

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

Proposed Travel Stop Development
(TOWN FILE # SPA 2019-0065)

AT
NE Corner of Hurontario Street & King Street
Town of Caledon

Prepared for
Glen Schnarr & Associates Inc.

Sep 25, 2022	Issued for 2 nd SPA Submission
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REVISIONS



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Complete civil engineering design solutions

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1.0 INTRODUCTION

Flora Designs Inc. has been retained by Glen Schnarr & Associates Inc. (the "Consultant") to prepare a Site Servicing and Stormwater Management Report for a proposed Travel Stop development, located at NE Corner of Hurontario Street & King Street, Town of Caledon, Ontario (**Appendix "A"**), in accordance with the Engineering Design Standards provided by the Town of Caledon, Region of Peel, and MOE Stormwater Management Planning and Design Manual 2003 (SWMPD).

This report is prepared in support of a Site Plan Application (SPA) by Glen Schnarr & Associates Inc. acting on behalf of the Owner. The purpose of this report is to provide site-specific information for the Town and Region's review with respect to the infrastructure required to support the proposed development regarding storm drainage, sanitary drainage and water supply.

An inventory of the existing infrastructure in the area of proposed development was carried out. This report discusses the existing services together with the servicing requirements for the proposed development.

2.0 SITE DESCRIPTION

The proposed development site is located at NE Corner of Hurontario Street & King Street, Town of Caledon, Ontario (**Appendix "A"**). The site is bounded as follows:

- An existing residential development East,
- King Street to the South,
- Hurontario Street to the West, and
- Undeveloped agricultural lands to the North.

The subject site is approximately 32,125 m² (3.21 hectares) in size. Currently the property is vacant.

3.0 SITE PROPOSAL

The Site Plan Application proposes Card Lock Fuelling Stations, Retail Gas Fuelling Stations, Convenient Store, Three standalone restaurants and associated parking lot. A reduced version of the architectural site plan is included in **Appendix "A"**. Please refer to the building and site statistics provided by Antrix Architects Inc.

In the post-development development condition, the stormwater runoff from the building roofs and site area will be conveyed to the on-site stormwater dry pond facility through the on-site private sewer network. The entire major and minor system flows from the site will be discharged to an existing municipal culvert located across King Street in compliance with the pre-development drainage pattern.

An on-site subsurface disposal facility will be provided for sanitary drainage system. Please refer to the design documents prepared by Envision Consultants Ltd. for MECP Sewage Treatment and Disposal System Design.

The water supply requirements for this development will be fulfilled by an existing 300 mm dia watermain located with the municipal allowance of King Street through an existing 300 mm dia fire and domestic combined service provided by the Region to serve future development on this land.

4.0 STORMWATER MANAGEMENT AND DRAINAGE

4.1 Design Criteria

The proposed development will meet the Province of Ontario standards as set out in the MOE Stormwater Management Planning and Design Manual 2003 (SWMPD), Region of Peel Design Guidelines and local engineering standards provided by the Town of Caledon in the Development Standards, Policies & Guidelines Manual. A brief summary of the design criteria are as follows;

- For new developments, return frequency values for design shall be 5-year for Minor System and 100-year for Major System.
- Town of Caledon Rainfall Intensity Curves provided in the Standards No.104 are to be used for analysis (**Appendix "B"**).
- The post-development peak flows for all events from the site up to and including 100-year rainfall event should be controlled to the peak flow resulting from the target pre-development conditions during respective rainfall events.
- The on-site storm sewer network is sized to convey minor system flows.
- Overland flow route shall be provided to direct runoff in excess of the 100-year storm event to a safe outlet.
- Maximum detention depth in parking areas during the 100-year storm event is not to exceed 300mm.
- Stormwater should be treated to Enhanced Protection level as defined in the MOE SWM Planning & Design Manual (2003).

4.2 Existing Conditions

Currently the property is vacant with an abandoned residential house. Based on review of the topographic survey and a site visit, we have concluded that, the site area drains towards the South property limits through overland sheet flow, which subsequently generates uncontrolled discharge to an existing municipal culvert and an unnamed municipal stream. In addition to this property, a small portion of upstream external lands to the North drains through this property that generates uncontrolled discharge to the same municipal culvert. The pre-development surface condition and drainage area for this site has been illustrated in **Appendix "B"**.

For calculating the pre-development discharge rates and runoff for the 5-Year and 100-Year storm events, Inlet time of Concentration (T_c) is based on the minimum T_c provided by the Town of Caledon. The value for the pre-development weighted runoff coefficient $C=0.26$ is calculated based on actual surface conditions for this site. Input parameters used to model the target pre-development condition are

provided in **Table-1** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-1 Pre-development Input Parameters

Drainage System	Catchment #	Drainage Area (ha)	Runoff Coefficient (C)	Time of Concentration (Tc)
Uncontrolled	CA-1-Pre	3.21	0.26	10
TOTAL		3.21	0.26	10

The pre-development peak flow was simulated using the Town of Caledon Rainfall Intensity Curves using the Rational Method. The results of the pre-development peak flow calculations are provided in **Table-2** below, and detailed calculations have been illustrated in **Appendix "B"**.

Table-2 Pre-development Peak Flows

Catchment #	Peak Flow (m ³ /s)	
	5-year	100-year
CA-1-Pre	0.254	0.456

4.3 Stormwater Management

In the post-development condition, the site grading is designed to restrict stormwater flow from the upstream lands from entering to this site. A bypass swale is provided along west property line to divert upstream flow to the existing municipal culvert across King Street. Therefore, only the lands occupied by this site is considered for the stormwater management design for this development proposal. There are uncontrolled site areas contributing to the total storm discharge from the site. Therefore, the site is divided into two primary drainage systems; “Controlled” (CA-1-Post) and “Uncontrolled” (CA-2-Post). The post-development drainage areas have been illustrated in **Appendix "B"**.

For calculating the post-development discharge rates and runoff for 5-Year and 100-Year storm events, Inlet time of Concentration (Tc) and weighted runoff coefficient (C) is calculated similar to the pre-development calculations. Input parameters used to model the target pre-development condition are provided in **Table-3** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-3 Post-development Input Parameters

Drainage System	Catchment #	Drainage Area (ha)	Runoff Coefficient (C)	Time of Concentration (Tc)
Controlled	CA-1-Post	2.95	0.65	10
Uncontrolled	CA-2-Post	0.27	0.33	10
TOTAL		3.21	0.62	10

Results of the post-development peak flow calculations by considering minimum Tc and IDF data similar to the pre-development flow calculations are provided in **Table-4** below, and detailed post-development flow calculations have been illustrated in **Appendix "B"**.

Table-4 Post-development Peak Flows

Catchment #	Peak Flow (m ³ /s)	
	5-year	100-year
CA-1-Post	0.585	1.048
CA-2-Post	0.027	0.049

The post-development peak flow targets will be achieved using a combination of surface storage, detention storage in the storm sewer system and an on-site End-of-Pipe Dry Storage facility (SU-1). Site grading for the controlled portion of the site area (CA-1-Post) has been designed to capture runoff from the site using a series of on-site catch basins. When the incoming flow is greater than the allowable peak discharge rate through an orifice plate and a weir installed at the dry pond Outlet-1, the storm sewer system will surcharge and the excess runoff volume will be stored within the storm sewer pipes and dry storage facility (SU-1). A summary of the stage and storage volumes available on site are provided in **Table-5** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-5 Available Stage Storage Summary

Stage Elevation	Stage Storage Volume (m ³)				
	CB-MH	Pipe	Surface	SU-1	Total
286.75	1.62	20.10	0.00	361.81	383.53
287.50	11.00	62.14	0.00	967.87	1041.01
287.75	14.83	63.11	148.23	1229.48	1455.65

The post-development Stormwater Management will be justified by discussing the following stormwater controls:

4.3.1 Quantity Control

Stormwater quantity control is typically implemented to minimise the potential for downstream flooding, stream bank erosion and overflow of infrastructure. As per minimum standards provided by the Town of Caledon, the post-development peak flows for all events from the site should be controlled in line with the respective peak flow resulting from the target pre-development condition during 5-year to 100-year storm events.

The site grading is designed such that, no external areas from the adjoining properties shall affect the stormwater flow from this site.

Modified Rational Method calculations were undertaken to determine the peak flows and required storage volume from the proposed site during 5-

Year and 100-Year storm events. This method calculates the storage volume using the composite runoff coefficient and the allowable release rate based on rainfall intensities over a three-hour storm event. A summary of the post-development quantity control analysis is provided in **Table-6** below and detailed calculations have been illustrated in **Appendix "B"**.

Table-6 Post-development Peak Flow and Quantity Control Analysis

Storm Event	Allowable Release Rate (m ³ /s)	Runoff from Controlled Area (m ³ /s)	Runoff from Uncont. Area (m ³ /s)	Total Peak Runoff (m ³ /s)	Available Storage Volume (m ³)	Storage Volume Used (m ³)	Water Surface Elevation (m)
5-year	0.254	0.047	0.027	0.074	1041.01	553.90	286.97
100-year	0.456	0.103	0.049	0.152	1455.65	1003.43	287.46

The post-development peak flow targets will be achieved by controlling discharge from the site area using a combination of 150mm dia orifice plate and 500mm(w) X 400mm(d) rectangle weir installed in the perforated CSP outlet structure (Outlet-1). Detailed calculations for orifice-weir ratings and stage storage in the dry storage facility have been illustrated in **Appendix "B"**.

4.3.2 Quality Control

In accordance with the MOE SWM Planning & Design Manual, various levels of treatment are defined with a goal of maintain or enhance existing aquatic habitat based on the total suspended solids (TSS) removal efficiency. For this development, based on the Town standards, enhanced (Level 1) quality protection is typically implemented to treat the runoff.

The quality control for the site is provided by a multiple component treatment train consisting of a dry, end-of-pipe, detention storage facility and CDS oil and grit separator unit. In the post-development condition, the site area occupied by CA-2-Post are mainly consists of grassed area which generates uncontrolled discharge to the municipal culvert and unnamed municipal stream. Considering, this portion of the site area does not have any vehicular traffic, it is excluded from the quality control modelling. Therefore, only 2.95 ha site area occupied by CA-1-Post having 61.50 % imperviousness that contributes to the proposed quality control unit are accounted in the quality control modelling.

CDS model PMSU 20-20 oil grit separator unit is proposed at downstream of the Outlet-1 structure. The CDS unit will receive controlled release through the orifice / weir installed at the Outlet-1 and hence it will not operate in a surcharged condition.

Please refer to **Appendix "B"** for the design summary of CDS model PMSU 20-20 oil grit separator unit provided by Echelon Environmental. Proposed water quality unit will treat 98.40% of average annual rainfall volume and remove 80.50% of TSS prior to discharging from the site. This is concluded by considering the controlled portion of the site area that discharges to the dry pond facilities and contributing to the proposed quality control unit. The option for upstream attenuation and storage-discharge relationship for dry pond facility SU-1 is used to access TSS removal by the CDS system.

An ongoing maintenance program, consisting of periodic inspection and cleaning of the CDS and on-site catch basins are recommended (minimum once per year).

