STORMWATER MANAGEMENT REPORT

FOR

76 BRYNE DRIVE, BARRIE ON

CITY OF BARRIE, COUNTY OF SIMCOE

PREPARED BY:

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Project No. 899-001-17

Table of Contents

Appendices

List of Figures & Drawings

1. Introduction

Gerrits Engineering Ltd. (GEL) has been retained by Di Gregorio (Client) to prepare Grading and Servicing design drawings and a Stormwater Management Brief for a proposed new 5-storey mixed use commercial/residential building (Project) to be located on Part of Lot 13, 14, and 15 and Part of Myers Court, on Registered Plan 51M-369, in the City of Barrie (City) as shown in Figure 1.

1.1. Development Concept

The subject site is approximately 0.79 ha in area, and it is proposed to construct a new 830 m^2 building located on the northern portion of the property. This report addresses the detailed design of the necessary Stormwater Management (SWM) controls for the subject site

1.2. Terms of Reference

The intent of this SWM Brief 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.

1.3. Supporting Documents

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

- Ministry of the Environment, Stormwater Management Planning and Design Manual, March 2003
- Ontario Building Code 2006 (O.B.C.)
- Storm Drainage and Stormwater Management Policies and Design Guidelines, City of Barrie, Nov. 2009.
- LSRCA Technical Guidelines for Stormwater Management Submissions (Apr. 26, 2013)

2. Existing Conditions

This site is located on the south side of Bryne Drive, east of Essa and is legally described on Part of Lot 13, 14, and 15 and Part of Myers Court, on Registered Plan 51M-369 in the City of Barrie. The site is partially occupied on the eastern half within a commercial/industrial subdivision. The site is sloped from south to north. The subject property is located in the Markborough Properties Inc. development and quantity control for stormwater are provided in downstream facilities. The existing drawing (Dwg. G-1, 1997-074-003), completed by RG Robinson, identifies that storm flows from the subject site toward the existing stormwater management pond will be designed to a Runoff Coefficient of 0.90. According to *Soil Survey of Simcoe County, Report No.29 of the Ontario Soil Survey, Ministry of Agriculture and Food*, the watershed site is comprised of Tioga

Sandy Loam. This material is characterized as a grey, calcareous outwash sand with good drainage in the Hydrologic Soil Group A.

3. Stormwater Management

3.1. Post-Development Impervious Area

The proposed development will increase the imperviousness of the site. It is important to quantify this increase to evaluate the potential downstream impacts and ensure the site complies with the overall development concept as detailed in the R.G. Robinson Drawing No. 1997-074-003, Sheet G-1. As per the site's statistics, the post development runoff coefficient is calculated as:

Building Area	=	830 m^2	R	=	0.95	AR	=	788.5
Asphalt Area	=	3,585 m^2	R	=	0.95	AR	=	3,405.8
Concrete Area	=	506 m^2	R	=	0.95	AR	=	480.7
Soft Landscape	=	2,947 m^2	R	=	0.10	AR	=	294.7
					Total	AR	=	4,969.7

Site Area = 7,868 m^2 AR = 4,969.7 m^2 Weighted R = 0.63

The calculated runoff coefficient of the proposed development a is approximately 0.63. This is less than the allowable of 0.90 as detailed on the RG Robison Drawings, therefore on-site quantity control will not be required.

3.2. Proposed Storm System Design

As shown in the appended drawings, the site has been designed to convey minor flows underground and major storm flows overland. In events larger than the 5-year return storm, the site has been graded to include an overland flow route. This route allows the stormwater to overtop and flows overland to the relief point of the site located at the western corner and to the existing watercourse to the south.

3.3. Stormwater Quality Control

3.3.1. During Construction Activities

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

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

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

- Site location description and area;
- Existing and proposed land use;
- Vegetative cover;
- Existing drainage routes;
- Proposed site works;
- Proposed outlets;
- Permits required;
- Sediment filters and barriers - silt fences;

- Construction entrance location;
- Protection to catch basins and ditch inlets;

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

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

Built up sediment should be removed and disposed off-site at least once a month, or more frequently as directed by the engineer.

3.3.2. Post Construction Activities

The developments hardened surfaces pose a risk to stormwater quality through the collection of grit, salt, sand and oils on the paved and gravel surfaces. A treatment train approach is proposed that will capture runoff from the site and provide quality control through a infiltration in the parking lot area and an existing Stormceptor treatment unit as an end-of-pipe facility prior to discharging to the municipal system. It should be noted that shortly downstream of the subject site, is a municipal dry pond facility that provides quantity control, and inherently a level of quality control due to its design and function. We have not included the downstream facility in our review.

The existing STC 6000 model has located during the Site Plan process for the Hampton Inn. From the Legal fabric of the Hampton Inn site and the subject lands, the contributing area to the STC unit is 2.05 ha. The subject site has a Total Imperviousness of about 70%, and from aerial mapping the Hampton site has a similar coverage. For this reason, when evaluating the STC unit, we have assumed a Total Imperviousness of 75%. Based on the PCSWMM software distributed by Stormceptor, using the Barrie WPCC rainfall data and a Fine particle distribution set, the STC-6000 is expected to achieve a TSS removal rate of approximately 83%. However, as per NJDEP testing, this type of facility is only credited with 50% TSS removal.

The onsite infiltration for water balance, in combination with the onsite Stormceptor and downstream dry pond is anticipated to provide the additional TSS removal to meet Enhanced Level of Protection.

3.4. Phosphorous Budget

In July 2009, the Lake Simcoe Protection Plan (LSPP) was finalized as a result of a collaboration and partnership among various agencies including, but not limited to, the MOE and the LSRCA. Through the study of Lake Simcoe's ecological health it was determined that there is an over-abundance of phosphorous within Lake Simcoe.

As per Section 4.8-DP of the LSPP, new developments are to be demonstrate ***"through an evaluation of anticipated changes in phosphorous loading between the pre & post-development, how the loadings shall be minimized".***

We have completed such an analysis and have included our finding below and in Appendix A. The existing site generates approximately 0.06 kg of phosphorous annually and the proposed Project will generate approximately 1.04 kg of phosphorous annually. This represents a substantial annual increase in phosphorous loading.

The following chart details the anticipated phosphorous loadings for the pre- and uncontrolled post-development conditions.

	Total P (kg/yr)
Pre-Development	0.06
Uncontrolled Post Development	1.04

As per the Phosphorous Budget Tool documentation as provided by the MOE, the removal efficiency of 63% was selected for the efficiency of the downstream stormwater management pond, as well as 60% for the infiltration facility located on site. No removal efficiency was attributed to the Oil/Grit Separator. The following chart details the anticipated phosphorous loading for the post-development treated condition.

	Total P (kg/yr)
Controlled Post-Development	0.18

The post-development treated site has an increased phosphorous loading than the pre-development condition, however the measures on site have removed approximately 83% of the anticipated phosphorous loadings.

3.5. Water Balance

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

Referencing Section 3.2 of the MOE “Stormwater Management Planning and Design Manual, (March 2003), and the historical rainfall distribution for the area, the following review of the water balance has been completed. The site area is approximately 0.8 ha in area, and referencing the Simcoe County Soil Maps, we know the soil is typically characterised as a Tioga Sandy Loam within the soil group of A. Referencing Table 3.1 of the MOE manual, a Pasture/Shrub ground cover comprised of a Sandy Loam, has an average annual evapotranspiration of 531mm Using this information, combined with the calculated infiltration factor determined for the subject property and the LSRCA water balance spreadsheet we calculate about 2,530 m^3 of infiltration per year.

We have assumed that the average percolation rate for the onsite soil material will be 25 mm/hr. Without any measures being instituted, the subject site has a calculated infiltration rate of 985 m^3 of infiltration per year using the urban lawn ground cover evapotranspiration rate of 515mm.

Therefore, we are proposing that at minimum the 5mm event will be infiltrated from impervious surfaces (building and asphalt) through the ADS Storm chamber system. These methods, in addition to the pervious infiltration across the site, result in a volume of 2,637 m^3 to be infiltrated per year which exceeds the current regime of the site.

The following table details the various infiltration with detailed calculations of these methods included in Appendix A.

	Total Infiltration (m^3/yr)
Pre-Development	2,530
Uncontrolled Post Development	985
Controlled Post Development	2,637

4. Maintenance

4.1. Stormceptor Unit

The Stormceptor unit should be inspected on a monthly basis during the rainy season to ensure that the unit is cleaned out at the appropriate time. Where site conditions may cause a rapid accumulation of pollutants, more frequent inspections should be carried out. It is recommended that the Stormceptor unit be cleaned out at the end of the rainy season. The Stormceptor 6000 system should be cleaned when the sediment depth has accumulated to a depth of 425mm. Maintenance is to be performed in dry weather. Material removed from the unit will be disposed of in a similar manner to other stormwater management facilities.

When oils are encountered in the unit, they should be immediately removed upon discovery using a small portable pump and/or adsorbent pads and the remaining water should be decanted to the sanitary sewer system for treatment at the local sewage treatment facility. Contact Stormceptor for a listing of recommended Oil Sorbents. Any sludge or sediment in the bottom of the unit should then be removed and disposed of appropriately. Servicing should be performed immediately after any oil/contaminant spills in the area. Regular maintenance of the Stormceptor unit will ensure satisfactory and long-term treatment.

5. Conclusions

Implementation of the designs outlined in this report will ensure that the stormwater drainage from the site complies with the requirements of the reviewing authorities. We confirm that the SWM flows from the site, as outlined in the enclosed, will be of acceptable quality both during and after construction, and further, in the event of a major storm, that proper facilities are in place to protect the buildings and adjacent properties.

All of which is respectfully submitted,

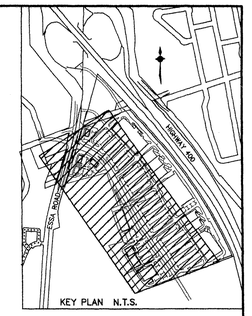
GERRITS ENGINEERING

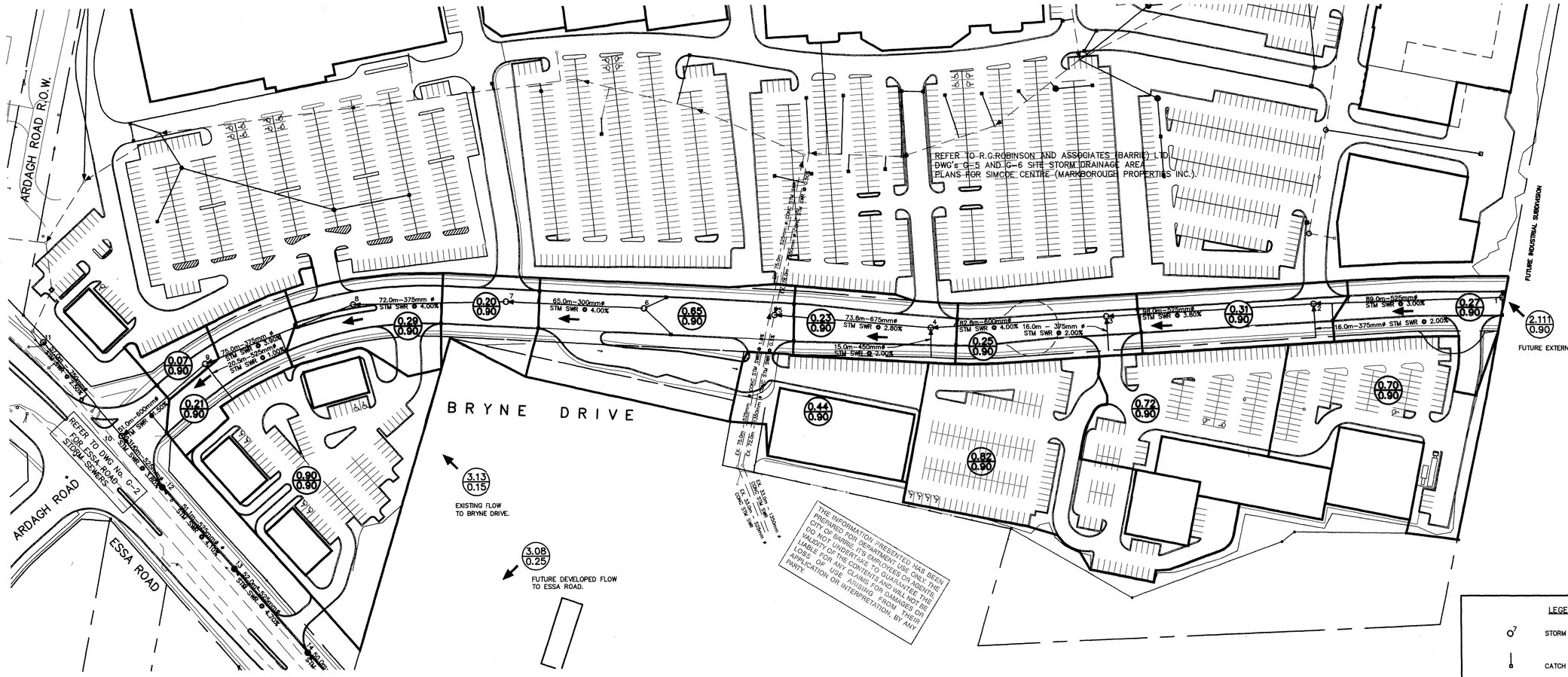
Peter Derro, P.Eng.
Civil Engineer

Jeff McCuaig, P.Eng.
Director, Civil Engineer

APPENDIX A

STORMWATER MANAGEMENT DESIGN CALCULATIONS





LEGEND

- STORM MANHOLE & NUMBER
- CATCH BASIN & LEAD
- AREA IN Ha.
- RUN-OFF COEFFICIENT
- PROPOSED OVERLAND FLOW

Notes

BENCHMARK:

"This Record Drawing has been prepared, in part, based upon information furnished by others. While this information is believed to be reliable, the City does not warrant the accuracy of this information, and shall not be held responsible for damages arising from the use of the Record Drawing. The user hereby releases and discharges the City, its employees or agents from any claims, losses or damages and agrees to indemnify and save harmless, the City, from any claims, losses, or damages arising from the use of the Record Drawing."

NO.	REVISIONS	DATE	INITIAL

Approved
CITY OF BARRIE
APPROVED
DATE . . . . . .

Approved

MARKBOROUGH PROPERTIES INC.
SIMCOE CENTRE
CITY OF BARRIE

GENERAL STORM DRAINAGE BOUNDARIES
BRYNE DRIVE

RG ROBINSON AND ASSOCIATES (BARRIE) LTD
CONSULTING ENGINEERS
10 High Street, Suite 200, Barrie, Ontario (705) 721-9222

SCALE: HORZ. 1:1000 VERT.		540-95079-21	
DESIGN H.G.	CHECKED H.G.	DWG. Nº G-1	
DRAWN D.C./L.K.	DATE FEB 97		

1997-074-003

97-74

GERRITS ENGINEERING LTD.

Calculation of Weighted Runoff Coefficient

Post Development Areas and Sub-Areas

Area ID	Total Area	0.10 Grass	0.95 Asphalt	0.95 Building	0.28 Pasture	0.5 Gravel	0.95 Conc.		Weighted Rational Coefficient
Pre-Development	7868	7868	0	0	0	0	0		0.10
X - 1	7868	7868	0	0	0	0	0		0.10
Post Total	7868	2947	3585	830	0	0	506		0.63
P - 1	562	562	0	0	0	0	0		0.10
P - 2	1730	399	1142	0	0	0	189		0.75
P - 3	830	0	0	830	0	0	0		0.95
P - 4	458	458	0	0	0	0	0		0.10
P - 5	715	21	612	0	0	0	82		0.93
P - 6	1534	528	815	0	0	0	191		0.66
P - 7	2039	979	1016	0	0	0	44		0.54
Post (Controlled) Total - P-2, 3, 5, 6, 7	6848	1927	3585	830	0	0	506		0.71
Post (Uncontrolled) Total - P1 & P-4	1020	1020	0	0	0	0	0		0.10

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

Q= 0.0028*C*I*A (cms)
C=RUNOFF COEFFICIENT
I-RAINFALL INTENSITY= 853.608/(Time+4.699)^0.766
A=AREA (ha)

CITY OF BARRIE

STORM SEWER DESIGN

DATE: 08-Jul-20
FILE 899-001-20
CONTRACT/PROJECT DI GREGORIO

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)
P-3	BLDG	CBMH #1	5.5	0.95	0.08	0.08	0.08	10.00	0.04	108.92	0.02	3.00	250	0.10	2.10
P-2	CBMH #1	STM MH #2	49.7	0.75	0.17	0.13	0.21	10.04	0.61	108.67	0.06	1.00	300	0.10	1.37
-	STM MH #2	STM MH #1	2.8	0.00	0.00	0.00	0.49	10.65	0.02	105.38	0.14	3.00	300	0.17	2.37
P-6	CB #2	CBMH #2	32.8	0.66	0.15	0.10	0.10	10.00	0.25	108.92	0.03	3.30	250	0.11	2.20
P-7	CB #3	CBMH #2	17.9	0.54	0.20	0.11	0.11	10.00	0.17	108.92	0.03	2.00	250	0.08	1.71
P-5	CBMH #2	STM MH #2	37.1	0.93	0.07	0.07	0.28	10.25	0.26	107.53	0.08	3.00	300	0.17	2.37
-	STM MH #1	DOGHOUSE MH#1	9.4	0.00	0.00	0.00	0.49	10.67	0.04	105.27	0.14	7.00	300	0.26	3.62

PRE-DEVELOPMENT	Site	
Catchment Designation		TOTALS
Area (m^2)	7,868	7,868
Pervious Area (m^2)	7,868	7,868
Impervious Area (m^2)	0	0
MOE Infiltration Factors		
Topography Infiltration Factor	0.30	
Soil Infiltration Factor	0.40	
Land Cover Infiltration Factor	0.10	
MOE Total Infiltration Factor	0.80	
Runoff Coefficient	0.20	
Runoff from Impervious Surfaces		
Inputs (per Unit Area)		
Precipitation (mm/yr)	933	933
TOTAL INPUTS (mm/yr)	933	933
Outputs (per Unit Area)		
Precipitation Surplus (mm/yr)	402	
Evapotranspiration (mm/yr)	531	
Infiltration (mm/yr)	322	
Rooftop Infiltration (mm/yr)	0	
Total Infiltration (mm/yr)	322	
Runoff Pervious Areas (mm/yr)	80	
Runoff Impervious Areas (mm/yr)	402	
Total Runoff (mm/yr)	482	
TOTAL OUTPUTS (mm/yr)	933	933
Difference (INPUTS-OUTPUTS)	0	0
Inputs (Volumes)		
Precipitation (m^3/yr)	7,341	7,341
TOTAL INPUTS (m^3/yr)	7,341	7,341
Outputs (Volumes)		
Precipitation Surplus (m^3/yr)	3,163	
Evapotranspiration (m^3/yr)	4,178	
Infiltration (m^3/yr)	2,530	
Rooftop Infiltration (m^3/yr)	0	
Total Infiltration (m^3/yr)	2,530	
Runoff Pervious Areas (m^3/yr)	633	
Runoff Impervious Areas (m^3/yr)	0	
Total Runoff (m^3/yr)	633	
TOTAL OUTPUTS (m^3/yr)	7,341	7,341
Difference (INPUTS-OUTPUTS)	0	0

