Stormwater Management Report, Water Report and Traffic Brief

1911882 Ontario Inc.
Addition and Renovations to Good Storage Plus
620 Veterans Drive

City of Barrie
County of Simcoe

City of Barrie D28-048-2021

PEARSON
ENGINEERING
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January 2022
14072.01

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STORMWATER MANAGEMENT REPORT, WATER REPORT AND TRAFFIC BRIEF

620 VETERANS DRIVE, BARRIE

1. INTRODUCTION

PEARSON Engineering Ltd. has been retained by 1911882 Ontario Inc. (Client) to prepare a Stormwater Management (SWM) Report, Water Report and Traffic Brief in support of the proposed building expansion located at 620 Veterans Drive within the Mapleview Industrial Developments subdivision in the City of Barrie (City), County of Simcoe (County). The subject property is located on the west side of Veterans Drive, South of Mapleview Drive and can be seen on Figure 1.

The subject property is approximately 0.85 ha in size and is currently occupied by the existing Good Storage Plus building and Auto Match by Jackson’s Toyota with a 1304 m^2 two storey commercial building and 102 m^2 car wash building. The Project site is bounded by Petro-Canada to the north, Veterans Drive to the east, Barrie Nissan dealership to the south and Jackson’s Toyota dealership to the west and drains towards Veterans Drive. The Project proposes the development of a three-storey 1,740 m^2 building addition and associated parking lot.

1.1. TERMS OF REFERENCE

The intent of this SWM Report is to:

- Identify the existing site characteristics including any external drainage conditions;
- Illustrate the design of the stormwater conveyance and detention system, capable of accommodating both minor and major storm flows from the site;
- Incorporate the appropriate Best Management Practices for controlling on-site erosion and sedimentation during construction while ultimately ensuring that the post-development release of stormwater is of adequate quality; and
- Summarize this design in a technically comprehensive and concise manner.

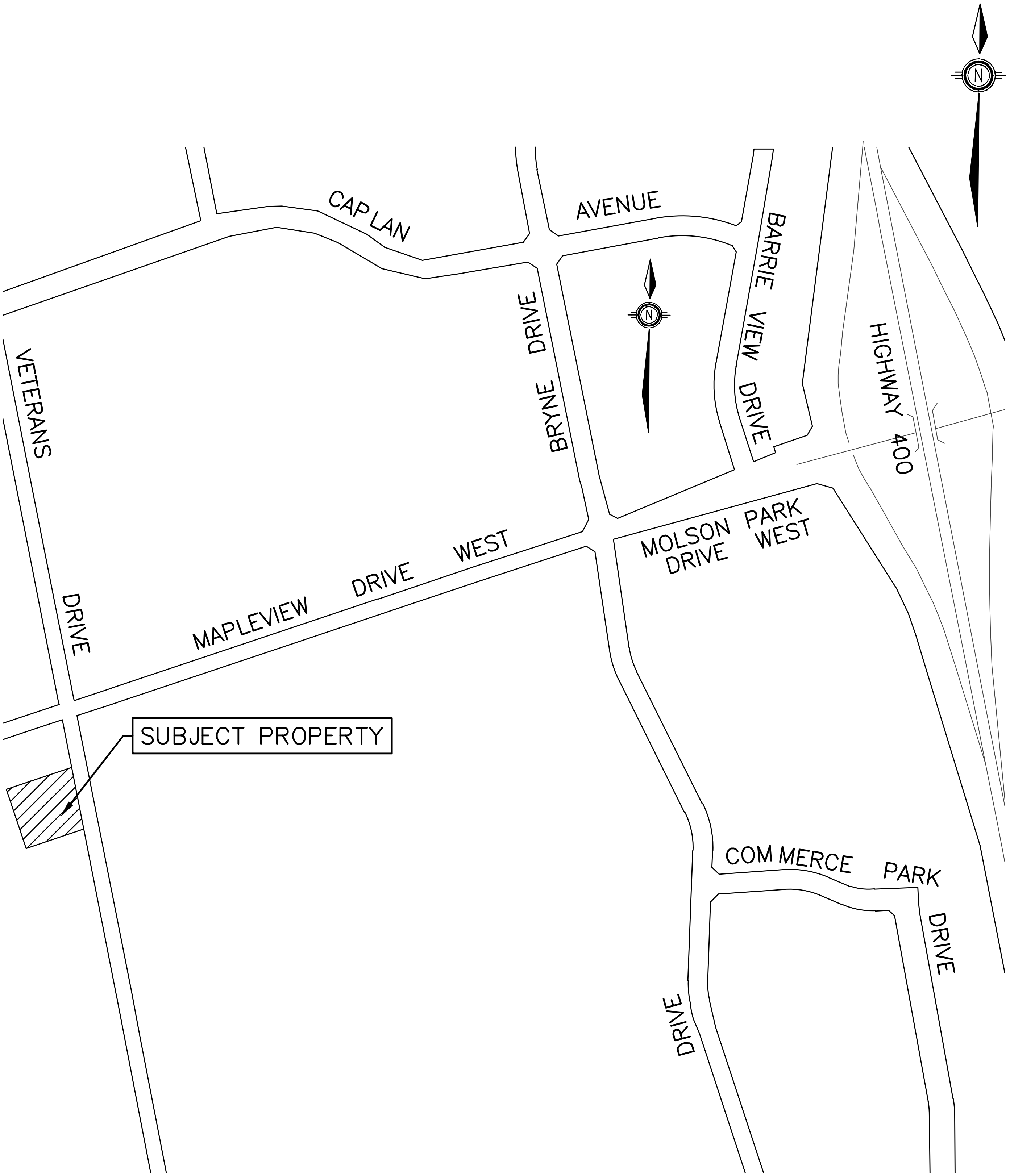
2. STORMWATER MANAGEMENT

A key component of the development needs to address environmental and related SWM issues. These are examined in a framework aimed at meeting the City, and Ministry of the Environment, Conservation and Parks (MECP) requirements. SWM parameters have evolved from an understanding of the location and sensitivity of the site's natural systems. This SWM Report 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.
- Maintain and protect significant natural features.

C:\Users\acleaves\AppData\Local\Temp\AcPublish_20856\14072.01 - BASE.dwg Layout: FIG-1 Plotted Jan 14, 2022 @ 10:53am by acleaves @ PEARSON-MCCUAIG ENGINEERING LTD.



1911882 ONTARIO INC.
620 VETERANS DRIVE
CITY OF BARRIE

FIGURE 1

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	N/A	PROJECT #	14072.01
DRAWN BY	JP	VERT SCALE	N/A	DRAWING #	FIG-1
CHECKED BY	GMP	DATE	SEPT 2021	REVISION #	0

2.1. 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 – August 2020

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.

2.2. EXISTING DRAINAGE CONDITIONS

The Project site fronts onto Veterans Drive and has an existing storm conveyance system designed by Pearson Engineering in 2015. The site currently drains via a catchbasin and storm sewer system with a connection to the existing storm sewer on Veterans Drive. Underground storage tanks were provided to infiltrate rooftop runoff, while parking lot ponding and storage within the storm sewers and manholes are providing quantity control for the site. An existing 300 mm diameter pipe located downstream of STM MH1 is restricting the flows to obtain allowable peak flow values.

The approved subdivision drawings completed by Richardson Foster Ltd, Consulting Engineers states in in their catchment plan that the allowable runoff coefficient for this lot is 0.75 which can be seen in DWG 9120-STM drawing in Appendix E.

According to the *Soil Survey of Simcoe County, Report No. 25 of the Ontario Soil Survey, Ministry of Agriculture and Food*, the project site is comprised of Bondhead sandy loam and Alliston sandy loam. Bondhead loam is characterized as light grey, calcareous, loam and sandy loam till with good drainage. Alliston sandy loam is characterized as grey, calcareous outwash sand with imperfect drainage.

The proposed site is to maintain the existing drainage flows towards Veterans Drive. The allowable peak flows for the proposed condition will be calculated using a runoff coefficient of 0.75 as per the approved Subdivision Storm Drainage Plan. The allowable peak flows are shown in Table 1. Detailed calculations can be found in Appendix A.

Table 1: Allowable Peak Flows

	2 Year Storm	**5 Year Storm**	**10 Year Storm**	**25 Year Storm**	**50 Year Storm**	**100 Year Storm**
Total Site Peak Flow (m^3/s)	0.15	0.20	0.23	0.29	0.35	0.40

2.3. PROPOSED DRAINAGE CONDITIONS

Post development drainage conditions will generally follow pre-development. The proposed development will not increase the imperviousness of the site as the proposed building addition is replacing existing asphalt. Parking lot runoff with drain via catchbasins and a storm sewer system. The majority of the existing storm sewer will be maintained, with one section being removed as it is located below the proposed building addition. The Project's storm sewer was sized for the minor storm, defined as all storms up to and including the 5-year storm event, using the rational method.

The existing infiltration tanks are located within the building addition area and therefore will be removed and replaced. Rooftop runoff will be conveyed to the proposed tanks which will infiltrate stormwater. The storm sewer system ultimately drains to the existing storm sewer on Veterans Drive.

In the event of a storm event greater than the 5-year storm, the storm sewer will overflow, and the site has been graded to allow stormwater to drain overland towards the driveway entrance to Veterans Drive and ultimately into the downstream wet pond constructed for the Mapleview Industrial Subdivision located on the west side of Reid Drive, north of Mapleview. The proposed storm drainage patterns can be seen on drawing STM-2 in Appendix G.

2.4. STORMWATER QUANTITY CONTROL

The calculated runoff coefficient of the development after the proposed building and site works is 0.85. This is larger than the allowable 0.75 and thus additional quantity control measures have been implemented on site. Runoff coefficient calculations can be found in Appendix A.

Quantity control storage will be provided via pipes and manholes and parking lot ponding. The existing 300 mm diameter pipe located downstream of STM MH1 will restrict flow and reduce the post development peak flows of the parking lot to allowable values while the driveway entrance will act as an emergency overflow weir.

Given the size of the site, the Modified Rational Method will be used to determine the SWM release rates. The City of Barrie (Aug. 2020) IDF curve parameters were used for determining the storm intensity values and the following post development release rates have been calculated. Calculations in Appendix A demonstrate that a storage volume of 28m³ is required for the 100 year storm. The site will provide 29 m³ of storage in the structures and pipes, 3 m³ of surface ponding for a total of 32 m³ of storage. By comparing Table 1 and Table 2 below, it can be seen that the proposed SWM controls will reduce peak flows to allowable flows.

Table 2: Post-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Controlled Peak Flows (m^3/s)	0.01	0.01	0.01	0.02	0.02	0.03
Uncontrolled Peak Flow (m^3/s)	0.14	0.18	0.21	0.27	0.30	0.33
Total Peak Flow (m^3/s)	0.15	0.19	0.23	0.29	0.32	0.35

2.5. STORMWATER QUALITY CONTROL

The MECP 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 development’s Stormwater Quality Control objective is to provide Enhanced Protection quality control as stated in the MECP manual. To achieve enhanced protection, permanent and temporary control of erosion and sediment transport are proposed and are discussed in the following sections.

2.5.1. PERMANENT QUALITY CONTROL

The development's active parking facilities pose a risk to stormwater quality through the collection of grit, salt, sand and oils on the paved surfaces. The downstream wet pond constructed for the Mapleview Industrial Subdivision located on the west side of Reid Drive, north of Mapleview treats the stormwater released from this site to the MECP's Enhanced or Level 1 Protection Standard.

2.5.2. QUALITY CONTROL DURING CONSTRUCTION

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 the stormwater runoff's quality.

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

- Installation of filter strips, silt fences and rock check dams or other similar facilities throughout the site, and specifically during all construction activities, in order to reduce stormwater drainage velocities and trap sediment on-site; and,
- 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.
- Provision of a mud-mat where applicable at the construction entrances in order to control the tracking of sediment and debris onto municipal streets.
- Reduce stormwater drainage velocities where possible.
- Minimize the amount of existing vegetation removed.

3. PHOSPHORUS BUDGET

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 NVCA. As such, best efforts are to be employed in order to reduce phosphorus levels to pre-development levels or better.

The existing developed site generates approximately 0.94 kg of phosphorus annually. Best efforts will be used in order to reduce the phosphorus loading as much as is reasonably possible.

It is recommended to utilize the existing treatment train approach to minimize the amount of phosphorus discharged from the site. The roof area is increasing and parking area decreasing therefore providing greater treatment compared to the existing development. The following are the recommended phosphorus reduction rates based on NVCA Phosphorus tool: rooftop infiltration 100% and wet detention pond 63%.

Table 7 details the anticipated phosphorus loadings for pre and post-development conditions based on the above noted treatment train approach and detailed phosphorous loading calculations can be found in Appendix C.

Table 3: Phosphorus Loadings

	Total P (kg)
Pre-Development & Uncontrolled Post-Development	0.94
Controlled Post-Development	0.22

4. Water Balance

The post development state will not increase the imperviousness of the site, however City of Barrie guidelines require that 5 mm of rainfall over the entire site is infiltrated to meet water balance objectives. Therefore, for a site area of 0.85 ha, a volume of 42.7 m³ is required. A storage volume of 44.1 m³ is provided in the underground chambers to ensure that the runoff is infiltrated. Calculations for water balance can be found in Appendix C.

5. Fire Flow

An existing 150 mm diameter fire fighting water service provides water supply for internal fire suppression and the onsite hydrant for the existing building. Both the existing and proposed building are expected to be sprinklered. The existing fire hydrant is being relocated adjacent to the driveway on the northeast corner of the site to provide adequate firefighting coverage for the proposed development as per City Standards. Refer to Drawing SS-1 for the fire hydrant locations.

The required fire flow was calculated as per the Fire Underwriters Survey (FUS) assessment and was determined to be approximately 233 L/s. However, as per the City of Barrie Water Guidelines, commercial land use requires a minimum fire flow of 283 L/s. The building construction consists of a fully sprinklered water system and a structure made from non-combustible materials. Fire flow calculations included in Appendix A were completed based on the FUS guide for the determination of required fire flow.

Vipond Inc. completed water pressure tests on March 10, 2015 indicating that a static pressure of 58 psi was available. This flow test also resulted in a fire flow that can be supplied to the Project site with a flow of approximately 73 L/s at a residual pressure of 56 psi from the existing hydrant. From extrapolation of the hydrant flow test, a flow of 283 L/s would result in an approximate residual pressure 48 psi. As the required fire flow for the development is 283 L/s, the proposed water infrastructure can supply the flow as per the City of Barrie requirements. Provided fire flow information can be found in Appendix F.

6. Traffic Brief

6.1. Existing Conditions

Historical traffic data has been provided by the City, found in Appendix G, for the intersection of Mapleview Drive and Veterans Drive and factored into the data for base 2021 trip data for Veterans Drive Traffic Count Data in Table 4 below. A 2% Annual Growth Rate has been applied to the 2018 data and average annual daily traffic (AADT) has been estimated using the following formula based on the methodology outlined in Section 5.2.2 in the Ontario Traffic Manual Book 15.

AADT = 8-hour traffic volumes x 2

Table 4: Traffic Count Data

Intersection	Count Date	8-Hour Peak	AM Peak Hour	MD Peak Hour	PM Peak Hour	8-hr Traffic Volumes	AADT
Mapleview Drive at Veterans Drive	Nov. 18, 2018	07:00 to 09:00 11:00 to 14:00 15:00 to 18:00	08:00 to 09:00 972	12:45 to 13:45 1,012	16:30 to 17:30 1,491	8,534	17,068

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 & 3, projected vehicle trip ends were determined. The Land Use used to determine these volumes are classified as New Car Sales (ITE land use code 841) and Mini-Warehouse (ITE land use code 151). The utilized charts can be found in Appendix G. The existing Project site is utilized as both storage and car dealership creating the following trip generation.

Table 5: Existing Trip Generation

Land Use	GFA	Weekday AM Peak	Traffic Distribution		Weekday PM Pear	Traffic Distribution		Saturday Peak	Traffic Distribution	
			In	Out					In	Out
Car Sales	447 m^2	10.6	56%	44%	13.1	45%	55%	14.3	51%	49%
Self-Storage Facility	2,161 m^2	6.5	48%	52%	6.7	53%	47%	9.3	n/a	n/a
TOTAL		17.1			19.8			23.6		

6.2. Existing Road Geometrics

The Project site is located on Veterans Drive between Mapleview Drive West and King Street. More specifically, the Project site shared driveway is approximately 112m south of the signalized Mapleview Drive/Veterans Drive intersection and approximately 202m north of the King Street/Veterans Drive non signalized Intersection.

Veterans Drive is a north-south arterial road under the jurisdiction of the City of Barrie and consists of a 5-lane arterial road cross section with a posted speed limit of 60 km/hr.

Veterans Drive has an existing capacity of 3000 vehicles based on 750 vehicles/lane/hour and 4 travel lanes (not including 1 turning lane) and the 2021 PM Peak Hour based on traffic counts from the City of Barrie fronting the Project site on Veterans is 1491. Therefore, the Veterans Drive fronting the Project site is operating at a maximum 49.7% of the road's capacity.

6.3. Proposed Conditions

The Project site will be removing the car dealership use of the site and expanding the storage portion of the business. The following trip generations are expected.

Table 6: Proposed Trip Generation

Land Use	GFA	Weekday AM Peak	Traffic Distribution		Weekday PM Pear	Traffic Distribution		Saturday Peak	Traffic Distribution	
			In	Out					In	Out
Self-Storage Facility	7828 m^2	23.6	48%	52%	24.4	53%	47%	33.7	n/a	n/a
TOTAL		23.6			24.4			33.7		

Therefore, the trip generations for the Project site are expected to be marginally larger, however based on the existing capacity of Veterans Drive and the increased traffic from the site a nominal increase of Veterans Drive capacity to 1501 trips or 50.0% of the roads capacity.

7. CONCLUSIONS

The existing downstream SWM pond will provide the required quality control to satisfy the MECP Enhanced level requirements.

Quantity control for the development is provided in the StormTech underground storage units, storm structures and surface ponding allowing post-development peak flows to be released at the allowable values through.

A treatment train approach has been implemented in order to reduce the phosphorous loading for the site and water balance will be achieved by infiltrating the 14mm storm over the rooftop area.

The required fire flow is available for the proposed building.

The change in use and increased building size will create a nominal increase to traffic on Veterans Drive.

All of which is respectfully submitted,

PEARSON ENGINEERING LTD.

