mm/hr
2 yr	1070	7.85	0.8759	85.7
5 yr	1593	11	0.8789	109.7
10 yr	2221	12	0.908	134.2
25 yr	3158	15	0.9335	156.5
50 yr	3886	16	0.9495	176.2
100 yr	4688	17	0.9624	196.5

Pre-Development Conditions				
Catchment ID	**Area (Ha)**	**Area (m2)**	**Weighted Average C**	
101	0.770	7700	0.300	Outlets to TRCA EPA Regulated Lands
102	0.080	800	0.250	Outlets to Nunnville Road R.O.W and Sewer
Total Site	**0.850**	8500	**0.30**	

Post-Development Conditions				
Catchment ID	**Area (Ha)**	**Area (m2)**	**Weighted Average C**	
UC1	0.641	6410	0.36	Outlets to TRCA EPA Regulated Lands
201	0.184	1842	0.66	Outlets to Nunnville Road R.O.W and Sewer
202	0.025	248	0.46	Outlets to Nunnville Road R.O.W and Sewer
Total Site	**0.850**	8500		

Return Period	i	Target Flow Rate Q_{101}		Uncontrolled Post-Development Peak Flow Q_{UC1}		% Difference Relative Flow to Target Rate
	mm/hr	Q (m3/s)	Q (L/s)	Q (m3/s)	Q (L/s)	
2 yr	85.72	0.055	55.44	0.06	55.25	-0.4%
5 yr	109.68	0.071	70.94	0.07	70.69	-0.4%
10 yr	134.16	0.087	86.78	0.09	86.47	-0.4%
25 yr	156.47	0.101	101.21	0.10	100.85	-0.4%
50 yr	176.19	0.114	113.96	0.11	113.56	-0.4%
100 yr	196.54	0.127	127.12	0.13	126.67	-0.4%

Return Period	i	Target Flow Rate Q_{102}		Uncontrolled Post-Development Peak Flow					% Difference Relative Flow to Target Rate
				Q_{201}		Q_{202}		Q_{total} (L/s)	
	mm/hr	Q (m3/s)	Q (L/s)	Q (m3/s)	Q (L/s)	Q (m3/s)	Q (L/s)		
2 yr	85.72	0.005	4.80	0.029	29.18	0.003	2.74	31.92	565%
5 yr	109.68	0.006	6.14	0.037	37.33	0.004	3.50	40.84	565%
10 yr	134.16	0.008	7.51	0.046	45.67	0.004	4.29	49.95	565%
25 yr	156.47	0.009	8.76	0.053	53.26	0.005	5.00	58.26	565%
50 yr	176.19	0.010	9.87	0.060	59.98	0.006	5.63	65.60	565%
100 yr	196.54	0.011	11.01	0.067	66.90	0.006	6.28	73.18	565%

CROZIER
CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

MODIFIED RATIONAL METHOD CALCULATIONS - 100 YEAR STORM EVENT

Rainfall Intensity Equation:

$I = A(T+b)^c$

Town of Caledon IDF (100-Year)	
a=	4688
b=	17
c=	-0.962

CONTROLLED AREA

Drainage Area ID = 201
Drainage Area = 0.18 ha
Runoff Coefficient = 0.66

Controlled Release Rate at Outlet = 3.33 L/s

Max. Storage Volume Required = 77.3 m3
Storage Volume Provided = 82.3 m3

UNCONTROLLED AREA

Drainage Area ID = 202
Drainage Area = 0.02 ha
Runoff Coefficient = 0.46 ha

Target Site Release Rate = 11.01 L/s

Controlled Release Rate at Outlet = 3.33 L/s
Uncontrolled Release Rate = 6.23 L/s
Total Site Release Rate = 9.56 L/s

Time (minutes)	Rainfall Intensity (mm/hr)	Q_{Runoff} (L/s)	$Q_{Release}$ (L/s)	Storage Volume Required (m^3)	Q_{Runoff} (L/s)
10	196.5	66.42	3.33	37.9	6.23
15	166.9	56.40	3.33	47.8	5.29
20	145.1	49.05	3.33	54.9	4.60
25	128.5	43.42	3.33	60.1	4.07
30	115.3	38.96	3.33	64.1	3.66
35	104.6	35.35	3.33	67.2	3.32
40	95.7	32.36	3.33	69.7	3.04
45	88.3	29.84	3.33	71.6	2.80
50	82.0	27.70	3.33	73.1	2.60
55	76.5	25.84	3.33	74.3	2.43
60	71.7	24.23	3.33	75.2	2.27
65	67.5	22.80	3.33	75.9	2.14
70	63.7	21.54	3.33	76.5	2.02
75	60.4	20.41	3.33	76.9	1.92
80	57.4	19.40	3.33	77.1	1.82
85	54.7	18.48	3.33	77.3	1.73
90	52.2	17.65	3.33	77.3	1.66
95	50.0	16.89	3.33	77.3	1.59
100	47.9	16.20	3.33	77.2	1.52
105	46.0	15.56	3.33	77.0	1.46
110	44.3	14.97	3.33	76.8	1.40
115	42.7	14.42	3.33	76.5	1.35
120	41.2	13.92	3.33	76.2	1.31
125	39.8	13.44	3.33	75.8	1.26
130	38.5	13.00	3.33	75.4	1.22
135	37.3	12.59	3.33	75.0	1.18
140	36.1	12.20	3.33	74.5	1.15
145	35.0	11.84	3.33	74.1	1.11
150	34.0	11.50	3.33	73.5	1.08
155	33.1	11.18	3.33	73.0	1.05
160	32.2	10.87	3.33	72.4	1.02
165	31.3	10.59	3.33	71.8	0.99
170	30.5	10.31	3.33	71.2	0.97

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CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

MODIFIED RATIONAL METHOD CALCULATIONS - 50 YEAR STORM EVENT

Rainfall Intensity Equation:

$I = A(T+b)^c$

Town of Halton Hills IDF (50-Year)	
a=	3886
b=	16
c=	-0.9495

CONTROLLED AREA		UNCONTROLLED AREA	
Drainage Area ID =	201	Drainage Area ID =	202
Drainage Area =	0.18 ha	Drainage Area =	0.02 ha
Runoff Coefficient =	0.66	Runoff Coefficient =	0.46 ha
Controlled Release Rate at MH18 =	**3.11**	**Target Site Release Rate =**	**9.87**
Max. Storage Volume Required =	**67.9 m3**	Controlled Release Rate at MH18 =	3.11
Storage Volume Provided =	**82.3 m3**	Uncontrolled Release Rate =	5.59
		Total Site Release Rate =	**8.70**

Time (minutes)	Rainfall Intensity (mm/hr)	Q_{Runoff} (L/s)	$Q_{Release}$ (L/s)	Storage Volume Required (m^3)	Q_{Runoff} (L/s)
10	176.2	59.55	3.11	33.9	5.59
15	149.1	50.39	3.11	42.6	4.73
20	129.4	43.72	3.11	48.7	4.10
25	114.3	38.64	3.11	53.3	3.63
30	102.5	34.64	3.11	56.8	3.25
35	92.9	31.41	3.11	59.4	2.95
40	85.0	28.74	3.11	61.5	2.70
45	78.4	26.50	3.11	63.1	2.49
50	72.8	24.59	3.11	64.4	2.31
55	67.9	22.94	3.11	65.4	2.15
60	63.6	21.51	3.11	66.2	2.02
65	59.9	20.24	3.11	66.8	1.90
70	56.6	19.12	3.11	67.3	1.79
75	53.6	18.12	3.11	67.6	1.70
80	51.0	17.23	3.11	67.8	1.62
85	48.6	16.42	3.11	67.9	1.54
90	46.4	15.68	3.11	67.9	1.47
95	44.4	15.01	3.11	67.8	1.41
100	42.6	14.39	3.11	67.7	1.35
105	40.9	13.83	3.11	67.5	1.30
110	39.4	13.31	3.11	67.3	1.25
115	37.9	12.82	3.11	67.0	1.20
120	36.6	12.38	3.11	66.7	1.16
125	35.4	11.96	3.11	66.4	1.12
130	34.2	11.57	3.11	66.0	1.09
135	33.2	11.21	3.11	65.6	1.05
140	32.1	10.86	3.11	65.1	1.02
145	31.2	10.54	3.11	64.7	0.99
150	30.3	10.24	3.11	64.2	0.96
155	29.5	9.96	3.11	63.7	0.93
160	28.7	9.69	3.11	63.2	0.91
165	27.9	9.43	3.11	62.6	0.89
170	27.2	9.19	3.11	62.1	0.86

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CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

MODIFIED RATIONAL METHOD CALCULATIONS - 25 YEAR STORM EVENT

Rainfall Intensity Equation:

$I = A(T+b)^c$

Town of Halton Hills IDF (25-Year)	
a=	3158
b=	15
c=	-0.9335

CONTROLLED AREA		UNCONTROLLED AREA	
Drainage Area ID =	201	Drainage Area ID =	202
Drainage Area =	0.18 ha	Drainage Area =	0.02 ha
Runoff Coefficient =	0.66	Runoff Coefficient =	0.46 ha
Controlled Release Rate at MH18 =	**2.91**	**Target Site Release Rate =**	**8.76**
Max. Storage Volume Required =	**59.1 m3**	Controlled Release Rate at MH18 =	2.91
Storage Volume Provided =	**82.3 m3**	Uncontrolled Release Rate =	4.96
		Total Site Release Rate =	**7.87**

Time (minutes)	Rainfall Intensity (mm/hr)	Q_{Runoff} (L/s)	$Q_{Release}$ (L/s)	Storage Volume Required (m^3)	Q_{Runoff} (L/s)
10	156.5	52.88	2.91	30.0	4.96
15	132.0	44.61	2.91	37.5	4.19
20	114.3	38.63	2.91	42.9	3.62
25	100.9	34.10	2.91	46.8	3.20
30	90.4	30.55	2.91	49.8	2.87
35	81.9	27.69	2.91	52.0	2.60
40	75.0	25.33	2.91	53.8	2.38
45	69.1	23.36	2.91	55.2	2.19
50	64.1	21.67	2.91	56.3	2.03
55	59.8	20.23	2.91	57.1	1.90
60	56.1	18.96	2.91	57.8	1.78
65	52.8	17.85	2.91	58.3	1.68
70	49.9	16.87	2.91	58.6	1.58
75	47.3	16.00	2.91	58.9	1.50
80	45.0	15.21	2.91	59.0	1.43
85	42.9	14.50	2.91	59.1	1.36
90	41.0	13.85	2.91	59.1	1.30
95	39.2	13.26	2.91	59.0	1.24
100	37.6	12.72	2.91	58.9	1.19
105	36.2	12.23	2.91	58.7	1.15
110	34.8	11.77	2.91	58.5	1.10
115	33.6	11.35	2.91	58.2	1.06
120	32.4	10.96	2.91	57.9	1.03
125	31.3	10.59	2.91	57.6	0.99
130	30.3	10.25	2.91	57.2	0.96
135	29.4	9.93	2.91	56.9	0.93
140	28.5	9.63	2.91	56.4	0.90
145	27.7	9.35	2.91	56.0	0.88
150	26.9	9.08	2.91	55.6	0.85
155	26.1	8.83	2.91	55.1	0.83
160	25.4	8.60	2.91	54.6	0.81
165	24.8	8.38	2.91	54.1	0.79
170	24.2	8.16	2.91	53.6	0.8

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Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

MODIFIED RATIONAL METHOD CALCULATIONS - 10 YEAR STORM EVENT

Rainfall Intensity Equation:

$I = A(T+b)^c$

Town of Halton Hills IDF (10-Year)	
a=	2221
b=	12
c=	-0.908

CONTROLLED AREA

Drainage Area ID = 201
Drainage Area = 0.18 ha
Runoff Coefficient = 0.66

Controlled Release Rate at MH18 = 2.62 L/s

Max. Storage Volume Required = 46.8 m3
Storage Volume Provided = 82.3 m3

UNCONTROLLED AREA

Drainage Area ID = 202
Drainage Area = 0.02 ha
Runoff Coefficient = 0.46 ha

Target Site Release Rate = 7.51 L/s

Controlled Release Rate at MH18 = 2.62 L/s
Uncontrolled Release Rate = 4.25 L/s
Total Site Release Rate = 6.87 L/s

Time (minutes)	Rainfall Intensity (mm/hr)	Q_{Runoff} (L/s)	$Q_{Release}$ (L/s)	Storage Volume Required (m^3)	Q_{Runoff} (L/s)
10	134.2	45.34	2.62	25.6	4.25
15	111.4	37.65	2.62	31.5	3.53
20	95.5	32.27	2.62	35.6	3.03
25	83.7	28.28	2.62	38.5	2.65
30	74.6	25.21	2.62	40.7	2.37
35	67.3	22.76	2.62	42.3	2.14
40	61.4	20.76	2.62	43.5	1.95
45	56.5	19.10	2.62	44.5	1.79
50	52.4	17.70	2.62	45.2	1.66
55	48.8	16.49	2.62	45.8	1.55
60	45.7	15.45	2.62	46.2	1.45
65	43.0	14.54	2.62	46.5	1.36
70	40.6	13.73	2.62	46.7	1.29
75	38.5	13.01	2.62	46.8	1.22
80	36.6	12.37	2.62	46.8	1.16
85	34.9	11.79	2.62	46.8	1.11
90	33.3	11.26	2.62	46.7	1.06
95	31.9	10.78	2.62	46.5	1.01
100	30.6	10.35	2.62	46.4	0.97
105	29.4	9.94	2.62	46.1	0.93
110	28.3	9.57	2.62	45.9	0.90
115	27.3	9.23	2.62	45.6	0.87
120	26.4	8.91	2.62	45.3	0.84
125	25.5	8.62	2.62	45.0	0.81
130	24.7	8.34	2.62	44.6	0.78
135	23.9	8.08	2.62	44.2	0.76
140	23.2	7.84	2.62	43.8	0.74
145	22.5	7.61	2.62	43.4	0.71
150	21.9	7.40	2.62	43.0	0.69
155	21.3	7.20	2.62	42.6	0.68
160	20.7	7.01	2.62	42.1	0.66
165	20.2	6.83	2.62	41.7	0.64
170	19.7	6.66	2.62	41.2	0.62

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Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

MODIFIED RATIONAL METHOD CALCULATIONS - 5 YEAR STORM EVENT

Rainfall Intensity Equation:

$I = A(T+b)^c$

Town of Halton Hills IDF (5-Year)	
a=	1593
b=	11
c=	-0.8789

CONTROLLED AREA		UNCONTROLLED AREA	
Drainage Area ID =	201	Drainage Area ID =	202
Drainage Area =	0.18 ha	Drainage Area =	0.02 ha
Runoff Coefficient =	0.66	Runoff Coefficient =	0.46 ha
Controlled Release Rate at MH18 =	**2.40**	**Target Site Release Rate =**	**6.14**
Max. Storage Volume Required =	**37.5 m3**	Controlled Release Rate at MH18 =	2.40
Storage Volume Provided =	**82.3 m3**	Uncontrolled Release Rate =	3.48
		Total Site Release Rate =	**5.88**

Time (minutes)	Rainfall Intensity (mm/hr)	Q_{Runoff} (L/s)	$Q_{Release}$ (L/s)	Storage Volume Required (m^3)	Q_{Runoff} (L/s)
10	109.7	37.07	2.40	20.8	3.48
15	90.9	30.72	2.40	25.5	2.88
20	77.9	26.32	2.40	28.7	2.47
25	68.3	23.08	2.40	31.0	2.17
30	60.9	20.59	2.40	32.7	1.93
35	55.1	18.61	2.40	34.0	1.75
40	50.3	16.99	2.40	35.0	1.59
45	46.3	15.65	2.40	35.8	1.47
50	43.0	14.52	2.40	36.4	1.36
55	40.1	13.55	2.40	36.8	1.27
60	37.6	12.71	2.40	37.1	1.19
65	35.4	11.97	2.40	37.3	1.12
70	33.5	11.32	2.40	37.5	1.06
75	31.8	10.74	2.40	37.5	1.01
80	30.2	10.22	2.40	37.5	0.96
85	28.8	9.75	2.40	37.5	0.91
90	27.6	9.32	2.40	37.4	0.87
95	26.4	8.93	2.40	37.2	0.84
100	25.4	8.58	2.40	37.1	0.81
105	24.4	8.25	2.40	36.9	0.77
110	23.5	7.95	2.40	36.7	0.75
115	22.7	7.68	2.40	36.4	0.72
120	21.9	7.42	2.40	36.1	0.70
125	21.2	7.18	2.40	35.8	0.67
130	20.6	6.95	2.40	35.5	0.65
135	20.0	6.74	2.40	35.2	0.63
140	19.4	6.55	2.40	34.8	0.61
145	18.8	6.36	2.40	34.5	0.60
150	18.3	6.19	2.40	34.1	0.58
155	17.8	6.02	2.40	33.7	0.57
160	17.4	5.87	2.40	33.3	0.55
165	16.9	5.72	2.40	32.9	0.54
170	16.5	5.58	2.40	32.5	0.52

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Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

MODIFIED RATIONAL METHOD CALCULATIONS - 2 YEAR STORM EVENT

Rainfall Intensity Equation:

$I = A(T+b)^c$

Town of Halton Hills IDF (2-Year)	
a=	1070
b=	7.85
c=	-0.8759

CONTROLLED AREA		UNCONTROLLED AREA	
Drainage Area ID =	201	Drainage Area ID =	202
Drainage Area =	0.18 ha	Drainage Area =	0.02 ha
Runoff Coefficient =	0.66	Runoff Coefficient =	0.46 ha
Controlled Release Rate at MH18 =	**2.05**	**Target Site Release Rate =**	**4.80**
Max. Storage Volume Required =	**25.0 m3**	Controlled Release Rate at MH18 =	2.05
Storage Volume Provided =	**82.3 m3**	Uncontrolled Release Rate =	2.72
		Total Site Release Rate =	**4.77**

