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41-43 Essa Rd. & 259 Innisfil St., City of Barrie

FUNCTIONAL SERVICING REPORT

Tonlu Holdings Ltd.

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Issue	Date	Description
0	August 6, 2021	Issued for Client Review
1	September 17, 2021	Issued for ZBA (First Submission)

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by Tonlu Holdings Limited to prepare a Functional Servicing Report (FSR) in support of a Zoning By-Law Amendment (ZBA) application for the redevelopment of 41-43 Essa Road & 259 Innisfil Street (subject site) located in the City of Barrie (City).

This report presents a municipal servicing strategy, covering:

- water supply and distribution;
- sanitary sewage collection;
- drainage and stormwater management;
- grading and landscaping; and
- utility servicing.

1.1 SITE DESCRIPTION & SURROUNDING LAND USE

The site is located approximately 150 m north of the existing signalized intersection of Essa Road and Innisfil Street. It is bound by the Barrie-Collingwood Railway (BCRY) to the north, Innisfil Street to the west, and Essa Road and existing developments to the east and south. The location of the property is illustrated on the Site Location Plan (Figure 1), overleaf. Under existing conditions, the site consists of buildings and parking lot area. The total site area is approximately 1.79 ha. The site topography is generally flat with slopes of approximately 1% towards the northeast.

The site is located within the Lake Simcoe Region Conservation Authority (LSRCA) watershed, but it is not located within LSRCA regulated area.

1.2 PROPOSED DEVELOPMENT

The proposed development consists of four towers (ranging from 20 to 37 storeys) with a total of 1,276 residential units and 1,313 parking spaces. Two of the towers (Building 1 and 4) will house commercial space on the ground floor. The development will be accessed from Essa Road and Innisfil Street. The proposed site plan is provided in Appendix A.

The proposed development will be serviced by municipal water, sanitary, and storm services. All existing water and sanitary services to the property will be permanently capped/cut off at the main to the satisfaction of the City of Barrie.

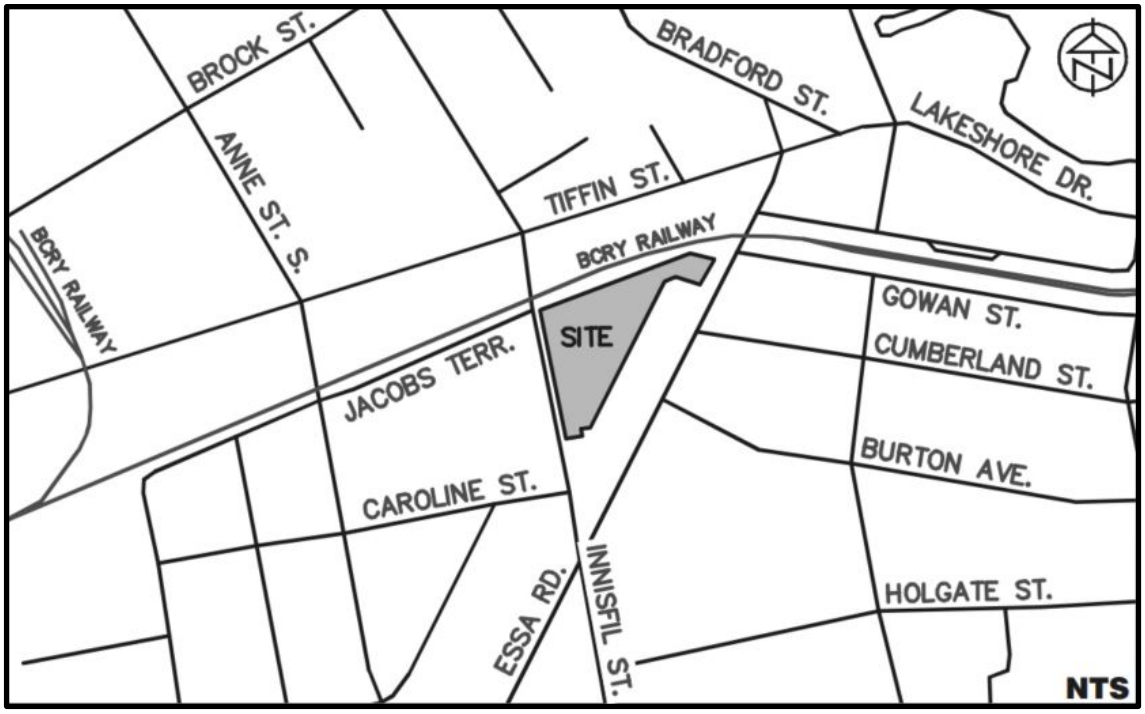


Figure 1: Site Location Plan

1.3 OBJECTIVES

The objective of this report is to present an overall servicing strategy to demonstrate the proposed development can be serviced appropriately. This report will also document the preliminary stormwater management (SWM) strategy for the site, demonstrating the proposed development will not adversely affect local surface water conditions.

1.4 GUIDELINES & BACKGROUND INFORMATION

This report has been prepared in accordance with local and provincial guidelines, including the following publications:

- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Stormwater Management Practices Planning and Design Manual* (2003);
- The Ministry of the Environment, Conservation, and Parks (MECP, formerly known as Ministry of Environment), *Lake Simcoe Protection Plan* (LSPP) (2009);
- Lake Simcoe Region Conservation Authority (LSRCA), *Technical Guidelines for SWM Submissions* (2016);
- Lake Simcoe Region Conservation Authority (LSRCA), *Phosphorous Offsetting Policy* (2019);

- City of Barrie, *Storm Drainage and Stormwater Management Policies and Design Guidelines* (2009);
- City of Barrie, *Sanitary Sewage Collection System Policies and Design Guidelines* (2017); and
- City of Barrie Engineering Department, *Water Transmission and Distribution Policies and Design Guidelines* (2017).

Information relating to existing topography, ground cover, and drainage patterns was obtained through a review of relevant background studies, available plans, base mapping, and topographic survey.

2 Water Supply & Distribution

2.1 EXISTING WATER SYSTEM

The site is located in an area of the City which is serviced by the municipal water system. There is an existing 300 mm dia. watermain on Essa Road and a 150 mm dia. watermain on Innisfil Street, which provide water supply and fire protection for the area.

2.2 PROPOSED WATER SYSTEM

The proposed development will be serviced with a 150 mm dia. domestic water service and a dedicated 150 mm dia. fire service from the existing 300 mm dia. watermain within Essa Road. Additional information is provided on the Preliminary Site Servicing Plan (Drawing SS-1) provided in Appendix F. It is expected that all 4 towers will be serviced via the water service connection from Essa Road. The final water system design will be confirmed during the detailed design stage.

2.3 PROPOSED WATER DEMANDS

The estimated population for the proposed development is 2,131 persons (applying the high-density unit population factor of 1.67 persons per unit as per the City's engineering standards). Demands generated by the commercial area have been estimated by applying a rate of 28 m^3/ha/day for 1,110 m^2 of commercial area. Water system demands were estimated by applying Maximum Day Factor and Peak Rate factors from Table 3-1 of the MOE Design Guidelines for Drinking Water Systems.

The estimated water system demands are:

- Average Day Demand (ADD), Residential: 2,131 persons x 225 L/person/day = 479,457 L/day = 5.55 L/s;
- Average Day Demand (ADD), Commercial: 1,110 m^2 x 28 m^3/ha/day = 3,108 L/day = 0.04 L/s;
- Maximum Daily Demand (MDD), Residential + Commercial: 482,565 L/day x 1.65 = 796,232 L/day = 9.22 L/s; and
- Peak Hourly Demand (PHD) Residential + Commercial: 482,565 L/day x 2.48 = 1,196,761 L/day = 13.85 L/s.

2.4 FIRE PROTECTION

Firefighting water demands have been estimated for the site using Water Supply Public Fire Protection (1999) prepared by the Fire Underwriters Survey (FUS). The required fire flow has been estimated at 83 L/s. Detailed calculations provided in Appendix B.

A fire hydrant flow test was conducted using two nearby fire hydrants located on Essa Road, as provided in Appendix B. Applying the equation provided in section 4.3.2 of the City's Water Transmission and Distribution Policies and Design Guidelines, the estimated fire flow available at 20 psi is 2,492 USgpm (157.0 L/s), which is greater than the required maximum water demand of 92.2 L/s (MDD + fire flow).

Details of the internal sprinkler systems and demands calculated by the mechanical engineering consultant have not yet been provided. Therefore, should the mechanical engineering consultant require additional information, or should the firefighting requirements change, our assessment will be updated accordingly.

3 Sanitary Sewer Collection

3.1 EXISTING SANITARY SYSTEM

The site is located in an area of the City serviced with a municipal sanitary sewer collection system that conveys flows to the Barrie Wastewater Treatment Facility (WWTF) located at the west end of Kempenfelt Bay on Lake Simcoe.

Currently, an existing 500 mm dia. sanitary sewer on Essa Road runs along the frontage of the site. The sewer conveys sewage flows approximately 300 m north towards the Barrie WWTF. The existing 500 mm pipe on Essa Road, which conveys sewage to the existing 1050 mm dia. Bradford Street sanitary trunk sewer, has a full flow capacity of 393.13 L/s. This is calculated in the Sanitary Sewer Design Sheet provided in Appendix C.

3.2 PROPOSED SANITARY SYSTEM

The proposed development will discharge sanitary sewage to the existing 500 mm dia. sanitary sewer on Essa Road via a new 250 mm dia. sanitary service. It is expected all 4 towers will be serviced via the sanitary connection to Essa Road. A sanitary maintenance hole will be constructed between on the property line to provide a sampling location, as per City standards. Refer to Drawing SS-1 for additional information.

The full flow capacity of the 250 mm dia. sanitary service is 84.10 L/s, which can accommodate the design peak flow of 20.03 L/s from the proposed development as per calculations provided below. Peak flows have been estimated as per the following:

Estimated sanitary design flows:

- Average Day Design Flow, Residential: 1.67 ppu x 1,276 units = 2,131 persons x 225 L/cap/day = 479,457 L/day = 5.55 L/s;
- Average Day Design Flow, Commercial: 1,110 m^2 x 28 m^3/ha/day = 3,108 L/day = 0.05 L/s; and
- Peak Hour Flow (incl. infiltration and commercial) = 1,731,456 L/day = 20.03 L/s.

Therefore, there is satisfactory capacity in the proposed service connection to service the development, as shown in the Sanitary Sewer Design Sheet. It is expected the existing sewers in Essa Road and Bradford Street have sufficient capacity to convey sewage flows to the WWTF. We expect the City to input the design flows into their sanitary model to confirm downstream capacity.

4 Preliminary Stormwater Management Plan

4.1 DESIGN CRITERIA

This preliminary SWM plan is subject to the review and approval of the City and the LSRCA. Applicable SWM design criteria for the proposed development are presented below.