POST-DEVELOPMENT	Site	
Catchment Designation	Site	TOTALS
Area (m^2)	7,868	7,868
Pervious Area (m^2)	2,947	2,947
Impervious Area (m^2)	4,921	4,921
MOE Infiltration Factors		
Topography Infiltration Factor	0.30	
Soil Infiltration Factor	0.40	
Land Cover Infiltration Factor	0.10	
MOE Total Infiltration Factor	0.80	
Runoff Coefficient	0.20	
Runoff from Impervious Surfaces	0	
Inputs (per Unit Area)		
Precipitation (mm/yr)	933	933
TOTAL INPUTS (mm/yr)	933	933
Outputs (per Unit Area)		
Precipitation Surplus (mm/yr)	418	
Evapotranspiration (mm/yr)	515	
Infiltration (mm/yr)	334	
Rooftop Infiltration (mm/yr)	0	
Total Infiltration (mm/yr)	334	
Runoff Pervious Areas (mm/yr)	84	
Runoff Impervious Areas (mm/yr)	418	
Total Runoff (mm/yr)	502	
TOTAL OUTPUTS (mm/yr)	933	
Difference (INPUTS-OUTPUTS)	0	
Inputs (Volumes)		
Precipitation (m^3/yr)	7,341	7,341
TOTAL INPUTS (m^3/yr)	7,341	7,341
Outputs (Volumes)		
Precipitation Surplus (m^3/yr)	3,289	3,289
Evapotranspiration (m^3/yr)	4,052	4,052
Infiltration (m^3/yr)	985	985
Rooftop Infiltration (m^3/yr)	0	0
Total Infiltration (m^3/yr)	985	985
Runoff Pervious Areas (m^3/yr)	246	246
Runoff Impervious Areas (m^3/yr)	2,057	2,057
Total Runoff (m^3/yr)	2,303	2,303
TOTAL OUTPUTS (m^3/yr)	7,341	7,341
Difference (INPUTS-OUTPUTS)	0	0

POST-DEVELOPMENT with MITIGATION	Site		
Catchment Designation	Uncontrolled	Controlled	TOTALS
Area (m^2)	1,020	6,848	7,868
Pervious Area (m^2)	1,020	1,927	2,947
Impervious Area (m^2)	0	4,921	4,921
MOE Infiltration Factors			
Topography Infiltration Factor	0.30	0.30	
Soil Infiltration Factor	0.40	0.40	
Land Cover Infiltration Factor	0.10	0.10	
MOE Total Infiltration Factor	0.80	0.80	
Runoff Coefficient	0.20	0.20	
Runoff from Impervious Surfaces	0	0	
Inputs (per Unit Area)			
Precipitation (mm/yr)	933	933	933
TOTAL INPUTS (mm/yr)	933	933	933
Outputs (per Unit Area)			
Precipitation Surplus (mm/yr)	418	418	
Evapotranspiration (mm/yr)	515	515	
Infiltration (mm/yr)	334	0	
Impervious Infiltration (mm/yr)	0	467	
Total Infiltration (mm/yr)	334	467	
Runoff Pervious Areas (mm/yr)	84	84	
Runoff Impervious Areas (mm/yr)	418	418	
Total Runoff (mm/yr)	502	502	
TOTAL OUTPUTS (mm/yr)	933	933	
Difference (INPUTS-OUTPUTS)	0	0	
Inputs (Volumes)			
Precipitation (m^3/yr)	952	6,389	7,341
TOTAL INPUTS (m^3/yr)	952	6,389	7,341
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	426	2,862	3,289
Evapotranspiration (m^3/yr)	525	3,527	4,052
Infiltration (m^3/yr)	341	0	341
Impervious Infiltration (m^3/yr)	0	2,296	2,296
Total Infiltration (m^3/yr)	341	2,296	2,637
Runoff Pervious Areas (m^3/yr)	85	161	246
Runoff Impervious Areas (m^3/yr)	0	2,057	2,057
Total Runoff (m^3/yr)	85	2,218	2,303
TOTAL OUTPUTS (m^3/yr)	952	6,389	7,341
Difference (INPUTS-OUTPUTS)	0	0	0

Determine Minimum Sizing of Infiltration Gallery

Table 4.4: Minimum Soil Percolation Rates

Soil Type	Percolation Rate (mm/h)
sand	210
loamy sand	60
sandy loam	25
loam	15

$$d_{r\,max} = i * t_s / V_r$$

Where:

- $d_{r\,max}$ = Maximum stone reservoir depth (mm)
- i = Infiltration rate for native soils (mm/hr)
- V_r = Void space ratio for aggregate used (typically 0.4 for 50 mm clear stone)
- t_s = Time to drain (design for 48 hour time to drain is recommended)

$$A_f = WQV / (d_r * V_r)$$

Where:

- A_f = Footprint surface area (m^2)
- WQV = Water quality volume (m^3)
- d_r = Stone reservoir depth (m)
- V_r = Void space ratio for aggregate used (typically 0.4 for 50 mm clear stone)

Soil Type

Tioga Sandy Loam

Volume Required:	35	m^3
Assumed Porosity:	0.4	
Percolation Rate:	25	mm/h
Percolation Rate (w/ F.S.):	10	mm/h
Area Req'd (48hr):	87.5	m^2
Maximum Depth:	1.2	m
Provided Infiltration Footprint:	100	m^2

Therfore, as the provided footprint is slightly larger than the required footprint for a 48hr drawdown, the drawdown time is about 48 hours.

Phosphorous Concentrations by Land Use

	High Intensity		Transition		Forest		
Average Total P (kg/ha/year)	1.32		0.07		0.06		

Pre-Development Condition

Total Annual Rainfall Percipitation 933.0 mm

	High Intensity	Transition	Forest
Area (ha):	0	0.7868	0
Total P (kg/yr) :	0.00	0.06	0.00

Total Pre-Development P (kg) : 0.06

Post Development Condition - Untreated

	High Intensity	Transition	Forest
Area (ha):	0.7868	0	0
Total P (kg/yr) :	1.04	0.00	0.00

Total Post Development P (kg/yr) : 1.04

Phosphorous Concentrations by Land Use

	High Intensity		Transition		Forest		
Average Total P (kg/ha/year)	1.32		0.07		0.06		

Post Development Condition - Treated

	Infiltration	Uncontrolled Release
Area (ha):	0.6848	0.1020
Total P (kg/yr) :	0.90	0.13
Without Treatment		
Total Post Development P (kg/yr) :	1.04	
With Treatment		
Treatment Train Approach Efficiency :	85.2	63
P Removed (kg/yr) :	0.77	0.08
Total Post Development P (kg/yr) :		**0.18**

Calculation of Treatment Train Efficiency				
	% Passed	100	100	100
Infiltration				
	Removal Efficiency	60	0	0
	% Passed	40	100	100
OGS				
	Removal Efficiency	0	0	0
	% Passed	40	100	100
Downstream Pond				
	Removal Efficiency	63	63	63
	% Passed	14.8	37	37
Aggregate Removal Efficiency		85.2%	63.0%	63.0%

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	8/18/2016
Project Name	TAP Fitness
Project Number	136-100
Location	Barrie

Designer Information

Company	Gerrits Enginering
Contact	Jeff McCuaig

Notes

N/A

Drainage Area

Total Area (ha)	2.05
Imperviousness (%)	75

The Stormceptor System model STC 5000 achieves the water quality objective removing 80% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	BARRIE WPCC
State	ON
ID	557
Years of Records	1968 to 2003
Latitude	44°23'N
Longitude	79°41'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	55
STC 750	67
STC 1000	67
STC 1500	68
STC 2000	74
STC 3000	75
STC 4000	79
STC 5000	**80**
STC 6000	83
STC 9000	86
STC 10000	86
STC 14000	89

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

Fine (organics, silts and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
20	20	1.3	0.0004					
60	20	1.8	0.0016					
150	20	2.2	0.0108					
400	20	2.65	0.0647					
2000	20	2.65	0.2870					

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

APPENDIX B

GEOTECHNICAL INVESTIGATIONS 76 BRYNE DRIVE – WSP JUNE 2016

GERRITS ENGINEERING LIMITED

GEOTECHNICAL INVESTIGATION

76 BRYNE DRIVE, BARRIE, ONTARIO

CONFIDENTIAL

JUNE 2016

WSP

GEOTECHNICAL INVESTIGATION

76 BRYNE DRIVE, BARRIE, ONTARIO

Gerrits Engineering Limited

Final Report

Project nº : 161-05741-00
Date : June 2016

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TABLE OF CONTENTS

TABLES

DRAWINGS

ENCLOSURES

APPENDICES

1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Cassie Frengopoulos of Gerrits Engineering Limited to undertake a Geotechnical Investigation for the proposed commercial development at 76 Bryne Drive in Barrie, Ontario. The property is currently vacant

The property is located at the south end of the north section of Bryne on the west side and south of Essa Road. The location of the proposed commercial development is shown on the attached **Site Location Plan - Drawing 1.** A topographic survey by Rudy Mak Surveying Ltd., including the proposed building was provided to WSP and is enclosed in **Appendix A**.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions through the advancement of six (6) boreholes and based upon the findings of the boreholes provide geotechnical recommendations pertaining to the design of the foundation, slab, service installation and driveway/parking.

This report is provided on the basis of the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The site investigation and recommendations follow generally accepted practice for Geotechnical Consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Cassie Frengopoulos of Gerrits Engineering Limited. Third party use of this report without WSP consent is prohibited.

2 FIELD AND LABORATORY WORK

The field investigation consisted of drilling six (6) boreholes (BH-1 to BH-6) at the site on May 24, 2016, as shown on the attached **Borehole Plan - Drawing 2**. Four (4) boreholes were drilled to a depth of five (5.0) meters and two (2) boreholes were drilled to a depth of 3.5 meters below existing ground surface with solid stem continuous flight auger equipment, supplied and operated by a drilling sub-contractor under the direction and supervision of WSP personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows required to drive the sampler a 0.3 m depth into the undisturbed soil (SPT 'N' values) gives an indication of the compactness condition or consistency of the sampled soil material. The SPT 'N' values are indicated on the Borehole Logs - **Enclosures 1-6**.

Soil samples were visually classified in the field and re-evaluated by a senior engineer in our laboratory. All soil samples were tested for moisture contents. Laboratory Grain Size Analyses were carried out on four samples and the results are enclosed in **Enclosures 7 & 8**.

Water level observations were made during the drilling and in the open boreholes upon the completion of drilling operations. A groundwater standpipe was installed at three (3) borehole locations (BH-1, BH-2 & BH-3) advanced for this investigation. The standpipe locations are shown on the Borehole Plan - **Drawing 2**.

The surface elevation at each borehole location was referenced to the Topographic Survey of Part of Lots 13, 14 and 15 and part of Myers Court, Registered Plan 51M-369, City of Barrie; Dated May 17, 2016. A fire hydrant located directly in front of the site along Bryne Drive, having an elevation of 289.50 masl as established by the Rudy Mak Survey, was utilized as a site Bench Mark. The resulting elevations of each borehole are shown on the Borehole Plan and each log.

3 SITE AND SUBSURFACE CONDITIONS

The subject site is located at 76 Bryne Drive. Details of the subsurface conditions encountered are presented on the Borehole Logs and summarized in the following sections.

3.1 SOIL CONDITIONS

Surface Cover: The surface cover at BH-1, BH-5 and BH-6 included between 5 and 10 cm of topsoil. It should be noted that topsoil quantities should not be calculated from the borehole information, as large variations in depth may exist between boreholes.

Sand with trace Silt: A deposit of Sand with trace Silt was encountered at each borehole. The deposit extended beyond the final depths investigated at BH-2 to BH5. The deposit frequently exhibited distinct layering with occasional seams of predominant sand or silt and an occasional layer of clay at approximately 4.6 m at BH-3. The overall deposit was generally brown in colour and generally in moist condition (i.e. above the water table) with Moisture Contents ranging from 3 to 24%.

Grain size analyses of samples from the deposit indicated a range of 48 - 91% sand, 9 - 52% silt. These results are presented on the attached Grain Size Distribution Analyses, **Enclosures 7 & 8**.

Standard Penetration Tests performed in this deposit yield 'N'-values generally ranging from 4 to 48 blows/0.3 m penetration, indicating the deposit varied from loose to compact.

Silt with some Sand: Below the sand with trace silt at BH-1 was a deposit of silt with some sand that extended beyond the final depth investigated. The Moisture Content of this silt varied between 18 to 23% indicating a generally wet condition; while the Compactness Condition of this deposit was generally considered compact to dense.

Grain size analysis of the sample from the silt with some sand deposit indicated 82% silt (& clay) and 18% sand. These results are presented on the attached Grain Size Distribution Analyses, **Enclosures 7 & 8**.

3.2 GROUNDWATER CONDITIONS

Three (3) 19 mm standpipes were installed in BH-1, BH-2 & BH-3, as shown on the Borehole Plan with water levels ranging between 3.2 and 3.8 meters below ground surface. Seepage was found at BH-4 to BH-6 ranging between 2.9 & 3.7 m below the existing ground level during the drilling operation. The standpipes were monitored on June 1, 2016 and there appeared to be no change in the water levels. Based upon this observation, the current groundwater elevation was recorded at approximately 286.3-287.0 masl. The groundwater elevation will be expected to vary dependent on time of year and rain events.

Based upon the information available to date, it is our opinion that sump pumps will control seepage encountered in short-term (shallow) excavations less than three meters in depth. However, sand deposits are highly water bearing and a more elaborate system of interconnected sumps or, depending upon depth, a vacuum well point dewatering system will be required for deeper excavations extended below the groundwater level currently recorded.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Further monitoring of the groundwater level is recommended.

4 DISCUSSION AND RECOMMENDATIONS

4.1 THE SITE AND GENERAL DISCUSSION

The property is relatively flat lying with a gentle slope to the north. Grass and shrubs are found on the site.

The site is located in the City of Barrie, south southeast of Essa Road on the west side of Bryne Drive. The area surrounding the property is grassed covered. A surface cover of topsoil overlay an original compact to dense sand with trace silt at all six boreholes. Groundwater was encountered within the piezometers installed in BH-1 to BH-3 and the water level was measured between 3.2 to 3.9 m below the existing ground surface, eight days after field drilling operations.

Based on information provided by Gerrits Engineering Limited, it is our understanding that the proposed commercial building, as depicted on the Borehole Plan, will be located along the west portion of the subject property.

4.2 EXCAVATIONS AND GROUNDWATER CONTROL

Based upon the subsurface conditions revealed at the boreholes, excavations can be carried out with heavy hydraulic back-hoes. We do advise due to the rolling nature of the ground surface as well as observed construction debris that provision be carried in the contract for the excavation and disposal of obstructions dumped on site – construction debris. Based on the borehole information, no major problems with respect to groundwater control is anticipated for shallow excavations for the proposed slab on grade building or driveway/parking lot areas. Perched water seepage emanating from layered materials, if encountered within a depth of three meters, should diminish and would generally be controlled by pumping from a conventional sump and pump arrangement at the base of the excavation.

All temporary excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the silty sand till would be classified as Type 2 soil above the ground water table.

The select inorganic fill and native soils free from topsoil and organics can be re-used as general construction backfill. Loose lifts of soil, which are to be compacted, should not exceed 200 mm. Imported granular fill, which can be compacted with hand held equipment, should be used in confined areas.

We do advise that due to the elevated silt content, most of the excavated soils are considered frost susceptible and moisture sensitive therefore imported material is recommended for use as fill. Furthermore, we recommend any site soil proposed for reuse should be assessed and approved. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

Finally, we stress that the excavated site soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

4.3 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all topsoil and any organic, weathered or otherwise unsuitable soils. Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of qualified geotechnical personnel, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by a representative of WSP. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Owing to the silty nature of the subsoil at the site, proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial for this project. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 300 mm of the subgrade. The compaction of the new fill should be checked by frequent field density tests.

4.4 FOUNDATIONS

BH-1 to BH-4 were drilled within the proposed addition area, BH-5 was drilled within the proposed driveway and BH-6 was drilled within the proposed parking lot area within expected servicing area. Based upon field testing and observations, it is our considered opinion that the proposed building may be supported by conventional spread and strip footings founded on the compact to dense sand with trace silt. Furthermore, Standard Penetration Testing has established that a Design Bearing Resistance of 200 kPa at the Serviceability Limit States (SLS), and for a factored geotechnical resistance of 300 kPa at the Ultimate Limit States (ULS).

The bearing values and the corresponding founding elevations at the borehole locations are summarized on **Table 1**.

Table 1: Bearing Values and Founding Levels for Spread and Strip Footings

BH No.	Material	Bearing Capacity at SLS(kPa)	Factored Geotechnical Resistance at ULS(kPa)	Minimum Depth below Existing Ground (m)	Founding Level At or Below Elevation (m)	Note (if any)
BH-1	Sand	200	300	1.8	288.0	
BH-2	Sand	200	300	1.3	288.5	

BH No.	Material	Bearing Capacity at SLS(kPa)	Factored Geotechnical Resistance at ULS(kPa)	Minimum Depth below Existing Ground (m)	Founding Level At or Below Elevation (m)	Note (if any)
BH-3	Sand	200	300	1.3	289.6	
BH-4	Sand	200	300	1.5	289.0	

Footings designed to the SLS Bearing Resistance provided are expected to settle less than 25 mm total and 13 mm differential.

We do advise that all footings exposed to seasonal freezing conditions must have at least 1.2 meters of soil cover for frost protection. Furthermore, in the vicinity of any existing buried utilities all footings must be lowered to undisturbed native soils or alternatively the services must be structurally bridged.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended bearing resistance have been calculated by WSP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

4.5 FLOOR SLABS AND PERMANENT DRAINAGE

The floor slab may be supported on the stripped grade provided the subgrade is thoroughly proof rolled and any soft and unstable areas detected are sub-excavated and replaced with compacted fill materials. Fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to at least 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab. This moisture barrier has been proven to be effective for conventional floor surfaces such as carpet, vinyl tile and ceramic tile. However, if special floor coverings such as sheet P.V.C. with heat sealed seams, as is used in gymnasiums, is considered, either a high efficiency vapour barrier or venting may be required to prevent moisture accumulating between the concrete floor and the P.V.C. flooring.

