FUNCTIONAL SERVICING REPORT

233 DUNLOP STREET WEST

CITY OF BARRIE, COUNTY OF SIMCOE

PEARSON
ENGINEERING LTD.
PEARSONENG.COM

(Revised February 2019)

December 2017

12081.01

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Functional Servicing Report
233 Dunlop Street West - Barrie

1. Introduction

PEARSON Engineering Ltd. has been retained by MDM Developments (Client) to prepare a Functional Servicing Report (FSR) in support of the proposed 8-storey residential building with ground floor commercial space located at 233, 237, 241, and 245 Dunlop Street West in the City of Barrie (City), County of Simcoe (County).

The subject property is approximately 0.72 ha in size and currently contains one residential lot and three vacant lots. The existing site drains to the south sloping towards Bunkers Creek at the rear of the property. The location of the site can be seen on Figure 1.

This FSR assesses the existing municipal infrastructure in the vicinity of the Project, the onsite Stormwater Management (SWM) facilities and internal services required to service the proposed Project. The report also includes design calculations and a brief outline of the proposed internal services, as well as comments regarding the ability of the various secondary utilities to service the site.

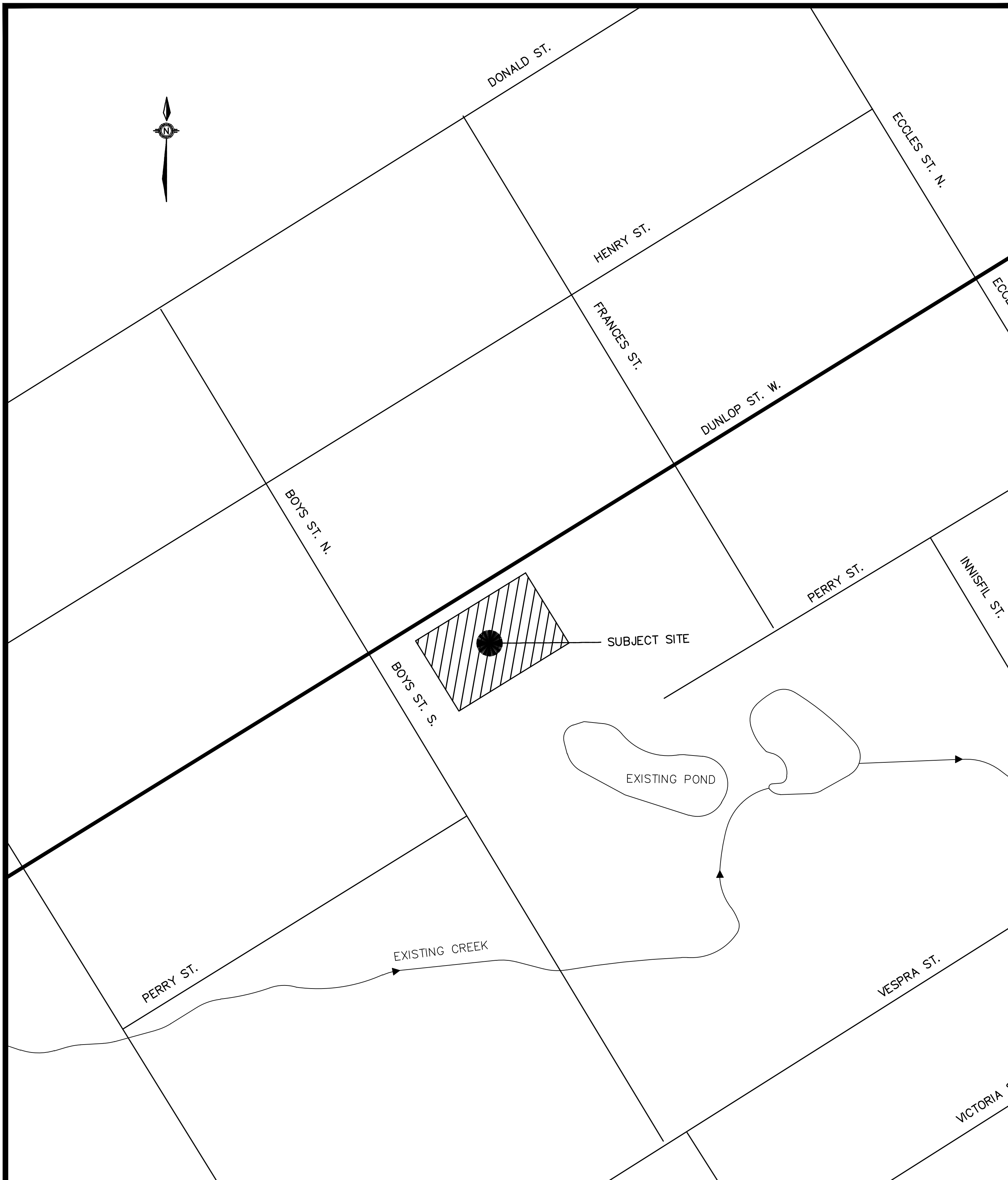
2. Supporting Documents

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

- Ministry of the Environment, Design Guidelines for Sewage Works, 2008
- Ministry of the Environment, Design Guidelines for Drinking-Water Systems, 2008
- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- City of Barrie, Sanitary Sewage Collection System Policies and Design Guidelines, September 2012
- City of Barrie, Water Distribution Specification, February 2005
- City of Barrie, Storm Drainage and Stormwater Management Policies and Design Guidelines, November 2009

3. Design Population

The proposed building is to have a total of 91 units and based on the average unit size, a design population of 2.34 persons per unit was selected. This results in a maximum projected design population of 213 persons. Refer to Appendix A for calculations.



233 DUNLOP STREET WEST
BARRIE, ONTARIO

LOCATION PLAN

PEARSON ENGINEERING LTD.
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DESIGNED BY	MWD	HORIZ SCALE	1:750	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	FIG-1
CHECKED BY	MWD	DATE	DEC 2017	REVISION #	0

4. Water Supply and Distribution

4.1. Water Servicing Design Criteria

The site is to have a total population of 213 persons. Utilizing the MECP Guidelines for domestic water use of 225 L/capita/day, an Average Day Demand (ADD) of 0.56 L/sec is required. The Peak Rate factor of 4.13 is used in calculating the Peak Hour Demand (PHD) of 2.31 L/sec for the development. Calculations for the domestic water requirements for the site can be found in Appendix A.

4.2. Internal Water Distribution System

The Project will be serviced by municipal water for domestic and fire service and designed as per City standards. A 100 mm diameter and a 300 mm diameter municipal watermain exists on Dunlop Street West. The site will be serviced by connecting to the existing 300 mm diameter watermain with a 150 mm diameter fire service and a 100 mm diameter domestic service. The existing hydrant adjacent to the proposed driveway will service the development. Refer to Drawing SS-1 – Site Servicing Plan in Appendix G for the water servicing layout.

We suggest that the City review the existing watermain distribution system with respect to the City's water treatment and supply capacities for both domestic and fire service for this development and confirm that pressure and capacity allocation is available. If required, a water pressure test can be completed.

5. Sanitary Servicing Overview

5.1. Sanitary Design Criteria

The site is to have a total population of 213 persons. Utilizing the City of Barrie Guidelines for domestic sewer use of 225 L/capita/day, the Average Daily Flow (ADF) of 0.56 L/s is calculated. Using the max Peaking Factor of 4.0 for this project, a Peak Flow of 2.24 L/s is calculated for the project site. The proposed sanitary sewer will be designed to convey the sanitary design flows for the project to an existing 300 mm diameter sanitary sewer on Dunlop Street West. The total capacity of the existing sewer is approximately 61 L/s, and therefore the flow from the proposed development would result in 3.7% of the sanitary sewer's capacity. An analysis of the existing sanitary sewer capacity can be completed if required. Sanitary design flow and pipe sizing calculations can be found in Appendix B.

5.2. Internal Sanitary Sewer System

The sanitary sewers will be constructed in accordance with the City of Barrie's Engineering Standards and the MECP guidelines in order to service the Project. The proposed sanitary sewer system for this Project is to convey sanitary flow to the existing sanitary sewer on Dunlop Street West. The proposed sewers will consist of a minimum diameter of 200 mm and will be designed to meet minimum design grades and the required minimum and maximum velocities under flow conditions. Refer to the Drawing SS-1 Site Servicing Plan in Appendix G for the proposed sanitary servicing layout.

We suggest that the City review the sanitary design flow from this Project with respect to the City's sanitary treatment capacities and confirm that capacity allocation is available for this development.

6. Stormwater Management

A key component of the development is the need to address environmental and related SWM issues. These are examined in a framework aimed at meeting the City, LSRCA and MECP requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems. This FSR focuses on the necessary measures to satisfy the MECP's SWM requirements.

It is understood 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; and
- Maintain and protect significant natural features.

6.1. Analysis Methodology

The design of the SWM Facilities for this site has been conducted in accordance with:

- The Ministry of the Environment Stormwater Management Planning and Design Manual, March 2003
- City of Barrie, Storm Drainage and Stormwater Management Policies and Design Guidelines, 30 November 2009
- Lake Simcoe Region Conversation Authority Technical Guidelines for Stormwater Management Submissions, September 2016

In order to design the facilities to meet these requirements, it is essential to select the appropriate modeling methodology for the storm system design. Given the size of the site, the Modified Rational Method is appropriate for the design for the SWM system.

6.2. Existing Drainage Conditions

The existing Project site currently consists of vacant and residential lots. Review of the site identifies that the majority of the site's stormwater flows from north to south overland at approximately 1 to 2%. The rear of the property slopes down to the existing creek bed at approximately 30 to 50%. The flows that are conveyed overland to Bunker Creek ultimately outlet to Kempenfelt Bay. Details of existing storm drainage conditions are shown on the Drawing STM-1 – Pre-Development Storm Catchment Plan in Appendix G.

According to the *Soil Map of Simcoe County, Report No.29 of the Ontario Soil Survey, Ministry of Agriculture and Food*, the project site is comprised of Wauseon Sandy Loam. This soil is characterized as outwash sand underlain by calcareous clay or silty clay loam, as well as having poor drainage. This material is characterized in the Hydrologic Soil Group CD. Allowable peak flows for the site were calculated using the site’s current conditions and can be seen in Table 1 below. Detailed calculations for the existing drainage conditions can be found in Appendix C.

Table 1: Pre-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Total Site (m^3/s)	0.023	0.031	0.035	0.046	0.055	0.063

6.3. Proposed Storm Drainage System

The proposed drainage from the building rooftop will flow via gravity through a 300 mm diameter storm sewer to underground storage chambers in the parking lot area south of the proposed building. First, the remaining stormwater will drain via overland flow to proposed permeable pavers and catch basins in the south portion of the parking lot. Underground storage chambers provided for quantity control will be designed as an off-line system, and discharge to the south through an outlet, ultimately draining to Bunker Creek. A small portion north of the proposed building will drain uncontrolled to Dunlop Street West and the environmentally protected land to the south of the proposed development will continue to drain southerly to Bunkers Creek. The layout for the stormwater servicing and storm drainage patterns can be found on the Drawing STM-2 in Appendix G. Calculations for the proposed stormwater management system can be found in Appendix C.

The Project site will be drained via the proposed storm sewer which will be sized for the 5-year storm event using the rational method. The storm sewer will ultimately convey stormwater to Bunkers Creek. An emergency overflow weir will be provided in the south side of the parking lot in order to convey stormwater to Bunkers Creek in the event of a storm greater than the 100-year storm. Refer to Drawing SG-1 for details of the grading design.

6.4. Stormwater Quantity Control

Quantity control on site will be provided through underground storage chambers and above grade parking lot storage located in the parking lot to the south of the proposed building. An orifice tube will be used prior to the STM OGS manhole to reduce the post-development peak flows leaving the site, causing stormwater to back up into the subsurface storage units. In the event of a storm greater than the 100-year storm, an overland flow route will be provided through the parking lot to the creek via the south edge of the parking lot. Post-development peak flows for the site can be seen in Table 2 below.

Calculations indicate that 136 m^3 of storage will be required. This will be provided through Brentwood Stormwater Chambers. Refer to Appendix C for calculations. The chambers are designed as an off-line system located under the parking lot. The units are wrapped with Geotextile fabric and use the storage located in the chamber only to provide storage. A catchbasin manhole near the underground chambers as well as an inspection port will be used to inspect and clean the system. The Brentwood system information can be found in Appendix C.

Table 2: Post-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Area 1 (Controlled) (m^3/s)	0.015	0.017	0.022	0.030	0.037	0.045
Area 2, 3 & 4 (Uncontrolled) (m^3/s)	0.008	0.010	0.012	0.014	0.015	0.017
Total Site (m^3/s)	**0.023**	**0.027**	**0.033**	**0.044**	**0.052**	**0.062**

6.5. Low Impact Development

Modern Stormwater Management (SWM) practices have evolved over recent years, with Low Impact Development (LID) techniques being widely used as the preferred method of Stormwater Management. The stormwater management for the site is to be provided by a combination of a treatment train approach consisting of LID features. As such, it is proposed that LID techniques be implemented throughout the development in the form of bioretention trenches.

Permeable pavers are proposed to be implemented on the south edge of the parking lot to treat stormwater runoff from the paved areas for quality control, as well as help reduce phosphorous levels. The filter component of permeable pavers is generally comprised of a mixture of sand, fines and organics. This soil mixture is then covered with a layer of mulch and vegetation to aid in treating the stormwater runoff. An underdrain will be required if underlying soil condition have an infiltration rate less than 15 mm/hr. In this case, a perforated pipe will be installed in the bottom of the trench that would connect to the storm sewer.

Low Impact Development features are an emerging technology and therefore the guidelines listed above are subject to change. As standard details and specifications are still being developed, all details and locations are to be reviewed and approved by the City.

6.6. Permanent Quality Control

The Ministry of the Environment (MOE) in March 2003 issued a “Stormwater Management Planning and Design Manual”. This manual has been adopted by a variety of agencies including the City of Barrie. The objective of our Stormwater Quality Control will be to ensure Enhanced Protection quality control as stated in the MOE manual. To achieve enhanced protection, permanent and temporary control of erosion and sediment transport are proposed and are discussed in the following sections.

6.6.1. During Construction Activities

During construction, earth grading and excavation will create the potential for soil erosion and sedimentation. It is imperative that effective environmental and sedimentation controls are in place and maintained throughout the duration of construction activities to ensure stormwater runoff's quality.

Therefore, the following recommendations shall be implemented and maintained during construction to achieve acceptable stormwater runoff quality:

- Installation of silt fence along the entire perimeter of the site to reduce sediment migration onto surrounding properties;
- Installation of a construction entrance mat to minimize transportation of sediment onto roadways;

- Restoration of exposed surfaces with vegetative and non-vegetative material as soon as construction schedules permit. The duration in which surfaces are disturbed/exposed shall not exceed 30 days;
- Reduce stormwater drainage velocities where possible; and
- Minimize the amount of existing vegetation removed.

6.6.2. Post Construction Activities

The development's parking facilities pose a risk to stormwater quality through the collection of grit, sand and oils on the paved surface. A CDS or equivalent treatment unit is proposed in order to treat the stormwater released from the site to MOE Enhanced or Level 1 Protection standard. This MOE standard stipulates a Total Suspended Solids (TSS) removal of at least 80%.

6.7. Water Balance

Since the post-development state will increase the imperviousness of the site, considerations were taken in regard to groundwater recharge. According to the *Soil Map of Simcoe County, Report No.29 of the Ontario Soil Survey,* the project site is comprised of Sandy Loam underlain by silty clay loam and therefore the ability to infiltrate will be reviewed further during the geotechnical investigation. Based on the presumption that the soils are able to accept infiltration, a water budget was completed as per LSRCA guidelines. Under pre-development conditions, the project site had an annual recharge volume of 898 m^3. With the increased imperviousness of the site, this recharge will be reduced to 270 m^3, resulting in a deficit volume of 628 m^3.

In order to infiltrate an additional 628 m^3 annually, a yearly rainfall depth of 505 mm from the rooftop is required to be infiltrated resulting in a storage volume of 11 m^3. This percentage of annual rainfall occurs for rain events of 6 mm or less. However, it is proposed to provide retention for the first 5 mm of rainfall over the site area as per City of Barrie Guidelines resulting in a required storage volume of 28 m^3. Detailed water balance calculations have been provided in Appendix D.

6.8. Phosphorus Calculations

Local conservation authorities have determined the importance of reducing phosphorus levels in water courses in this area. The reduction was based on conservative values derived from the LSRCA. As such, best efforts are to be employed in order to reduce phosphorus levels to pre-development levels or better.

