46-UNIT APARTMENT DEVELOPMENT
FUNCTIONAL SERVICING REPORT
520-526 BIG BAY POINT ROAD
CITY OF BARRIE

Prepared by:

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20-11559B – rev. 0

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APPENDICES

1.0 INTRODUCTION

1.1 General

The proposed development site is located on lots 520-526 Big Bay Point Road in the City of Barrie. The property is legally described as Part of Lot 13, Concession 13 in the Geographic Township of Innisfil, City of Barrie, County of Simcoe.

The subject site is approximately 0.35 hectares in area and is currently occupied by two (2) single-family residential homes. Access to the site is provided directly from Big Bay Point Road by two (2) separate asphalt driveways. The site is bounded by Warnica Public School to the north, Big Bay Point Road to the south, and existing residential development to the east and west. The location of the subject site is illustrated on Figure 1.

The developer is proposing construction of a 6-storey apartment building, totaling 46 residential units. Access to the development will be provided from Big Bay Point Road and parking will be provided via surface parking facility. A reduced copy of the proposed site plan concept and parking lot layout plan prepared by ISM Architects Inc. for the purposes of the rezoning application is included in Appendix A for additional information.

1.2 Purpose and Scope

Pinestone Engineering Ltd. (PEL) has been retained by the developer to provide professional engineering services related to the preparation of a Functional Servicing Report (FSR). This report has been prepared to support a Rezoning 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.

2.0 EXISTING CONDITIONS

2.1 General

The subject site is approximately 0.35 hectares in area and is currently occupied by two (2) single-family residential homes. Access to the site is provided directly from Big Bay Point Road by two (2) separate asphalt driveways. The site is located within the City's urban servicing area and municipal services are readily available for connection underneath Big Bay Point Road. Existing vegetation on the site generally consists of maintained grass area throughout, with sporadic tree growth along the peripheral of the property.

2.2 Topography

Based on a review of the topographic survey provided by Rudy Mak Surveying Ltd., the property is moderately sloped and generally slopes from the northern side of the property to the south towards Big Bay Point Road at an average slope of 3.0%. Elevations across the site range between 253.85m ASL at the northern corner of the site to 251.03m ASL at the

southern corner.

2.3 Site Geology

A geotechnical investigation was completed by Central Earth Engineering in November 2020. Field work for this investigation consisted of three boreholes advanced approximately 6.6m deep. Based on our review of their report, the borehole logs reveal topsoil was encountered over a deep layer of silty sand with traces of gravel and clay. Groundwater was not evident in the boreholes during the investigation and recorded as 5.46-6.0m below the ground surface from the monitoring wells on November 24th, 2020.

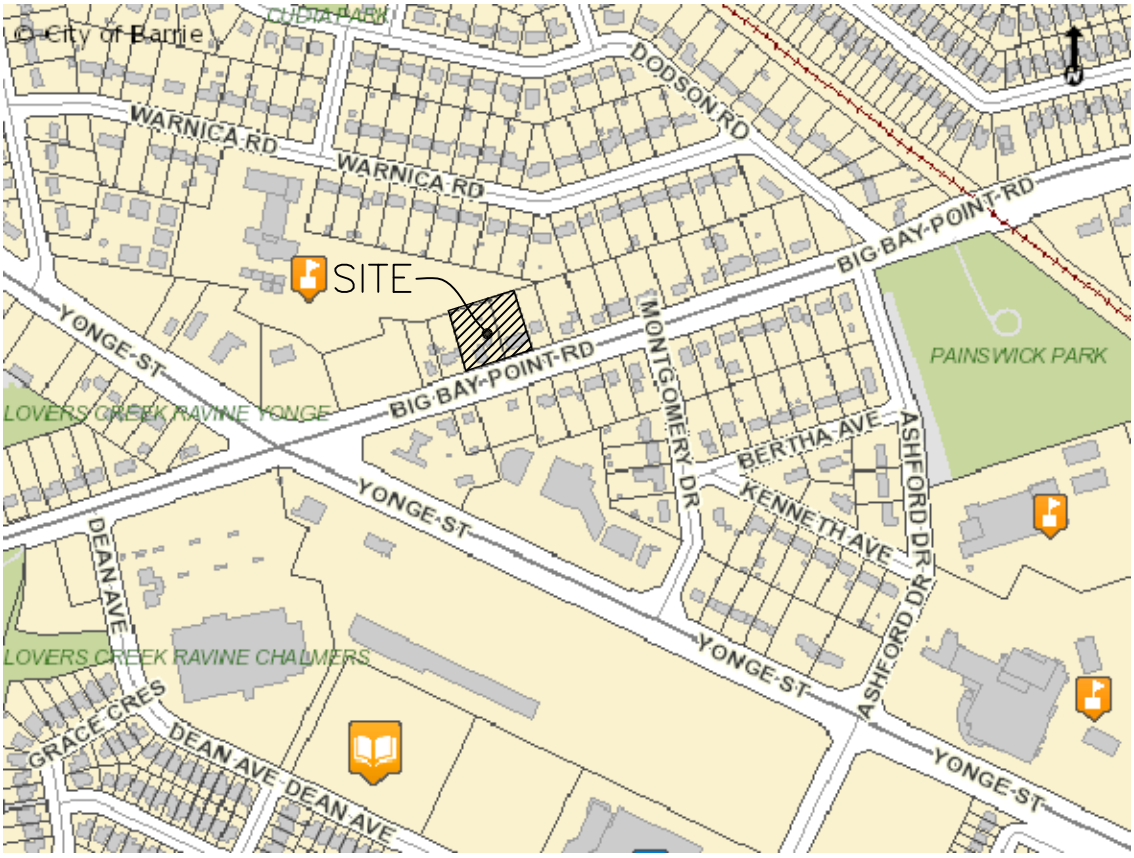
Based on our review of the soil descriptions outlined in the MTO Drainage Manual on Chart 1.08, we have classified the site material as a Type B under the Soil Conservation Service, hydrologic soil group.

A copy of the geotechnical investigation, prepared by Central Earth Engineering, and Chart 1.08 of the MTO Drainage Manual is included in Appendix B.

2.4 Drainage Conditions

Drainage from the site is generally conveyed south in the form of overland sheet flow towards the existing 600mm dia. concrete storm sewer underneath Big Bay Point Road. Flows are conveyed west and ultimately discharge to Lovers Creek.

This site is considered a “major development” as defined in the Lake Simcoe Protection Plan, therefore stormwater quality and quantity control measures are required in accordance with the Lake Simcoe Regional Conservation Authority (LSRCA).



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520-526 BIG BAY POINT ROAD

LOCATION PLAN

DATE:	SCALE:	PROJECT No.	FIGURE No.
NOV.2020	N.T.S.	20-11559B	FIGURE 1

3.0 SANITARY SERVICING

3.1 Existing Sanitary Servicing

An existing 250mm diameter sanitary sewer exists along Big Bay Point Road and conveys sewage northwesterly to City Pumping Station 10 (Barrie WwTF) located on Bradford Street. According to the information provided in the City of Barrie Wastewater Collection Master Plan (Cole Engineering, July 15th, 2019), the Barrie WwTF has a firm capacity of 2,205 L/sec and is currently operating around 1,910 L/sec, or 87% capacity.

Based on our review of the existing wastewater collection performance assessments completed by Cole Engineering in the Wastewater Collection Master Plan, under 2019 wet weather flow conditions for the 25-year storm event, the downstream sewers maintain a peak conduit depth ratio of less than 0.5 and a freeboard of greater than 1.8m. Therefore, no surcharging of downstream sanitary sewers from the subject site were noted.

The development area is currently serviced with two (2) 150mm diameter sanitary laterals to each of the existing homes. As part of the development works, the existing sanitary lateral not utilized by the proposed apartment building will be decommissioned per City of Barrie standards.

3.2 Proposed Sanitary Flows

Contributing sanitary flows from the proposed development were calculated using City of Barrie design criteria for high density apartment dwellings, as follows:

- A residential average sewage flow of 225 litres/capita/day
- A residential population density of 1.67 persons/unit
- An extraneous flow rate of 0.1 litres/sec/ha
- A peaking factor based on Harmon's equation

With a total residential count of 46 apartment units, the total population to be serviced is 77 persons based on the above distribution. Incorporating extraneous flows, the combined peak sewage flow generated by the proposed development is calculated to be approximately 0.89 L/sec. Detailed sanitary calculations are included in Appendix C.

A review of the existing capacity of the immediate downstream reach of 250mm sanitary sewer underneath Big Bay Point Road was completed. The existing reach of sewer has a conveyance capacity of approximately 59 L/sec and the proposed peak sanitary flows from the development represents approximately 1.5% of the total pipe capacity.

Based on the total conveyance capacity of the immediate downstream reach of sewer, the existing infrastructure is expected to have the available capacity necessary to support the development without the need for external sanitary upgrades.

3.3 Proposed Sanitary Servicing

The proposed development will utilize the existing 150mm diameter sanitary service for 526 Big Bay Point Road. A new 150mm diameter service will connect to the existing service at lot line and extend to the proposed building. Servicing details will conform to City of Barrie standards and the exact size and location of the service lateral will be determined during detailed design to support the Site Plan Application.

A conceptual servicing layout is provided on the attached drawings included in Appendix E.

4.0 WATER SERVICING

4.1 Existing Water Servicing

A 150mm diameter watermain exists underneath the north side of Big Bay Point Road. The site is currently serviced by two (2) 38mm diameter water service connections to each of the residential homes. These services will require decommissioning by turning off the main stop and cutting the service at the main.

For the proposed zoning amendment, onsite pressures and flows have been confirmed to ensure there is sufficient capacity available for both domestic and firefighting conditions.

We have utilized information obtained from the municipal hydrants in the vicinity of the subject site connected to the existing 150mm diameter watermain including Hydrant #3628. Table 1 illustrates the flow results of the testing conducted by Johnson Controls International.

Table 1
Results of Hydrant Flow Tests

Test #	Outlet Inside Dia. (in.)	Number of Outlets	Residual Reading (PSI)	Flow@ Residual (gal/min)
1	n/a	n/a	80 (static)	n/a
2	1.75	1	79	683

Refer to Appendix C for the flow testing information obtained from Johnston Controls International.

4.2 Proposed Water Demands

The subject site is located within water servicing Zone 2S, as per the City of Barrie Water Supply Masterplan (WSP, July 2019). Domestic water demand for the development are listed in Table 2 below:

Table 2
Domestic Water Demand

Population	Per Capita Flow (L/day)	Peaking Factors (based on MECP and City of Barrie Guidelines)		Flows (L/sec)	
		Peak Hour	Maximum Day	Peak Hour	Maximum Day
77	129	2.25	1.75	0.26	0.21

Fire demands for the proposed development were calculated in accordance with the Fire Underwriters Survey (FUS) as follows:

$$F = 220C(A)^{0.5}$$

Where,

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
A = total floor area of building (excluding basements)

Table 3
Water Requirements for Fire Fighting

Total Area (m^2)	Coefficient "C"	Required Flow (L/min)	Require Flow (L/sec)
4,590	0.8	11,924	198.73

The total area represents 6 floors for a 765 m^2 apartment building (765m^2 x 6). Based on the guidance provided in the FUS, and applying the relevant reductions and charges in flow for construction type (-25%), sprinkler system (-30%), and exposure distances due to the proximity of the other existing buildings (+35%), the required fire flow for the development will be reduced to 156.5 L/sec. Detailed FUS calculations are provided in Appendix C.

4.3 Proposed Water Servicing

The proposed development will be serviced via a new 150mm diameter fire service connection and a new 100mm diameter domestic water service connection from the existing 150mm diameter watermain located on the north side of Big Bay Point Road. Requirements for separate domestic and fire lines will be assessed at the detailed design stage. Servicing details will conform to City of Barrie standards and the exact size and location of the service laterals will be determined during detailed design to the support the Site Plan Application.

Based on the provided flow test results, it can be concluded that the max day plus fire flow rate of 156.7 L/sec can be delivered to the proposed building with a residual pressure of 53.5 psi. Preliminary fire flow calculations are included in Appendix C. A conceptual servicing layout is provided on the drawings included in Appendix E.

5.0 HYDROLOGY

5.1 Design Criteria

Based on a review of the City of Barrie's Storm Water Management (SWM) Guidelines and LSRCA Technical Guidelines, the following design criteria, in accordance with the current MECP SWM Planning and Design Manual (MECP, 2003) were established for the proposed development:

Quantity Control:

- Peak flow attenuation for the 2-year through 100-year storm events to pre-development rates based on the rainfall runoff event simulation model OTTHYMO using the City of Barrie's WPCC IDF parameters.

- Both the 4-hour Chicago and 24-hour SCS Type II storms must be modelled for the specified storm events.

- Safe conveyance of the Regulatory flows through the site to a sufficient outlet is required. The Regulatory flows are taken as the greater of the uncontrolled 100-year or Hurricane Hazel flows through the development.

Quality Control:

- The City of Barrie and the LSRCA in accordance with Ontario Regulation 219/09 regarding water quality and phosphorus loading to Lake Simcoe, requires that all new storm water management facilities provide as a minimum the "enhanced" level of protection in accordance with the MECP Storm Water Management Planning and Design Manual (MECP, 2003).

- Preparation of phosphorus and water balance calculations to meet City of Barrie and LSRCA 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.

5.2 Design Storms

We have selected the following design storms as part of our evaluation:

- 2-year design storm
- 5-year design storm
- 10-year design storm
- 25-year design storm
- 50-year design storm
- 100-year design storm
- Hurricane Hazel

The rainfall runoff event simulation model OTTHYMO was used to simulate watershed response to design rainfall events. Derivation of the design storm hyetographs were based on the 24-hour SCS Type II storms, the 4-hr Chicago design storms, and the Hurricane Hazel storm event. STM files for the applicable design storms are provided from the City of Barrie website.

5.3 Drainage Catchments

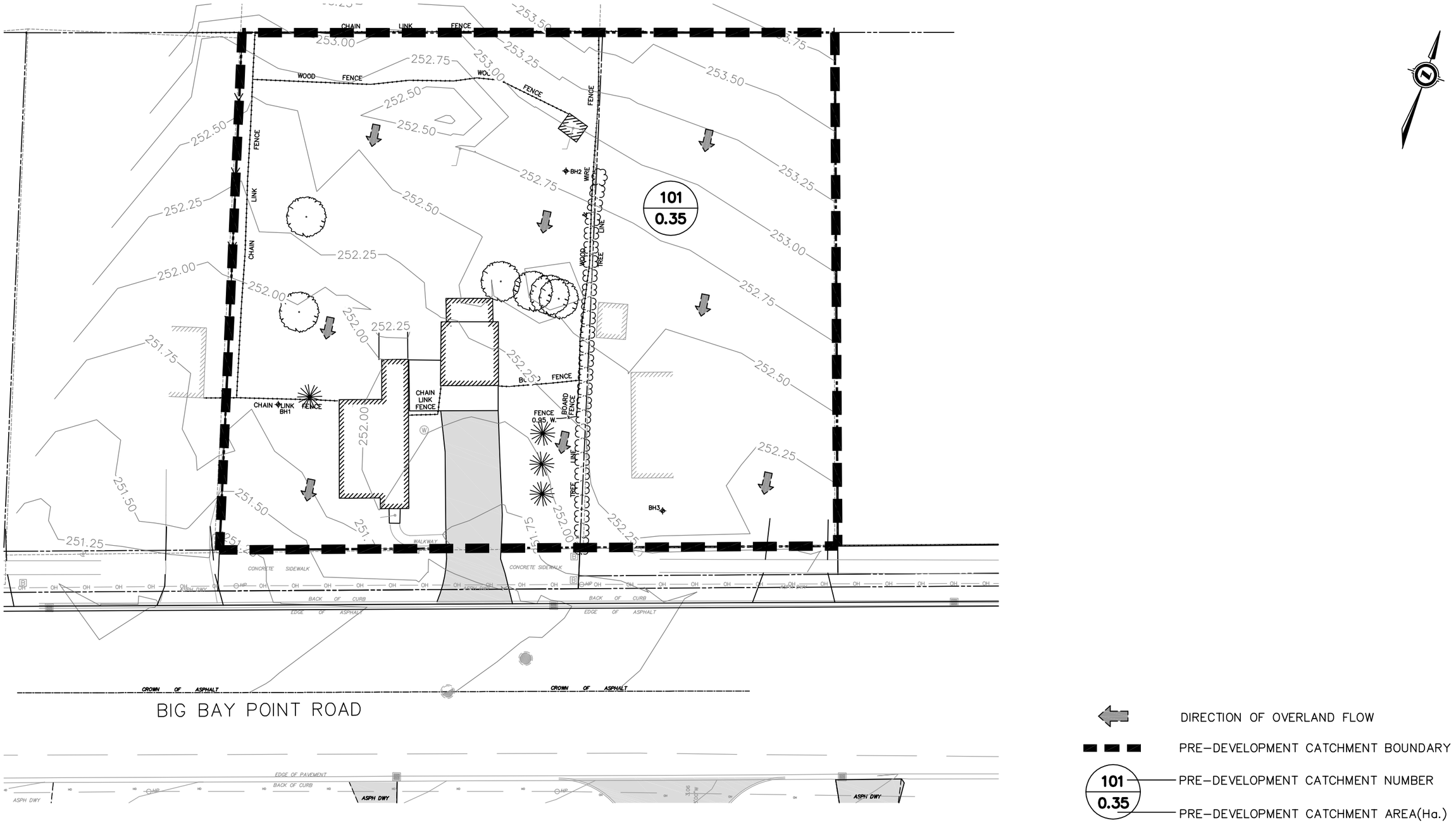
One (1) pre-development and two (2) post-development catchments have been delineated for the site in order to estimate the corresponding peak runoff rates for the site. The pre-development catchment area represents the existing condition of the proposed development area, which consists of single-family residential development. The post-development catchments represent the proposed grading concept for the development area. The pre-development and post-development catchment parameters are listed in Table 4. Pre-development and post-development catchment areas are illustrated on Figure 2 and Figure 3.

Table 4
Post-Development Catchment Parameters

Catchments	Area (ha)	Total Impervious (%)	Directly Connected Imperviousness (%)	Weighted Pervious Initial Abstraction / Depression Storage (mm)	Weighted Pervious SCS Curve #
101	0.35	17.1	10.2	5.0	61
201	0.317	80.3	63.4	5.0	61
202	0.033	24.2	24.2	5.0	61

5.4 Model Results

The results of the hydrologic modelling are displayed in Tables 5 and 6 below for the Hurricane Hazel storm event, and the 2-year to 100-year return frequency storm events for the 4hr Chicago distribution, and the 24hr SCS Type II distribution. The model outputs for all events are included in Appendix D.



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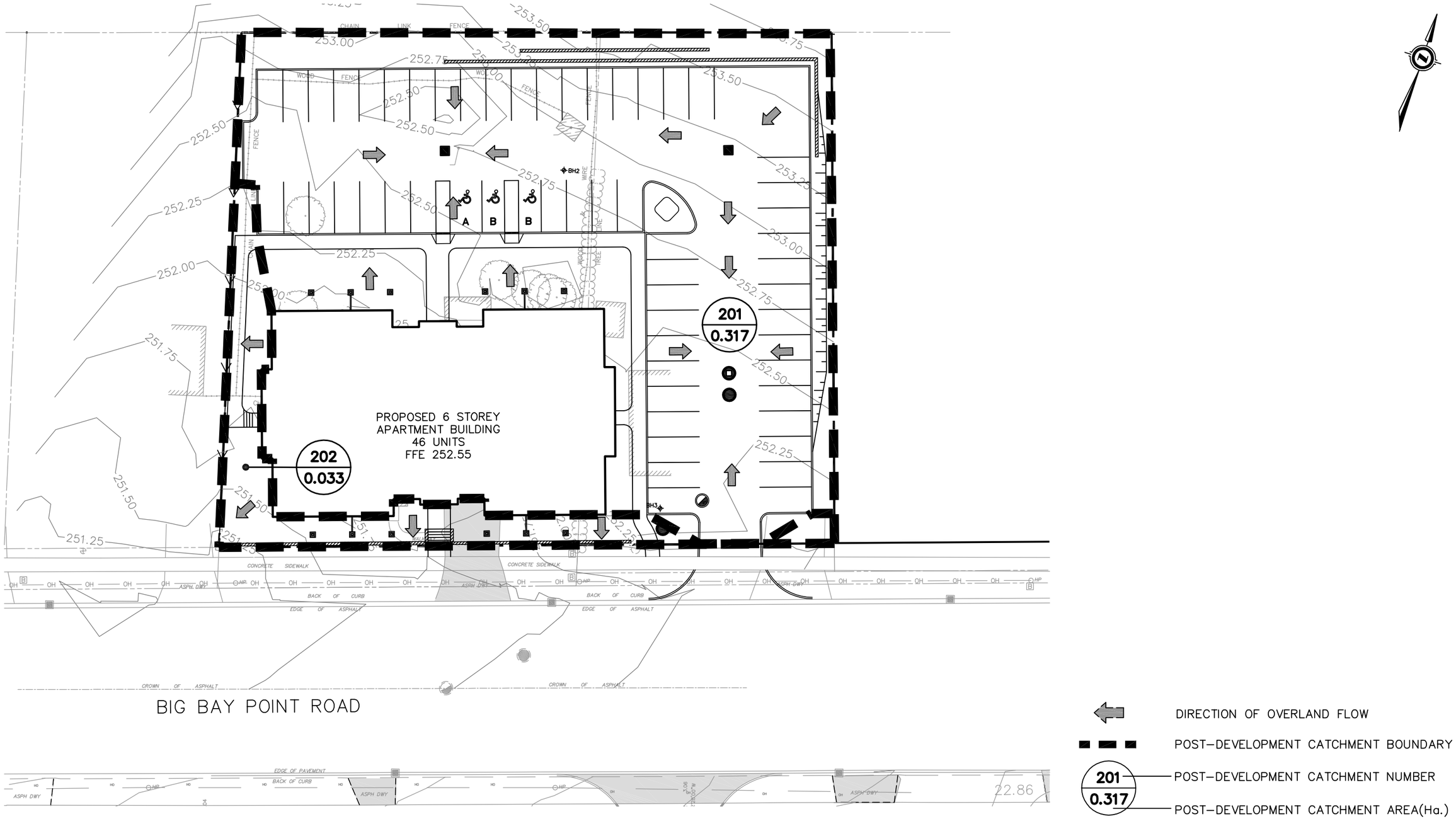
520-526 BIG BAY POINT ROAD
RESIDENTIAL APARTMENT DEVELOPMENT

PRE-DEVELOPMENT CATCHMENT PLAN

PROJECT NO. 20-11559B

SCALE: 1:400 | DATE: DEC 2020

FIGURE 2



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520-526 BIG BAY POINT ROAD
RESIDENTIAL APARTMENT DEVELOPMENT

PROJECT NO. 20-11559B

SCALE: 1:400 | DATE: DEC 2020

POST-DEVELOPMENT CATCHMENT PLAN

FIGURE 3

Table 5
Model Results - 4hr Chicago and Hurricane Hazel Storm Distributions

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr	Hazel
PRE-DEVELOPMENT (m^3/sec)							
Catchment 101	0.009	0.013	0.017	0.024	0.031	0.038	0.039
Total Pre-Development Runoff Rate (m^3/sec)	**0.009**	**0.013**	**0.017**	**0.024**	**0.031**	**0.038**	**0.039**
POST- DEVELOPMENT (m^3/sec)							
Catchment 201	0.052	0.071	0.084	0.101	0.115	0.128	0.044
Catchment 202	0.002	0.004	0.005	0.006	0.007	0.008	0.004
Total Post-Development Runoff Rate (m^3/sec)	**0.054**	**0.074**	**0.089**	**0.107**	**0.122**	**0.136**	**0.048**

Table 6
Model Results - 24hr SCS Type II Storm Distributions

	2Yr	5Yr	10Yr	25Yr	50Yr	100Yr
PRE-DEVELOPMENT (m^3/sec)						
Catchment 101	0.012	0.022	0.031	0.044	0.054	0.065
Total Pre-Development Runoff Rate (m^3/sec)	**0.012**	**0.022**	**0.031**	**0.044**	**0.054**	**0.065**
POST- DEVELOPMENT (m^3/sec)						
Catchment 201	0.042	0.061	0.074	0.090	0.103	0.116
Catchment 202	0.002	0.004	0.005	0.006	0.008	0.009
Total Post-Development Runoff Rate (m^3/sec)	**0.044**	**0.065**	**0.079**	**0.097**	**0.111**	**0.124**

Based on the results of the hydrological modelling, an increase in storm water runoff rates can be expected during all storm events.