Time (minutes)	Rainfall Intensity (mm/hr)	Q_{Runoff} (L/s)	$Q_{Release}$ (L/s)	Storage Volume Required (m^3)	Q_{Runoff} (L/s)
10	85.7	28.97	2.05	16.2	2.72
15	69.0	23.34	2.05	19.2	2.19
20	58.1	19.62	2.05	21.1	1.84
25	50.2	16.98	2.05	22.4	1.59
30	44.4	15.00	2.05	23.3	1.41
35	39.8	13.45	2.05	23.9	1.26
40	36.1	12.21	2.05	24.4	1.15
45	33.1	11.20	2.05	24.7	1.05
50	30.6	10.34	2.05	24.9	0.97
55	28.5	9.62	2.05	25.0	0.90
60	26.6	9.00	2.05	25.0	0.84
65	25.0	8.45	2.05	25.0	0.79
70	23.6	7.97	2.05	24.9	0.75
75	22.3	7.55	2.05	24.8	0.71
80	21.2	7.17	2.05	24.6	0.67
85	20.2	6.83	2.05	24.4	0.64
90	19.3	6.53	2.05	24.2	0.61
95	18.5	6.25	2.05	23.9	0.59
100	17.7	5.99	2.05	23.7	0.56
105	17.0	5.76	2.05	23.4	0.54
110	16.4	5.55	2.05	23.1	0.52
115	15.8	5.35	2.05	22.8	0.50
120	15.3	5.16	2.05	22.4	0.48
125	14.8	4.99	2.05	22.1	0.47
130	14.3	4.83	2.05	21.7	0.45
135	13.9	4.69	2.05	21.4	0.44
140	13.5	4.55	2.05	21.0	0.43
145	13.1	4.42	2.05	20.6	0.41
150	12.7	4.29	2.05	20.2	0.40
155	12.4	4.18	2.05	19.8	0.39
160	12.0	4.07	2.05	19.4	0.38
165	11.7	3.97	2.05	19.0	0.37
170	11.4	3.87	2.05	18.5	0.36

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

Created By: JB
Checked By: PS

Date: 11/21/2023

100-Year Superpipe Storage Calculations

100-Year Storm Elevation: 241.960 **masl**

Storm Sewer Network Parameters										Water Depth at Sewer Invert (m)		Water-Filled Area in Sewer (m^2)		Storage Volume in Sewer (m^3)	Storage Volume in MH (m^3)	Total Storage Volume (m^3)
To	From	Length (m)	Slope (%)	DS Invert	US Invert	Pipe Dia. (mm)	Pipe Dia. (m)	DS MH Dia. (mm)	DS MH Dia. (m)	DS Invert	US Invert	DS Invert	US Invert			
MH 3 (CTRL MH)	MH 4	8.5	0.4	240.910	240.944	1050	1.05	2400	2.4	1.05	1.02	0.8659	0.8574	7.3	4.8	12.1
MH 4	MH 5	5.5	0.4	240.960	240.982	1050	1.05	1800	1.8	1.00	0.98	0.8508	0.8401	4.6	2.5	7.2
MH 5	MH 6	36.2	0.4	240.990	241.135	1050	1.05	1800	1.8	0.97	0.83	0.8357	0.7300	28.3	2.5	30.8
MH 6	MH 7	21.8	0.4	241.140	241.227	1050	1.05	2400	2.4	0.82	0.73	0.7255	0.6453	14.9	3.7	18.7
MH 6	MH 8	16.8	0.4	241.140	241.207	1050	1.05	2400	2.4	0.82	0.75	0.7255	0.6644	11.7	3.7	15.4
MH 8	CBMH 9	6.2	0.5	241.220	241.251	1050	1.05	1800	1.8	0.74	0.71	0.6522	0.6221	4.0	1.9	5.8
														70.9	**19.1**	**89.9**

Note:

1. Water Depth in each sewer is calculated as Storm Event Water Elevation - Invert Elevation (DS or US). In cases where the sewer invert is above the storm water elevation, the water depth is equal to 0.
2. Water-Filled Areas are calculated using the following equation, where R = Sewer radius (m) and h = Water depth in sewer (m)
3. In cases where the sewer cross-section is full, the Water-Filled Area is calculated as π x R^2.
4. Storage Volume is calculated as the Sewer Length multiplied by the average of the DS and US Water-Filled Areas.
Total Storage in the system is calculated as the sum of the storage volume in each sewer.

$$\text{Area} = R^2 \cos^{-1}\left(\frac{R-h}{R}\right) - (R-h)\sqrt{2Rh-h^2}$$

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CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

Superpipe Storage

Superpipe Diameter:	1.050	m
Superpipe Radius:	0.525	m
Superpipe Length:	95	m
Depth increments:	0.01	m

Flow Depth (m)	Storage (m3)
0.00	0.00
0.01	0.13
0.02	0.37
0.03	0.67
0.04	1.03
0.05	1.43
0.06	1.87
0.07	2.36
0.08	2.87
0.09	3.41
0.10	3.99
0.11	4.58
0.12	5.21
0.13	5.85
0.14	6.52
0.15	7.21
0.16	7.92
0.17	8.64
0.18	9.39
0.19	10.15
0.20	10.92
0.21	11.71
0.22	12.52
0.23	13.34
0.24	14.17
0.25	15.01
0.26	15.87
0.27	16.73
0.28	17.61
0.29	18.50
0.30	19.39
0.31	20.30
0.32	21.21
0.33	22.14
0.34	23.07
0.35	24.00
0.36	24.95
0.37	25.90
0.38	26.85
0.39	27.81
0.40	28.78
0.41	29.75
0.42	30.73
0.43	31.71
0.44	32.69
0.45	33.67
0.46	34.66
0.47	35.65
0.48	36.65
0.49	37.64
0.50	38.64
0.51	39.63
0.52	40.63
0.53	41.63
0.54	42.63
0.55	43.62
0.56	44.62
0.57	45.61
0.58	46.61
0.59	47.60
0.60	48.59
0.61	49.57
0.62	50.55
0.63	51.53
0.64	52.51
0.65	53.48
0.66	54.45
0.67	55.41
0.68	56.36
0.69	57.31
0.70	58.26
0.71	59.19
0.72	60.12
0.73	61.05
0.74	61.96
0.75	62.87
0.76	63.76
0.77	64.65
0.78	65.53
0.79	66.39
0.80	67.25
0.81	68.09
0.82	68.92
0.83	69.74
0.84	70.55
0.85	71.34
0.86	72.12
0.87	72.88
0.88	73.62
0.89	74.34
0.90	75.05
0.91	75.74
0.92	76.41
0.93	77.05
0.94	77.68
0.95	78.28
0.96	78.85
0.97	79.39
0.98	79.91
0.99	80.39
1.00	80.83
1.01	81.23
1.02	81.59
1.03	81.90
1.04	82.13
1.05	82.26

volume =

$$L\left(R^2\cos^{-1}\left(\frac{R-D}{R}\right)-(R-D)\sqrt{2RD-D^2}\right)$$

where:
R is the **radius** of the cylinder.
D is the depth.
L is the length of the cylinder

CROZIER
CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-04-20
Designed By: JB
Checked By: PS

Orifice Rating Curve

Depth Increment (m) = 0.010
Inlet Elevation (m) = 241.08
Orifice Type = 73mm Contech Vortex Valve (CEV190)

Storage Rating Curve

	Water Elev. (m)	Depth (m)	Orifice 1 check for inlet E.L. control	Head 1 (m)	Volume (m3)	Orifice1 Q (L/s)	
Pipe Invert	241.10	0.00	0.02	0.00	0.00	0.00	Note: Flow from Orifice based on 73mm Contect Vortext Valve CEV190 Rating Curve
	241.11	0.01	0.03	0.01	0.13	0.09	
	241.12	0.02	0.04	0.02	0.37	0.18	
	241.13	0.03	0.05	0.03	0.67	0.39	
	241.14	0.04	0.06	0.04	1.03	0.58	
	241.15	0.05	0.07	0.05	1.43	0.77	
	241.16	0.06	0.08	0.06	1.87	0.94	
	241.17	0.07	0.09	0.07	2.36	1.10	
	241.18	0.08	0.10	0.08	2.87	1.24	
	241.19	0.09	0.11	0.09	3.41	1.38	
	241.20	0.10	0.12	0.10	3.99	1.49	
	241.21	0.11	0.13	0.11	4.58	1.60	
	241.22	0.12	0.14	0.12	5.21	1.69	
	241.23	0.13	0.15	0.13	5.85	1.77	
	241.24	0.14	0.16	0.14	6.52	1.84	
	241.25	0.15	0.17	0.15	7.21	1.90	
	241.26	0.16	0.18	0.16	7.92	1.94	
	241.27	0.17	0.19	0.17	8.64	1.96	
	241.28	0.18	0.20	0.18	9.39	1.98	
	241.29	0.19	0.21	0.19	10.15	1.91	
	241.30	0.20	0.22	0.20	10.92	1.74	
	241.31	0.21	0.23	0.21	11.71	1.61	
	241.32	0.22	0.24	0.22	12.52	1.64	
	241.33	0.23	0.25	0.23	13.34	1.67	
	241.34	0.24	0.26	0.24	14.17	1.70	
	241.35	0.25	0.27	0.25	15.01	1.73	
	241.36	0.26	0.28	0.26	15.87	1.76	
	241.37	0.27	0.29	0.27	16.73	1.79	
	241.38	0.28	0.30	0.28	17.61	1.82	
	241.39	0.29	0.31	0.29	18.50	1.85	
	241.40	0.30	0.32	0.30	19.39	1.88	
	241.41	0.31	0.33	0.31	20.30	1.91	
	241.42	0.32	0.34	0.32	21.21	1.94	
	241.43	0.33	0.35	0.33	22.14	1.96	
	241.44	0.34	0.36	0.34	23.07	1.99	
	241.45	0.35	0.37	0.35	24.00	2.02	**2-Year**
	241.46	0.36	0.38	0.36	24.95	2.05	
	241.47	0.37	0.39	0.37	25.90	2.08	
	241.48	0.38	0.40	0.38	26.85	2.10	
	241.49	0.39	0.41	0.39	27.81	2.13	
	241.50	0.40	0.42	0.40	28.78	2.16	
	241.51	0.41	0.43	0.41	29.75	2.19	
	241.52	0.42	0.44	0.42	30.73	2.21	
	241.53	0.43	0.45	0.43	31.71	2.24	
	241.54	0.44	0.46	0.44	32.69	2.27	
	241.55	0.45	0.47	0.45	33.67	2.29	
	241.56	0.46	0.48	0.46	34.66	2.32	
	241.57	0.47	0.49	0.47	35.65	2.34	
	241.58	0.48	0.50	0.48	36.65	2.37	**5-Year**
	241.59	0.49	0.51	0.49	37.64	2.40	
	241.60	0.50	0.52	0.50	38.64	2.42	
	241.61	0.51	0.53	0.51	39.63	2.45	
	241.62	0.52	0.54	0.52	40.63	2.47	
	241.63	0.53	0.55	0.53	41.63	2.50	
	241.64	0.54	0.56	0.54	42.63	2.52	
	241.65	0.55	0.57	0.55	43.62	2.54	
	241.66	0.56	0.58	0.56	44.62	2.57	
	241.67	0.57	0.59	0.57	45.61	2.59	
	241.68	0.58	0.60	0.58	46.61	2.62	**10-Year**
	241.69	0.59	0.61	0.59	47.60	2.64	
	241.70	0.60	0.62	0.60	48.59	2.66	
	241.71	0.61	0.63	0.61	49.57	2.69	
	241.72	0.62	0.64	0.62	50.55	2.71	
	241.73	0.63	0.65	0.63	51.53	2.73	
	241.74	0.64	0.66	0.64	52.51	2.76	
	241.75	0.65	0.67	0.65	53.48	2.78	
	241.76	0.66	0.68	0.66	54.45	2.80	
	241.77	0.67	0.69	0.67	55.41	2.82	
	241.78	0.68	0.70	0.68	56.36	2.84	
	241.79	0.69	0.71	0.69	57.31	2.87	
	241.80	0.70	0.72	0.70	58.26	2.89	**25-Year**
	241.81	0.71	0.73	0.71	59.19	2.91	
	241.82	0.72	0.74	0.72	60.12	2.93	
	241.83	0.73	0.75	0.73	61.05	2.95	
	241.84	0.74	0.76	0.74	61.96	2.97	
	241.85	0.75	0.77	0.75	62.87	2.99	
	241.86	0.76	0.78	0.76	63.76	3.01	
	241.87	0.77	0.79	0.77	64.65	3.03	
	241.88	0.78	0.80	0.78	65.53	3.05	
	241.89	0.79	0.81	0.79	66.39	3.07	
	241.90	0.80	0.82	0.80	67.25	3.09	**50-Year**
	241.91	0.81	0.83	0.81	68.09	3.11	
	241.92	0.82	0.84	0.82	68.92	3.13	
	241.93	0.83	0.85	0.83	69.74	3.15	
	241.94	0.84	0.86	0.84	70.55	3.17	
	241.95	0.85	0.87	0.85	71.34	3.19	
	241.96	0.86	0.88	0.86	72.12	3.21	
	241.97	0.87	0.89	0.87	72.88	3.23	
	241.98	0.88	0.90	0.88	73.62	3.25	
	241.99	0.89	0.91	0.89	74.34	3.26	
	242.00	0.90	0.92	0.90	75.05	3.28	
	242.01	0.91	0.93	0.91	75.74	3.30	
	242.02	0.92	0.94	0.92	76.41	3.32	
	242.03	0.93	0.95	0.93	77.05	3.33	**100-Year**
	242.04	0.94	0.96	0.94	77.68	3.35	
	242.05	0.95	0.97	0.95	78.28	3.37	
	242.06	0.96	0.98	0.96	78.85	3.38	
	242.07	0.97	0.99	0.97	79.39	3.40	
	242.08	0.98	1.00	0.98	79.91	3.42	
	242.09	0.99	1.01	0.99	80.39	3.43	
	242.10	1.00	1.02	1.00	80.83	3.45	
	242.11	1.01	1.03	1.01	81.23	3.47	
	242.12	1.02	1.04	1.02	81.59	3.48	
	242.13	1.03	1.05	1.03	81.90	3.50	
	242.14	1.04	1.06	1.04	82.13	3.51	
Pipe Obvert	242.15	1.05	1.07	1.05	82.26	3.53	

CROZIER CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 649-6278
Date: 2023-11-21
Designed By: MJB/JB
Checked By: PS

Orifice Rating Curve

Depth Increment (m) = 0.010
Inlet Elevation (m) = 240.91
Orifice Type = 70mm Contech Vortex Valve (CEV225)

Storage Rating Curve

	Water Elev. (m)	Depth (m)	Orifice 1 check for inlet E.L. control	Head 1 (m)	Volume (m3)	Orifice Q (L/s)	
Pipe Invert	240.91	0.00	0.00	0.00	89.95	0.00	Note: Flow from Orifice based on 70mm Contect Vortex Valve CEV225 Rating Curve
	240.92	0.01	0.01	0.01	0.05	0.06	
	240.93	0.02	0.02	0.02	0.11	0.21	
	240.94	0.03	0.03	0.03	0.17	0.36	
	240.95	0.04	0.04	0.04	0.23	0.51	
	240.96	0.05	0.05	0.05	0.30	0.65	
	240.97	0.06	0.06	0.06	0.41	0.78	
	240.98	0.07	0.07	0.07	0.52	0.90	
	240.99	0.08	0.08	0.08	0.65	1.02	
	241.00	0.09	0.09	0.09	0.83	1.13	
	241.01	0.10	0.10	0.10	1.03	1.23	
	241.02	0.11	0.11	0.11	1.26	1.33	
	241.03	0.12	0.12	0.12	1.50	1.42	
	241.04	0.13	0.13	0.13	1.76	1.51	
	241.05	0.14	0.14	0.14	2.02	1.59	
	241.06	0.15	0.15	0.15	2.30	1.66	
	241.07	0.16	0.16	0.16	2.59	1.73	
	241.08	0.17	0.17	0.17	2.88	1.79	
	241.09	0.18	0.18	0.18	3.19	1.84	
	241.10	0.19	0.19	0.19	3.50	1.88	
	241.11	0.20	0.20	0.20	3.82	1.92	
	241.12	0.21	0.21	0.21	4.15	1.80	
	241.13	0.22	0.22	0.22	4.48	1.86	
	241.14	0.23	0.23	0.23	4.83	1.79	
	241.15	0.24	0.24	0.24	5.33	1.59	
	241.16	0.25	0.25	0.25	5.87	1.30	
	241.17	0.26	0.26	0.26	6.45	1.32	
	241.18	0.27	0.27	0.27	7.04	1.34	
	241.19	0.28	0.28	0.28	7.66	1.37	
	241.20	0.29	0.29	0.29	8.31	1.39	
	241.21	0.30	0.30	0.30	8.97	1.41	
	241.22	0.31	0.31	0.31	9.66	1.44	
	241.23	0.32	0.32	0.32	10.40	1.46	
	241.24	0.33	0.33	0.33	11.19	1.48	
	241.25	0.34	0.34	0.34	12.01	1.50	
	241.26	0.35	0.35	0.35	12.86	1.53	
	241.27	0.36	0.36	0.36	13.73	1.55	
	241.28	0.37	0.37	0.37	14.63	1.57	
	241.29	0.38	0.38	0.38	15.55	1.59	
	241.30	0.39	0.39	0.39	16.49	1.61	
	241.31	0.40	0.40	0.40	17.44	1.63	
	241.32	0.41	0.41	0.41	18.42	1.65	
	241.33	0.42	0.42	0.42	19.41	1.67	
	241.34	0.43	0.43	0.43	20.41	1.69	
	241.35	0.44	0.44	0.44	21.43	1.71	
	241.36	0.45	0.45	0.45	22.46	1.73	
	241.37	0.46	0.46	0.46	23.51	1.75	
	241.38	0.47	0.47	0.47	24.56	1.77	
	241.39	0.48	0.48	0.48	25.63	1.79	**2 - Year**
	241.40	0.49	0.49	0.49	26.71	1.81	
	241.41	0.50	0.50	0.50	27.80	1.83	
	241.42	0.51	0.51	0.51	28.89	1.85	
	241.43	0.52	0.52	0.52	30.00	1.86	
	241.44	0.53	0.53	0.53	31.12	1.88	
	241.45	0.54	0.54	0.54	32.24	1.90	
	241.46	0.55	0.55	0.55	33.37	1.92	
	241.47	0.56	0.56	0.56	34.51	1.93	
	241.48	0.57	0.57	0.57	35.65	1.95	
	241.49	0.58	0.58	0.58	36.80	1.97	
	241.50	0.59	0.59	0.59	37.96	1.98	
	241.51	0.60	0.60	0.60	39.12	2.00	**5 - Year**
	241.52	0.61	0.61	0.61	40.28	2.02	
	241.53	0.62	0.62	0.62	41.45	2.03	
	241.54	0.63	0.63	0.63	42.62	2.05	
	241.55	0.64	0.64	0.64	43.80	2.06	
	241.56	0.65	0.65	0.65	44.98	2.08	
	241.57	0.66	0.66	0.66	46.16	2.09	
	241.58	0.67	0.67	0.67	47.35	2.11	
	241.59	0.68	0.68	0.68	48.53	2.12	**10 - Year**
	241.60	0.69	0.69	0.69	49.72	2.15	
	241.61	0.70	0.70	0.70	50.91	2.16	
	241.62	0.71	0.71	0.71	52.10	2.18	
	241.63	0.72	0.72	0.72	53.29	2.19	
	241.64	0.73	0.73	0.73	54.48	2.21	
	241.65	0.74	0.74	0.74	55.67	2.22	
	241.66	0.75	0.75	0.75	56.86	2.24	
	241.67	0.76	0.76	0.76	58.05	2.25	
	241.68	0.77	0.77	0.77	59.23	2.26	
	241.69	0.78	0.78	0.78	60.42	2.28	
	241.70	0.79	0.79	0.79	61.60	2.29	**25 - Year**
	241.71	0.80	0.80	0.80	62.78	2.31	
	241.72	0.81	0.81	0.81	63.95	2.32	
	241.73	0.82	0.82	0.82	65.12	2.33	
	241.74	0.83	0.83	0.83	66.29	2.35	
	241.75	0.84	0.84	0.84	67.45	2.36	
	241.76	0.85	0.85	0.85	68.61	2.38	
	241.77	0.86	0.86	0.86	69.76	2.39	
	241.78	0.87	0.87	0.87	70.91	2.40	**50 - Year**
	241.79	0.88	0.88	0.88	72.05	2.42	
	241.80	0.89	0.89	0.89	73.19	2.43	
	241.81	0.90	0.90	0.90	74.31	2.44	
	241.82	0.91	0.91	0.91	75.43	2.46	
	241.83	0.92	0.92	0.92	76.54	2.47	
	241.84	0.93	0.93	0.93	77.65	2.48	
	241.85	0.94	0.94	0.94	78.74	2.50	
	241.86	0.95	0.95	0.95	79.82	2.51	
	241.87	0.96	0.96	0.96	80.90	2.52	
	241.88	0.97	0.97	0.97	81.96	2.54	**100 - Year**
	241.89	0.98	0.98	0.98	83.01	2.55	
	241.90	0.99	0.99	0.99	84.04	2.56	
	241.91	1.00	1.00	1.00	85.07	2.58	
	241.92	1.01	1.01	1.01	86.08	2.59	
	241.93	1.02	1.02	1.02	87.07	2.60	
	241.94	1.03	1.03	1.03	88.05	2.62	
	241.95	1.04	1.04	1.04	89.01	2.63	
Pipe Obvert	241.96	1.05	1.05	1.05	89.95	2.64	