The existing site generates approximately 0.07 kg of phosphorus annually and the proposed Project will generate approximately 0.52 kg of phosphorus annually if uncontrolled. Best efforts will be used in order to reduce the phosphorus loading as much as is reasonably possible.

To minimize the amount of phosphorus discharged from the site, a treatment train approach is to be utilized. Rooftop runoff from the proposed buildings and parking lot will be conveyed to underground storage chambers. Additional stormwater runoff from the parking lot will be conveyed to a bioretention trench as well as catchbasins complete with sumps to capture larger particles. Storm runoff will be held in underground storage chambers to reduce post-development peak flows and phosphorous levels.

The following Table 3 details the anticipated phosphorus loadings for the pre and post-development conditions.

Table 3: Phosphorus Loadings

	Total P (kg)
Pre-Development	0.07
Uncontrolled Post-Development	0.52
Controlled Post-Development	0.08

The post-development site has an increase of total phosphorus. Detailed calculations can be found in Appendix E.

7. Traffic Analysis

The Project site is located approximately 400 m east of Anne Street between Boys Street South and Frances Street along Dunlop Street West. Dunlop Street West consists of a 4-lane road with a posted speed limit of 50 km/hr and slopes west at approximately 0.5%.

7.1. Data Collection

This analysis has been derived from traffic volumes for the intersection of Dunlop Street West and Anne Street based on a traffic count Provided by the City of Barrie in the summer of 2017 over a one-day period in the AM & PM peak hour. A detailed volume report can be found in Appendix F.

Table 4: Dunlop Street West Traffic Counts

Start Time	WB	EB
	# of Veh.	# of Veh.
AM		
7:00	89	64
8:00	100	159
PEAK	100	159
MD		
11:00	115	169
12:00	131	195
1:00	128	176
PEAK	131	195
PM		
3:00	133	223
4:00	138	190
5:00	136	215
PEAK	138	223

7.2. Traffic Generation

Trip Generations are based on land use and types of development. Using trip generation charts from the 7th Edition of the Institute of Transportation Engineers (ITE) Trip Generation Volume 2, projected vehicle trip ends were determined. The Land Use used to determine these volumes are classified as Mid-Rise Apartment Residential Use (ITE land use code 223) and Specialty Retail Center (ITE land use code 814). These Generation charts can be found in Appendix F.

The proposed estimated AM and PM weekday peak hour trips are shown below in Table 5.

Table 5: Site Generated Traffic Flows

		Traffic Distribution			Traffic Distribution	
ITE Land Use	Weekday AM Peak	AM In	AM Out	Weekday PM Peak	PM In	PM Out
Residential - Mid-Rise Apartment	27	31%	69%	35	57%	43%
Specialty Retail Center	12	48%	52%	9	56%	44%
Total:	39	-	-	44	-	-

As indicated above, the highest traffic volume generated from the development was estimated during the Weekday PM Peak Hour.

7.3. Level-of-Service (LOS)

Level of Service (LOS) is a standard method of quantifying the efficiency of operating conditions within traffic systems. It is based on the physical characteristics of a highway and the different operating characteristics that may occur through various movements. Delay is a term used that relates to the number of vehicles desiring to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to the opposing traffic flows.

Table 6 contains the Level of Service criteria for un-signalized (stop-controlled) and signalized intersections. According to the Highway Capacity Manual (HCM), LOS for an un-signalized intersection is determined by control delay and is defined for each minor movement. LOS is not defined for the intersection. The Ministry of Transportation (MTO) states that the LOS for a signalized intersection is based on the concept that vehicles arriving at an intersection will be able to clear the intersection during the first green interval encountered upon their arrival. The highest rating of LOS is A, under which the average control delay on a movement, approach, or intersection is less than 10 seconds per vehicle. Remedial measures are considered as soon as the intersection conditions result in a LOS E. However, LOS E for left turning traffic at un-signalized intersections with major roads is commonly accepted. The lowest rating is LOS F, where the average delay exceeds 80 seconds at signalized intersections. Under such a condition, remedial measures are usually implemented.

Table 6: Level of Service Definitions

Level of Service	Stop-Controlled Average Control Delay (s/vehicle)	Signalized Average Control Delay (s/vehicle)
A	≤ 10	≤ 10
B	> 10 and ≤ 15	> 10 and ≤ 20
C	> 15 and ≤ 25	> 20 and ≤ 35
D	> 25 and ≤ 35	> 35 and ≤ 55
E	> 35 and ≤ 50	> 55 and ≤ 80
F	> 50	> 80

Using the site generated traffic flows and the provided traffic data counts for Dunlop Street West, the LOS for the AM and PM Peak hour traffic movements fronting the site, are tabulated below in Table 7 for the 2018 year. A review of the LOS for five years post-development can be found tabulated below in Table 8. A growth value of 2.0% per year has been assumed for the traffic counts.

AM Peak hour distribution is estimated at 31% entering and 69% exiting and PM Peak hour is estimated at 57% entering and 43% exiting for the Mid-Rise Apartment ITE Land Use. AM Peak hour distribution is estimated at 48% entering and 52% exiting and PM Peak hour is estimated at 56% entering and 44% exiting for the Specialty Retail Center ITE Land Use.

Table 7: 2018 AM and PM Peak Hour Level of Service

Intersection	AM Peak Hour		
	Critical Movement	Delay (sec)	LOS
Dunlop Street West	WB – Left Turn Entry	8.0	A
Site Entrance	NB - Left Turn Exit	13.4	B
Site Entrance	NB - Right Turn Exit	9.4	A

Intersection	PM Peak Hour		
	Critical Movement	Delay (sec)	LOS
Dunlop Street West	WB – Left Turn Entry	8.3	A
Site Entrance	NB - Left Turn Exit	16.1	C
Site Entrance	NB - Right Turn Exit	9.7	A

Table 8: 2024 AM and PM Peak Hour Level of Service

Intersection	AM Peak Hour		
	Critical Movement	Delay (sec)	LOS
Dunlop Street West	WB – Left Turn Entry	8.2	A
Site Entrance	NB - Left Turn Exit	14.2	B
Site Entrance	NB - Right Turn Exit	9.6	A

Intersection	PM Peak Hour		
	Critical Movement	Delay (sec)	LOS
Dunlop Street West	WB – Left Turn Entry	8.5	A
Site Entrance	NB - Left Turn Exit	17.5	C
Site Entrance	NB - Right Turn Exit	9.9	A

7.4. Traffic Analysis Conclusion

The analysis indicates that based on the generated traffic from the proposed project the site would have a good Level of Service (LOS A & B) for the left/right turn out movements in the AM Peak hour and a good Level of service (LOS A & C) for the left turn out movements in the PM Peak hour. The Level of Service Calculation sheets can be found in Appendix F.

8. Secondary Utilities

Given the location of the subject site, it is anticipated that secondary utilities (hydro, cable, phone and gas) will be readily available to service the site. This will be investigated further in the near future and utilities will be contacted as the project progresses.

9. Conclusions

The proposed development will require the connection of sanitary and watermain services to the existing municipal services on Dunlop Street West. Storm drainage for the development will be conveyed to Bunker Creek.

The SWM design for this site takes into account the existing conditions and is contained within the site's boundaries. An oil/grit separator is proposed to provide the required quality control to satisfy the MOE Enhanced level requirements and underground storage chambers are proposed for quantity control.

The analysis and designs outlined in this report demonstrates that the servicing is feasible.

All of which is respectfully submitted,
Pearson Engineering Ltd.

Taylor Arkell, P.Eng.
Project Engineer

Mike Dejean, P.Eng.
Manager of Engineering Services

Appendix A

Water Servicing Calculations

PEARSON ENGINEERING LTD.

233 Dunlop Street West
Water Flow Calculations

Design Criteria

Demand per capita (Q):	225 L/cap/day	
Peak Rate Factor (Max. Hour)	4.13	(Table 3-1: Peaking Factors, MOE Design Guidelines for Drinking-Water Systems)
Max. Day Factor	2.75	(Table 3-1: Peaking Factors, MOE Design Guidelines for Drinking-Water Systems)

Site Data

Description	**Density**		**Units**		**Flow Rate**		**Peaking Factors**	
Apartments	2.34	people/unit	91	units	225	L/cap/d	MAX DAY FACTOR*	2.75
Commercial Space	165	m^2	1	units	28,000	L/ha*d	PEAK RATE FACTOR*	4.13

*From MOE Manual based on Population of 500 - 1,000

Calculate Population

Pop. Apartments	=	2.34	x	91
Pop. Total	=	213	people	

Calculate Average Day Demand (ADD)

ADD	=	225	x	213	+	2.8	*	165
ADD	=	48,374	L/day					
ADD	=	0.56	L/s					

Calculate Max Day Flow

MDF	=	0.56	x	2.75
MDF	=	1.54	L/s	

Calculate Peak Hour Demand

PHD	=	0.56	x	4.13
PHD	=	2.31	L/s	

Appendix B

Sanitary Servicing Calculations

233 Dunlop Street West
Sanitary Flow Calculations

Design Criteria

Flow per capita (Q):	225 L/cap/day		
Peak Flow	Qp = P * Q * M / 86400 + I * A		
Peaking Factor (Harmon Formula)	M = 1 + (14 / (4 + (P / 1000) ^ 0.5))	Where:	2 <= "M" <= 4

Site Data

Description	Density	Units	Flow Rate
Apartments	2.34 people/unit	91 units	225 L/cap/d
Commercial Space	165 m^2	1 units	28,000 L/ha/d

Calculate Population

Pop. Apartments	=	2.34	x	91
Pop.	=	213	people	

Calculate Average Daily Flows

ADF (L/s)	=	225	x	213	+	2.8	x	165
ADF (L/s)	=	48,374	L/day					
ADF (L/s)	=	0.56	L/s					

Calculate Peaking Factor

$$M = 1 + \frac{14}{4 + \left(\frac{213}{1,000}\right)^{0.5}} + 0.1 * 0.12$$

M = 4.15

Use Max Peaking Factor 4

Calculate Peak Flow

Qp	=	0.56	x	4.00
	=	2.24	L/s	

233 Dunlop Street West
Sanitary Sewer Design

n = 0.013
Q_p = (P/1000)*Q*M/86.4 (Q = 340 l/day/person)
M = 1+(14/(4+(P/1000)^0.5)) (1.5 <= M <= 4)
Q_i = (P*90)/86400 (90 L/Capita/Day)
(includes peaking factor)
D_{min} = 200 mm

$Q_{tot} = Q_p + Q_i$
Design Period = 20 years
Q_{Design} = 35 m^3/ha/day (commercial)
V: > 0.6 m/s & < 3.0 m/s
Grade: >0.5%
Population (P) = 45 PPL / ha or 3.5 PPL / Unit

FILE: 12081.01
CONTRACT/PROJECT: 233 Dunlop St. W.
DATE: 14-Feb-19

Areas	MANHOLE FROM	MANHOLE TO	DWELLING UNITS	AREA (ha)	DENSITY P.P.U	POP. (P)	POP. (ACC.)	M	Qp (l/s)	LENGTH (m)	LENGTH (ACC.) (m)	Qi (l/s)	TOTAL Q (l/s)	D (mm)	S (%)	Q FULL (l/s)	V FULL (m/s)	PERCENT FULL (%)
	SAN CAP	SAN MH2	91	0.12	2.34	212.94	212.94	4.00	3.35	10.1	10.10	0.22	3.57	200	5.00	73.35	2.33	4.87
	SAN MH2	SAN MH1	0	0.00	2.34	0.00	212.94	4.00	0.00	19.0	29.10	0.00	3.57	200	1.00	32.80	1.04	10.89

Appendix C

Stormwater Management Calculations

233 Dunlop Street West
Calculation of Runoff Coefficients

Runoff Coefficient	=	0.15	0.95	0.95	0.60	0.95		Weighted
Surface Cover	=	Grass	Asphalt	Building	Gravel	Concrete		Runoff Coefficient
PRE DEVELOPMENT	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)		
1	5584	5371	54	159	0	0		0.18
Pre Total	5584	5371	54	159	0	0		0.18

POST DEVELOPMENT	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)		
1	1218	0	0	1218	0	0		0.95
2	933	55	760	0	0	118		0.90
3	1777	70	1678	0	0	29		0.92
4	1096	1082	0	0	0	14		0.16
5	560	468	54	0	0	38		0.28
Post Total	5584	1676	2492	1218	0	199		0.71

233 Dunlop Street West
Pre-Development Peak Flows

Storm (yrs)	City of Barrie Coeff A	Coeff B	Coeff C
2	**678.085**	**4.699**	**0.781**
5	**853.608**	**4.699**	**0.766**
10	**975.865**	**4.699**	**0.760**
25	**1146.275**	**4.922**	**0.757**
50	**1236.152**	**4.699**	**0.751**
100	**1426.408**	**5.273**	**0.759**

Modified Rational Method
$Q = C_iCIA / 360$

Where:

Q -	Flow Rate (m^3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

Area Number	1	
Area	0.56	ha
Runoff Coefficient	0.18	
Time of Concentration	10	min
Return Rate	2	year
Peaking Coefficient (C_i)	1.0	
Rainfall Intensity	83.1	mm/hr
Pre-Development Peak Flow	0.023	m^3/s
Return Rate	5	year
Peaking Coefficient (C_i)	1.0	
Rainfall Intensity	108.9	mm/hr
Pre-Development Peak Flow	0.031	m^3/s
Return Rate	10	year
Peaking Coefficient (C_i)	1.0	
Rainfall Intensity	126.5	mm/hr
Pre-Development Peak Flow	0.035	m^3/s
Return Rate	25	year
Peaking Coefficient (C_i)	1.1	
Rainfall Intensity	148.2	mm/hr
Pre-Development Peak Flow	0.046	m^3/s
Return Rate	50	year
Peaking Coefficient (C_i)	1.2	
Rainfall Intensity	164.2	mm/hr
Pre-Development Peak Flow	0.055	m^3/s
Return Rate	100	year
Peaking Coefficient (C_i)	1.25	
Rainfall Intensity	180.2	mm/hr
Pre-Development Peak Flow	0.063	m^3/s

233 Dunlop Street West
Post-Development Peak Flows

Storm (yrs)	City of Barrie Coeff A	Coeff B	Coeff C
2	**678.085**	**4.699**	**0.781**
5	**853.608**	**4.699**	**0.766**
10	**975.865**	**4.699**	**0.760**
25	**1146.275**	**4.922**	**0.757**
50	**1236.152**	**4.699**	**0.751**
100	**1426.408**	**5.273**	**0.759**

Modified Rational Method
$Q = C_i CIA / 360$

Where:

Q -	Flow Rate (m^3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

	Areas to Quantity Control		Total Uncontrolled Flows	
Area Number	1, 2 & 3		4 & 5	
Area	0.39	ha	0.17	ha
Runoff Coefficient	0.92		0.20	
Time of Concentration	10	min	10	min
Return Rate	2	year	2	year
Peaking Coefficient (C_i)	1.00		1.00	
Rainfall Intensity	83.1		83.1	
Post-Development Peak Flow	0.084	m^3/s	0.008	m^3/s
Return Rate	5	year	5	year
Peaking Coefficient (C_i)	1.00		1.00	
Rainfall Intensity	108.9		108.9	
Post-Development Peak Flow	0.110	m^3/s	0.010	m^3/s
Return Rate	10	year	10	year
Peaking Coefficient (C_i)	1.00		1.00	
Rainfall Intensity	126.5		126.5	
Post-Development Peak Flow	0.128	m^3/s	0.012	m^3/s
Return Rate	25	year	25	year
Peaking Coefficient (C_i)	1.10		1.10	
Rainfall Intensity	148.2		148.2	
Post-Development Peak Flow	0.149	m^3/s	0.014	m^3/s
Return Rate	50	year	50	year
Peaking Coefficient (C_i)	1.20		1.20	
Rainfall Intensity	164.2		164.2	
Post-Development Peak Flow	0.166	m^3/s	0.015	m^3/s
Return Rate	100	year	100	year
Peaking Coefficient (C_i)	1.25		1.25	
Rainfall Intensity	180.2		180.2	
Post-Development Peak Flow	0.182	m^3/s	0.017	m^3/s

PEARSON ENGINEERING LTD.