4.6 EARTHQUAKE CONSIDERATIONS

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2006). The classification is based on the determination of the average shear wave velocity in the top 30 meters of the site stratigraphy, where shear wave velocity measurements have been taken or alternatively estimated on the basis of rational analysis of un-drained shear strength or penetration resistance.

At this site, the shallow stratigraphy includes predominately fine sand with silty layers and silt that extended beyond the final depth investigated. More specifically, penetration resistances below the sand in the upper

five meters ranged from 4 to 48 blows per 300 mm of penetration, generally increasing with depth. Our experience in this area has revealed deeper stratigraphy continues compact to dense with increased depth and bedrock present beyond a depth of 30 meters.

When considering the five meter maximum depth boreholes at this site, it is our opinion that the Average Standard Penetration Resistance (N_{60}) can be taken as 15 and 50. Therefore for seismic design purposes, the site designation for seismic analysis is Class D (OBC 4.1.8.4 Table 4.1.8.4.A.).

4.7 UNDERGROUND SERVICES

4.7.1 TRENCHING, EXCAVATION, TRENCH SUPPORT

In general, excavations will be carried out through compact silty sand/sand. Excavation of the overburden material can be carried out with heavy hydraulic backhoe. Major problems with groundwater are not anticipated for installation of underground services less than three (3.0) meters in depth and any seepage which occurs from wet sand seams / layers or perched water should be removed by pumping from sumps. However, the contractor should be prepared to employ more elaborate dewatering procedures if flow from sand seams / perched water becomes severe.

Also, provisions must be made in the excavation contract for the removal of possible obstructions.

All excavations should be carried out in accordance with the Construction Safety Act of the Province and excavation should conform to the Ontario Reg. 213/91 for Construction projects. The native undisturbed soil would be a considered a Type 3 soil. Where the existing fill is deeper or uncompacted (loose), the side slopes in these sections will have to be flattened. If steep side slopes are required, the sides should be supported by using braced trenching boxes meeting OHSA requirements. .

The lateral earth pressure for the design of shoring or trench boxes can be estimated from the following expression:

$$p = K (\gamma h + q)$$

where p = lateral earth pressure in kPa acting at depth h

K = earth pressure coefficient, assumed to be 0.5

γ = unit weight of backfill, a value of 20 kN/ cu.m may be assumed

h = depth to point of interest in meters

q = equivalent value of surcharge on the ground surface in kPa

4.7.2 BEDDING MATERIAL

The compact silty sand encountered in the boreholes will provide adequate support for underground services and will allow the use of normal Class B type bedding. The bedding should conform to the current Ontario Provincial Standard specifications and/or standards set by the local municipalities. At locations where an existing loose fill is encountered or considered unsuitable below the invert level, this material should be removed and replaced with compacted suitable fill.

The minimum bedding thickness should be 150 mm but this should be increased as dictated by the pipe diameter and/or aforementioned specifications. In addition, where the subgrade is wet, the minimum bedding thickness should be increased to 250 mm.

It is recommended that the bedding material consist of well-graded granular material such as Granular ‘A’ (OPSS 1010).

4.8 PAVEMENT CONSTRUCTION

The investigation has shown that the predominant native subgrade soil, after stripping of topsoil, fill or unsuitable subsoil, will generally consist of sand with some silt.

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.8.1 PAVEMENT SECTIONS

The recommended pavement structures provided in Table 2 are based upon an estimate of the ultimate subgrade soil properties determined from visual examination and textural classification of the soil samples. The values may need to be adjusted based on the town/city standards. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of 15 years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Table 2: Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Light Duty Parking (Cars)	Heavy Duty Pavement (Delivery Trucks)
Asphaltic Concrete	92.0 to 96.5% Max Relative Density (MRD)	40 mm OPSS HL 3 50 mm OPSS HL 8	40 mm OPSS HL 3 80 mm OPSS HL 8
OPSS Granular A Base (or 20mm Crusher Run Limestone)	100% SPMDD*	150 mm	150 mm
OPSS Granular B	100% SPMDD	300 mm	3050 mm

- Denotes Standard Proctor Maximum Dry Density, ASTM-D698

The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed sections before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic. The subgrade must be compacted to 98% SPMDD for at least the upper 300 mm unless accepted by WSP.

The long term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-

emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening. This is particularly important in heavy-duty pavement areas.

Additional comments on the construction of parking areas and access driveways are as follows:

1. As part of the subgrade preparation, proposed parking areas and access driveways should be stripped of topsoil and other obvious objectionable material. Fill required to raise the grades to design elevations should conform to backfill requirements outlined in previous sections of this report. The subgrade should be properly shaped, crowned then proof-rolled in the full time presence of a representative of this office. Soft or spongy subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98% SPMDD.
2. The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed lot grading. Assuming that satisfactory cross falls in the order of two percent have been provided, sub drains extending from and between catch basins may be satisfactory. In the event that shallower cross falls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by WSP.
3. The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted access lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.
4. It is recommended that WSP be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations of this report.

5 SLOPE STABILITY ASSESSMENT

5.1 SITE DESCRIPTION

The section of property under investigation is relatively flat lying with a gentle slope to the north. Grass and shrubs are found on the site plateau. Based on information provided by Gerrits Engineering Limited, it is our understanding that the proposed commercial building, as depicted on the Borehole Plan, will be located along the west portion of the subject property.

Further west of the proposed building is shallow slope that extends down to a creek over a distance of approximately 40 to 45 m. Also based upon the topographic features provided by Rudy Mak Surveying Ltd. (RMS), the plateau is situated less than 10 meters above the valley floor and creek.

The slope surface included mature trees of varying species. Trees especially those with vertical trunk orientation would suggest that the integrity of the slope has not been compromised over the lifetime of the tree. At this site, numerous straight and vertical trees were situated on the slope. Some fallen trees were observed but at this site they were considered to a have fallen due to a rotten core.

Although groundwater was encountered within the piezometers installed in BH-1 to BH-3 and the water level was measured between 3.2 to 3.9 m below the existing ground surface, no groundwater seeps were observed on the slope surface.

5.2 SLOPE GEOMETRY

The referenced datum elevations of the Top and Bottom of the Slope, as shown on the topographic information provided were established as follows:

Top of Slope: 288.93-289.62 meters
Bottom of Slope: 281.21-285.58 meters

Based upon site observations and the Topographic Survey provided by the RMS (**Appendix A),** the top of slope is currently located approximately 14 to 25 meters from the toe. Therefore as shown in **Table 3**, the overall pre-development slope appears to be inclined at a degree in the order of 16° to 23° (2.4-3.5:1, horizontal: vertical) at the topographic sections completed. The pre development sections are shown on the enclosed Slope Section Plan, **Drawing 3,** and resulting Cross Sections A-A'-C-C', **Drawings 4 - 6**. Based upon the Cross Sections, it is our considered opinion that a representative portion of the overall slope was reviewed relative to the proposed structure.

Table 3 Slope Inclination

Cross Section	Length (m)	Top of Slope Elevation (m)	Toe of Slope Elevation (m)	Height (m)	Inclination of Slope		
					Horiz.	Vertical	Angle
A-A'	14.5	288.93	282.83	6.1	2.4	1	23°
B-B'	25.6	289.32	281.56	7.8	3.3	1	17°
C-C'	13.9	289.62	285.58	4.0	3.5	1	16°

5.3 SLOPE STABILITY

The Geotechnical Investigation has established that the original subsurface soils are comprised predominantly of sand with silt layers. Furthermore, the sand was found to predominantly exist in a compact to dense state. The Angle of Internal Friction for the sand, as described, are in the order of 35°. The angle for the sand further correspond to an order of inclination of approximately 1.4:1. Finally, since no groundwater was evident seeping from the slope during the field visual assessment, it is not anticipated that groundwater will have an impact on the stability of the slope.

Since the overall slope is inclined at a degree in the order of 3:1 or less, the slope height is less than ten meters, there is no evidence of slope activity and the soil present is capable of a stability at steeper inclination; it is our considered opinion that the slope is stable.

Nevertheless, vegetation on the slope must be both maintained and promoted to resist the effects of erosion from surface run-off and surface run-off from the developed site must not be directed over the top of slope.

5.4 TOE EROSION

A small creek flows within a valley corridor that is situated approximately 20 meters from the Toe of Slope below the subject property. Consequently, the property represents a Confined System in which the Erosion Hazard Limit must also be assessed for an allowance for toe erosion.

The Natural Hazard Considerations required allowance for toe erosion in a Confined System where the bank material is comprised of sand and/or silt is 1 - 2 meters where no evidence of active erosion is apparent and the river bank full width is less than 5 meters.

5.5 EROSION ACCESS ALLOWANCE

The Natural Hazard Guideline requires a six (6) meter allowance for Erosion Access. Currently, the structure is proposed at a location seven (7) meters from the Top of Slope.

6 GENERAL COMMENTS

WSP should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, WSP will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions for the boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

7 LIMITATION OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to WSP at the time of preparation. Unless otherwise agreed in writing by WSP, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the borehole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the borehole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

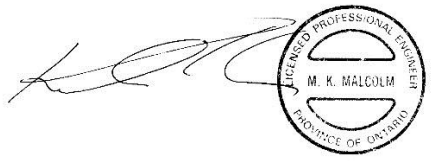
We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

SIGNATURES

PREPARED BY

Brian Cooper
Environmental Technologist

REVIEWED BY



Kent Malcolm, P. Eng.
Principal Engineer
Manager, Barrie Office

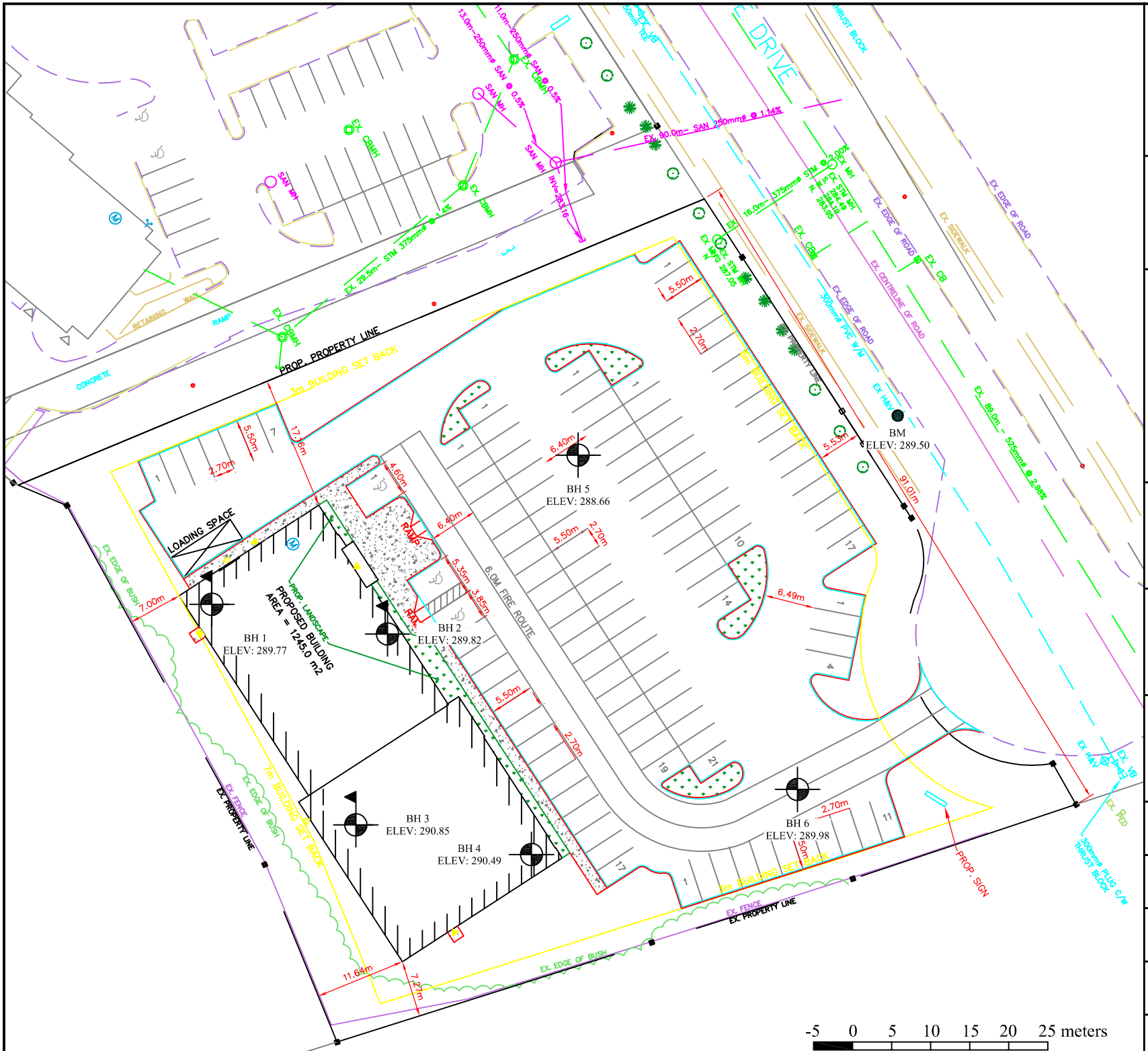
Drawings

Drawing 1:	Site Location Plan
Drawing 2:	Borehole Plan
Drawing 3:	Section Plan
Drawing 4:	Cross Section A-A’
Drawing 5:	Cross Section B-B’
Drawing 6:	Cross Section C-C’

SITE LOCATION PLAN

287 Tiffin Street, Unit 10
Barrie, ON L4N 7R8
T: 705-722-4638
F: 705-722-4958

Date: June 2016	**GEOTECHNICAL INVESTIGATION** 76 BRYNE DRIVE BARRIE, ONTARIO	Prepared by: KY Reviewed by: KM
Project: 161-05741-00	Prepared for: Gerrits Engineering Limited	Drawing No. **1**



WSP
287 Tiffin Street, Unit 10
Barrie, Ontario, L4N 7R8
TEL: (705) 722-4638
FAX: (705) 722-4958

NOTES

ALL MEASUREMENTS ARE IN METERS.

BASE PLAN PROVIDED BY GERRITS ENGINEERING LIMITED.

LEGEND:

BOREHOLE

BENCHMARK (BM)

STANDPIPE

TITLE

BOREHOLE PLAN

PROJECT NAME

**76 BRYNE DRIVE
BARRIE, ON**

CLIENT

GERRITS ENGINEERING LIMITED.

PROJECT NUMBER

161-05741-00

DRAWING

2

SCALE

AS SHOWN

DATE

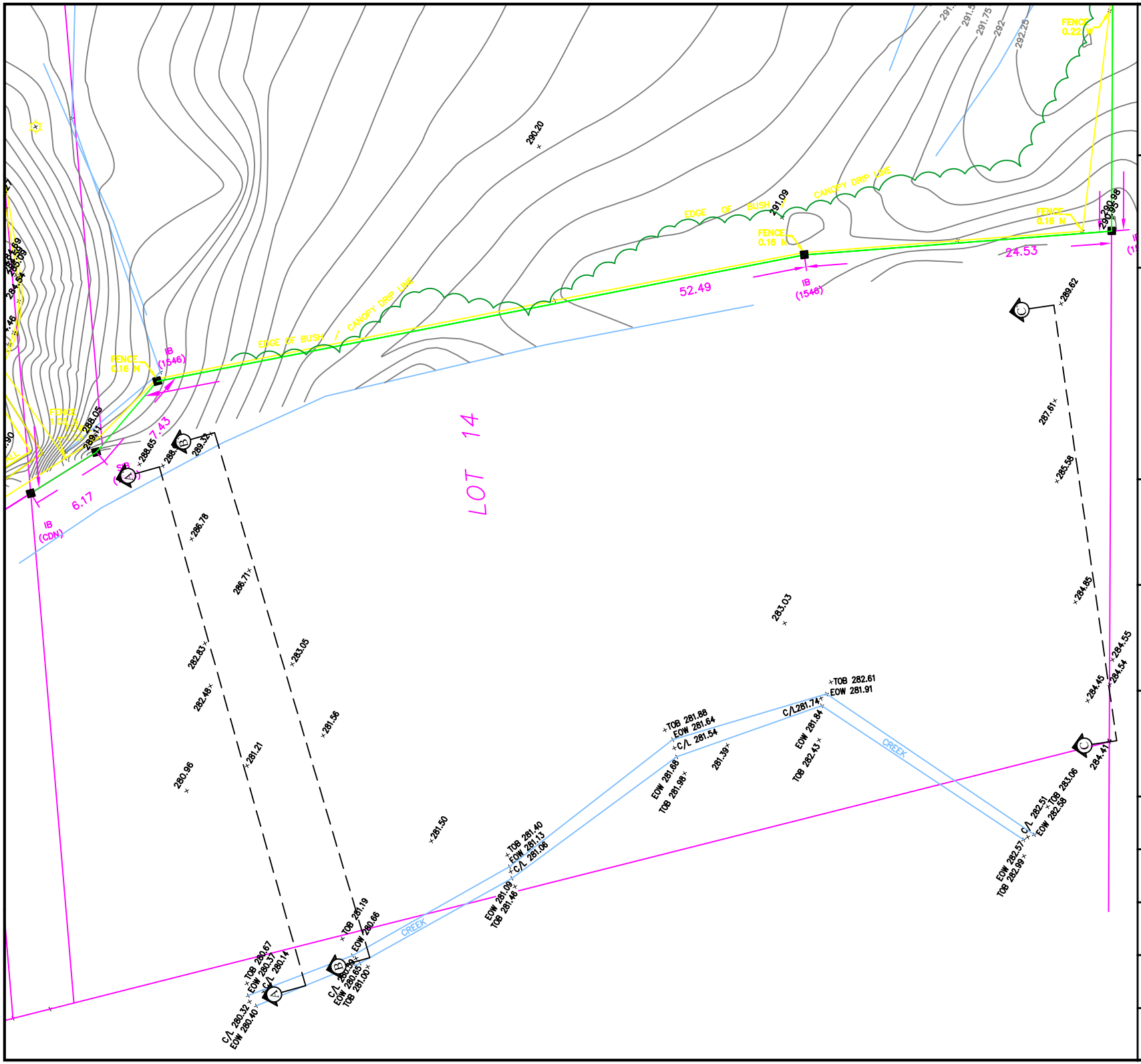
JUNE 13, 2016

DRAWN BY

A.Z.

CHECKED BY

B.C./K.M.



WSP

287 Tiffin Street, Unit 10
Barrie, Ontario, L4N 7R8
TEL: (705) 722-4638
FAX: (705) 722-4958

NOTES

ALL MEASUREMENTS ARE IN METERS.

