185 DUNLOP STREET EAST
FUNCTIONAL SERVICING & SWM REPORT
AALTO DEVELOPMENT INC.
CITY OF BARRIE

Prepared by:

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17-11338B – rev. 1

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APPENDICES

1.0 INTRODUCTION

1.1 General

The proposed waterfront condominium site is located at 185 Dunlop Street East adjacent to the Dunlop Street East and Poyntz Street intersection. The property is legally described as Part of Dunlop Street Registered Plan 2, Part of Water Lots 25 to 30 (inclusive), and Part of the Water Lot in front of Poyntz Street. The subject property is 0.47 hectares in area and is currently vacant. The site is bounded by Dunlop Street East to the north, existing residential high-rise (Flamenco Condos) to the east, the extension of Poyntz Street (unopened right-of-way) to the west, and the City's walkway and trail system along Kempenfelt Bay (former CNR line) to the south. The location of the subject site is illustrated on Figure 1.

The proposed development includes a twelve-storey waterfront condominium building with the following features:

- 178 condo units;
- 2,357m^2 of commercial space on the first storey;
- 248 parking spaces.

A reduced copy of the proposed site plan prepared by ISM Architects is included in Appendix A for further information.

1.2 Purpose and Scope

Pinestone Engineering Ltd. (PEL) has been retained by Aalto Development Inc. to provide professional engineering services related to the preparation of a Functional Servicing and Storm Water Management Report in support of a Site Plan Application for the subject lands.

The purpose of this report is to describe the existing servicing infrastructure in the vicinity of the site and provide recommendations for the provision of sanitary drainage, water distribution, and storm water management in accordance with City of Barrie criteria.

1.3 Reference Reports

The following reports and studies have been used for reference in the preparation of this Storm Water Management Report:

i) *City of Barrie Storm Drainage and Storm Water Management Policies and Design Guidelines, prepared by Valdor Engineering Inc., November 2009*

ii) *LSCRA Technical Guidelines for Storm Water Management Submissions, Effective Date: September 1, 2016*

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DUNLOP STREET WATERFRONT DEVELOPMENT

LOCATION PLAN

DATE:	SCALE:	PROJECT No.	FIGURE No.
DEC 2017	N.T.S.	17-11338	FIGURE 1

iii) *Lake Simcoe Protection Plan, June 2009*

iv) *City of Barrie Urban Design Manual, April 2007*

v) *City of Barrie Sanitary Sewage Collection System Polices and Design Guideline, October 2017*

vi) *City of Barrie Water Transmission and Distribution Polices and Design Guidelines, May 2015.*

vii) *Ministry of the Environment Storm Water Management Planning and Design Manual, March 2003.*

viii) *Low Impact Development Manual prepared by Credit Valley Conservation and Toronto and Region Conservation, 2010*

ix) *Functional Servicing Report prepare by exp. for B.E. Groupe, May 2011.*

x) *City of Barrie Secondary Plan, Background Studies & Infrastructure Master Plans prepare by amec, October 2013*

2.0 SANITARY SERVICING

2.1 Existing Sanitary Infrastructure

There is an existing 350mm dia. AC sanitary sewer installed along Dunlop Street East and 825mm dia. concrete sanitary sewer located immediately south of the property. The 825mm dia. sewer is part of the Lakeshore Trunk Sanitary Sewer constructed in 1995.

The subject site is located within the Barrie North sanitary drainage area (sewershed ID 18700) and based on our review of the City of Barrie's Infrastructure Master Plan prepared by amec dated October 2013, no downstream surcharging of the existing infrastructure was noted in 2011. Copies of the sanitary mapping for years 2011, 2031, and 2051 prepared by amec are included in Appendix B for further information.

2.2 Proposed Sanitary Flows

The proposed peak sanitary design flow for the development was calculated using City of Barrie Sanitary Sewage Collection System Polices and Design Guidelines 2012 and the Ontario Building Code (OBC) as follows:

- Residential flow for high density of 1.67 ppu.
- Average day flow of 225 L/day/person or 0.0026 L/sec/person with Harmon Peaking Factor.

- Commercial flow of 5 L/day per 1.0m2 of floor area with a peaking factor of 4.0
- Extraneous flow of 0.1 L/s/ha

The proposed peak design flow including extraneous flows for the development was determined to be 3.8 L/sec. A copy of the sanitary sewer design sheet is included in Appendix D. The capacity of the existing immediate downstream reach of 825mm dia. sanitary sewer is approximately 390 L/sec and the proposed design flow is expected to utilize approximately 1.0% of the total flow pipe capacity in this reach.

The City of Barrie's Infrastructure Master Plan prepared by amec dated October 2013 indicates a sewer shed equivalent population density of 148.3 people per hectare in 2011, and 230 people per hectare in 2051 for sewer shed ID 18700. The proposed development will have an equivalent population of about 631 people per hectare (not including the commercial component). If higher densities become the norm in the downtown area and throughout the City, future sewer capacity may become an issue in the long-term horizon. It is anticipated that sewer allocation would be granted on a first come first serve basis, however, confirmation from the City is required to ensure the necessary allocation for the proposed density can be secured.

2.3 Proposed Sanitary Servicing

The proposed development will be serviced with a 200mm dia. service connecting to the existing Lakeshore Trunk Sanitary Sewer. Due to the proximity of the site to Kempenfelt Bay, inline backflow protection is required on the sanitary service. This is to be detailed by the mechanical engineering at the building construction approval stage.

3.0 WATER SERVICING

3.1 Existing Water Infrastructure

A 200mm diameter watermain currently exists along the frontage of the subject site on Dunlop Street East. A hydrant flow test was conducted on the existing watermain in the vicinity of the site to determine the available supply volumes and pressures in the existing distribution system. Table 1 illustrates the flow test results completed by Vipond on July 31st, 2017.

Table 1: Results of Hydrant Flow Tests

Test #	Outlet Inside Dia. (in.)	Number of Outlets	Pitot Reading (PSI)	Flow@ Residual (gal/min)
1	n/a	n/a	89 (static)	n/a
2	1.125	1	80	335
3	1.75	1	64	727
4	2.5	1	46	1140
5	2.5	2	37	2050

Refer to Appendix D for the information obtained by Vipond.

3.2 Proposed Water Demands

Based on the City of Barrie's Water Transmission and Distribution Policies and Design Guidelines dated May 2015 and the MOECC Design Guidelines for water distribution systems, the following conditions apply:

- Max day factor of 1.50 and peak hour factor of 2.25 based on MOECC Guidelines Table 3-1 in the Design Guidelines for Drinking Water Systems, 2008 (included in Appendix B).
- Minimum operating pressure of 345 kPa (50 psi).
- Maximum operating pressure of 620 kPa (90 psi).
- Minimum operating pressure of 140 kPa (20 psi) during fire flow and max day.
- Residential water demand of 225 L/cap/day.
- Minimum fire flow of 136 L/sec for downtown commercial type development. Preferred fire flow rate of 189 L/sec as provided in the City of Barrie's Water Transmission and Distribution Policies and Design Guidelines.

Based on the above conditions, Table 2 illustrates the proposed domestic demands for the development.

Table 2: Residential Water Demand

Population	Per Capita Flow (L/day)	Peaking Factors (based on MOECC Guidelines)		Flows (L/sec)	
		Peak Hour	Maximum Day	Peak Hour	Maximum Day
297	225	2.25	1.5	1.74	1.16

Incorporating an estimated maximum day water usage from the commercial usages of 0.55 L/sec, the maximum day domestic flow including commercial use is 1.71 L/sec.

Using the information provided from the flow test completed by Vipond, the following flow volume can be supplied from Dunlop Street East while maintaining a residual pressure of 140 kPa (20 psi) in the distribution system. The calculation is based on information provided within the City of Barrie's Water Transmission and Distribution Policies and Design Guidelines.

$$QA = QT * (ha/ht)^{0.5}$$

Where, QA = Flow at 20 psi
QT = Flow at test
Ha = pressure drop available
Ht = pressure drop at test

Therefore, the following supply is available:

$$QA = 2050 * ((89-20)/(89-74))^{0.5}$$
$$QA = 4397 \text{ gpm } (277 \text{ L/sec})$$

Based on the hydrant flow test information, adequate domestic and fire flows are available to service the development.

3.3 Proposed Water Servicing

Separate fire and domestic services will extend from the existing 200mm dia. watermain on Dunlop Street East. A 200mm dia. fire service and 150mm dia. domestic service are proposed to service the building (to be confirmed by the mechanical engineer at the building approvals stage). The 200mm diameter fire service was sized to ensure a fire flow of 189 L/sec can be supplied to the building. At this flow rate, the calculated losses in the fire service connection are 17.1 kPa while maintaining a residual pressure in the distribution system of 388 kPa (see fire service analysis sheet in Appendix D.)

Internal boosting pumps may be required on both the domestic and fire supply lines to ensure adequate pressures are available to upper floors. Booster pump design details will be detailed by the building Mechanical Engineer at the building permit stage.

Existing service connections not being utilized for the proposed development will be removed as per City standards.

4.0 STORM DRAINAGE

4.1 Existing Storm Drainage and Topography

A 600mm diameter storm sewer exists on Dunlop Street East along the frontage of the site. Storm water is conveyed westerly on Dunlop Street East and discharges to Kempenfelt Bay along the west limit of the property through the unopened Poyntz Street road allowance. A grass swale also exists along the southern limits of the property located between the property line and gravel pedestrian path. Runoff collected in this swale is conveyed to Kempenfelt Bay through a ditch inlet catch basin and 300mm diameter CSP outlet pipe.

Based on our site visit, no external drainage appears to enter the property. We did note that the unopened Poyntz Street road allowance boarding the west limit of the property provides a major overland flow outlet to Kempenfelt Bay for Dunlop Street East. City of Barrie records indicate approximately 5.2 hectares of drainage area is conveyed through this outlet to Kempenfelt Bay (record plan 94-09 STM1).

Review of the topographic survey provided by Rudy Mak Surveying Ltd. indicates the property slopes from the north to the south towards Kempenfelt Bay. Elevations across the site range between 225.30 ASL along Dunlop Street East to 220.50m ASL along the south property limit adjacent to the gravel pedestrian path.

4.2 Site Geology

A detailed geotechnical investigation for the subject property was completed by Geospec Engineering Ltd. in July 1999. Based on our review of their report, the boreholes generally revealed an original stratified deposit that included layers of sand and gravel, silty sand and silt. Groundwater was encountered in all boreholes at an approximate elevation of 218.4m. The elevation of the groundwater in the boreholes coincided with the lake level, at the time of the investigation.

A copy of the geotechnical investigation prepared by Geospec Engineering Ltd. is included in Appendix B.

4.3 Storm Water Management Criteria

Based on a review of the City of Barrie's Storm Water Management (SWM) Guidelines and the LSRCA Guidelines, the following criteria applies:

Quantity Control:

- Peak flow attenuation for the 2-year through 100-year storm events to pre-development rates based on the Rational Method using the City of Barrie's WPCC IDF parameters.

Quality Control:

- Water quality enhancement to an "enhanced" level of protection.
- Preparation of phosphorus and water balance calculations to meet City of Barrie requirements and the Lake Simcoe Protection Plan.
- Preparation of detailed erosion, sediment control and construction mitigation plan to be implemented as part of the construction program.

Water Balance & Volume Control:

- For new, nonlinear developments that create more than 0.5 hectares of new impervious surface on sites without restrictions, stormwater runoff volumes will be controlled, and the post-construction runoff volume shall be captured and retained / treated on site from a 25 mm rainfall event from the total impervious area.

4.4 Quantity Control

Due to the proximity of Kempenfelt Bay (13m) and no risk of downstream flood impact on adjacent properties, quantity control is not required or necessary. Storm discharge from the subject is proposed via a 250mm diameter storm sewer connection to the existing double catch basin manhole located within the Poyntz Street right of way. The existing storm structure currently discharges to Kempenfelt Bay via a 750mm dia. storm submerged sewer. This sewer provides a direct connection with Lake Simcoe. See attached email correspondence from City of Barrie Engineering staff included in Appendix C and Report Section 4.9 confirming the outlet size.

4.5 Quality Control – TSS Removal

The proposed development encompasses the entire site with impervious rooftop area. Rooftop runoff is considered clean and only contains atmospheric contaminates. (Reference: MOE Stormwater Management Planning and Design Manual, March 2003, pg 4-3 – see attached page in Appendix C). Therefore, quality control (TSS removal) is not proposed for the development.

4.6 Phosphorus Loading & Phosphorus Offsetting

LSPOP (Lake Simcoe Phosphorus Off-Setting Policy) requires that all new development must control 100% of the phosphorus from leaving their property. This is referred to as the Zero Export Target, a key component of the LSPOP that ensures new development or

redevelopment activities do not continue to contribute to phosphorus loading to Lake Simcoe.

A meeting was held with Mr. Hogenbirk from the LSRCA on March 13th, 2019 to discuss LSRCA criteria related to this site. Due the location of the site with respect to the lake and the fact that the building occupies the entire site boundary, it was agreed upon with the LSRCA that monetary compensation could be provided to address phosphorus removal.

The LID Treatment Train Tool (TTT) was used to model the proposed roof area. The LID TTT results indicate a load of 0.327kg. Using the P Offsetting calculation, the monetary compensation calculates as 0.327*2.5*$35,000 =$28,612.50.

Email correspondence indicating this is provided in Appendix C along with a post development phosphorus summary calculation.

4.7 Water Balance and Volume Control

Flexible treatment alternatives for sites with restrictions were reviewed to satisfy the requirements of Section 2.2.2 of the LSRCA's 2016 Technical Guidelines. Alternate 1 and Alternate 2 cannot be achieved for this development and infiltration / volume control measures are not proposed for this development due to the following:

- The proposed development consists of constructing a foundation perimeter wall around the entire property.
- The shallow groundwater aquifer is expected to be connected directly to Lake Simcoe. Therefore, infiltration would not occur.
- High ground water levels are noted in the geotechnical report.
- Risk Management Measures (RMM) identified in the Certificate of Property (CUP) Use No. 1141-AD4SQL suggest against disturbance of the contaminated soils beneath the site. By introducing infiltration on the site, contaminate transport may be impacted due to the additional groundwater flow from infiltration.
- The site is located with Wellhead Protection Area B (2-year time of travel), and an Issue Contributing Area for chloride and sodium. This means groundwater beneath the subject property is flowing towards the municipal wells and could eventually be drawn up by these wells. Volume control activities by way of infiltration could impact the source of municipal drinking water, if chemicals or pathogens migrate to the supply aquifer.

Due to the reasons noted above, we are not proposing water balance or volume control measures.

4.8 Proposed Storm Sewer Outlet

The proposed development will be serviced with a single 250mm diameter storm service connection extending to the existing double catch basin manhole (DCBMH) located within the Poyntz Street right of way. This existing DCBMH outlets provides a direct connection to Lake Simcoe via a submerged 750mm diameter outlet. Internal building plumbing will convey roof water to the proposed service connection. A hydraulic grade line calculation was completed to assess the impact the proposed 100-year peak flow of 235 L/sec has on the existing submerged outlet to Lake Simcoe. The results indicate that the water elevation in the existing outlet structure will raise 11mm as a result of the incoming uncontrolled peak flow from the condo development. This is considered negligible in relation to surcharging within the existing structure. The existing outlet is therefore suitable to accommodate uncontrolled discharge from the subject property. We also note that the time of concentration difference from the condo development (0.47 hectares) and the remaining upstream Dunlop catchment area (5.2 hectares) will be offset. Therefore, peak flows from the condo development will pass through the existing outlet structure prior to the influx of runoff coming from the larger Dunlop catchment area. A hydraulic grade line calculation is included in Appendix D illustrating the 11 mm increase in the hydraulic grade line at the outlet structure.

4.9 Poyntz Street Major Overland Flow Route

The proposed development also includes a second access to the underground parking level via the unopened Poyntz Street right of way located along the west limits of the property line. This right of way also provides a major overland flow outlet for Dunlop Street East for storm water flows from approximately 5.2ha of downtown Barrie.

Using the rational method, during the 100-year storm event, the peak discharge from major overland flow was calculated to be 0.676 m^3/sec. This assumes 50% of the 5-year storm event is conveyed through the existing municipal storm sewer infrastructure (see calculations included in Appendix D).

Conveyance capacity for the proposed entrance configuration was confirmed to ensure the major overland flow route is maintained in the post development conditions. The proposed 7.5m depressed curb for the proposed access to the underground parking level was modelled as a broad crested weir per below where L is 7.5m and Q is 0.676m^3/sec.

$$Q = 1.705 * L * H^{3/2}$$
$$H = 0.141m$$

Therefore, the proposed depressed curb and driveway at 7.5m wide has sufficient capacity to convey the major overland flows to Kempenfelt Bay. The flow depth over the depressed curb is expected to be 0.14m or 14cm. A second curb drop is proposed south of the proposed double catch basin. The curb drop proposed in this location is also 7.5m to ensure safe overland conveyance of the major flows to the lake without impacting the parking garage level.

