SITE SERVICING
AND
STORMWATER MANAGEMENT REPORT

Proposed Marriott Hotel

AT
12476 Highway 50
Town of Caledon

Prepared for
Antrix Architects Inc.

Sep 21, 2020	Issued for 1st SPA Submission

REVISIONS

FLORA DESIGNS INC.
Complete civil engineering design solutions

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TABLE OF CONTENTS

TABLE OF CONTENTS..... (Continued)

LIST OF APPENDICES

1.0 INTRODUCTION

Flora Designs Inc. has been retained by Antrix Architects Inc. (the "Consultant") to prepare a Site Servicing and Stormwater Management Report for a proposed addition of five-storey Hotel development to the partially developed site located at 12476 Highway 50, 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) and minor Zoning By-Law Amendment Application (ZBL) by Antrix Architects 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 subject property is approximately 12,602 m^2 (1.26 hectares) in size. The subject site consists of one building: Retail Fuel Outlet (Gas Station) and associated convenience store located in the south-east corner of the property, and vacant unoccupied land in the remaining portions of the property. An existing Robinson Creek tributary runs through the property along the east property limits. The property is located in a commercial/industrial area, bounded as follows:

- Robinson Creek to the north
- George Bolton Parkway to the south
- An existing industrial development to the west, and
- An existing gas station and Highway 50 to the east.

3.0 SITE PROPOSAL

The Site Plan Application proposes a five-storey hotel building and associated parking area on the vacant unoccupied land. 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 hotel building roof and the portion of site area considered under this development proposal will be collected by the on-site private storm sewer network. The entire major and minor system flows from the site will be discharged to an existing 450 mm dia storm sewer located within the municipal road allowance of George Bolton Parkway through an existing 375 mm dia service.

The sanitary discharge from the site will be conveyed by an existing 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway through a new 200 mm dia service.

The water supply requirements for this development will be fulfilled by an existing 300 mm dia watermain located within the municipal road allowance of George Bolton Parkway through an existing 150 mm dia fire and domestic combined service.

The Owner has retained C.F. Crozier & Associates Consulting Engineers (Crozier) to prepare Flood Plain Modelling and Cut/Fill Analysis for the existing Robinson Creek tributary in support of this development proposal. Crozier's scope of work also includes preparation of required documents for Natural Heritage Assessment, Geomorphological Assessment and Landscape design in compliance with TRCA's requirements for the development approval.

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 Standard 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 5-year rainfall event.
- The on-site storm sewer network is sized to convey minor system flows.
- An overland flow route is 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 partially developed. An existing gas station development is located on a small portion of approximate 0.21 ha site area at the south-east corner of the lot. The remaining portion of site area is vegetated undeveloped land. The topographic survey indicates the property has split drainage where approximately half of the undeveloped portion of the property slopes towards Robinson Creek, while the other half slopes towards George Bolton Parkway. Based on the mapping provided by TRCA, the Regional floodplain of Robinson Creek tributary extends onto approximately one third of the property.

However, for the calculations of the post-development allowable discharge rates from the portion of site area considered in current development proposal in line with the proposed development concept, the pre-development site area is subdivided as follows:

1. The sub catchment area CA-1-Pre is considered to be discharging to the municipal sewer located with the road allowance of George Bolton Parkway through an existing 375mm dia storm service.
2. The site area occupied by an existing Robinson Creek tributary (CA-2-Pre) is considered to drain similar to the existing condition without any alteration to the surface treatment and drainage pattern.
3. The portion of existing developed site area occupied by an existing gas station (CA-3-Pre) is considered to have well established storm controls in accordance with the Town standards. Therefore, this portion of site area is excluded in the post-development stormwater management modelling.

The pre-development surface condition and drainage area for this site has been illustrated in **Appendix "B"**.

Table-1 Pre-development Input Parameters

Drainage System	Catchment #	Drainage Area (ha)	Runoff Coefficient (C)	Time of Concentration (Tc)
Controlled	CA-1-Pre	0.78	0.28	10
Uncontrolled	CA-2-Pre	0.27	0.25	10
Excluded	CA-3-Pre	0.21	0.83	10
TOTAL		**1.26**	**0.36**	**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	0.067	0.119
CA-2-Pre	0.021	0.037
CA-3-Pre	0.053	0.095

4.3 Stormwater Management

In the post-development condition, the site area occupied by an existing Robinson Creek tributary (CA-2-Post) is considered to drain similar to the existing condition without any alteration to the surface treatment and drainage pattern. Similarly, the portion of existing developed site area occupied by an existing gas station (CA-3-Post) is considered to have well established storm controls in

accordance with the Town standards. Therefore, both of this catchment areas are excluded in the post-development stormwater management modelling.

The site grading for the controlled portion of site area (CA-1-Post) is designed to restrict stormwater flow from the external catchment areas from entering to this site. Therefore, only the portion of land occupied by proposed hotel development (CA-1-Post) is considered for the stormwater management design for this development proposal. 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	0.78	0.83	10
Uncontrolled	CA-2-Post	0.27	0.25	10
Excluded	CA-3-Post	0.21	0.83	10
TOTAL		**1.26**	**0.36**	**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 #	**Unmitigated Peak Flow** (m^3/s)	
	5-year	**100-year**
CA-1-Post	0.197	0.354
CA-2-Post	0.021	0.037
CA-3-Post	0.053	0.095

The post-development peak flow targets will be achieved using a combination of surface storage and detention storage in the storm sewer system and underground storage system (UG-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 tube installed at the outlet of MH#5, the storm sewer system will surcharge and the excess runoff volume will be stored within the storm sewer pipes and underground storage system (UG-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	UG-1	Total
238.20	5.940	20.866	0.000	57.905	**84.712**
238.95	13.286	21.906	0.000	78.850	**114.041**
239.20	14.807	21.906	262.738	78.850	**378.301**

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 peak flow resulting from the target pre-development condition during 5-year storm event.

The site grading is designed such that, no external areas from the adjoining catchments shall affect the stormwater flow from the site considered under this development proposal.

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	0.067	0.052	0.000	0.052	114.04	106.52	238.76
100-year	0.067	0.058	0.000	0.058	378.30	274.05	239.10

The post-development peak flow targets will be achieved by controlling discharge from the site area using 125mm dia orifice tube installed at the outlet of MH#5. Detailed calculations for orifice ratings and stage storage on the site have been illustrated in **Appendix "B".**

A total of 114.04 m^3 storage volume is provided below the lowest surface elevation of 238.95 through the CB/MH, Storm Sewer and UG Storage Chambers. A total of 106.52 m^3 storage volume is used during 5-year storm event, which is less than the available storage volume below lowest surface elevation. The storage used summary confirms that the surface ponding will not occur within any portion of the site area during minor storm events up to and including 5-year event.

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.

In the post-development condition, the site area occupied by an existing Robinson Creek tributary (CA-2-Post) is considered to drain uncontrolled similar to the existing condition without any alteration to the surface treatment and drainage pattern. Similarly, the portion of existing developed site area occupied by an existing gas station (CA-3-Post) is considered to have well established storm controls in accordance with the Town standards. Therefore, only 0.78 ha site area occupied by CA-1-Post having 89.33 % imperviousness that contributes to the proposed quality control unit are accounted in the quality control modelling.

Stormcon model SDD3 1200 oil grit separator unit is proposed at downstream of the orifice tube installed at the outlet of MH#5. The SDD3 unit will receive controlled release through the orifice and hence it will not operate in a surcharged condition.

Please refer to **Appendix "B"** for the design summary of Stormcon model SDD3 1200 oil grit separator unit provided by Next Stormwater Solutions. Proposed water quality unit will treat 95.03% of average annual rainfall volume and remove 81.20% of TSS prior to discharging from the site. This is concluded by considering the controlled portion of the site area that contributing to the proposed quality control unit.

An ongoing maintenance program, consisting of periodic inspection and cleaning of the SDD3 unit and on-site catch basins are recommended (minimum once per year).

4.4 Downstream Capacity

The site area occupied by this development is considered to contributing to the existing municipal sewer in the pre-development condition. Since, the post-development peak flows from this site are controlled in line with the peak flow resulting from the target pre-development condition during 5-year storm event,

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 portion of the site area considered under this development proposal is vacant currently and not services by the regional infrastructure of existing sanitary sewers. A 150mm dia sanitary service is provided at the property line to serve the future development on this lot.

6.1 Proposed Population Density

In the post-development condition, the maximum anticipated population accountable are 63 persons based on type of development in accordance with the Sanitary Sewer Design Criteria Manual provided by the Region of Peel. Detailed population density calculations have been illustrated in **Appendix "C".**

6.2 Proposed Sanitary Drainage System

In accordance with the Sanitary Sewer Design Criteria Manual provided by the Region of Peel, the proposed sanitary discharge from this site is estimated at 13.35 L/s. Detailed post-development sanitary flow calculations has been illustrated in **Appendix "C".**

6.3 Proposed Sanitary Service

This development application proposes to provide remove existing 150mm dia sanitary service and provide a new 200mm dia sanitary service from the existing regional infrastructure of 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway.

6.4 Downstream Capacity

The site area occupied by this development is accounted to contribute to the existing regional infrastructure of 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway.

7.0 WATER SUPPLY SYSTEM

The portion of the site area considered under this development proposal is vacant currently and not services by the regional infrastructure of existing sanitary sewers. The region of Peel has provided a 150 mm dia fire and domestic combined service with Detector Check Valve in chamber at property line to serve future development on the vacant portion of lot.

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 0.22 L/s with a peak hourly demand of 0.66 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 hotel development is estimated at 116.67 L/s for 4 hours, delivered with a residual pressure of not less then 140 kilopascals. Detailed calculations have been illustrated in **Appendix "C"**.

A flow and pressure test were conducted Cortese Design Inc. on the Region of Peel hydrants connected to an existing 300mm dia watermain located within the municipal allowance of George Bolton Parkway. The test report is included in **Appendix "D".** A flow of 68 L/s (1075 USgpm) was measured at the 3rd Hydrant at West side of HWY 50 on George Bolton Parkway using one 2.5" orifice, that resulted in a residual pressure of 497 kPa (72 psi) at the 2nd Hydrant at West side of HWY 50 on George Bolton Parkway. Based on actual pressure test on nearby municipal hydrants, a maximum flow of 252 L/s (1,550 USgpm) can be achieved while maintaining a water pressure of 20 psi (140 kPa), that is in compliance with the minimum requirements for fire suppression outlined in the FUS and the Region of Peel guidelines. Detailed calculations for the projected fire flow at 20 psi residual pressure is included in **Appendix "D"**.

7.2 Proposed Water Service

This development application proposes to make use of the existing 150mm dia fire and domestic combines service provided by the Region of Peel from the existing 300mm dia municipal watermain located within road allowance of George Bolton Parkway. 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 five-storey Hotel development located at 12476 Highway 50, Town of Caledon, Ontario.

