Gerrits
ENGINEERING

CIVIL | STRUCTURAL | MECHANICAL | ELECTRICAL

ENGINEERING | BUILDINGS | RELATIONSHIPS

BARRIE | ONTARIO | 705-737-3303
WWW.GERRENG.COM

June 21, 2024

Project Number 1614-001-21

SITE SERVICING REPORT

Regarding:

19 Lennox Drive
Barrie, Ontario

Prepared on behalf of:

Innisfil Beach Development Inc.

By:

GERRITS ENGINEERING LIMITED
222 Mapleview Dr. W., Suite 300
Barrie, ON L4N 9E7

Date:

June 21, 2024

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES & DRAWINGS

1. Introduction

Gerrits Engineering Ltd. (GEL) has been retained by Innisfil Beach Development Inc. (Client) to provide engineering services for a new commercial development located at 19 Lennox Drive, in the City of Barrie (City), located east of Ferndale Drive N., and west of the Hwy 400 N. This Functional Servicing Report (FSR) will be submitted to the City of Barrie and other required agencies in support of Site Plan Approval for the subject land, to demonstrate how the proposed development will connect to the existing municipal infrastructure. In particular, this FSR will examine the property's functional servicing with relation to:

- Water Supply
- Sanitary Sewerage
- Storm Sewerage

1.1. Supporting & Reference Documents

The following documents have been referenced in the preparation of this report:

- Ministry of the Environment, Guidelines for the Design of Sanitary Sewage Works and Water Works – 2008
- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- LSRCA Technical Guidelines for Stormwater Management Submissions – September 2016
- Hutchison Environmental Sciences Ltd. Phosphorous Budget Tool, March 30, 2012
- Ontario Building Code 2012 (O.B.C.)
- City of Barrie Sanitary Sewage Collection System Policies and Design Guideline, October 2017
- City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines, February 2022
- City of Barrie Water Transmission and Distribution Policies and Design Standard, June 2022

1.2. Subject Property

The property located at 440 Dunlop Street West is about 0.71 ha in size. It is legally described as Lot 1 of Plan 51M-199 in the City of Barrie. In general, the property has a gentle slope from the East to the West. Currently the site has one (2) rinks approximately 1128 m^2 while the remaining property is covered by an existing asphalt and gravel surface. The topographical information is based on survey completed by Rudy Mak Surveying LTD. and aerial mapping from Google Earth and Simcoe County Geographical Information Systems.

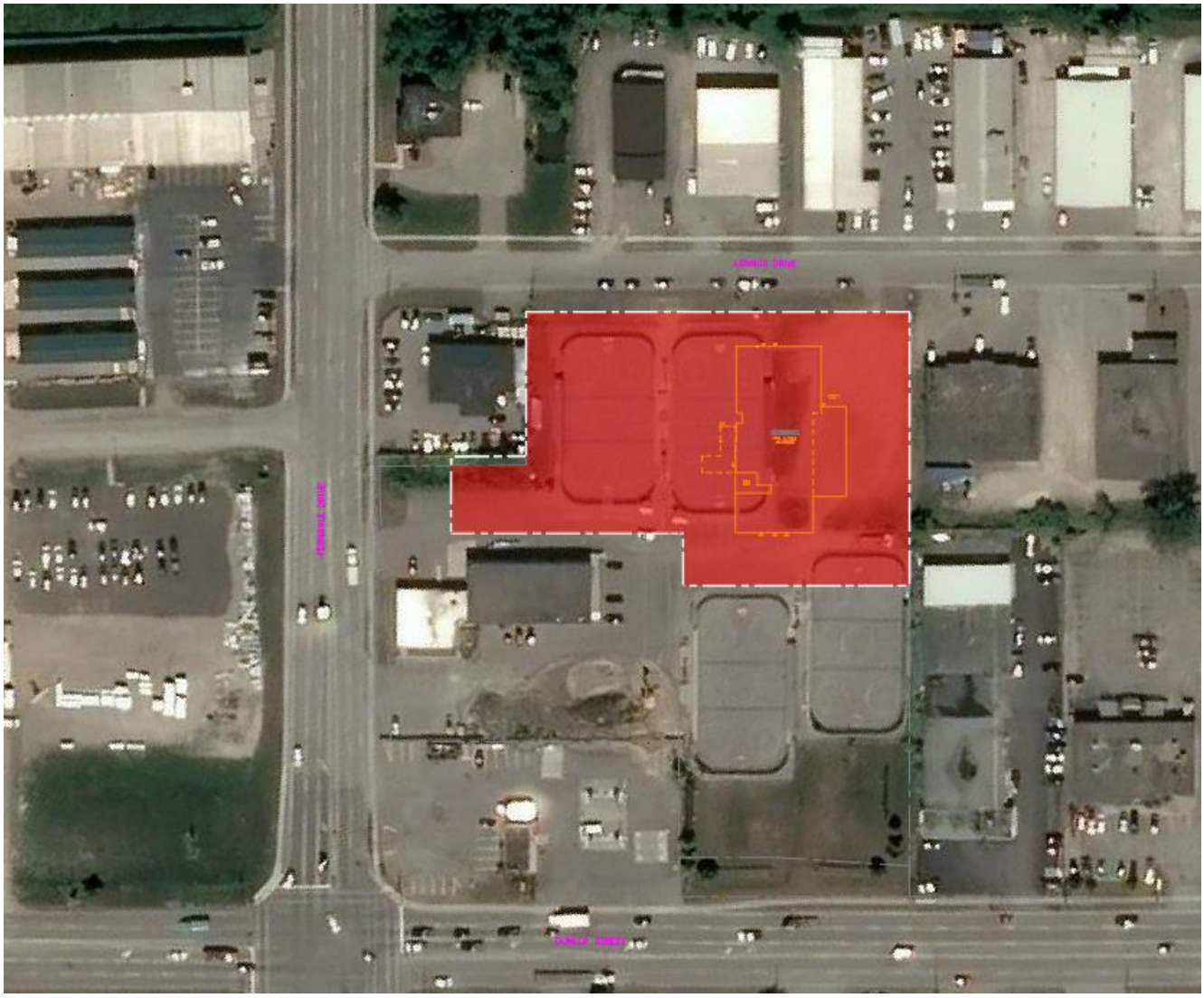


Figure 1 – Subject Property

1.3. Proposed Land Use

It is proposed to build a 6-storey hotel with 101 units on the eastern side of the property. The site entrance is proposed to on Lennox drive and Ferndale drive, with parking located around the building and mostly in the western of the property.

2. Servicing

2.1. Overview

It is proposed to service the Development by completing connections to the City's water and sanitary distribution & collection system. The Development's internal collection and distribution system will be constructed as per the City of Barrie and Ministry of Environment (MOE) design guidelines. The site's internal water distribution system will be designed to account for domestic and fire protection requirements.

2.2. Design Criteria

For the hotel usage an apartment equivalency was utilized. These values result in a more conservative water and wasterwater usage than a generic commercial application. A summary of the water and wastewater design criteria is as follows:

Serviced Population

- Density – Hotel (use Apartment equivalency) = 1.67 ppu
- Development residential population – 101 units x 1.67 ppu = 169 pers

Wastewater Criteria

- Average Day Flow (ADF) Residential = 225 L/c/d
- Extraneous flows (peak per developable ha) = 0.1 L/s/ha
- Peak Factor Harmon

Water Criteria

- Average Day Demand (ADD) Residential = 225 L/c/d
- Max Day Factor (MDF) (MOE: Table 3-3) = 4.90
- Peak Hour factor (PHF) (MOE: Table 3-3) = 7.40
- Minimum pressure in system at MDD = 275 kPa
- Maximum pressure in system at MDD = 700 kPa
- Minimum pressure in system at Peak Hour demand = 275 kPa
- Minimum pressure in system at Fire + MDD = 140 kPa

3. Sanitary Servicing

The projected daily average and peak sewage flows from the subject property are summarized in the table below.

Table 1 – Design Wastewater Flows

Average Daily Demand (Design)	51.8	m^3/d
	0.60	L/s
Peak Hour Flow (Design)	165.9	m^3/d
	1.92	L/s

3.1. Proposed Sanitary Connection Point

It is proposed that sanitary servicing to the hotel be made by provide a connection to the sanitary sewer on Lennox Dr. Assuming a pipe slope of 2% from the building to the mainline sewer, a 200mm diameter PVC pipe will be able to convey approximately 46 L/s. The anticipated peak flow of 2 L/s is well within the capacity range of the service connection in question. An inspection maintenance hole & maintenance hole is proposed to be installed as shown on the attached servicing plan in Appendix B.

3.2. Internal Sanitary Collection System

Sanitary sewers are proposed to be constructed in accordance with the City's Engineering Standards and the MOE guidelines to service the Development. The proposed sewers will consist of PVC DR35 pipe designed to meet minimum and maximum velocities under full flow conditions.

The City's Engineering Standards require manhole structures at maximum intervals of 110m and at bends or deflections in the sewer. The minimum manhole diameter will be 1200mm, with larger structures being incorporated as required in accordance with Ontario Provincial Standard Specifications (OPSS).

4. Water Supply and Distribution

4.1. Design Criteria

The water servicing of this Project has been considered from an internal perspective and the preliminary analysis of the onsite demands has been as per the City of Barrie and the MOE guidelines. The projected daily average, maximum day, and peak hourly flows from the subject property are summarized in the table below.

Table 2 – Design Water Flows

Average Daily Demand (Design)	38.0	m^3/d
	0.44	L/s
Maximum Day Demand (Design)	186.3	m^3/d
	2.16	L/s
Peak Hour Flow (Design)	281.4	m^3/d
	3.26	L/s

4.2. Internal Water Distribution System

As per section 10.8 of the MOE Design Guidelines for Drinking-Water Systems 2008, larger residences and buildings located far from the watermain connection should have a 25 mm (1 in) or larger service. Therefore, it is proposed to connect to the Municipal watermain within Lennox Dr. and install a new 100mm (4in) diameter water service at the minimum 1.7m depth below finished grade. The 100mm service ensures that the maximum velocity under normal operating conditions (average and maximum day demands) will not exceed 1.5 m/s, as per City Standard. All systems will be constructed and tested in accordance with the City of Barrie Engineering Standards and MOE Guidelines.

4.3. Fire Flow Analysis

The subject building is a 6 Storey Hotel. The subject building will be constructed such that it will be classified as Non-Combustible Construction (Type II). In addition it will have a fully supervised sprinkler system. For conservativism we have assumed that any vertical openings within the building are unprotected, and as such the Total Effective Area will be to consider the two largest adjoining floor areas plus 50% of all floors immediately above them to a maximum of eight. This results in a Total Effective Area of about 4,427 sq.m.

As per the Fire Underwriters Survey for Water Supply for Public Fire Protection (2020), the calculated minimum fire flows for this specific building and projected occupancy is 8,000 L/min (133.3 L/s). To calculate the available hydrant flow, the following equation is outlined in Section 4.3.2. of the design guidelines.

$Q_A = Q_T \times \sqrt{h_a/h_t}$

Where:

Q_A – Flow at 20 psi
Q_T – Flow at Test – 1,652 GPM
h_a – Pressure Drop Available (psi)
h_t – Pressure Drop at Test (psi)

Using the information from the hydrant test completed, the following is the calculated available hydrant flow:

$Q_A = Q_T \times \sqrt{h_a/h_t}$

$= 1{,}652 \times \sqrt{(60-20) / (60-50)}$

$= 3{,}304$ GPM (208.5 L/s)

As it can be seen, the anticipated hydrant flow will exceed the FUS calculated minimum flow criteria of 133.3 L/s.

5. Storm Drainage and Stormwater Management

A key component of the Development is the need to address environmental and related Stormwater Management (SWM) issues. These are examined in a framework aimed at meeting the City of Barrie, Lake Simcoe Region Conservation Authority (LSRCA), and MECP requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems.

It is understood that the objectives of the SWM plan are to:

- Protect life and property from flooding and erosion.
- Maintain water quality for ecological integrity, recreational opportunities etc.
- Protect and maintain groundwater flow regime(s).
- Protect aquatic and fishery communities and habitats.
- Maintain and protect significant natural features.
- Protect and provide diverse recreational opportunities that are in harmony with the environment.

5.1. Existing Drainage Conditions

The existing subject lands can be characterized with a single catchment consisting primarily of hardened surfaces that slopes towards Ferndale Dr North and Dunlop St West. Referencing the City of Barrie Engineering Design Criteria, we determine the runoff coefficient for the existing drainage conditions as follows:

Grass	=	995 m²	R	=	0.10	AR	=	99.5
Gravel	=	2,055 m²	R	=	0.60	AR	=	1,233.0
Asphalt	=	1,685 m²	R	=	0.95	AR	=	1,600.8
Concrete	=	2,350 m²	R	=	0.95	AR	=	2,232.5
					Total	AR	=	5,165.8

Site Area = 7,085 m² AR = 5,165.8 m² Weighted R = 0.73

5.2. Proposed Drainage Conditions

The proposed development will increase the imperviousness of the site and it is important to quantify this change to determine quantity control requirements. As per the proposed site's statistics, the post development weighted runoff coefficient is:

Grass	=	995 m²	R	=	0.10	AR	=	99.5
Asphalt	=	4,355 m²	R	=	0.95	AR	=	4,137.3
Building	=	1,300 m²	R	=	0.95	AR	=	1,235.0
Concrete	=	435 m²	R	=	0.95	AR	=	413.3
					Total	AR	=	5,885.1

Site Area = 7,085 m² AR = 5,885.1 m² Weighted R = 0.83

5.3. Hydrology Model Results

Given the size of the site, the Modified Rational Method will be used to determine the existing and anticipated SWM release rates:

Catchment Area	= 0.71 ha
Runoff Coefficient	= 0.73 (*existing condition*)
	= 0.83 (*proposed condition*)
Time of Concentration (t_c)	= 10 minutes
Rainfall Intensity	= Barrie WPCC IDF Curve Parameters
Peaking Factor (C_i)	= 1.00 (2-10 year design periods)
	= 1.10 (25 year design period)
	= 1.20 (50 year design period)
	= 1.25 (100 year design period)
Peak Runoff Rate (Q_r)	= C x I x A x 360^{-1}

Applying the above results in the following release rates:

Table 1: Existing & Post Development Uncontrolled Release Rates

	2 year (m^3/s)	5 year (m^3/s)	10 year (m^3/s)	25 year (m^3/s)	50 year (m^3/s)	100 year (m^3/s)
Existing Condition (allowable release rate)	0.12	0.16	0.18	0.23	0.28	0.32
Post Development (uncontrolled rate)	0.14	0.18	0.21	0.27	0.32	0.37

5.4. Quantity Control

The development of this Site increases the existing stormwater runoff rate above that of the allowable release rate. Therefore, site quantity controls have been designed to closely approximate the above determined allowable release rates. The release rate from the proposed orifice has been sized using the following equation:

$Q = cA\sqrt{2gh}$

Q = allowable release rate
A = orifice area
c = orifice coefficient = 0.80
g = gravitational constant = $9.81 m/s^2$
h = high water level over center of orifice

Applying the above equation with the various control points on site, the proposed outlet will restrict the flows from the site to a rate of less than the allowable release rates for all storm events.

Table 2: Existing & Post Development Controlled Release Rates

	2 year (m^3/s)	5 year (m^3/s)	10 year (m^3/s)	25 year (m^3/s)	50 year (m^3/s)	100 year (m^3/s)
Existing Condition (allowable release rate)	0.12	0.16	0.18	0.23	0.28	0.32
Post Development (controlled rate)	0.08	0.10	0.12	0.14	0.16	0.17
Required Storage Volume (m^3)	45	59	68	92	114	132

As per the above table, the maximum quantity storage requirements are calculated to be approximately 132 m^3. The proposed storage will be provided via subsurface and surface detention storage with a total available quantity control volume of approximately 157m^3, which exceeds storage requirements. Detailed calculations have been provided in Appendix A. In the event of a blockage or the regulatory event, the site has been graded to allow for surcharging and overland flow towards the South of the site

5.5. Stormwater Quality Control During Construction

To ensure stormwater quality control during construction, it is imperative that effective environmental and sedimentation controls be in place throughout the entire area subject to construction activities. With the requirement of earth grading, there will be a potential of soil erosion. It is therefore recommended that the following be implemented to assist in achieving acceptable stormwater runoff quality:

- Restoration of exposed surfaces with vegetation and non-vegetative material as soon as construction schedules permit;
- Installation of filter strips, silt fences and rock check dams or other similar facilities throughout the site, and specifically during all construction activities;
- Reduce stormwater drainage velocities where possible;
- Ensure that disturbed areas that are left inactive for more than 30 days shall be vegetated and stabilized as instructed by the Engineer;
- Minimize the amount of existing vegetation removed.

5.6. Permanent Quality Control

The objective of the permanent SWM quality controls will be to ensure MECP's Enhanced Protection. The proposed development will increase the imperviousness of the site. It is important to quantify this increase to evaluate the potential downstream impacts. As per the site's assumed statistics, the post development Total Imperviousness is:

Impervious Area = 6,090 m^2
Total Area = 7,085 m^2

$TIMP = A_{IMP} / A_{Total}$
$= (A_{ASPH} + A_{BLDG} + A_{CONC}) / A_{Total}$
$= 6090\ m^2 / 7085\ m^2$
$= 86.0\%$

Given the nature of the site it is proposed that a Low Impact Development method be utilized to provide quality control. On-site controls in the form of an Oil/Grit Separator and Infiltration Gallery are proposed to be used as the means of addressing quality controls for runoff from the hardened surfaces.

Oil/Grit Separator

The development's parking area poses a risk to stormwater quality through the collection of grit, salt, sand and oils on the paved surface. A CDS or equivalent treatment unit is proposed in order to pre-treat the stormwater before being infiltrated or released from this site to the MOE's Enhanced or Level 1 Protection standard. This MOE standard stipulates a Total Suspended Solids (TSS) removal of at least 80%. The CDS PMIU2015_4 model will treat the post development flows to the required MOE quality standard, with a TSS removal rate of approximately 91.1%. The design criteria and background information on how the CDS unit is sized is provided within Appendix A.