233 Dunlop Street West
Stage-Storage-Discharge Table

Elevation (m)	Area (m^2)	Volume (m^3)	Cum. Vol. (m^3)	Orifice Head (m)	Orifice Flow (m^3/s)	Weir Head (m)	Weir Flow (m^3/s)	Total Flow (m^3/s)
225.88	120	0	0	0.45	0.011	0.000	0.000	0.011
225.90	120	2	2	0.47	0.011	0.000	0.000	0.011
226.00	120	12	14	0.57	0.012	0.000	0.000	0.012
226.10	120	12	26	0.67	0.013	0.000	0.000	0.013
226.20	120	12	38	0.77	0.014	0.000	0.000	0.014
226.30	120	12	50	0.87	0.015	0.000	0.000	0.015
226.40	120	12	62	0.97	0.015	0.000	0.000	0.015
226.50	120	12	74	1.07	0.016	0.000	0.000	0.016
226.60	120	12	86	1.17	0.017	0.000	0.000	0.017
226.70	120	12	98	1.27	0.018	0.000	0.000	0.018
226.80	0	6	104	1.37	0.018	0.000	0.000	0.018
226.90	0	0	104	1.47	0.019	0.000	0.000	0.019
227.00	0	0	104	1.57	0.020	0.000	0.000	0.020
227.10	0	0	104	1.67	0.020	0.000	0.000	0.020
227.20	0	0	104	1.77	0.021	0.000	0.000	0.021
227.30	0	0	104	1.87	0.021	0.000	0.000	0.021
227.40	0	0	104	1.97	0.022	0.000	0.000	0.022
227.50	0	0	104	2.07	0.023	0.000	0.000	0.023
227.60	88	4	109	2.17	0.023	0.000	0.000	0.023
227.70	206	15	123	2.27	0.024	0.000	0.000	0.024
227.80	397	30	154	2.37	0.024	0.050	0.038	0.062
227.90	615	51	204	2.47	0.025	0.150	0.198	0.222
228.00	0	31	235	2.57	0.025	0.250	0.425	0.450

Orifice	
Diameter	75 mm
Invert Elevation	225.39
Orifice Constant	0.80
Orifice Centroid	225.43
Orifice Flow Formula	$0.80\pi(D/2000)^2x(2x9.81xH)^{0.5}$

Major Storm Control Weir	
Width	2.00 m
Invert of Weir	227.75 m
Weir Flow Formula	$1.7WH^{1.5}$

233 Dunlop Street West
Quantity Control Volume Calculations

DATE:	14-Feb-19
FILE:	12081.01
CONTRACT/PROJECT:	233 DUNLOP STREET WEST
COMPLETED BY:	MJWP

Modified Rational Method Parameters

Pre Development Area (ha)	Post Development Area (ha)	Time of Concentration (min)	Time Increments (min)	Pre Development Runoff Coefficient	Post Development Runoff Coefficient
0.56	0.39	10	1	0.18	0.92

Note: Refer to page Calculation of Runoff Coefficients for detailed calculations of Modified Rational Method parameters.

Pre-Development Runoff Rate

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
C	0.18	0.18	0.18	0.18	0.18	0.18
C_i	1.00	1.00	1.00	1.10	1.20	1.25
I	83.11	108.92	126.55	148.15	164.22	180.15
A	0.56	0.56	0.56	0.56	0.56	0.56
Q	0.02	0.03	0.04	0.05	0.06	0.06

Note: $Q = 0.00278CC_iIA$

Rainfall Station	Barrie

SWM Pond Design Input

Storm (yrs)	Chicago Storm Coefficient	Chicago Storm Coefficient	Chicago Storm Coefficient	Allowable Outflow	Post Development Runoff Coefficient
	A	B	C	(m3/s)	
2	678.085	4.699	0.781	0.015	0.92
5	853.608	4.699	0.766	0.017	0.92
10	975.865	4.699	0.760	0.022	0.92
25	1146.275	4.922	0.757	0.030	1.00
50	1236.152	4.699	0.751	0.037	1.00
100	1426.408	5.273	0.759	0.045	1.00

Results

Storm Event	Storage (m^3)	Time (min)
2	63	56
5	91	73
10	104	68
25	128	65
50	134	57
100	141	51

Note: Storage volume calculated as per Hydrology Handbook, Second Edition, American Society of Civil Engineers, 1996

Time (min)	2 Year Intensity mm/hr	2 Year Inflow m^3/s	2 Year Outflow m^3/s	2 Year Storage m^3	Difference	5 Year Intensity mm/hr	5 Year Inflow m^3/s	5 Year Outflow m^3/s	5 Year Storage m^3	Difference	10 Year Intensity mm/hr	10 Year Inflow m^3/s	10 Year Outflow m^3/s	10 Year Storage m^3	Difference
1	174.18	0.18	0.02	5	8	225.07	0.23	0.02	8	10	260.01	0.26	0.02	9	11
2	153.52	0.15	0.02	13	6	198.85	0.20	0.02	18	8	229.94	0.23	0.02	20	9
3	137.71	0.14	0.02	19	5	178.75	0.18	0.02	26	6	206.87	0.21	0.02	29	7
4	125.19	0.13	0.02	24	4	162.79	0.16	0.02	32	5	188.54	0.19	0.02	36	6
5	114.99	0.12	0.02	28	3	149.77	0.15	0.02	38	5	173.57	0.18	0.02	43	5
6	106.50	0.11	0.02	31	3	138.93	0.14	0.02	42	4	161.10	0.16	0.02	48	5
7	99.33	0.10	0.02	34	3	129.73	0.13	0.02	46	4	150.52	0.15	0.02	53	4
8	93.16	0.09	0.02	37	2	121.83	0.12	0.02	50	3	141.42	0.14	0.02	57	4
9	87.81	0.09	0.02	39	2	114.96	0.12	0.02	53	3	133.51	0.13	0.02	60	3
10	83.11	0.08	0.02	41	2	108.92	0.11	0.02	56	3	126.55	0.13	0.02	63	3
11	78.94	0.08	0.02	43	2	103.57	0.10	0.02	58	2	120.37	0.12	0.02	66	3
12	75.23	0.08	0.02	44	1	98.78	0.10	0.02	60	2	114.85	0.12	0.02	69	2
13	71.88	0.07	0.02	46	1	94.48	0.10	0.02	62	2	109.89	0.11	0.02	71	2
14	68.86	0.07	0.02	47	1	90.58	0.09	0.02	64	2	105.39	0.11	0.02	74	2
15	66.12	0.07	0.02	48	1	87.04	0.09	0.02	66	2	101.30	0.10	0.02	76	2
16	63.61	0.06	0.02	50	1	83.80	0.08	0.02	68	1	97.56	0.10	0.02	77	2
17	61.31	0.06	0.02	51	1	80.82	0.08	0.02	69	1	94.12	0.09	0.02	79	2
18	59.19	0.06	0.02	52	1	78.08	0.08	0.02	71	1	90.95	0.09	0.02	81	1
19	57.23	0.06	0.02	52	1	75.55	0.08	0.02	72	1	88.02	0.09	0.02	82	1
20	55.41	0.06	0.02	53	1	73.19	0.07	0.02	73	1	85.30	0.09	0.02	84	1
21	53.72	0.05	0.02	54	1	71.00	0.07	0.02	74	1	82.77	0.08	0.02	85	1
22	52.14	0.05	0.02	55	1	68.95	0.07	0.02	75	1	80.40	0.08	0.02	86	1
23	50.67	0.05	0.02	55	1	67.04	0.07	0.02	76	1	78.18	0.08	0.02	87	1
24	49.28	0.05	0.02	56	1	65.24	0.07	0.02	77	1	76.10	0.08	0.02	88	1
25	47.98	0.05	0.02	56	1	63.55	0.06	0.02	78	1	74.15	0.07	0.02	89	1
26	46.76	0.05	0.02	57	0	61.96	0.06	0.02	79	1	72.31	0.07	0.02	90	1
27	45.60	0.05	0.02	57	0	60.46	0.06	0.02	80	1	70.57	0.07	0.02	91	1
28	44.51	0.04	0.02	58	0	59.04	0.06	0.02	80	1	68.92	0.07	0.02	92	1
29	43.47	0.04	0.02	58	0	57.69	0.06	0.02	81	1	67.36	0.07	0.02	93	1
30	42.49	0.04	0.02	59	0	56.41	0.06	0.02	82	1	65.88	0.07	0.02	93	1
31	41.56	0.04	0.02	59	0	55.20	0.06	0.02	82	1	64.47	0.07	0.02	94	1
32	40.67	0.04	0.02	59	0	54.04	0.05	0.02	83	1	63.13	0.06	0.02	95	1
33	39.83	0.04	0.02	60	0	52.94	0.05	0.02	83	1	61.86	0.06	0.02	95	1
34	39.02	0.04	0.02	60	0	51.89	0.05	0.02	84	0	60.64	0.06	0.02	96	1
35	38.25	0.04	0.02	60	0	50.89	0.05	0.02	84	0	59.47	0.06	0.02	97	1
36	37.51	0.04	0.02	60	0	49.92	0.05	0.02	85	0	58.36	0.06	0.02	97	0
37	36.81	0.04	0.02	61	0	49.01	0.05	0.02	85	0	57.29	0.06	0.02	98	0
38	36.13	0.04	0.02	61	0	48.12	0.05	0.02	86	0	56.27	0.06	0.02	98	0
39	35.49	0.04	0.02	61	0	47.28	0.05	0.02	86	0	55.29	0.06	0.02	98	0
40	34.87	0.04	0.02	61	0	46.47	0.05	0.02	87	0	54.35	0.05	0.02	99	0
41	34.27	0.03	0.02	61	0	45.68	0.05	0.02	87	0	53.44	0.05	0.02	99	0
42	33.69	0.03	0.02	62	0	44.93	0.05	0.02	87	0	52.57	0.05	0.02	100	0
43	33.14	0.03	0.02	62	0	44.21	0.04	0.02	88	0	51.73	0.05	0.02	100	0
44	32.61	0.03	0.02	62	0	43.51	0.04	0.02	88	0	50.92	0.05	0.02	100	0
45	32.09	0.03	0.02	62	0	42.84	0.04	0.02	88	0	50.14	0.05	0.02	101	0
46	31.60	0.03	0.02	62	0	42.19	0.04	0.02	88	0	49.38	0.05	0.02	101	0
47	31.12	0.03	0.02	62	0	41.57	0.04	0.02	89	0	48.66	0.05	0.02	101	0
48	30.66	0.03	0.02	62	0	40.96	0.04	0.02	89	0	47.95	0.05	0.02	101	0
49	30.21	0.03	0.02	62	0	40.37	0.04	0.02	89	0	47.27	0.05	0.02	102	0
50	29.78	0.03	0.02	62	0	39.81	0.04	0.02	89	0	46.61	0.05	0.02	102	0
51	29.36	0.03	0.02	62	0	39.26	0.04	0.02	90	0	45.98	0.05	0.02	102	0
52	28.96	0.03	0.02	62	0	38.73	0.04	0.02	90	0	45.36	0.05	0.02	102	0
53	28.56	0.03	0.02	62	0	38.21	0.04	0.02	90	0	44.76	0.05	0.02	102	0
54	28.18	0.03	0.02	63	0	37.71	0.04	0.02	90	0	44.18	0.04	0.02	103	0
55	27.81	0.03	0.02	63	0	37.23	0.04	0.02	90	0	43.62	0.04	0.02	103	0
56	27.45	0.03	0.02	63	0	36.76	0.04	0.02	90	0	43.07	0.04	0.02	103	0
57	27.11	0.03	0.02	63	0	36.30	0.04	0.02	91	0	42.54	0.04	0.02	103	0
58	26.77	0.03	0.02	63	0	35.86	0.04	0.02	91	0	42.02	0.04	0.02	103	0
59	26.44	0.03	0.02	63	0	35.42	0.04	0.02	91	0	41.52	0.04	0.02	103	0
60	26.12	0.03	0.02	62	0	35.00	0.04	0.02	91	0	41.03	0.04	0.02	103	0
61	25.81	0.03	0.02	62	0	34.59	0.03	0.02	91	0	40.56	0.04	0.02	103	0
62	25.51	0.03	0.02	62	0	34.20	0.03	0.02	91	0	40.09	0.04	0.02	103	0
63	25.21	0.03	0.02	62	0	33.81	0.03	0.02	91	0	39.64	0.04	0.02	103	0
64	24.92	0.03	0.02	62	0	33.43	0.03	0.02	91	0	39.20	0.04	0.02	103	0
65	24.64	0.02	0.02	62	0	33.06	0.03	0.02	91	0	38.77	0.04	0.02	103	0
66	24.37	0.02	0.02	62	0	32.70	0.03	0.02	91	0	38.36	0.04	0.02	103	0
67	24.11	0.02	0.02	62	0	32.35	0.03	0.02	91	0	37.95	0.04	0.02	103	0
68	23.85	0.02	0.02	62	0	32.01	0.03	0.02	91	0	37.55	0.04	0.02	104	0
69	23.59	0.02	0.02	62	0	31.68	0.03	0.02	91	0	37.16	0.04	0.02	103	0
70	23.35	0.02	0.02	62	0	31.35	0.03	0.02	91	0	36.78	0.04	0.02	103	0
71	23.11	0.02	0.02	62	0	31.04	0.03	0.02	91	0	36.42	0.04	0.02	103	0
72	22.87	0.02	0.02	62	0	30.73	0.03	0.02	91	0	36.05	0.04	0.02	103	0
73	22.64	0.02	0.02	62	0	30.42	0.03	0.02	91	0	35.70	0.04	0.02	103	0
74	22.41	0.02	0.02	62	0	30.13	0.03	0.02	91	0	35.36	0.04	0.02	103	0
75	22.19	0.02	0.02	61	0	29.84	0.03	0.02	91	0	35.02	0.04	0.02	103	0
76	21.98	0.02	0.02	61	0	29.55	0.03	0.02	91	0	34.69	0.03	0.02	103	0
77	21.77	0.02	0.02	61	0	29.28	0.03	0.02	91	0	34.36	0.03	0.02	103	0
78	21.56	0.02	0.02	61	0	29.00	0.03	0.02	91	0	34.05	0.03	0.02	103	0
79	21.36	0.02	0.02	61	0	28.74	0.03	0.02	91	0	33.74	0.03	0.02	103	0
80	21.16	0.02	0.02	61	0	28.48	0.03	0.02	91	0	33.44	0.03	0.02	103	0