8.1 STORM

1. Only the portion of land occupied by proposed hotel development (CA-1-Post) is considered for the stormwater management design for this development proposal.
2. The post-development peak flow targets will be achieved using a combination of surface storage and detention storage in the storm sewer system and underground storage system (UG-1).
3. The post-development peak flow targets will be achieved by controlling discharge from the site area using 125mm dia orifice tube installed at the outlet of MH#5.
4. Total 274.05 m^3 of storage is used out of 378.30 m^3 storage volume provided during 100-year storm event.
5. The storage used summary confirms that the surface ponding will not occur within any portion of the site area during minor storm events up to and including 5-year event.
6. The quality control for the site is provided by Stormcon model SDD3 1200 oil grit separator unit.
7. Proposed water quality control unit will treat 95.03% of average annual rainfall volume and remove 81.20% of TSS prior to discharging from the site.
8. An ongoing maintenance program consists of periodic inspection and cleaning of the Stormcon model SDD3 and Catch basins are recommended (minimum once per year).
9. 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 maximum anticipated population accountable are 63 persons based on type of development in accordance with the Sanitary Sewer Design Criteria Manual provided by the Region of Peel.
2. The proposed peak sanitary discharge from the site is calculates as 13.35 L/s.
3. This development application proposes to provide remove existing 150mm dia sanitary service and provide a new 200mm dia sanitary service from the existing regional infrastructure of 250 mm dia sanitary sewer located within the municipal road allowance of George Bolton Parkway.

8.3 WATER

1. The estimated water consumption of approximately 0.22 L/s with a peak hourly demand of 0.66 L/s will be required to service proposed development with domestic water.

2. The fire flow required for proposed development is estimated at 116.67 L/s for 4 hours, delivered with a residual pressure of not less then 140 kilopascals.
3. This development application proposes to make use of the existing 150mm dia fire and domestic combines service provided by the Region of Peel from the existing 300mm dia municipal watermain located within road allowance of George Bolton Parkway.
4. The proposed combined service will split at the property line into fire and domestic services.
5. A flow and pressure test conducted on the municipal hydrants confirms that a maximum flow of 252 L/s can be achieved while maintaining a water pressure of 20 psi (140 kPa).

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.

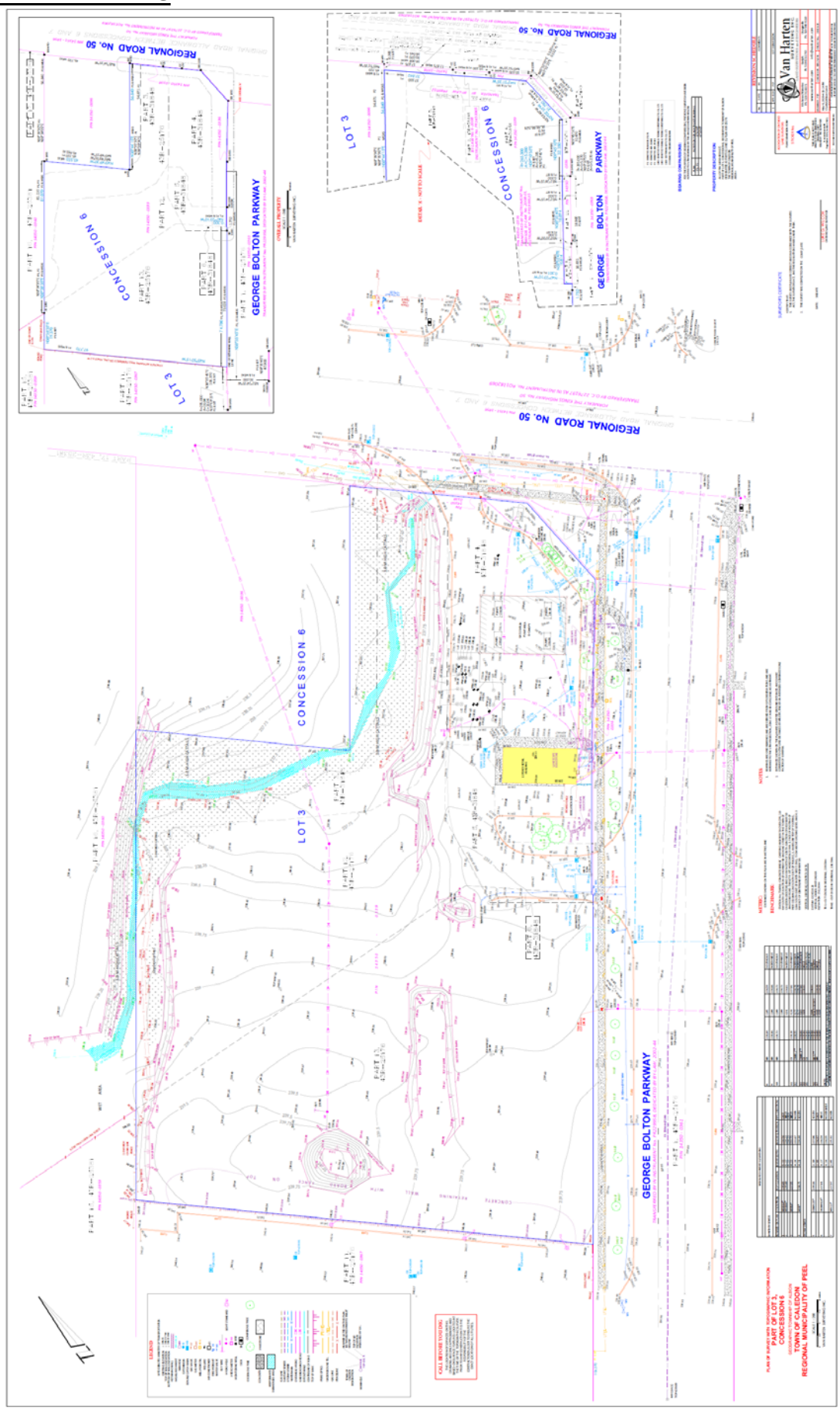
Chirag C. Patel, P.Eng, PMP
Senior Project Manager

Appendix "A" Plans

- Location Map
- Site Survey Drawing
- Architectural Site Plan
- Architectural Building Elevations

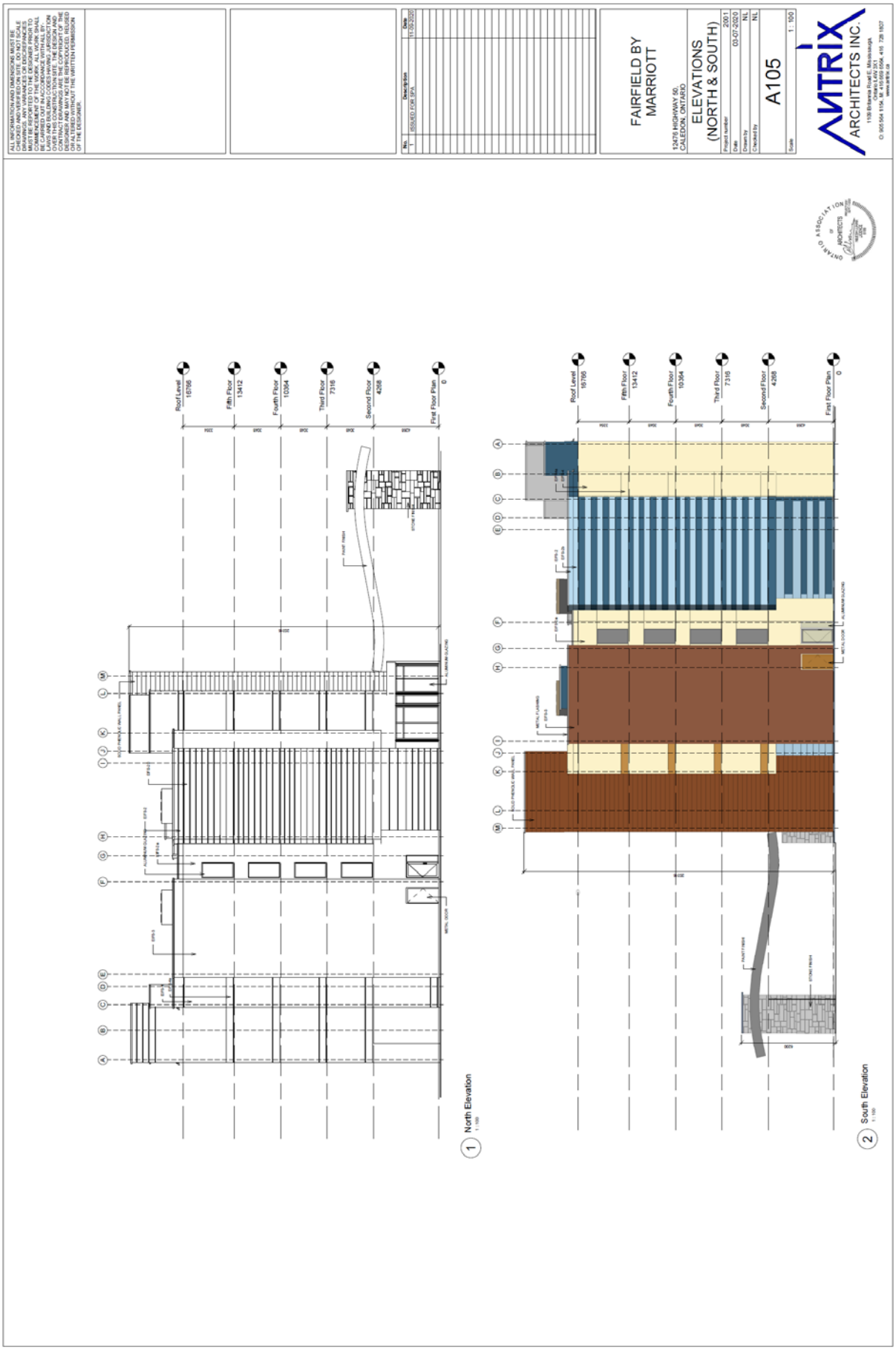
LOCATION MAP (NTS)

SITE SURVEY DRAWING (NTS)



ARCHITECTURAL SITE PLAN (NTS)

ARCHITECTURAL BUILDING ELEVATIONS (NTS)

