FUNCTIONAL SERVICING & PRELIMINARY STORMWATER MANAGEMENT REPORT

7170 GOREWAY DRIVE

CITY OF MISSISSAUGA
REGION OF PEEL

PREPARED FOR:

2150745 ONTARIO INC.

PREPARED BY:

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

DECEMBER 2017

CFCA FILE NO. 1346-4573

CROZIER
CONSULTING ENGINEERS

Revision Number	Date	Comments
Rev.0	December 15, 2017	Issued for Zoning By-Law Amendment

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1.0 Introduction

C.F. Crozier & Associates Inc. (Crozier) was retained by 2150745 Ontario Inc. to prepare a Functional Servicing & Preliminary Stormwater Management Report to support the Zoning By-Law Amendment to permit the development of 7170 Goreway Drive in the City of Mississauga and Region of Peel.

The purpose of this report is to demonstrate that the proposed site can be developed in accordance with the City of Mississauga and Region of Peel guidelines from a functional servicing & preliminary stormwater management perspective.

The following reports and design standards were referenced during the preparation of this report:

- City of Mississauga Transportation and Works Development Requirements Manual, September 2016
- Region of Peel Public Works Design, Specifications & Procedures Manual – Sanitary Sewer Design Criteria, July 2009
- Region of Peel Public Works Design, Specifications & Procedures Manual – Watermain Design Criteria, June 2010

2.0 Site Description

The subject property is approximately 0.41 ha and is located in a mixed residential and commercial area in the City of Mississauga. The subject property is currently vacant but previously contained one house.

The property is bounded by:

- Etude Drive to the north
- Goreway Drive to the east
- Residential properties to the south and west

The project will consist of a 14 unit residential townhouse development and private road with access through Etude Drive.

3.0 Water Servicing

3.1 Existing Water Servicing

A review of Region of Peel as-constructed drawing no. 40529-D dated September 22, 2008 indicates that:

- There is an existing 300 mm diameter watermain within the far side (north side) of Etude Drive, north of the subject property
- There is an existing fire hydrant in the north boulevard of Etude Drive near the subject property

A review of Region of Peel as-constructed drawing no. 20065-D dated April, 1993 indicates that:

- There is an existing 150 mm diameter within the near side (west side) of Goreway Drive
- There is also an existing 400 mm diameter watermains within the east boulevard of Goreway Drive
- There is an existing fire hydrant within the east boulevard of Goreway Drive near the subject property
- The site appears to have been previously serviced by the 150 mm diameter watermain within Goreway Drive

3.2 Design Water Demand

The water demands for the proposed development were calculated with reference to the Region of Peel Watermain Design Criteria. An average daily water demand of 280 L/capita/day was used with an occupancy density of 175 persons/ha. **Table 1** summarizes the water demands. **Appendix A** contains detailed water demand calculations.

Table 1: Estimated Design Water Demand

Standard	Average Daily Demand (L/s)			Maximum Daily Demand (L/s)	Peak Hourly Demand (L/s)
	Existing	Proposed	Increase		
Region of Peel	0	0.23	0.23	0.46	0.69

Note: The subject property appears to have previously contained one residence. The subject property no longer contains any buildings and currently sits vacant.

Using the Region of Peel Design Criteria for domestic water demand, the estimated maximum daily demand and peak flows for the additional units will be 0.46 L/s and 0.69 L/s, respectively.

3.3 Fire Flow Demand

The Fire Underwriters Survey method was used to estimate the fire flow requirements for the proposed development. This calculation estimates the preliminary watermain size required to service the development and is based on a building type of ordinary construction and a gross floor area (GFA) of 1,162 sq. m. for the largest on-site block of townhomes, per the Jardin Design Group Townhouse Plans. **Table 2** summarizes the required fire flow and duration to meet fire protection for the proposed development.

Table 2: Estimated Fire Demand Flows

Method	Demand Flow (L/s)	Duration (h)
Fire Underwriters Survey (1999)	150	2.00

The proposed fire service is required to accommodate a fire flow of 150 L/s for a duration of 2.00 hours. **Appendix A** contains the Fire Underwriters Survey calculations. The building architect and the mechanical engineer will confirm the estimated fire flow demand.

Please note that the Fire Underwriters Survey value is a conservative estimate for comparison purposes only, used to estimate the size of the incoming waterline. The mechanical engineer for this development will complete the required analyses for fire protection and the architect will design fire separation methods per the determined fire flow rate, in order to meet municipally available flows and pressures.

3.4 Proposed Water Servicing

The development is proposed to be serviced by a 150 mm diameter PVC water service. The proposed 150 mm diameter water service will connect to the existing 150 mm diameter watermain within Etude Drive using a tee. A valve & box per Region standard drawing 1-3-3A is proposed at the property line.

The proposed Water Servicing Plan is shown on **Figure 1**.

Based on the water demand calculations for the proposed development, we conclude that the existing municipal infrastructure has sufficient capacity to support the proposed development without any required external improvements.

4.0 Sanitary Servicing

4.1 Existing Sanitary Servicing

A review of Region of Peel as-constructed drawing no. 40529-D dated September 22, 2008 indicates that:

- There are no existing sanitary mains within Etude Drive directly in front of the subject property

A review of Region of Peel as-constructed drawing no. 20065-D dated April, 1993 indicates that:

- There is an existing 250 mm diameter sanitary sewer that flows south with an approximate 0.5% slope within the west boulevard of Goreway Drive
- There is an existing sanitary manhole directly in front of the subject property which may facilitate connections

4.2 Design Sanitary Flow

The Region of Peel Sanitary Sewer Design Criteria was referenced to calculate sanitary design flows for the proposed development. A unit sewage flow of 302.8 L/capita/day was used with an occupancy density of 175 persons/ha. Infiltration flow and a peaking factor were applied to the unit sewage flow to obtain the total estimated design sewage flow. A summary of the results is presented in **Table 3** and detailed calculations are provided in **Appendix A**.

Table 3: Estimated Sanitary Design Flows

Standard	**Average Flow** (L/s)	**Peaking Factor**	**Peak Flow** (L/s)	**Infiltration Flow** (L/s)
Region of Peel	0.25	4.28	1.15	0.08

The proposed sanitary service was sized to convey a peak sanitary flow of 1.15 L/s for the development, as determined by the Region of Peel Sanitary Sewer Design Criteria.