BASE PLAN PROVIDED BY RUDY MAK SURVEYING LTD.

LEGEND:

----- SECTION LINE

TITLE

SECTION PLAN

PROJECT NAME

**76 BRYNE DRIVE
BARRIE, ON**

CLIENT

GERRITS ENGINEERING LIMITED

PROJECT NUMBER

161-05741-00

DRAWING

3

SCALE

NTS

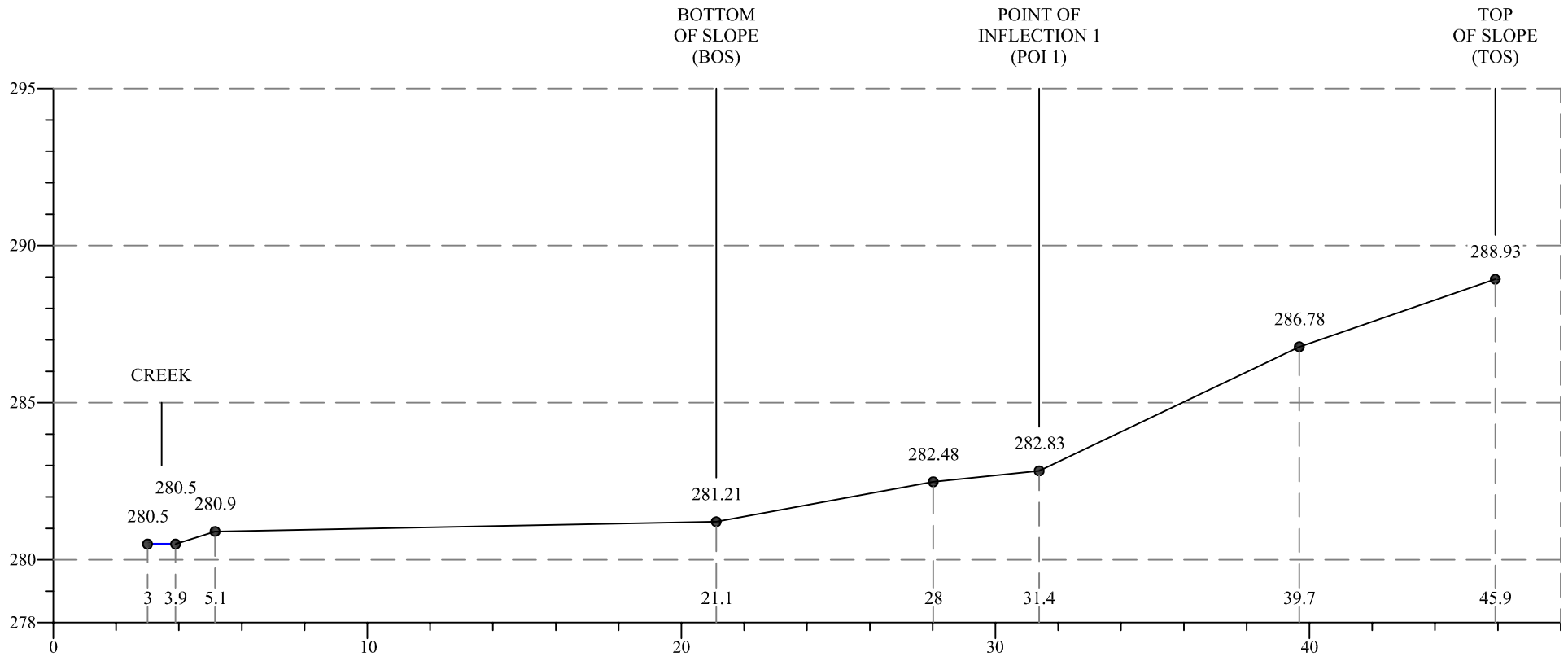
DATE

JUNE 13, 2016

DRAWN BY	CHECKED BY
A.Z.	K.M.

SLOPE DETAILS:

Vertical Exaggeration= 1
TOS to POI 1, 2.4: 1, 23°
POI 1 to BOS, 6.3: 1, 9°
TOS to BOS, 3.2: 1, 17°



CROSS SECTION A-A`

NOTES

ALL MEASUREMENTS ARE IN METERS.

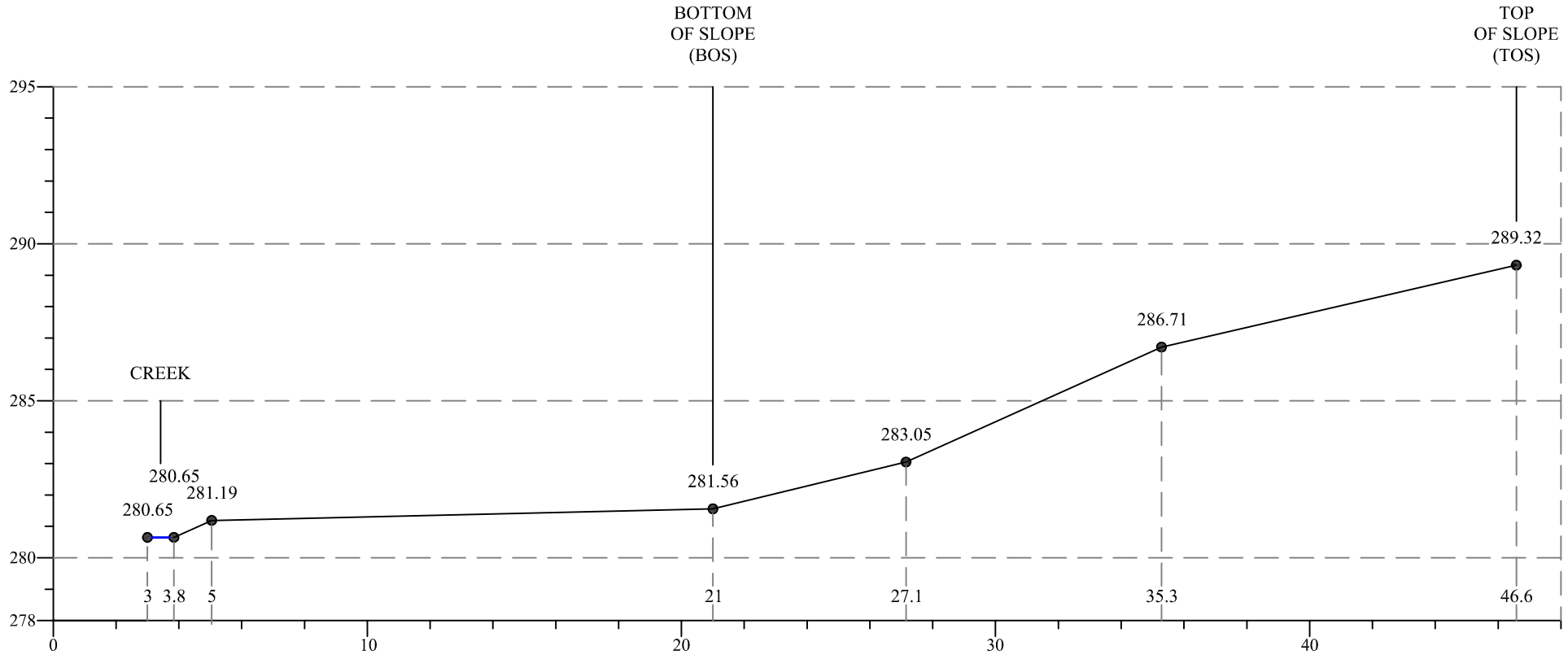
ELEVATIONS OBTAINED FROM BASE PLAN PROVIDED BY RUDY MAK SURVEYING LTD.

WSP
287 Tiffin Street, Unit 10
Barrie, Ontario, L4N 7R8
TEL: (705) 722-4638
FAX: (705) 722-4958

PROJECT:	76 BRYNE DRIVE, BARRIE, ON	DATE: JUNE 13, 2016	DRAWING: 4
CLIENT:	GERRITS ENGINEERING LIMITED	PROJECT Nº: 161-05741-00	SCALE: NTS

SLOPE DETAILS:

Vertical Exaggeration= 1
TOS to BOS, 3.3: 1, 17°



CROSS SECTION B-B`

NOTES

ALL MEASUREMENTS ARE IN METERS.

ELEVATIONS OBTAINED FROM BASE PLAN PROVIDED BY RUDY MAK SURVEYING LTD.

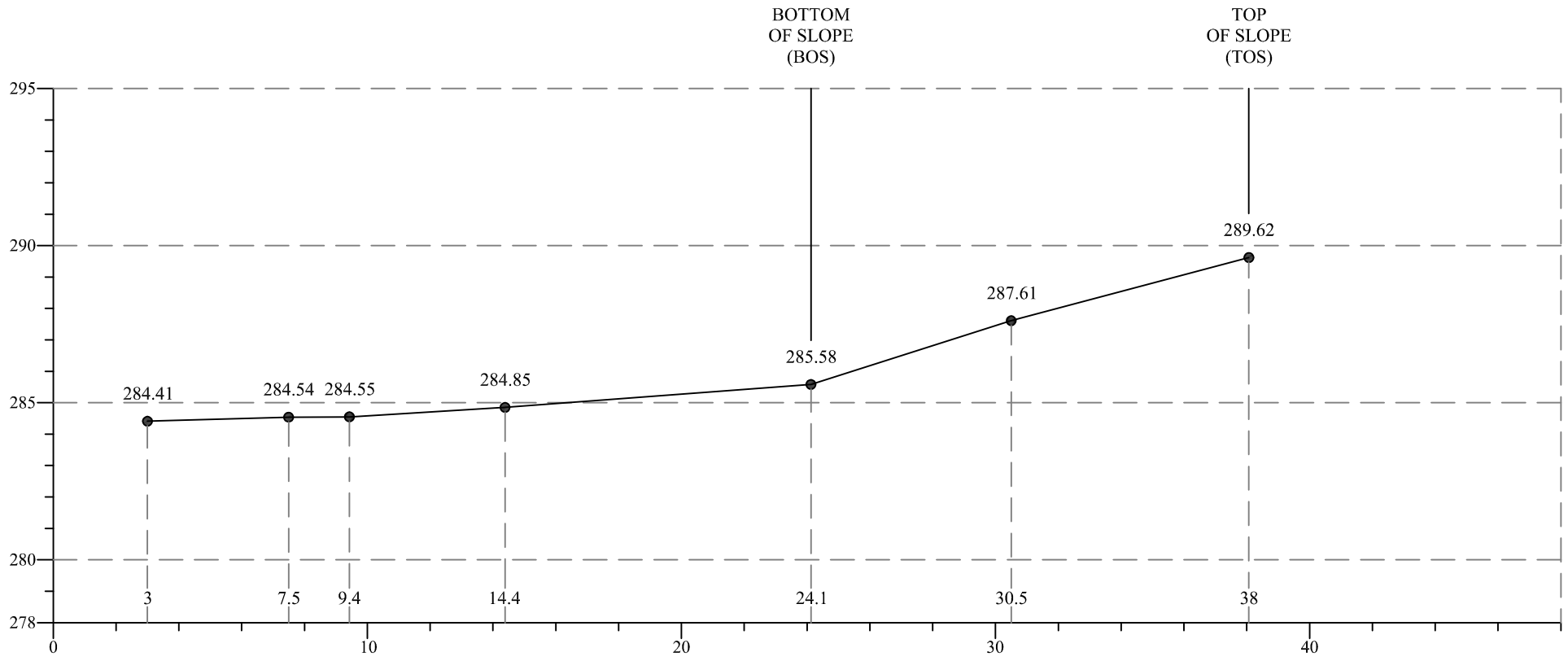
WSP

287 Tiffin Street, Unit 10
Barrie, Ontario, L4N 7R8
TEL: (705) 722-4638
FAX: (705) 722-4958

PROJECT: 76 BRYNE DRIVE, BARRIE, ON	
CLIENT: GERRITS ENGINEERING LIMITED	
DATE: JUNE 13, 2016	DRAWING: 5
PROJECT Nº: 161-05741-00	SCALE: NTS

SLOPE DETAILS:

Vertical Exaggeration= 1
TOS to BOS, 3.5: 1, 16°



CROSS SECTION C-C`

NOTES

ALL MEASUREMENTS ARE IN METERS.

ELEVATIONS OBTAINED FROM BASE PLAN PROVIDED BY RUDY MAK SURVEYING LTD.

WSP
287 Tiffin Street, Unit 10
Barrie, Ontario, L4N 7R8
TEL: (705) 722-4638
FAX: (705) 722-4958

PROJECT:	76 BRYNE DRIVE, BARRIE, ON	DATE: JUNE 13, 2016	DRAWING: 6
CLIENT:	GERRITS ENGINEERING LIMITED	PROJECT Nº: 161-05741-00	SCALE: NTS

Enclosures

Enclosures 1-6:	Borehole Logs
Enclosures 7 & 8:	Grain Size Analyses

LOG OF BOREHOLE BH-1

PROJECT: Geotechnical Investigation
CLIENT: Gerrits Engineering Ltd.
PROJECT LOCATION: 76 Bryne Drive, Barrie, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 175 mm
Date: May/24/2016

REF. NO.: 161-05741-00
ENCL NO.: 1

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
289.8					
0.0	(5 cm) **TOPSOIL** over **SAND** with trace Silt *brown, moist, loose to compact*	1	SS	4	
289.0					
0.8	Becoming wet	2	SS	8	289
1					
		3	SS	12	288
2					
		4	SS	25	
					287
3					
286.6					
3.2	Becoming dense	5	SS	48	
286.3					
3.5	**SILT** with some Sand and trace Clay *grey, wet, compact to dense*				W. L. 286.3 m
					W. L. 286.3 m
					286
4		6	SS	26	
		7	SS	32	285
284.7					
5.0	**END OF BOREHOLE** Hole open and dry upon completion 19 mm Piezometer installed to 5.0 meters Water at 3.47 on May 24, 2016 Water at 3.52 on June 1, 2016				

SPT/DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED
● QUICK TRIAXIAL
+ FIELD VANE & Sensitivity
× LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

18 82

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG-SPT PLOT 161-05741-00 BH.GPJ SPL.GDT 6/21/16

LOG OF BOREHOLE BH-2

PROJECT: Geotechnical Investigation
CLIENT: Gerrits Engineering Ltd.
PROJECT LOCATION: 76 Bryne Drive, Barrie, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 175 mm
Date: May/24/2016

REF. NO.: 161-05741-00
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT/DYNAMIC CONE PENETRATION RESISTANCE PLOT; SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
289.8											
0.0	**SAND** with trace Silt *brown, moist, loose to compact*	1	SS	9			9				
		2	SS	15		289	15				
		3	SS	27		288	27				
287.5											
2.3	Becoming saturated and dense	4	SS	35			35				91 9
		5	SS	40	W. L. 286.7 m W. L. 286.6 m	287	40				
		6	SS	17		286	17				
		7	SS	25		285	25				
284.8											
5.0	**END OF BOREHOLE** Hole open with minor water 19 mm Piezometer installed to 4.3 m Water level at 3.16 on May 24, 2016 Water level at 3.21 on June 1, 2016										

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG-SPT PLOT 161-05741-00 BH.GPJ SPL.GDT 6/21/16

LOG OF BOREHOLE BH-3

PROJECT: Geotechnical Investigation
CLIENT: Gerrits Engineering Ltd.
PROJECT LOCATION: 76 Bryne Drive, Barrie, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 175 mm
Date: May/24/2016

REF. NO.: 161-05741-00
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT/DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
290.9											
0.0	**SAND** with trace Silt *brown, moist to wet, loose to compact*		1	SS	5			5			
	Becoming layered										
1			2	SS	16		290	16			
289.2 1.7	Becoming dense		3	SS	31			31			48 52
2			4	SS	45		289	45			
3			5	SS	46		288	46			
4			6	SS	38	W.L. 287.0 m W. L. 287.0 m	287	38			
286.3 4.6	Occasional clay layers		7	SS	33			33			
285.8 5.0	**END OF BOREHOLE** Hole open with minor water 19 mm Piezometer installed to 4.6 m Water level at 3.83 on May 24, 2016 Water level at 3.89 on June 1, 2016						286				

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG-SPT PLOT 161-05741-00 BH.GPJ SPL.GDT 6/21/16

LOG OF BOREHOLE BH-4

PROJECT: Geotechnical Investigation
CLIENT: Gerrits Engineering Ltd.
PROJECT LOCATION: 76 Bryne Drive, Barrie, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 175 mm
Date: May/24/2016

REF. NO.: 161-05741-00
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	SPT/DYNAMIC CONE PENETRATION RESISTANCE PLOT; SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
290.5												
0.0	**SAND** with trace Silt *brown, moist, loose to compact*		1	SS	5		290	5				
1			2	SS	14			14				
							289					
			3	SS	22			22				
2												
288.2												
2.3	Becoming saturated and dense		4	SS	31		288	31				
3												
			5	SS	25			25				
							287					
4			6	SS	39			39				92 18
							286					
			7	SS	29			29				
285.5												
5.0	**END OF BOREHOLE** Hole open with minor water											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH-5

PROJECT: Geotechnical Investigation
CLIENT: Gerrits Engineering Ltd.
PROJECT LOCATION: 76 Bryne Drive, Barrie, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 175 mm
Date: May/24/2016

REF. NO.: 161-05741-00
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	SPT/DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
288.7											
0.0	(10 cm) **TOPSOIL** over **SAND** with trace Silt *brown, moist, loose to compact*		1	SS	11			11			
							288				
1			2	SS	22			22			
287.0											
1.7	Becoming dense		3	SS	34		287	34			
2											
			4	SS	32			32			
							286				
3			5	SS	23			23			82 18
285.2											
3.5	**END OF BOREHOLE** Hole open with minor water										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH-6

PROJECT: Geotechnical Investigation
CLIENT: Gerrits Engineering Ltd.
PROJECT LOCATION: 76 Bryne Drive, Barrie, ON
DATUM: Geodetic
BH LOCATION:

DRILLING DATA
Method: Solid Stem Auger
Diameter: 175 mm
Date: May/24/2016

REF. NO.: 161-05741-00
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	SPT/DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
290.0											
0.0	(10 cm) **TOPSOIL** over **SAND** with trace Silt *brown, moist, loose to compact*		1	SS	9			9			
			2	SS	13		289	13			
			3	SS	23			23			
			4	SS	22		288	22			
			5	SS	31		287	31			
286.5											
3.5	**END OF BOREHOLE** Hole open with minor water										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