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	Tuesday, November 21, 2023
Project Name	13290 Nunnville Road
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:

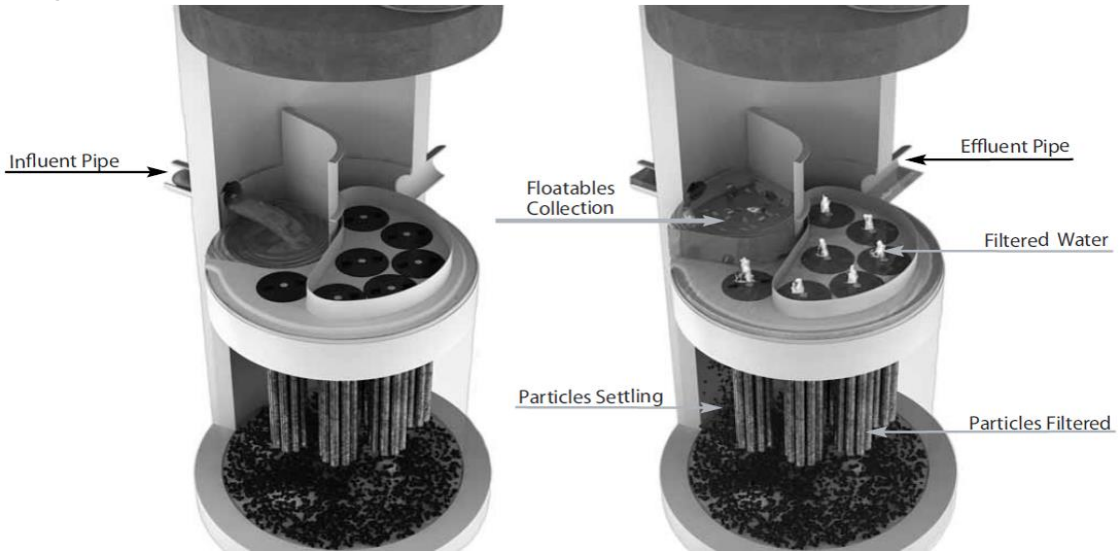
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 77% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash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

Field Proven Peformance

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

- A median TSS removal efficiency of 90%, 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

Project Information

Date:	Tuesday, November 21, 2023
Project Name:	13290 Nunnville Road
Project Number:	
Location:	Caledon

Designer Information

Company:	Crozier
Contact:	Matthew Baldesarra
Phone #:	

Notes

revised

Rainfall

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

Drainage Area

Total Area:	0.18 ha
Runoff Coefficient:	0.66

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:	**3.8 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 715 m³, with a suspended sediment concentration of 60 mg/L.	**43 kg**

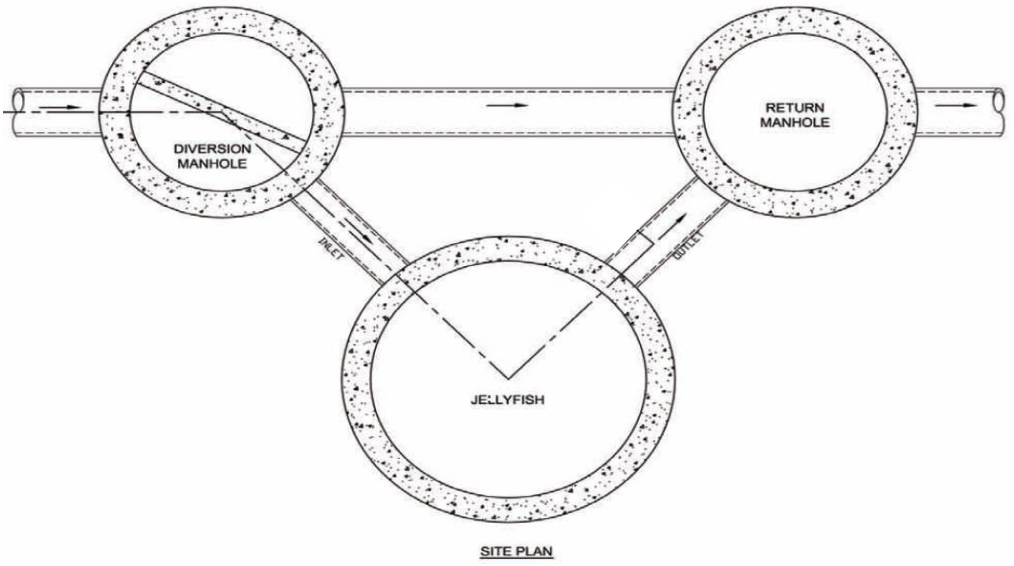
Recommendation

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.

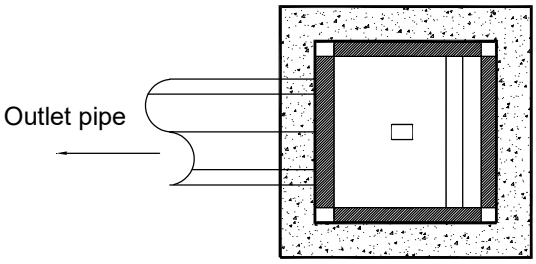
5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

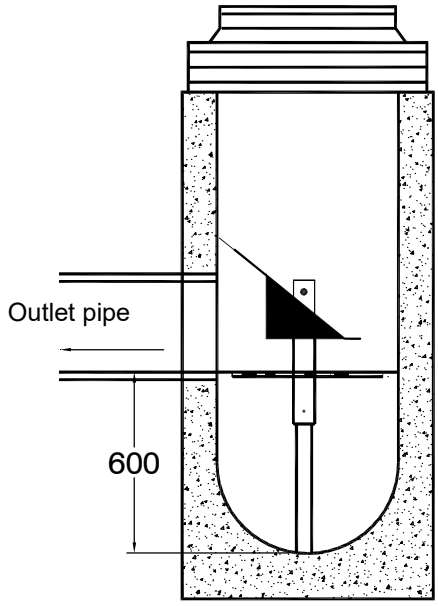
Notes

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.

CROZIER
CONSULTING ENGINEERS

Project: 13290 Nunnville Road
Project No.: 0649-6278
Date: 2023.11.01
Designed By: MJB
Checked By: JB

CB Capture Analysis

Storm Data: City of Mississauga

Time of Concentration: 10 min = 0.17 hours
= 600 sec

Return Period	A	B	C	i mm/hr
100 yr	4688	17	0.9624	196.5

INLET CAPACITY - CURB & GUTTER

STRUCTURE LABEL	MTO DESIGN CHART	SX	GUTTER GRADE	T	INLET CAPACITY (m^3/s)
CB 1	4.06	0.02	3.9%	3.00	0.30
CBMH 9	4.06	0.02	1.0%	3.00	0.16

INLET CAPACITY AT ROAD SAG

STRUCTURE LABEL	MTO DESIGN CHART	T/G	MAX GRADE	PONDING DEPTH (m)	INLET CAPACITY (m^3/s)
CB 2	4.19	244.33	244.63	0.30	0.20
CB 3	4.19	244.36	244.63	0.27	0.20

Catchment ID	Impervious Area (m^2)	Pervious Area (m^2)	Area (m^2)	Weighted Average RC
CB1	266	173	438	0.64
CB2	719	191	910	0.76
CB3	544	112	655	0.79
CBMH9	401	108	509	0.76
Total	1929	583	2513	

Catchbasin #	Return Period	i	Peak Flow to Catchbasin [1]			Ponding Depth	Capture Capacity [2]	Remaining Capacity [3]
		mm/hr	RC	A (ha)	Q (m3/s)	m	m3/s	m3/s
CB1	100 yr	196.54	0.64	0.04	0.02	N/A	0.15	0.135
CB2	100 yr	196.54	0.76	0.09	0.04	0.30	0.10	0.062
CB3	100 yr	196.54	0.79	0.07	0.03	0.27	0.10	0.069
CBMH9	100 yr	196.54	0.76	0.05	0.02	N/A	0.08	0.059

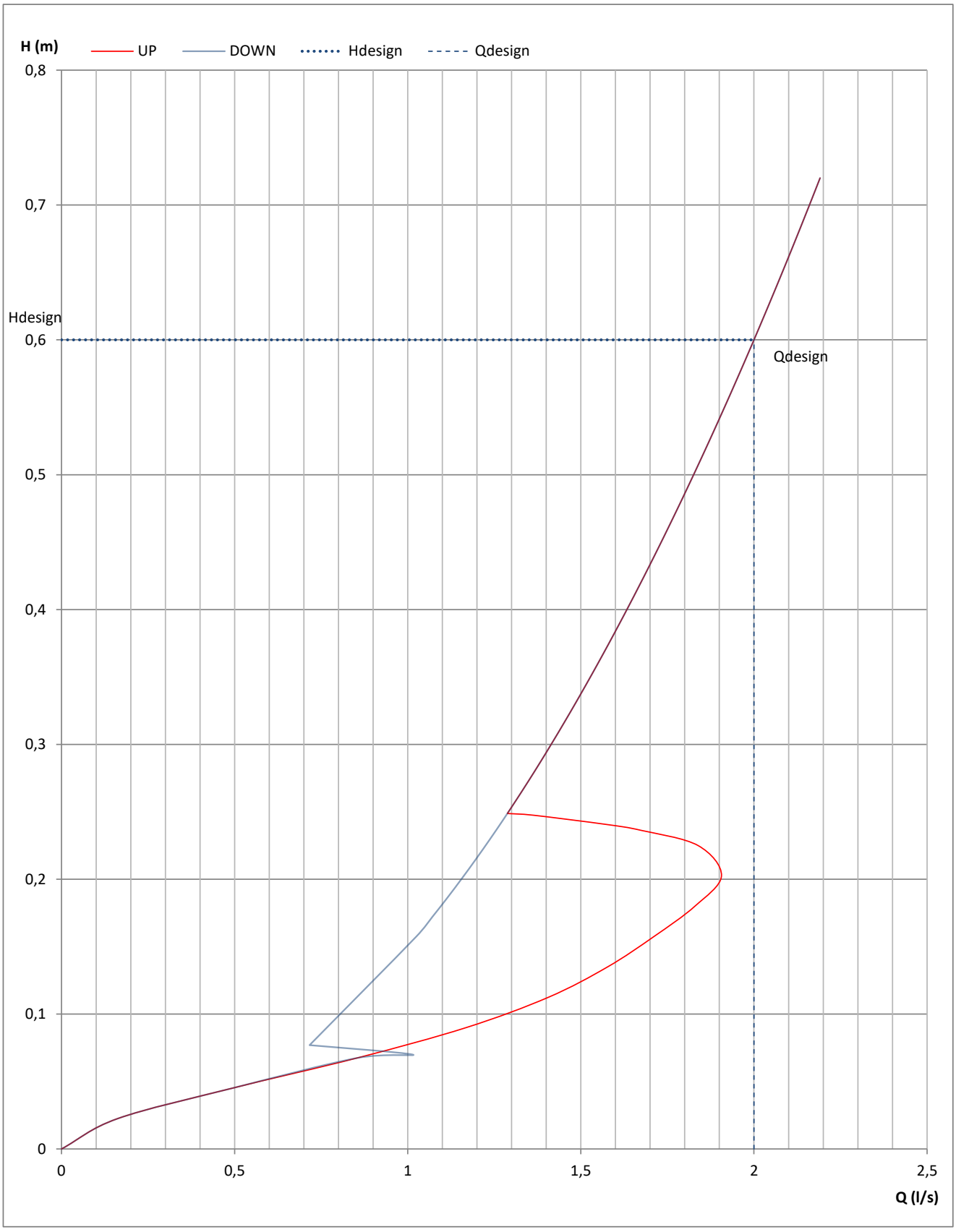
1 See attched figure for major system catchment information.
2 50% blockage of catchbasins assumed for inlet capacity calculations for catchbasins at low points. Capture capacity of standard catchbasin grates based on MTO Design Chart 4.19 (attached).
3 Positive values indicate that catchbasin(s) has sufficient capacity to capture runoff (Q). Negative values indicate insufficient capacity, and runoff spills to next downstream catchbasin(s)

References

IDF Values for 100 Year Storm and minimum time of concentration from Town of Caledon Rainfall Intensity Curves Standard No. 103

Ref: 27673.2.1
Date: 07-11-2023
Design: Q=2l/s
H=0,6m

CEV 225 ø70



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Tel 905-948-0000

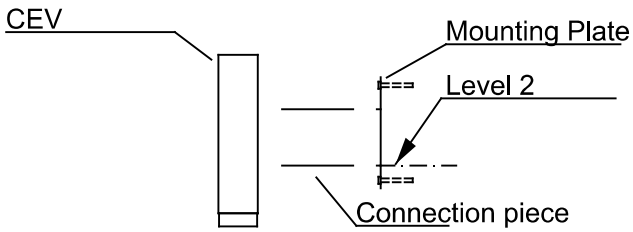
Mosbaek A/S
Vaerkstedsvej 20
DK-4600 Koege, Denmark
Tel +45 56 63 85 80

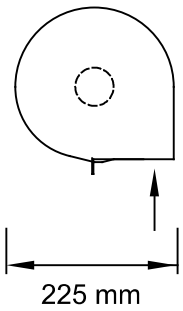
Date: 07 NOV 2023 Ref.: 27673.2.1
Type: CEV 225
Q = 2 l/s at h = 0,6 m

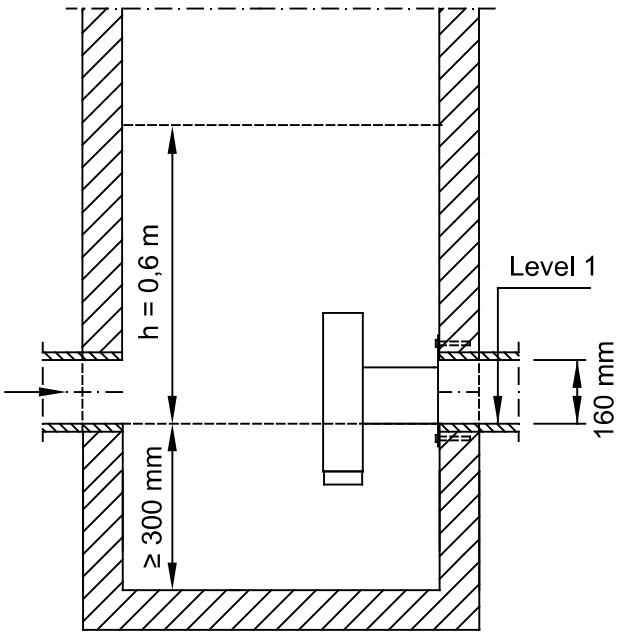
Your ref.: 13290 Nunnville Rd

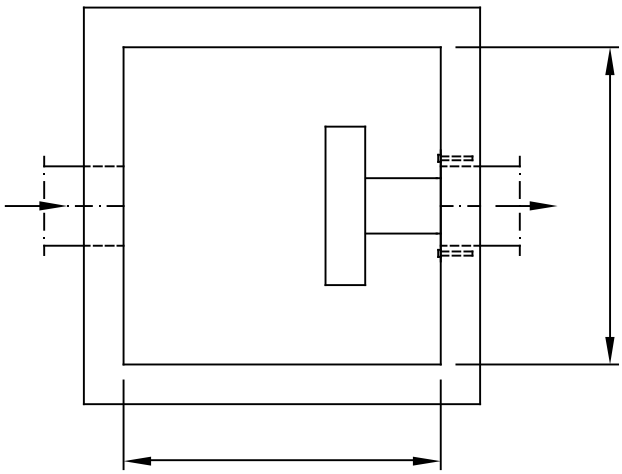
Installation

The mounting plate must be fastened to the wall covering the outlet opening by means of supplied bolts.
Please note that level 1 and level 2 must be equal.
Tightening between plate and wall is made with waterresistant silicone, rubber sealing or the like.