Time (min)	25 Year Intensity mm/hr	25 Year Inflow m^3/s	25 Year Outflow m^3/s	25 Year Storage m^3	Difference	50 Year Intensity mm/hr	50 Year Inflow m^3/s	50 Year Outflow m^3/s	50 Year Storage m^3	Difference	100 Year Intensity mm/hr	100 Year Inflow m^3/s	100 Year Outflow m^3/s	100 Year Storage m^3	Difference
1	298.22	0.33	0.03	10	14	334.55	0.37	0.04	10	16	353.96	0.39	0.05	8	17
2	264.99	0.29	0.03	24	11	296.30	0.32	0.04	25	13	316.38	0.35	0.05	25	14
3	239.26	0.26	0.03	35	9	266.91	0.29	0.04	38	10	286.90	0.31	0.05	39	11
4	218.67	0.24	0.03	45	8	243.52	0.27	0.04	48	9	263.10	0.29	0.05	50	9
5	201.77	0.22	0.03	53	7	224.41	0.24	0.04	57	7	243.43	0.27	0.05	59	8
6	187.63	0.20	0.03	59	6	208.47	0.23	0.04	64	6	226.85	0.25	0.05	67	7
7	175.59	0.19	0.03	65	5	194.94	0.21	0.04	70	6	212.68	0.23	0.05	74	6
8	165.20	0.18	0.03	70	5	183.29	0.20	0.04	76	5	200.41	0.22	0.05	80	5
9	156.14	0.17	0.03	75	5	173.15	0.19	0.04	81	4	189.66	0.21	0.05	86	5
10	148.15	0.16	0.03	79	4	164.22	0.18	0.04	85	4	180.15	0.20	0.05	91	4
11	141.05	0.15	0.03	83	3	156.30	0.17	0.04	89	4	171.69	0.19	0.05	95	4
12	134.69	0.15	0.03	86	3	149.22	0.16	0.04	93	3	164.09	0.18	0.05	99	4
13	128.97	0.14	0.03	89	3	142.84	0.16	0.04	96	3	157.23	0.17	0.05	103	3
14	123.77	0.14	0.03	92	3	137.07	0.15	0.04	99	3	151.00	0.16	0.05	106	3
15	119.04	0.13	0.03	94	2	131.81	0.14	0.04	102	2	145.31	0.16	0.05	109	3
16	114.71	0.13	0.03	97	2	127.00	0.14	0.04	104	2	140.09	0.15	0.05	111	2
17	110.72	0.12	0.03	99	2	122.58	0.13	0.04	106	2	135.29	0.15	0.05	114	2
18	107.05	0.12	0.03	101	2	118.50	0.13	0.04	108	2	130.86	0.14	0.05	116	2
19	103.64	0.11	0.03	103	2	114.72	0.13	0.04	110	2	126.75	0.14	0.05	118	2
20	100.48	0.11	0.03	105	2	111.22	0.12	0.04	112	2	122.92	0.13	0.05	120	2
21	97.53	0.11	0.03	106	2	107.95	0.12	0.04	114	2	119.35	0.13	0.05	122	2
22	94.78	0.10	0.03	108	1	104.90	0.11	0.04	115	1	116.02	0.13	0.05	124	2
23	92.19	0.10	0.03	109	1	102.04	0.11	0.04	117	1	112.89	0.12	0.05	125	1
24	89.77	0.10	0.03	111	1	99.36	0.11	0.04	118	1	109.95	0.12	0.05	126	1
25	87.49	0.10	0.03	112	1	96.84	0.11	0.04	120	1	107.18	0.12	0.05	128	1
26	85.34	0.09	0.03	113	1	94.46	0.10	0.04	121	1	104.57	0.11	0.05	129	1
27	83.31	0.09	0.03	114	1	92.21	0.10	0.04	122	1	102.10	0.11	0.05	130	1
28	81.39	0.09	0.03	115	1	90.09	0.10	0.04	123	1	99.76	0.11	0.05	131	1
29	79.56	0.09	0.03	116	1	88.07	0.10	0.04	124	1	97.55	0.11	0.05	132	1
30	77.83	0.08	0.03	117	1	86.16	0.09	0.04	125	1	95.44	0.10	0.05	133	1
31	76.19	0.08	0.03	118	1	84.34	0.09	0.04	126	1	93.44	0.10	0.05	134	1
32	74.62	0.08	0.03	119	1	82.61	0.09	0.04	126	1	91.53	0.10	0.05	135	1
33	73.13	0.08	0.03	119	1	80.96	0.09	0.04	127	1	89.71	0.10	0.05	135	1
34	71.70	0.08	0.03	120	1	79.38	0.09	0.04	128	1	87.97	0.10	0.05	136	1
35	70.33	0.08	0.03	121	1	77.87	0.08	0.04	128	1	86.31	0.09	0.05	137	1
36	69.03	0.08	0.03	121	1	76.43	0.08	0.04	129	1	84.71	0.09	0.05	137	0
37	67.78	0.07	0.03	122	1	75.05	0.08	0.04	129	1	83.19	0.09	0.05	138	0
38	66.58	0.07	0.03	123	1	73.73	0.08	0.04	130	0	81.73	0.09	0.05	138	0
39	65.43	0.07	0.03	123	0	72.46	0.08	0.04	130	0	80.32	0.09	0.05	138	0
40	64.32	0.07	0.03	124	0	71.24	0.08	0.04	131	0	78.97	0.09	0.05	139	0
41	63.26	0.07	0.03	124	0	70.06	0.08	0.04	131	0	77.67	0.08	0.05	139	0
42	62.24	0.07	0.03	124	0	68.93	0.08	0.04	132	0	76.42	0.08	0.05	139	0
43	61.25	0.07	0.03	125	0	67.84	0.07	0.04	132	0	75.22	0.08	0.05	140	0
44	60.30	0.07	0.03	125	0	66.80	0.07	0.04	132	0	74.05	0.08	0.05	140	0
45	59.39	0.06	0.03	126	0	65.78	0.07	0.04	133	0	72.93	0.08	0.05	140	0
46	58.50	0.06	0.03	126	0	64.81	0.07	0.04	133	0	71.85	0.08	0.05	140	0
47	57.65	0.06	0.03	126	0	63.86	0.07	0.04	133	0	70.81	0.08	0.05	140	0
48	56.82	0.06	0.03	126	0	62.95	0.07	0.04	133	0	69.80	0.08	0.05	140	0
49	56.02	0.06	0.03	127	0	62.07	0.07	0.04	133	0	68.82	0.08	0.05	140	0
50	55.25	0.06	0.03	127	0	61.21	0.07	0.04	134	0	67.87	0.07	0.05	141	0
51	54.50	0.06	0.03	127	0	60.39	0.07	0.04	134	0	66.95	0.07	0.05	141	0
52	53.77	0.06	0.03	127	0	59.58	0.07	0.04	134	0	66.06	0.07	0.05	141	0
53	53.07	0.06	0.03	128	0	58.81	0.06	0.04	134	0	65.20	0.07	0.05	140	0
54	52.38	0.06	0.03	128	0	58.05	0.06	0.04	134	0	64.36	0.07	0.05	140	0
55	51.72	0.06	0.03	128	0	57.32	0.06	0.04	134	0	63.55	0.07	0.05	140	0
56	51.08	0.06	0.03	128	0	56.61	0.06	0.04	134	0	62.76	0.07	0.05	140	0
57	50.45	0.06	0.03	128	0	55.92	0.06	0.04	134	0	62.00	0.07	0.05	140	0
58	49.84	0.05	0.03	128	0	55.25	0.06	0.04	134	0	61.25	0.07	0.05	140	0
59	49.25	0.05	0.03	128	0	54.60	0.06	0.04	134	0	60.53	0.07	0.05	140	0
60	48.68	0.05	0.03	128	0	53.96	0.06	0.04	134	0	59.82	0.07	0.05	140	0
61	48.12	0.05	0.03	128	0	53.34	0.06	0.04	134	0	59.14	0.06	0.05	140	0
62	47.57	0.05	0.03	128	0	52.74	0.06	0.04	134	0	58.47	0.06	0.05	139	0
63	47.04	0.05	0.03	128	0	52.16	0.06	0.04	134	0	57.82	0.06	0.05	139	0
64	46.52	0.05	0.03	128	0	51.58	0.06	0.04	134	0	57.18	0.06	0.05	139	0
65	46.02	0.05	0.03	128	0	51.03	0.06	0.04	134	0	56.56	0.06	0.05	139	0
66	45.52	0.05	0.03	128	0	50.49	0.06	0.04	134	0	55.96	0.06	0.05	138	0
67	45.04	0.05	0.03	128	0	49.96	0.05	0.04	133	0	55.37	0.06	0.05	138	0
68	44.58	0.05	0.03	128	0	49.44	0.05	0.04	133	0	54.80	0.06	0.05	138	0
69	44.12	0.05	0.03	128	0	48.93	0.05	0.04	133	0	54.24	0.06	0.05	137	0
70	43.67	0.05	0.03	128	0	48.44	0.05	0.04	133	0	53.69	0.06	0.05	137	0
71	43.24	0.05	0.03	128	0	47.96	0.05	0.04	133	0	53.15	0.06	0.05	137	0
72	42.81	0.05	0.03	128	0	47.49	0.05	0.04	133	0	52.63	0.06	0.05	136	0
73	42.39	0.05	0.03	128	0	47.03	0.05	0.04	132	0	52.12	0.06	0.05	136	0
74	41.99	0.05	0.03	128	0	46.58	0.05	0.04	132	0	51.62	0.06	0.05	136	0
75	41.59	0.05	0.03	128	0	46.14	0.05	0.04	132	0	51.13	0.06	0.05	135	0
76	41.20	0.04	0.03	128	0	45.71	0.05	0.04	132	0	50.65	0.06	0.05	135	0
77	40.82	0.04	0.03	128	0	45.29	0.05	0.04	131	0	50.18	0.05	0.05	135	0
78	40.44	0.04	0.03	127	0	44.88	0.05	0.04	131	0	49.73	0.05	0.05	134	0
79	40.08	0.04	0.03	127	0	44.47	0.05	0.04	131	0	49.28	0.05	0.05	134	0
80	39.72	0.04	0.03	127	0	44.08	0.05	0.04	131	0	48.84	0.05	0.05	133	0

Maximum Storage Volume

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

233 Dunlop Street West
Storm Sewer Design
5-Year

DATE: 14-Feb-19
FILE: 12081.01
CONTRACT/PROJECT 233 DUNLOP ST. W.

Areas	MANHOLE		LENGTH	INCREMENT			TOTAL	FLOW TIME (min)		I	TOTAL Q	S	D	Q FULL	V FULL
	FROM	TO	(m)	C	A	CA	CA	TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(m/s)
Area 1	ROOF	CBMH1	2.1	0.95	0.12	0.12	0.12	10.00	0.03	108.92	0.05	1.0	300	0.10	1.37
-	CBMH1	STM TANKS	4.6	0.00	0.00	0.00	0.12	10.03	0.03	108.78	0.05	5.0	300	0.22	3.06
Area 2	CB1	MH2	25.2	0.90	0.09	0.08	0.08	10.00	0.31	108.92	0.03	1.0	300	0.10	1.37
-	MH2	MH1	16.7	0.00	0.00	0.00	0.08	10.31	0.20	107.21	0.04	1.0	300	0.10	1.37
Area 3	CB2	MH1	9.9	0.92	0.18	0.16	0.16	10.00	0.07	108.92	0.06	2.7	300	0.16	2.25
Area 3	MH1	STM OGS	2.0	0.00	0.00	0.00	0.25	10.51	0.02	106.11	0.02*	1.0	300	0.10	1.37
	STM OGS	OUTLET	12.6	0.00	0.00	0.00	0.25	10.53	0.11	105.98	0.02*	2.0	300	0.14	1.94

* denotes 100 year flow through orifice tube taken from SSD.

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233 Dunlop Street West
Permeable Pavers Sizing Calculations

Infiltration volumes from MOE Stormwater Management Planning and Design Manual to size Bioretention Filter Table 3.2 Water Quality Storage Requirements are as follows:

Design Area 1 Total	=	0.09	ha		
Total Imperviousness	=	90%			
Storage Volume	=	41.2	m^3/ha	(Enhanced 80% long-term S.S. removal)	
Area 1 Storage Volume Required	=	0.09	x	41.2	
	=	3.8	m^3		
Design Area 2 Total	=	0.18	ha		
Total Imperviousness	=	92%			
Storage Volume	=	41.7	m^3/ha	(Enhanced 80% long-term S.S. removal)	
Area 2 Storage Volume Required	=	0.18	x	41.7	
	=	7.4	m^3		

Required storage volume calculated over 25 mm of the total impervious area on the site:

Storage Volume	=	3,908	x	0.025
Area Storage Volume Required	=	97.7	m^3	

Note: Therefore, the storage required with 25 mm of the total impervious area on the site governs.

Find Storage Volume provided in Permeable Pavers:

Area of West Pavers (A_1)	=	89.6	m^2
Depth of Trench (d)	=	0.40	m
Storage Volume (V)	=	0.4 (A x d)	
	=	14.3	m^3
Area of South Pavers (A_2)	=	118.8	m^2
Depth of Trench (d)	=	0.40	m
Storage Volume (V)	=	0.4 (A x d)	
	=	19.0	m^3
Area of East Pavers (A_3)	=	312.0	m^2
Depth of Trench (d)	=	0.40	m
Storage Volume (V)	=	0.4 (A x d)	
	=	49.9	m^3

		Required		Provided	
Total Area Storage Volume	=	97.7	m^3	83.3	m^3
Remaining Required Storage	=	14.4	m^3		

Note: the remaining required storage amount of 14.4 m^3 will be provided in the rooftop infitration tanks.

Use Equation 4.12 to find Area of Permeable Pavers:

Area Design Volume (V)	=	83.3	m^3
Depth of Controlling Filter Medium (d)	=	0.80	m
Coefficient of Permeability of the Controlling Filter Media (k)	=	45.0	mm/hr
Design Drawdown Time (t)	=	24	hr
Surface Area Of Filter (A)	=	$\frac{1000Vd}{kdt}$	
	=	77.1	m^2

		Required		Provided	
Total Area Surface Area	=	90.5	m^2	208.4	m^2

Appendix D

Water Balance Calculations

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233 Dunlop Street West
Pre Development Water Balance

Catchment Designation	Site				
	Grassed	Paved	Building	Total	
Area	5371	54	159	5584	
Pervious Area	5371	0	0	5371	
Impervious Area	0	54	159	214	
Infiltration Factors					
Topography Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Rolling Land)
Soil Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Medium combinations of clay and loam)
Land Cover Infiltration Factor	0.1	0	0		
MOE Infiltration Factor	0.5	0	0		
Actual Infiltration Factor	0.5	0	0		
Run-Off Coeffiecient	0.5	1	1		
Runoff from Impervious Surfaces	0.0	0.95	0.95		
Inputs (per Unit Area)					
Precipitation	932.9	932.9	932.9	932.9	(Precipitation values from Environment Canada)
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	932.9	932.9	932.9	932.9	
Outputs (per Unit Area)					
Precipitation Surplus	371.9	886.3	886.3	391.6	
Net Surplus	371.9	886.3	886.3	391.6	
Evapotranspiration	561.0	46.6	46.6	541.3	(Evapotranspiration values for pervious area from Table 5-2 in the City of Barrie Tier Three Recharge Estimation, dated June 2012. Values for impervious areas is the difference between the total precipitation and the net surplus)
Infiltration	186.0	0.0	0.0	178.8	
Rooftop Infiltration	0.0	0.0	0.0	0.0	
Total Infiltration	186.0	0.0	0.0	178.8	
Runoff Pervious Areas	186.0	0.0	0.0	178.8	
Runoff Impervious Areas	0.0	886.3	886.3	33.9	
Total Runoff	186.0	886.3	886.3	212.7	
Total Outputs	932.9	932.9	932.9	932.9	
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0	
Inputs (Volumes)					
Precipitation	5010	50	149	5209	
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	5010	50	149	5209	
Outputs (Volumes)					
Precipitation Surplus	1997	48	141	2187	
Net Surplus	1997	48	141	2187	
Evapotranspiration	3013	3	7	3023	
Infiltration	999	0	0	999	
Rooftop Infiltration	0	0	0	0	
Total Infiltration	999	0	0	999	
Runoff Pervious Areas	999	0	0	999	
Runoff Impervious Areas	0	48	141	189	
Total Runoff	999	48	141	1188	
Total Outputs	5010	50	149	5209	
Difference (Inputs - Outputs)	0	0	0	0	

Note: Highlighted cells are input cells.

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233 Dunlop Street West

Post Development Water Balance (No Infiltration)

Catchment Designation	Site			
	Grassed	Paved	Building	Total
Area	126	878	1218	2221
Pervious Area	126	0	0	126
Impervious Area	0	878	1218	2095
Infiltration Factors				
Topography Infiltration Factor	0.2	0	0	
Soil Infiltration Factor	0.2	0	0	
Land Cover Infiltration Factor	0.1	0	0	
MOE Infiltration Factor	0.5	0	0	
Actual Infiltration Factor	0.5	0	0	
Run-Off Coeffiecient	0.5	1	1	
Runoff from Impervious Surfaces	0.0	0.95	0.95	
Inputs (per Unit Area)				
Precipitation	932.9	932.9	932.9	932.9
Run-On	0	0	0	0
Other Inputs	0	0	0	0
Total Inputs	932.9	932.9	932.9	932.9
Outputs (per Unit Area)				
Precipitation Surplus	371.9	886.3	886.3	857.2
Net Surplus	371.9	886.3	886.3	857.2
Evapotranspiration	561.0	46.6	46.6	75.7
Infiltration	186.0	0.0	0.0	10.5
Rooftop Infiltration	0.0	0.0	0.0	0.0
Total Infiltration	186.0	0.0	0.0	10.5
Runoff Pervious Areas	186.0	0.0	0.0	10.5
Runoff Impervious Areas	0.0	886.3	886.3	836.1
Total Runoff	186.0	886.3	886.3	846.7
Total Outputs	932.9	932.9	932.9	932.9
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0
Inputs (Volumes)				
Precipitation	117	819	1136	2072
Run-On	0	0	0	0
Other Inputs	0	0	0	0
Total Inputs	117	819	1136	2072
Outputs (Volumes)				
Precipitation Surplus	47	778	1079	1904
Net Surplus	47	778	1079	1904
Evapotranspiration	70	41	57	168
Infiltration	23	0	0	23
Rooftop Infiltration	0	0	0	0
Total Infiltration	23	0	0	23
Runoff Pervious Areas	23	0	0	23
Runoff Impervious Areas	0	778	1079	1857
Total Runoff	23	778	1079	1880
Total Outputs	117	819	1136	2072
Difference (Inputs - Outputs)	0	0	0	0

(From MOE Table 3.1 for Rolling Land)
(From MOE Table 3.1 for Medium combinations of clay and loam)

(Precipitation values from Environment Canada)

(Evapotranspiration values for pervious area from Table 5-2 in the City of Barrie Tier Three Recharge Estimation, dated June 2012. Values for impervious areas is the difference between the total precipitation and the net surplus)

Note: Highlighted cells are input cells.