Taylor Arkell, P.Eng.
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LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
JAN. 14, 2022
PROVINCE OF ONTARIO

APPENDIX A

STORMWATER MANAGEMENT CALCULATION

620 Veterans Drive
Calculation of Runoff Coefficients

Runoff Coefficient	=	0.10	0.95	0.95	0.40	0.95	Weighted Runoff Coefficient
Surface Cover	=	Grass	Asphalt	Building	Gravel	Conc.	
Pre-Development	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	
1	1090	123	942	22	0	3	0.85
2	1328	0	1154	130	0	44	0.95
3	1375	0	1184	0	0	191	0.95
4	2367	0	984	1326	0	58	0.95
5	1271	55	1103	0	0	113	0.91
6	1114	770	245	0	0	99	0.36
Pre Total	8545	948	5611	1478	0	508	0.86
Post-Development	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	
1	1090	123	942	22	0	3	0.85
2	1091	0	884	155	0	53	0.95
3	703	0	681	0	0	22	0.95
4	3096	0	0	3096	0	0	0.95
5	860	21	776	0	0	63	0.93
6	1114	770	245	0	0	99	0.36
7	591	0	591	0	0	0	0.95
Post Total	8545	914	4118	3273	0	240	0.86

620 Veterans Drive
Allowable Peak Flows

Storm Event (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 = CiCIA / 360

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

Area Number		
Area	0.85	ha
Runoff Coefficient	0.75	
Time of Concentration	10	min
Return Rate	2	year
Peaking Coefficient (Ci)	1.00	
Rainfall Intensity	83.1	mm/hr
Pre-Development Peak Flow	0.15	m^3/s
Return Rate	5	year
Peaking Coefficient (Ci)	1.00	
Rainfall Intensity	108.9	mm/hr
Pre-Development Peak Flow	0.19	m^3/s
Return Rate	10	year
Peaking Coefficient (Ci)	1.00	
Rainfall Intensity	126.5	mm/hr
Pre-Development Peak Flow	0.23	m^3/s
Return Rate	25	year
Peaking Coefficient (Ci)	1.10	
Rainfall Intensity	148.2	mm/hr
Pre-Development Peak Flow	0.29	m^3/s
Return Rate	50	year
Peaking Coefficient (Ci)	1.20	
Rainfall Intensity	164.2	mm/hr
Pre-Development Peak Flow	0.35	m^3/s
Return Rate	100	year
Peaking Coefficient (Ci)	1.25	
Rainfall Intensity	180.2	mm/hr
Pre-Development Peak Flow	0.40	m^3/s

620 Veterans Drive
Post-Development Peak Flows

Storm Event (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 = CiCIA / 360

Where:

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

Area Number	Controlled Area		Uncontrolled Area	
Area	0.74	ha	0.11	ha
Runoff Coefficient	0.93		0.36	
Time of Concentration	10	min	10	min
Return Rate	2	year	2	year
Peaking Coefficient (Ci)	1.00		1.00	
Rainfall Intensity	83.1	mm/hr	83.1	mm/hr
Post-Development Peak Flow	0.16	m^3/s	0.01	m^3/s
Return Rate	5	year	5	year
Peaking Coefficient (Ci)	1.00		1.00	
Rainfall Intensity	108.9	mm/hr	108.9	mm/hr
Post-Development Peak Flow	0.21	m^3/s	0.01	m^3/s
Return Rate	10	year	10	year
Peaking Coefficient (Ci)	1.00		1.00	
Rainfall Intensity	126.5	mm/hr	126.5	mm/hr
Post-Development Peak Flow	0.24	m^3/s	0.01	m^3/s
Return Rate	25	year	25	year
Peaking Coefficient (Ci)	1.10		1.10	
Rainfall Intensity	148.2	mm/hr	148.2	mm/hr
Post-Development Peak Flow	0.31	m^3/s	0.02	m^3/s
Return Rate	50	year	50	year
Peaking Coefficient (Ci)	1.20		1.20	
Rainfall Intensity	164.2	mm/hr	164.2	mm/hr
Post-Development Peak Flow	0.38	m^3/s	0.02	m^3/s
Return Rate	100	year	100	year
Peaking Coefficient (Ci)	1.25		1.25	
Rainfall Intensity	180.2	mm/hr	180.2	mm/hr
Post-Development Peak Flow	0.43	m^3/s	0.03	m^3/s

620 Veterans Drive
Front Parking Area Storage Volumes

Storm Sewer Pipes

Pipe Diameter = 0.3 m
Length = 213.6 m
Pipe Area = π x r^2
= π x 0.023
= 0.07 m^2

Volume = Area x L
= 0.07 x 213.6
= 15 m^3

Manholes

Manhole Diameter = 1.2 m
Height = 1.5 m
# of Manholes = 8
MH Area = π x r^2
= π x 0.300
= 1.13 m^2

Volume = Area x Height x # of Manholes
= 1.13 x 1.5 x 8
= 14 m^3

Surface Storage

Ponding Elevation = 308.67 m
Ponding Area = m
CB Rim Elevation = 308.54 m

Volume
(from AutoCAD) = 3 m^3

Total Stoage Volume
= Underground + Pipe + Manholes + Surface
= 0 + 15.1 + 14 + 3
= 32 m^3

Required Storage Volume for 100 year storm is 28m³.

620 Veterans Drive
Stage-Storage-Discharge Table

Elevation (m)	Area (m^2)	Parking Lot Ponding (m^3)	Pipe & Manhole (m^3)	Cum. Vol. (m^3)	Orifice 1 Head (m)	Orifice 1 Flow (m^3/s)	Weir Head (m)	Weir Flow (m^3/s)	Total Flow (m^3/s)
306.95	0	0	0.0	0	0.040	0.050	0.000	0.000	0.050
307.00	0	0	1.1	1	0.090	0.075	0.000	0.000	0.075
307.05	0	0	1.1	2	0.140	0.094	0.000	0.000	0.094
307.10	0	0	1.1	3	0.190	0.109	0.000	0.000	0.109
307.15	0	0	1.1	4	0.240	0.123	0.000	0.000	0.123
307.20	0	0	1.1	5	0.290	0.135	0.000	0.000	0.135
307.25	0	0	1.1	6	0.340	0.146	0.000	0.000	0.146
307.30	0	0	1.1	7	0.390	0.156	0.000	0.000	0.156
307.35	0	0	1.1	9	0.440	0.166	0.000	0.000	0.166
307.40	0	0	1.1	10	0.490	0.175	0.000	0.000	0.175
307.45	0	0	1.1	11	0.540	0.184	0.000	0.000	0.184
307.50	0	0	1.1	12	0.590	0.192	0.000	0.000	0.192
307.55	0	0	1.1	13	0.640	0.200	0.000	0.000	0.200
307.60	0	0	1.1	14	0.690	0.208	0.000	0.000	0.208
307.65	0	0	1.1	15	0.740	0.215	0.000	0.000	0.215
307.70	0	0	1.1	16	0.790	0.223	0.000	0.000	0.223
307.75	0	0	1.1	17	0.840	0.230	0.000	0.000	0.230
307.80	0	0	1.1	18	0.890	0.236	0.000	0.000	0.236
307.85	0	0	1.1	19	0.940	0.243	0.000	0.000	0.243
307.90	0	0	0.5	20	0.990	0.249	0.000	0.000	0.249
307.95	0	0	0.5	20	1.040	0.255	0.000	0.000	0.255
308.00	0	0	0.5	21	1.090	0.262	0.000	0.000	0.262
308.05	0	0	0.5	21	1.140	0.267	0.000	0.000	0.267
308.10	0	0	0.5	22	1.190	0.273	0.000	0.000	0.273
308.15	0	0	0.5	22	1.240	0.279	0.000	0.000	0.279
308.20	0	0	0.5	23	1.290	0.284	0.000	0.000	0.284
308.25	0	0	0.5	23	1.340	0.290	0.000	0.000	0.290
308.30	0	0	0.5	24	1.390	0.295	0.000	0.000	0.295
308.35	0	0	0.5	24	1.440	0.301	0.000	0.000	0.301
308.40	0	0	0.5	25	1.490	0.306	0.000	0.000	0.306
308.45	0	0	0.5	25	1.540	0.311	0.000	0.000	0.311
308.50	0	0	0.5	26	1.590	0.316	0.000	0.000	0.316
308.55	10	0	0.5	27	1.640	0.321	0.000	0.000	0.321
308.60	15	1	0.5	28	1.690	0.326	0.000	0.000	0.326
308.65	45	1	0.5	30	1.740	0.330	0.030	0.106	0.436
308.70	60	3	0.5	33	1.790	0.335	0.080	0.462	0.797
308.75	0	0	0.5	33	1.840	0.340	0.130	0.956	1.296
308.80	0	0	0.5	34	1.890	0.344	0.180	1.558	1.902

Orifice 1		
Diameter		300 mm
Invert Elevation		306.76
Orifice Constant		0.80
Orifice Centroid		306.91
Orifice Flow Formula		$0.80\pi(D/2000)^2x(2x9.81xH)^{0.5}$

Major Storm Control Weir		
Width		12.00 m
Invert of Weir		308.62 m
Weir Flow Formula		$1.7WH^{1.5}$

620 Veterans Drive
Quantity Control Volume Calculations

DATE: 14-Jan-22
FILE: 14072.01
CONTRACT/PROJECT: 620 Veterans
COMPLETED BY: AMC

Modified Rational Method Parameters

Pre Development Area (ha)	Post Development Area (ha)	Time of Concentration (min)	Time Increments (min)	Allowable Runoff Coefficient	Post Development Runoff Coefficient
0.85	0.74	10	1	0.75	0.93

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	0.75	0.75	0.75	0.83	0.90	0.94
I	83.11	108.92	126.55	148.15	164.22	180.15
A	0.85	0.85	0.85	0.85	0.85	0.85
Q	0.148	0.194	0.225	0.290	0.351	0.401

Note: Q= 0.00278CIA

Rainfall Station	Barrie

SWM Pond Design Input

Storm Event (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	0.139	0.929662226
5	853.608	4.699	0.766	0.182	0.929662226
10	975.865	4.699	0.760	0.211	0.929662226
25	1146.275	4.922	0.757	0.271	1
50	1236.152	4.699	0.751	0.300	1
100	1426.408	5.273	0.759	0.327	1

Results

Storm Event (yrs)	Storage m^3	Time min
2	13	11
5	17	11
10	19	11
25	22	11
50	24	11
100	28	12

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

Time (min)	2 Year					5 Year				
	Intensity mm/hr	Inflow m^3/s	Outflow m^3/s	Storage m^3	Difference	Intensity mm/hr	Inflow m^3/s	Outflow m^3/s	Storage m^3	Difference
1	174.18	0.335	0.139	-26	11	225.07	0.432	0.182	-34	14
2	153.52	0.295	0.139	-15	8	198.85	0.382	0.182	-20	11
3	137.71	0.264	0.139	-6	6	178.75	0.343	0.182	-9	8
4	125.19	0.240	0.139	-1	4	162.79	0.312	0.182	-1	6
5	114.99	0.221	0.139	4	3	149.77	0.287	0.182	4	4
6	106.50	0.205	0.139	7	2	138.93	0.267	0.182	9	3
7	99.33	0.191	0.139	9	2	129.73	0.249	0.182	12	2
8	93.16	0.179	0.139	11	1	121.83	0.234	0.182	14	1
9	87.81	0.169	0.139	12	1	114.96	0.221	0.182	16	1
10	83.11	0.160	0.139	13	0	108.92	0.209	0.182	16	0
11	78.94	0.152	0.139	13	0	103.57	0.199	0.182	17	0
12	75.23	0.144	0.139	13	-13	98.78	0.190	0.182	17	-17
13	71.88	0.138	0.000	0	0	94.48	0.181	0.000	0	0
14	68.86	0.132	0.000	0	0	90.58	0.174	0.000	0	0
15	66.12	0.127	0.000	0	0	87.04	0.167	0.000	0	0
16	63.61	0.122	0.000	0	0	83.80	0.161	0.000	0	0
17	61.31	0.118	0.000	0	0	80.82	0.155	0.000	0	0
18	59.19	0.114	0.000	0	0	78.08	0.150	0.000	0	0
19	57.23	0.110	0.000	0	0	75.55	0.145	0.000	0	0
20	55.41	0.106	0.000	0	0	73.19	0.140	0.000	0	0

Time (min)	10 Year					25 Year				
	Intensity mm/hr	Inflow m^3/s	Outflow m^3/s	Storage m^3	Difference	Intensity mm/hr	Inflow m^3/s	Outflow m^3/s	Storage m^3	Difference
1	260.01	0.499	0.211	-40	17	298.22	0.616	0.271	-52	21
2	229.94	0.441	0.211	-23	12	264.99	0.547	0.271	-32	15
3	206.87	0.397	0.211	-11	9	239.26	0.494	0.271	-17	11
4	188.54	0.362	0.211	-2	7	218.67	0.451	0.271	-5	8
5	173.57	0.333	0.211	5	5	201.77	0.416	0.271	3	6
6	161.10	0.309	0.211	10	4	187.63	0.387	0.271	9	5
7	150.52	0.289	0.211	14	3	175.59	0.362	0.271	14	3
8	141.42	0.271	0.211	16	2	165.20	0.341	0.271	17	2
9	133.51	0.256	0.211	18	1	156.14	0.322	0.271	20	1
10	126.55	0.243	0.211	19	0	148.15	0.306	0.271	21	1
11	120.37	0.231	0.211	19	0	141.05	0.291	0.271	22	0
12	114.85	0.220	0.211	19	-19	134.69	0.278	0.271	21	-21
13	109.89	0.211	0.000	0	0	128.97	0.266	0.000	0	0
14	105.39	0.202	0.000	0	0	123.77	0.255	0.000	0	0
15	101.30	0.194	0.000	0	0	119.04	0.246	0.000	0	0
16	97.56	0.187	0.000	0	0	114.71	0.237	0.000	0	0
17	94.12	0.181	0.000	0	0	110.72	0.229	0.000	0	0
18	90.95	0.175	0.000	0	0	107.05	0.221	0.000	0	0
19	88.02	0.169	0.000	0	0	103.64	0.214	0.000	0	0
20	85.30	0.164	0.000	0	0	100.48	0.207	0.000	0	0

Time (min)	50 Year					100 Year				
	Intensity mm/hr	Inflow m^3/s	Outflow m^3/s	Storage m^3	Difference	Intensity mm/hr	Inflow m^3/s	Outflow m^3/s	Storage m^3	Difference
1	334.55	0.691	0.300	-57	23	353.96	0.731	0.327	-64	25
2	296.30	0.612	0.300	-34	17	316.38	0.653	0.327	-40	18
3	266.91	0.551	0.300	-18	12	286.90	0.592	0.327	-21	14
4	243.52	0.503	0.300	-5	9	263.10	0.543	0.327	-7	11
5	224.41	0.463	0.300	4	7	243.43	0.502	0.327	3	8
6	208.47	0.430	0.300	11	5	226.85	0.468	0.327	11	6
7	194.94	0.402	0.300	16	4	212.68	0.439	0.327	17	4
8	183.29	0.378	0.300	20	2	200.41	0.414	0.327	22	3
9	173.15	0.357	0.300	22	1	189.66	0.391	0.327	25	2
10	164.22	0.339	0.300	24	1	180.15	0.372	0.327	27	1
11	156.30	0.323	0.300	24	0	171.69	0.354	0.327	28	0
12	149.22	0.308	0.300	24	-24	164.09	0.339	0.327	28	-28
13	142.84	0.295	0.000	0	0	157.23	0.325	0.000	0	0
14	137.07	0.283	0.000	0	0	151.00	0.312	0.000	0	0
15	131.81	0.272	0.000	0	0	145.31	0.300	0.000	0	0
16	127.00	0.262	0.000	0	0	140.09	0.289	0.000	0	0
17	122.58	0.253	0.000	0	0	135.29	0.279	0.000	0	0
18	118.50	0.245	0.000	0	0	130.86	0.270	0.000	0	0
19	114.72	0.237	0.000	0	0	126.75	0.262	0.000	0	0
20	111.22	0.230	0.000	0	0	122.92	0.254	0.000	0	0

🟨 : Maximum Storage Volume

Q = 0.0028*C*I*A (m^3/s)
C = Runoff Coefficient
I = Rainfall Intensity = A/(Time+B)^C
A = Area (ha)

620 Veterans Drive
Storm Sewer Design
5-Year Storm Event

DATE: 14-Jan-22
FILE: 14072.01
CONTRACT/PROJECT 620 Veterans

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)	(m^3/s)	(%)	(mm)	(m^3/s)	(m/s)
1.0	CB1	MH2	30.8	0.85	0.11	0.09	0.09	10.00	0.48	108.92	0.03	0.6	300.0	0.07	1.06
-	MH2	MH3	19.7	0.00	0.00	0.00	0.09	10.48	0.34	106.25	0.03	0.5	300.0	0.07	0.97
2.0	MH3	MH4	65.7	0.95	0.11	0.10	0.20	10.82	1.13	104.47	0.06	0.5	300.0	0.07	0.97
-	MH4	DCBMH1	20.0	0.00	0.00	0.00	0.20	11.96	1.13	98.98	0.05	0.5	300.0	0.07	0.97
5.0	CBMH3	DCBMH1	35.0	0.93	0.09	0.08	0.08	10.00	0.60	108.92	0.02	0.5	300.0	0.07	0.97
7.0	DCBMH1	EX STMMH2	39.4	0.95	0.06	0.06	0.14	10.60	0.60	105.62	0.04	0.5	300.0	0.07	0.97

APPENDIX B

WATER BALANCE CALCULATIONS

Table 3.1: Hydrologic Cycle Component Values

	Water Holding Capacity mm	Hydrologic Soil Group	Precipitation mm	Evapo-transpiration mm	Runoff mm	Infiltration* mm
Urban Lawns/Shallow Rooted Crops (spinach, beans, beets, carrots)						
Fine Sand	50	A	940	515	149	276
Fine Sandy Loam	75	B	940	525	187	228
Silt Loam	125	C	940	536	222	182
Clay Loam	100	CD	940	531	245	164
Clay	75	D	940	525	270	145
Moderately Rooted Crops (corn and cereal grains)						
Fine Sand	75	A	940	525	125	291
Fine Sandy Loam	150	B	940	539	160	241
Silt Loam	200	C	940	543	199	199
Clay Loam	200	CD	940	543	218	179
Clay	150	D	940	539	241	160
Pasture and Shrubs						
Fine Sand	100	A	940	531	102	307
Fine Sandy Loam	150	B	940	539	140	261
Silt Loam	250	C	940	546	177	217
Clay Loam	250	CD	940	546	197	197
Clay	200	D	940	543	218	179
Mature Forests						
Fine Sand	250	A	940	546	79	315
Fine Sandy Loam	300	B	940	548	118	274
Silt Loam	400	C	940	550	156	234
Clay Loam	400	CD	940	550	176	215
Clay	350	D	940	549	196	196

Notes: Hydrologic Soil Group A represents soils with low runoff potential and Soil Group D represents soils with high runoff potential. The evapotranspiration values are for mature vegetation. Streamflow is composed of baseflow and runoff.

