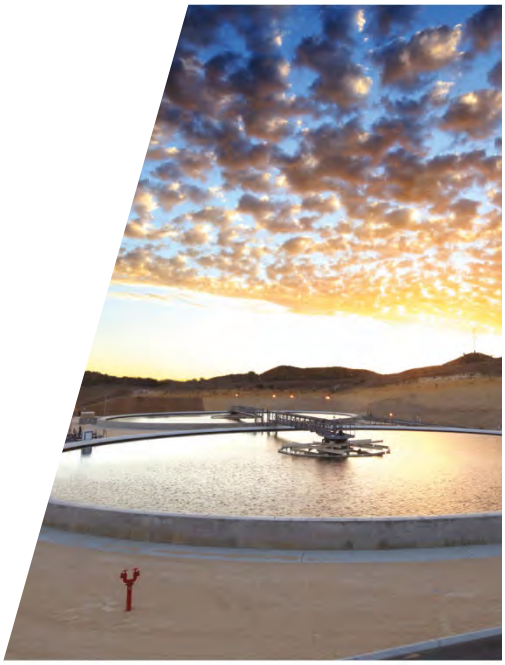


Better Living Retirement Residence

Functional Servicing and Stormwater Management Report
441 Maple Avenue









City of Burlington

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Preliminary Site Grading & Servicing Plan (SG-1) ..... Rear Pocket

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Appendix E	Pre-Consultation Meeting Notes

1. Introduction

GHD Limited has been retained by Better Living Retirement Residence Inc., to prepare a Functional Servicing and Stormwater Management Report in support of a re-zoning application for the proposed development located at 441 Maple Avenue, City of Burlington and Region of Halton.

The Site is a 0.29 ha parcel bounded by Brock Avenue to the north, an 11-storey apartment building to the east, a 6-storey apartment building to the west, and Maple Avenue to the south. Refer to the attached Location Plan in Figure 1.

The site is currently occupied by a 2-storey Retirement Development. The Owner is proposing to re-develop the property by constructing an 11-storey residential building comprising of 153 units and 3 levels of underground parking. The proposed Site Plan is shown on Figure 2.

This Functional Servicing and Stormwater Management Report (FSR) supports the Re-Zoning Application and subsequent Site Plan and Building Permit Applications for the proposed development of the Site.

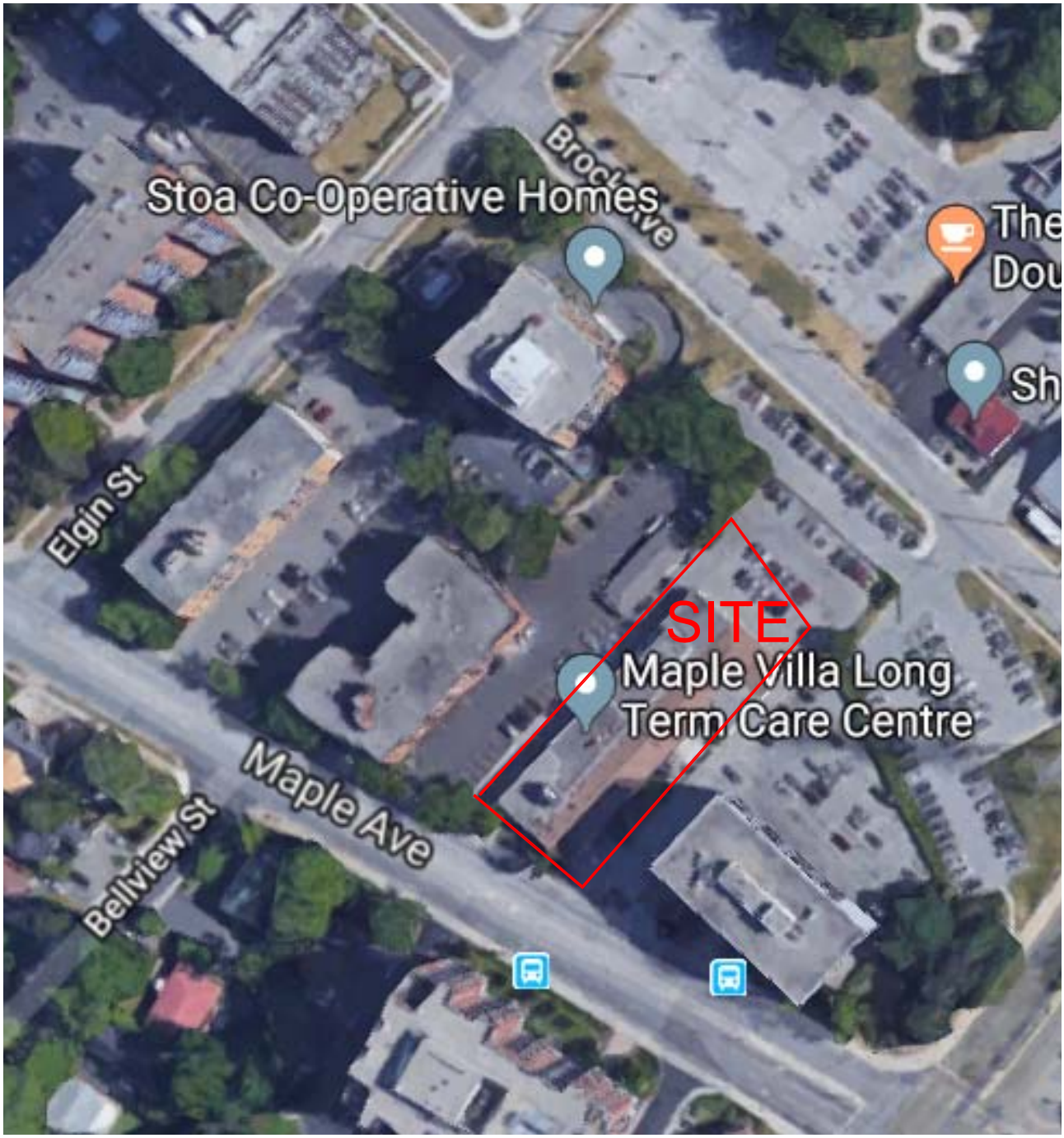
The proposed servicing plan requires connections to the City of Burlington and Region of Halton servicing infrastructure, and as such this Report will address the engineering requirements for these connections.

2. Objectives

The objectives of this Functional Servicing and Stormwater Management Report are to:

- Confirm the location of existing infrastructure both internal and adjacent to the subject site.
- Evaluate and confirm adequate elevations for connection to the existing sanitary sewer.
- Water pressure analysis (hydrant flow test) has not been completed as we understand that Halton Region has recently constructed a new 300 mm diameter watermain on Maple Ave and once the 300 mm diameter watermain is functional, a hydrant flow test will be completed.
- Evaluate possible stormwater management designs, to ensure the required post-development runoff rates and quality controls are met.

All of the above will be done in accordance with accepted engineering practices and as per the City of Burlington and the Region of Halton Standards.



N

441 MAPLE AVENUE, BURLINGTON

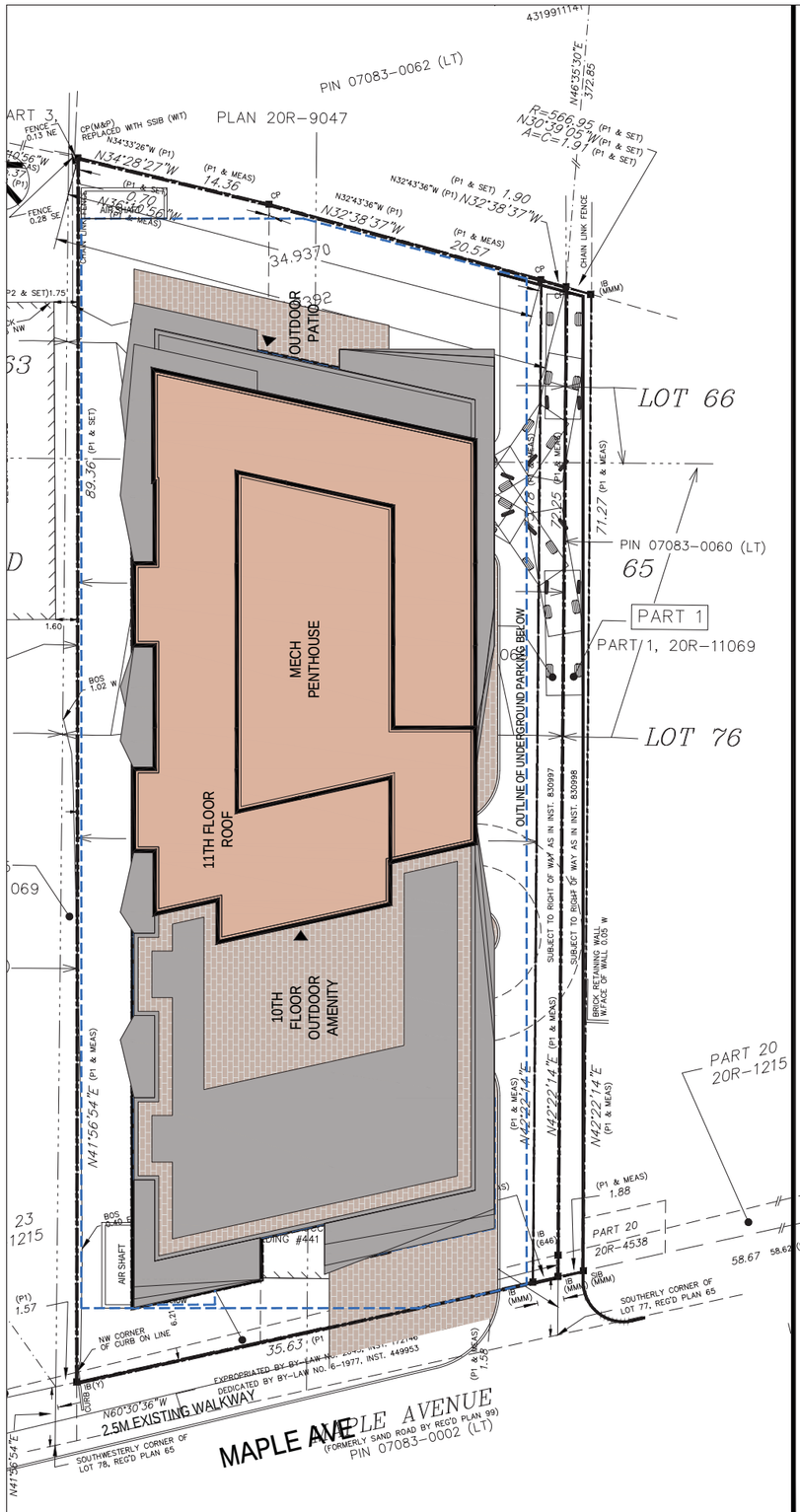
LOCATION PLAN

Job Number	11180500
Revision	A
Date	OCT, 2018

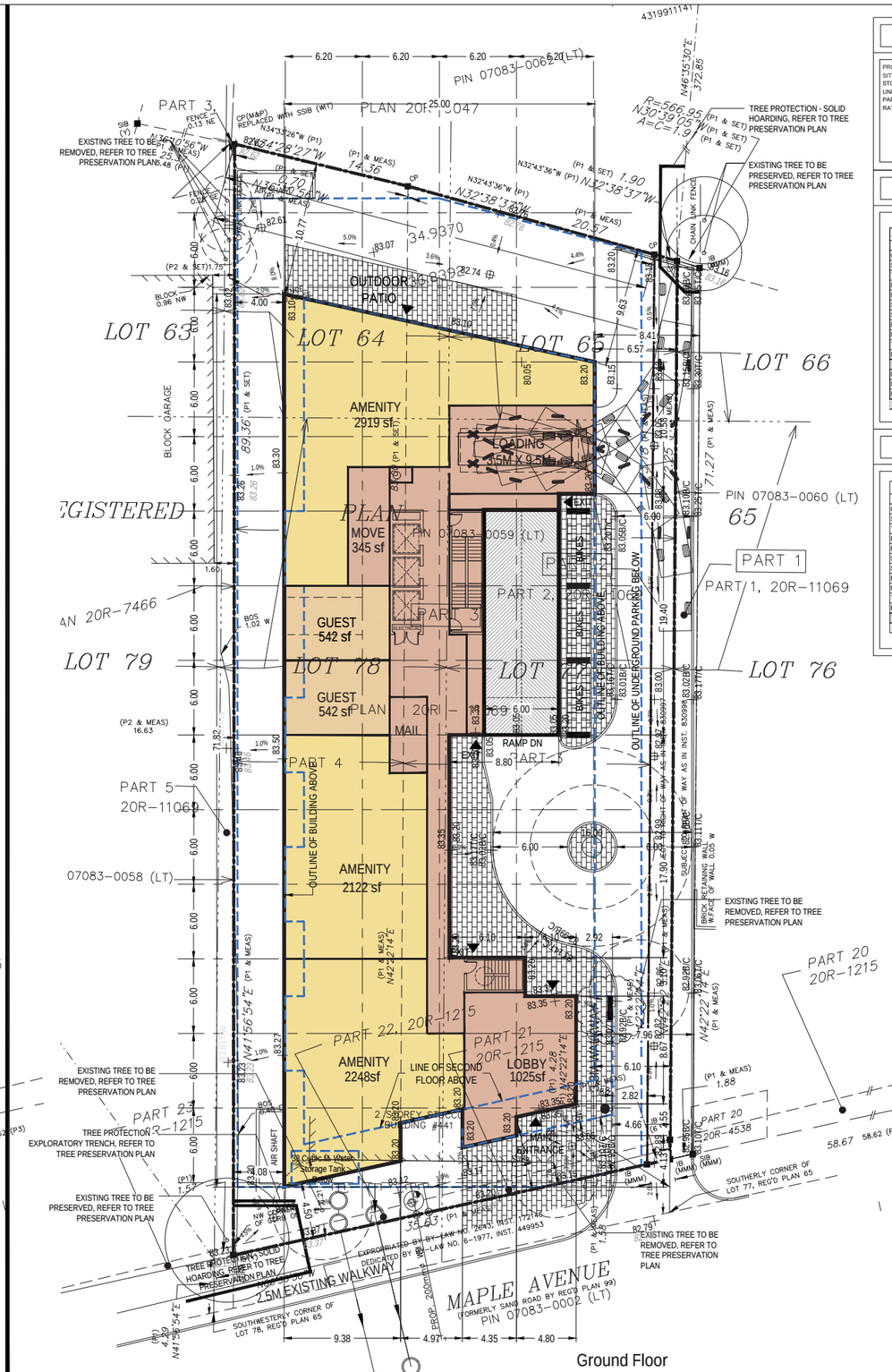
Figure 1

6705 MILLCREEK DRIVE UNIT 1 MISSISSIAUGA ON, L5N 5M4 T 1 416 213 7121 F 1 905 890 8499 E ytomall@ghd.com W www.ghd.com

Plot Date: 8 November 2018 - 3:31 PM Plotted by: Muhammad Paracha
Cad File No: N:\CA\Mississauga\Projects\111\11180500\CADD\Drawings\Civil\Figure 1.dwg