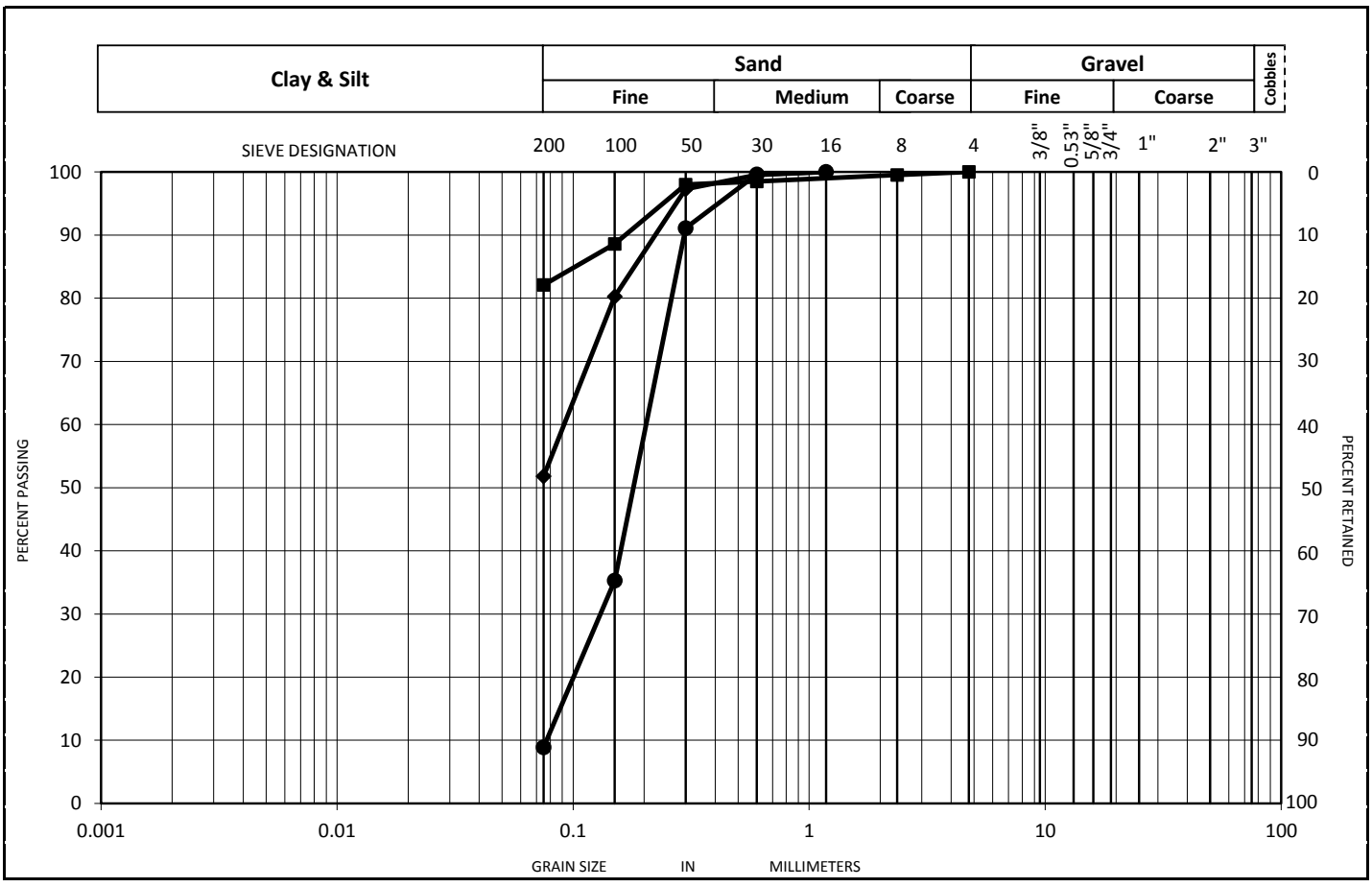
GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

GRAIN SIZE DISTRIBUTION CHART

CLIENT:	Gerrits Engineering Ltd.	**DATE:**	June 2, 2016
		ENCLOSURE N°:	7
PROJECT:	76 Bryne Drive, Barrie, ON	**PROJECT N°:**	161-05741-00
LAB N° / TYPE:	59 / 1 / Native	**DATE SAMPLED:**	May 24, 2016
SAMPLED BY:	B.C.	**DATE RECEIVED:**	May 24, 2016
SAMPLED TYPE:	Split Spoon	**DATE TESTED:**	June 2, 2016
SAMPLED FROM:	BH 1 / 3.8 m Silt with some Sand		BH 2 / 2.2 m Sand with trace Silt
	BH 3 / 1.5 m Silt and Sand		

BH = BoreHole

UNIFIED SOIL CLASSIFICATION SYSTEM *(ASTM D 2487)*

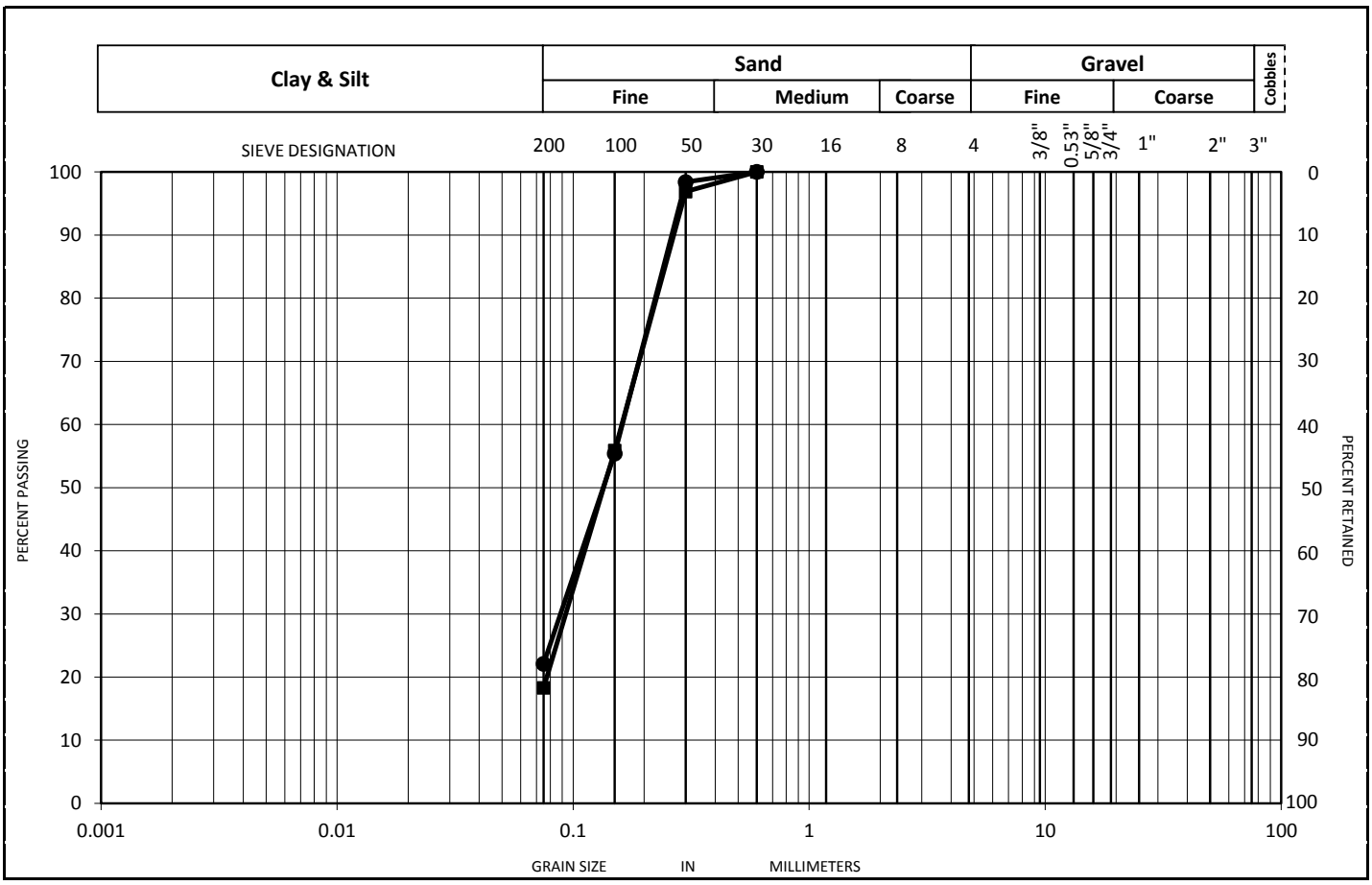


GRAIN SIZE DISTRIBUTION CHART

CLIENT:	Gerrits Engineering Ltd.	**DATE:**	June 2, 2016
		ENCLOSURE N°:	8
PROJECT:	76 Bryne Drive, Barrie, ON	**PROJECT N°:**	161-05741-00
LAB N° / TYPE:	59 / 1 / Native	**DATE SAMPLED:**	May 24, 2016
SAMPLED BY:	B.C.	**DATE RECEIVED:**	May 24, 2016
SAMPLED TYPE:	Split Spoon	**DATE TESTED:**	June 2, 2016
SAMPLED FROM:	BH 4 / 3.8 m Sand with some Silt		BH 5 / 3 m Silty Sand

BH = BoreHole

UNIFIED SOIL CLASSIFICATION SYSTEM *(ASTM D 2487)*



Appendices

Appendix A: Topographic Survey, Rudy Mark Surveying Ltd.

TOPOGRAPHIC SURVEY OF

PART OF LOT 13, 14 AND 15

AND PART OF

MYERS COURT

(CLOSED BY LT300036)

REGISTERED PLAN 51M-369

CITY OF BARRIE

COUNTY OF SIMCOE

SCALE 1 : 300

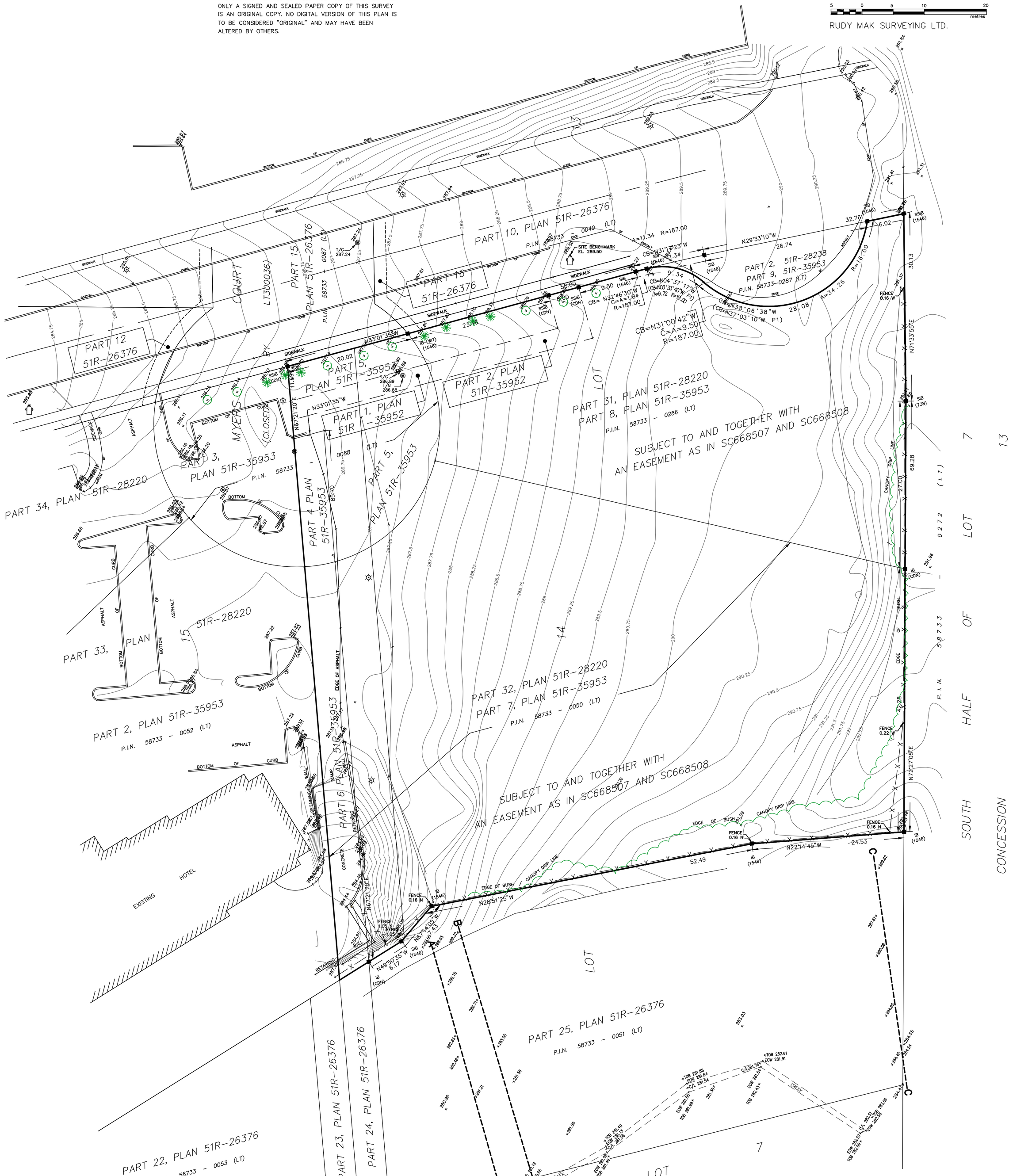
5 0 5 10 20

metres

RUDY MAK SURVEYING LTD.

NOTES:

THIS TOPOGRAPHIC SURVEY PLAN DELINEATES THE FEATURES AS SHOWN AND VISIBLE, GIVEN THE SITE CONDITIONS. CONSTRUCTION ACTIVITY, FROZEN GROUND, SNOW COVER, ETC. MAY HAVE HIDDEN FEATURES OTHERWISE VISIBLE. THE LOCATION OF UNDERGROUND SERVICES, IF SHOWN, WAS DERIVED FROM PLANS OBTAINED FROM OTHER AGENCIES. RUDY MAK SURVEYING CANNOT BE HELD RESPONSIBLE FOR THE LOCATION AND ACCURACY OF UNDERGROUND SERVICES. THE LOCATION OF ALL SERVICES MUST BE VERIFIED ON SITE. ONLY A SIGNED AND SEALED PAPER COPY OF THIS SURVEY IS AN ORIGINAL COPY. NO DIGITAL VERSION OF THIS PLAN IS TO BE CONSIDERED "ORIGINAL" AND MAY HAVE BEEN ALTERED BY OTHERS.



LEGEND

■	DENOTES	FOUND SURVEY MONUMENT
□	DENOTES	PLANTED SURVEY MONUMENT
SIB	DENOTES	STANDARD IRON BAR
SSIB	DENOTES	SHORT STANDARD IRON BAR
IB	DENOTES	IRON BAR
(738)	DENOTES	R. C. KIRKPATRICK, O.L.S.
(1546)	DENOTES	RUDY MAK, O.L.S.
(CDN)	DENOTES	CDN LAND SURVEYORS INC.
☼	DENOTES	LIGHT STANDARD
Ⓜ	DENOTES	MANHOLE
	DENOTES	FIRE HYDRANT
	DENOTES	DECIDUOUS TREE
	DENOTES	CONIFEROUS TREE
C/L	DENOTES	CENTRELINE OF CREEK
EOW	DENOTES	EDGE OF WATER
TOB	DENOTES	TOP OF BANK

BEARING NOTE

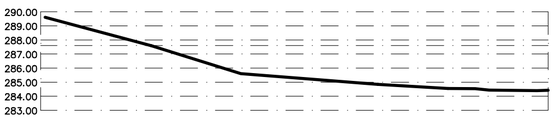
BEARINGS ARE UTM GRID BEARING AND ARE REFERRED TO THE CENTRAL MERIDIAN ZONE 17(81°W) AND ARE DERIVED FROM GPS OBSERVATION IN WGS84 AND CALIBRATED TO NAD 83(ORIGINAL).

ELEVATION NOTE:

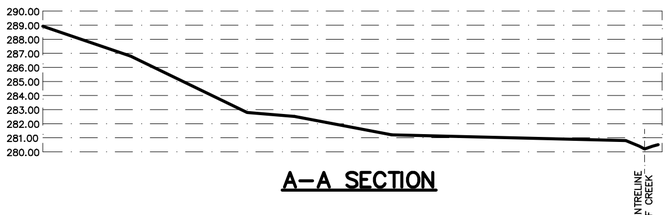
ELEVATIONS ARE REFERRED TO A TOPOGRAPHIC SURVEY COMPLETED BY RUDY MAK SURVEYING LTD. FILE 8889T

BENCHMARK

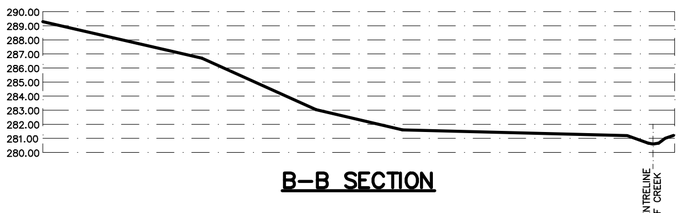
SITE BENCHMARK IS THE TOP OF THE FIRE HYDRANT LOCATED AT THE EASTERN LIMITOF PART 8, PLAN 51R-35953



C-C SECTION



A-A SECTION



B-B SECTION

METRIC

DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

REVISION	BY	DATE
FIRST ISSUE	AP	APR 04/16
ADDED CREEK AND SECTION VIEWS	HFD	MAY 17/16

RUDY MAK SURVEYING LTD.
ONTARIO LAND SURVEYORS
89 BIG BAY POINT ROAD
BARRIE, ONTARIO L4N 8M5 (705) 722-3845
E-MAIL MAIL@MAKSURVEYING.COM

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APPENDIX C

DRAWINGS & FIGURES

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS Canada

SiteASSIST FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

76 BRYNE DR
BARRIE, ON

SC-310 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-310.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE OR POLYETHYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418-16a (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. 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 50 mm (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 F2922 SHALL BE GREATER THAN OR EQUAL TO 400 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2922 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310 SYSTEM

1. STORMTECH SC-310 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-310 & SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