5.7. Volume Control

In accordance with the LSRCA Technical Guidelines for Stormwater Management Submissions – April 2022, section 3.2.4 Stormwater Volume Control must be provided for nonlinear redevelopment projects creating 0.5 or more hectares of impervious surfaces. The runoff from a 25mm event from the net increase in impervious area is to be captured and retained/treated on-site. As the proposed works do not create more than 0.5ha of new impervious surfaces, the site is exempt from Volume Control.

5.8. Water Balance

The proposed development will increase the impervious cover of the site, which decreases the infiltration of groundwater. This decrease in infiltration reduces groundwater recharge and soil moisture replenishment. Therefore, it is important to maintain this natural hydrologic cycle as much as possible. Paragraph 6.3 of the LSRCA Watershed Development Policies state that "the Stormwater Management plan must make every feasible effort to maintain the pre-development infiltration and evapotranspiration rates and temperatures to the receiving waterbody and watershed".

Referencing Section 3.2 of the MOE "Stormwater Management Planning and Design Manual, (March 2003), and the historical rainfall distribution for the area, the following review of the water balance has been completed. The site area is approximately 0.71 ha in area, and referencing the Simcoe County Soil Maps, we know the soil is typically characterized as an Alliston Sandy Loam within the soil group of AB. Referencing Table 3.1 of the MOE manual, an urban lawn ground cover comprised of a Sandy Loam, the existing site has an average annual evapotranspiration of 525 mm.

Using this information, combined with the calculated infiltration factor determined for the subject property and the LSRCA water balance spreadsheet we calculate about 330 m^3 of infiltration per year.

As per the Lake Simcoe Protection Plan's definition of a major development, the subject site falls under this category. However, the site has various constraints that restrict it from achieving 25mm of infiltration from all impervious surfaces. Notably amongst this is the groundwater being on average within 0.9m of the finished grade elevation which eliminates the ability to complete any infiltration on the site and does not allow the site to meet the Volume Control criteria of the LSRCA. It should be noted however, that through the re-development of the site, the anticipated post-development surface infiltration exceeds the existing development condition through the introduction of more pervious surfaces. The following chart details the total infiltration with detailed calculations of these methods included in Appendix A.

	Total Infiltration (m^3/yr)
Pre-Development	330
Post-Development *(uncontrolled)*	330

5.9. Phosphorous Budget

In July 2009, the Lake Simcoe Protection Plan (LSPP) was finalized as a result of a collaboration and partnership among various agencies including, but not limited to, the MOE and the LSRCA. Through the study of Lake Simcoe's ecological health, it was determined that there is an over-abundance of phosphorous within Lake Simcoe. As per Section 4.8-DP of the LSPP, new developments are to be demonstrate "through an evaluation of anticipated changes in phosphorous loading between the pre & post-development, how the loadings shall be minimized".

The existing site generates approximately 0.35 kg of phosphorous annually and the proposed lands will generate approximately 0.35 kg of phosphorous annually. The following chart details the anticipated phosphorous loadings for the pre- and uncontrolled post-development conditions.

	Total P (kg/yr)
Pre-Development	0.346
Uncontrolled Post Development	0.346

5.10. Erosion and Sediment Control

To ensure Stormwater runoff quality is controlled during construction, an erosion and sediment control strategy will be implemented to mitigate transportation of silt off-site to the existing roads and sewers. It is imperative that effective controls be put in place and maintained until all areas are stabilized with surface cover.

All erosion and sediment control Best Management Practices (BMP) shall be designed, constructed and maintained in accordance with the NVCA's erosion control requirements.

Items that will be addressed for both temporary and permanent erosion and sediment controls are based on the following:

- Site location description and area;
- Existing and proposed land use;
- Vegetative cover;
- Existing drainage routes;
- Proposed site works;
- Proposed outlets;
- Permits required;
- Sediment filters and barriers - silt fences;
- Construction entrance location;
- Protection to catch basins and ditch inlets;

To prevent construction generated sediments from entering the storm sewers or leaving the site by overland flow, the following measures should be implemented during the construction phase:

- Temporary sediment control fencing should be erected around the perimeter of the grading activities.
- Temporary sediment fabric and stone filters should be installed on existing and proposed catch basins until surface cover has been stabilized.
- A temporary construction access mud mat should be implemented to reduce the amount of materials that may be transported off site.
- Construction during drier months should be monitored for wind-borne transport of sediments. At the direction of the engineer, the contractor may be directed to water down exposed earth areas with an aqueous solution of calcium chloride.
- All disturbed areas not under immediate construction for 30 days, or not intended for building activities within a 3-month time period, should be stabilized with seeding.

Built up sediment should be removed and disposed off-site at least once a month, or more frequently as directed by the engineer. Details have been provided on drawing ESC-1 and can be found in Appendix C.

6. Conclusions

A summary of the servicing recommendations are as follows:

- **Water Servicing** – it is proposed to connect to the existing Municipal Watermain on Lennox Dr. and install a new 100mm (4in) diameter Water Service to provide water servicing to the subject site. A 150mm diameter PVC pipe will be provided to feed the Siamese connection and fire water demands.
- **Sanitary Servicing** – it is proposed to connect to the existing Municipal sanitary sewer on Lennox Dr. with an inspection maintenance hole to provide sanitary servicing to the subject site.
- **Stormwater Drainage and Management** – stormwater runoff from the proposed building and hardened surfaces are proposed to be controlled via an orifice plate and a combination of subsurface and surface storage within the parking area. Given the zoning of the subject site and high groundwater elevations, infiltration based methods are not allowed. An OGS unit will be provided on site to provide best efforts at quality control.

The analysis and conceptual design outlined in this report demonstrates that the servicing of this proposed Development is feasible, is based on sound engineering principles and, the development will become a cohesive part of the City of Barrie.

All of which is respectfully submitted,

Gerrits Engineering Ltd.

Jeff McCuaig, P.Eng
Director, Civil Engineer

Appendix A
Design Calculations

COMMERCIAL DEVELOPMENT

SANITARY FLOW CALCULATIONS

CLIENT: Dunlop/Ferndale Development **Date:** 7-Nov-23

PROJECT: ProposedCommercial Development **Design** Jeff McCuaig

FILE: 1614-001

n = 0.013
M = 1 + (14 / (4 + (P / 1000) ^ 0.5)) 2 <= "M" <= 4
Qp = P * Q * M / 86400 Q = 450 L/cap/day

Qtot = Qp + Qi

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE	
Commercial (Hotel)	1.67 people/unit	225 L/cap/d	excluding extraneous flows
Total Developed Area	0.71 hectare		
Extraneous Flow		0.23 L/s/ha	

	SINGLE UNITS	DEVELOPMENT AREA (Ha)	TOTAL UNITS	POPULATION (P)		Extraneous Flow (L/s)	PEAKING FACTOR (M)	AVERAGE FLOW (L/s)	PEAK FLOW (L/s)
Commercial (Hotel)	101	0.71	101	169		0.16	4.00	0.60	1.92
TOTAL UNITS	**101**	**0.71**	**101**	**169**		**0.16**	**4.00**	0.60	1.92

COMMERCIAL DEVELOPMENT

WATER FLOW CALCULATIONS

CLIENT: Dunlop/Ferndale Development **Date:** 7-Nov-23

PROJECT: ProposedCommercial Development **Design** Jeff McCuaig

FILE: 1614-001

ASSUMPTIONS

DESCRIPTION	DENSITY	FLOW RATE	PEAKING FACTORS*	
			MAX DAY FACTOR	4.90
Commerical (Hotel)	1.67 people/unit	225 L/cap/d	PEAK RATE FACTOR	7.40

*From MOE Manual based on Population of 3001 - 10,000

Total Developed Area 0.71 hectare

PHASE	SINGLE UNITS		TOTAL UNITS	POPULATION (P)	COMMERCIAL AREA (ha)	COMMERCIAL EQUIVALENT POPULATION	EQUIVALENT POPULATION	AVERAGE FLOW (L/s)	MAX DAY FLOW (L/s)	PEAK FLOW (L/s)
Commercial (Hotel)	101		101	169			169	0.44	2.16	3.26
TOTAL UNITS	**101**	**0**	**101**	**169**		**0**	**169**	**0.44**	**2.16**	**3.26**

Project: 19 Lennox Dr.
Project Number 1614-001
Location City of Barrie

1 FUS Formula

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

where: F = required fire flow in litres per minute
C= the Coefficient related to the type of construction; and
A = the total flow area in square metres (including all storeys but excluding basements at least 50% below grade)

Type of Construction: non-combustible construction

C = 0.8
A = 4427

F = 12000 L/min
200 L/s

2 Occupancy Adjustment

Type of Occupancy:	Combustible	
Hazard Allowance:		-15%
Adjusted Fire Flow		10200 L/min

3 Sprinkler Adjustment

		CREDIT	
NFPA 13 sprinkler standard:	Yes	30%	
Standard water supply:	Yes	10%	
Fully Supervised system:	Yes	10%	
Sprinkler Credit			5100 L/min

4 Exposure Adjustment

		Charge	
North Side	3.1 to 10m	11%	
East Side	10.1 to 20m	8%	
South Side	10.1 to 20m	8%	
West Side	>30m	0%	
Exposures Surcharge		3240	L/min

Total Required Fire Flow	8000 L/min
	133.3 L/sec

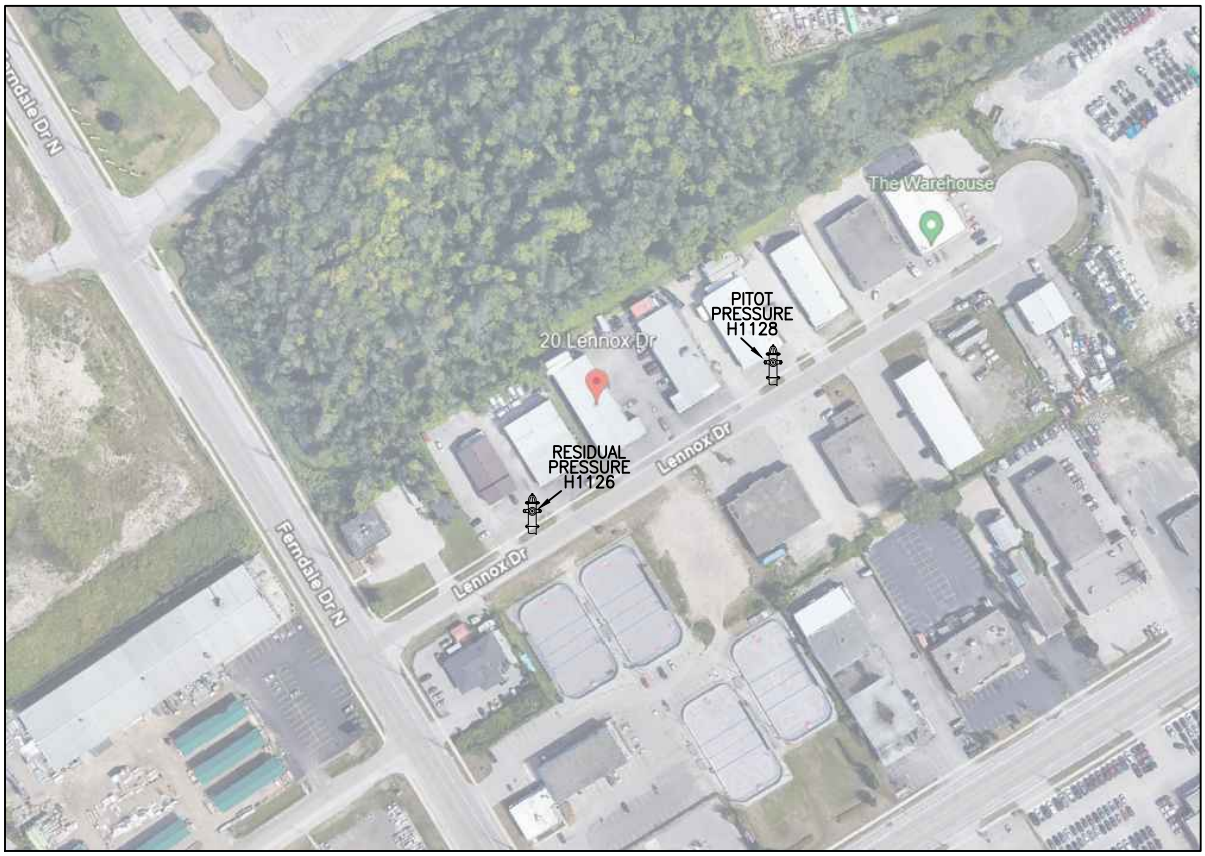
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : JUNE 13, 2024

LOCATION : 20 LENNOX DRIVE
BARRIE
ONTARIO

TEST BY : LEN K. – T.H.



STATIC PRESSURE : 60 PSI

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO–EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1–1/8	0.995	60	57	282
2	1	1–3/4	0.90	59	45	597
3	1	2–1/2	0.90	59	30	924
4	2	2–1/2	0.90	50	24	1652

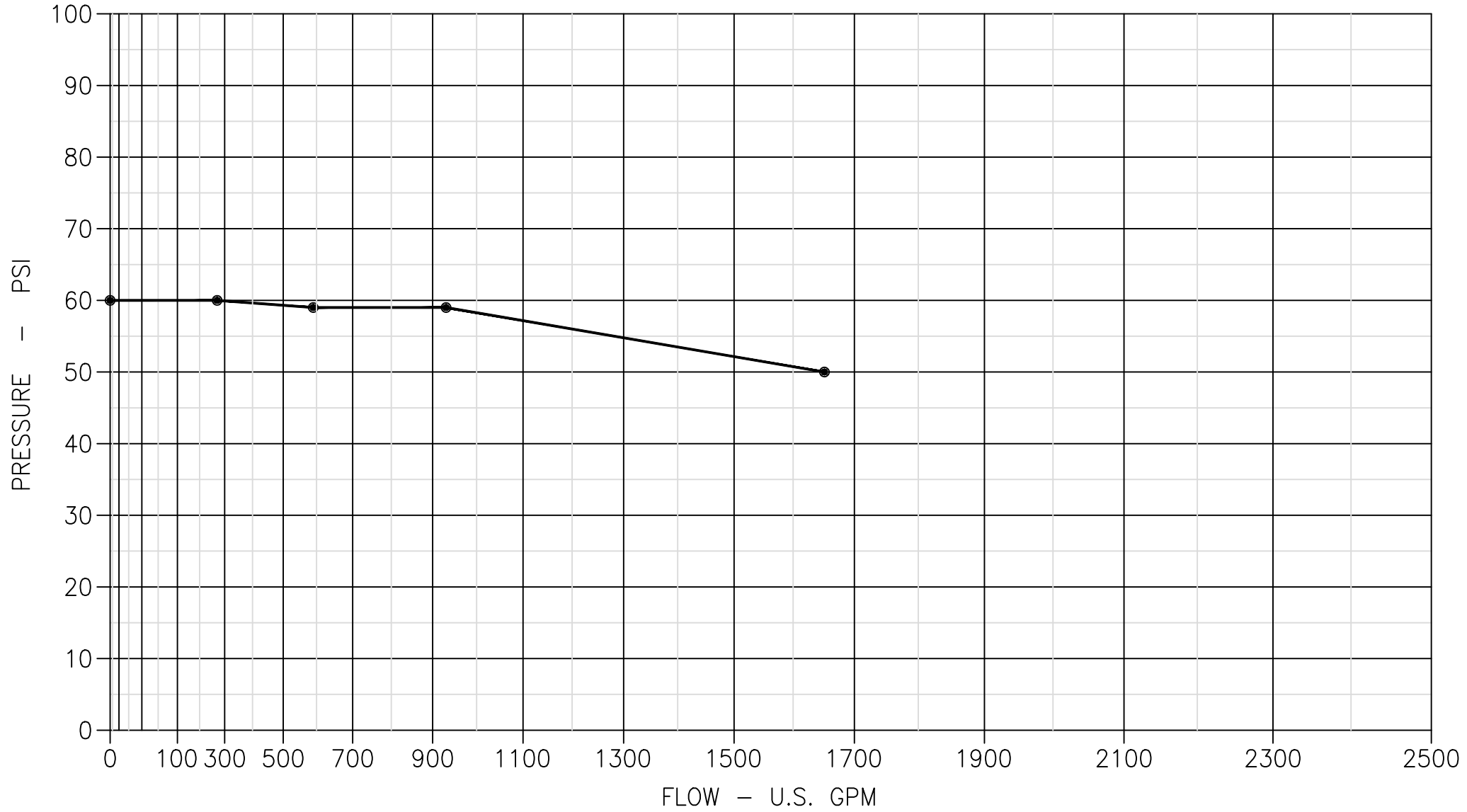
FIRST FOR FIRE, LIFE SAFETY & SECURITY

VIPOND INC

est. 1945

20 LENNOX DRIVE	BY : LEN K. – T.H.
BARRIE	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : JUNE 13, 2024

STATIC:	RESIDUAL:		FLOW:
60 PSI	TEST#1 60 PSI	@	282 GPM
	TEST#2 59 PSI	@	597 GPM
	TEST#3 59 PSI	@	924 GPM
	TEST#4 50 PSI	@	1652 GPM