ROOF PLAN - 1:200



SITE PLAN SHOWING GROUND FLOOR - 1:200

Ground Floor
Area: 1230 sm

SITE STATISTICS

PROPOSED USE:	Multi - Residential
SITE AREA:	0.28 HA (2,863.19 sm)
STOREYS:	11 Storeys
UNITS	153 Units
PARKING:	164 Cars
RATIO:	1.17

AREA CALCULATION

AREA BREAK DOWN PER FLOOR

	AREA (SQ.M)	AREA (SQ.FT)
Ground Floor	1,230	13,240
Second Floor	1,507	16,220
Third Floor	1,507	16,220
Forth Floor	1,507	16,220
Fifth Floor	1,507	16,220
Sixth Floor	1,507	16,220
Seventh Floor	1,507	16,220
Eighth Floor	1,507	16,220
Ninth Floor	1,507	16,220
Tenth Floor	866	9,322
Eleventh Floor	866	9,322
TOTAL AREA ABOVE GRADE:	15,018	161,644
P1	2,540	27,287
P2	2,540	27,287
P3	2,540	27,287
TOTAL AREA BELOW GRADE:	7,620	81,861

UNIT COUNT

UNIT BREAK DOWN PER FLOOR

	1 BED	1 BED + D	2 BED	3 BED	TOTAL
Ground Floor	-	-	-	-	-
Second Floor	3	7	4	3	17
Third Floor	3	7	4	3	17
Forth Floor	3	7	4	3	17
Fifth Floor	3	7	4	3	17
Sixth Floor	3	7	4	3	17
Seventh Floor	3	7	4	3	17
Eighth Floor	3	7	4	3	17
Ninth Floor	3	7	4	3	17
Tenth Floor	3	-	4	1	8
Eleventh Floor	3	-	4	2	9
TOTAL UNITS:	30	56	40	27	153
PERCENTAGE:	20%	37%	26%	17%	100%

MSAi
MICHAEL SPAZIANI ARCHITECT INC
6 Helene Street N, Suite 100
Port Credit, Mississauga ON L5G 3B2
t 905 891 0691 f 905 891 0514

ONTARIO ASSOCIATION OF ARCHITECTS
MICHAEL SPAZIANI
LICENCE 9431

NO:	REVISIONS:	ISSUED:
6		
5		
4		
3		
2		
1	Issued for OPA / ZBA	Dec 07, '18

NOTE: This drawing is the property of the Architect and may not be reproduced or used without the expressed consent of the Architect. The contractor is to verify all dimensions and conditions on the project and to report any discrepancies to the Architect prior to commencing work. These drawings are not to be used for construction purposes unless indicated as "issued for construction".

CLIENT:
Better Life Retirement Residence Inc.

PROJECT:
441 Maple Street

Burlington, ON

SHEET TITLE:
Proposed Site Plan

PROJECT NO.
C6075

SCALE: 1:200	DATE: Nov, '18
DRAWN: msai	SHEET NO:
CHECKED: ms	
FILE NO.	

Figure 2

3. Grading

The property has a high elevation located towards the middle which splits the drainage into two catchments: one to the south (Maple Avenue) and the other to the north which will drain to other lands owned by the Client.

The existing overland fall of the land varies between 0.3 m and 0.75 m. The maximum slope is approximately 0.5 percent. It is proposed to maintain the existing grading as much as possible. Stormwater runoff will be collected and directed southward towards Maple Avenue.

All existing elevations surrounding the property have been maintained. In addition, the proposed grading design [Site Grading Plan (SG-1)] ensures that no negative impacts will occur to the neighbouring properties.

4. Water Servicing

The water distribution approach for the proposed development follows the latest Region of Halton design requirements and connects to the existing watermain located on Maple Avenue. On the west side of the Site adjacent to Maple Avenue a new 200 mm fire connection to the existing 300 mm watermain is proposed. A 150 mm ø domestic line will connect to this fire line. These two new fire and domestic connections will service the proposed development. The existing water service is shown to be removed to the property line and then abandoned as per Region of Halton standards.

Further details of the water connections are shown in the 'Site Servicing Plan SS-1'.

The fire line will be connected to the sprinkler mechanical room located within the proposed building underground structure adjacent to Maple Avenue Road.

4.1 Calculation of Domestic Demand

The domestic water demand for the site has been calculated as per the Region's 2017 Water and Wastewater Linear Design Manual where the water consumption rate is specified as 275 L/capita/day.

The estimated domestic demand for the proposed development has been determined as follows:

Total number of people = 230 from Appendix C (using 2017 Development Change Background Study)

Average Day Flow = 275 ℓ/cap/day x 230 persons = 0.7 L/s per Region and MOE Standards

Maximum Day Flow = 2.25 x Average Day = 1.6 L/s

Peaking Factor = 4.0 from Appendix C per Calculations

Peak Hour Flow = 4.00 x Average Day = 2.9 L/s

4.2 Calculation of Fire Demand

Based on the proposed site plan, the 11-storey residential building will have protected openings (as defined by the Fire Underwriters Survey). It is also assumed that the proposed building will be constructed with fire resistive material. Given the above, the estimated fire flow required is given by the following formula (as based on the Fire Underwriters Survey):

F = 220 * C * A^0.5

For a building with non-combustible construction, C = 0.8.

For fire resistive buildings with adequately protected vertical openings, 'A' is taken as the area of the largest floor plus 25 percent of each of the two immediately adjoining floors.

As such, A = 2,157 m^2

Therefore, F = 8,000 L/min

As development will have a non-combustible occupancy, the fire flow can be reduced by 25 percent; thus, F = 6,000 L/min.

The development will be equipped with an automatic sprinkler system, so the fire flow may be reduced by 30 percent or 1,800 L/min.

Finally, the fire flow will be increased by 45 percent due to exposure to structures on three sides of the building, one between 3.1–10 m, another between 10.1–20 m, and the last between 20.1–30 m.

Thus, F = 6,900 L/min

Fire demand has been rounded to the nearest 1,000 L/min as per Fire Underwriters Survey (FUS), thus total fire demand is F = 7,000 L/min

Our calculations are included in Appendix B at the back of this report.

There is a new 300 mm ø watermain installed on Maple Avenue. It is believed that the additional increase in water demand for the fire protection of the larger proposed 11-storey building can be easily accommodated by this new 300 mm ø watermain. The need for a hydrant flow test to verify pressures is still to be determined through discussions with the Region of Halton.

5. Sanitary Servicing

5.1 Existing Conditions

As shown in the Site Servicing Plan (SS-1) located at the back of the report, an existing 825 mm ø sanitary trunk sewer is located on Maple Avenue adjacent to the Site. The sanitary trunk sewer currently conveys sewage southerly along Maple Avenue toward Lakeshore Road.

Record drawings show the existing sanitary service connecting to the existing 825 mm ø sanitary trunk sewer on Maple Avenue as shown in Site Servicing Plan (SS-1). The diameter of the existing sanitary sewer is unknown at this time.

After reviewing the existing demands from the current development using the Regional Municipality of Halton's *Water and Wastewater Linear Design Manual,* the proposed peak sewage flows were calculated. Below is the existing calculated flow from the site:

- 0.41 L/s peak sanitary flow to the Maple Avenue trunk sewer.

Refer to Appendix C for the sanitary flow calculations of existing site.

5.2 Proposed Conditions

The proposed sanitary service connection for the proposed 11-storey building is intended to connect to the existing 825 mm ø trunk sewer along Maple Avenue as shown in Site Servicing Plan (SS-1). The domestic flow for the overall development was calculated for an equivalent population of 230 people. Below is the calculated peak flow for the proposed development:

- 3.10 L/s peak sanitary flow to the Maple Avenue trunk sewer.

Refer to Appendix C for the sanitary flow calculations.

Therefore, based on the completed sanitary calculations, an overall theoretical post-development peak flow increase of 2.7 L/s will be added into the 825 mm ø sanitary trunk sewer. We believe that the increased flow of 2.7 L/s to the trunk sewer will have a negligible effect to the capacity of existing infrastructure.

The post-development peak sanitary sewage flow is larger than pre-development and a new 250 mm ø sanitary service lateral connection is proposed and will be installed per Region's standards.

6. Storm Servicing

6.1 Storm Quantity Control Criteria

6.1.1 Storm Criteria

As per the Pre-Consultation Meeting Notes (Appendix E) dated March 14, 2018, City of Burlington, Mr. Umar Malik provided Stormwater Management criteria which can be summarized as follows:

- Enhanced Quality Control achieving 80 percent Total Suspended Solids Removal. OGS units providing 80 percent TSS removal will be credited at 50 percent. A treatment train approach is to be utilized.
- Quantity Control – post-development flows to be controlled to pre-development flow levels by providing on site storage for all storm events from the 2-year through to 100-year storm event. Confirm capacity of receiving system.
- Clearly show the overland flow route to ensure existing drainage patterns are maintained. No surface ponding in accessible parking spaces, and no surface ponding in a 5-year storm.
- Confirm if permanent dewatering is required for underground parking – and incorporate into design.

- Low Impact Development Stormwater Management techniques (CVC/TRCA LID guidelines) are encouraged.
- Landscape areas over underground parking will be considered 0.9 runoff coefficient.

6.1.2 Peak Flow Control

Rational Method is used to calculate the flow rates. All post-development peak flows for design storms ranging from 2-year to 100-year design storm events will be controlled to the 2-year pre-development release rate of 46 L/s to Maple Avenue municipal 1050 mm ø storm sewer.

The existing receiving storm sewer capacity will be verified upon receipt of design sheets and/or other information from the City of Burlington.

The runoff will be collected by surface area drains and conveyed by a series of storm sewers and internal piping to the underground parking garage which will then be conveyed to a 38 m^3 storage tank. The outflows will be controlled by a 100 mm ø orifice tube which will control the release rate to a maximum of 46 L/s.

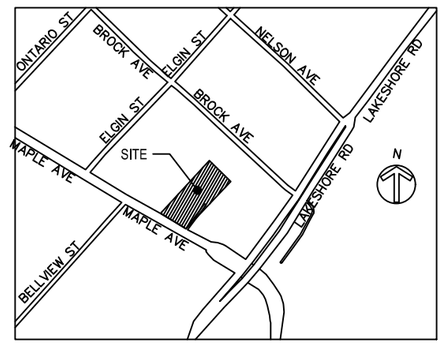
The proposed access road will be used to convey overland flows. The runoff greater than 100-year storm event will be directed to Maple Avenue.

Please refer to Appendix D for design calculations, and rear pockets for Servicing and Grading Plans.



Legend

- DRAINAGE AREA
- 101 / 0.38 — AREA ID / AREA (HECTARES)
- EX. OVERLAND FLOW DIRECTION
- PROPERTY LINE
- LANDSCAPE AREA



KEY PLAN
N.T.S.

0 5.0 10.0 15.0m
SCALE 1:500

Better Living Retirement Residence Inc.
441 MAPLE AVENUE, BURLINGTON

PREDEVELOPMENT DRAINAGE CONDITIONS

Job Number 11180500
Revision A
Date OTC. 2018

Figure 3

6705 Millcreek Drive, Unit 1, Mississauga Ontario L5N 5M4 **T** 1 416 213 7121 **F** 1 416 890 8499

Plot Date: 9 November 2018 - 11:33 AM Plotted by: Purav Prajapati Cad File No: N:\CA\Mississauga\Projects\111\11180500\CADD\Drawings\Civil\11180500- Pre-Drainage Area.dwg

6.2 Water Retention/Balance

The existing site has 382 m^2 area covered by grass & trees. Under the post-development conditions, 1011 m^2 of vegetated landscaping area will be created to intercept the first 5 mm of rainfall. In addition, the collected rainwater from 552 m^2 of rooftop area will be stored for irrigation. A cistern will be placed at the rooftop for this seasonal use. The harvested rainwater can feed the distribution system by gravity.

Currently the 5 mm storm event contributes 10.3 m^3 runoff from the site. With the rooftop storage the runoff will be reduced to 5.5 m^3.

Please refer to Appendix D for Water Balance calculations.

6.3 Stormwater Quality

The SWM water quality criteria required for this site is an 'Enhanced' level of protection achieving 80 percent Total Suspended Solids Removal.

A treatment train approach has been proposed to treat runoff. Landscaping areas on the rooftop and ground level will provide infiltration, transpiration, plant metabolism and attenuation for runoff. A filtering medium, such as a roof drain filter will also improve stormwater quality.

Lastly, an on-line Jellyfish Filter unit (Model JF6-3-1-L1) will be installed downstream of the stormwater detention storage tank and upstream of the control manhole (MH2). This device has been sized to provide 89 percent TSS removal.

Please refer to Servicing Drawing SS-1, Jellyfish Sizing Report and ETV Verification Statement in Appendix D.