4.4 Downstream Capacity

The site area occupied by this development is contributing to the existing municipal culvert and an unnamed stream located at the south property limits in the pre-development condition. Since, the post-development peak flows from this site are controlled in line with the respective peak flow resulting from the target pre-development condition during 5-year to 100-year storm events, the total release from the site will be less than the pre-development condition. Hence, there will be no need to map downstream capacity of existing municipal conveyance system.

5.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

Construction activity, especially operations involving the handling of earthen material, dramatically increases the availability of particulate matter for erosion and transport by surface drainage. In order to mitigate the adverse environmental impacts caused by the release of silt-laden stormwater runoff into receiving watercourses, measures for erosion and sediment control are required for construction sites.

The impact of construction on the environment is recognized by the Greater Golden Horseshoe Area Conservation Authorities. "Erosion & Sediment Control Guidelines for Urban Construction" released by Authority in December 2006, provides guidance for the preparation of effective erosion and sediment control plans. Control measures must be selected in light of the erosion potential of the site. It is important to have implementations and modifications on a staged basis to reflect the site's activities. Furthermore, the effectiveness of control measures decreases with sediment loading as a result inspection and maintenance is recommended. The selection, implementation, inspection, and maintenance of the control features are summarized as follows:

5.1 Control Measures

On relatively small sites, measures for erosion and sediment control typically include the use of silt fencing, mud mats and sediment traps. The description of the sediment controls to be implemented on the subject site is as follows.

- Installation of **Silt Fences** adjacent to all property limits subject to drainage from the development area prior to topsoil stripping and in other locations, such as at the bases of topsoil stockpiles.
- Installation of **Mud Mats** at all construction entrances prior to commencing earthworks to minimize the tracking of mud onto municipal roads.
- Installation of **Sediment Traps** at all catch basins and area drain locations once the storm sewer system has been constructed to prevent silt-laden runoff from entering the municipal storm sewer system.

5.2 Construction Sequencing

The schedule of construction activities with respect to sediment controls is as follows:

- Installation of the silt fences prior to any other activities on the site.
- Construction of temporary mud mats at all construction access.
- Installation of site servicing and underground utilities.
- Construction of building foundations and disposal of all the surplus excavated materials off site.
- Construction of building, parking lot and driveways.
- Restoration / re-vegetation of disturbed areas either with temporary measures such as mulch or seeding or with final landscape and paving.
- Removal of the sediment controls following stabilization of disturbed areas.

5.3 Inspection & Maintenance

In order to ensure that the erosion and sediment control measures operate effectively, regular monitoring together with periodic cleaning (e.g. removal of accumulated silt), maintenance and/or re-construction is strongly recommended. Inspections of all the erosion and sediment controls on the construction site should be undertaken with the following frequency:

- On a weekly basis
- After every rainfall event
- After significant snow melt events
- Prior to forecasted rainfall events

If damaged control measures are found, they should be repaired and/or replaced within 48 hours. Site inspection staff and construction managers should refer to the Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authorities. This Inspection Guide provides information related to the inspection reporting, problem response and proper installation techniques. Infiltration Gallery shall be kept offline until the site has been stabilised.

6.0 SANITARY DRAINAGE SYSTEM

The Owner has retained Envision Consultants Ltd. to prepare design documents for private on-site sub-surface disposal facility in accordance with the MECP design guidelines.

The Envision Consultant is working with MECP regional and head office and already filed an ECA Application for the approval of proposed Sewage Treatment and Disposal System.

Please refer to the design documents prepared by Envision Consultants Ltd. for MECP Sewage Treatment and Disposal System Design.

7.0 WATER SUPPLY SYSTEM

Currently the property is vacant with an abandoned residential house. An existing 300mm dia watermain located within the municipal allowance of King Street is available to serve the future development on this site. The region of Peel has provided a 300 mm dia fire and domestic combined service to serve future development on this land.

7.1 Proposed Water Supply Requirements

The post-development water supply requirement is calculated in accordance with the Watermain Linear Design Manual provided by the Region of Peel. This manual provides peaking factors to calculate peak hour and maximum day based on Ministry of Environment Guidelines.

The estimated water consumption of approximately 0.78 L/s with a peak hourly demand of 1.68 L/s will be required to service proposed development with domestic water based on population density calculated for this site and proposed land use. Detailed calculations have been illustrated in **Appendix "C"**.

The Town of Caledon and Region of Peel requires the fire flow calculations based on the Water Supply for Public Fire Protection Guidelines provided by the Fire Underwriters Survey (FUS). The fire flow required for the proposed Travel Stop development is estimated at 100.00 L/s for 4 hours, delivered with a residual pressure of not less than 140 kilopascals. Detailed calculations have been illustrated in **Appendix "C"**.

A flow and pressure test will be performed on the nearest hydrant to the site prior to the building permit application to determine compliance for minimum suppression outlined in the FUS and Town's guidelines.

7.2 Proposed Water Service

This development application proposes to make use of the existing 300mm dia fire and domestic combines service provided by the Region of Peel from the existing 300mm dia municipal watermain located within road allowance of King Street. The proposed combined service will split at the property line into fire and domestic services. An internal network of 150 mm dia fire main and 100 mm dia domestic watermain are proposed in accordance with the Region of Peel Standard Drawing 1-8-5A to serve future development.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This report is to be read in conjunction with the submission materials for the project proposal known as proposed Travel Stop development, located at NE Corner of Hurontario Street & King Street, Town of Caledon, Ontario.

8.1 STORM

1. The site is divided into two primary drainage systems; "Controlled" (CA-1-Post) and "Uncontrolled" (CA-2-Post).
2. The post-development peak flow targets will be achieved using detention storage within an on-site End-of-Pipe Dry Storage facility (SU-1).
3. The post-development peak flow targets will be achieved by controlling discharge from the site area using a combination of 150mm dia orifice plate and 500mm(w) X 400mm(d) rectangle weir installed in the perforated CSP outlet structure (Outlet-1).
4. Total 1,003.43 m³ of storage is used out of 1,455.65 m³ storage volume provided during 100-year storm event.
5. The quality control for the site is provided by a multiple component treatment train consisting of a dry, end-of-pipe, detention storage facility and CDS oil and grit separator unit.
6. Proposed water quality unit will treat 98.40% of average annual rainfall volume and remove 80.50% of TSS prior to discharging from the site.
7. An ongoing maintenance program consists of periodic inspection and cleaning of the Stormceptor and Catch basins are recommended (minimum once per year).
8. Erosion and Sediment controls are to be implemented during construction to prevent silt-laden runoff from leaving the site in accordance with the "Erosion & Sediment Control Guidelines for Urban Construction".

8.2 SANITARY

1. The Envision Consultants Ltd. is working with MECP regional and head office and already filed an ECA Application for the approval of proposed Sewage Treatment and Disposal System.
2. Please refer to the design documents prepared by Envision Consultants Ltd. for MECP Sewage Treatment and Disposal System Design.

8.3 WATER

1. The estimated water consumption of approximately 0.78 L/s with a peak hourly demand of 1.68 L/s will be required to service the proposed development with domestic water.
2. The fire flow required for proposed development is estimated at 100.00 L/s for 4 hours, delivered with a residual pressure of not less than 140 kilopascals.
3. This development application proposes to make use of the existing 300mm dia fire and domestic combines service provided by the Region of Peel from the existing 300mm dia municipal watermain located within road allowance of King Street.

4. The proposed combined service will split at the property line into fire and domestic services.
5. A flow and pressure test will be performed on the nearest hydrant to the site prior to the building permit application to determine compliance for minimum suppression outlined in the FUS and Town's guidelines.

We trust that this report satisfies the requirements of the Town of Caledon and Region of Peel with respect to the subject development. Should you have any questions, please feel free to contact the undersigned.

Yours truly,
FLORA DESIGNS INC.



Chirag C. Patel, P.Eng, PMP
Senior Project Manager

Appendix "A" Plans

- Location Map
- Site Survey Drawing
- Architectural Site Plan

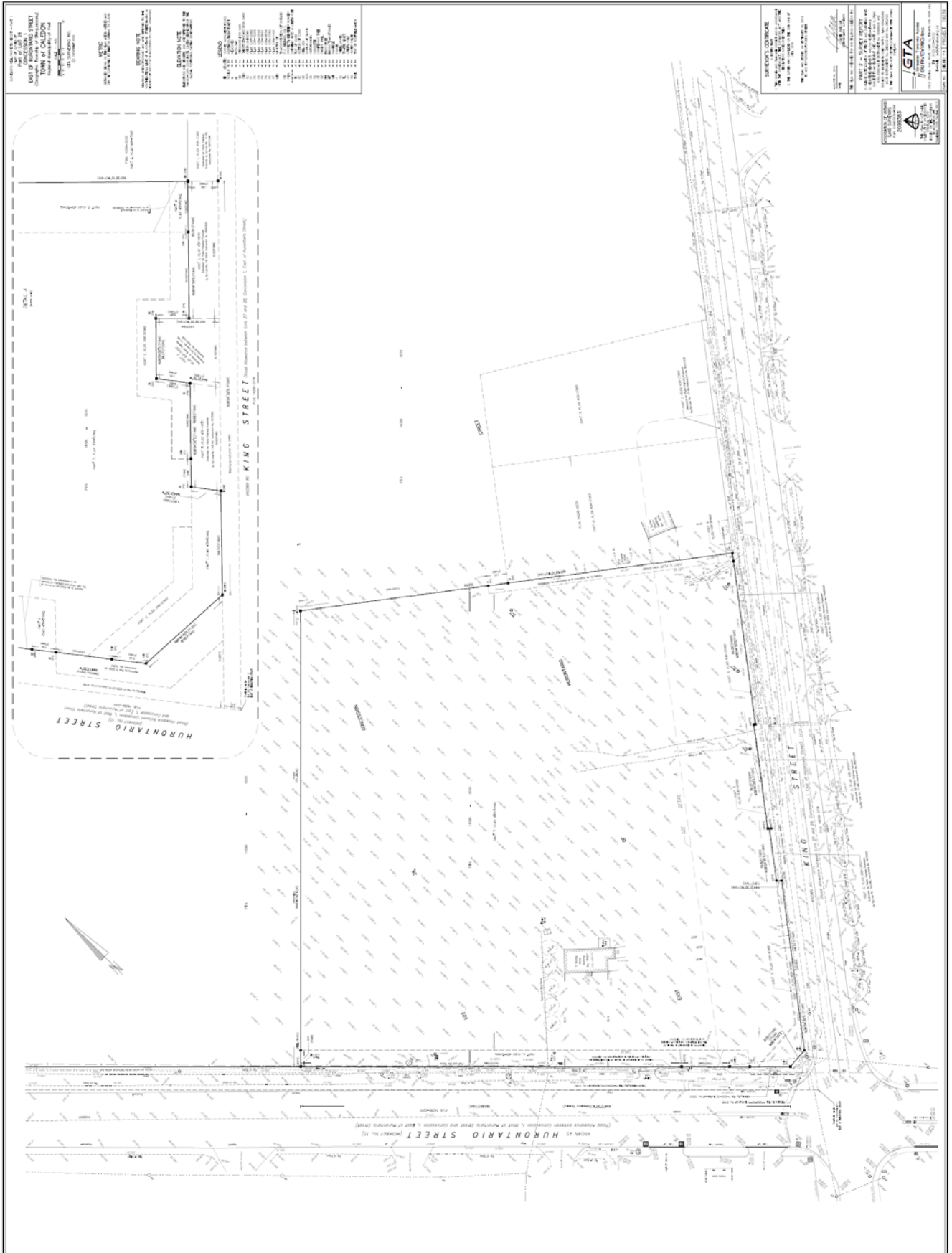
LOCATION MAP

(NTS)