4.3 Proposed Sanitary Servicing

The development is proposed to be serviced via a 150 mm diameter service with a slope between 0.6 % and 2.0 %. The proposed sanitary service will be designed per Region of Peel standards.

The Preliminary Site Servicing Plan (**Figure 1**) illustrates the location of the sanitary sewer and all connections. The internal sanitary system of any buildings will be designed per the mechanical engineer's details and specifications.

Based on the sanitary demand calculations for the proposed development, we conclude that the existing municipal infrastructure has sufficient capacity to support the proposed development without any required external improvements.

5.0 Drainage Conditions

5.1 Existing Drainage

The subject property is currently composed of a mostly grassed cover and contains no existing buildings. A pre-development runoff coefficient of 0.25 was selected based on the existing topography.

A review of topographic survey indicates that a portion of stormwater runoff is currently directed to Goreway Drive, while the remainder of stormwater runoff is directed to low points within the site. Overland flows above existing on-site ponding levels are currently directed to Goreway Drive and the neighbouring property to the south. Stormwater runoff directed toward Goreway Drive is captured by catchbasins on the west side of Goreway Drive.

5.2 Proposed Drainage

The proposed development consists of a fourteen (14) unit row-style townhouse development and private road with access through Etude Drive. The landscape of the proposed development will be approximately 65% impervious, thus raising the weighted runoff coefficient to 0.68.

Upon development, the minor storm event will be collected through multiple catch basins within the private road. The stormwater will then be conveyed through to the municipal storm sewer within Goreway Drive.

The major system overland flow will be conveyed through the pathway at the northeast corner of the subject property with a spill elevation of 166.74 m.

The Preliminary Site Servicing and Site Grading Plans (**Figures 1** and **2**) illustrate the proposed site drainage, the location and design of the storm sewers, and all proposed connections. Please refer to **Figure 3** and **4** which highlights the pre- and post-development pervious and impervious areas for the site. **Table 4** summarizes the results.

Table 4: Land Area Comparison

Conditions	Impervious Area (ha)	Pervious Area (ha)	Total Area (ha)	Runoff Coefficient
Pre-Development	0	0.41	0.41	0.25
Post-Development	0.27	0.14	0.41	0.68

Following the City of Mississauga's Transportation and Works Department's Development Requirements Manual, adjustment factors have been applied to the runoff coefficients to account for increased runoff due to saturation of the catchment surface occurring from large storm events. These adjustment factors are provided in **Table 5** below.

Table 5: Adjusted Runoff Coefficients

Storm	Adjustment Factor	Adjusted Pre-Development Runoff Coefficient	Adjusted Post-Development Runoff Coefficient
2-year	1.0	0.25	0.68
5-year	1.0	0.25	0.68
10-year	1.0	0.25	0.68
25-year	1.1	0.28	0.74
50-year	1.2	0.30	0.81
100-year	1.25	0.31	0.85

6.0 Stormwater Management

Stormwater management design criteria were established through a review of the City of Mississauga's Transportation and Works Department's Development Requirements Manual. The stormwater management criteria include:

Quantity Control

Provide post to pre control for all design storms (2, 5, 10, 25, 50, and 100-year) per the Mimico Creek requirements in the City of Mississauga Transportation and Works Manual.

Quality Control

"Enhanced" level protection (80% TSS removal) per the MOECC SWM Design Manual (2003).

Water Balance

The initial 5 mm of runoff shall be retained on-site and managed through infiltration, evapotranspiration, or re-use.

6.1 Stormwater Quantity Control

Stormwater is proposed to be collected through multiple catchbasins within the shared road on the subject property. It will then be conveyed through an underground pipe network, surcharging into an underground storage chamber, restricted due to an orifice tube of 125 mm diameter. Stormwater is then conveyed into the municipal storm sewer at the required controlled rates for the respective storm events.

Using the City of Mississauga intensity-duration-frequency (IDF) data, the Modified Rational Method was used to determine the pre-development and post-development peak flow rates for site stormwater runoff. The amount of on-site storage was determined through comparing these post-development and pre-development peak flow rates.

The proposed stormwater quantity controls consist of a 125 mm orifice tube and underground storage chamber. Rooftop controls are not proposed as the development is residential. The proposed underground chamber will be designed to contain a maximum volume of approximately 115 m^3, as required to control the 100-year storm event to the capacity of the downstream pipe. Refer to **Appendix B** for complete stormwater calculations. The Preliminary Servicing Plan (**Figure 1**) illustrates the location of the underground storage system.

A summary of site flows and required storage volumes have been provided in **Table 6.**

Table 6: Pre- and Post-Development Flow Rates and Required Storage Volumes

Storm	Pre-Development Uncontrolled Flow Rate (L/s)	Post-Development Uncontrolled Flow Rate (L/s)	Post-Development Controlled Flow Rate (L/s)	Storage Volume Required (m^3)	Storage Volume Provided (m^3)
2-year	0.017	0.046	0.022	30.4	115
5-year	0.023	0.062	0.026	40.8	
10-year	0.028	0.076	0.030	50.3	
25-year	0.036	0.096	0.034	63.5	
50-year	0.043	0.117	0.038	77.6	
100-year	0.050	0.135	0.041	90.2	

6.2 Stormwater Quality Control

Additional stormwater quality control is required for the proposed development in order to meet the required control criteria.

A Stormceptor oil grit separator has been proposed in order to meet the 80% TSS removal requirement of the MOECC SWM Design Manual. Supporting calculations and reports are provided in **Appendix B**.

6.3 Water Balance

A storage volume of 20 m^3 will be provided below the outlet elevation of the proposed storage chamber. This storage volume is necessary to comply with the water balance criteria of retaining the first 5 mm of runoff on site. The stored stormwater uses will be determined at the detailed design phase for Site Plan Approval.

7.0 Erosion and Sediment Controls During Construction

Erosion and sediment controls will be installed prior to the beginning of any construction activities. They will be maintained until the site is stabilized or as directed by the Site Engineer and/or the City of Mississauga. Erosion and sediment controls will be inspected after each significant rainfall event and maintained in proper working condition. The following erosion and sediment controls will be included during construction on the site:

Heavy Duty Silt Fencing

Silt fencing will be installed on the perimeter of the site to intercept sheet flow. Additional silt fence may be added based on field decisions by the Site Engineer and Owner, prior to, during, and following construction.