Calculation of Weighted Runoff Coefficient

Existing & Proposed Development Areas and Sub-Areas

Area ID	Total Area	0.10 Grass	0.60 Gravel	0.95 Asphalt	0.95 Building	0.95 Conc.	Weighted Rational Coefficient
Existing Development	7085	995	2055	1685	0	2350	0.73
X - 1	7085	995	2055	1685	0	2350	0.73
Proposed Development	7085	995	0	4355	1300	435	0.83
P - 1	1030	0	0	0	1030	0	0.95
P - 2	200	0	0	0	200	0	0.95
P - 3	1680	218	0	1310	0	152	0.84
P - 4	850	45	0	665	0	140	0.91
P - 5	770	95	0	517	70	88	0.85
P - 6	1840	277	0	1563	0	0	0.82
P - 7	460	120	0	300	0	40	0.73
P - 8	120	120	0	0	0	0	0.10
P - 9	135	120	0	0	0	15	0.19
CONTROLLED 1							
P - 6	1840	277	0	1563	0	0	0.82
CONTROLLED 2							
P-1 - P-5, P-7 ,P-20	5420	506	0	3194	1300	420	0.87
UNCONTROLLED							
P-8 - P-9	255	240	0	0	0	15	0.15
External Catchment	430	28	0	402	0	0	0.89
P - 20	430	28	0	402	0	0	0.89

STORM SEWER DESIGN

Q = 0.0028*C*I*A (cms)
C: RUNOFF COEFFICIENT
I: RAINFALL INTENSITY = A/(Tc+B)^C
A: AREA (ha)

	A	B	C
IDF Curve Parameters (5-Yr Return Period):	843.019	4.582	0.763

PROJECT NUMBER: 1614-001
PROJECT NAME: Dunlop Ferndale Development
DESIGN SHEET NO.: STM-2
DATE: 10/4/2023

STREET NAME	SUBBASIN	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	SLOPE	DIA.	Q FULL	V FULL	% FULL
		FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(m/s)	
	P-2				0.95	0.02	0.02										
	P-3	CB #1	CBMH #1	43.4	0.84	0.168	0.14	0.16	10.00	0.75	109.11	0.05	0.50	300	0.07	0.97	71%
	P-4	CBMH #1	MH #1	12.4	0.91	0.085	0.08	0.24	10.75	0.18	105.02	0.07	0.50	375	0.12	1.12	56%
	P-5	CB #2	MH #1	42.7	0.85	0.077	0.07	0.07	10.00	0.52	109.11	0.02	1.00	300	0.10	1.37	20%
	P-1				0.95	0.10	0.10										
	P-20	MH #1	CBMH #2	46.3	0.89	0.04	0.04	0.44	10.93	0.61	104.07	0.13	0.50	450	0.20	1.27	63%
	P-6	CB #3	CBMH #2	28.8	0.82	0.184	0.15	0.15	10.00	0.35	109.11	0.05	1.00	300	0.10	1.37	47%
	P-7	CBMH #2	OGS	15.7	0.73	0.05	0.03	0.62	11.54	0.21	101.06	0.17	0.50	450	0.20	1.27	87%
	/	OGS	MH #3	32.9	/	/	/	0.62	11.75	0.43	100.08	0.17	0.50	450	0.20	1.27	86%

Existing Development Runoff Calculation

Uncontrolled Release Rates

	Total Site	
Area	0.71	ha
Runoff Coefficient	0.73	
Time of Concentration	10	min
	Interpolated	
Return Rate	2	year
Coefficient	1	
Rainfall Intesity	83.1	mm/hr
Release Rate	0.12	m^3/s
Return Rate	5	year
Coefficient	1	
Rainfall Intesity	109.1	mm/hr
Release Rate	0.16	m^3/s
Return Rate	10	year
Coefficient	1	
Rainfall Intesity	126.4	mm/hr
Release Rate	0.18	m^3/s
Return Rate	25	year
Coefficient	1.1	
Rainfall Intesity	148.3	mm/hr
Release Rate	0.23	m^3/s
Return Rate	50	year
Coefficient	1.2	
Rainfall Intesity	164.1	mm/hr
Release Rate	0.28	m^3/s
Return Rate	100	year
Coefficient	1.25	
Rainfall Intesity	180.4	mm/hr
Release Rate	0.32	m^3/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	**675.586**	**4.681**	**0.780**
5	**843.019**	**4.582**	**0.763**
10	**976.898**	**4.745**	**0.760**
25	**1133.123**	**4.734**	**0.756**
50	**1251.473**	**4.847**	**0.753**
100	**1383.628**	**4.905**	**0.754**

Modified Rational Method

$$Q = C_i C I A / 360$$

Where:

Q -	Flow Rate (m3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

Proposed Development Runoff Calculation

Uncontrolled Release Rates

	Total Site	
Area	0.71	ha
Runoff Coefficient	0.83	
Time of Concentration	10	min
	Interpolated	
Return Rate	2	year
Coefficient	1	
Rainfall Intesity	83.1	mm/hr
Release Rate	0.14	m^3/s
Return Rate	5	year
Coefficient	1	
Rainfall Intesity	109.1	mm/hr
Release Rate	0.18	m^3/s
Return Rate	10	year
Coefficient	1	
Rainfall Intesity	126.4	mm/hr
Release Rate	0.21	m^3/s
Return Rate	25	year
Coefficient	1.1	
Rainfall Intesity	148.3	mm/hr
Release Rate	0.27	m^3/s
Return Rate	50	year
Coefficient	1.2	
Rainfall Intesity	164.1	mm/hr
Release Rate	0.32	m^3/s
Return Rate	100	year
Coefficient	1.25	
Rainfall Intesity	180.4	mm/hr
Release Rate	0.37	m^3/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	**675.586**	**4.681**	**0.780**
5	**843.019**	**4.582**	**0.763**
10	**976.898**	**4.745**	**0.76**
25	**1133.123**	**4.734**	**0.756**
50	**1251.473**	**4.847**	**0.753**
100	**1383.628**	**4.905**	**0.754**

Modified Rational Method

$$Q = C_i CIA / 360$$

Where:

Q -	Flow Rate (m3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

Proposed Development Runoff Calculation

Uncontrolled Release Rates

	P-1 - P-5, P-7 ,P-20 CONTROLLED 2	P - 6 CONTROLLED 1	P-8 - P-9 UNCONTROLLED
Area	0.54 ha	0.18 ha	0.03 ha
Runoff Coefficient	0.87	0.82	0.15
Time of Concentration	10 min	10 min	10 min
	Interpolated	Interpolated	Interpolated
Return Rate	2 year	2 year	2 year
Coefficient	1	1	1
Rainfall Intesity	83.1 mm/hr	83.1 mm/hr	83.1 mm/hr
Release Rate	0.109 m^3/s	0.035 m^3/s	0.001 m^3/s
Return Rate	5 year	5 year	5 year
Coefficient	1	1	1
Rainfall Intesity	109.1 mm/hr	109.1 mm/hr	109.1 mm/hr
Release Rate	0.143 m^3/s	0.046 m^3/s	0.001 m^3/s
Return Rate	10 year	10 year	10 year
Coefficient	1	1	1
Rainfall Intesity	126.4 mm/hr	126.4 mm/hr	126.4 mm/hr
Release Rate	0.166 m^3/s	0.053 m^3/s	0.001 m^3/s
Return Rate	25 year	25 year	25 year
Coefficient	1.1	1.1	1.1
Rainfall Intesity	148.3 mm/hr	148.3 mm/hr	148.3 mm/hr
Release Rate	0.214 m^3/s	0.069 m^3/s	0.002 m^3/s
Return Rate	50 year	50 year	50 year
Coefficient	1.2	1.2	1.2
Rainfall Intesity	164.1 mm/hr	164.1 mm/hr	164.1 mm/hr
Release Rate	0.258 m^3/s	0.083 m^3/s	0.002 m^3/s
Return Rate	100 year	100 year	100 year
Coefficient	1.25	1.25	1.25
Rainfall Intesity	180.4 mm/hr	180.4 mm/hr	180.4 mm/hr
Release Rate	0.296 m^3/s	0.095 m^3/s	0.002 m^3/s

Storm (yrs)	Coeff A	Coeff B	Coeff C
2	**675.586**	**4.681**	**0.780**
5	**843.019**	**4.582**	**0.763**
10	**976.898**	**4.745**	**0.76**
25	**1133.123**	**4.734**	**0.756**
50	**1251.473**	**4.847**	**0.753**
100	**1383.628**	**4.905**	**0.754**

Modified Rational Method

$Q = C_iCIA / 360$

Where:

Q -	Flow Rate (m3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

STAGE - STORAGE - DISCHARGE - CB#3 Ponding

Elevation	Area	Vol.	Cum. Volume	Storage Vol.	Depth 1	Flow 1	Major Storm Control Weir				Total Flow
(m)	(m^2)	(m^3)	(m^3)	(m^3)	(m)	(m^3/s)	Depth 3 (m)	Overflow (x)	Rectangular 'C'	Flow (m^3/s)	(m^3/s)
235.50	0	0.0	0.0	0.0	1.58	0.0197	0.00	0.00		0.0000	0.0197
235.51	1	0.0	0.0	0.0	1.59	0.0198	0.00	0.00		0.0000	0.0198
235.52	5	0.0	0.1	0.1	1.60	0.0198	0.00	0.00		0.0000	0.0198
235.53	11	0.1	0.2	0.2	1.61	0.0199	0.00	0.00		0.0000	0.0199
235.54	19	0.2	0.4	0.4	1.62	0.0199	0.00	0.00		0.0000	0.0199
235.55	30	0.3	0.7	0.7	1.63	0.0200	0.00	0.00		0.0000	0.0200
235.56	43	0.4	1.1	1.1	1.64	0.0201	0.00	0.00		0.0000	0.0201
235.57	58	0.6	1.7	1.7	1.65	0.0201	0.00	0.00		0.0000	0.0201
235.58	76	0.8	2.4	2.4	1.66	0.0202	0.00	0.00		0.0000	0.0202
235.59	96	1.0	3.4	3.4	1.67	0.0202	0.00	0.00		0.0000	0.0202
235.60	118	1.2	4.6	4.6	1.68	0.0203	0.00	0.00		0.0000	0.0203
235.61	142	1.4	6.0	6.0	1.69	0.0204	0.00	0.00		0.0000	0.0204
235.62	167	1.7	7.7	7.7	1.70	0.0204	0.00	0.00		0.0000	0.0204
235.63	195	1.9	9.6	9.6	1.71	0.0205	0.00	0.00		0.0000	0.0205
235.64	224	2.2	11.8	11.8	1.72	0.0205	0.00	0.00		0.0000	0.0205
235.65	254	2.5	14.4	14.4	1.73	0.0206	0.00	0.00		0.0000	0.0206
235.66	286	2.9	17.2	17.2	1.74	0.0207	0.00	0.00		0.0000	0.0207
235.67	320	3.2	20.4	20.4	1.75	0.0207	0.00	0.00		0.0000	0.0207
235.68	356	3.6	24.0	24.0	1.76	0.0208	0.00	0.00		0.0000	0.0208
235.69	393	3.9	27.9	27.9	1.77	0.0208	0.00	0.00		0.0000	0.0208
235.70	432	4.3	32.3	32.3	1.78	0.0209	0.00	0.00		0.0000	0.0209
235.71	473	4.7	37.0	37.0	1.79	0.0210	0.00	0.00		0.0000	0.0210
235.72	515	5.1	42.1	42.1	1.80	0.0210	0.00	0.00		0.0000	0.0210
235.73	559	5.6	47.7	47.7	1.81	0.0211	0.00	0.00		0.0000	0.0211
235.74	605	6.0	53.8	53.8	1.82	0.0211	0.00	0.00		0.0000	0.0211
235.75	652	6.5	60.3	60.3	1.83	0.0212	0.00	0.00		0.0000	0.0212

Orifice 1	
Diameter	75 mm
Elevation	233.88 m
Orifice Constant	0.8
Orifice Centroid	233.92 m

Elevation	Outflow	Storage	Storage
(m)	(m3/sec)	(ha - m)	(m3)
235.50	0.0197	0	0
235.54	0.0199	0.00004	0
235.58	0.0202	0.00024	2
235.62	0.0204	0.00077	8
235.67	0.0207	0.00204	20
235.71	0.0210	0.00370	37
235.75	0.0212	0.00603	60

STAGE - STORAGE - DISCHARGE - Surbsurface Storage

Elevation	Area	Vol.	Cum. Volume	Storage Vol.	Depth 1	Flow 1	Major Storm Control Weir				Total Flow
(m)	(m^2)	(m^3)	(m^3)	(m^3)	(m)	(m^3/s)	Depth 3 (m)	Overflow (x)	Rectangular 'C'	Flow (m^3/s)	(m^3/s)
233.61	85.2	0	0.0	0	0.00	0.0000	0.00	0.00		0.0000	0.0000
233.76	85.2	12.1	12.1	12.1	0.00	0.0000	0.00	0.00		0.0000	0.0000
233.91	85.2	12.1	24.3	24.3	0.06	0.0408	0.00	0.00		0.0000	0.0408
234.06	85.2	12.1	36.4	36.4	0.21	0.0788	0.00	0.00		0.0000	0.0788
234.21	85.2	12.1	48.6	48.6	0.36	0.1036	0.00	0.00		0.0000	0.1036
234.36	85.2	12.1	60.7	60.7	0.51	0.1236	0.00	0.00		0.0000	0.1236
234.51	85.2	12.1	72.8	72.8	0.66	0.1408	0.00	0.00		0.0000	0.1408
234.66	85.2	12.1	85.0	85.0	0.81	0.1561	0.00	0.00		0.0000	0.1561
234.81	85.2	12.1	97.1	97.1	0.96	0.1700	0.00	0.00		0.0000	0.1700

Orifice 2	
Diameter	250 mm
Elevation	233.73 m
Orifice Constant	0.8
Orifice Centroid	233.86 m

Elevation	Outflow	Storage	Storage
(m)	(m3/sec)	(ha - m)	(m3)
233.61	0.0000	0	0
233.91	0.0408	0.00243	24
234.21	0.1036	0.00486	49
234.36	0.1236	0.00607	61
234.51	0.1408	0.00728	73
234.66	0.1561	0.00850	85
234.81	0.1700	0.00971	97

CHECKING STORAGE RELEASE CHARACTERISTICS OF SURFACE PONDING
- CITY OF BARRIE IDF EQUATIONS -

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 2

100 Year Post Development Flow	0.296	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
233.61	0.00	0.00	0.00
233.91	0.04	0.00	24.28
234.21	0.10	0.00	48.55
234.36	0.12	0.01	60.69
234.51	0.14	0.01	72.83
234.66	0.16	0.01	84.97
234.81	0.17	0.01	97.11

P-1 - P-5, P-7 ,P-20

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.03	0.000	2	2
2	0.08	0.003	5	6
3	0.11	0.011	6	12
4	0.14	0.021	7	19
5	0.17	0.032	8	27
6	0.20	0.049	9	36
7	0.23	0.072	9	46
8	0.26	0.096	10	55
9	0.29	0.115	10	66
10	0.32	0.131	11	77
11	0.29	0.146	8	85
12	0.26	0.156	6	91
13	0.23	0.163	4	95
14	0.20	0.168	2	97
15	0.17	0.170	0	97
16	0.14	0.170	-2	95
17	0.11	0.168	-3	92
18	0.08	0.164	-5	87
19	0.05	0.158	-6	80
20	0.02	0.150	-8	72
21	0.02	0.140	-7	65
22	0.02	0.130	-7	59
23	0.02	0.120	-6	53
24	0.02	0.110	-5	47
25	0.02	0.101	-5	43
26	0.02	0.088	-4	39
27	0.02	0.078	-3	35
28	0.02	0.069	-3	32
29	0.02	0.061	-2	30
30	0.02	0.055	-2	28
31	0.02	0.050	-2	26
32	0.02	0.045	-1	25
33	0.02	0.041	-1	23
34	0.02	0.039	-1	22
35	0.02	0.037	-1	21
36	0.02	0.036	-1	20
37	0.02	0.034	-1	19
38	0.02	0.033	-1	19
39	0.02	0.031	-1	18
40	0.02	0.030	-1	17
41	0.02	0.029	-1	17
42	0.02	0.028	0	16
43	0.02	0.028	0	16
44	0.02	0.027	0	16
45	0.02	0.026	0	15
46	0.02	0.026	0	15
47	0.02	0.025	0	15
48	0.00	0.025	-1	13
49	0.00	0.022	-1	12
50	0.00	0.020	-1	11

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 1

100 Year Post Development Flow	0.095	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
235.50	0.02	0.00	0.00
235.54	0.02	0.00	0.36
235.58	0.02	0.00	2.43
235.62	0.02	0.00	7.66
235.67	0.02	0.00	20.45
235.71	0.02	0.00	36.99
235.75	0.02	0.01	60.30

P - 6

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.01	0.000	1	1
2	0.02	0.020	0	1
3	0.03	0.020	1	1
4	0.04	0.020	1	2
5	0.05	0.020	2	4
6	0.06	0.020	2	6
7	0.07	0.020	3	9
8	0.08	0.020	3	12
9	0.09	0.021	4	16
10	0.09	0.021	4	20
11	0.09	0.021	4	24
12	0.08	0.021	3	28
13	0.07	0.021	3	30
14	0.06	0.021	2	32
15	0.05	0.021	2	34
16	0.04	0.021	1	35
17	0.03	0.021	0	35
18	0.02	0.021	0	35
19	0.01	0.021	-1	35
20	0.00	0.021	-1	33
21	0.00	0.021	-1	32
22	0.00	0.021	-1	31
23	0.00	0.021	-1	30
24	0.00	0.021	-1	28
25	0.00	0.021	-1	27
26	0.00	0.021	-1	26
27	0.00	0.021	-1	25
28	0.00	0.021	-1	23
29	0.00	0.021	-1	22
30	0.00	0.021	-1	21
31	0.00	0.021	-1	20
32	0.00	0.021	-1	18
33	0.00	0.021	-1	17
34	0.00	0.021	-1	16
35	0.00	0.021	-1	15
36	0.00	0.021	-1	13
37	0.00	0.021	-1	12
38	0.00	0.021	-1	11
39	0.00	0.021	-1	10
40	0.00	0.020	-1	9
41	0.00	0.020	-1	7
42	0.00	0.020	-1	6
43	0.00	0.020	-1	5
44	0.00	0.020	-1	4
45	0.00	0.020	-1	2
46	0.00	0.020	-1	1
47	0.00	0.020	-1	0
48	0.00	0.000	0	0
49	0.00	0.000	0	0
50	0.00	0.000	0	0