6.4 Erosion and Sediment Control

Sediment and erosion control measures will be implemented as follows:

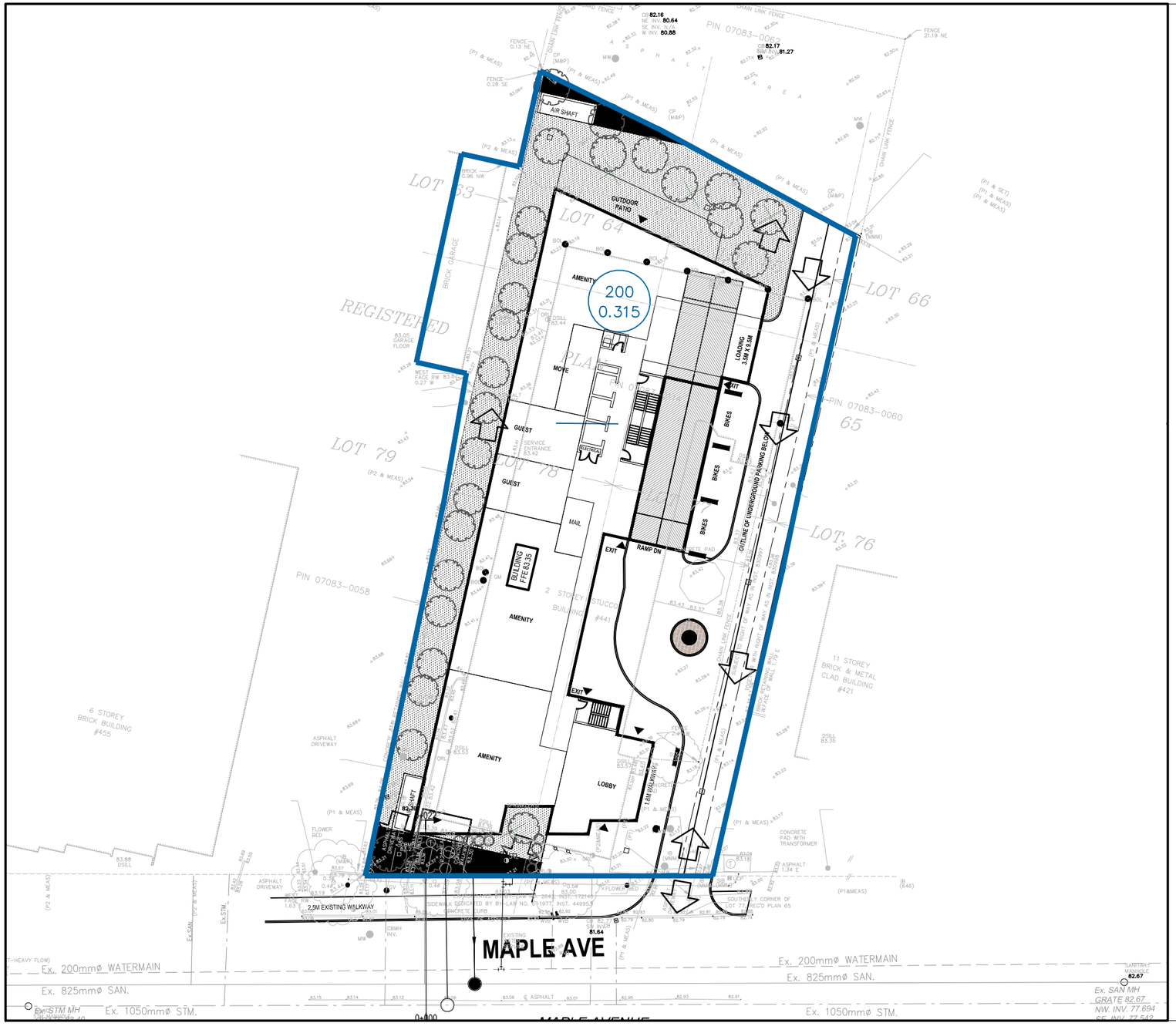
- Sediment control fence to be installed around construction area prior to commencement of any activities on the site.
- Mud-mats to be installed and maintained at all construction entrances.
- Sediment traps to be installed at all catchbasin and catchbasin manhole locations upon completion of servicing, or as directed by the engineer.

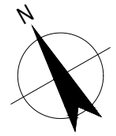
All construction vehicles shall leave the site at the designated exit points provided with an approved mud-mat.

Regular inspection and maintenance of the erosion and sediment control measures are required before and after big rainfall events per Erosion and Sediment Control Inspection Guide (2008) prepared by the Greater Golden Horseshoe Area Conservation Authority. An erosion and Sediment Control Plan will be provided with the detailed design submission.

6.5 Groundwater

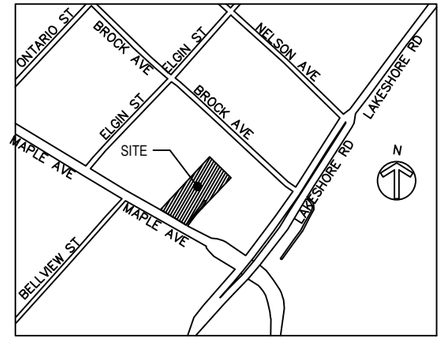
With the construction of a 3-storey parking garage the building will come into contact with the groundwater table. During the detailed design stage an analysis of the groundwater flow will be completed. The Owner, architect, hydrologist, and structural engineer will need to evaluate the feasibility of surrounding the structure with a watertight membrane so as to minimize pumping of the groundwater. If the soil permeability is such that the groundwater flow is very low standard sump pumps may suffice and only a minor watertight membrane would be needed. The quality and quantity of the groundwater flow is to be determined prior to the submission of the detailed design drawings and reports.





Legend

- DRAINAGE AREA
- 101 / 0.38 — AREA ID / AREA (HECTARES)
- OVERLAND FLOW DIRECTION
- PROPERTY LINE
- LANDSCAPE AREA ABOVE UNDERGROUND PARKING
- LANDSCAPE AREA OUTSIDE UNDERGROUND PARKING



KEY PLAN
N.T.S.

0 5.0 10.0 15.0m
SCALE 1:500



GHD

Better Living Retirement Residence Inc.
441 MAPLE AVENUE, BURLINGTON

POSTDEVELOPMENT DRAINAGE CONDITIONS

Job Number 11180500
Revision A
Date OTC. 2018

Figure 4

6705 Millcreek Drive, Unit 1, Mississauga Ontario L5N 5M4 **T** 1 416 213 7121 **F** 1 416 890 8499

Plot Date: 9 November 2018 - 11:33 AM Plotted by: Purav Prajapati
Cad File No: N:\CA\Mississauga\Projects\111\11180500\CADD\Drawings\Civil\11180500- Post-Drainage Area.dwg

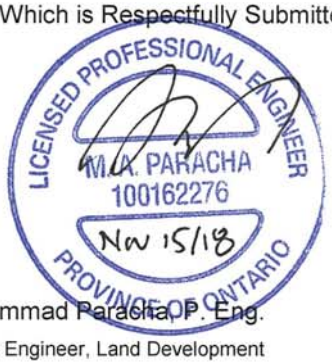
7. Conclusions

This Report confirms that the proposed development can be adequately serviced by the existing municipal infrastructure in the vicinity of the Site without negatively impacting existing developments. The key findings are summarized as follows:

- The proposed grading design can adequately meet all surrounding property line elevations without any negative impact to neighbouring properties.
- Water servicing will be provided through a proposed 150 mm ø domestic and a 200 mm ø fire connections to the existing 300 mm ø watermain from Maple Avenue.
- Sanitary servicing will be provided through a new 250 mm ø sanitary service connection to the existing 825 mm ø sanitary sewer on Maple Avenue.
- Storm servicing can be provided through the proposed service connection to the existing 1050 mm ø storm sewer on Maple Avenue.
- SWM Quantity controls will be provided by a 38 m^3 underground storage tank and a 100 mm ø orifice tube.
- SWM quality controls will be provided with the use of a Jellyfish Filter (Model JF6-3-1-L1).

All of Which is Respectfully Submitted,

GHD



Muhammad Paracha, P. Eng.
Project Engineer, Land Development



Alecia Hu, P. Eng.
Design Manager

Appendices

Appendix A
Topographic Survey

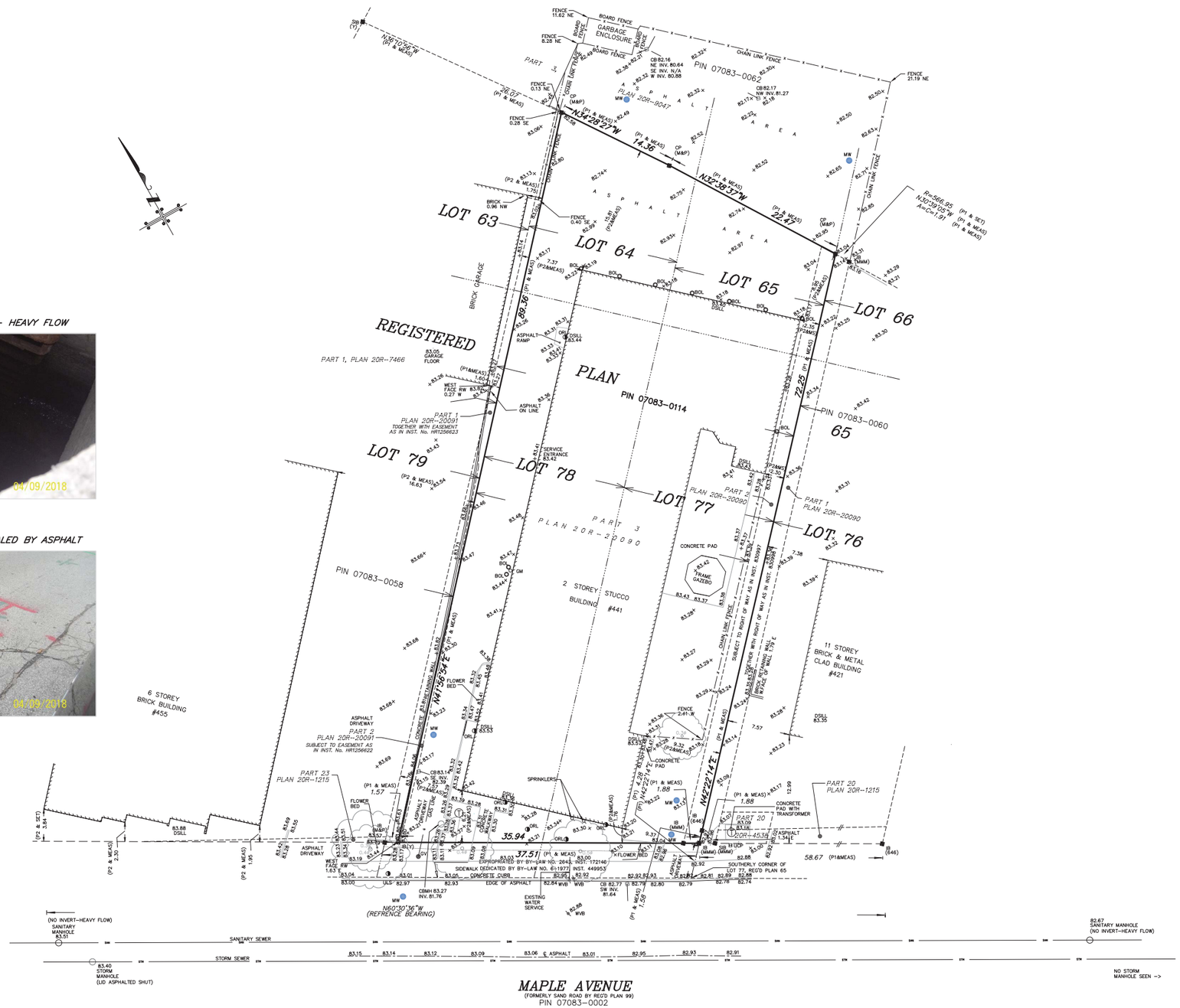
PLAN BEING PART 1
MUST BE READ IN CONJUNCTION WITH
SURVEY REPORT (BEING PART 2)

MAPLE AVENUE SANITARY SEWER – HEAVY FLOW



MAPLE AVENUE STORM SEWER – SEALED BY ASPHALT





SURVEYOR'S REAL PROPERTY REPORT
WITH TOPOGRAPHICAL FEATURES
PLAN OF
PART OF LOTS 64, 65, 77 & 78 REGISTERED PLAN 65
BEING IN THE
CITY OF BURLINGTON
REGIONAL MUNICIPALITY OF HALTON

SCALE 1 : 250

0 5 10 20 metres

MacKAY, MacKAY & PETERS LIMITED – ONTARIO LAND SURVEYORS
© 2018

KNOWN AS MUNICIPAL No. 441 MAPLE AVENUE

SURVEY REPORT (BEING PART 2)
(to be read in conjunction with plan being Part 1)

LAND REGISTRY OFFICE TITLE INFORMATION ON SUBJECT PROPERTY INCLUDING BOUNDARIES, EASEMENTS AND RIGHT OF WAYS – JULY 24, 2018

REGISTERED EASEMENTS AND/OR RIGHTS-OF-WAY:
SUBJECT TO A RIGHT OF WAY OVER PART 2, PLAN 20R-20090 AS IN INST. 830997
TOGETHER WITH AN EASEMENT OVER PART 1, PLAN 20R-20090 AS IN INST. 830998
SUBJECT TO AN EASEMENT OVER PART 2, PLAN 20R-20091 IN FAVOUR OF PART OF LOT 79, REGISTERED PLAN 65, PART 1, PLAN 20R-7466 AS IN INST. No. HR1256622
TOGETHER WITH AN EASEMENT OVER PART 1, PLAN 20R-20091 AS IN INST. No. HR1256623

ADDITIONAL REMARKS:
REFER TO PART 1 OF PROPERTY REPORT FOR LOCATION OF BUILDINGS AND OTHER SETBACKS

Note :
MacKAY, MacKAY & PETERS LIMITED grants MAPLE AVE BETTER LIFE ["The Client(s)"], their solicitor and other related parties permission to use "Original Copies" of the Surveyor's Real Property Report in transactions involving "The Client(s)".

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

Legend :
- ■ DENOTES A SURVEY MONUMENT FOUND
- SIB DENOTES STANDARD IRON BAR
- IB DENOTES IRON BAR
- ℄ DENOTES CENTRE LINE
- P1 DENOTES PLAN 20R-20090
- P2 DENOTES PLAN BY MACKAY, MACKAY & PETERS LIMITED, DATED MAY 24, 2014 (FILE 14-025-1)
- # DENOTES ROUND
- CP DENOTES CONCRETE PIN
- PIN DENOTES PROPERTY IDENTIFICATION NUMBER
- WVB DENOTES WATER VALVE BOX
- CB DENOTES CATCH BASIN
- UCP DENOTES UTILITY CABLE PEDESTAL
- T DENOTES TRANSFORMER
- MH DENOTES MANHOLE
- DSILL DENOTES ELEVATION AT DOOR SILL
- MW DENOTES MONITORING WELL
- GV DENOTES GAS VALVE
- BOL DENOTES BOLLARDS
- GM DENOTES GAS METER
- ULS DENOTES UTILITY LIGHT STANDARD
- RW DENOTES RETAINING WALL

BUILDING TIES SHOWN HEREON ARE TO FOUNDATION UNLESS OTHERWISE NOTED.

Benchmark Note:
CITY OF BURLINGTON BENCHMARK No. 314 — ELEVATION = 84.163 METRES (CGVD 1928: 1978 READJUSTMENT)
BRASS CAP IN THE TOP OF CURB AT THE NORTHWESTERLY END OF THE PARAPLEGIC RAMP LOCATED AT THE NORTHEAST INTERSECTION OF MAPLE AVENUE AND ELGIN STREET.

Bearing Reference :
BEARINGS ARE UTM GRID AND ARE REFERRED TO THE NORTHEASTERLY LIMIT OF MAPLE AVENUE, HAVING A BEARING OF N60°30'36"W, AS SHOWN ON PLAN 20R-20090.

Surveyor's Certificate :
I CERTIFY THAT :
1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH *THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT* AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON THE 6th DAY OF SEPTEMBER, 2018.