SITE SURVEY DRAWING

(NTS)

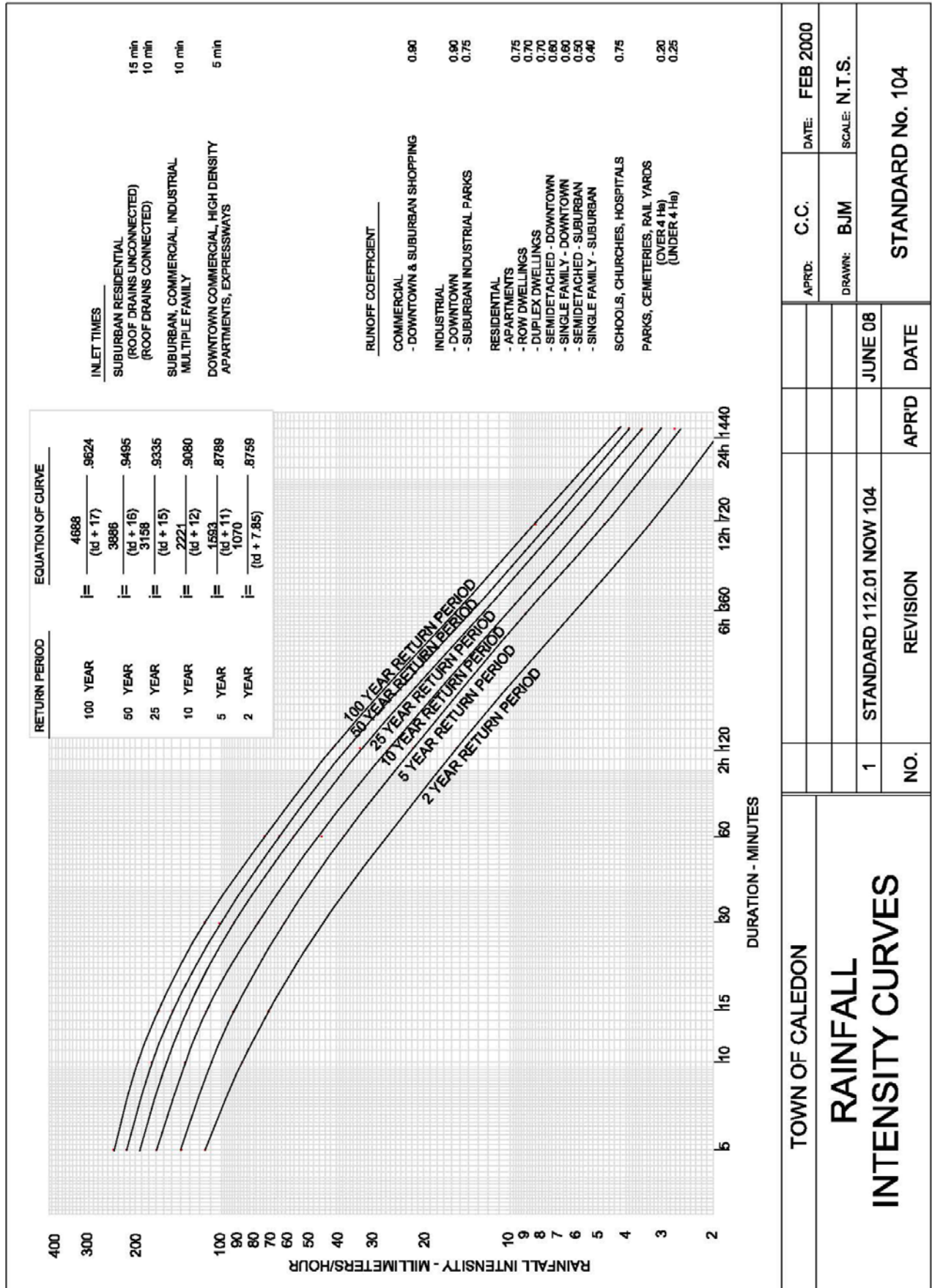


Appendix "B" Stormwater Management

- IDF Curve – Town of Caledon
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IDF CURVE - TOWN OF CALEDON

(Standard No. 104)



APRD: C.C.		DATE: FEB 2000
DRAWN: BJM		SCALE: N.T.S.
JUNE 08		STANDARD No. 104
NO.	DATE	
1	STANDARD 112.01 NOW 104	
NO.	REVISION	APR'D

RUNOFF COEFFICIENT CALCULATIONS

In Accordance with STD No.104, Development Standards, Policies & Guidelines Manual

Character of Surface	Runoff Coeff. "C"
Parks (Under 4 Ha)	0.25
Asphalt, Concrete, Roof Areas	0.90

Pre-Development Drainage Area

Catchment Type	Catchment #	Area (m ²)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Uncontrolled	CA-1-Pre	509.55	32125.68	0.05	3.21	1.59	0.26
Total Site		509.55	32125.68	0.05	3.21	1.59	0.26

Post-Development Drainage Area

Catchment Type	Catchment #	Area (m ²)		Area (ha)		% Imp.	Runoff Coeff. "C"
		Imp.	Total	Imp.	Total		
Controlled	CA-1-Post	18113.44	29450.94	1.81	2.95	61.50	0.65
Uncontrolled	CA-2-Post	346.19	2674.74	0.03	0.27	12.94	0.33
Total Site		18459.63	32125.68	1.85	3.21	57.46	0.62

Runoff Coefficient (C)

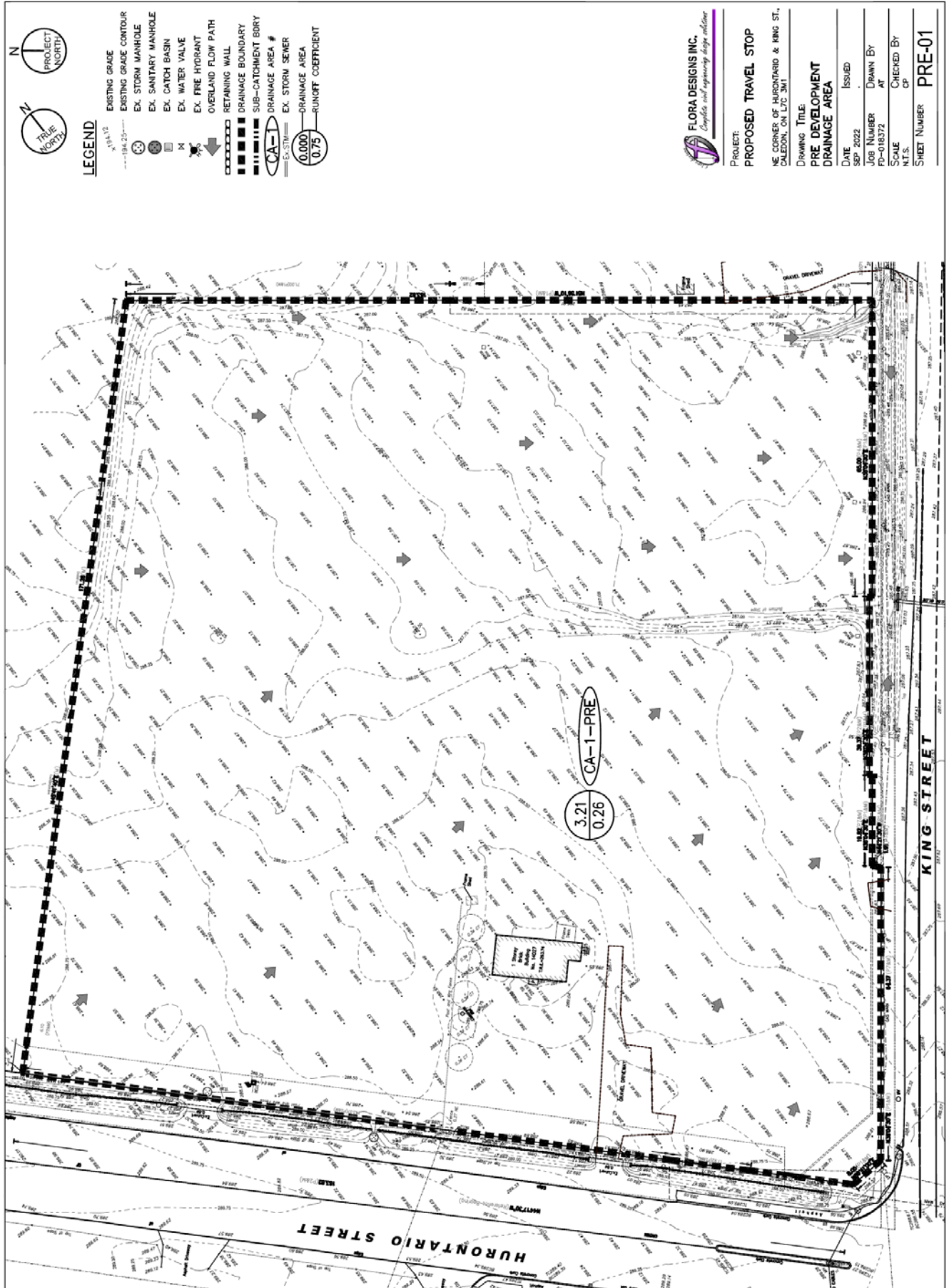
C = 0.9 i + 0.25 (1 - i), Where i = Imperviousness Ratio

Sub-Catchment Area of CA-1-Post

Catchment Type	Inlet Location	Area (m ²)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	CB-1	1522.77	1875.90	0.15	0.19	81.18	0.78
	CB-2	781.58	896.03	0.08	0.09	87.23	0.82
	Canopy-Retail	216.87	216.87	0.02	0.02	100.00	0.90
	CBMH-3	1773.13	3113.34	0.18	0.31	56.95	0.62
	Canopy-Comm	238.06	238.06	0.02	0.02	100.00	0.90
	DCB-3	2186.59	2327.44	0.22	0.23	93.95	0.86
	CB-4	619.64	789.41	0.06	0.08	78.49	0.76
	CB-5	966.81	1207.97	0.10	0.12	80.04	0.77
	Bldg-A Roof	548.75	548.75	0.05	0.05	100.00	0.90
	Bldg-B Roof	298.00	298.00	0.03	0.03	100.00	0.90
	CBMH-6	182.72	232.17	0.02	0.02	78.70	0.76
	Bldg-C Roof	334.96	334.96	0.03	0.03	100.00	0.90
	Bldg-D Roof	334.96	334.96	0.03	0.03	100.00	0.90
	DCB-6	1582.79	2057.62	0.16	0.21	76.92	0.75
	CBMH-8	2406.13	2453.53	0.24	0.25	98.07	0.89
	CB-7	0.00	4683.35	0.00	0.47	0.00	0.25
	CB-8	1306.49	1552.77	0.13	0.16	84.14	0.80
CB-9	1665.64	1665.64	0.17	0.17	100.00	0.90	
CB-10	325.01	325.01	0.03	0.03	100.00	0.90	
POND	822.54	4299.16	0.08	0.43	19.13	0.37	
Sub Total - Controlled		18113.44	29450.94	1.81	2.95	61.50	0.65