* *This is the total infiltration of which some discharges back to the stream as base flow. The infiltration factor is determined by summing a factor for topography, soils and cover.*

Topography	Flat Land, average slope < 0.6 m/km	0.3
	Rolling Land, average slope 2.8 m to 3.8 m/km	0.2
	Hilly Land, average slope 28 m to 47 m/km	0.1
Soils	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open Sandy loam	0.4
Cover	Cultivated Land	0.1
	Woodland	0.2

620 Veterans Drive
Water Balance Calculations

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 Required = Site Area x 5 mm
= 8,545 x 0.005
= 42.7 m^3

It is proposed to infiltrate the 14 mm storm event over the rooftop area, resulting in a storage volume of 45m^3 exceeding the City of Barrie Criteria. Therefore, water balance for the site is achieved.

APPENDIX C

PHOSPHORUS BUDGET CALCULATIONS

Veterans Drive Commercial Building
Phosphorus Loading

Phosphorus Export Coefficients from the Phosphorus Budget Tool in Support of Sustainable Development for the Lake Simcoe Watershed

Dissolved % from The National Stormwater Quality Database - US

	Commercial Development
Phosphorus Export (kg/ha/year)	1.1

Pre-Development Condition

Total Annual Rainfall Percipitation (Barrie) mm / year

Commercial

Area (ha): 0.85

Total P (kg) : 0.94

Total Pre-Development P (kg) : 0.94

Post Development Condition

Commercial Development

Area (ha): 0.85

Total P (kg) : 0.94

Total Uncontrolled (kg): 0.94

Area from Rooftop Draining to Infiltration Commercial

Area (ha): 0.31

Total P (kg) : 0.34

Soakaway Infiltration

Total P (kg): 0.34

Soakaway Infiltration Proficiency (%): 100

P Removed (kg): 0.34

P Remaining (kg): 0.00

Area Draining to Wet Detention Pond Commercial

Area (ha): 0.54

Total P (kg) : 0.60

Wet Detention Ponds

Total P (kg): 0.60

Wet Detention Ponds Proficiency (%): 63

P Removed (kg): 0.38

P Remaining (kg): 0.22

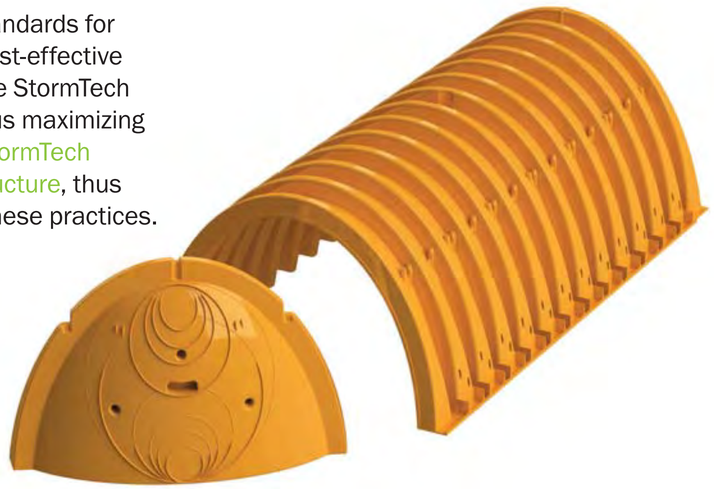
Total Post-Development P (kg): 0.22

APPENDIX D

STORMTECH STORAGE SYSTEM INFORMATION

STORMTECH SC-740 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



STORMTECH SC-740 CHAMBER

(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

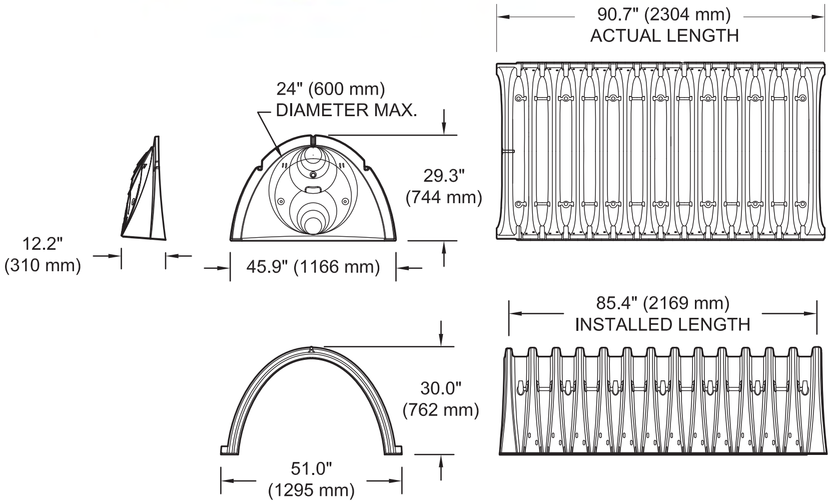
Chamber Storage
45.9 ft^3 (1.30 m^3)

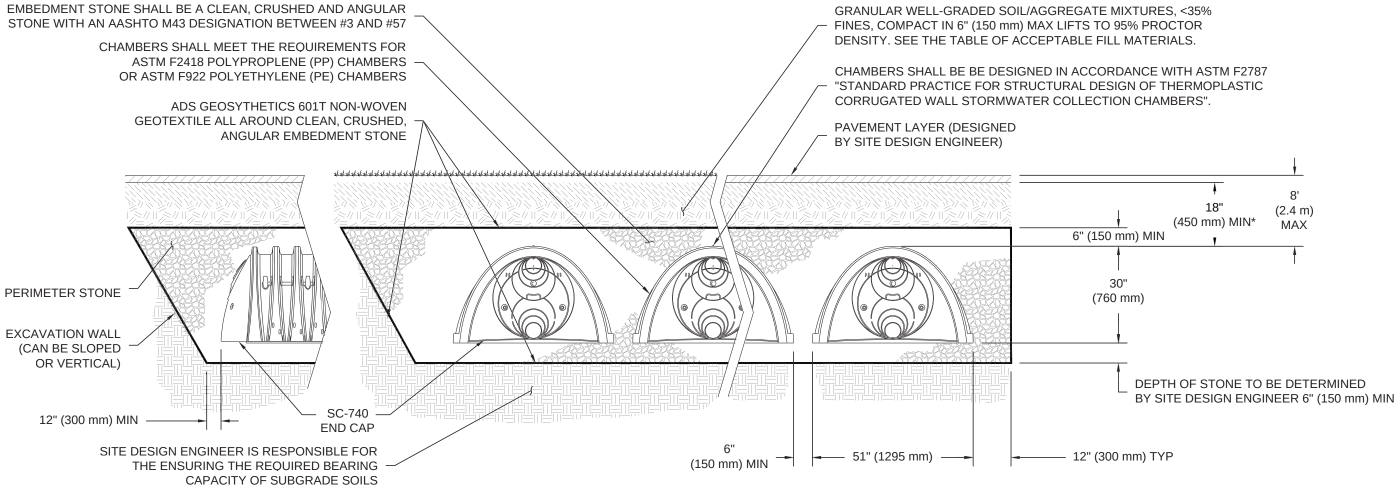
Min. Installed Storage*
74.9 ft^3 (2.12 m^3)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

StormTech®

ADS®

SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	↑	45.90 (1.300)	74.90 (2.121)
41 (1041)		45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone	45.90 (1.300)	72.64 (2.057)
39 (991)	Cover	45.90 (1.300)	71.52 (2.025)
38 (965)		45.90 (1.300)	70.39 (1.993)
37 (940)	↓	45.90 (1.300)	69.26 (1.961)
36 (914)		45.90 (1.300)	68.14 (1.929)
35 (889)		45.85 (1.298)	66.98 (1.897)
34 (864)		45.69 (1.294)	65.75 (1.862)
33 (838)		45.41 (1.286)	64.46 (1.825)
32 (813)		44.81 (1.269)	62.97 (1.783)
31 (787)		44.01 (1.246)	61.36 (1.737)
30 (762)		43.06 (1.219)	59.66 (1.689)
29 (737)		41.98 (1.189)	57.89 (1.639)
28 (711)		40.80 (1.155)	56.05 (1.587)
27 (686)		39.54 (1.120)	54.17 (1.534)
26 (660)		38.18 (1.081)	52.23 (1.479)
25 (635)		36.74 (1.040)	50.23 (1.422)
24 (610)		35.22 (0.977)	48.19 (1.365)
23 (584)		33.64 (0.953)	46.11 (1.306)
22 (559)		31.99 (0.906)	44.00 (1.246)
21 (533)		30.29 (0.858)	1.85 (1.185)
20 (508)		28.54 (0.808)	39.67 (1.123)
19 (483)		26.74 (0.757)	37.47 (1.061)
18 (457)		24.89 (0.705)	35.23 (0.997)
17 (432)		23.00 (0.651)	32.96 (0.939)
16 (406)		21.06 (0.596)	30.68 (0.869)
15 (381)		19.09 (0.541)	28.36 (0.803)
14 (356)		17.08 (0.484)	26.03 (0.737)
13 (330)		15.04 (0.426)	23.68 (0.670)
12 (305)		12.97 (0.367)	21.31 (0.608)
11 (279)		10.87 (0.309)	18.92 (0.535)
10 (254)		8.74 (0.247)	16.51 (0.468)
9 (229)		6.58 (0.186)	14.09 (0.399)
8 (203)		4.41 (0.125)	11.66 (0.330)
7 (178)		2.21 (0.063)	9.21 (0.264)
6 (152)	↑	0 (0)	6.76 (0.191)
5 (127)		0 (0)	5.63 (0.160)
4 (102)	Stone	0 (0)	4.51 (0.128)
3 (76)	Foundation	0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)	↓	0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

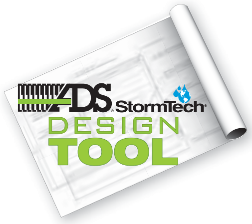
ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	150 mm	300 mm	450 mm
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.



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Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

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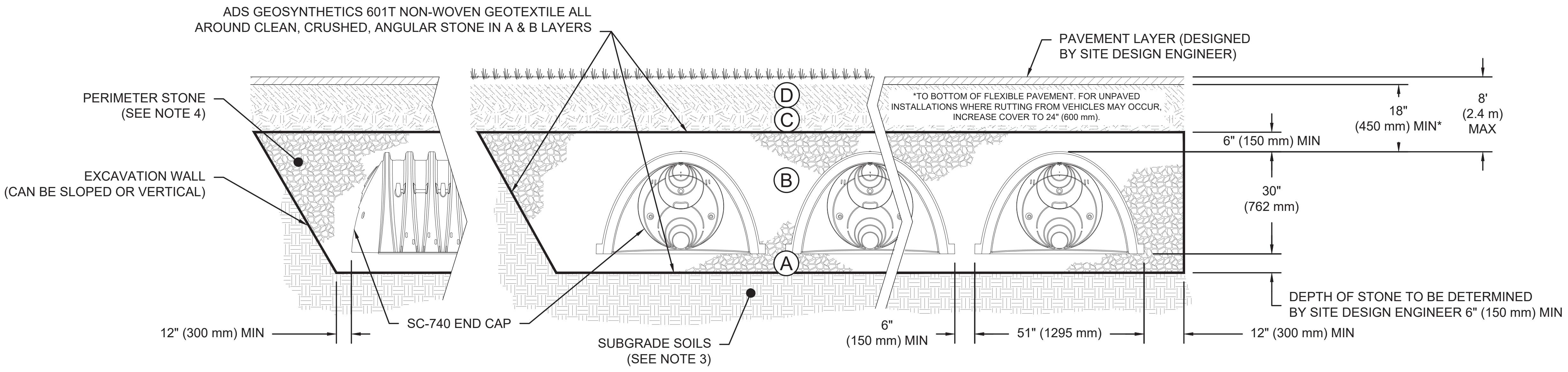
ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-740
STANDARD CROSS SECTION

DATE: 05-10-19
DRAWN: KR
PROJECT #:
CHECKED: KR

DATE	DRWN	CHKD	DESCRIPTION

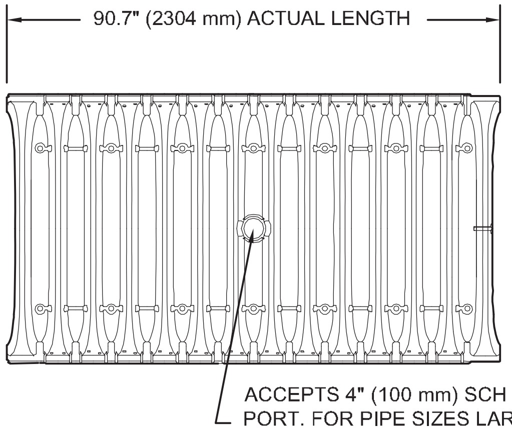
StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

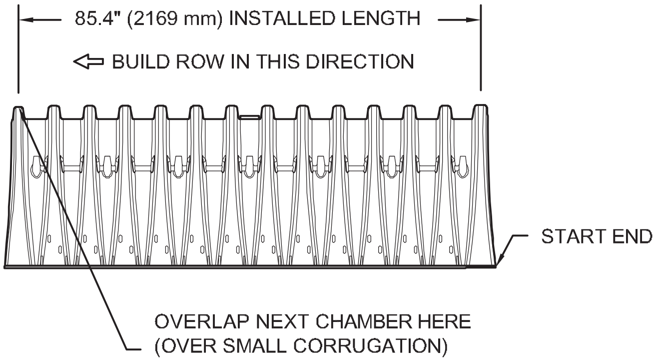
SHEET 1 OF 1

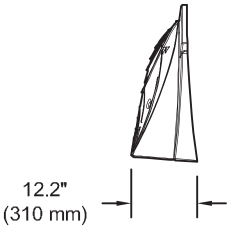
SC-740 TECHNICAL SPECIFICATION

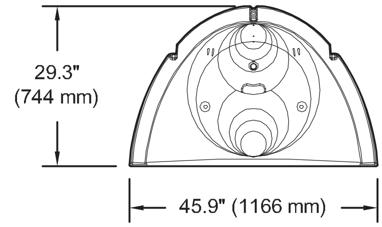
NTS

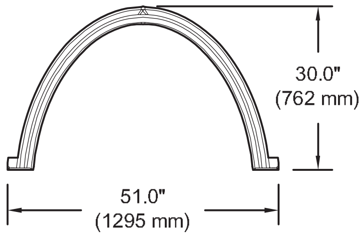


ACCEPTS 4" (100 mm) SCH 40 PVC PIPE FOR INSPECTION PORT. FOR PIPE SIZES LARGER THAN 4" (100 mm) UP TO 10" (250 mm) USE INSERTA TEE CONNECTION CENTERED ON A CHAMBER CREST CORRUGATION





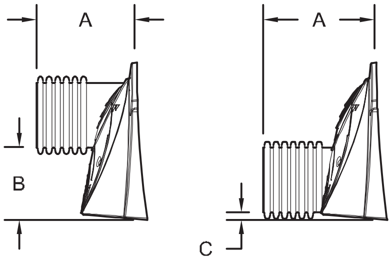




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

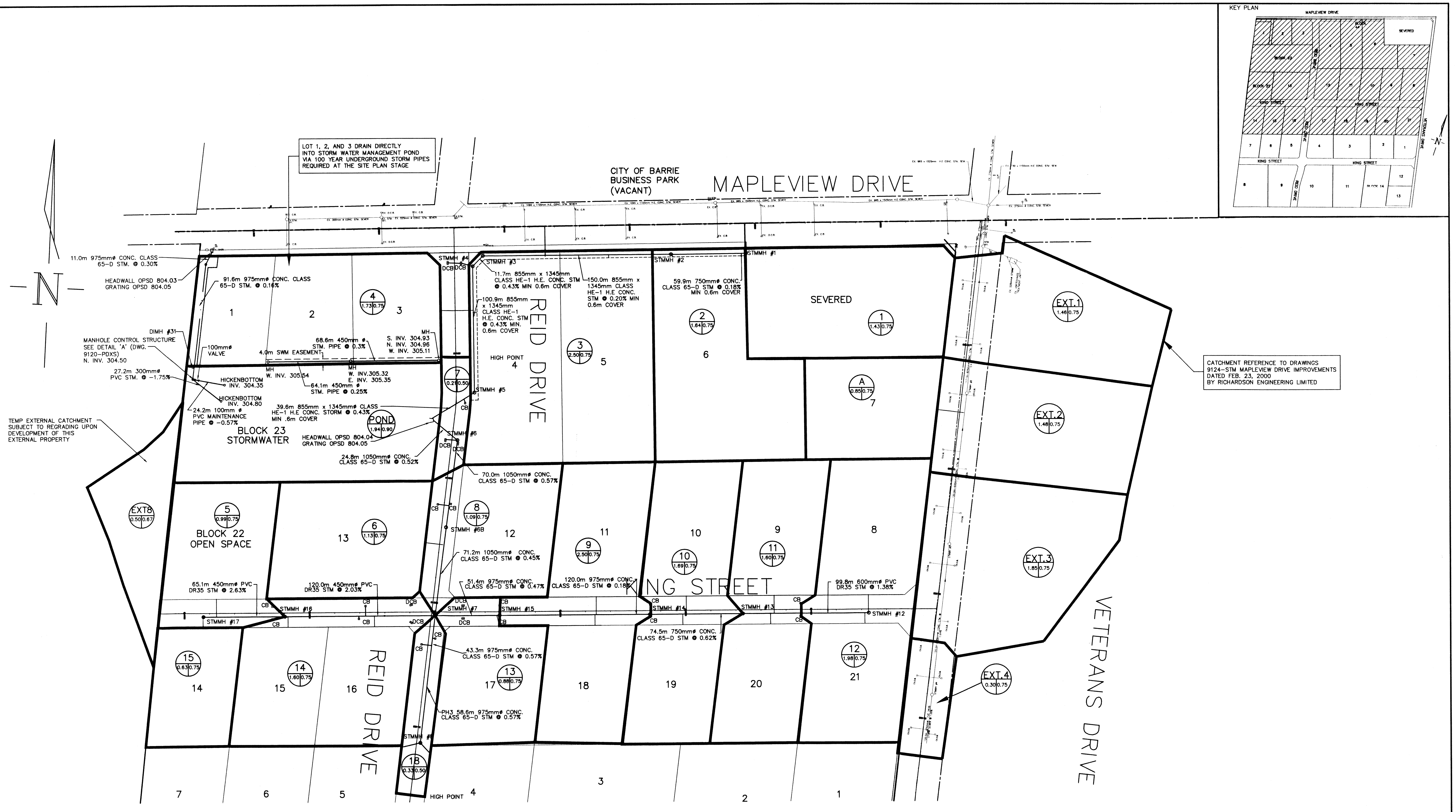
ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

APPENDIX E

MAPLEVIEW INDUSTRIAL SUBDIVISION STORM DRAINAGE DRAWING



GENERAL NOTES:

1. SEE DRAWING 9120-GN FOR NOTES.

LEGEND:

AREA No.