233 Dunlop Street West
Post Development Water Balance (With Infiltration)

Catchment Designation	Site				Notes
	Grassed	Paved	Building	Total	
Area	126	878	1218	2221	
Pervious Area	126	0	0	126	
Impervious Area	0	878	1218	2095	
Infiltration Factors					
Topography Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Rolling Land)
Soil Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Medium combinations of clay and loam)
Land Cover Infiltration Factor	0.1	0	0		
MOE Infiltration Factor	0.5	0	0		
Actual Infiltration Factor	0.5	0	0		
Run-Off Coeffiecient	0.5	1	1		
Runoff from Impervious Surfaces	0.0	0.95	0.95		
Inputs (per Unit Area)					
Precipitation	932.9	932.9	932.9	932.9	(Precipitation values from Environment Canada)
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	932.9	932.9	932.9	932.9	
Outputs (per Unit Area)					
Precipitation Surplus	371.9	886.3	886.3	857.2	
Net Surplus	371.9	886.3	886.3	857.2	
Evapotranspiration	561.0	46.6	46.6	75.7	(Evapotranspiration values for pervious area from Table 5-2 in the City of Barrie Tier Three Recharge Estimation, dated June 2012. Values for impervious areas is the difference between the total precipitation and the net surplus)
Infiltration	186.0	0.0	0.0	10.5	
Rooftop Infiltration	0.0	0.0	**801.0**	439.2	Depth of rainfall over the rooftop required to be infiltrated to achieve water balance.
Total Infiltration	186.0	0.0	801.0	449.7	
Runoff Pervious Areas	186.0	0.0	0.0	10.5	
Runoff Impervious Areas	0.0	886.3	85.3	397.0	
Total Runoff	186.0	886.3	85.3	407.5	
Total Outputs	932.9	932.9	932.9	932.9	
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0	
Inputs (Volumes)					
Precipitation	117	819	1136	2072	
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	117	819	1136	2072	
Outputs (Volumes)					
Precipitation Surplus	47	778	1079	1904	
Net Surplus	47	778	1079	1904	
Evapotranspiration	70	41	57	168	
Infiltration	23	0	0	23	
Rooftop Infiltration	0	0	975	975	
Total Infiltration	23	0	975	999	
Runoff Pervious Areas	23	0	0	23	
Runoff Impervious Areas	0	778	104	882	
Total Runoff	23	778	104	905	
Total Outputs	117	819	1136	2072	
Difference (Inputs - Outputs)	0	0	0	0	

Note: Highlighted cells are input cells.

PEARSON ENGINEERING LTD.

233 Dunlop Street West
Water Balance Calculations

Annual Rainfall Depth Req'd

Req'd Rainfall Depth	=	801.0	mm	(From Post-Development Water Balance (With Infiltration))

Find Percent of Annual Rainfall that Req'd Rainfall Depth represents

Annual Rainfall for Study Area = 932.9 mm

$$\% \text{ Annual Rainfall} = \frac{801.0 \text{ mm}}{932.9 \text{ mm}} = 86\%$$

From MOE Figure C-2, 86% of annual rainfall occurs for storm events of 16 mm or less.

Find storage volume required for rainfall events of 16 mm to Rooftop Infiltration Gallery

Roof Top Area	=	1,218	m^2	
Rainfall Depth	=	16	mm	
Storage Volume Req'd	=	A	x	D
	=	1,218	x	16
	=	19	m^3	

Minimum Infiltration Volume as per City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines Section 4.1.3 is as follows:

Storage Volume Req'd	=	Site Area	x	5	mm
	=	5,584	x	0.005	
	=	28	m^3		

Minimum Infiltration Volume as per LSRCA Standards and Guidelines:

Storage Volume Req'd	=	Imp. Area	x	25	mm
	=	3,908	x	0.025	
	=	98	m^3		

Therefore, LSRCA guidelines governs over water balance/infiltration requirements.

The permeable pavers will provide 83.3 m^3 of storage and StormTech chambers required will be based on the roof area of the proposed building to provide 14.4 m^3:

Total Roof Top Area	=	1,218	m^2
Storage Required	=	14.4	m^3
Storage per Chamber	=	0.37	m^3
Chambers Required	=	39.00	
	=	40	Chambers

The rooftop infiltration tanks will account for 14.4 m^3 of the required 28 m^3 of storage. The remaining storage will be provided in the east permeable pavers. Therefore, water balance for the site is achieved.

Appendix E

Phosphorus Calculations

233 Dunlop Street West
Phosphorus Budget Tool

	Residential	Commercial	Pasture	Forest
Phosphorus Export (kg/ha/year)	1.32	1.82	0.07	0.05
Pre-Development Condition				
	Residential	Commercial	Pasture	Forest
Area (ha):	0.02	0.00	0.54	0.00
Total P (kg):	0.03	0.00	0.04	0.00
Total Pre-Development P (kg):		**0.07**		
Post-Development Condition (Uncontrolled)				
Total Area	Residential	Commercial	Pasture	Forest
Area (ha):	0.39	0.00	0.17	0.00
Total P (kg):	0.52	0.00	0.01	0.00
Total Post-Development P (kg):		**0.53**		
Post Development Condition (Controlled)				
Untreated Area	Residential	Commercial	Pasture	Forest
Area (ha):	0.00	0.00	0.17	0.00
Total P (kg):	0.00	0.00	0.01	0.00
Area Draining to Infiltration Trench				
Area (ha):	0.12	0.00	0.00	0.00
Total P (kg):	0.16	0.00	0.00	0.00
Infiltration Trench Treatment				
Infiltration Trench Proficiency (%):		60		
P Removed (kg):		0.10		
P Remaining (kg):		0.06		
Area Draining to Permeable Pavers				
Area (ha):	0.27	0.00	0.00	0.00
Total P (kg):	0.36	0.00	0.00	0.00
Permeable Pavers Treatment				
Permeable Pavers Proficiency (%):		45		
P Removed (kg):		0.16		
P Remaining (kg):		0.20		
Underground Storage Treatment				
P from Permeable Pavers & Infiltration Trench (kg):		0.26		
Underground Storage Proficiency (%):		25		
P Removed (kg):		0.07		
P Remaining (kg):		0.20		
Filter Strip Treatment				
P from Underground Storage (kg):		0.20		
Filter Strip Proficiency (%):		65		
P Removed (kg):		0.13		
P Remaining (kg):		0.07		
Total Post-Development P (kg) :		**0.08**		

Appendix F

Trip Generation Calculations & Traffic Distribution Drawings

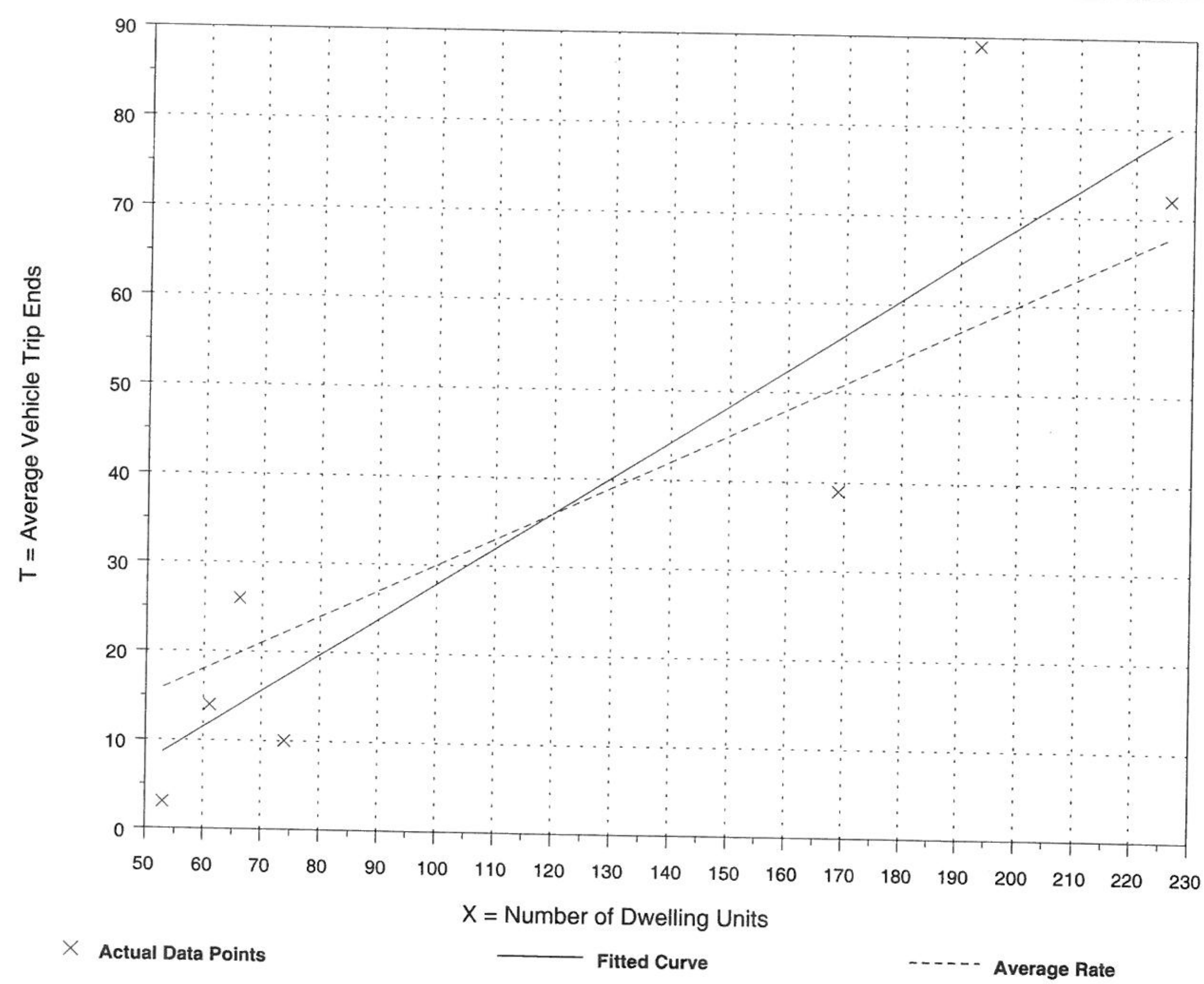
Mid-Rise Apartment
(223)

Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 7 and 9 a.m.**
Number of Studies:	7
Avg. Number of Dwelling Units:	120
Directional Distribution:	31% entering, 69% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.30	0.06 - 0.46	0.56

Data Plot and Equation



Fitted Curve Equation: T = 0.41(X) - 13.06 **R^2 = 0.83**

Mid-Rise Apartment
(223)

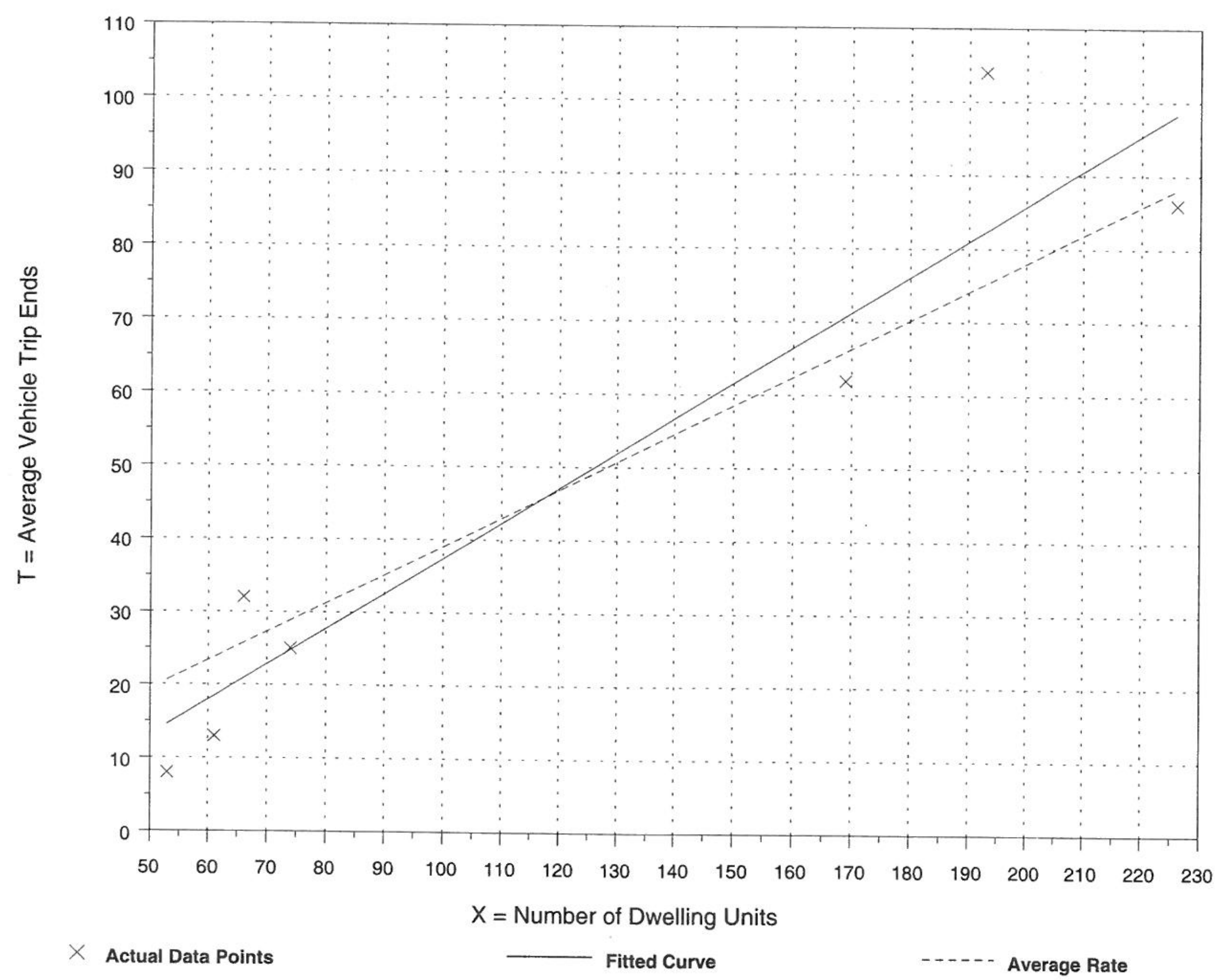
Average Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday, Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 p.m.**

Number of Studies:	7
Avg. Number of Dwelling Units:	120
Directional Distribution:	58% entering, 42% exiting

Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.39	0.15 - 0.54	0.63

Data Plot and Equation



Fitted Curve Equation: $T = 0.48(X) - 11.07$ **$R^2 = 0.89$**

Specialty Retail Center
(814)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Leasable Area**
On a: **Weekday,**
A.M. Peak Hour of Generator