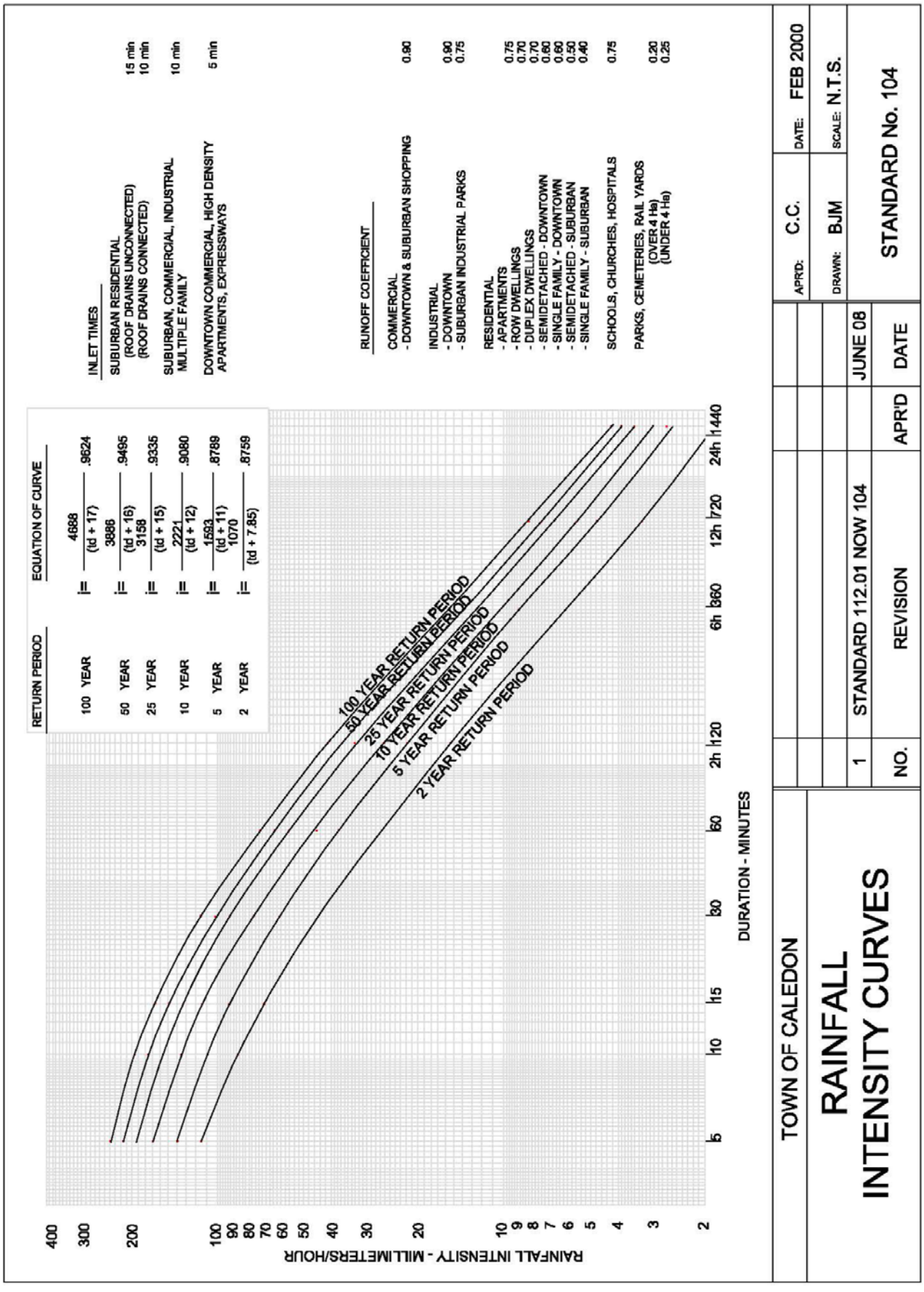

ALL INFORMATION AND DIMENSIONS MUST BE CHECKED AND VERIFIED ON SITE. DO NOT SCALE DRAWINGS. ALL DISCREPANCIES OR OMISSIONS MUST BE REPORTED TO THE DESIGNER PRIOR TO COMMENCEMENT OF THE WORK. ALL WORK SHALL BE EXECUTED IN ACCORDANCE WITH ALL APPLICABLE LAWS AND BUILDING CODES HAVING JURISDICTION IN THE LOCALITY OF THE PROJECT. THESE AND OTHER CONTRACT DRAWINGS ARE THE COPYRIGHT OF THE DESIGNER AND MAY NOT BE REPRODUCED, ISSUED OR ALTERED WITHOUT THE WRITTEN PERMISSION OF THE DESIGNER.
No. Description Date
1 ISSUED FOR SPA 11-05-2020
FAIRFIELD BY MARRIOTT
12475 HIGHWAY 50, CALEDON, ONTARIO
ELEVATIONS (NORTH & SOUTH)
Project number 2001
Date 03-07-2020
Drawn by N.L.
Checked by N.L.
Scale 1 : 100
A105
MTRIX ARCHITECTS INC.
Roof Level 16795
Fifth Floor 13412
Fourth Floor 10364
Third Floor 7316
Second Floor 4268
First Floor Plan 0
1 North Elevation
2 South Elevation

Appendix "B" Stormwater Management

- IDF Curve – Town of Caledon
- Runoff Coefficient Calculations
- Existing Storm Drainage Plan
- Pre-Development Peak Flow Calculations
- Proposed Storm Drainage Plan
- Proposed Sub-Catchment Area Plan
- Post-Development Peak Flow Calculations
- ADS Sanitite Underground Storage Calculations (UG-1)
- Stage Storage Calculations
- Post-Development Site Flow and Storage Used Summary – 5-Year Storm
- Post-Development Site Flow and Storage Used Summary – 100-Year Storm
- Orifice Rating Calculations
- Storm Sewer Design Sheet
- Stormcon SDD3 1200 – Sizing Report
- Stormcon SDD3 1200 – Typical Drawing

IDF CURVE - TOWN OF CALEDON

(Standard No. 104)



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

Drainage System	Catchment #	Area (m^2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	**CA-1-Pre**	335.70	7831.57	0.03	0.78	4.29	0.28
Uncontrolled	**CA-2-Pre**	0.00	2686.14	0.00	0.27	0.00	0.25
Excluded	**CA-3-Pre**	1873.58	2084.48	0.19	0.21	89.88	0.83
Total Site		**2209.28**	**12602.19**	**0.22**	**1.26**	**17.53**	**0.36**

Post-Development Drainage Area

Drainage System	Catchment #	Area (m^2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	**CA-1-Post**	6996.08	7831.57	0.70	0.78	89.33	0.83
Uncontrolled	**CA-2-Post**	0.00	2686.14	0.00	0.27	0.00	0.25
Excluded	**CA-3-Post**	1873.58	2084.48	0.19	0.21	89.88	0.83
Total Site		**8869.66**	**12602.19**	**0.89**	**1.26**	**70.38**	**0.71**

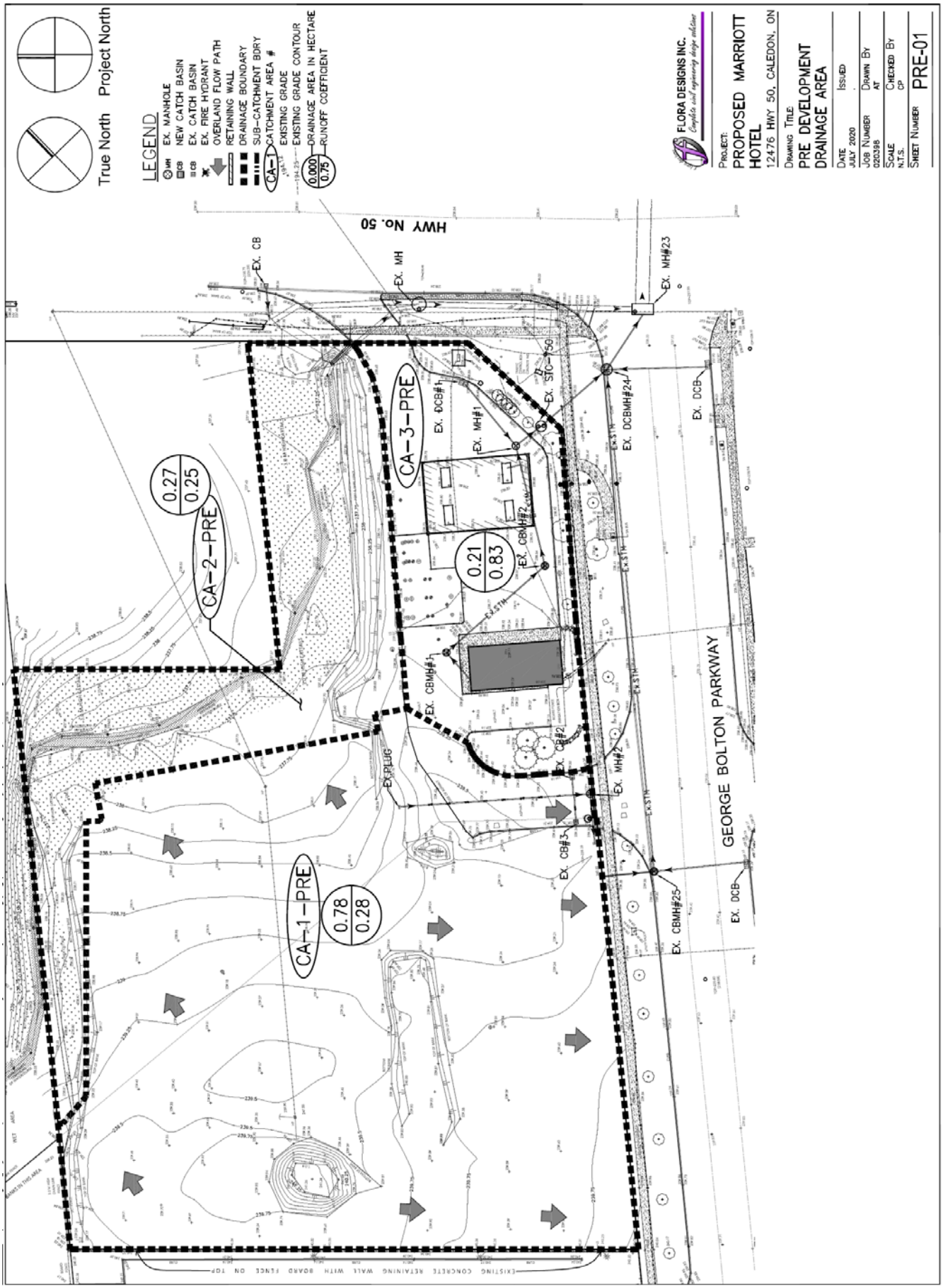
Runoff Coefficient (C)

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**	713.87	859.43	0.07	0.09	83.06	0.79
	CB-2	805.73	824.44	0.08	0.08	97.73	0.89
	CBMH-1	477.88	484.05	0.05	0.05	98.73	0.89
	CB-3	620.40	682.47	0.06	0.07	90.91	0.84
	ROOF	1269.83	1269.83	0.13	0.13	100.00	0.90
	CB-4	1137.70	1194.62	0.11	0.12	95.24	0.87
	CB-5	871.53	979.04	0.09	0.10	89.02	0.83
	CB-6	362.24	570.72	0.04	0.06	63.47	0.66
	CB-7	592.09	780.21	0.06	0.08	75.89	0.74
	CBMH-4/Ex.CB-3	144.81	186.76	0.01	0.02	77.54	0.75
Sub Total - Controlled		**6996.08**	**7831.57**	**0.70**	**0.78**	**89.33**	**0.83**

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	0.78	0.28	10
CA-2-Pre	0.27	0.25	10
CA-3-Pre	0.21	0.83	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

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

IDF Data Set, Town of Caledon

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

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	0.78	109.68	0.28	66.59	0.067
CA-2-Pre	0.27	109.68	0.25	20.58	0.021
CA-3-Pre	0.21	109.68	0.83	53.14	0.053