4.1.1 Stormwater Quality Control

Water quality controls must be provided to satisfy the MECP's Stormwater Management Practices Planning and Design Manual. This corresponds to providing Enhanced Protection Level water quality protection of 80% total suspended solids (TSS) removal.

4.1.2 Stormwater Quantity Control

The City requires that post-development peak flow rates be controlled to pre-development levels at any given outlet location to ensure no adverse impacts for downstream landowners. As such, water quantity controls will be provided to attenuate post-development peak flow rates to pre-development levels. In addition, as stormwater runoff generated from the site will discharge directly into the existing Essa Road storm sewer, post-development peak flows will be controlled to the 5-year pre-development peak flow rate (design rate for storm sewer conveyance).

4.1.3 Water Balance

As the development area is over 500 m^2, the proposed development is categorized as a "major development" under the LSPP. Therefore, best efforts must be demonstrated to maintaining pre-development infiltration rates in the post-development scenario through the completion of a water balance assessment.

A water balance assessment has been completed DS Consultants Ltd. As part of the Hydrogeological Investigation, provided under separate cover.

4.1.4 Phosphorous Budget

The proposed development is expected to be subject to the Lake Simcoe Phosphorous Offsetting Policy (LSPOP), which requires all major development to control 100% of the phosphorous generated from the site.

4.2 EXISTING CONDITIONS

Under existing conditions, the 1.79 ha site drains north via overland flow towards the Essa Road right-of-way (Catchment 101). It is understood runoff is collected in the existing catch basin located in Essa Road at the Gowan Street intersection. Runoff is conveyed via sewers to Lake Simcoe approximately 470m downstream of the subject site. Existing drainage patterns are shown on the Pre-Development Drainage Plan (Drawing DP-1) provided in Appendix F.

The rational method has been used to calculate peak flow rates under pre-development conditions. The results are summarized in Table 1 while detailed calculations are provided in Appendix D.

Table 1: Pre-Development Peak Flow Rates

DESIGN STORM	PEAK FLOW [m^3/s]
2-Year	0.33
5-Year	0.43
10-Year	0.50
25-Year	0.64
50-Year	0.73
100-Year	0.80

4.3 PROPOSED CONDITIONS

Under proposed conditions, the total impervious area of the site decreases from 1.67 ha to 1.60 ha due to the increase in landscaped area. The site has been modeled as Catchment 201 with a runoff coefficient of 0.86. Runoff generated from Catchment 201 will be collected internally and will discharge to the existing Essa Road storm sewer, as per existing conditions.

Proposed drainage patterns are shown on the Post-Development Drainage Plan (Drawing DP-2) provided in Appendix F.

4.3.1 Water Quantity

As all site generated runoff (Catchment 201) will discharge to the existing storm sewer network, the modified rational method was used to quantify the storage volume required to control the post-development peak flow rates to the 5-year pre-development rate, which is the peak flow

received by the downstream sewers under existing conditions. A summary of the post-development peak flow rates and storage volumes are provided in Table 2. Detailed calculations are provided in Appendix D.

Table 2: Post-Development Peak Flow Rates

DESIGN STORM	PEAK FLOW [m^3/s]	STORAGE VOLUME REQUIRED [m^3]
2-Year	0.15 *(0.33)*	142.3
5-Year	0.21 *(0.43)*	174.6
10-Year	0.24 *(0.50)*	205.5
25-Year	0.32 *(0.64)*	257..1
50-Year	0.40 *(0.73)*	277.7
100-Year	0.43 *(0.80)*	320.0

Note: Values presented in italics denote existing condition peak flow rates.

As shown, a maximum storage volume of 320.0 m^3 is required to control post-development flow rates from the 100-year storm to the 5-year pre-development release rate (0.43 m^3/s). The required storage will be provided by an underground stormwater storage system located within the driveway area. Collected runoff (not including greywater) will be controlled to the maximum permissible release rate (0.43 m^3/s) via a 490 mm dia. orifice.

Attenuated peak flows will discharge via a 500 mm dia. storm sewer connection to the existing 2,400 mm x 1,500 mm box culvert within Essa Road, as depicted on Drawing SS-1. A storm sewer design sheet has been prepared for the proposed storm sewer connection and is provided in Appendix D.

4.3.2 Water Quality

Enhanced level water quality control (corresponding to 80% TSS removal) is required for the site. Water quality controls will be provided for Catchment 201 via a jellyfish filter unit. The jellyfish filter unit is located immediately downstream of the underground stormwater storage unit and has been sized to provide 89% TSS removal. Sizing calculations have been provided in Appendix D.

4.3.3 Phosphorous Budget

In order to comply with LSPOP requirements, a phosphorous budget for the site has been completed using the loading rates and removal efficiencies from the MECP Phosphorous Budget tool through a spreadsheet method, summarized below in Table 3.

Existing Conditions

Under existing conditions, the site has been modelled as a single land use category (high intensity development – commercial/industrial) for the purpose of the phosphorous budget calculations.

Applying the relevant loading rate of 1.82 kg/ha/year, the pre-development phosphorous load is 3.26 kg/year.

Proposed Conditions

Under proposed conditions, the site has also been modelled as a single land use category (high intensity development – residential) with a loading rate of 1.32 kg/ha/year. The proposed site will include an underground stormwater storage system (25% removal efficiency) and a jellyfish filter unit (59% removal efficiency), resulting in a total removal efficiency of 69.25%.

Applying the relevant loading rate, the post-development phosphorous load with controls is 0.73 kg/year.

A summary of the phosphorous loading rates for each scenario is provided in Table 3. Additional details and outputs are provided in Appendix E. As shown, phosphorous loading is reduced under proposed conditions.

Table 3: Phosphorous Loading Summary

SCENARIO	AREA (ha)	PHOSPHOROUS LOADING (kg/year)
Pre-Development	1.79	3.26
Post-Development (Without Controls)	1.79	2.36
Post-Development (With Controls)	1.79	0.73

4.4 SWM FACILITY MAINTENANCE

Ongoing maintenance of SWM facilities is necessary to ensure continued effectiveness. The storage tank and jellyfish filter unit should be inspected regularly and particularly after large

rainfall events to ensure the system and all its component parts are functioning properly and are in good repair.

5 Siltation & Erosion Control Plan

Siltation and erosion controls will be implemented for all construction activities, including demolition, earthworks, material stockpiling, pavement construction, and grading operations. Details of the sedimentation and erosion control will be provided during detailed design and are summarized as follows:

- heavy duty silt control fences will be erected to control sediment movement to abutting properties and the Essa Road and Innisfil Street right-of-ways;
- a stone mud mat will be installed at the construction entrances from Essa Road and Innisfil Street; and
- regular inspection of control measures will be implemented and repairs made as necessary during construction.

6 Grading & Landscaping

The grading of the proposed development will match to the existing grades along the limits of the development. The site will be graded to suit the existing boundary conditions on the boulevard to the north and the existing service road to the south. Refer to the Preliminary Site Grading Plan (Drawing SG-1) provided in Appendix F for additional details.

7 Utilities

We have reached out to all relevant utility companies (Alectra, Bell, Rogers, and Enbridge) for comment on this project. We are waiting to receive response comments but do not expect issues related to utility servicing for the proposed development.

8 Summary

8.1 WATER SUPPLY & DISTRIBUTION

The site will be serviced with a 150 mm dia. domestic water service and a dedicated 150 mm dia. fire service from the existing 300 mm dia. watermain on Essa Road.

8.2 SANITARY SEWER COLLECTION

The site will be serviced via a 250 mm dia. sanitary sewer lateral connected to the existing 500 mm dia. sanitary sewer on Essa Road. It is expected there is sufficient capacity in downstream existing sewers to convey sewage flow to the Barrie Wastewater Treatment Facility.

8.3 STORMWATER MANAGEMENT PLAN

The preliminary SWM plan demonstrates the proposed development will not result in negative impacts with respect to stormwater. Post-development peak flows will be controlled to the existing 5-year flow rates via an underground stormwater storage system. Controlled runoff from the site will be conveyed to the existing box culvert storm sewer on Essa Road. Water quality controls will be provided by the underground stormwater storage system and a jellyfish filter unit.

8.4 SILTATION & EROSION CONTROL

Siltation and erosion controls will be provided with the proper construction mitigation efforts.

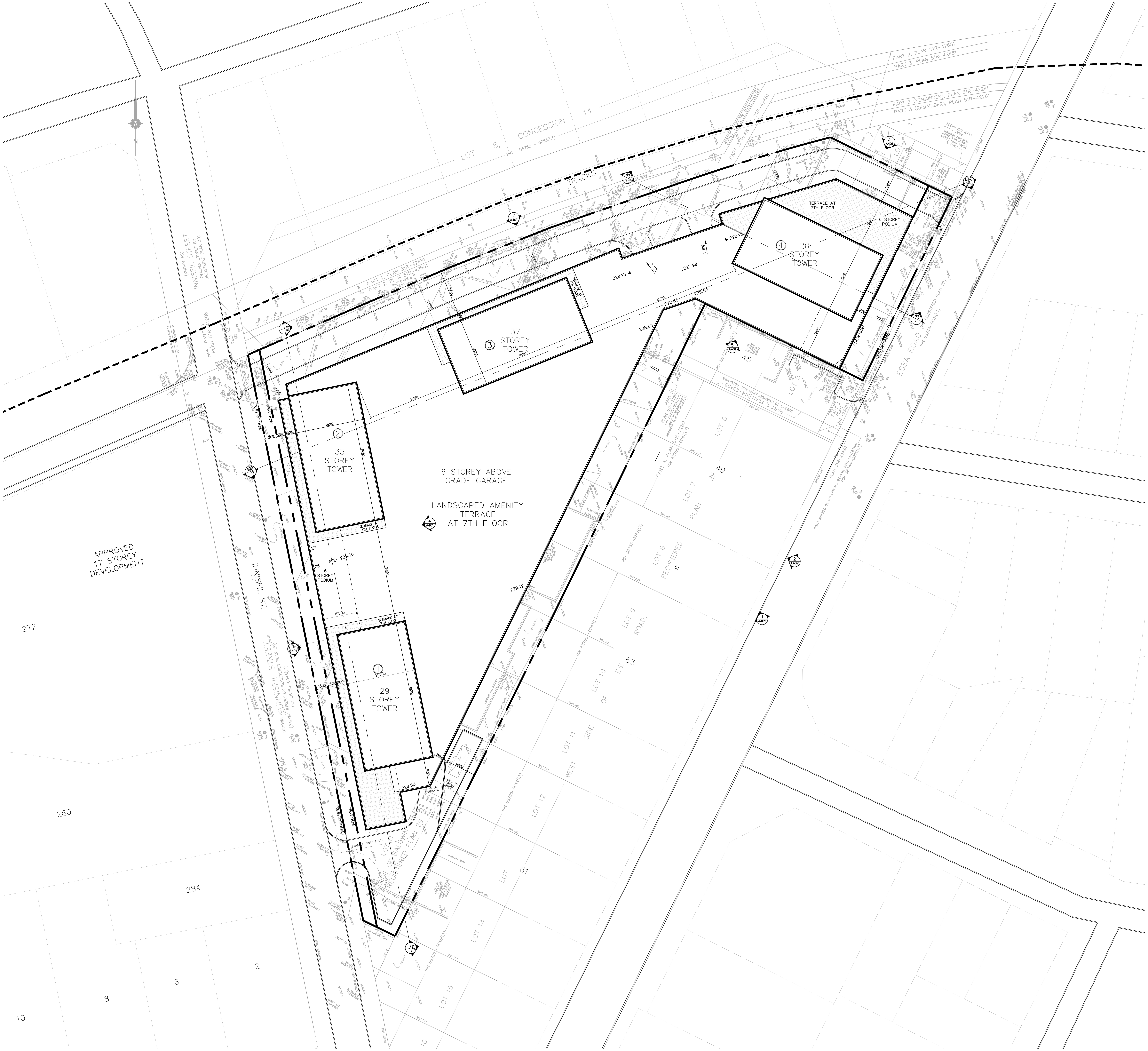
8.5 GRADING & LANDSCAPING

The grading of the proposed development will match to existing perimeter grades along the limits of the development.