AREA (ha)

RUNOFF COEFFICIENT

No.	REVISION	DATE	APPROVED
1.	AS CONSTRUCTED DRAWING PHASE 2	NOV 2007	B.R.
2.	UPDATE BLOCK 22 AND 23 NUMBERS	02/07/08	B.R.
3.	AS BUILT INFO FOR MAPLEVIEW DRIVE AND VETERANS DRIVE	02/28/08	B.R.

CITY OF BARRIE
APPROVED

DATE . . . .

. . . .
DIRECTOR OF MUNICIPAL WORKS

B. RICHARDSON
3/3/08

MAPLEVIEW INDUSTRIAL
DEVELOPMNTS INC.

STORM
DRAINAGE PLAN

RICHARDSON FOSTER LTD.
CONSULTING ENGINEERS
PHONE: (705) 728-0009 TOLL FREE (1-877) 220-2461 FAX: (705) 727-7774
4 CEDAR POINTE DRIVE, UNIT L BARRIE, ONTARIO L4N 5R7

CITY of BARRIE
MUNICIPAL WORKS DEPARTMENT

0 15 30 60 90 120 150 METRES

D12-197

DESIGN B.SCOTT
DRAWN S.McFADDEN
DATE APR. 20, 2001
MMA No. 43T-89002

SCALE: 1:1500

REVIEWED B. RICHARDSON

SHEET No. 7 OF 30

DRAWING No.
9120-STM

2001-084-004

APPENDIX F

FLOW TEST RESULTS

620 Veterans Drive
Fire Flow Calculations

Location:	620 Veterans Drive, Barrie ON	
OBC Occupancy	Industrial Occupencies	
Building Foot Print:	3,111 m^2 **	
# of Stories:	3	**Industrial Building**

**existing and proposed building

Project: Good Storage Plus

Project Number: 14072.01

Construction Class	Charge
Wood Frame	1.5
Ordinary	1.0
Non-Combustible	0.8
Fire Resistive	0.6

Construction Class: Non-Combustible

Contents	Charge
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Automated Sprinkler Protection		Credit	Total
NFPA 13 sprinkler standard	Yes	30%	50%
Standard Water Supply	Yes	10%	
Fully Supervised System	Yes	10%	

Contents Factor: Combustible

Charge: 0%

Exposure 1 (north)	Distance to Exposure Building (m)	18.5	15%
Exposure 2 (east)	Distance to Exposure Building (m)	>45.1	0%
Exposure 3 (south)	Distance to Exposure Building (m)	>45.1	0%
Exposure 4 (west)	Distance to Exposure Building (m)	10.3	15%

Separation	Charge
0 - 3.0 m	25%
3.1 - 10.0 m	20%
10.1 - 20.0 m	15%
20.1 - 30.0 m	10%
30.1 - 45.0 m	5%
> 45.1 m	0%

Total: 30% *no more than 75%

Are Buildings Contigious? Yes

Fire Resistant Building: Are vertical openings and exterior vertical communications protected with a minimum one (1) hr rating?

Calculations: $C =$ 0.8 Non-Combustible

RFF = 220 x C x √A $A =$ 9,333 m²

Where: *RFF* = required fire flow in liters per minute

C = Coefficient related to the type of construction

A = the total floor area in square meters (excluding basements in building considered

RFF = 17,003 L/min

Round to Nearest 1000 L/min RFF = 17,000 L/min *Must be > 2000 L/min or < 45,000 L/min

Correction Factors:

Occupancy		0	L/min
Fire Flow Adjusted for Occupancy	E =	17,000	L/min
Reduction For Sprinkler	F =	8,500	L/min
Fire Flow w/ Sprinkler Reduction		8,500	L/min
Exposure Charge	G =	5,100	L/min
Fire Flow w/ Exposure Charge		13,600	L/min

As per "Water Supply for Public Fire Protection" pg.20 note H:

E	F	G
17,000	8,500	5,100

RFF= 17000 L/min - 8500 L/min + 5100 L/min

RFF = 13,600 L/min

Required Fire Flow: RFF = 13,600 L/min

Round to Nearest 1,000 L/min **RFF = 14,000 L/min**

RFF= 3,696 GPM

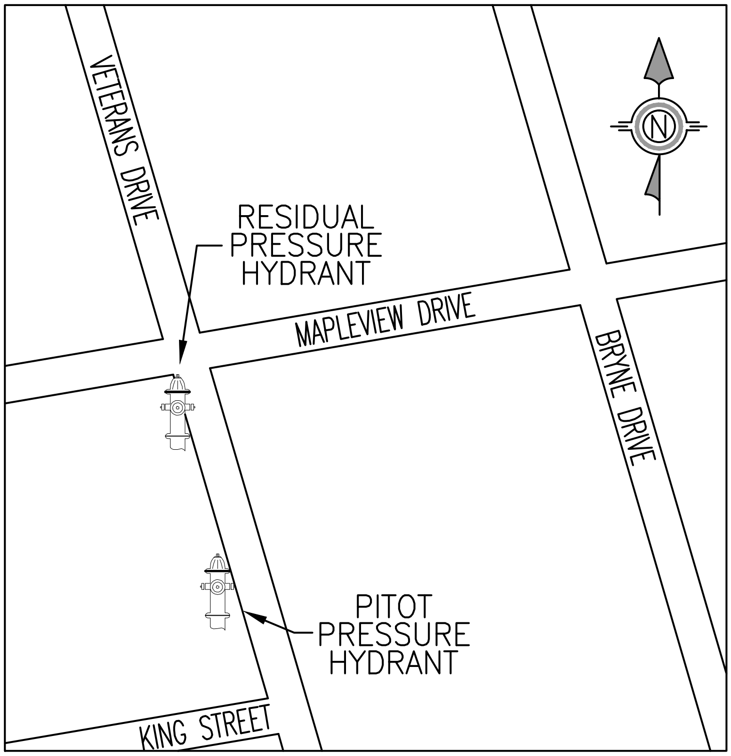
RFF = 233 L/s

FLOW TEST RESULTS

DATE : MARCH 10, 2015 TIME : 8:30 AM

LOCATION : 620 VETERANS ROAD
VETERANS ROAD & MAPLEVIEW DRIVE
BARRIE, ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 58 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	0.97	58	52	264
2	1	1-3/4	0.97	58	50	627
3	1	2-1/2	0.9	56	48	1163

FIRST FOR FIRE, LIFE SAFETY & SECURITY

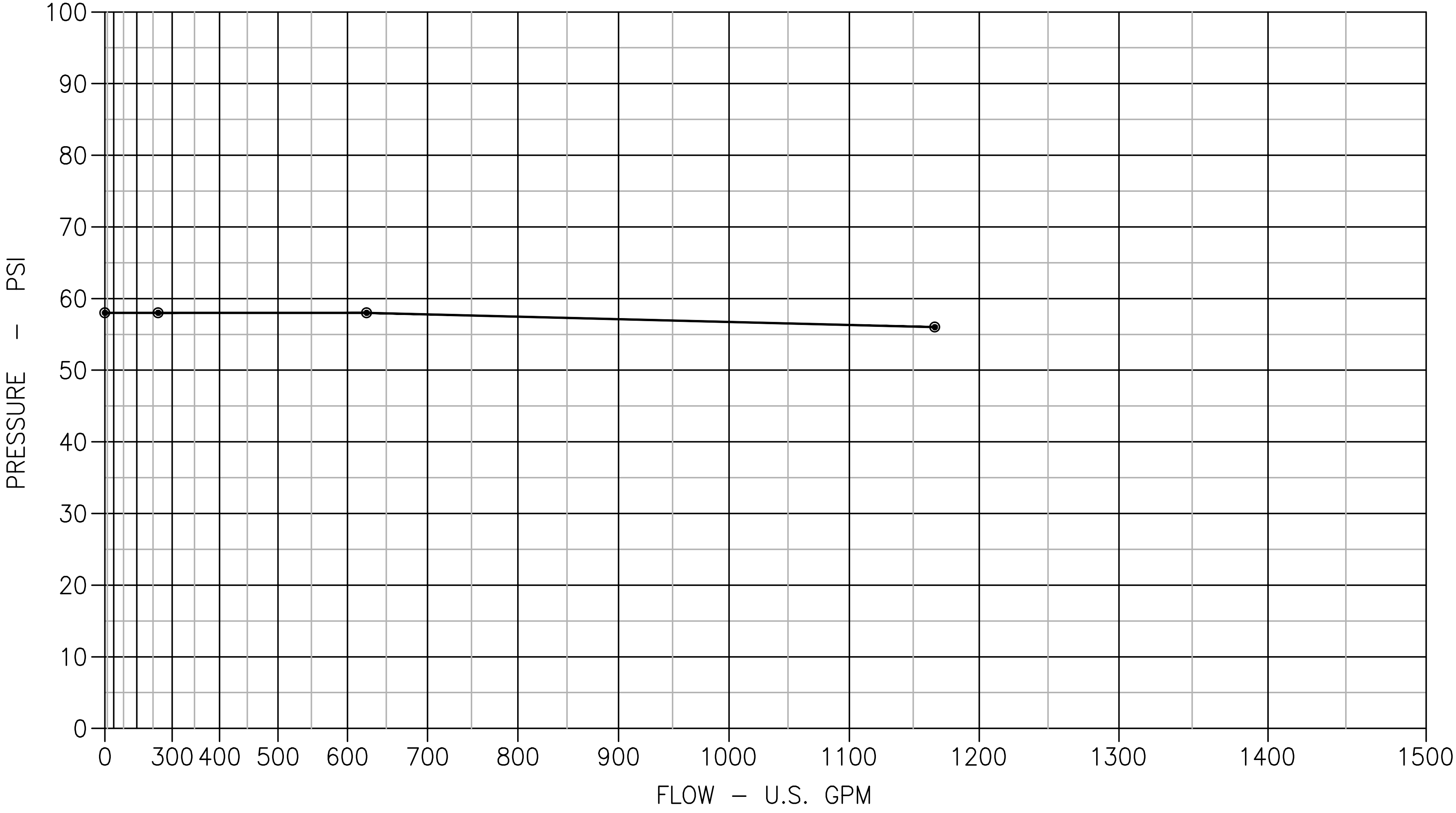
VIPOND INC

est. 1945

620 VETERANS ROAD
VETERANS DRIVE & MAPLEVIEW DRIVE
BARRIE, ONTARIO

BY : ZAC SCHELL
OFFICE : BARRIE
TEST BY : VIPOND & PUC
DATE : MARCH 10, 2015

STATIC:		RESIDUAL:		FLOW:
58 PSI	TEST#1	58 PSI	@	264 GPM
	TEST#2	58 PSI	@	627 GPM
	TEST#3	56 PSI	@	1163 GPM



APPENDIX G

TRAFFIC COUNTS AND TRIP GENERATION

Trans-Plan Transportation Inc.

Site ID Code:
Intersection Location: Mapleview Drive at Veteran's Drive
Municipality: Barrie, Ontario
Count Date: Thursday, November 15, 2018
Weather and Temperature: Partly Sunny, -4 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	49	44	7	2	1	0	0	0	0	0	103	19	47	20	3	2	6	0	0	0	2	99	8	17	18	1	0	2	0	0	0	2	48	7	143	18	2	2	1	0	0	0	0	173	423
7:15	48	66	3	1	0	0	0	0	0	0	118	27	63	28	1	8	2	0	0	0	0	129	9	14	16	1	2	2	0	0	0	3	47	9	117	15	1	3	0	0	1	0	0	146	440
7:30	70	95	6	1	1	2	0	0	0	0	175	27	91	24	2	4	1	0	0	0	1	150	7	28	18	1	1	1	0	0	0	0	56	14	185	14	0	1	1	0	0	0	0	215	596
7:45	77	94	13	3	2	2	0	0	0	0	191	42	103	23	3	6	3	0	0	0	0	180	13	34	13	0	0	0	0	0	0	1	61	15	168	25	0	1	1	0	0	0	0	210	642
8:00	52	89	7	0	2	1	0	0	0	0	151	40	87	17	1	2	2	0	0	0	1	150	13	38	15	1	0	0	0	0	0	2	69	10	153	22	3	4	2	0	0	0	0	194	564
8:15	54	81	5	1	0	1	0	0	0	0	142	36	94	23	5	2	3	0	0	0	0	163	11	39	31	0	1	0	0	0	0	2	84	21	191	23	0	4	2	0	0	0	0	241	630
8:30	67	79	12	1	0	0	0	0	0	0	159	43	103	27	4	6	1	0	0	0	1	185	14	28	31	0	4	2	0	0	0	1	80	11	186	24	0	7	0	0	0	0	0	228	652
8:45	61	76	11	3	3	0	0	0	0	0	154	48	93	41	2	7	0	0	0	0	0	191	13	39	28	4	1	4	0	0	0	2	91	24	194	14	0	9	3	0	0	0	0	244	680
MD																																													
11:00	61	30	7	3	0	0	0	0	0	1	102	30	118	57	3	7	3	0	0	0	0	218	9	38	27	0	0	2	0	0	0	1	77	13	158	15	1	2	3	0	0	0	0	192	589
11:15	51	54	12	1	2	1	0	0	0	0	121	32	88	62	3	2	2	0	0	0	0	189	18	40	36	1	0	0	0	0	0	0	95	13	151	13	0	6	2	0	0	0	0	185	590
11:30	61	44	11	3	0	0	0	0	0	0	119	31	153	39	2	5	0	0	0	0	1	231	15	27	34	1	0	0	0	0	0	1	78	18	164	17	0	4	1	0	0	0	0	204	632
11:45	76	68	10	2	2	0	0	0	0	1	159	42	127	55	3	4	1	0	0	0	0	232	10	44	42	1	4	1	0	0	0	4	106	14	148	17	0	4	1	0	0	0	0	184	681
12:00	67	57	13	2	1	0	0	0	0	0	140	38	134	52	2	5	1	0	0	0	0	232	16	46	45	0	1	4	0	0	0	1	113	17	180	20	0	3	0	0	0	0	0	220	705
12:15	64	58	12	1	1	0	0	0	0	0	136	42	125	47	1	2	1	0	0	0	2	220	16	39	50	1	1	1	0	0	0	2	110	11	149	15	0	6	1	0	0	0	0	182	648
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12:45	69	47	8	1	1	0	0	0	0	0	126	59	132	48	0	3	2	0	0	0	0	244	23	46	51	0	2	4	0	0	0	1	127	10	152	21	0	3	2	0	0	0	0	188	685
13:00	65	66	7	1	1	0	0	0	0	1	141	59	161	47	0	5	1	0	0	0	2	275	22	52	43	3	0	2	0	0	0	1	123	12	174	22	0	2	2	0	0	0	0	212	751
13:15	52	51	8	3	2	0	0	0	0	1	117	48	137	73	0	1	1	0	0	0	0	260	20	34	52	0	3	4	0	0	0	3	116	10	145	17	0	6	1	0	0	0	0	179	672
13:30	59	46	8	2	0	1	0	0	0	0	116	37	162	76	2	6	1	0	0	0	0	284	20	38	28	1	0	1	0	0	0	0	88	11	143	21	0	2	0	0	0	0	0	177	665
13:45	57	41	14	1	0	1	0	0	0	0	114	46	122	55	3	2	0	0	0	0	0	228	18	43	51	0	3	0	0	0	0	1	116	12	123	16	1	5	2	0	0	0	0	159	617
PM																																													
15:00	69	65	12	3	2	0	0	0	0	1	152	47	162	74	4	7	3	0	0	0	0	297	24	69	46	1	3	2	0	0	0	1	146	15	128	22	0	8	1	0	0	0	0	174	769
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15:45	67	83	14	2	5	0	0	1	0	1	173	48	172	62	2	2	1	0	0	0	0	287	28	63	36	0	1	0	0	0	0	0	128	18	152	26	0	7	3	0	0	0	0	206	794
16:00	61	72	11	1	2	1	0	0	0	0	148	45	198	84	2	4	1	0	0	0	0	334	32	74	41	2	1	1	0	0	0	3	154	19	164	19	2	10	0	0	0	0	0	214	850
16:15	61	71	17	3	1	0	0	0	0	0	153	53	202	76	1	2	2	0	0	0	0	336	32	86	43	0	0	1	0	0	0	1	163	16	171	17	1	12	1	0	0	0	0	218	870
16:30	46	66	12	5	1	0	0	0	0	0	130	41	213	103	2	1	0	0	0	0	0	360	36	108	40	0	2	1	0	0	0	0	187	26	168	23	1	3	2	0	0	0	0	223	900
16:45	57	87	10	3	0	1	0	0	0	0	158	37	211	86	0	2	1	0	0	0	0	337	46	101	27	2	2	0	0	0	0	1	179	17	133	40	1	6	1	0	0	0	0	198	872
17:00	41	84	18	2	0	0	0	0	0	2	147	47	220	105	0	1	2	0	0	0	0	375	55	106	37	0	2	0	0	0	0	1	201	33	161	25	0	4	0	0	0	0	0	223	946
17:15	36	89	9	3	1	0	0	0	0	0	138	54	202	93	0	1	1	0	0	0	0	351	42	130	39	2	0	0	0	0	0	0	213	27	120	22	0	4	5	0	0	0	0	178	880
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17:45	48	69	10	0	1	1	0	0	0	0	129	45	171	111	3	2	0	0	0	0	0	332	45	93	35	1	0	0	0	0	0	0	174	21	125	16	0	3	2	0	0	0	0	167	802