EXISTING STORM DRAINAGE PLAN

(NTS)



PRE-DEVELOPMENT PEAK FLOW CALCULATIONS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Pre	3.21	0.26	10

Where: Q = Runoff Quantity (Flow) in litre/sec
 A = Drainage Area in Hectors
 C = Runoff Coefficient
 I = Average Rainfall Intensity - mm/h

Event 5 yr

IDF Data Set, Town of Caledon

Coefficient, a =	1593.00
Coefficient, b =	11.00
Exponent, c =	-0.879

$$(I) = a * (Tc + b)^c$$

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m³/s)
CA-1-Pre	3.21	109.68	0.26	254.47	0.254

Event 100 yr

IDF Data Set, Town of Caledon

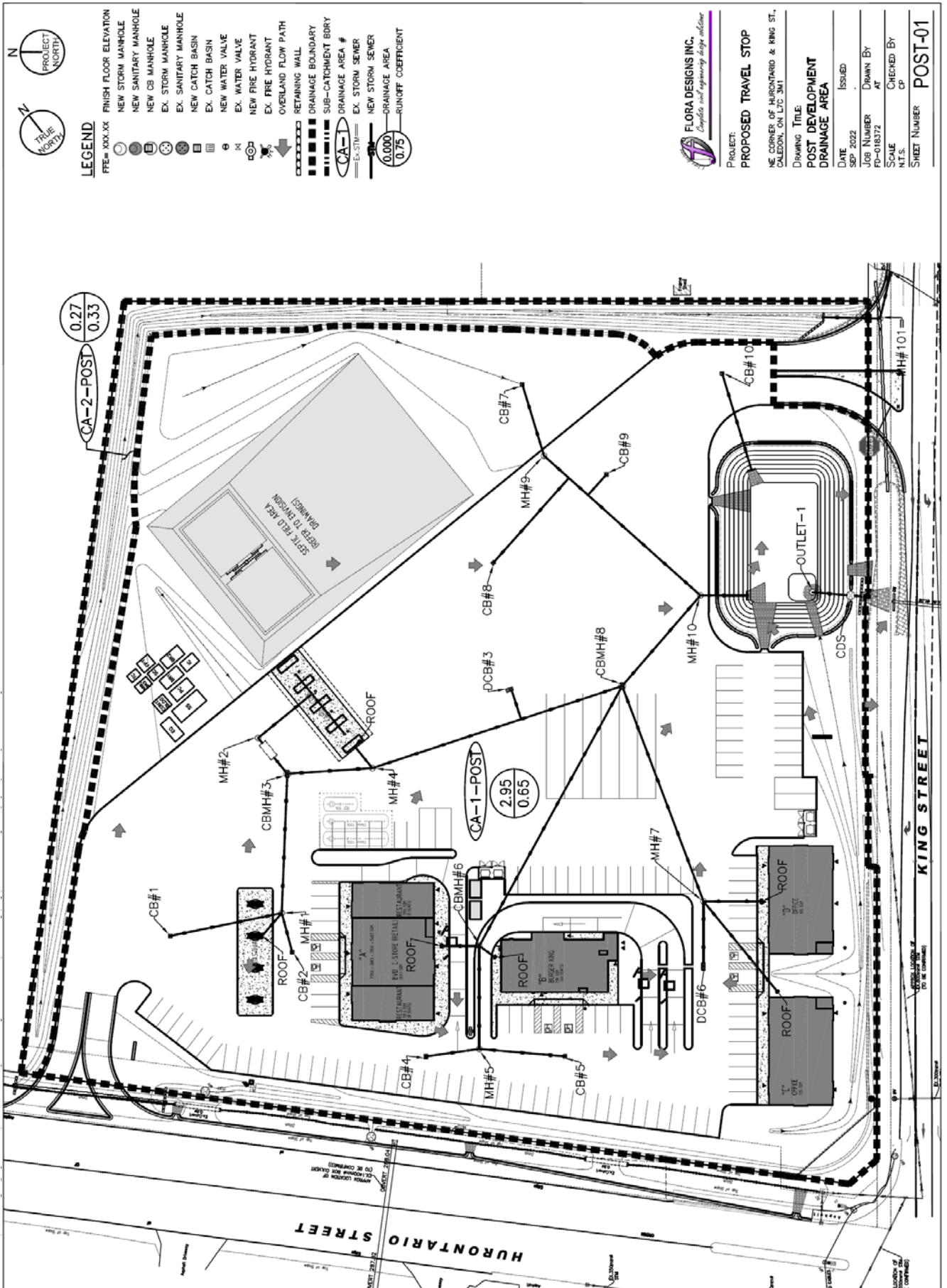
Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.962

$$(I) = a * (Tc + b)^c$$

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m³/s)
CA-1-Pre	3.21	196.54	0.26	456.00	0.456

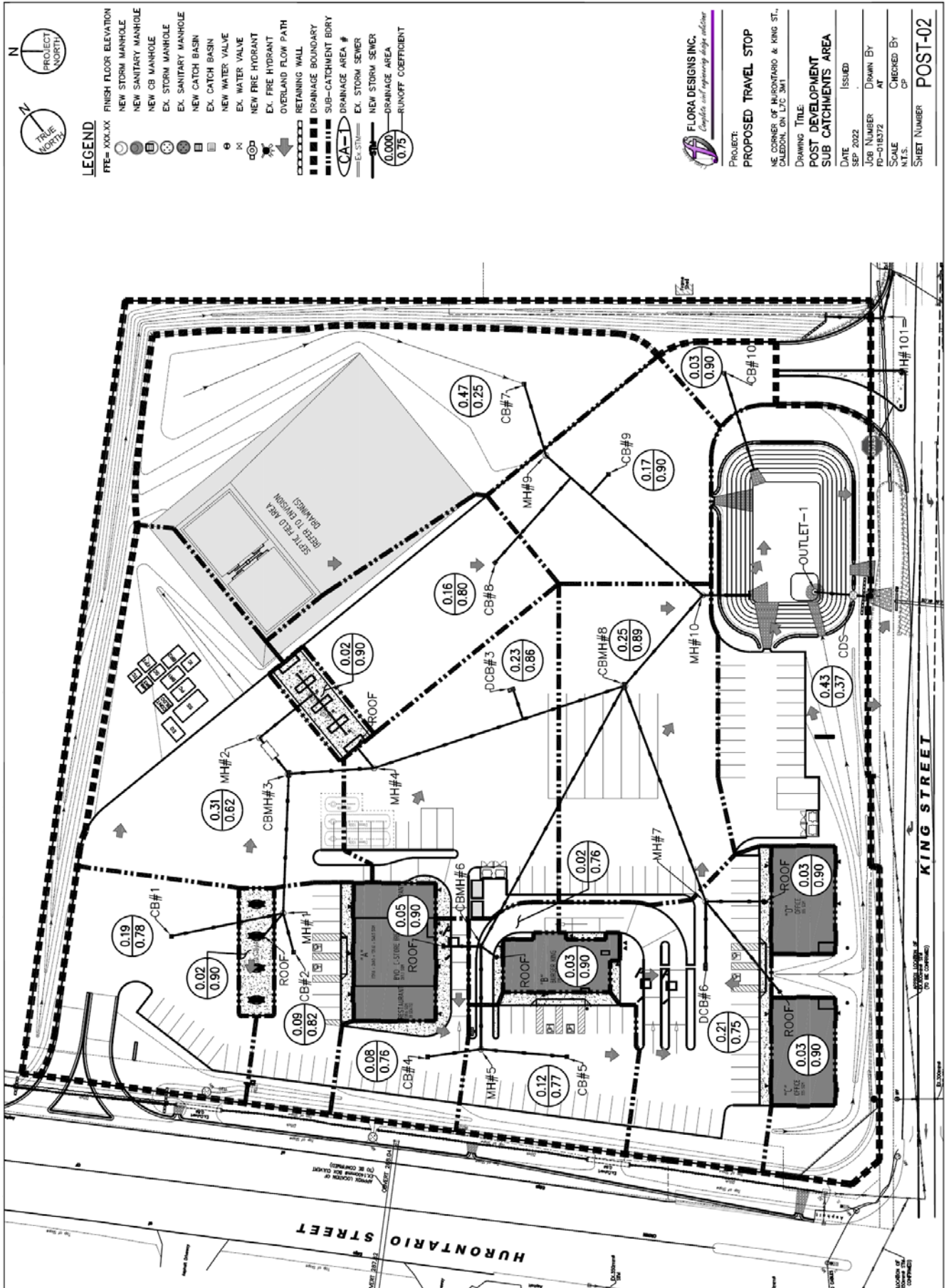
PROPOSED STORM DRAINAGE PLAN

(NTS)



PROPOSED SUB-CATCHMENT AREA PLAN

(NTS)



POST-DEVELOPMENT PEAK FLOW CALCULATIONS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Post	2.95	0.65	10
CA-2-Post	0.27	0.33	10

Where: Q = Runoff Quantity (Flow) in litre/sec
 A = Drainage Area in Hectors
 C = Runoff Coefficient
 I = Average Rainfall Intensity - mm/h

Event 5 yr

IDF Data Set, Town of Caledon

Coefficient, a =	1593.00
Coefficient, b =	11.00
Exponent, c =	-0.879

$$(I) = a * (Tc + b)^c$$

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m³/s)
CA-1-Post	2.95	109.68	0.65	584.65	0.585
CA-2-Post	0.27	109.68	0.33	27.17	0.027

Event 100 yr

IDF Data Set, Town of Caledon

Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.962

$$(I) = a * (Tc + b)^c$$

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m³/s)
CA-1-Post	2.95	196.54	0.65	1047.67	1.048
CA-2-Post	0.27	196.54	0.33	48.68	0.049

STAGE STORAGE CALCULATIONS – POND SU-1

Bottom Elevation, Base = 286.00 m

Stage-Storage Information:

POND STORAGE (SU-1)					Incremental Storage Volume (SITE)	Cumulative Storage Volume
	Elevation	Stage	Surface Area	Incremental Storage Volume (POND) <small>$V = [(A1+A2)/2]d$</small>		
	(m)	(m)	(m ²)	(m ³)	(m ³)	(m ³)
Base	286.00	0.00	34.10	--	--	0.00
	286.10	0.10	389.76	21.19	0.00	21.19
	286.25	0.25	461.64	63.85	5.01	90.06
	286.50	0.50	551.95	126.70	8.35	225.11
	286.75	0.75	648.54	150.06	8.35	383.53
	287.00	1.00	751.42	175.00	17.14	575.66
	287.25	1.25	860.57	201.50	17.14	794.30
	287.50	1.50	976.01	229.57	17.14	1041.01
Top	287.75	1.75	1116.80	261.60	153.04	1455.65