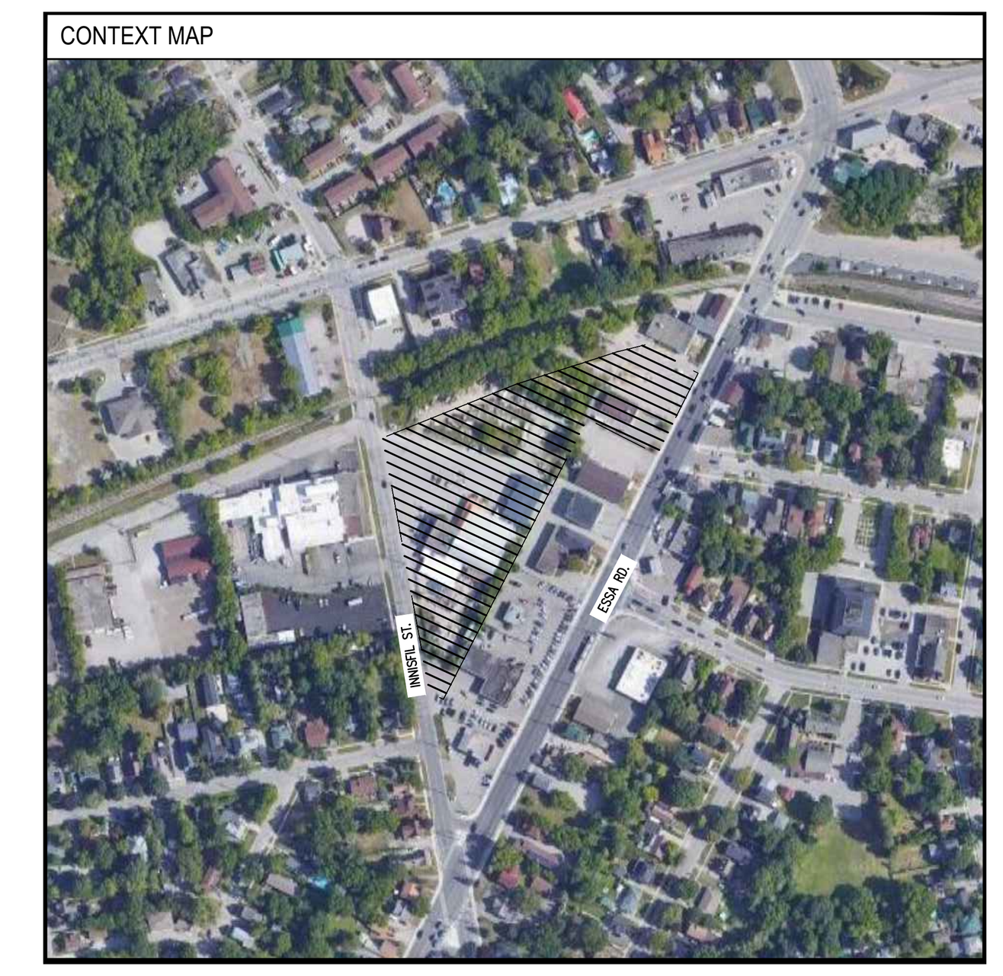
8.6 UTILITIES

We have reached out to all relevant utility companies (Alectra, Bell, Rogers, and Enbridge) for comment on this project and are awaiting comment.

Appendix A:
Site Plan



CONTEXT MAP



STATISTICS

ZONING					N/A			
SITE AREA	TOTAL				17,889.3	192,559	4.42	5.3
TFA	BUILDING #1							
	GND RETAIL				482.0	5,188		
	GND RESIDENTIAL				529.8	5,703		
	GND GARAGE				7,110.2	76,534		
	2ND RESIDENTIAL				882.6	9,500		
	2ND GARAGE				7,655.1	82,399		
	3RD-6TH RES	1393.3	m2 x	4	5,573.2	59,989		
	3ND-6TH GAR	10334	m2 x	4	41,337.2	444,950		
	7TH				800.0	8,611		
	8TH-29TH	800	m2 x	22	17,600.0	189,445		
	TOTAL				81,970.1	882,319	includes parking	
	BUILDING #2							
	GND RETAIL				0.0	0		
	GND RESIDENTIAL				860.9	9,267		
	2ND RESIDENTIAL				710.3	7,646		
	3RD-6TH RES	803.1	m2 x	4	3,212.4	34,578		
	7TH	800	m2 x	1	800.0	8,611		
	8TH-35TH	800	m2 x	28	22,400.0	241,112		
	TOTAL				27,983.6	301,213		
	BUILDING #3							
	GND RETAIL				0.0	0		
	GND RESIDENTIAL				610.1	6,567		
	2ND RESIDENTIAL				395.4	4,256		
	3RD-6TH RES	256.2	m2 x	4	1,024.8	11,031		
	7TH	800	m2 x	1	800.0	8,611		
	8TH-37ST	800	m2 x	30	24,000.0	258,334		
	TOTAL				26,830.3	288,799		
	BUILDING #4							
	GND RETAIL				741.6	7,983		
	GND RESIDENTIAL				712.5	7,669		
	2ND RESIDENTIAL				1,150.9	12,388		
	3RD-6TH	834	m2 x	4	3,336.0	35,908		
	7TH				800.0	8,611		
	8TH-20TH	800	m2 x	13	10,400.0	111,945		
	TOTAL				17,141.0	184,504		
	GRAND TOTAL				153,925.0	1,656,834.9		
GFA	BUILDING #1							
	GND RETAIL				482.0	5,188		
	GND RESIDENTIAL				529.8	5,703		
	2ND RESIDENTIAL				882.6	9,500		
	3RD-6TH RES	1,393	m2 x	4	5,573.2	59,989		
	7TH				800.0	8,611	amenity this floor	
	8TH-29TH	800.0	m2 x	22	17,600.0	189,445		
	TOTAL				25,867.6	278,436.5		
	BUILDING #2							
	GND RETAIL				0.0	0		
	GND RESIDENTIAL				860.9	9,267		
	2ND RESIDENTIAL					0		
	3RD-6TH RES	803.1	m2 x	4	3,212.4	34,578		
	7TH				800.0	8,611	amenity this floor	
	8TH-35TH	800.0	m2 x	27	21,600.0	232,500		
	TOTAL				26,473.3	284,956.2		
	BUILDING #3							
	GND RETAIL				0.0	0		
	GND RESIDENTIAL				610.1	6,567		
	2ND RESIDENTIAL					0		
	3RD-6TH RES	256.2	m2 x	4	1,024.8	11,031		
	7TH				800.0	8,611	amenity this floor	
	8TH-37ST	800.0	m2 x	30	24,000.0	258,334		
	TOTAL				26,434.9	284,542.9		
	BUILDING #4							
	GND RETAIL				414.0	4,456		
	GND RESIDENTIAL				712.5	7,669		
	2ND RESIDENTIAL					0		
	3RD-6TH RES	834.0	m2 x	4	3,336.0	35,908		
	7TH				834.0	8,977	amenity this floor	
	8TH-20TH	800.0	m2 x	13	10,400.0	111,945		
	TOTAL				15,696.5	168,955.7		
	GRAND TOTAL				94,472.3	1,016,891.4		
NET SALEABLE AREA	BUILDING #1							
	GND RETAIL				418.0	4,499		
	GND RESIDENTIAL				168.9	1,818		
	2ND RESIDENTIAL				213.2	2,295		
	3RD-6TH RES	724.2	m2 x	4	2,896.8	31,181		
	7TH				335.2	3,608	amenity this floor	
	8TH-29TH	710.1	m2 x	22	15,622.2	168,156		
	TOTAL				19,654.3	211,557.1		
	BUILDING #2							
	GND RETAIL				0.0	0		
	GND RESIDENTIAL				435.8	4,691		
	2ND RESIDENTIAL				467.1	5,028		
	3RD-6TH RES	562.2	m2 x	4	2,248.8	24,206	amenity this floor	
	7TH				335.2	3,608		
	8TH-35TH	710.1	m2 x	28	19,882.8	214,017		
	TOTAL				23,369.7	251,549.4		
	BUILDING #3							
	GND RETAIL				0.0	0		
	GND RESIDENTIAL				0.0	0		
	2ND RESIDENTIAL				0.0	0		
	3RD-6TH RES	0.0	m2 x	4	0.0	0		
	7TH				331.4	3,567	amenity this floor	
	8TH-37TH	710.1	m2 x	30	21,303.0	229,304		
	TOTAL				21,634.4	232,870.7		
	BUILDING #4							
	GND RETAIL				414.0	4,456		
	GND RESIDENTIAL				0.0	0		
	2ND RESIDENTIAL				596.9	6,425		
	3RD-6TH RES	514.2	m2 x	3	1,542.6	16,604		
	7TH				350.8	3,776		
	8TH-20TH	708.6	m2 x	13	9,211.8	99,155		
	TOTAL				12,116.1	130,416.6		
	GRAND TOTAL				76,774.5	826,393.8		
EFFICIENCY	BUILDING#1				76.0%			
	BUILDING#2				88.3%			
	BUILDING#3				81.8%			
	BUILDING#4				77.2%			