Uncontrolled

100 Year Post Development Flow	0.002	m3/sec
Storm Duration	20	min

P-8 - P-9

Hydrograph Data

Minute	In Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.000
3	0.001
4	0.001
5	0.001
6	0.001
7	0.002
8	0.002
9	0.002
10	0.002
11	0.002
12	0.002
13	0.002
14	0.001
15	0.001
16	0.001
17	0.001
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.000
47	0.000
48	0.000
49	0.000
50	0.000

Outflow from SITE

Minute	Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.003
3	0.011
4	0.021
5	0.034
6	0.050
7	0.074
8	0.098
9	0.117
10	0.133
11	0.148
12	0.158
13	0.165
14	0.169
15	0.171
16	0.171
17	0.168
18	0.164
19	0.158
20	0.150
21	0.140
22	0.130
23	0.120
24	0.110
25	0.101
26	0.088
27	0.078
28	0.069
29	0.061
30	0.055
31	0.050
32	0.045
33	0.041
34	0.039
35	0.037
36	0.036
37	0.034
38	0.033
39	0.031
40	0.030
41	0.029
42	0.028
43	0.028
44	0.027
45	0.026
46	0.026
47	0.025
48	0.025
49	0.022
50	0.020

CHECKING STORAGE RELEASE CHARACTERISTICS OF SUBSURFACE PONDING
- CITY OF BARRIE IDF EQUATIONS -

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 2

50 Year Post Development Flow	0.258	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
233.61	0.00	0.00	0.00
233.91	0.04	0.00	24.28
234.21	0.10	0.00	48.55
234.36	0.12	0.01	60.69
234.51	0.14	0.01	72.83
234.66	0.16	0.01	84.97
234.81	0.17	0.01	97.11

P-1 - P-5, P-7 ,P-20

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.03	0.000	2	2
2	0.07	0.003	4	6
3	0.08	0.010	4	10
4	0.12	0.016	6	16
5	0.15	0.027	7	24
6	0.18	0.040	8	32
7	0.20	0.060	8	40
8	0.23	0.082	9	49
9	0.25	0.104	9	58
10	0.28	0.119	10	67
11	0.25	0.133	7	75
12	0.23	0.143	5	80
13	0.20	0.149	3	83
14	0.18	0.153	1	84
15	0.15	0.155	0	84
16	0.12	0.155	-2	82
17	0.10	0.152	-3	79
18	0.07	0.148	-5	74
19	0.05	0.142	-6	68
20	0.02	0.135	-7	62
21	0.02	0.125	-6	55
22	0.02	0.115	-6	50
23	0.02	0.106	-5	45
24	0.02	0.093	-4	40
25	0.02	0.082	-4	37
26	0.02	0.073	-3	33
27	0.02	0.065	-3	31
28	0.02	0.058	-2	29
29	0.02	0.052	-2	27
30	0.02	0.047	-2	25
31	0.02	0.043	-1	24
32	0.02	0.040	-1	23
33	0.02	0.038	-1	22
34	0.02	0.036	-1	21
35	0.02	0.035	-1	20
36	0.02	0.033	-1	19
37	0.02	0.032	-1	18
38	0.02	0.031	-1	18
39	0.02	0.030	-1	17
40	0.02	0.029	-1	17
41	0.02	0.028	0	16
42	0.02	0.027	0	16
43	0.00	0.026	-2	14
44	0.00	0.024	-1	13
45	0.00	0.021	-1	11
46	0.00	0.019	-1	10
47	0.00	0.017	-1	9
48	0.00	0.016	-1	8
49	0.00	0.014	-1	8
50	0.00	0.013	-1	7

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 1

50 Year Post Development Flow	0.083	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
235.50	0.02	0.00	0.00
235.54	0.02	0.00	0.36
235.58	0.02	0.00	2.43
235.62	0.02	0.00	7.66
235.67	0.02	0.00	20.45
235.71	0.02	0.00	36.99
235.75	0.02	0.01	60.30

P - 6

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.01	0.000	0	0
2	0.02	0.020	0	0
3	0.02	0.000	1	2
4	0.03	0.020	1	3
5	0.04	0.020	1	4
6	0.05	0.020	2	6
7	0.06	0.020	2	8
8	0.07	0.020	3	11
9	0.07	0.020	3	14
10	0.08	0.021	4	18
11	0.07	0.021	3	21
12	0.07	0.021	3	24
13	0.06	0.021	2	26
14	0.05	0.021	2	27
15	0.04	0.021	1	29
16	0.03	0.021	1	29
17	0.02	0.021	0	30
18	0.02	0.021	0	29
19	0.01	0.021	-1	29
20	0.00	0.021	-1	27
21	0.00	0.021	-1	26
22	0.00	0.021	-1	25
23	0.00	0.021	-1	24
24	0.00	0.021	-1	22
25	0.00	0.021	-1	21
26	0.00	0.021	-1	20
27	0.00	0.021	-1	19
28	0.00	0.021	-1	17
29	0.00	0.021	-1	16
30	0.00	0.021	-1	15
31	0.00	0.021	-1	14
32	0.00	0.021	-1	13
33	0.00	0.021	-1	11
34	0.00	0.021	-1	10
35	0.00	0.020	-1	9
36	0.00	0.020	-1	8
37	0.00	0.020	-1	6
38	0.00	0.020	-1	5
39	0.00	0.020	-1	4
40	0.00	0.020	-1	3
41	0.00	0.020	-1	1
42	0.00	0.020	-1	0
43	0.00	0.000	0	0
44	0.00	0.000	0	0
45	0.00	0.000	0	0
46	0.00	0.000	0	0
47	0.00	0.000	0	0
48	0.00	0.000	0	0
49	0.00	0.000	0	0
50	0.00	0.000	0	0

Uncontrolled

50 Year Post Development Flow	0.002	m3/sec
Storm Duration	20	min

P-8 - P-9

Hydrograph Data

Minute	In Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.000
3	0.001
4	0.001
5	0.001
6	0.001
7	0.001
8	0.002
9	0.002
10	0.002
11	0.002
12	0.002
13	0.001
14	0.001
15	0.001
16	0.001
17	0.001
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.000
47	0.000
48	0.000
49	0.000
50	0.000

Outflow from SITE

Minute	Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.003
3	0.010
4	0.017
5	0.028
6	0.041
7	0.061
8	0.083
9	0.106
10	0.121
11	0.135
12	0.145
13	0.151
14	0.155
15	0.156
16	0.155
17	0.153
18	0.149
19	0.143
20	0.135
21	0.125
22	0.115
23	0.106
24	0.093
25	0.082
26	0.073
27	0.065
28	0.058
29	0.052
30	0.047
31	0.043
32	0.040
33	0.038
34	0.036
35	0.035
36	0.033
37	0.032
38	0.031
39	0.030
40	0.029
41	0.028
42	0.027
43	0.026
44	0.024
45	0.021
46	0.019
47	0.017
48	0.016
49	0.014
50	0.013

CHECKING STORAGE RELEASE CHARACTERISTICS OF SUBSURFACE PONDING
- CITY OF BARRIE IDF EQUATIONS -

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 2

25 Year Post Development Flow	0.214	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
233.61	0.00	0.00	0.00
233.91	0.04	0.00	24.28
234.21	0.10	0.00	48.55
234.36	0.12	0.01	60.69
234.51	0.14	0.01	72.83
234.66	0.16	0.01	84.97
234.81	0.17	0.01	97.11

P-1 - P-5, P-7 ,P-20

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.02	0.000	1	1
2	0.06	0.002	4	5
3	0.06	0.008	3	8
4	0.11	0.014	5	14
5	0.13	0.023	6	20
6	0.15	0.034	7	27
7	0.17	0.048	7	34
8	0.19	0.067	7	42
9	0.21	0.086	8	49
10	0.23	0.105	8	57
11	0.21	0.118	6	63
12	0.19	0.127	4	67
13	0.17	0.132	2	69
14	0.15	0.135	1	70
15	0.13	0.137	-1	69
16	0.11	0.136	-2	68
17	0.08	0.133	-3	65
18	0.06	0.129	-4	61
19	0.04	0.124	-5	56
20	0.02	0.116	-6	50
21	0.02	0.106	-5	45
22	0.02	0.094	-4	41
23	0.02	0.083	-4	37
24	0.02	0.073	-3	34
25	0.02	0.065	-3	31
26	0.02	0.058	-2	29
27	0.02	0.052	-2	27
28	0.02	0.047	-2	25
29	0.02	0.043	-1	24
30	0.02	0.040	-1	23
31	0.02	0.038	-1	22
32	0.02	0.036	-1	21
33	0.02	0.035	-1	20
34	0.02	0.033	-1	19
35	0.02	0.032	-1	18
36	0.02	0.031	-1	18
37	0.00	0.030	-2	16
38	0.00	0.027	-2	14
39	0.00	0.024	-1	13
40	0.00	0.022	-1	12
41	0.00	0.019	-1	10
42	0.00	0.017	-1	9
43	0.00	0.016	-1	8
44	0.00	0.014	-1	8
45	0.00	0.013	-1	7
46	0.00	0.011	-1	6
47	0.00	0.010	-1	5
48	0.00	0.009	-1	5
49	0.00	0.008	0	4
50	0.00	0.007	0	4

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 1

25 Year Post Development Flow	0.069	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
235.50	0.02	0.00	0.00
235.54	0.02	0.00	0.36
235.58	0.02	0.00	2.43
235.62	0.02	0.00	7.66
235.67	0.02	0.00	20.45
235.71	0.02	0.00	36.99
235.75	0.02	0.01	60.30

P - 6

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.01	0.000	0	0
2	0.01	0.020	0	0
3	0.02	0.000	1	1
4	0.03	0.020	0	2
5	0.03	0.020	1	3
6	0.04	0.020	1	4
7	0.05	0.020	2	5
8	0.05	0.020	2	8
9	0.06	0.020	2	10
10	0.07	0.020	3	13
11	0.06	0.021	2	15
12	0.05	0.021	2	17
13	0.05	0.021	2	19
14	0.04	0.021	1	20
15	0.03	0.021	1	21
16	0.03	0.021	0	22
17	0.02	0.021	0	21
18	0.01	0.021	0	21
19	0.01	0.021	-1	20
20	0.00	0.021	-1	19
21	0.00	0.021	-1	18
22	0.00	0.021	-1	17
23	0.00	0.021	-1	15
24	0.00	0.021	-1	14
25	0.00	0.021	-1	13
26	0.00	0.021	-1	12
27	0.00	0.021	-1	10
28	0.00	0.020	-1	9
29	0.00	0.020	-1	8
30	0.00	0.020	-1	7
31	0.00	0.020	-1	5
32	0.00	0.020	-1	4
33	0.00	0.020	-1	3
34	0.00	0.020	-1	2
35	0.00	0.020	-1	1
36	0.00	0.020	-1	0
37	0.00	0.000	0	0
38	0.00	0.000	0	0
39	0.00	0.000	0	0
40	0.00	0.000	0	0
41	0.00	0.000	0	0
42	0.00	0.000	0	0
43	0.00	0.000	0	0
44	0.00	0.000	0	0
45	0.00	0.000	0	0
46	0.00	0.000	0	0
47	0.00	0.000	0	0
48	0.00	0.000	0	0
49	0.00	0.000	0	0
50	0.00	0.000	0	0

Uncontrolled

25 Year Post Development Flow	0.002	m3/sec
Storm Duration	20	min

P-8 - P-9

Hydrograph Data

Minute	In Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.000
3	0.001
4	0.001
5	0.001
6	0.001
7	0.001
8	0.001
9	0.002
10	0.002
11	0.002
12	0.001
13	0.001
14	0.001
15	0.001
16	0.001
17	0.001
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.000
47	0.000
48	0.000
49	0.000
50	0.000

Outflow from SITE

Minute	Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.003
3	0.009
4	0.015
5	0.024
6	0.035
7	0.049
8	0.068
9	0.088
10	0.107
11	0.119
12	0.128
13	0.133
14	0.136
15	0.137
16	0.136
17	0.134
18	0.129
19	0.124
20	0.116
21	0.106
22	0.094
23	0.083
24	0.073
25	0.065
26	0.058
27	0.052
28	0.047
29	0.043
30	0.040
31	0.038
32	0.036
33	0.035
34	0.033
35	0.032
36	0.031
37	0.030
38	0.027
39	0.024
40	0.022
41	0.019
42	0.017
43	0.016
44	0.014
45	0.013
46	0.011
47	0.010
48	0.009
49	0.008
50	0.007

CHECKING STORAGE RELEASE CHARACTERISTICS OF SUBSURFACE PONDING
- CITY OF BARRIE IDF EQUATIONS -

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 2

10 Year Post Development Flow	0.166	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
233.61	0.00	0.00	0.00
233.91	0.04	0.00	24.28
234.21	0.10	0.00	48.55
234.36	0.12	0.01	60.69
234.51	0.14	0.01	72.83
234.66	0.16	0.01	84.97
234.81	0.17	0.01	97.11

P-1 - P-5, P-7 ,P-20

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.02	0.000	1	1
2	0.03	0.002	2	3
3	0.07	0.005	4	7
4	0.09	0.011	4	11
5	0.10	0.019	5	16
6	0.12	0.027	6	22
7	0.14	0.037	6	28
8	0.15	0.050	6	34
9	0.17	0.066	6	40
10	0.19	0.082	6	46
11	0.17	0.098	4	51
12	0.15	0.107	3	53
13	0.14	0.112	1	55
14	0.12	0.114	0	55
15	0.10	0.115	-1	55
16	0.09	0.114	-2	53
17	0.07	0.111	-2	51
18	0.05	0.107	-3	47
19	0.04	0.101	-4	44
20	0.02	0.091	-4	39
21	0.02	0.080	-4	36
22	0.02	0.071	-3	33
23	0.02	0.063	-3	30
24	0.02	0.056	-2	28
25	0.02	0.051	-2	26
26	0.02	0.046	-2	25
27	0.02	0.042	-1	23
28	0.02	0.039	-1	22
29	0.00	0.037	-2	20
30	0.00	0.034	-2	18
31	0.00	0.030	-2	16
32	0.00	0.027	-2	15
33	0.00	0.024	-1	13
34	0.00	0.022	-1	12
35	0.00	0.020	-1	11
36	0.00	0.018	-1	10
37	0.00	0.016	-1	9
38	0.00	0.014	-1	8
39	0.00	0.013	-1	7
40	0.00	0.012	-1	6
41	0.00	0.010	-1	6
42	0.00	0.009	-1	5
43	0.00	0.008	-1	5
44	0.00	0.008	0	4
45	0.00	0.007	0	4
46	0.00	0.006	0	3
47	0.00	0.006	0	3
48	0.00	0.005	0	3
49	0.00	0.005	0	2
50	0.00	0.004	0	2

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 1

10 Year Post Development Flow	0.053	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
235.50	0.02	0.00	0.00
235.54	0.02	0.00	0.36
235.58	0.02	0.00	2.43
235.62	0.02	0.00	7.66
235.67	0.02	0.00	20.45
235.71	0.02	0.00	36.99
235.75	0.02	0.01	60.30

P - 6

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.01	0.000	0	0
2	0.01	0.000	1	1
3	0.02	0.020	0	1
4	0.02	0.020	0	1
5	0.03	0.020	0	1
6	0.03	0.020	1	2
7	0.04	0.020	1	3
8	0.04	0.020	1	4
9	0.05	0.020	2	6
10	0.05	0.020	2	8
11	0.05	0.020	2	9
12	0.04	0.020	1	11
13	0.04	0.021	1	12
14	0.03	0.021	1	12
15	0.03	0.021	0	13
16	0.02	0.021	0	13
17	0.02	0.021	0	13
18	0.01	0.021	-1	12
19	0.01	0.021	-1	11
20	0.00	0.021	-1	10
21	0.00	0.020	-1	9
22	0.00	0.020	-1	7
23	0.00	0.020	-1	6
24	0.00	0.020	-1	5
25	0.00	0.020	-1	4
26	0.00	0.020	-1	3
27	0.00	0.020	-1	1
28	0.00	0.020	-1	0
29	0.00	0.000	0	0
30	0.00	0.000	0	0
31	0.00	0.000	0	0
32	0.00	0.000	0	0
33	0.00	0.000	0	0
34	0.00	0.000	0	0
35	0.00	0.000	0	0
36	0.00	0.000	0	0
37	0.00	0.000	0	0
38	0.00	0.000	0	0
39	0.00	0.000	0	0
40	0.00	0.000	0	0
41	0.00	0.000	0	0
42	0.00	0.000	0	0
43	0.00	0.000	0	0
44	0.00	0.000	0	0
45	0.00	0.000	0	0
46	0.00	0.000	0	0
47	0.00	0.000	0	0
48	0.00	0.000	0	0
49	0.00	0.000	0	0
50	0.00	0.000	0	0

Uncontrolled

10 Year Post Development Flow	0.001	m3/sec
Storm Duration	20	min

P-8 - P-9

Hydrograph Data

Minute	In Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.000
3	0.000
4	0.001
5	0.001
6	0.001
7	0.001
8	0.001
9	0.001
10	0.001
11	0.001
12	0.001
13	0.001
14	0.001
15	0.001
16	0.001
17	0.000
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.000
47	0.000
48	0.000
49	0.000
50	0.000

Outflow from SITE

Minute	Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.002
3	0.005
4	0.012
5	0.020
6	0.028
7	0.038
8	0.051
9	0.067
10	0.083
11	0.099
12	0.108
13	0.113
14	0.115
15	0.115
16	0.114
17	0.111
18	0.107
19	0.101
20	0.091
21	0.080
22	0.071
23	0.063
24	0.056
25	0.051
26	0.046
27	0.042
28	0.039
29	0.037
30	0.034
31	0.030
32	0.027
33	0.024
34	0.022
35	0.020
36	0.018
37	0.016
38	0.014
39	0.013
40	0.012
41	0.010
42	0.009
43	0.008
44	0.008
45	0.007
46	0.006
47	0.006
48	0.005
49	0.005
50	0.004