Rock Mud Mat

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

Sediment Control Devices

Additionally, TRCA approved storm drain inlet protection is to be used on all internal catchbasins and external catchbasins directly abutting or immediately downstream during construction of the subject property.

8.0 Conclusions and Recommendations

Based on the information offered in this report, we offer the following conclusions:

- Water servicing is proposed via a 150 mm service tying into the existing 150 mm watermain within Etude Drive, which will provide an average daily flow of 0.23 L/s, a max day flow of 0.46 L/s and a peak hourly flow of 0.69 L/s
- A fire flow demand of 9,000 L/s at 2 hours is to be provided via hydrants adjacent to the site within Etude Drive and Goreway Drive
- Sanitary servicing is proposed via a 150 mm service tying into the existing 250 mm sanitary sewer within Goreway Drive, which will convey an average flow of 0.25 L/s and a max flow of 1.15 L/s
- Peak flow matching from post-development to pre-development (quantity control) was achieved through a 125 mm orifice and approximately 120 m^3 of underground storage

- Water quality requirements of 80% TSS removal was achieved through the use of a Stormceptor oil-grit separator
- Approximately 20 m^3 of "dead storage" is provided within the underground storage unit to account for the water balance requirement of 5 mm

Based on the above conclusions, we recommend the approval of the Zoning By-Law Amendment, from the perspective of functional servicing and preliminary stormwater management.

Respectfully submitted,

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APPENDIX A

Water and Sanitary Demand Design and Calculations

Domestic Water Demand

Site Area:	0.41	ha
Population Density:	175	persons/ha
Population:	71	

Notes & References

Region of Peel Public Works Design Criteria Manual - Sanitary Sewer (2009)

Design Parameters

Average Demand (L/capita/d)
280

Region of Peel Public Works Watermain Design Criteria (2010)

Water Demand:

Average Daily Demand =	19,933	L/day
	0.23	**L/s**

Peaking Factors

Max Day =	2.0	
Peak Hour =	3.0	

Region of Peel Public Works Watermain Design Criteria (2010)

Average Day =	0.23	L/s
Max Day =	**0.46**	L/s
Peak Hour =	**0.69**	L/s

Max Day = Average Day Demand * Max Day
Peak Hour = Average Day Demand * Peak Hour

Municipality	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Peel	0.23	0.46	0.69

Project: 717 Goreway Drive	**Created By:** JH	**Date:**	10/5/2017
Project No.: 1346-4573	**Checked By:** KJF	**Updated:**	10/5/2017

Fire Flow Calculations - Fire Underwriters Survey Method

Notes:

1. The development will use ordinary construction (C-value = 1.0).
2. Total gross-floor-area (GFA) of the largest block is 1162 sq. m. per Jardin Design Group Townhouse Plans.
3. The building is assumed to have no sprinkler protection.
4. The building is classified as a low hazard occupancy per the appendix of the Water Supply for Public Fire Protection (1999) by FUS.

Part II - Guide for Determination of Required Fire Flow

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

F = 220 * C * sqrt A

where:

F = the required fire flow in litres per minute

C = coefficient related to the type of construction

= 1.5 for wood frame construction (structure essentially all combustible)

= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)

= 0.8 for non-combustible construction (unprotected metal structural components)

= 0.6 for fire-resistive construction (fully protected frame, floors, roof)

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

Proposed Development: Building Ordinary Construction

A = 1162 sq. m GFA

C = 1.0

Therefore, F= 7,000 L/ min (rounded to nearest 1000 L/min)

Fire flow determined above shall not exceed:

30,000 L/min for wood frame construction
30,000 L/min for ordinary construction
25,000 L/min for non-combustible construction
25,000 L/min for fire-resistive construction

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

Non-Combustible	-25%	Free Burning	+15%
Limited Combustible	-15%	Rapid Burning	+25%
Combustible	No Charge		

Combustible:	0% Reduction

0 L/min reduction

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

CROZIER & ASSOCIATES Consulting Engineers

Project: 717 Goreway Drive | **Created By:** JH | **Date:** 10/5/2017
Project No.: 1346-4573 | **Checked By:** KJF | **Updated:** 10/5/2017

Fire Flow Calculations - Fire Underwriters Survey Method

3. Sprinklers: The value obtained in No. 2 may be reduced by up to 50% for complete automatic sprinkler protection.

No automatic sprinklers:
0 L/min reduction

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

Separation	Charge
0 - 3 m	25%
3.1 - 10 m	20%
10.1 - 20 m	15%
20.1 - 30 m	10%
30.1 - 45 m	5%

Exposed Buildings				
Direction	Distance	Charge	Surcharge	
North	10	20%	1400	L/min
East		0%	0	L/min
South		0%	0	L/min
West	13	15%	1050	L/min
		Total Surcharge:	**2450**	**L/min**

Determine Required Fire Flow

1.	7,000	base fire flow
2.	0	reduction
3.	0	reduction
4.	2,450	surcharge

Required Flow: **9,000 L/min, or**
150.0 L/s
2,376.0 USGPM

Required Duration of Fire Flow	
Flow Required (L/min)	Duration (hours)
2,000 or less	1.00
3,000	1.25
4,000	1.50
5,000	1.75
6,000	2.00
8,000	2.00
10,000	2.00
12,000	2.50
14,000	3.00
16,000	3.50
18,000	4.00
20,000	4.50
22,000	5.00
24,000	5.50
26,000	6.00
28,000	6.50
30,000	7.00
32,000	7.50
34,000	8.00
36,000	8.50
38,000	9.00
40,000 and over	9.50

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Project: 7170 Goreway Drive | **Created By:** JH | **Date:** 9/29/2017
Project No.: 1346-4573 | **Checked By:** KJF | **Updated:** 9/29/2017

Domestic Sanitary Design Flow

Site Area:	0.4068	ha	
Population Density:	175	persons/ha	Region of Peel Public Works Design Criteria Manual - Sanitary Sewer (2009)
Population:	71		

Design Parameters

Average Flow (L/capita/d)	
302.8	Region of Peel Public Works Design Criteria Manual - Sanitary Sewer (2009)

Sanitary Design Flow:

	Average Daily Flow =	302.8	L/capita/d	Average Daily Flow = Average Daily Flow (L/cap./day) * population / 86400
	Average Daily Flow =	**0.25**	L/s	
Harmon Peak Factor:	M =	**4.28**		M = 1 + 14 / (4 + (p/1000)^.5)
	Peak Flow =	**1.07**	L/s	Peak Flow = Average Daily Flow * M
Infiltration Flow:	Infiltration =	0.20	L/ha/s	Region of Peel Public Works Design Criteria Manual - Sanitary Sewer (2009)
	Total Infiltration =	**0.08**	L/s	
	Total Peak Flow =	**1.15**	L/s	Total Peak Flow = Peak Flow + Total Infiltration

Summary Table

Average Daily Flow (L/s)	Peaking Factor	Peak Flow (L/s)	Infiltration Flow (L/s)	Total Peak Flow (L/s)
0.25	4.28	1.07	0.08	1.15

Connection Demand Table

WATER CONNECTION

Connection point [3]			
WND 6587287 WND 6587291 } ETUDE			
Pressure zone of connection point		4	
Total equivalent population to be serviced [1]		71	
Total lands to be serviced		0.41 ha	
Hydrant flow test		N/A DUE TO WEATHER CONDITIONS.	
Hydrant flow test location		↳ TO BE COMPLETED IN NEW YEAR.	
	Pressure (kPa)	Flow (in l/s)	Time
Minimum water pressure			
Maximum water pressure			

No.	Water demands		
	Demand type	**Demand**	**Units**
1	Average day flow	0.23	l/s
2	Maximum day flow	0.46	l/s
3	Peak hour flow	0.69	l/s
4	Fire flow [2]		l/s
Analysis			
5	Maximum day plus fire flow	150	l/s

WASTEWATER CONNECTION

Connection point [4]		1801888	MH ID → EXTENSION OF THIS.
Total equivalent population to be serviced [1]		71	
Total lands to be serviced		0.41 ha	
6	Wastewater sewer effluent (in l/s)	PEAK = 1.15 L/S, AVG = 0.25 L/S.	

[1] Please refer to design criteria for population equivencies

[2] Please reference the Fire Underwriters Survey Document

[3] Please specify the connection point ID

[4] Please specify the connection point (wastewater line or manhole ID)
Also, the "total equivalent popopulation to be serviced" and the "total lands to be serviced" should reference the connection point. (The FSR should contain one copy of Site Servicing Plan)

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

APPENDIX B

Stormwater Management Design and Calculations

Project: 7170 Goreway Drive **Created By:** JH **Date:** 9/27/2017
Project No.: 1346-4573 **Checked By:** KJF **Updated:** 9/27/2017

Modified Rational Calculations - Input Parameters

Storm Data: City of Mississauga

Time of Concentration: T_c = **15** **min** (per City of Mississauga standards)

Return Period	A	B	C	I (mm/hr)
2 yr	610	4.6	0.78	59.89
5 yr	820	4.6	0.78	80.51
10 yr	1010	4.6	0.78	99.17
25 yr	1160	4.6	0.78	113.89
50 yr	1300	4.7	0.78	127.13
100 yr	1450	4.9	0.78	140.69

Pre - Development Conditions				
Land Use	**Area** (ha)	**Area** (m^2)	**C**	**Weighted Average C**[1]
Pervious	0.41	4068	**0.25**	**0.25**
Impervious	0.00	0	**0.9**	**0.00**
Total Site	**0.41**	**4068**	**-**	**0.25**

Post - Development Conditions				
Land Use	**Area** (ha)	**Area** (m^2)	**C**	**Weighted Average C**
Pervious	0.14	1402	**0.25**	**0.09**
Impervious	0.27	2666	**0.9**	**0.59**
Total Site	**0.41**	**4068**	**-**	**0.68**

Equations:

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

Intensity
$$i(T_d) = A / (T + B)^C$$

Modified Rational Calculations - Peak Flows Summary

Peak Flows (m^3/s)				
Return Period	**Adjusted C_{pre}**	**Adjusted C_{post}**	**Q_{pre}**	**Q_{post}**
2 yr	0.250	0.676	0.017	0.046
5 yr	0.250	0.676	0.023	0.062
10 yr	0.250	0.676	0.028	0.076
25 yr	0.275	0.744	0.036	0.096
50 yr	0.300	0.811	0.043	0.117
100 yr	0.313	0.845	0.050	0.135

Equations:

Peak Flow

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

Modified Rational Calculations - 100-Year Storm Event

Control Criteria

100 yr: Control Post-Development Peak Flows to Pre-Development Peak Flow

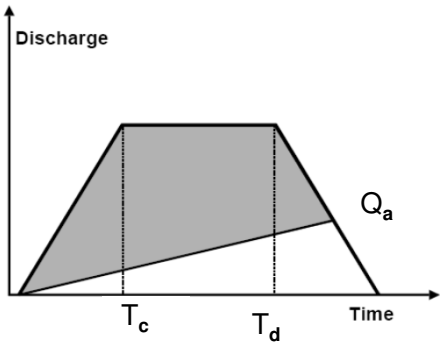
100 yr: Uncontrolled Post-Development Flow:

Q_{post} = 0.135 m^3/s

100 yr: Pre-Development Flow:

Q_{pre} = 0.050 m^3/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Uncont} (m^3/s)	S_d (m^3)
5	242.53	300	0.233	40.0
10	176.31	600	0.170	64.3
15	140.69	900	0.135	76.8
20	118.12	1200	0.114	83.8
25	102.41	1500	0.099	87.8
30	90.77	1800	0.087	89.7
35	81.77	2100	0.079	90.2
40	74.58	2400	0.072	89.6
45	68.68	2700	0.066	88.3
50	63.75	3000	0.061	86.4
55	59.56	3300	0.057	84.0
60	55.95	3600	0.054	81.2
65	52.81	3900	0.051	78.0
70	50.03	4200	0.048	74.6
75	47.58	4500	0.046	70.8
80	45.38	4800	0.044	66.9
85	43.39	5100	0.042	62.8
Required Storage Volume:				**90.2**