6.0 STORM WATER MANAGEMENT PLAN

6.1 Quantity Control

As noted in the comparison of the pre-development and post-development flows, an increase in runoff will occur due to the proposed construction of the building and paved surfaces. To satisfy the selected design criteria, peak flow attenuation of post-development flows to pre-development levels for all storm events up to and including the 100-year storm event will be provided by directing roof drainage and driveway runoff to surface storage cells within the parking lot.

Peak flow attenuation for catchment 201 (building, asphalt surfaces, and amenity space) will be achieved using parking lot ponding. Peak flows will be controlled using an orifice plate installed on the outlet pipe from CBMH#1. The maximum ponding elevation during the 100-year storm event will be limited to a maximum 0.3m above the catch basin grates and asphalt surface. Major overland flow from catchment 201 during the Hurricane Hazel storm event will overflow out of the grate at CBMH#1 and will be directed to Big Bay Point Road through the entrance once ponding levels exceed the driveway grade.

Drainage from catchment 202, which includes perimeter landscape areas, balconies, and a portion of sidewalk, will continue to drain offsite uncontrolled like pre-development conditions.

Further hydrological modelling, and calculations including the stage-storage-discharge relationship of the proposed surface storage facility, and control sizing for the orifice will be conducted during detailed design to support the Site Plan Application. The location of the storm water management facility and further design details are illustrated on the conceptual drawings included in Appendix E (envelope at the rear of this report).

6.2 Quality Control

The primary objective of the stormwater management plan for this development is to maintain acceptable water quality within the receiving storm sewer network and ultimate outfall, Lovers Creek, by maintaining existing site drainage patterns and flowrates. In order to provide water quality enhancement to an “enhanced” level of protection (80% TSS removal) for this development, we have incorporated a “treatment train” approach consisting of the following elements:

- Provision of “soft” landscaping where feasible.
- Yard grading using minimal surface slopes where possible to promote infiltration.
- Provision of an Imbrium Jellyfish treatment unit (or equivalent) for oil and sediment removal. The PCSWMM for Stormceptor Online Tool, by Imbrium Systems Inc., will be utilized to design the appropriate treatment unit to achieve 80% TSS removal for this site. Design calculations utilizing the manufacturer’s software, and a copy of the Imbrium Jellyfish Owner’s manual, by Imbrium Systems Inc., will be included in the

next submission for the Site Plan Application.

- Suitable construction mitigation measures to be utilized during the site development.

According to the Drainage Master Plan for the City of Barrie, prepared by Tatham Engineering in March 2019, the subject site is located within Intake Protection Zone-2, but not within a significant groundwater recharge area (SGRA), nor a Wellhead Protection Area (WHPA), therefore infiltration based practices are permitted as outlined in Table 1.2 of the Infiltration Low Impact Development Screening Process prepared by the City of Barrie. Excerpts from the Drainage Master Plan and a copy of Table 1.2 of the LID Screening Process is included in Appendix D.

6.3 Water Budget

As per the City of Barrie SWM guidelines, sites are required to minimize any anticipated changes in the water balance between pre-development and post-development conditions and shall provide a minimum infiltration equivalent to the first 5mm of rainfall. Based on a total development area of 3,500m^2, the first 5mm of rainfall to be retained on the site for infiltration equates to 17.5m^3. Initial abstraction values provided in the City of Barrie SWM guidelines are shown in Table 7.

Table 7
Initial Abstraction Values

Cover	Initial Abstraction / Depression Storage (mm)
Woods	10
Meadow	8
Cultivated	7
Lawns	5
Impervious Areas	2

Adapted from UNESCO, Manual on Drainage in Urbanized Areas, 1987

Using the values provided in Table 7 above, approximately 9.6m^3 of rainfall will be retained on the site through initial abstraction in the post-development condition. Based on a review of the geotechnical report prepared for the site, and the infiltration techniques outlined in the MECP SWM Manual (2003) and the LID Manual (2010), infiltration measures are suitable for the site given the soils condition and development-built form. The proposed exfiltration system between the OGS unit and STMMH#1 will provide the additional 7.9m^3 of storage for infiltration. With the water balance benefit from the proposed low impact development practice, the site will yield an overall post-development abstraction value that will meet or exceed the pre-development rate. Detailed design calculations for the exfiltration system will be provided at the detailed design stage to support the Site Plan Application.

A water budget analysis is also required in accordance with the LSRCA Technical Guidelines and the Lake Simcoe Protection Plan (LSPP) Water Budget Policy. The analysis will follow the Thronthwaite and Mather approach, where surplus is estimated based on precipitation minus evapotranspiration (Steenhuis and Van Der Molen, 1986). The infiltration portion of the surplus is estimated by applying infiltration factors from Table 3.1 of the MECP

SWMPD Manual. This water budget analysis will be conducted during detailed design to support the Site Plan Application.

6.4 Phosphorus Budget

As part of the LSRCA requirements, according to section 2.3.2 of the LSRCA Technical Guidelines, any "major development" requires the removal of 80% of the annual Total Phosphorus (TP) load. In addition, the site must also conform to the Lake Simcoe Phosphorus Offsetting Program (LSPOP). The LSPOP requires that all new development must control 100% of the phosphorus from leaving the property, in order to maintain or improve the water quality of Lake Simcoe. Visual OTTHYMO was utilized to determine pre and post development phosphorus loadings for the proposed development area. The event mean concentration (EMC) values for each land use are chosen from the LID TTT Tool, accepted by the TRCA and the LSRCA. In the pre-development and post-development condition, the existing and proposed urban residential development was broken down into pavement, rooftop, and landscape land uses. The calculated phosphorus loadings are illustrated in Table 8.

Table 8
Model Results – Phosphorus Loading

	4hr Chicago		**24hr SCS Type II**	
	2Yr	**100Yr**	**2Yr**	**100Yr**
Pre-Development (kg)				
Total Pre-Development	**0.009**	**0.036**	**0.017**	**0.068**
Post Development (kg)				
Catchment 201	0.017	0.047	0.028	0.076
Catchment 202	0.001	0.004	0.002	0.007
Total Post-Development	**0.019**	**0.051**	**0.029**	**0.083**

In order to provide water quality enhancement to achieve the above phosphorus loading requirements for this development, we have proposed a "treatment train" approach consisting of the following elements:

- Installation of an Imbrium Jellyfish treatment unit (or equivalent) to provide 50% TP removal for runoff generated from catchment 201.
- Construction of an exfiltration trench to provide 60% TP removal (LID TTT Tool) for runoff generated from catchment 201.
- Installation of permeable pavement in the parking areas to provide 60% TP removal (LID TTT Tool) for catchment 201.

Further phosphorus loading calculations, incorporating the above TP removal strategy, will be conducted during the detailed design stage to support the Site Plan Application.

7.0 SUMMARY AND CONCLUSIONS

The findings of this report are summarized as follows:

- The existing 250mm diameter gravity sewer underneath Big Bay Point Road has the capacity to service the proposed development. The existing 150mm dia. sanitary service lateral not utilized by the proposed development will be decommissioned in accordance with City of Barrie standards.

- The max day plus fire flow rate of 156.7 L/sec can be delivered to the proposed development, via a new 150mm dia. fire service, from the existing 150mm dia. watermain underneath Big Bay Point Road with a residual pressure of 53.5 psi. All existing 38mm dia. water services will be decommissioned in accordance with City of Barrie standards.

- This site is considered a “major development” as defined in the Lake Simcoe Protection Plan, therefore stormwater quality and quantity control measures are required in accordance with the Lake Simcoe Regional Conservation Authority (LSRCA).

- Attenuation of peak post-development flowrates to below pre-development levels will be provided by utilizing parking lot surface ponding. An orifice plate installed on the outlet pipe from CBMH#1 will control flows to or below pre-development levels.

- Quality control for the development will be provided by a treatment train approach consisting of a perforated pipe infiltration/exfiltration system sized to meet water balance requirements and to provide 60% removal of annual total phosphorus for catchment 201, permeable pavement in the parking areas of catchment 201 to provide 60% removal of annual total phosphorus, and an Imbrium Jellyfish treatment unit (or approved equivalent) sized to provide a minimum of 80% TSS and 50% TP removal for catchment 201.

It is therefore recommended that:

1) This report and drawings be submitted to the City of Barrie and LSRCA for review and approval.

We trust this is satisfactory and should you have any questions, please call.

All of which is respectfully submitted by,

PINESTONE ENGINEERING LTD.

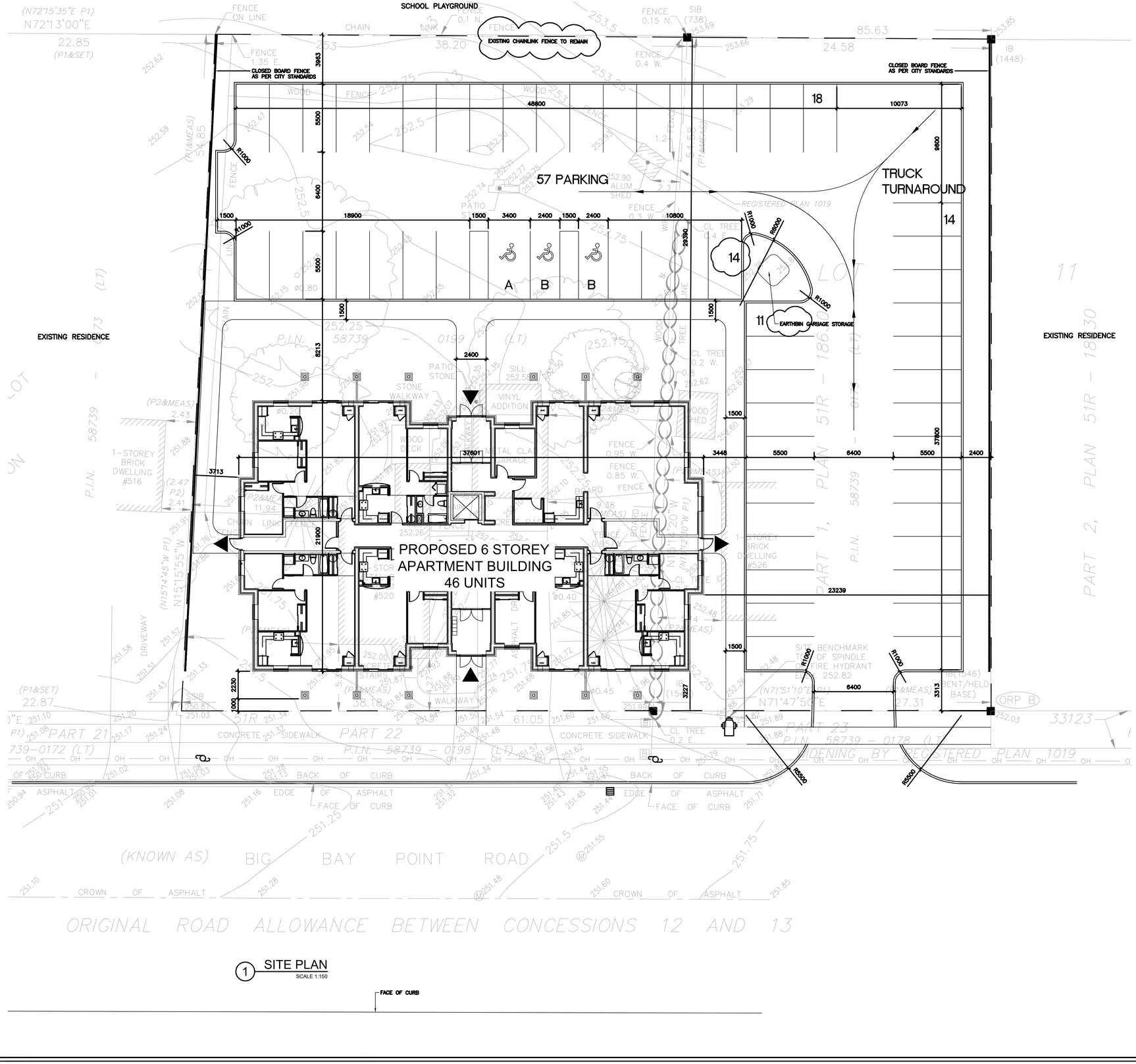
Dwight Hordyk, EIT
Project Designer

Joe Voisin, P.Eng
Senior Eng

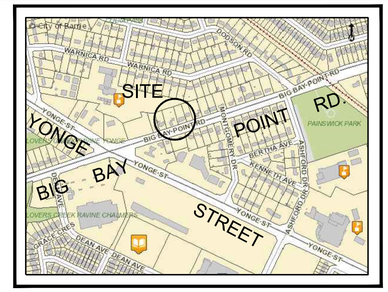
APPENDIX A

Proposed Site Plan Concept

PINESTONE ENGINEERING LTD.



1 SITE PLAN
SCALE 1:150



KEY PLAN

ZONE RA1-3 SITE STATISTICS		
STANDARD	REQUIRED BY RA1-3	PROPOSED
LOT AREA (min.)	1100.0 m2	3592.7 m2
LOT FRONTAGE (min.)	24.00 m	65.49 m
FRONT YARD (min.)	7.00 m	3.22 m
WEST SIDE YARD (min.)	5.00 m	3.71 m
EAST SIDE YARD (min.)	5.00 m	23.23 m
REAR YARD (min.)	7.00 m	29.39 m
BUILDING HT. (max.)	30.00 m	16.85 m
LOT COVERAGE (max.)	35.00 %	21.33 %
GFA (max.)	100.00 %	
No. OF APTS. (max.)		46
No. OF CARS (min.)	69	57
B.F. PARKING (min.)	TYPE A – 1 TYPE B – 2	TYPE A – 1 TYPE B – 2
AMENITY SPACE (min.)	552 m2	

ISM Architects Inc.
97 Toronto Street
Barrie, ON L4N 1V1
T: 705.726.2342
E: ian@ismarchitects.ca

No.	ISSUE/ REVISION	DATE
1	PRECONSULT SPC	MAR.23/20
2	PER CITY COMMENTS	OCT.22/20
3	PER LANDSCAPE ARCH.	DEC.07/20
4	WIDEN LANDSCAPE STRIP AND FENCE	DEC.14/20
5	PER CITY COMMENTS	MAR.05/21

STAMP
ONTARIO ASSOCIATION OF ARCHITECTS
IAN S. MALCOLM
LICENCE 2853

DO NOT SCALE DRAWINGS.
THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ARCHITECT BEFORE PROCEEDING WITH THE WORK.

A DETAIL No.
B SHEET No. WHERE DETAILED

ORIENTATION

CLIENT
MORRIELLO CONSTRUCTION
OFFICE: 705 436 2263
CEL.: 705 790 1441

PROJECT
6 STOREY
28 APARTMENT UNIT BUILDING
520 BIG BAY POINT RD
BARRIE, ON L4N 3Z5

PROJECT INFORMATION

PROJECT No.:	194095
DRAWN BY:	PB
CHECKED BY:	ISM
DATE:	Mar. 31, 21
SCALE:	AS NOTED

DRAWING
SITE PLAN
D28-012-2020

DRAWING No.
A100

APPENDIX B

Geotechnical Report

PINESTONE ENGINEERING LTD.

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Barrie, Ontario, L4N 0B7
P: (705) 719-7994
F: (888) 558-9424
www.centralearth.ca

GEOTECHNICAL REPORT

Proposed Residential Multi-Storey Building
520 & 526 Big Bay Point Road
Barrie, Ontario

Prepared For: Morriello Construction Ltd.
Type of Document: Final Report
Reference Number: 20-1016A
Prepared By: Anar Jafarov, P.Eng.
Reviewed By: Alexander Winkelmann, P.Eng.
Date Issued: December 3, 2020

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Figures

Appendices

1 Introduction

Central Earth Engineering Inc. (CEE) was retained by Morriello Construction Ltd. to complete a subsurface investigation and geotechnical report for a proposed residential development to be located at 520 & 526 Big Bay Point Road, in Barrie, Ontario. A site location plan is provided as Figure 1.

The site to be developed is rectangular in shape and measures approximately 65 metres wide (east to west) and 55 metres long (north to south) with a total site area of approximately 3500 square metres. The site is bounded by Big Bay Point Road to the south, residential properties to the east and west, and Warnica Public School to the north. The properties currently contain two single family residential dwellings with detached garages. CEE was provided with the following Surveyor's Real Property Report for 520 Big Bay Point Road:: *"Part of Lot 13, Concession 13, Geographic Township of Innisfil, City of Barrie, County of Simcoe*", File No. 13928, dated October 28, 2019, by Rudy Mak Surveying Ltd. Based on the on this drawing, there is approximately 2 metres of topographic relief across the site which slopes from near Elev. 253.5 metres in the north down to near Elev. 251.5 metres in the south.

CEE was provided with the following conceptual plan for review: "*6-Storey, 28 Apartment Unit Building, 520 Big Bay Point Rd, Barrie, ON, L4N 3Z5*", Project No. 194095, Drawing No. A100, Drawing: *Site Plan*, dated Feb. 4, 2020, by ISM Architects Inc. Based on the above site plan drawing, it is proposed to demolish the existing buildings and construct a new 6-storey residential apartment building with a footprint of approximately 900 m^2 and surrounding on-grade parking areas. It is unknown if the proposed building will have a basement level. It is understood that this concept plan is preliminary and subject to change. The development is expected to be municipally serviced. The footprint of the proposed apartment building will overlap with the footprint of the existing residential dwellings at the site (to be demolished).

The purpose of the current geotechnical investigation was to assess the subsurface soil conditions at the site by advancing three (3) exploratory boreholes, each with a monitoring well, to provide geotechnical engineering recommendations in support of the proposed development. This report summarizes the borehole findings, provides design recommendations for foundations, slabs-on-grade, seismic site classification, earth pressures, pavements, basement drainage and site servicing, as well as considerations for constructability such as soil excavation, soil compaction, and temporary groundwater control.

2 Procedures and Methodology

Prior to the commencement of drilling activities, the locations of underground utilities including natural gas, electrical, telephone, water, etc. were marked out by public and private utility locating companies. The fieldwork for the drilling program was carried out on November 9th, 2020. A total of three boreholes (Boreholes 1 to 3) were advanced on site using a track-mounted drill rig. To advance the boreholes, hollow stem augers and standard soil sampling equipment was utilized. All samples were collected as per ASTM D1586 to assess the strength characteristics of the substrate.

The boreholes were advanced to a depth of 6.6 metres below existing grade (Elev. 246.3 to 245.2 metres). The horizontal locations were laid out in the field by CEE prior to the drilling operations. Ground surface elevations of the boreholes were measured using survey equipment in reference to a geodetic benchmark (top of the fire hydrant

spindle located in front of 526 Big Bay Point Road) taken from the above noted Surveyor's Real Property Report by Rudy Mak Surveying Ltd. GPS coordinates were measured with a handheld GPS unit and referenced to the NAD 83 geodetic datum, UTM Zone 17T.

The CEE field staff examined and classified characteristics of the soils encountered in the boreholes, including the presence of fill materials, made groundwater observations during and upon completion of the drilling, recorded observations of borehole construction, and processed the recovered samples. Soil sampling was conducted at regular intervals for the full depth of the borehole. The boreholes were backfilled upon completion. All recovered soil samples were logged in the field, carefully packaged and transported to the laboratory for more detailed examination and classification. In the laboratory, the samples were classified as to their visual and textural characteristics and geotechnical laboratory testing was carried out with the results included in Appendix B. A total of three (3) monitoring wells were installed on site (one per borehole) to facilitate the measurement of stabilized groundwater levels. Monitoring well construction is shown on the borehole logs in Appendix A.

3 Subsurface Conditions

3.1 General Overview

The detailed soil profiles encountered in the boreholes are indicated on the attached borehole logs in Appendix A. The borehole locations are shown on Figure 2 and the geotechnical laboratory results are included in Appendix B. It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change.

In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including: visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.). The passage of time also may result in changes in conditions interpreted to exist at locations where sampling was conducted.

3.2 Stratigraphy

Boreholes 1 to 3 encountered a topsoil layer at the ground surface that ranged from 75 to 300 mm thick.

A zone of earth fill was encountered in the boreholes underlying the topsoil layer. The earth fill consisted of silty sand to sandy silt, with trace to some clay, trace to some gravel, and trace organics / rootlets. The earth fill extended to a depths ranging from 0.8 to 1.5 metres below grade (Elev. 252.1 to 250.2 metres). The earth fill was generally brown to dark brown and moist. The Standard Penetration Test (SPT) results ("N" Values) measured in the earth fill ranged from 6 to 14 blows per 300 mm of penetration, indicating a loose to compact (but typically loose) relative density.

Underlying the earth fill, the boreholes encountered a native glacial till deposit with a cohesionless matrix consisting of silty sand with trace to some gravel and trace clay. Cobbles and boulders may be embedded within the deposit. The upper 0.8 metres of the glacial till deposit in Borehole 1 was weathered/disturbed and loose, which is often caused by frost effects, or may consist of reworked native glacial till (i.e. earth fill). The brown and moist glacial till

was encountered at a depth ranging from 0.8 to 1.5 metres below grade (Elev. 252.1 to 250.2 metres), extended to a depth of 6.1 metres below grade (Elev. 245.7 metres) in Borehole 1, and extended beyond the vertical depth of investigation in Boreholes 2 and 3 at 6.6 metres below grade (Elev. 246.3 to 246.0 metres). The SPT "N" Values measured in the glacial till ranged from 13 to 71 blows per 300 mm of penetration, indicating a compact to very dense relative density. The glacial till was generally compact to a depth of approximately 3 metres below grade and it was dense to very dense below a depth of 3 metres.

A 0.8-metre-thick layer of brown and damp silty sand was interbedded within the glacial till deposit in Borehole 2. The silty sand was encountered at a depth of 2.3 metres below grade (Elev. 250.6 metres). An SPT "N" Value of 24 blows was measured within the silty sand layer.

The glacial till in Borehole 1 was underlain by a deposit of gravelly sand with some silt. The brown and wet gravelly sand was encountered at a depth of 6.1 metres below grade (Elev. 245.7 metres) and extended beyond the vertical depth of investigation at 6.6 metres below grade (Elev. 245.2 metres). The measured SPT "N" Value was 59, indicating a very dense relative density.

3.3 Groundwater

Unstabilized groundwater level measurements and cave measurements were taken upon completion of drilling of each borehole. These measurements provide a rough estimate of the possible excavation and temporary groundwater control constructability considerations that may arise. All three boreholes remained dry and open upon completion of drilling.

Each borehole was instrumented with a 50 mm diameter PVC monitoring well with a 1.5-metre-long screen to facilitate the measurement of stabilized groundwater levels. The results are shown on the borehole logs in Appendix A and are summarized in the table below.

Monitoring Well	Well Screen Location		Strata Screened	Depth / Elevation (m) of Groundwater
	Depth (m)	Local Elevation (m)		November 24, 2020
1	4.6 to 6.1	247.2 to 245.7	Silty Sand Glacial Till	5.46 / 246.29
2	4.6 to 6.1	248.3 to 246.8		Dry
3	4.6 to 6.1	248.0 to 246.5		6.00 / 246.57

Based on the groundwater level measurements and moisture contents of the recovered soil samples, it is expected that the groundwater table ranges from a depth of approximately 5.5 to 6.0 metres below grade.

The silty sand glacial till contains a moderately high percentage of fines (about 40% fines) and is expected that have a lower permeability, precluding the free flow of water. Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

4 Engineering Design Parameters & Analysis

4.1 Foundation Design

The topsoil, earth fill, and the upper 0.8-metre-thick weathered/disturbed zone of the silty sand glacial till deposit (in Borehole 1) are not suitable for the support of new foundations. Foundations at this site may be constructed as conventional shallow spread and strip footing foundations that bear on the undisturbed and compact to very dense native silty sand glacial till or interbedded sand deposits.

Foundations set a minimum of 0.3 metres into the compact to dense and undisturbed glacial till encountered at depths of 0.8 to 2.3 metres below grade (Elev. 249.5 to 252.1 metres) may be designed using a geotechnical reaction at SLS of 150 kPa, for an estimated settlement of 25 mm or less. The maximum factored geotechnical resistance at ULS is 225 kPa.

If the foundations are made to bear uniformly on the dense glacial till at or below a depth of 3 metres below existing grade (e.g. if the apartment building will have a basement level or if the foundations are extended deeper for an on-grade building), the spread and strip footings may be designed using a geotechnical reaction at SLS of 250 kPa, for an estimated settlement of 25 mm or less. The maximum factored geotechnical resistance at ULS is 350 kPa.