CHECKING STORAGE RELEASE CHARACTERISTICS OF SUBSURFACE PONDING
- CITY OF BARRIE IDF EQUATIONS -

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 2

5 Year Post Development Flow	0.143	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
233.61	0.00	0.00	0.00
233.91	0.04	0.00	24.28
234.21	0.10	0.00	48.55
234.36	0.12	0.01	60.69
234.51	0.14	0.01	72.83
234.66	0.16	0.01	84.97
234.81	0.17	0.01	97.11

P-1 - P-5, P-7 ,P-20

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.01	0.000	1	1
2	0.03	0.001	2	2
3	0.06	0.004	4	6
4	0.08	0.010	4	10
5	0.07	0.017	3	13
6	0.11	0.022	5	18
7	0.12	0.031	5	24
8	0.13	0.040	6	29
9	0.15	0.054	6	35
10	0.16	0.069	6	41
11	0.15	0.083	4	45
12	0.13	0.094	2	47
13	0.12	0.100	1	48
14	0.11	0.103	0	49
15	0.09	0.104	-1	48
16	0.08	0.102	-1	46
17	0.06	0.098	-2	44
18	0.05	0.093	-3	42
19	0.03	0.086	-3	39
20	0.02	0.078	-3	35
21	0.02	0.069	-3	32
22	0.02	0.062	-2	30
23	0.02	0.055	-2	28
24	0.02	0.050	-2	26
25	0.02	0.045	-1	24
26	0.02	0.041	-1	23
27	0.00	0.039	-2	21
28	0.00	0.035	-2	19
29	0.00	0.031	-2	17
30	0.00	0.028	-2	15
31	0.00	0.025	-2	14
32	0.00	0.023	-1	12
33	0.00	0.021	-1	11
34	0.00	0.019	-1	10
35	0.00	0.017	-1	9
36	0.00	0.015	-1	8
37	0.00	0.013	-1	7
38	0.00	0.012	-1	6
39	0.00	0.011	-1	6
40	0.00	0.010	-1	5
41	0.00	0.009	-1	5
42	0.00	0.008	0	4
43	0.00	0.007	0	4
44	0.00	0.006	0	3
45	0.00	0.006	0	3
46	0.00	0.005	0	3
47	0.00	0.005	0	2
48	0.00	0.004	0	2
49	0.00	0.004	0	2
50	0.00	0.003	0	2

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 1

5 Year Post Development Flow	0.046	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
235.50	0.02	0.00	0.00
235.54	0.02	0.00	0.36
235.58	0.02	0.00	2.43
235.62	0.02	0.00	7.66
235.67	0.02	0.00	20.45
235.71	0.02	0.00	36.99
235.75	0.02	0.01	60.30

P - 6

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.00	0.000	0	0
2	0.01	0.000	1	1
3	0.01	0.020	0	0
4	0.02	0.020	0	0
5	0.02	0.000	1	2
6	0.03	0.020	0	2
7	0.03	0.020	1	3
8	0.04	0.020	1	4
9	0.04	0.020	1	5
10	0.05	0.020	2	7
11	0.04	0.020	1	8
12	0.04	0.020	1	9
13	0.03	0.020	1	10
14	0.03	0.020	0	10
15	0.02	0.020	0	10
16	0.02	0.020	0	10
17	0.01	0.020	0	10
18	0.01	0.020	-1	9
19	0.00	0.020	-1	8
20	0.00	0.020	-1	7
21	0.00	0.020	-1	6
22	0.00	0.020	-1	4
23	0.00	0.020	-1	3
24	0.00	0.020	-1	2
25	0.00	0.020	-1	1
26	0.00	0.020	-1	0
27	0.00	0.000	0	0
28	0.00	0.000	0	0
29	0.00	0.000	0	0
30	0.00	0.000	0	0
31	0.00	0.000	0	0
32	0.00	0.000	0	0
33	0.00	0.000	0	0
34	0.00	0.000	0	0
35	0.00	0.000	0	0
36	0.00	0.000	0	0
37	0.00	0.000	0	0
38	0.00	0.000	0	0
39	0.00	0.000	0	0
40	0.00	0.000	0	0
41	0.00	0.000	0	0
42	0.00	0.000	0	0
43	0.00	0.000	0	0
44	0.00	0.000	0	0
45	0.00	0.000	0	0
46	0.00	0.000	0	0
47	0.00	0.000	0	0
48	0.00	0.000	0	0
49	0.00	0.000	0	0
50	0.00	0.000	0	0

Uncontrolled

5 Year Post Development Flow	0.001	m3/sec
Storm Duration	20	min

P-8 - P-9

Hydrograph Data

Minute	In Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.000
3	0.000
4	0.000
5	0.001
6	0.001
7	0.001
8	0.001
9	0.001
10	0.001
11	0.001
12	0.001
13	0.001
14	0.001
15	0.001
16	0.000
17	0.000
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.000
47	0.000
48	0.000
49	0.000
50	0.000

Outflow from SITE

Minute	Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.002
3	0.005
4	0.011
5	0.017
6	0.023
7	0.032
8	0.041
9	0.055
10	0.070
11	0.085
12	0.095
13	0.101
14	0.104
15	0.104
16	0.102
17	0.098
18	0.093
19	0.086
20	0.078
21	0.069
22	0.062
23	0.055
24	0.050
25	0.045
26	0.041
27	0.039
28	0.035
29	0.031
30	0.028
31	0.025
32	0.023
33	0.021
34	0.019
35	0.017
36	0.015
37	0.013
38	0.012
39	0.011
40	0.010
41	0.009
42	0.008
43	0.007
44	0.006
45	0.006
46	0.005
47	0.005
48	0.004
49	0.004
50	0.003

CHECKING STORAGE RELEASE CHARACTERISTICS OF SUBSURFACE PONDING
- CITY OF BARRIE IDF EQUATIONS -

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 2

2 Year Post Development Flow	0.109	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
233.61	0.00	0.00	0.00
233.91	0.04	0.00	24.28
234.21	0.10	0.00	48.55
234.36	0.12	0.01	60.69
234.51	0.14	0.01	72.83
234.66	0.16	0.01	84.97
234.81	0.17	0.01	97.11

P-1 - P-5, P-7 ,P-20

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.01	0.000	1	1
2	0.02	0.001	1	2
3	0.05	0.003	3	5
4	0.04	0.008	2	7
5	0.07	0.012	4	11
6	0.09	0.018	4	15
7	0.10	0.025	4	19
8	0.11	0.032	5	24
9	0.12	0.040	5	28
10	0.13	0.051	5	33
11	0.12	0.063	3	36
12	0.11	0.072	2	38
13	0.10	0.077	1	40
14	0.09	0.080	0	40
15	0.07	0.081	0	39
16	0.06	0.080	-1	39
17	0.05	0.078	-1	37
18	0.04	0.074	-2	35
19	0.03	0.069	-2	33
20	0.02	0.063	-3	30
21	0.02	0.056	-2	28
22	0.00	0.051	-3	25
23	0.00	0.043	-3	22
24	0.00	0.038	-2	20
25	0.00	0.034	-2	18
26	0.00	0.031	-2	16
27	0.00	0.027	-2	15
28	0.00	0.025	-1	13
29	0.00	0.022	-1	12
30	0.00	0.020	-1	11
31	0.00	0.018	-1	10
32	0.00	0.016	-1	9
33	0.00	0.015	-1	8
34	0.00	0.013	-1	7
35	0.00	0.012	-1	6
36	0.00	0.011	-1	6
37	0.00	0.009	-1	5
38	0.00	0.009	-1	5
39	0.00	0.008	0	4
40	0.00	0.007	0	4
41	0.00	0.006	0	3
42	0.00	0.006	0	3
43	0.00	0.005	0	3
44	0.00	0.005	0	2
45	0.00	0.004	0	2
46	0.00	0.004	0	2
47	0.00	0.003	0	2
48	0.00	0.003	0	2
49	0.00	0.003	0	1
50	0.00	0.002	0	1

CONTROLLED RELEASE FROM SUBJECT SITE

CONTROLLED 1

2 Year Post Development Flow	0.035	m3/sec
Storm Duration	20	min

Subsurface Storage

Elevation (m)	Outflow (m3/sec)	Storage (ha - m)	Storage (m3)
235.50	0.02	0.00	0.00
235.54	0.02	0.00	0.36
235.58	0.02	0.00	2.43
235.62	0.02	0.00	7.66
235.67	0.02	0.00	20.45
235.71	0.02	0.00	36.99
235.75	0.02	0.01	60.30

P - 6

Hydrograph Data

Minute	In Flow	Out Flow	Del_Storage	Cumulative Storage
	(m3/sec)	(m3/sec)	(m3)	(m3)
(1)	(2)	(4)	(5)	(6)
0	0.00	0.000	0	0
1	0.00	0.000	0	0
2	0.01	0.000	0	1
3	0.01	0.020	-1	0
4	0.01	0.000	1	1
5	0.02	0.020	0	1
6	0.02	0.020	0	1
7	0.02	0.020	0	1
8	0.03	0.020	0	2
9	0.03	0.020	1	2
10	0.03	0.020	1	3
11	0.03	0.020	1	4
12	0.03	0.020	0	4
13	0.02	0.020	0	4
14	0.02	0.020	0	5
15	0.02	0.020	0	4
16	0.01	0.020	0	4
17	0.01	0.020	-1	3
18	0.01	0.020	-1	3
19	0.00	0.020	-1	2
20	0.00	0.020	-1	0
21	0.00	0.020	-1	0
22	0.00	0.000	0	0
23	0.00	0.000	0	0
24	0.00	0.000	0	0
25	0.00	0.000	0	0
26	0.00	0.000	0	0
27	0.00	0.000	0	0
28	0.00	0.000	0	0
29	0.00	0.000	0	0
30	0.00	0.000	0	0
31	0.00	0.000	0	0
32	0.00	0.000	0	0
33	0.00	0.000	0	0
34	0.00	0.000	0	0
35	0.00	0.000	0	0
36	0.00	0.000	0	0
37	0.00	0.000	0	0
38	0.00	0.000	0	0
39	0.00	0.000	0	0
40	0.00	0.000	0	0
41	0.00	0.000	0	0
42	0.00	0.000	0	0
43	0.00	0.000	0	0
44	0.00	0.000	0	0
45	0.00	0.000	0	0
46	0.00	0.000	0	0
47	0.00	0.000	0	0
48	0.00	0.000	0	0
49	0.00	0.000	0	0
50	0.00	0.000	0	0

Uncontrolled

2 Year Post Development Flow	0.001	m3/sec
Storm Duration	20	min

P-8 - P-9

Hydrograph Data

Minute	In Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.000
3	0.000
4	0.000
5	0.000
6	0.001
7	0.001
8	0.001
9	0.001
10	0.001
11	0.001
12	0.001
13	0.001
14	0.001
15	0.000
16	0.000
17	0.000
18	0.000
19	0.000
20	0.000
21	0.000
22	0.000
23	0.000
24	0.000
25	0.000
26	0.000
27	0.000
28	0.000
29	0.000
30	0.000
31	0.000
32	0.000
33	0.000
34	0.000
35	0.000
36	0.000
37	0.000
38	0.000
39	0.000
40	0.000
41	0.000
42	0.000
43	0.000
44	0.000
45	0.000
46	0.000
47	0.000
48	0.000
49	0.000
50	0.000

Outflow from SITE

Minute	Flow
	(m3/sec)
(1)	(2)
0	0.000
1	0.000
2	0.001
3	0.003
4	0.009
5	0.012
6	0.019
7	0.025
8	0.033
9	0.040
10	0.052
11	0.064
12	0.073
13	0.078
14	0.081
15	0.082
16	0.081
17	0.078
18	0.074
19	0.069
20	0.063
21	0.056
22	0.051
23	0.043
24	0.038
25	0.034
26	0.031
27	0.027
28	0.025
29	0.022
30	0.020
31	0.018
32	0.016
33	0.015
34	0.013
35	0.012
36	0.011
37	0.009
38	0.009
39	0.008
40	0.007
41	0.006
42	0.006
43	0.005
44	0.005
45	0.004
46	0.004
47	0.003
48	0.003
49	0.003
50	0.002

Phosphorous Concentrations by Land Use							
	High Intensity		**Low Intensity**		**Transition**		
Average Total P (kg/ha/year)	1.32		0.13		0.07		

Pre-Development Condition

Total Annual Rainfall Percipitation 940.0 mm

	High Intensity	**Low Intensity**	**Transition**
Area (ha):	0.7085	0	0
Total P (kg/yr) :	0.935	0.000	0.000
Total Pre-Development P (kg/yr):		0.346	

Post Development Condition - Untreated

	High Intensity	**Low Intensity**	**Transition**
Area (ha):	0.7085	0	0
Total P (kg/yr) :	0.346	0.000	0.000
Total Post Development P (kg/yr) - Untreated:		0.346	

WATER BALANCE SUMMARY

PRE-DEVELOPMENT	Site	
Catchment Designation	**SITE**	**TOTALS**
Area (m^2)	7,085	7,085
Pervious Area (m^2)	995	995
Impervious Area (m^2)	6,090	6,090
Rooftop Infiltration	#N/A	
MECP Infiltration Factors		
Soil Type	Fine Sandy Loam	
Hydrologic Soil Group	B	
Topography	Flat Land, average slope < 0.6 m/km	
Soils	Open sandy loam	
Cover	Cultivated Land	
Vegetative Cover	Urban Lawns/Shallow Rooted Crops	
Topography Infiltration Factor	0.30	
Soil Infiltration Factor	0.40	
Land Cover Infiltration Factor	0.10	
MOE Total Infiltration Factor	0.80	
Runoff Coefficient	0.2	
Runoff from Impervious Surfaces	1	
Inputs (per Unit Area)		
Precipitation (mm/yr)	940	940
TOTAL INPUTS (mm/yr)	940	940
Outputs (per Unit Area)		
Precipitation Surplus (mm/yr)	415	
Evapotranspiration (mm/yr)	525	
Infiltration (mm/yr)	332	
Rooftop Infiltration (mm/yr)	0	
Total Infiltration (mm/yr)	332	
Runoff Pervious Areas (mm/yr)	83	
Runoff Impervious Areas (mm/yr)	415	
Total Runoff (mm/yr)	368	
TOTAL OUTPUTS (mm/yr)	940	940
Difference (INPUTS-OUTPUTS)	0	0
Inputs (Volumes)		
Precipitation (m^3/yr)	6,660	6,660
TOTAL INPUTS (m^3/yr)	6,660	6,660
Outputs (Volumes)		
Precipitation Surplus (m^3/yr)	2,940	2,940
Evapotranspiration (m^3/yr)	3,720	3,720
Infiltration (m^3/yr)	330	330
Rooftop Infiltration (m^3/yr)	0	0
Total Infiltration (m^3/yr)	330	330
Runoff Pervious Areas (m^3/yr)	83	83
Runoff Impervious Areas (m^3/yr)	2,527	2,527
Total Runoff (m^3/yr)	2,610	2,610
TOTAL OUTPUTS (m^3/yr)	6,660	6,660
Difference (INPUTS-OUTPUTS)	0	0

POST-DEVELOPMENT	Site	
Catchment Designation	**SITE**	**TOTALS**
Area (m^2)	7,085	7,085
Pervious Area (m^2)	995	995
Impervious Area (m^2)	6,090	6,090
Rooftop Infiltration	#N/A	
MECP Infiltration Factors		
Soil Type	Fine Sandy Loam	
Hydrologic Soil Group	B	
Topography	Flat Land, average slope < 0.6 m/km	
Soils	Open sandy loam	
Cover	Cultivated Land	
Vegetative Cover	Urban Lawns/Shallow Rooted Crops	
Topography Infiltration Factor	0.30	
Soil Infiltration Factor	0.40	
Land Cover Infiltration Factor	0.10	
MOE Total Infiltration Factor	0.80	
Runoff Coefficient	0.2	
Runoff from Impervious Surfaces	1	
Inputs (per Unit Area)		
Precipitation (mm/yr)	940	940
TOTAL INPUTS (mm/yr)	940	940
Outputs (per Unit Area)		
Precipitation Surplus (mm/yr)	415	
Evapotranspiration (mm/yr)	525	
Infiltration (mm/yr)	332	
Rooftop Infiltration (mm/yr)	0	
Total Infiltration (mm/yr)	332	
Runoff Pervious Areas (mm/yr)	83	
Runoff Impervious Areas (mm/yr)	415	
Total Runoff (mm/yr)	368	
TOTAL OUTPUTS (mm/yr)	940	
Difference (INPUTS-OUTPUTS)	0	
Inputs (Volumes)		
Precipitation (m^3/yr)	6,660	6,660
TOTAL INPUTS (m^3/yr)	6,660	6,660
Outputs (Volumes)		
Precipitation Surplus (m^3/yr)	2,940	2,940
Evapotranspiration (m^3/yr)	3,720	3,720
Infiltration (m^3/yr)	330	330
Rooftop Infiltration (m^3/yr)	0	0
Total Infiltration (m^3/yr)	330	330
Runoff Pervious Areas (m^3/yr)	83	83
Runoff Impervious Areas (m^3/yr)	2,527	2,527
Total Runoff (m^3/yr)	2,610	2,610
TOTAL OUTPUTS (m^3/yr)	6,660	6,660
Difference (INPUTS-OUTPUTS)	0	0

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

CDS Hydrodynamic Separator®

Developed by CONTECH Engineered Solutions LLC
Scarborough, Maine, USA

Registration: GPS-ETV_VR2023-03-31_CDS

In accordance with

ISO 14034:2016

Environmental Management —
Environmental Technology Verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

March 31, 2023
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The CDS® is a Stormwater treatment device designed to remove pollutants, including sediment, trash and hydrocarbons from Stormwater runoff. The CDS is typically comprised of a manhole that houses flow and screening controls that use a combination of swirl concentration and continuous deflective separation.