STAGE STORAGE CALCULATIONS – SITE AREA

Orifice Invert = 286.00
 Stage = 286.75
 Storage Depth = 0.75 m

CB & MH Storage:

ID	RIM Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Water Depth (m)	Nominal MH Dia (mm)	MH Diameter (m)	Area (m ²)	Storage Volume (m ³)
CB-1	288.70	287.38	286.75	0.00	CB	N/A	0.36	0.00
CB-2	288.75	287.34	286.75	0.00	CB	N/A	0.36	0.00
DCB-3	287.90	286.76	286.75	0.00	DCB	N/A	0.72	0.00
CB-4	288.70	287.25	286.75	0.00	CB	N/A	0.36	0.00
CB-5	288.50	287.28	286.75	0.00	CB	N/A	0.36	0.00
DCB-6	288.25	287.02	286.75	0.00	DCB	N/A	0.72	0.00
CB-7	287.55	286.81	286.75	0.00	CB	N/A	0.36	0.00
CB-8	287.80	286.74	286.75	0.01	CB	N/A	0.36	0.00
CB-9	287.50	286.63	286.75	0.12	CB	N/A	0.36	0.04
CB-10	287.65	286.47	286.75	0.28	CB	N/A	0.36	0.10
MH-1	288.84	287.17	286.75	0.00	1200	1.22	1.17	0.00
CBMH-3	288.20	286.94	286.75	0.00	1500	1.52	1.81	0.00
MH-4	288.27	286.77	286.75	0.00	1200	1.22	1.17	0.00
MH-5	288.74	287.14	286.75	0.00	1200	1.22	1.17	0.00
CBMH-6	288.55	286.95	286.75	0.00	1200	1.22	1.17	0.00
MH-7	288.48	286.87	286.75	0.00	1200	1.22	1.17	0.00
CBMH-8	287.90	286.40	286.75	0.35	1500	1.52	1.81	0.63
MH-9	287.80	286.58	286.75	0.17	1200	1.22	1.17	0.20
MH-10	288.17	286.20	286.75	0.55	1200	1.22	1.17	0.64
Total CB & MH Storage Volume								1.62

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From				To				Storage Volume (m ³)
		ID	Invert Elevation (m)	Water Depth (m)	Area (m ²)	ID	Invert Elevation (m)	Water Depth (m)	Area (m ²)	
0.300	25.00	CB-1	287.38	0.00	0.00	MH-1	287.25	0.00	0.00	0.00
0.200	6.61	Canopy	287.42	0.00	0.00	MH-1	287.35	0.00	0.00	0.00
0.250	8.82	CB-2	287.34	0.00	0.00	MH-1	287.30	0.00	0.00	0.00
0.375	30.67	MH-1	287.17	0.00	0.00	CBMH-3	287.02	0.00	0.00	0.00
0.450	18.76	CBMH-3	286.94	0.00	0.00	MH-4	286.85	0.00	0.00	0.00
0.200	6.16	Canopy	287.16	0.00	0.00	MH-4	287.10	0.00	0.00	0.00
0.300	6.98	DCB-3	286.76	0.00	0.00	Lead	266.72	0.30	0.07	0.24
0.525	57.83	MH-4	286.77	0.00	0.00	CBMH-8	286.48	0.27	0.11	3.18
0.250	11.83	CB-4	287.25	0.00	0.00	MH-5	287.19	0.00	0.00	0.00
0.250	18.95	CB-5	287.28	0.00	0.00	MH-5	287.19	0.00	0.00	0.00
0.300	22.67	MH-5	287.14	0.00	0.00	CBMH-6	287.03	0.00	0.00	0.00
0.250	8.47	Roof-A	287.16	0.00	0.00	CBMH-6	287.08	0.00	0.00	0.00
0.250	4.41	Roof-B	287.12	0.00	0.00	CBMH-6	287.08	0.00	0.00	0.00
0.375	65.23	CBMH-6	286.95	0.00	0.00	CBMH-8	286.62	0.13	0.03	0.98
0.300	13.97	DCB-6	287.02	0.00	0.00	MH-7	286.95	0.00	0.00	0.00
0.250	25.80	Roof-C	287.13	0.00	0.00	MH-7	287.00	0.00	0.00	0.00
0.250	12.88	Roof-D	287.06	0.00	0.00	MH-7	287.00	0.00	0.00	0.00
0.375	50.63	MH-7	286.87	0.00	0.00	CBMH-8	286.62	0.13	0.03	0.76
0.600	26.33	CBMH-8	286.40	0.35	0.17	MH-10	286.26	0.49	0.25	5.53
0.300	16.41	CB-7	286.81	0.00	0.00	MH-9	287.73	0.00	0.00	0.00
0.300	25.00	CB-8	286.74	0.01	0.00	Lead	286.62	0.13	0.03	0.38
0.300	6.05	CB-9	286.63	0.12	0.03	Lead	286.60	0.15	0.04	0.21
0.450	46.10	MH-9	286.58	0.17	0.06	MH-10	286.35	0.40	0.15	4.84
0.600	10.40	MH-10	286.20	0.55	0.27	Head Wall	286.10	0.60	0.28	2.86
0.250	22.33	CB-10	286.47	0.25	0.05	Head Wall	286.25	0.25	0.05	1.12
Total Pipe Storage Volume									20.10	

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m ²)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m ³)
CB-7	287.55	287.75	425.11	286.75	0.00	0.00
CB-9	287.50	287.75	780.10	286.75	0.00	0.00
CB-10	287.65	287.75	164.15	286.75	0.00	0.00
Total Surface Storage Volume						0.00

TOTAL STAGE STORAGE AT ELEVATION	286.75	=	21.72	m³
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Orifice Invert = 286.00
 Stage = 287.50
 Storage Depth = 1.50 m

CB & MH Storage:

ID	RIM Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Water Depth (m)	Nominal MH Dia (mm)	MH Diameter (m)	Area (m ²)	Storage Volume (m ³)
CB-1	288.70	287.38	287.50	0.12	CB	N/A	0.36	0.04
CB-2	288.75	287.34	287.50	0.16	CB	N/A	0.36	0.06
DCB-3	287.90	286.76	287.50	0.74	DCB	N/A	0.72	0.53
CB-4	288.70	287.25	287.50	0.25	CB	N/A	0.36	0.09
CB-5	288.50	287.28	287.50	0.22	CB	N/A	0.36	0.08
DCB-6	288.25	287.02	287.50	0.48	DCB	N/A	0.72	0.35
CB-7	287.55	286.81	287.50	0.69	CB	N/A	0.36	0.25
CB-8	287.80	286.74	287.50	0.76	CB	N/A	0.36	0.27
CB-9	287.50	286.63	287.50	0.87	CB	N/A	0.36	0.31
CB-10	287.65	286.47	287.50	1.03	CB	N/A	0.36	0.37
MH-1	288.84	287.17	287.50	0.33	1200	1.22	1.17	0.39
CBMH-3	288.20	286.94	287.50	0.56	1500	1.52	1.81	1.02
MH-4	288.27	286.77	287.50	0.73	1200	1.22	1.17	0.85
MH-5	288.74	287.14	287.50	0.36	1200	1.22	1.17	0.42
CBMH-6	288.55	286.95	287.50	0.55	1200	1.22	1.17	0.64
MH-7	288.48	286.87	287.50	0.63	1200	1.22	1.17	0.74
CBMH-8	287.90	286.40	287.50	1.10	1500	1.52	1.81	2.00
MH-9	287.80	286.58	287.50	0.92	1200	1.22	1.17	1.07
MH-10	288.17	286.20	287.50	1.30	1200	1.22	1.17	1.52
Total CB & MH Storage Volume								11.00

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From				To				Storage Volume (m ³)
		ID	Invert Elevation (m)	Water Depth (m)	Area (m ²)	ID	Invert Elevation (m)	Water Depth (m)	Area (m ²)	
0.300	25.00	CB-1	287.38	0.12	0.03	MH-1	287.25	0.25	0.06	1.13
0.200	6.61	Canopy	287.42	0.08	0.01	MH-1	287.35	0.15	0.03	0.13
0.250	8.82	CB-2	287.34	0.16	0.03	MH-1	287.30	0.20	0.04	0.31
0.375	30.67	MH-1	287.17	0.33	0.10	CBMH-3	287.02	0.38	0.11	3.22
0.450	18.76	CBMH-3	286.94	0.45	0.16	MH-4	286.85	0.45	0.16	3.00
0.200	6.16	Canopy	287.16	0.20	0.03	MH-4	287.10	0.20	0.03	0.18
0.300	6.98	DCB-3	286.76	0.30	0.07	Lead	266.72	0.30	0.07	0.49
0.525	57.83	MH-4	286.77	0.53	0.22	CBMH-8	286.48	0.53	0.22	12.72
0.250	11.83	CB-4	287.25	0.25	0.05	MH-5	287.19	0.25	0.05	0.59
0.250	18.95	CB-5	287.28	0.22	0.05	MH-5	287.19	0.25	0.05	0.95
0.300	22.67	MH-5	287.14	0.30	0.07	CBMH-6	287.03	0.30	0.07	1.59
0.250	8.47	Roof-A	287.16	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.42
0.250	4.41	Roof-B	287.12	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.22
0.375	65.23	CBMH-6	286.95	0.38	0.11	CBMH-8	286.62	0.38	0.11	7.18
0.300	13.97	DCB-6	287.02	0.30	0.07	MH-7	286.95	0.30	0.07	0.98
0.250	25.80	Roof-C	287.13	0.25	0.05	MH-7	287.00	0.25	0.05	1.29
0.250	12.88	Roof-D	287.06	0.25	0.05	MH-7	287.00	0.25	0.05	0.64
0.375	50.63	MH-7	286.87	0.38	0.11	CBMH-8	286.62	0.38	0.11	5.57
0.600	26.33	CBMH-8	286.40	0.60	0.28	MH-10	286.26	0.60	0.28	7.37
0.300	16.41	CB-7	286.81	0.30	0.07	MH-9	287.73	0.00	0.00	0.57
0.300	25.00	CB-8	286.74	0.30	0.07	Lead	286.62	0.30	0.07	1.75
0.300	6.05	CB-9	286.63	0.30	0.07	Lead	286.60	0.30	0.07	0.42
0.450	46.10	MH-9	286.58	0.45	0.16	MH-10	286.35	0.45	0.16	7.38
0.600	10.40	MH-10	286.20	0.60	0.28	Head Wall	286.10	0.60	0.28	2.91
0.250	22.33	CB-10	286.47	0.25	0.05	Head Wall	286.25	0.25	0.05	1.12
Total Pipe Storage Volume									62.14	

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m ²)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m ³)
CB-7	287.55	287.75	425.11	287.50	0.00	0.00
CB-9	287.50	287.75	780.10	287.50	0.00	0.00
CB-10	287.65	287.75	164.15	287.50	0.00	0.00
Total Surface Storage Volume						0.00

TOTAL STAGE STORAGE AT ELEVATION	287.50	=	73.13	m³
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Orifice Invert = 286.00
 Stage = 287.75
 Storage Depth = 1.75 m

CB & MH Storage:

ID	RIM Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Water Depth (m)	Nominal MH Dia (mm)	MH Diameter (m)	Area (m ²)	Storage Volume (m ³)
CB-1	288.70	287.38	287.75	0.37	CB	N/A	0.36	0.13
CB-2	288.75	287.34	287.75	0.41	CB	N/A	0.36	0.15
DCB-3	287.90	286.76	287.75	0.99	DCB	N/A	0.72	0.71
CB-4	288.70	287.25	287.75	0.50	CB	N/A	0.36	0.18
CB-5	288.50	287.28	287.75	0.47	CB	N/A	0.36	0.17
DCB-6	288.25	287.02	287.75	0.73	DCB	N/A	0.72	0.53
CB-7	287.55	286.81	287.55	0.74	CB	N/A	0.36	0.27
CB-8	287.80	286.74	287.75	1.01	CB	N/A	0.36	0.36
CB-9	287.50	286.63	287.50	0.87	CB	N/A	0.36	0.31
CB-10	287.65	286.47	287.65	1.18	CB	N/A	0.36	0.42
MH-1	288.84	287.17	287.75	0.58	1200	1.22	1.17	0.68
CBMH-3	288.20	286.94	287.75	0.81	1500	1.52	1.81	1.47
MH-4	288.27	286.77	287.75	0.98	1200	1.22	1.17	1.15
MH-5	288.74	287.14	287.75	0.61	1200	1.22	1.17	0.71
CBMH-6	288.55	286.95	287.75	0.80	1200	1.22	1.17	0.93
MH-7	288.48	286.87	287.75	0.88	1200	1.22	1.17	1.03
CBMH-8	287.90	286.40	287.75	1.35	1500	1.52	1.81	2.45
MH-9	287.80	286.58	287.75	1.17	1200	1.22	1.17	1.37
MH-10	288.17	286.20	287.75	1.55	1200	1.22	1.17	1.81
Total CB & MH Storage Volume								14.83

Pipe Storage:

Pipe Dia. (m)	Pipe Length (m)	From				To				Storage Volume (m ³)
		ID	Invert Elevation (m)	Water Depth (m)	Area (m ²)	ID	Invert Elevation (m)	Water Depth (m)	Area (m ²)	
0.300	25.00	CB-1	287.38	0.30	0.07	MH-1	287.25	0.30	0.07	1.75
0.200	6.61	Canopy	287.42	0.20	0.03	MH-1	287.35	0.20	0.03	0.20
0.250	8.82	CB-2	287.34	0.25	0.05	MH-1	287.30	0.25	0.05	0.44
0.375	30.67	MH-1	287.17	0.38	0.11	CBMH-3	287.02	0.38	0.11	3.37
0.450	18.76	CBMH-3	286.94	0.45	0.16	MH-4	286.85	0.45	0.16	3.00
0.200	6.16	Canopy	287.16	0.20	0.03	MH-4	287.10	0.20	0.03	0.18
0.300	6.98	DCB-3	286.76	0.30	0.07	Lead	266.72	0.30	0.07	0.49
0.525	57.83	MH-4	286.77	0.53	0.22	CBMH-8	286.48	0.53	0.22	12.72
0.250	11.83	CB-4	287.25	0.25	0.05	MH-5	287.19	0.25	0.05	0.59
0.250	18.95	CB-5	287.28	0.25	0.05	MH-5	287.19	0.25	0.05	0.95
0.300	22.67	MH-5	287.14	0.30	0.07	CBMH-6	287.03	0.30	0.07	1.59
0.250	8.47	Roof-A	287.16	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.42
0.250	4.41	Roof-B	287.12	0.25	0.05	CBMH-6	287.08	0.25	0.05	0.22
0.375	65.23	CBMH-6	286.95	0.38	0.11	CBMH-8	286.62	0.38	0.11	7.18
0.300	13.97	DCB-6	287.02	0.30	0.07	MH-7	286.95	0.30	0.07	0.98
0.250	25.80	Roof-C	287.13	0.25	0.05	MH-7	287.00	0.25	0.05	1.29
0.250	12.88	Roof-D	287.06	0.25	0.05	MH-7	287.00	0.25	0.05	0.64
0.375	50.63	MH-7	286.87	0.38	0.11	CBMH-8	286.62	0.38	0.11	5.57
0.600	26.33	CBMH-8	286.40	0.60	0.28	MH-10	286.26	0.60	0.28	7.37
0.300	16.41	CB-7	286.81	0.30	0.07	MH-9	287.73	0.02	0.00	0.57
0.300	25.00	CB-8	286.74	0.30	0.07	Lead	286.62	0.30	0.07	1.75
0.300	6.05	CB-9	286.63	0.30	0.07	Lead	286.60	0.30	0.07	0.42
0.450	46.10	MH-9	286.58	0.45	0.16	MH-10	286.35	0.45	0.16	7.38
0.600	10.40	MH-10	286.20	0.60	0.28	Head Wall	286.10	0.60	0.28	2.91
0.250	22.33	CB-10	286.47	0.25	0.05	Head Wall	286.25	0.25	0.05	1.12
Total Pipe Storage Volume									63.11	

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m ²)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m ³)
CB-7	287.55	287.75	425.11	287.75	0.20	42.51
CB-9	287.50	287.75	780.10	287.75	0.25	97.51
CB-10	287.65	287.75	164.15	287.75	0.10	8.21
Total Surface Storage Volume						148.23

TOTAL STAGE STORAGE AT ELEVATION 287.75 = 226.17 m³

Stage Storage Summary

Stage Elevation	Stage Storage Volume (m ³)			
	CB-MH	Pipe	Surface	Total
286.75	1.62	20.10	0.00	21.72
287.50	11.00	62.14	0.00	73.13
287.75	14.83	63.11	148.23	226.17

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 5-YEAR STORM

Actual Release Rate (RR)				0.047	m ³ /s
Actual Release Volume per 5-min. Interval				13.98	m ³
5-year Design Storm				Catchment #	CA-1-Post
a =	1593.00				
b =	11.00				
c =	-0.879				
i =	a * (Tc + b)^c			Area (ha) =	2.95
				C =	0.65
				Tc (min.) =	10
1	2	3	4	5	6
Time (min.)	Rainfall Intensity (mm/hr)	Storm Runoff (m³/s)	Storm Runoff Volume (m³)	Released Volume (m³)	Storage Volume (m³)
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	109.68	0.584	350.51	27.96	322.55
15	90.91	0.484	435.78	41.94	393.84
20	77.89	0.415	497.82	55.92	441.90
25	68.29	0.364	545.64	69.90	475.74
30	60.92	0.324	584.04	83.88	500.16
35	55.06	0.293	615.84	97.86	517.98
40	50.28	0.268	642.80	111.84	530.96
45	46.32	0.247	666.09	125.82	540.27
50	42.96	0.229	686.50	139.80	546.70
55	40.09	0.214	704.64	153.78	550.86
60	37.60	0.200	720.91	167.76	553.15
65	35.41	0.189	735.64	181.74	553.90
70	33.48	0.178	749.08	195.72	553.36
75	31.77	0.169	761.43	209.70	551.73
80	30.23	0.161	772.84	223.68	549.16
85	28.84	0.154	783.43	237.66	545.77
90	27.58	0.147	793.31	251.64	541.67
95	26.43	0.141	802.57	265.62	536.95
100	25.39	0.135	811.27	279.60	531.67
105	24.42	0.130	819.48	293.58	525.90
110	23.53	0.125	827.24	307.56	519.68
115	22.71	0.121	834.61	321.54	513.07
120	21.95	0.117	841.61	335.52	506.09
125	21.23	0.113	848.29	349.50	498.79
130	20.57	0.110	854.66	363.48	491.18
135	19.95	0.106	860.76	377.46	483.30
140	19.37	0.103	866.61	391.44	475.17
145	18.82	0.100	872.23	405.42	466.81
150	18.31	0.098	877.63	419.40	458.23
155	17.82	0.095	882.83	433.38	449.45
160	17.36	0.092	887.85	447.36	440.49
165	16.93	0.090	892.69	461.34	431.35
170	16.52	0.088	897.38	475.32	422.06
175	16.13	0.086	901.91	489.30	412.61
180	15.75	0.084	906.30	503.28	403.02

POST-DEVELOPMENT SITE FLOW AND STORAGE USED SUMMARY - 100-YEAR STORM

Actual Release Rate (RR)				0.103	m ³ /s
Actual Release Volume per 5-min. Interval				30.97	m ³
100-year Design Storm				Catchment #	CA-1-Post
a =	4688.00				
b =	17.00				
c =	-0.962				
i =	a * (Tc + b)^c			Area (ha) =	2.95
				C =	0.65
				Tc (min.) =	10
1	2	3	4	5	6
Time (min.)	Rainfall Intensity (mm/hr)	Storm Runoff (m³/s)	Storm Runoff Volume (m³)	Released Volume (m³)	Storage Volume (m³)
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	196.54	1.047	628.10	61.94	566.15
15	166.89	0.889	800.03	92.92	707.11
20	145.13	0.773	927.61	123.89	803.72
25	128.46	0.684	1026.35	154.86	871.49
30	115.28	0.614	1105.26	185.83	919.43
35	104.59	0.557	1169.93	216.80	953.12
40	95.75	0.510	1223.99	247.78	976.21
45	88.31	0.470	1269.95	278.75	991.20
50	81.95	0.437	1309.57	309.72	999.85
55	76.47	0.407	1344.12	340.69	1003.43
60	71.69	0.382	1374.56	371.66	1002.90
65	67.47	0.359	1401.62	402.64	998.99
70	63.74	0.339	1425.86	433.61	992.25
75	60.40	0.322	1447.72	464.58	983.14
80	57.40	0.306	1467.55	495.55	972.00
85	54.69	0.291	1485.64	526.52	959.12
90	52.23	0.278	1502.23	557.50	944.73
95	49.98	0.266	1517.50	588.47	929.03
100	47.93	0.255	1531.62	619.44	912.18
105	46.03	0.245	1544.71	650.41	894.30
110	44.29	0.236	1556.91	681.38	875.53
115	42.67	0.227	1568.30	712.36	855.94
120	41.17	0.219	1578.97	743.33	835.64
125	39.78	0.212	1588.98	774.30	814.68
130	38.47	0.205	1598.41	805.27	793.14
135	37.25	0.198	1607.31	836.24	771.06
140	36.11	0.192	1615.72	867.22	748.50
145	35.04	0.187	1623.69	898.19	725.50
150	34.03	0.181	1631.25	929.16	702.09
155	33.08	0.176	1638.44	960.13	678.31
160	32.18	0.171	1645.29	991.10	654.19
165	31.33	0.167	1651.82	1022.08	629.74
170	30.52	0.163	1658.06	1053.05	605.01
175	29.75	0.158	1664.03	1084.02	580.01
180	29.03	0.155	1669.74	1114.99	554.75

ORIFICE-WEIR RATING CALCULATIONS

Active Storage Stage-Orifice Flow Relationship: (Dry Pond Outlet-1)