The minimum strip and spread footing widths to be used shall be dictated as per the Ontario Building Code, regardless of loading considerations. Footings stepped from one level to another must be at a slope not exceeding 7 vertical to 10 horizontal. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services unless rigid shoring is provided. All footings exposed to ambient air temperature throughout the year must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation for frost protection.

The foundation design parameters provided above are predicated on the assumption that the foundation subgrade surface is undisturbed, and that all deleterious, softened, disturbed, organic, and caved material is removed. The foundation excavation must be done in such a way that groundwater is controlled to prevent any disturbance to the foundation base. Temporary groundwater control during construction is discussed in Section 5.1.

The foundation subgrade must be reviewed by the geotechnical engineer prior to concrete placement to ensure the foundation design parameters described above are applicable, and to provide remedial recommendations if necessary. If the foundation excavation will be open for a prolonged period of time, the foundation subgrade should be protected with a skim coat of lean mix concrete (after inspection by the geotechnical engineer), to ensure that no deterioration will occur due to weather effects.

4.2 Earth Pressures

Underground levels, basements, retaining walls, cantilevered shoring walls and shoring walls with a single level of earth anchors all must be designed to resist unbalanced lateral earth pressures imparted from the weight of adjacent soils. Lateral earth pressures are calculated using the following equation:

$$\boldsymbol{P = K[\gamma h + q]}$$

where, **P** = the horizontal pressure at depth, **h** (m)
K = the earth pressure coefficient (dimensionless)
h = depth below surface in metres
γ = the bulk unit weight of soil, (kN/m^3)
q = surcharge loading (kPa)

The above equation assumes that a drainage system is present which prevents the build up of any hydrostatic pressure behind the structure subjected to the unbalanced lateral earth pressures. If this is not the case, the equation must be revised to also incorporate the submerged unit weight of the soil multiplied by the earth pressure coefficient, in addition to the water pressure itself.

The values for use in the design of structures subjected to unbalanced lateral earth pressures at this site are as follows:

Soil Type	γ - Bulk Unit Weight (kN/m^3)	φ - Friction Angle (degrees)	Earth Pressure Coefficient (dimensionless)		
			K_a - Active	K_o – At-Rest	K_p - Passive
Granular 'B' (OPSS 1010)	21.0	32	0.31	0.47	3.25
Earth Fill	19.0	30	0.33	0.50	3.00
Weathered / Disturbed Glacial Till					
Upper Compact Glacial Till & Silty Fine Sand	21.0	33	0.29	0.46	3.39
Lower Dense to Very Dense Glacial Till	21.0	36	0.26	0.41	3.85

The calculation of the earth pressure coefficients is based on Rankine theory, which provides a conservative estimate as no friction between the soil and the structure is accounted for. The earth pressure coefficients provided above are only applicable for flat ground surfaces beyond the structure and must be increased for sloping ground surfaces.

The earth pressure coefficients referenced within the above table are a function of the friction angle of the adjacent soil, and both the degree and direction of movement of the structure subjected to unbalanced lateral earth pressures. For structures that are restrained at the top (such as basement walls), the at-rest earth pressure coefficient will apply. For structures that allow for 0.1 to 1% of movement away from the soil, the full active earth pressure coefficient will apply. For structures that allow for 1 to 10% of movement into the soil, the full passive earth pressure coefficient will apply. The percentage movement is based on the height of the structure.

Other types of structures such as shoring walls with multiple rows of tiebacks and soil nail walls are subject to different loading conditions and must be analyzed separately.

4.3 Seismic Site Classification

Section 4.1.8.4 of the Ontario Building Code provides values of the acceleration and velocity-based site coefficients (F_a and F_v) for various time periods, associated with specific Site Classes. These Site Classes are based on the energy-corrected Average Standard Penetration Resistance values and undrained shear strength within the upper 30 metres of soil underlying the foundations of the proposed structure. As the boreholes were advanced less than this depth at the site, the site classification recommendation provided below assumes that the soil conditions are similar below the drilled depth.

Underneath the proposed foundations, the subsoil will consist of compact to very dense silty sand glacial till with an average SPT "N" Value of greater than 15 but less than 50. Based on this, the Site Classification for this site is "D".

4.4 Slab on Grade Design

The topsoil and any soft, wet, organic, or highly disturbed earth fill or native soils are not suitable for the support of a slab on grade. Undisturbed native soils and surface compacted earth fill are suitable for the support of a lightly supported unreinforced concrete slab on-grade. The subgrade for the slab on grade must be assessed by the geotechnical engineer, prior to the placement of an aggregate base. If any soft or weak subgrade areas are identified, or if there are areas containing excessive amounts of deleterious/organic material, they must be locally sub-excavated and backfilled with approved clean earth fill or imported granular material and compacted to a minimum of 98% SPMDD. If the subgrade will consist of earth fill or the weathered / disturbed glacial till, it should be surface compacted to 98% Standard Proctor Maximum Dry Density (SPMDD). A subgrade made on the compact to dense glacial till or silty fine sand should be proof-rolled.

The modulus of subgrade reaction appropriate for design of a slab on grade on the earth fill or weathered / disturbed glacial till (provided it is surface compacted to 98% SPMDD) is 25,000 kPa/m. The modulus of subgrade reaction appropriate for design of a slab on grade on the undisturbed and compact to dense glacial till or interbedded cohesionless deposits (generally encountered at depths ranging from 0.8 to 2.3 metres below grade) is 50,000 kPa/m.

All building floor slabs must be provided with a capillary moisture barrier and drainage layer. This is made by placing the concrete slab on a minimum 200 mm layer of 19 mm clear stone (OPSS.MUNI 1004) compacted by vibration to a dense state. The upper 50 mm of clear stone can be replaced with 19 mm crusher run limestone for a working surface. The clear stone and the cohesionless subgrade must be separated by a geotextile such as Terrafix 270R (or approved equivalent) to prevent the migration of fines into the clear stone layer which could result in loss of support for the slab.

4.5 Basement Drainage

For new structures that will be slab on grade with no basement levels, perimeter and under-slab drainage at the foundation level is not required, provided that the underside of concrete slab is at least 200 mm above the prevailing grade of the site and the surrounding surfaces slope away from the building at a gradient of at least 2% to promote surface water run-off and to reduce groundwater infiltration adjacent to foundations. To minimize infiltration of surface water, the upper 150 mm of backfill could comprise relatively impervious compacted soil

material. Any small below grade areas (e.g. elevator pits) for a slab on grade building could be fully waterproofed and designed to resist hydrostatic pressure.

Where basements are constructed, all basement foundation walls must be provided with damp-proofing provisions in conformance to the Ontario Building Code. Backfill along the foundation wall must consist of Granular 'B' Type 1 (OPSS.MUNI 1010) for a minimum lateral distance of 600 mm out from the foundation wall. Alternatively, if a filtered cellular drainage media is provided adjacent to the foundation wall, the backfill may consist of common earth fill.

For buildings with basements, a perimeter drainage system must be installed that will remove any water that infiltrates into the building backfill, to ensure that any water does not infiltrate into the basement. The perimeter drains must consist of minimum 100 mm diameter perforated pipes wrapped in filter socks, sufficiently covered on all sides by 19 mm clear stone. Perimeter drains should be directed to the sump underneath the basement floor in solid pipes so as not to surcharge the underfloor drainage layer with water. The basement slab should also be provided with subfloor 100 mm diameter perforated pipes, trenched 0.3 metres below the slab granular base material and covered with 19 mm clear stone with 6 metre on-centre spacing. All sump pumps should be on emergency power for redundancy in case of a power outage. A typical basement drainage detail is included in Appendix C.

Considering a full depth basement (in the event that one level basement is included in the conceptual design) of about 3 metres, the basement level is not expected to extend below the groundwater table which is approximately 5.5 to 6.0 metres below existing grade.

4.6 Site Servicing

4.6.1 Bedding

The type of material and depth of granular bedding below the pipe will, to some extent, depend on the method of construction used by the contractor. Pipe bedding for flexible pipes should follow the requirements in Ontario Provincial Standard Drawing 802.010 or 802.013 or applicable municipal standards. Pipe bedding for rigid pipes should follow the requirements in Ontario Provincial Standard Drawings 802.030 to 802.033 or applicable municipal standards.

A subgrade consisting of the earth fill or native soils at the site will provide adequate support for pipes with the bedding requirements as laid out in the above referenced OPS drawings. Where disturbance of the trench base has occurred from groundwater seepage, construction traffic, etc., the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill. If weak zones are encountered, additional bedding materials and differing construction practices may be required and should be determined during construction.

Regardless of whether flexible or rigid pipes are implemented, granular bedding and cover material should consist of a well graded, free draining material, such as Granular "A" (OPSS.MUNI 1010). All granular bedding must be compacted to a minimum of 98% SPMDD. Clear stone or high-performance bedding is permitted at this site but it must be fully wrapped in a non-woven filter fabric to prevent the migration of fines and loss of pipe support.

4.6.2 Backfill

Excavated native soils may be used as backfill in trenches provided the moisture content is within 2% of optimum. The backfill should be compacted to a minimum of 98% SPMDD. In confined areas the layer thickness will have to be reduced to utilize smaller compaction equipment efficiently or by using granular material instead of locally sourced fill. Any backfill that is frozen, contains a high percentage of organic material (topsoil, peat, etc.) or moisture, or has otherwise unsuitable deleterious inclusion should not be used as backfill. The maximum cobble or boulder size should not exceed half of the loose lift thickness (i.e. all particles with a diameter greater than 100 mm should be removed).

Where trenches are within the traveled portions of a roadway, backfill within the frost penetration depth of 1.2 metres should consist of native, non-organic, excavated material consistent with the soils surrounding the trench. If this technique is not undertaken, then frequently problems arise with yearly differential frost heave movements between the trench backfill and the adjacent native soil. This would occur, for example, if imported granular fill was used to backfill the trenches. Alternatively, if different soil is used as the backfill due to issues with achieving compaction, a frost taper of 5H:1V can be implemented to help mitigate the potential for differential settlement and frost heave.

4.7 Pavement Design

4.7.1 Subgrade Preparation

All topsoil, organics, and earth fill containing excessive moisture or organics must be removed from beneath the pavement structures. A review of the borehole data suggests that the proposed parking lot and driveway subgrade will consist of loose to compact earth fill or cohesionless glacial till. These types of soil are an adequate subgrade for the support of a pavement structure, provided the subgrade surfaced is compacted to 98% SPMDD, inspected, and approved by a geotechnical engineer at the time of construction and does not contain excessive amounts of organics, moisture, or deleterious materials (as may be the case for zones within the any earth fill).

A proof-roll is recommended to facilitate the subgrade inspection by the geotechnical engineer. If any soft or weak subgrade areas are identified, or if there are areas containing excessive amounts of moisture or deleterious / organic material, they must be locally sub-excavated and backfilled with approved clean earth fill or imported granular material and compacted to a minimum of 98% SPMDD. Any fill placed to raise the grades of the pavement subgrade must be compacted to 98% SPMDD. The modulus of subgrade reaction appropriate for design of a pavement structure on the earth fill (surface compacted to 98% SPMDD) is 25,000 kPa/m.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures must be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as possible when fill is placed, and the natural subgrade is not disturbed or weakened after it is exposed.

4.7.2 Drainage

Control of surface water is an important factor in achieving a good pavement life. The need for adequate subgrade drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (at a minimum grade

of 3 percent) to provide effective drainage toward subgrade drains. Grading adjacent to pavement areas should be designed to ensure that water is not allowed to pond adjacent to the outside edges of the pavement.

Continuous pavement subdrains should be provided along both sides of the roadway and parking areas and drained into respective catchbasins to facilitate drainage of the subgrade and the granular materials. The subdrain invert should be maintained at least 0.3 metres below subgrade level. To minimize the problems of differential movement between the pavement and catchbasins/manhole due to frost action, the backfill around the structures should consist of free-draining granular material. Typical pavement drainage details are included in Appendix C.

4.7.3 Pavement Structure

There are two different types of pavements that need to be designed for:

- Light Duty: Includes driveways and parking lots which will not see frequent heavy traffic loads such as buses, delivery or fire trucks, etc., and will mostly service small vehicles such as cars or pickup trucks.
- Heavy Duty: Includes driveways and parking lots which are designated fire truck routes, or will see frequent heavy traffic loads such as buses, delivery or garbage trucks, etc.

The industry pavement design methods are based on a design life of 15 to 20 years for typical weather conditions depending on actual traffic volumes. The following pavement thickness designs are provided on the above noted considerations and subgrade basis.

Pavement Layer	Compaction Requirements	Minimum Component Thickness	
		Light Duty	Heavy Duty
Surface Course Asphaltic Concrete: HL3 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)	OPSS 310	40 mm	40 mm
Binder Course Asphaltic Concrete: HL8 (OPSS 1150) with PG 58-28 Asphalt Cement (OPSS.MUNI 1101)		50 mm	70 mm
Base Course: Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Subbase Course: Granular B Type I or II (OPSS.MUNI 1010)		300 mm	450 mm

The granular materials should be placed in lifts 200 mm thick or less and be compacted to a minimum of 100% SPMDD for both granular base and subbase. Asphalt materials should be rolled and compacted as per OPSS 310. The granular and asphalt pavement materials and their placement should conform to OPSS 310, 501, 1010 and 1150.

If the pavement construction occurs in wet, winter or inclement weather, it may be necessary to provide additional subgrade support for heavy construction traffic by increasing the thickness of the granular subbase, base or both. Further, traffic areas for construction equipment may experience unstable subgrade conditions. These areas may be stabilized utilizing additional thickness of granular materials.

It should be noted that in addition to adherence of the above pavement design recommendations, a close control on the pavement construction process will also be required in order to obtain the desired pavement life. Therefore, it is recommended that regular inspection and testing should be conducted during the pavement construction to confirm material quality, thickness, and to ensure adequate compaction.

5 Constructability Considerations

5.1 Excavations

Excavations must be carried out in accordance with the Occupational Health and Safety Act, Ontario Regulation 213/91 (as amended), Construction Projects, Part III - Excavations, Section 222 through 242. Where workers must enter a trench or excavation the soil must be suitably sloped and/or braced in accordance with the OHSA. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. For this site, the earth fill and cohesionless native soil deposits are classified as Type 3 soils, which require excavation sidewalls to be constructed no steeper than 1 horizontal to 1 vertical from the base of the excavation.

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the OHSA and include provisions for timbering, shoring and moveable trench boxes. To reduce the potential for instability of the trench excavations, materials excavated from the service trenches and/or other fill materials or heavy equipment should not be placed near the crest of the trench excavations.

It is not expected that excavations for the basement level or foundations will extend below the prevailing groundwater table that was encountered at depths of approximately 5.5 to 6.0 metres below existing grade. It is expected that any minor seepage of perched water or precipitation can be controlled using local sump pumps. If the elevator pit excavation extends into the groundwater table, continuously pumping with sump pumps is expected to be sufficient to temporarily control groundwater in that scenario.

It is important to note that soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in the boreholes advanced on site. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, we recommend that CEE be contacted immediately to evaluate the conditions encountered.

5.2 Compaction Specifications

Standard Proctor Maximum Dry Density (SPMDD) is the level to which a soil or aggregate is compacted. To achieve the specified SPMDD as indicated in this report, all soils or aggregates must be placed in lift thicknesses no greater than 200 mm. If this is not the case, only the upper portion of the lift will be adequately compacted, and the lower portion of the lift has a high probability of not meeting compaction specifications. In addition, industry standard equipment used to determine the degree of compaction consists of nuclear densometers. These devices

have an inherent limitation in that they cannot test beyond 300 mm in depth, and so the degree of compaction beyond this depth cannot be quantitatively determined.

Along with lift thickness, ensuring that the soil or aggregate is within 2% of its optimum moisture content ensures that the specified compaction can be reached. If the soil or aggregate is too dry/wet, it is either very difficult or impossible to reach the specified compaction. This is especially true for when higher compaction specifications such as 98% and 100% SPMDD are required.

Based on our review of the soil types encountered in the boreholes with associated moisture content, it is expected that about one-third of the in-situ soils are at optimum moisture content, one-third are above optimum, and one-third are below optimum. Any zones with higher or lower moisture content will require moisture conditioning prior to re-use in areas that require compaction. Moisture could be reduced by tilling the soil, spreading the soil out, or blending it with drier material. Soil that is dry of optimum could be blended with wetter soil or have water added prior to re-use. It must be noted that the above percentages can change significantly based on the time of year in which construction occurs, as the prevailing weather can have a significant effect on the moisture content of stockpiled and in-situ soil.

In addition to the above compaction specifications, in any areas where compacted fill will be placed over the exposed native soil subgrade, any loose, soft, wet or unstable areas should be sub-excavated, and backfilled with clean earth fill of Granular 'B' (OPSS.MUNI 1010) compacted to a minimum of 98% SPMDD. This recommendation applies to site servicing, pavement and slab on grade subgrades.

5.3 Quality Verification Services

On-site quality verification services are an integral part of the geotechnical design function, and for foundations and retaining walls, are required under the Ontario Building Code (OBC). Quality verification services are used to confirm that construction is being conducted in general conformance with the requirements as outlined in the drawings, reports and specifications prepared for the proposed development.

Central Earth Engineering can provide all the on-site quality verification services outlined below:

- The subgrade for shallow foundations must be field reviewed by the geotechnical engineer as required by the OBC.
- Installation of retaining structures over 1.0 metres high and related backfilling operations must be field reviewed on a continuous basis by the geotechnical engineer as required in the OBC.
- Part-time monitoring of the subgrade support capabilities (i.e. proof-roll), material quality, lift thickness, moisture content, degree of compaction, etc. is recommended for the following areas to ensure the recommendations within this report are followed and they perform adequately in the long-term:
    - Slab-on-grades.
    - Pavements.
    - Bedding/backfilling of site servicing.
- Testing of the concrete (compressive strength, slump, air content, etc.) is recommended to ensure that the quality of the materials being brought to site meet the requirements of the project.

5.4 Site Work

The soils found at this site may become weakened when subjected to traffic, particularly when wet. If there is site work carried out during periods of wet weather, then it can be expected that the subgrade will be disturbed unless an adequate granular working surface is provided to protect the integrity of the subgrade soils from construction traffic. Subgrade preparation works cannot be adequately accomplished during wet weather and the project must be scheduled accordingly. The disturbance caused by the traffic can result in the removal of disturbed soil and use of granular fill material for site restoration or underfloor fill that is not intrinsic to the project requirements.

The most severe loading conditions on the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of earth and aggregate fills, restricted construction lanes, and half-loads during paving and other work may be required, especially if construction is carried out during unfavourable weather.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the founding subgrade and concrete must be provided. The soil at this site is susceptible to frost damage. Consideration must be given to frost effects, such as heave or softening, on exposed soil surfaces in the context of this particular project development.

6 Limitations and Conclusion

6.1 Limitations

The recommendations and comments provided are necessarily on-going as new information of underground conditions becomes available. More specific information with respect to the conditions between samples, or the lateral and vertical extent of materials may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operations. Consequently, conditions not observed during this investigation may become apparent. Should this occur, CEE should be contacted to assess the situation and additional testing and reporting may be required.

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

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

This report was prepared by CEE for the account of Morriello Construction Ltd. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Central Earth Engineering Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

6.2 Conclusion

It is recognized that municipal/regional governing bodies, in their capacity as the planning and building authority under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both as are expressed and implied.

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to contact our office.

Yours Truly,

Central Earth Engineering Inc.

Alexander Winkelmann, P.Eng.
President, Geotechnical Engineer

Anar Jafarov, P.Eng.
Geotechnical Engineer

Figures –

SITE LOCATION PLAN

BOREHOLE LOCATION PLAN

Central Earth ENGINEERING

Geotechnical Engineering and Construction
Materials Testing & Inspection

647 Welham Rd, Unit 14, Barrie, ON, L4N 0B7
P: (705) 719-7994 | E: info@centralearth.ca

Project:	520 & 526 Big Bay Point Road, Barrie				
Title:	SITE LOCATION PLAN				
Approved by:	A.W.	Date:	December 2020	Project No.:	20-1016A
Drawn by:	A.J.	Scale:	N.T.S.	Figure No.:	1

Central Earth ENGINEERING
Geotechnical Engineering and Construction
Materials Testing & Inspection
647 Welham Rd, Unit 14, Barrie, ON, L4N 0B7
P: (705) 719-7994 | E: info@centralearth.ca

Project:	520 & 526 Big Bay Point Road, Barrie				
Title:	BOREHOLE LOCATION PLAN				
Approved by:	A.W.	Date:	December 2020	Project No.:	20-1016A
Drawn by:	A.J.	Scale:	1:600	Figure No.:	2

Appendix A –

BOREHOLE LOGS

RECORD OF BOREHOLE No. 1

Central Earth ENGINEERING

Project Number:	**20-1016A**						
Project Client:	**Morriello Construction Ltd.**						
Project Name:	**520 & 526 Big Bay Point Road**	Drilling Method:	**Hollow Stem Augers**	Drilling Machine:	**Track Mount**		
Project Location:	**Barrie, Ontario**	Logged By:	**AJ**	Northing:	**4912503**	Date Started:	**2020-11-09**
Drilling Location:	**See Figure 2**	Reviewed By:	**AW**	Easting:	**607906**	Date Completed:	**2020-11-09**

Lithology Plot	DESCRIPTION	Geodetic 251.75m	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Topsoil = 200mm	0.2 / 251.6					0	251
	FILL: Silty Sand, Trace to Some Clay, Trace Organics/Rootlets, Loose, Dark Brown, Moist		SS	1	42	8		
			SS	2	61	6	1	250
		1.5 / 250.2						
	Weathered/Disturbed		SS	3	61	8	2	249
		2.3 / 249.5						
	SILTY SAND GLACIAL TILL, Trace Clay, Trace Gravel, Compact, Brown, Moist		SS	4	86	15	3	248
	- - - Very Dense - - -		SS	5	44	60	4	247
	- - - Dense - - -		SS	6	61	31	5	246
		6.1 / 245.7						
	GRAVELLY SAND, Some Silt, Very Dense, Brown, Wet	6.6 / 245.2	SS	7	78	59	6	
	End of Borehole @ 6.6m							

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ○ Water Content (%) LL
10 20 30 40

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
3	55	33	9

CENTRAL EARTH ENGINEERING
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B8
T : (705) 719-7994
E: info.com
W: centralearth.com

Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **Nov. 24/20** at a depth of: **5.46m**

RECORD OF BOREHOLE No. 2

Central Earth ENGINEERING

Project Number:	**20-1016A**				
Project Client:	**Morriello Construction Ltd.**				
Project Name:	**520 & 526 Big Bay Point Road**	Drilling Method: **Hollow Stem Augers**		Drilling Machine: **Track Mount**	
Project Location:	**Barrie, Ontario**	Logged By: **AJ**	Northing: **4912533**	Date Started: **2020-11-09**	
Drilling Location:	**See Figure 2**	Reviewed By: **AW**	Easting: **607929**	Date Completed: **2020-11-09**	

Lithology Plot	DESCRIPTION (Geodetic 252.88m)	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)
	Topsoil = 300mm (0.3 / 252.6)	SS	1	67	14	0	252
	FILL: Sandy Silt, Some Clay, Trace Rootlets, Comapct, Dark Brown, Moist (0.8 / 252.1)						
	SILTY SAND GLACIAL TILL, Trace to Some Clay, Trace Gravel, Compact, Brown, Moist	SS	2	100	13	1	251
		SS	3	94	21	2	250
	(2.3 / 250.6) SILTY FINE SAND, Compact, Light Brown, Damp	SS	4	72	24	3	249
	(3.1 / 249.8) SILTY SAND GLACIAL TILL, Trace Gravel, Trace Clay, Dense, Brown, Moist	SS	5	83	32	4	248
	- - - Very Dense - - -	SS	6	94	71	5	247
	(6.6 / 246.3)	SS	7	100	59	6	
	End of Borehole @ 6.6m						

FIELD TESTING — Shear Strength Testing (kPa): Other Test; Pocket Penetrometer; Field Vane (Intact); Field Vane (Remolded). Penetration Testing: SPT, DCPT.

LAB TESTING — Combustible Organic Vapour (ppm); Combustible Organic Vapour (%LEL); Total Organic Vapour (ppm). Atterberg Limits: PL, LL, Water Content (%).