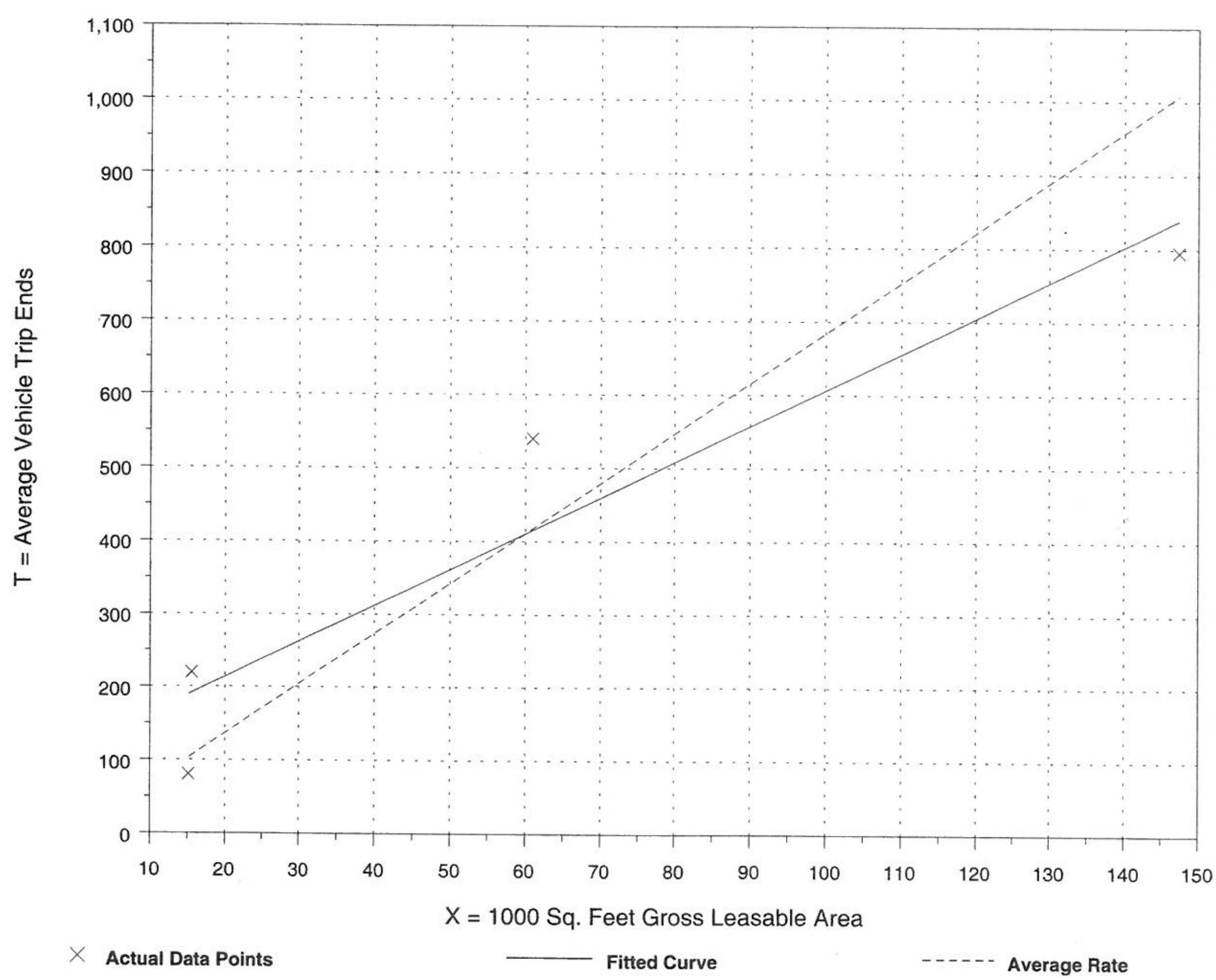
Number of Studies: 4
Average 1000 Sq. Feet GLA: 60
Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
6.84	5.33 - 14.08	3.55

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: $T = 4.91(X) + 115.59$

$R^2 = 0.90$

Specialty Retail Center
(814)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Leasable Area**
On a: **Weekday,**
P.M. Peak Hour of Generator

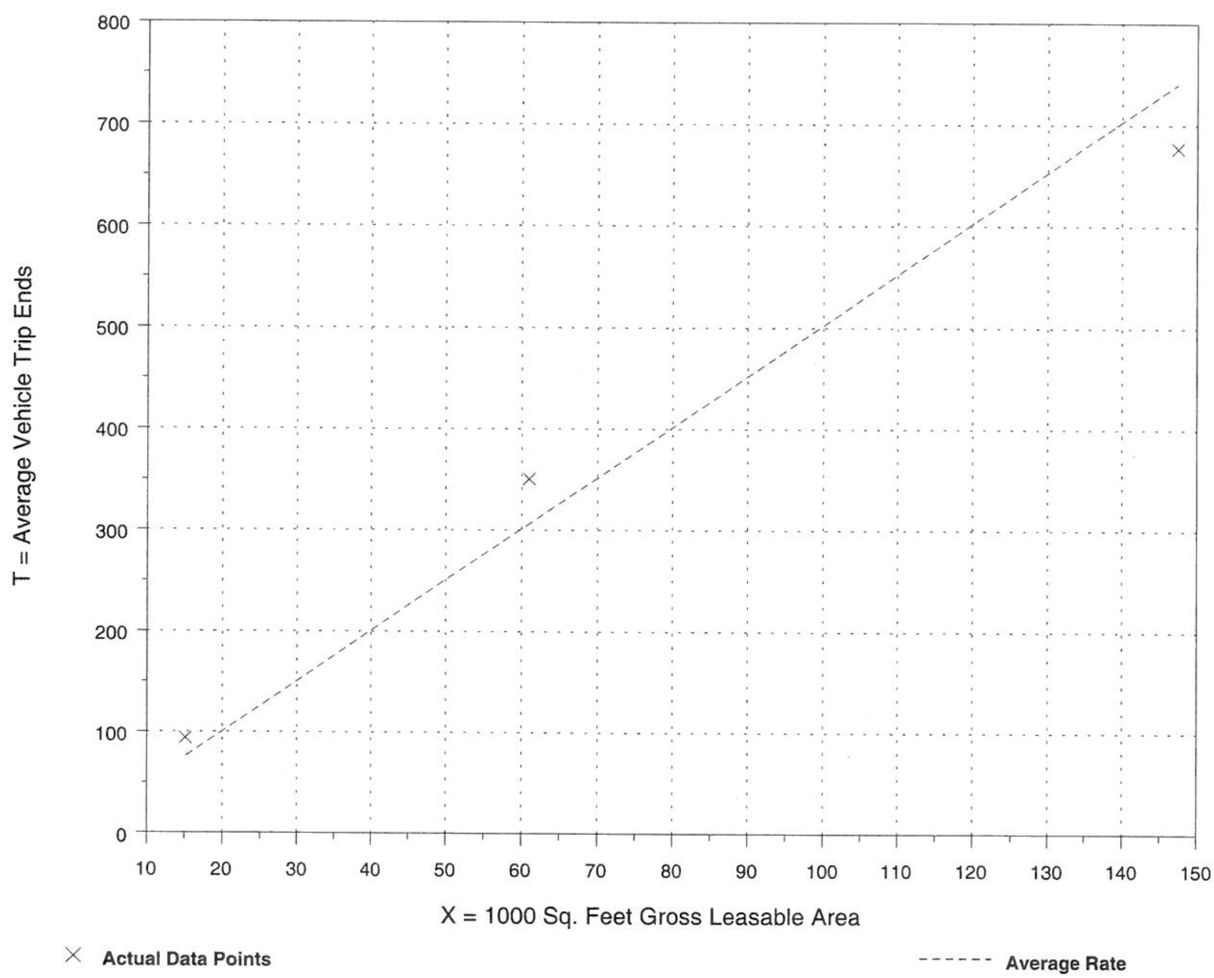
Number of Studies: 3
Average 1000 Sq. Feet GLA: 75
Directional Distribution: 56% entering, 44% exiting

Trip Generation per 1000 Sq. Feet Gross Leasable Area

Average Rate	Range of Rates	Standard Deviation
5.02	4.59 - 6.18	2.31

Data Plot and Equation

Caution - Use Carefully - Small Sample Size



Fitted Curve Equation: Not given

R^2 = ****

TRANS-PLAN

Turning Movement Count Diagram

Intersection: Dunlop Street West and Anne Street

Municipality: Barrie, Ontario

Intersection ID:

Date: Thursday, June 15, 2017

AM Peak Hour: 8:00 to 9:00

Anne Street

North Total	1245
North Entering	644
North Receiving	601
North Peds	2
East Total	767
East Entering	392
East Receiving	375
East Peds	12
West Total	1294
West Entering	673
West Receiving	621
West Peds	11
South Total	1120
South Entering	504
South Receiving	616
South Peds	9

Cyclists	0	2	0
Truck	5	24	5
Cars	199	359	50

Dunlop Street West

0	6	257
0	12	248
0	20	130

46	1	0
257	7	0
78	3	0

134	287	57
19	4	3
0	0	0

MD Peak Hour: 13:00 to 14:00

Anne Street

North Total	1586
North Entering	754
North Receiving	832
North Peds	1
East Total	996
East Entering	514
East Receiving	482
East Peds	8
West Total	1465
West Entering	761
West Receiving	704
West Peds	7
South Total	1415
South Entering	702
South Receiving	713
South Peds	9

Cyclists	0	0	0
Truck	2	10	1
Cars	241	427	73

Dunlop Street West

0	7	264
0	8	322
0	13	147

88	1	0
298	11	0
112	4	0

140	463	73
12	7	5
0	2	0

PM Peak Hour: 16:15 to 17:15

Anne Street

North Total	1918
North Entering	723
North Receiving	1195
North Peds	3
East Total	1019
East Entering	556
East Receiving	463
East Peds	8
West Total	1628
West Entering	853
West Receiving	775
West Peds	4
South Total	1833
South Entering	1067
South Receiving	766
South Peds	9

Cyclists	0	2	0
Truck	2	16	1
Cars	232	429	41

Dunlop Street West

3	2	326
0	11	318
0	12	181

82	1	0
340	7	0
122	4	0

187	778	90
7	3	2
0	0	0

Total 8-Hour Count

Anne Street

North Total	12092
North Entering	5369
North Receiving	6723
North Peds	25
East Total	7120
East Entering	3809
East Receiving	3311
East Peds	100
West Total	11225
West Entering	5901
West Receiving	5324
West Peds	73
South Total	11219
South Entering	5749
South Receiving	5470
South Peds	79

Cyclists	0	9	0
Truck	24	88	13
Cars	1646	3179	410

Dunlop Street West

4	40	2169
6	76	2259
0	105	1242

562	8	1
2311	73	7
811	35	1

1173	3885	520
90	50	25
0	4	2

Trans-Plan Transportation Inc.

Site ID Code:
Intersection Location: Dunlop Street West and Anne Street
Municipality: Barrie, Ontario
Count Date: Thursday, June 15, 2017
Weather and Temperature: Sunny, 21 Degrees
Surveyor: TP

AM	NORTH APPROACH										Total	EAST APPROACH										Total	SOUTH APPROACH										Total	WEST APPROACH										Total	Grand Total
	CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds		
	L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			
7:00	5	84	52	0	0	0	0	3	0	0	144	14	65	8	0	2	0	0	0	0	2	89	21	41	9	6	3	1	0	0	0	1	81	13	20	26	2	1	1	0	1	0	1	64	378
7:15	7	78	42	1	1	3	0	0	0	0	132	16	57	9	2	1	0	0	1	0	4	86	21	47	12	7	3	0	0	0	0	3	90	37	33	39	5	6	3	0	0	0	5	123	431
7:30	7	85	57	0	1	0	0	0	0	1	150	29	59	4	3	3	1	0	2	0	0	101	18	45	8	3	1	1	0	1	0	0	77	37	45	53	4	2	4	0	0	0	0	145	473
7:45	6	138	35	1	4	2	0	0	0	1	186	23	73	8	2	3	1	0	1	0	2	111	22	57	7	7	3	1	0	0	0	0	97	52	55	49	3	3	1	0	0	0	3	163	557
8:00	11	91	55	2	2	1	0	0	0	0	162	20	68	9	0	2	1	0	0	0	6	100	39	63	17	6	2	1	0	0	0	1	128	63	47	37	3	2	7	0	0	0	2	159	549
8:15	11	85	53	1	5	2	0	1	0	0	158	14	63	4	1	2	0	0	0	0	0	84	27	75	15	7	1	0	0	0	0	2	125	70	65	27	1	6	6	0	0	0	1	175	542
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8:45	12	86	44	1	14	2	0	0	0	1	159	26	58	13	2	2	0	0	0	0	3	101	36	77	14	2	1	0	0	0	0	1	130	66	72	35	1	4	4	0	0	0	4	182	572
MD																																													
11:00	8	89	38	0	3	0	0	0	0	0	138	23	69	18	1	3	0	0	1	0	7	115	29	112	11	2	2	1	0	0	0	2	157	65	67	30	2	1	3	0	1	0	1	169	579
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11:30	11	108	42	0	2	1	0	0	0	0	164	31	56	15	0	1	2	0	1	0	4	106	32	102	17	2	1	1	0	0	0	1	155	66	58	33	0	0	2	0	0	0	0	159	584
11:45	15	99	46	0	2	1	0	0	0	0	163	27	63	12	1	4	0	0	0	0	3	107	47	113	12	3	0	0	0	0	0	2	175	67	71	43	3	2	1	0	0	0	3	187	632
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PM																																													
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233 Dunlop Street West
Trip Generation Calculations

<u>AM Peak Weekday:</u>

Mid-Rise Apartment (ITE Code 223)

Average Rate = 0.30 veh./dwelling unit

Building = 91 units

Trip Count = 0.30 x 91
= 27 trips

Specialty Retail Center (ITE Code 814)

Average Rate = 6.84 veh. / $1000ft^2$

Building = 1,778 ft^2

Trip Count = $\frac{6.84}{1000}$ x 1778
= 12 trips

Total AM Peak Weekday Trips = 27 + 12
= $\boxed{\textbf{39 trips}}$

<u>PM Peak Weekday:</u>

Mid-Rise Apartment (ITE Code 223)

Average Rate = 0.39 veh./dwelling unit

Building = 91 units

Trip Count = 0.39 x 91
= 35 trips

Specialty Retail Center (ITE Code 814)