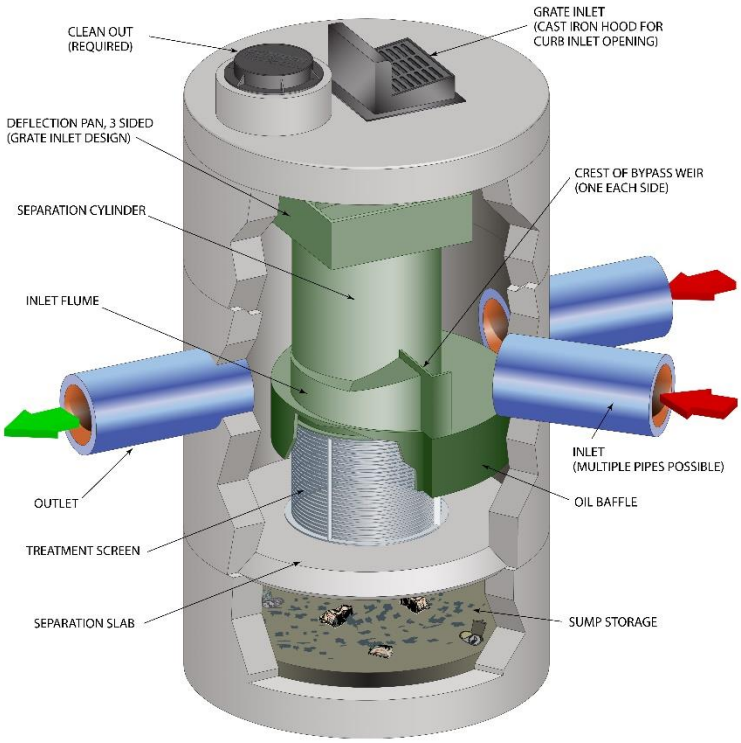


Figure 1. Graphic of typical inline CDS unit and core components.

When stormwater runoff enters the CDS unit, treatment flows are routed through one of two inlet flumes into the separation chamber. During high intensity rain events the water surface elevation in the system rises and once flows exceed the capacity of the inlet flumes a portion of flow begins to overtop the weirs at the top of the flumes which serve as an internal bypass. Flows routed over the internal bypass are then conveyed to the outlet. The water and associated gross pollutants contained within the separation cylinder are kept in continuous circular motion by the energy generated from the incoming flow. This has the effect of a continuous deflective separation of the pollutants and their eventual deposition into the sump storage below. A perforated screen plate allows the filtered water to pass through to a volute return system and thence to the outlet pipe. The oil and other light liquids are retained within the oil baffle. Figure 1 shows a schematic representation of a typical CDS unit including critical components

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Contech CDS-4 OGS device, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program requirements. A copy of the Procedure may be accessed at www.etvcanada.ca.

Performance claim(s)

Capture test[1]:

During the sediment capture test, the Contech CDS OGS device with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removed 74, 70, 63, 53, 45, 42, 32 and 23 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1893 L/min/m^2, respectively.

Scour test[a]:

During the scour test, the Contech CDS OGS device with preloaded test sediment reaching 50% of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 1.8, 6.5, 8.2, 11.2, and 309.3 mg/L during a test run[2] with approximately 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[a]:

During the light liquid re-entrainment test, the Contech CDS OGS device with surrogate low-density polyethylene beads preloaded within the oil collection skirt area, representing floating liquid to a volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.9, 98.6, 99.5, and 99.7 percent of loaded beads by volume during a test run[2] with 5 minutes duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

[1] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

[2] See variance #1 in "Variances from testing procedure" section below.

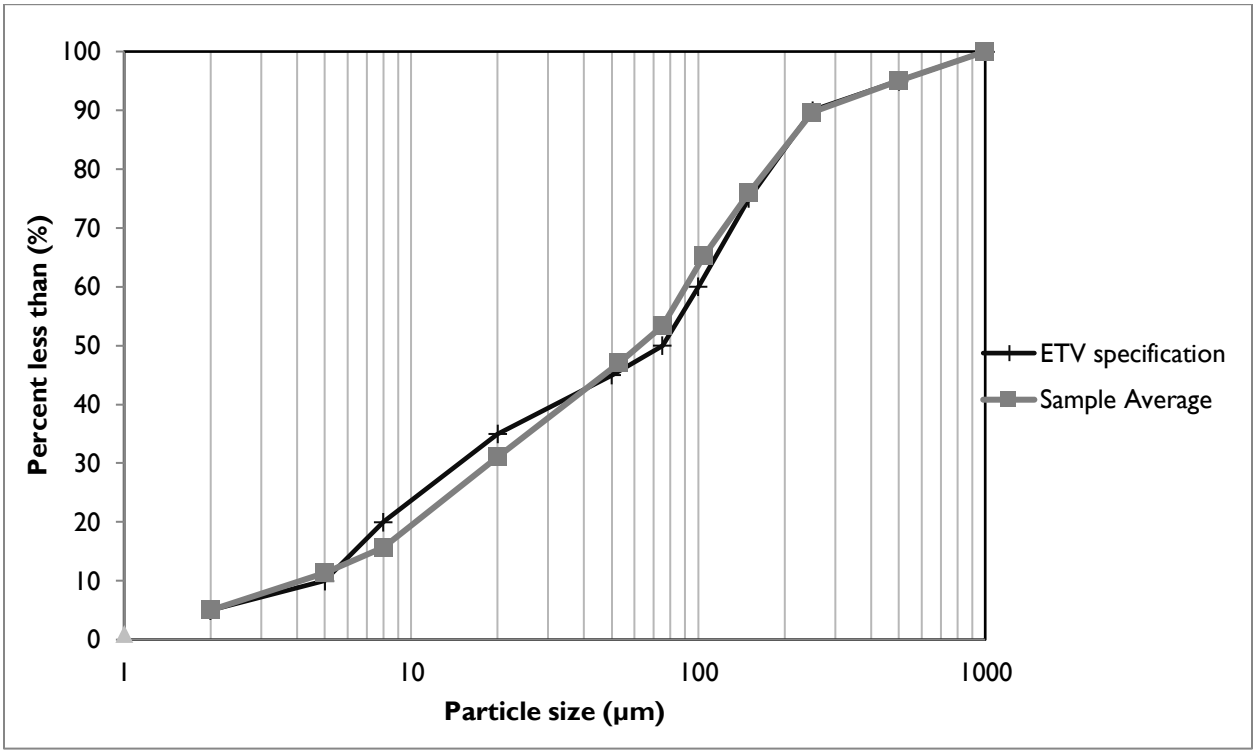


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at eight surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the calculated removal efficiencies were above 100% for certain particle size fractions (marked with asterisks in Table 1). These discrepancies are not entirely avoidable and may be attributed to errors relating to the blending of sediment, collection of representative samples, and laboratory analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" in Table 1 are based on measurements of the total injected and retained sediment mass, and are therefore not subject to sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) at specified surface loading rates.

Particle size fraction (µm)	Surface loading rate (L/min/m²)							
	40	80	200	400	600	1000	1400	1893
>500	100	100*	66	79	97	100*	84	77
250 - 500	100*	100*	85	95	100*	91	100*	75
150 - 250	99	100*	100*	97	100	75	68	37
105 - 150	100	100*	100*	74	47	45	30	27
75 - 105	90	91	100*	61	33	36	26	18
53 - 75	71	27	54	100	42	44	15	16
20 - 53	65	51	20	8	10	8	5	4
8 - 20	28	22	9	7	1	1	2	1
5 – 8	30	9	0	8	2	0	1	0
<5	11	8	16	2	6	5	2	2
All particle sizes by mass balance	**73.5**	**70.3**	**63.4**	**52.6**	**45.1**	**41.5**	**32.4**	**23.0**

* Removal efficiencies were calculated to be above 100%. Calculated values typically ranged between 101 and 175% (average 126%). Higher values were observed for the >500 µm and 150-250 µm size fractions during the 80 L/min/m² test run. See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the retained sediment at each of the tested surface loading rates. As expected, the capture efficiency for fine particles was generally found to decrease as surface loading rates increased.

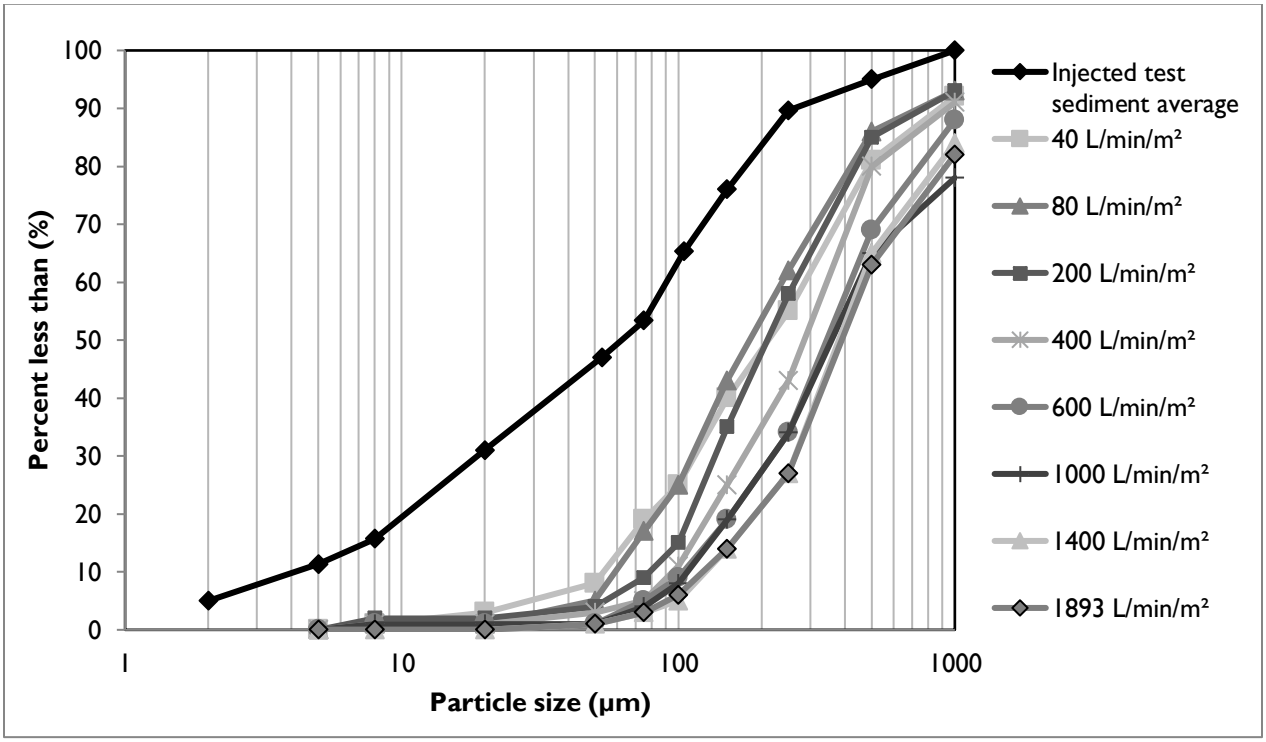


Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading 10.2 cm of fresh test sediment into the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Sediment was also pre-loaded to the same depth on the separation slab (see Figure 1) since sediment was observed to have been deposited in this area during the sediment capture test. Clean water was run through the device at five surface loading rates over a 36 minute period. The test was stopped and started after the second flow rate in order to change flow meters. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water and the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001.

Table 2. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L)[†]	Average (mg/L)
1	200	1.03	0.5	1.0	1.8
		2.03		1.6	
		3.03		1.8	
		4.03		1.8	
		5.03		2.6	
2	800	6.23	2.0	5.0	6.5
		7.23		6.7	
		8.23		9.4	
		9.23		5.4	
		10.23		5.9	
3	1400	11.43[‡]	2.0	3.1	8.2
		12.43		11.0	
		13.43		14.6	
		14.43		7.1	
		15.43		5.2	
4	2000	17.20	3.2	7.3	11.2
		18.20		22.8	
		19.20		6.9	
		20.20		6.8	
		21.20		12.1	
5	2600	22.40	8.5	248.5	309.3
		23.40		83.0	
		24.40		438.9	
		25.40		338.7	
		26.40		437.5	

[†] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the smallest 5% of sediment particles (i.e. d5) removed during the 40 L/min/m^2 capture test, minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

[‡] See variance #1 in "Variances from testing procedure" section below.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 3. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2) over a 38 minute period. As with the sediment scour test, flow was stopped and started after the second flow rate to change flow meters. Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 3. Light liquid re-entrainment test results.

Target Flow (L/min/m^2)	Time Stamp	Collected Volume (L)	Collected Mass (g)	Percent re-entrained by volume	Percent retained by volume
200	10:48:42	27 pellets	0.8	0.01	99.99
800	10:55:09	0.07	41	0.12	99.88
1400	11:06:59	0.8	439	1.37	98.63
2000	11:13:00	0.31	177	0.53	99.47
2600	11:19:00	0.18	98	0.31	99.69
Interim Collection Net		0.025	14.2	0.04	99.96
Total Loaded		58.3	33398	--	--
Total Re-entrained		1.385	770	--	--
Percent Re-entrained and retained		--	--	2.38	97.62

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. It was necessary to change flow meters during the scour and light liquid re-entrainment test, as the required flows exceeded the minimum and/or maximum range of any single meter. After the loading rate of 800 L/min/m^2, the flow was gradually shut down and re-initiated through the larger meter immediately after closing the valve controlling flows to the small meter. The transition time of 1-minute for each target flow was followed, resulting in an elapsed time of 3 minutes to reach the next target flow of 1400 L/min/m^2. This procedure was approved by CETV prior to testing, in recognition that most particles susceptible to scour at low flows would not be in the sump at higher flows. Similarly, re-entrainment of the oil beads was not expected to be significantly affected by the flow meter change.

2. As part of the capture test, evaluation of the 40 L/min/m^2 surface loading rate was split into 3 parts due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit. At the end of the first and second parts of the test, the flow rates were gradually shutdown to prevent capture of particles that would have been washed out under normal circumstances. The amended procedure was reviewed and approved by the verifier prior to testing.

3. Inflow concentrations during the 40 L/min/m^2 surface loading rate varied from 162 mg/L to 246 mg/L, which is wider than specified ±25 mg/L range in the Procedure.

Verification

This verification was first completed in March 2017 and is considered valid for subsequent renewal periods every three (3) years thereafter, subject to review and confirmation of the original performance and performance claims. The original verification was completed by the Toronto and Region Conservation Authority of Mississauga, Ontario, Canada using the Canadian ETV Program's General Verification Protocol (June 2012) and taking into account ISO 14034:2016. This ETV renewal is considered to meet the equivalency of an ETV verification completed using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***.

Data and information provided by Contech Engineered Solutions to support the performance claim included the following: Performance test report prepared by Alden Research Laboratory, Inc of Holden, Massachusetts, USA and dated February 2015; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV) and was developed and published by the International Organization for Standardization (ISO). The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the CDS Stormwater Treatment System please contact:

CONTECH Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME
04074 USA
Tel: 207-885-9830
info@conteches.com
www.conteches.com

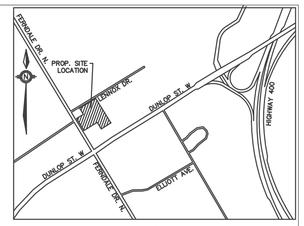
For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com
www.globeperformance.com

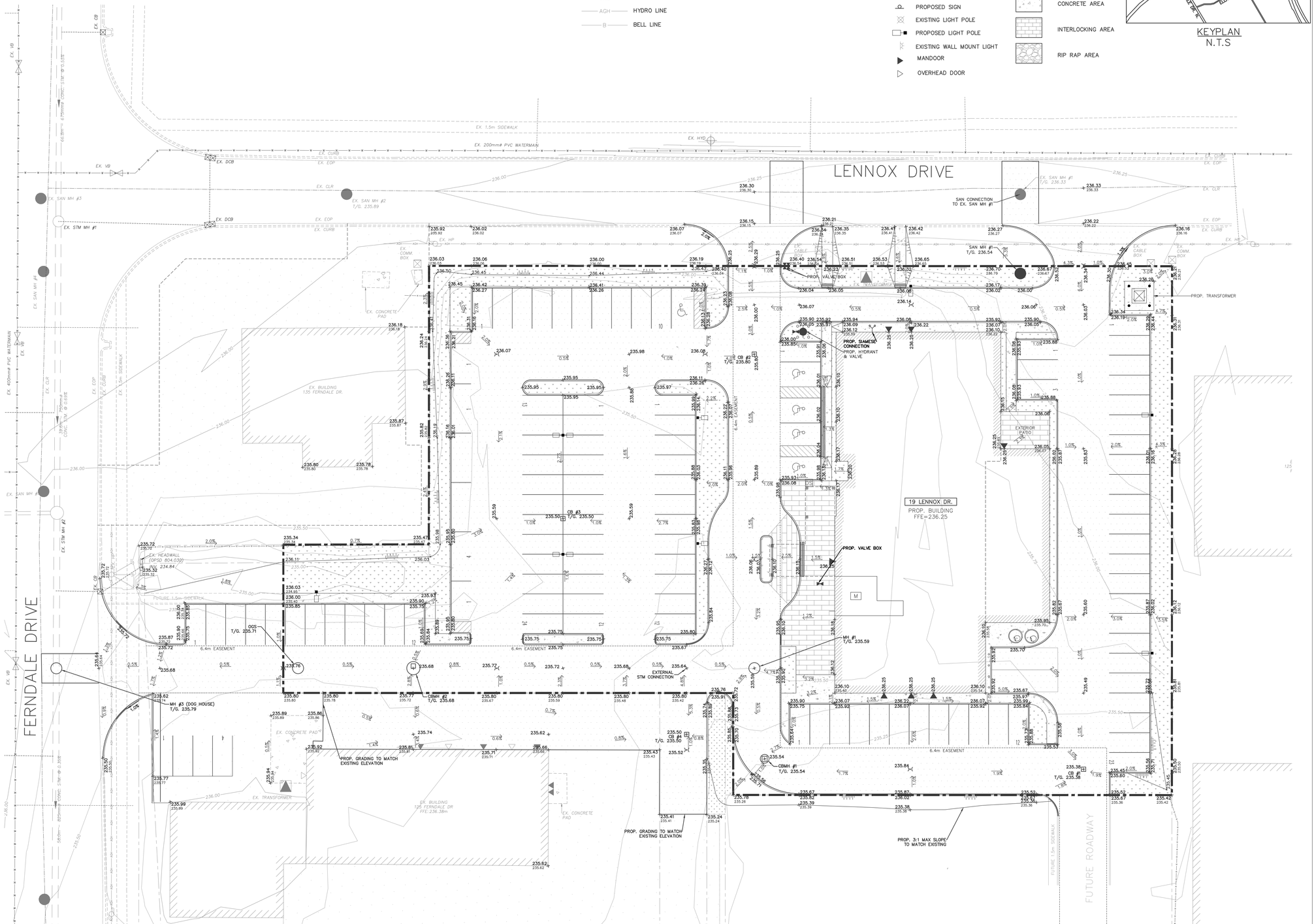
Appendix B
Drawing & Figures

LEGEND

- RETAINING WALL
- PRIVACY FENCE
- ACOUSTIC FENCE
- CHAIN LINK FENCE
- SILT FENCE
- GAS LINE
- HYDRO LINE
- BELL LINE
- EXISTING SANITARY MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING STORM MAINTENANCE HOLE
- PROPOSED STORM MAINTENANCE HOLE
- SERVICE CAP
- DOWN SPOUTS
- FIRE DEPT CONNECTION
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EXISTING VALVE BOX
- PROPOSED VALVE BOX
- PROPOSED SIGN
- EXISTING LIGHT POLE
- PROPOSED LIGHT POLE
- EXISTING WALL MOUNT LIGHT
- MANDOOR
- OVERHEAD DOOR
- LANDSCAPE AREA
- ASPHALT AREA
- GRAVEL AREA
- CONCRETE AREA
- INTERLOCKING AREA
- RIP RAP AREA



KEYPLAN
N.T.S



Gerrits ENGINEERING

222 Mapleview Drive West, Suite 300
Barrie, ON L4N 9E7 Canada
Tel.: 705.737.3303
Fax.: F.705.737.1772
www.gerreng.com

This drawing may have been reduced.