Instrumentation Installation

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
7	46	31	16

CENTRAL EARTH ENGINEERING
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B8
T : (705) 719-7994
E: info.com
W: centralearth.com

Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

Groundwater depth observed on **Nov. 24/20** at a depth of: **Dry**

Scale: **1 :50**

RECORD OF BOREHOLE No. 3

Central Earth ENGINEERING

Project Number:	**20-1016A**						
Project Client:	**Morriello Construction Ltd.**						
Project Name:	**520 & 526 Big Bay Point Road**	Drilling Method:	**Hollow Stem Augers**	Drilling Machine:	**Track Mount**		
Project Location:	**Barrie, Ontario**	Logged By:	**AJ**	Northing:	**4912506**	Date Started:	**2020-11-09**
Drilling Location:	**See Figure 2**	Reviewed By:	**AW**	Easting:	**607949**	Date Completed:	**2020-11-09**

Lithology Plot	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT "N" Value	DEPTH (m)	ELEVATION (m)	Instrumentation Installation	GR	SA	SI	CL
Geodetic 252.57m												
0.1 / 252.5	Topsoil = 75mm											
	FILL: Silty Sand, Trace to Some Gravel, Trace Clay, Loose, Dark Brown, Moist	SS	1	67	8	0	252					
		SS	2	72	10	1	251					
1.5 / 251.1	SILTY SAND GLACIAL TILL, Trace to Some Gravel, Trace Clay, Very Dense, Brown, Moist	SS	3	61	61	2	250					
	- - - Compact to Dense - - -	SS	4	83	21	3	249					
		SS	5	11	36	4	248					
		SS	6	89	21	5	247		10	51	30	9
	- - - Very Dense - - -	SS	7	52	52	6						
6.6 / 246.0	End of Borehole @ 6.6m											

FIELD TESTING
Shear Strength Testing (kPa)
× Other Test; + Pocket Penetrometer; ▲ Field Vane (Intact); △ Field Vane (Remolded)
40 80 120 160
Penetration Testing
○ SPT ● DCPT
10 20 30 40

LAB TESTING
△ Combustible Organic Vapour (ppm)
▲ Combustible Organic Vapour (%LEL)
✳ Total Organic Vapour (ppm)
100 200 300 400
Atterberg Limits
PL ○ Water Content (%) LL
10 20 30 40

COMMENTS & GRAIN SIZE DISTRIBUTION (%)

CENTRAL EARTH ENGINEERING
647 Welham Road, Unit 14
Barrie, Ontario L4N 0B8
T : (705) 719-7994
E: info.com
W: centralearth.com

Groundwater depth encountered on completion of drilling: **Dry**

Cave depth after auger removal: **Open**

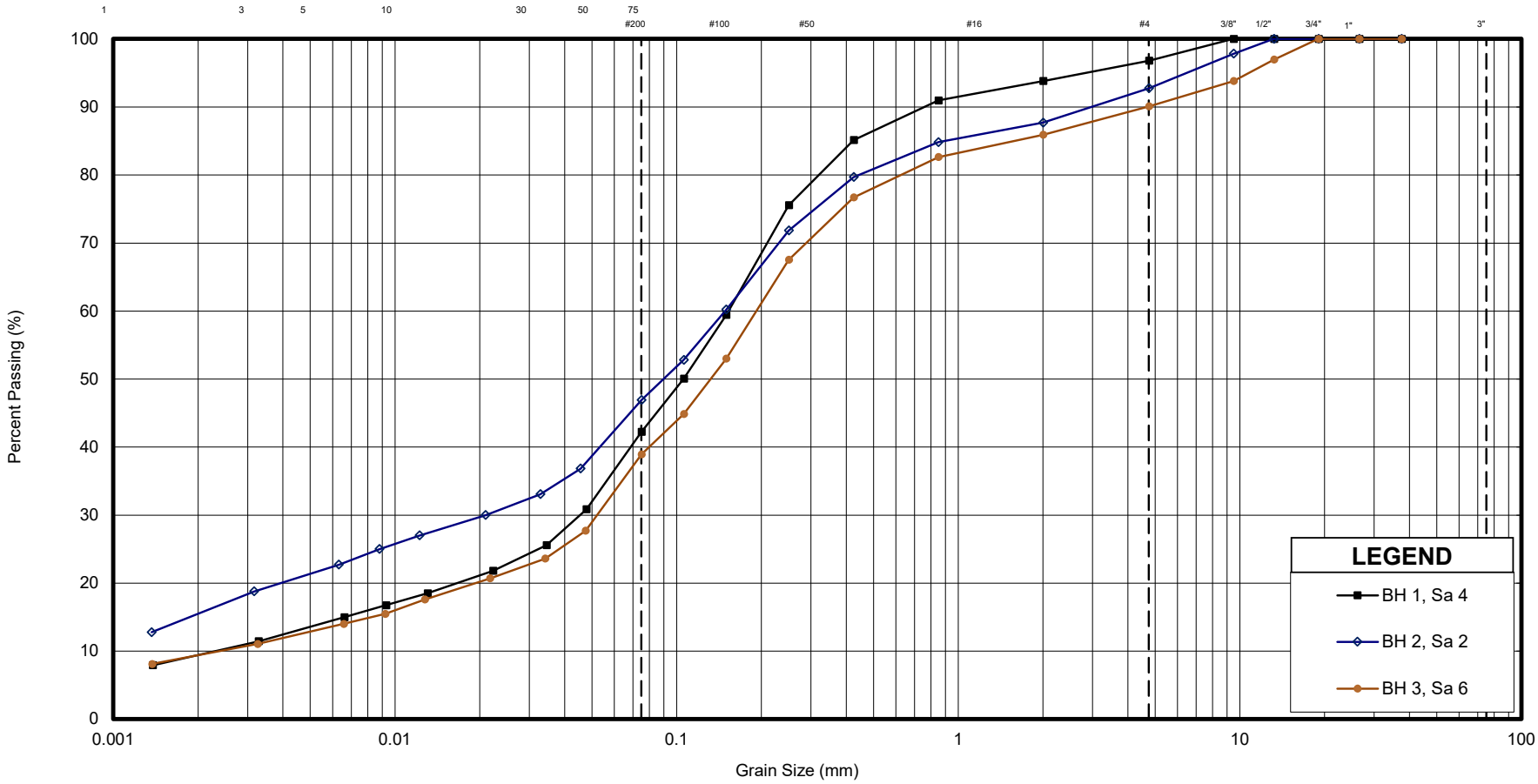
Groundwater depth observed on **Nov. 24/20** at a depth of: **6.00m**

Appendix B –

GEOTECHNICAL LABORATORY DATA

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
BH 1, Sa 4	SILTY SAND GLACIAL TILL, Trace Clay, Trace Gravel	3	55	33	9	0.002	0.045	0.15	66.7	5.9
BH 3, Sa 6	SILTY SAND GLACIAL TILL, Trace Clay, Trace Gravel	10	51	30	9	0.002	0.052	0.19	80.4	5.9
BH 2, Sa 2	SILTY SAND GLACIAL TILL, Some Clay, Trace Gravel	7	46	31	16	-	0.021	0.15	-	-

Central Earth ENGINEERING

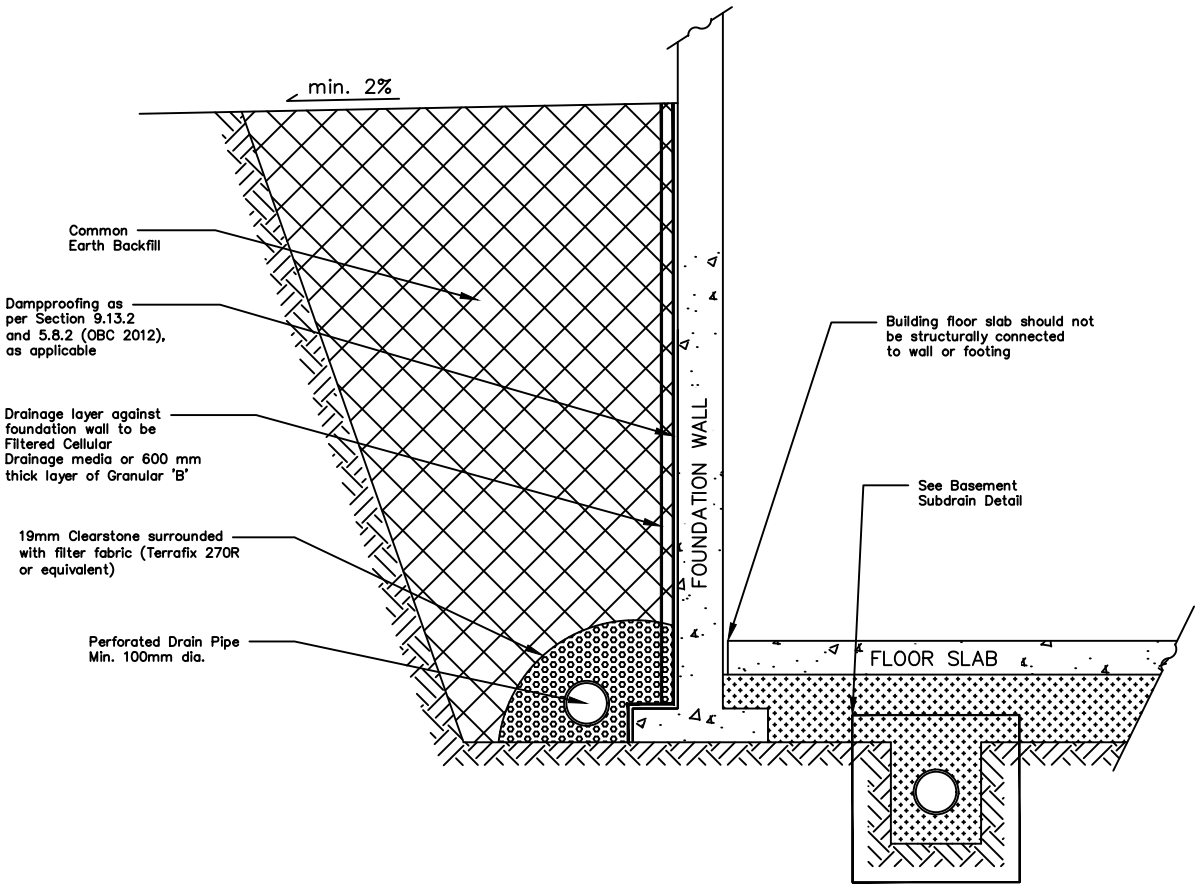
GRAIN SIZE DISTRIBUTION

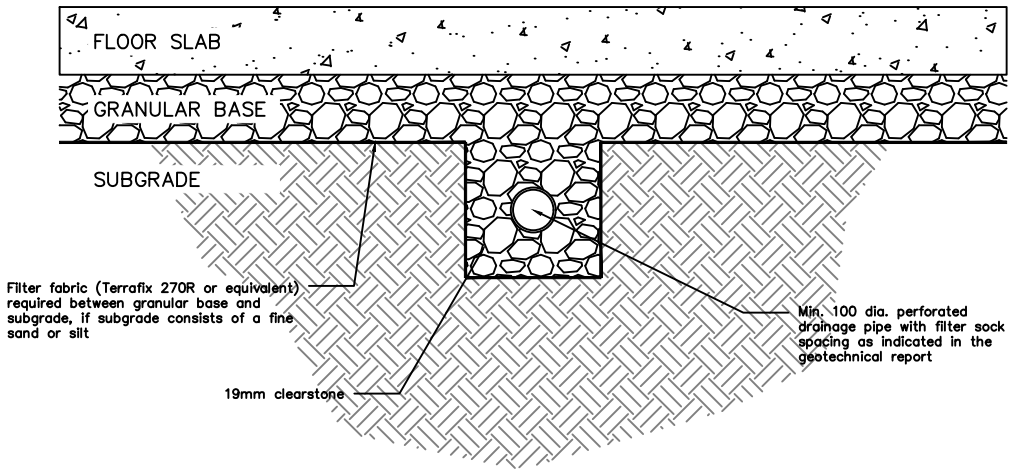
SILTY SAND GLACIAL TILL

FIGURE No.	B1
REF. No.	20-1016A
DATE	December 2020

Appendix C –

TYPICAL DETAILS





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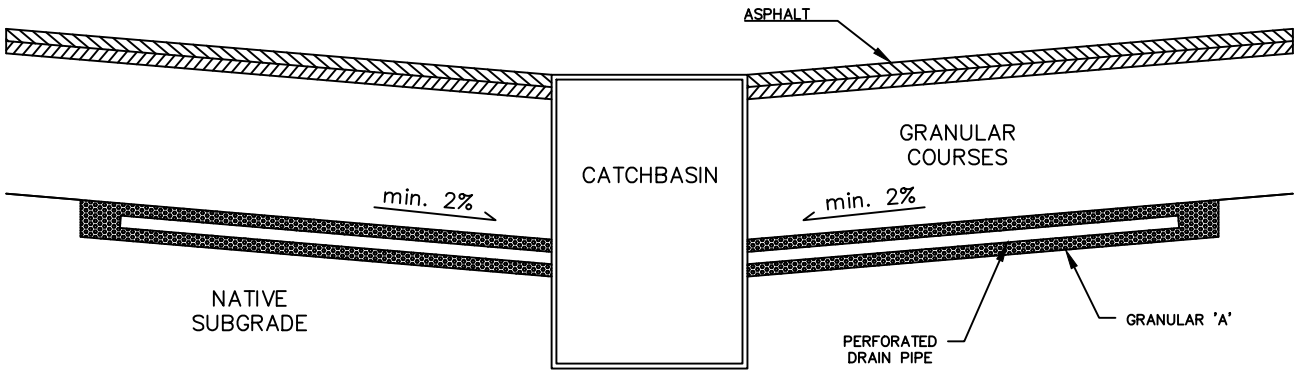
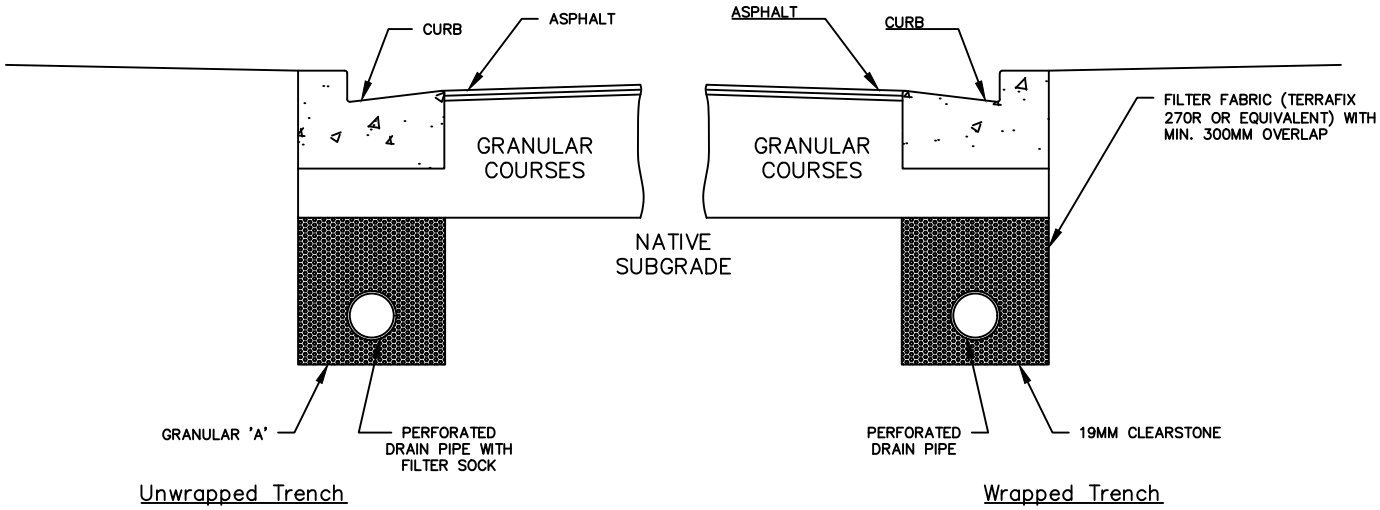
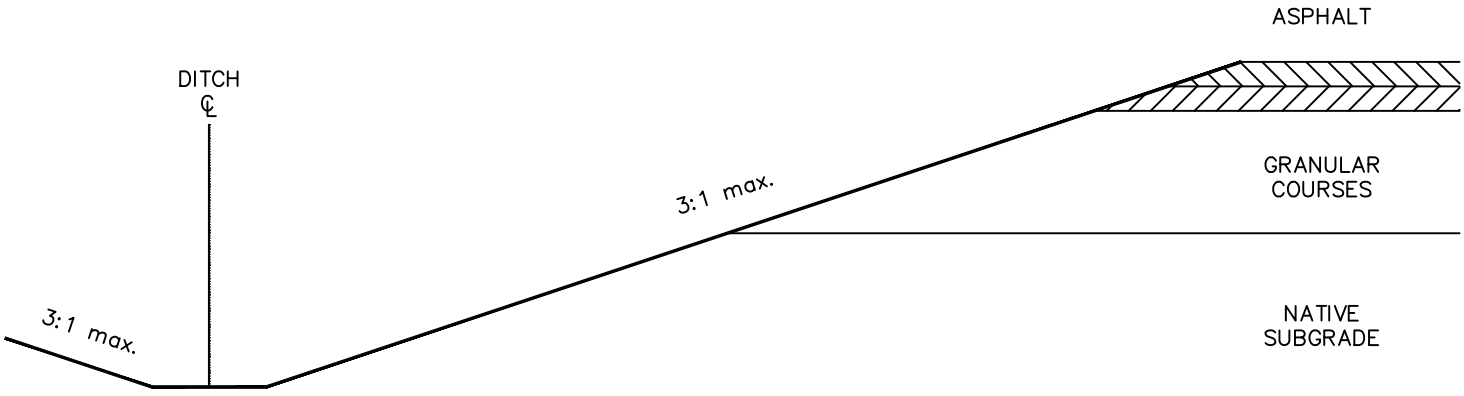
BASEMENT FOUNDATION WALL & SUBFLOOR DRAINAGE TYPICAL DETAIL





Urban Cross Sections



Rural Cross Section

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PAVEMENT DRAINAGE ALTERNATIVES TYPICAL DETAILS

Design Chart 1.08: Hydrologic Soil Groups (Continued)

- Based on Soil Texture

Sands, Sandy Loams and Gravels	
- overlying sand, gravel or limestone bedrock, very well drained	A
- ditto, imperfectly drained	AB
- shallow, overlying Precambrian bedrock or clay subsoil	B
Medium to Coarse Loams	
- overlying sand, gravel or limestone, well drained	AB
- shallow, overlying Precambrian bedrock or clay subsoil	B
Medium Textured Loams	
- shallow, overlying limestone bedrock	B
- overlying medium textured subsoil	BC
Silt Loams, Some Loams	
- with good internal drainage	BC
- with slow internal drainage and good external drainage	C
Clays, Clay Loams, Silty Clay Loams	
- with good internal drainage	C
- with imperfect or poor external drainage	C
- with slow internal drainage and good external drainage	D

Source: U.S. Department of Agriculture (1972)

APPENDIX C

Water and Sanitary Servicing Calculations

PINESTONE ENGINEERING LTD.

– street townhouses ≤ 47 units / hectare @ 2.34 ppu
– 'walk-up' apartments 26 - 53 units / hectare @ 2.34 ppu

- *Typical zoning designations for Medium Density Development may include RM2 and RM2-TH. 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-law's and designations are being used.*

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-law's 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

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*)

The peaking factor, M, is to be calculated using the Harmon Formula:

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

8.2.2 Evaluation of Existing Pumping Stations

The capacity of existing pump stations to convey future flows was also evaluated for the various planning horizons. For this analysis, peak modelled flows corresponding to the 25-year design event were compared against the firm capacity of each station. **Table 8.3** presents the results. The station firm capacity represents the current available capacity at each station while the 2017 Existing, 2021, 2026, 2031, 2036 and 2041 values represent the required capacity in the time period. It is noted that the Huronia PS has already been decommissioned and the Lockhart PS is planned to be decommissioned. In addition, the Holly PS is currently being expanded and the station firm capacity is being increased. The values shown in **Table 8.3** correspond to the post-construction firm capacity.

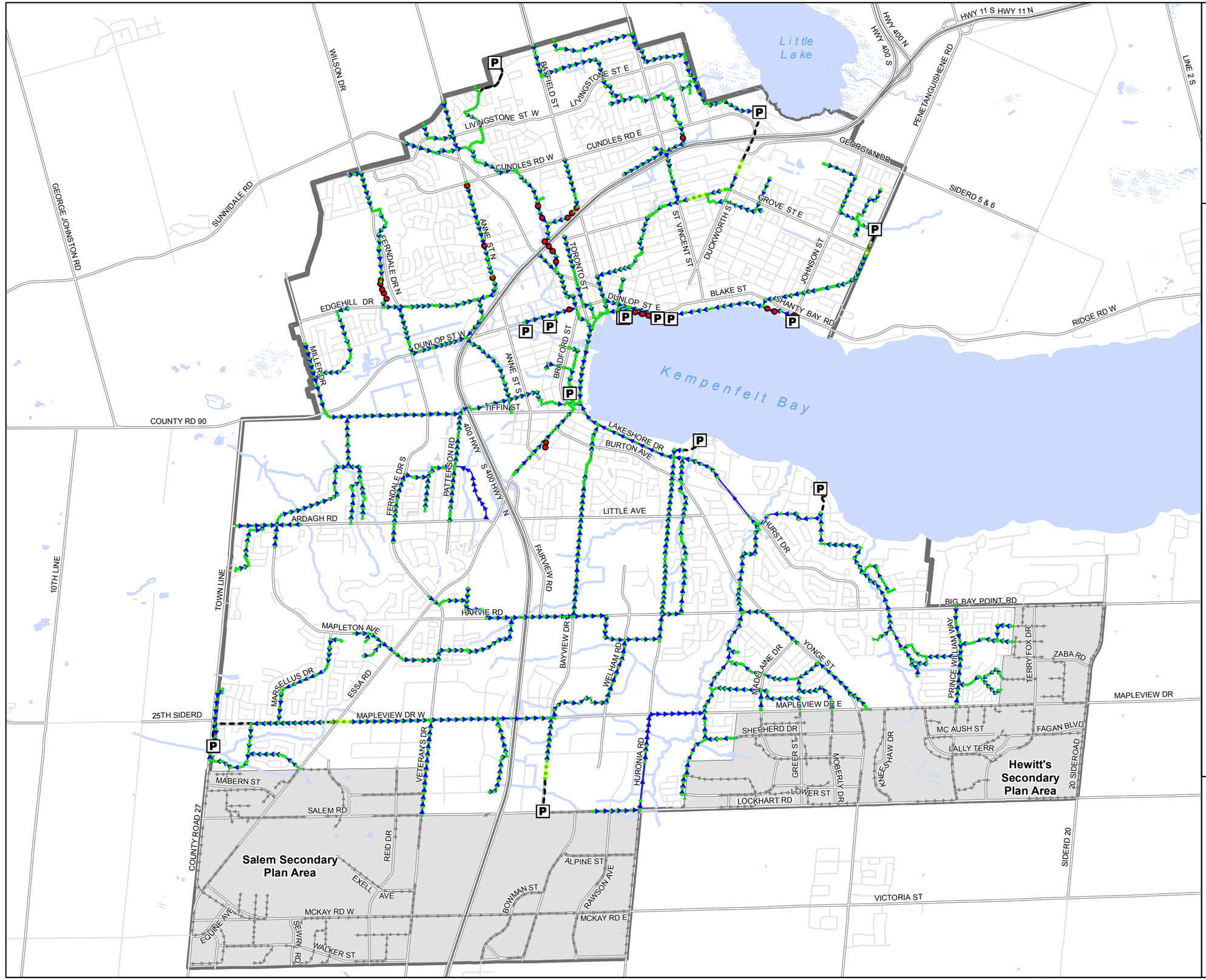
Table 8.3 Pumping Station Capacity Assessment (2017-2041)

Modelled Pumping Station	Station Firm Capacity (L/s)	2017 Existing Peak Flow Entering Station (L/s)	2021 Peak Flow Entering Station (L/s)	2026 Peak Flow Entering Station (L/s)	2031 Peak Flow Entering Station (L/s)	2036 Peak Flow Entering Station (L/s)	2041 Peak Flow Entering Station (L/s)
Barrie WwTF (PS10)	2,205	1,736	1,910	1,963	2,057	2,061	2,109
Grove Street (PS1)	158	53	52	54	54	57	63
Minets Point (PS2)	61.3	22.1	22.2	22.3	22.6	22.9	23.6
Huronia (PS3)	91	Decommissioned					
Lockhart (PS4)	51	5	Planned to Be Decommissioned				
Holly (PS5)	200.9	67	81	95	108	120	130
Little Lake (PS6)	110	37	37	40	40	41	42
Tynedale (PS12)	11	10	**15**	**15**	**16**	**16**	**16**
Mooregate (PS18)	21	8	8.5	8.5	8.7	8.9	9.1

It is noted that the influent flow to PS10 does not include any recycle streams. For PS10, the Wastewater Treatment Master Plan contains a detailed examination of future needs.