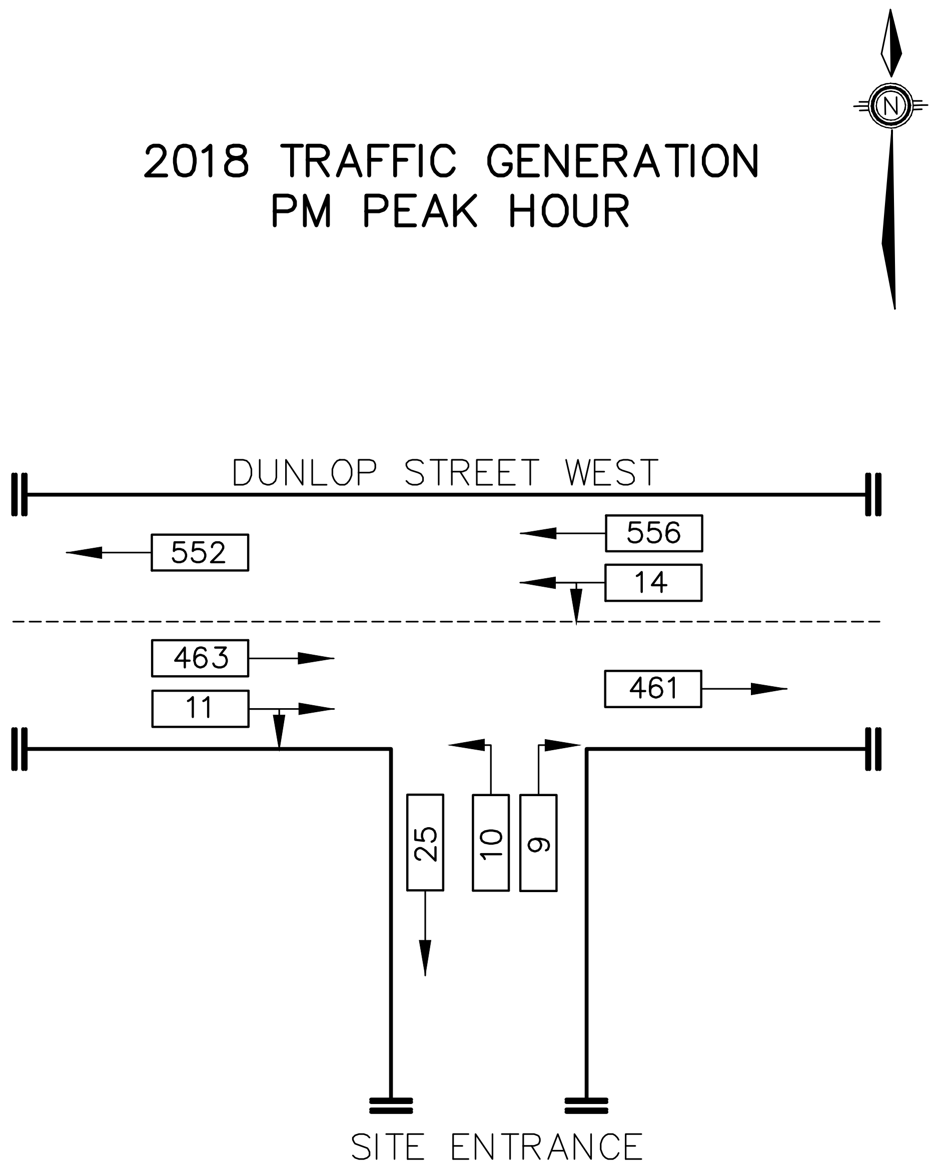
Average Rate = 5.02 veh. / $1000ft^2$

Building = 1,778 ft^2

Trip Count = $\frac{5.02}{1000}$ x 1778
= 9 trips

Total AM Peak Weekday Trips = 35 + 9
= $\boxed{\textbf{44 trips}}$

2018 TRAFFIC GENERATION
PM PEAK HOUR



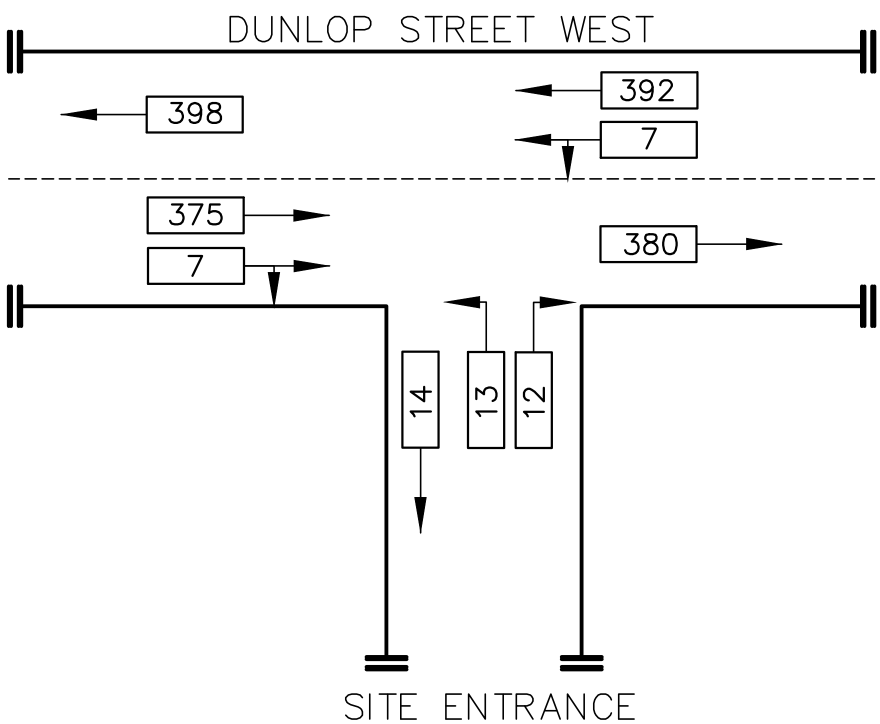
233 DUNLOP STREET WEST
BARRIE, ONTARIO

GENERATED 2018 TRAFFIC
PM PEAK HOUR

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	MWD	HORIZ SCALE	NTS	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	FIG-3
CHECKED BY	MWD	DATE	AUGUST 2018	REVISION #	0

2018 TRAFFIC GENERATION
AM PEAK HOUR



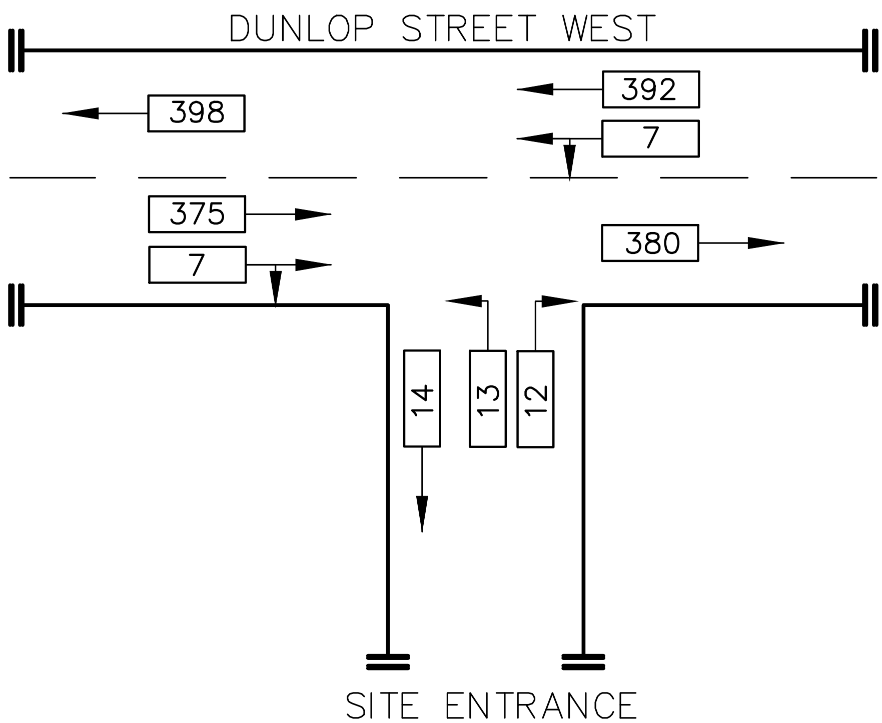
233 DUNLOP STREET WEST
BARRIE, ONTARIO

GENERATED 2018 TRAFFIC
AM PEAK HOUR

PEARSON
ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	MWD	HORIZ SCALE	NTS	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	FIG-2
CHECKED BY	MWD	DATE	AUGUST 2018	REVISION #	0

2024 TRAFFIC GENERATION
AM PEAK HOUR



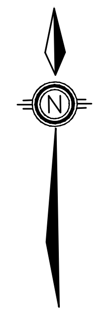
233 DUNLOP STREET WEST
BARRIE, ONTARIO

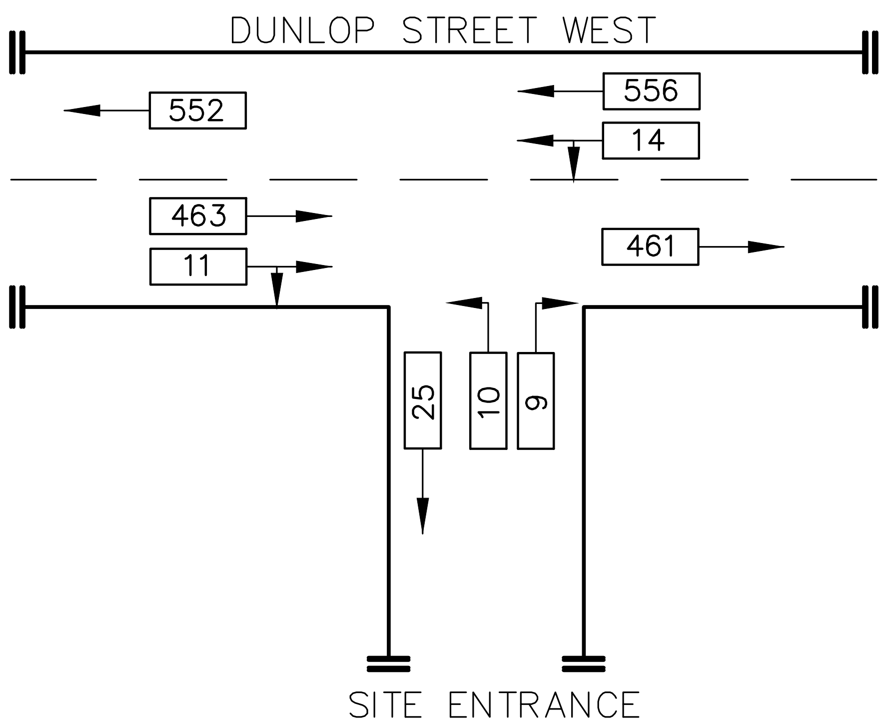
PROJECTED 2024 TRAFFIC
AM PEAK HOUR

PEARSON
ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	MWD	HORIZ SCALE	NTS	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	FIG-4
CHECKED BY	MWD	DATE	FEBRUARY 2019	REVISION #	0

2024 TRAFFIC GENERATION
PM PEAK HOUR





233 DUNLOP STREET WEST
BARRIE, ONTARIO

PROJECTED 2024 TRAFFIC
PM PEAK HOUR

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	MWD	HORIZ SCALE	NTS	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	FIG-5
CHECKED BY	MWD	DATE	FEBRUARY 2019	REVISION #	0

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Mac Pinkney*
Agency/Co.	*Pearson Engineering*
Date Performed	*2/5/2019*
Analysis Time Period	*AM Peak Hour 8:00-9:00*

Site Information

Intersection	*Dunlop Street West*
Jurisdiction	*City of Barrie*
Analysis Year	*2018*

Project Description *12081.01 - 233 Dunlop Street West*

East/West Street: *Dunlop Street West*
North/South Street:

Intersection Orientation: *East-West*
Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*375*	*7*	*7*	*392*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*375*	*7*	*7*	*392*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*13*		*12*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*13*	*0*	*12*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*7*	*13*		*12*			
C (m) (veh/h)		*1188*	*442*		*825*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.02*	*0.09*		*0.04*			
Control Delay (s/veh)		*8.0*	*13.4*		*9.4*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*11.5*					
Approach LOS	--	--	*B*					

HCS+™ Version 5.2
Generated: 2/5/2019 10:49 AM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Mac Pinkney*
Agency/Co.	*Pearson Engineering*
Date Performed	*2/5/2019*
Analysis Time Period	*AM Peak Hour 8:00-9:00*

Site Information

Intersection	*Dunlop Street West*
Jurisdiction	*City of Barrie*
Analysis Year	*2023*

Project Description *12081.01 - 233 Dunlop Street West*

East/West Street: *Dunlop Street West* — North/South Street:

Intersection Orientation: *East-West* — Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*414*	*7*	*7*	*433*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*414*	*7*	*7*	*433*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*13*		*12*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*13*	*0*	*12*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*7*	*13*		*12*			
C (m) (veh/h)		*1149*	*406*		*802*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.02*	*0.10*		*0.05*			
Control Delay (s/veh)		*8.2*	*14.2*		*9.6*			
LOS		*A*	*B*		*A*			
Approach Delay (s/veh)	--	--	*12.0*					
Approach LOS	--	--	*B*					

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*Mac Pinkney*	Intersection	*Dunlop Street West*
Agency/Co.	*Pearson Engineering*	Jurisdiction	*City of Barrie*
Date Performed	*8/17/2018*	Analysis Year	*2018*
Analysis Time Period	*PM Peak Hour 16:15-17:15*		

Project Description *12081.01 - 233 Dunlop Street West*

East/West Street: *Dunlop Street West*	North/South Street:
Intersection Orientation: *East-West*	Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		463	11	14	556	
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	463	11	14	556	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	2	0	0	2	0
Configuration		T	TR	LT	T	
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	10		9			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	10	0	9	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		14	10		9			
C (m) (veh/h)		1099	335		771			
v/c		0.01	0.03		0.01			
95% queue length		0.04	0.09		0.04			
Control Delay (s/veh)		8.3	16.1		9.7			
LOS		A	C		A			
Approach Delay (s/veh)	--	--	13.1					
Approach LOS	--	--	B					

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Mac Pinkney*
Agency/Co.	*Pearson Engineering*
Date Performed	*2/5/2019*
Analysis Time Period	*PM Peak Hour 16:15-17:15*

Site Information

Intersection	*Dunlop Street West*
Jurisdiction	*City of Barrie*
Analysis Year	*2018*

Project Description *12081.01 - 233 Dunlop Street West*

East/West Street: *Dunlop Street West* — North/South Street:

Intersection Orientation: *East-West* — Study Period (hrs): *1.00*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)		*511*	*11*	*14*	*614*	
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*0*	*511*	*11*	*14*	*614*	*0*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*2*	*0*	*0*	*2*	*0*
Configuration		*T*	*TR*	*LT*	*T*	
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	*10*		*9*			
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*
Hourly Flow Rate, HFR (veh/h)	*10*	*0*	*9*	*0*	*0*	*0*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)	*0*			*0*		
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*1*	*0*	*1*	*0*	*0*	*0*
Configuration	*L*		*R*			

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		*LT*	*L*		*R*			
v (veh/h)		*14*	*10*		*9*			
C (m) (veh/h)		*1055*	*299*		*744*			
v/c		*0.01*	*0.03*		*0.01*			
95% queue length		*0.04*	*0.10*		*0.04*			
Control Delay (s/veh)		*8.5*	*17.5*		*9.9*			
LOS		*A*	*C*		*A*			
Approach Delay (s/veh)	--	--	*13.9*					
Approach LOS	--	--	*B*					

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Appendix G

Pearson Engineering Drawings

NO.	REVISION NOTE	DATE	BY

BENCHMARK:

MDM DEVELOPMENTS
233 DUNLOP STREET WEST
CITY OF BARRIE

SITE SERVICING PLAN

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	TA/MJWP	HORIZ SCALE	1:300	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	SS-1
CHECKED BY	MWD	DATE	FEBRUARY 2019	REVISION #	0

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NO.	REVISION NOTE	DATE	BY

BENCHMARK:

MDM DEVELOPMENTS
233 DUNLOP STREET WEST
CITY OF BARRIE

SITE GRADING PLAN

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	TA/MJWP	HORIZ SCALE	1:300	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	SG-1
CHECKED BY	MWD	DATE	FEBRUARY 2019	REVISION #	0

NO.	REVISION NOTE	DATE	BY

BENCHMARK:

MDM DEVELOPMENTS
233 DUNLOP STREET WEST
CITY OF BARRIE

PRE-DEVELOPMENT STORM
CATCHMENT PLAN

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	TA/MJWP	HORIZ SCALE	1:300	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	STM-1
CHECKED BY	MWD	DATE	FEBRUARY 2019	REVISION #	0

NO.	REVISION NOTE	DATE	BY

BENCHMARK:

MDM DEVELOPMENTS
233 DUNLOP STREET WEST
CITY OF BARRIE

POST-DEVELOPMENT STORM
CATCHMENT PLAN

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	TA/MJWP	HORIZ SCALE	1:300	PROJECT #	12081.01
DRAWN BY	MJWP	VERT SCALE		DRAWING #	STM-2
CHECKED BY	MWD	DATE	FEBRUARY 2019	REVISION #	0

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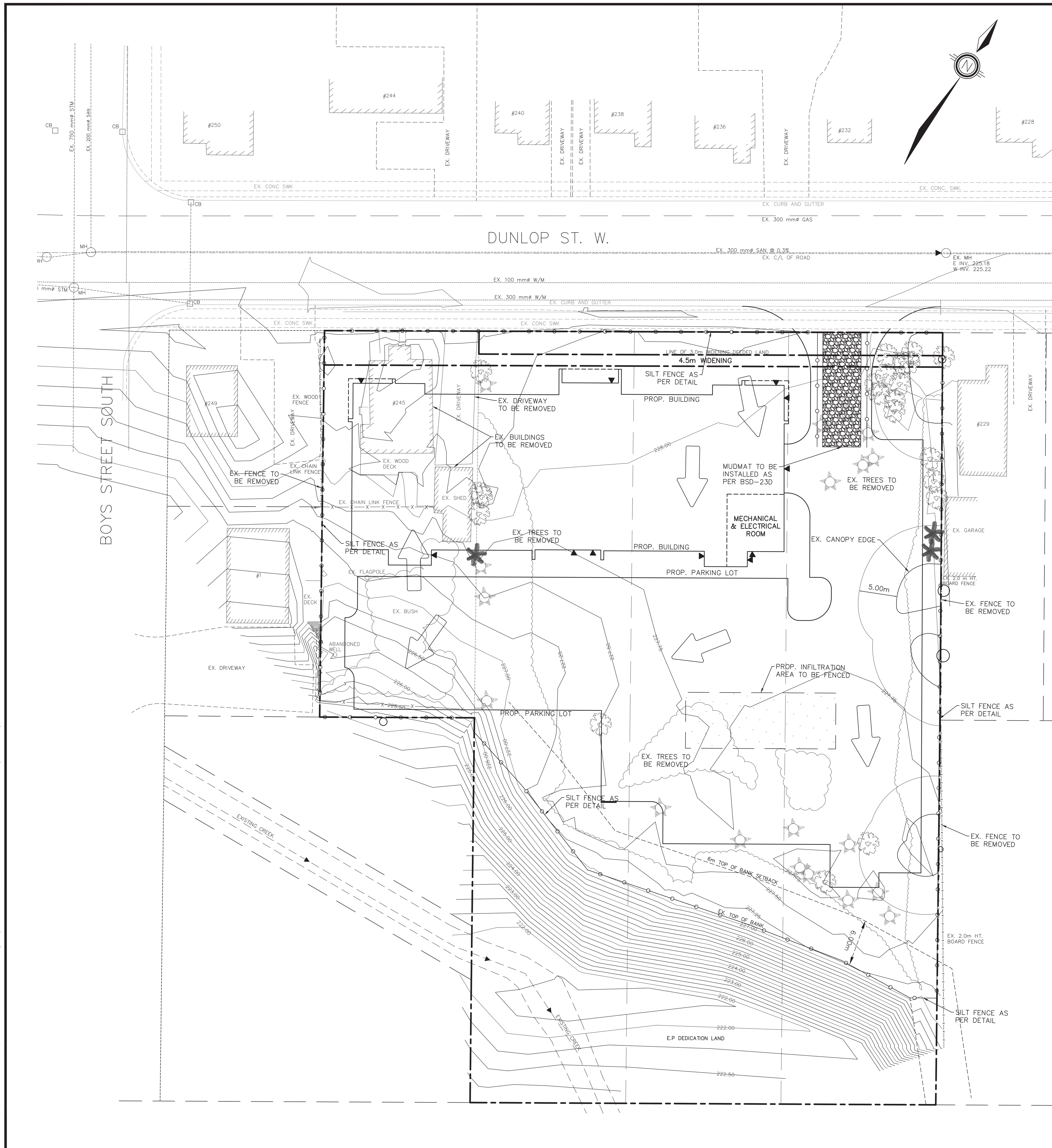