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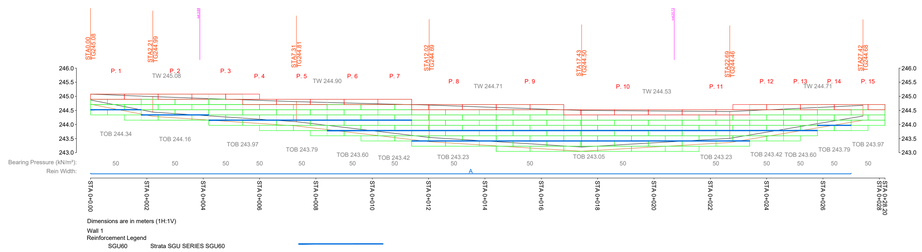
Q	H
0	0
0.16	0.022
0.49	0.045
0.85	0.068
1.17	0.09
1.41	0.112
1.58	0.135
1.71	0.158
1.83	0.18
1.91	0.202
1.84	0.225
1.67	0.236
1.57	0.241
1.36	0.248
1.29	0.249
1.29	0.249
1.31	0.258
1.35	0.273
1.38	0.287
1.42	0.302
1.45	0.316
1.48	0.331
1.52	0.345
1.55	0.359
1.58	0.374
1.61	0.388
1.64	0.403
1.67	0.417
1.7	0.432
1.72	0.446
1.75	0.46
1.78	0.475
1.81	0.489
1.83	0.504
1.86	0.518
1.88	0.532
1.91	0.547
1.93	0.561
1.96	0.576
1.98	0.59
2.35	0.83
2.67	1.07
2.96	1.31
3.21	1.55
3.45	1.79
3.46	1.8

0.677	
2.15	0.691
2.17	0.706
2.19	0.72

WALL ELEVATION VIEW

Scale 1:100

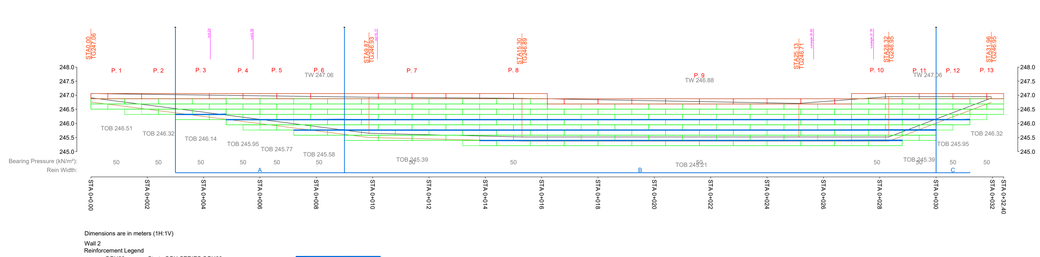


Dimensions are in meters (1H:1V)

Wall 1

Reinforcement Legend

SGU60 Strata SGU SERIES SGU60

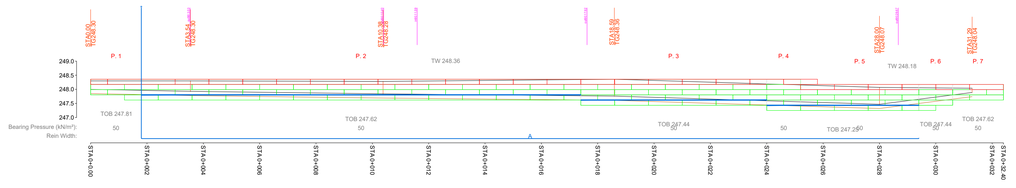


Dimensions are in meters (1H:1V)

Wall 2

Reinforcement Legend

SGU60 Strata SGU SERIES SGU60



Dimensions are in meters (1H:1V)

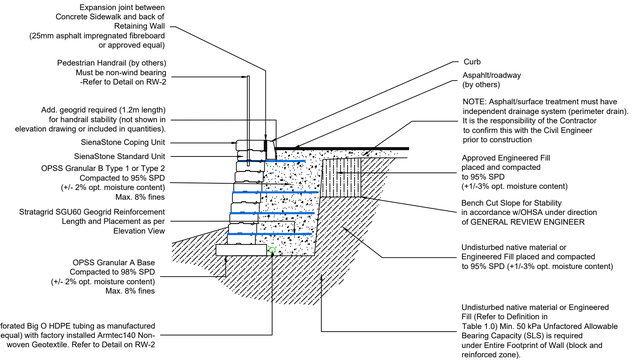
Wall 3

Reinforcement Legend

SGU60 Strata SGU SERIES SGU60

TYPICAL MAXIMUM HEIGHT SECTION

Scale 1:50



Not for Construction

Design is Not for Construction until a third party Professional Engineer has been retained by the Contractor/Owner to provide General Review of construction for the proposed wall(s) in accordance with the requirements of the Ontario Building Code and PEO Guidelines. The General Review Engineer must inform this office in writing that they have been retained to undertake the General Review of the wall(s). Refer to the letter of Intent included in the Design Report.
(email to info@risistone.com or fax/mail to contact information shown in titleblock - please quote the RSS Project Number) .

PANEL GEOMETRY & GEOGRID GROUPS

Wall 1 - Panel Geometry

Column No.	Top Elev.	Base Elev.	Left Stn.	Right Stn.
1	245.08	244.34	0.00	1.80
2	245.08	244.16	1.80	4.20
3	245.08	243.97	4.20	5.40
4	244.90	243.97	5.40	6.60
5	244.90	243.79	6.60	8.40
6	244.90	243.60	8.40	10.20
7	244.90	243.42	10.20	11.40
8	244.71	243.23	11.40	14.40
9	244.71	243.05	14.40	16.80
10	244.53	243.05	16.80	21.00
11	244.53	243.23	21.00	23.40
12	244.71	243.42	23.40	24.60
13	244.71	243.60	24.60	25.80
14	244.71	243.79	25.80	27.00
15	244.71	243.97	27.00	28.20

Markers

Marker	Station	Note
out	3.88	
out	20.72	

Geogroups

Group	Layer	Length (m)	Panels	Wall Span (m)
A	All	1.50	1 - 14	0.00 - 27.00

Wall 2 - Panel Geometry

Column No.	Top Elev.	Base Elev.	Left Stn.	Right Stn.
1	247.06	246.51	0.00	1.80
2	247.06	246.32	1.80	3.00
3	247.06	246.14	3.00	4.80
4	247.06	245.95	4.80	6.00
5	247.06	245.77	6.00	7.20
6	247.06	245.58	7.20	9.00
7	247.06	245.39	9.00	13.80
8	247.06	245.21	13.80	16.20
9	246.88	245.21	16.20	27.00
10	247.06	245.21	27.00	28.80
11	247.06	245.39	28.80	30.00
12	247.06	245.95	30.00	31.20
13	247.06	246.32	31.20	32.40

Markers

Marker	Station	Note
in	4.24	
out	10.17	
out	5.76	
outangle	27.78	
outangle	25.65	

Geogroups

Group	Layer	Length (m)	Panels	Wall Span (m)
A	All	1.20	3 - 6	3.00 - 9.00
B	All	1.50	7 - 11	9.00 - 30.00
C	All	1.20	12 - 12	30.00 - 31.20

Wall 3 - Panel Geometry

Column No.	Top Elev.	Base Elev.	Left Stn.	Right Stn.
1	248.36	247.81	0.00	1.80
2	248.36	247.62	1.80	17.40
3	248.36	247.44	17.40	24.00
4	248.36	247.25	24.00	25.20
5	248.18	247.25	25.20	29.40
6	248.18	247.44	29.40	30.60
7	248.18	247.62	30.60	32.40

Markers

Marker	Station	Note
out90	5.53	
out90	10.40	
in90	11.59	
out90	17.62	
out90	28.67	

Geogroups

Group	Layer	Length (m)	Panels	Wall Span (m)
A	All	1.20	2 - 5	1.80 - 29.40

TABLE 1.0 - SOIL ZONES & ASSUMED PROPERTIES

MUST BE VERIFIED BY GENERAL REVIEW ENGINEER - REFER TO SECTION 3.03 OF SPECIFICATION

Soil Region	Reinforced Fill	Retained Fill/Soil**	Foundation Soil**	Base	Drainage Fill (as req. - ref to section)
Description (by USCS)	GW Well graded gravel Max. 8% fines	ML-CL Lean Silty Clay Low Plasticity	ML-CL Lean Silty Clay Low Plasticity	GW Well graded gravel Max. 8% fines	GP Gap graded, rapid draining gravel
Effective Internal Friction Angle (Deg.)	33°	28°	28°	39°	NA
Compaction Requirement (Eng. Fills Only)	95% SPD (+/- 2% opt. moist.)	95% SPD (+/- 2% opt. moist.)	98% SPD (+/- 2% opt. moist.)	98% SPD (+/- 2% opt. moist.)	Dense State
Moist Unit Weight (kN/cu.m)	22	20	20	22	18
Effective Cohesion (kPa)	NA	NA	NA	NA	NA
Soil Notes	Max. 150-200mm Compaction Lifts	Max. 150-200mm Compaction Lifts	See Section for req. ALLOW Bearing Capacites	Max. 150-200mm Compaction Lifts	Max. 150-200mm Compaction Lifts
Geotextile at Interface	Interface: Reinforced/Retained Geotextile Not Req. if gradations listed below are met. Otherwise : TBD		NA	NA	NA
Assumed Gradation for Filtration Req.*	D(15) <0.3mm D(50) <1.18mm MAX 8% FINES	D(85) >0.075mm D(15) <0.002mm D(50)>0.05mm	NA	NA	NA

* If the above gradation requirements are not met, an alternative filter fabric will be required. Contact RSS to discuss alternatives.

** Engineered Fill is defined as Clean earth fill placed and compacted in maximum lift thicknesses of 150mm to at least 98 percent Standard Proctor Density for Foundation Soils and 95 percent Standard Proctor Density for Retained Soils, under the full-time inspection and testing of a geotechnical engineering firm who provides written confirmation and certification of the completed Engineered Fill.

TABLE 2.0 - DESIGN INFORMATION

Retaining Wall System	Max. Slope Above Wall	Max. Surcharge Above Wall (kPa)	Batter of Wall (Degrees)	Maximum Height (mm)
Siena Stone Manufactured by Unilock Inc.	horizontal	12	7.12	See Detail

Geogrid Type	Min. Geogrid LTDS (kN / m)	Max. Slope Below Wall	Depth of Embedment (mm)	Compacted Base Dimensions (mm height x mm width)
Stratagrid SGU60 by Stratagsystems	26	3H:1V	See Elevation	200 x 900

GENERAL NOTES

1. THE INFORMATION PROVIDED ON THIS SHEET MUST BE USED IN CONJUNCTION WITH THE ATTACHED SPECIFICATIONS.

2. THIS DESIGN IS BASED ON INFORMATION PROVIDED IN DRAWING NO. C103 BY CROZIER CONSULTING ENGINEERS, DATE OF LAST REVISION 2023/DEC/12. THESE WALL DESIGN DRAWINGS ARE NOT INTENDED TO BE "STAND ALONE" DRAWINGS. THE WALL CONTRACTOR AND GENERAL CONTRACTOR ARE REQUIRED TO HAVE A COMPLETE UNDERSTANDING OF ANY AND ALL OTHER STRUCTURES THAT MAY INTERACT WITH THIS SEGMENTAL RETAINING WALL. THE WALL CONTRACTOR AND GENERAL CONTRACTOR MUST REFER TO A FULL SET OF CIVIL, STRUCTURAL AND ARCHITECTURAL DRAWINGS (AS APPLICABLE) FOR THE PROJECT TO ENSURE SUCCESSFUL CONSTRUCTION AND PERFORMANCE OF THE WALL SYSTEM. THIS WALL DESIGN DRAWING SHOULD NOT BE REFERRED TO FOR MANHOLE LOCATIONS, ELEVATIONS, OR ANY OTHER CIVIL OR SITE INFRASTRUCTURE INFORMATION BECAUSE DATA MAY HAVE BEEN SELECTIVELY REMOVED FROM THIS DRAWING FOR CLARITY OF WALL ILLUSTRATION.

3. DESIGN ASSUMPTIONS:
THE SRW DESIGN ASSUMES THE FOLLOWING.
A) THE FOUNDATION SOILS WILL PRODUCE ACCEPTABLE TOTAL AND DIFFERENTIAL SETTLEMENT GIVEN THE APPLIED LOAD OF THE SRW (MAX. 25 mm TOTAL OR DIFFERENTIAL SETTLEMENT AS VERIFIED BY GRE).
B)THE MAXIMUM GROUNDWATER ELEVATION IS BELOW THE BASE OF THE SRW.
C)THERE WILL BE NO HYDROSTATIC PRESSURE WITHIN OR BEHIND THE SRW.
D) THE SURROUNDING STRUCTURES WILL NOT EXERT ANY ADDITIONAL LOADING ON THE SRW (I.E. AN ADJACENT STRUCTURAL FOUNDATION IS AT OR BELOW PROPOSED LEVELING BASE OR OUTSIDE OF A THEORETICAL ZONE OF INFLUENCE AS DETERMINED BY THE GENERAL REVIEW ENGINEER).
E) THERE ARE NO STRUCTURES (UTILITIES SUCH AS GASWATER MAINS, STORM SEWERS, ELECTRICAL/COMMUNICATIONS CABLES, ETC) TO BE PLACED WITHIN OR BELOW THE REINFORCED FILL DURING OR AFTER CONSTRUCTION.

4. AT THIS STAGE IN THE DESIGN, RISI STONE SYSTEMS HAS NOT RECEIVED SITE SPECIFIC GEOTECHNICAL INFORMATION / GEOTECHNICAL REPORT. FOR DESIGN PURPOSES, WE HAVE ASSUMED A SET OF GEOTECHNICAL PARAMETERS. UPON EXCAVATION OR FURTHER EXPLORATION IN THE WALL LOCATION(S), THESE DESIGN PARAMETERS MUST BE VERIFIED AS BEING ACCEPTABLE BY THE GENERAL REVIEW ENGINEER (REFER TO NOTE 6) OR REVISED PARAMETERS MUST BE PROVIDED FOR A REDESIGN. BOTH THE CONTRACTOR AND THE PRIME CONSULTANT MUST BE ADVISED THAT THE DESIGN MAY HAVE TO BE ALTERED BASED ON ACTUAL CONDITIONS FOUND ON SITE. ALTERATION OF THE DESIGN MAY RESULT IN ADDITIONAL CONSTRUCTION COSTS AND PROJECT DELAYS. IT IS RECOMMENDED THAT CONTINGENCIES BE ADDRESSED IN THE CONTRACT TO UNDERTAKE THE WALL CONSTRUCTION FOR DEALING WITH THE DISCOVERY OF UNFAVORABLE SOIL CONDITIONS.

5. THIS DESIGN MUST BE CHECKED WITH THE FINAL GRADING PLAN TO VERIFY ACCURACY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THE WALL LAYOUT(S) PROVIDED MATCH THE FINAL SITE GRADING. CONTRACTOR MUST VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO BIDDING / CONSTRUCTION. RISI STONE SYSTEMS MAKES EVERY EFFORT TO ENSURE ACCURACY OF THE DESIGN, HOWEVER, AS INFORMATION PROVIDED MAY HAVE BEEN UNKNOWINGLY OUT OF DATE, UNCLEAR IN AREAS, OR INCORRECT, IT IS ULTIMATELY THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THE DIMENSIONS AND ELEVATIONS (QUANTITIES) OF THE WALL(S) WITH THE MOST RECENT GRADING PLAN AND ACTUAL SITE CONDITIONS.

6. THE ONTARIO BUILDING CODE REQUIRES THAT THE CONSTRUCTION OF EVERY BUILDING DESIGNED BY AN ARCHITECT AND/OR PROFESSIONAL ENGINEER IS TO BE REVIEWED FOR GENERAL CONFORMITY TO THE APPROVED DESIGN BY PROFESSIONALS (RETAINING WALLS FALL UNDER THE CATEGORY OF DESIGNATED STRUCTURES AND THEREFORE INCLUDED UNDER THE OBC). RISI STONE SYSTEMS AND/OR THEIR LICENSEE DOES NOT PROVIDE THIS SERVICE. THE CONTRACTOR MUST ENSURE THAT A THIRD THIRD PARTY ENGINEER HAS BEEN RETAINED TO PROVIDE GENERAL REVIEW OF THE WALL CONSTRUCTION IN ACCORDANCE WITH PART 3 EXECUTION SUB SECTION 3.03 OF RISISTONE SYSTEMS STANDARD SPECIFICATIONS.

7. THIS DESIGN HAS BEEN CONDUCTED IN ACCORDANCE WITH THE NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA) DESIGN MANUAL FOR SEGMENTAL RETAINING WALLS, THIRD EDITION. THE NCMA METHODOLOGY IS AN APPROVED DESIGN APPROACH IN CANADA AS STATED IN THE CANADIAN FOUNDATION ENGINEERING MANUAL, 4th EDITION (SECTION 27.3.2). THE PREFACE OF THE CFEM STATES THAT IT PROVIDES INFORMATION ON GEOTECHNICAL ENGINEERING, AS PRACTICED IN CANADA. **SO THAT THE USER WILL MORE READILY BE ABLE TO INTERPRET THE INTENT AND PERFORMANCE REQUIREMENTS OF SECTION 4.2 (FOUNDATIONS) OF THE NATIONAL BUILDING CODE OF CANADA.** AS THE ONTARIO BUILDING CODE OR NATIONAL BUILDING CODE DO NOT PROVIDE EXPLICIT METHODOLOGIES TO ADDRESS THE DESIGN OF SEGMENTAL RETAINING WALLS, COMPLIANCE OF THIS DESIGN WITH THE OBC AND NBC IS BY WAY OF THE CFEM RECOMMENDATIONS.
SEISMIC ANALYSIS HAS BEEN CONDUCTED AND ASSUMES A PGA OF 0.07 (OBC - SITE CLASS C). SITE CLASS MUST BE VERIFIED BY GENERAL REVIEW ENGINEER UPON INSPECTION OF SUBGRADE (AS DETAILED ON SECTION).
ANALYSIS OF OVERALL GLOBAL AND/OR COMPOUND STABILITY HAS NOT BEEN CONDUCTED. IT IS REQUIRED THAT THE PROJECT GEOTECHNICAL ENGINEER BE RETAINED BY THE OWNER TO ASSESS THE NEED FOR A GLOBAL STABILITY ANALYSIS AND PROVIDE THIS, IF NECESSARY. RISI STONE SYSTEMS CAN WORK WITH THE GEOTECHNICAL ENGINEER TO PROVIDE DETAILS OF THE WALL DESIGN TO BE INCORPORATED INTO THE GLOBAL STABILITY ANALYSIS.