The results presented above indicated that all SPSs, with the exception of Tynedale SPS (PS12), have sufficient firm capacity to convey peak flows associated with the 25-year design event through to the year 2041. PS12 will require a pump capacity increase in the planning phase 2021.

Figure 6-2
City of Barrie
Existing Wastewater Collection System Performance
Peak Dry Weather Flow Conditions



- Pumping Stations
- Secondary Plan Boundaries
- City of Barrie Limits
- Forcemain
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

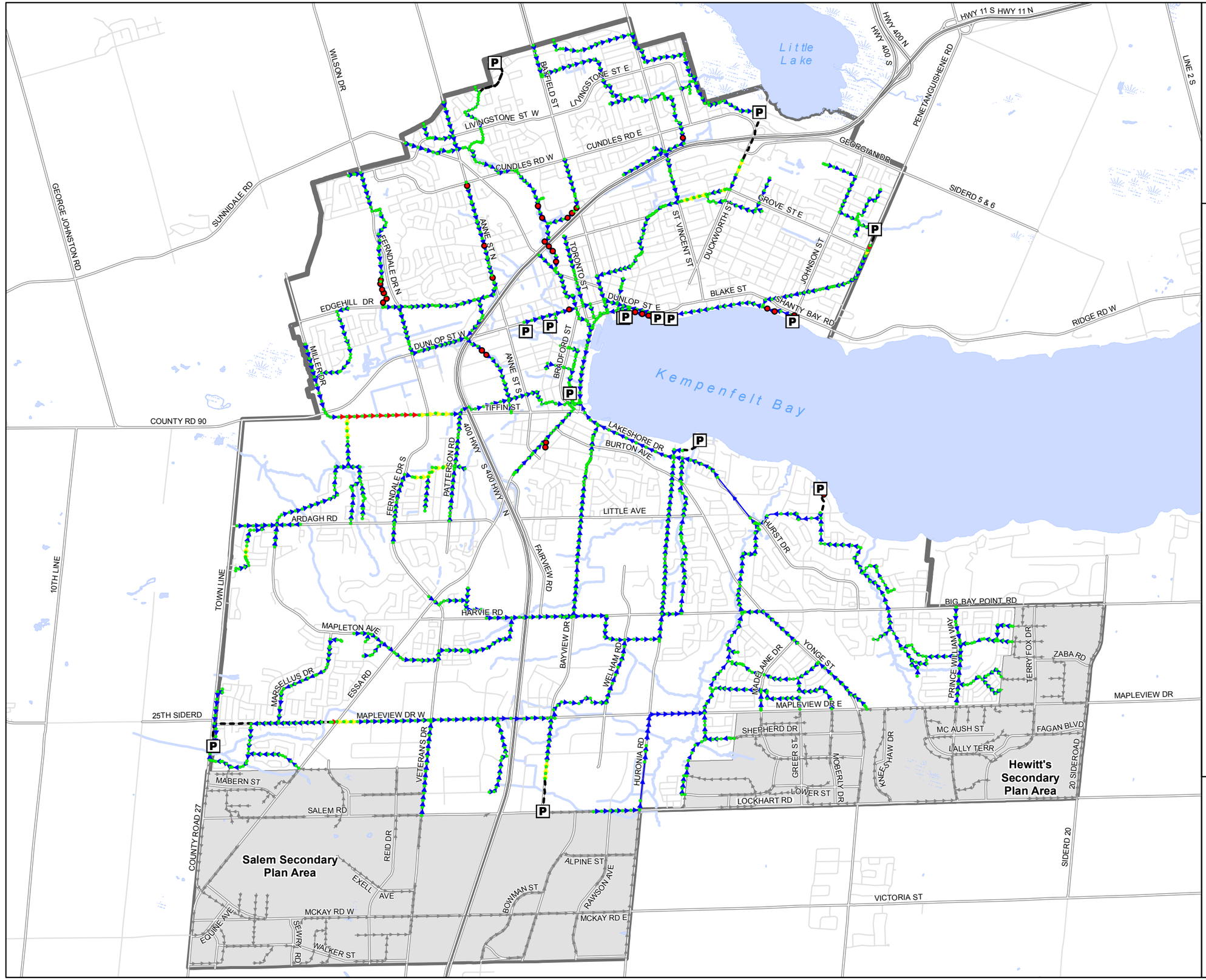
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-3
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(2 Year Storm Event)



- Pumping Stations
- Secondary Plan Boundaries
- Forcemain
- Future Annexed Lands Sewers
- City of Barrie Limits

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

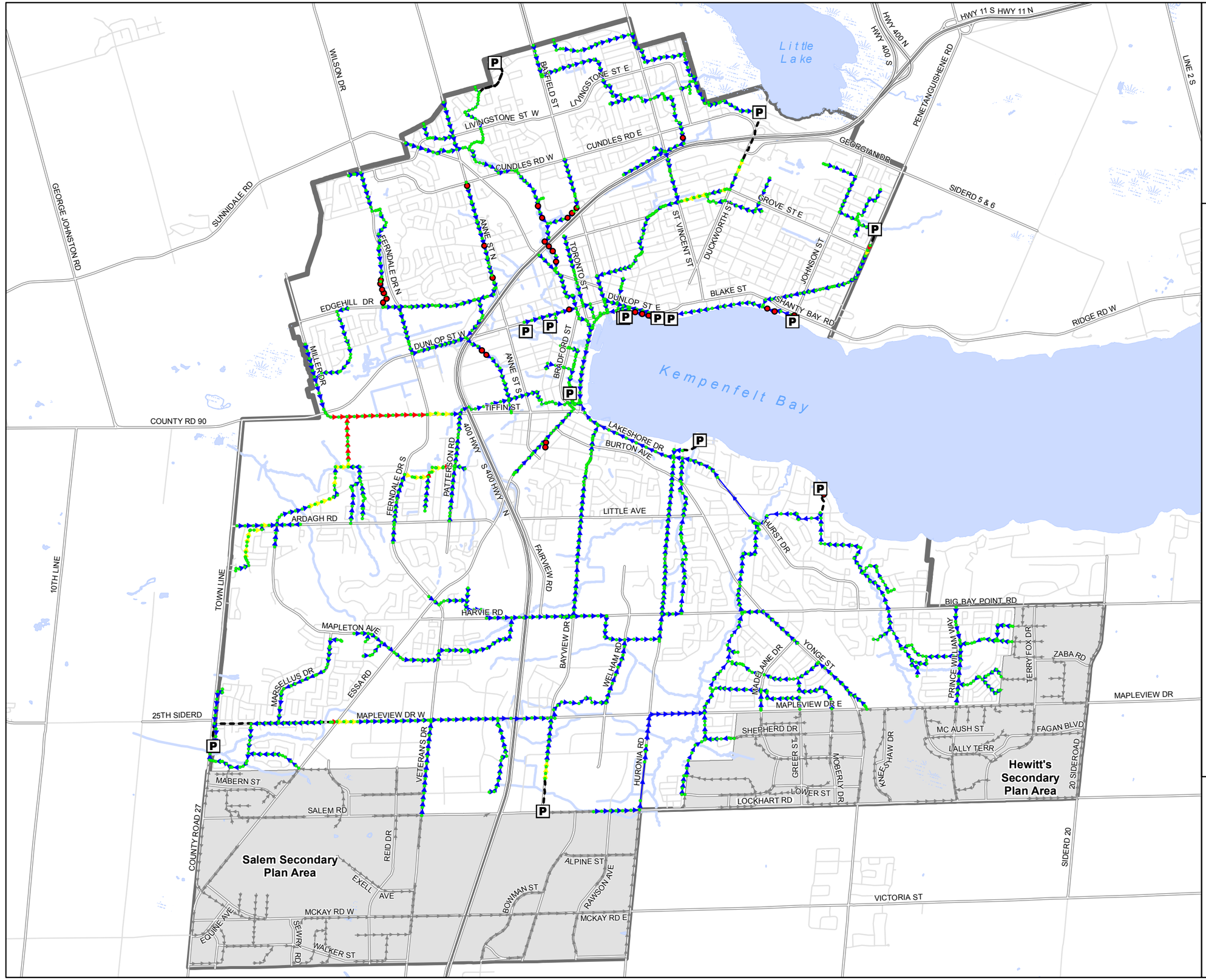
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-4
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(5 Year Storm Event)



- Pumping Stations
- Secondary Plan Boundaries
- City of Barrie Limits

Sanitary Collection System

- Forcemain
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

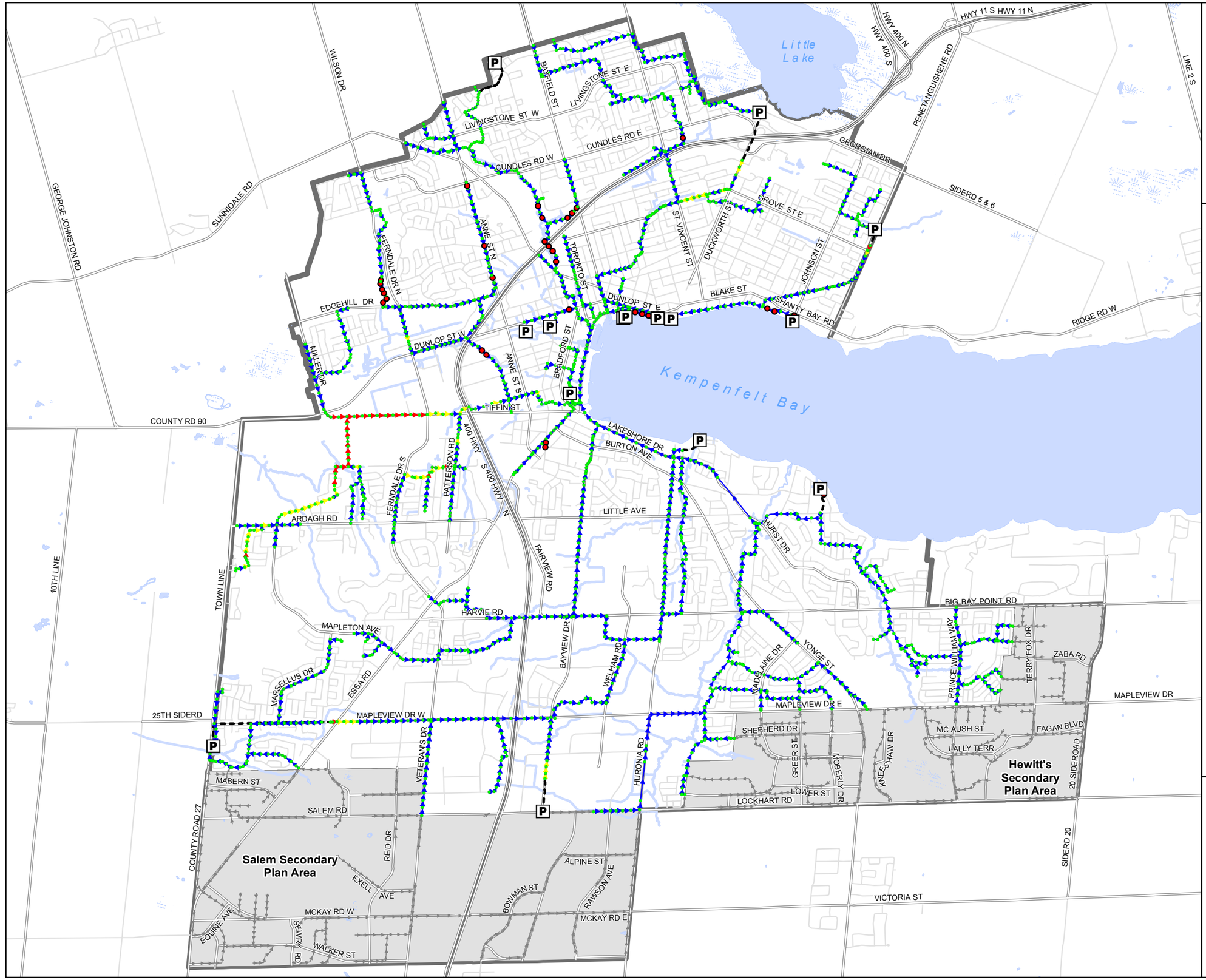
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-5
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(10 Year Storm Event)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

Freeboard (m)

- <= 1.8m
- > 1.8m

Peak Conduit Depth Ratio (d/D)

- < 0.5
- 0.5 - 0.7
- > 0.7

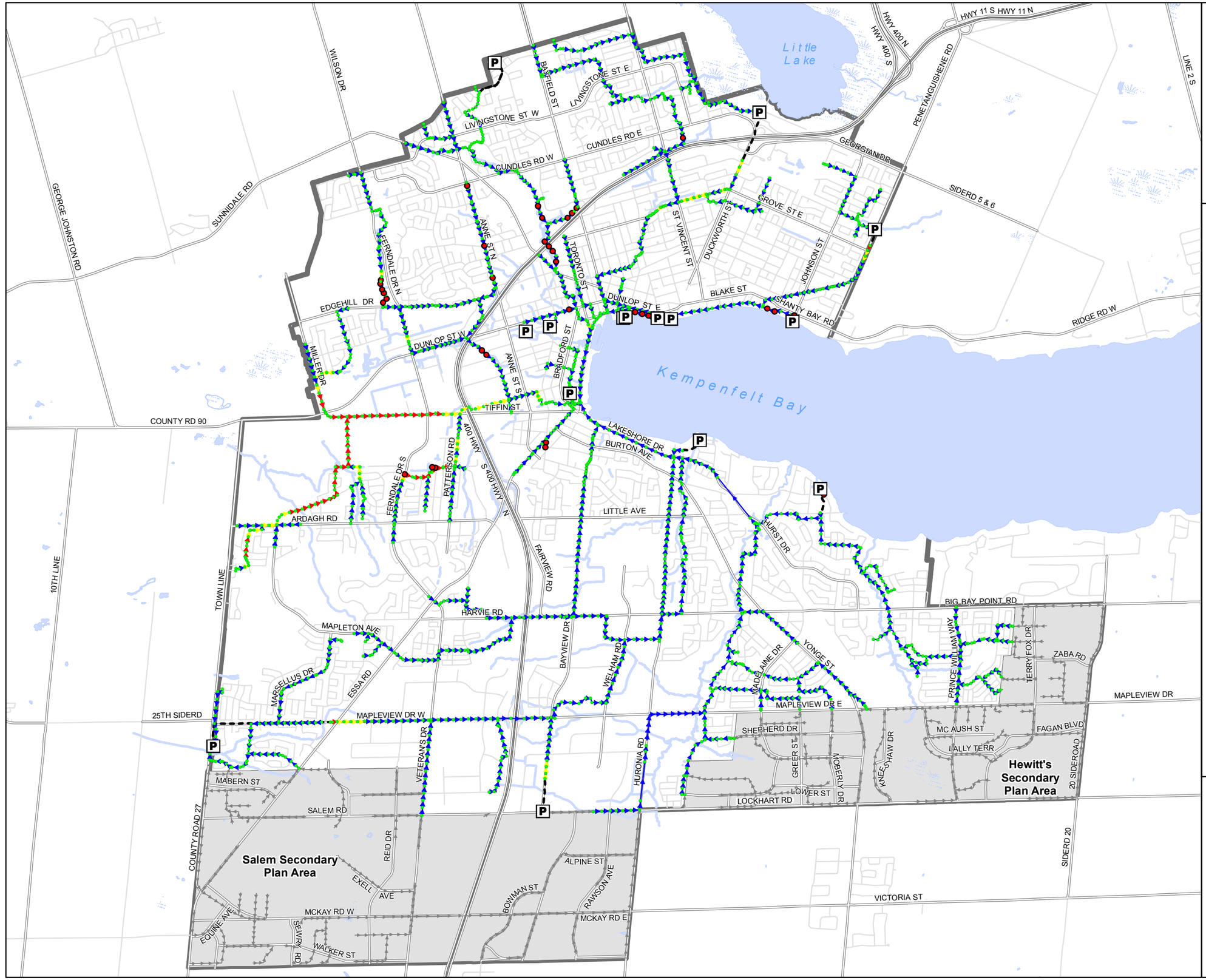
COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

Figure 6-6
City of Barrie
Existing Wastewater Collection System Performance
Wet Weather Flow Conditions
(25 Year Storm Event)



- Pumping Stations
- Forcemain
- Secondary Plan Boundaries
- City of Barrie Limits
- Future Annexed Lands Sewers

NewFreebrd25yr

- <= 1.8m
- > 1.8m

NewMaxFullDpth25yr

- < 0.5
- 0.5 - 0.7
- > 0.7

COLE

N

0 0.25 0.5 1 1.5 2
Kilometers

Updated: 4/5/2019

520-526 Big Bay Point Road Apartment Development

City of Barrie

SANITARY SEWER DESIGN SHEET

ENGINEERING AND PUBLIC WORKS

Project Number: 20-11559B
Date: December 4, 2020
Design By: DH
Checked By: JHV
File: Z:\Project Documents\11559B 520-526 BBPR FSR\FSR\Sanitary Sewer Design Sheet.xls

Drainage Area Plan No: N/A

Design Parameters

Average Daily Flow
Residential 0.0026 L/s/c
Commercial 0.326 L/s/ha

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						
STREET	AREA NO.	MANHOLE LOCATION FROM MH	MANHOLE LOCATION TO MH	AREA	UNITS	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING 0.00 *L/s/ha* AREA	CUMUL AREA	PEAK FLOW	0.326 *L/s/ha* AREA	CUMUL AREA	PEAK FLOW	0.00 *L/s/ha* 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		*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 Apartment Building (46 Units)	1	1	Main	0.35	46.00	0.077	0.077	4.273197	0.8549											0.35	0.35	0.0350	0.8899	29.0	2.00	150	21.5267	1.219	0.598
																Capacity of Immediate Downstream Reach of 250mm dia. Sanitary Sewer =								110.0	1.00	250	59.4373	1.211	

From:	bruno morriello
To:	Joe Voisin
Subject:	Fw: Hydrant Flow Test Results - 520/526 Big Bay Point Rd., Barrie, ON
Date:	November 17, 2020 8:16:31 AM

Good Morning Joe,

Please see below the results from the hydrant test at 520/526 Big Bat Point Road.

Thank you,
Bruno Morriello
Morriello Construction Ltd.
Box 7184, Innisfil, Ontario, L9S 1A9
cell (705) 790-1441
office (705) 436-2263

----- Forwarded Message -----
From: Awiral Gautam <awiral.gautam@jci.com>
To: bmorriello@rogers.com <bmorriello@rogers.com>
Cc: Andrew Cyopick <andrew.cyopick@jci.com>; Moinyoungor Karsor <moinyoungor.karsor@jci.com>
Sent: Tuesday, November 17, 2020, 08:08:43 a.m. EST
Subject: Hydrant Flow Test Results - 520/526 Big Bay Point Rd., Barrie, ON

Goodmorning Bruno,

Please find the results of the Hydrant Flow test below :

Hydrant number : 3628

Static- 80 PSI

Residual- 79 PSI

Pitot- 69 PSI

GPM- 683

Flow conducted using 1 port with 1 3/4” smooth bore play pipe.

Hi Moinyoungor,

Can you please provide an e-copy of the invoice to Bruno please ?

Thankyou,

Avi Gautam / Project Coordinator **/ B.Eng., M.Eng., E.I.T.**

Cell: 905-302-0871 / Tel: 905-212-4448 / Emergency Service 1+905 212 4620

2400 Skymark Avenue / Mississauga, Ontario L4W5K5 / CANADA

awiral.gautam@jci.com / www.jci.com / www.simplexgrinnell.com

Table 3-5 Maximum Day Factor and Average Daily Demand Per Capita Per Zone

	ZONE 1	ZONE 2N	ZONE 3N	ZONE 2S	ZONE 3S
Maximum Day Factor from 2015 to 2017 [1]	2.30	1.66	2.41	2.32	1.63
Maximum Day Factor for Established Population	2.30	1.80	2.41	2.32	1.80
Maximum Day Factor for Future Population [2]					
2021	1.90	1.80	2.00	1.75	1.80
2026	1.80	1.80	2.00	1.75	1.80
2031	1.80	1.75	2.00	1.75	1.80
2036	1.80	1.75	2.00	1.65	1.80
2041	1.80	1.75	2.00	1.65	1.80
2071	1.75	1.75	1.90	1.65	1.75
Average Daily Demand Per Capita (Lpcd) for Established and Future Population [3]	174	162	210	129	224

[1] Based on the maximum day factor of each zone found in Table 3-2, Table 3-3 and Table 3-4.

[2] The maximum day factors for the future population were based on Table 3-1: Peaking factors of *Design Guidelines For-Drinking Water Systems, 2008* from MECP, according to the total equivalent population of each projected year.

[3] The average daily demand each zone was calculated based on the average daily demand per capita found in Table 3-2, Table 3-3 and Table 3-4.

The combined population projections, average day demand and maximum day demand projections to ultimate buildout are summarized in Table 3-6. The demands associated with growth in the Salem and Hewitts Secondary Plan Areas have been included in Zones 2S and 3S.

WATER SERVICE AREAS

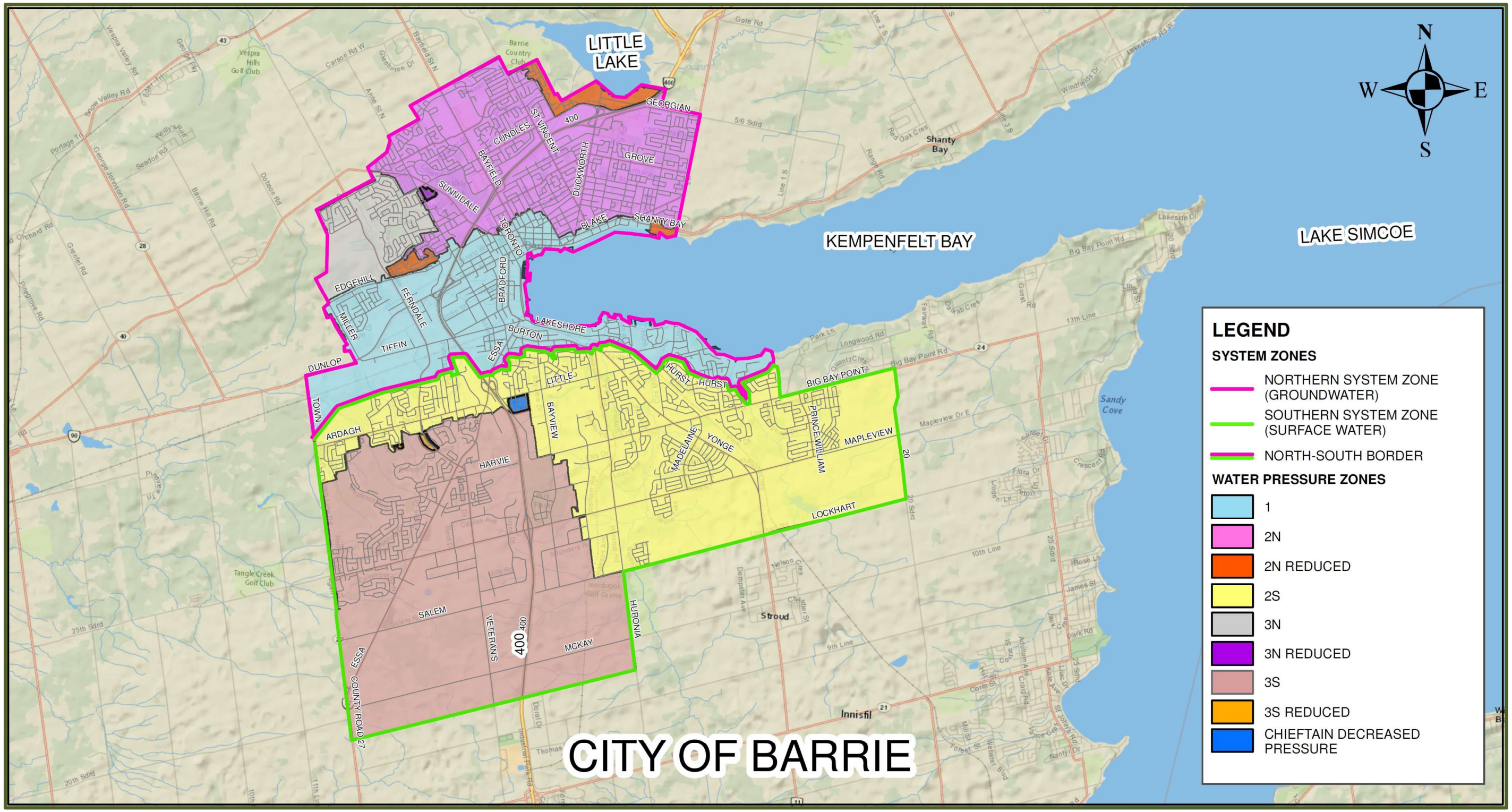


Table 3-1: Peaking Factors

POPULATION	MINIMUM RATE FACTOR (MINIMUM HOUR)	MAXIMUM DAY FACTOR	PEAK RATE FACTOR (PEAK HOUR)
500 - 1 000	0.40	2.75	4.13
1 001 - 2 000	0.45	2.50	3.75
2 001 - 3 000	0.45	2.25	3.38
3 001 - 10 000	0.50	2.00	3.00
10 001 - 25 000	0.60	1.90	2.85
25 001 - 50 000	0.65	1.80	2.70
50 001 - 75 000	0.65	1.75	2.62
75 001 -150 000	0.70	1.65	2.48
greater than 150 000	0.80	1.50	2.25

3.4.3 Commercial and Institutional Water Demands

Institutional and commercial flows should be determined by using historical records, where available. Where no records are available, the values in Table 3.2 should be used. For other commercial and tourist-commercial areas, an allowance of 28 m^3/(ha·d) [3000 USgal/(acre·d)] average flow should be used in the absence of reliable flow data.