Event 100 yr

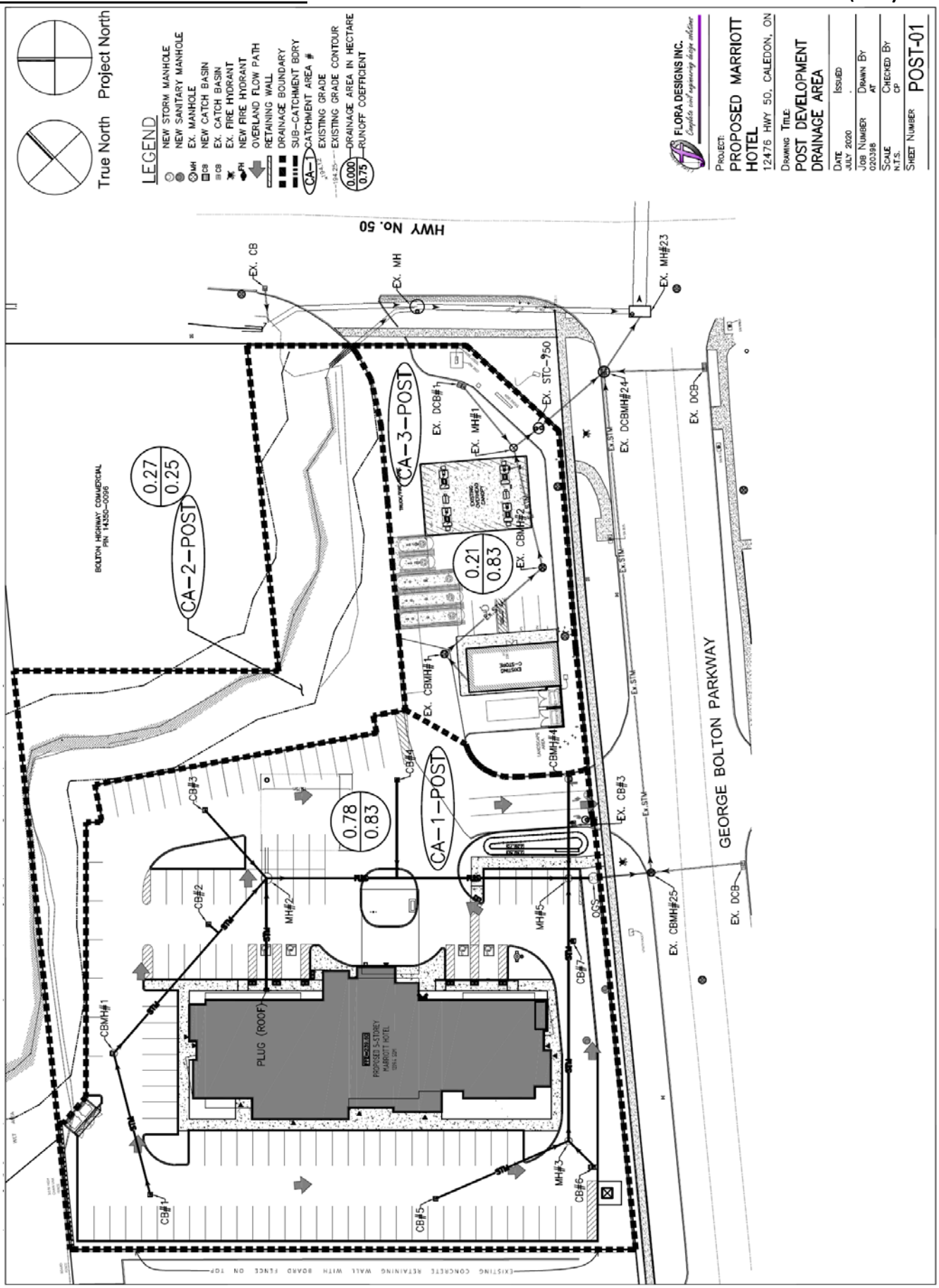
*(I) = a * (Tc + b)^c*

IDF Data Set, Town of Caledon

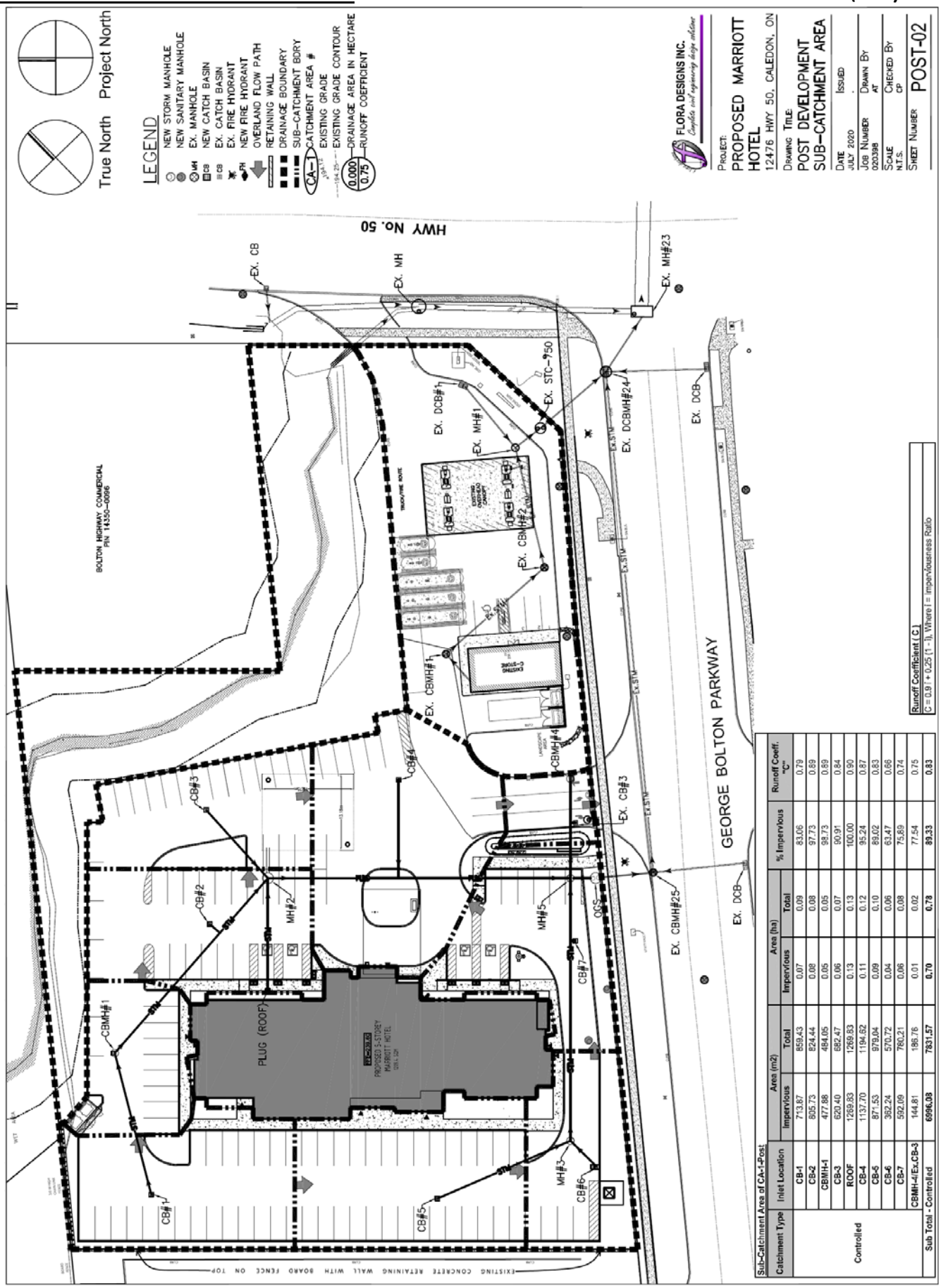
Coefficient, a =	4688.00
Coefficient, b =	17.00
Exponent, c =	-0.962

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Pre	0.78	196.54	0.28	119.33	0.119
CA-2-Pre	0.27	196.54	0.25	36.88	0.037
CA-3-Pre	0.21	196.54	0.83	95.23	0.095

PROPOSED STORM DRAINAGE PLAN (NTS)



PROPOSED SUB-CATCHMENT AREA PLAN (NTS)



Sub-Catchment Area of CA-1-Post								
Catchment Type	Inlet Location	Area (m2)		Area (ha)		% Impervious	Runoff Coeff. "C"
		Impervious	Total	Impervious	Total		
Controlled	CB-1	713.87	859.43	0.07	0.09	83.06	0.79
	CB-2	805.73	824.44	0.08	0.08	97.73	0.89
	CBMH-1	477.88	484.05	0.05	0.05	98.73	0.89
	CB-3	620.40	682.47	0.06	0.07	90.91	0.84
	ROOF	1269.83	1269.83	0.13	0.13	100.00	0.90
	CB-4	1137.70	1194.62	0.11	0.12	95.24	0.87
	CB-5	871.53	979.04	0.09	0.10	89.02	0.83
	CB-6	362.24	570.72	0.04	0.06	63.47	0.66
	CB-7	592.09	780.21	0.06	0.08	75.89	0.74
	CBMH-4/Ex.CB-3	144.81	186.76	0.01	0.02	77.54	0.75
	Sub Total - Controlled	6996.08	7831.57	0.70	0.78	89.33	0.83

Runoff Coefficient (C)
C = 0.9 * + 0.25 (1 - I), Where I = imperviousness Ratio

POST-DEVELOPMENT PEAK FLOW CALCULATIONS

Catchment #	Drainage Area	Runoff Coefficient	Time of Concentration
	"A" in Hector	"C"	"Tc" in Minute
CA-1-Post	0.78	0.83	10
CA-2-Post	0.27	0.25	10
CA-3-Post	0.21	0.83	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

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

IDF Data Set, Town of Caledon

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

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	0.78	109.68	0.83	197.39	0.197
CA-2-Post	0.27	109.68	0.25	20.58	0.021
CA-3-Post	0.21	109.68	0.83	53.14	0.053

Event 100 yr

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

IDF Data Set, Town of Caledon

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

Catchment #	A (ha)	I (mm/h)	C	Q (L/s)	Q (m^3/s)
CA-1-Post	0.78	196.54	0.83	353.72	0.354
CA-2-Post	0.27	196.54	0.25	36.88	0.037
CA-3-Post	0.21	196.54	0.83	95.23	0.095

ADS SANITITE UNDERGROUND STORAGE CALCULATION (UG-1)

Diameter of Pipe	**900**	mm	**900**	mm
Normal O.D.	1067	mm	1067	mm
Typical Length of Each Pipe	**6000**	mm	**3000**	mm
Cross Section Area of Pipe	0.636	m^2	0.636	m^2
Volume in each Pipe	3.815	m^3	1.908	m^3
Typical Length Header-L	1150	mm	1150	mm
Volume in Header-L	0.731	m^3	0.731	m^3
Typical Length Header-T	1950	mm	1950	mm
Volume in Header-T	1.240	m^3	1.240	m^3
Typical Length Header-CAP	1250	mm	1250	mm
Volume in Header-CAP	0.795	m^3	0.795	m^3
Number of Lengths	**2**		**0**	
Number of Rows	**8**		**0**	
Number of header-L Required	**4**			
Number of header-T Required	**12**			
Number of header-CAP Required	**0**			
Total Volume Provided	**78.85**	**m^3**		
	System Dimension			
Total Length of Pipes	14.834	m		
Total Width of Pipes	12.267	m		
Clear Spacing between Pipes	0.533	m		
Total Length of Stone Later	**15.75**	**m**		
Total Width of Stone Later	**13.18**	**m**		
Pipe Outer Top	238.65	m		
Pipe Obvert	238.48	m		
Pipe Invert	**237.58**	m		