Turning Movement Count Diagram

Intersection: Mapleview Drive at Veteran's Drive
Municipality: Barrie, Ontario

Intersection ID:
Date: Thursday, November 15, 2018

AM Peak Hour: 8:00 to 9:00

Veteran's Drive

North Total	939
North Entering	606
North Receiving	333
North Peds	0

Cyclists	0	0	0
Truck	2	5	5
Cars	35	325	234
	↲	↓	↳

East Total	1785
East Entering	687
East Receiving	1098
East Peds	2

Mapleview Drive

0	3	66	↱
0	24	724	→
0	7	83	↴

↰	108	6	0
←	377	17	0
↓	167	12	0

↰	↑	↱
51	144	105
5	6	6
0	0	0

West Total	1394
West Entering	907
West Receiving	487
West Peds	0

South Total	916
South Entering	317
South Receiving	599
South Peds	7

MD Peak Hour: 12:45 to 13:45

Veteran's Drive

North Total	965
North Entering	498
North Receiving	467
North Peds	2

Cyclists	0	0	0
Truck	1	4	7
Cars	31	210	245
	↲	↓	↳

East Total	2125
East Entering	1061
East Receiving	1064
East Peds	2

Mapleview Drive

0	0	43	↱
0	13	614	→
0	5	81	↴

↰	244	5	0
←	592	15	0
↓	203	2	0

↰	↑	↱
85	170	174
4	5	11
0	0	0

West Total	1484
West Entering	756
West Receiving	728
West Peds	0

South Total	954
South Entering	449
South Receiving	505
South Peds	5

PM Peak Hour: 16:30 to 17:30

Veteran's Drive

North Total	1518
North Entering	571
North Receiving	947
North Peds	2

Cyclists	0	0	0
Truck	1	2	13
Cars	49	326	180
	↲	↓	↳

East Total	2359
East Entering	1423
East Receiving	936
East Peds	0

Mapleview Drive

0	2	103	↱
0	17	582	→
0	8	110	↴

↰	387	4	0
←	846	5	0
↓	179	2	0

↰	↑	↱
179	445	143
4	6	1
0	0	0

West Total	1906
West Entering	822
West Receiving	1084
West Peds	0

South Total	1405
South Entering	778
South Receiving	627
South Peds	2

Total 8-Hour Count

Veteran's Drive

North Total	8753
North Entering	4439
North Receiving	4314
North Peds	10

Cyclists	0	1	0
Truck	14	37	59
Cars	332	2135	1861
	↲	↓	↳

East Total	16210
East Entering	8028
East Receiving	8182
East Peds	14

Mapleview Drive

0	14	511	↱
1	141	4928	→
0	43	643	↴

↰	1911	50	0
←	4561	106	0
↓	1341	59	0

↰	↑	↱
734	1784	1150
29	44	42
0	0	0

West Total	12057
West Entering	6281
West Receiving	5776
West Peds	0

South Total	8042
South Entering	3783
South Receiving	4259
South Peds	37

Land Use: 151
Mini-Warehouse

Description

Mini-warehouses are buildings in which a number of storage units or vaults are rented for the storage of goods. They are typically referred to as "self-storage" facilities. Each unit is physically separated from other units, and access is usually provided through an overhead door or other common access point.

Additional Data

Truck trips accounted for 2 to 15 percent of the weekday traffic at the sites surveyed.

Vehicle occupancy ranged from 1.2 to 1.9 persons per automobile on an average weekday.

Peak hours of the generator —

> The weekday p.m. peak hour was between 1:00 p.m. and 5:00 p.m. The Saturday peak hour was between 12:00 noon and 1:00 p.m. The Sunday peak hour was between 1:00 p.m. and 4:00 p.m.

The sites were surveyed from 1979 to 2002 in California, Colorado and New Jersey.

Source Numbers

113, 212, 403, 551, 568

Mini-Warehouse
(151)

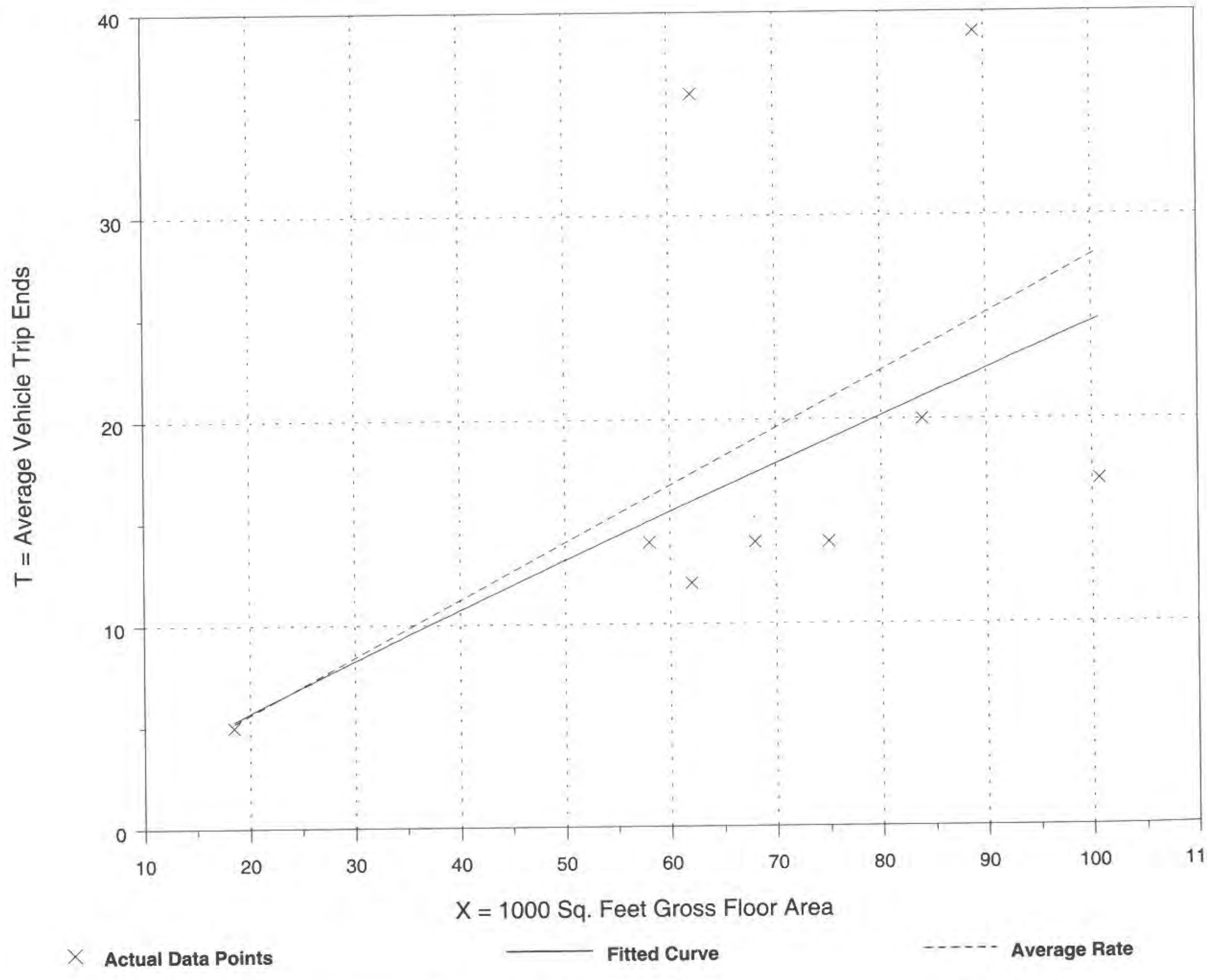
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday,**
A.M. Peak Hour of Generator

Number of Studies: 9
Average 1000 Sq. Feet GFA: 69
Directional Distribution: 48% entering, 52% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.28	0.17 - 0.58	0.54

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.91 Ln(X) - 1.00

R^2 = 0.55

Mini-Warehouse
(151)

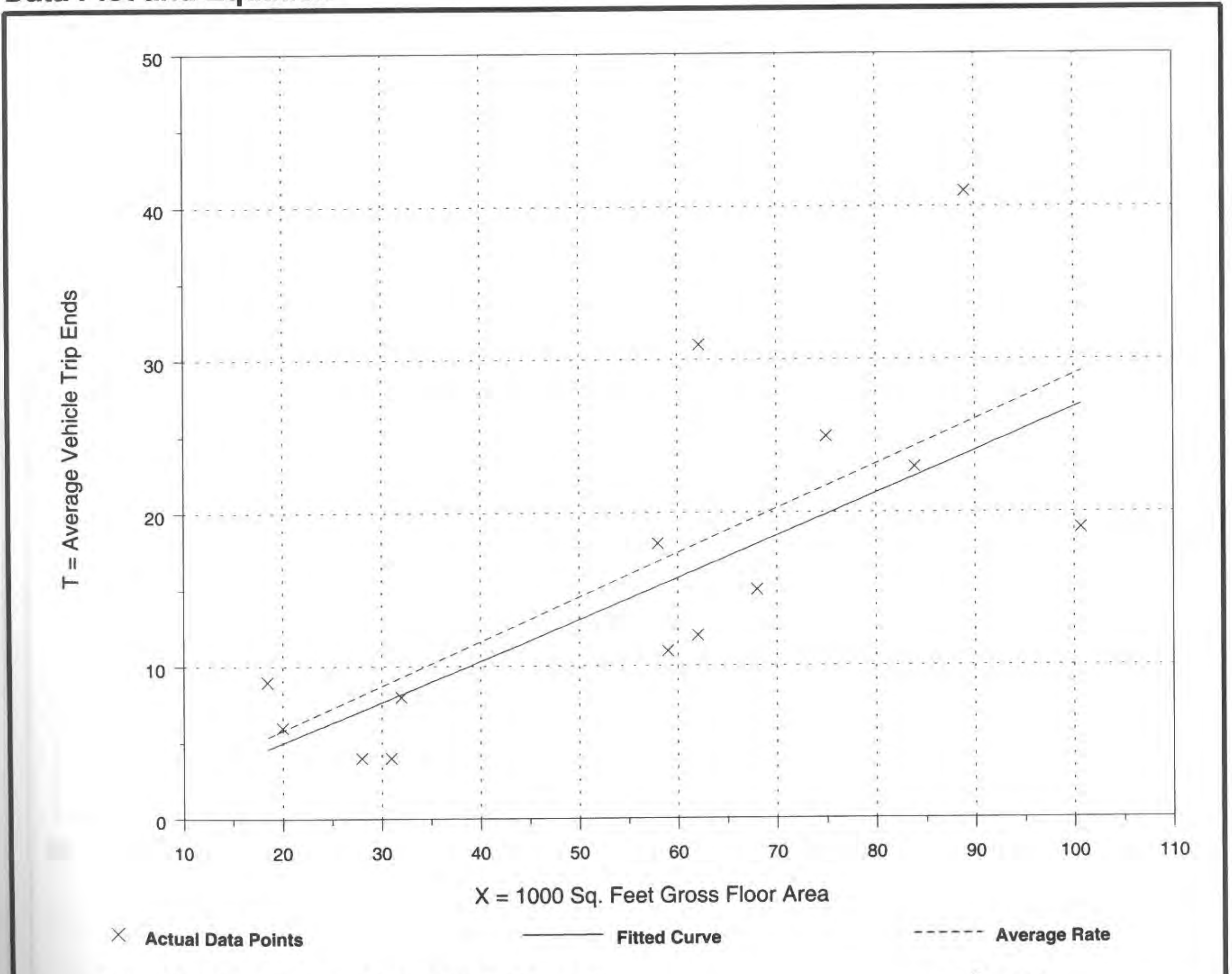
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday,**
P.M. Peak Hour of Generator

Number of Studies: 14
Average 1000 Sq. Feet GFA: 56
Directional Distribution: 53% entering, 47% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.29	0.13 - 0.50	0.54

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 1.04 Ln(X) - 1.52 **R^2 = 0.65**

Mini-Warehouse
(151)

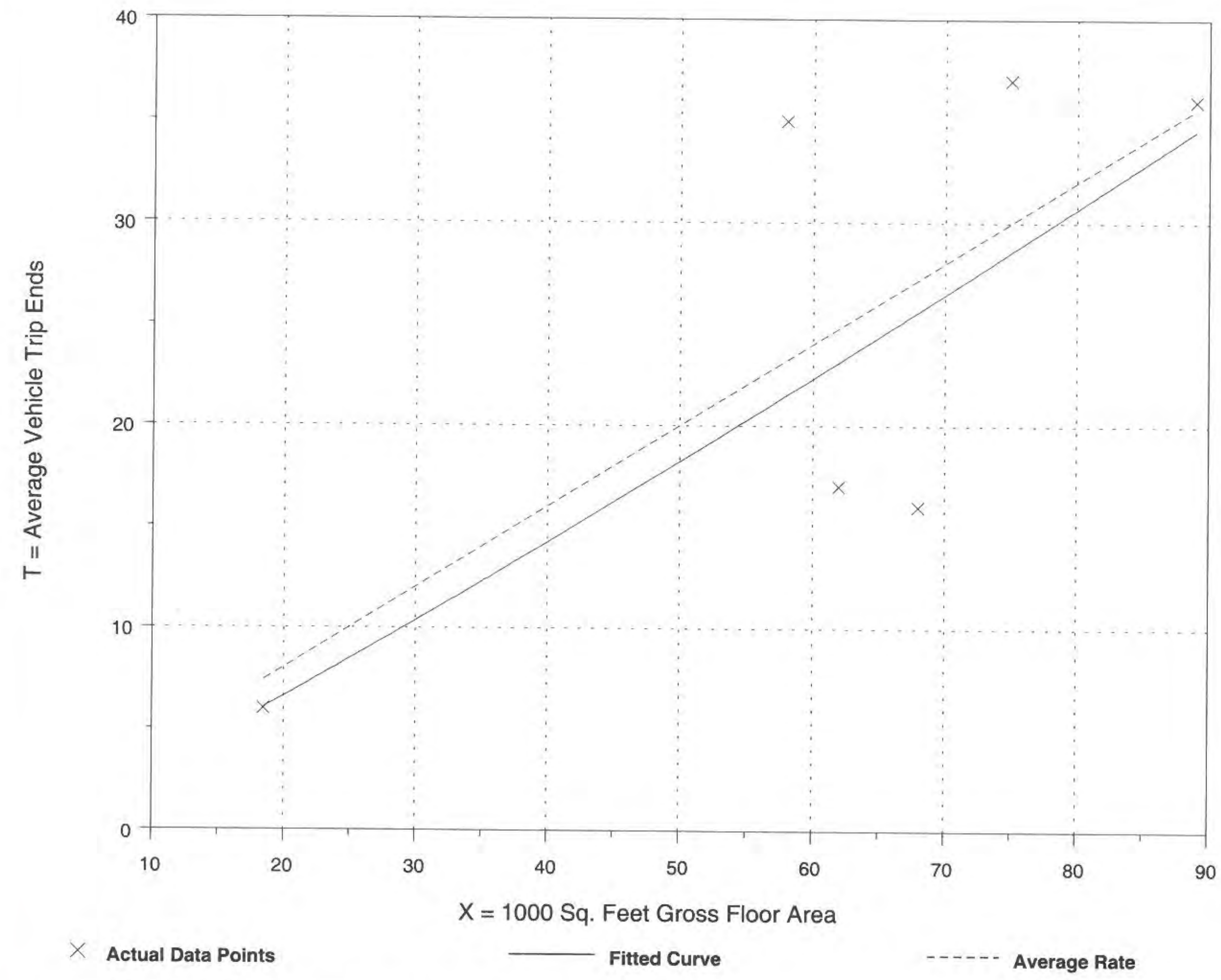
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Saturday,**
Peak Hour of Generator

Number of Studies: 6
Average 1000 Sq. Feet GFA: 62
Directional Distribution: Not available

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
0.40	0.24 - 0.60	0.64

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 1.11 Ln(X) - 1.43 **R^2 = 0.76**

Land Use: 841
New Car Sales

Description

New car sales dealerships are typically located along major arterial streets characterized by abundant commercial development. Automobile services, parts sales and substantial used car sales may also be available. Some dealerships also include leasing options, truck sales and servicing.

Additional Data

Three sites provided information on the number of service stalls. The average number of stalls was 34, which included a range of 12 to 49.

The sites were surveyed from the late 1960s to the 2000s at domestic and foreign dealerships throughout the United States, with many conducted in Florida and California.