A channel analysis using Manning's Formula was also completed on the proposed access driveway to the underground parking garage to ensure major overland flows do not enter the parking garage or overtop the proposed curbs. Using a flow of 0.676m3/sec, the depth of water within the access driveway was calculated to be 0.07m or 7cm (see calculations included in Appendix D).

4.10 Erosion and Sediment Control

Sedimentation and erosion control measures are required during construction and until such a time that site development has been completed and the driveway/entrance has been resurfaced.

The use of various siltation control measures will be implemented to protect the adjacent properties and receiving waterbodies from migrating sediments. These works include but may not be limited to:

- Installation of siltation fencing along perimeter of the development area.
- Filter cloth / silt sack placement over drains.
- Installation of vehicle tracking mud mats at the entrance to the site.

Prior to carrying out site grading the siltation barriers and mud mats shall be in place. Any onsite storm sewer works will not be permitted to outlet to the municipal sewers until the site has been stabilized.

Other temporary installations of silt fence or other appropriate measures may be required during grading to minimize silt migration from the site. The measures will need to be removed, replaced and relocated as required during the construction period until the site works have been completed and vegetation established. During construction all stockpiled material will be placed up-gradient of the siltation controls.

It is the responsibility of the contractor and owner to maintain the siltation control devices until suitable grass cover has been established. A regular review of the facilities by the contractor shall be carried out during the construction period to ensure that the facilities are being properly maintained, and if necessary, replaced. The contractor should inspect the siltation devices immediately after each rainfall. Damaged devices should be repaired immediately, and additional devices installed if necessary.

5.0 UTILITIES

Correspondence was received from both Enbridge Gas and Alectra. Alectra has noted some modifications to either the 4.16kV or 44 kV circuit would be required to service the proposed development. Enbridge has noted gas is available along Dunlop Street East to service the development.

Correspondence with the utility agencies is included in Appendix C.

6.0 TRAFFIC AND ACCESS

Access to the proposed development will be provided directly from Dunlop Street East. A traffic report has been submitted under sperate cover.

7.0 CONCLUSION

The findings of this report are summarized as follows:

- The proposed development will be serviced by a new 200mm dia. gravity sanitary service from the existing Lakeshore Trunk sewer. Review of the sanitary servicing capacity maps provided in the City of Barrie's Infrastructure Master Plan indicate no downstream constraints or reaches of pipe surcharging in 2011.

- The proposed development will have an equivalent population of about 694 people per hectare (not including the commercial components). If higher densities become the norm in the downtown area and throughout the City, future sewer capacity may become an issue in the long-term horizon. It is anticipated that sewer allocation would be granted on a first come first serve basis, and sufficient capacity can be secured for the proposed development (to be confirmed by the City).

- A ground water discharge connection to the sanitary sewer requires a discharge agreement which must be approved by Environmental Services per Sewer Use Bylaw 2012-172. The discharge agreement application will be submitted under separate cover once the further flow data is obtained from the in-situ pump test.

- A new 200mm dia. PVC fire service and 150mm dia. domestic service will extend from the existing 200mm dia. watermain on Dunlop Street East and service the site. Based on the hydrant flow test information, adequate domestic and fire flows are available to service the development.

- Due to the proximity of Kempenfelt Bay, peak flow attenuation for the proposed development is not required.

- The development is subject to phosphorus offsetting and monetary compensation is required to address the phosphorus criteria.

- Due to the proximity of the lake and with the construction of the parking garage encompassing the entire site area, infiltration facilities are not feasible nor practical to construct.

- Suitable construction erosion and sediment controls can be implements for the development.

It is recommended that:

1) This report and drawings be submitted to the City of Barrie and LSRCA to support the planning applications for the development.

All of which is respectfully submitted by,

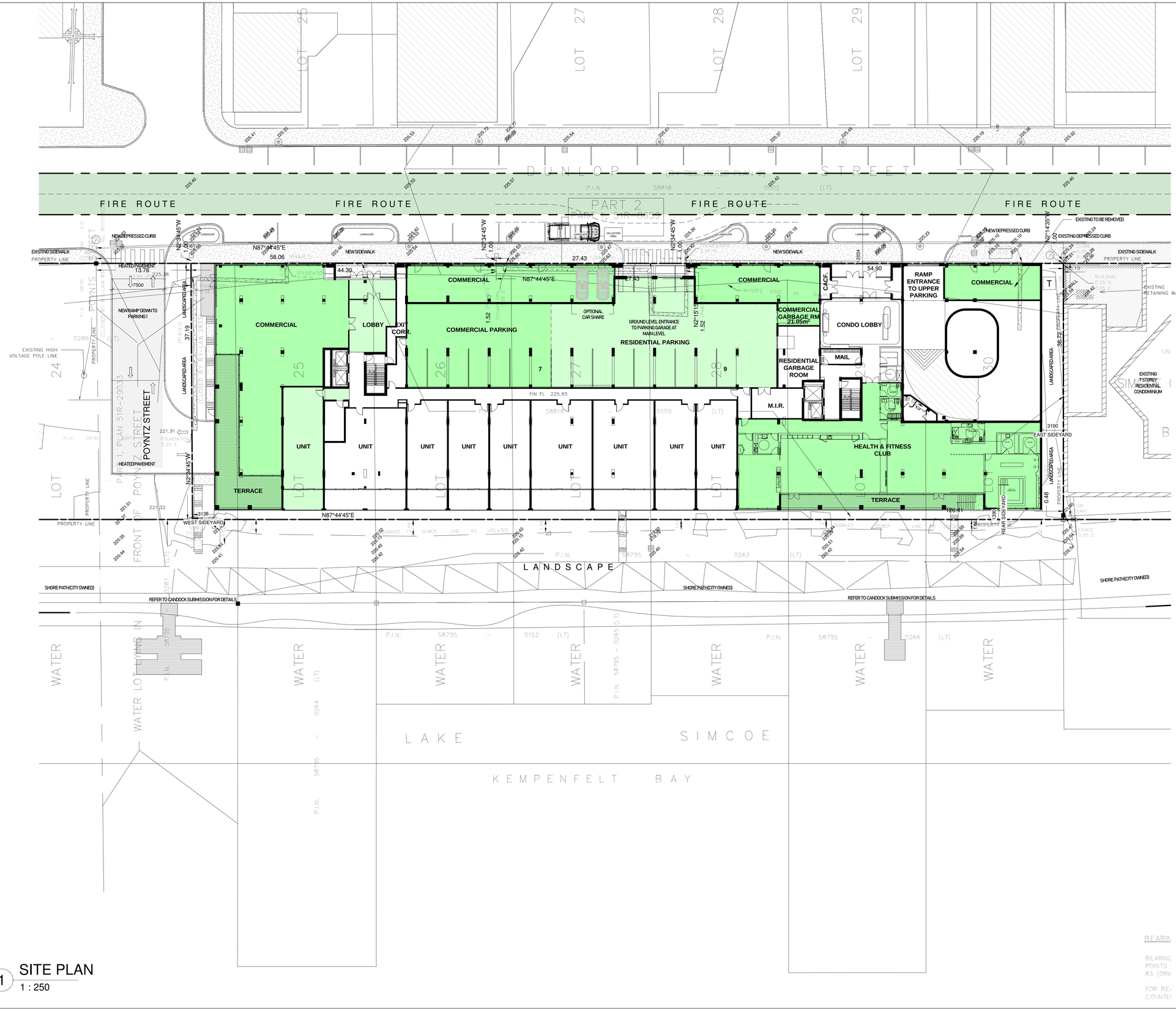
PINESTONE ENGINEERING LTD.

Joe Voisin, P.Eng.

APPENDIX A

Proposed Site Plan – ISM Architects

PEL
PINESTONE ENGINEERING LTD.



ZONING BY-LAW 2009-141

ZONED C1-1

	REQUIRED	PROVIDED
LOT AREA (MIN)	-	4705 m²
LOT FRONTAGE (MIN)	-	140.4 m
FRONT YARD (MIN)	-	0.0 m
SIDE YARD EAST (MIN)	-	3.1 m
SIDE YARD WEST (MIN)	-	3.1 m
REAR YARD (MIN)	-	1.39 m
SIDE YARD LANDSCAPE BUFFER (MIN)	3.0 m	3.1 m
REAR YARD LANDSCAPE BUFFER (MIN)	3.0 m	*1.39 m
HT. PODIUM (DUNLOP)	-	10.0 m
HT. FROM AVG. GRADE TO CONDO ROOF	-	*33.0 m
LOT COVERAGE GRND. FLR/SITE (MAX.)	-	93.7%
COVERAGE FOR COMMERCIAL USES (MIN.)	50%	50.1% *36.8%
GROSS FLOOR AREA (MAX.% OF LOT AREA)	600%	480%
PARKING (SPACES)	1/UNIT - 178	241
B.F. PARKING (SPACES)	3% x 178 - 5.34	6

LEVEL 1	2,702 m²	9
GROSS FLOOR AREA	2,702 m²	
COMMERCIAL GROUND AREA	2,357 m² + *1,734 m²	
CONDO UNITS		9
LEVEL 2	1,737 m²	13
GROSS FLOOR AREA	1,737 m²	
CONDO UNITS		13
LEVEL 3	1,788 m²	13
GROSS FLOOR AREA	1,788 m²	
GUEST SUITE		1
CONDO UNITS		13
LEVEL 4, 5, 6, 7, 8, 9	15,126 m²	132
GROSS FLOOR AREA (EACH FLOOR)	2,521 m²	
CONDO UNITS (EACH FLOOR)		22
LEVEL 10 (PENTHOUSE)	1,231 m²	11
GROSS FLOOR AREA	1,231 m²	
CONDO UNITS		11
TOTAL	22,584 m²	178

PARKING		248
P1		128 (+3)
LEVEL 1	7 COMMERCIAL 9 RESIDENTIAL	16
LEVEL 2		51
LEVEL 3		53
STREET PARKING		6

BEARIN

BEARING POINTS 83 (ORI

FOR BE COUNTE

1 SITE PLAN
1 : 250

ISM ARCHITECTS Inc.
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No.	Description	Date
1	REVISIONS	12/07/16
2	ISSUED FOR PRECONSULT	7/11/16
3	CITY PLANNER REVIEW	06/22/17
4	SPC SUBMISSION	10/17/17
5	PER POST SPC MTG.	04/06/18
6	PER POST SPC MTG	05/10/18
7	COM. OF ADJ. SUBM	06/28/18
8	CLIENT REVIEW	12/13/18
9	LARGER ISLAND	04/09/19
10	CONSULTANTS SET	05/21/19

Stamp

ONTARIO ASSOCIATION OF ARCHITECTS
IAN S. MALCOLM
LICENCE
2853

Orientation

N

Client Information

AALTO DEVELOPMENT INC.

Project

WATERFRONT CONDO

185 DUNLOP STREET
BARRIE, ONT

Project Information

Project No.:	153834
Drawn by:	JB
Checked by:	ISM
Date:	DEC 13, 2018
Scale:	As indicated

Drawing

SITE PLAN

Drawing No.

A100

APPENDIX B

Geotechnical Report – Geospec Engineering Ltd.

PEL
PINESTONE ENGINEERING LTD.

GEOSPEC ENGINEERING LTD.

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GEOTECHNICAL INVESTIGATION

185-205 DUNLOP STREET

BARRIE, ONTARIO

PREPARED FOR:

Mr. Erkki Laakkonen

RR #1

Gilford, Ontario

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Project N° 99-555

July 19, 1999

Distribution: 2- Client

1 - For ISM Arch Nov 16/06.

1 - ISM Dec 7/06

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EXECUTIVE SUMMARY

Geospec Engineering Ltd. completed a Geotechnical Investigation at the site of a proposed commercial development, situated at 185-205 Dunlop Street, in the City of Barrie. It is our understanding that the proposed development will include a two storey garage that extends below the level of Dunlop Street with a ten storey hotel constructed above. The lowest garage slab is proposed at 220.15 m and will cover the entire site; while the hotel portion will be recessed on three sides.

The investigation was completed once a majority of the existing fill had been removed, in order to provide detailed geotechnical data and augment a previous study completed by others. Some areas of fill were left in place to maintain the stability of the existing walls on the north side of the property and provide access to the site. Recommendations made previously with respect to vibration monitoring and a pre-construction survey still apply.

Ultimately, four boreholes were drilled at the approximate locations identified on the Borehole Plan (Enclosure N° 2). The boreholes generally revealed an original stratified deposit that included layers of sand & gravel, silty sand and silt. A sand & gravel fill, which has subsequently been removed, was encountered over the original soil at Borehole N° 2. The relative density of the soil, within the depth of the investigation, varied from loose to very dense; but generally dense.

Groundwater was encountered at all borehole locations at an approximate elevation of 218.4 metres. The elevation of the groundwater in the boreholes coincided with the lake level, at the time of the investigation.

Based upon the results of the investigation and the type of structure proposed, it is our considered opinion that a combination of conventional spread and strip footings and deep foundations will be suitable for support of the proposed development. The two to three storey sections of the structure may be supported on "shallow" strip foundations. However, the higher loads developed by the multi-storey structure should be supported at depth with either driven or auger press piles.

1.0 INTRODUCTION

Geospec Engineering Ltd. was retained by Mr. Erkki Laakkonen to complete a Geotechnical Investigation for a proposed commercial development, located at 185-205 Dunlop Street, in the City of Barrie. The site location is shown on the appended Site Plan (Enclosure N° 1). The project and purpose of the investigation were discussed with Mr. Laakkonen and Ian Malcolm, Architect. It is our understanding that the proposed development will cover the property in its entirety and include a multi storey structure with two levels of underground parking.

This investigation was completed following the removal of a majority of the existing fill, in order to recover technical data with respect to the subsurface conditions at the site. Furthermore, recommendations made, in a previous study completed by others, with respect to vibration monitoring and pre-construction surveys still apply.

This report briefly describes the field work, subsurface conditions encountered, and our general recommendations based on the information obtained.

2.0 FIELD WORK

The field investigation included one borehole drilled to depth of 30.9 metres, two boreholes drilled to a depth of 23.3 metres, and one borehole drilled to a depth of 14.7 metres below the existing grade levels, in the anticipated building area. The approximate locations are shown on the accompanying Borehole Plan (Enclosure N° 2). Field work was carried out under the full time supervision of a technologist from our office between June 15 to June 21, 1999.

The boreholes were augured by a track mounted drilling machine provided and operated by a specialist, drilling contractor. Standard penetration tests were carried out

intermittently, and discontinuous soil samples were recovered at intervals through the subsurface soil.

A Standard Penetration Test is a method of sampling soil, which has been standardized by ASTM D1586. The test consists of driving a standard split-barrel sampler a distance of 45 cm into undisturbed soil, at the elevation to be tested, using a 63.5 kg driving mass falling free from a height of 76 cm, and totalling the number of blows to drive the sampler the last 31 cm.

All soil samples recovered were visually classified, and appropriately tested in the field. They were then individually bagged, labelled, and returned to our laboratory for a formal assessment.

Groundwater conditions, if encountered, were observed in each open borehole during and on completion of drilling. Observations are detailed on the accompanying Borehole Logs.

The surface elevation at each borehole location is shown on the Borehole Plan and each log. The borehole elevations were referenced to a catch basin cover on Poyntz Street. The geodetic elevation of the Bench Mark was 221.49 m.

3.0 SUMMARIZED SUBSURFACE SOIL CONDITIONS

The properties of the soil strata encountered at the boreholes are given in the appended Borehole Logs. The conditions are summarized in the following sections.

3.1 Fill

Borehole N° 2 encountered a layer of fill approximately 250 cm in thickness. The fill was mainly comprised of sand and gravel, with trace silt and occasional organic inclusions. The relative density of the fill was loose; while moisture contents were in the order of 7 to 12%.

3.2 Sand & Gravel

Extending below the surface cover at each borehole and fill at Borehole N° 2 was a deposit of sand & gravel with moisture contents varying from 5 to 20%. This deposit extended to depths ranging from 11.1 metres (BH N°1) to 20.3 metres (BH N°3) below the existing grade levels. Grain Size Distribution Analyses (Enclosure N° 5) established a composition that consisted predominantly of sand and gravel with trace silt.

Standard Penetration Test results indicate that the Relative Density was compact to very dense. In addition, resistance to auguring suggests occasional cobble layers are included in the deposit.

3.3 Silty Sand/Sandy Silt

Underlying the sand & gravel was a dense silty sand and/or sandy silt. Determination of the Moisture Contents were in the order of 18% to 38%, indicative of a very moist to saturated state. While, Standard Penetration Test results indicate that the Relative Density varied from dense to very dense.

3.4 Silt

Extending below the sandy silt at Borehole N°1 was a dense deposit of silt with moisture contents varying from 10 to 28%. This silt deposit extended beyond the final depths investigated at this particular borehole.

4.0 GROUNDWATER CONDITIONS

Groundwater was encountered at all boreholes, at an approximate elevation of 218.4 metres below the existing grade level. As anticipated the level coincided with the prevailing lake level.

Groundwater levels are subject to seasonal fluctuations and due to the proximity of Kempenfelt Bay, the lake level will essentially govern water levels at this site.