UNITS

			B	1B	1B+d	2B	2B+d	3B	TOTAL
BUILDING #1									
	GND		0	0	0	1	0	1	2
	2ND		0	0	1	2	0	0	3
	3ND-6TH	4	0	0	12	28	0	0	40
	7TH		0	4	0	2	0	0	6
	8TH-29TH	22	0	88	0	176	0	0	264
	TOTAL		0	92	13	209	0	1	315
	%		0%	29%	4%	66%	0%	0%	
BUILDING #2									
	GND		0	0	0	2	1	2	5
	2ND				1	5	1		7
	3RD-6TH	5	0	0	5	40	5	0	50
	7TH		0	4	0	2	0	0	6
	8TH-35TH	28	0	112	0	224	0	0	336
	TOTAL		0	116	6	273	7	2	404
	%		0%	29%	1%	68%	2%	0%	
BUILDING #3									
	GND		0	0	0	0	0	0	0
	2ND								
	3RD-6TH	5	0	0	0	0	0	0	0
	7TH		0	4	0	2	0	0	6
	8TH-37ST	30	0	120	0	240	0	0	360
	TOTAL		0	124	0	242	0	0	366
	%		0%	34%	0%	66%	0%	0%	
BUILDING #4									
	GND		0	0	0	0	0	0	0
	2ND		0	0	3	3	1	1	8
	3RD-6TH	3	0	0	9	9	3	0	21
	7TH		0	2	0	4	0	0	6
	8TH-20TH	13	0	52	0	104	0	0	156
	TOTAL		0	54	12	120	4	1	191
	%		0%	28%	6%	63%	2%	1%	
GRAND TOTAL			0	386	31	844	11	4	1276
%			0%	30%	2%	66%	1%	0%	

PARKING	REQUIRED	Retail	1.0 sp/30m2	28
		Residential (incl Vis)	1.0 sp/unit	1276
		Total		1304
	PROPOSED			TOTAL
		Gnd		188
		2nd		202
		3rd		230
		4th		230
		5th		230
		6th		233
		Total		1313

AMENITY	REQUIRED		n/a	
	PROPOSED	INDOOR		
		BUILDING #1	375.0	m2
		BUILDING #2	375.0	m2
		BUILDING #3	379.0	m2
		BUILDING #4	351.0	m2
		TOTAL	1,480.0	m2
		OUTDOOR		
		BLD 1,2,3	4,544.0	m2
		BLD 4	287.5	m2
		TOTAL	4,831.5	m2
		GRAND TOTAL	6,311.5	m2
HEIGHT	PERMITTED		N/A	
	PROPOSED	BUIDING #1	91.25	29 STOREYS
		BUIDING #2	109.35	35 STOREYS
		BUIDING #3	115.25	37 STOREYS
		BUIDING #4	64.30	20 STOREYS

architectureunfolded

368 dufferin street, toronto, on, m6k 1z8 tel: (416)601.5416 info@unfolded.ca

notes:

revisions: date

1 ZBA submission 07-09-21

submissions: date

architectural team :

mark zwicker
ihab daakour

planning:
IPS Consulting Inc.
647 Welham Road, Unit 9A, Barrie, ON, L4N 0B7

landscape:
Studio TLA
20 Champlain Blvd., Suite 102, Toronto, ON, M3H 2Z1, Canada

traffic:
GHD Ltd.
6705 Millcreek Drive, Unit 1, Mississauga, ON L5N 5M4

site services:
Tatham Engineering
41 King Street, Unit 4, Barrie, ON, L4N 6B5

structural:
Jablonsky, Ast and Partners International
400-3 Concorde Gate, Toronto, ON, M3C 3N7

project:

259 Innisfil Street
barrie, ontario

site plan

2020	date:
1:400	scale:
21-04	project:
mz - id	drawn by:

true north · construction north

drawing number:

A101

Appendix B:
Water Demand Calculations

Project:	41-43 Essa Rd. & 259 Innisfil St., Barrie	Date:	July 26, 2021
File No.:	421406	Designed:	JLM
Subject:	Water Demand Calculations	Checked	DJR
Revisions:			

41-43 Essa Rd. & 259 Innisfil St.

Residential		
Number of Units =	1276	units
Population per Unit =	1.67	ppu
Population =	2131	persons
Domestic Water Demand =	225	L/person/day
Average Daily Demand (Residential)=	479,457	L/day
	5.55	L/s
Commercial		
Commercial Area	1,110	m^2
Commercial Daily Water Demand	28	m^3/ha/day
Average Daily Demand (Commercial)	3,108.00	L/day
	0.04	L/s
Total Average Daily Demand (Residential + Commercial) =	482,565	L/day
	5.59	L/s
Maximum Day Factor =	1.65	From MOE Design Guidelines for Drinking Water Systems - Table 3-1
Peak Rate Factor =	2.48	From MOE Design Guidelines for Drinking Water Systems - Table 3-1
Maximum Daily Demand =	796,232	L/day
	9.22	L/s
Peak Hourly Demand =	1,196,761	L/day
	13.85	L/s

Project:	41-43 Essa Road & 259 Innisfil Street - **Subject Building: Building 1**	Date:	July 26, 2021
File No.:	421406	Designed:	JLM
Subject:	Preliminary Fire Flow Calculations	Checked	DJR
Revisions:			

Fire Underwriters Survey Fire Flow Calculations
Long Method

Calculation Based on 1999 Publication "Water Supply for Public Fire Protection" by Fire Underwriters Survey (FUS).

Step	Description	Term	Options		Multiplier Associated with Option	Choose	Value used	Unit	Total Fire Flow (L/min)	
		Framing Material								
1	Frame Use for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame		1.5	Fire resistive construction (> 2 hrs)	**0.8**	-	N/A	
			Ordinary Construction		1					
			Non-combustible construction		0.8					
			Fire resistive construction (< 2 hrs)		0.7					
			Fire resistive construction (> 2 hrs)		0.6					
		Floor Space Area								
2	Type of Housing (if Tow House, enter number of units per TH block)	Type of Housing	Single Family		1		**0**	Units	N/A	
			Townhouse / Apartment- inform # of units		1		**333**			
			Other (Comm. Ind., etc.)		1		**0**			
2.1	Number of Storeys	Number of Floors / Storeys in the unit (do not include basement)					**29**	Storeys	N/A	
3	Floor Area	Largest Floor Area					**800**	m^2	N/A	
		Ground Floor Area = Largest Floor + 25% of 2 immediately adjoining floors	Square Feet (ft2)		0.093	Square metres	**1200**			
			Square Metres (m^2)		1					
			Hectares (ha)		10000					
4	Required Fire Flow without Reductions or Increases	Required Fire Flows without Reductions or Increases per FUS): (FF= 220 x C x $A^{0.5}$)						L/min	6,000	
5	Factors Affecting Burning	**Reductions / Increases Due to Factors Affecting Burning**								
5.1	Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible		-0.25	Limited combustible	**-0.15**	N/A	0	(900)
			Limited combustible		-0.15					
			Combustible		0.00					
			Free burning		0.15					
			Rapid burning		0.25					
5.2	Reduction Due to Presence of Sprinklers	Sprinkler reduction	Complete automatic sprinkler protection		-0.3	Automatic Sprinkler System	**-0.3**	N/A	0	(1,800)
			None		0					
5.3	Separation Distance Between Units	Exposure distance between units	North Side		20.1-30	0.1	**0.4**	m	0	2,040
			East Side		20.1-30	0.1				
			South Side		20.1-30	0.1				
			West Side		20.1-30	0.1				
							Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:		0	5,000
6	Required Fire Flow, Duration and Volume						Total Required Fire Flow (above) in L/s:		0	83
							Required Duration of Fire Flow of 5,000 L/min (hrs):		2.25	
							Required volume for Fire Flow of 5,000 L/min (m^3):		675	

Test location: 43 Essa Road

CITY OF BARRIE

Tatham File No. 421406

AVAILABLE FIRE FLOW AT 20 P.S.I.

TEST 1

QA = $QT\ (ha/ht)^{0.5}$ From City of Barrie "Water transmission and Distribution Policies and Design Guidelines" page 4

Where QA = Flow at 20 P.S.I.		Value	
QT = Flow at Test		666	GPM from Fire Flow Test by Vipond
ha = Pressure Drop Available	76-20 =	56	P.S.I.
ht = Pressure Drop at Test	76-72 =	4	P.S.I.

QA =	2,491.94	GPM
	156.99	L/s

TEST 2

QA = $QT\ (ha/ht)^{0.5}$ From City of Barrie "Water transmission and Distribution Policies and Design Guidelines" page 4

Where QA = Flow at 20 P.S.I.		Value	
QT = Flow at Test		924	GPM from Fire Flow Test by Vipond
ha = Pressure Drop Available	76-20 =	56	P.S.I.
ht = Pressure Drop at Test	76-69 =	7	P.S.I.

QA =	2,613.47	GPM
	164.65	L/s

TEST 3

QA = $QT\ (ha/ht)^{0.5}$ From City of Barrie "Water transmission and Distribution Policies and Design Guidelines" page 4

Where QA = Flow at 20 P.S.I.		Value	
QT = Flow at Test		1686	GPM from Fire Flow Test by Vipond
ha = Pressure Drop Available	76-20 =	56	P.S.I.
ht = Pressure Drop at Test	76-69 =	7	P.S.I.

QA =	4,768.73	GPM
	300.43	L/s

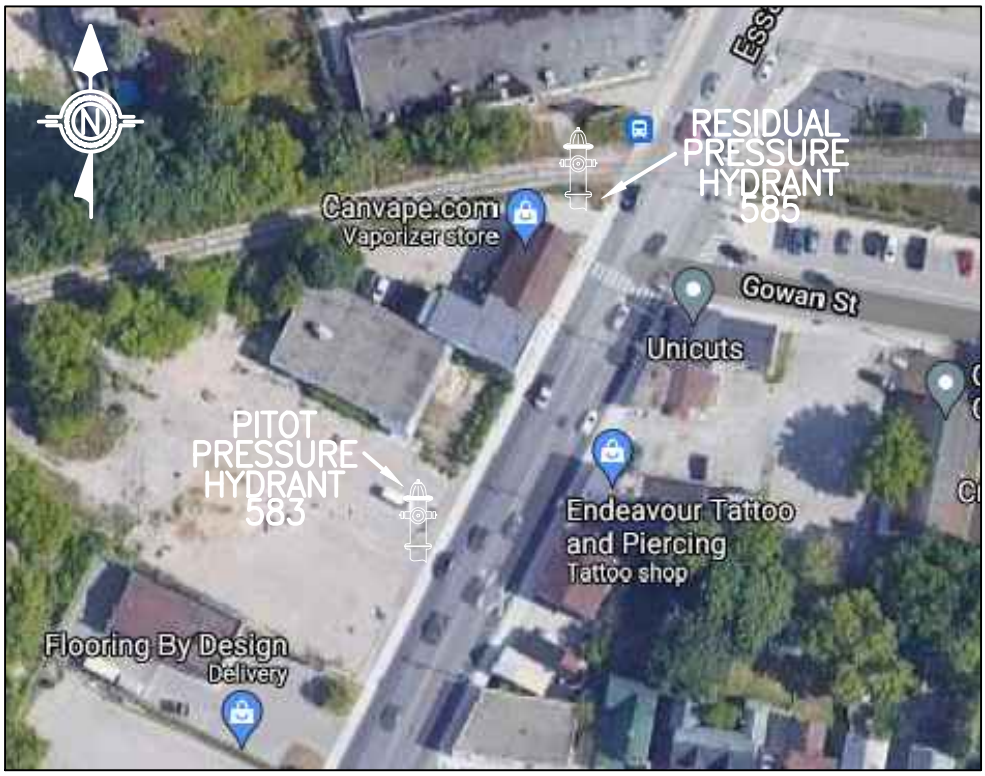
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : MAY 27, 2021 TIME : 1:00 PM