Source Numbers

98, 100, 172, 260, 271, 280, 328, 406, 414, 424, 427, 438, 440, 507, 571, 583

New Car Sales
(841)

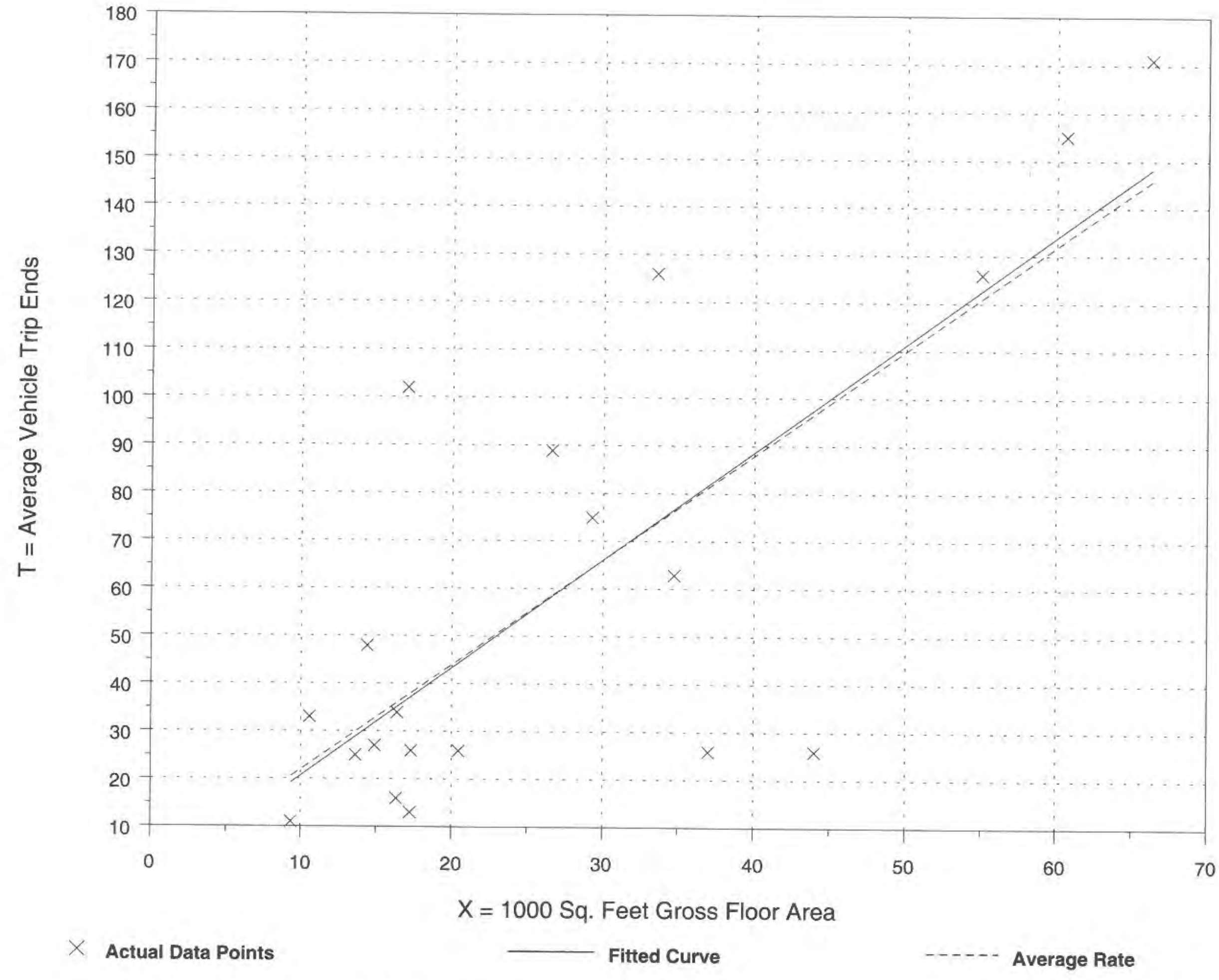
Average Vehicle Trip Ends vs: 1000 Sq. Feet Gross Floor Area
On a: Weekday,
A.M. Peak Hour of Generator

Number of Studies: 20
Average 1000 Sq. Feet GFA: 28
Directional Distribution: 56% entering, 44% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.20	0.59 - 6.00	1.85

Data Plot and Equation



Fitted Curve Equation: $T = 2.27(X) - 1.92$

$R^2 = 0.60$

New Car Sales
(841)

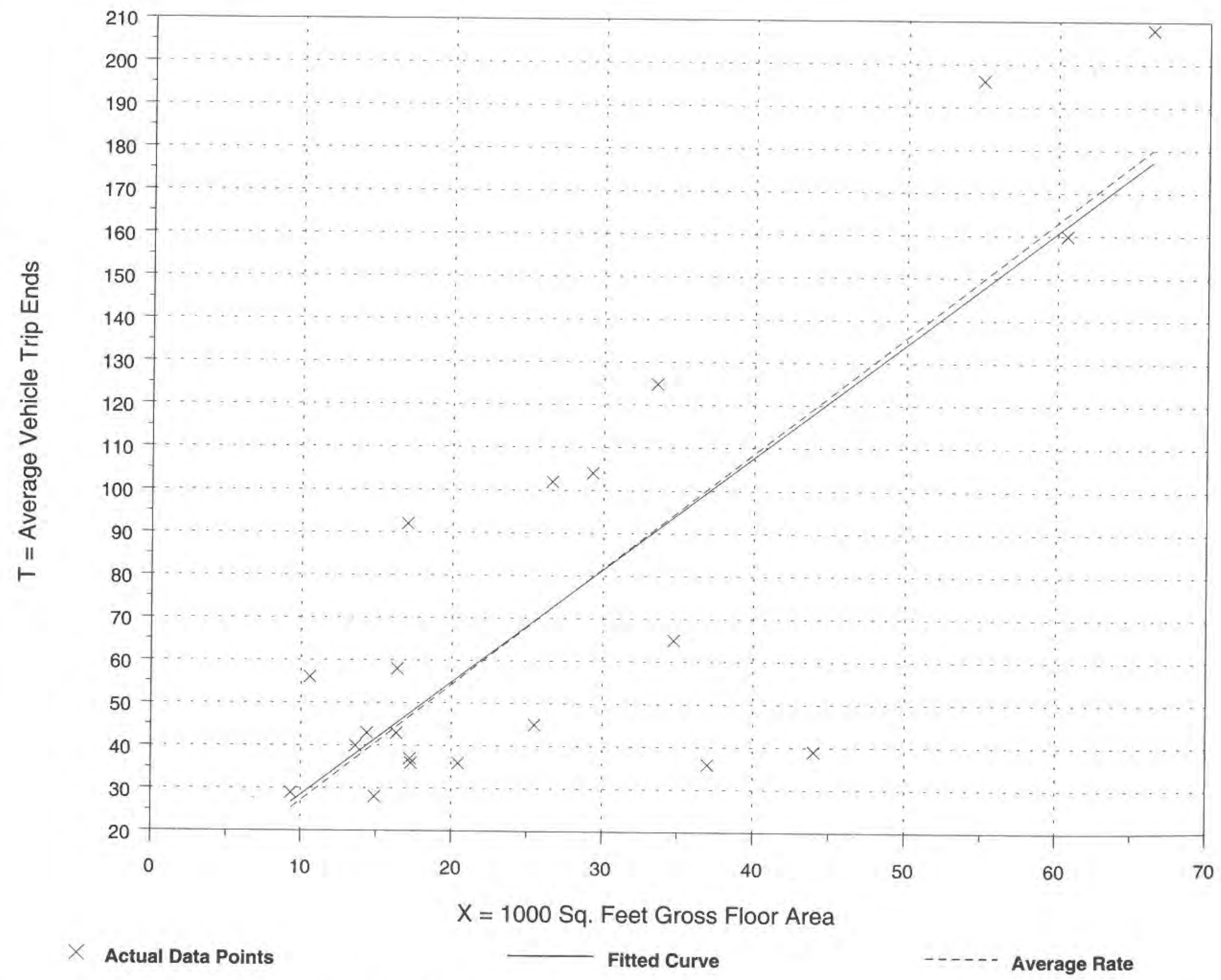
Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Weekday,**
P.M. Peak Hour of Generator

Number of Studies: 21
Average 1000 Sq. Feet GFA: 28
Directional Distribution: 45% entering, 55% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.72	0.89 - 5.41	1.96

Data Plot and Equation



Fitted Curve Equation: $T = 2.64(X) + 2.09$ **$R^2 = 0.64$**

New Car Sales
(841)

Average Vehicle Trip Ends vs: **1000 Sq. Feet Gross Floor Area**
On a: **Saturday,**
Peak Hour of Generator

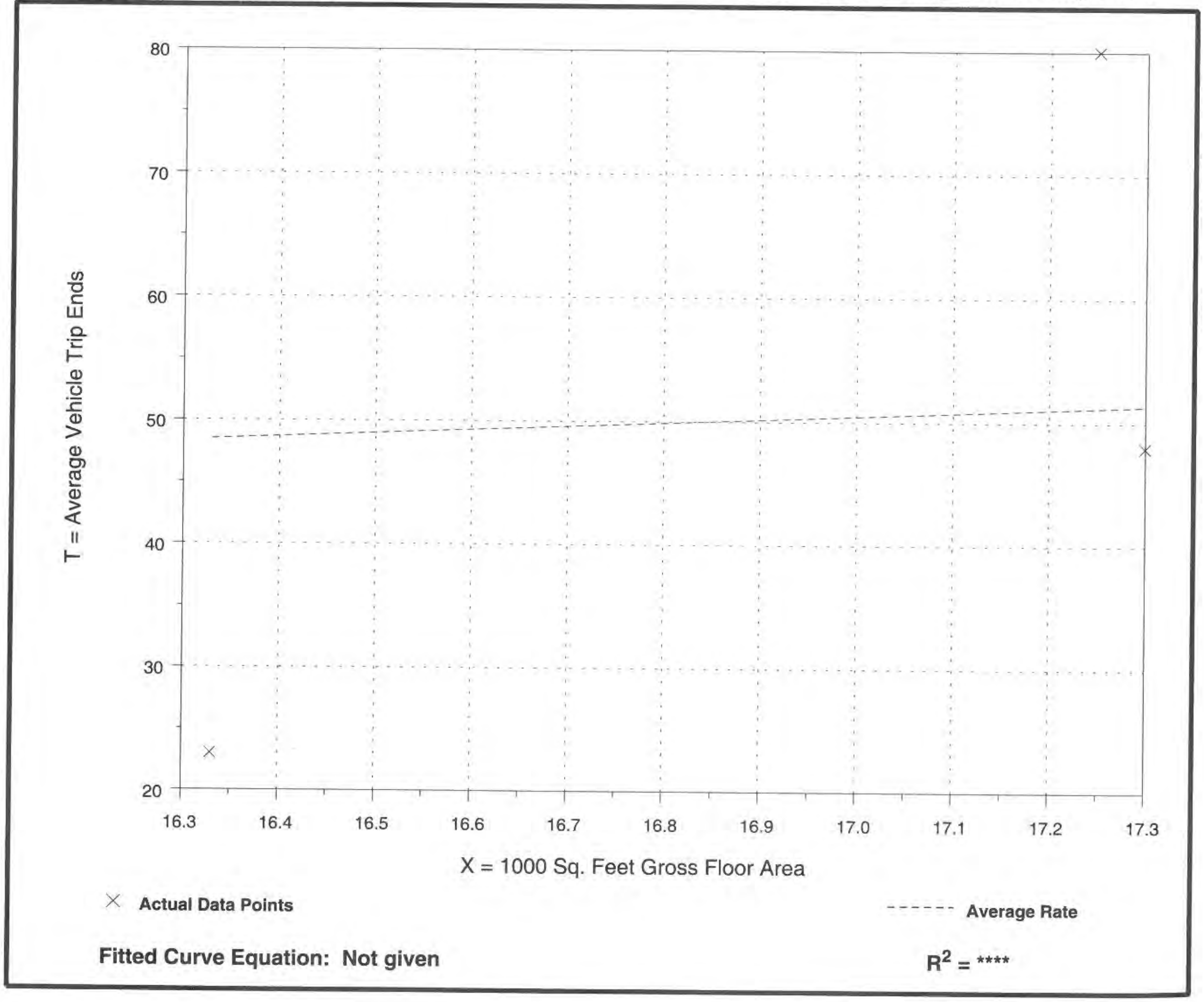
Number of Studies: 3
Average 1000 Sq. Feet GFA: 17
Directional Distribution: 51% entering, 49% exiting

Trip Generation per 1000 Sq. Feet Gross Floor Area

Average Rate	Range of Rates	Standard Deviation
2.97	1.41 - 4.64	2.15

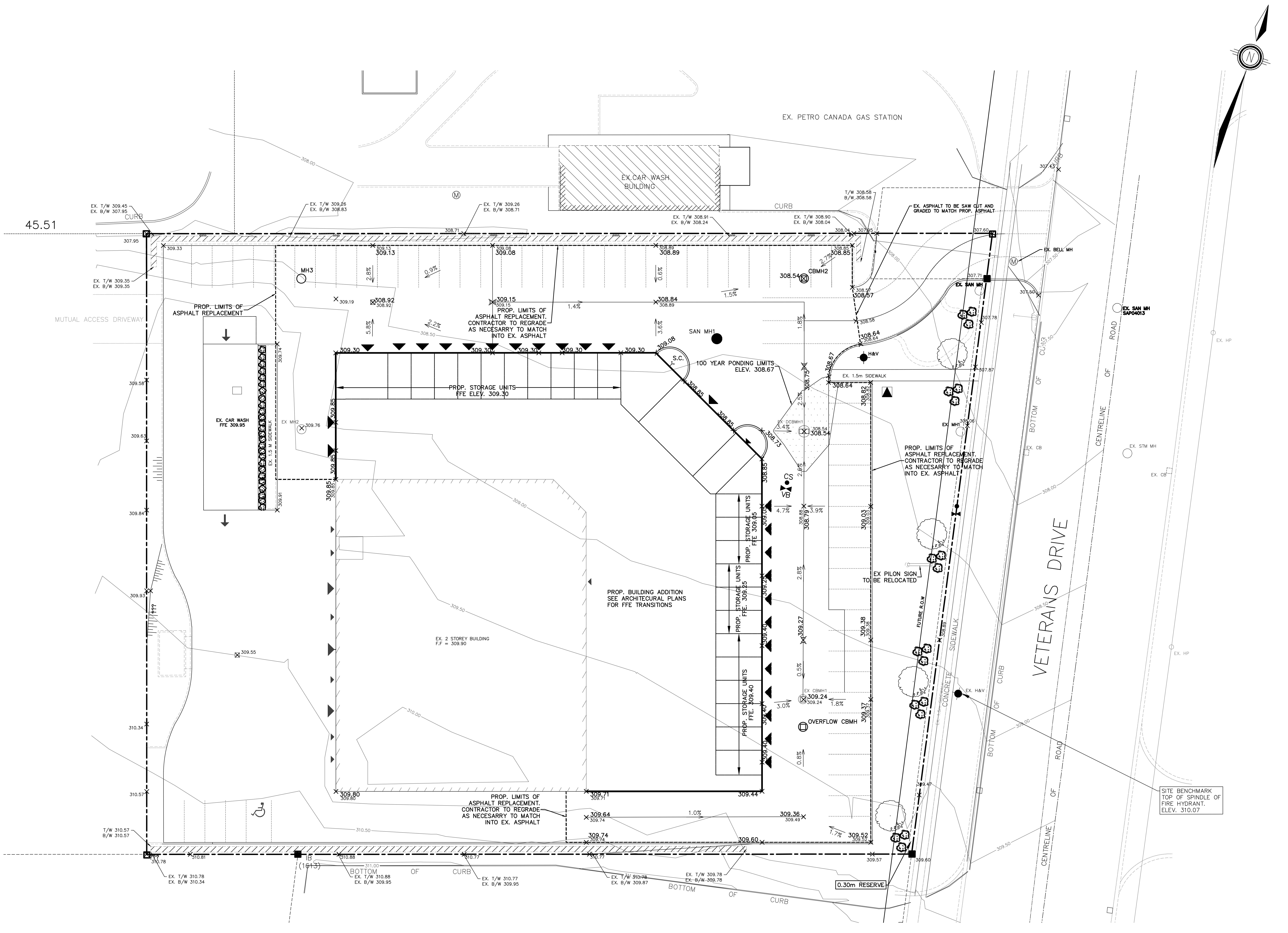
Data Plot and Equation

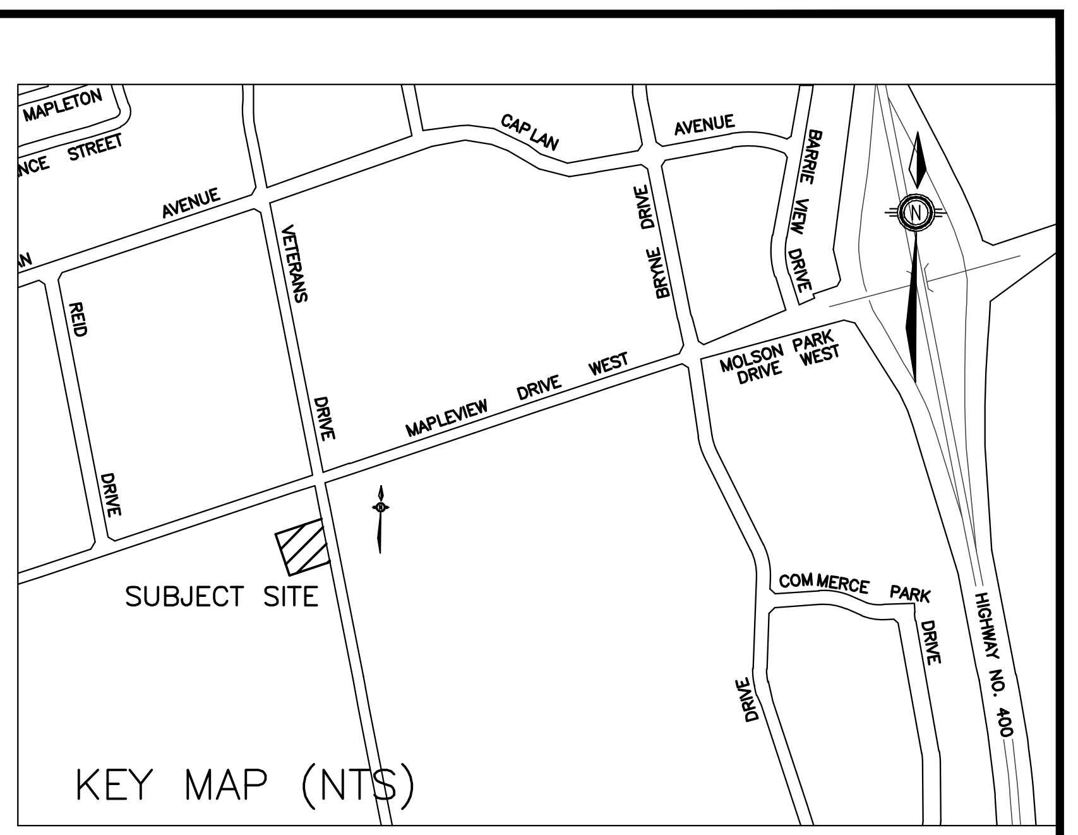
Caution - Use Carefully - Small Sample Size



APPENDIX H

PEARSON ENGINEERING DRAWING





KEY MAP (NTS)

LEGEND

●	PROPOSED SANITARY MANHOLE
○	EXISTING SANITARY MANHOLE
◻	CATCH BASIN
◫	DOUBLE CATCH BASIN
⊟	DOUBLE CATCH BASIN–MANHOLE
◙	CATCH BASIN–MANHOLE
○	STORM MANHOLE
×274.37	PROPOSED ELEVATION
274.37	EXISTING ELEVATION
1.6% ←	PROPOSED GRADE
▲	PROPOSED HYDRO TRANSFORMER
⌐	SERVICE CAP
HYD. ✦	FIRE HYDRANT
VB ⋈	WATER VALVE
CS •	CURB STOP
↓	PROPOSED DRIVE IN ENTRANCE
◻-⊙	LIGHT STANDARD
▶	OVERHEAD DOORS
▸	PEDESTRIAN DOORS
━	DEPRESSED CURB
═	BARRIER CURB

HORIZONTAL CONTROL:
ID# 03120040035
LOCATED BEHIND SOUTH CURB LINE OF MAPLEVIEW DRIVE WEST,
APPROXIMATELY 170m EAST OF VETERAN'S DR., OPPOSITE THE YOM FACTORY.
NORTHING–N4909639.122m, EASTING–E603897.741m

VERTICAL CONTROL:
ID# 03120030018
CULVERT INVERT ON NORTHEAST CORNER OF MAPLEVIEW & VETERANS DRIVE.
SET FLUSH IN THE EAST FACE OF CULVERT HEADWALL. TABLET IS 110mm
BELOW THE TOP OF CULVERT AND 110mm NORTH OF THE SOUTH INSIDE
CORNER TO HEADWALL.
ELEVATION=306.589

COMBINED CONTROL:
ID# 03120080060
LOCATED APPROXIMATELY 17.4m SOUTH OF CENTERLINE OF MAPLEVIEW
DRIVE WEST AND APPROXIMATELY 265m EAST OF ESSA ROAD.
ELEVATION=307.474
NORTHING–N4909251.737m, EASTING–E602722.947m

NO.	REVISION NOTE	DATE	BY

BENCHMARK

SITE BENCHMARK IS THE TOP OF THE SPINDLE OF THE FIRE HYDRANT AT THE WEST SIDE OF VETERAN'S DRIVE HAVING AN ELEVATION OF 310.07.