5.0 EXCAVATION CONSIDERATIONS

In no case should vertical cuts be made without providing shoring and/or underpinning of the existing structures on the north and east sides of the site.

Specific recommendations concerning the design of shoring and underpinning will be given once the exact building configuration (i.e. depth and position) relative to adjacent structures and services has been established. General recommendations are provided in the following sections but are dependent upon the type of foundation system ultimately selected for support.

6.0 FOUNDATION CONSIDERATIONS

We have been advised that consideration is being given to the construction of a multi storey commercial structure, in the area of the boreholes. The structure will include a two storey unheated underground garage with a ten storey building extending above the current level of Dunlop Street. The lowest parking elevation is presently proposed at 220.15 m.

Several alternatives are available for the support of the proposed structure. Based upon the building configuration and variation of column loads between the multi-storey and two storey sections, a combination of strip footings and deep foundations are recommended. However, consideration may be given to a concrete raft foundation provided the site can be safely dewatered by vacuum well points.

A combined system of support is only considered because the proposed structure includes a two storey underground garage on the north, east and west sides with a third storey lobby on the north side. The multi-storey portion of the development is recessed five to eight metres from the garage perimeter. Therefore the reduced loads applied at the

perimeter may be supported on conventional strip and spread footings; while the increased loads of the high rise are supported on deep foundations.

Furthermore, discussions with the structural engineer have established that the concrete garage deck extending between the strip footings and piles will tolerate the maximum anticipated differential settlement of 25 mm.

6.1 Perimeter Spread Footings Founded on Original Soil

Following the removal of the fill which remains at Borehole N° 2, the perimeter strip foundations of the two storey parking structure may be founded on the original sand & gravel deposit. A maximum allowable bearing capacity of 200 kPa may be used for design purposes for footings founded at the elevations tabulated below.

TABLE 1

Founding Elevation for 150 kPa		
Borehole Number	**Depth (m)**	**Elevation (m)**
1	1.1	220.0
2	2.7	217.6
3	1.0	217.8
4	1.1	218.0

The elevations specified above will require the groundwater level be lowered to Elevation 217.0 m. Since the soil at the site is cohesionless and moderately to highly permeable we advise that a vacuum well point dewatering system would represent the most effective method of groundwater control. Once the site is adequately dewatered the footing excavations may proceed.

It must be noted that bearing pressure given is based on information obtained from the boreholes. Specific information with respect to soil conditions between boreholes is available during excavation of the foundations. Therefore, all excavated founding elevations, must be inspected by a representative of **Geospec Engineering Ltd.** prior to

forming and the placement of concrete, to ensure that the required bearing capacity is being complied with.

6.2 Spread Footings Founded on Engineered Fill

As yet our office has not been provided with the finished exterior grade levels; however, the lowest parking level elevation has been established at 220.15 m. Therefore, if both the lowest floor elevation and frost protection requirements are taken into account; consideration may be given to the creation of an engineered fill pad that will accommodate the difference between the stripped grade level and minimum depth requirements. As with excavated footings dewatering by vacuum well points will be necessary.

Once the site is dewatered, the construction of the engineered fill pad will begin with the subexcavation and removal of any existing fill. The exposed subgrade must them be thoroughly compacted and inspected by personnel from Geospec Engineering Ltd. Following inspection, the area may be raised to the floor slab subbase grade level with approved on-site material or a well graded, granular material with a maximum 8% silt content. Fill must be compacted in lifts not exceeding 20 cm in thickness, to at least 100% Standard Proctor Density. The moisture content of the fill material placed should be within 2% of the Optimum Moisture Content in order to achieve optimum compactive effort.

The engineered fill must extend at least one metre beyond the proposed building envelope and slope down to the surrounding subexcavated level at 45°.

In order to ensure the above criteria are satisfied, the removal of the existing fill and topsoil as well as the placement of engineered fill must be supervised on a continuous basis by a qualified soil technologist from our office.

In addition, all footings founded on engineered fill must be reinforced in order to minimize the effects of variations in the degree of compaction of the engineered fill. For the purpose of frost protection, all exterior footings and footings exposed to frost action should be covered by at least 150 cm of soil.

6.3 Deep Foundations

Due to the high loads generated by the multi-storey portion of the hotel and the presence of a relatively loose soil that extends to at least eight metres below the existing grade, it is our opinion that a deep foundation system will be required. Such a system will transfer the main building load to the dense sand & gravel encountered at an Elevation of 209 m.

A variety of deep foundation systems are available and include driven piles or auger press piles. Driven piles represent a viable method of support; however, the selection of a suitable foundation system also must take into account the vibration effects on neighbouring properties, contractor availability and cost. It is therefore recommended that a structural engineer establish the pile requirements and configuration so experienced pile driving contractors may determine the most economical pile type.

For tendering purposes, it is estimated that end bearing piles would be driven to refusal at an anticipated depth of between eight (BH N° 1) to sixteen (BH N° 2) metres below the existing grade levels. While an expanded base pile would set up at depths of between five (BH N° 1) to ten (BH N° 4) metres below the existing grade. Furthermore, for design purposes the sand & gravel, at refusal, is considered capable of supporting a design bearing pressure of 450 kPa. We do advise that once the piling design has been developed, our office be contacted for further information.

It should be noted that driving of at least two test piles and load testing is the most reliable method of defining the pile lengths and capacity. In addition, it is recommended that the pile driving operations be inspected by a representative from our office during installation.

It is also recommended that prior to the installation of any pile a preconstruction survey of nearby structures be completed. This survey must document signs of distress in all surrounding structures including pavement. In addition, we recommend a vibration survey be undertaken during the placement of test piles, in order to achieve an indication of the velocities created. In this respect, adjustments can be made during the placement of piles in order to limit vibration.

The soil conditions on the site indicate that special design and construction factors should be taken into account. For instance, problems can arise on this site where the heterogeneous fill contains construction debris or material which can obstruct or impede the advancement of a pile. If an obstruction is encountered the piles may deflect and deviate from their design alignment to an unacceptable extent, may be deformed at the pile toe, or suffer from local buckling along the pile. When considering these possibilities, the design engineer must determine the best suited pile type and may have to accommodate changes in the location of the piles, during pile driving.

If driven piles are the ultimate alternative, an allowance must be made in the pile driving contract, for the retapping of piles in order to verify the obtained driving resistances.

Pile groups should be driven from the interior outward because the lateral displacement of soil may cause excessively hard driving and heaving of already driven piles.

7.0 SLAB ON GRADE RECOMMENDATIONS

For normal slab on grade construction, we recommend any fill or organic matter be removed. The subgrade at the stripped grade level should then be proofrolled with a heavy smooth drum roller prior to placing any underfloor fill. Any soft areas encountered during proofrolling should be subexcavated and replaced with a well compacted and approved granular material.

Due to the sandy nature of the native soil at the site it is considered suitable for use as backfill. All fill must be uniformly compacted, in lifts not exceeding 20 cm in thickness, to at least 98% Standard Proctor Dry Density. Furthermore, at least 15 cm of Granular 'A' type material should be placed directly below the floor slab to act as a moisture barrier.

The floor slab should be founded above the finished exterior grade and all surface run-off water should be directed away from the building.

8.0 UNDERGROUND WALL RECOMMENDATIONS

The proposed development will be constructed with a parking garage floor elevation above the groundwater table level.

During the excavation of the underground parking garage or any underground opening deeper than 120 cm, the sides of the excavation must be sloped to a maximum 1:1 inclination. All excavations must be carried out in full compliance with the most recent guidelines of the Occupational Health and Safety Act.

We further recommend that the exterior underground walls be damp-proofed and perimeter weeping tile installed around the exterior footings. A system of weeping tiles installed beneath the slab is not mandatory for slabs founded above the groundwater level; still their installation would be considered a valuable precaution.

The underground walls should be designed to resist a lateral earth pressure as defined by the following expression;

$$P[kN/m] = K_o h(½h\gamma + q)$$

Where:

$\mathbf{K_o}$	is the Coefficient of Lateral Earth Pressure at Rest ($\mathbf{K_o = 0.5}$)
γ	is the Bulk Unit Weight of Soil (γ= **22 kN/m^3**)
q	is the surcharge load (Minimum **q = 20 kPa)**
h	is the Height of the underground wall below the finished exterior grade

See appended drawing for the drainage and backfilling requirements for the exterior subsurface walls with perimeter and underfloor weepers.

9.0 GENERAL RECOMMENDATIONS

To reiterate no vertical cuts can be made without providing shoring and/or underpinning of the existing structures on the north and east sides of the site. As yet we understand the building configuration has not been finalized. However, it is estimated that the retaining wall footing on the north property line as well as the north half of the building to the east would be underpinned; while, the remaining walls and earth on the north property line would be shored.

Underpinning is a method by which the footing of an existing structure is extended to a deeper elevation. At this site the method is required to permit the installation of the proposed perimeter garage footings. There are several procedures used to underpin including; hand dug piers or sections, bracket piles or jacked piles. Based upon the results of the geotechnical investigation, the in-situ soil has the bearing capacity to support an underpinning procedure.

The most appropriate procedure is dependent upon the capacity of the contractor. However, we recommend a maximum underpinned section of 120 cm long, 150 cm high and a depth that extends the full width of the footing to be underpinned. Furthermore, the progression of the underpinning operation must stagger each section a minimum 240 cm so the footing is safely supported at all times. Finally, a minimum100 cm gap must be left at the top of each section to accommodate concrete shrinkage and allow for the insertion of a non-shrink grout.

Due to the diversity of the shoring requirements at this site, it is recommended that Shoring Specialists be contacted to provide detailed recommendations. Geotechnical criteria pertinent to shoring will be provided as required. Preliminary data including the Lateral Earth Pressure criteria have been stated in section 8.0 (Underground Wall Recommendations).

It is recommended that the King Piles in the shoring design be installed in pre-augured holes taken to a suitable bearing stratum and filled with 20 MPa concrete to the proposed excavation level. The ultimate founding level will be determined by several factors including the type of material to retain (concrete wall, rubble wall or soil), height and type of restraint (tiebacks or rakers).

All vertical cuts should be lagged on exposure and care taken not to over-cut beyond the proposed line of lagging. Any water encountered must be allowed to drain without the loss of fines through erosion. If seepage persists, consideration must be given to the installation of vertical drains behind the shoring wall to relieve hydrostatic pressure. If shoring proceeds in the winter months, measures must taken to ensure the pore water behind the wall does not freeze.

If tiebacks are included in the final design, it is recommended that six be load tested to two times the working load.

Finally, shoring systems are a temporary measure and are not intended for long-term lateral support of soils and surcharge loads.

10.0 STATEMENT OF LIMITATIONS

The statement of limitations, as enclosed in Appendix A, is an integral part of this report.

Respectfully,

GEOSPEC ENGINEERING LTD.

K. Malcolm, P. Eng.

KM:mj

Appendix A

Statement of Limitations

STATEMENT OF LIMITATIONS

The conclusions and recommendations provided in this report, with respect to subsurface conditions, are based on information determined at the borehole locations. Soil and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations. Furthermore, conditions may exist which could not be detected or anticipated at the time of subsurface investigation.

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 of the alignment and elevations stated in the report. Since all details of the design may not be known to **Geospec Engineering Ltd.**, certain assumptions had to be made. The actual conditions may, however, vary from those assumed; in which case, changes and modifications may be required to our recommendations.

We recommend, therefore, that **Geospec Engineering Ltd.** be retained during the final design stage to review the design drawings and to verify that they are consistent with our recommendations or the assumptions which were made in our analysis. We recommend also that we be retained during construction in order to confirm that the subsurface conditions throughout the site do not deviate significantly from those encountered in the boreholes. In instances where these limitations are not followed, **Geospec Engineering Ltd.** responsibility is limited to accurately interpreting the information encountered at the boreholes.

The comments and recommendations given in this report on potential construction problems and possible methods are intended only for the guidance of the design engineer. The number of boreholes and parameters analysed may not be sufficient to determine all the factors that may affect construction methods and cost. Therefore, the contractors bidding on this project or undertaking the construction must make their own interpretation of the factual information presented and draw conclusions as to how the subsurface conditions may affect their work, with the knowledge, that specific locations were investigated.

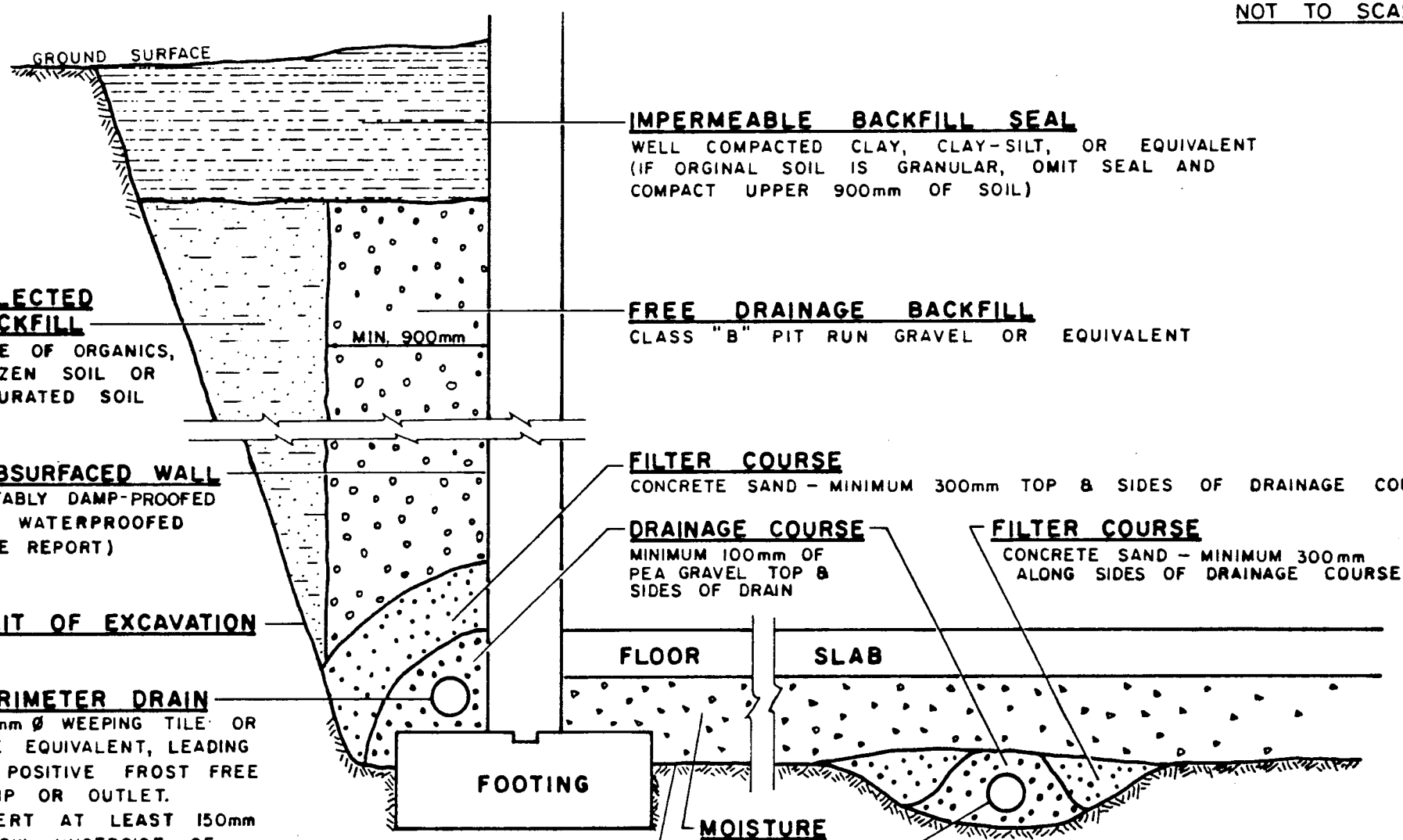
Appendix B

Weeping Tile Details

RECOMMENDED DRAINAGE AND BACKFILLING REQUIREMENTS FOR EXTERIOR SUBSURFACE WALLS WITH TILE DRAIN ABOVE FOOTING & UNDERFLOOR DRAINS

FOR BASEMENT FLOOR LOCATED AT/OR BELOW THE WATER TABLE

NOT TO SCALE



IMPERMEABLE BACKFILL SEAL
WELL COMPACTED CLAY, CLAY-SILT, OR EQUIVALENT (IF ORGINAL SOIL IS GRANULAR, OMIT SEAL AND COMPACT UPPER 900mm OF SOIL)

SELECTED BACKFILL
FREE OF ORGANICS, FROZEN SOIL OR SATURATED SOIL

FREE DRAINAGE BACKFILL
CLASS "B" PIT RUN GRAVEL OR EQUIVALENT

SUBSURFACED WALL
SUITABLY DAMP-PROOFED OR WATERPROOFED (SEE REPORT)