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

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

Modified Rational Calculations - 50-Year Storm Event

Control Criteria

50 yr: Control Post-Development Peak Flows to Pre-Development Peak Flow

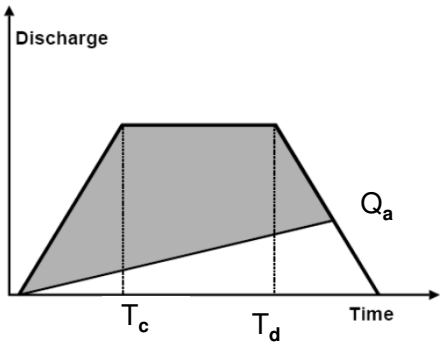
50 yr: Uncontrolled Post-Development Flow:

Q_{post} = 0.117 m^3/s

50 yr: Pre-Development Flow:

Q_{pre}= 0.043 m^3/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Uncont} (m^3/s)	S_d (m^3)
5	220.93	300	0.204	35.2
10	159.75	600	0.148	56.0
15	127.13	900	0.117	66.6
20	106.57	1200	0.098	72.5
25	92.30	1500	0.085	75.8
30	81.75	1800	0.076	77.3
35	73.60	2100	0.068	77.6
40	67.10	2400	0.062	77.1
45	61.77	2700	0.057	75.9
50	57.32	3000	0.053	74.2
55	53.54	3300	0.049	72.0
60	50.28	3600	0.046	69.5
65	47.45	3900	0.044	66.7
70	44.95	4200	0.042	63.7
75	42.74	4500	0.039	60.4
80	40.76	4800	0.038	56.9
85	38.97	5100	0.036	53.3
Required Storage Volume:				**77.6**



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

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

CROZIER & ASSOCIATES Consulting Engineers

Project: 7170 Goreway Drive | **Created By:** JH | **Date:** 9/27/2017
Project No.: 1346-4573 | **Checked By:** KJF | **Updated:** 9/27/2017

Modified Rational Calculations - 25-Year Storm Event

Control Criteria

25 yr: Control Post-Development Peak Flows to Pre-Development Peak Flow

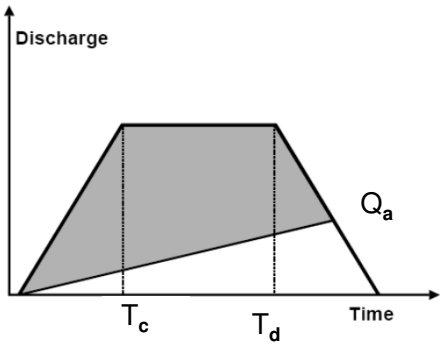
25 yr: Uncontrolled Post-Development Flow:

Q_{post}= 0.096 m^3/s

25 yr: Pre-Development Flow:

Q_{pre}= 0.036 m^3/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Uncont} (m^3/s)	S_d (m^3)
5	198.74	300	0.168	29.1
10	143.31	600	0.121	46.1
15	113.89	900	0.096	54.7
20	95.40	1200	0.081	59.5
25	82.58	1500	0.070	62.1
30	73.11	1800	0.062	63.3
35	65.80	2100	0.056	63.5
40	59.98	2400	0.051	63.1
45	55.21	2700	0.047	62.0
50	51.22	3000	0.043	60.6
55	47.84	3300	0.041	58.8
60	44.92	3600	0.038	56.7
65	42.39	3900	0.036	54.4
70	40.15	4200	0.034	51.9
75	38.17	4500	0.032	49.2
80	36.40	4800	0.031	46.3
85	34.81	5100	0.029	43.3
Required Storage Volume:				**63.5**



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

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

Modified Rational Calculations - 10-Year Storm Event

Control Criteria

10 yr: Control Post-Development Peak Flows to Pre-Development Peak Flow

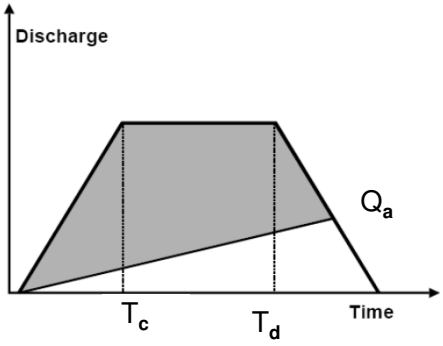
10 yr: Uncontrolled Post-Development Flow:

Q_{post} = 0.076 m^3/s

10 yr: Pre-Development Flow:

Q_{pre} = 0.028 m^3/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Uncont} (m^3/s)	S_d (m^3)
5	173.04	300	0.133	23.0
10	124.77	600	0.096	36.5
15	99.17	900	0.076	43.3
20	83.06	1200	0.064	47.1
25	71.90	1500	0.055	49.2
30	63.66	1800	0.049	50.1
35	57.30	2100	0.044	50.3
40	52.22	2400	0.040	49.9
45	48.07	2700	0.037	49.1
50	44.60	3000	0.034	48.0
55	41.65	3300	0.032	46.5
60	39.11	3600	0.030	44.9
65	36.91	3900	0.028	43.0
70	34.96	4200	0.027	41.1
75	33.24	4500	0.026	38.9
80	31.69	4800	0.024	36.7
85	30.31	5100	0.023	34.3
Required Storage Volume:				**50.3**



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

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

Modified Rational Calculations - 5-Year Storm Event

Control Criteria

5 yr: Control Post-Development Peak Flows to Pre-Development Peak Flow

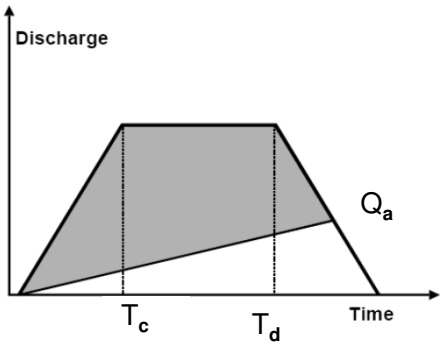
5 yr: Uncontrolled Post-Development Flow:

Q_{post} = 0.062 m^3/s

5 yr: Pre-Development Flow:

Q_{pre}= 0.023 m^3/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Uncont} (m^3/s)	S_d (m^3)
5	140.49	300	0.108	18.7
10	101.30	600	0.078	29.6
15	80.51	900	0.062	35.2
20	67.43	1200	0.052	38.2
25	58.37	1500	0.045	39.9
30	51.68	1800	0.040	40.7
35	46.52	2100	0.036	40.8
40	42.40	2400	0.033	40.5
45	39.02	2700	0.030	39.9
50	36.21	3000	0.028	38.9
55	33.82	3300	0.026	37.8
60	31.76	3600	0.024	36.4
65	29.96	3900	0.023	35.0
70	28.38	4200	0.022	33.3
75	26.98	4500	0.021	31.6
80	25.73	4800	0.020	29.8
85	24.60	5100	0.019	27.8
Required Storage Volume:				**40.8**