MACKAY, MACKAY & PETERS LIMITED

DECEMBER 5, 2018 — DATE
PER: ROSS A. CLARKE, O.L.S.

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
2063989

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR
In accordance with Regulation 1026, Section 29(3)

CAD FILE: E:\(20) Halton\Registered Plans\RP0065\Lots 64-66 and 76-78\18-200\18-200.dwg

MACKAY MACKAY & PETERS LIMITED
Established 1906
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3380 SOUTH SERVICE ROAD
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PHONE: (905) 639-1375
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e-mail: halton@mmplimited.com
Records of Sewell & Sewell and Yates & Yates LTD.

DRAWN BY:	M.S.
PARTY CHIEF:	C.M.
CHECKED BY:	K.J.D.
PROJECT NO.:	18-200

Appendix B
Water Servicing Calculations

Project Name	441 Malple Ave
Project No.	11180500
Subject	Water Demand Calculations

	Area (ha)	Population	Average Day		Maximum Day		Peak Hour	
			Flows (L/d)	Flows (L/s)	Flows (L/d)	Flows (L/s)	Flows (L/d)	Flows (L/s)
Residential-Demand	**0.27**	**230**	**63,214**	**0.7**	**142,231**	**1.6**	**252,856**	**2.9**

Water Demands

residential	275.0	L/cap/d	Apartment less than 2 bdrm	1.329
max. day factor	2.25		Apartment less than 2 bdrm	1.725
peak hour factor	4.00	Residential	As per Region's 2017 Development Charges Background Study (2017 DC Background Study) Page 124 Table A-4 (Column 2)	

Peak Hour Flows< Max. Day Flows +Fire Flow

Total System Demand (appartment)=Max. Day Flows+ Fire Flow= 118.3 L/s

	Units	Population / unit	Total Population
I bdrm and 1 bdrm + den	86	1.329	114
2 bdrm and 3 bdrm	67	1.725	116
Total	153		230

Project Name	441 Maple Ave
Project No.	11180500
Subject	Water Demand Calculations

11-Storey Residential Development

As per Fire Underwriter's Survey Guidelines

PROJ:	**441 Maple Ave**	**DATE CREATED:**	**Aug/1/2018**
JOB#:	**11180500**	**DATE PRINTED:**	**Oct/3/2018**

C **Coefficient related to type of construction**

	[yes/no]	
• Wood frame		1.5
• Ordinary construction		1
• Non-combustible construction	yes	0.8
• Fire resistive construction (< 2 hrs)		0.7
• Fire resistive construction (> 2 hrs)		0.6
• Interpolation (Using FUS Tables)		

Assumes Vertical Openings & Exterior Vertical Communications Are Properly Protected (One Hour Rating)

A **Area of structure considered (m^2)** ***2,157*** <==> 23,218 ft^2
(All floors excluding Basement, under 2-Storeys)

F **Required fire flow (L/min)**
$F = 220\ C\ (A)^{0.5}$ ***8,000 L/min***

Occupancy hazard reduction of surcharge

	[yes/no]	
• Non-combustible	yes	-25%
• Limited combustible		-15%
• Combustible		0%
• Free burning		15%
• Rapid burning		25%

6,000 L/min

Sprinkler Reduction

• Non-combustible - Fire Resistive (3)	yes	30%

1,800 L/min

Exposure surcharge (cumulative (%), 4 side

	[yes/no]			
0 - 3 m		25%		
3.1 - 10 m	yes	20%	1 side	20%
10.1 - 20 m	yes	15%	1 side	15%
20.1 - 30 m	yes	10%	1 side	10%
30.1- 45 m		5%		
			Cumulative Total	**45%**

2,700 L/min

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***7,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***116.67 L/s***
	or	***1,849 USGPM***

Table A-4
Halton Region 2017 Development Charge Study
Housing Occupancy Rates By Dwelling Type in New Units (PPU) [1]

	Region-Wide		Area Specific	
Residential Unit Category	**2017-2026 (General Services)**	**2017-2031 (Hard Services)[2]**	**2017-2031 (Built Boundary)**	**2017-2031 (Greenfield)**
Single Family and Semi-Detached	3.497	3.520	3.516	3.520
Multiples [3]				
Multiples- Less Than 3 Bedrooms	1.952	2.044	2.027	2.054
Multiples - 3 or More Bedrooms	2.637	2.813	2.789	2.825
Apartments				
Apartments - Less than 2 Bedrooms	1.278	1.329	1.328	1.333
Apartments - 2 or More Bedrooms	1.673	1.725	1.724	1.730
Special Care or Special Need	1.100	1.100	1.100	1.100

1. Forecast occupancy rates (Persons Per Unit) by unit category and number of bedrooms are based on 2011 Statistics Canada custom tabulation provided by dwelling type and dwelling age.

2. Hard services refer to roads and police.

3. Multiples are defined as townhomes and apartments in duplexes.

Appendix C
Sanitary Servicing Calculations

Project: 441 Maple Ave
Project No: 11180500
Date: October/03/2018

441 Maple Ave - Existing Sanitary Flow

A. Better Living Retirement Residence to Maple Ave =	**0.27**	**ha**
Used Criteria for Hospitals		
93 beds in total - (4 person per bed)	372	people
Average Sewage Flow / bed =	1.1	**m3/s**
Flow	**102.3**	**m3/s**
	0.10	**L/s**
Peaking Factor (commercial)	3.23	
Infiltration =	0.000286	$m^3/ha/s$
	0.00007722	m^3/s
	0.08	L/s
Peak Sewage Flow =	0.33	L/s
Peak + Infiltration Flow =	**0.41**	**L/s**
Total Flow to Maple Ave. =	**0.41**	**L/s**

Project: 441 Maple Ave
Project No: 11180500
Date: October/03/2018

441 Maple Ave - Proposed Sanitary Flow

A. 11-storey Residential Development to Maple Ave =	**0.27**	**ha**
Based on 2.7 persons per unit (163 units proposed)		
Total Population =	230	
Residential Average Flow =	0.275	m^3/cap/d
Flow	**0.73**	**L/s**
Peaking Factor =	4.13	
Infiltration =	0.000286	m^3/ha/s
	0.00007722	m^3/s
	0.08	L/s
Peak Sewage Flow =	3.02	L/s
Peak + Infiltration Flow =	**3.10**	**L/s**
Total Flow to Maple Ave. =	**3.10**	**L/s**

Apartment less than 2 bdrm	1.329
Apartment less than 2 bdrm	1.725

As per Region's 2017 Development Charges Background Study (2017 DC Background Study) Page 124 Table A-4 (Column 2)

	Units	Population / Unit	Total Population
1 bdrm and 1 bdrm plus den	86	1.329	114
2 bdrm and 3 bdrm	67	1.725	116
Total	153		230

Table A-4
Halton Region 2017 Development Charge Study
Housing Occupancy Rates By Dwelling Type in New Units (PPU) [1]

	Region-Wide		Area Specific	
Residential Unit Category	**2017-2026 (General Services)**	**2017-2031 (Hard Services)[2]**	**2017-2031 (Built Boundary)**	**2017-2031 (Greenfield)**
Single Family and Semi-Detached	3.497	3.520	3.516	3.520
Multiples [3]				
Multiples- Less Than 3 Bedrooms	1.952	2.044	2.027	2.054
Multiples - 3 or More Bedrooms	2.637	2.813	2.789	2.825
Apartments				
Apartments - Less than 2 Bedrooms	1.278	1.329	1.328	1.333
Apartments - 2 or More Bedrooms	1.673	1.725	1.724	1.730
Special Care or Special Need	1.100	1.100	1.100	1.100

1. Forecast occupancy rates (Persons Per Unit) by unit category and number of bedrooms are based on 2011 Statistics Canada custom tabulation provided by dwelling type and dwelling age.

2. Hard services refer to roads and police.

3. Multiples are defined as townhomes and apartments in duplexes.

Appendix D
Stormwater Management Calculations

Project Name:	441 Maple Ave., Burlington
Project No.:	11180500
Description:	Pre-development Uncontrolled Release Rate

Utilizing the Modified Rational Method, the post-development flow rates can be determined:

Q = CCa I A where,

Q = Flow rate (cms)
C = Runoff Coefficient
Ca = Antecedent Precipitation Factor , Ca value are listed below
1 to 10 year storm Ca=1.00
25 year storm Ca=1.10
50 year storm Ca=1.20
100 year storm Ca=1.25
I = Intensity (mm/hr)
A = Area (ha)

The Intensity for: The City of Burlington can be calculated as:

	I = a / (b + t)^c, where		**Intensity (mm/hr)**					
			2 Year	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
a =	Constant		592.60	697.40	798.50	926.90	1019.40	1114.20
b =	Constant		6.00	5.00	5.00	5.00	5.00	5.00
c =	Constant		0.780	0.764	0.763	0.762	0.761	0.761
t =	Time of Concentration (min)		10.00	10.00	10.00	10.00	10.00	10.00
			68.2	**88.1**	**101.1**	**117.7**	**129.8**	**141.9**

Based on the exisiting land use the pre-development flow rates are:

Area ID	**Area Description**	**Area, A (ha)**	**Runoff Coefficient, C**		**Flow Rate, Q (m^3/s)**					
					2 Year	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
101A	Building & Pavement	0.142	0.90	0.13	0.024	0.031	0.036	0.042	0.046	0.051
101B	Landscape	0.028	0.30	0.01	0.002	0.002	0.002	0.003	0.003	0.003
102A	Building & Pavement	0.114	0.90	0.10	0.019	0.025	0.029	0.034	0.037	0.041
102B	Landscape	0.011	0.30	0.00	0.001	0.001	0.001	0.001	0.001	0.001
Total		**0.295**	**0.82**	**0.24**	**0.046**	**0.059**	**0.068**	**0.079**	**0.087**	**0.096**

Project Name:	441 Maple Ave., Burlington
Project No.:	11180500
Description:	Post-development Uncontrolled Release Rate

Utilizing the Modified Rational Method, the post-development flow rates can be determined:

Q = CCa I A where,

Q = Flow rate (cms)
C = Runoff Coefficient
Ca = Antecedent Precipitation Factor , Ca value are listed below
1 to 10 year storm Ca=1.00
25 year storm Ca=1.10
50 year storm Ca=1.20
100 year storm Ca=1.25
I = Intensity (mm/hr)
A = Area (ha)

The Intensity for: The City of Burlington can be calculated as:

	I = a / (b + t)^c, where		**Intensity (mm/hr)**					
			2 Year	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
a =	Constant		592.60	697.40	798.50	926.90	1019.40	1114.20
b =	Constant		6.00	5.00	5.00	5.00	5.00	5.00
c =	Constant		0.780	0.764	0.763	0.762	0.761	0.761
t =	Time of Concentration (min)		10.00	10.00	10.00	10.00	10.00	10.00
			68.2	**88.1**	**101.1**	**117.7**	**129.8**	**141.9**

Based on the proposed land use the post-development uncontrolled flow rates are:

Area ID	**Area Description**	**Area, A (ha)**	**Runoff Coefficient, C**		**Flow Rate, Q (m^3/s)**					
					2 Year	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
200A	Building, Pavement & Landscape*	0.306	0.90	0.28	0.052	0.067	0.077	0.090	0.099	0.109
200B	Landscape	0.009	0.30	0.00	0.000	0.001	0.001	0.001	0.001	0.001
Total		**0.315**	**0.87**	**0.28**	**0.053**	**0.068**	**0.078**	**0.091**	**0.100**	**0.110**

Note: Landscape areas within 200A & 201A over underground parking garage are considered as 0.9 runoff coefficient.

Project Name:	441 Maple Ave., Burlington
Project No.:	11180500
Description:	Tank Storage

100 Year Rainfall Event

Catchment IDs =	200 & 201	
Time of Concentration (t_c) =	10	minutes
Time Step (t_1) =	5	minutes
Runoff Coefficient (C) =	0.87	
Catchment Area (A) =	0.315	ha

Release Rate (Q_o) =	**0.046**	m^3/s

Time $t = t_c + t_1$ (minutes)	Intensity $I = a/(t_c+b)^c$ (mm/hr)	Runoff $Q = C\ I\ A$ (m^3/s)	Storage Rate $Q_s = Q - Q_o$ (m^3/s)	Required Storage $S = Q_s\ t$ (m^3)
10	141.9	0.109	0.063	37.6
15	114.0	0.087	0.041	37.2
20	96.2	0.074	0.028	33.2
25	83.7	0.064	0.018	27.3
30	74.5	0.057	0.011	19.9

Required Storage =	**37.6**	**m^3**

PRE-DEVELOPMENT WATER BALANCE

Surface Type	Area (m^2)	IA (mm)	Volume Abstracted (m^3)	5 mm Volume (m^3)	Water Balance (m^3)
Soft/Pervious Landscaping	382	0.005	1.9	1.9	0.0
Impervious Surface	2568	0.001	2.6	12.8	10.3
Total	2950	-	4.5	14.8	10.3

POST-DEVELOPMENT WATER BALANCE

Surface Type	Area (m^2)	IA (mm)	Volume Abstracted (m^3)	5 mm Volume (m^3)	Water Balance (m^3)
Soft/Pervious Landscaping	1011	0.005	5.1	5.1	0.0
Impervious Surface	1383	0.001	1.4	6.9	5.5
Roof Rainwater Harvesting	556	0.005	2.8	2.8	0.0
Total	2950	-	6.4	12.0	5.5

Notes:

1. It is assumed impervious surfaces can abstract 1 mm of rainfall, and soft lanscaping and permeable paving can absorb 5 mm of rainfall.
2. 302 sq.m rooftop landscape area has been included in calculations.