FILTER COURSE
CONCRETE SAND - MINIMUM 300mm TOP & SIDES OF DRAINAGE COURSE

DRAINAGE COURSE
MINIMUM 100mm OF PEA GRAVEL TOP & SIDES OF DRAIN

FILTER COURSE
CONCRETE SAND - MINIMUM 300mm ALONG SIDES OF DRAINAGE COURSE

LIMIT OF EXCAVATION

PERIMETER DRAIN
100mm ø WEEPING TILE OR PIPE EQUIVALENT, LEADING TO POSITIVE FROST FREE SUMP OR OUTLET. INVERT AT LEAST 150mm BELOW UNDERSIDE OF FLOOR SLAB

SUBGRADE
COMPETENT ORIGINAL SOIL OR WELL-COMPACTED FILL

MOISTURE BARRIER
MINIMUM 200mm CRUSHED STONE

UNDERFLOOR DRAIN
100mm ø WEEPING TILE OR PIPE EQUIVALENT, LEADING TO POSITIVE FROST FREE SUMP OR OUTLET. INVERT AT LEAST 300mm BELOW UNDERSIDE OF FLOOR SLAB. TILE OR PIPE PLACED IN PARALLEL ROWS OF 3 TO 5 m CENTRES (SEE REPORT)

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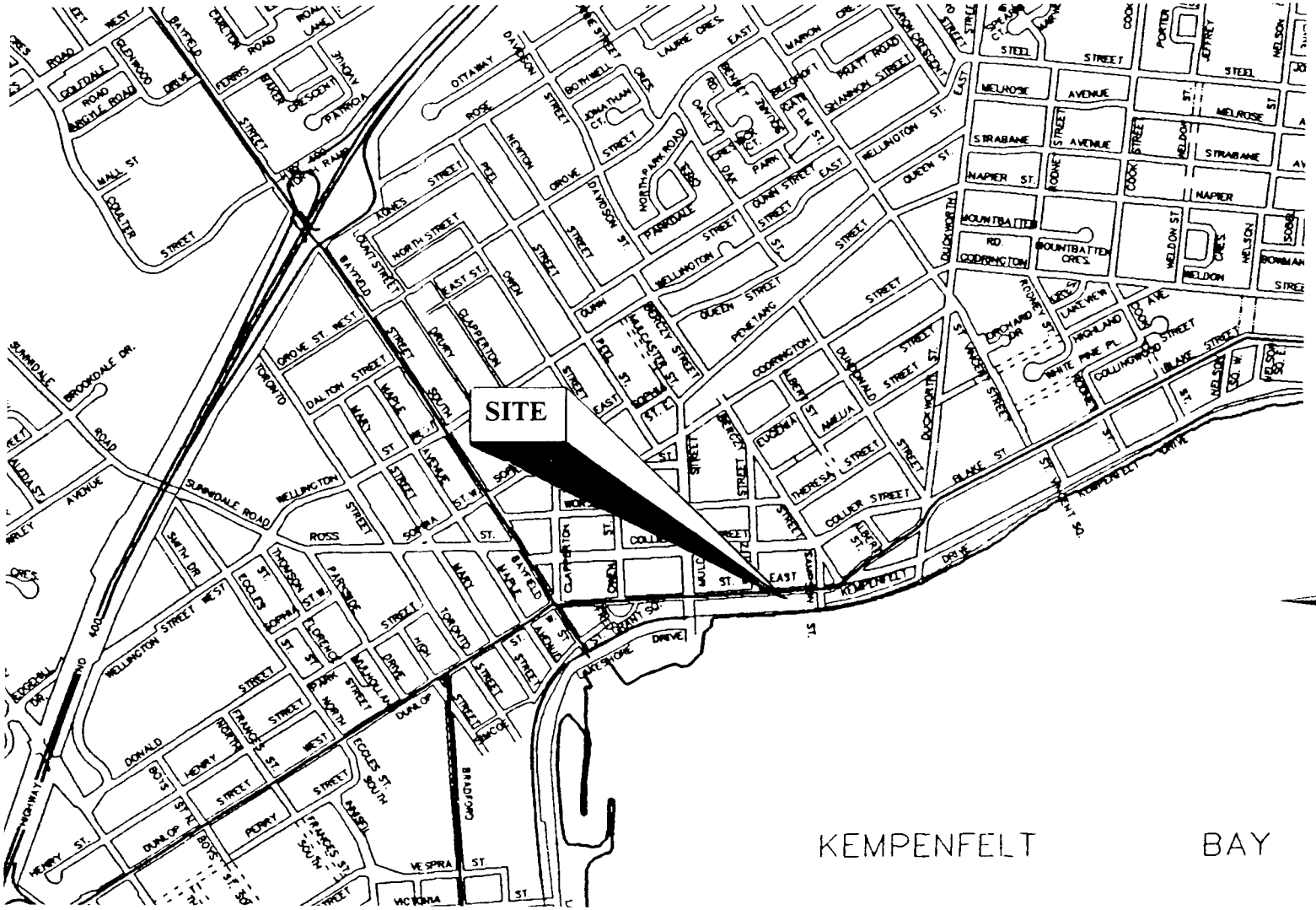
Barrie, Ontario. L4N 7R8

Enclosures

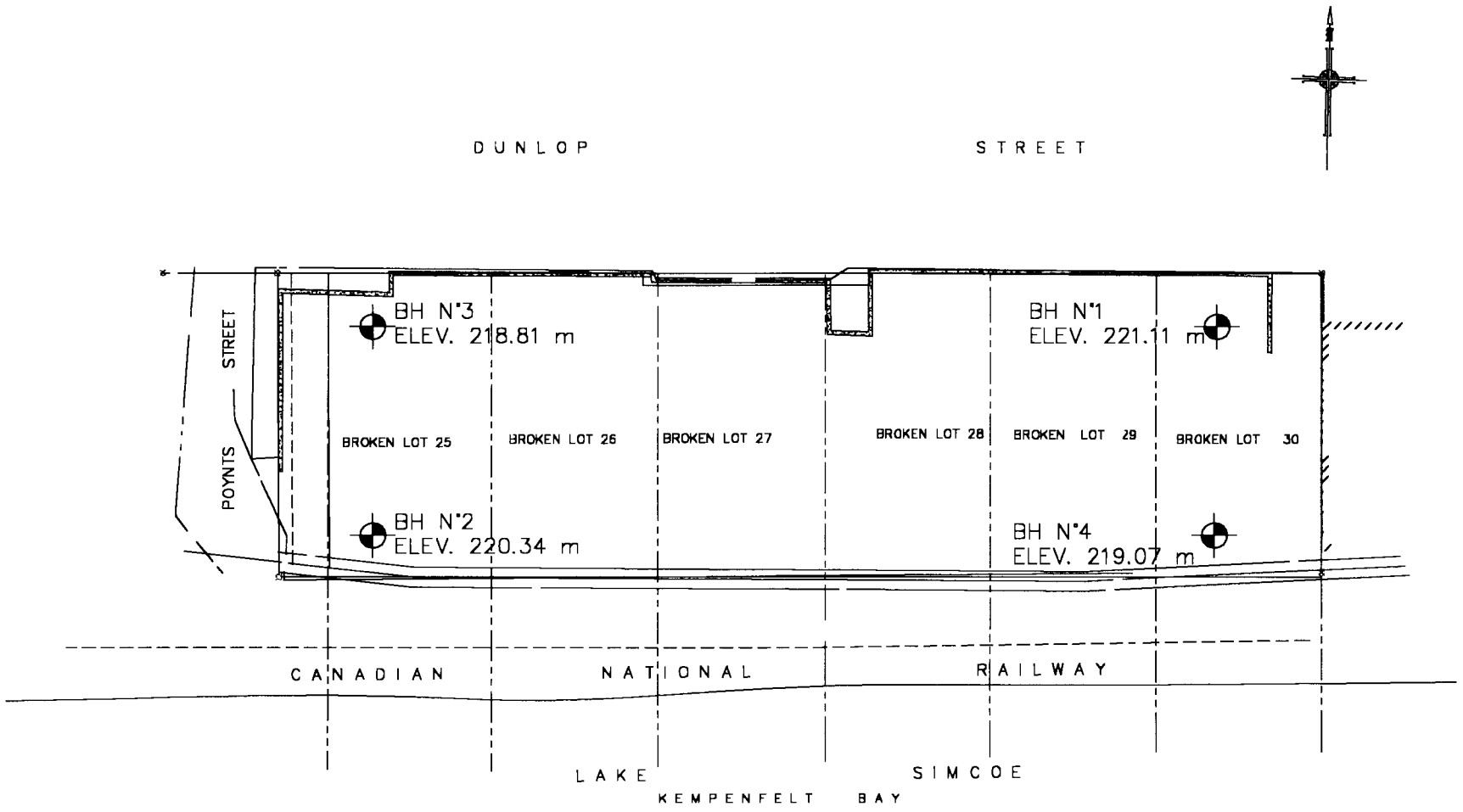
Site Plan
Borehole Plan
Borehole Logs
Grain Size Distribution Charts



SITE PLAN

GEOSPEC ENGINEERING LTD.
287 TIFFIN STREET, UNIT 10
BARRIE, ONTARIO, L4N 7R8 TEL. 722 4638 FAX 722 4958

CLIENT: ERKKI LAAKKONEN	PROJECT #: 99-555.GEO	ENCLOSURE #: 1
PROJECT: 185-205 DUNLOP STREET	DATE: JUNE 28, 1999	SCALE: NTS



BOREHOLE PLAN

GEOSPEC ENGINEERING LTD.
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BARRIE, ONTARIO, L4N 7R8 TEL. 722 4638 FAX 722 4958

CLIENT: ERKKI LAAKKONEN	PROJECT #: 99-555.GEO	ENCLOSURE #: 2
PROJECT: 185-205 DUNLOP STREET	DATE: JUNE 28, 1999	SCALE: NTS

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BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	1
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 15, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	221.11 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
221.1						
				41		
			2	72		
		2.8 ▼		39		
				30		
	Brown to grey, moist to wet, dense to very dense **SAND & GRAVEL** with trace silt		4			
				32		
	Gradation @ 5.0m 70% Sand 28% Gravel 2% Silt		6			
				>99	→	
	becoming sandier with depth		8			
				>99	→	
			10	>99	→	
210.0						
				72		
			12			
	Grey, wet, very dense **SILTY SAND** with some layering			81		
			14			

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BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	1 continued
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 15, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	221.11 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
	Borehole N°1 continued.....			63		
			16	5		
				>99	→	
			18			
202.4				>99	→	
			20			
				>99	→	
			22	>99	→	
	Grey, wet, very dense **SANDY SILT**			>99	→	
			24			
				>99	→	
			26			
				>99	→	
193.2						
			28	52		
	Grey, wet, very dense **SILT** with trace sand					

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BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	1 continued
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 15, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	221.11 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
	Gradation @30.9m 97% Silt 1% Sand <1% Gravel		30	53		
190.2	**END OF BOREHOLE**		32	58		

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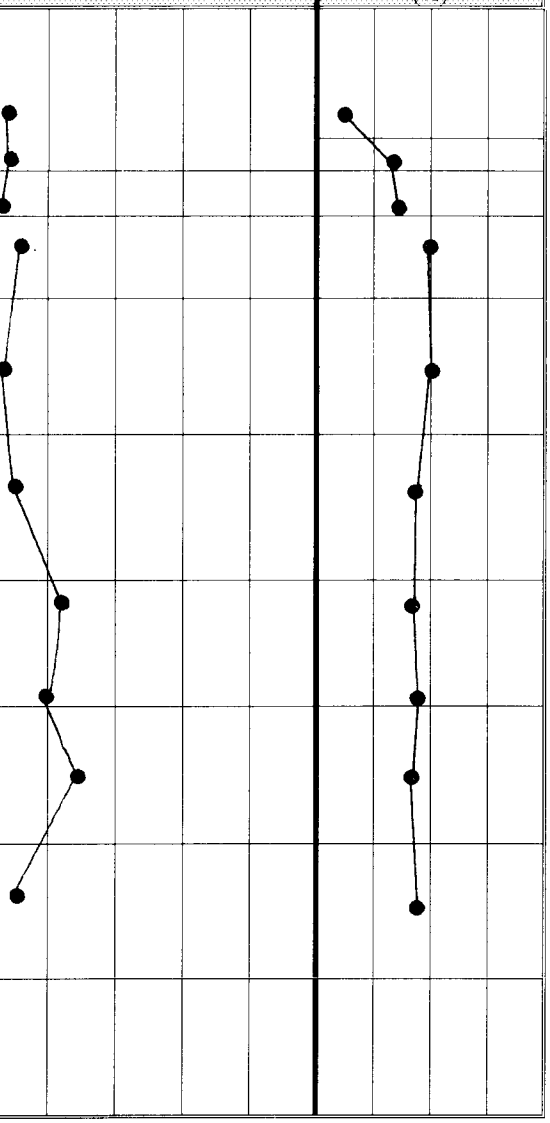
BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	2
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 16, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	220.34 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION ♦ DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
220.3						
	Light brown, moist, loose **SAND & GRAVEL (POSSIBLE FILL)** with trace silt and occasional organic inclusions	1.7 ▼	2	7 8 5		
217.8	Brownish grey, moist to wet, loose to very dense **SAND & GRAVEL** with trace silt and occasional layering		4 6 8 10 12 14	14 7 10 22 20 32 14		



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BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	2 continued
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 16, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	220.34 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
	Borehole N°2 continued....		16	26 >99		
203.1				>99		
	Grey, wet, very dense **SILTY SAND**		18			
201.6				>99		
	Brownish grey, wet, very dense **SAND & GRAVEL** with trace silt and frequent cobbles and boulders		20			
				>99		
			22	>99		
197.0						
	END OF BOREHOLE Note: Refusal at 23.6 m due to a boulder.			>99		
			24			
			26			
			28			

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BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	3
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 18, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	218.81 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
218.8		0.4 ▼				
	Brown, moist to wet, compact to very dense **SAND & GRAVEL** with occasional layering and silt seams		2	14		
				14		
			4	10		
				16		
			6	24		
			8	15		
209.2				38		
	Gradation @ 9.6m 79% Sand 15% Gravel 6% Silt		10	>99 →		
	Grey, wet, very dense **SILTY SAND** with some silt and trace gravel		12	>99 →		
			14	65		

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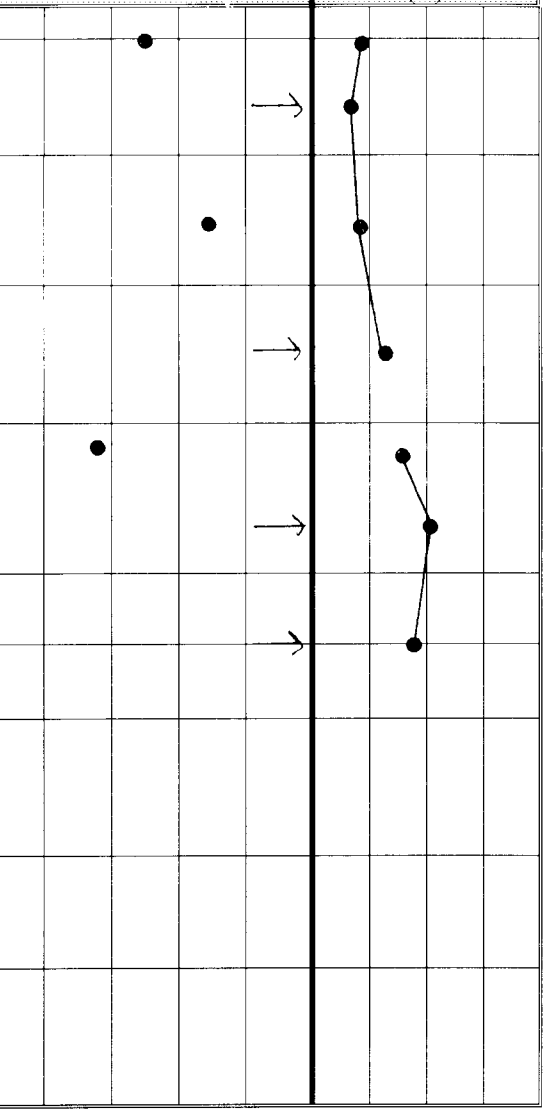
BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	3 continued
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 18, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	218.81 m	**BORING METHOD:**	Hollow Stem Augers

ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
204.6				50		
	Brownish grey, wet very dense **SAND & GRAVEL** with frequent silt seams		16	>99		
			18	71		
198.5			20	>99		
	Grey, wet, very dense **SILTY SAND**		22	39		
195.5				>99		
	END OF BOREHOLE Note: Refusal at 23.3 m.		24	>99		
			26			
			28			



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

BOREHOLE LOG

CLIENT:	Erkki Laakkonen	**BORE HOLE N° (s):**	4
PROJECT NAME:	185-205 Dunlop Street	**BORING DATE:**	June 21, 1999
PROJECT N°:	99-555.GEO	**SAMPLING METHOD:**	Split Spoon
GROUND ELEVATION:	219.07 m	**BORING METHOD:**	Hollow Stem Augers