SITE DATA

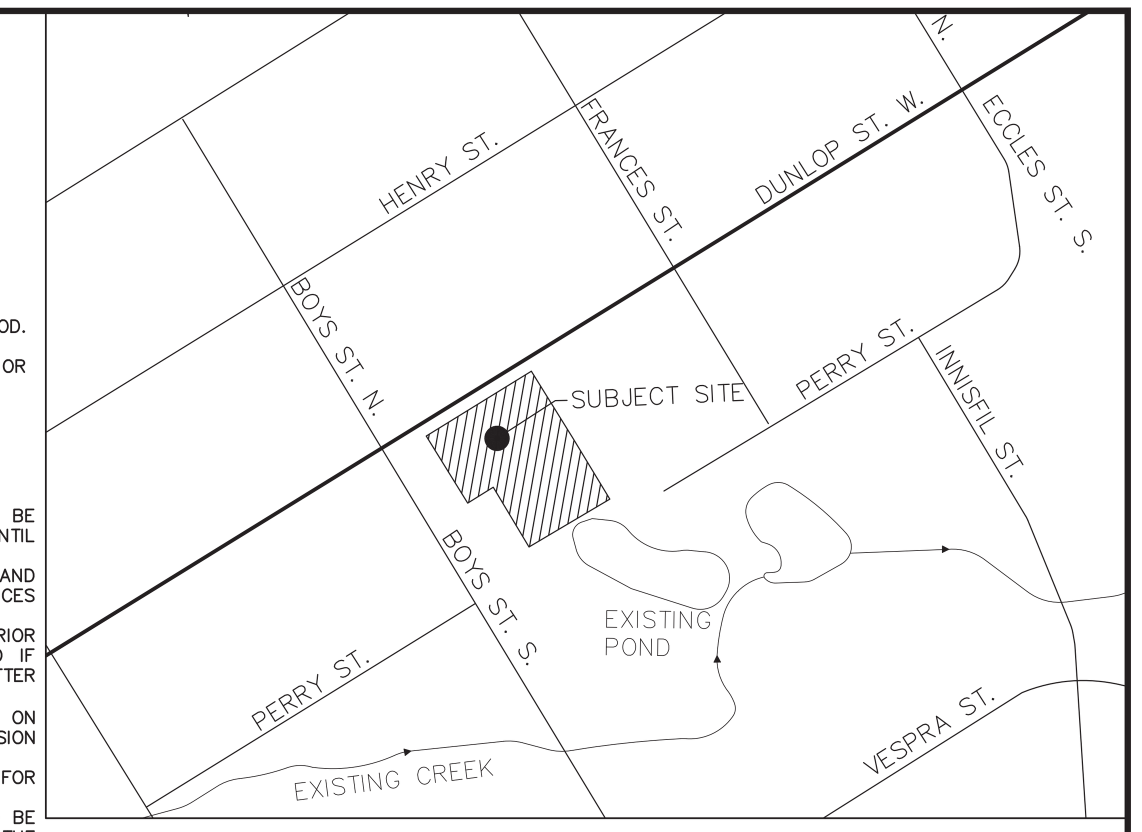
1. OVERALL SITE AREA – 0.72 ha
2. EXISTING LAND USE – RESIDENTIAL & VACANT

SEQUENCE OF CONSTRUCTION

1. ENGINEER 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 (TO BE REMOVED FROM SITE – NO STOCKPILE).
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. PERMEABLE PAVERS WILL BE CONSTRUCTED ONCE THE SITE HAS COMPLETED FINAL GRADING WORKS.
8. PERMEABLE PAVERS AND INFILTRATION TANK AREAS NOT TO BE COMPACTED.

NOTES FOR SEDIMENT & EROSION CONTROL

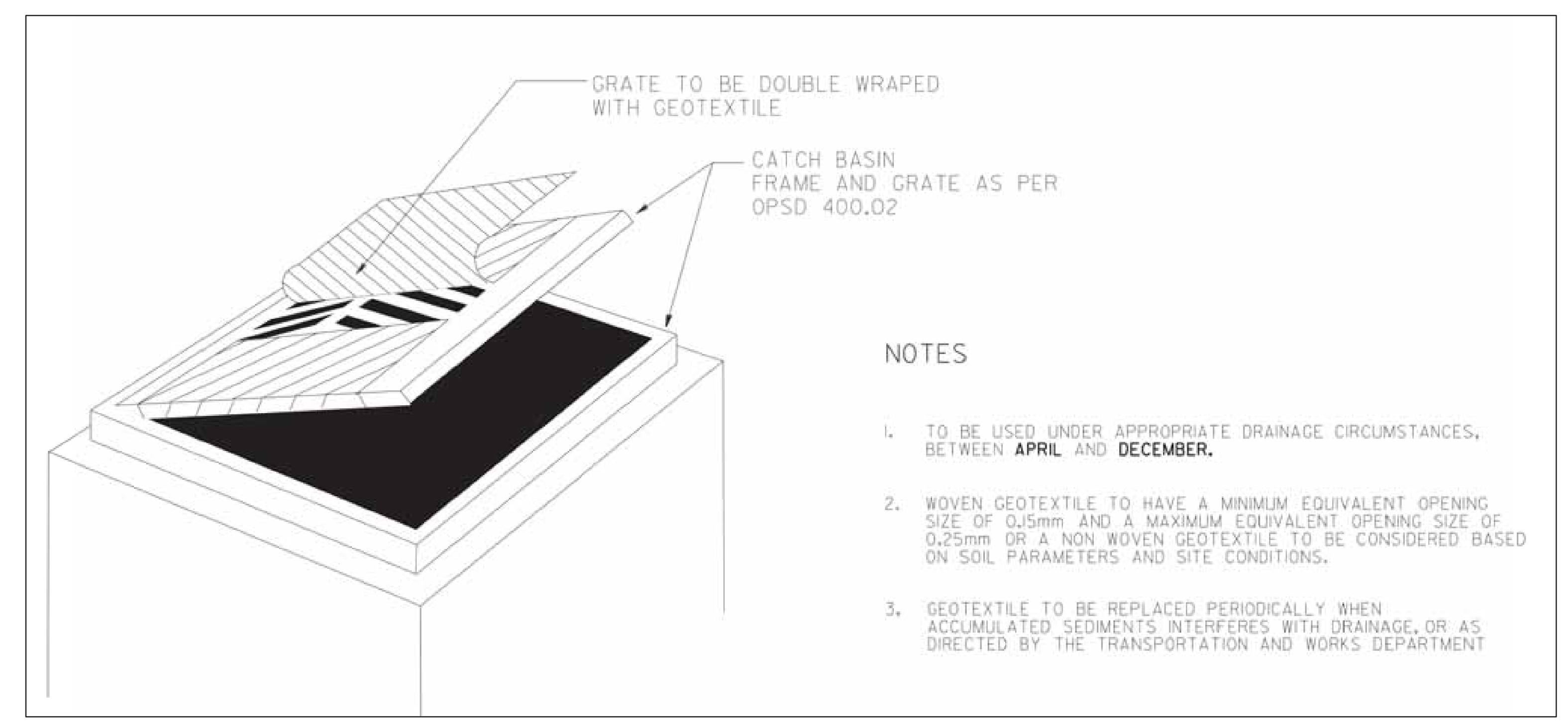
1. DISTURBED AREAS THAT HAVE FAILED TO HAVE STABLE GROUND COVER ESTABLISHED BY OCTOBER 30TH SHALL BE PROTECTED WITH A SILTATION CONTROL FENCE OR STRAW MULCH ETC. AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION BECOMES ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
2. ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30m FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE ADMINISTRATOR. DISCHARGE TO MUNICIPAL SERVICES MUST BE APPROVED BY THE CITY OF BARRIE PRIOR TO STARTING WORK AND ADHERE TO CITY OF BARRIE STANDARDS
3. SILT FENCE SHALL BE PUT IN PLACE PRIOR TO AND MAINTAINED DURING ALL GRADING. 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. CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 577, CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES AS WELL AS ALL APPLICABLE MUNICIPAL STANDARDS.
6. 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 MUNICIPALITY AND CONSERVATION AUTHORITY.
7. 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.
8. 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 CITY OF BARRIE MANAGER OF ENGINEERING BUT SHALL NOT EXCEED THIRTY DAYS.
9. CONTRACTOR SHALL INSTALL AND MAINTAIN CATCHBASIN SEDIMENT BARRIERS THROUGHOUT THE SITE DURING ALL CONSTRUCTION ACTIVITIES IN ORDER TO TRAP SEDIMENT. REFER TO DETAIL



KEYMAP

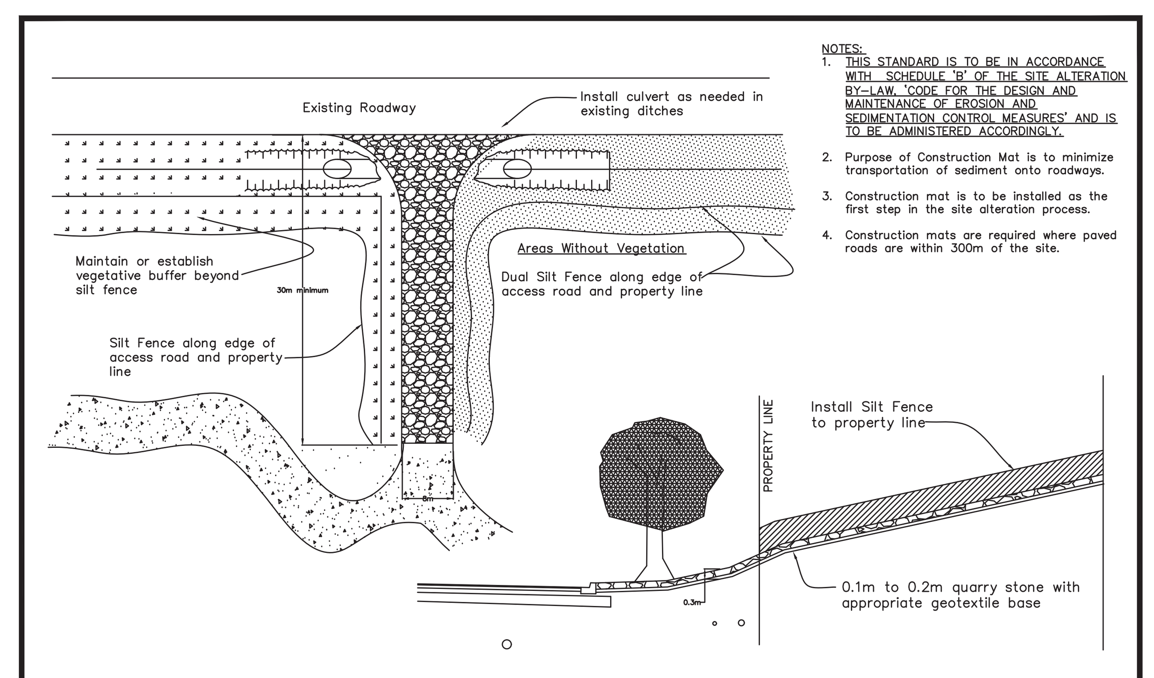
LEGEND

- FIRE HYDRANT
- WATER VALVE
- EXISTING CURB STOP
- EX. SANITARY MANHOLE
- EX. STORM MANHOLE
- EX. CATCH BASIN
- EX. SEPTIC BED AREA
- PROP. BIO–RETENTION OR INFILTRATION AREA TO BE FENCED
- EX. OVERLAND FLOW ROUTE
- PROP. OVERLAND FLOW ROUTE
- EX. TREES TO BE REMOVED
- SILT FENCE

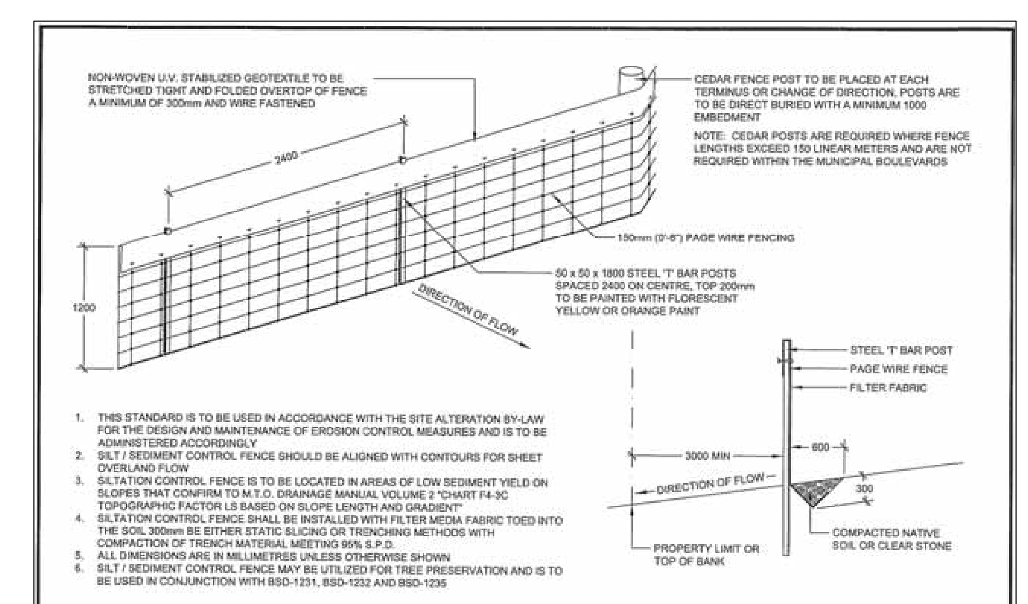


NOTES

1. TO BE USED UNDER APPROPRIATE DRAINAGE CIRCUMSTANCES, BETWEEN APRIL AND DECEMBER.
2. WOVEN GEOTEXTILE TO HAVE A MINIMUM EQUIVALENT OPENING SIZE OF 0.15mm AND A MAXIMUM EQUIVALENT OPENING SIZE OF 0.25mm OR A NON WOVEN GEOTEXTILE TO BE CONSIDERED BASED ON SOIL PARAMETERS AND SITE CONDITIONS.
3. GEOTEXTILE TO BE REPLACED PERIODICALLY WHEN ACCUMULATED SEDIMENTS INTERFERES WITH DRAINAGE, OR AS DIRECTED BY THE TRANSPORTATION AND WORKS DEPARTMENT



CITY OF BARRIE STANDARD	1.	Standardized Dimension Text	J.S.	05.10.28	APR'D: R.G.N.	DATE: 04.03.16
CONSTRUCTION ENTRANCE MAT					DRAWN: A.S.C	SCALE: N.T.S
	NO.	REVISION	APR'D	DATE	BSD-23D	



Barrie STANDARD DETAIL	SILTATION CONTROL FENCING	REV No. 1	DATE: OCT 2017 / SCALE: N.T.S.	APPROVED DATE Oct 10/17 DIRECTOR OF ENGINEERING
		BSD-1233 FORMERLY BSD-23A		

NO.	REVISION NOTE	DATE	BY

BENCHMARK:

MDM DEVELOPMENTS
233 DUNLOP STREET WEST
CITY OF BARRIE

ENVIRONMENTAL PROTECTION AND REMOVALS PLAN

PEARSON ENGINEERING LTD.
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY TA/MJWP	HORIZ SCALE 1:300	PROJECT # 12081.01
DRAWN BY MJWP	VERT SCALE	DRAWING # EPR–1
CHECKED BY MWD	DATE FEBRUARY 2019	REVISION # 0