STAGE STORAGE CALCULATIONS

Orifice Invert = 237.25
Stage = 238.20
Storage Depth = 0.95 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	238.95	238.12	238.20	0.08	CB	N/A	0.36	0.029
CB-2	239.05	237.82	238.20	0.38	CB	N/A	0.36	0.137
CB-3	238.95	237.84	238.20	0.36	CB	N/A	0.36	0.130
CB-4	238.95	237.64	238.20	0.56	CB	N/A	0.36	0.202
CB-5	238.95	237.74	238.20	0.46	CB	N/A	0.36	0.166
CB-6	238.95	237.64	238.20	0.56	CB	N/A	0.36	0.202
CB-7	239.00	237.55	238.20	0.65	CB	N/A	0.36	0.234
CBMH-1	239.05	237.91	238.20	0.29	1200	1.22	1.17	0.339
MH-2	239.22	237.56	238.20	0.64	1800	1.82	2.60	1.664
MH-3	239.12	237.53	238.20	0.67	1200	1.22	1.17	0.783
CBMH-4	239.14	237.39	238.20	0.81	1200	1.22	1.17	0.946
MH-5	239.19	237.25	238.20	0.95	1200	1.22	1.17	1.110
Total CB & MH Storage Volume								**5.940**

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)	
0.250	25.24	CB-1	238.12	0.08	0.01	CBMH-1	237.99	0.21	0.04	0.631
0.250	2.32	CB-2	237.82	0.25	0.05	Lead	237.80	0.25	0.05	0.116
0.300	40.16	CBMH-1	237.91	0.29	0.07	MH-2	237.71	0.30	0.07	2.811
0.250	19.44	Roof	238.15	0.05	0.01	MH-2	237.76	0.25	0.05	0.583
0.250	15.85	CB-3	237.84	0.25	0.05	MH-2	237.76	0.25	0.05	0.793
0.450	4.40	UG-1	237.58	0.45	0.16	MH-2	237.56	0.45	0.16	0.704
0.250	17.00	CB-4	237.64	0.25	0.05	Lead	237.55	0.25	0.05	0.850
0.450	52.18	MH-2	237.56	0.45	0.16	MH-5	237.30	0.45	0.16	8.349
0.250	25.00	CB-5	237.74	0.25	0.05	MH-3	237.61	0.25	0.05	1.250
0.250	6.40	CB-6	237.64	0.25	0.05	MH-3	237.61	0.25	0.05	0.320
0.250	1.00	CB-7	237.55	0.25	0.05	Lead	237.35	0.25	0.05	0.050
0.300	45.41	MH-3	237.53	0.30	0.07	MH-5	237.30	0.30	0.07	3.179
0.250	1.00	Ex.CB-3	238.13	0.07	0.01	Lead	237.35	0.25	0.05	0.030
0.300	17.15	CBMH-4	237.39	0.30	0.07	MH-5	237.30	0.30	0.07	1.201
Total Pipe Storage Volume										**20.866**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-1	238.95	239.20	571.42	238.20	0.00	0.000
CB-2	239.05	239.20	339.06	238.20	0.00	0.000
CB-3	238.95	239.20	473.66	238.20	0.00	0.000
CB-4	238.95	239.20	627.80	238.20	0.00	0.000
CB-5	238.95	239.20	630.64	238.20	0.00	0.000
CB-6	238.95	239.20	248.83	238.20	0.00	0.000
CB-7	239.00	239.20	291.94	238.20	0.00	0.000
CBMH-1	239.05	239.20	226.84	238.20	0.00	0.000
CBMH-4	239.14	239.20	114.22	238.20	0.00	0.000
Total Surface Storage Volume						**0.000**

ADS Sanitite UG Storage:

ID	Top Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Depth (m)	Storage Volume (m^3)
UG-1	238.48	237.58	238.20	0.62	57.905
Total Tank Storage Volume					**57.905**

TOTAL STAGE STORAGE AT ELEVATION	238.20	=	84.712	m^3

Orifice Invert = 237.25
Stage = 238.95
Storage Depth = 1.70 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	238.95	238.12	238.95	0.83	CB	N/A	0.36	0.299
CB-2	239.05	237.82	238.95	1.13	CB	N/A	0.36	0.407
CB-3	238.95	237.84	238.95	1.11	CB	N/A	0.36	0.400
CB-4	238.95	237.64	238.95	1.31	CB	N/A	0.36	0.472
CB-5	238.95	237.74	238.95	1.21	CB	N/A	0.36	0.436
CB-6	238.95	237.64	238.95	1.31	CB	N/A	0.36	0.472
CB-7	239.00	237.55	238.95	1.40	CB	N/A	0.36	0.504
CBMH-1	239.05	237.91	238.95	1.04	1200	1.22	1.17	1.215
MH-2	239.22	237.56	238.95	1.39	1800	1.82	2.60	3.614
MH-3	239.12	237.53	238.95	1.42	1200	1.22	1.17	1.659
CBMH-4	239.14	237.39	238.95	1.56	1200	1.22	1.17	1.823
MH-5	239.19	237.25	238.95	1.70	1200	1.22	1.17	1.986
Total CB & MH Storage Volume								**13.286**

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)	
0.250	25.24	CB-1	238.12	0.25	0.05	CBMH-1	237.99	0.25	0.05	1.262
0.250	2.32	CB-2	237.82	0.25	0.05	Lead	237.80	0.25	0.05	0.116
0.300	40.16	CBMH-1	237.91	0.30	0.07	MH-2	237.71	0.30	0.07	2.811
0.250	19.44	Roof	238.15	0.25	0.05	MH-2	237.76	0.25	0.05	0.972
0.250	15.85	CB-3	237.84	0.25	0.05	MH-2	237.76	0.25	0.05	0.793
0.450	4.40	UG-1	237.58	0.45	0.16	MH-2	237.56	0.45	0.16	0.704
0.250	17.00	CB-4	237.64	0.25	0.05	Lead	237.55	0.25	0.05	0.850
0.450	52.18	MH-2	237.56	0.45	0.16	MH-5	237.30	0.45	0.16	8.349
0.250	25.00	CB-5	237.74	0.25	0.05	MH-3	237.61	0.25	0.05	1.250
0.250	6.40	CB-6	237.64	0.25	0.05	MH-3	237.61	0.25	0.05	0.320
0.250	1.00	CB-7	237.55	0.25	0.05	Lead	237.35	0.25	0.05	0.050
0.300	45.41	MH-3	237.53	0.30	0.07	MH-5	237.30	0.30	0.07	3.179
0.250	1.00	Ex.CB-3	238.13	0.25	0.05	Lead	237.35	0.25	0.05	0.050
0.300	17.15	CBMH-4	237.39	0.30	0.07	MH-5	237.30	0.30	0.07	1.201
Total Pipe Storage Volume										**21.906**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-1	238.95	239.20	571.42	238.95	0.00	0.000
CB-2	239.05	239.20	339.06	238.95	0.00	0.000
CB-3	238.95	239.20	473.66	238.95	0.00	0.000
CB-4	238.95	239.20	627.80	238.95	0.00	0.000
CB-5	238.95	239.20	630.64	238.95	0.00	0.000
CB-6	238.95	239.20	248.83	238.95	0.00	0.000
CB-7	239.00	239.20	291.94	238.95	0.00	0.000
CBMH-1	239.05	239.20	226.84	238.95	0.00	0.000
CBMH-4	239.14	239.20	114.22	238.95	0.00	0.000
Total Surface Storage Volume						**0.000**

ADS Sanitite UG Storage:

ID	Top Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Depth (m)	Storage Volume (m^3)
UG-1	238.48	237.58	238.95	0.90	78.850
Total Tank Storage Volume					**78.850**

TOTAL STAGE STORAGE AT ELEVATION	238.95	=	114.041	m^3

Orifice Invert = 237.25
Stage = 239.20
Storage Depth = 1.95 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	238.95	238.12	238.95	0.83	CB	N/A	0.36	0.299
CB-2	239.05	237.82	239.05	1.23	CB	N/A	0.36	0.443
CB-3	238.95	237.84	238.95	1.11	CB	N/A	0.36	0.400
CB-4	238.95	237.64	238.95	1.31	CB	N/A	0.36	0.472
CB-5	238.95	237.74	238.95	1.21	CB	N/A	0.36	0.436
CB-6	238.95	237.64	238.95	1.31	CB	N/A	0.36	0.472
CB-7	239.00	237.55	239.00	1.45	CB	N/A	0.36	0.522
CBMH-1	239.05	237.91	239.05	1.14	1200	1.22	1.17	1.332
MH-2	239.22	237.56	239.20	1.64	1800	1.82	2.60	4.264
MH-3	239.12	237.53	239.12	1.59	1200	1.22	1.17	1.858
CBMH-4	239.14	237.39	239.14	1.75	1200	1.22	1.17	2.045
MH-5	239.19	237.25	239.19	1.94	1200	1.22	1.17	2.267
Total CB & MH Storage Volume								**14.807**

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)	
0.250	25.24	CB-1	238.12	0.25	0.05	CBMH-1	237.99	0.25	0.05	1.262
0.250	2.32	CB-2	237.82	0.25	0.05	Lead	237.80	0.25	0.05	0.116
0.300	40.16	CBMH-1	237.91	0.30	0.07	MH-2	237.71	0.30	0.07	2.811
0.250	19.44	Roof	238.15	0.25	0.05	MH-2	237.76	0.25	0.05	0.972
0.250	15.85	CB-3	237.84	0.25	0.05	MH-2	237.76	0.25	0.05	0.793
0.450	4.40	UG-1	237.58	0.45	0.16	MH-2	237.56	0.45	0.16	0.704
0.250	17.00	CB-4	237.64	0.25	0.05	Lead	237.55	0.25	0.05	0.850
0.450	52.18	MH-2	237.56	0.45	0.16	MH-5	237.30	0.45	0.16	8.349
0.250	25.00	CB-5	237.74	0.25	0.05	MH-3	237.61	0.25	0.05	1.250
0.250	6.40	CB-6	237.64	0.25	0.05	MH-3	237.61	0.25	0.05	0.320
0.250	1.00	CB-7	237.55	0.25	0.05	Lead	237.35	0.25	0.05	0.050
0.300	45.41	MH-3	237.53	0.30	0.07	MH-5	237.30	0.30	0.07	3.179
0.250	1.00	Ex.CB-3	238.13	0.25	0.05	Lead	237.35	0.25	0.05	0.050
0.300	17.15	CBMH-4	237.39	0.30	0.07	MH-5	237.30	0.30	0.07	1.201
Total Pipe Storage Volume										**21.906**

Surface Storage:

ID	RIM Elevation (m)	HWL (m)	Surface Area @ HWL (m^2)	Stage Elevation (m)	Ponding Depth (m)	Storage Volume (m^3)
CB-1	238.95	239.20	571.42	239.20	0.25	47.618
CB-2	239.05	239.20	339.06	239.20	0.15	16.953
CB-3	238.95	239.20	473.66	239.20	0.25	39.472
CB-4	238.95	239.20	627.80	239.20	0.25	52.317
CB-5	238.95	239.20	630.64	239.20	0.25	52.553
CB-6	238.95	239.20	248.83	239.20	0.25	20.736
CB-7	239.00	239.20	291.94	239.20	0.20	19.463
CBMH-1	239.05	239.20	226.84	239.20	0.15	11.342
CBMH-4	239.14	239.20	114.22	239.20	0.06	2.284
Total Surface Storage Volume						**262.738**

ADS Sanitite UG Storage:

ID	Top Elevation (m)	INV Elevation (m)	Stage Elevation (m)	Depth (m)	Storage Volume (m^3)
UG-1	238.48	237.58	239.20	0.90	78.850
Total Tank Storage Volume					**78.850**