	Elevation (m)	Stage (m)	Cumulative Storage Volume (m ³)	Flow Orifice-1 (m ³ /s)	Flow Weir-1 (m ³ /s)	Total Flow (m ³ /s)
Base	286.00	0.00	0.00	0.000	0.000	0.000
	286.10	0.10	21.19	0.008	0.000	0.008
	286.25	0.25	90.06	0.021	0.000	0.021
	286.50	0.50	225.11	0.032	0.000	0.032
	286.75	0.75	383.53	0.040	0.000	0.040
	287.00	1.00	575.66	0.047	0.000	0.047
	287.25	1.25	794.30	0.053	0.000	0.053
Top	287.50	1.50	1041.01	0.059	0.053	0.112
	287.75	1.75	1455.65	0.064	0.232	0.296

Orifice-1

Orifice Invert = 286.00 m

Orifice Characteristics:

$$Q_p = C A_o (2gh_{cl})^{0.5}$$

where,

- Orifice Coefficient, C = 0.63
- Orifice Plate Diameter, D_o = 150 mm
- Orifice sectional area, A_o = 0.01766 m²
- Elev at Centre of Orifice = 286.08 m
- Acceleration - gravity, g = 9.81 m/s²
- Elev at Centre of Orifice = 0.14 m

Weir-1 (Sharp Crested Rectangular)

Weir Invert = 287.35 m

Weir Characteristics:

$$Q_p = C_w * b * (h)^{3/2}$$

where,

- Weir Coefficient, C_w = 1.837
- Head on the Weir, h = Per Stage m
- Downstream Headwater, h_s = Nan m
- Width of the Weir, b = 0.50 m
- Max. Depth of the Weir, d = 0.40 m

STORM SEWER DESIGN SHEET

MUNICIPALITY: Town of Caledon		Proposed Travel Stop		DESIGNER: Flora Designs Inc.																	
PROJECT NAME: Proposed Travel Stop		A = 1593.00		PROJECT No: 18372																	
RAINFALL PARAMETERS:		B = 11.00		Pipe Roughness (n Value): 0.013 Plastic																	
Event: 5 Year Rainfall		C = -0.8789		0.013 Concrete																	
IDF Data: Town of Caledon				0.024 CSP																	
				Pipe Capacity Q: $1/n \cdot A \cdot R^{2.3} \cdot S^{1.48}$																	
				Pipe Velocity V: Q/A																	
				Time of Flow: (L/V ^{0.48})/60																	
				STORM SEWER DESIGN																	
				STORMWATER ANALYSIS																	
DESCRIPTION	From MH	To MH	Contri. Area A (ha)	Runoff Coeff. C	A x C	Accum. A x C	Time of Conc. Tc (min)	Rainfall Intensity I (mm/hr)	Total Peak Flow Q _{act} (L/s)	Actual Flow Velocity V _{act} (m/s)	Length (m)	Diameter (mm)	Slope (%)	Pipe Material	"n" Value	Full Capacity Q _{cap} (L/s)	Full Flow Velocity V _{cap} (m/s)	Percent Full Q _{act} /Q _{cap}	Travel Time (min)	Total Time of Flow (min)	
	CB-1	MH-1	0.19	0.78	0.15	0.15	10.0	109.68	45.19	1.02	25.00	300	0.50%	PVC	0.013	68.28	0.97	66.17%	0.4	10.4	
	CB-2	MH-1	0.09	0.82	0.07	0.07	10.0	109.68	22.50	0.87	8.82	250	0.50%	PVC	0.013	41.99	0.86	53.59%	0.2	10.2	
	Canopy-Retail	MH-1	0.02	0.90	0.02	0.02	10.0	109.68	5.49	0.76	6.61	200	1.00%	PVC	0.013	32.75	1.04	16.76%	0.1	10.1	
	MH-1	CBMH-3			0.00	0.24	10.4	107.87	71.97	1.16	30.67	375	0.50%	PVC	0.013	123.82	1.12	58.13%	0.4	10.8	
	CBMH-3	MH-4	0.31	0.62	0.19	0.43	10.8	106.13	127.52	1.34	18.76	450	0.50%	CONC	0.013	201.35	1.27	63.33%	0.2	11.0	
	Canopy-Comm	MH-4	0.02	0.90	0.02	0.02	10.0	109.68	5.49	0.76	6.16	200	1.00%	PVC	0.013	32.75	1.04	16.76%	0.1	10.1	
	DCB-3	Lead	0.23	0.86	0.20	0.20	10.0	109.68	60.31	1.16	6.98	300	0.60%	PVC	0.013	74.80	1.06	80.63%	0.1	10.1	
	MH-4	CBMH-8			0.00	0.65	11.0	105.28	189.66	1.48	57.83	525	0.50%	CONC	0.013	303.74	1.40	62.44%	0.7	11.7	
	CB-4	MH-5	0.08	0.76	0.06	0.06	10.0	109.68	18.54	0.83	11.83	250	0.50%	PVC	0.013	41.99	0.86	44.15%	0.2	10.2	
	CB-5	MH-5	0.12	0.77	0.09	0.09	10.0	109.68	28.17	0.91	18.95	250	0.50%	PVC	0.013	41.99	0.86	67.10%	0.3	10.3	
	MH-5	CBMH-6			0.00	0.15	10.3	106.32	46.13	1.03	22.67	300	0.50%	PVC	0.013	68.28	0.87	67.56%	0.4	10.7	
	Blldg-A Roof	CBMH-6	0.05	0.90	0.05	0.05	10.0	109.68	13.72	0.98	8.47	250	1.00%	PVC	0.013	59.38	1.21	23.11%	0.1	10.1	
	Blldg-B Roof	CBMH-6	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.85	4.41	250	1.00%	PVC	0.013	59.38	1.21	13.86%	0.1	10.1	
	CBMH-6	CBMH-8	0.02	0.76	0.02	0.24	10.7	106.56	71.22	1.16	65.23	375	0.50%	PVC	0.013	123.82	1.12	57.52%	0.9	11.6	
	Blldg-C Roof	MH-7	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.64	25.80	250	0.50%	PVC	0.013	41.99	0.86	19.61%	0.7	10.7	
	Blldg-D Roof	MH-7	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.64	12.88	250	0.50%	PVC	0.013	41.99	0.86	19.61%	0.3	10.3	
	DCB-6	MH-7	0.21	0.75	0.16	0.16	10.0	109.68	48.02	1.04	13.97	300	0.50%	PVC	0.013	68.28	0.97	70.33%	0.2	10.2	
	MH-7	CBMH-8			0.00	0.21	10.7	106.56	62.66	1.12	50.63	375	0.50%	PVC	0.013	123.82	1.12	50.60%	0.8	11.5	
	CBMH-8	MH-10	0.25	0.89	0.22	1.32	11.7	102.42	376.54	1.79	26.33	600	0.55%	CONC	0.013	454.84	1.61	82.78%	0.2	11.9	
	CB-7	MH-9	0.47	0.25	0.12	0.12	10.0	109.68	35.83	0.98	16.41	300	0.50%	PVC	0.013	68.28	0.97	52.47%	0.3	10.3	
	CB-8	Lead	0.16	0.80	0.13	0.13	10.0	109.68	39.03	1.00	25.00	300	0.50%	PVC	0.013	68.28	0.97	57.15%	0.4	10.4	
	CB-9	Lead	0.17	0.90	0.15	0.15	10.0	109.68	46.65	1.03	6.05	300	0.50%	PVC	0.013	68.28	0.97	68.32%	0.1	10.1	
	MH-9	MH-10			0.00	0.40	10.4	107.87	119.51	1.32	46.10	450	0.50%	CONC	0.013	201.35	1.27	59.35%	0.6	11.0	
	MH-10	Pond			0.00	1.72	11.9	101.64	486.25	2.40	10.40	600	1.00%	CONC	0.013	613.31	2.17	79.28%	0.1	12.0	
	CB-10	Pond	0.03	0.90	0.03	0.03	10.0	109.68	8.23	0.85	22.33	250	1.00%	PVC	0.013	59.38	1.21	13.86%	0.4	10.4	
	Outlet-1	CDS	100-Year Max Flow from Outlet-1						103.24	1.64	7.53	450	1.00%	CONC	0.013	284.75	1.79	36.26%	0.1	0.1	
	CDS	Head Wall	100-Year Max Flow from Outlet-1						103.24	1.64	1.40	450	1.00%	CONC	0.013	284.75	1.79	36.26%	0.0	0.0	

PERFORATED CSP PIPE CALCULATIONS (OUTLET-1)

Pipe Diameter =	1500	mm	Perforation Diameter =	50	mm
Perforated Pipe Length =	1.75	m	Perforation Spacing =	125	mm (center to center)
Pipe Circumference =	4.710	m	Perforation Area =	0.00196	m ²

of Perforations per Row (Pipe Circumference)
 = 37
 # of Rows per Perforated Pipe Length = 13
 Total # of Perforations in Pipe = 481

Total Perforated Area of Pipe =	0.944	m ²
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NOTE:

The perforated portion of the outlet pipe is designed to provide sufficient flow to the downstream orifice plate even under a 75% blockage condition of the perforated pipe. The perforated area of the outlet pipe provides a minimum opening area that is four (4) times greater than the cross-sectional area of the proposed orifice plate located downstream.

Orifice / Weir Characteristics:

	<u>Orifice-1</u>		<u>Weir-1</u>		
Size	150	mm	500	400	mm
Area	0.018	m ²	0.200		m ²

4 x Orifice/Weir Area =	0.871	m ²
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Total Perforated Area of Pipe > 4 x Orifice/Weir AreaO.K.

CDS DESIGN SUMMARY

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated										
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	10.18	92.05	83288	83288	100.00	10.18	10.18	0.00	100.00
2-M	0.17	15.14	88.61	125498	125498	99.75	15.14	15.14	0.00	100.00
3-M	0.25	19.06	85.82	160123	160123	98.17	19.06	19.06	0.00	100.00
4-M	0.33	22.45	83.36	191153	191153	95.04	22.45	22.45	0.00	100.00
5-M	0.42	24.92	81.51	214687	214687	90.91	24.92	24.92	0.00	100.00
6-M	0.50	27.39	79.67	238221	238221	86.47	27.39	27.39	0.00	100.00
7-M	0.58	29.10	78.26	254694	255355	82.01	29.10	29.10	0.00	99.77
8-M	0.67	30.80	76.84	271168	272489	77.67	30.80	30.80	0.00	99.54
9-M	0.75	32.51	75.43	287641	289624	73.64	32.51	31.15	1.36	99.32
10-M	0.83	33.74	74.03	297000	302710	69.90	33.74	31.15	2.59	98.21
11-M	0.92	34.98	72.62	306359	315797	66.40	34.98	31.15	3.83	97.10
1-Yr	1	36.21	71.22	315717	328884	63.21	36.21	31.15	5.06	96.00
2-Yr	2	45.00	60.17	362989	430466	39.35	45.00	31.15	13.85	84.32
5-Yr	5	47.00	57.58	369717	455512	18.13	47.00	31.15	15.85	81.17
10-Yr	10	55.00	47.33	378545	563130	9.52	55.00	31.15	23.85	67.22
25-Yr	25	68.00	36.68	380930	730728	3.92	68.00	31.15	36.85	52.13
50-Yr	50	81.00	31.97	381972	840530	1.98	81.00	31.15	49.85	45.44
100-Yr	100	103.00	27.39	382701	982719	1.00	103.00	31.15	71.85	38.94
Average Annual TSS Removal Efficiency [%]:				80.5	Ave. Ann. T. Volume [%]:		98.4			