Project Name:	441 Maple Ave., Burlington
Project No.:	11180500
Description:	Orifice Tube Size Calculation

ORIFICE TUBE EQUATION	Q=CdAo(2gH)^0.5	
COEFFICIENT	0.8	
ORIFICE DIAMETER (mm)	100	<---------- ENTER
AREA OF ORIFICE (sq.m.)	0.00785398	
TOP of WATER LEVEL - m	83.050	<---------- ENTER
ORIFICE INVERT - m	80.270	<---------- ENTER
Orifice c/l - m	80.3200	
HEAD (H)-m	2.7300	
CAPACITY (Q)	45.98	lps
Velocity	5.85	
ALLOWABLE (Q)	46.00	lps

ON-LINE
Jellyfish Filter Sizing Report

Project Information

Date	Friday, November 02, 2018
Project Name	441 Maple Ave
Project Number	
Location	Burlington

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 JF6-3-1-L1 is recommended to meet the water quality objective by treating a flow of 17.7 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This Jellyfish Model has a Peak Flow Capacity of 131 L/s. This model has a sediment capacity of 199 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)	Peak Capacity (L/s)	Bypass MAW	Sediment Capacity (kg)
JF6-3-1-L1	3	1	1.8	17.7	131	Yes	199

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 maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance inverval is designed to be a minimum of 12 months, but this will vary significantly with on-line desings based on storm event conditions, 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:

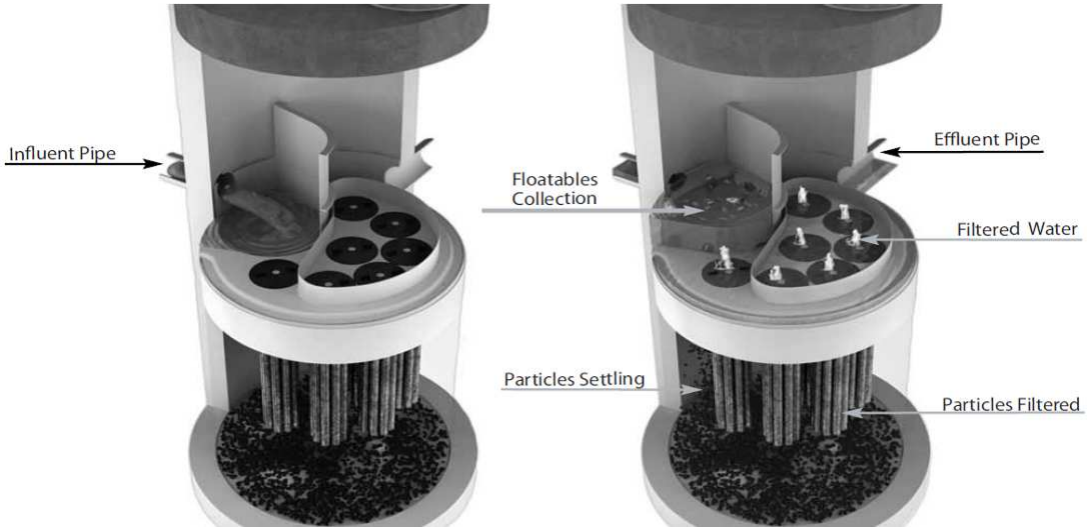
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash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

Jellyfish® Filter

Project Information

Date:	Friday, November 02, 2018
Project Name:	441 Maple Ave
Project Number:	
Location:	Burlington

Designer Information

Company:	GHD
Contact:	Alecia Hu
Phone #:	

Notes

Rainfall

Name:	TORONTO CENTRAL
State:	ON
ID:	100
Record:	1982 to 1999
Co-ords:	45°30'N, 90°30'W

Drainage Area

Total Area:	0.316 ha
Imperviousness:	77.2%

Upstream Detention

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

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 18 years of TORONTO CENTRAL rainfall data:	**7.7 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 1468 m³, with a suspended sediment concentration of 100 mg/L.	**147 kg***
Peak Flow	The flow which must pass through the unit, includes treatment flow	**46 L/s**

** Indicates that sediment loading is the limiting parameter in the sizing of this Jellyfish system.*

Recommendation

The Jellyfish Filter model JF6-3-1-L1 is recommended to meet the water quality objective by treating a flow of 17.7 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This Jellyfish Model has a Peak Flow Capacity of 131 L/s. This model has a sediment capacity of 199 kg, which meets or exceeds the estimated average annual sediment load.

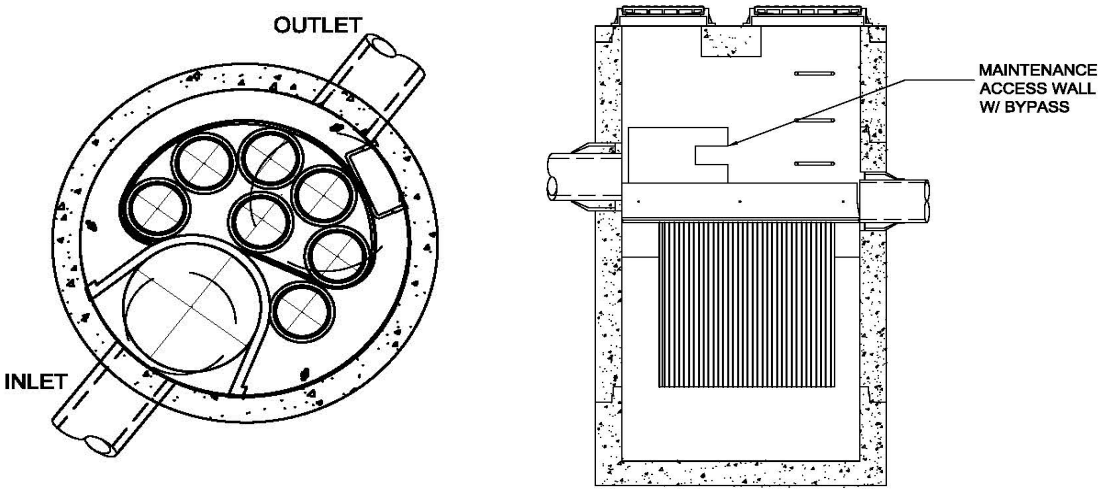
Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Bypass MAW	Addt'l Sump (ft)	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1-L0	1	1	No	0	1.2	2313	0.34	379	7.6	85
JF4-1-1-L1	1	1	Yes	1	1.2	2661	0.34	379	7.6	85
JF4-2-1-L0	2	1	No	0	1.2	2313	0.34	379	12.6	142
JF4-2-1-L1	2	1	Yes	1	1.2	2661	0.34	379	12.6	142
JF6-3-1-L0	3	1	No	0	1.8	5205	0.79	848	17.7	199
JF6-3-1-L1	**3**	**1**	**Yes**	**1**	**1.8**	**6003**	**0.79**	**848**	**17.7**	**199**
JF6-4-1-L0	4	1	No	0	1.8	5205	0.79	848	22.7	256
JF6-4-1-L1	4	1	Yes	1	1.8	6003	0.79	848	22.7	256
JF6-5-1-L0	5	1	No	0	1.8	5205	0.79	848	27.8	313
JF6-5-1-L1	5	1	Yes	1	1.8	6003	0.79	848	27.8	313
JF6-6-1-L0	6	1	No	0	1.8	5205	0.79	848	28.6	370
JF6-6-1-L1	6	1	Yes	1	1.8	6003	0.79	848	28.6	370
JF8-6-2-L0	6	2	No	0	2.4	9252	1.42	1469	35.3	398
JF8-6-2-L1	6	2	Yes	1	2.4	10675	1.42	1469	35.3	398
JF8-7-2-L0	7	2	No	0	2.4	9252	1.42	1469	40.4	455
JF8-7-2-L1	7	2	Yes	1	2.4	10675	1.42	1469	40.4	455
JF8-8-2-L0	8	2	No	0	2.4	9252	1.42	1469	45.4	512
JF8-8-2-L1	8	2	Yes	1	2.4	10675	1.42	1469	45.4	512
JF8-9-2-L0	9	2	No	0	2.4	9252	1.42	1469	50.5	569
JF8-9-2-L1	9	2	Yes	1	2.4	10675	1.42	1469	50.5	569
JF8-10-2-L0	10	2	No	0	2.4	9252	1.42	1469	50.5	626
JF8-10-2-L1	10	2	Yes	1	2.4	10675	1.42	1469	50.5	626
JF10-11-3-L0	11	3	No	0	3.0	14456	2.21	2302	63.1	711
JF10-11-3-L1	11	3	Yes	1	3.0	16678	2.21	2302	63.1	711
JF10-12-3-L0	12	3	No	0	3.0	14456	2.21	2302	68.2	768
JF10-12-3-L1	12	3	Yes	1	3.0	16678	2.21	2302	68.2	768
JF10-12-4-L0	12	4	No	0	3.0	14456	2.21	2302	70.7	796
JF10-12-4-L1	12	4	Yes	1	3.0	16678	2.21	2302	70.7	796

JF10-13-4-L0	13	4	No	0	3.0	14456	2.21	2302	75.7	853
JF10-13-4-L1	13	4	Yes	1	3.0	16678	2.21	2302	75.7	853
JF10-14-4-L0	14	4	No	0	3.0	14456	2.21	2302	78.9	910
JF10-14-4-L1	14	4	Yes	1	3.0	16678	2.21	2302	78.9	910
JF10-15-4-L0	15	4	No	0	3.0	14456	2.21	2302	78.9	967
JF10-15-4-L1	15	4	Yes	1	3.0	16678	2.21	2302	78.9	967
JF10-16-4-L0	16	4	No	0	3.0	14456	2.21	2302	78.9	1024
JF10-16-4-L1	16	4	Yes	1	3.0	16678	2.21	2302	78.9	1024
JF10-17-4-L0	17	4	No	0	3.0	14456	2.21	2302	78.9	1081
JF10-17-4-L1	17	4	Yes	1	3.0	16678	2.21	2302	78.9	1081
JF10-18-4-L0	18	4	No	0	3.0	14456	2.21	2302	78.9	1138
JF10-18-4-L1	18	4	Yes	1	3.0	16678	2.21	2302	78.9	1138
JF10-19-4-L0	19	4	No	0	3.0	14456	2.21	2302	78.9	1195
JF10-19-4-L1	19	4	Yes	1	3.0	16678	2.21	2302	78.9	1195
JF12-20-5-L0	20	5	No	0	3.6	20820	3.2	2771	113.6	1280
JF12-20-5-L1	20	5	Yes	1	3.6	24012	3.2	2771	113.6	1280
JF12-21-5-L0	21	5	No	0	3.6	20820	3.2	2771	113.7	1337
JF12-21-5-L1	21	5	Yes	1	3.6	24012	3.2	2771	113.7	1337
JF12-22-5-L0	22	5	No	0	3.6	20820	3.2	2771	113.7	1394
JF12-22-5-L1	22	5	Yes	1	3.6	24012	3.2	2771	113.7	1394
JF12-23-5-L0	23	5	No	0	3.6	20820	3.2	2771	113.7	1451
JF12-23-5-L1	23	5	Yes	1	3.6	24012	3.2	2771	113.7	1451
JF12-24-5-L0	24	5	No	0	3.6	20820	3.2	2771	113.7	1508
JF12-24-5-L1	24	5	Yes	1	3.6	24012	3.2	2771	113.7	1508
JF12-25-5-L0	25	5	No	0	3.6	20820	3.2	2771	113.7	1565
JF12-25-5-L1	25	5	Yes	1	3.6	24012	3.2	2771	113.7	1565
JF12-26-5-L0	26	5	No	0	3.6	20820	3.2	2771	113.7	1622
JF12-26-5-L1	26	5	Yes	1	3.6	24012	3.2	2771	113.7	1622
JF12-27-5-L0	27	5	No	0	3.6	20820	3.2	2771	113.7	1679
JF12-27-5-L1	27	5	Yes	1	3.6	24012	3.2	2771	113.7	1679

Jellyfish® Filter

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 that 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 Online 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. Alternative driving head values are only possible with off-line configuration.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation.
- The Jellyfish Filter can not accommodate multiple inlet pipes in an on-line configuration.
- Typical systems conform to the following pipe orientations:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Maximum Inlet Pipe Diameter (mm)
1.2	62º	150	300
1.8	**59º**	**200**	**300**
2.4	52º	250	375
3.0	48º	300	450
3.6	40º	300	450

- Outlet pipes to be one size larger than inlet pipes on new projects.
- 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

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Jellyfish® Filter JF4-2-1

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

In accordance with

ISO 14034:2016

Environmental management —
Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

August 3, 2017
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Jellyfish® Filter is an engineered stormwater quality treatment technology designed to remove a variety of stormwater pollutants including floatable trash and debris, oil, coarse and fine suspended sediments, and particulate-bound pollutants such as nutrients, heavy metals, and hydrocarbons. The Jellyfish Filter combines gravitational pre-treatment (sedimentation and floatation) and membrane filtration in a single compact structure. The system utilizes membrane filtration cartridges comprised of multiple pleated filter elements ("filtration tentacles") that provide high filtration surface area with the associated advantages of high flow rate, high sediment capacity, and low filtration flux rate.

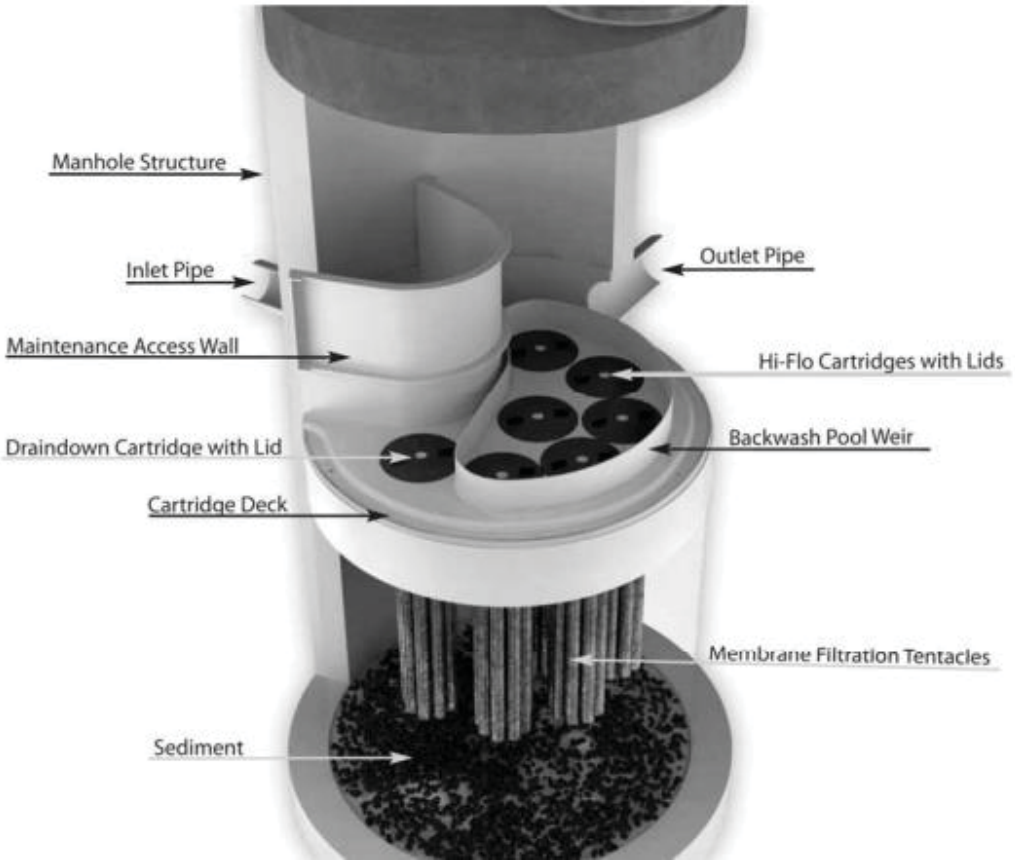


Figure 1. Cut-away graphic of a Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge

Figure 1 depicts a cut-away graphic of a typical 6-ft diameter Jellyfish® Filter manhole with 6 hi-flo cartridges and 1 draindown cartridge (JF6-6-1). Stormwater influent enters the system through the inlet pipe and builds a pond behind the maintenance access wall, with the pond elevation providing driving head. Flow is channeled downward into the lower chamber beneath the cartridge deck. A flexible separator skirt (not shown in the graphic) surrounds the filtration zone where the filtration tentacles of each cartridge are suspended, and the volume between the vessel wall and the outside surface of the separator skirt comprises a pretreatment channel. As flow spreads throughout the pretreatment channel, floatable pollutants accumulate at the surface of the pond behind the maintenance access wall and also beneath the cartridge deck in the pretreatment channel, while coarse sediments settle to the sump. Flow proceeds under the separator skirt and upward into the filtration zone, entering each filtration tentacle and depositing fine suspended sediment and associated particulate-bound pollutants on the outside surface of the membranes. Filtered water proceeds up the center tube of each tentacle, with the flow from each tentacle combining under the cartridge lid, and discharging to the top of the

cartridge deck through the cartridge lid orifice. Filtered effluent from the hi-flo cartridges enters a pool enclosed by a 15-cm high weir, and if storm intensity and resultant driving head is sufficient, filtered water overflows the weir and proceeds across the cartridge deck to the outlet pipe. Filtered effluent discharging from the draindown cartridge(s) passes directly to the outlet pipe, and requires only a minimal amount of driving head (2.5 cm) to provide forward flow. As storm intensity subsides and driving head drops below 15 cm, filtered water within the backwash pool reverses direction and passes backward through the hi-flo cartridges, and thereby dislodges sediment from the membranes which subsequently settles to the sump below the filtration zone. During this passive backwashing process, water in the lower chamber is displaced only through the draindown cartridge(s). Additional self-cleaning processes include gravity, as well as vibrational pulses emitted when flow exits the orifice of each cartridge lid, and these combined processes significantly extend the cartridge service life and maintenance cleaning interval. Sediment removal from the sump by vacuum is required when sediment depths reach 30 cm, and cartridges are typically removed, externally rinsed, and recommissioned on an annual basis, or as site-specific maintenance conditions require. Filtration tentacle replacement is typically required every 3 – 5 years.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from a field monitoring program conducted on a Jellyfish® Filter JF4-2-1 (4-ft diameter manhole with 2 hi-flo cartridges and 1 draindown cartridge), in accordance with the provisions of the TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements—Amendments to TARP Tier II Protocol (NJDEP, 2009). Testing was completed by researchers led by Dr. John Sansalone at the University of Florida's Engineering School of Sustainable Infrastructure and Environment. The drainage area providing stormwater runoff to the test unit varied between 502 m^2 and 799 m^2 (5400 ft^2 to 8600 ft^2) depending on storm intensity and wind direction. The unit was monitored for a total of 25 TARP qualifying storm events (i.e. $\geq$ 2.5 mm of rainfall) contributing cumulative rainfall of 381 mm (15 in) over the 13-month period between May 28, 2010 and June 27, 2011. Only TARP-qualified storms were routed through the unit, and maintenance was not required during the testing period based on sediment accumulation less than the depth indicated for maintenance, and also based on hydraulic testing performed on the system after the conclusion of monitoring.

Table 1 shows the specified and achieved amended TARP criteria for storm selection and sampling.
Table 2 shows the observed ranges of operational conditions that occurred over the testing period.

Table 1. Specified and achieved amended TARP criteria for storm selection and sampling

Description	Criteria value	Achieved value
Total rainfall	$\geq$ 2.5 mm (0.1 in)	> 2.5 mm (0.1 in)
Minimum inter-event period	6 hrs	10 hrs
Minimum flow-weighted composite sample storm coverage	70% including as much of the first 20% of the storm	100%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	Minimum of 8 subsamples for composite samples
Total sampled rainfall	Minimum 381 mm (15 in)	384 mm (15.01 in)
Number of storms	Minimum 20	25

Table 2. Observed operational conditions for events monitored over the study period

Operational condition	Observed range
Storm durations	26 – 691 min
Previous dry hours	10 - 910 hrs
Rainfall depth	3 – 50 mm
Initial rainfall to runoff lag time	1 – 34 min
Runoff volume	206 – 13,229 L
Peak rainfall intensity	5 – 137 mm/hr
Peak runoff flow rate	0.5 – 14.3 L/s
Event median flow rate	0.01 – 5.5 L/s

The 4-ft diameter test unit has sedimentation surface area of 1.17 m^2 (12.56 ft^2). Each of the three filter cartridges employed in the test unit uses filtration tentacles of 137 cm (54 in) length, with filter surface area of 35.4 m^2 (381 ft^2) per cartridge, and total filter surface area of 106.2 m^2 (1143 ft^2) for the three cartridges combined. The design treatment flow rate is 5 L/s (80 gal/min) for each of the two hi-flo cartridges and 2.5 L/s (40 gal/min) for the single draindown cartridge, for a total design treatment flow rate of 12.6 L/s (200 gal/min) at design driving head of 457 mm (18 in). This translates to a filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) for the draindown cartridge. The design flow rate for each cartridge is controlled by the sizing of the orifice in the cartridge lid. The distance from the bottom of the filtration tentacles to the sump is 61 cm (24 in).

Performance claims

The Jellyfish® Filter demonstrated the removal efficiencies indicated in **Table 3** for respective constituents during field monitoring of 25 TARP qualified storm events with cumulative rainfall of 381 mm, conducted in accordance with the provisions of the TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements—Amendments to TARP Tier II Protocol (NJDEP, 2009), and using the following design parameters:

- System hydraulic loading rate (system treatment flow rate per unit of sedimentation surface area) of 10.8 L/s/m^2 (15.9 gal/min/ft^2) or lower
- Filtration flux rate (flow rate per unit filter surface area) of 0.14 L/s/m^2 (0.21 gal/min/ft^2) or lower for each hi-flo cartridge and 0.07 L/s/m^2 (0.11 gal/min/ft^2) or lower for each draindown cartridge
- Distance from the bottom of the filtration tentacles to the sump of 61 cm (24 in) or greater
- Driving head of 457 mm (18 in) or greater

Table 3. Mean, median and 95% confidence interval (median) for removal efficiencies of selected stormwater constituents

Parameter	Mean	Median	Median - 95% Lower Limit	Median - 95% Upper Limit
TSS	84.7	85.6	82.8	89.8
SSC	97.5	98.3	97.1	98.7
Total phosphorus	48.8	49.1	43.3	60.1
Total nitrogen	37.9	39.3	31.2	54.6
Zinc	55.3	69	39	75
Copper	83.0	91.7	75.1	98.9
Oil and grease	60.1	60	42.7	100

N.B. As with any field test of stormwater treatment devices, removal efficiencies will vary based on pollutant influent concentrations and other site specific conditions.

Performance results

The frequency of rainfall depths monitored during the study is presented in **Figure 2**. The median and 90th percentile rainfall depths were 11 mm and 31.7 mm, respectively. These values represent the depth of rainfall that is not exceeded in 50 and 90 percent of the monitored rainfall events.

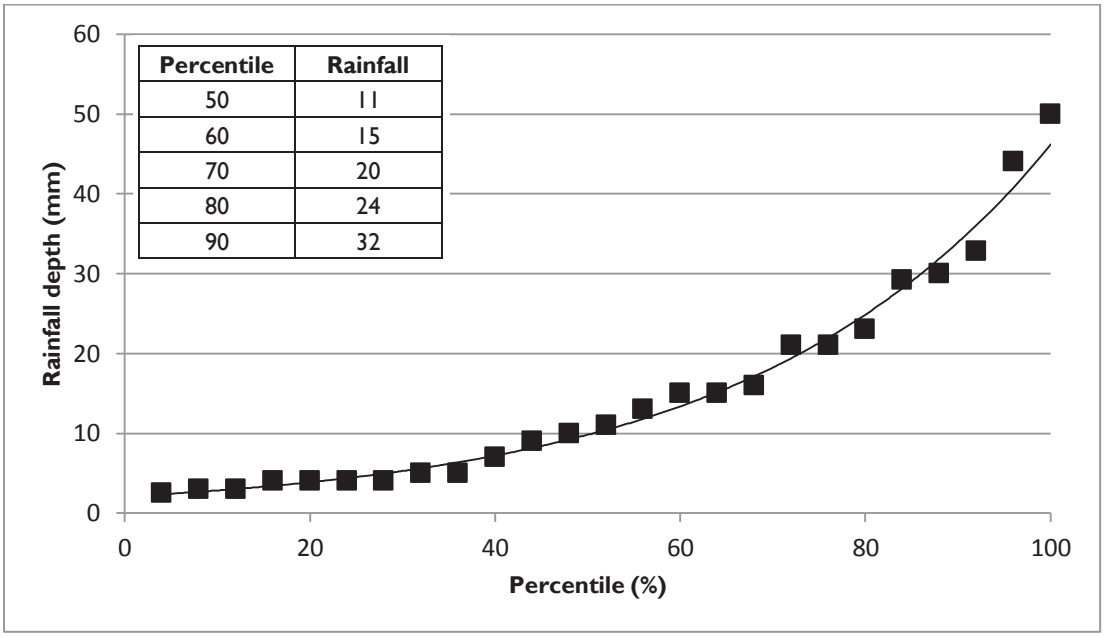


Figure 2. Rainfall depth frequency curve

Sediment removal performance was assessed by measuring the event mean concentration and mass of suspended sediment entering and leaving the unit during runoff events. This involved sampling the full cross-section of influent and effluent flows manually at 2 - 10 minute intervals for the full duration of each storm event and combining discrete samples into flow-weighted composites. Comparing the theoretical mass recovery from the sump calculated by the difference between the influent and effluent mass to the actual dry weight of the recovered sump mass showed an overall mass balance recovery of 94.5% over the study period.

The median d50 particle size (i.e. 50th percentile particle size) of the influent and effluent was 82 and 3 µm, respectively (**Figure 3**). The median influent particles sizes ranged between 22 and 263 µm, whereas median effluent particle sizes ranged between 1 and 11 µm.

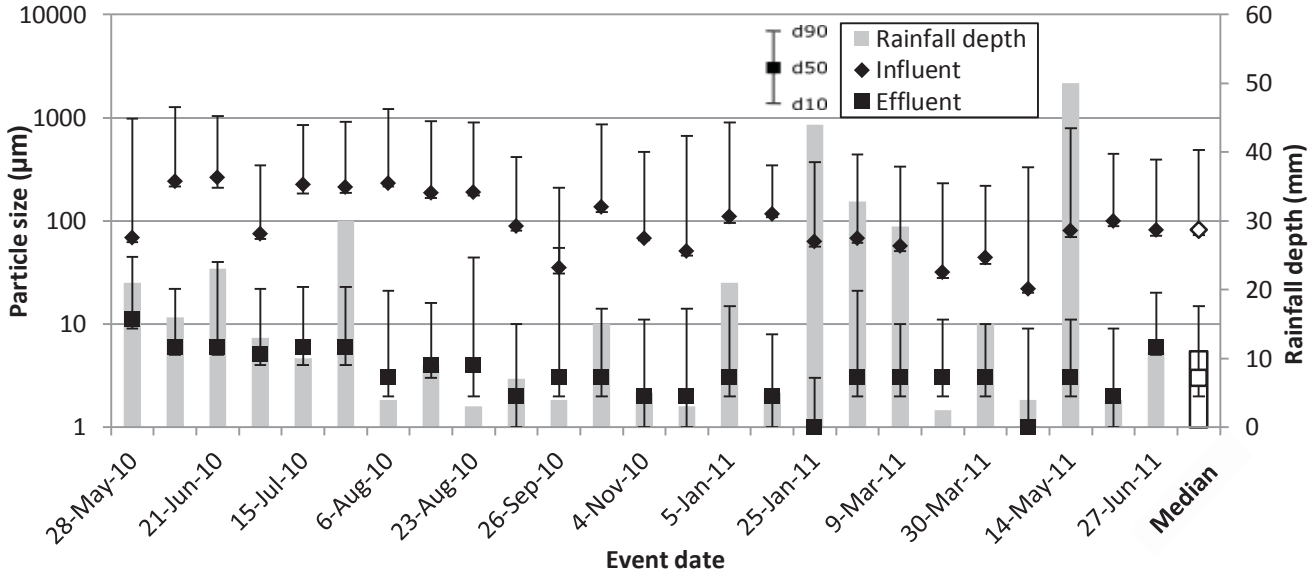


Figure 3. The rainfall depth and d10, d50, and d90 particle sizes of the influent and effluent composite samples for each monitored storm event over the 13-month testing period

Sampling of flows into and out of the Jellyfish Filter over the testing period showed statistically significant reductions ($p < 0.05$; Wilcoxon signed-rank test) in influent event mean concentrations for all selected stormwater constituents (**Table 4** and **Figure 4**). Effluent event mean Suspended Sediment Concentrations (SSC) were below 19 mg/L during all monitored events. Load-based removal rates were also calculated based on the sum of loads over the study period. These removal rages ranged from 46.3 for Total Nitrogen to 98.6 for SSC (**Table 4**).