8. THE LOCATION OF EXISTING OR PROPOSED UTILITIES MUST BE VERIFIED PRIOR TO CONSTRUCTION. GENERALLY IT IS RECOMMENDED THAT UTILITIES BE OFFSET FROM THE WALL TO A) PREVENT ADDITIONAL LOADING ON THE CONDUIT (I.E. A 1H:1V LINE OF INFLUENCE FROM THE BASE OF THE WALL SHOULD BE ASSUMED) UNLESS ACCOUNTED FOR IN DESIGN OF THE UTILITY B) TO ENSURE FUTURE ACCESS TO THE UTILITY WITHOUT UNDERMINING THE WALL. THE ENGINEERED FILL ABOVE THESE UTILITIES MUST BE COMPACTED TO 98% SPD. THE CIVIL ENGINEER MUST REVIEW THE DESIGN TO VERIFY THE ABOVE (REFER TO NOTE 9 AND SPECIFICATION FOR FURTHER DETAILS).

9. THE RETAINING WALL DRAWINGS AND SPECIFICATIONS MUST BE REVIEWED BY THE CIVIL ENGINEER, LANDSCAPE ARCHITECT/ARCHITECT, AND GENERAL REVIEW ENGINEER PRIOR TO THE GENERAL REVIEW ENGINEER AUTHORIZING THE DRAWINGS TO BE USED FOR CONSTRUCTION IN ACCORDANCE WITH SECTION 3.02, SEGMENTAL RETAINING WALL DESIGN REVIEW, OF THE SPECIFICATIONS.

RisiStone retaining wall systems

10 - 480 Harry Walker Parkway S.
Newmarket, Ontario, Canada L3Y 0B3
T 905.868.9255 | F 905.686.9254 | www.risistone.com

LICENSED PROFESSIONAL ENGINEER
E.C. Jonasson
100049955
12/14/23
PROVINCE OF ONTARIO

NOT FOR CONSTRUCTION

SEALED FOR DESIGN ONLY
Contingent on general review as detailed in 1.05b and 3.02b in SPECIFICATIONS

PROJECT Risi Project No. 202312001

13290 Nunnville Rd.
Caledon, Ontario

SienaStone®

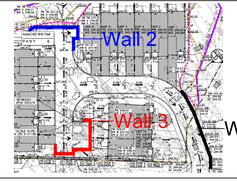
Geogrid Reinforced
Segmental Retaining Wall

Drawn By	ECJ
Design By	ECJ
Checked By	*
Date	12/13/23
Drawing No.	1 of 2
Drawing File	202312001RW1

REVISIONS

No.	Date	By	Revisions

WALL LOCATION PLAN n.t.s.



RISI PROJECT NO. 202312001

RETAINING WALL ELEVATION VIEW AND SECTIONS

SHEET RW-1

DRAWING NO. 1 of 2

Detail - Pedestrian Guardrail Installation

Notes:

1. Pedestrian Guardrail or Chain_link Fence
(Designed by others).

a) Must be non-wind bearing. Wall Designed to resist loads as specified in the Ontario Building Code.
b) Max. Post O/D = 75mm (3")

c) Post shape to be circular. If square post is required,
circular post must be sleeved into square post as per fence designers detail.

d) Grouted portion of the post must be unpainted.

e) Post must be sealed or capped from the top to prevent infiltration of water.

f) Post must be filled with grout inside and outside to crowing elevations (just above top of block)

g) Max. 1.8 m post spacing or as per design.

2. Grouting and Core Drilling

a) Grout manufacturers specifications must be adhered to. Failure to follow these specifications may lead to failure of the SRW block.

b) Holes are to be core drilled. Use of percussion type instrument is not allowed.

c) Core drill hole to extend completely through the specified number of courses to allow high pressure water jet (or other suitable means) to clean hole of dust and debris prior to grouting.

d) O/D of core drill hole not to exceed 100mm. Core drill hole O/D to exceed post O/D by min. 25mm. Core drill hole to be centered midway through block as shown. Min. 300mm offset to either end of block.

e) Installation must take place during the grout manufacturer's recommended temperature ranges.

f) The core drilled holes must be cleaned and free of dust and debris prior to pouring of the grout.

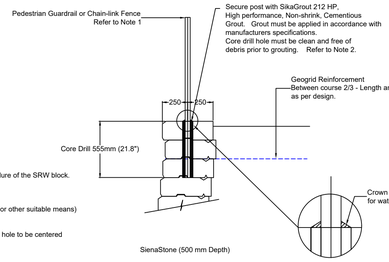
g) The core drill holes must be wet down prior to pouring the grout to promote a damp curing environment.

h) The grout must be brought up to just above the top of the coping unit and sloped away (crowned) from the post to prevent the future infiltration of water into the core drill hole. Contractor must ensure water is prevented from infiltrating post hole.

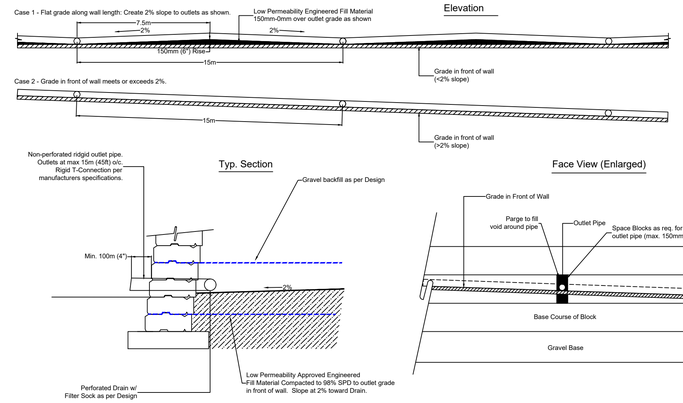
i) All contaminated water (used in cleaning the hole or core drilling) must be washed from the face of the wall to prevent staining.

j) Additional requirements and provisions are required by Grout manufacturer for proper performance than those noted here. Strict adherance to specifications required.

k) The Ontario Building Code requires that the contractor retain a General Review Engineer to ensure installation is in compliance with design and specifications (Wall and grout manufacturers specs).



Detail - Drain Outlet Thru Face of Wall



Detail - Inside Corner Construction

SienaStone (1.2m) Inside Modified Corners

Imperial dimensions

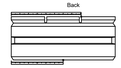
Angle [degrees]	Front [inches]	Back [inches]	Split [inches]	Cut [inches]	Unit to Modify
5	23 5/8	24 1/2	7/8	19 5/8	Standard
10	23 5/8	25 3/8	1 3/4	19 5/8	Standard
15	23 5/8	26 1/4	2 5/8	19 5/8	Standard
20	23 5/8	27 1/8	3 1/2	19 5/8	Standard
25	23 5/8	28	4 3/8	19 5/8	Standard
30	23 5/8	28 7/8	5 1/4	19 5/8	Standard
35	23 5/8	29 7/8	6 1/4	19 5/8	Standard
40	23 5/8	30 3/4	7 1/8	19 5/8	Standard
45	23 5/8	31 3/4	8 1/8	19 5/8	Standard
50	23 5/8	32 3/4	9 1/8	19 5/8	Standard
55	23 5/8	33 7/8	10 1/4	19 5/8	Standard
60	23 5/8	35	11 3/8	19 5/8	Standard
65	23 5/8	36 1/8	12 1/2	19 5/8	Standard
70	23 5/8	37 3/8	13 3/4	19 5/8	Standard
75	23 5/8	38 3/4	15 1/8	19 5/8	Standard
80	23 5/8	40 1/8	16 1/2	19 5/8	Standard
85	23 5/8	41 5/8	18	19 5/8	Standard
90	Use manufactured 90° corner unit				
91-180	Not recommended				

Metric dimensions

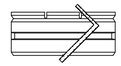
Angle [degrees]	Front [mm]	Back [mm]	Split [mm]	Cut [mm]	Unit to Modify
5	600	622	22	500	Standard
10	600	644	44	500	Standard
15	600	666	66	500	Standard
20	600	688	88	500	Standard
25	600	711	111	500	Standard
30	600	734	134	500	Standard
35	600	758	158	500	Standard
40	600	782	182	500	Standard
45	600	807	207	500	Standard
50	600	833	233	500	Standard
55	600	860	296	500	Standard
60	600	889	289	500	Standard
65	600	919	319	500	Standard
70	600	950	350	500	Standard
75	600	984	384	500	Standard
80	600	1020	420	500	Standard
85	600	1058	458	500	Standard
90	Use manufactured 90° corner unit				
91-180	Not recommended				

1. Create modified right corner unit using required unit.

a. Identify inside angle required. Mark corresponding Front and Back dimensions from left end of unit.



b. Mark Split and Cut dimensions on square. Line up marks on square with marks on unit

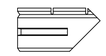


c. Scribe Split and Cut lines on unit.

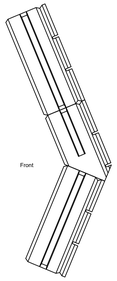
d. Use concrete saw to cut along Cut line.

e. Optional: Use chisel and hammer to score then split along Split line.

f. Use concrete saw to remove key from the right end, leaving approximately 575mm (23 inches) of the key intact at the left side.

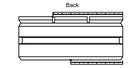


2. Place modified right corner unit on first course.

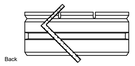


3. Create modified left corner unit using required unit.

a. Identify inside angle required. Mark corresponding Front and Back dimensions from right end of unit.



b. Mark Split and Cut dimensions on square. Line up marks on square with marks on block

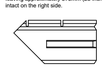


c. Scribe Split and Cut lines on unit.

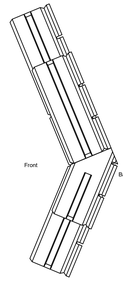
d. Use concrete saw to cut along Cut line.

e. Optional: Use chisel and hammer to score then split along Split line.

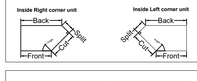
f. Use concrete saw to remove key from the left end, leaving approximately 575mm (23 inches) of the key intact on the right side.



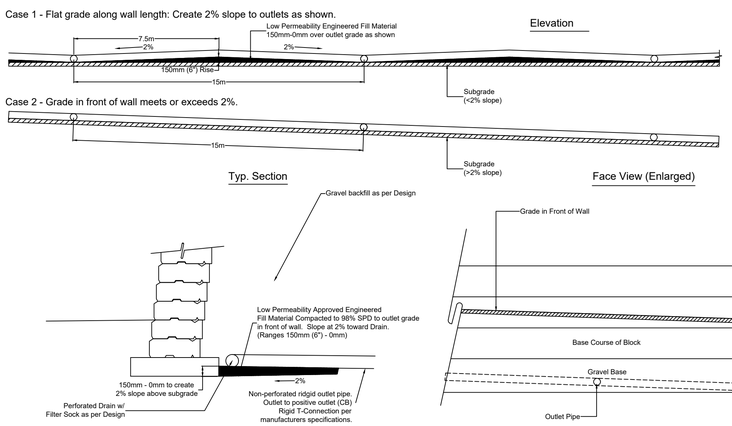
4. Place modified left corner unit on next course.



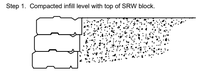
5. Repeat step 1 through 4 until desired height is achieved.

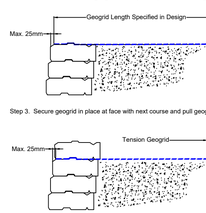


Detail - Drain at Base of Wall



Detail - Geogrid Installation





Notes:

1. Follow geosynthetic manufacturer's installation instructions and specifications. Care must be taken to ensure geogrid is not damaged during construction or subject to UV exposure.

2. Do not allow ANY tracked equipment directly on top of the geogrid. For necessary travel on the geogrid; use only lightweight rubber tired equipment operating at slow speeds (less than 10 mph); do not allow braking or sharp turning.

3. Geogrid length, placement and type shall be as indicated in the Wall Design.

3. Geogrid must be placed in direction of highest strength (roll direction) perpendicular to face of wall. (i.e. - Do not roll out geogrid along the length of the wall).

4. COMPACTED INFILL MUST BE LEVEL WITH THE TOP OF THE BLOCK PRIOR TO PLACEMENT OF GEOGRID.

5. Remove all debris from the top of the SRW block prior to placement of geogrid.

6. Geogrid must be placed within 25mm (1") of the front face of the block.

7. Geogrid must be pulled taut, removing any slack or wrinkles prior to the placement of infill material. The use of temporary stakes to maintain tension of the geogrid is good practice. Infill material should be dumped close to the face of the wall and raked away from the wall to maintain tension in the geogrid during backfilling. When infill material is placed, caution must be used to ensure hand equipment (shovels and rakes) does not contact the geogrid or cause damage.

8. Adjacent sections of geogrid shall abut eachother (not overlap or gap) at the face of the wall to ensure continuous geogrid coverage. Geogrid cannot be spliced to create the required length into the back - the geogrid must be one continous piece.

9. Do not stack more than two (2) courses of block prior to backfilling wall.

Detail - Outside Corner Construction

SienaStone (1.2m) Outside Modified Corners

Imperial dimensions

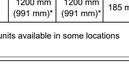
Angle [degrees]	Front [inches]	Back [inches]	Split [inches]	Cut [inches]	Unit to Modify
5	24 1/2	23 5/8	7/8	19 5/8	Standard
10	25 3/8	23 5/8	1 3/4	19 5/8	Standard
15	26 1/4	23 5/8	2 5/8	19 5/8	Standard
20	27 1/8	23 5/8	3 1/2	19 5/8	Standard
25	28	23 5/8	4 3/8	19 5/8	Standard
30	28 7/8	23 5/8	5 1/4	19 5/8	Standard
35	29 7/8	23 5/8	6 1/4	19 5/8	Standard
40	30 3/4	23 5/8	7 1/8	19 5/8	Standard
45	31 3/4	23 5/8	8 1/8	19 5/8	90° corner
50	32 3/4	23 5/8	9 1/8	19 5/8	90° corner
55	33 7/8	23 5/8	10 1/4	19 5/8	90° corner
60	35	23 5/8	11 3/8	19 5/8	90° corner
65	36 1/8	23 5/8	12 1/2	19 5/8	90° corner
70	37 3/8	23 5/8	13 3/4	19 5/8	90° corner
75	38 3/4	23 5/8	15 1/8	19 5/8	90° corner
80	40 1/8	23 5/8	16 1/2	19 5/8	90° corner
85	41 5/8	23 5/8	18	19 5/8	90° corner
90	Use manufactured 90° corner unit				
91-180	Not recommended				

Metric dimensions

Angle [degrees]	Front [mm]	Back [mm]	Split [mm]	Cut [mm]	Unit to Modify
5	622	600	22	500	Standard
10	644	600	44	500	Standard
15	666	600	66	500	Standard
20	688	600	88	500	Standard
25	711	600	111	500	Standard
30	734	600	134	500	Standard
35	758	600	158	500	Standard
40	782	600	182	500	Standard
45	807	600	207	500	90° corner
50	833	600	233	500	90° corner
55	860	600	266	500	90° corner
60	889	600	289	500	90° corner
65	919	600	319	500	90° corner
70	950	600	350	500	90° corner
75	984	600	384	500	90° corner
80	1020	600	420	500	90° corner
85	1058	600	458	500	90° corner
90	Use manufactured 90° corner unit				
91-180	Not recommended				

1. Create modified right corner unit using required unit.

a. Identify inside angle required. Mark corresponding Front and Back dimensions from left end of unit.



b. Mark Split and Cut dimensions on square. Line up marks on square with marks on unit

c. Scribe Split and Cut lines on unit.

d. Use concrete saw to cut along Cut line.

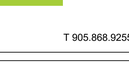
e. Use chisel and hammer to score then split along Split line.

f. If necessary, use concrete saw to remove knob from the right end, leaving approximately 575mm (23 inches) of the key intact at the left side.

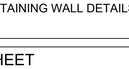
2. Place modified right corner unit on first course.

3. Create modified left corner unit using required unit.

a. Identify inside angle required. Mark corresponding Front and Back dimensions from right end of unit.



b. Mark Split and Cut dimensions on square. Line up marks on square with marks on block



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f. If necessary, use concrete saw to remove knob from the left end, leaving approximately 575mm (23 inches) of the key intact at the right side.

4. Place modified left corner unit on next course.

5. Repeat step 1 through 4 until desired height is achieved.

GRID WALL - GRAVEL BACKFILL

Potential Water Source	Drainage Measures (To be Verified by General Review Engineer)	Add. Notes
Surface Infiltration Above Reinforced Zone and beyond. Rainfall, normal snow melt, run-off, etc. If irrigation systems are used immediately above the reinforced zone of the wall, additional measures will be required in case of leakage/failure of the system. Contractor must verify that area above wall is not used for storage of snow during winter months. Drainage system and assumed loading conditions do not account for this use.	Grade behind must direct water away from back of wall. If slope toward wall exists, swale system must be implemented to carry water at min. 2% grade to positive drainage area. Dimensions of swale will be based on anticipated water collection requirements as specified by the Civil Engineer as part of the overall site drainage plan. The swale system must be constructed with a low permeability layer (100-150mm) of engineered fill material compacted to 95% SPD to act as a conduit for the surface water and prevent infiltration behind the wall facing and into the reinforced zone.	**Other structures and paved surfaces adjacnet to Wall.** Other structures adjacent to the retaining wall must have independent drainage systems. For example, pavements must have independent collection systems (perimeter drains) to collect water that penetrates cracks in the surface, etc. Building downspouts must not direct water towards the walls and must be connected to independent outlets.
Lateral Underground. Design assumes that groundwater is below bottom of wall. The following drainage measures address other potential sources of lateral groundwater that may be the results of infiltration through the surface (i.e. cracks in asphalt beyond the reinforced zone) or other below grade sources.	The reinforced zone of the wall is specified as a well graded gravel with a maximum of 8% fines with a collection pipe at the bottom. The retained zone (up stream source of potential water) is assumed to be of a lower permeability as compared to the imported infill. The reinforced zone is therefore assumed to allow for the drainage of potential water seepage as discussed in Column 1. The perforated collection pipe (Min. 100mm dia. at 2% grade) must be connected to a positive outlet as determined by the Civil Engineer prior to construction. NOTE: These drainage measures are provided as an extra precaution against the possibility of an unknown water source that may or may not occur at some point during the life of the structure. If, upon excavation, a specific water source is identified (perched water condition, sand seams, etc) in the cut or is anticipated, additional drainage measures will be required (i.e. chimney drains).	**Water Management During Construction.** At all times the contractor must ensure measures such as temporary swales and drainage ditches are employed to manage surface water and seepage during and after the construction of the wall. If final grading is not part of the contractors scope of work, the area around the wall must still be properly graded to ensure water does not collect behind or is directed toward the wall.