LOCATION : 43 ESSA RD.
CITY OF BARRIE
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 76 PSI

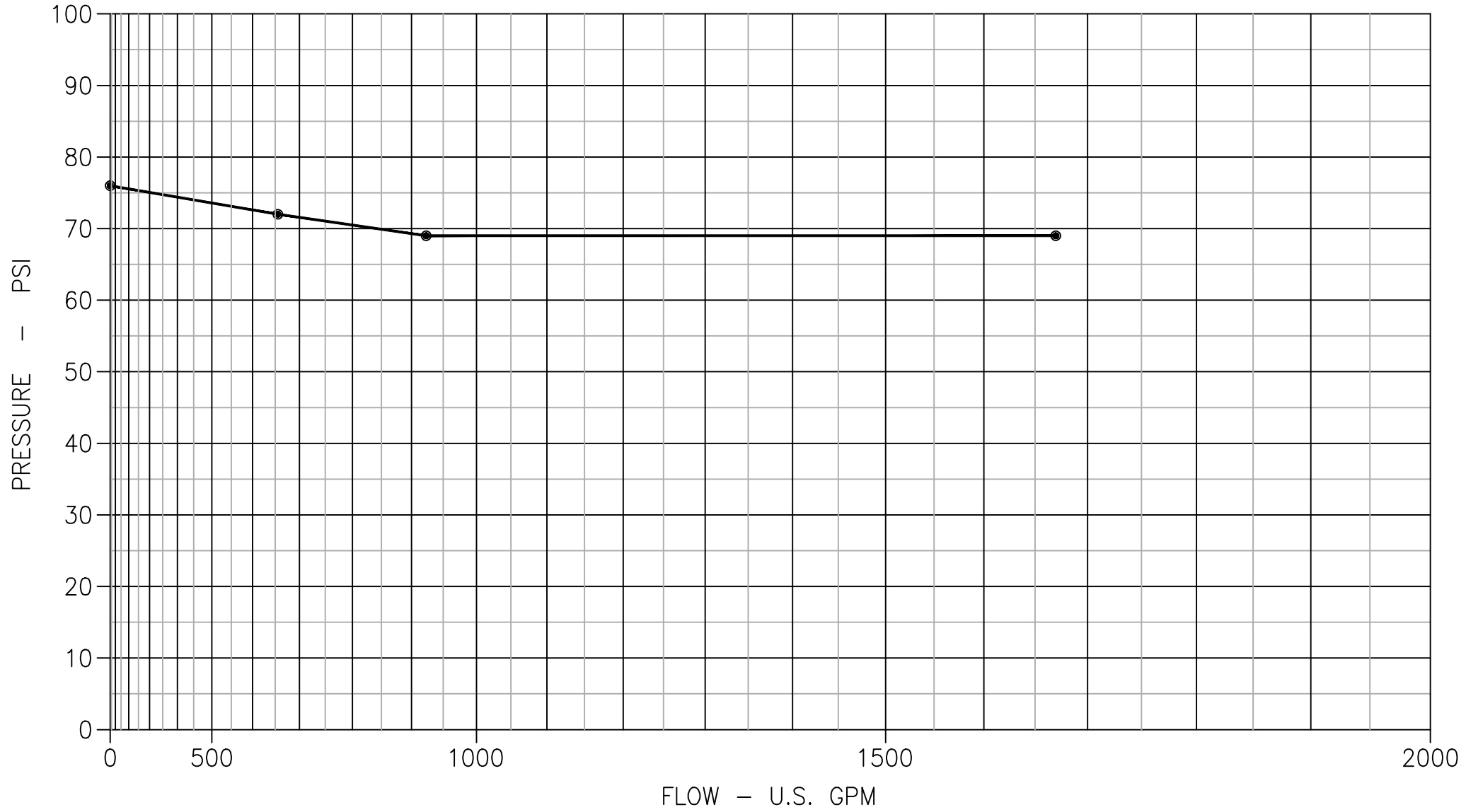
TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-3/4	0.995	72	56	666
2	1	2-1/2	0.9	69	30	924
3	2	2-1/2	0.9	69	25	1686

FIRST FOR FIRE, LIFE SAFETY & SECURITY

VIPOND INC est. 1945

43 ESSA RD.	BY : LEN K./RILEY P.
CITY OF BARRIE	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : MAY 27, 2021

STATIC:	RESIDUAL:		FLOW:
76 PSI	TEST#1 72 PSI	@	666 GPM
	TEST#2 69 PSI	@	924 GPM
	TEST#3 69 PSI	@	1686 GPM



Appendix C: Sanitary Sewage Design Calculations

TATHAM ENGINEERING

Sanitary Sewer Design Sheet

Version Number: 1 **Version Date:** September 8, 2021

Project Information

41-43 Essa Road & 259 Innisfil Street	421406

Drawing Reference

N/A	N/A

Prepared By

JLM/DR	September 08-21

Reviewed By

NM	September 08-21

Municipality

City of Barrie

Population Density

Capita per Unit	Low	Medium	High
	3.13	2.34	1.67

Infiltration

Infiltration (L/s/ha)	0.1

Flow

Development Type	Average (L/cap/day)	Peaking Factor
Residential	225	Harmon
Development Type	**Average (L/ha/day)**	**Peaking Factor**
Institution	28,000	2
Commercial	28,000	2
Industrial High Intensity	55,000	-
Industrial Low Intensity	50,000	-

Manning's Coefficient

Pipe Material	Value
Concrete	0.013
PVC	0.013
Applied	0.013

Engineer Stamp

Street Name	Area Label/ID	Upstream Maintenance Hole	Downstream Maintenance Hole	Development Type	Population Density	Number of Units	Population (cap)	Accumulated Population (cap)	Peaking Factor	Area (ha)	Cumulative Area (ha)	Average Flow (L/s)			Peak Flow (L/s)			Proposed Sanitary Sewer							
												Development	Infiltration	Total	Development	Infiltration	Total	Sewer Length (m)	Sewer Slope (%)	Actual Sewer Diameter (mm)	Full Flow Velocity (m/s)	Full Flow Capacity (L/s)	Actual Velocity (m/s)	Calculated Sewer Diameter (mm)	Percentage of Full Flow Capacity (%)
41-43 Essa Road	201	C	Bldng	Commercial				0.0	2.00	0.11	0.11	0.04	0.01	0.05	0.07	0.01	0.08								
41-43 Essa Road		Bldng	SAN MH2	Residential	High	1276	2130.9	2130.9	3.56	1.79	1.90	5.58	0.19	5.77	19.85	0.19	20.04	7.1	2.0%	250	1.71	84.10	1.34	146	23.8%
41-43 Essa Road		SAN MH2	SAN MH1	Residential	High	0	0.0	2130.9	3.56	0.00	1.90	5.62	0.19	5.82	19.92	0.19	20.11	9.6	2.0%	250	1.71	84.10	1.34	146	23.9%
Essa Road	Ex	SAN MH1	8305	Residential	High	0	0.0	2130.9	3.56	1.79	3.69	5.66	0.19	5.82	19.92	0.19	20.11	58.1	1.1%	500	2.02	396.03	1.04	163	5.1%

Appendix D: Stormwater Management Calculations

TATHAM ENGINEERING

Modified Rational Method Calculation

Project Details

41-43 Essa Rd & 259 Innisfil St	421406

Prepared By

JLM	September 7, 2021

Municipality

City of Barrie

Pre-Development Analysis

Catchment ID:	101
Catchment Area (ha):	1.79
Runoff Coefficient:	0.89
Time of Concentration (mir	12.41

Post-Development Analysis

	Controlled	Uncontrolled
Catchment ID:		201
Catchment Area (ha):		1.79
Runoff Coefficient:		0.86
Time of Concentration (min):		12.41

Design Storm	2YR	5YR	10YR	25YR	50YR	100YR
A	678	854	976	1146	1236	1426
B	4.70	4.70	4.70	4.92	4.70	5.27
C	0.78	0.77	0.76	0.76	0.75	0.76
i (mm/hr)	74	97	113	132	147	161
Runoff C	0.89	0.89	0.89	0.98	1.00	1.00
Q (m^3/s)	0.33	0.43	0.50	0.64	0.73	0.80

	Design Storm	2YR	5YR	10YR	25YR	50YR	100YR
	i (mm/hr)	74	97	113	132	147	161
201	Runoff C	0.86	0.86	0.86	0.95	1.00	1.00
	Q (m^3/s)	0.32	0.41	0.48	0.62	0.73	0.80

Peak Runoff Rate (m^3/s) - Rational Method (Q=CiA/360)

Storm	$Q_{EXISTING}$	$Q_{NO\ CONTROLS}$	$Q_{UNCONTROLLED}$	$Q_{CONTROLLED}$	Q_{TOTAL}	$Q_{REDUCTION}$	
2YR	0.326	0.315	0.000	0.147	0.147	0.168	m^3/s
5YR	0.428	0.414	0.000	0.207	0.207	0.207	m^3/s
10YR	0.498	0.481	0.000	0.240	0.240	0.241	m^3/s
25YR	0.643	0.621	0.000	0.320	0.320	0.301	m^3/s
50YR	0.727	0.727	0.000	0.395	0.395	0.332	m^3/s
100YR	0.800	0.800	0.000	0.426	0.426	0.374	m^3/s

Required Storage Volumes (m^3) - Modified Rational Method ($V_p = Q_p \times D - Q_o \times ((D + t_c)/2)$)

Dur. (min)	2YR	5YR	10YR	25YR	50YR	100YR
5	70.5	83.7	96.9	117.1	127.9	140.0
10	114.0	139.8	162.8	202.3	223.6	250.2
15	133.2	164.2	191.9	240.0	264.0	298.9
20	140.9	173.7	203.6	255.1	278.4	318.0
25	142.3	174.6	205.5	257.1	277.7	320.0
30	139.5	170.1	200.9	250.7	267.3	310.8
35	133.8	161.8	191.8	238.5	250.0	293.8
40	126.1	150.6	179.4	221.8	227.6	271.0
45	116.8	137.3	164.5	201.8	201.4	243.8
50	106.2	122.2	147.6	179.1	172.0	213.1