TOTAL STAGE STORAGE AT ELEVATION	239.20	=	378.30	m^3

Stage Storage Summary - CA-1-Post

Stage Elevation	Stage Storage Volume (m^3)				
	CB-MH	Sewer Pipe	Surface	UG Storage	Total
238.20	5.940	20.866	0.000	57.905	**84.712**
238.95	13.286	21.906	0.000	78.850	**114.041**
239.20	14.807	21.906	262.738	78.850	**378.301**

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

Actual Release Rate (RR)				0.052	m^3/s
Actual Release Volume per 5-min. Interval				15.54	m^3
5-year Design Storm				**Catchment #**	**CA-1-Post**
a =	1593.00			Area (ha) =	0.78
b =	11.00			C =	0.83
c =	-0.879			Tc (min.)=	10
i =	a * (Tc + b)^c				
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	109.68	0.197	118.34	31.08	87.26
15	90.91	0.163	147.13	46.62	100.51
20	77.89	0.140	168.08	62.16	105.92
25	68.29	0.123	184.22	77.70	**106.52**
30	60.92	0.110	197.19	93.24	103.95
35	55.06	0.099	207.93	108.78	99.15
40	50.28	0.090	217.03	124.32	92.71
45	46.32	0.083	224.89	139.86	85.03
50	42.96	0.077	231.78	155.40	76.38
55	40.09	0.072	237.90	170.94	66.96
60	37.60	0.068	243.40	186.48	56.92
65	35.41	0.064	248.37	202.02	46.35
70	33.48	0.060	252.91	217.56	35.35
75	31.77	0.057	257.08	233.10	23.98
80	30.23	0.054	260.93	248.64	12.29
85	28.84	0.052	264.51	264.18	0.33
90	27.58	0.050	267.84	279.72	0.00
95	26.43	0.048	270.97	295.26	0.00
100	25.39	0.046	273.91	310.80	0.00
105	24.42	0.044	276.68	326.34	0.00
110	23.53	0.042	279.30	341.88	0.00
115	22.71	0.041	281.79	357.42	0.00
120	21.95	0.039	284.15	372.96	0.00
125	21.23	0.038	286.40	388.50	0.00
130	20.57	0.037	288.56	404.04	0.00
135	19.95	0.036	290.62	419.58	0.00
140	19.37	0.035	292.59	435.12	0.00
145	18.82	0.034	294.49	450.66	0.00
150	18.31	0.033	296.31	466.20	0.00
155	17.82	0.032	298.07	481.74	0.00
160	17.36	0.031	299.76	497.28	0.00
165	16.93	0.030	301.40	512.82	0.00
170	16.52	0.030	302.98	528.36	0.00
175	16.13	0.029	304.51	543.90	0.00
180	15.75	0.028	305.99	559.44	0.00

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

Actual Release Rate (RR)				0.058	m^3/s
Actual Release Volume per 5-min. Interval				17.40	m^3
100-year Design Storm				**Catchment #**	**CA-1-Post**
a =	4688.00			Area (ha) =	0.78
b =	17.00			C =	0.83
c =	-0.962			Tc (min.)=	10
i =	a * (Tc + b)^c				
1	2	3	4	5	6
Time (min.)	**Rainfall Intensity (mm/hr)**	**Storm Runoff (m^3/s)**	**Storm Runoff Volume (m^3)**	**Released Volume (m^3)**	**Storage Volume (m^3)**
	(2)=a*((1))^b	(3)=[(2)*A*C]/360	(4)=(3)*(1)*60	(5)=(RR)*(1)*60	(6)=(4)-(5)
10	196.54	0.353	212.06	34.80	177.26
15	166.89	0.300	270.11	52.20	217.91
20	145.13	0.261	313.19	69.60	243.59
25	128.46	0.231	346.52	87.00	259.52
30	115.28	0.207	373.17	104.40	268.77
35	104.59	0.188	395.00	121.80	273.20
40	95.75	0.172	413.25	139.20	**274.05**
45	88.31	0.159	428.77	156.60	272.17
50	81.95	0.147	442.14	174.00	268.14
55	76.47	0.138	453.81	191.40	262.41
60	71.69	0.129	464.09	208.80	255.29
65	67.47	0.121	473.23	226.20	247.03
70	63.74	0.115	481.41	243.60	237.81
75	60.40	0.109	488.79	261.00	227.79
80	57.40	0.103	495.48	278.40	217.08
85	54.69	0.098	501.59	295.80	205.79
90	52.23	0.094	507.19	313.20	193.99
95	49.98	0.090	512.35	330.60	181.75
100	47.93	0.086	517.11	348.00	169.11
105	46.03	0.083	521.54	365.40	156.14
110	44.29	0.080	525.66	382.80	142.86
115	42.67	0.077	529.50	400.20	129.30
120	41.17	0.074	533.10	417.60	115.50
125	39.78	0.072	536.48	435.00	101.48
130	38.47	0.069	539.67	452.40	87.27
135	37.25	0.067	542.67	469.80	72.87
140	36.11	0.065	545.51	487.20	58.31
145	35.04	0.063	548.20	504.60	43.60
150	34.03	0.061	550.75	522.00	28.75
155	33.08	0.059	553.18	539.40	13.78
160	32.18	0.058	555.49	556.80	0.00
165	31.33	0.056	557.70	574.20	0.00
170	30.52	0.055	559.81	591.60	0.00
175	29.75	0.054	561.82	609.00	0.00
180	29.03	0.052	563.75	626.40	0.00

ORIFICE-WEIR RATING CALCULATIONS

Orifice-1 (At Outlet of MH-5)

Orifice TUBE Diameter, D_O =	125	mm
Orifice Invert =	237.25	m
Orifice Coefficient, C =	0.80	
Orifice sectional area, A_O =	0.01227	m^2
Elev at Centre of Orifice =	237.31	m
Acceleration due to gravity, g =	9.81	m/s^2

Stage Elevation (m)	Head (m)	Storage Provided (m^3)	Orifice Flow (m^3/s)
237.25	0.00	0.00	0.0000
238.20	0.89	84.71	0.0409
238.95	1.64	114.04	0.0556
239.20	1.89	378.30	0.0597

STORM SEWER DESIGN SHEET

STORM SEWER DESIGN SHEET

MUNICIPALITY: Town of Caledon
PROJECT NAME: Proposed Marriott Hotel
DESIGNER: Flora Designs Inc.
PROJECT No: 20398

RAINFALL PARAMETERS:
Event: 5 Year Rainfall
IDF Data: Town of Caledon
A = 1593.00
B = 11.00
C = -0.8789

Pipe Capacity Q : $1/n \cdot A \cdot R^{2/3} \cdot S^{1/2}$
Pipe Velocity V : Q / A
Time of Flow: $(L/V_{act})/60$

Pipe Roughness ("n" Value): 0.013 Plastic; 0.013 Concrete; 0.024 CSP

LOCATION			STORMWATER ANALYSIS									STORM SEWER DESIGN										
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 Flow 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	CBMH-1	0.09	0.79	0.07	0.07	10.0	109.68	21.68	0.87	25.24	250	0.50%	PVC	0.013	41.99	0.86	51.63%	0.5	10.5		
	CB-2	Lead	0.08	0.89	0.07	0.07	10.0	109.68	21.71	1.12	2.32	250	1.00%	PVC	0.013	59.38	1.21	36.56%	0.0	10.0		
	CBMH-1	MH-2	0.05	0.89	0.04	0.19	10.5	107.43	55.79	1.07	40.16	300	0.50%	PVC	0.013	68.28	0.97	81.70%	0.6	11.1		
	CB-3	MH-2	0.07	0.84	0.06	0.06	10.0	109.68	17.93	0.82	15.85	250	0.50%	PVC	0.013	41.99	0.86	42.70%	0.3	10.3		
	ROOF	MH-2	0.13	0.90	0.12	0.12	10.0	109.68	35.67	1.63	19.44	250	2.00%	PVC	0.013	83.98	1.71	42.48%	0.2	10.2		
	CB-4	Lead	0.12	0.87	0.10	0.10	10.0	109.68	31.83	0.93	17.00	250	0.50%	PVC	0.013	41.99	0.86	75.81%	0.3	10.3		
	MH-2	MH-5				0.47	11.1	104.86	136.14	1.35	52.18	450	0.50%	CONC	0.013	201.35	1.27	67.61%	0.6	11.7		
	CB-5	MH-3	0.10	0.83	0.08	0.08	10.0	109.68	25.31	0.89	25.00	250	0.50%	PVC	0.013	41.99	0.86	60.27%	0.5	10.5		
	CB-6	MH-3	0.06	0.66	0.04	0.04	10.0	109.68	12.07	0.73	6.40	250	0.50%	PVC	0.013	41.99	0.86	28.76%	0.1	10.1		
	CB-7	Lead	0.08	0.74	0.06	0.06	10.0	109.68	18.05	1.05	1.00	250	1.00%	PVC	0.013	59.38	1.21	30.40%	0.0	10.0		
	MH-3	MH-5				0.18	10.5	107.43	54.30	1.06	45.41	300	0.50%	PVC	0.013	68.28	0.97	79.52%	0.7	11.2		
	CBMH-4/Ex.CB-3	MH-5	0.02	0.75	0.02	0.02	10.0	109.68	4.57	0.72	17.18	300	1.00%	PVC	0.013	96.57	1.37	4.74%	0.4	10.4		
	CDS	Ex.CBMH-25	100-Year Max Flow from Orifice-1						58.00	1.36	9.00	375	0.89%	CONC	0.013	165.19	1.50	35.11%	0.1	0.1		

FLORA DESIGNS INC.
Complete civil engineering design solutions

STORMCON SDD3 1200 – SIZING REPORT

STORMCON

StormCon SDD3 SIZING REPORT

PROJECT INFORMATION

Project Name :	Marriott Hotel, 12476 Highway 50, George Bolton Parkway
Location	Caledon, ON
Unit :	OGS1

SITE INFORMATION AND SIZING CRITERIA

Site Area (hectares)	0.78
Cumulative runoff	0.93
Target TSS removal (%)	80%
Imperviousness %	89%
Rainfall station :	Toronto, ONT
Particle Size Distribution	50-1000 µm
Peak Flow (L/s)	59.70

STORMWATER TREATEMENT RECOMMENDATION

RESULTS SUMMARY		
Model	TSS	Volume
SDD3-1200	81.2%	98.4%
SDD3-1500	83.5%	99.4%
SDD3-1800	85.9%	99.7%
SDD3-2100	87.2%	99.8%
SDD3-2400	88.1%	100.0%
SDD3-3000	89.2%	100.0%
SDD3-3200	89.5%	100.0%
SDD3-3600	90.1%	100.0%
SDD3-4000	90.5%	100.0%