When using the above unit demands, maximum day and peak rate factors should be developed. For establishments in operation for only a portion of the day such as schools and shopping plazas, the water usage should also be factored accordingly. For instance, with schools operating for 8 hours per day, the water use rate would be at an average rate of 70 L/(student·day) [19 USgal/(student·day)] x 24/8 or 210 L/student (55 USgal/student) over the 8-hour period of operation. The water use will drop to a residual amount during the remainder of the day. Schools generally do not exhibit large maximum day to average day ratios and a factor of 1.5 will generally cover this variation. For estimation of ***peak demand*** rates, an assessment of the water-using fixtures is generally necessary and a fixture-unit approach should be used.

Fire Flow Calculations – Fire Underwriters Survey 1999

Building Area = 765 m^2 @ 6 floors = 4,590 m^2

Fire demands for the proposed development were calculated in accordance with the Fire Underwriters Survey (FUS) as follows:

$$F = 220C(A)^{0.5}$$

Where,

F = the required fire flow in litres per minute.

C = coefficient related to the type of construction.

A = total floor area of building (excluding basements) calculated as per FUS

C = 0.8 for non-combustible construction

F = 220*0.8*(4,590)^0.5
F = 11,924 L/min
F = 198.73 L/sec

Reductions:

Reduction for low hazard occupancy (-25%)
Fire Flow = 149.05 L/sec

Reduction for sprinkler system in conformance with NFPA standards (-30%)
Fire Flow = 104.34 L/sec

Exposure charge for proposed building to the south (+5%)
Exposure charge for existing building to the east (+10%)
Exposure charge for proposed building to the west (+20%)

Total charge = +35% or 52.17 L/sec on the 149.05 L/sec fire flow

Required fire flow as per FUS 1999 calculation = 156.5 L/sec

520-526 Big Bay Point Road Development
FIRE FLOW ANALYSIS
Barrie, Ontario

PINESTONE ENGINEERING LTD.

Project Number: 20-11559B
Date: December 4, 2020
Design By: DPH
File: Z:\Project Documents\11559B 520-526 BBPR FSR\FSR\Site Fire Flow Analysis.xls

CALCULATION OF RESIDUAL PRESSURE AT BUILDING

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

	Metric		Imperial		
P0 - Starting Pressure	56.26	*m*	80	*psi*	
P1 - Pressure at Q1	55.56	*m*	79	*psi*	
Q1 - From Fire Flow Test	2585	*L/min*	683	*U.S. gal/min*	
Q2 - Required Flow	9403	*L/min*	2484	*U.S. gal/min*	From FUS
P-loss 1	0.70	*m*	1	*psi*	
P-loss 2	7.68	*m*	11	*psi*	
P2 - Residual Pressure	**48.58**	***m***	**69**	***psi***	Extrapolated from Fire Flow Test Results

2. Friction Losses Through Water Service:

Hazen-Williams Equation	Metric		Imperial	
C_{hw} = Pipe Friction Factor	140		140	
k = conversion factor	10.675		4.727	
n = constant	1.852		1.852	
m = constant	4.8704		4.8704	
Q = Flow	0.156717	m^3/s	2484	*U.S. gal/min*
d = Pipe Diameter	150	mm	5.91	in
p = Loss/Length	0.3766	m/m	0.1632	psi/ft
Length	12	m	39	ft
Loss	**4.52**	**m**	**6.4**	**psi**
	44	**kPa**		

3. Friction Losses Through Apurtenances:

Apurtenances	Number	K	Velocity	Head Loss	Total Loss	
			m/s	*m*	*m*	*psi*
150mm Tee (run)	0	0.400	8.868	1.603	0.000	0.000
150mm Tee (branch)	1	1.000	8.868	4.009	4.009	5.700
Valve - 150mm dia.	2	0.17	8.868	0.681	1.363	1.938
Elbow - 150mm dia.	0	0.35	8.868	1.403	0.000	0.000
Total Minor Losses					**5.371**	**7.638**

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

	Metric	Imperial
Elevation at Boundary (i.e. Residual Hydrant):	251.3 m	824 ft
Elevation at Proposed Building:	252.4 m	828 ft
Elevation Difference = Loss/Gain	**1.1 m**	**1.6 psi**

ANALYSIS SUMMARY

Total Losses	**10.990**	**m**		
	107.82	**kPa**	**15.6**	**psi**
Residual Pressure after Losses	**37.59**	**m**		
	369	**kPa**	**53.5**	**psi** **PASS**
Allowable Residual Pressure	*140*	*kPa*	*20.3*	*psi*

APPENDIX D

SWM Design Calculations

PINESTONE ENGINEERING LTD.

Table 1.2 Infiltration LID requirements for **paved area** runoff for major and non-major development

Note: This table outlines requirements for paved area runoff only. Runoff from vegetated areas and rooftop are always permitted to be infiltrated, while runoff from pollution hot spot is never permitted.

Land Use	Vulnerable Area	Requirement
Low Density Residential	***Wellhead Protection Area A and B***	Infiltration based practices are not permitted
	Issues Contributing Area	Infiltration based practices are permitted
	Wellhead Protection Area C and D	
	Intake Protection Zone-1 and Zone-2	
	Lake Simcoe Protection Plan Significant Groundwater Recharge Areas	
	Highly Vulnerable Aquifers	
	Not Vulnerable	
Commercial & Institutional	***Wellhead Protection Area A and B***	Infiltration based practices are not permitted
	Issues Contributing Area	
	Wellhead Protection Area C and D	Infiltration based practices are permitted with conditions
	Intake Protection Zone-1 and Zone-2	Infiltration based practices are permitted
	Lake Simcoe Protection Plan Significant Groundwater Recharge Areas	Infiltration based practices are not permitted
	Highly Vulnerable Aquifers	
	Not Vulnerable	Infiltration based practices are permitted
Industrial	***Wellhead Protection Area A and B***	Infiltration based practices are not permitted
	Issues Contributing Area	
	Wellhead Protection Area C and D	
	Intake Protection Zone-1 and Zone-2	
	Lake Simcoe Protection Plan Significant Groundwater Recharge Areas	
	Highly Vulnerable Aquifers	
	Not Vulnerable	
Mixed Use and High Density Residential	***Wellhead Protection Area A and B***	Infiltration based practices are not permitted
	Issues Contributing Area	Infiltration based practices are permitted with conditions
	Wellhead Protection Area C and D	
	Intake Protection Zone-1 and Zone-2	Infiltration based practices are permitted
	Lake Simcoe Protection Plan Significant Groundwater Recharge Areas	Infiltration based practices are permitted with conditions
	Highly Vulnerable Aquifers	
	Not Vulnerable	Infiltration based practices are permitted
Open Spaces and Environmental Protection Areas	***Wellhead Protection Area A and B***	Infiltration based practices are permitted with conditions
	Issues Contributing Area	
	Wellhead Protection Area C and D	
	Intake Protection Zone-1 and Zone-2	
	Lake Simcoe Protection Plan Significant Groundwater Recharge Areas	
	Highly Vulnerable Aquifers	
	Not Vulnerable	Infiltration based practices are permitted

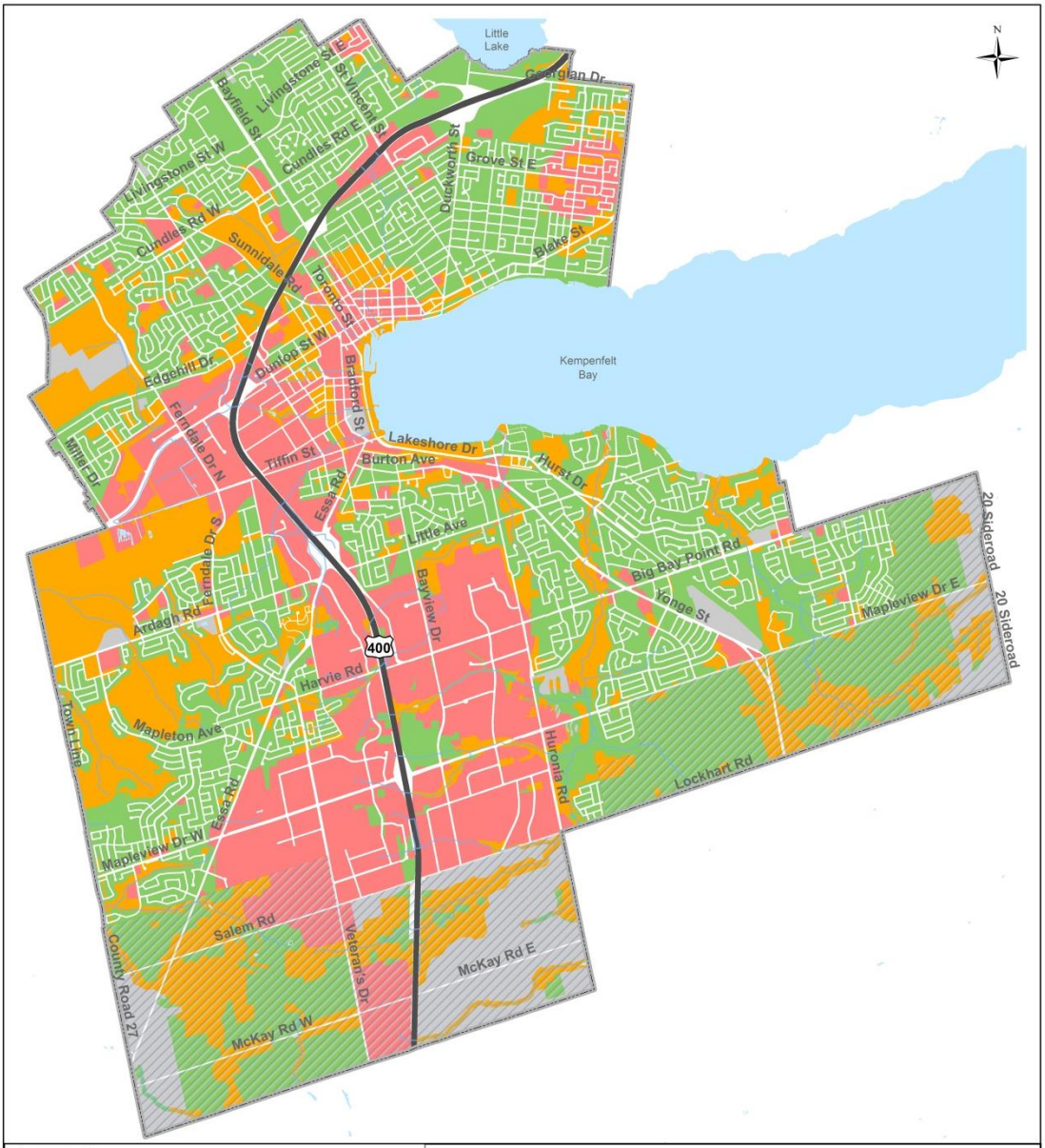


Figure 3. Screening map showing infiltration LID recommendations for paved area runoff for major and non-major development

520-526 BIG BAY POINT ROAD APARTMENT DEVELOPMENT

PRE DEVELOPMENT SWM INPUT PARAMETERS - CITY OF BARRIE / LSRCA JURISDICTION

Barrie, Ontario

Project Number: 20-11559B
Date: December 4, 2020
Design By: DH
File: Z:\Project Documents\11559B 520-526 BBPR FSR\FSR\HYMO SWM Calculations - DH.xls

Runoff Coefficients	
Land Use	**"C"**
Lawn (<2%)	0.11
Lawn (2-7%)	0.16
Single Family Rooftop Area	0.95
Semi-detached Rooftop Area	0.95
Townhouse Rooftop Area	0.95
Medium/High Density Impervious Area	0.60
Industrial	0.65
Commercial	0.70
Paved areas	0.95

* Taken from City of Barrie Stormwater Management Policies and Design Guidelines (2020)

Pre Development Runoff Coefficients:

Catchment	Total Area (m^2)	Lawn (<2%) (m^2)	Lawn (2-7%) (m^2)	Single Family Rooftop Area (m^2)	Semi-detached Rooftop Area (m^2)	Townhouse Rooftop Area (m^2)	Medium/High Density Impervious Area (m^2)	Industrial Area (m^2)	Commercial Area (m^2)	Paved Area (m^2)	Weighted C
101	3,500		2,900	345						255	0.30

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	101	
Catchment Area	=	0.3500	ha
Flow Length	=	50	m
Slope	=	0.03	m/m
Weighted Runoff Coefficient	=	0.30	
Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	2.5	min.
Airport Formula (use for C<0.4)	=	12.9	min.
Time to Peak			
2/3 of Time of Concentration	=	0.14	hr

Pre Development Curve Number (CN):

Catchment	Hydrologic Soil Group	Soil Texture	Total Area (m^2)	Lakes / Wetlands / SWMF's (m^2)	Forest / Woodlot Area (m^2)	Meadow / Field Area (m^2)	Lawn / Grass Area (m^2)	Crop Area (m^2)	Weighted CN
101	B	Silty Sand	2,900				2,900		61.0

SCS Curve Numbers							
	Hydrologic Soil Group						
Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands / Lakes/ SWMF's	100	100	100	100	100	100	100
Forest/Woodlot	25	40	55	63	70	74	77
Meadow/Field	30	44	58	65	71	75	78
Lawn/Grass	39	50	61	68	74	77	80
Pasture/Range	39	50	61	68	74	77	80
Impervious Areas	98	98	98	98	98	98	98

* Taken from City of Barrie Stormwater Management Policies and Design Guidelines (2020)

Pre Development Initial Abstraction (IA):

Catchment	Total Area (m^2)	Lawn/Grass Area (m^2)	Forest/Woodlot Area (m^2)	Lakes / Wetlands SWMF (m^2)	Meadow/Field Area (m^2)	Pasture/Range Area (m^2)	Weighted IA
101	2,900	2,900		0			5.0

Initial Abstraction / Depression Storage	
Cover	**Depth (mm)**
Wetlands / Lakes/ SWMF	0
Forest/Woodlot	10
Meadow/Field	8
Lawn/Grass	5
Pasture/Range	7
Impervious Areas	2

* Taken from City of Barrie Stormwater Management Policies and Design Guidelines (2020)

For STANDHYD Command in Otthymo:

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)				
	101	2,900				
Impervious Area Calulations:	**Catchment**	**Total Directly Connected Area (m2)**	**Total Indirectly Connected Area (m2)**	**Total Impervious Area (m2)**	**% Ximp**	**% Timp**
	101	359	242	600	10.2	17.1

520-526 BIG BAY POINT ROAD APARTMENT DEVELOPMENT

POST DEVELOPMENT SWM INPUT PARAMETERS - CITY OF BARRIE / LSRCA JURISDICTION

Barrie, Ontario

Project Number: 20-11559B
Date: December 4, 2020
Design By: DH
File: Z:\Project Documents\11559B 520-526 BBPR FSR\FSR\HYMO SWM Calculations - DH.xls

Runoff Coefficients	
Land Use	**"C"**
Lawn (<2%)	0.11
Lawn (2-7%)	0.16
Single Family Rooftop Area	0.95
Semi-detached Rooftop Area	0.95
Townhouse Rooftop Area	0.95
Medium/High Density Impervious Area	0.60
Industrial	0.65
Commercial	0.70
Paved areas	0.95

* Taken from City of Barrie Stormwater Management Policies and Design Guidelines (2020)

Post Development Runoff Coefficients:

Catchment	Total Area (m^2)	Lawn (<2%) (m^2)	Lawn (2-7%) (m^2)	Single Family Rooftop Area (m^2)	Semi-detached Rooftop Area (m^2)	Townhouse Rooftop Area (m^2)	Medium/High Density Impervious Area (m^2)	Industrial Area (m^2)	Commercial Area (m^2)	Paved Area (m^2)	Weighted C
201	3,170		625			765				1,780	0.79
202	330		250							80	0.35

Time of Concentration Calculations:

Catchment Parameters			
Catchment ID	=	201	
Catchment Area	=	0.3170	ha
Flow Length	=	40	m
Slope	=	0.03	m/m
Weighted Runoff Coefficient	=	0.79	
Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	2.1	min.
Airport Formula (use for C<0.4)	=	4.4	min.
Time to Peak			
2/3 of Time of Concentration	=	0.02	hr

Catchment Parameters			
Catchment ID	=	202	
Catchment Area	=	0.0330	ha
Flow Length	=	10	m
Slope	=	0.2	m/m
Weighted Runoff Coefficient	=	0.35	
Time of Concentration Results			
Bransby Williams Formula (use for C>=0.4)	=	0.4	min.
Airport Formula (use for C<0.4)	=	2.9	min.
Time to Peak			
2/3 of Time of Concentration	=	0.03	hr

Post Development Curve Number (CN):

Catchment	Hydrologic Soil Group	Soil Texture	Total Area (m^2)	Lakes / Wetlands / SWMF's (m^2)	Forest / Woodlot Area (m^2)	Meadow / Field Area (m^2)	Lawn / Grass Area (m^2)	Crop Area (m^2)	Weighted CN
201	B	Silty Sand	625				625		61.0
202	B	Silty Sand	250				250		61.0

Post Development Initial Abstraction (IA):

Catchment	Total Area (m^2)	Lawn/Grass Area (m^2)	Forest/Woodlot Area (m^2)	Lakes / Wetlands SWMF (m^2)	Meadow/Field Area (m^2)	Cultivated Area (m^2)	Weighted IA
201	625	625					5.0
202	250	250					5.0

For STANDHYD Command in Otthymo:

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)
	201	625

Impervious Area Calulations:	Catchment	Total Directly Connected Area (m2)	Total Indirectly Connected Area (m2)	Total Impervious Area (m2)	% Ximp	% Timp
	201	2,010	536	2,545	63.4	80.3

Pervious Area Calculations:	Catchment	Total Pervious Area (m2)
	202	250

Impervious Area Calulations:	Catchment	Total Directly Connected Area (m2)	Total Indirectly Connected Area (m2)	Total Impervious Area (m2)	% Ximp	% Timp
	202	80	0	80	24.2	24.2

SCS Curve Numbers							
	Hydrologic Soil Group						
Cover	**A**	**AB**	**B**	**BC**	**C**	**CD**	**D**
Wetlands / Lakes/ SWMF's	100	100	100	100	100	100	100
Forest/Woodlot	25	40	55	63	70	74	77
Meadow/Field	30	44	58	65	71	75	78
Lawn/Grass	39	50	61	68	74	77	80
Pasture/Range	39	50	61	68	74	77	80
Impervious Areas	98	98	98	98	98	98	98

* Taken from City of Barrie Stormwater Management Policies and Design Guidelines (2020)

Initial Abstraction / Depression Storage	
Cover	**Depth (mm)**
Wetlands / Lakes/ SWMF	0
Forest/Woodlot	10
Meadow/Field	8
Lawn/Grass	5
Cultivated	7
Impervious Areas	2

* Taken from City of Barrie Stormwater Management Policies and Design Guidelines (2020)

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USER:


COMMENTS: _____________________________________________________________


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mg/l   mg/l

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       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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USER:
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COMMENTS: _____

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                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

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        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\96ba
15da-5770-450b-a322-448a324b1c09\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\96ba
15da-5770-450b-a322-448a324b1c09\scen


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  ***********************************************
  ** SIMULATION : C - CHI10YR                   **
  ***********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha    '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 59.69 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\df8325b6-2
a0a-4b3a-a96d-d71
    remark: CHI10YR

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.02  1.35  19.15 0.32   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L             (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
```

```
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\8812
afd3-24f7-4236-b492-edb1350f75a4\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\8812
afd3-24f7-4236-b492-edb1350f75a4\scen


DATE: 12-04-2020                          TIME: 02:58:36

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  ************************************************
  ** SIMULATION : D - CHI25YR                    **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                   min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 71.24 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\ec74334d-7
cc4-4f24-a804-e43
    remark: CHI25YR

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.02  1.37  25.45 0.36   0.000
90.10    0.29
```

```
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\4203
984d-47b9-4d2f-96f6-778be75bc76b\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\4203
984d-47b9-4d2f-96f6-778be75bc76b\scen


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  ***********************************************
  ** SIMULATION : E - CHI50YR                   **
  ***********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l
```

```
      START @  0.00 hrs
      -------------------
    READ STORM                 10.0
    [ Ptot= 79.45 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\63d4fef5-0
635-41aa-a8ee-871
    remark: CHI50YR

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.03  1.37  30.26 0.38   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\bc21
f17b-2739-4732-a62f-ac51a7aa6325\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\bc21
f17b-2739-4732-a62f-ac51a7aa6325\scen


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```
  ********************************************
  ** SIMULATION : F - CHI100YR                **
  ********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                    min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                 10.0
    [ Ptot= 87.58 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\626a5da9-1
5a6-4aba-b8fd-69d
    remark: CHI100YR

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.04  1.38  35.25 0.40   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\de44
8523-622d-4b49-b805-721864e73ffa\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\de44
8523-622d-4b49-b805-721864e73ffa\scen


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COMMENTS: _____________________________________________________________


  ************************************************
  ** SIMULATION : G - 2Y24H                      **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                    min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 55.00 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\8a794aa8-f
a48-46d6-91fa-8ce
    remark: 2Y24H

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.01 12.27  16.76 0.30   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L             (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL
```

```
        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\04aba402-da1f-4916-8ba0-02dd5eca1fc2\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\04aba402-da1f-4916-8ba0-02dd5eca1fc2\scen

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```
  ************************************************
  ** SIMULATION : H - 5Y24H                     **
  ************************************************
```

W/E	COMMAND	HYD ID	DT	AREA	' Qpeak	Tpeak	R.V.	R.C.	Qbase	TSS CONC	TP CONC
			min	ha	' cms	hrs	mm		cms	mg/l	mg/l

START @ 0.00 hrs

READ STORM 15.0
[Ptot= 76.01 mm]
fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\216f913d-7f27-4d15-b1d4-952
remark: 5Y24H

*

```
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.02 12.27  28.21 0.37   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\fb99
cadb-60fd-4aa2-a935-ce8cf5fd5587\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\fb99
cadb-60fd-4aa2-a935-ce8cf5fd5587\scen


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  ********************************************
  ** SIMULATION : I - 10Y24H                 **
  ********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
```

```
                                  min     ha    '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 89.94 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\b7465618-c
b70-4b2b-83f5-f01
    remark: 10Y24H

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.03 12.28  36.74 0.41   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L             (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\87a0
125e-d0b5-4b06-bcee-e3a293852e9c\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\87a0
125e-d0b5-4b06-bcee-e3a293852e9c\scen


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```
  ************************************************
  ** SIMULATION : J - 25Y24H                     **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha    '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                15.0
    [ Ptot=107.47 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\16047390-3
687-4d50-9b4e-7e8
    remark: 25Y24H