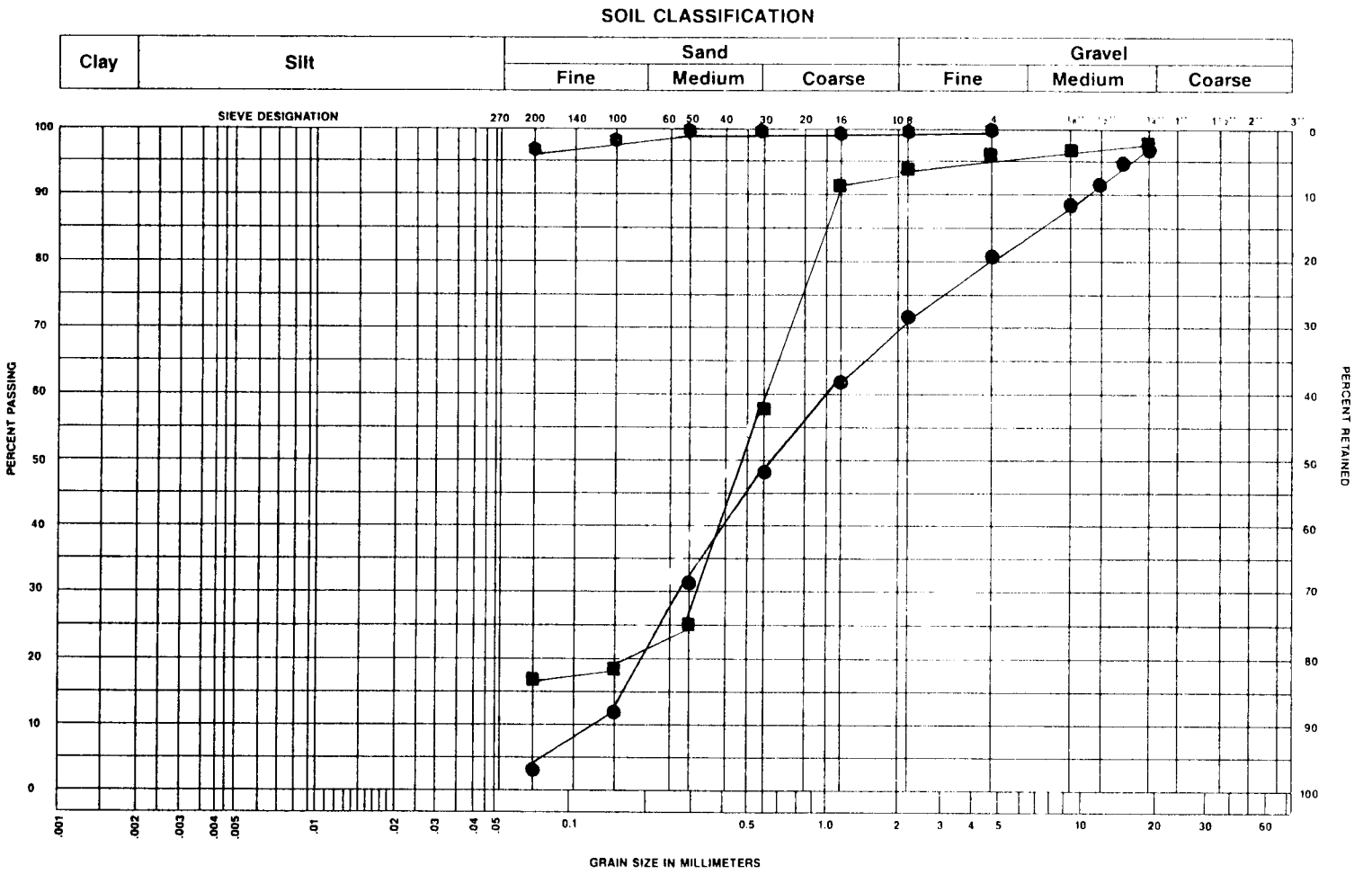
ELEVATION (m)	SOIL DESCRIPTION	WATER LEVEL (m)	DEPTH (m)	'N' VALUE BLOWS PER 0.3m	N VALUE (BLOWS/0.3m) STANDARD PENETRATION • DYNAMIC CONE ♦ 20 40 60 80 SHEAR STRENGTH kPa	LIQUID LIMIT W_L PLASTIC LIMIT W_P W_P W W_L 10 20 30 WATER CONTENT (%)
219.1						
		0.7 ▼		9		
			2	45		
				17		
				23		
			4			
				33		
			6			
	Brownish grey, moist to wet. loose to very dense **SAND & GRAVEL** with occasional silt seams and frequent cobbles and boulders			16		
			8			
				7		
			10	10		
				33		
			12			
				>99	→	
			14			
				>99	→	
204.4				>99	→	
	END OF BOREHOLE Note: Refusal at 14.7 m.					

GEOSPEC ENGINEERING LTD.

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

GRAIN SIZE DISTRIBUTION CHART

CLIENT:	Erkki Laakkonen	**DATE:**	June 28, 1999
		ENCLOSURE N°:	
PROJECT:	185-205 Dunlop Street, Barrie	**PROJECT N°:**	99-555
SAMPLE N°:		**DATE SAMPLED:**	June 15-21, 1999
SAMPLE TYPE:	Split Spoon	**DATE RECEIVED:**	June 15-21, 1999
SAMPLED BY:	MJ	**DATE TESTED:**	June 26, 1999
SAMPLED FROM:			
	BH 1/5.0 m ●——— Sand & gravel with trace silt		BH 3/9.6 m ■——— Sand with some silt and trace gravel
	BH 1/30.9m●——— Silt with trace sand		



APPENDIX C

Correspondence and Background Information

PINESTONE ENGINEERING LTD.

flow testing is required for all development applications to establish and confirm boundary conditions for the development. This information will provide a basis for the design proposal. Fire flow testing is required for all development applications to establish and confirm boundary conditions for the development, and will provide the basis for the design proposal.

Fire flows shall meet the following criteria:

- Residential Single Family Streets: minimum 57 l/sec (750 gpm) @ 138 kpa residual (20 psi); preferred 76 l/sec (1,000 gpm) @ 138 kpa residual (20 psi).
- Institutional/Convenience Commercial: minimum 91 l/sec (1,200 gpm) @ 138 kpa residual (20 psi); preferred 114 l/sec (1,500 gpm) @ 138 kpa residual (20 psi).
- Industrial/Commercial Subdivisions: minimum 136 l/sec (1,800 gpm) @ 138 kpa residual (20 psi); preferred 152 l/sec (2,000 gpm) @ 138 kpa residual (20 psi).
- Downtown Commercial: minimum 136 l/sec (1,800 gpm) @ 138 kpa residual (20 psi); preferred 189 l/sec (2,500 gpm) @ 138 kpa residual (20 psi).

Flows to be calculated using hydrant flow formula in section 4.3.2.

189 L/sec

VSCO

4.3.2. *Typical Hydrant Flow Calculations:*

Calculate Flow at 20 P.S.I. Residual Pressure

$$QA = QT \sqrt{\frac{ha}{ht}}$$

Where: QA = Flow at 20 P.S.I.

QT = Flow at Test

ha = Pressure Drop Available

ht = Pressure Drop at Test

Example: Static - 56 PSIG; Residual - 40 PSIG; Flow - 976 GPM

$$QA = 976 \sqrt{\frac{56-20}{56-40}} = 1464 \text{ GPM}$$

4.3.3. *Minimum Watermain Sizing*

For distribution systems designed to provide fire protection, the minimum diameter of watermains shall be 150 mm, except beyond the last hydrant on cul-de-sacs where the minimum diameter of watermains may be 50 mm.

For distribution systems that are not designed to provide fire protection, the minimum diameter of watermains shall be 75 mm.

4.3.4. *Maximum Velocity*

The maximum velocity for watermains 300 mm and larger; under normal operating conditions will not exceed 1.5 m/s, while during fire flow conditions, the maximum velocity will not exceed 3 m/s. In all cases, watermain diameters shall be such that a flushing velocity of 0.8 m/s can be achieved for cleaning and flushing procedures.

4.3.5. *Head Loss Gradient*

Maximum head loss gradient allowed under normal operating pressures is 2.5 m/km.

4.3.6. *Minimum Slope*

The minimum slope for a transmission watermain installation is 0.5% where possible. This is to prevent the accumulation of trapped air and to avoid localized high points.

High Density	Apartment dwellings	54 - 300 units/hectare @ 1.67ppu

- Typical zoning designations for High Density Development may include RA1 and RA2. It should be noted that zoning designations are subject to change, and it is the responsibility of the designer to ensure that the most current zoning by-laws and designations are being used.

The method of determining design population for residential flows will depend upon the particular stage that is being considered and the appropriate detail required for the desired level of design accuracy. Reference shall be made to current zoning policies.

Development Details Basis

When the details regarding the proposed uses on individual lots are known, or can be assumed with reasonable certainty, a more detailed approach to design population and associated design flow estimation is required. This approach involves the determination of individual design flows for the various areas in the tributary area which will contribute to an individual sewer reach. The actual number of units shall be used and the design population estimated using the following people per unit (ppu) values.

Low Density	3.13 ppu
Medium Density	2.34 ppu
High Density	1.67 ppu

COMMERCIAL + RESTAURANT FLOWS BASED on O.B.C.

3.3.1.2. Average Daily Flow

Average daily domestic flow = 225 L/day/person (excluding extraneous flows)

3.3.1.3. Peak Flow

Peak domestic flow is to be calculated using the following formula:

$$Qp = \frac{P \times q \times M}{86.4} + I \times A$$

Where Qp = Peak residential sanitary sewage flow, including peak extraneous flows (L/s)

P = Design population in thousands (see Section 3.3.1.1)

q = Average daily domestic flow per capita (L/day/person) (see Section 3.3.1.2)

M = Peaking factor (see Section 3.3.1.3)

I = Peak extraneous flow (L/s/ha) (see Section 3.3.4)

A = Tributary area (ha) (see Section 3.2.2)

As per the MOECC Design Guidelines for Sewage Works, 2008 (MOE Guidelines), the peaking factor, M, can be calculated using the Harmon Formula or Babbit Formula. The Babbit Formula gives peaking factors that are more representative of instantaneous peaks, and the Harmon Formula gives peaking factors that are more representative of peak hour. The Babbit Formula shall only be used to assess the upstream reaches of the sewer shed where depth of flow and minimum scour is a concern for partial flow conditions where depth of flow is less than 30% of the pipe diameter.

Harmon Formula

$$M = 1 + \frac{14}{4 + P^{0.5}}$$

MOE SWM MANUAL, 2003

- grassed swales;
- pervious pipe systems;
- vegetated filter strips; and
- stream and valley corridor buffer strips.

The primary function of infiltration controls is to mitigate the impacts that urbanization normally has on the water balance (i.e., increased surface runoff, reduced soil moisture replenishment and groundwater recharge). Concentrated infiltration of stormwater collected from larger areas (e.g., infiltration basins, an end-of-pipe infiltration type control) will not match the characteristics of distributed infiltration which occurred under pre-development conditions. The natural hydrologic cycle can be maintained to the greatest extent possible by lot level infiltration controls.

Infiltration technologies can achieve water quality enhancement; however, stormwater containing high concentrations of suspended solids will tend to clog these controls. Further, infiltration of contaminated water can impair groundwater quality. Therefore, these measures are ideally suited to the infiltration of relatively clear stormwater, such as stormwater from rooftops which contains only atmospheric contaminants (i.e., contaminants deposited on the rooftop by precipitation or dryfall) or foundation drainage.

If the quality of the stormwater is such that there may be a problem with clogging in the system or degradation of groundwater quality, pre-treatment is required. Infiltration controls are not appropriate for applications with the potential for highly contaminated stormwater (e.g., industrial land uses).

By reducing the size of storm sewer infrastructure and end-of-pipe facilities, lot level and conveyance controls provide economic benefits. Section 4.8 provides guidance with respect to the reductions in end-of-pipe storage requirements which various lot level and conveyance controls allow.

The successful implementation of many lot level and conveyance measures require innovative subdivision design. In addition to the measures which are the focus of this manual, there are complementary controls which can be undertaken by home owners. For example, cisterns or rain barrels may be used in combination with bioretention gardens. Lot grading can be used to direct runoff to garden areas. Trickle irrigation systems may be used to make use of captured runoff in soils with lower infiltration capacities. Public education programs within municipalities can help to educate the public on the role they can play in the application of complementary measures.

A significant challenge in designing and implementing a stormwater management strategy which incorporates lot level techniques and other source controls is that many of these initiatives will be implemented on lands held in private ownership. Consequently, maintenance and the long-term effectiveness of the system is contingent on the actions of the landowner. Landowner education is the key to ensuring that systems remain effective over time. The successful application of lot level landscape solutions therefore requires the commitment of the municipality and the

-----Original Message-----
From: Steve Troan [mailto:S.Troan@lsrca.on.ca]
Sent: Monday, July 23, 2007 10:17 AM
To: jamsen@richardsonfoster.ca
Subject: Re: High water elevation

Jennifer:

The high water elevation in this area is approximately 220.67 m.a.s.l.

Stephen Troan, C.E.T.
Engineering Technologist
Lake Simcoe Region Conservation Authority
120 Bayview Parkway
Box 282, Newmarket, Ontario
L3Y 4X1
Phone (905) 895-1281
Fax (905) 853-5881
s.troan@lsrca.on.ca
www.lsrca.on.ca

>>> "Jennifer Amsen" <jamsen@richardsonfoster.ca> 20/07/2007 1:32:04 pm >>>

Hi

Our office has been speaking with Tom Hogenbirk as you were on Holidays. We are looking for the high water elevation for the site that is hatched in below. Dunlop and Poyntz Street. If you need anything else from me please let me know.

Thanks

BD21295_Jen Amsen BD21295_

RICHARDSON FOSTER LTD.
<mailto:bhuffman@richardsonfoster.ca> jamsen@richardsonfoster.ca

<http://www.richardsonfoster.ca/> http://www.richardsonfoster.ca
ph: 705-728-0009 ext 240
fx: 705-727-7774
Unit L, 4 Cedar Pointe Dr.
Barrie, Ontario
L4N 5R7

Joe Voisin

From: Stephen Cranley <stephen.cranley@alectrautilities.com>
Sent: November 30, 2017 2:30 PM
To: Joe Voisin
Cc: Geoff Harris
Subject: RE: 185 Dunlop Street East

Hi Joe,

Our existing distribution (4.16kV) and sub-transmission (44kV) overhead circuits are located along the west side of the proposed site at Dunlop Street East and Poyntz Street.

The 4.16kV distribution voltage can accommodate the following:

- Secondary Voltage 120/208V (3 phase, 4 wire) – Maximum service size 2000A and pad-mounted transformer 750kVA.
- Secondary Voltage 600/347V (3 phase, 4 wire) – Maximum service size 800A and pad-mounted transformer 750kVA.

Service requirements above what has been noted would require the customer to install/maintain their own transformer and service connected to our 44kV sub-transmission circuit.

Based on my high level review modifications to either the 4.16kV or 44kV circuit would be required to accommodate connection of the customer's proposed service.

Regards,

Steve

From: Joe Voisin [mailto:jvoisin@pel.ca]
Sent: November-27-17 10:48 AM
To: Stephen Cranley
Cc: Geoff Harris; David Smith
Subject: RE: 185 Dunlop Street East

For Phase 1 is has. The docking facility will be phase 2 or move forward at a later date.

Joe

From: Stephen Cranley [mailto:stephen.cranley@alectrautilities.com]
Sent: November 27, 2017 10:47 AM
To: Joe Voisin <jvoisin@pel.ca>
Cc: Geoff Harris <geoff.harris@alectrautilities.com>; David Smith <David.Smith@enbridge.com>
Subject: RE: 185 Dunlop Street East

Thanks Joe. Has the marina facility been removed from the proposed development?

Steve

From: Joe Voisin [mailto:jvoisin@pel.ca]
Sent: November-27-17 10:24 AM
To: Stephen Cranley
Cc: Geoff Harris; David Smith
Subject: RE: 185 Dunlop Street East

Hi Stephen,

See below development proposal breakdown:

1. Total commercial floor area in m2 **340m2**
2. Total restaurant area in m2 or total number of restaurant seats (1st floor and roof) **765m2 + 240m2 rooftop**
3. Total number of one bedroom units **33**
4. Total number of one bedroom plus den units **49**
5. Total number of two bedroom units **32**
6. Total number of two bedroom plus den units **63**
7. Total number of three bedroom units **17**

Joe

From: Stephen Cranley [mailto:stephen.cranley@alectrautilities.com]
Sent: November 23, 2017 12:39 PM
To: Joe Voisin <jvoisin@pel.ca>
Cc: Geoff Harris <geoff.harris@alectrautilities.com>
Subject: RE: 185 Dunlop Street East

Hi Joe,

You are correct, back in 2011 we were involved with a different customer regarding electrical servicing of a proposed development.

December 1st, 2016 we received a pre-consultation site plan application from the City of Barrie for this development. At the time the applicant was proposing a 220 unit residential condominium development with 416sqm of commercial space and a marina facility. It looks like the number of units has been reduced to 194. Is that correct? Has anything else changed?