Table 4. Summary statistics for influent and effluent event mean concentrations for selected constituents

Water Quality Variable	Sampling Location	Min	Max	Median	Range	Mean	SD	Load based removal efficiency (%)
TSS	Influent (mg/L)	16.30	261.00	79.30	244.70	86.26	51.37	87.2
	Effluent (mg/L)	3.20	21.70	11.80	18.50	10.99	4.79	
SSC	Influent (mg/L)	78.20	1401.70	444.50	1323.50	482.26	338.34	98.6
	Effluent (mg/L)	2.80	18.10	7.30	15.30	7.88	3.77	
TP	Influent (µg/L)	887.00	8793.00	3063.00	7906.00	3550.20	1914.50	64.2
	Effluent (µg/L)	472.00	4769.00	1480.00	4297.00	1688.08	1059.98	
TN	Influent (µg/L)	1170.00	10479.00	3110.00	9309.00	3519.32	2161.47	46.3
	Effluent (µg/L)	553.00	6579.00	1610.00	6026.00	2091.76	1613.61	
Zn	Influent (µg/L)	0.005	7600.00	1500.00	7600.00	1792.00	1852.91	76.1
	Effluent (µg/L)	0.005	2760.00	450.00	2760.00	561.64	594.70	
Cu	Influent (µg/L)	0.001	880.40	79.50	880.40	171.28	229.33	92.1
	Effluent (µg/L)	0.001	51.30	6.90	51.30	14.36	17.22	
Oil and Grease	Influent (mg/L)	0.20	4.06	0.93	3.86	1.07	0.82	46.4
	Effluent (mg/L)	0.00	2.32	0.35	2.32	0.50	0.60	

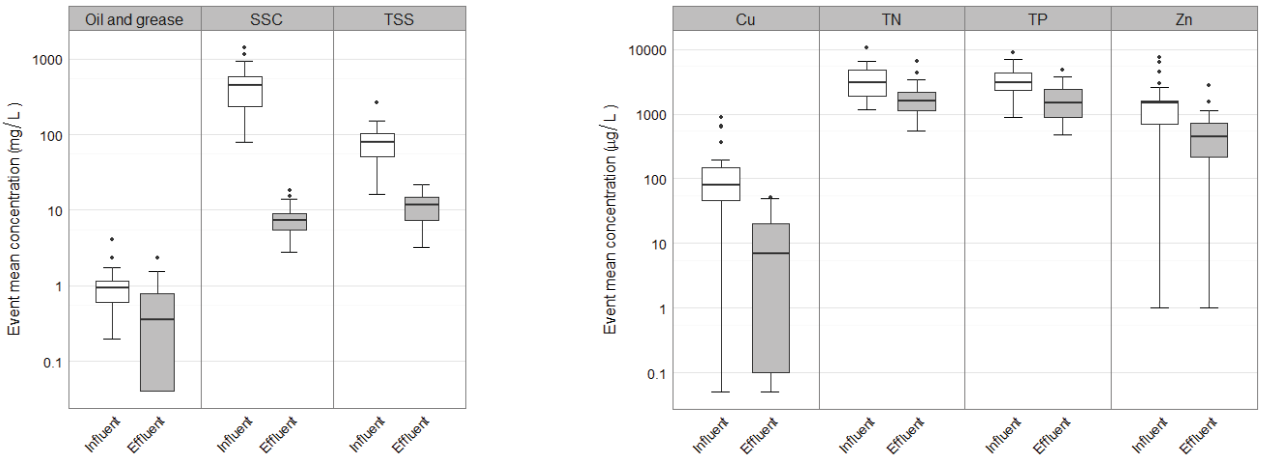


Figure 4. Boxplots showing the distribution of influent and effluent event mean concentrations (EMC) for selected stormwater constituents over the study period

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems to support the performance claim included the performance monitoring report prepared by University of Florida, Engineering School of Sustainable Infrastructure and Environment, and dated November 2011. This report is based on testing completed in accordance with the Technology Acceptance Reciprocity Partnership (TARP) Tier II Protocol (2003) and New Jersey Tier II Stormwater Test Requirements--Amendments to TARP Tier II Protocol (NJDEP, 2009).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Jellyfish® Filter please contact:

Imbrium Systems, Inc.
407 Fairview Drive
Whitby, ON
L1N 3A9, Canada
Tel: 416-960-9900
info@imbriumsystems.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
World Trade Centre
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com

Limitation of verification
GLOBE Performance Solutions and the Verification Expert provide the verification services solely on the basis of the information supplied by the applicant or vendor and assume no liability thereafter. The responsibility for the information supplied remains solely with the applicant or vendor and the liability for the purchase, installation, and operation (whether consequential or otherwise) is not transferred to any other party as a result of the verification.

Appendix E
Pre-Consultation Meeting Notes

CITY OF Burlington

DEVELOPMENT APPLICATION PRE-CONSULTATION FORM

Meeting Date: March 14, 2018	**Property Owner:** 2435481 Ontario Inc.
Site Address: 441 Maple Avenue	**Applicant / Address / Phone / Email** Kelly Martel MHBC Planning 442 Brant St., Suite 240 Burlington, ON, L7R 2G4 905-639-8686 x230 kmartel@mhbcplan.com
Site Area: 0.28 ha	

APPLICATION TYPE (check applicable applications):

Local Official Plan Amendment	x	Zoning By-law Amendment	x	Plan of Subdivision		Parkway Belt Amendment	
Other Application							

1. **Brief description of proposed development:**

   -19 storey, 163 unit residential apartment with underground parking

   -existing long term care facility to be demolished

2. **Conformity with Regional Official Plan Designation?** YES x NO _____

   Has an application been made to amend the Regional Official Plan: YES _____ NO x

3. **Existing Official Plan Designation:** Downtown Mixed Use Centre, Medium & High Density Residential

   Conformity with City Official Plan land use designation? YES _____ NO x

   If 'NO' what is the nature of the OP amendment needed? Increased density

4. **Existing Zoning:** DRH

   Conformity with existing zoning? YES _____ NO x

   If 'NO' what is the nature of the zoning amendment needed? -site specific regulations including increased height and density

5. **Design Guidelines in effect?** YES __x__ NO _____

Name of Design Guidelines **Downtown Urban Design Guidelines, Tall Building Design Guidelines**

6. **Is the property listed in Municipal Heritage Register, designated under the Ontario Heritage Act or adjacent to a designated property?**

YES _____ NO __x__

---

7. **Fees Required at Time of Application**

APPLICATION	CITY	REGION	CONSERVATION HALTON	PROVINCE
Official Plan Amendment:	21,119.00	8,215.64	-	-
Rezoning - Base Fee: (70%) Rezoning - Variable Fee:	13,933.50 71,633.00	969.08	-	-
Subdivision - Base Fee: Subdivision - Variable Fee:		-	-	-
Parkway Belt Amendment:		-	-	-
TOTAL	$106,685.50	$9,184.72	-	-

Separate cheques are payable to City, Region, Conservation Halton and Province (Ministry of Finance.)

8. **Additional Agencies to be contacted:** **Burlington Hydro, Hydro One, TransNorthern Pipeline**

9. **Neighbourhood Meeting**

Is a neighbourhood meeting required? (e.g. residential intensification / infill, increased height and/or density, abutting residential zone, other neighbourhood/community impacts).

YES __x__ NO _____ TO BE DETERMINED _____

If "YES" a Neighbourhood Meeting **will be** required

- *The Neighbourhood meeting will be held after submission and public circulation of the application.*
- *Meeting logistics will be organized by the City Building Department.*
- *The Ward Councillor, the applicant, City planner and other City staff as determined will attend the Neighbourhood Meeting. Presentations will be made by the City planner about the planning process and by the applicant about the development proposal.*
- *The meeting will be chaired by the City planner, or by the Ward Councillor.*

10. **Section 37 Agreement**

Is this an application for increased height and/or density? YES __x__ NO ____

If "YES" a Section 37 Agreement **may be** required.

11. Required Information for Complete Application

Reports, Studies, Plans * *(See Appendix for additional details)* **All identified reports must be submitted in Accessible PDF form before an application is deemed complete.**		Number of Paper Copies (plus one in PDF form) If Study is Required	Required Study (Yes/No)
6.1	Planning Justification Report	8	Yes
6.2	Conceptual Site Plan Layout & Site Survey	15	Yes
6.3	Draft Plan of Subdivision	15	No
6.4	Storm Water Management Report	9	FSR
6.5	Functional Servicing Report (Including Stormwater, Water & Wastewater)	9	Yes
6.6	Tree Inventory and Protection Plan	9	Yes
6.7	Traffic/Transportation Impact Study including Parking Justification Report	7	Yes Yes
6.8	Top-of-Bank Demarcation	6	No
6.9	Environmental Evaluation Report	7	No
6.10	Noise Feasibility Study	7	Yes
6.11	Shadow Analysis	3	Yes
6.12	Environmental Site Screening Checklist	5	Yes
6.13	Phase One or Two Environmental Site Assessment/ Record of Site Condition Report	5	Phase One TBD
6.14	Land Assembly Documents	2	No
6.15	Height Survey of adjacent buildings	2	Yes
6.16	Heritage Impact Statement	3	No
6.17	Archaeological Report	3	No
6.18	Wind Impact Study	3	Yes
6.19	Sensitive Land Use (Risk Assessment) Report	6	No
6.20	Burlington Urban Design Advisory Panel Meeting Minutes	4	Yes
6.22	Other (specify)		
	Urban Design Brief	5	Yes
	Grading, Drainage & Servicing Plans	12	Yes
	Geotechnical Report	4	Yes
	Draft Zoning By-law	2	Yes
	3D Model of Proposed Building(s)	1	Yes

12. **ADDITIONAL COMMENTS**: See attached notes

NOTES:

1. Notwithstanding the fees noted above, all fees are payable based on the rate in the fee schedule by-law in effect on the date the payment is made. Further fees, such as variable fees may be required at a later date as per the fee schedule by-law.

2. The purpose of this document is to identify the information required to commence processing a complete application as set out in the Planning Act. Pre-consultation does not imply or suggest any decision whatsoever on behalf of City staff or the Corporation of the City of Burlington to either support or refuse the application.

3. This document expires 120 days from the date of signing or at the discretion of the Director of City Building. Please note that development application fees may change during this period and it is the applicant's responsibility to ensure that the correct fees are paid at time of application.

4. The City may require the peer review of a technical report submitted by the applicant. If this is required, the applicant will be advised and will be charged a fee equal to the cost of the peer review.

5. In the event this Pre-consultation Document expires prior to the application being accepted by the City, another document may be required.

6. An application submitted without the information identified in this Pre-consultation Document may be recommended for refusal based on insufficient information to properly evaluate the application.

7. Acknowledgement of Public Information:
The applicant acknowledges that the City considers the application forms and all supporting materials, including studies and drawings, filed with any application to be public information and to form part of the public record. With the filing of an application, the applicant consents to the City photocopying and releasing the application and any supporting materials either for its own use in processing the application or at the request of a third party, without further notification to or permission from the applicant. The applicant also hereby states that it has authority to bind its consultants to the terms of this acknowledgement.

8. It may be determined during the review of the application that additional studies or information will be required as a result of issues arising during the processing of the application.

9. The applicant must grant permission for municipal and agency staff to visit and access the property while the application is being processed.

10. There may also be financial requirements arising from the application, including, but not limited to, park dedication, development charges, payment of outstanding property taxes, deferred local improvement charges, costs for lifting 0.3-metre reserves, and reimbursement for road widening acquisition or road improvements.

11. All electronic file submissions must be named using the following naming protocol:
"Address_StudyName_MM-DD-YYYY". If a document is revised and resubmitted the file name should indicate that it is a revised submission and the date of the revision should be noted:
"Address_StudyName_Revised_MM-DD-YYYY".

12. Digital copies of all plans are required along with paper copies. Digital plans must be submitted in Autocad and/or GIS Shapefile format that must be geospatially positioned to match the City of Burlington's Geographic and Projected Coordinate Systems (Geographic Coordinate System: GCS_North_American_1983; Projected Coordinate System: NAD83_UTM_ZONE 17N).

13. Personal information contained in this form is collected under the authority of the Planning Act, R.S.O. 1990, cP.13, as amended. The information will be used for the purpose of administering the City of Burlington's pre-consultation process on development applications. Questions about this collection can be directed to the Manager of Development Planning, City of Burlington, 426 Brant Street, Burlington, Ontario, L7R 3Z6, 905-335-7600, ex 7638.

14. The applicant requests that the information submitted on this pre-consultation form and associated documents be kept confidential. It is understood; however, that an access request may be filed under the Municipal Freedom of Information and Protection of Privacy Act, and information may be subject to release, notwithstanding the request to keep information confidential.

Staff and Agency Signatures:

Rosalind Maji	R Maji	March 14, 2018
Planning Staff	Planning Staff (Signature)	Date
Annette Simpson		March 14/18
Site Engineering Staff	Site Engineering Staff (Signature)	Date
Site Engineering Staff	Site Engineering Staff (Signature)	Date
Capital Works Staff	Capital Works Staff (Signature)	Date
Dan Olimkovic		3/14/2018
Transportation Staff	Transportation Staff (Signature)	Date
Sarah Cranston	Sarah Cranston	March 14/18.
Regional Staff	Regional Staff (Signature)	Date
John Kisneris		March 14, 2018
Regional Staff	Regional Staff (Signature)	Date
Conservation Halton Staff	Conservation Halton Staff (Signature)	Date

Proponent Signatures:

In signing this agreement, I acknowledge that the drawings, reports and other requirements indicated above must be submitted, along with a completed application form, any information or materials required by statute, the required application fees and a copy of this agreement in order for the planning application to be considered complete. In addition, I have read and agreed to the Notes listed above.

Property Owner	Property Owner (Signature)	Date
Kelly Martel		mar. 14/2018
Agent	Agent (Signature)	Date

(I have authority to bind the owner)

APPENDIX—REQUIREMENTS FOR REPORTS/STUDIES AND PLANS

6.1 Planning Justification Report
A qualified planner (Registered Professional Planner) must submit a report providing planning justification for the proposed amendment in light of the principles, objectives and policies of the City's Official Plan and the technical studies accompanying the application. The goal of the report is to document how the proposed departure from the local policies and regulations represents good planning and is in the public interest. The report must: describe the site context; address applicable provincial and regional policy; describe the proposal in detail including preliminary site plan details if applicable; address applicable local Official Plan policies (e.g. policies relating to compatibility, intensification, redesignation criteria and conversion policies); describe how the proposal meets Council approved Design Guidelines, discuss findings of the technical studies in the context of the Part II Functional Policies of the Official Plan; and other Council policy.

6.2 Conceptual Site Plan Layout & Site Survey
General plan required showing proposed building envelopes, driveways, parking and landscape areas. Survey of site showing PINs, easements, property boundaries etc.

6.3 Draft Plan of Subdivision
The plan of subdivision map is to contain information required under Section 51(17) of the Planning Act, as well as: legend, map scale, boundary of property to be subdivided, north marker, address, registered plan number, lot and concession, date plan prepared and date of any revisions, name of person or firm who prepared the plan, all landowners names, signatures and date, and the Ontario land surveyor's name, signature and date.

6.4 Storm Water Management Report
Required in accordance with Part II, Section 2.11.3 subsections a) & d) of the Official Plan.

6.5 Functional Service Report
Required in accordance with Part II, Section 2.11.3 subsection e) of the Burlington Official Plan. Required for all applications in urban areas in accordance with Part III, Sections 87-89 of the Regional Official Plan. Municipal (Urban) Servicing Guidelines are available from the Region of Halton.

6.6 Tree Inventory and Protection Plan
Required when a property under application contains woodlots, tree stands or hedgerows, in accordance with Part II, Section 6.0 of the City's Official Plan and Part IV, Sections 146-147 of the Regional Official Plan. A tree survey must be prepared by a qualified professional, identifying all existing trees, their type, size and condition, those trees proposed to be removed and retained, and the methods to be used to ensure preservation and protection of those trees to be retained.