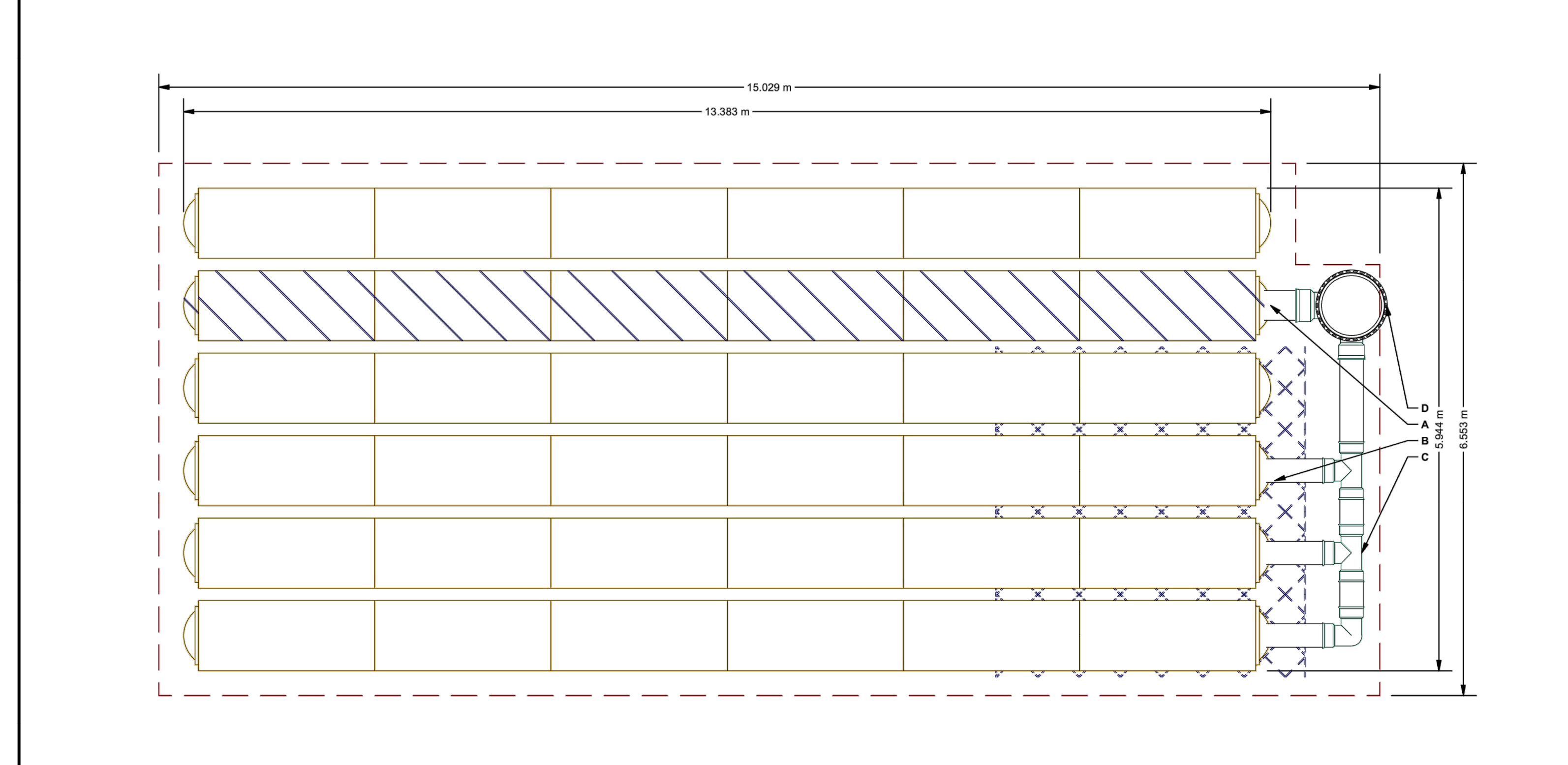
USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
36	STORMTECH SC-310 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	287.847
12	STORMTECH SC-310 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	286.018
152	STONE ABOVE (mm)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	285.866
152	STONE BELOW (mm)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	285.866
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	285.866
36.7	INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	285.561
		TOP OF SC-310 CHAMBER:	285.409
		250 mm x 250 mm TOP MANIFOLD INVERT:	285.038
		300 mm ISOLATOR ROW INVERT:	285.025
97.2	SYSTEM AREA (m²)	BOTTOM OF SC-310 CHAMBER:	285.002
43.2	SYSTEM PERIMETER (m)	BOTTOM OF STONE:	284.850

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	300 mm BOTTOM PREFABRICATED END CAP/TYP OF ALL 300 mm BOTTOM CONNECTIONS AND ISOLATOR ROWS	23 mm	
PREFABRICATED END CAP	B	250 mm TOP PREFABRICATED END CAP/TYP OF ALL 250 mm TOP CONNECTIONS	36 mm	
MANIFOLD	C	250 mm x 250 mm TOP MANIFOLD, MOLDED FITTINGS	36 mm	
NYLOPLAST (INLET W/ ISO ROW)	D	750 mm DIAMETER (610 mm SUMP MIN)		105 L/s IN



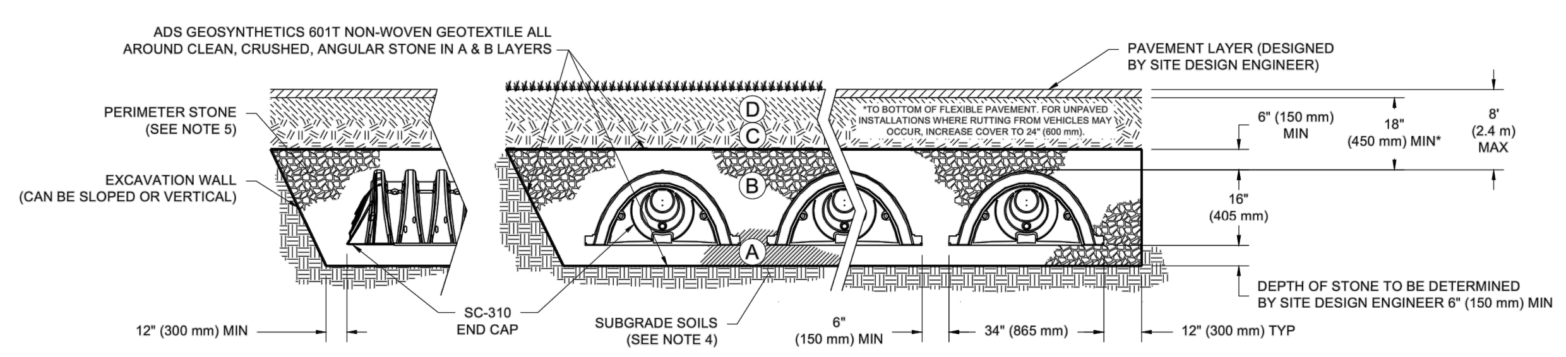
NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

76 BRYNE DR, BARRIE, ON — DRAWN: CN — CHECKED: N/A — SCALE = 1 : 50 — SHEET 2 OF 6

ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

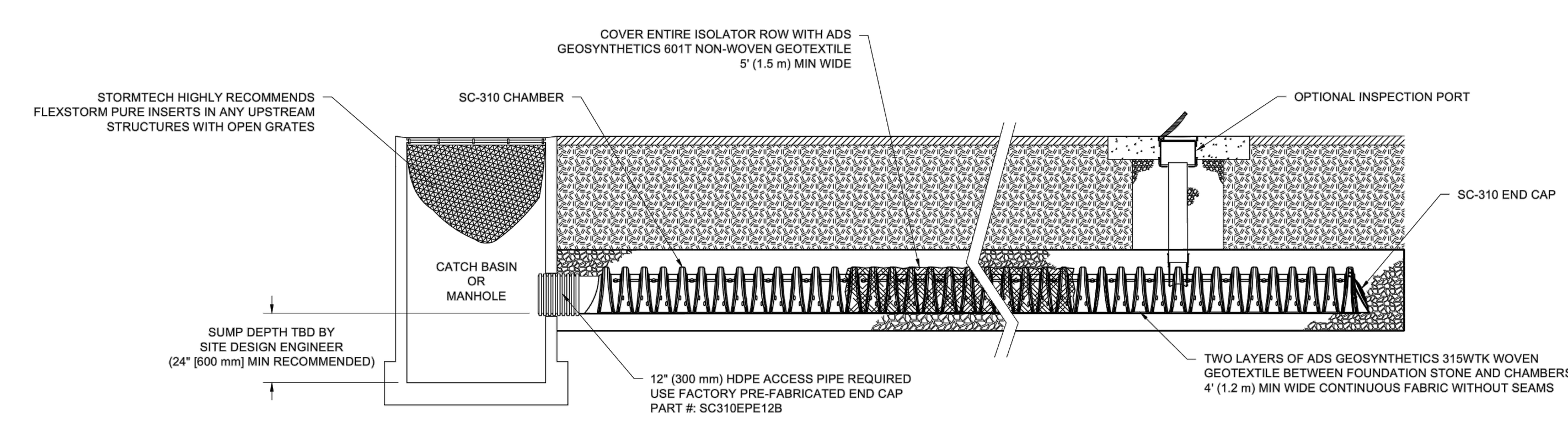
	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	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 F2922 (POLETHYLENE) OR ASTM F2418-16a (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-310 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 F2922 SHALL BE GREATER THAN OR EQUAL TO 400 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.

76 BRYNE DR, BARRIE, ON — DRAWN: CN — 4640 TRUEMAN BLVD, HILLIARD, OH 43026, 1-800-733-7473 — SHEET 3 OF 6



SC-310 ISOLATOR ROW DETAIL
NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES
1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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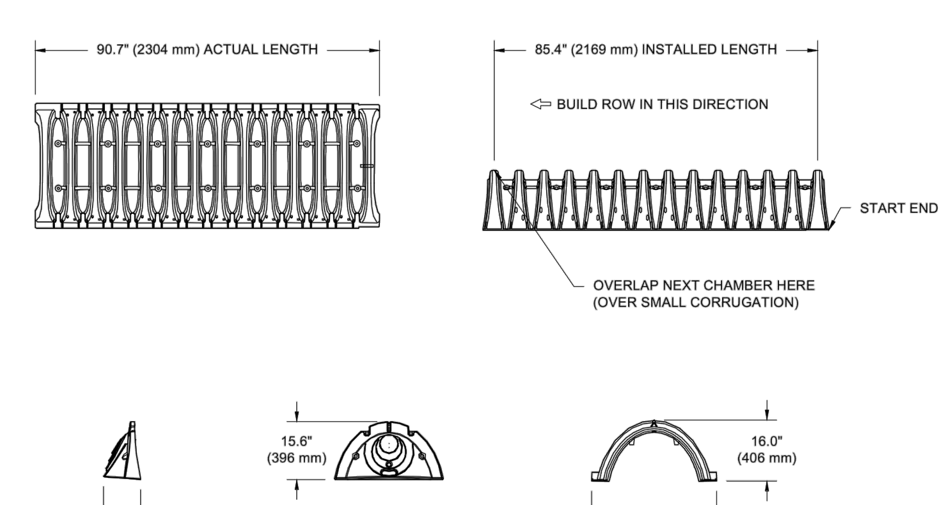
SC-310 TECHNICAL SPECIFICATION
NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	34.0" X 16.0" X 85.4"	(864 mm X 406 mm X 2169 mm)
CHAMBER STORAGE	14.7 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	31.0 CUBIC FEET	(0.88 m³)
WEIGHT	35.0 lbs.	(16.8 kg)

*ASSUMES 6" (152 mm) 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
SC310EPE06T / SC310EPE06TPC	6" (150 mm)	9.6" (244 mm)	5.8" (147 mm)	---
SC310EPE06B / SC310EPE06BPC			---	0.5" (13 mm)
SC310EPE08T / SC310EPE08TPC	8" (200 mm)	11.9" (302 mm)	3.5" (89 mm)	---
SC310EPE08B / SC310EPE08BPC			---	0.6" (15 mm)
SC310EPE10T / SC310EPE10TPC	10" (250 mm)	12.7" (323 mm)	1.4" (36 mm)	---
SC310EPE10B / SC310EPE10BPC			---	0.7" (18 mm)
SC310EPE12B	12" (300 mm)	13.5" (343 mm)	---	0.9" (23 mm)

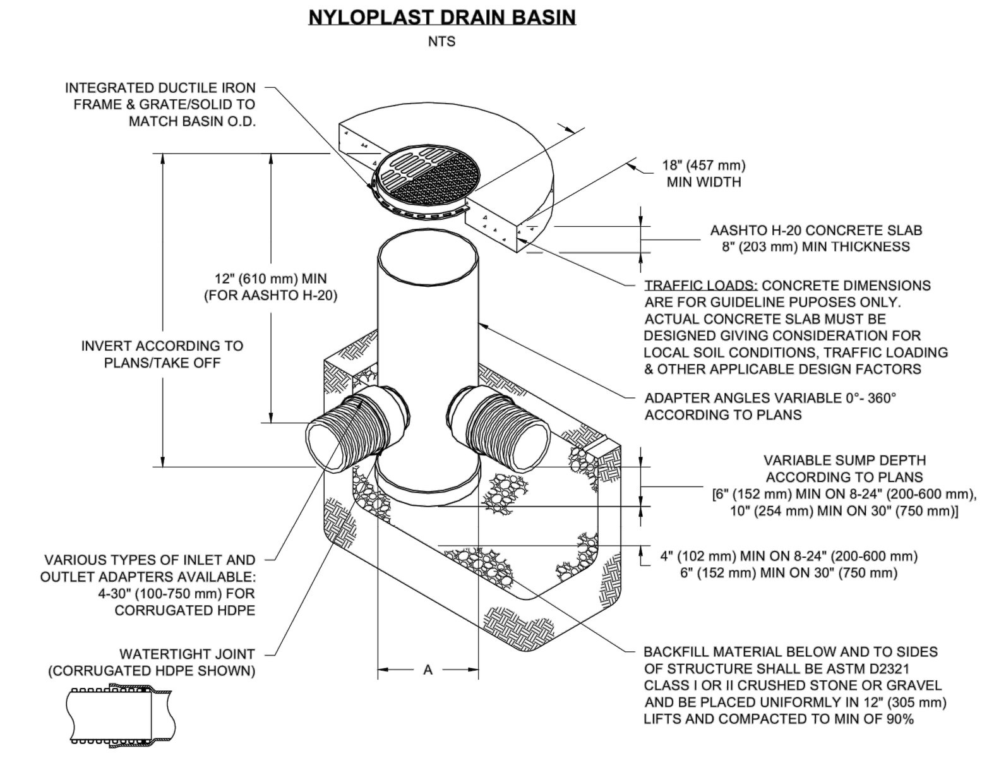
ALL STUBS, EXCEPT FOR THE SC310EPE12B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC310EPE12B THE 12" (300 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 0.25" (6 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

SHEET 5 OF 6

NYLOPLAST DRAIN BASIN
NTS



NOTES
1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

SHEET 6 OF 6

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

No.	Issuance Description	YY/MM/DD
1.	SITE PLAN APPROVAL	20/07/22
2.		