Regards,

alectra utilities
Discover the possibilities

Stephen Cranley, C.E.T.
Supervisor, Subdivisions & New Services
55 Patterson Rd. Barrie, ON L4N 3V9
t 705.722.7244 x31297 | **m** 705.241.7950
alectrautilities.com

From: Joe Voisin [mailto:jvoisin@pel.ca]
Sent: November-20-17 1:10 PM
To: Stephen Cranley; David Smith
Subject: 185 Dunlop Street East

Hi Stephen and David,

We are working on a FSR for the attached development proposal at the subject location. Can you please review and confirm if servicing along Dunlop can accommodate this proposal. There is a lot of history with this site, so you have likely looked into this before with a difference development concept proposed.

Thanks in advance.

Joe Voisin, P.Eng.
Senior Engineer, Partner

PEL
PINESTONE ENGINEERING LTD.

20 Bell Farm Road, Unit 1, Barrie, ON, L4M 6E4
jvoisin@pel.ca | PEL.ca

T: 705-503-1777
F: 705-645-7262
C: 705-641-8301

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Hi Joe.

With the limited data provided we used a total load of 346.5m3/hr.

194 units at 1.275m3/hr each
Commercial/restaurant at 99.1m3/hr.

Based on these values, gas is available. Please let me know if you get solid figures showing a load higher than this and we will re-run. Also, this gas availability is valid for 6 months.

Give me a call if you have any questions.

Thanks.

David K. Smith
Customer Connections Field Representative
—
ENBRIDGE GAS DISTRIBUTION
TEL: 705-739-5254 | FAX: 705-739-5200 | CELL: 705-220-5997
10 Churchill Dr. Barrie, ON L4N 8Z5
David.smith@enbridge.com

enbridgegas.com
Integrity. Safety. Respect.

From: Gary Matthie
To: Joe Voisin
Subject: RE: 185 Dunlop Street East
Date: May 22, 2018 12:09:58 PM

Hi Joe,

As you state below, if the post development flow does not exceed the capacity of the existing outlet pipe and the existing path is not impacted, then we could be in the position to waive the Post-to-Pre quantity control requirements.

I believe that trying to satisfy any water balance requirements on this site could be problematic considering the existing subsurface conditions that likely prohibit active infiltration efforts. I think if appropriate justification/background is provided to show that water balance is not achievable on this site due to these existing conditions, then this requirement could be shown to have been addressed (spoken to).

Regards,

Gary Matthie, P.Eng.
Senior Development Services Technologist
Engineering Department
705.739.4220
Ext 4448

From: Joe Voisin [mailto:jvoisin@pel.ca]
Sent: Monday, May 14, 2018 1:35 PM
To: Gary Matthie <Gary.Matthie@barrie.ca>
Subject: RE: 185 Dunlop Street East

Hi Gary,

Just wondering if you have had a chance to confirm SWM criteria for this waterside development?

Thanks,
Joe

From: Joe Voisin
Sent: Tuesday, May 8, 2018 3:00 PM
To: Gary Matthie <Gary.Matthie@barrie.ca>
Subject: 185 Dunlop Street East

Hi Gary,

We are working on a site plan submission for a new development at 185 Dunlop Street East. The

site is essentially adjacent to Lake Simcoe and the LSRCA is suggesting, quantity control, volume control, water balance are all required. Understanding that quality control and phosphorus needs to be dealt with, can the City please confirm if quantity control and water balance is required for site developments adjacent to the lake? I also believe the City owns the gravel pedestrian path so could you also confirm we are OK to send uncontrolled drainage to the lake provided our post development peak flows are not exceeding the capacity of the existing outlet and we are not impacting the pedestrian path?

Once I understand the City's position on SWM criteria for this particular site, I will reconfirm criteria with the LSRCA.

Thanks in advance.

Joe Voisin, P.Eng.
Senior Engineer, Partner

PEL
PINESTONE ENGINEERING LTD.

20 Bell Farm Road, Unit 1, Barrie, ON, L4M 6E4
jvoisin@pel.ca | PEL.ca

T: 705-503-1777
F: 705-645-7262

From: Tom Hogenbirk
To: Joe Voisin
Subject: RE: 185 Dunlop Street - Condo Development Barrie
Date: March 18, 2019 10:40:06 AM

Joe: Your calculations look reasonable.

Regards…TH

Tom Hogenbirk, P.Eng.
Manager, Engineering
Lake Simcoe Region Conservation Authority
120 Bayview Parkway,
Newmarket, Ontario L3Y 3W3
905-895-1281, ext. 240 | 1-800-465-0437
t.hogenbirk@LSRCA.on.ca | www.LSRCA.on.ca
Twitter: @LSRCA
Facebook: LakeSimcoeConservation

Please note: The LSRCA Board of Directors have approved a change to our Fees Policy. The new fees will take effect on January 1, 2019. Please click here for the new fee schedule.

From: Joe Voisin [mailto:jvoisin@pel.ca]
Sent: March 15, 2019 10:08 AM
To: Tom Hogenbirk
Subject: 185 Dunlop Street - Condo Development Barrie

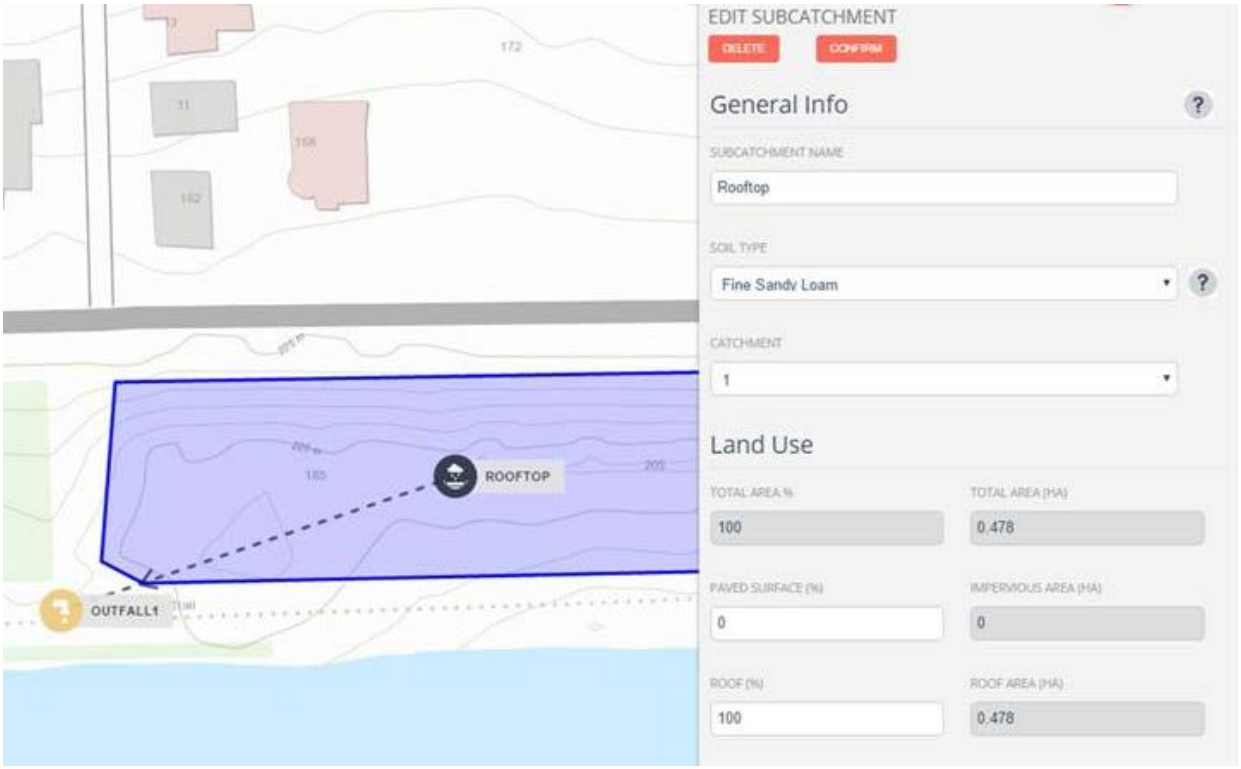
Hi Tom,

Thanks again for taking the time to meet with me this week. I am in the process of having the developer provide me with a cheque for the P-Offsetting. Before I have this made out to the LSRCA, I would like to confirm/agree on the amount.

We have used the LID TTT as discussed to model the roof area. The site area is actually 0.47ha but the program rounded to 0.48ha as shown below on the screen clip. I have also attached the output summary for total P loading. The results indicate a load of 0.327kg. Using the P Offsetting calculation, the fee would is 0.327*2.5*$35,000 =$28,612.50. I believe this is similar to what you had calculated.

If you could please kindly confirm the P-Offsetting amount provided in this email, I will have a cheque made up and provide with my revised submission.

Thanks in advance.



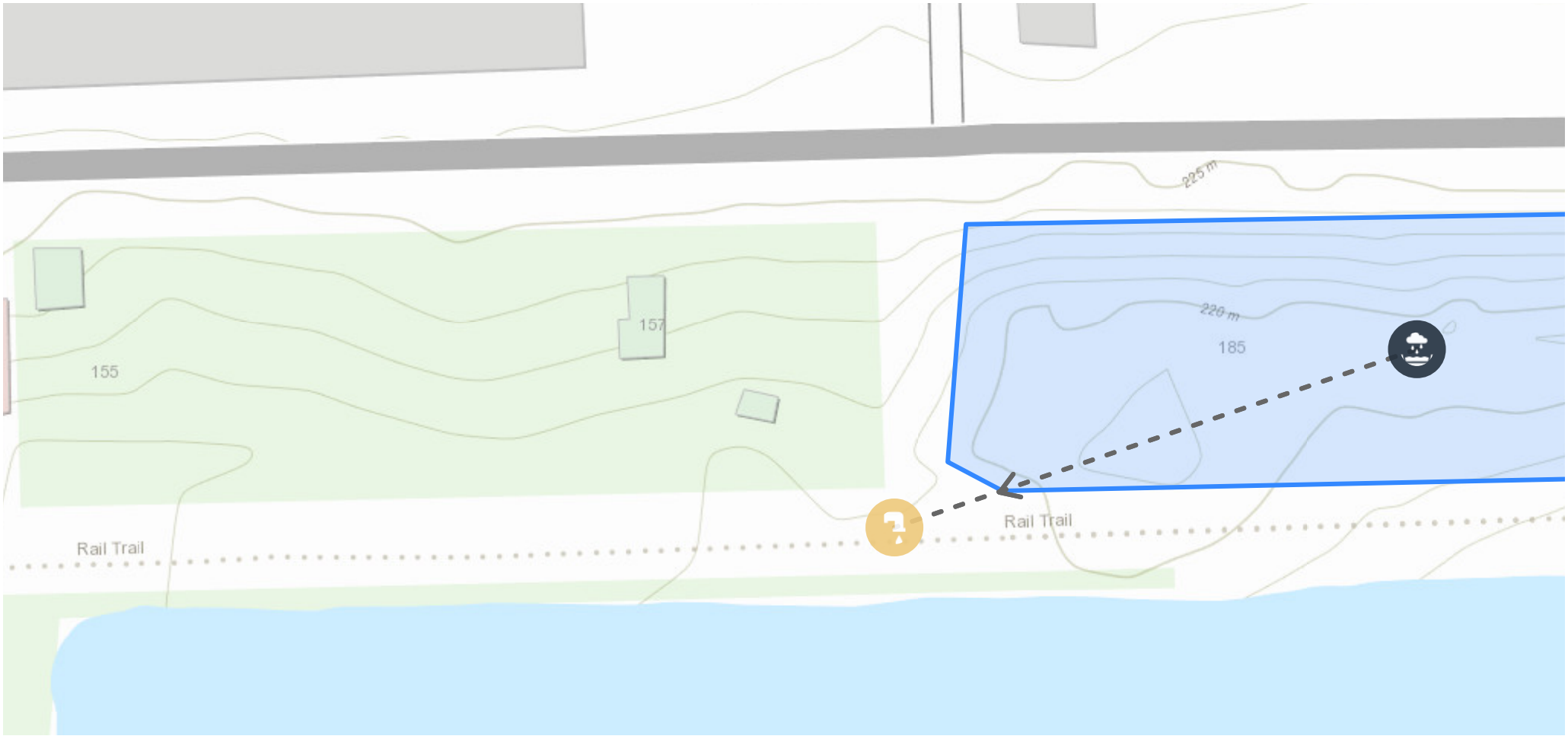
Joe Voisin, P.Eng.
Senior Engineer, Partner

PINESTONE ENGINEERING LTD.

110 Kimberley Ave., Bracebridge, ON, P1L 1Z8
jvoisin@pel.ca | PEL.ca

T: 705-645-8853
F: 705-645-7262

Map | Post-Development



Loading Summary TP | Post Development

Catchment	Total Catchment TP Removal	Peak Outflow	Generated Total Flow (m^3) Average Concentration (mg/l) Total Load (kg)	Outgoing Total Flow (m^3) Average Concentration (mg/l) Total Load (kg)
Catchment 1	0.000 %	0.066 m^3/s	3,630.000 m^3 0.090 mg/l 0.327 kg	3,625.000 m^3 0.090 mg/l 0.327 kg
Total	**0.000 %**	**0.066 m^3/s**	**3,630.000 m^3** **0.090 mg/l** **0.327 kg**	**3,625.000 m^3** **0.090 mg/l** **0.327 kg**

APPENDIX D

Sanitary Design Calculations
Water Analysis Design Calculations
Drainage Calculations

PINESTONE ENGINEERING LTD.

185 Dunlop Street

City of Barrie

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

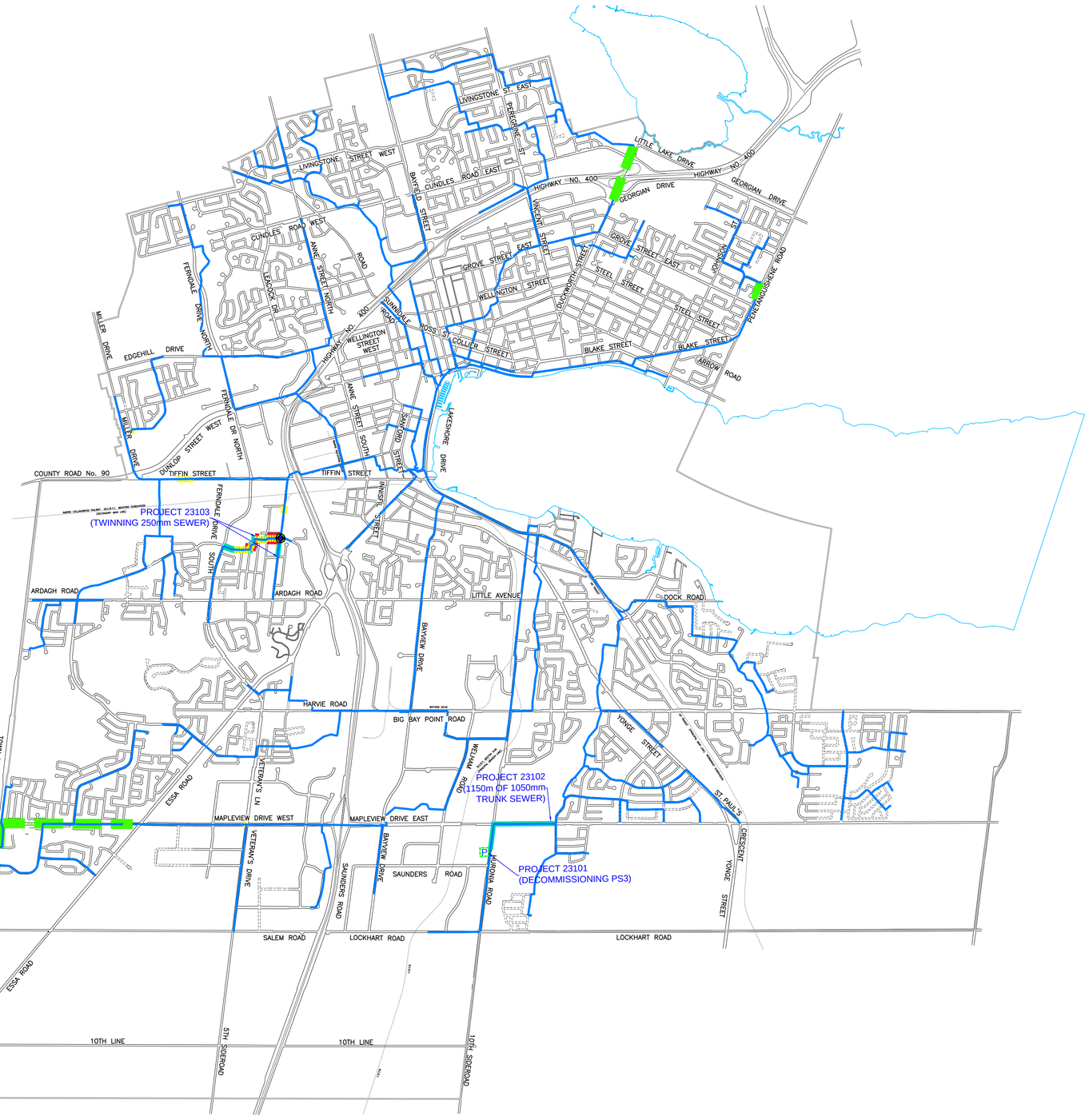
Project Number: 17-11338B
Date: November 1, 2017
Design By: JHV
Checked By: JHV
Drainage Area Plan No: N/A
File: \\PINESTONESERVER\Shared Folders\Company\Project Documents\11338B 185 Dunlop Street\Second Submission\FSR&SWM\Sanitary Sewer Design Sheet.xls

Design Parameters

Average Daily Flow
Residential 0.0026 L/s/c
Commercial 0.326 L/s/ha (peak x4)
Mannings "n" 0.0130
Min. Velocity 0.75 m/sec
Max. Velocity 3.0 m/sec
Residential Harmon Peaking Factor (F)
Infiltration 0.10 L/s/ha

PEL PINESTONE ENGINEERING LTD.