0 5 10 20 30 40 50mm
0" 1/4" 1/2" 1" 1 1/2" 2"

No.	Issuance Description	YY/MM/DD
1.	CLIENT REVIEW	24/01/31
2.	SITE PLAN APPROVAL	24/05/17

Issued For:

SITE PLAN APPROVAL

Client

INNISFIL BEACH DEVELOPMENTS INC.

241 Bradwick Drive, Concord, ON L4K 1K5

Project

HOME2 SUITES BY HILTON HOTEL

19 Lennox Drive, Barrie, ON L4N 9V8

Drawing:

SITE GRADING PLAN

Project No.	1614-001-21	Designed by: RM	Checked by: KF
Scale:	1:250	Drawn by: RM	Approved by: JDM

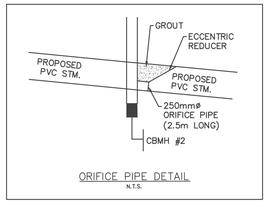
Orientation

Stamp

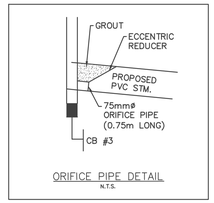
LICENSED PROFESSIONAL ENGINEER
J.D.J. McCuaig
100064895
2024/06/21
PROVINCE OF ONTARIO

Drawing No.

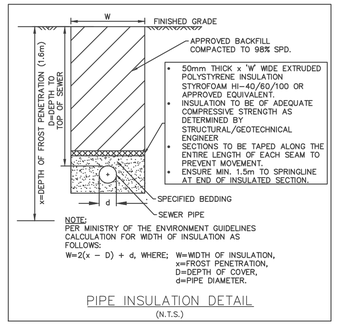
GR-1



ORIFICE PIPE DETAIL
N.T.S.



ORIFICE PIPE DETAIL
N.T.S.

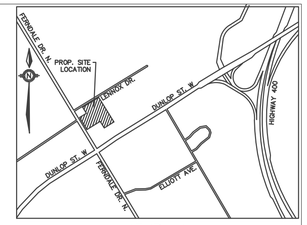


NOTE:
PER MINISTRY OF THE ENVIRONMENT GUIDELINES CALCULATION FOR WIDTH OF INSULATION AS FOLLOWS:
W=2(x − D) + d, WHERE; W=WIDTH OF INSULATION, x=FROST PENETRATION, D=DEPTH OF COVER, d=PIPE DIAMETER.

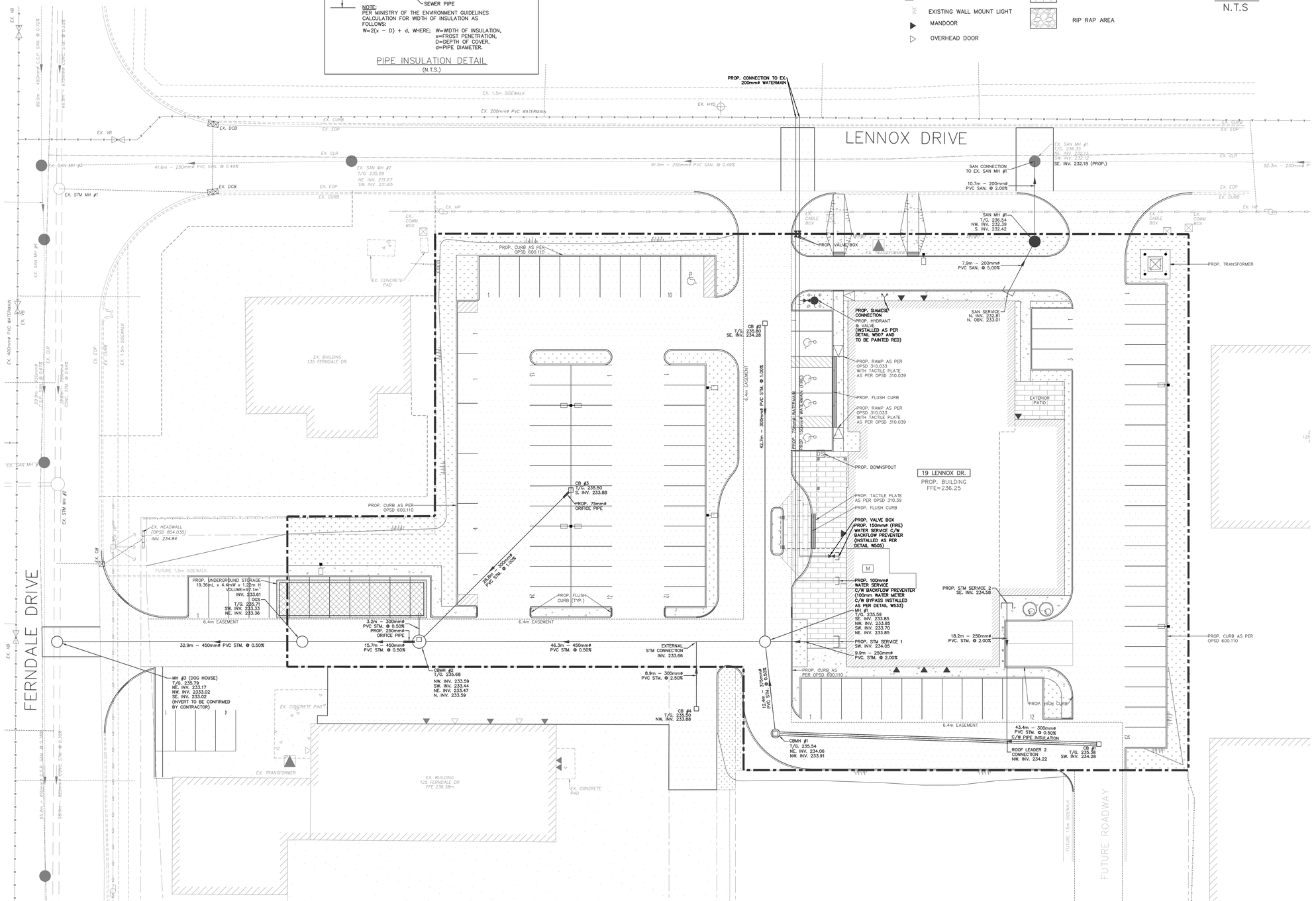
PIPE INSULATION DETAIL
(N.T.S.)

LEGEND

- RETAINING WALL
- PRIVACY FENCE
- ACOUSTIC FENCE
- CHAIN LINK FENCE
- SILT FENCE
- GAS — GAS LINE
- AGH — HYDRO LINE
- B — BELL LINE
- SAN# — EXISTING SANITARY MAINTENANCE HOLE
- SAN# — PROPOSED SANITARY MAINTENANCE HOLE
- CB# — EXISTING CATCH BASIN
- CB# — PROPOSED CATCH BASIN
- STM# — EXISTING STORM MAINTENANCE HOLE
- STM# — PROPOSED STORM MAINTENANCE HOLE
- SERVICE CAP
- DOWN SPOUTS
- FIRE DEPT CONNECTION
- HYD&V# — EXISTING FIRE HYDRANT
- HYD&V# — PROPOSED FIRE HYDRANT
- VB# — EXISTING VALVE BOX
- VB# — PROPOSED VALVE BOX
- PROPOSED SIGN
- EXISTING LIGHT POLE
- PROPOSED LIGHT POLE
- EXISTING WALL MOUNT LIGHT
- MANDOOR
- OVERHEAD DOOR
- LANDSCAPE AREA
- ASPHALT AREA
- GRAVEL AREA
- CONCRETE AREA
- INTERLOCKING AREA
- RIP RAP AREA



KEYPLAN
N.T.S



Gerrits ENGINEERING
222 Mapleview Drive West, Suite 300
Barrie, ON L4N 9E7 Canada
Tel.: 705.737.3303
Fax.: F.705.737.1772
www.gerreng.com

This drawing has been created electronically.

Handwritten or manual revisions to the drawing are only valid when accompanied by the design engineer's initials.

Do not scale drawings.
Check and verify all dimensions and information on the drawings and report all errors or ommissions to the Consultant before proceeding with the work.
This drawing shall not be reproduced in any manner, in part or in whole, for any project other than that for which it was prepared.
this drawing, and all design concepts it contains, are an instrument of professional service and remain the property of Gerrits Engineering.

This drawing may have been reduced.

0 5 10 20 30 40 50mm
0" 1/4" 1/2" 1" 1 1/2" 2"

No.	Issuance Description	YY/MM/DD
1.	CLIENT REVIEW	24/01/31
2.	SITE PLAN APPROVAL	24/05/17

Issued For:
SITE PLAN APPROVAL

Client
INNISFIL BEACH DEVELOPMENTS INC.
241 Bradwick Drive, Concord, ON L4K 1K5

Project
HOME2 SUITES BY HILTON HOTEL
19 Lennox Drive, Barrie, ON L4N 9V8

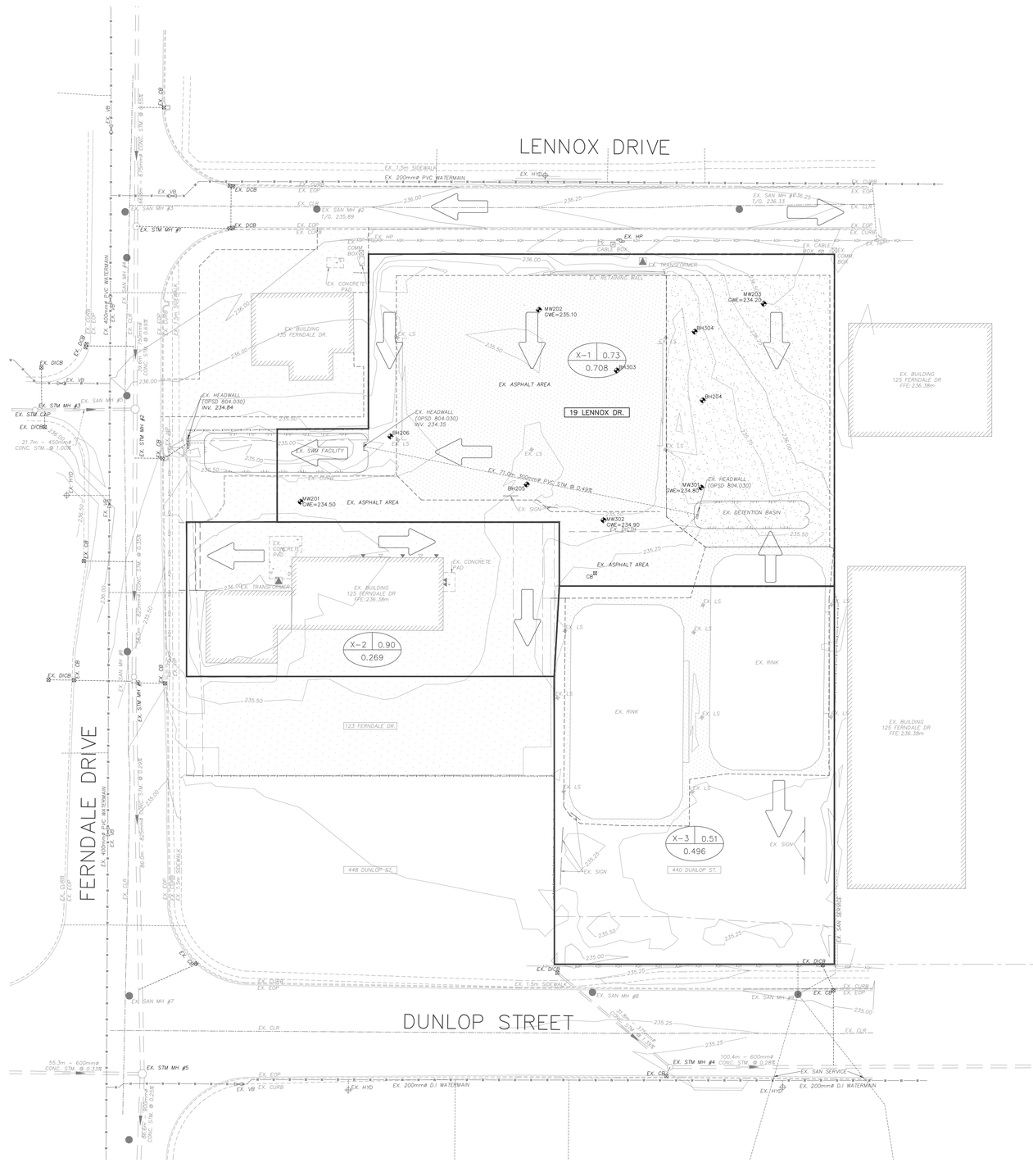
Drawing:
SITE SERVICING PLAN

Project No.	1614-001-21	Designed by: RM	Checked by: KF
Scale:	1:250	Drawn by: RM	Approved by: JDM

Orientation

Stamp
LICENSED PROFESSIONAL ENGINEER
J.D.J. McCuaig
100084895
2024/06/21
PROVINCE OF ONTARIO

Drawing No.
SS-1



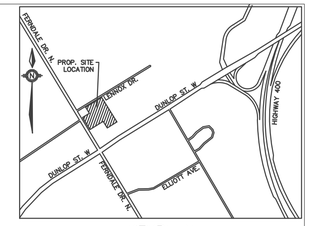
LEGEND

ID X/P–1 0.75 5.55 — RUNOFF COEFFICIENT; AREA (ha)

CATCHMENT BOUNDARY

OVERLAND FLOW ROUTE

100 YEAR PONDING AREA



KEYPLAN
N.T.S

Gerrits ENGINEERING

222 Mapleview Drive West, Suite 300
Barrie, ON L4N 9E7 Canada
Tel.: 705.737.3303
Fax.: F.705.737.1772
www.gerreng.com

0 5 10 20 30 40 50mm
0" 1/4" 1/2" 1" 1 1/2" 2"

No.	Issuance Description	YY/MM/DD
1.	CLIENT REVIEW	24/01/31
2.	SITE PLAN APPROVAL	24/05/17

Issued For:

SITE PLAN APPROVAL

Client

INNISFIL BEACH DEVELOPMENTS INC.

241 Bradwick Drive, Concord, ON L4K 1K5

Project

HOME2 SUITES BY HILTON HOTEL

19 Lennox Drive, Barrie, ON L4N 9V8

Drawing:

PRE–DEVELOPMENT STORMWATER MANAGEMENT PLAN

Project No.	1614-001-21	Designed by: RM	Checked by: KF
Scale:	1:500	Drawn by: RM	Approved by: JDM

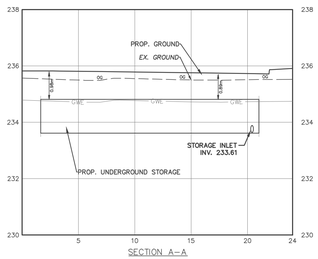
Orientation

Stamp

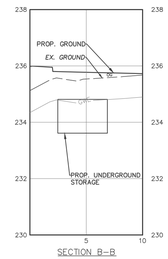
LICENSED PROFESSIONAL ENGINEER
J.D.J. McCuaig
100084895
2024/06/21
PROVINCE OF ONTARIO

Drawing No.