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

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

Modified Rational Calculations - 2-Year Storm Event

Control Criteria

2 yr: Control Post-Development Peak Flows to Pre-Development Peak Flow

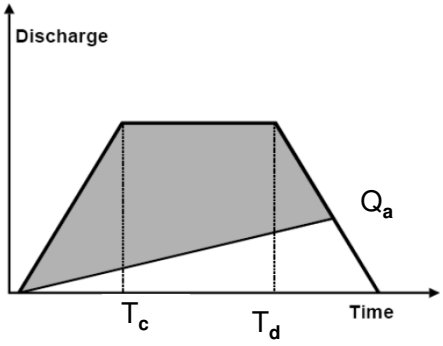
2 yr: Uncontrolled Post-Development Flow:

Q_{post}= 0.046 m^3/s

2 yr: Pre-Development Flow:

Q_{pre} = 0.017 m^3/s

Storage Volume Determination				
T_d (min)	i (mm/hr)	T_d (sec)	Q_{Uncont} (m^3/s)	S_d (m^3)
5	104.51	300	0.080	13.9
10	75.36	600	0.058	22.0
15	59.89	900	0.046	26.2
20	50.16	1200	0.039	28.4
25	43.42	1500	0.033	29.7
30	38.45	1800	0.030	30.3
35	34.60	2100	0.027	30.4
40	31.54	2400	0.024	30.1
45	29.03	2700	0.022	29.7
50	26.94	3000	0.021	29.0
55	25.16	3300	0.019	28.1
60	23.62	3600	0.018	27.1
65	22.29	3900	0.017	26.0
70	21.12	4200	0.016	24.8
75	20.07	4500	0.015	23.5
80	19.14	4800	0.015	22.1
85	18.30	5100	0.014	20.7
Required Storage Volume:				**30.4**



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

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

Modified Rational Calculations - Summary

Storm Event (yr)	Peak Flow Rate			Required Storage (m^3)
	Pre-Development (L/s)	Post-Development[1] (L/s)		
		Uncontrolled	Controlled	
2	0.017	0.046	0.017	30.4
5	0.023	0.062	0.023	40.8
10	0.028	0.076	0.028	50.3
25	0.036	0.096	0.036	63.5
50	0.043	0.117	0.043	77.6
100	0.050	0.135	0.050	90.2

CROZIER & ASSOCIATES
Consulting Engineers

Project: 7170 Goreway Drive
Project No: 1346-4573
Design: JH
Check: -
Date: 11/1/2017

ORIFICE RATING CURVE

Orifice Parameters

Diameter Ø (m) = 0.125
Area (A) (m^2) = 0.0123
Coefficient (C) = 0.82
Orifice Invert= 164.60
Centroid (h)= 164.66
Control MH # = STM MH 4

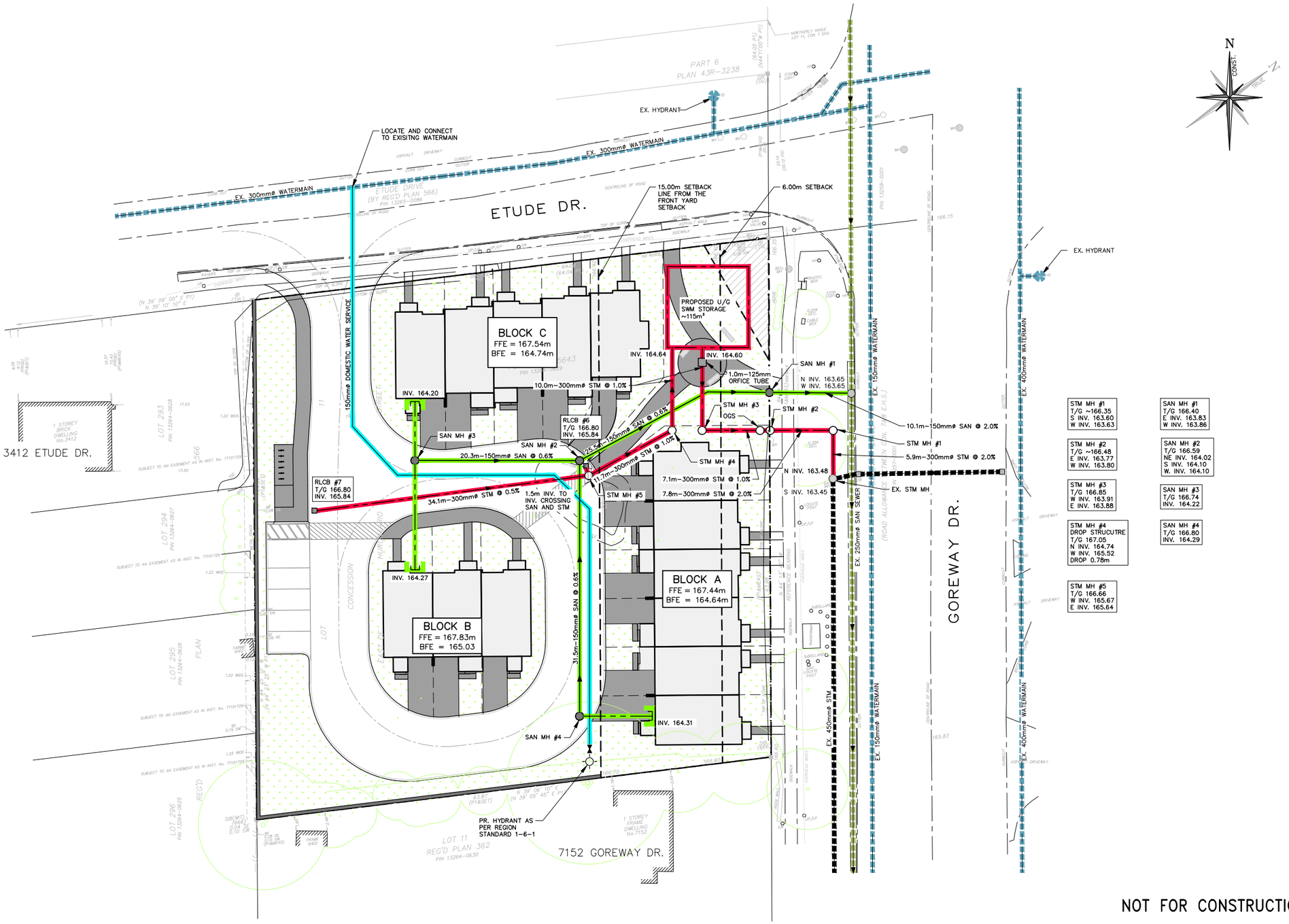
Orifice Tube

Discharge, Q = CA x sqrt(2gh)