TATHAM ENGINEERING

Visual OTTHYMO Model Parameter Calculations (NasHYD)

Project Details

41-43 Essa Road	421406

Prepared By

DJR	Sept 17 2021

Data Sources

Detailed Soil Survey Reports for Ontario, LSRCA Technical Guidelines for Stormwater Management Submissions (2016), MTO Drainage Management Manual (1997)

Pre-Development Condition

Watershed:	LSRCA
Catchment ID:	101
Catchment Area (ha):	1.79
Impervious %:	93%

Average Curve Number (CN), Runoff Coefficient (C) and Initial Abstraction (IA)

Soil Symbol		**Tis**											
Soil Series		Tioga											
Hydrologic Soils Group		A											
Soil Texture		Sand Loam											
Runoff Coefficient Type		1											
Area (ha)		1.79											
Percentage of Catchment		100%											
Land Cover Category	**IA**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**
Impervious	2	1.67	98	0.95									
Gravel	3		76	0.09									
Woodland	10		32	0.08									
Pasture/Lawns	5	0.12	49	0.10									
Meadows	8		38	0.09									
Cultivated	7		62	0.22									
Waterbody	12		50	0.05									
Average CN		94.72											
Average C		0.89											
Average IA		2.20											

Time to Peak Calculations

Max. Catchment Elev. (m):	228.26
Min. Catchment Elev. (m):	226.75
Catchment Length (m):	215
Catchment Slope (%):	0.70%
Method: Bransby-Williams Formula	
Time of Concentration (mins):	12.41

Summary

Catchment CN:	94.7
Catchment C:	0.89
Catchment IA (mm):	2.20
Time of Concentration (hrs):	0.21
Catchment Time to Peak (hrs):	0.14
Catchment Time Step (mins):	1.65

TATHAM ENGINEERING

Visual OTTHYMO Model Parameter Calculations (NasHYD)

Project Details

41-43 Essa Road	421406

Prepared By

DJR	Sept 17 2021

Data Sources

Detailed Soil Survey Reports for Ontario, LSRCA Technical Guidelines for Stormwater Management Submissions (2016), MTO Drainage Management Manual (1997)

Post Development Condition

Watershed:	LSRCA
Catchment ID:	201
Catchment Area (ha):	1.79
Impervious %:	90%

Average Curve Number (CN), Runoff Coefficient (C) and Initial Abstraction (IA)

Soil Symbol		**Tis**											
Soil Series		Tioga											
Hydrologic Soils Group		A											
Soil Texture		Sand Loam											
Runoff Coefficient Type		1											
Area (ha)		1.79											
Percentage of Catchment		100%											
Land Cover Category	**IA**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**	**A (ha)**	**CN**	**C**
Impervious	2	1.60	98	0.95									
Gravel	3		76	0.09									
Woodland	10		32	0.08									
Pasture/Lawns	5	0.19	49	0.10									
Meadows	8		38	0.09									
Cultivated	7		62	0.22									
Waterbody	12		50	0.05									
Average CN		92.80											
Average C		0.86											
Average IA		2.32											

Time to Peak Calculations

Max. Catchment Elev. (m):	228.26
Min. Catchment Elev. (m):	226.75
Catchment Length (m):	215
Catchment Slope (%):	0.70%
Method: Bransby-Williams Formula	
Time of Concentration (mins):	12.41

Summary

Catchment CN:	92.8
Catchment C:	0.86
Catchment IA (mm):	2.32
Time of Concentration (hrs):	0.21
Catchment Time to Peak (hrs):	0.14
Catchment Time Step (mins):	1.65

TATHAM ENGINEERING	Project :	41-43 Essa Roadd	Designed By:	DJR
	File:	421406	Checked By:	
	Municipality:	City of Barrie	Date:	2021-09-08

Proposed SWM Facility Preliminary Volume Table

Active Pool	StormTank
Side Slopes	0
Bottom Elev.	224.03
Modeule Footprint (m^2)	370.00
Void Ratio	0.97

Water Level Elev.	**Depth**	**Areas**		**Storage**	
(m)	**(m)**	**Area (m^2)**	**Avg. Area (m^2)**	**Stage (m^3)**	**Cumulative Total (m^3)**
224.03	0.00	**System Invert**		0.0	0.0
224.08	0.05			17.85	17.9
224.13	0.10			17.85	35.7
224.18	0.15			17.85	53.6
224.23	0.20			17.85	71.4
224.28	0.25			17.85	89.3
224.33	0.30			17.85	107.1
224.38	0.35			17.85	125.0
224.43	0.40			17.85	142.8
224.48	0.45			17.85	160.7
224.53	0.50			17.85	178.5
224.58	0.55			17.85	196.4
224.63	0.60			17.85	214.2
224.68	0.65			17.85	232.1
224.73	0.70			17.85	249.9
224.78	0.75			17.85	267.8
224.83	0.80			17.85	285.6
224.88	0.85			17.85	303.5
224.93	0.90	**Top of Module**		17.85	321.3

Note: Volume estimated based on StormTank Module 20 (Model 2036)

TATHAM ENGINEERING	Project:	41-43 Essa Road	Designed By:	DJR
	File:	421406	Checked By:	NM
	Municipality:	City of Barrie	Date:	2021-09-08

Proposed SWM Facility Preliminary Discharge Table

ORIFICE CONTROL #1
Orifice Plate

diameter =	490	mm
area =	0.1886	m^2
Orifice C =	0.63	
Invert =	224.03	m

WEIR CONTROL
Overflow Weir

Length of Weir	N/A	m
Weir Sill Elevation	N/A	m
Weir constant K	1.6	
Side Slope (H:V)	4	

Orifice Equation $Q = C \times A \times (2gH)^{0.5}$

where
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Weir Equation $Q = K \times L \times H^{1.5}$

where
Q = flow rate (cms)
K = constant
L = length (m)
H = head on the weir (m)

Water Level	Orifice Plate		Emergency Spillway		Hydraulic Control	Total Discharge
	Head	Discharge	Head	Discharge		
(m)	(m)	(m^3)	(m)	(m^3)		(cms)
224.03	0.00	0.000	0.00	0.0000	**Orifice Plate**	0.000
224.08	0.05	0.002	0.00	0.0000	**Orifice Plate**	0.002
224.13	0.10	0.010	0.00	0.0000	**Orifice Plate**	0.010
224.18	0.15	0.024	0.00	0.0000	**Orifice Plate**	0.024
224.23	0.20	0.042	0.00	0.0000	**Orifice Plate**	0.042
224.28	0.25	0.064	0.00	0.0000	**Orifice Plate**	0.064
224.33	0.30	0.090	0.00	0.0000	**Orifice Plate**	0.090
224.38	0.35	0.118	0.00	0.0000	**Orifice Plate**	0.118
224.43	0.40	0.147	0.00	0.0000	**Orifice Plate**	0.147
224.48	0.45	0.177	0.00	0.0000	**Orifice Plate**	0.177
224.53	0.50	0.207	0.00	0.0000	**Orifice Plate**	0.207
224.58	0.55	0.236	0.00	0.0000	**Orifice Plate**	0.236
224.63	0.60	0.264	0.00	0.0000	**Orifice Plate**	0.264
224.68	0.65	0.291	0.00	0.0000	**Orifice Plate**	0.291
224.73	0.70	0.316	0.00	0.0000	**Orifice Plate**	0.316
224.78	0.75	0.374	0.00	0.0000	**Orifice Plate**	0.374
224.83	0.80	0.392	0.00	0.0000	**Orifice Plate**	0.392
224.88	0.85	0.409	0.00	0.0000	**Orifice Plate**	0.409
224.93	0.90	0.426	0.00	0.0000	**Orifice Plate**	0.426

TATHAM ENGINEERING	Project:	41-43 Essa Road	Designed By:	DJR
	File:	421406	Checked By:	NM
	Municipality:	City of Barrie	Date:	2021-09-08

Proposed SWM Facility Preliminary Stage-Storage-Discharge Table

Water Level	PIPE FLOW	WEIR FLOW			
	Orifice Plate Discharge	Overflow Discharge	Hydraulic Control	Total Discharge	Total Storage
(m)	(m^3/s)	(m^3/s)		(m^3/s)	(m^3)
224.03	0.0000	0.0000	Orifice Plate	**0.000**	0.0
224.08	0.0023	0.0000	Orifice Plate	**0.002**	17.9
224.13	0.0103	0.0000	Orifice Plate	**0.010**	35.7
224.18	0.0236	0.0000	Orifice Plate	**0.024**	53.6
224.23	0.0419	0.0000	Orifice Plate	**0.042**	71.4
224.28	0.0643	0.0000	Orifice Plate	**0.064**	89.3
224.33	0.0899	0.0000	Orifice Plate	**0.090**	107.1
224.38	0.1178	0.0000	Orifice Plate	**0.118**	125.0
224.43	0.1471	0.0000	Orifice Plate	**0.147**	142.8
224.48	0.1771	0.0000	Orifice Plate	**0.177**	160.7
224.53	0.2069	0.0000	Orifice Plate	**0.207**	178.5
224.58	0.2360	0.0000	Orifice Plate	**0.236**	196.4
224.63	0.2642	0.0000	Orifice Plate	**0.264**	214.2
224.68	0.2910	0.0000	Orifice Plate	**0.291**	232.1
224.73	0.3163	0.0000	Orifice Plate	**0.316**	249.9
224.78	0.3740	0.0000	Orifice Plate	**0.374**	267.8
224.83	0.3920	0.0000	Orifice Plate	**0.392**	285.6
224.88	0.4093	0.0000	Orifice Plate	**0.409**	303.5
224.93	0.4259	0.0000	Orifice Plate	**0.426**	321.3

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Saturday, July 31, 2021
Project Name	41-43 Essa Rd. and 259 Innisfil St.
Project Number	
Location	Barrie

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.
Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF8-6-2 is recommended to meet the water quality objective by treating a flow of 35.3 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 398 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF8-6-2	6	2	2.4	35.3	398