SienaStone Wall System Information

SIENASTONE® System Units	Face Width	Back Width	Height	Depth	Weight
Standard Unit	48" (39")*	48" (39")*	7.25"	20"	570 lbs (463 lbs)*
	1200 mm (991 mm)*	1200 mm (991 mm)*	185 mm	500 mm	259 kg (210 kg)*
925 Unit	48" (39")*	48" (39")*	7.25"	36"	1102 lbs (895 lbs)*
	1200 mm (991 mm)*	1200 mm (991 mm)*	185 mm	925 mm	450 kg (366 kg)*
Left Corner Unit	44" (35")*	44" (35")*	7.25"	20"	525 lbs (426 lbs)*
	1100 mm (900 mm)*	1100 mm (900 mm)*	185 mm	500 mm	238 kg (194 kg)*
Right Corner Unit	44" (35")*	44" (35")*	7.25"	20"	525 lbs (426 lbs)*
	1100 mm (900 mm)*	1100 mm (900 mm)*	185 mm	500 mm	238 kg (194 kg)*
45 Degree Corner Unit	34"	34"	7.25"	20"	330 lbs
	856 mm	856 mm	185 mm	500 mm	150 kg
Coping Unit	48" (39")*	48" (39")*	7.25"	20"	570 lbs (463 lbs)*
	1200 mm (991 mm)*	1200 mm (991 mm)*	185 mm	500 mm	259 kg (210 kg)*

* -indicates dimensions of alternate units available in some locations

RisiStone® retaining wall systems
10 - 480 Harry Walker Parkway S.
Newmarket, Ontario, Canada L3Y 0B3
T 905.868.9255 | F 905.686.9254 | www.risistone.com

LICENSED PROFESSIONAL ENGINEER
E.C. Jonasson
100049999
12/13/23
PROVINCE OF ONTARIO
NOT FOR CONSTRUCTION
SEALED FOR DESIGN ONLY
Contingent on general review as detailed in 1.05b and 3.02b in SPECIFICATIONS

PROJECT Risi Project No. 202312001

13290 Nunnville Rd.
Caledon, Ontario

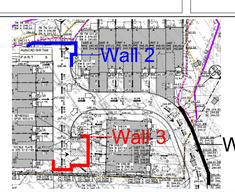
SienaStone®
Geogrid Reinforced
Segmental Retaining Wall

Drawn By ECJ
Design By ECJ
Checked By -
Date 12/13/23
Drawing No. 2 of 2
Drawing File 202312001RW2

REVISIONS

No.	Date	By	Revisions

WALL LOCATION PLAN n.t.s.



RISI PROJECT NO. 202312001

RETAINING WALL DETAILS

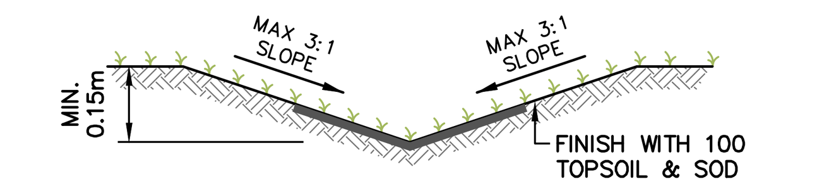
SHEET RW-2

DRAWING NO. 2 of 2

DRAWINGS AND FIGURES

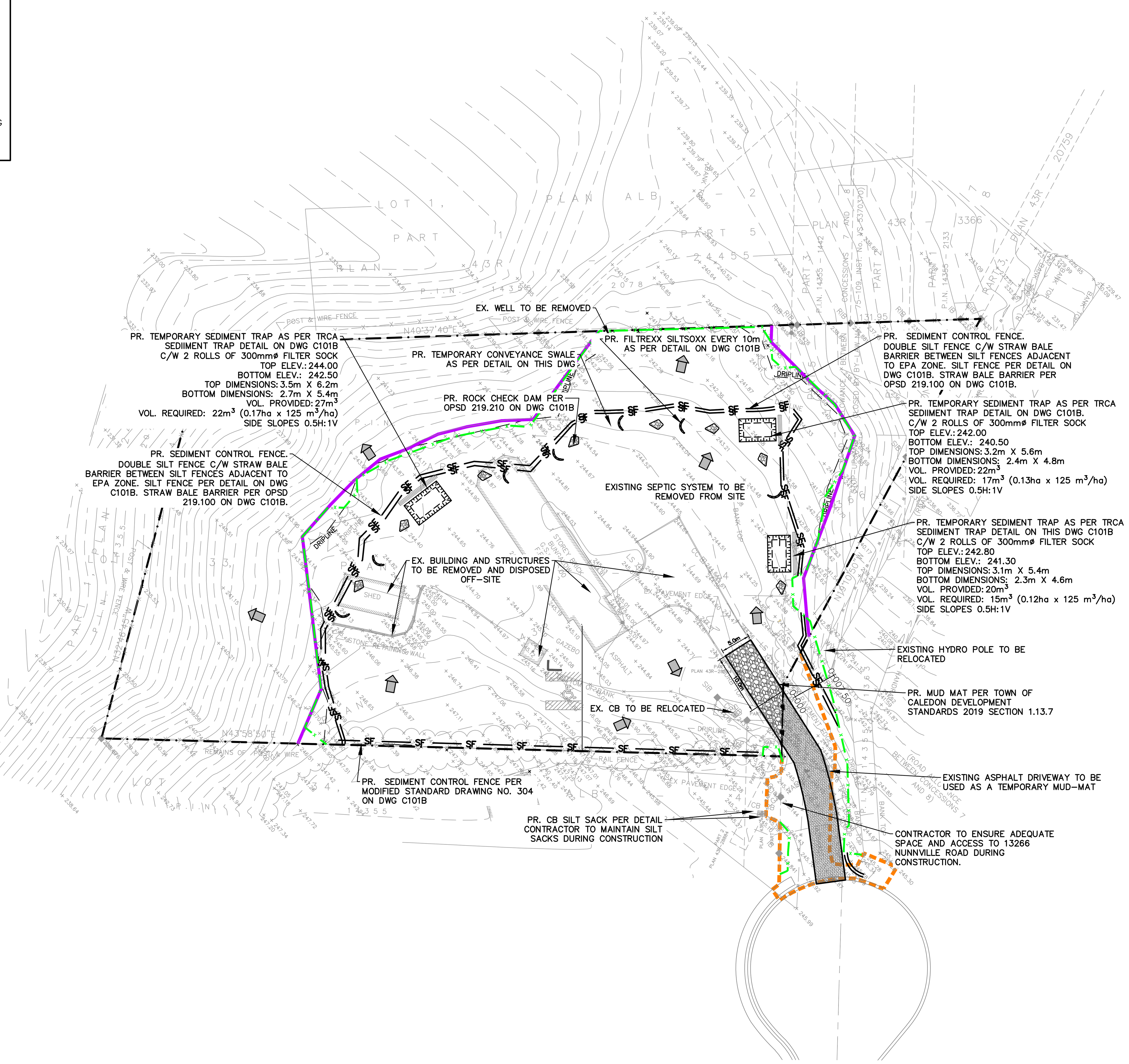
TEMPORARY CONVEYANCE SWALE – DETAIL A

Scale N.T.S.



NOTES :

1. SWALE TO BE CONSTRUCTED AT MIN. 0.5% SLOPE.
2. CONTRACTOR TO ENSURE SWALE IS STABILIZED WITH STAKED SOD OR EROSION MAT WITH SEED AND REMAINS FREE OF DEBRIS.
3. SWALE ONLY TO BE REMOVED ONCE ALL STORM SEWERS HAVE BEEN INSTALLED AND THE STORMWATER SYSTEM IS FUNCTIONING AS DESIGNED.
4. BOTTOM OF CHANNEL TO BE LINED WITH EROSION PROTECTION MAT OR EQUIVALENT.



KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- 215.00 EXISTING GRADE
- MUD-MAT; SEE DETAIL
- SF SILT FENCE
- EXISTING FENCE
- x 215.00 EXISTING GRADE
- EXISTING OVERLAND FLOW DIRECTION
- LONG TERM STABLE TOP OF SLOPE
- TREE PRESERVATION LINE & FENCE (KUNTZ FORESTRY, FEBRUARY 2023)
- LIMIT OF GRADING
- EXTERNAL ENTRANCE CIVIL WORKS LIMIT
- PROPOSED ROCK CHECK DAM PER OPSD 219.210
- TEMPORARY CONVEYANCE SWALE (DETAIL 'A')
- PROPOSED FILTREXX SILTSOXX PER DETAIL ON DWG C101B

No.	ISSUE / REVISION	YYYY/MMM/DD
4	ISSUED FOR SECOND SUBMISSION SPA	2023/DEC/19
3	ISSUED FOR FIRST SUBMISSION SPA	2023/APR/25
2	ISSUED FOR PRE-DART SUBMISSION	2023/APR/05
1	ISSUED FOR SECOND SUBMISSION ZBA	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION ZBA	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/NOV/23)

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.

SITE REMOVAL NOTE:

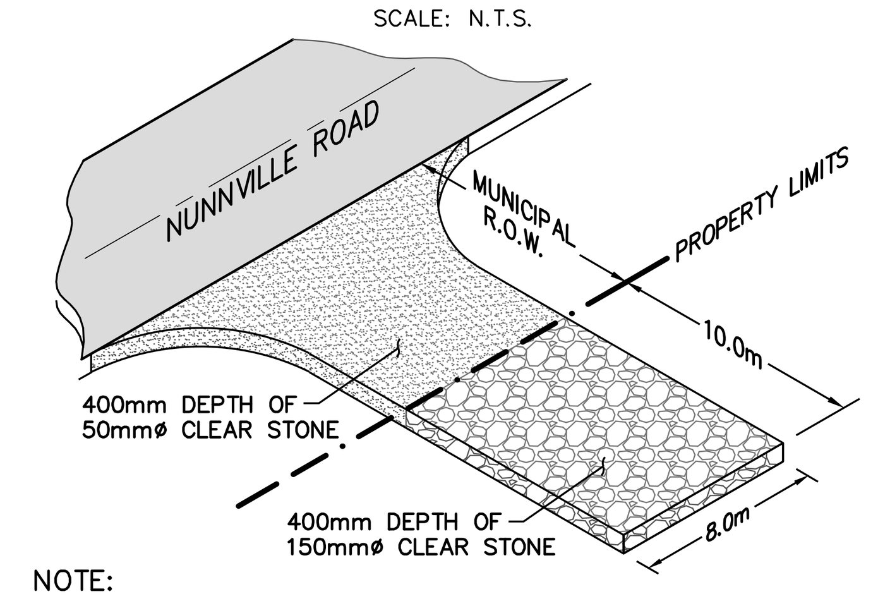
1. REMOVE ALL EXISTING SURFACE MATERIALS AS REQUIRED TO COMPLETE THE SITE WORKS AND DISPOSE OF OFF SITE
2. STRIP AND REMOVE ALL TOPSOIL
3. REMOVE ALL SURFACE INFRASTRUCTURE ON TOWN PROPERTY AS REQUIRED TO ACCOMODATE NEW CONSTRUCTION
4. STRIPPED TOPSOIL TO BE STOCKPILED OR DISPOSED OF OFF-SITE

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.

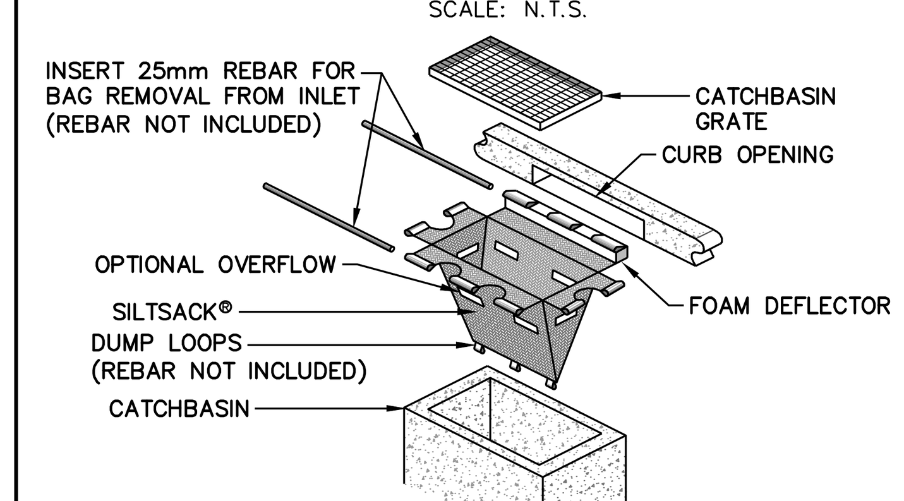


NOTE:

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

'SILTSACK' DETAIL

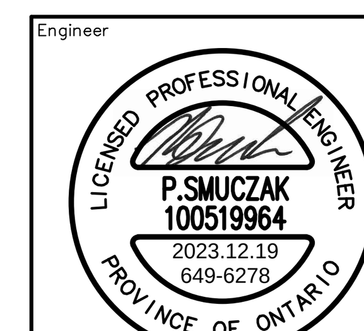
SCALE: N.T.S.



NOTES:

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

Engineer



Engineer

Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

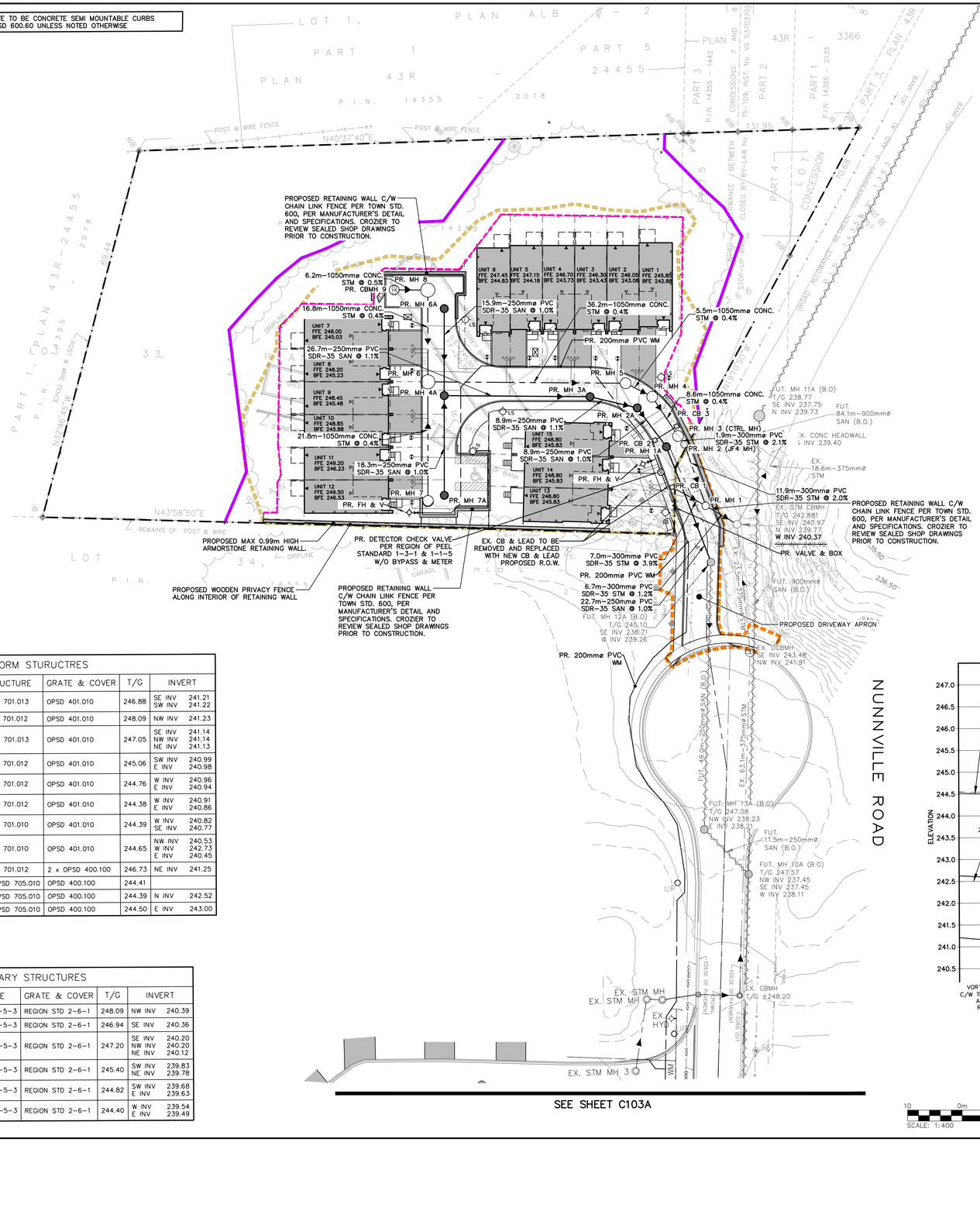
REMOVALS, EROSION & SEDIMENT CONTROL PLAN

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. C101A

PROPOSED CURBS INSIDE THE SITE TO BE CONCRETE SEMI MOUNTABLE CURBS WITH STANDARD GUTTER PER OPSD 600.60 UNLESS NOTED OTHERWISE



REGION OF PEEL NOTES:

1. PUBLIC AND PRIVATE SERVICES, APPURTENANCES, MATERIALS AND CONSTRUCTION METHODS MUST COMPLY WITH THE MOST CURRENT REGION OF PEEL STANDARDS AND SPECIFICATIONS, THE LOCAL MUNICIPALITY'S REQUIREMENTS FOR THE ONTARIO BUILDING CODE AND ONTARIO PROVINCIAL STANDARDS. ALL WORKS SHALL ADHERE TO ALL APPLICABLE LEGISLATION, INCLUDING REGIONAL BY–LAWS.
2. WATERMAIN AND / OR WATER SERVICE MATERIALS 100 MM (4") AND LARGER MUST BE PVC DR18 CONSTRUCTED AS PER AWWA C900–16. SIZE 50 MM (2") AND SMALLER MUST BE TYPE K SOFT COPPER CONSTRUCTED AS PER ASTM B88–49 OR POLYETHYLENE CONSTRUCTED AS PER AWWA C901 AND CSA B.137.10 (CHOOSE ONLY ONE MATERIAL).
3. WATERMAINS AND / OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7 M (5'6") WITH A MINIMUM HORIZONTAL SPACING OF 1.2 M (4') FROM THEMSELVES AND ALL OTHER UTILITIES.
4. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC. MUST BE PROVIDED WITH AT LEAST A 50 MM (2") OUTLET ON 100 MM (4") AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, THE SAME SIZE AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW THE WATER TO DRAIN ONTO A PARKING LOT OR DOWN A DRAIN. ON FIRE LINES, FLUSHING OUTLET TO BE 100 MM (4") DIAMETER MINIMUM ON A HYDRANT.
5. ALL CURB STOPS TO BE 3.0 M (10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
6. HYDRANT AND VALVE SET TO REGION STANDARD 1 – 6 – 1 DIMENSION A AND B, 0.7 M (2') AND 0.9 M (3') AND TO HAVE PUMPER NOZZLE.
7. WATERMAINS TO BE INSTALLED TO GRADES AS SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
8. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 0.3 M (12") OVER / 0.5 M (20") UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
9. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATING FROM EXISTING SYSTEMS.
10. ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.
11. LOCATION OF ALL EXISTING UTILITIES IN THE FIELD TO BE ESTABLISHED BY THE CONTRACTOR.
12. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURES EXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF THEIR WORK. WHETHER SHOWN ON THE PLANS OR NOT AND FOR ALL REPAIRS AND CONSEQUENCES RESULTING FROM DAMAGE TO SAME.
13. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO THE UTILITIES PRIOR TO CROSSING SUCH UTILITIES, FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COSTS ARISING FROM SUCH INSPECTION.
14. ALL PROPOSED WATER PIPING MUST BE ISOLATED THROUGH A TEMPORARY CONNECTION THAT SHALL INCLUDE AN APPROPRIATE CROSS–CONNECTION CONTROL DEVICE, CONSISTENT WITH THE DEGREE OF HAZARD, FOR BACKFLOW PREVENTION OF THE ACTIVE DISTRIBUTION SYSTEM, CONFORMING TO REGION OF PEEL STANDARDS 1–7–7 OR 1–7–8.
15. ALL WATER METERS MUST BE INSTALLED IN HEATED AND ACCESSIBLE SPACE.