A. Rating Table

Elevation	Discharge	Storage Volume	
m	m^3/s	m^3	
164.60	0.000	0	ORIFICE INVERT
164.91	0.022	31	2-year
165.01	0.026	41	5-year
165.11	0.030	51	10-year
165.24	0.034	64	25-year
165.38	0.038	78	50-year
165.51	0.041	91	100-year
165.80	0.048	120	

FIGURES



LEGEND

- PROPERTY LINE
- EXISTING WATERMAIN & GATE VALVE
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE / DOUBLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- PROPOSED WATERMAIN & GATE VALVE
- PROPOSED WATER SERVICE LATERAL (XXmmø)
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE / DOUBLE CATCHBASIN
- PROPOSED SANITARY SEWER & MANHOLE
- PROPOSED SAN. SERVICE LATERAL (XXXmmø)
- PROPOSED ELECTRICAL TRANSFORMER

No.	ISSUE / REVISION	YYYY/MMM/DD
0	ISSUED FOR ZBA/OPA	2017/DEC/15

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE DERIVED FROM THE CANADIAN GEODETIC DATUM BENCHMARK No. 448

ELEVATION = 162.55m

SURVEY NOTES:

SURVEY COMPLETED BY J.H. GELBLOOM SURVEYING LIMITED. (2017/MAY/08)
PROJECT No.: 17-089

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS
UTM ZONE 17, NAD83 (CSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9996781

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY JARDIN DESIGN GROUP INC.
DRAWING No.: A-01, REV.7 (2017/NOV/01)
PROJECT No.: 17-18

DRAWING NOTES:

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EXISTING INVERTS FROM AS-BUILT DRAWINGS 20065-D, 40529-D

NOT FOR CONSTRUCTION

Project

7170 GOREWAY DRIVE
CITY OF MISSISSAUGA

Drawing

PRELIMINARY
SITE SERVICING PLAN

Stamp

PRELIMINARY

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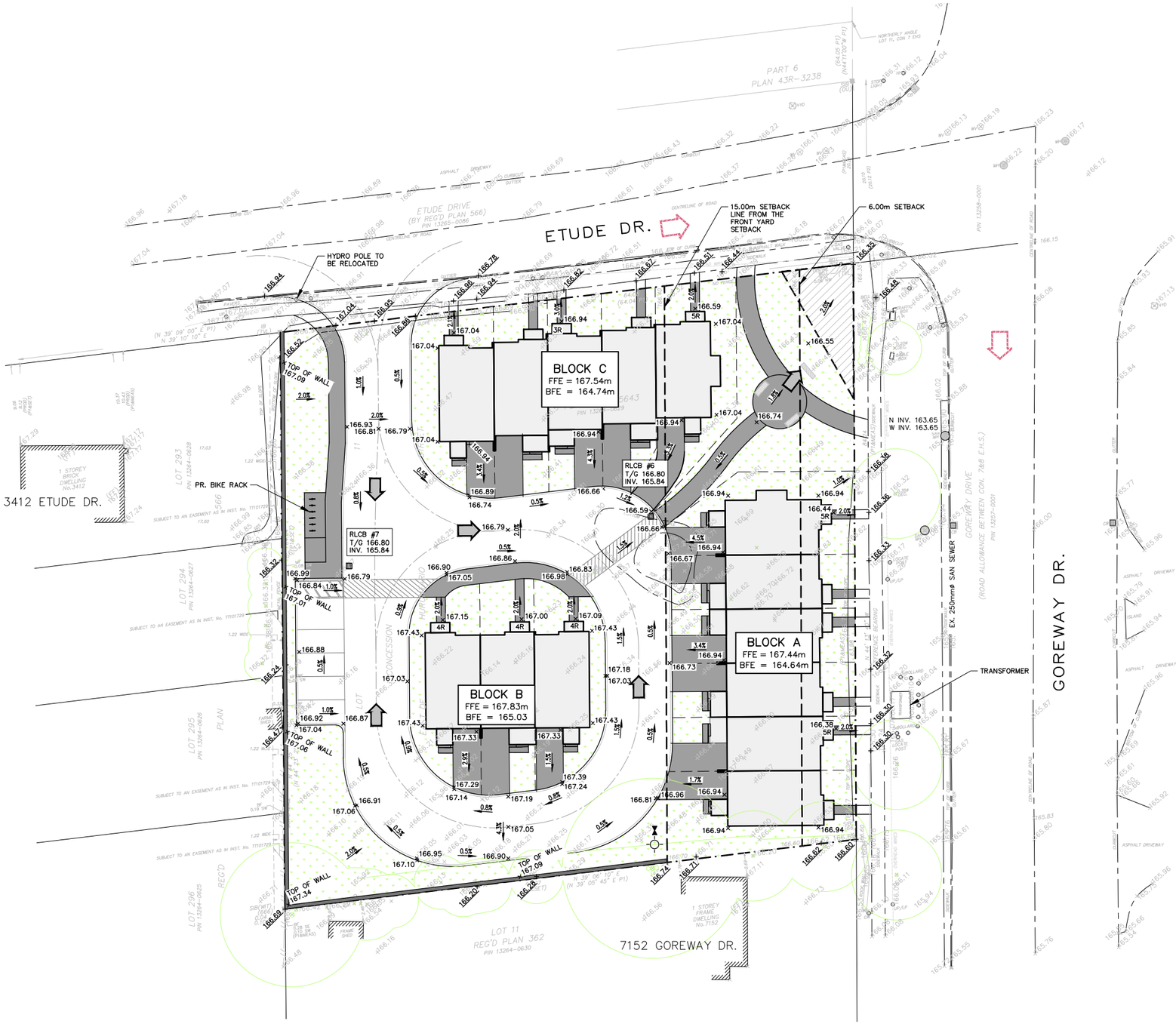
2800 High Point Drive
Suite 100
Milton, ON L9T 6P4
905 875-0026 T
905 875-4915 F
www.cfcrozier.ca