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.04 12.27  48.33 0.45   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\3e25
c42b-f516-441e-8f77-924e32f82540\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\3e25
c42b-f516-441e-8f77-924e32f82540\scen


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  ************************************************
  ** SIMULATION : K - 50Y24H                     **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                    min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot=120.63 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\9daf060a-1
0d0-4492-ab95-116
    remark: 50Y24H

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.05 12.27  57.53 0.48   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L             (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
```

```
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\e6f702ca-1a17-4dae-bce3-c5c749b970a2\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\e6f702ca-1a17-4dae-bce3-c5c749b970a2\scen

DATE: 12-04-2020 TIME: 02:58:37

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```
  ********************************************
  ** SIMULATION : L - 100Y24H                **
  ********************************************
```

W/E	COMMAND	HYD ID	DT	AREA	' Qpeak	Tpeak	R.V.	R.C.	Qbase	TSS CONC	TP CONC
			min	ha	' cms	hrs	mm		cms	mg/l	mg/l
	START @ 0.00 hrs										
	READ STORM		15.0								
	[Ptot=133.60 mm]										
	fname : C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\5573b2d1-a249-438f-a7c1-0ce										
	remark: 100Y24H										

```
*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.07 12.27  66.97 0.50   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\a8b7
838e-086b-4595-aa9e-0b0d35562cf5\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\a8b7
838e-086b-4595-aa9e-0b0d35562cf5\scen


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USER:


COMMENTS: _____________________________________________________________


  ********************************************
  ** SIMULATION : M - HAZEL                  **
  ********************************************
```

```
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                 12.0
    [ Ptot=212.00 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bcf86b82-792d-456c-b762-570b2f830e2a\eb6c8d7f-2
728-4df6-9973-5d7
    remark: HAZEL

*
 *  CALIB STANDHYD       0101  1  1.0    0.35    0.04 10.00 129.49 0.61   0.000
90.10    0.29
    [I%=10.2:S%= 3.00]
*
 FINISH

================================================================================
========================
```

```
================================================================================
========================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\0037
0822-8425-4bf4-b36e-6b17545d5940\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\0037
0822-8425-4bf4-b36e-6b17545d5940\scen


DATE: 12-04-2020                          TIME: 02:35:17

USER:


COMMENTS: _____________________________________________________________


  ************************************************
  ** SIMULATION : A - CHI2YR                    **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                   min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
```

```
      --------------------
    READ STORM                 10.0
    [ Ptot= 36.95 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\e1c50cc7-4
779-4ec1-8cad-bc3
    remark: CHI2YR

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.00  1.33  12.09 0.33   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                 10.0
    [ Ptot= 36.95 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\e1c50cc7-4
779-4ec1-8cad-bc3
    remark: CHI2YR

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.05  1.33  25.69 0.70   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.05  1.33  24.40  n/a   0.000
73.14    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****
```

```
  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\7bc1
41d9-d0b7-4ff5-b0f1-004c45230273\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\7bc1
41d9-d0b7-4ff5-b0f1-004c45230273\scen


DATE: 12-04-2020                          TIME: 02:35:17

USER:


COMMENTS: _____________________________________________________________


  ************************************************
  ** SIMULATION : B - CHI5YR                     **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 50.52 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\eff3b7b2-7
086-4ea7-b1f2-8bd
    remark: CHI5YR

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.00  1.33  19.25 0.38   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                10.0
    [ Ptot= 50.52 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\eff3b7b2-7
086-4ea7-b1f2-8bd
    remark: CHI5YR

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.07  1.33  36.95 0.73   0.000
```

```
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.07  1.33  35.28  n/a   0.000
73.26    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\67a8
c5e6-ec1a-47e3-8e73-655052351b61\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\67a8
c5e6-ec1a-47e3-8e73-655052351b61\scen


DATE: 12-04-2020                          TIME: 02:35:17

USER:


COMMENTS: _____________________________________________________________


  ********************************************
  ** SIMULATION : C - CHI10YR                 **
  ********************************************
```

```
  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 59.69 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\df8325b6-2
a0a-4b3a-a96d-d71
    remark: CHI10YR

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.00  1.33  24.38 0.41   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                10.0
    [ Ptot= 59.69 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\df8325b6-2
a0a-4b3a-a96d-d71
    remark: CHI10YR

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.08  1.33  44.81 0.75   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.09  1.33  42.88  n/a   0.000
73.32    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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```

***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\3745f78f-0624-464c-a0a9-fb4738767bdc\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\3745f78f-0624-464c-a0a9-fb4738767bdc\scen

DATE: 12-04-2020 TIME: 02:35:18

USER:

COMMENTS: _____

****
** SIMULATION : D - CHI25YR **
****

W/E COMMAND HYD ID DT AREA ' Qpeak Tpeak R.V. R.C. Qbase TSS CONC TP CONC
min ha ' cms hrs mm cms mg/l mg/l

START @ 0.00 hrs

READ STORM 10.0
[Ptot= 71.24 mm]
fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\ec74334d-7cc4-4f24-a804-e43
remark: CHI25YR

*
* CALIB STANDHYD 0202 1 1.0 0.03 0.01 1.33 31.26 0.44 0.000 97.58 0.30
[I%=24.2:S%=20.00]
*
READ STORM 10.0
[Ptot= 71.24 mm]
fname :

C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\ec74334d-7cc4-4f24-a804-e43
    remark: CHI25YR

*
 * CALIB STANDHYD   0201 1 1.0   0.32   0.10 1.33 54.92 0.77   0.000   71.94   0.21
    [I%=63.4:S%= 4.00]
*
    ADD [0201+ 0202] 0203 3 1.0   0.35   0.11 1.33 52.69 n/a   0.000   73.38   0.22
*
==
========================

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

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***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename: C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\53a6c12d-d8cd-4be4-a4ab-d2ef86323281\scen
Summary filename: C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\53a6c12d-d8cd-4be4-a4ab-d2ef86323281\scen

DATE: 12-04-2020 TIME: 02:35:18

USER:

COMMENTS: _____

```
  ********************************************
  ** SIMULATION : E - CHI50YR                **
  ********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 79.45 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\63d4fef5-0
635-41aa-a8ee-871
    remark: CHI50YR

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.01  1.33  36.46 0.46   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                10.0
    [ Ptot= 79.45 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\63d4fef5-0
635-41aa-a8ee-871
    remark: CHI50YR

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.11  1.33  62.24 0.78   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.12  1.33  59.81  n/a   0.000
73.42    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL
```

```
        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\b977cd2a-b089-4af3-b9da-c2a0ac10817f\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\b977cd2a-b089-4af3-b9da-c2a0ac10817f\scen

DATE: 12-04-2020 TIME: 02:35:18

USER:

COMMENTS: _____

****
** SIMULATION : F - CHI100YR **
****

W/E	COMMAND	HYD ID	DT	AREA	Qpeak	Tpeak	R.V.	R.C.	Qbase	TSS CONC	TP CONC
			min	ha	cms	hrs	mm		cms	mg/l	mg/l
	START @ 0.00 hrs										
	READ STORM	10.0									
	[Ptot= 87.58 mm]										
	fname : C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\626a5da9-15a6-4aba-b8fd-69d										
	remark: CHI100YR										
*											
*	CALIB STANDHYD	0202	1	1.0	0.03	0.01	1.33	41.79	0.48	0.000	

```
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                10.0
    [ Ptot= 87.58 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\626a5da9-1
5a6-4aba-b8fd-69d
    remark: CHI100YR

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.13  1.33  69.56 0.79   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.14  1.33  66.94  n/a   0.000
73.45    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\caee
a159-6646-4f23-82f0-bfbf99d813d3\scen
  Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\caee
a159-6646-4f23-82f0-bfbf99d813d3\scen
```

DATE: 12-04-2020 TIME: 02:35:18

USER:

COMMENTS: _____

```
  ********************************************
  ** SIMULATION : G - 2Y24H                  **
  ********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                    min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
    READ STORM                 15.0
    [ Ptot= 55.00 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\8a794aa8-f
a48-46d6-91fa-8ce
    remark: 2Y24H

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.00 12.25  16.47 0.30   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                 15.0
    [ Ptot= 55.00 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\8a794aa8-f
a48-46d6-91fa-8ce
    remark: 2Y24H

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.04 12.25  40.77 0.74   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.04 12.25  38.48  n/a   0.000
72.98    0.22
*
================================================================================
========================
```

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** S U M M A R Y O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\60b45c80-82e7-404d-8b78-8ea44185a6e1\scen
Summary filename:
C:\Users\dhordyk\AppData\Local\Civica\VH5\122a7995-7292-458d-a392-be8e0631d945\60b45c80-82e7-404d-8b78-8ea44185a6e1\scen

DATE: 12-04-2020 TIME: 02:35:18

USER:

COMMENTS: _____

****
** SIMULATION : H - 5Y24H **
****

W/E	COMMAND	HYD ID	DT	AREA	Qpeak	Tpeak	R.V.	R.C.	Qbase	TSS CONC	TP CONC
			min	ha	cms	hrs	mm		cms	mg/l	mg/l
	START @ 0.00 hrs										
	READ STORM		15.0								
	[Ptot= 76.01 mm]										
	fname :										

```
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\216f913d-7
f27-4d15-b1d4-952
    remark: 5Y24H

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.00 12.25  28.62 0.38   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                 15.0
    [ Ptot= 76.01 mm ]
    fname :
C:\Users\dhordyk\AppData\Local\Temp\bdc5a67c-5b00-43e9-82bf-faf67c66fe1c\216f913d-7
f27-4d15-b1d4-952
    remark: 5Y24H

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.06 12.25  59.16 0.78   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.06 12.25  56.28  n/a   0.000
73.17    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                 *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

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DATE: 12-04-2020   TIME: 02:35:18

USER:

COMMENTS: _____

  ****
  ** SIMULATION : I - 10Y24H   **
  ****

  W/E COMMAND   HYD ID   DT   AREA ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min   ha   ' cms   hrs   mm   cms
mg/l   mg/l

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b70-4b2b-83f5-f01
    remark: 10Y24H

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97.58   0.30
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*
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*
 * CALIB STANDHYD   0201 1 1.0   0.32   0.07 12.25 71.70 0.80   0.000
71.94   0.21
    [I%=63.4:S%= 4.00]
*
    ADD [0201+ 0202] 0203 3 1.0   0.35   0.08 12.25 68.37 n/a   0.000

73.23   0.22
*
==========
==========

       V   V   I   SSSSS U   U   A   L   (v 6.2.2001)
       V   V   I   SS   U   U   A A   L
        V V   I   SS   U   U AAAAA L
        V V   I   SS   U   U A   A L
         VV   I   SSSSS UUUUU A   A LLLLL

        OOO   TTTTT TTTTT H   H Y   Y M   M   OOO   TM
       O   O   T   T   H   H   Y Y   MM MM O   O
       O   O   T   T   H   H   Y   M   M O   O
        OOO   T   T   H   H   Y   M   M   OOO
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                  ***** S U M M A R Y   O U T P U T *****

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DATE: 12-04-2020   TIME: 02:35:18

USER:

COMMENTS: _____

  ****
  ** SIMULATION : J - 25Y24H   **
  ****

  W/E COMMAND   HYD ID   DT   AREA ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min   ha   ' cms   hrs   mm   cms
mg/l   mg/l

```
      START @  0.00 hrs
      -------------------
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    [ Ptot=107.47 mm ]
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687-4d50-9b4e-7e8
    remark: 25Y24H

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.01 12.25  51.91 0.48   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                15.0
    [ Ptot=107.47 mm ]
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687-4d50-9b4e-7e8
    remark: 25Y24H

*
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71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.10 12.25  84.39  n/a   0.000
73.43    0.22
*
================================================================================
========================


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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****
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DATE: 12-04-2020                          TIME: 02:35:18

USER:


COMMENTS: _____________________________________________________________


  ************************************************
  ** SIMULATION : K - 50Y24H                     **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha    '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
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    [ Ptot=120.63 mm ]
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0d0-4492-ab95-116
    remark: 50Y24H

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.01 12.25  60.96 0.51   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                15.0
    [ Ptot=120.63 mm ]
    fname :
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0d0-4492-ab95-116
    remark: 50Y24H
```

```
*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.10 12.25 100.00 0.83   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.11 12.25  96.32  n/a   0.000
73.47    0.22
*
================================================================================
========================


       V    V   I    SSSSS  U   U    A    L              (v 6.2.2001)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


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  Summary filename:
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DATE: 12-04-2020                          TIME: 02:35:18

USER:


COMMENTS: _____________________________________________________________


  ********************************************
  ** SIMULATION : L - 100Y24H                 **
```

```
  ********************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
TSS CONC TP CONC
                                  min     ha   '  cms   hrs     mm          cms
mg/l   mg/l

      START @  0.00 hrs
      --------------------
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    [ Ptot=133.60 mm ]
    fname :
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249-438f-a7c1-0ce
    remark: 100Y24H

*
 *  CALIB STANDHYD       0202  1  1.0    0.03    0.01 12.25  74.88 0.56   0.000
97.58    0.30
    [I%=24.2:S%=20.00]
*
    READ STORM                15.0
    [ Ptot=133.60 mm ]
    fname :
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249-438f-a7c1-0ce
    remark: 100Y24H

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.12 12.25 112.16 0.84   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.12 12.25 108.64  n/a   0.000
73.61    0.22
*
================================================================================
========================


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        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
          VV    I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

***** S U M M A R Y O U T P U T *****

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Summary filename:
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DATE: 12-04-2020 TIME: 02:35:18

USER:

COMMENTS: _____

****
** SIMULATION : M - HAZEL **
****

W/E	COMMAND	HYD ID	DT	AREA	Qpeak	Tpeak	R.V.	R.C.	Qbase	TSS CONC	TP CONC
			min	ha	cms	hrs	mm		cms	mg/l	mg/l

START @ 0.00 hrs

READ STORM 12.0
[Ptot=212.00 mm]
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remark: HAZEL

*
* CALIB STANDHYD 0202 1 1.0 0.03 0.00 10.00 138.68 0.65 0.000 97.58 0.30
[I%=24.2:S%=20.00]
*
READ STORM 12.0

```
    [ Ptot=212.00 mm ]
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728-4df6-9973-5d7
    remark: HAZEL

*
 *  CALIB STANDHYD       0201  1  1.0    0.32    0.04 10.00 187.17 0.88   0.000
71.94    0.21
    [I%=63.4:S%= 4.00]
*
    ADD [  0201+  0202]  0203  3  1.0    0.35    0.05 10.00 182.60  n/a   0.000
73.78    0.22
*
 FINISH

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```

GENERAL DESCRIPTION

Permeable pavements, an alternative to traditional impervious pavement, allow stormwater to drain through them and into a stone reservoir where it is infiltrated into the underlying native soil or temporarily detained. They can be used for low traffic roads, parking lots, driveways, pedestrian plazas and walkways. Permeable pavement is ideal for sites with limited space for other surface stormwater BMPs. Examples of permeable pavement types include:

- permeable interlocking concrete pavers (i.e., block pavers);
- plastic or concrete grid systems (i.e., grid pavers);
- pervious concrete; and
- porous asphalt.

Depending on the native soils and physical constraints, the system may be designed with no underdrain for full infiltration, with an underdrain for partial infiltration, or with an impermeable liner and underdrain for a no infiltration or detention and filtration only practice.

DESIGN GUIDANCE

GEOMETRY & SITE LAYOUT

Permeable pavement systems can be used for entire parking lot areas or driveways or can be designed to receive runoff from adjacent impervious pavement. For example, the parking spaces of a parking lot or road can be permeable pavers while the drive lanes are impervious asphalt. In general, the impervious area should not exceed 1.2 times the area of the permeable pavement which receives the runoff (GVRD, 2005).

PRE-TREATMENT

In most permeable pavement designs, the pavement bedding layer acts as pretreatment to the stone reservoir below. Periodic vacuum sweeping and preventative measures like not storing snow or other materials on the pavement are critical to prevent clogging. An optional pretreatment element can be a pea gravel choking layer above the coarse gravel storage reservoir.

CONVEYANCE AND OVERFLOW

All designs require an overflow outlet connected to a storm sewer with capacity to convey larger storms. One option is to set storm drain inlets slightly above the surface elevation of the pavement, which allows for temporary shallow ponding above the surface. Another design option is an overflow edge, which is a gravel trench along the downgradient edge of the pavement surface that drains to the stone reservoir below.

Pavements designed for full infiltration, where native soil infiltration rate is 15 mm/hr or greater, do not require incorporation of a perforated pipe underdrain. Pavements designed for partial infiltration, where native soil infiltration rate is less than 15 mm/hr, should incorporate a perforated pipe underdrain placed near the top of the granular stone reservoir. Partial infiltration designs can also include a flow restrictor assembly on the underdrain to optimize infiltration with desired drawdown time between storm events.

MONITORING WELLS

A capped vertical standpipe consisting of an anchored 100 to 150 mm diameter perforated pipe with a lockable cap installed to the bottom of the facility is recommended for monitoring the length of time required to fully drain the facility between storms.

STONE RESERVOIR

The stone reservoir must be designed to meet both runoff storage and structural support requirements. Clean washed stone is recommended as any fines in the aggregate material will migrate to the bottom and may prematurely clog the native soil. The bottom of the reservoir should be flat so that runoff will be able to infiltrate evenly through the entire surface. If the system is not designed for infiltration, the bottom should be sloped at 1 to 5% toward the underdrain.

GEOTEXTILE

A non-woven needle punched, or woven monofilament geotextile fabric should be installed between the stone reservoir and native soil to maintain separation.

EDGE RESTRAINTS

Pavers must abut tightly against the restraints to prevent rotation under load and any consequent spreading of joints. The restraints must be able to withstand the impact of temperature changes, vehicular traffic and snow removal equipment. Metal or plastic stripping is acceptable in some cases, but concrete edges are preferred. Concrete edge restraints should be supported on a minimum base of 150 mm of aggregate.

LANDSCAPING

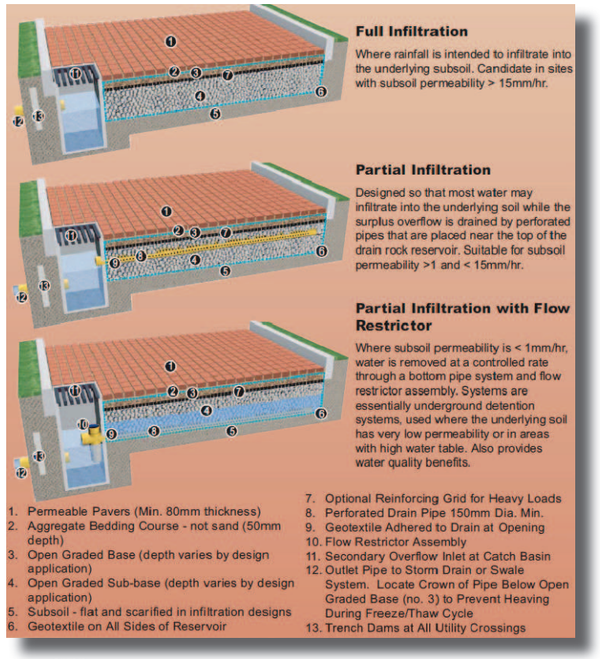
Adjacent landscaping areas should drain away from permeable pavement to prevent sediments from running onto the surface. Urban trees also benefit from being surrounded by permeable pavement rather than impervious cover, because their roots receive more air and water.

OPERATION AND MAINTENANCE

Annual inspections of permeable pavement should be conducted in the spring to ensure continued infiltration performance. Check for deterioration and whether water is draining between storms. The pavement reservoir should drain completely within 72 hours of the end of the storm event. The following maintenance procedures and preventative measures should be incorporated into a maintenance plan:

Surface Sweeping: Sweeping should occur once or twice a year with a commercial vacuum sweeping unit. Permeable pavement should not be washed with high pressure water systems or compressed air units.

Inlet Structures: Drainage pipes and structures within or draining to the subsurface bedding beneath permeable pavement should be cleaned out on regular intervals.



Source: GVRD

ABILTY TO MEET SWM OBJECTIVES

BMP	Water Balance Benefit	Water Quality Improvement	Stream Channel Erosion Control Benefit
Permeable pavement with no underdrain	Yes	Yes - size for water quality storage requirement	Partial - based on available storage volume and soil infiltration rate
Permeable pavement with underdrain	Moderate - based on native soil infiltration rates and storage beneath the underdrain	Yes - size for water quality storage requirement	Partial - based on available storage volume and soil infiltration rate
Permeable pavement with underdrain and liner	No - some volume reduction occurs through evapotranspiration	Moderate - limited filtering and settling of sediments	Partial - based on available storage volume and soil infiltration rate

Heavy Vehicles: Trucks and other heavy vehicles should be prevented from tracking or spilling dirt onto the permeable pavement.

Construction and Hazardous Materials: Due to the potential for groundwater contamination, all construction or hazardous material carriers should be prohibited from entering a permeable pavement site.

Drainage Areas: Impervious areas contributing to the permeable pavement should be regularly swept and kept clear of litter and debris. Flows from any landscaped areas should be diverted away from thepavement or be well stabilized with vegetation.

Grid Pavers: Grid paver systems that have been planted with grass should be mowed regularly with the clippings removed. Grassed grid pavers may require periodic watering and fertilization to establish and maintain healthy vegetation.

Winter Maintenance: Sand should not be spread on permeable pavement as it can quickly lead to clogging. Deicers should only be used in moderation and only when needed. Pilot studies have found that permeable pavement requires 75% less de-icing salt than conventional pavement over the course of a typical winter season. Permeable pavement is plowed for snow removal like any other pavement. Plowed snow piles should not be stored on permeable pavement systems.

GENERAL SPECIFICATIONS

Material	Specification	Quantity
Pervious Concrete	• NO4-RG-S7 mix with air entrainment proven to have the best freeze-thaw durability after 300 freeze-thaw cycles. • 28 day compressive strength = 5.5 to 20 MPa • Void ratio = 14% - 31% • Permeability = 900 to 21,500 mm/hr	Thickness will range from 100mm - 150 mm depending on the expected loads
Porous Asphalt	• Open-graded asphalt mix with a minimum of 16% air voids • Polymers can be added to provide additional strength for heavy loads • The University of New Hampshire Stormwater Center has detailed design specifications for porous asphalt on their webpage: http://www.unh.edu/erg/cstev/pubs_specs_info	Thickness will range from 50 mm to 100 mm depending on the expected loads.
Permeable Pavers	• Permeable pavers should conform to manufacturer specifications. • ASTM No. 8 (5 mm dia.) crushed aggregate is recommended for fill material in the paver openings. For narrow joints between interlocking shapes, a smaller sized aggregate may be used (Smith, 2006). • Pavers shall meet the minimum material and physical properties set forth in CAN 3-A231.2, Standard Specification for Precast Concrete Pavers. • Pigment in concrete pavers shall conform to ASTM C 979. • Maximum allowable breakage of product is 5%.	For vehicular applications, the minimum paver thickness is 80 mm and for pedestrian applications is 60 mm. Joint widths should be no greater than 15 mm for pedestrian applications.
Stone Reservoir	All aggregates should meet the following criteria: • Maximum wash loss of 0.5% • Minimum durability index of 35 • Maximum abrasion of 10% for 100 revolutions and maximum of 50% for 500 revolutions Granular Subbase The granular subbase material shall consist of granular material graded in accordance with ASTM D 2940. Material should be clear crushed 50 mm diameter stone with void space ratio of 0.4. Granular Base The granular base material shall be crushed stone conforming to ASTM C 33 No 57. Material should be clear crushed 20 mm diameter stone. Bedding The granular bedding material shall be graded in accordance with the requirements of ASTM C 33 No 8. The typical bedding thickness is between 40 mm and 75 mm. Material should be 5 mm diameter stone or as determined by the Design Engineer (Smith, 2006).	See BMP Sizing section for aggregate bed depth and multiply by application are to get total volume.
Geotextile	Material specifications should conform to Ontario Provincial Standard Specification (OPSS) 1860 for Class II geotextile fabrics. Should be woven monofilament or non-woven needle punched fabrics. Woven slit film and non-woven heat bonded fabrics should not be used as they are prone to clogging. Primary considerations are: • Suitable apparent opening size (AOS) for non-woven fabrics, or percent open area (POA) for woven fabrics, to maintain water flow even with sediment and microbial film build-up; • Maximum forces that will be exerted on the fabric (i.e., what tensile, tear and puncture strength ratings are required?); • Load bearing ratio of the underlying native soil (i.e., is geotextile needed to prevent downward migration of aggregate into the native soil?); • Texture (i.e., grain size distribution) of the overlying aggregate material; and • Permeability of the native soil. For further guidance see CVC/TRCA LID SWM Planning and Design Guide, Table 4.7.3.	Between stone reservoir and native soil.
Underdrain (optional)	• HDPE or equivalent material, continuously perforated with smooth interior and a minimum inside diameter of 100 mm. • Perforations in pipes should be 10 mm in diameter. • A standpipe from the underdrain to the pavement surface can be used for monitoring and maintenance of the underdrain. The top of the standpipe should be covered with a screw cap and a vandal-proof lock.	Pipes should terminate 0.3 m short from the sides of the base.