STM-1



SECTION A–A



SECTION B–B

LEGEND

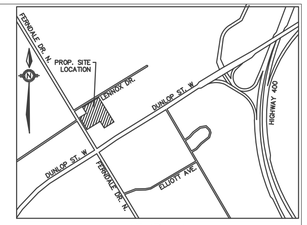
ID — X/P–1 0.75 / 5.55 — RUNOFF COEFFICIENT

AREA (ha)

CATCHMENT BOUNDARY

OVERLAND FLOW ROUTE

100 YEAR PONDING AREA



KEYPLAN
N.T.S

LENNOX DRIVE

FERNDALE DRIVE

FUTURE ROADWAY

EX. 1.5m SIDEWALK
EX. 200mmø PVC WATERMAIN
EX. CURB
EX. EOP
EX. CLR
EX. HYD
EX. CB
EX. VB
EX. DCB
EX. SAN MH #3
EX. SAN MH #2
T/G. 235.89
EX. SAN MH #1
T/G. 236.33
EX. STM MH #1
EX. HP
EX. COMM. BOX
EX. CABLE BOX
EX. HP
EX. 400mmø PVC WATERMAIN
80.5m – 450mmø C.S.P. SAN. @ 0.72%
66.8m – 675mmø CONC. STM. @ 0.54%
41.6m – 250mmø PVC SAN. @ 0.49%
91.5m – 250mmø PVC SAN. @ 0.49%
92.3m – 250mmø P
EX. CONCRETE PAD
EX. BUILDING 135 FERNDALE DR.
EX. TRANSFORMER
EX. BUILDING 125 FERNDALE DR FFE-236.38m
EX. CONCRETE PAD
FUTURE 1.5m SIDEWALK
PROP. CURB AS PER OPSD 600.110
PROP. 100 YEAR PONDING VOLUME=34.9m³ ELEV.235.71
PROP. UNDERGROUND STORAGE 19.36mL x 4.4mW x 1.22m H VOLUME=97.1m³ INV. 233.61 (OG) T/G. 235.71 SW. INV. 233.33 NE. INV. 233.36
EX. HEADWALL (OPSD 804.032) INV. 234.84
6.4m EASEMENT
3.2m – 300mmø PVC STM. @ 0.50%
PROP. 250mmø ORIFICE PIPE
32.9m – 450mmø PVC STM. @ 0.50%
15.7m – 450mmø PVC STM. @ 0.50%
46.3m – 450mmø PVC STM. @ 0.50%
EXTERNAL STM CONNECTION INV. 233.66
CBMH #2 T/G. 235.68 NW. INV. 233.59 SW. INV. 233.44 NE. INV. 233.47 N. INV. 233.59
8.9m – 300mmø PVC STM. @ 2.50%
CB #4 T/G. 235.60 NW. INV. 233.88
MH #3 (DOG HOUSE) T/G. 235.79 NE. INV. 233.17 NW. INV. 233.02 SE. INV. 233.02 (INVERT TO BE CONFIRMED BY CONTRACTOR)
CB #2 T/G. 235.60 SE. INV. 234.28
CB #3 T/G. 235.50 S. INV. 233.88
PROP. 75mmø ORIFICE PIPE
42.7m – 300mmø PVC STM. @ 1.00%
6.4m EASEMENT
PROP. FLUSH CURB (TYP.)
PROP. VALVE BOX
PROP. HYDRANT
PROP. SIAMESE CONNECTION
PROP. RAMP AS PER OPSD 310.033 WITH TACTILE PLATE AS PER OPSD 310.039
PROP. FLUSH CURB
PROP. RAMP AS PER OPSD 310.033 WITH TACTILE PLATE AS PER OPSD 310.039
PROP. DOWNSPOUT
PROP. TACTILE PLATE AS PER OPSD 310.39
PROP. FLUSH CURB
PROP. VALVE BOX
19 LENNOX DR.
PROP. BUILDING FFE=236.25
EXTERIOR PATIO
PROP. STM SERVICE 2 SE. INV. 234.58
MH #1 T/G. 235.59 SE. INV. 233.85 NW. INV. 233.85 SW. INV. 233.70 NE. INV. 233.85
PROP. STM SERVICE 1 SW. INV. 234.05
9.9m – 250mmø PVC. STM. @ 2.00%
18.2m – 250mmø PVC. STM. @ 2.00%
PROP. CURB AS PER OPSD 600.110
PROP. HIGH CURB
PROP. TRANSFORMER
PROP. CURB AS PER OPSD 600.110
CBMH #1 T/G. 235.54 NE. INV. 234.06 NW. INV. 233.91
43.4m – 300mmø PVC STM. @ 0.50% C/W PIPE INSULATION
ROOF LEADER 2 CONNECTION NW. INV. 234.22
CB #1 T/G. 235.58 SW. INV. 234.28
P–1 0.95 / 0.103 ha
P–2 0.95 / 0.020 ha
P–3 0.84 / 0.168 ha
P–4 0.91 / 0.085 ha
P–5 0.85 / 0.077 ha
P–6 0.82 / 0.184 ha
P–7 0.73 / 0.046 ha
P–8 0.10 / 0.012 ha
P–9 0.19 / 0.014 ha
P–20 0.89 / 0.043 ha

Gerrits ENGINEERING

222 Mapleview Drive West, Suite 300
Barrie, ON L4N 9E7 Canada
Tel.: 705.737.3303
Fax.: F.705.737.1772
www.gerreng.com

No.	Issuance Description	YY/MM/DD
1.	CLIENT REVIEW	24/01/31
2.	SITE PLAN APPROVAL	24/05/17

Issued For:

SITE PLAN APPROVAL

Client

INNISFIL BEACH DEVELOPMENTS INC.

241 Bradwick Drive, Concord, ON L4K 1K5

Project

HOME2 SUITES BY HILTON HOTEL

19 Lennox Drive, Barrie, ON L4N 9V8

Drawing:

POST DEVELOPMENT STORMWATER MANAGEMENT PLAN

Project No.	1614-001-21	Designed by: RM	Checked by: KF
Scale:	1:250	Drawn by: RM	Approved by: JDM

Orientation

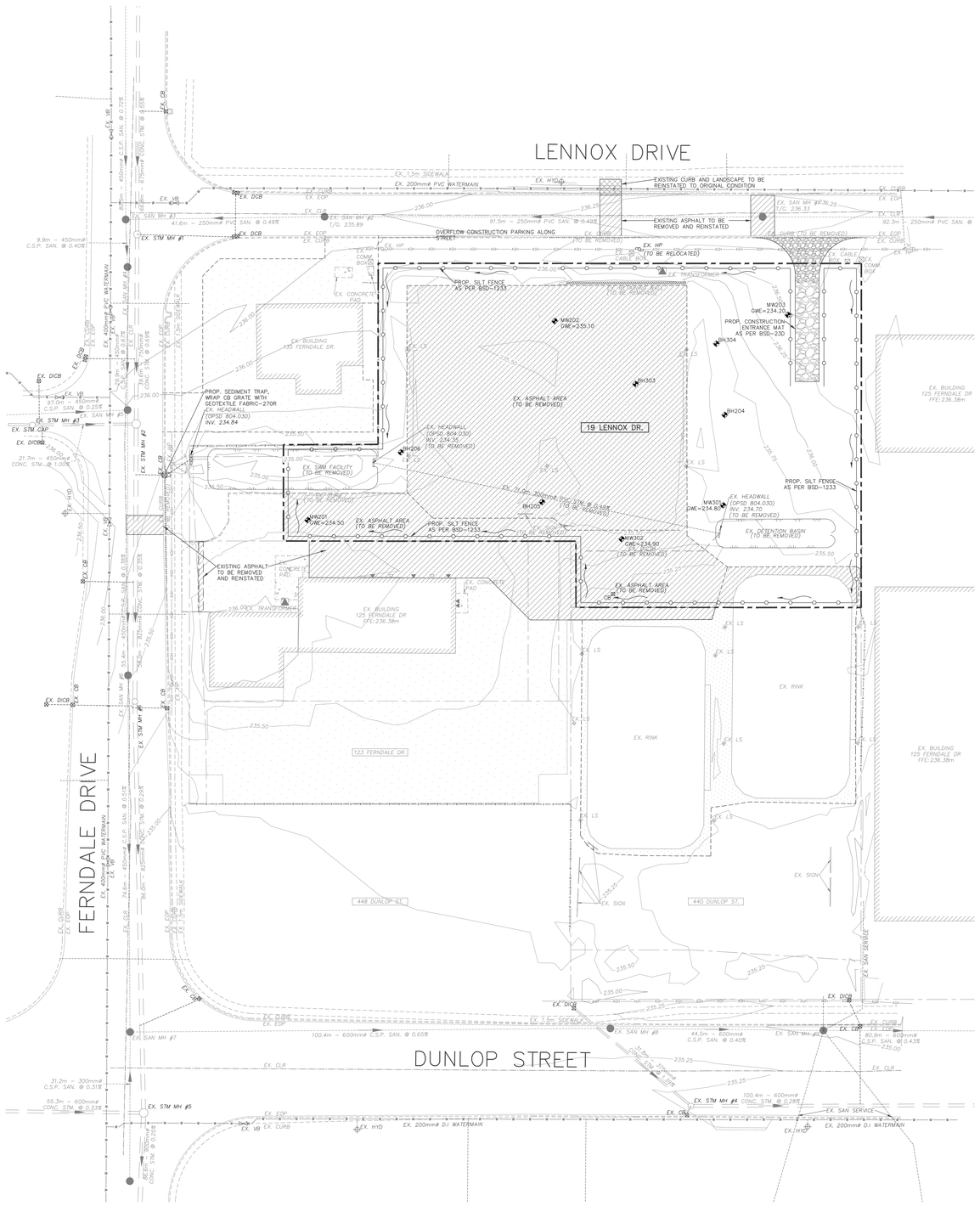
Stamp

LICENSED PROFESSIONAL ENGINEER
J.D.J. McCuaig
100064895
2024/06/21
PROVINCE OF ONTARIO

Drawing No.

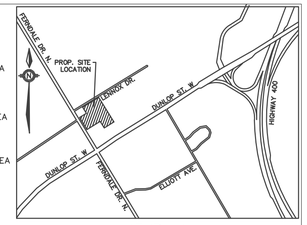
STM-2

SAVED: X:\1600\1614 Dunlop Ferndale Inc\1614-001-21 Dunlop Ferndale Development\DWGS_Civil\1614-001-21 LAYOUT, 6/11/2024 10:29:03 AM , RMODELEY PRINTED: 6/21/2024 2:11:00 PM, STM-2, JMCCUAIG



LEGEND

- SILT FENCE
- ROCK CHECK DAM
- STRAW BALE
- SAND BAG BARRIER
- TEMPORARY SWALE
- DIRECTION OF INTERIM OVERLAND FLOW
- LSRCA REGULATION LIMIT
- ASPHALT REMOVAL AREA
- SIDEWALK REMOVAL AREA
- CONCRETE REMOVAL AREA
- DECIDUOUS TREE
- CONIFEROUS TREE



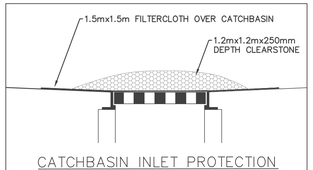
KEYPLAN
N.T.S

NOTES FOR SEDIMENT & EROSION CONTROL

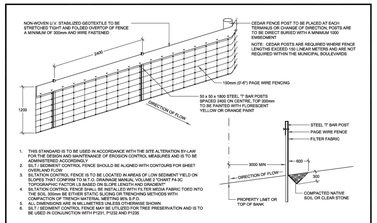
1. DISTURBED AREAS THAT HAVE FAILED TO HAVE STABLE GROUND COVER ESTABLISHED BY OCTOBER 30TH SHALL BE PROTECTED WITH A SILTATION CONTROL FENCE OR STRAW MULCH ETC. AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION BECOMES ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
2. ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30 M FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE ADMINISTRATOR.
3. SILT FENCE SHALL BE PUT IN PLACE PRIOR TO AND MAINTAINED DURING ALL GRADING. SILT FENCE SHALL COMPLY WITH OPSD 219.110 FOR LIGHT DUTY AND / OR OPSD 219.130 FOR HEAVY DUTY; UNLESS NOTED OTHERWISE. SILT FENCE TO BE INSPECTED PRIOR TO COMMENCEMENT OF EARTH GRADING ACTIVITIES. SILT FENCE TO BE INSPECTED AND REPAIRED OR REPLACED IF DAMAGED AS DIRECTED BY THE SITE ADMINISTRATOR. SILT CONTROLS TO BE INSPECTED ON A REGULAR BASIS AND AFTER EVERY RAIN EVENT. INSTALLATION SHALL BE TO THE MANUFACTURER'S SUGGESTED SPECIFICATIONS.
4. THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES. ALL SEDIMENT AND EROSION CONTROL MEASURES SHALL BE INSPECTED AT LEAST ONCE A WEEK, AND AFTER EVERY RAINFALL EVENT.
5. MUD MATS WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES THE SITE SHALL BE USED. MUD MATS TO BE 300mm IN DEPTH, 6.0m WIDE BY 20.0m LONG, FIRST 10.0m TO 150mmø CLEAR STONE WITH THE REMAINING 10.0m CONSISTING OF 50mmø CLEAR STONE; OR MEET MUNICIPAL STANDARDS WHERE IDENTIFIED.
6. CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805, CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AS WELL AS ALL APPLICABLE MUNICIPAL STANDARDS.
7. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES. SUCH MEASURES SHOULD BE PRESENTED IN WRITING FOR APPROVAL OF THE SITE ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE CONSERVATION AUTHORITY.
8. THE TOPS OF ALL FILTER FABRIC MUST BE A MINIMUM OF 1.0 METRES ABOVE THE GROUND LEVEL AND ATTACHED TO THE FENCE WITH A CONTINUOUS STEEL WIRE, ALTERNATIVELY, THE FILTER FABRIC MUST BE FOLDED OVER THE TOP OF THE FENCE AND ATTACHED TO THE FENCE WITH WIRE LOOPED THROUGH THE FABRIC ON BOTH SIDES OF THE FENCE. FILTER FABRIC IS TO BE TERRAFIX 270R OR EQUIVALENT.
9. ALL DISTURBED GROUND LEFT INACTIVE SHALL BE STABILIZED BY SEEDING, SODDING, MULCHING, OR COVERING OR OTHER EQUIVALENT CONTROL MEASURES. THIS PERIOD OF INACTIVITY SHALL BE AT THE DISCRETION OF THE MUNICIPAL DIRECTOR OF ENGINEERING BUT SHALL NOT EXCEED (30) DAYS OR SUCH LONGER PERIOD DEEMED ADVISABLE BY THE MUNICIPAL DIRECTOR OF ENGINEERING.
10. CONTRACTOR SHALL INSTALL AND MAINTAIN CATCHBASIN SEDIMENT BARRIERS THROUGHOUT THE SITE DURING ALL CONSTRUCTION ACTIVITIES IN ORDER TO MITIGATE SEDIMENT ENTERING THE STORM SEWERS.
11. NO FUEL TO BE STORED ON SITE. IN CASE OF A SPILL PLEASE CONTACT: MOECC SPILLS ACTION CENTER 1-800-268-6060.
12. SEDIMENT CONTROLS ARE TO REMAIN IN PLACE UNTIL WRITTEN DIRECTION IS RECEIVED FROM THE ENGINEER REGARDING THEIR REMOVAL.
13. EROSION AND SEDIMENT CONTROLS WILL BE INSPECTED ON AS PER MUNICIPAL REQUIREMENTS OR AFTER SIGNIFICANT RAINFALL EVENTS.

SEQUENCE OF CONSTRUCTION

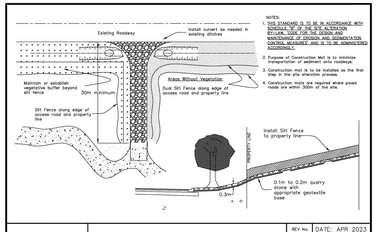
1. ENGINEER AND MUNICIPALITY TO BE NOTIFIED PRIOR TO INITIATION OF ANY ON SITE WORKS.
2. SILT FENCE AND CONSTRUCTION ACCESS MATS TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ONSITE.
3. VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
4. COMMENCE WITH EARTH EXCAVATION AND SITE SERVICING (STOCKPILE TO BE DETERMINED DURING CONSTRUCTION AND SITE ALTERATION PERMIT).
5. EROSION CONTROL MEASURES TO BE MAINTAINED AS DIRECTED BY THE ENGINEER DURING THE CONSTRUCTION PERIOD. ADDITIONAL CONTROL MEASURES MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
6. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED WITH SEED, SOD, MULCH OR OTHER ADEQUATE COVERING, AS INSTRUCTED BY THE ENGINEER.
7. ALL CONSTRUCTION VEHICLES TO ACCESS THE SITE VIA THE DESIGNATED CONSTRUCTION ENTRANCES AS SHOWN.



CATCHBASIN INLET PROTECTION
N.T.S.



Barrie	FENCE SILTATION CONTROL	REV No. 3	DATE: APR 2023	SCALE: N.T.S.	P1233



Barrie	Construction Entrance	REV No. 2	DATE: APR 2023	SCALE: N.T.S	D710

Gerrits ENGINEERING
222 Mapleview Drive West, Suite 300
Barrie, ON L4N 9E7 Canada
Tel.: 705.737.3303
Fax.: F.705.737.1772
www.gerreng.com

No.	Issuance Description	YY/MM/DD
1.	CLIENT REVIEW	24/01/31
2.	SITE PLAN APPROVAL	24/05/17

Issued For:

SITE PLAN APPROVAL

Client
INNISFIL BEACH DEVELOPMENTS INC.
241 Bradwick Drive, Concord, ON L4K 1K5

Project
HOME2 SUITES BY HILTON HOTEL
19 Lennox Drive, Barrie, ON L4N 9V8

Drawing:
EROSION & SEDIMENT CONTROL PLAN

Project No.	1614-001-21	Designed by:	RM	Checked by:	KF
Scale:	1:500	Drawn by:	RM	Approved by:	JDM

Orientation

Stamp
LICENSED PROFESSIONAL ENGINEER J.D.LI McCuaig 100084895 2024/06/21 PROVINCE OF ONTARIO

Drawing No.
ESC-1