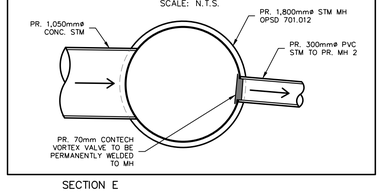
SERVICING NOTE:
MAINTENANCE HOLES TO BE BENCHED FOLLOWING SUPERPIPE SLOPE.

KEY PLAN
SCALE: N.T.S.

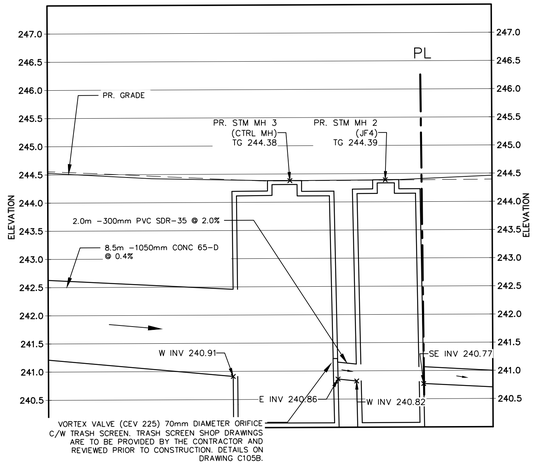
LEGEND

- PROPERTY LINE
- EXISTING WATERMAIN & GATE VALVE
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- PROPOSED WATERMAIN & GATE VALVE
- 25mm COPPER DOMESTIC WATER SERVICE C/W VALVE AND BOX
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE CATCHBASIN
- PROPOSED SANITARY SEWER & MANHOLE
- FUTURE SANITARY SEWER & MANHOLE
- LIMIT OF GRADING
- EXTERNAL ENTRANCE CIVIL WORKS LIMIT
- LONG TERM STABLE TOP OF SLOPE
- DEVELOPMENT LIMIT
- EXISTING ELECTRICAL TRANSFORMER

STM MH 3 (CTRL MH) DETAIL
SCALE: N.T.S.



SECTION E
SCALE: V=1:100, H=1:50



VORTEX VALVE (CEV 225) 70mm DIAMETER ORIFICE C/W TRASH SCREEN. TRASH SCREEN SHOP DRAWINGS ARE TO BE PROVIDED BY THE CONTRACTOR AND REVIEWED PRIOR TO CONSTRUCTION. DETAILS ON DRAWING C105B.

SCALE: 1:400

STORM STURUCTRES					
I.D.	SIZE & STRUCTURE	GRATE & COVER	T/G	INVERT	
PR. MH 8	2,400 mm OPSD 701.013	OPSD 401.010	246.88	SE INV SW INV	241.21 241.22
PR. MH 7	1,800 mm OPSD 701.012	OPSD 401.010	248.09	NW INV	241.23
PR. MH 6	2,400 mm OPSD 701.013	OPSD 401.010	247.05	SE INV NW INV NE INV	241.14 241.14 241.13
PR. MH 5	1,800 mm OPSD 701.012	OPSD 401.010	245.06	SW INV E INV	240.99 240.98
PR. MH 4	1,800 mm OPSD 701.012	OPSD 401.010	244.76	W INV E INV	240.96 240.94
PR. MH 3 (CTRL MH)	1,800 mm OPSD 701.012	OPSD 401.010	244.38	W INV E INV	240.91 240.86
PR. MH 2 (JF4 MH)	1,200 mm OPSD 701.010	OPSD 401.010	244.39	W INV SE INV	240.82 240.77
PR. MH 1	1,200 mm OPSD 701.010	OPSD 401.010	244.65	NW INV W INV E INV	240.53 242.73 240.45
PR. CBMH 9	1,800 mm OPSD 701.012	2 x OPSD 400.100	246.73	NE INV	241.25
PR. CB 3	600x600 mm OPSD 705.010	OPSD 400.100	244.41		
PR. CB 2	600x600 mm OPSD 705.010	OPSD 400.100	244.39	N INV	242.52
PR. CB 1	600x600 mm OPSD 705.010	OPSD 400.100	244.50	E INV	243.00

SANITARY STRUCTURES					
I.D.	SIZE & STRUCTURE	GRATE & COVER	T/G	INVERT	
PR. MH 7A	1,200 mm REGION STD 2–5–3	REGION STD 2–6–1	248.09	NW INV	240.39
PR. MH 6A	1,200 mm REGION STD 2–5–3	REGION STD 2–6–1	246.94	SE INV	240.36
PR. MH 4A	1,200 mm REGION STD 2–5–3	REGION STD 2–6–1	247.20	SE INV NW INV NE INV	240.20 240.20 240.12
PR. MH 3A	1,200 mm REGION STD 2–5–3	REGION STD 2–6–1	245.40	SW INV NE INV	239.83 239.78
PR. MH 2A	1,200 mm REGION STD 2–5–3	REGION STD 2–6–1	244.82	SW INV E INV	239.68 239.63
PR. MH 1A	1,200 mm REGION STD 2–5–3	REGION STD 2–6–1	244.40	W INV E INV	239.54 239.49

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2	ISSUED FOR PRE–DART SUBMISSION	2023/APR/05
1	ISSUED FOR SECOND SUBMISSION ZBA	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION ZBA	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/NOV/23)

DRAWING NOTES:

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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

SITE SERVICING PLAN

Engineer

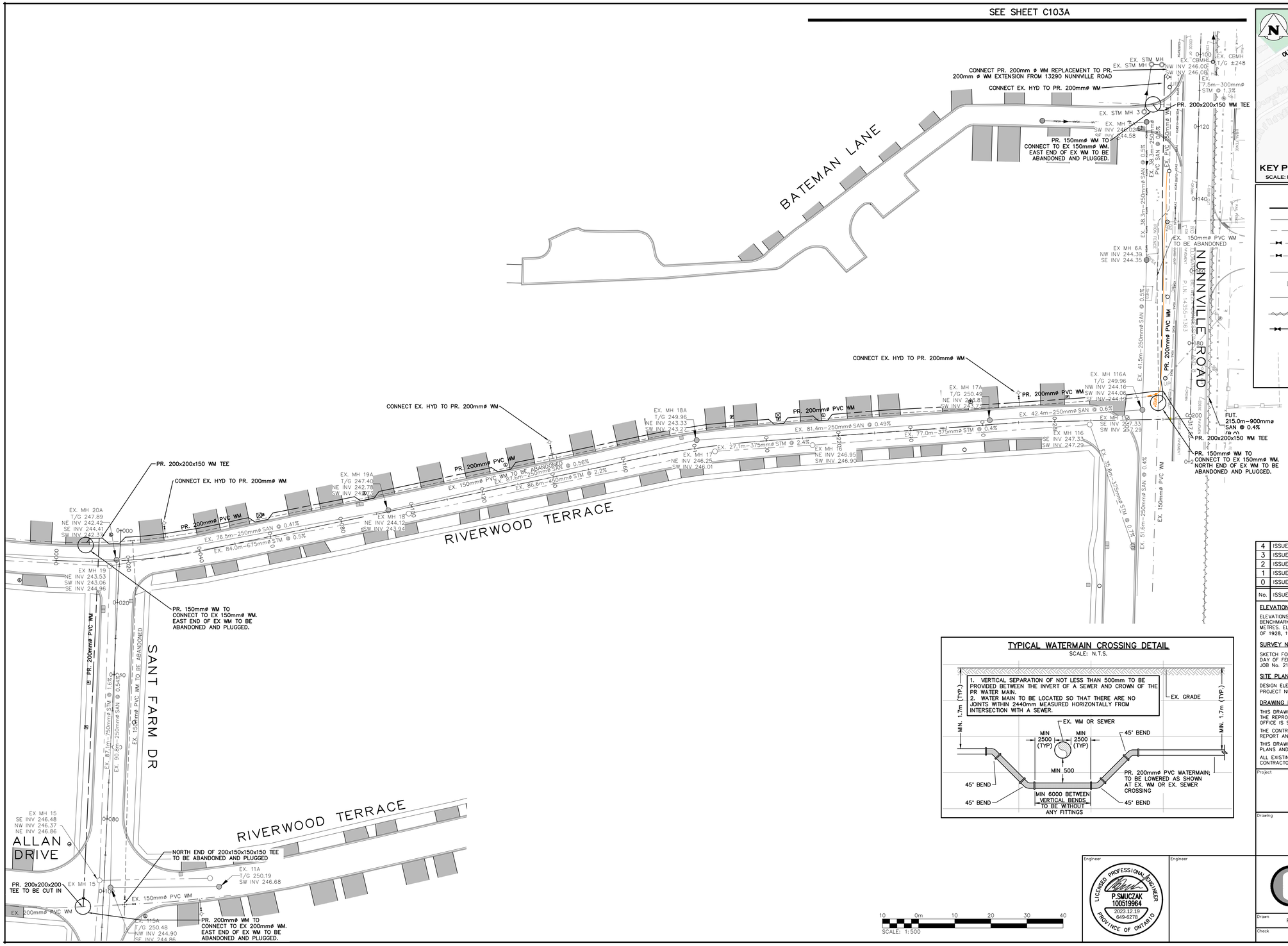
LICENSED PROFESSIONAL ENGINEER
P.SMUCZAK
100519964
2023.12.19
649-6278
PROVINCE OF ONTARIO

Engineer

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

SEE SHEET C103A



KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING ELEVATION CONTOUR (1m)
- EXISTING ELEVATION CONTOUR (0.5m)
- EXISTING WATERMAIN & GATE VALVE
- EXISTING WATERMAIN & GATE VALVE TO BE ABANDONED
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE / DOUBLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- FUTURE SANITARY SEWER & MANHOLE
- PROPOSED WATERMAIN & GATE VALVE
- EXISTING ELECTRICAL TRANSFORMER
- P — EXISTING PEDESTAL
- L — EXISTING UTILITY POLE/LUMINAIRE

TYPICAL WATERMAIN CROSSING DETAIL

SCALE: N.T.S.

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2	ISSUED FOR PRE-DART SUBMISSION	2023/APR/05
1	ISSUED FOR SECOND SUBMISSION ZBA	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION ZBA	2022/APR/13

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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

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PROJECT NUMBER: 22008 (2023/NOV/23)

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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

EXTERNAL SERVICING PLAN

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

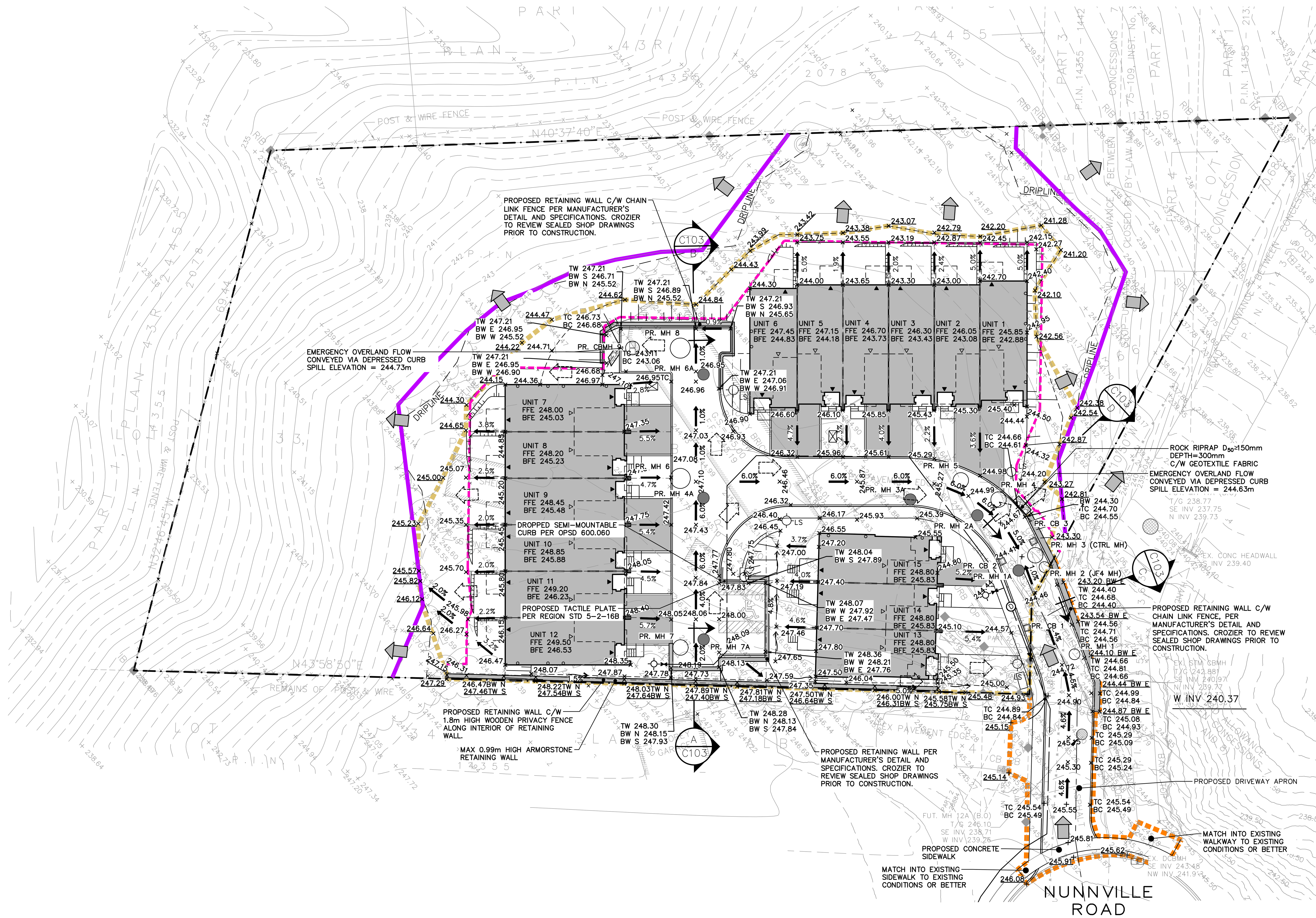
Engineer

LICENSED PROFESSIONAL ENGINEER
P.SMUCZAK
100519964
2023.12.19
649-6278
PROVINCE OF ONTARIO

Engineer

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

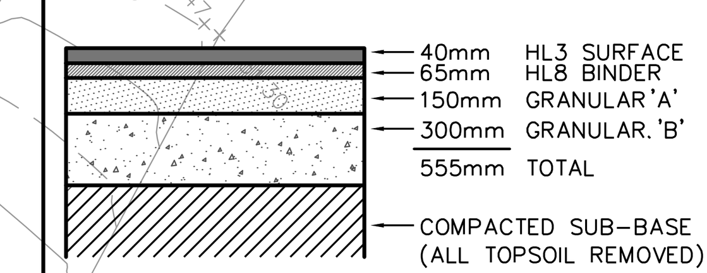
Drawn	Design	Project No.	
P.S./J.B.	P.S./J.B.	649-6278	
Check	Check	Scale	Dwg.
P.S.	P.S./N.C.	1:500	C102B



KEY PLAN
SCALE: N.T.S.

PAVEMENT STRUCTURE

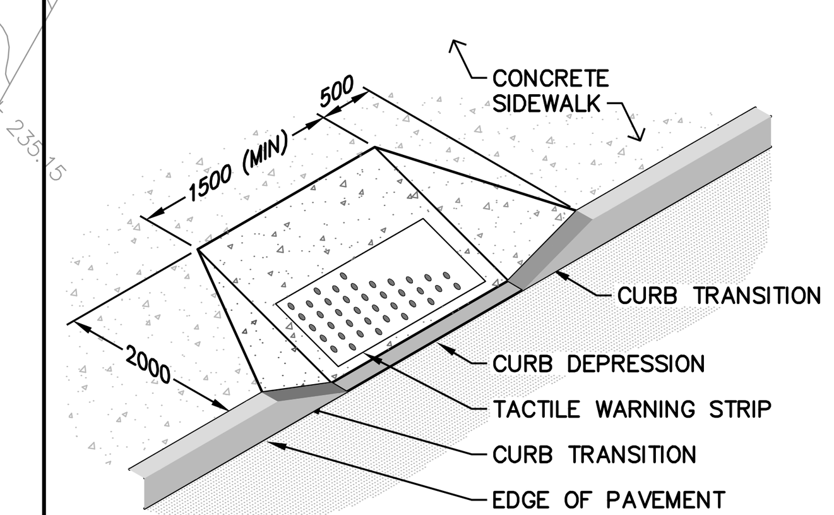
SCALE: N.T.S.



NOTE:
REFER TO CONSTRUCTION NOTES FOR DETAILS ON COMPACTION. PAVEMENT STRUCTURE TO BE CONFIRMED BY GEOTECHNICAL CONSULTANT.

WALKWAY CURB DEPRESSION DETAIL

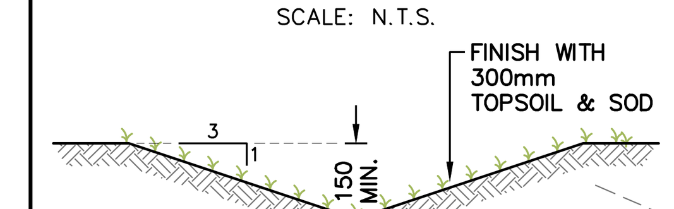
SCALE: N.T.S.



NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

TYPICAL GRASSED SWALE DETAIL

SCALE: N.T.S.



NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS.

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 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
- LIMIT OF GRADING
- EXTERNAL ENTRANCE CIVIL WORKS LIMIT
- LONG TERM STABLE TOP OF SLOPE
- DEVELOPMENT LIMIT

ROOFTOP DRAINAGE NOTE :

- ROOFTOP DRAINAGE AND ROOF LEADERS TO DISCHARGE TO THE REAR YARDS.
- NO ROOF LEADER SHALL DRAIN TO THE FRONT OF THE LOT UNLESS APPROVED BY DESIGN.
- ROOF LEADERS MUST DISCHARGE ONTO CONCRETE SPLASH PADS WHICH DIRECT WATER AWAY FROM BUILDING.

GRADING NOTE :

- LOTS, INCLUDING DRAINAGE DITCHES, SWALES, AND ROAD BOULEVARDS TO BE COMPLETELY TOPSOILED AND SODDED WITH MIN 300mm OF TOPSOIL, PER TOWN OF CALEDON STANDARDS
- ALL RETAINING WALLS GREATER THAN 0.60m TO HAVE PEDESTRIAN BARRICADE.
- CURB DEPRESSIONS AND TACTILE PLATE LOCATIONS AND STANDARDS ARE SHOWN ON DRAWING C106.

PROPOSED CURBS INSIDE THE SITE TO BE CONCRETE SEMI MOUNTABLE CURBS WITH STANDARD GUTTER PER OPSD 600.60 UNLESS NOTED OTHERWISE

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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

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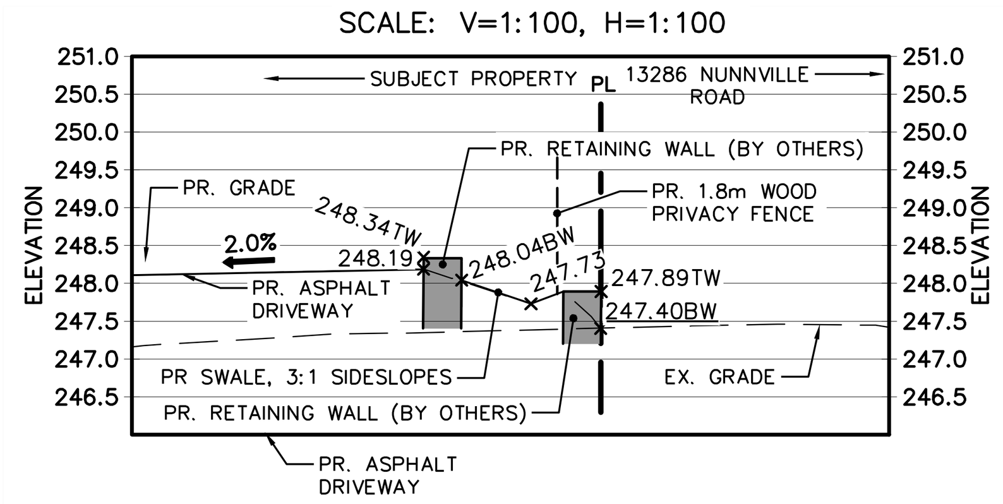
Project
13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing
SITE GRADING PLAN

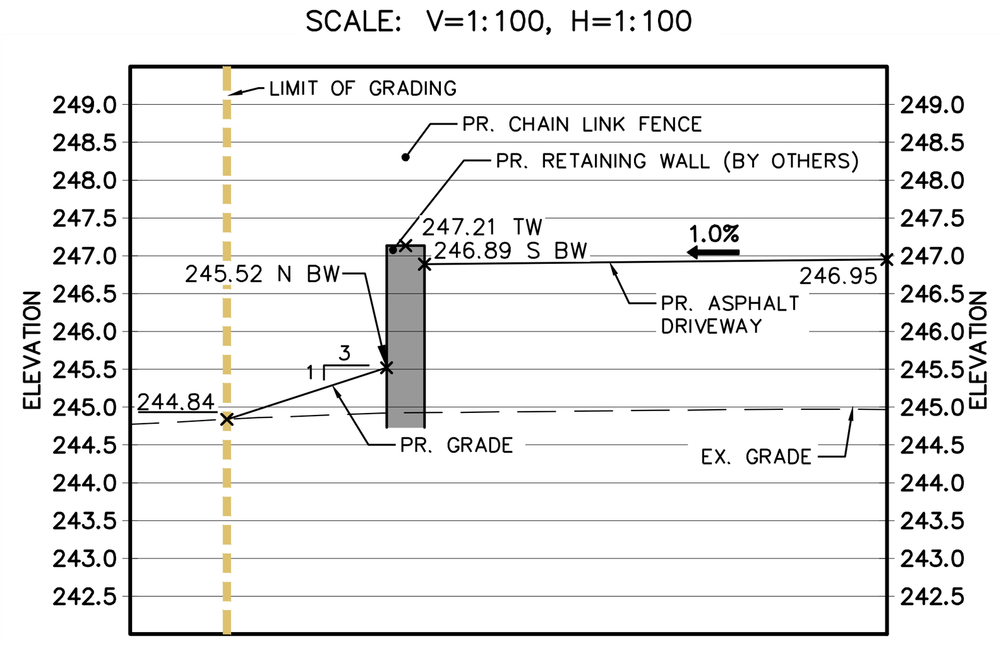
SECTION A

SCALE: V=1:100, H=1:100



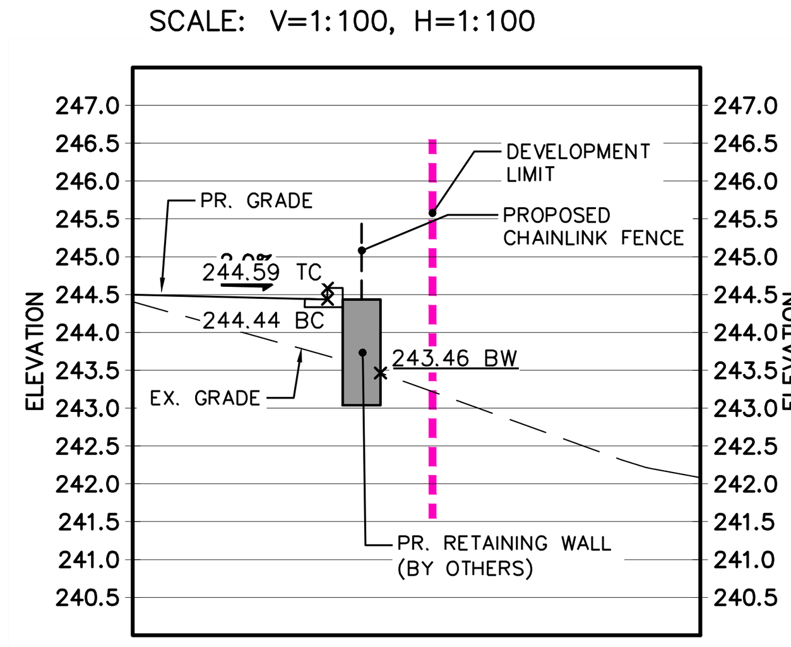
SECTION B

SCALE: V=1:100, H=1:100



SECTION C

SCALE: V=1:100, H=1:100



SECTION D

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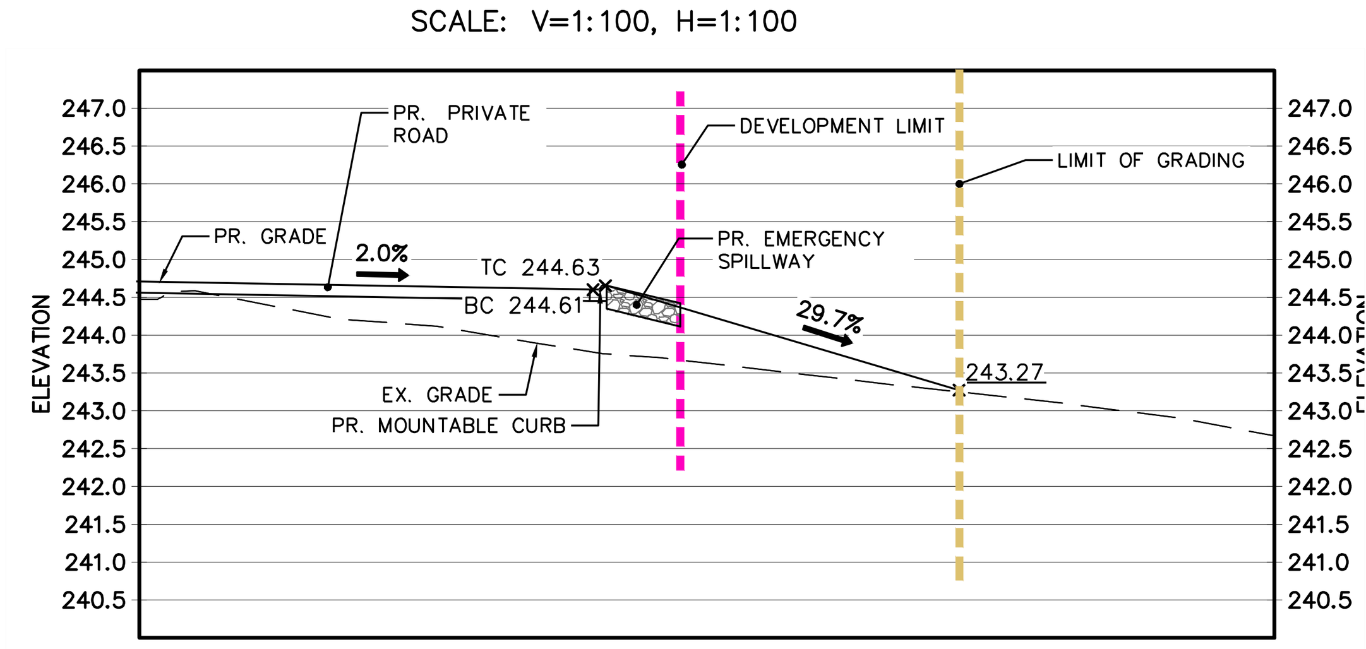


SCALE: 1:300

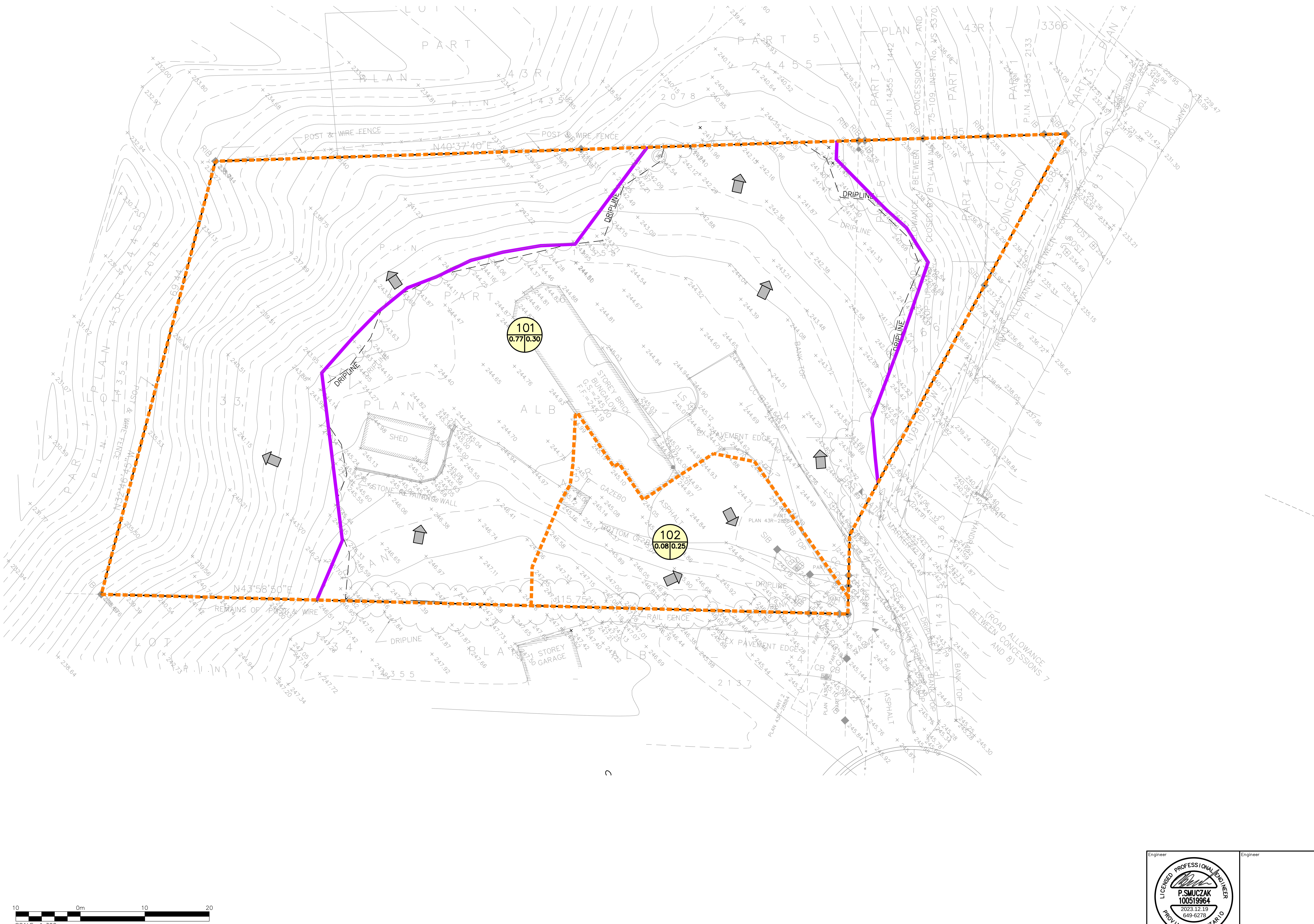
Engineer
LICENSED PROFESSIONAL ENGINEER
P. SMUCZAK
100519964
2023.12.19
649-6278
PROVINCE OF ONTARIO

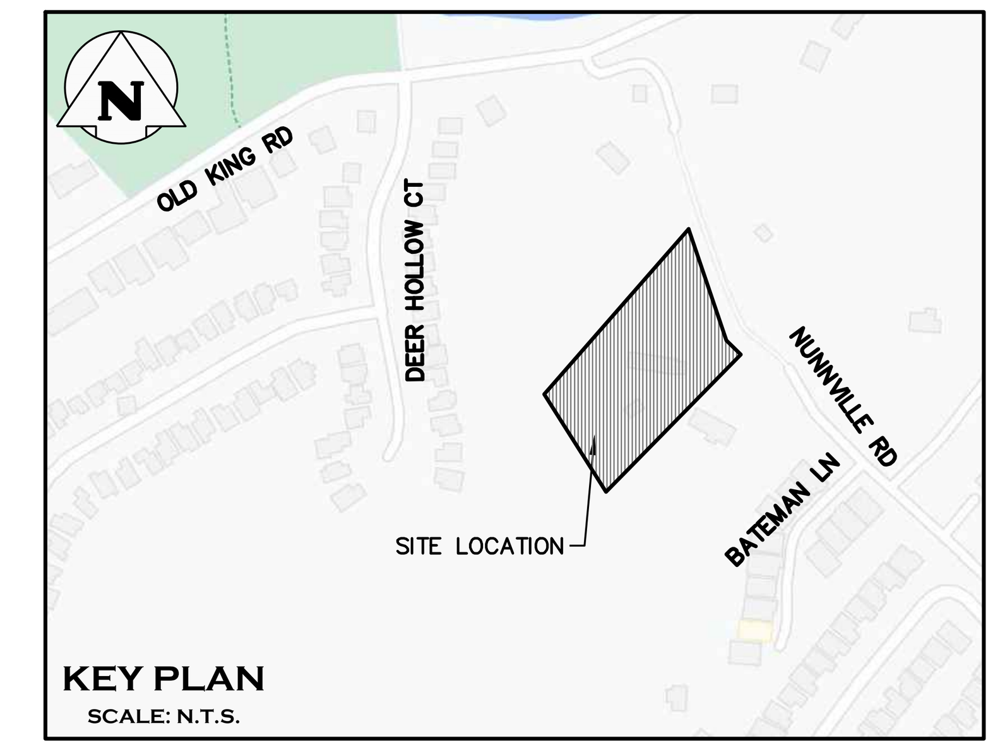
Engineer

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. C103





KEY PLAN
SCALE: N.T.S.

LEGEND

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

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4	ISSUED FOR SECOND SUBMISSION SPA	2023/DEC/19
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1	ISSUED FOR SECOND SUBMISSION ZBA	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION ZBA	2022/APR/13

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JOB No. 21–434

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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

PRE–DEVELOPMENT DRAINAGE PLAN

Engineer

LICENSED PROFESSIONAL ENGINEER
P.SMUCZAK
100519964
2023.12.19
649-6278
PROVINCE OF ONTARIO

Engineer

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	**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
- CATCHMENT I.D. (ID); AREA (ha) | RUNOFF COEFFICIENT (A | RC)
- LONG TERM STABLE TOP OF SLOPE
- INTERNAL DEVELOPMENT LIMIT

No.	ISSUE / REVISION	YYYY/MMM/DD
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Project

13290 NUNNVILLE RD
TOWN OF CALEDON

Drawing

POST-DEVELOPMENT DRAINAGE PLAN

Engineer

LICENSED PROFESSIONAL ENGINEER
P.SMUCZAK
100519964
2023.12.19
649-6278
PROVINCE OF ONTARIO

Engineer

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. FIG2

KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- 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
- 100-YEAR CAPTURE BOUNDARY

10 0m 10 20
SCALE: 1:300

No.	ISSUE / REVISION	YYYY/MMM/DD
4	ISSUED FOR SECOND SUBMISSION SPA	2023/DEC/19
3	ISSUED FOR FIRST SUBMISSION SPA	2023/APR/25
2	ISSUED FOR PRE-DART SUBMISSION	2023/APR/05
1	ISSUED FOR SECOND SUBMISSION ZBA	2023/MAR/06
0	ISSUED FOR FIRST SUBMISSION ZBA	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/NOV/23)

DRAWING NOTES:

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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

TOTAL SYSTEM CAPTURE PLAN

Engineer

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P.S.	P.S./N.C.	1:300	FIG3