ISSUED FOR:
SITE PLAN APPROVAL

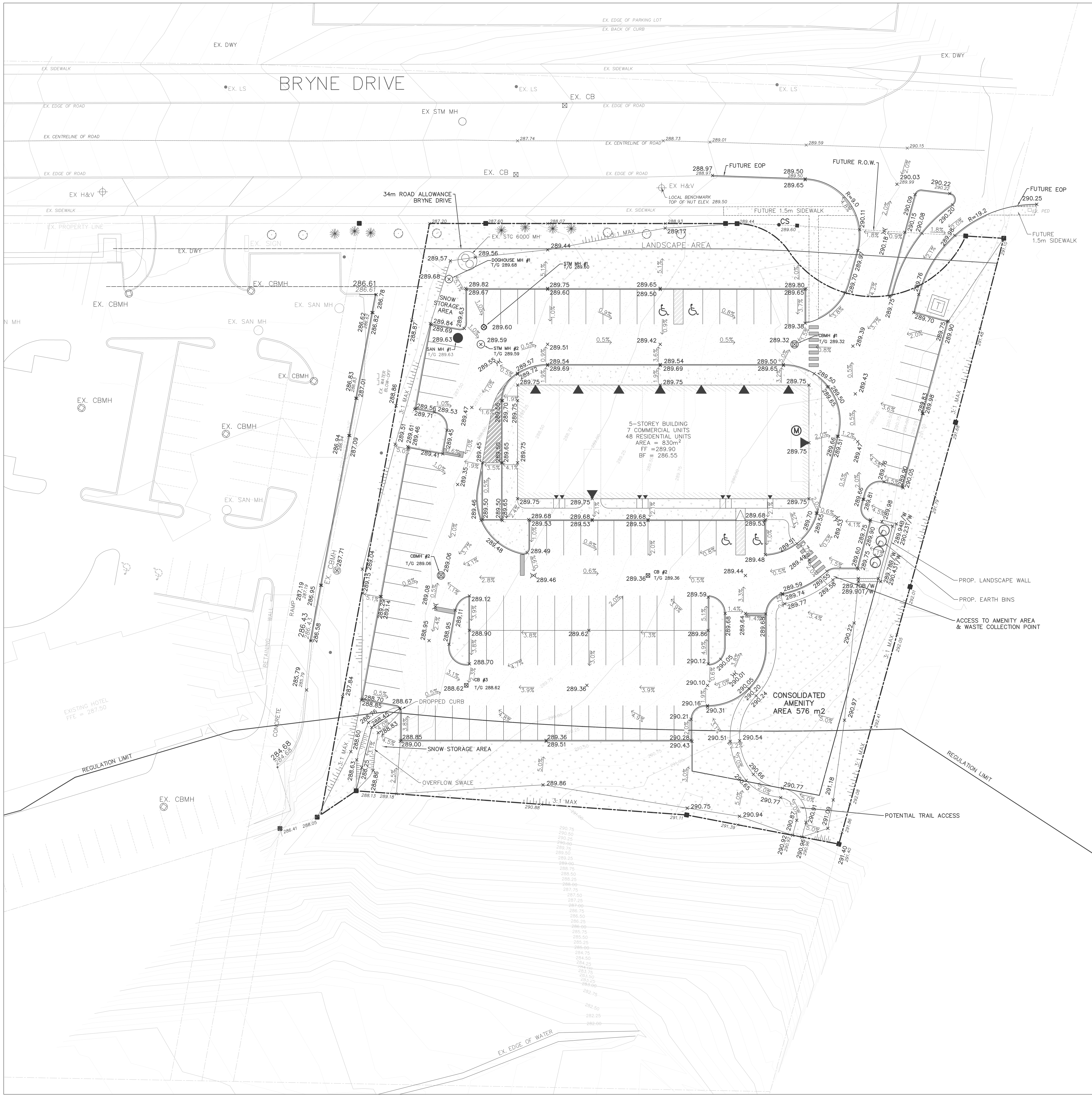
Client
DI GREGORIO

Project
76 BRYNE, DRIVE BARRIE, ON

Drawing:
NOTES AND DETAILS
-2-

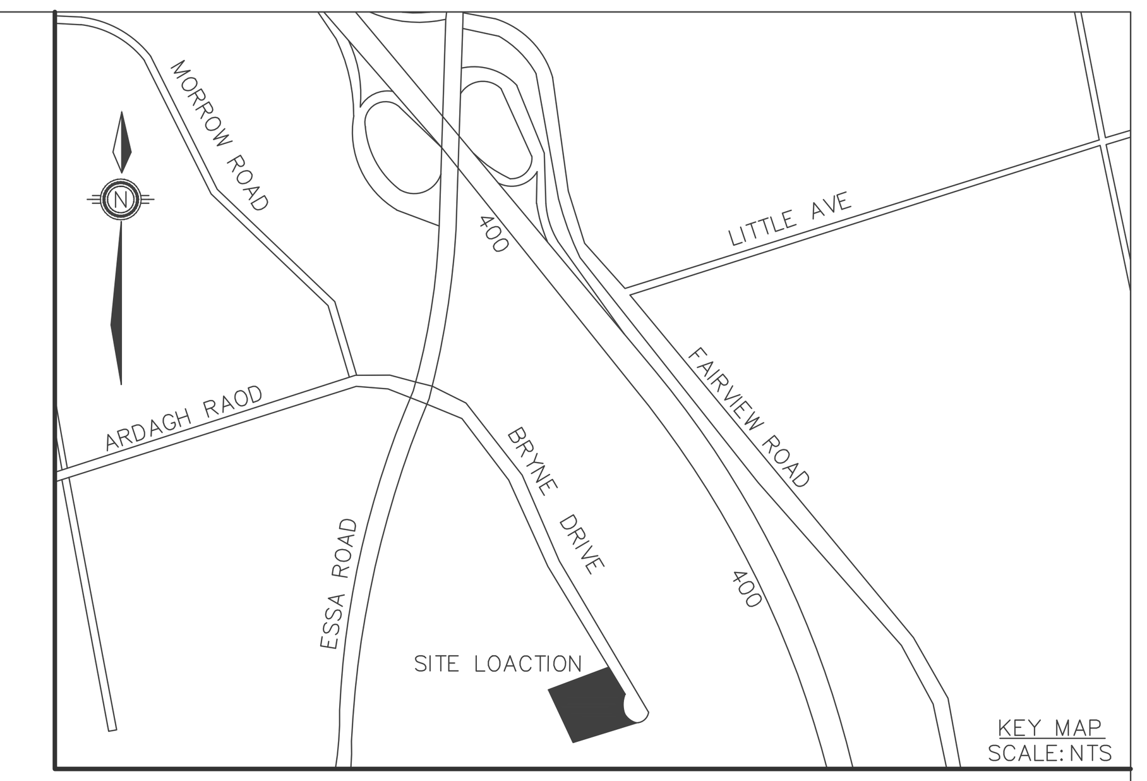
Project No. 899-001-17	Designed by: AC	Checked by: KF	
Scale: N/A	Drawn by: AC	Approved by: PMD	
Orientation	Stamp		

Drawing No. ND-2



LEGEND

- EXISTING SANITARY MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING CATCH BASIN MAINTENANCE HOLE
- PROPOSED CATCH BASIN MAINTENANCE HOLE
- EXISTING STORM MAINTENANCE HOLE
- PROPOSED STORM MAINTENANCE HOLE
- 324.00 / 324.00 — PROPOSED ELEVATION (T) (B) – DENOTES TOP OR BOTTOM OF WALL; EXISTING ELEVATION
- 1.6% — PROPOSED GRADE
- EXISTING HYDRO TRANSFORMER
- SERVICE CAP
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EX.VB — EXISTING WATER VALVE
- VB — PROPOSED WATER VALVE
- EX.CS — EXISTING CURB STOP
- CS — PROPOSED CURB STOP
- PROPOSED SIGN
- EXISTING LIGHT POLE
- MANDOOR
- OVERHEAD DOOR
- FIRE DEPT CONNECTION
- LANDSCAPE AREA
- ASPHALT AREA
- CONCRETE AREA
- E — ELECTRICAL ROOM
- M — WATER METER LOCATION
- T — PROPOSED TRANSFORMER



Gerrits ENGINEERING

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Fax.: F.705.737.1772
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0 5 10 20 30 40 50mm
0" 1/4" 1/2" 1" 1 1/2" 2"

No.	Issuance Description	YY/MM/DD
1.	SITE PLAN APPROVAL	20/07/22
2.		

HORIZONTAL CONTROL:
ID# 03120040040
R.I.B. /w BRASS CAP. LOCATED ON THE NORTH SIDE OF ARDAGH, APPROX. 50m EAST OF PATTERSON RD. @ 1st HYDRO POLE ANCHOR.
NORTHING–N4912365.421m, EASTING–E603187.237m

ID# 03120040033
R.I.B. /w BRASS CAP. LOCATED @ BACK OF SIDEWALK ON NORTHWEST CORNER OF ESSA RD. & LOGGERS RUN.
NORTHING–N4912126.819m, EASTING–E603646.991m

VERTICAL CONTROL:
ID# 68U500
BRASS TABLET. LOCATED ON HWY 400 OVERPASS OVER ESSA RD., SET IN NORTHEAST FACE OF NORTHEAST CONCRETE WALL (SOUTHERN ABUTMENT) 1.2m NORTHWEST FROM END OF ABUTMENT, 20.2m SOUTHEAST OF CENTRELINE OF ESSA RD., 18cm BELOW TOP OF SIDEWALK AT THE HWY 400 LEVEL. HAVING AN NORTHING–N4912930m, EASTING–E603811m, ELEVATION–253.169m

ID# 97–68
BRASS TABLET. LOCATED ON CONC. BRIDGE CARRYING HWY 400 OVER ESSA RD. TABLET IS SET HORIZ. IN WEST FACE OF NORTH CONC. ABUTMENT, 3.84m SOUTH OF NORTHWEST CORNER, 24cm BELOW COPING & 9.0m WEST OF CENTRELINE OF HWY 400 SOUTHBOUND LANE.
NORTHING–N4912906m, EASTING–E603786m, ELEVATION–252.723m

BENCHMARK: TOP NUT OF EX. HYDRANT HAVING AN ELEVATION OF 289.50

ISSUED FOR:

SITE PLAN APPROVAL

Client

DI GREGORIO

Project

76 BRYNE, DRIVE BARRIE, ON

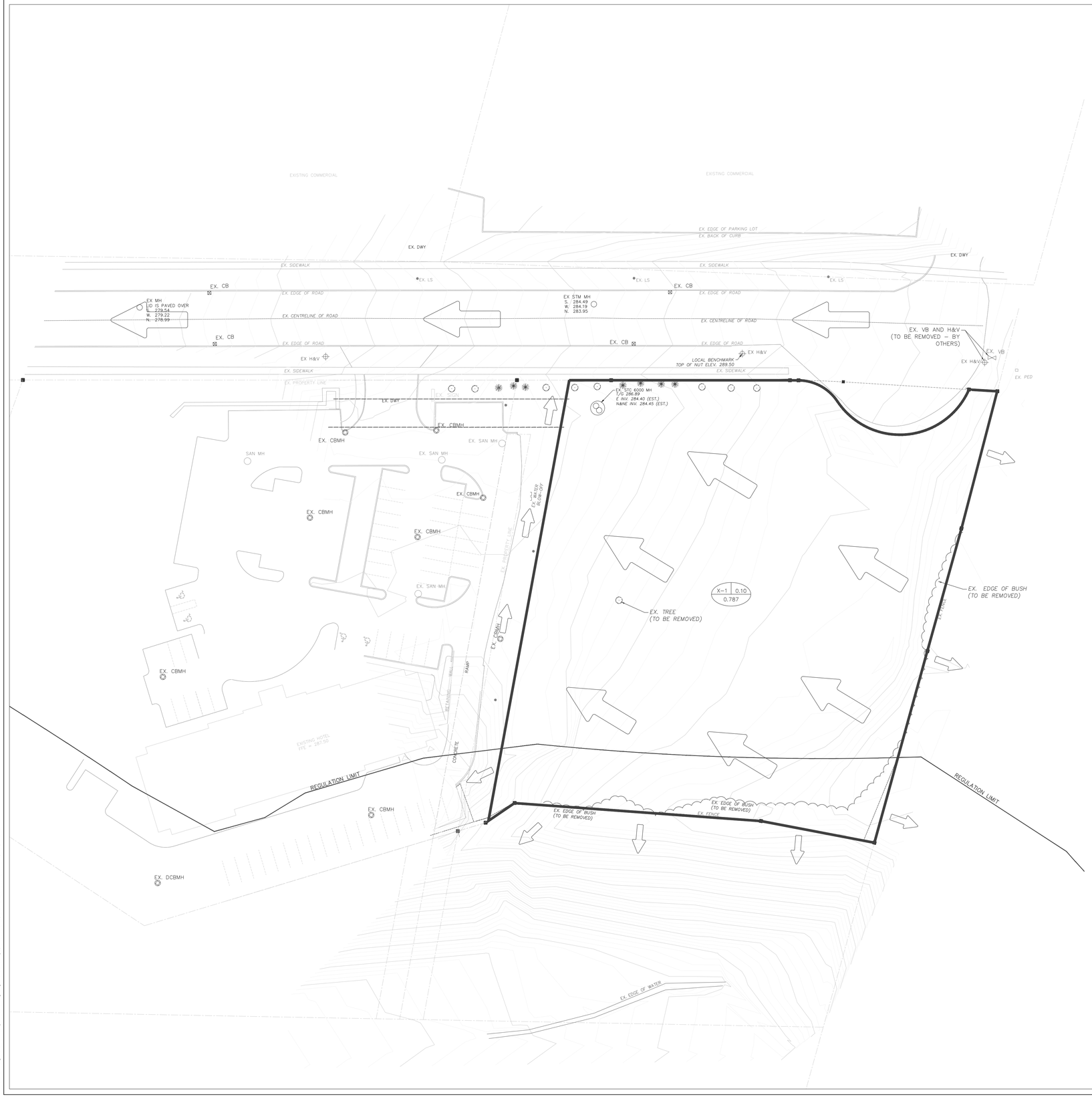
Drawing:

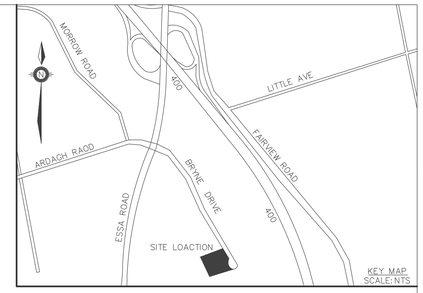
SITE GRADING PLAN

Project No. 899-001-17	Designed by: AC	Checked by: KF	
Scale: 1:300	Drawn by: AC	Approved by: PMD	
Orientation	Stamp		

Drawing No.

SG-1





LEGEND

- EXISTING SANITARY MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
- EXISTING CATCH BASIN MAINTENANCE HOLE
- PROPOSED CATCH BASIN MAINTENANCE HOLE
- EXISTING STORM MAINTENANCE HOLE
- PROPOSED STORM MAINTENANCE HOLE
- T — PROPOSED TRANSFORMER
- 324.00 / *324.00 — PROPOSED ELEVATION / EXISTING ELEVATION
- 1.6% — PROPOSED GRADE
- EXISTING HYDRO TRANSFORMER
- SERVICE CAP
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EX.VB — EXISTING WATER VALVE
- VB — PROPOSED WATER VALVE
- EX.CS — EXISTING CURB STOP
- CS — PROPOSED CURB STOP
- PROPOSED SIGN
- EXISTING LIGHT POLE
- MANDOOR
- OVERHEAD DOOR
- FIRE DEPT CONNECTION
- E — ELECTRICAL ROOM
- M — MECHANICAL ROOM
- ID: P-2 | 0.75 / 5.55 — RUNOFF COEFFICIENT / AREA (ha)
- OVERLAND FLOW

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www.gerreng.com

No.	Issuance Description	YY/MM/DD
1.	SITE PLAN APPROVAL	20/07/22
2.		

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ID# 0312004004O
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ID# 97-58
BRASS TABLET. LOCATED ON CONC. BRIDGE CARRYING HWY 400 OVER ESSA RD. TABLET IS SET HORIZ. IN WEST FACE OF NORTH CONC. ABUTMENT, 3.84m SOUTH OF NORTHWEST CORNER, 24cm BELOW COPING & 9.0m WEST OF CENTRELINE OF HWY 400 SOUTHBOUND LANE.
NORTHING=N4912906m, EASTING=E603786m,
ELEVATION=252.723m

ISSUED FOR:
SITE PLAN APPROVAL

Client
DI GREGORIO

Project
76 BRYNE, DRIVE BARRIE, ON

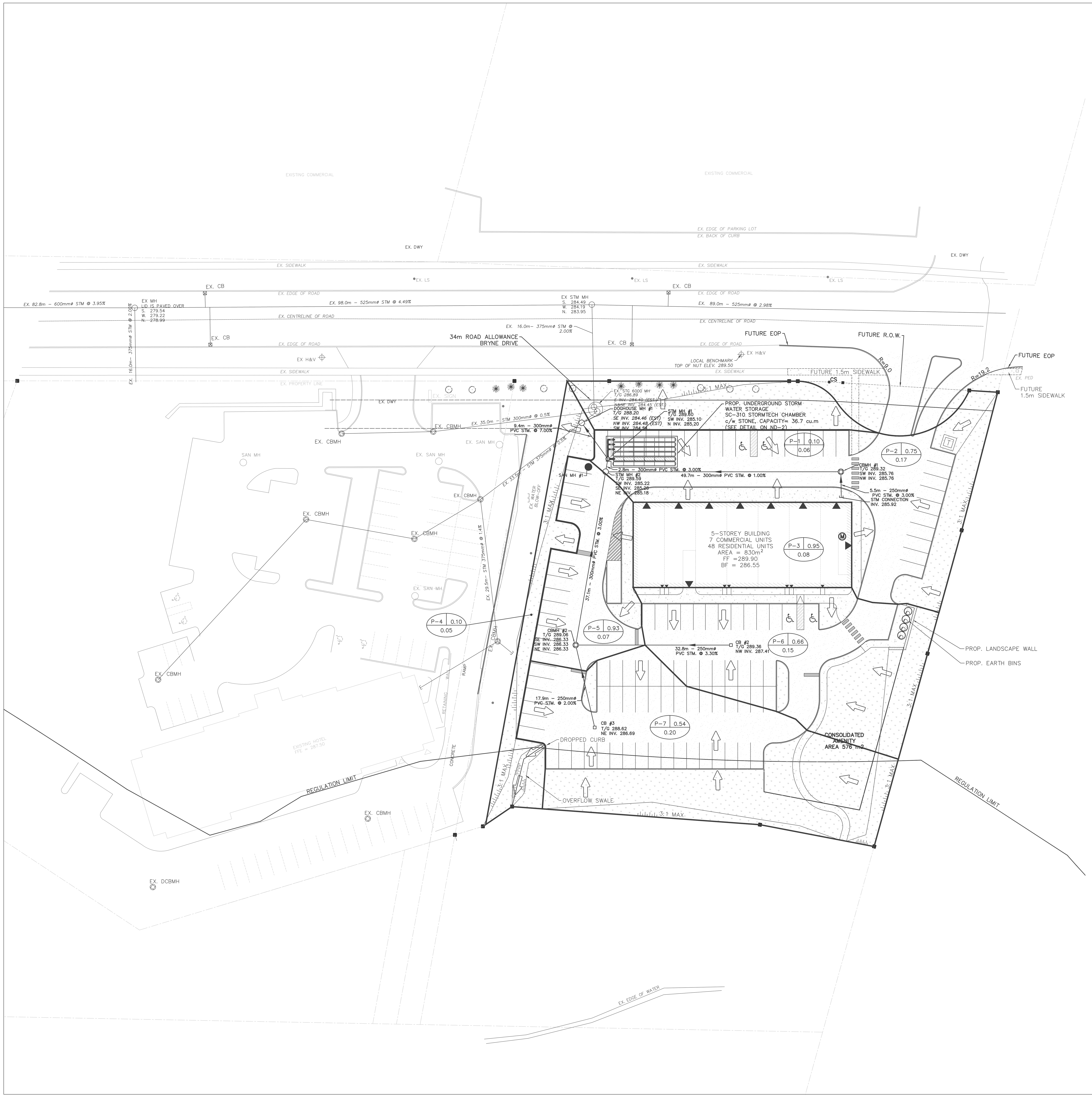
Drawing:
PRE-DEVELOPMENT STORMWATER MANAGEMENT PLAN

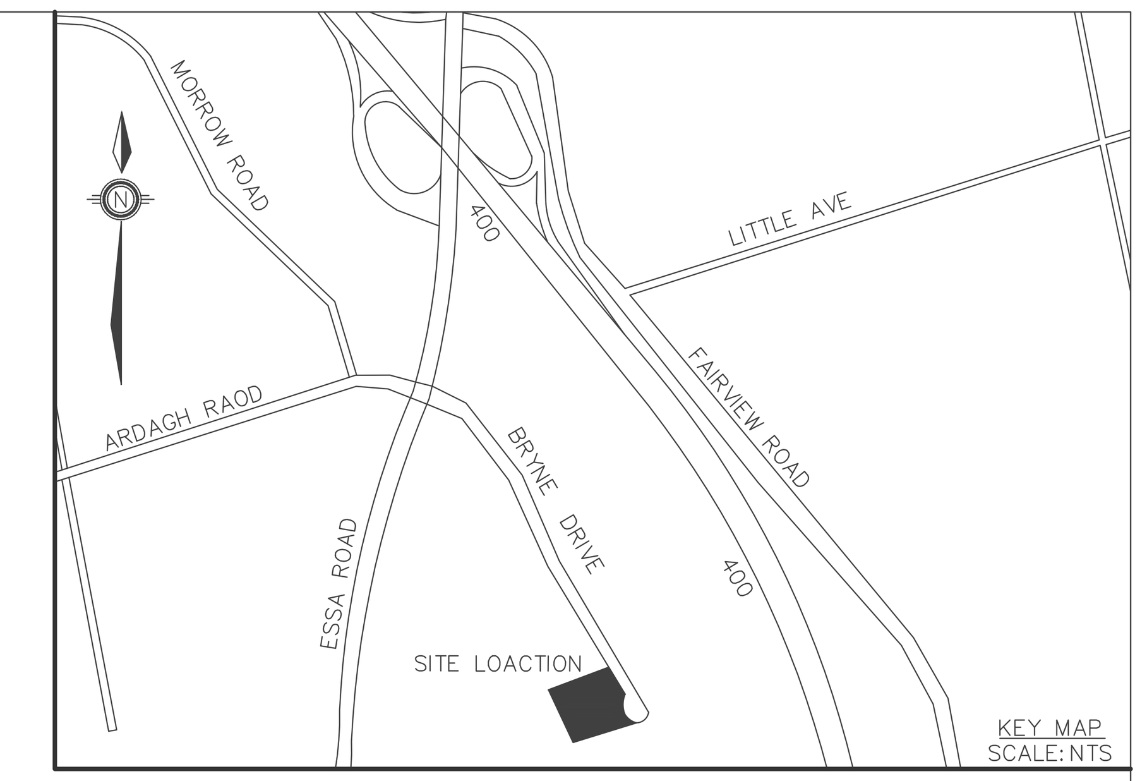
Project No.	899-001-17	Designed by: AC	Checked by: KF
Scale:	1:400	Drawn by: AC	Approved by: PMD