BEARING NOTE:

BEARINGS ARE UTM GRID AND ARE REFERRED TO PART OF THE WESTERLY LIMIT OF VETERAN'S DRIVE AS SHOWN ON REGISTERED PLAN 51M–695, HAVING A BEARING OF N11°01'00"W.

M.W. DEJEAN
JAN. 14, 2022

1911882 ONTARIO INC.
620 VETERANS DRIVE
CITY OF BARRIE

SITE GRADING PLAN

PEARSON
ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	1:250	PROJECT #	14072.01
DRAWN BY	JP	VERT SCALE	VERT	DRAWING #	SG–1
CHECKED BY	GMP	DATE	SEPTEMBER 2021	REVISION #	0

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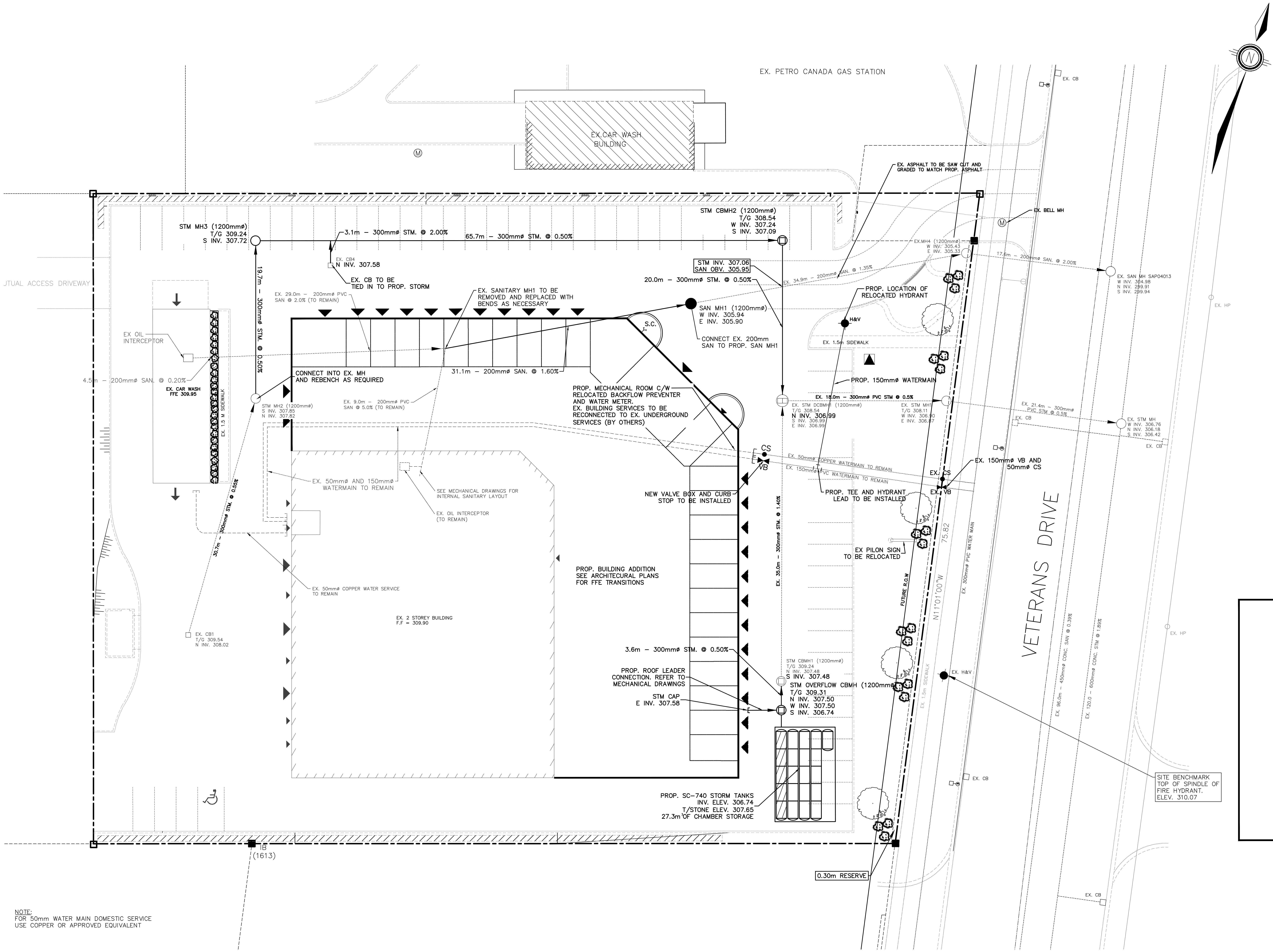
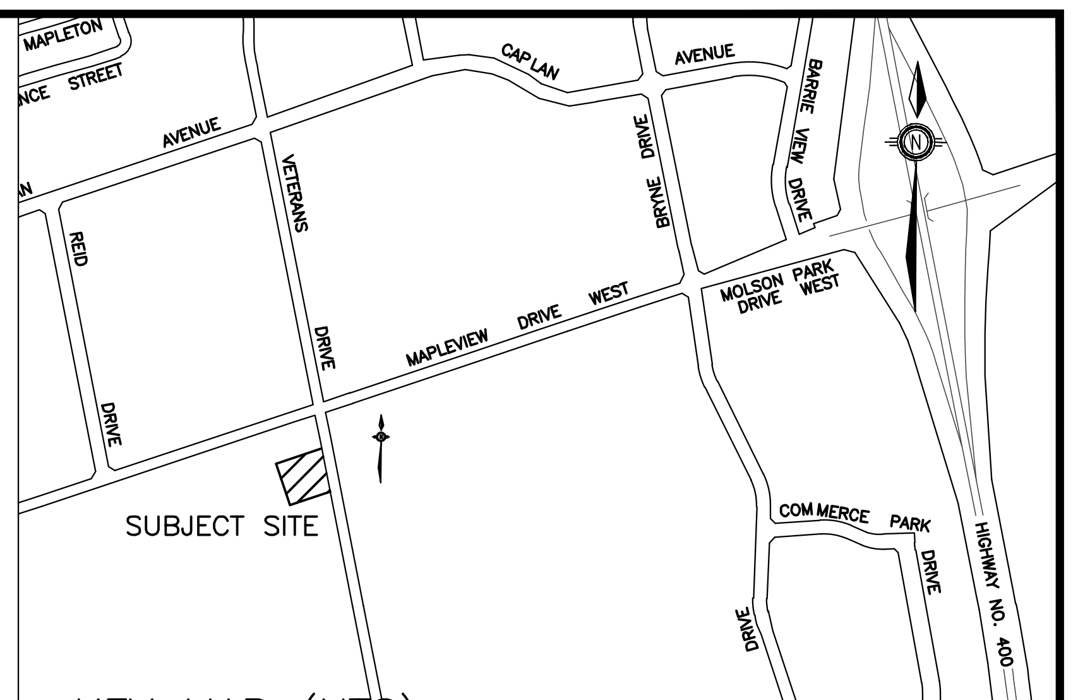


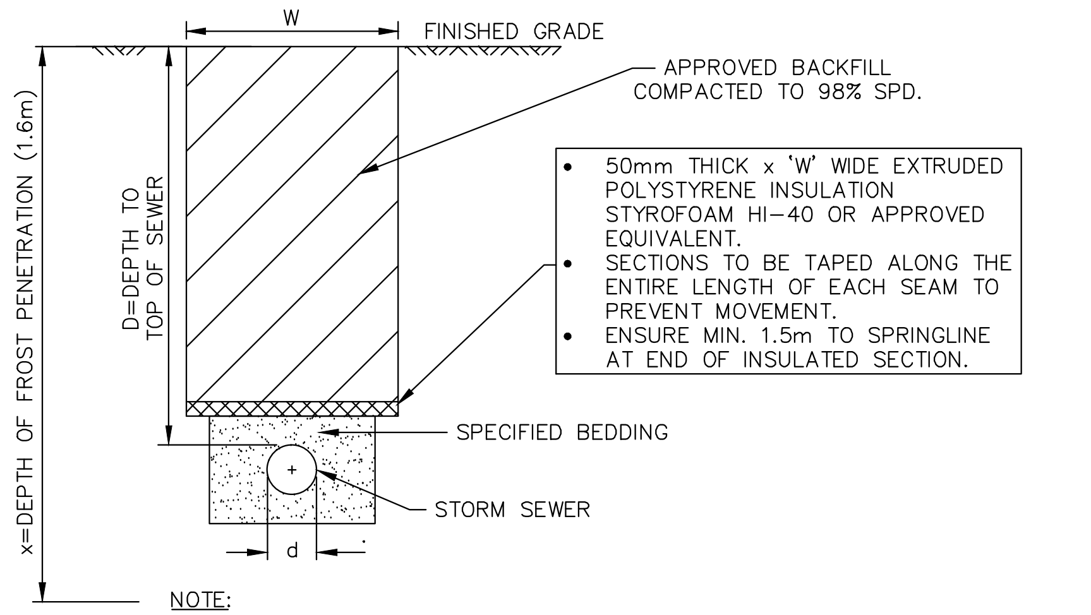
NOTE:
FOR 50mm WATER MAIN DOMESTIC SERVICE
USE COPPER OR APPROVED EQUIVALENT



KEY MAP (NTS)

LEGEND

- ● PROPOSED SANITARY MANHOLE
- ○ EXISTING SANITARY MANHOLE
- □ CATCH BASIN
- ◫ DOUBLE CATCH BASIN
- ⊞ DOUBLE CATCH BASIN–MANHOLE
- ⊡ CATCH BASIN–MANHOLE
- ○ STORM MANHOLE
- 274.37 PROPOSED ELEVATION
- 274.37 EXISTING ELEVATION
- 1.6% PROPOSED GRADE
- ▲ PROPOSED HYDRO TRANSFORMER
- ⊓ SERVICE CAP
- HYD. FIRE HYDRANT
- VB WATER VALVE
- CS CURB STOP
- ↓ PROPOSED DRIVE IN ENTRANCE
- □-⊖ LIGHT STANDARD
- ◀ ENTRANCE/EXIT



- 50mm THICK x 'W' WIDE EXTRUDED POLYSTYRENE INSULATION STYROFOAM HI–40 OR APPROVED EQUIVALENT.
- SECTIONS TO BE TAPED ALONG THE ENTIRE LENGTH OF EACH SEAM TO PREVENT MOVEMENT.
- ENSURE MIN. 1.5m TO SPRINGLINE AT END OF INSULATED SECTION.

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.)

HORIZONTAL CONTROL:
ID# 03120040035
LOCATED BEHIND SOUTH CURB LINE OF MAPLEVIEW DRIVE WEST, APPROXIMATELY 170m EAST OF VETERAN'S DR., OPPOSITE THE YOM FACTORY.
NORTHING–N4909639.122m, EASTING–E603897.741m

VERTICAL CONTROL:
ID# 03120030018
CULVERT INVERT ON NORTHEAST CORNER OF MAPLEVIEW & VETERANS DRIVE. SET FLUSH IN THE EAST FACE OF CULVERT HEADWALL. TABLET IS 110mm BELOW THE TOP OF CULVERT AND 110mm NORTH OF THE SOUTH INSIDE CORNER TO HEADWALL.
ELEVATION=306.589

COMBINED CONTROL:
ID# 03120080060
LOCATED APPROXIMATELY 17.4m SOUTH OF CENTERLINE OF MAPLEVIEW DRIVE WEST AND APPROXIMATELY 265m EAST OF ESSA ROAD.
ELEVATION=307.474
NORTHING–N4909251.737m, EASTING–E602722.947m

NO.	REVISION NOTE	DATE	BY

BENCHMARK
SITE BENCHMARK IS THE TOP OF THE SPINDLE OF THE FIRE HYDRANT AT THE WEST SIDE OF VETERAN'S DRIVE HAVING AN ELEVATION OF 310.07.

BEARING NOTE:
BEARINGS ARE UTM GRID AND ARE REFERRED TO PART OF THE WESTERLY LIMIT OF VETERAN'S DRIVE AS SHOWN ON REGISTERED PLAN 51M–695, HAVING A BEARING OF N11°01'00"W.

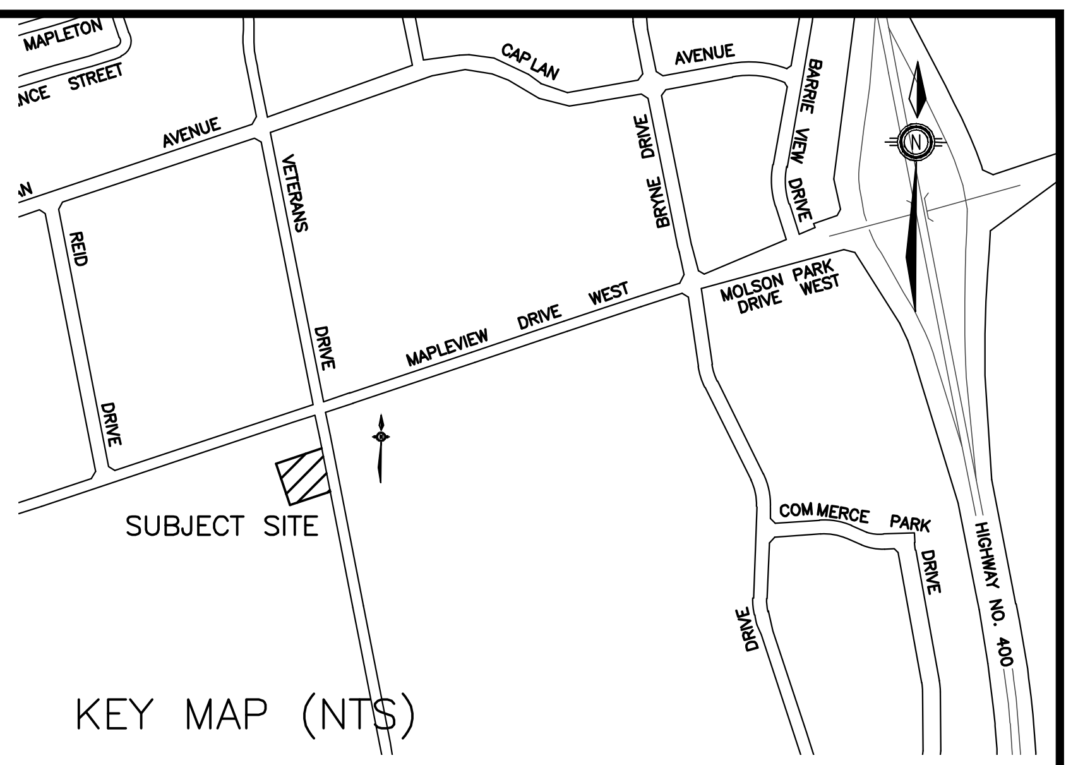
M.W. DEJEAN
JAN. 14, 2022

1911882 ONTARIO INC.
620 VETERANS DRIVE
CITY OF BARRIE

SITE SERVICING PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

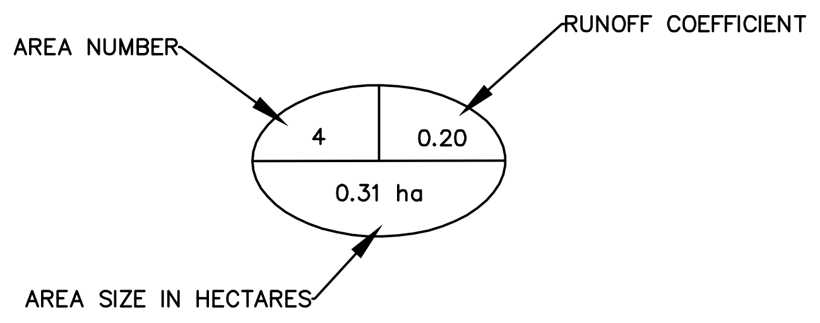
DESIGNED BY	AMC	HORIZ SCALE	1:250	PROJECT #	14072.01
DRAWN BY	JP	VERT SCALE	VERT	DRAWING #	SS–1
CHECKED BY	GMP	DATE	SEPTEMBER 2021	REVISION #	0



KEY MAP (NTS)

LEGEND

●	PROPOSED SANITARY MANHOLE
○	EXISTING SANITARY MANHOLE
▫	CATCH BASIN
◫	DOUBLE CATCH BASIN
⊟	DOUBLE CATCH BASIN–MANHOLE
⊡	CATCH BASIN–MANHOLE
○	STORM MANHOLE
×274.37	PROPOSED ELEVATION
274.37	EXISTING ELEVATION
←1.6%	PROPOSED GRADE
◪	PROPOSED HYDRO TRANSFORMER
⊓	SERVICE CAP
✦ HYD.	FIRE HYDRANT
⋈ VB	WATER VALVE
CS	CURB STOP
↓	PROPOSED DRIVE IN ENTRANCE
□-⊙	LIGHT STANDARD
◀	ENTRANCE/EXIT
⇨	OVERLAND FLOW ROUTE



NOTE:

ALLOWABLE RUNOFF COEFFICIENT OF 0.75
AS PER STORM DRAINAGE PLAN DWG. NO.
9120 STM BY RICHARDSON FOSTER LTD.
SIGNED BY BRYAN RICHARDSON REV. 3
DATED FEB 28, 2008