Engineer: Flora Designs
Contact: Chirag Patel, P.Eng, P.M.P
Date: 23/Sep/22
Project: Highway 10 & King Street
Location: Caledon, ON
OGS ID: OGS 1

Upstream Storage: 1003 m³
Storage

Area = 2.95 ha
Impervious: 62 %
CDS Model: PMSU2020_5
Flowrate: 31 l/s
IDF Data: Toronto Airport
PSD: FINE

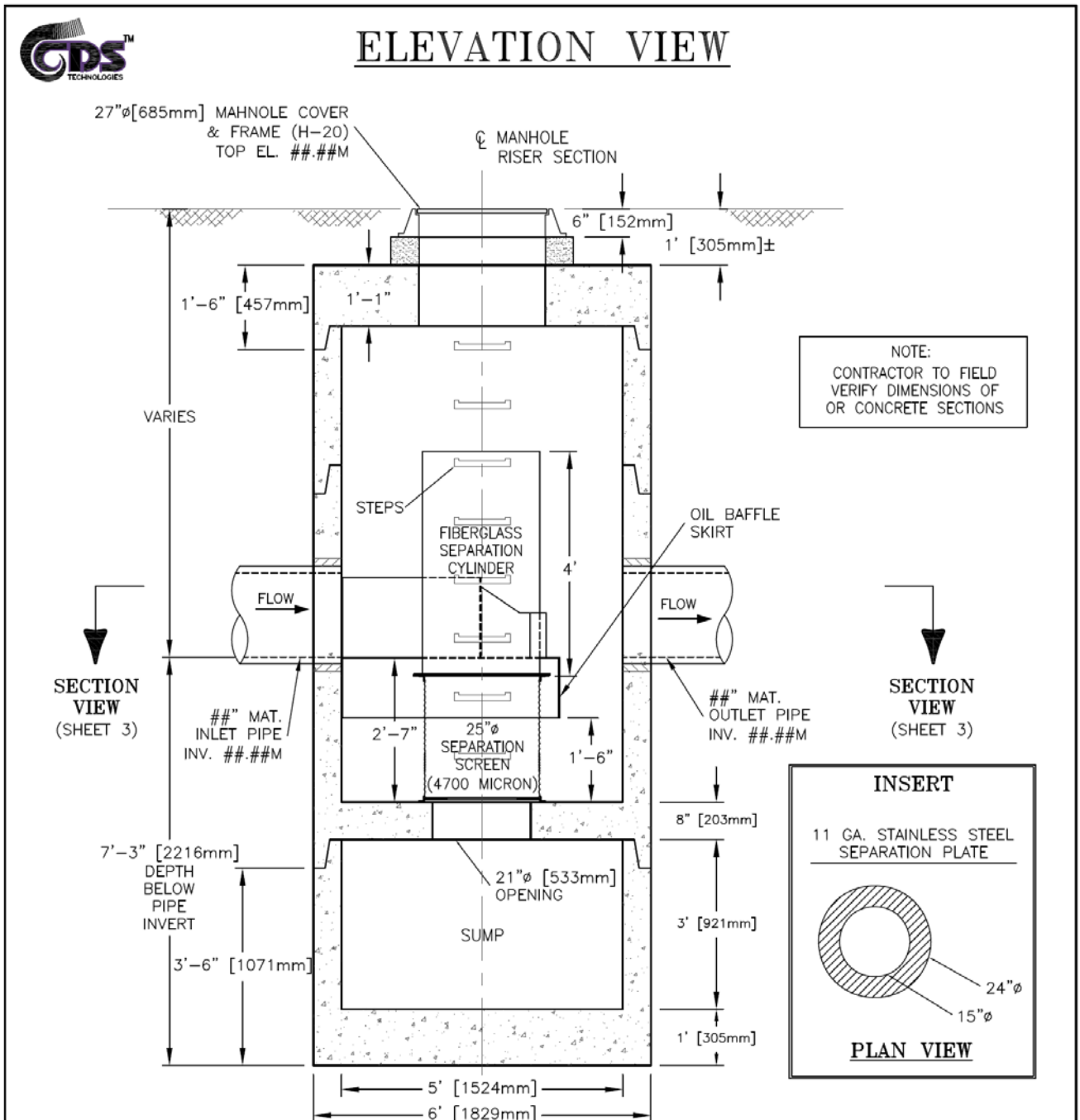
Notes:

- 1) CDS Efficiency based on testing conducted at the University of Central Florida
- 2) CDS design flowrate and scaling based on standard manufacturer model & product specifications



CDS MODEL 2020 - TYPICAL DRAWING

(NTS)



**CDS MODEL PMSU20_20m, 31 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT**

	<p>NE CORNER OF KING STREET & HURONTARIO STREET TOWN OF CALEDON, ONTARIO</p>	JOB#	XX-##-###	SCALE	N.T.S.
		DATE	##/##/##	SHEET	2
		DRAWN	INITIALS		
		APPROV.			
<p>Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577 CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955</p>					

Appendix "C" Water Supply System

- Post-development Population Density Calculations
- Post-development Water Supply Requirement Calculations
- Post-development Fire Flow Requirement Calculations

POST-DEVELOPMENT POPULATION DENSITY CALCULATIONS

(According to the Sanitary Sewer Design Criteria, Region of Peel)

Development Type	Equivalent Population Density (Persons/ha)	Area of Site (ha)	Population (Persons)
Commercial	50	3.21	161

POST-DEVELOPMENT WATER SUPPLY REQUIREMENT CALCULATIONS

Typical Water Demand Criteria (According to the Watermain Design Criteria, Region of Peel)

Population Type	Unit	Average Consumption Rate	Max Day Factor	Peak Hour Factor
ICI	L / Employee . D	300	1.4	3.0

Post-development Water Supply Requirements

Development Type	Commercial
Eq. Population Density	161

No.	Demand Type	Demand	Units
1	Average day flow	0.56	L/Sec
2	Maximum day flow	0.78	L/Sec
3	Peak hour flow	1.68	L/Sec
4	Fire flow	100.00	L/Sec
Analysis			
5	Maximum day plus fire flow	100.78	L/Sec
6	Peak hour flow	1.68	L/Sec
7	Maximum demand flow	100.78	L/Sec

POST-DEVELOPMENT FIRE FLOW REQUIREMENT CALCULATIONS

The Fire Underwriters Survey requires that a minimum water supply source "F" be provided at 140 kPa.

1 Estimate of Required Fire Flow

	F =	220 * C * (A)^0.5
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Where => F = Required Fire Flow (L/min)
 C = Coefficient related to construction
 A = Total Area (m²)

Determining "C"

	C =	0.8	For non-combustible construction
--	-----	-----	----------------------------------

Determining "A"

	A =	Total floor area of all storeys in the building	For non-combustible construction
--	-----	---	----------------------------------

Largest Floor Area =	548.75	m ²	
1st adjoining Floor Area =	0.00	m ²	
2nd adjoining Floor Area =	0.00	m ²	
A =	548.75	m ²	Building-A

So that,

	F =	4,000.00	L/min.
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 (Rounded per FUS Guide Page # 20)

2 Addition / Reduction for occupancy type

	Increased by	25%	For the occupancies having high contents of fire hazard
--	--------------	-----	---

So that,

	F =	5,000.00	L/min.
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3 Reduction for sprinkler system

	No Charge	0%	No sprinkler system
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4 Addition for structures exposed within distance of fire area

Side	Distance (m)	% Addition
North	None	0%
South	14.51	15%
East	None	0%
West	None	0%
Total		15%

Shall not exceed 75%

Net Reduction / Addition for step 3 & 4

	Increased by	15%
--	--------------	-----

So that,

	F =	6000.00	L/min.
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 (Rounded per FUS Guide Page # 20)

N.B. - As per FUS requirements fire flow shall not exceed **45000 L/min** nor be less than **2000 L/min**.

Therefore, the fire flow required is =	6000.00	L/min.
	100.00	L/sec
	1585.03	USGPM
	1320.86	Imp. GPM

REGION OF PEEL DEMAND TABLE

Project : Proposed Travel Stop
Project Address : NW Corner of Hurontario Street & King Street
SPA No. : 2019-0065

WATER CONNECTION

Connection Point :		Approximate 38.0m west of centerline of Hurontario Street from the existing 300mm dia watermain located within road allowance of King Street	
Pressure zone of connection point			
Total equivalent population to be serviced ¹⁾		161	
Total lands to be serviced		3.21 ha	
Hydrant Flow Test:		To be performed	
Hydrant flow test location			
Hydrant residual test location			
		Pitot Pressure (kPa)	Time
Minimum water pressure			
Maximum water pressure			

WATER DEMANDS

No.	Demand Type	Demand	Units
1	Average day flow	0.56	L/Sec
2	Maximum day flow	0.78	L/Sec
3	Peak hour flow	1.68	L/Sec
4	Fire flow ²⁾	100.00	L/Sec
Analysis			
5	Maximum day plus fire flow	100.78	L/Sec

WASTEWATER CONNECTION

Connection Point ³⁾:		Private on-site sub-surface disposal facility	
Total equivalent population to be serviced ¹⁾		161	
Total lands to be serviced		3.21 ha	
6	Wastewater sewer effluent	N.A.	L/Sec

- 1) The calculations should be based on the development estimated population (employment or residential).
 - 2) Please reference the Fire Underwriters Survey Document
 - 3) Please specify the connection point ID
 - 4) Please specify the connection point (wastewater line of 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)

Appendix "D" Statement of Limiting Conditions and Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other than the intended users have the right to use and rely on the work without first obtaining the written authorization of FLORA DESIGNS INC. and its Owners. All concerned governing authorities and reviewing agencies are permitted to use all engineering design documents prepared for this project.
2. The comments, recommendations and material in this report reflect Flora Designs best judgement in light of the information available to it at the time of preparation of this report. It is not qualified to and is not providing legal or planning advice in this work.
3. Flora Designs expressly excludes liability to any third party except the Intended Users for any use of, and/or reliance upon, the work.
4. Flora Designs notes that the following assumptions were made in completing the work
 - a) The land use description(s) supplied to Flora Designs are correct
 - b) The surveys and other data supplied to Flora Designs by the Owner are accurate
 - c) Market timing, approval delivery and secondary information is within the control of parties other than Flora Designs
 - d) There are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances, which would significantly affect the use or servicingInvestigations have not carried out to verify these assumptions. Flora Designs deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respects.
5. All the plans, photographs, and sketches prepared and presented in this report/study are included solely to aid the visualizing the location of the property, the boundaries of the site, and the relative position of the improvements on the said lands are based on information provided by Owner
6. Flora Designs accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub soil conditions, environmental, engineering or other factual and technical matters disclosed by the owner, the clients, or any public agency, which by their nature, may change the outcome of the work.
7. In the preparation of this report, Flora Designs have made investigations from secondary sources as documented in the work, but did not checked compliance with by-laws, codes, agency and government regulations, etc., unless specifically noted in the work.
8. The value of proposed improvements should apply only with regard to the purpose and function of the work, as outlined in the body of this work. Any cost estimated set out in the work based on construction averages and subject to change.
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