LOCATION				RESIDENTIAL AREAS and POPULATION						SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL				INFILTRATION			DESIGN						
										HECTARES AND FLOW OF EACH ZONING																		
										0.00 L/s/ha						0.00 L/s/ha												
STREET	AREA NO.	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA	UNITS	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	TOTALS-C-I FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY	ACTUAL VELOCITY
				ha	*1.67pp/unit*	*1000s*	*1000s*		*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*ha*	*ha*	*L/sec*	*L/sec*	*m*	*%*	*mm*	*L/sec.*	*m/s*	*m/s*
Proposed Sanitary Flows																												
Residential				0.47	178.00	0.297	0.297	4.080162	3.1585											0.47	0.47	0.0470	3.2055						
Commercial (@ 5L/m2)													0.2357		0.5456				0.5456				0.5456						
TOTAL SEWAGE FLOW																							**3.7511**	1.0	2.00	200	46.3604	1.476	0.886
Long Term Ground Water Discharge Allowance																							**0.5000**						
TOTAL SEWAGE FLOW WITH GROUND WATER DISCHARGE																							**4.2511**						
																Capacity of Immediate Downstream Reach of 825mm dia. Sanitary Sewer =								94.0	0.07	825	390.2826	0.730	



LEGEND:

- SURCHARGING CONDUITS (GREATER THAN 100% CAPACITY)
- SURCHARGING CONDUITS (GREATER THAN 85% CAPACITY)
- PROPOSED WORKS SEWER
- EXISTING SANITARY SEWER
- FORCEMAIN
- PROPOSED FLOW MONITORING STATION

No.	DATE	BY	REVISIONS	MAN	CAD

APPROVALS

Municipal

Engineer

Date

Design	D.H.S.	Checked	P.D.S.	
Drawn	P.D.	Checked	D.H.S.	
Scale	N.T.S.			
Date	OCTOBER 2013			

WASTEWATER COLLECTION SYSTEM
DRAFT FINAL
YEAR 2011 EXISTING CONDITION

The City of BARRIE

amec

Contract No. 2011-29

Consultant File No. 110135

Drawing No. SHEET 4 OF 8

P:\Work\110135\Hwy\dwg\Contract\Sanitary\Third_Submission\October Submission\Existing City\04-2011 Surcharge.dwg

City of Barrie Wastewater Collection System Calculation

Pre 2010 City Boundary: Sanitary Flow Before Adjustment (for 2011)

Landsue based

225l/cap.day
0.002604167

1	2	3	4	5	6	7	8	9	10	11
Sewershed ID	PCSWMM ID	Flow Assignment (Manhole ID)	Sewershed Area (hectare)	Sewershed Population Equivalent Density (cap/hectare)	Population Equivalent (single catchment)	Population Equivalent (adding upstream)	Harmon Peak Factor (adding upstream)	Regulated Peak Factor (1.5<X<4)	(Accumulated) Sanitary Base Flow (l/s)	(Accumulated) Sanitary Peak Flow (l/s)
NCAT16850	318	SAC07018	21.3518	39.7	848	2012	3.5838	3.5838	5.2	18.8
NCAT16900	283	SAC04009	14.1912	0	0	11624	2.8895	2.8895	30.3	87.5
NCAT17000	268	SAC03004	102.1799	24.1	2463	2463	3.5137	3.5137	6.4	22.5
NCAT17100	291	SAC02094	10.5413	43.5	459	14546	2.7917	2.7917	37.9	105.7
NCAT17200	290	SAC02044	34.3444	31.3	1075	1075	3.7795	3.7795	2.8	10.6
NCAT17300	289	SAC02035	46.5709	54.8	2552	3627	3.3711	3.3711	9.4	31.8
NCAT17400	317	SAC02001	9.0574	130.6	1183	19356	2.6668	2.6668	50.4	134.4
NCAT17500	500	SAC01031	8.7297	117.8	1028	20384	2.6442	2.6442	53.1	140.4
NCAT17600	292	SAL02041	9.5787	36.3	348	348	4.0502	4.0000	0.9	3.6
NCAT17700	293	SAL08271	12.0064	83.8	1006	1354	3.7113	3.7113	3.5	13.1
NCAT17800	264	SAL08275	11.2240	183.8	2063	3417	3.3938	3.3938	8.9	30.2
NCAT17900	323	SAL02075	1.6252	173.8	282	282	4.0898	4.0000	0.7	2.9
NCAT18000	307	SAL03212	37.1812	54.8	2038	2038	3.5794	3.5794	5.3	19.0
NCAT18100	493	SAL03209	4.2428	172.6	732	2770	3.4716	3.4716	7.2	25.0
NCAT18200	305	SAL03014	8.0458	215.3	1732	1732	3.6335	3.6335	4.5	16.4
NCAT18300	494	SAL03012	2.1768	221.8	483	4985	3.2462	3.2462	13.0	42.1
NCAT18400	265	SAL03108	29.1003	59.1	1720	1720	3.6358	3.6358	4.5	16.3
NCAT18500	306	SAL03101	8.9252	135.7	1211	2931	3.4510	3.4510	7.6	26.3
NCAT18600	503	SAL03009	2.9188	212	619	8535	3.0227	3.0227	22.2	67.2
NCAT18700	496	SAL03192	2.3581	148.3	350	16272	2.7426	2.7426	42.4	116.2
NCAT18800	545	SAL03239	2.1365	54.1	116	24923	2.5569	2.5569	64.9	166.0
NCAT18900	544	SAL03242	1.9391	25.5	49	24972	2.5560	2.5560	65.0	166.2
NCAT18950	312	SAL03243	1.8750	153.6	288	25260	2.5511	2.5511	65.8	167.8
NCAT19000	543	SAL03227	0.8887	209.7	186	59336	2.1963	2.1963	154.5	339.4
NCAT19100	449	SAL02070	1.7464	0	0	59618	2.1944	2.1944	155.3	340.7
NCAT19200	497	SAL02073	1.3104	0	0	63035	2.1726	2.1726	164.2	356.6
NCAT19300	546	SAL01016	1.9757	62	122	83541	2.0654	2.0654	217.6	449.3
NCAT19400	498	SAL01017	4.3791	106.7	467	84008	2.0634	2.0634	218.8	451.4
NCAT19999	499	SAL01020	10.2157	2	20	**84028**	2.0633	2.0633	218.8	451.5
SCAT30000	189	SAP01074	3.5286	39.2	138	138	4.2026	4.0000	0.4	1.4
SCAT30010	187	SAP01071	15.6091	28.5	445	583	3.9390	3.9390	1.5	6.0
SCAT30020	188	SAP01066	9.8387	39.4	388	971	3.8082	3.8082	2.5	9.6
SCAT30030	190	SAP01064	6.0934	27.4	167	1138	3.7631	3.7631	3.0	11.2

City of Barrie Wastewater Collection System Calculation

Pre 2010 City Boundary: Sanitary Flow Before Adjustment (for 2031)

225l/cap.day
0.002604167

1	2	3	4	5	6	7	8	9	10	11
Sewershed ID	PCSWMM ID	Flow Assignment (Manhole ID)	Sewershed Area (hectare)	Sewershed Population Equivalent Density (cap/hectare)	Population Equivalent (single catchment)	Population Equivalent (adding upstream)	Harmon Peak Factor (adding upstream)	Regulated Peak Factor (1.5<X<4)	(Accumulated) Sanitary Base Flow (l/s)	(Accumulated) Sanitary Peak Flow (l/s)
NCAT16850	318	SAC07018	21.3518	53.7	1147	2716	3.4787	3.4787	7.1	24.6
NCAT16900	283	SAC04009	14.1912	0	0	14978	2.7789	2.7789	39.0	108.4
NCAT17000	268	SAC03004	102.1799	30.4	3106	3106	3.4295	3.4295	8.1	27.7
NCAT17100	291	SAC02094	10.5413	52.7	556	18640	2.6832	2.6832	48.5	130.2
NCAT17200	290	SAC02044	34.3444	41	1408	1408	3.6993	3.6993	3.7	13.6
NCAT17300	289	SAC02035	46.5709	68.3	3181	4589	3.2793	3.2793	12.0	39.2
NCAT17400	317	SAC02001	9.0574	161.7	1465	24694	2.5609	2.5609	64.3	164.7
NCAT17500	500	SAC01031	8.7297	148.8	1299	25993	2.5387	2.5387	67.7	171.8
NCAT17600	292	SAL02041	9.5787	47.4	454	454	3.9954	3.9954	1.2	4.7
NCAT17700	293	SAL08271	12.0064	105	1261	1715	3.6367	3.6367	4.5	16.2
NCAT17800	264	SAL08275	11.2240	226	2537	4252	3.3095	3.3095	11.1	36.6
NCAT17900	323	SAL02075	1.6252	214	348	348	4.0502	4.0000	0.9	3.6
NCAT18000	307	SAL03212	37.1812	66.7	2480	2480	3.5113	3.5113	6.5	22.7
NCAT18100	493	SAL03209	4.2428	212.3	901	3381	3.3978	3.3978	8.8	29.9
NCAT18200	305	SAL03014	8.0458	263.8	2122	2122	3.5656	3.5656	5.5	19.7
NCAT18300	494	SAL03012	2.1768	271.9	592	6095	3.1642	3.1642	15.9	50.2
NCAT18400	265	SAL03108	29.1003	72.3	2104	2104	3.5686	3.5686	5.5	19.6
NCAT18500	306	SAL03101	8.9252	169.4	1512	3616	3.3722	3.3722	9.4	31.8
NCAT18600	503	SAL03009	2.9188	259.9	759	10470	2.9348	2.9348	27.3	80.0
NCAT18700	496	SAL03192	2.3581	182	429	20376	2.6444	2.6444	53.1	140.3
NCAT18800	545	SAL03239	2.1365	66.4	142	30988	2.4634	2.4634	80.7	198.8
NCAT18900	544	SAL03242	1.9391	31.3	61	31049	2.4626	2.4626	80.9	199.1
NCAT18950	312	SAL03243	1.8750	188.3	353	31402	2.4578	2.4578	81.8	201.0
NCAT19000	543	SAL03227	0.8887	257.2	229	74824	2.1067	2.1067	194.9	410.5
NCAT19100	449	SAL02070	1.7464	0	0	75172	2.1050	2.1050	195.8	412.1
NCAT19200	497	SAL02073	1.3104	0	0	79424	2.0843	2.0843	206.8	431.1
NCAT19300	546	SAL01016	1.9757	76.6	151	105568	1.9808	1.9808	274.9	544.5
NCAT19400	498	SAL01017	4.3791	131.8	577	106145	1.9788	1.9788	276.4	547.0
NCAT19999	499	SAL01020	10.2157	2.5	26	**106171**	1.9788	1.9788	276.5	547.1
SCAT30000	189	SAP01074	3.5286	47.5	168	168	4.1747	4.0000	0.4	1.8
SCAT30010	187	SAP01071	15.6091	34.9	545	713	3.8899	3.8899	1.9	7.2
SCAT30020	188	SAP01066	9.8387	47.6	468	1181	3.7523	3.7523	3.1	11.5
SCAT30030	190	SAP01064	6.0934	33	201	1382	3.7050	3.7050	3.6	13.3

City of Barrie Wastewater Collection System Calculation

Pre 2010 City Boundary: Sanitary Flow Before Adjustment (for 2051)

225l/cap.day
0.002604167

1	2	3	4	5	6	7	8	9	10	11
Sewershed ID	PCSWMM ID	Flow Assignment (Manhole ID)	Sewershed Area (hectare)	Sewershed Population Equivalent Density (cap/hectare)	Population Equivalent (single catchment)	Population Equivalent (adding upstream)	Harmon Peak Factor (adding upstream)	Regulated Peak Factor (1.5<X<4)	(Accumulated) Sanitary Base Flow (l/s)	(Accumulated) Sanitary Peak Flow (l/s)
NCAT16850	318	SAC07018	21.3518	84	1794	4238	3.3107	3.3107	11.0	36.5
NCAT16900	283	SAC04009	14.1912	0	0	20136	2.6495	2.6495	52.4	138.9
NCAT17000	268	SAC03004	102.1799	41.1	4200	4200	3.3143	3.3143	10.9	36.3
NCAT17100	291	SAC02094	10.5413	64.6	681	25017	2.5553	2.5553	65.1	166.5
NCAT17200	290	SAC02044	34.3444	60	2061	2061	3.5756	3.5756	5.4	19.2
NCAT17300	289	SAC02035	46.5709	89.3	4159	6220	3.1558	3.1558	16.2	51.1
NCAT17400	317	SAC02001	9.0574	208.6	1889	33126	2.4351	2.4351	86.3	210.1
NCAT17500	500	SAC01031	8.7297	201.3	1757	34883	2.4133	2.4133	90.8	219.2
NCAT17600	292	SAL02041	9.5787	69.1	662	662	3.9084	3.9084	1.7	6.7
NCAT17700	293	SAL08271	12.0064	139.7	1677	2339	3.5319	3.5319	6.1	21.5
NCAT17800	264	SAL08275	11.2240	287	3221	5560	3.2020	3.2020	14.5	46.4
NCAT17900	323	SAL02075	1.6252	272.6	443	443	4.0007	4.0000	1.2	4.6
NCAT18000	307	SAL03212	37.1812	82.2	3056	3056	3.4356	3.4356	8.0	27.3
NCAT18100	493	SAL03209	4.2428	269.5	1143	4199	3.3144	3.3144	10.9	36.2
NCAT18200	305	SAL03014	8.0458	332.4	2674	2674	3.4844	3.4844	7.0	24.3
NCAT18300	494	SAL03012	2.1768	343.2	747	7620	3.0709	3.0709	19.8	60.9
NCAT18400	265	SAL03108	29.1003	90.5	2634	2634	3.4898	3.4898	6.9	23.9
NCAT18500	306	SAL03101	8.9252	223.1	1991	4625	3.2762	3.2762	12.0	39.5
NCAT18600	503	SAL03009	2.9188	328.1	958	13203	2.8340	2.8340	34.4	97.4
NCAT18700	496	SAL03192	2.3581	230	542	26802	2.5255	2.5255	69.8	176.3
NCAT18800	545	SAL03239	2.1365	83.8	179	40184	2.3541	2.3541	104.6	246.3
NCAT18900	544	SAL03242	1.9391	39.5	77	40261	2.3533	2.3533	104.8	246.7
NCAT18950	312	SAL03243	1.8750	237.7	446	40707	2.3487	2.3487	106.0	249.0
NCAT19000	543	SAL03227	0.8887	324.6	288	99936	2.0002	2.0002	260.3	520.6
NCAT19100	449	SAL02070	1.7464	0	0	100379	1.9986	1.9986	261.4	522.5
NCAT19200	497	SAL02073	1.3104	0	0	105939	1.9795	1.9795	275.9	546.1
NCAT19300	546	SAL01016	1.9757	98.1	194	141016	1.8819	1.8819	367.2	691.1
NCAT19400	498	SAL01017	4.3791	168.8	739	141755	1.8802	1.8802	369.2	694.1
NCAT19999	499	SAL01020	10.2157	3.1	32	**141787**	1.8801	1.8801	369.2	694.2
SCAT30000	189	SAP01074	3.5286	58.2	205	205	4.1441	4.0000	0.5	2.1
SCAT30010	187	SAP01071	15.6091	43.8	684	889	3.8324	3.8324	2.3	8.9
SCAT30020	188	SAP01066	9.8387	57.9	570	1459	3.6882	3.6882	3.8	14.0
SCAT30030	190	SAP01064	6.0934	40.2	245	1704	3.6388	3.6388	4.4	16.1

FIRST FOR FIRE PROTECTION
VIPOND INC
est. 1945

FLOW TEST RESULTS

DATE : FRIDAY MAY 27, 2011 TIME : 1:00 PM

LOCATION : HYDRANT FLOW TEST
180 DUNLOP STREET
BARRIE, ONTARIO

TEST BY : VIPOND FIRE PROTECTION

STATIC PRESSURE : 89 PSI

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-1/8"	0.90	84	80	335
2	1	1-3/4"	0.90	84	64	727
3	1	2-1/2"	0.90	78	46	1140
4	2	2-1/2"	0.90	74	37	2050