HORIZONTAL CONTROL:

ID# 03120040035
LOCATED BEHIND SOUTH CURB LINE OF MAPLEVIEW DRIVE WEST,
APPROXIMATELY 170m EAST OF VETERAN'S DR., OPPOSITE THE YOM FACTORY.
NORTHING–N4909639.122m, EASTING–E603897.741m

VERTICAL CONTROL:

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BELOW THE TOP OF CULVERT AND 110mm NORTH OF THE SOUTH INSIDE
CORNER TO HEADWALL.
ELEVATION=306.589

COMBINED CONTROL:

ID# 03120080060
LOCATED APPROXIMATELY 17.4m SOUTH OF CENTERLINE OF MAPLEVIEW
DRIVE WEST AND APPROXIMATELY 265m EAST OF ESSA ROAD.
ELEVATION=307.474
NORTHING–N4909251.737m, EASTING–E602722.947m

NO.	REVISION NOTE	DATE	BY

BENCHMARK

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LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
JAN. 14, 2022
PROVINCE OF ONTARIO

1911882 ONTARIO INC.
620 VETERANS DRIVE
CITY OF BARRIE

PRE–DEVELOPMENT STORM
CATCHMENT PLAN

PEARSON
ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	HORIZ	PROJECT #	14072.01
DRAWN BY	JP	VERT SCALE	VERT	DRAWING #	STM–1
CHECKED BY	GMP	DATE	SEPTEMBER 2021	REVISION #	0

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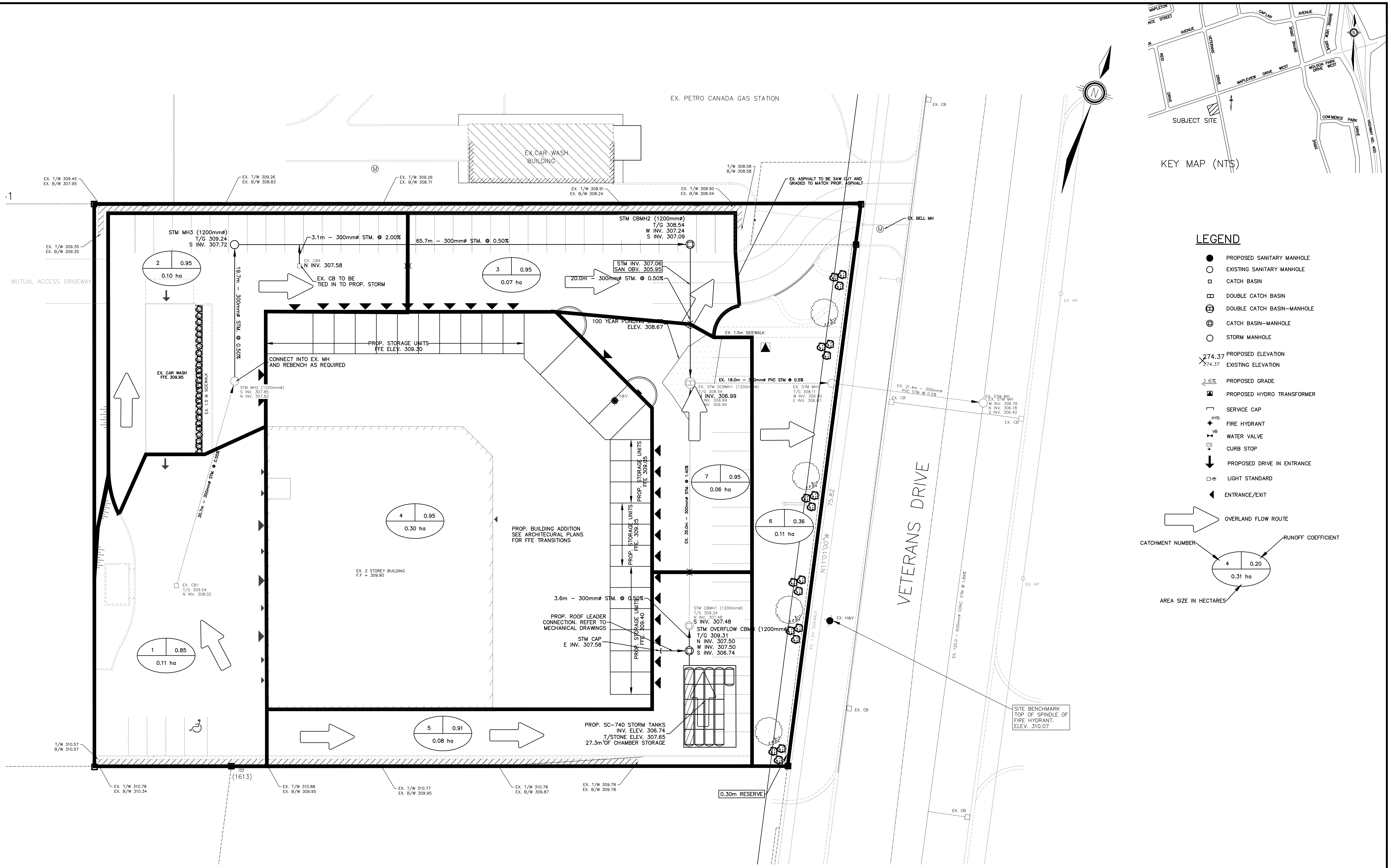

HORIZONTAL CONTROL:

ID# 03120040035
LOCATED BEHIND SOUTH CURB LINE OF MAPLEVIEW DRIVE WEST, APPROXIMATELY 170m EAST OF VETERAN'S DR., OPPOSITE THE YOM FACTORY.
NORTHING–N4909639.122m, EASTING–E603897.741m

VERTICAL CONTROL:

ID# 03120030018
CULVERT INVERT ON NORTHEAST CORNER OF MAPLEVIEW & VETERANS DRIVE. SET FLUSH IN THE EAST FACE OF CULVERT HEADWALL. TABLET IS 110mm BELOW THE TOP OF CULVERT AND 110mm NORTH OF THE SOUTH INSIDE CORNER TO HEADWALL.
ELEVATION=306.589

COMBINED CONTROL:

ID# 03120080060
LOCATED APPROXIMATELY 17.4m SOUTH OF CENTERLINE OF MAPLEVIEW DRIVE WEST AND APPROXIMATELY 265m EAST OF ESSA ROAD.
ELEVATION=307.474
NORTHING–N4909251.737m, EASTING–E602722.947m

NO.	REVISION NOTE	DATE	BY

BENCHMARK

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BEARING NOTE:

BEARINGS ARE UTM GRID AND ARE REFERRED TO PART OF THE WESTERLY LIMIT OF VETERAN'S DRIVE AS SHOWN ON REGISTERED PLAN 51M–695, HAVING A BEARING OF N11°01'00"W.

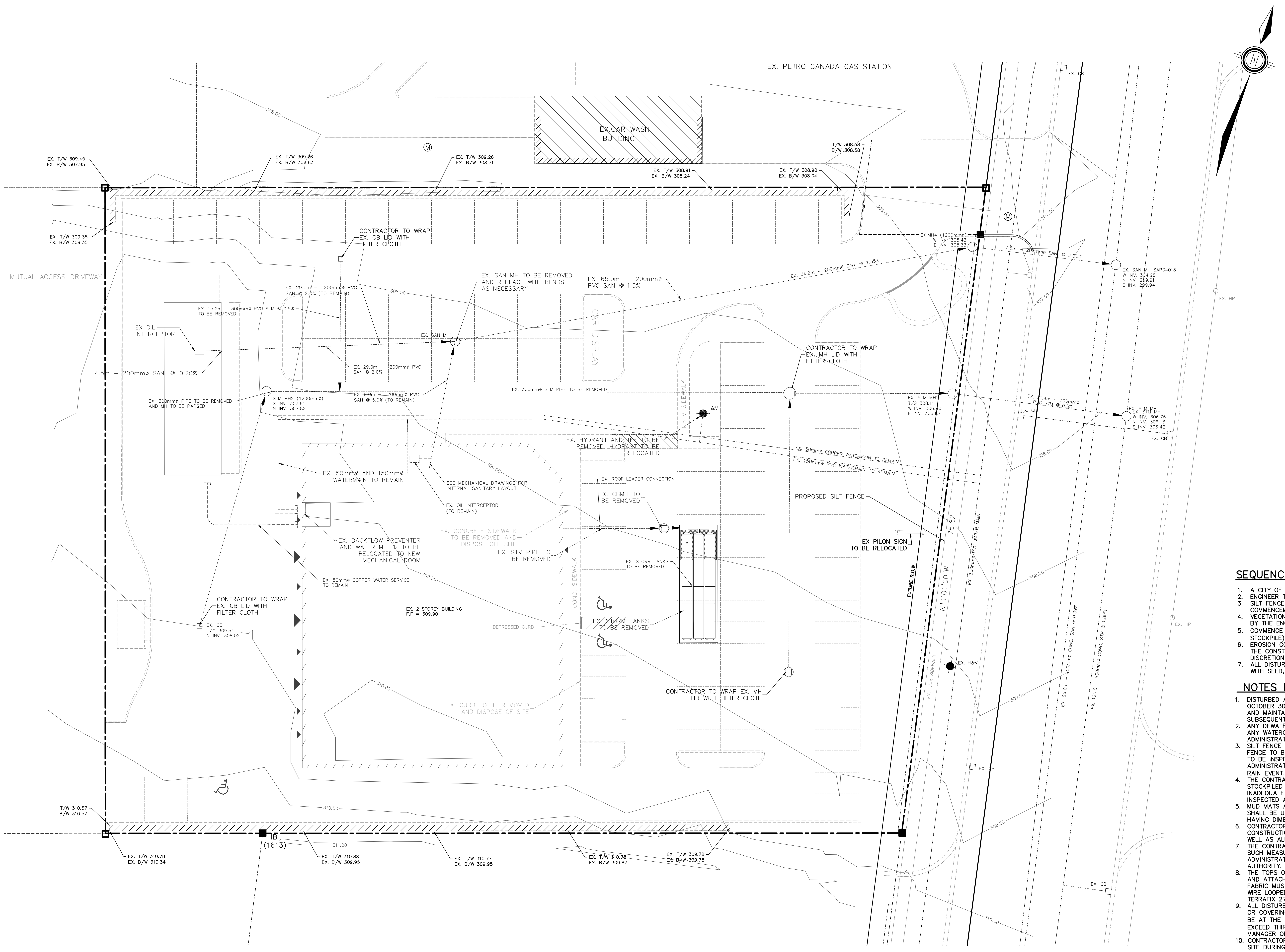
M.W. DEJEAN
JAN. 14, 2022

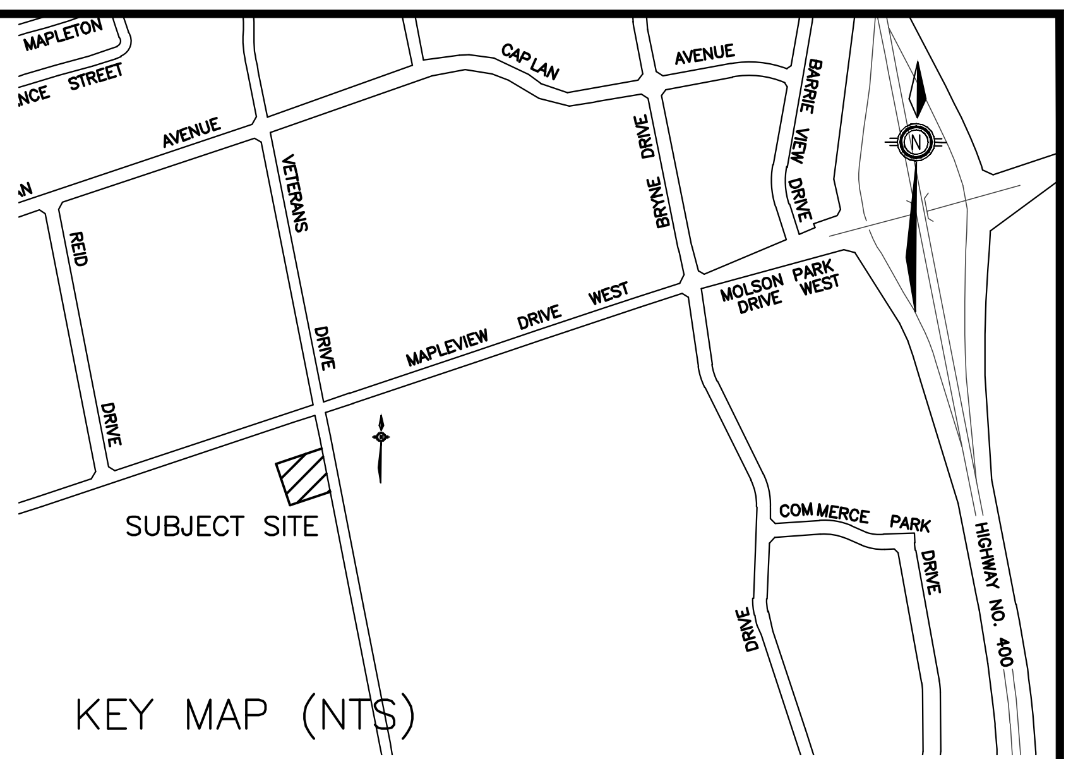
1911882 ONTARIO INC.
620 VETERANS DRIVE
CITY OF BARRIE

POST–DEVELOPMENT STORM CATCHMENT PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AMC	HORIZ SCALE	1:250	PROJECT #	14072.01
DRAWN BY	JP	VERT SCALE	N/A	DRAWING #	STM–2
CHECKED BY	GMP	DATE	SEPTEMBER 2021	REVISION #	0





KEY MAP (NTS)

LEGEND

●	PROPOSED SANITARY MANHOLE
○	EXISTING SANITARY MANHOLE
□	CATCH BASIN
◫	DOUBLE CATCH BASIN
⊟	DOUBLE CATCH BASIN–MANHOLE
▣	CATCH BASIN–MANHOLE
○	STORM MANHOLE
×274.37	PROPOSED ELEVATION
274.37	EXISTING ELEVATION
← 1.6%	PROPOSED GRADE
◭	PROPOSED HYDRO TRANSFORMER
⊓	SERVICE CAP
HYD. ✦	FIRE HYDRANT
VB ⋈	WATER VALVE
CS ◉	CURB STOP
↓	PROPOSED DRIVE IN ENTRANCE
□–⊙	LIGHT STANDARD
◀	ENTRANCE/EXIT

SEQUENCE OF CONSTRUCTION

1. A CITY OF BARRIE SITE ALTERATION PERMIT IS REQUIRED PRIOR TO ANY WORK COMMENCING.
2. ENGINEER TO BE NOTIFIED MINIMUM 72 HOURS PRIOR TO INITIATION OF ANY ON SITE WORKS.
3. SILT FENCE AND CONSTRUCTION ACCESS MATS TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ONSITE.
4. VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
5. COMMENCE WITH EARTH EXCAVATION AND SITE SERVICING (TO BE REMOVED FROM SITE – NO STOCKPILE).
6. 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.
7. 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.

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.
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. MUD MATS AT ALL LOCATIONS WHERE CONSTRUCTION TRAFFIC ENTERS OR LEAVES THE SITE SHALL BE USED. MUD MATS TO CONSIST OF 300mm MIN.100mm TO 200mm CLEAR STONE HAVING DIMENSIONS 8.0m WIDE X 30.0m LONG.
6. 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.
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 MUNICIPALITY AND CONSERVATION AUTHORITY.
8. THE TOPS OF ALL FILTER FABRIC MUST BE A MINIMUM OF 1.0 METER 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 CITY OF BARRIE'S MANAGER OF ENGINEERING BUT SHALL NOT EXCEED THIRTY DAYS OR SUCH LONGER PERIOD DEEMED ADVISABLE BY THE CITY OF BARRIE'S MANAGER OF ENGINEERING.
10. CONTRACTOR SHALL INSTALL AND MAINTAIN CATCHBASIN SEDIMENT BARRIERS THROUGHOUT THE SITE DURING ALL CONSTRUCTION ACTIVITIES IN ORDER TO TRAP SEDIMENT.

HORIZONTAL CONTROL:
ID# 03120040035
LOCATED BEHIND SOUTH CURB LINE OF MAPLEVIEW DRIVE WEST,
APPROXIMATELY 170m EAST OF VETERAN'S DR., OPPOSITE THE YOM FACTORY.
NORTHING–N4909639.122m, EASTING–E603897.741m

VERTICAL CONTROL:
ID# 03120030018
CULVERT INVERT ON NORTHEAST CORNER OF MAPLEVIEW & VETERANS DRIVE.
SET FLUSH IN THE EAST FACE OF CULVERT HEADWALL. TABLET IS 110mm
BELOW THE TOP OF CULVERT AND 110mm NORTH OF THE SOUTH INSIDE
CORNER TO HEADWALL.
ELEVATION=306.589

COMBINED CONTROL:
ID# 03120080060
LOCATED APPROXIMATELY 17.4m SOUTH OF CENTERLINE OF MAPLEVIEW
DRIVE WEST AND APPROXIMATELY 265m EAST OF ESSA ROAD.
ELEVATION=307.474
NORTHING–N4909251.737m, EASTING–E602722.947m

NO.	REVISION NOTE	DATE	BY

BENCHMARK

SITE BENCHMARK IS THE TOP OF THE SPINDLE OF THE FIRE HYDRANT AT THE WEST SIDE OF VETERAN'S DRIVE HAVING AN ELEVATION OF 310.07.

BEARING NOTE:

BEARINGS ARE UTM GRID AND ARE REFERRED TO PART OF THE WESTERLY LIMIT OF VETERAN'S DRIVE AS SHOWN ON REGISTERED PLAN 51M–695, HAVING A BEARING OF N11°01'00"W.

LICENCED PROFESSIONAL ENGINEER
M.W. DEJEAN
JAN. 14, 2022
PROVINCE OF ONTARIO

1911882 ONTARIO INC.
620 VETERANS DRIVE
CITY OF BARRIE

ENVIRONMENTAL PROTECTION AND
REMOVAL PLAN

PEARSON
ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY AMC	HORIZ SCALE HORIZ	PROJECT # 14072.01	
DRAWN BY JP	VERT SCALE VERT	DRAWING # EPR–1	
CHECKED BY GMP	DATE SEPTEMBER 2021	REVISION # 0	