SITE CONSIDERATIONS

Wellhead Protection

Permeable pavement should not be used for road or parking surfaces within two (2) year time-of-travel wellhead protection areas.

Site Topography

Permeable pavement surface should be at least 1% and no greater than 5%.

Water Table

The base of permeable pavement stone reservoir should be at least one (1) metre above the seasonally high water table or top of bedrock elevation.

Soil

Systems located in native soils with an infiltration rate of less than 15 mm/hr (i.e., hydraulic conductivity of less than 1x10-6 cm/s) require a perforated pipe underdrain. Native soil infiltration rate at the proposed location and depth should be confirmed through measurement of hydraulic conductivity under field saturated conditions.

Drainage Area & Runoff Volume

In general, the impervious area treated should not exceed 1.2 times the area of permeable pavement which receives the runoff.

Setback from Buildings

Should be located downslope from building foundations. If the pavement does not receive runoff from other surfaces, no setback is required. If the pavement receives runoff from other surfaces a minimum setback of four (4) metres downgradient is recommended.

Pollution Hot Spot Runoff

To protect groundwater from possible contamination, runoff from pollution hot spots should not be treated by permeable pavement.

CONSTRUCTION CONSIDERATIONS

SEDIMENT CONTROL

The treatment area should be fully protected during construction so that no sediment reaches the permeable pavement system. Construction traffic should be blocked from the permeable pavement and its drainage areas once the pavement has been installed.

BASE CONSTRUCTION

In parking lots, the stone aggregate should be placed in 100 mm to 150 mm lifts and compacted with a minimum 9,070 kg (10 ton) steel drum roller.

WEATHER

Porous asphalt and pervious concrete will not properly pour and set in extremely high and low temperatures.

PAVEMENT PLACEMENT

Properly installed permeable pavement requires trained and experienced producers and construction contractors.

CVC/TRCA LOW IMPACT DEVELOPMENT
PLANNING AND DESGIN GUIDE - FACT SHEET

PERMEABLE PAVEMENT

TORONTO AND REGION Conservation for The Living City

CVC CREDIT VALLEY CONSERVATION

FOR FURTHER DETAILS SEE SECTION 4.7 OF THE CVC/TRCA LID SWM GUIDE

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - PEAK DIVERSION MANHOLE\JELLYFISH FILTER JF4 - PEAK DIVERSION.DWG 4/15/2019 9:34 AM

GENERAL NOTES:
1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:
1. 457 MM Ø (18") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

PEAK DIVERSION JELLYFISH DESIGN NOTES:
1. STRUCTURE SHALL MEET AASHTO HS-20 OR PER APPROVING JURISDICTION REQUIREMENTS; WHICHEVER IS MORE STRINGENT, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
2. STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 AND AASHTO LOAD FACTOR DESIGN METHOD.
3. INLET HGL NOT TO EXCEED 6" BELOW THE TOP OF THE M.A.W. DURING THE PEAK DESIGN STORM, OR 10-YEAR STORM (WHICHEVER IS GREATER).
4. INLET PIPE INVERT ELEVATION VARIES FROM 1" TO 6" MAXIMUM ABOVE THE OUTLET PIPE INVERT.
5. OUTLET PIPE INVERT IS EQUAL TO THE CARTRIDGE DECK ELEVATION.
6. THE OUTLET PIPE DIAMETER FOR NEW INSTALLATIONS IS TO BE ONE PIPE SIZE LARGER THAN THE INLET PIPE AT EQUAL OR GREATER SLOPE.
7. THE DIFFERENCE IN THE INLET AND OUTLET PIPE ELEVATIONS FOR RETROFIT INSTALLATIONS TO EXISTING STORM DRAIN PIPES SHALL BE EQUAL TO THE SLOPE OVER THE DIAMETER OF THE MANHOLE; NOT THE EXCEED 6" IN VERTICAL DIFFERENTIAL BETWEEN INLET AND OUTLET PIPES.

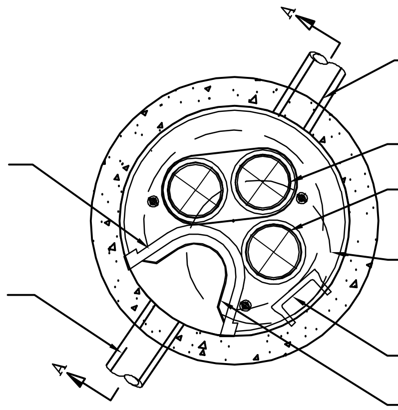
INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

PEAK DIVERSION JELLYFISH RECOMMENDED PIPE DIAMETERS

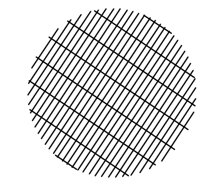
MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MAXIMUM INLET PIPE DIAMETER (mm)
1.2	62	150	300
1.8	59	200	300
2.4	52	250	375
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.

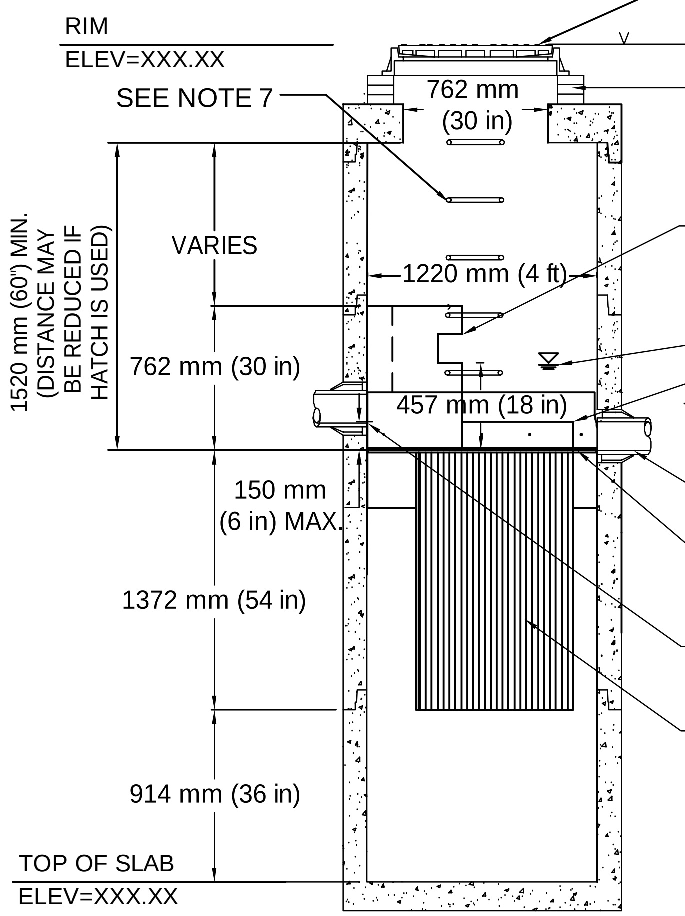
DRAWING NOT TO BE USED FOR CONSTRUCTION



JF4 (PEAK DIVERSION) PLAN VIEW



XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



JELLYFISH CROSS SECTION A-A

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1220 mm (48") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 12.7 L/s (0.54 CFS), AND MAXIMUM BYPASS CAPACITY IS 70.8 L/s (2.50 CFS). IF THE SITE CONDITIONS EXCEED TOTAL CAPACITY, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED. TREATMENT FLOW RATE IS BASED ON 457 mm (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION				
CARTRIDGE DEPTH	54"	40"	27"	15"
OUTLET INVERT TO STRUCTURE BASE SLAB	90"	76"	63"	51"
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
MAX. CARTS HIGH-FLO/DRAINDOWN	2 / 1			
MAX. BYPASS (L/s)	70.8			
MAX. SEDIMENT CAPACITY (kg)	142	105	70	40
MAX. TREATMENT (L/s)	12.7	9.3	6.2	3.4
MAX. TREATMENT AND BYPASS (L/s) (PEAK CAPACITY)	83.5	80.1	77.0	74.2

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*
STRUCTURE ID	*
WATER QUALITY FLOW RATE (L/s)	*
BYPASS FLOW RATE (L/s)	*
PEAK FLOW RATE (L/s)	*
RETURN PERIOD OF PEAK FLOW (yrs)	*
# OF CARTRIDGES REQUIRED (HF / DD)	*
CARTRIDGE SIZE (inches)	*
MAX ALLOWABLE BYPASS FLOW RATE (L/s)	70.8

PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

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Jellyfish®

JF4 PEAK DIVERSION

Scale = 1:50

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SHEET: 1 OF 2	

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:

ASTM C 891:	SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478:	SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990:	SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101:	SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

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JELLYFISH FILTER SPECIFICATIONS

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THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING: AUS NO. 2008/288748, U.S.A. NO. US 8,287,726, US 8,221,618, US 8,123,935, CA 2,696,482, CA, 2,534,542, KR 10-1287539, NZ 583461, NZ 604227, ZA 2010/01068; OTHER INTERNATIONAL PATENTS PENDING

DATE: #####	
DESIGNED:	DRAWN: BSF
CHECKED: BW	APPROVED: SP
IMBRIUM PROJECT #: #####	
SHEET: 2 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - PEAK DIVERSION MANHOLE\JELLYFISH FILTER JF4 - PEAK DIVERSION.DWG 4/15/2019 9:35 AM

APPENDIX E

Preliminary Engineering Drawings

PINESTONE ENGINEERING LTD.

HORIZONTAL CONTROL MONUMENTS
U.T.M. (ZONE 17) NAD 83

MONUMENT # 03120040064
THE HORIZONTAL MONUMENT IS LOCATED ON THE SOUTH SIDE OF BIG BAY POINT ROAD ON BRIDGE OVER LOVER'S CREEK AT SOUTH-EAST CORNER OF BRIDGE IN WALKWAY OPPOSITE THE VERTICAL CONTROL MONUMENT #03120030007.

N = 4912309.381 E = 607444.743

MONUMENT # 03120040065

THE HORIZONTAL MONUMENT (03120040065) IS LOCATED IN THE BRIDGE WALKWAY ON THE WEST SIDE OF YONGE STREET, APPROXIMATELY 100M SOUTH OF THE INTERSECTION AT D'AMBROSIO DRIVE. IT IS LOCATED ON THE NORTH END OF THE BRIDGE WHICH CROSSES OVER LOVER'S CREEK..

N = 4913385.898 E = 607173.330

VERTICAL CONTROL MONUMENTS

BENCHMARK:

MONUMENT # 03120030007
ELEVATION: 244.787
BRIDGE ON BIG BAY POINT RD 0.3 KM WEST OF YONGE ST OVER LOVERS CREEK
THE VERTICAL CONTROL MONUMENT IS SET FLUSH IN THE NORTH FACE OF THE CONCRETE ABUTMENT, AT THE SOUTHEAST CORNER OF BRIDGE. THE TABLET IS LOCATED 1.8m WEST OF THE EAST END OF THE BRIDGE AND 50 cm BELOW THE TOP OF THE BRIDGE.

MONUMENT # 03120030305
ELEVATION: 250.827
CULVERT HEADWALL TO DETENTION POND EAST OF EDWARDS DR & NORTH OF BIG BAY POINT RD. THE VERTICAL CONTROL MONUMENT IS SET FLUSH IN THE EAST FACE OF THE CONCRETE CULVERT HEADWALL. THE TABLET IS 140MM BELOW THE TOP OF THE CULVERT HEADWALL AND 160MM SOUTH OF THE NORTH-EAST INSIDE CORNER OF THE HEADWALL.

PEL
PINESTONE ENGINEERING LIMITED | www.pel.ca

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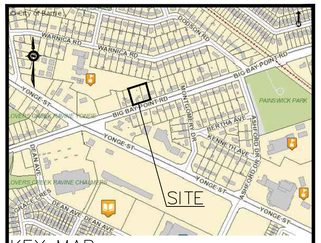


NOTES
1. TOPOGRAPHIC SURVEY COMPLETED BY RUDY MAK SURVEYING LTD., OCTOBER 17 2019.

LEGEND

- EXISTING TREE
- LIMIT OF EXISTING VEGETAION
- EX. SANITARY MANHOLE
- EX. CATCH BASIN
- EX. CATCH BASIN MANHOLE
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING CSV
- DIRECTION OF MAJOR OVERLAND FLOW
- BH1 APPROXIMATE BOREHOLE LOCATION

BENCHMARK

TBM#1 – TOP NUT OF HYDRANT 3628
ELEVATION 252.83

NO.	YY.MM.DD	REVISION	BY

SEAL

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED	J.V.
DATE:	DEC 2020
SCALE:	1:200

CLIENT/PROJECT

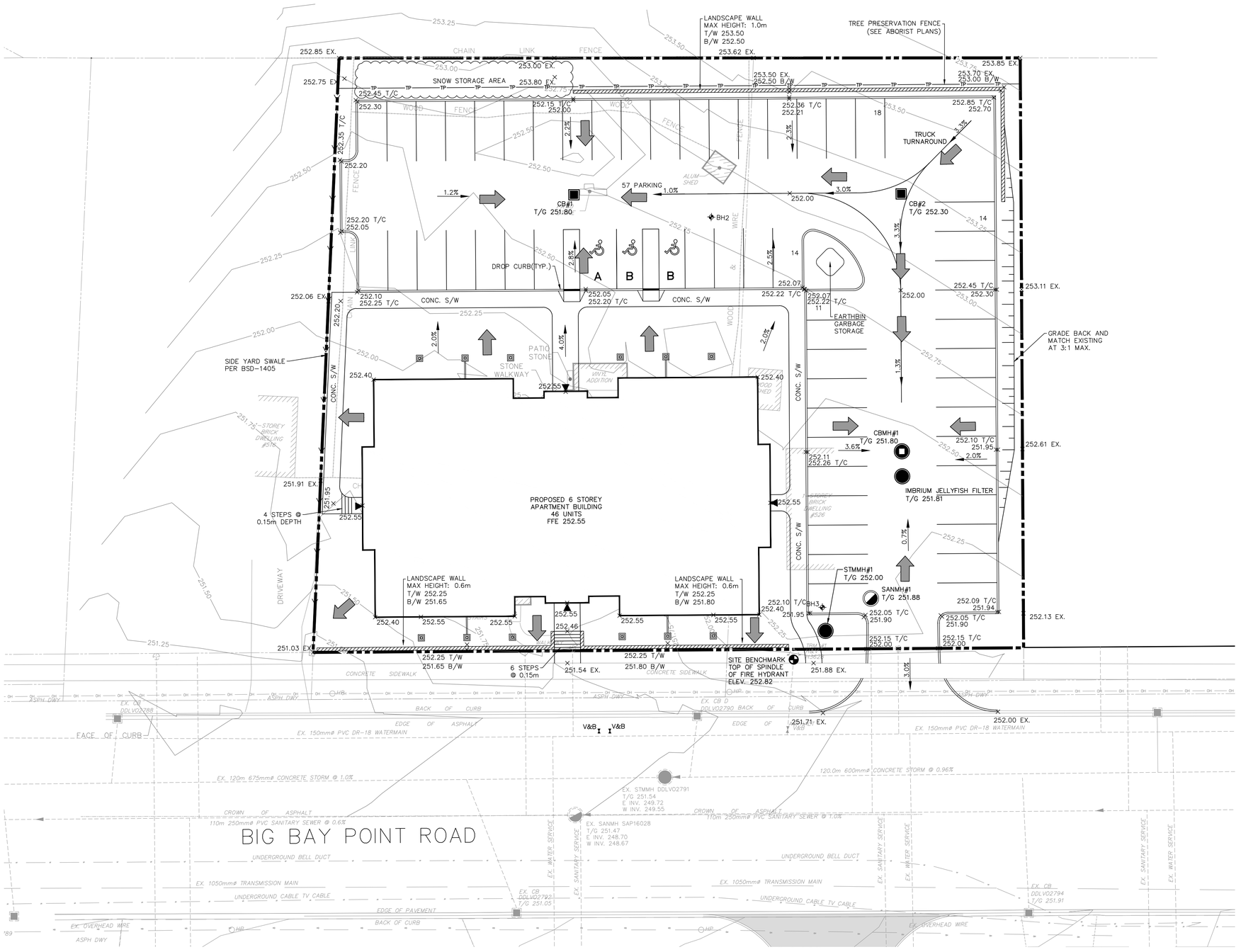
520-526 BIG BAY POINT ROAD
APARTMENT DEVELOPMENT

DRAWING TITLE

EXISTING CONDITIONS PLAN

PROJECT NO.	DRAWING NO.	REVISION
20-11559-B	EX-1	0

DWG NAME



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LEGEND

- SITE BOUNDARY
- LEGAL BOUNDARY
- IRON BAR
- 230.00m EXISTING MAJOR CONTOUR
- 229.50m EXISTING MINOR CONTOUR
- EXISTING TREELINE
- EXISTING TREES: CONIFEROUS, DECIDUOUS
- PROP. VALVE AND BOX
- PROP. STMMH
- PROP. CBMH
- PROP. CATCHBASIN
- PROP. SANITARY MANHOLE
- × 273.05 EX EXISTING GRADE
- × 273.50 PROPOSED GRADE
- × T/W 274.80 PROPOSED TOP OF WALL GRADE
- × B/W 273.85 PROPOSED BOTTOM OF WALL GRADE
- × T/C 273.85 PROPOSED TOP OF CURB GRADE
- EX. SANITARY MANHOLE
- EX. CATCH BASIN
- EX. CATCH BASIN MANHOLE
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING CSV
- DIRECTION OF MAJOR OVERLAND FLOW
- BH1 APPROXIMATE BOREHOLE LOCATION

PINESTONE ENGINEERING LIMITED | www.pel.ca

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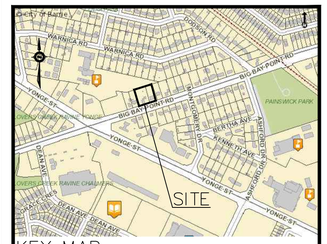


KEY MAP

NOTES

1. TOPOGRAPHIC SURVEY COMPLETED BY RUDY MAK SURVEYING LTD., OCTOBER 17 2019.

BENCHMARK

TBM#1 – TOP NUT OF HYDRANT 3628
ELEVATION 252.83

NO.	YY.MM.DD	REVISION	BY

SEAL

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED	J.V.
DATE:	DEC 2020
SCALE:	1:200

CLIENT/PROJECT

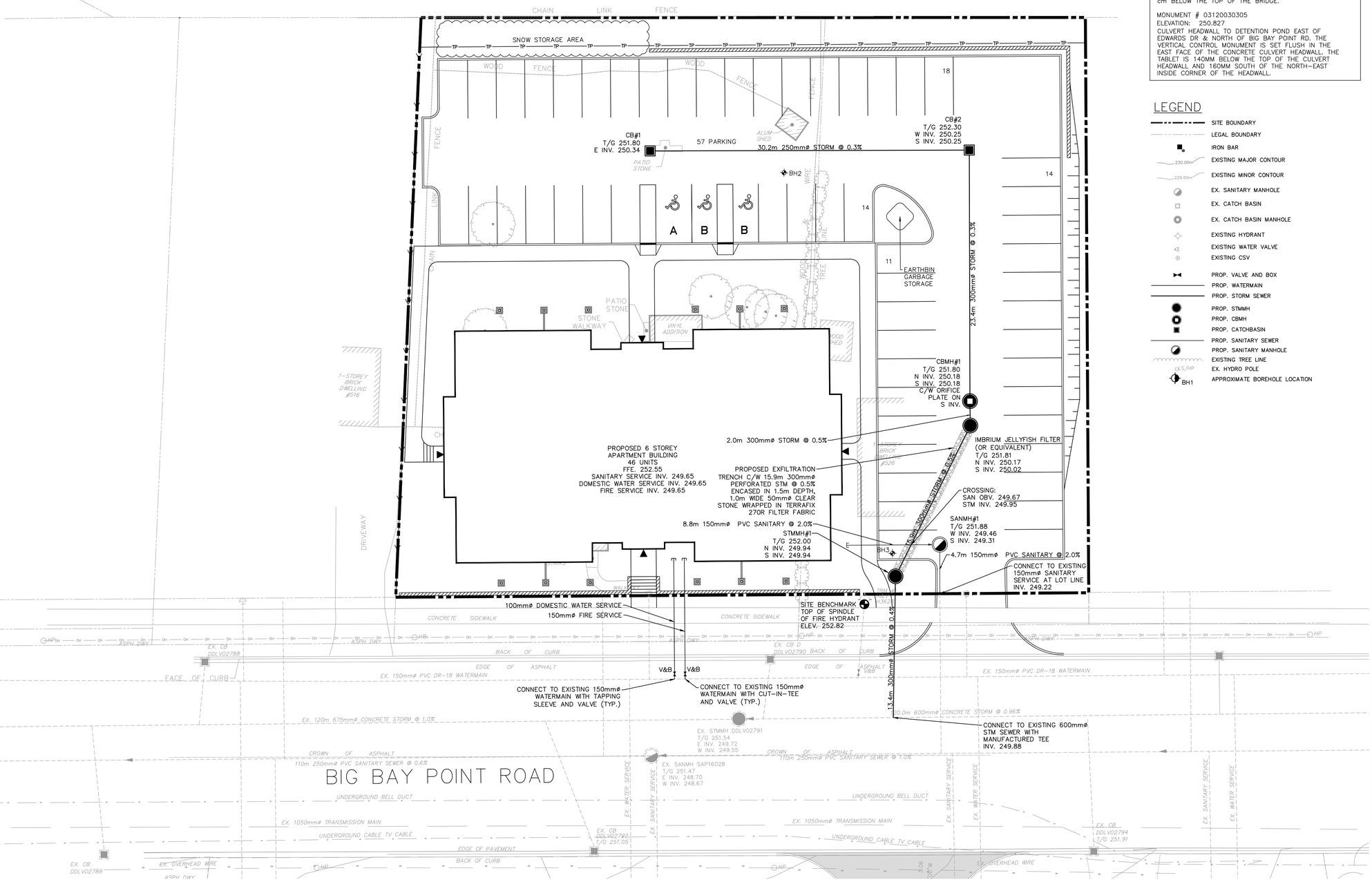
520-526 BIG BAY POINT ROAD APARTMENT DEVELOPMENT

DRAWING TITLE

SITE GRADING PLAN

PROJECT NO.	DRAWING NO.	REVISION
20-11559-B	GP-1	0

DWG NAME



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- EX. CATCH BASIN
- EX. CATCH BASIN MANHOLE
- EXISTING HYDRANT
- EXISTING WATER VALVE
- EXISTING CSV
- PROP. VALVE AND BOX
- PROP. WATERMAIN
- PROP. STORM SEWER
- PROP. STMMH
- PROP. CBMH
- PROP. CATCHBASIN
- PROP. SANITARY SEWER
- PROP. SANITARY MANHOLE
- EXISTING TREE LINE
- HP EX. HYDRO POLE
- BH1 APPROXIMATE BOREHOLE LOCATION

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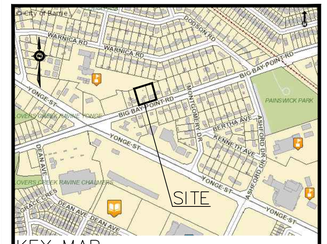

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BENCHMARK

TBM#1 – TOP NUT OF HYDRANT 3628
ELEVATION 252.82

NO.	YY.MM.DD	REVISION	BY

SEAL

NORTH ARROW

DESIGN BY:	D.H.
DRAWN BY:	C.A.
CHECKED	J.V.
DATE:	DEC 2020
SCALE:	1: 200

CLIENT/PROJECT

520-526 BIG BAY POINT ROAD APARTMENT DEVELOPMENT

DRAWING TITLE

SITE SERVICING PLAN

PROJECT NO.	DRAWING NO.	REVISION
20-11559-B	SERV-1	0

DWG NAME