Orientation

Stamp

Drawing No.
STM-1





LEGEND

- EXISTING SANITARY MAINTENANCE HOLE
- PROPOSED SANITARY MAINTENANCE HOLE
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN
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- EXISTING STORM MAINTENANCE HOLE
- PROPOSED STORM MAINTENANCE HOLE
- T PROPOSED TRANSFORMER
- 324.00 PROPOSED ELEVATION / 324.00 EXISTING ELEVATION
- 1.6% PROPOSED GRADE
- EXISTING HYDRO TRANSFORMER
- SERVICE CAP
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- EX.VB EXISTING WATER VALVE
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- FIRE DEPT CONNECTION
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- M MECHANICAL ROOM
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- ID: P-2 | 0.75 | 5.55 — RUNOFF COEFFICIENT; AREA (ha)

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

No.	Issuance Description	YY/MM/DD
1.	SITE PLAN APPROVAL	20/07/22
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ISSUED FOR:
SITE PLAN APPROVAL

Client
DI GREGORIO

Project
76 BRYNE, DRIVE BARRIE, ON

Drawing:
POST-DEVELOPMENT STORMWATER MANAGEMENT PLAN

Project No. 899-001-17	Designed by: AC	Checked by: KF	
Scale: 1:400	Drawn by: AC	Approved by: PMD	
Orientation	Stamp		

Drawing No.
STM-2

NOTES FOR SEDIMENT & EROSION CONTROL

1. DISTURBED AREAS THAT HAVE FAILED TO HAVE STABLE GROUND COVER ESTABLISHED BY OCTOBER 30TH SHALL BE PROTECTED WITH A SILTATION CONTROL FENCE OR STRAW MULCH ETC. AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION BECOMES ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
2. ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30 M FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE ADMINISTRATOR.
3. SILT FENCE SHALL BE PUT IN PLACE PRIOR TO AND MAINTAINED DURING ALL GRADING. SILT FENCE 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 REQUIRED 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 6.0m WIDE X 15.0m 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 CONSERVATION AUTHORITY.
8. THE TOPS OF ALL FILTER FABRIC MUST BE A MINIMUM OF 1.0 METRES ABOVE THE GROUND LEVEL AND ATTACHED TO THE FENCE WITH A CONTINUOUS STEEL WIRE. ALTERNATIVELY, THE FILTER FABRIC MUST BE FOLDED OVER THE TOP OF THE FENCE AND ATTACHED TO THE FENCE WITH WIRE LOOPED THROUGH THE FABRIC ON BOTH SIDES OF THE FENCE. FILTER FABRIC IS TO BE TERRAFIX 270R OR EQUIVALENT.
9. ALL DISTURBED GROUND LEFT INACTIVE SHALL BE STABILIZED BY SEEDING, SODDING, MULCHING, OR COVERING OR OTHER EQUIVALENT CONTROL MEASURES. THIS PERIOD OF INACTIVITY SHALL BE AT THE DISCRETION OF THE MUNICIPAL DIRECTOR OF ENGINEERING BUT SHALL NOT EXCEED THIRTY DAYS OR SUCH LONGER PERIOD DEEMED ADVISABLE BY THE MUNICIPAL DIRECTOR OF ENGINEERING.
10. CONTRACTOR SHALL INSTALL AND MAINTAIN CATCHBASIN SEDIMENT BARRIERS THROUGHOUT THE SITE DURING ALL CONSTRUCTION ACTIVITIES IN ORDER TO TRAP SEDIMENT.

SEQUENCE OF CONSTRUCTION

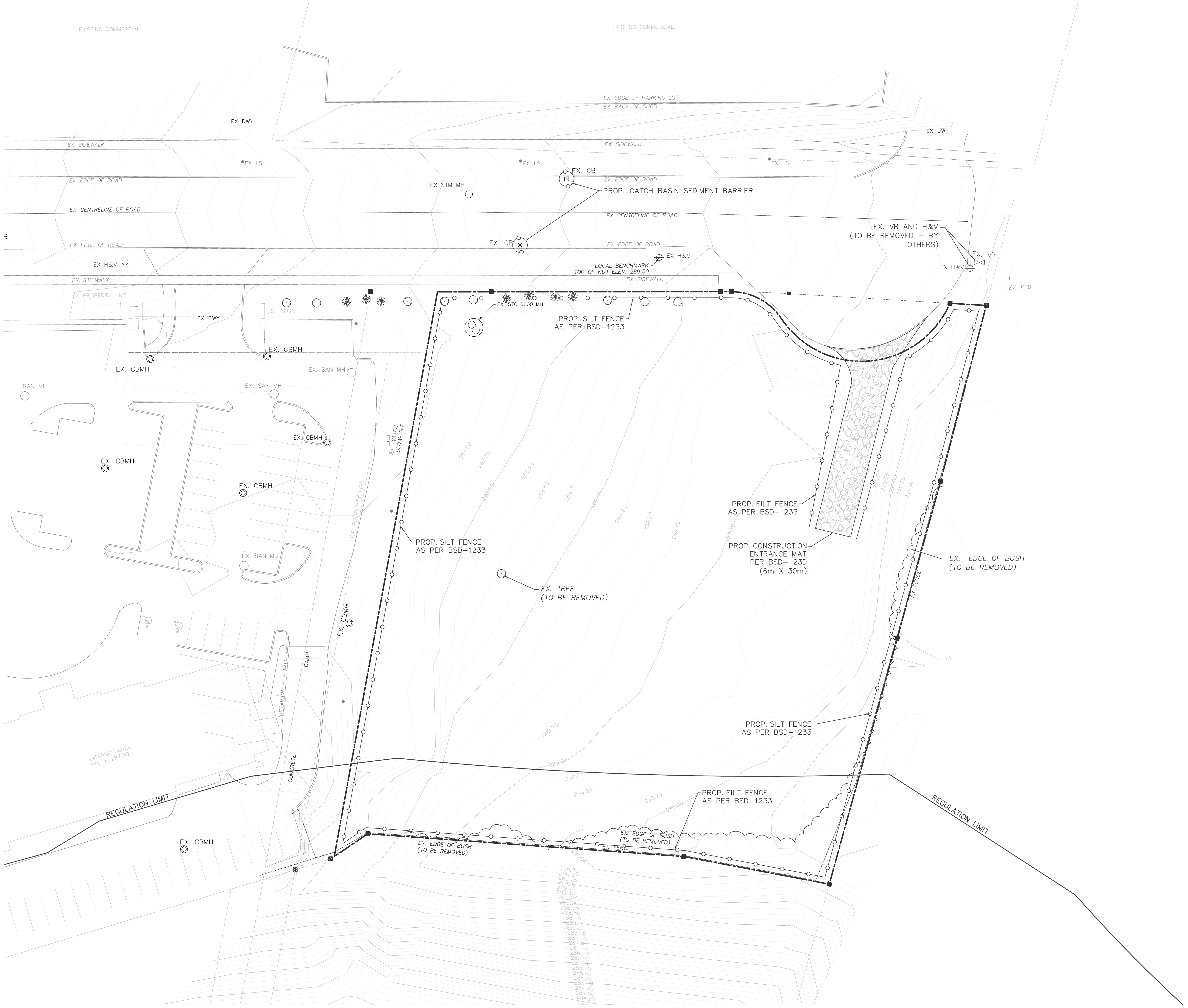
1. ENGINEER TO BE NOTIFIED PRIOR TO INITIATION OF ANY ON SITE WORKS.
2. SILT FENCE AND CONSTRUCTION ACCESS MATS TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ONSITE.
3. VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
4. COMMENCE WITH EARTH EXCAVATION 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.

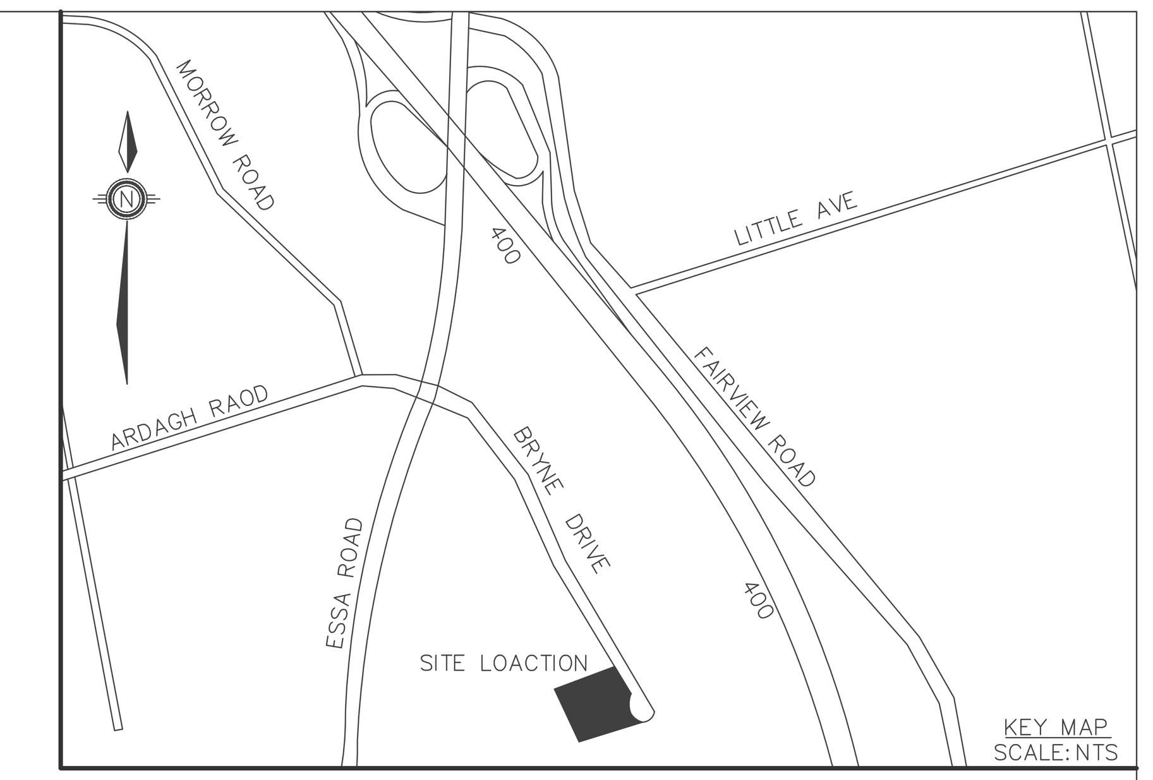
NO FUEL TO BE STORED ON SITE. IN CASE OF A SPILL PLEASE CONTACT: MOECC SPILLS ACTION CENTER 1-800-268-6060

THE ON-CALL CITY OF BARRIE ENVIRONMENTAL OFFICER SHALL ALSO BE NOTIFIED VIA PAGER (705) 720-5056 IN THE EVENT THE SPILL REACHES PUBLIC PROPERTY.

THE SEDIMENT CONTROLS ARE TO REMAIN IN PLACE UNTIL WRITTEN DIRECTION IS RECEIVED FROM THE ENGINEER REGARDING THEIR REMOVAL.

Site Area	7869 sq.m.
Area of Alteration	7869 sq.m.
Existing Land Use	Open Space
Adjoining Property Land Use	Commercial
Soil Type	– Sandy Loam (TiSl)





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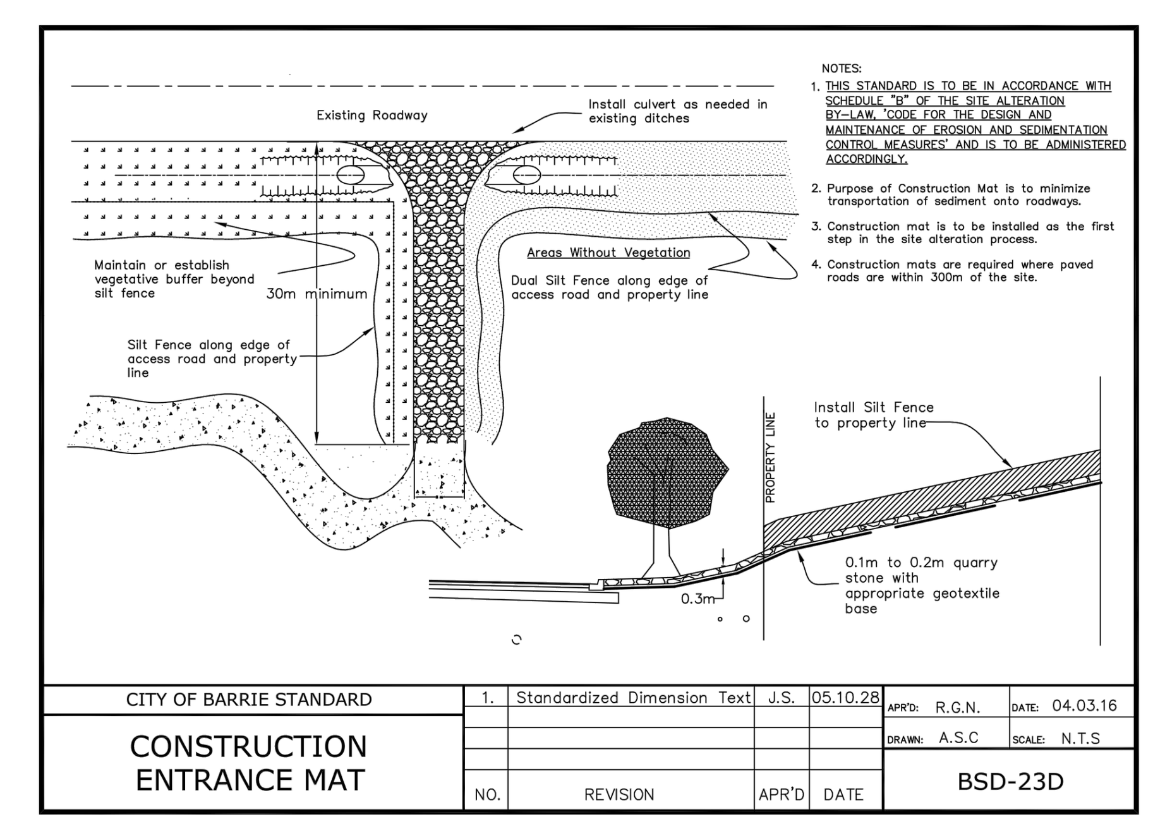
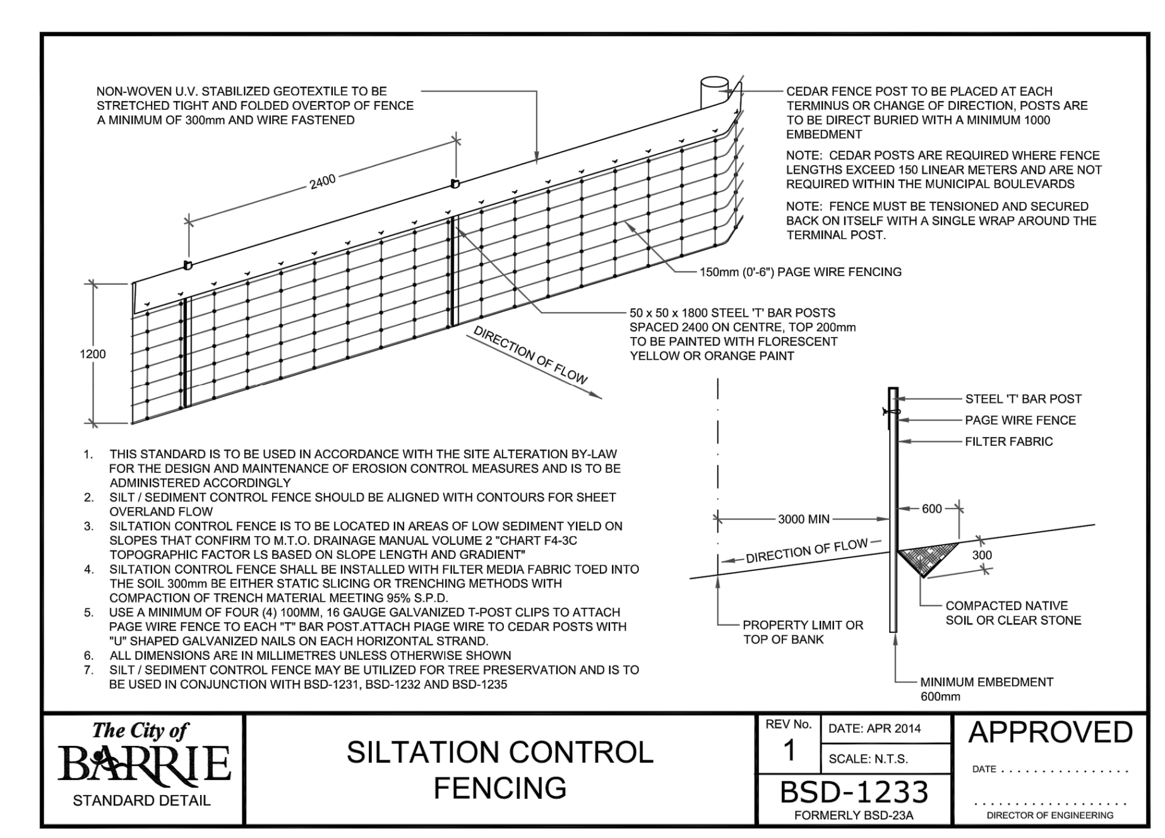
- PROPOSED SIGN
- EXISTING LIGHT POLE
- MANDOOR
- OVERHEAD DOOR
- FIRE DEPT CONNECTION
- PROPOSED SILT FENCE
- T PROPOSED TRANSFORMER





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No.	Issuance Description	YY/MM/DD
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ISSUED FOR:

SITE PLAN APPROVAL

Client

DI GREGORIO

Project

76 BRYNE, DRIVE BARRIE, ON

Drawing:

EROSION CONTROL PLAN & REMOVALS PLAN

Project No.	899-001-17	Designed by:	AC	Checked by:	KF
Scale:	1:400	Drawn by:	AC	Approved by:	PMD

Orientation

Stamp

Drawing No.

EP-1