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

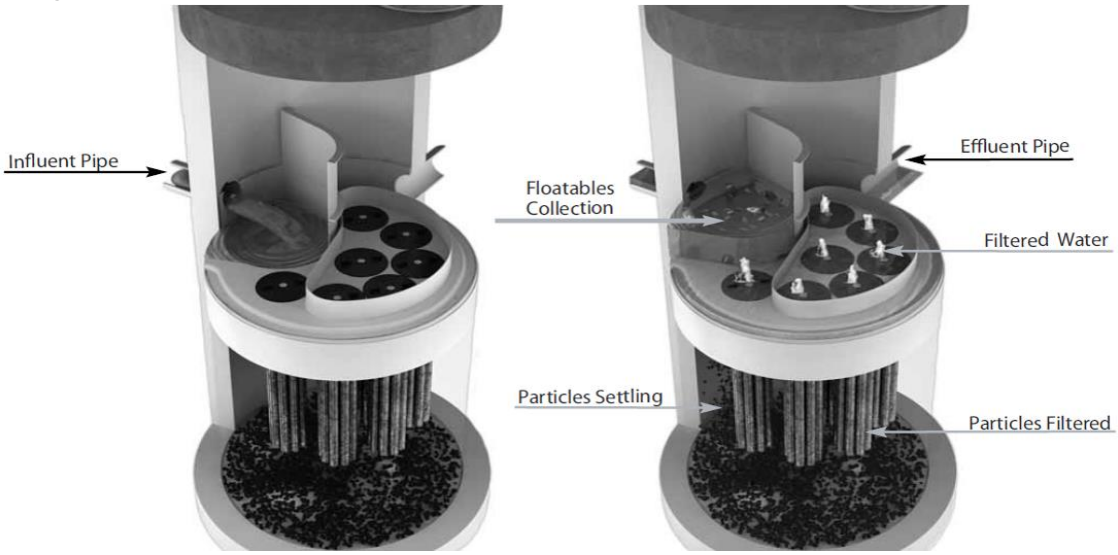
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 59%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Saturday, July 31, 2021
Project Name:	41-43 Essa Rd. and 259 Innisfil St.
Project Number:	
Location:	Barrie

Designer Information

Company:	Tatham Engineering Ltd.
Contact:	David Reid
Phone #:	(705) 323-2859

Notes

Rainfall

Name:	BARRIE WPCC
State:	ON
ID:	557
Record:	1968 to 2003
Co-ords:	44°23'N, 79°41'W

Drainage Area

Total Area:	1.79 ha
Imperviousness:	75.98%

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 36 years of BARRIE WPCC rainfall data:	**35.2 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 3970 m³, with a suspended sediment concentration of 60 mg/L.	**238 kg**

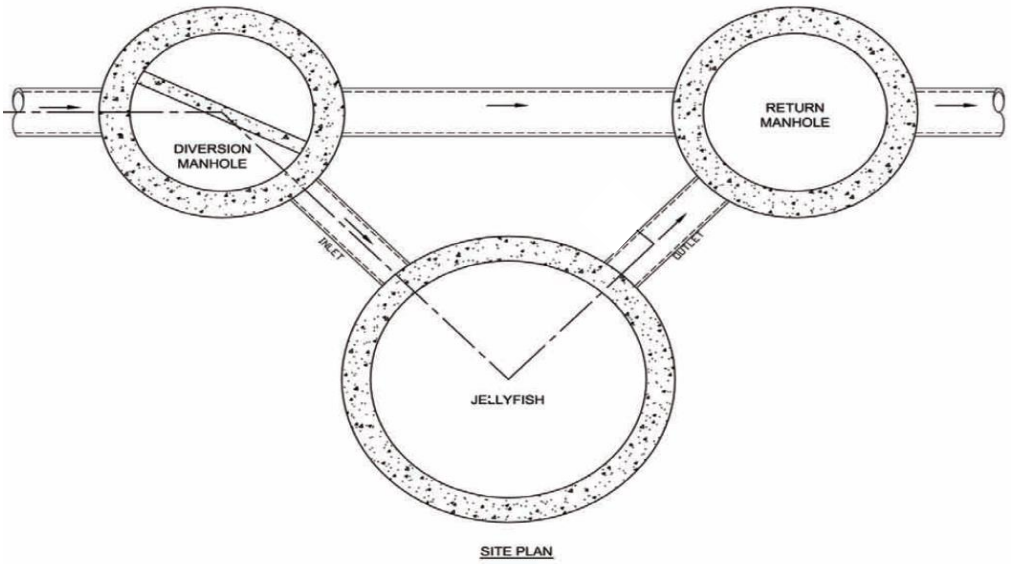
Recommendation

The Jellyfish Filter model JF8-6-2 is recommended to meet the water quality objective by treating a flow of 35.3 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 36 years of BARRIE WPCC rainfall data for this site. This model has a sediment capacity of 398 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	2313	0.34	379	7.6	85
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	**6**	**2**	**2.4**	**9252**	**1.42**	**1469**	**35.3**	**398**
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	62º	150	200
1.8	59º	200	250
2.4	**52º**	**250**	**300**
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 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 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 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's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 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.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 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.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck 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 (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges 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) 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 design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. 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.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear 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.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump 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 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

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.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER 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.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS 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.

2.9 STEPS 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.

2.10 INSPECTION 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.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - 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.

3.1.4 Bypass - 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 avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - 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%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - 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 d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - 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%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 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.

3.3.2 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).

3.3.3 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.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 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.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable 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.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

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.

4.1.1.1 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

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes 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.

4.1.5 Frame and Cover Installation 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.

4.2 MAINTENANCE ACCESS WALL
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.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's 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.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION 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.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 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.

5.3 REPLACEMENT FILTER CARTRIDGES 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

Appendix E:
Phosphorous Budget Calculations

TATHAM ENGINEERING

PROJECT	41-43 Essa Road & 259 Innisfil Street	FILE	421406
		DATE	2021-09-14
SUBJECT	Phosphorus Budget Assessment	DESIGNED	DJR/JLM
		CHECKED	NM

Phosphorus Loading

			Existing		Proposed	
LAND USE CATEGORY	Existing Phosphorous Loading Rate (kg/ha/year)	Future Phosphorous Loading Rate (kg/ha/year)	Existing Area (ha)	Existing Phosphorous Loading (kg/year)	Area (ha)	Phosphorous Load (kg/year)
Cropland	0.19	0.19	0.00	0.00	0.00	0.00
Hay-Pasture	0.07	0.07	0.00	0.00	0.00	0.00
Turf-Sod	0.12	0.12	0.00	0.00	0.00	0.00
High Intensity Development - C/I	1.82	1.82	1.79	3.26	0.00	0.00
High Intensity Development - R	1.32	1.32	0.00	0.00	1.79	2.36
Low Intensity Development	0.13	0.13	0.00	0.00	0.00	0.00
Quarry	0.08	0.08	0.00	0.00	0.00	0.00
Unpaved Road	0.83	0.83	0.00	0.00	0.00	0.00
Forest	0.05	0.05	0.00	0.00	0.00	0.00
Transition	0.06	0.06	0.00	0.00	0.00	0.00
Wetland	0.05	0.05	0.00	0.00	0.00	0.00
Open Water	0.26	0.26	0.00	0.00	0.00	0.00
Total			1.79	3.26	1.79	2.36

Controls

	Removal Efficiency (%)		Proposed	
Area contributing to Infiltration control	Underground Storage	Jellyfish Filter	Area (ha)	Phosphorous Load (kg/year)
High Intensity Development - Residential	25%	59%	1.79	0.73
Total Phosphorous (No Controls)				2.36
Total Phosphorous (With Controls)				0.73

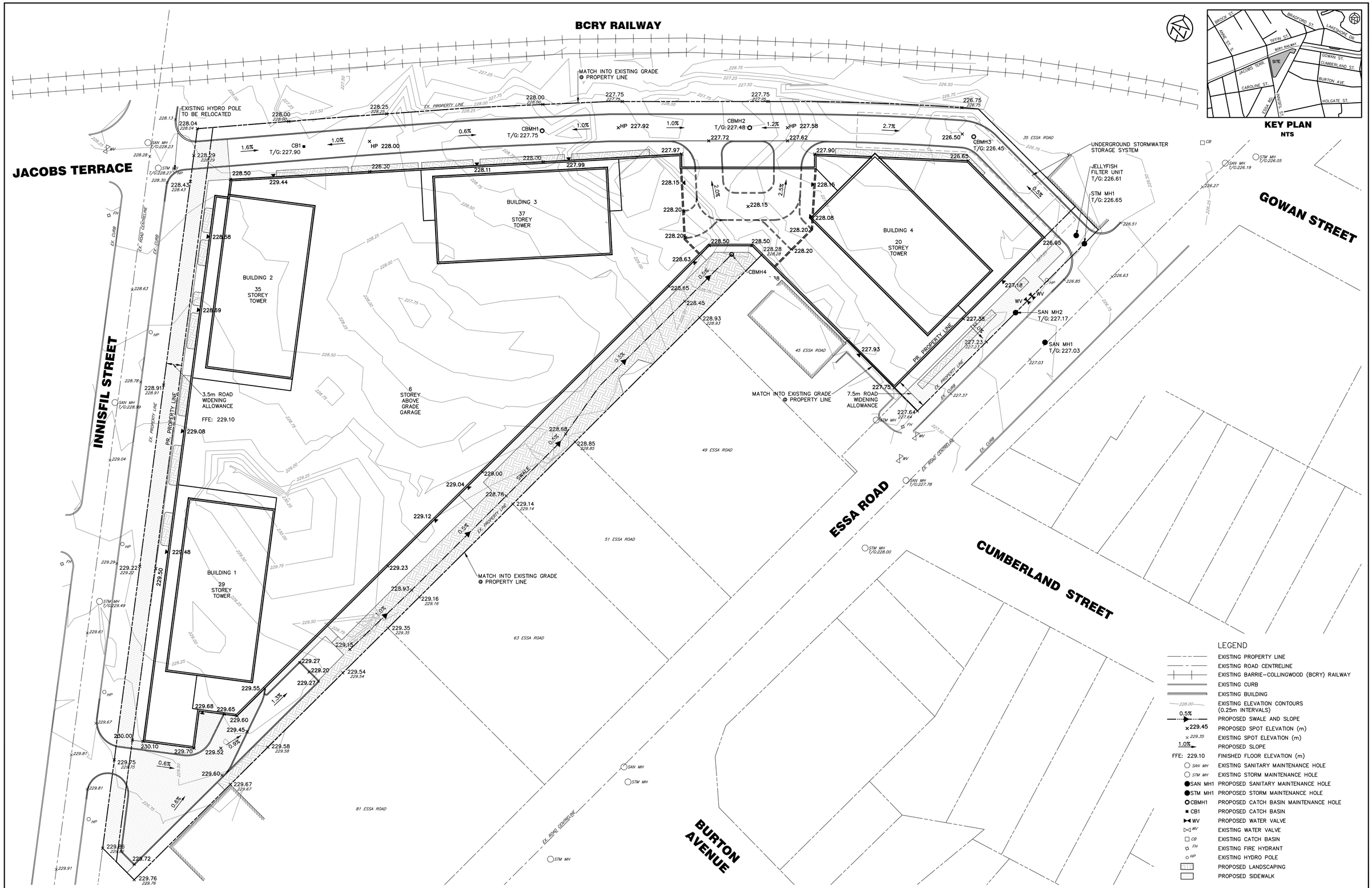
Summary

Existing Phosphorous Load	3.26	kg/year
Post Development Phosphorous Load (no controls)	2.36	kg/year
Decrease	0.90	kg/year
Post Development Phosphorous Load (with controls)	0.73	kg/year

Phosphorous Offsetting Policy

Post Development Phosphorous Load (with controls)	0.73	kg/year
Offset Calculation (2.5 * P deficit * $35,000)	**$ 63,574.09**	

Appendix F: Drawings



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BENCHMARKS

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE RELATED TO CITY OF BARRIE BENCHMARK No. 03120080023, HAVING AN ELEVATION OF 226.540 METRES.