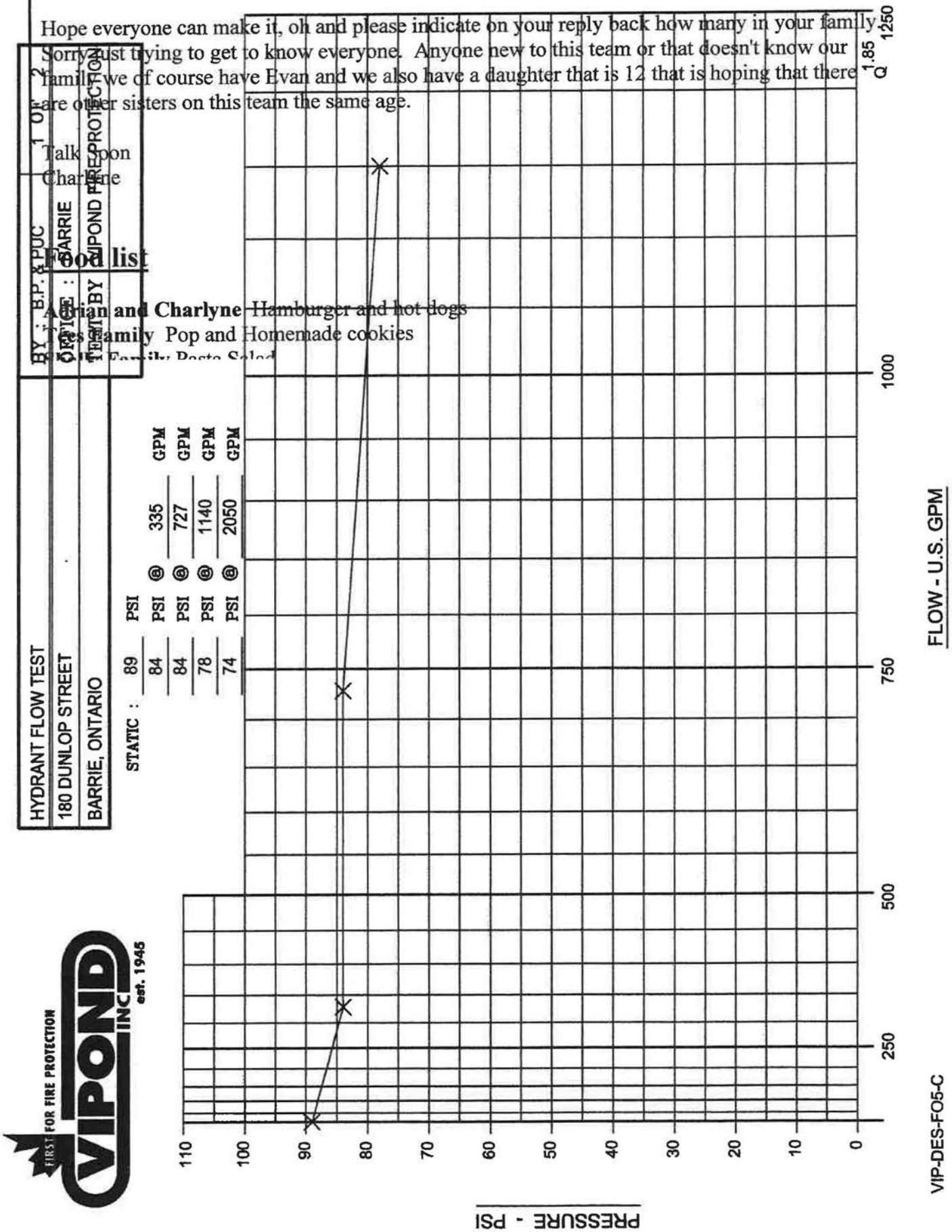
park (wonderful college area) so please park on the same side of the street as our house. You may have to park down the street a bit but at least you won't get a ticket.

Hope everyone can make it, oh and please indicate on your reply back how many in your family. Sorry just trying to get to know everyone. Anyone new to this team or that doesn't know our family we of course have Evan and we also have a daughter that is 12 that is hoping that there are other sisters on this team the same age.

Talk Soon
Charlene

Food list

Adrian and Charlyne Hamburger and hot dogs
The Family Pop and Homemade cookies
The Family Pasta Salad



185 Dunlop Street

FIRE FLOW ANALYSIS - 189 L/sec FIRE w/ 200mm dia. FIRE SERVICE

City of Barrie

Project Number: 17-11338B
Date: November 1, 2017
Design By: JHV
File: \\PINESTONESERVER\Shared Folders\Company\Project Documents\11149 5 Points Barrie\SPA - 11149.1\FSR\Site Fire Flow Analysis.xls

CALCULATION OF RESIDUAL PRESSURE AT PROPOSED SERVICE

1. Boundary Conditions (Based on City Fire Flow Test Results):

	Metric		Imperial		
P0 - Starting Pressure	62.59	*m*	89	*psi*	
P1 - Pressure at Q1	52.04	*m*	74	*psi*	
Q1 - From Fire Flow Test	7760	*L/min*	2050	*U.S. gal/min*	
Q2 - Required Flow	11340	*L/min*	2996	*U.S. gal/min*	
P-loss 1	10.55	*m*	15	*psi*	
P-loss 2	21.30	*m*	30	*psi*	
P2 - Residual Pressure	**41.29**	***m***	**59**	***psi***	Extrapolated from Fire Flow Test Results

2. Friction Losses Through Water Service:

Hazen-Williams Equation	Metric		Imperial	
C_{hw} = Pipe Friction Factor	110		110	
k = conversion factor	10.675		4.727	
n = constant	1.852		1.852	
m = constant	4.8704		4.8704	
Q = Flow	0.189	m^3/s	2996	*U.S. gal/min*
d = Pipe Diameter	200	mm	7.87	in
p = Loss/Length	0.2051	m/m	0.0889	psi/ft
Length	4	m	13	ft
Loss	**0.82**	**m**	**1.2**	**psi**
	8	**kPa**		

3. Friction Losses Through Apurtenances:

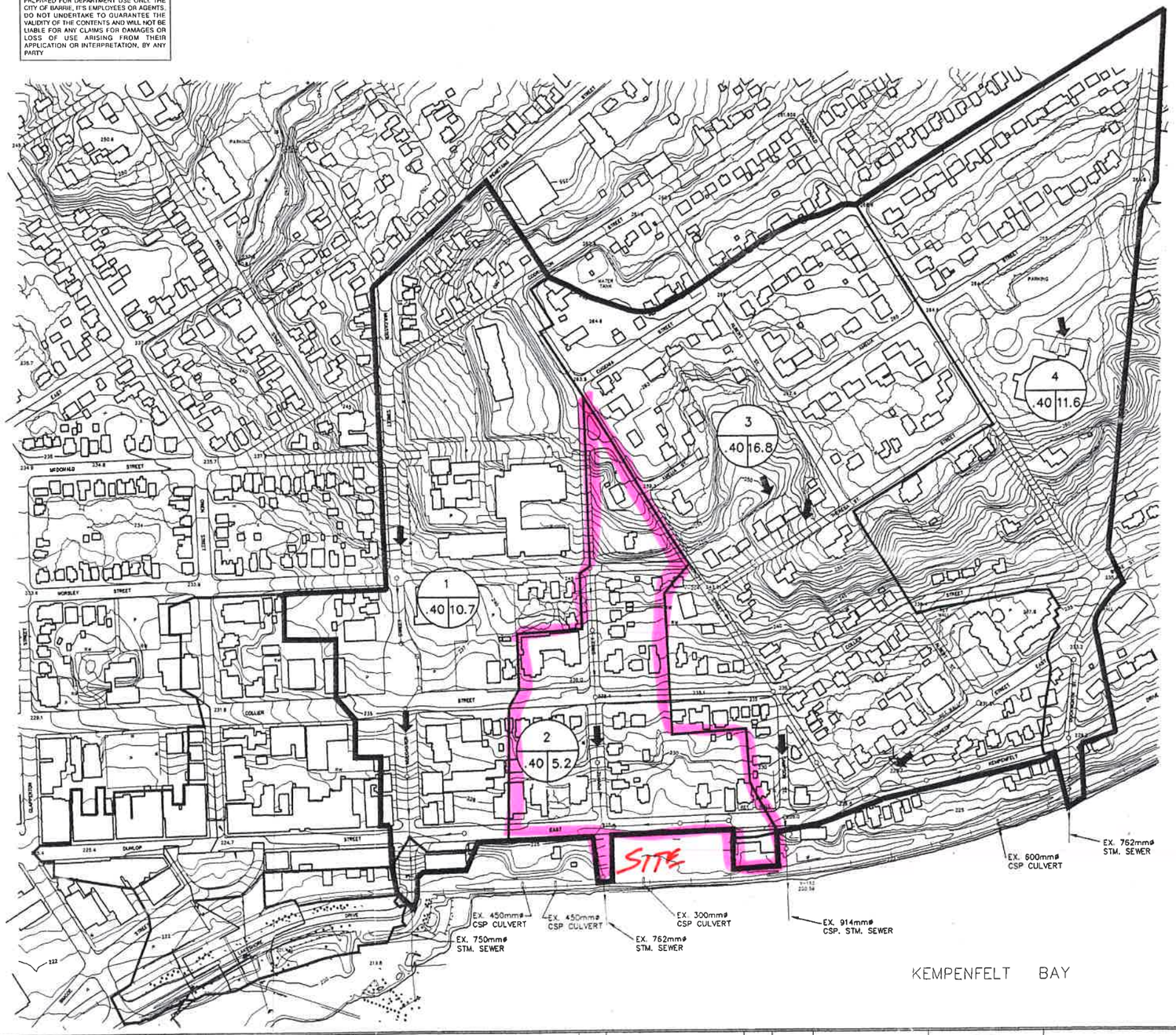
Apurtenances	Number	K	Velocity	Head Loss	Total Loss	
			m/s	*m*	*m*	*psi*
200mm Tee (run)	1	0.280	6.016	0.517	0.517	0.734
200mm Tee (branch)	0	0.840	6.016	1.550	0.000	0.000
Valve - 200mm dia.	1	0.112	6.016	0.207	0.207	0.294
Elbow/Bend - 200mm dia.	0	0.224	6.016	0.413	0.000	0.000
Total Minor Losses					**0.723**	**1.028**

4. Elevation - Elevational differences from existing hydrant to proposed hydrant

	Metric		Imperial	
Elevation at Boundary (i.e. Residual Hydrant):	225.3	m	739	ft
Elevation at Bldg:	225.5	m	740	ft
Elevation Difference = Loss/Gain	**0.2**	**m**	**0.3**	**psi**

ANALYSIS SUMMARY

Total Losses	**1.744**	**m**			
	17.10	**kPa**	**2.5**	**psi**	
Residual Pressure after Losses	**39.55**	**m**			
	388	**kPa**	**56.3**	**psi**	**PASS**
Allowabale Residual Pressure	*140*	*kPa*	*20.3*	*psi*	



-N-

LEGEND

- DRAINAGE BOUNDARY
- CATCHMENT BOUNDARY
- EXISTING STORM SEWER
- FLOW DIRECTION
- CATCHMENT AREA
- AREA (ha)
- RUNOFF COEFFICIENT

THE INFORMATION PRESENTED HAS BEEN PREPARED FOR DEPARTMENT USE ONLY. THE CITY OF BARRIE, IT'S EMPLOYEES OR AGENTS, DO NOT UNDERTAKE TO GUARANTEE THE VALIDITY OF THE CONTENTS AND WILL NOT BE LIABLE FOR ANY CLAIMS FOR DAMAGES OR LOSS OF USE ARISING FROM THEIR APPLICATION OR INTERPRETATION, BY ANY PARTY

GENERAL NOTES

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BENCH MARKS

NO.	REVISIONS	DATE	APPROVED

CITY OF BARRIE
APPROVED
DATE 95.09.11
R. J. McRobbie, P.Eng.
DIRECTOR OF MUNICIPAL WORKS

LICENSED PROFESSIONAL ENGINEER
R. J. FORWARD
PROVINCE OF ONTARIO

LAKESHORE TRUNK
SANITARY SEWER RECONSTRUCTION
DUCKWORTH ST. TO MULCASTER ST.

EXTERNAL
STORM DRAINAGE PLAN

CITY of BARRIE
MUNICIPAL WORKS DEPARTMENT

SCALE HOR. 1:2000	VERT. ——	DRAWING NO.	94-09
DESIGN M.D.N.	DRAWN C.L.M.	SHEET NO.	STM1
REVIEWED R.J.F.	DATE 95.04.27		

185 Dunlop Street East - Condo Development

CATCHMENT AREA 2 - SEE CITY OF BARRIE CATCHMENT PLAN 94-09

City of Barrie

Project Number: 17-11338B
Date: November 27, 2017
Design By: JHV
File: \\PINESTONESERVER\Shared Folders\Company\Project Documents\11338B 185 Dunlop Street\FSR&SWM\MRM.xls

IDF Curve Parameters				Intensity
Storm Event	A	B	C	(mm/hr)
2 year	678.085	4.699	0.7810	55.41
5 year	853.608	4.699	0.7660	73.19
10 year	975.865	4.699	0.7600	85.30
25 year	1146.275	4.922	0.7570	100.48
50 year	1236.152	4.699	0.7510	111.22
100 year	1426.408	5.273	0.7590	122.92

Tc = 20.0 minutes

$$i = \frac{A}{(t_c + B)^C}$$

I = average rainfall intensity (mm/hr)
A,B,C, = the IDF equation coefficients (dimensionless)
T_c = time of concentration (min) (valued used by City of Barrie)

Pre-Development Runoff Coefficients:

Catchment	Total Area (m^2)	Unimproved Area (m^2)	Pasture Area (m^2)	Woodlot Area (m^2)	Lakes/Swamps Area (m^2)	Impervious Area (m^2)	Building Area (m^2)	Gravel Area (m^2)	Lawn Area (m^2)	X Area (m^2)	Y Area (m^2)	Z Area (m^2)	Weighted C
2	52,000												0.40

Runoff Coefficient Adjustment for 25-100 yr Storm Events:

Catchment	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
2	0.40	0.40	0.40	0.44	0.48	0.50

Notes:
1) Runoff coefficients from City of Barrie Storm Drainage and SWM Policies and Design Guidelines Table 3.2
2) Runoff coefficients for events greater than the 10 year storm have been adjusted as per City Policies and Guidelines Table 3.3

Pre-Development Peak Flow Rates:

Catchment	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)
2	0.320	0.423	0.493	0.639	0.771	0.888

Assume 50% blockage of storm sewers sized for 5 year design storm = 0.211

Major overland flow rate (100year - 0.211) = 0.676

Overland Land Flow – 6.5m Wide Channel / Access Driveway

Project No.: 185 Dunlop Street

Given:

Channel bottom width (m): 1

Left side slope (x:1) : 50

Right side slope (x:1) : 50

'Q' required (cm/s) : 0.676

Mannings 'N' value : 0.013

Channel slope (decimal) : 0.08

Calculations:

Area of channel (m2): .315

Wetted perimeter (m): 8.00139986002799

Hydraulic Radius (m): 3.93681112693321E-02

Discharge 'Q' (cm/s): .793296561162455

Depth of channel (m): .07

Using an average driveway slope of 8%, the depth of water is 0.07m or 7cm within the driveway to convey major flows to Kempenfelt Bay.

Hydraulic Grade Line Calculation

185 Dunlop Street - Condo Development
City of Barrie

Total 100 YR Uncontrolled Discharge = 0.235 L/sec
100 YEAR

PINESTONE ENGINEERING LTD.

Project Number: 11338
Date: march, 2019
Design By: JHV
Checked By: JHV
File: Z:\Project Documents\11338B 185 Dunlop Street\Second Submission\FSR&SWM\backwater.xls

LOCATION & PROPERTIES									HEADLOSS CALCULATIONS									DESIGN				
LOCATION	Catchments Serviced	100 YR Design Flow	PIPE TYPE	FROM	TO	Downstream Invert	Upstream Invert	Difference	Pipe X-Sectional Area	Hydraulic Radius	Pipe Length/Dia. (L/D)	Friction Factor	Average Velocity	Velocity Head	Pipe Losses (HL PIPE)	MH Losses (HL MH)	Total Head Loss (HL TOTAL)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY
		cms							*A(m2)*	*R(m)*	*L/D*	*f*	*Vf (m/s)*	$V^2/2g$	*(m)*	*(m)*	*(m)*	*mm*	*m*	*%*	*L/s*	*m/s*
Outlet @ Lake Simcoe	Site Area	0.235	Conc.	Outlet	Ex. DCBMH	217.5	217.78	0.28	0.442	0.19	32.00	0.0231	0.5319	0.0144	0.0106	0.00000	0.011	750	24.0	1.17	651.34149	1.4743

APPENDIX F

Drawings

PINESTONE ENGINEERING LTD.