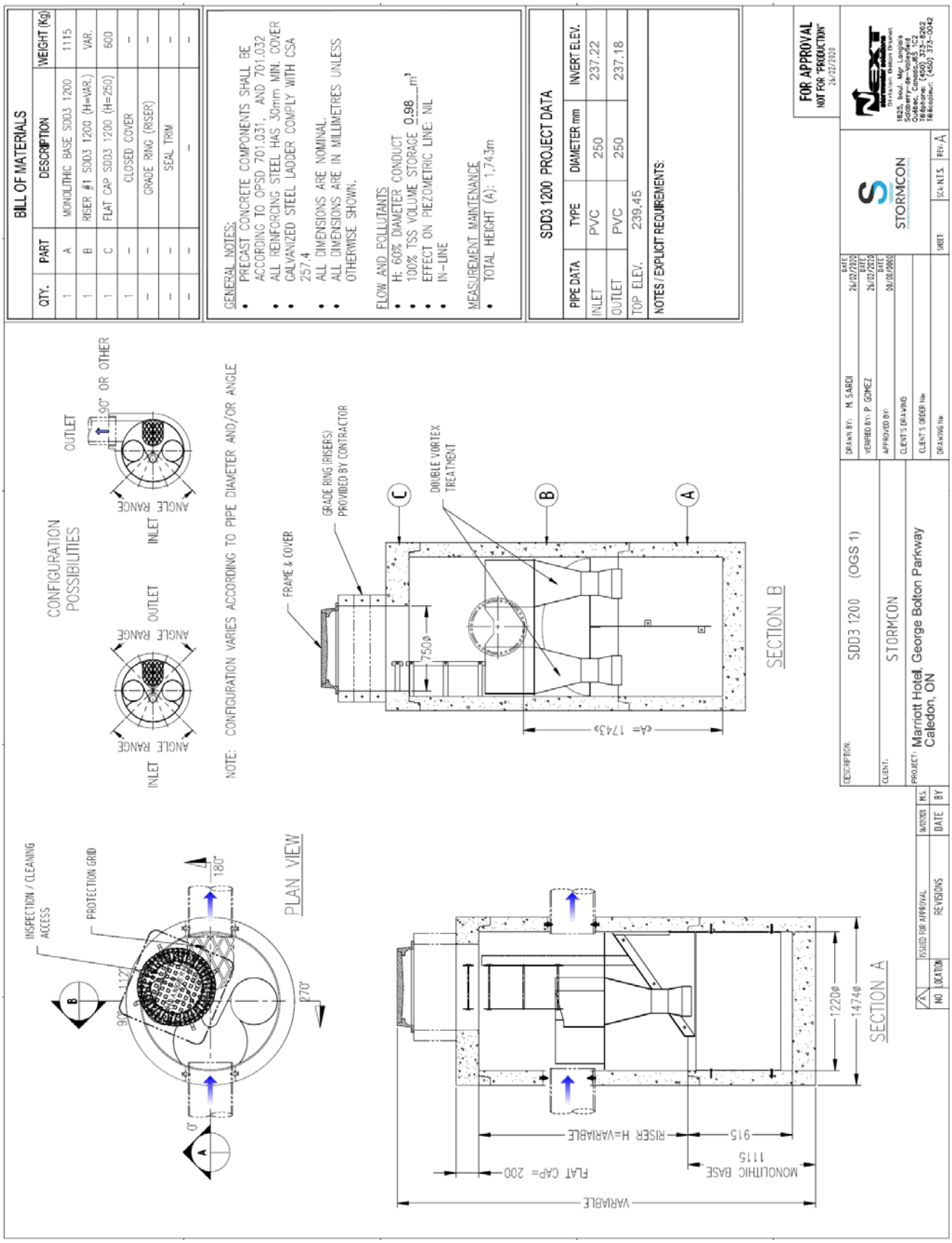
Recommended Model	SDD3-1200

Annual TSS removal efficiency (%)[1]	Manhole Diameter (mm)	No Bypass Flow (lps)	Maximum Flow (lps)	Maximum Pipe Diameter (mm)	Oil Storage Capacity (L)	Sediment Storage Capacity (m^3)	Height from invert to SDD floor (m)	Treatment area (m^2)
81.2%	1220	27	51	475	0.28	0.98	1.74	1.17

DETAILED SDD3 SIZING REPORT

Rainfall Interval Point (mm/hr)[2]	Flow Rate (Lps)	Loading Rate (Lps/m^2)	Loading Rate (Lpm/m^2)	Total Rainfall (%)	Removal Efficiency (%)	Cumulative rainfall volume (%)	Relative Efficiency (%)
0.5	1.0	0.9	51.7	0.19%	91.38	0.19%	0.18%
1.0	2.0	1.7	103.4	13.38%	90.02	13.57%	12.04%
1.5	3.0	2.6	155.1	16.44%	88.22	30.01%	14.50%
2.0	4.0	3.4	206.8	13.68%	86.31	43.69%	11.81%
2.5	5.0	4.3	258.6	3.36%	83.74	47.05%	2.82%
3.0	6.0	5.2	310.3	1.37%	81.17	48.43%	1.12%
3.5	7.1	6.0	362.0	8.99%	78.59	57.41%	7.06%
4.0	8.1	6.9	413.7	5.39%	76.63	62.80%	4.13%
4.5	9.1	7.8	465.4	1.33%	76.35	64.13%	1.01%
5.0	10.1	8.6	517.1	5.16%	76.08	69.29%	3.93%
6.0	12.1	10.3	620.5	4.23%	75.70	73.52%	3.20%
7.0	14.1	12.1	724.0	4.48%	76.01	78.00%	3.40%
8.0	16.1	13.8	827.4	3.17%	76.33	81.17%	2.42%
9.0	18.1	15.5	930.8	2.31%	76.64	83.48%	1.77%
10.0	20.2	17.2	1034.2	2.18%	76.32	85.66%	1.67%
20.0	40.3	34.5	2068.5	9.37%	70.73	95.03%	6.63%
			Total cumulative rainfall (%)[4] :	100.0%		Net Annual (%) :	81.20%

STORMCON SDD3 1200 - TYPICAL DRAWING (NTS)



Appendix "C" Sanitary Drainage System

- Population Density Calculations
- Sanitary Flow Calculations
- Sanitary Service Capacity Calculation

POPULATION DENSITY CALCULATIONS

Post-development population density

(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	1.26	63

SANITARY FLOW CALCULATIONS

Post-development Condition

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

Equivalent Design Population (P) =	0.063	In thousand
Average Daily Per Capita Flow (q) =	302.8	L/cap. Day
Infiltration Allowance (I) =	0.20	L/ha. Sec
Tributary Area (A) =	1.26	ha

Average Flow =	((P * q) / 86.4)	
(Q) =	**0.22**	L/Sec

Harmon Peaking Factor (M) =	1 + (14 / (4 + P^0.5))
(M) =	4.293

Peak Design Flows (Q) =	((P * q * M) / 86.4) + (I * A)	
(Q) =	**1.20**	L/Sec

Post-development Condition

(According to Standard DWG 2-9-2, Region of Peel)

Domestic Sewage Flow for less then 1000 persons	0.013	m^3/sec

Infiltration Allowance (I) =	0.00028	m^3/ha. Sec

Gross Area of Site (ha) =	1.26	ha

Design Flows (Q) =	Based on Equivalent Population	+	Infiltration Allowance (I)

Design Flows (Q) =	**0.01335**	**m^3/sec**
	13.35	**L/sec**

SANITARY SERVICE CAPACITY CALCULATION

Pipe Capacity Q = $1/n * A * R^{2/3} * S^{1/2}$

Where:
- n = Manning's Roughness Coeff. (For PVC Pipe = 0.013)
- R = Hydraulic Radius (m) = Area/Wetted Perimeter
- S = Slope (m/m)
- A = Cross Sectional Area of Flow (m^2)

Pipe Capacities - Existing and New Sanitary Sewers

From MH	To MH	Pipe Dia (mm)	Length (m)	Slope (%)	Pipe Capacity (m^3/s)	Pipe Capacity (L/s)	Maximum Velocity (m/s)
Bldg	MH-1A	200	6.38	2.00%	0.046	**46.31**	**1.47**
MH-1A	MH-2A	200	9.40	2.00%	0.046	**46.31**	**1.47**
MH-2A	Ex.MH-10A	200	16.84	2.00%	0.046	**46.31**	**1.47**

Appendix "D" Water Supply System

- Post-development Water Supply Requirement Calculations
- Post-development Fire Flow Requirement Calculations
- Water Flow Test Report
- Fire Protection Calculations
- Region of Peel Demand Table

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	63

No.	Demand Type	Demand	Units
1	Average day flow	0.22	L/Sec
2	Maximum day flow	0.31	L/Sec
3	Peak hour flow	0.66	L/Sec
4	Fire flow	116.67	L/Sec
Analysis			
5	Maximum day plus fire flow	116.97	L/Sec
6	Peak hour flow	0.66	L/Sec
7	**Maximum demand flow**	**116.97**	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

Where => F = Required Fire Flow (L/min)
C = Coefficient related to construction
A = Total Area (m^2)

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 =	1209.00	m^2	Ground Floor
Adjoining Floor Area =	4880.00	m^2	2nd to 5th Floor
A =	6089.00	m^2	

So that,	**F =**	**14,000.00**	**L/min.**	(Rounded per FUS Guide Page # 20)

2 Addition / Reduction for occupancy type

Reduced by	-25%	For the occupancies having low contents of fire hazard

So that,	**F =**	**10,500.00**	**L/min.**

3 Reduction for sprinkler system

Reduced by	-30%	Adequately designed sprinkler system per NFPA

4 Addition for structures exposed within distance of fire area

Side	Distance (m)	% Addition
North	None	0%
South	None	0%
East	51.9	0%
West	58.00	0%
Total		**0%**

Shall not exceed 75%

Net Reduction / Addition for step 3 & 4

Reduced by	-30%

So that,	**F =**	**7000.00**	**L/min.**	(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 =	**7000.00**	L/min.
	116.67	L/sec
	1849.20	USGPM
	1541.00	Imp. GPM

WATER FLOW TEST REPORT

CORTESE DESIGN INC.

PHONE: 416-806-5800
CORTESE@CORTESEDESIGN.CA
SPECIALIZING IN SPRINKLER DESIGN
1995 WESTON ROAD
P.O. BOX #79741
TORONTO, ONTARIO M9N 3W9