Drawn	Design	Project No.	
D.Z.	J.H.	1346-4573	
Check	Check	Scale	Dwg.
S.C.S.	K.J.F.	1:250	FIG. 1

5 0m 5 10 15 20
SCALE: 1:250



LEGEND

	PROPERTY LINE
	EXISTING CONTOUR (0.5m)
	EXISTING CONTOUR (1.0m)
x x	EXISTING FENCE
HP	EXISTING HYDRO POLE
x215.00	EXISTING GRADE
x215.00	PROPOSED GRADE
x215.00	PROPOSED GRADE (TO MATCH EXISTING)
	PROPOSED OVERLAND FLOW DIRECTION
	EXISTING DRAINAGE DIRECTION
	PROPOSED RETAINING WALL
	PROPOSED CATCHBASIN
	Survey Monument Found
	Survey Monument Set
SIB	*Standard Iron Bar*
IB	*Iron Bar*
(OU)	*Origin Unknown*
(WIT)	*Witness*
(TVL)	*Ted Van Lankveld, O.L.S.*
(666)	*Arthur Death O.L.S.*
P1	*Plan 43R-25643*
P2	*Plan 43R-3238*
FF	*Finished Floor*
BF	*Board Fence*
MF	*Metal Fence*
UP	*Utility Pole*
LP	*Light Pole*
GW	*Guy Wire*
HH	*Hand Hole*
PROD	*Denotes Production Distance*
WV	*Water Valve*
MH	*Maintenance Hole*
SAN	*Sanitary*
CB	*Catch Basin*
HYD	*Hydrant*

No.	ISSUE / REVISION	YYYY/MMM/DD
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Project
7170 GOREWAY DRIVE
CITY OF MISSISSAUGA

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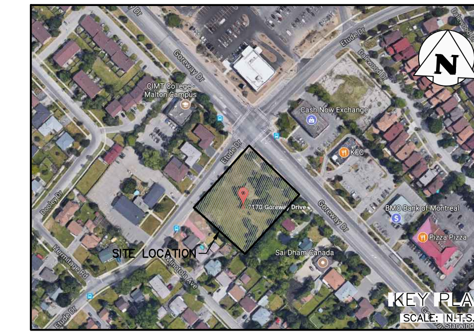
Drawn	Design	Project No.	
D.Z.	J.H.	1346-4573	
Check	Check	Scale	Dwg.
S.C.S.	K.J.F.	1:250	FIG. 2

5 0m 5 10 15 20
SCALE: 1:250



LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING FENCE
- EXISTING GRADE
- EXISTING DRAINAGE CATCHMENTS
- ID / A | IMP — EXISTING DRAINAGE CATCHMENT I.D. / AREA (ha) | % IMP
- EXISTING DRAINAGE DIRECTION
- DEVELOPMENT LIMITS
- ROW RUNOFF DIRECTION

No.	ISSUE / REVISION	YYYY/MMM/DD
0	ISSUED FOR ZBA/OPA	2017/DEC/15

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE DERIVED FROM THE CANADIAN GEODETIC DATUM BENCHMARK No. 448

ELEVATION = 162.55m

SURVEY NOTES:

SURVEY COMPLETED BY J.H. GELBLOOM SURVEYING LIMITED. (2017/MAY/08) PROJECT No.: 17-089

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS UTM ZONE 17, NAD83 (GSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9996781

SITE PLAN NOTES:

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DRAWING No.: A-01, REV.7 (2017/NOV/01)
PROJECT No.: 17-18

DRAWING NOTES:

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EXISTING INVERTS FROM AS-BUILT DRAWINGS 20065-D, 40529-D

Project

7170 GOREWAY DRIVE
CITY OF MISSISSAUGA

Drawing

PRE-DEVELOPMENT DRAINAGE PLAN

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905 875-0026 T
905 875-4915 F
www.cfcrozier.ca

Drawn	D.Z.	Design	J.H.	Project No.	1346-4573
Check	S.C.S.	Check	K.J.F.	Scale 1:250	Dwg. FIG. 3

5 0m 5 10 15 20
SCALE: 1:250

N

CONST.

TRUE

LEGEND

- PROPERTY LINE
- EXISTING CONTOUR (0.5m)
- EXISTING CONTOUR (1.0m)
- EXISTING DITCH
- EXISTING FENCE
- ×215.00 EXISTING GRADE
- PROPOSED DRAINAGE CATCHMENTS
- ID / A | IMP — CATCHMENT I.D. / AREA (ha) | % IMP
- PROPOSED DRAINAGE CONDITIONS
- PROPOSED STORMWATER MANAGEMENT POND
- DEVELOPMENT LIMITS
- ROW RUNOFF DIRECTION

5 0m 5 10 15 20
SCALE: 1:250

NOT FOR CONSTRUCTION

No.	ISSUE / REVISION	YYYY/MMM/DD
0	ISSUED FOR ZBA/OPA	2017/DEC/15

ELEVATION NOTE:

ELEVATIONS SHOWN ON THIS PLAN ARE DERIVED FROM THE CANADIAN GEODETIC DATUM BENCHMARK No. 448
ELEVATION = 162.55m

SURVEY NOTES:

SURVEY COMPLETED BY J.H. GELBLOOM SURVEYING LIMITED. (2017/MAY/08)
PROJECT No.: 17-089

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS
UTM ZONE 17, NAD83 (GSRS) (2010.0)

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SITE PLAN NOTES:

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PROJECT No.: 17-18

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EXISTING INVERTS FROM AS-BUILT DRAWINGS 20065-D, 40529-D

Project

7170 GOREWAY DRIVE
CITY OF MISSISSAUGA

Drawing

POST-DEVELOPMENT DRAINAGE PLAN

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Drawn	Design	Project No.	
D.Z.	J.H.	1346-4573	
Check	Check	Scale	Dwg.
S.C.S.	K.J.F.	1:250	FIG. 4