DRAWING REFERENCES

SITE PLAN PREPARED BY ARCHITECTURE UNFOLDED DATED SEPTEMBER 7, 2021.

TOPOGRAPHIC SURVEY COMPLETED BY KRCMAR DATED MAY 4, 2021.

No.	REVISION DESCRIPTION	DATE
0.	ISSUED FOR CLIENT REVIEW	AUG 6/21
1.	ISSUED FOR ZBA (FIRST SUBMISSION)	SEP 17/21

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
D. J. REID
100225660
SEPT 17/21
PROVINCE OF ONTARIO

41-43 ESSA RD. & 259 INNISFIL ST.

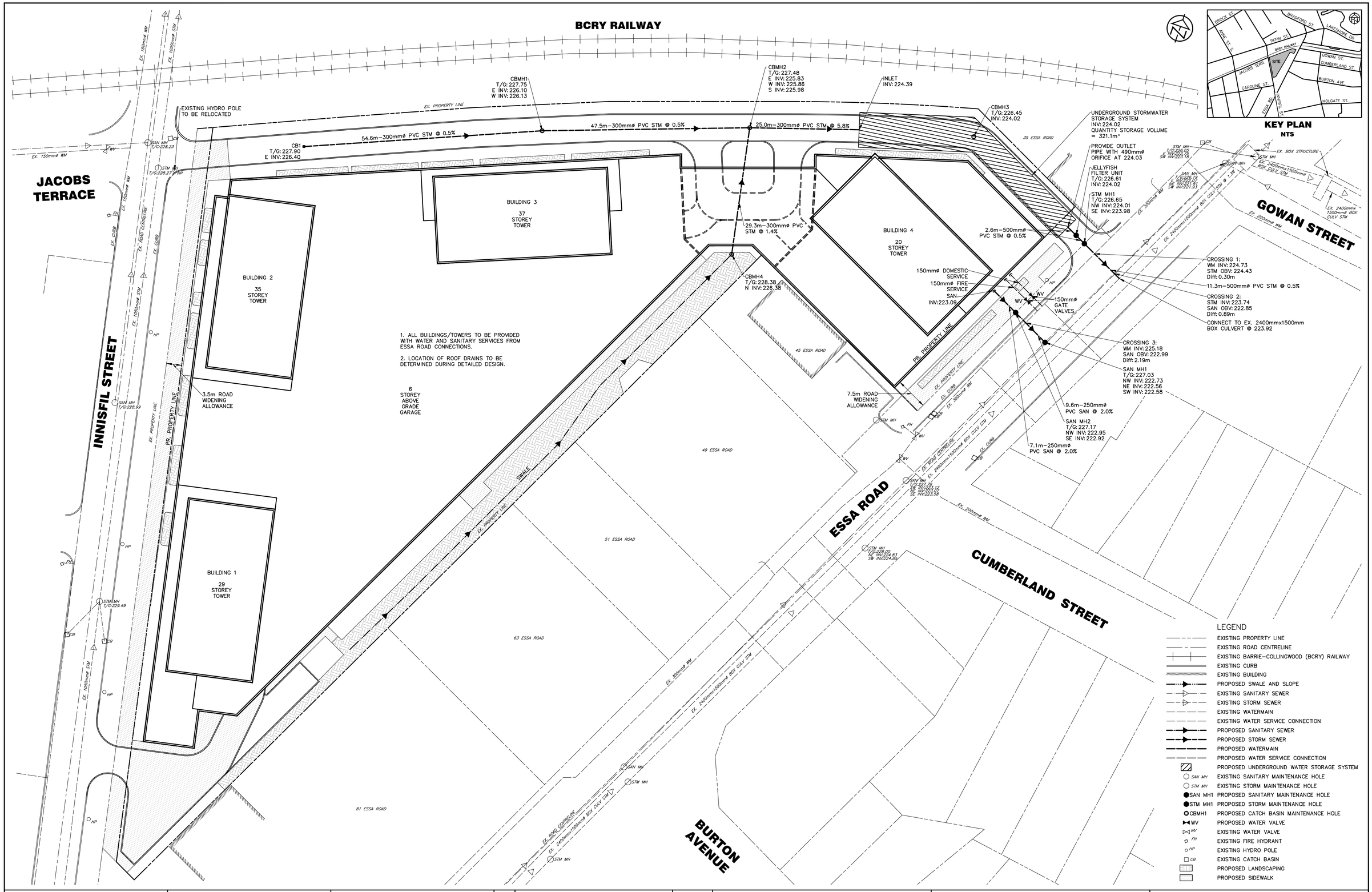
CITY OF BARRIE

PRELIMINARY SITE GRADING PLAN

TATHAM ENGINEERING

DESIGN: DJR	FILE: 421406	DWG: SG-1
DRAWN: JLM	DATE: JUN 2021	
CHECK: NM	SCALE: 1:400	

Drawing Name: 421406-SG01.dwg, Plotted: Sep 17, 2021



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No.	REVISION DESCRIPTION	DATE
0.	ISSUED FOR CLIENT REVIEW	AUG 6/21
1.	ISSUED FOR ZBA (FIRST SUBMISSION)	SEP 17/21

ENGINEER STAMP

LICENSED PROFESSIONAL ENGINEER
D. J. REID
100225660
SEPT 17/21
PROVINCE OF ONTARIO

41-43 ESSA RD. & 259 INNISFIL ST.
CITY OF BARRIE

PRELIMINARY SITE SERVICING PLAN

TATHAM ENGINEERING

DESIGN: DJR	FILE: 421406	DWG: SS-1
DRAWN: JLM	DATE: JUN 2021	
CHECK: NM	SCALE: 1:400	

Drawing Name: 421406-SS01.dwg, Plotted: Sep 17, 2021

BCRY RAILWAY

JACOBS TERRACE

GOWAN STREET

CUMBERLAND STREET

ESSA ROAD

INNISFIL STREET

EX. PROPERTY LINE

35 ESSA ROAD

45 ESSA ROAD

49 ESSA ROAD

51 ESSA ROAD

63 ESSA ROAD

81 ESSA ROAD

41–43 ESSA ROAD & 259 INNISFIL STREET

101
1.79 | 0.89

EX. BUILDING

EX. 600mmø STM

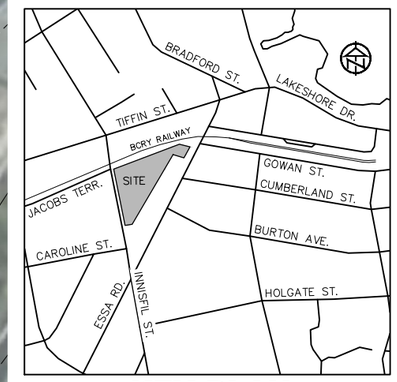
EX. 1050mmø STM

EX. 2400mmx1500mm BOX CULV STM

STM MH

CB

227.00 227.50 226.50 228.00 228.50 229.00 229.50



KEY PLAN
NTS

LEGEND

280.00 — EXISTING ELEVATION CONTOURS (0.50 m INTERVALS)

EXISTING CONDITIONS OVERLAND FLOW DIRECTION

PRE–DEVELOPMENT CATCHMENT BOUNDARY

101 — PRE–DEVELOPMENT CATCHMENT ID

1.79 | 0.89 — RUNOFF COEFFICIENT

PRE–DEVELOPMENT CATCHMENT AREA (ha)

EXISTING STORM SEWER

TATHAM ENGINEERING

41-43 ESSA ROAD & 259 INNISFIL STREET
CITY OF BARRIE
PRE-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-1**

SCALE: 1:750	DRAWN: JLM	DATE: JUL/21	JOB NO. 421406

Drawing Name: 421406–DP01.dwg, Plotted: Sep 16, 2021

BCRY RAILWAY

JACOBS TERRACE

INNISFIL STREET

ESSA ROAD

GOWAN STREET

EX. 1050mmø STM

EX. PROPERTY LINE

PR. PROPERTY LINE

EX. 600mmø STM

EX. 2400mmx1500mm BOX CULV STM

BUILDING 1
29 STOREY TOWER

BUILDING 2
35 STOREY TOWER

BUILDING 3
37 STOREY TOWER

BUILDING 4
20 STOREY TOWER

UNDERGROUND STORMWATER STORAGE SYSTEM

6 STOREY ABOVE GRADE GARAGE

201
1.79 | 0.86

41–43 ESSA ROAD & 259 INNISFIL STREET

35 ESSA ROAD

45 ESSA ROAD

49 ESSA ROAD

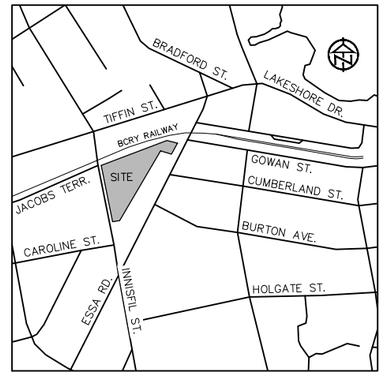
51 ESSA ROAD

63 ESSA ROAD

81 ESSA ROAD

227.50 227.00 226.50 228.00 228.50 229.00 227.50 229.00 229.50 230.00 229.50 229.50 229.00 228.50 228.00 227.00 226.50 227.00

CB STM MH



KEY PLAN
NTS

LEGEND

- 228.00 — EXISTING ELEVATION CONTOURS (0.50 m INTERVALS)
- EXISTING CONDITIONS OVERLAND FLOW DIRECTION
- PROPOSED CONDITIONS OVERLAND FLOW DIRECTION
- POST–DEVELOPMENT CATCHMENT BOUNDARY
- 201 — POST–DEVELOPMENT CATCHMENT ID
- 1.79 | 0.86 — RUNOFF COEFFICIENT / POST–DEVELOPMENT CATCHMENT AREA (ha)
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- PROPOSED SWALE

TATHAM ENGINEERING

41-43 ESSA ROAD & 259 INNISFIL STREET
CITY OF BARRIE
POST-DEVELOPMENT DRAINAGE PLAN

DWG. No. **DP-2**

SCALE: 1:750	DRAWN: JLM	DATE: JUL/21	JOB NO. 421406

Drawing Name: 421406–DP02.dwg, Plotted: Sep 16, 2021