HYDRANT FLOW TEST REPORT

LOCATION MARRIOTT HOTEL
12476 HIGHWAY 50 AT GEORGE BOLTON PKWY
CALEDON, ONTARIO

DATE : JUNE 10, 2020

TEST DONE BY FRANK CORTESE
REPRESENTATIVE OF CORTESE DESIGN INC.
WITNESS REGION OF PEEL

TIME : 11:30 AM

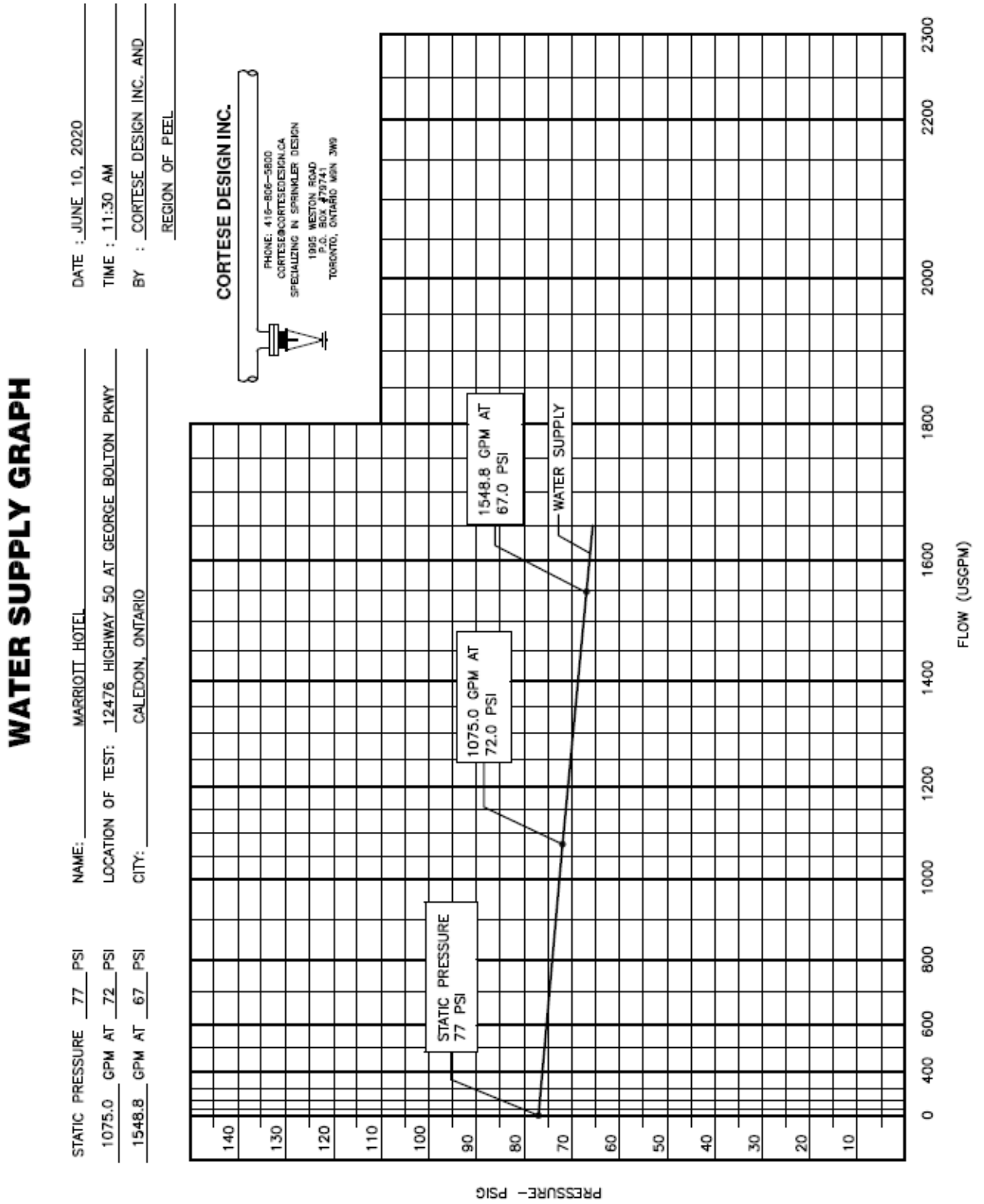
FLOW HYDRANT:

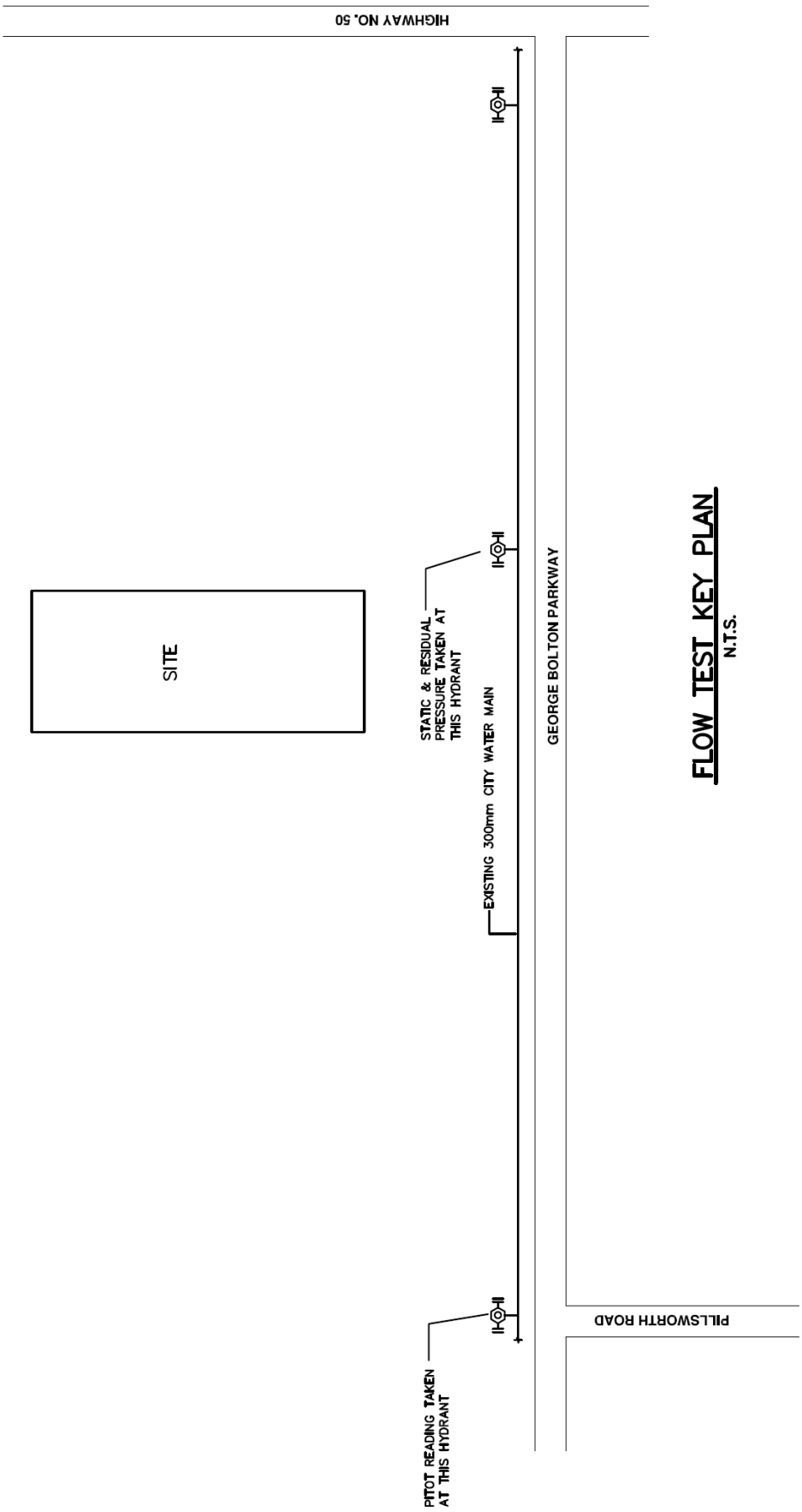
NOZZLE SIZE 2 1/2" POLLARD DIFFUSER
MODEL #LPD-250A

DISCHARGE COEFFICIENT 0.80

STATIC PRESSURE 77 PSI

NUMBER OF OUTLETS & ORIFICE SIZE	PITOT PRESSURE	FLOW (U.S. GPM)	RESIDUAL PRESSURE
1 X 2 1/2"	50	1075.0	72
1 X 2 1/2"	26	774.4	
1 X 2 1/2"	26	774.4	
		1548.8	67


WATER SUPPLY GRAPH
STATIC PRESSURE 77 PSI
1075.0 GPM AT 72 PSI
1548.8 GPM AT 67 PSI
NAME: MARRIOTT HOTEL
LOCATION OF TEST: 12476 HIGHWAY 50 AT GEORGE BOLTON PKWY
CITY: CALEDON, ONTARIO
DATE : JUNE 10, 2020
TIME : 11:30 AM
BY : CORTESE DESIGN INC. AND
REGION OF PEEL
CORTESE DESIGN INC.
PHONE: 416-806-5800
CORTESE@CORTESEDESIGN.CA
SPECIALIZING IN SPRINKLER DESIGN
1995 WESTON ROAD
P.O. BOX #79741
TORONTO, ONTARIO M9N 3W9
STATIC PRESSURE 77 PSI
1075.0 GPM AT 72.0 PSI
1548.8 GPM AT 67.0 PSI
WATER SUPPLY
PRESSURE- PSIG
FLOW (USGPM)
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
400
600
800
1000
1200
1400
1600
1800
2000
2200
2300



FLOW TEST KEY PLAN
N.T.S.

FIRE PROTECTION CALCULATIONS

(According to the National Fire Protection Association (NFPA) Guidelines)

MUNICIPALITY:	Town of Caledon
PROJECT NAME:	Proposed Marriott Hotel
PROJECT ADDRESS:	12476 HWY 50, Caledon, Ontario
PROJECT No:	20398
Flow Test Conducted By	Cortese Design Inc.
Location of Test (FLOW)	3rd Hydrant at West side of HWY 50 on George Bolton Parkway
Location of Test (RESIDUAL)	2nd Hydrant at West side of HWY 50 on George Bolton Parkway
Mainline Pipe Size	300 mm Ø

Observed Flow From Hydrant Test $Q_f = 29.83 * c * (d^2)*(p^{1/2})$								**Projected Fire Flow** $Q_r = Q_f*((P_s-P_{rd})/(P_s-P_{ra})$		
Test #	**# of Nozzle/ Orifice**	**Nozzle/ Orifice Dia. d** (in)	**Discharge Coeff. (c)**	**Static Pressure (P_s)** (psi)	**Pitot Pressure (P_p)** (psi)	**Actual Residual Pressure (P_{ra})** (psi)	**Q_f** (USGPM)	**Desired Residual Pressure (P_{rd})** (psi)	**Q_r** (USGPM)	**Q_r** (L/sec)
1	1	2.5	0.815	77	50	72	1075	20	4001	253
2	1	2.5	0.815	77	26	67	775	20	1984	126
	1	2.5	0.815	77	26	67	775	20	1984	126
							1550			**252**

REGION OF PEEL DEMAND TABLE

Project : Proposed Marriott Hotel
Project Address : 12476 HWY 50, Caledon, Ontario
SPA No. : xx-xx

WATER CONNECTION

Connection Point :	From the existing 300mm dia watermain located within road allowance of George Bolton Parkway at an approximate distance of 104.0m west of centreline of HWY 50		
Pressure zone of connection point			
Total equivalent population to be serviced [1]			63
Total lands to be serviced			1.26 ha
Hydrant Flow Test:	Performed by Cortese Design Inc.		
Hydrant flow test location	3rd Hydrant at West side of HWY 50 on George Bolton Parkway		
Hydrant residual test location	2nd Hydrant at West side of HWY 50 on George Bolton Parkway		
		Pitot Pressure (kPa)	Time
Minimum water pressure		345	11:30 AM
Maximum water pressure			

WATER DEMANDS

No.	Demand Type	Demand	Units
1	Average day flow	0.22	L/Sec
2	Maximum day flow	0.31	L/Sec
3	Peak hour flow	0.66	L/Sec
4	Fire flow [2]	116.67	L/Sec
Analysis			
5	Maximum day plus fire flow	116.97	L/Sec

WASTEWATER CONNECTION

Connection Point [3]**:**	From the existing SAN MH#10A connected to the existing 250mm dia municipal sanitary sewer located within road allowance of George Bolton Parkway		
Total equivalent population to be serviced [1]			63
Total lands to be serviced			1.26 ha
6	Wastewater sewer effluent	13.35	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 "E" 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 then 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 then 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 servicing

   Investigations 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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