6.7 Traffic/Transportation Impact Study
Required for applications as set out in Part II, Subsection 3.2.2 d) of the City's Official Plan and Part IV, Sections 171-173 of the Regional Official Plan. Contact City Transportation Planning staff (City roads) or Regional Public Works staff (Regional roads) for background information and to discuss TIS assumptions. For Regional roads, applicants are referred to the "Guidelines for the Preparation of Traffic Impact Studies". MTO must be contacted for lands near provincial highways

6.8 Top-of-Bank Demarcation
Required for applications on any property containing, or abutting a creek or valley feature, Lake Ontario or Burlington Bay shoreline, in accordance with Part II, Section 9.2.2 subsection b) and Part III, Section 6.4.2, subsections d) and e) of the City's Official Plan. Applicant's surveyor must meet on-site with representatives of the City Capital Works Department and Conservation Halton to survey the top of bank and/or floodline, and this surveyed line shall be incorporated into the applicant's subdivision or site plan. A geotechnical report may be required to identify stable top-of-bank.

6.9 Environmental Evaluation Report
Required for applications as set out in Part II, Section 2.5 of the City's Official Plan, the Regional Official Plan and the Region's Environmental Impact Assessment guidelines. These assessments will be reviewed by the Halton Ecological and Environmental Advisory Committee (EEAC).

6.10 Noise Feasibility and Vibration Study
Required for applications as set out in Part II, Section 3.3.2, subsections r), s) and t), and Part II, Section 3.7.2, subsections d), e) and f) of the City's Official Plan, Part IV, Sections 142-143 of the Regional Official Plan, and for all properties abutting arterial roads. In the case of Regional roads, applicants shall refer to the Region's "Noise Attenuation Policy for Regional Roads," dated October 2000.

6.11 Shadow Analysis
Required for all applications where, in the opinion of the City Building Department, the proposal may result in impacts on adjacent properties from sun shadowing, in accordance with Part III, Section 2.5.2, subsection (vii) of the City's Official Plan. Guidelines for this analysis are contained in the City's Site Plan Application Guidelines.

6.12 Environmental Site Screening Checklist
Required for all applications as set out in the "Protocol for Reviewing Development Applications with respect to Contaminated Sites," dated March 2003. Applicants should contact the Region of Halton for historical data and any environmental records.

6.13 Phase One or Two Environmental Site Assessment/Record of Site Condition Report (prepared in accordance with O.Reg. 153/04)
Required to assess site contamination in accordance with Part II, Section 2.4, subsections i) and j) of the City's Official Plan. All requirements of O. Reg. 153/04 must be met for Phase One and Two studies and required Records of Site Condition (RSCs). A letter of reliance from the Environmental Consultant/Qualified Person, confirming the City of Burlington and the Region of Halton can rely on the information contained in the report(s) is required. All reports must be signed by a Qualified Person as defined under O.Reg. 153/04.

6.14 Land Assembly Documents
Required for applications where, in the opinion of the City Building Department, the assembly of additional lands is required to facilitate orderly development of the area. Applicants are required to submit documentation demonstrating that a reasonable, bona fide offer has been made to acquire such lands.

6.15 Height Survey of adjacent buildings
Required for all residential infill and intensification rezoning applications, in accordance with City Council policy. A surveyor's report must identify the highest points of the existing adjoining roofs measured from the existing average grade of the shared property line.

6.16 Heritage Impact Statement
Required as determined by Planning staff for any property designated pursuant to the Ontario Heritage Act, identified on the City's Inventory of Heritage Resources, or for any property located adjacent to a designated or otherwise inventoried property.

6.17 Archaeological Report
Required for all applications in or near areas of archaeological potential, as determined by the Region of Halton. Reports must be completed in accordance with Provincial requirements and the Regional Archaeological Master Plan.

6.18 Wind Impact Study
May be required, as determined by Planning staff, for any building over 6 storeys in height. The report will provide information related to wind comfort conditions for pedestrians both on and around the development.

6.19 Sensitive Land Use (Risk Assessment) Report
Required for applications proposing sensitive land uses in proximity to existing industrial uses, or proposing industrial uses in proximity to existing sensitive uses, in accordance with Part II, Section 2.7.3 subsections n) & o) and Part II, Section 4.3 subsection d) of the City's Official Plan, Part IV, Sections 146-147 of the Regional Official Plan, and the Ministry of the Environment D-6 series guidelines.

6.20 Agricultural Impact Assessment Report
Required for applications as set out in Part II, Subsection 13.3 e) of the City's Official Plan and for certain proposals in certain designations in the Regional Official Plan. Guidelines for these assessments are available from the Region of Halton, and these assessments will be reviewed by the Halton Agricultural Advisory Committee (HAAC).

6.20 Burlington Urban Design Advisory Panel Meeting Minutes
The Burlington Urban Design Advisory Panel (BUD) is an independent advisory body comprised of design professionals that provides urban design advice to the City Building Department on all tall and mid rise buildings (5 storeys or greater) and all public development projects. Advice from BUD will be integrated early in the review process to reinforce the City's expectation for a high standard of design excellence resulting in a more efficient and effective municipal development review. A copy of BUD meeting minutesmust be submitted with the application along with a Design Brief explaining how their advice has been incorporated into the development proposal.

6.21 Hydrogeology Study
Required for all applications in areas subject to private water and septic services, as set out in Part IV, Subsection 2.1.3 b) and Part IV, Subsection 3.3 d) of the City's Official Plan, the Regional Official Plan and the Region's "Guidelines for Hydrogeological Studies and Standards for Private Services, revised June 2000. Applicants should contact the Halton Health Department for more details regarding site-specific studies, which must be approved by the Region following a peer review.

6.22 Other
Any other studies as determined to be necessary to facilitate proper consideration of the application.

Preconsultation Meeting Notes

441 Maple Avenue - March 14, 2018

Attendees:

Agencies: Rosalind Minaji, John Kisneris, Annette Simpson, Dan Ozimkovic, Sarah Cranston

Applicant: Kelly Martel –MHBC

Description of Development Concept:

- Want to reconsider landuse in the context of the downtown mobility hub and the work being done by the City
- Existing long term care facility must be replaced prior to demolition
- 19 storey, 163 unit residential apartment with underground parking
- Parking for 162 cars
- Preliminary diagrams to show the approach for this site
- Surrounding context of 11 to 15 storeys – proposed building is stepped back from Maple Ave. in order to maintain views for surrounding lower rise buildings. Mid-rise height has been cut back and added to the storeys at the eastern side of the building.
- Looking at tower separation between new and existing buildings.
- Two levels of underground parking, & four levels above ground

Planning Comments:

- The current Official Plan designation of Downtown Mixed Use Centre Medium and/or High Density permits residential development up to 185 units per hectare. All development must be compatible with the existing character of the surrounding precinct.
- The DRH zone has a maximum height of 22m and density of 185uph
- The lands are located within the Downtown Urban Growth Centre and the Downtown Mobility Hub Study Area. Area Specific Plans for the City's four Mobility Hubs are currently underway. Designations for the Downtown Mobility Hub are expected to be adopted by Council in April 2018.
- This property has been designated as "Downtown Mid-Rise Residential Precinct" in the draft Official Plan. This Precinct will primarily accommodate existing residential development consisting of eleven storeys or less, in predominantly residential areas of the downtown. Limited development opportunities existing within the precinct will be expected to transition to, as well as achieve compatibility with the St. Luke's and Emerald Neighbourhood Precinct as well as other established residential neighbourhoods outside of the Downtown.
- The draft new Official Plan policies represent the Planning Department's current position on the most appropriate form of redevelopment in the downtown. Additional height and density will not be supported. However, through the ongoing Downtown Mobility Hub Area Specific Plan process, proposed height and or density permissions may be subject to change prior to the approval of the final Area Specific Plan.
- Planning policy for downtown Burlington is in flux. While development applications will continue to be processed under the current Official Plan 1994, staff is encouraging applicants to conform to the objectives of the Downtown Mobility Hub in the proposed new Official Plan.
- The applicant is therefore strongly advised to conform to the 11 storey height limit in any future redevelopment proposal.
- A Planning Justification Report is required:
    - to discuss the impact of Provincial, Regional and local planning policy on the proposed development;
    - to explain why the requested change to higher intensity and taller residential use is desirable and represents good planning;
    - to discuss how the results of required technical studies have been used to refine the redevelopment proposal; and

- to explain how the proposed development is compatible with surrounding land uses including height, setbacks, massing, design and community features.

- Sun shadowing and height survey will be required. An angular plane should show how terracing can address pedestrian comfort.
- A wind study is required to address ground level wind conditions.
- Consider how additional landscaping may be included on the site.
- Prior to submitting the application, consultation with the Burlington Urban Design Panel will be required. An Urban Design Brief will be required to explain how the Tall Building Design Guidelines have been addressed and how the comments of BUD have been taken into account. A copy of the BUD meeting minutes must be submitted with the application. BUD Terms of Reference provided.
- Generally design of tall buildings should include the following:
  - avoidance of heavy massing and floor plates along street frontages –instead provision of articulated base buildings with a plenty of pedestrian interest and wide sidewalks;
  - provision of slender towers with approximately 750m^2 floor plates which are separated from other towers by at least 30m;
  - consideration of scale of the podium in relation to the tower;
  - orientation of buildings to consider impacts on surrounding development by providing appropriate setbacks, transitions in scale, terracing, and height limits to retain access to sunlight and privacy
- A 3D model of the proposed building is required with the submission to assist with public engagement. Model specifications provided.
- Section 37 Benefits may be required.
- Consider parking for visitors, as well as temporary drop off parking for part time workers (housekeeping, home care, etc.)

Region of Halton Planning Comments:

- The subject lands are located within the Urban Area and within the Urban Growth Centre as per the 2009 ROP
  - S. 76 of the ROP directs that the range of permitted uses and creation of lots within in the Urban Area is to be in accordance with local official plans and zoning bylaws.
  - S.81(1) directs development with higher densities and mixed uses to Intensification Areas
- All development within the Urban Area to be on full municipal services, as per Section 89(3)
- S.156(1) of the ROP requires proponents of development applications to have regard for the Region's Healthy Community Guidelines. A review the Healthy Community Guidelines should be included as part of the Planning Justification Report.
- Planning Justification Report will need to identify compliance with Provincial Legislation with respect to the conversion of a long term care facility to a freehold residential building
  - Please reference the Region's State of Housing Report 2016 and include a comprehensive analysis of the availability of long term beds in Halton.
- In accordance with In accordance with S.147(17) of the Region's Official Plan, a property is to be free of contamination prior to any development taking place
  - Regional Environmental Site Screening Questionnaire to be submitted with the application
  - Phase One ESA at the time of application (prepared to O.Reg 153-04 standards and with a Letter of Reliance), further studies may be required depending on the results of the ESA
  - Hydro vaults on private property will trigger need for Phase Two during process.
- Waste Management:
  - Concept plan shows internal Regional waste collection is proposed
  - Recommended a waste management plan be submitted with the application, as site-specific zoning may be affected
  - Please reference the Region's Development Design Guidelines for Source Separation of Solid Waste (Section 2.3) for design requirements
  - Region requires 9m overhead truck clearance and 13m truck turning radius
- Required Plans/Studies:
  - All submitted materials on a USB stick/CD

- Planning Justification Report (to include analysis of Region's Healthy Community Guidelines)
- Functional Servicing Report, Site Servicing Plan (part of FSR)
- Environmental Site Screening Questionnaire & Phase One ESA (prepared to O.Reg 153/04 standards and with a Letter of Reliance)
- Waste Management Plan recommended
- Regional review fees

Region of Halton Servicing Comments:

- There is a Halton Region local watermain, and a trunk watermain, within Maple Avenue adjacent to the proposed development. Any proposed trunk watermain service connection lateral requires special review and Regional permission to connect into, and it should be noted that permission is not always guaranteed.
- There is a Halton Region trunk wastewater main (sanitary sewer) within Maple Avenue adjacent to the proposed development. Any proposed trunk wastewater main service connection lateral requires special review and Regional permission to connect into, and it should be noted that permission is not always guaranteed.
- The Region forecasts a future capital works project for the replacement of the wastewater main within Maple Avenue tentatively for 2018-2020.
- The developer should undertake to locate the size and location of all watermains, water services, water meters, wastewater mains (sanitary sewers), wastewater (sanitary) services, stormwater mains and stormwater services that exist within the road right-of-way, to the property and within the property and place them on an Existing Site Servicing Plan drawings within their reports. Public and private utility companies can be utilized for this purpose.
- A Functional Servicing Report is required to be prepared by the developer's civil engineering consultant (watermains, water services, fire hydrants, sanitary sewer mains, sanitary sewer services, stormwater mains and stormwater services) to show options for how the property is proposed to be serviced according to City of Burlington and Halton Region standards. Local watermain and wastewater main (sanitary sewer) hydraulic analysis should be completed by the developer's consultant as well for the local sewers and the drainage area down the to the nearest trunk sewer. The consultant should include details about other developments properties in the drainage area in their analysis of the local sewers (if any). The report should speak to the number/type of units proposed and the phasing of the development with respect to the impacts on the Region's water distribution system and wastewater collection system. Phasing, timing of the development and required/available capacity shall be detailed in the report. The consultant will include details about potential external main upsizing or main extensions to accommodate the development, etc.
- The FSR report should incorporate Fire Flow Rate Testing. The proponent should undertake fireflow rate testing of representative Regional fire hydrants in the area, with the proponent's fireflow contractor and Region forces present. Include within the Report a copy of the fireflow rate testing results, and the Fire Underwriters Survey (FUS) requirements for the development. This information will help to assist in informing the watermain design and watermain hydraulic modelling analysis that is being undertaken by the proponent's consultants.
- Further to the formal hydraulic analysis requirement, the developer's consultant can utilize the Region's current water and wastewater models (if required). The developer's civil consulting engineering firm will be required to enter into a Data License Agreement prior to obtaining any digital information from the Region.
- The FSR should include information related to all other utilities infrastructure in the area and potential conflicts.
- The FSR should show the existing site services and note how they are proposed to be decommissioned to make way for the development.
- New development must be on the basis of full municipal services.
- The developer should be aware of the Region's Multi-Unit Servicing Policy with respect to the number and location of water meters.
- Regional policies state that water and sanitary services cannot cross lot lines, the owner will ensure this throughout the process. Each lot must be independently serviced if it is proposed to be a separate lot.

- Any major servicing works required for this project would fall under the Regional Servicing Agreement process, including securities, Agreement registration, developer's liability insurance and the payment of Agreement fees.
- Servicing of a standard nature is required to go through the Regional Services Permit process.
- The size and scope of, utility trench and road cut, road restoration shall be to the satisfaction of the City of Burlington for local roads.
- Watermain and wastewater main (sanitary) servicing capacity is not guaranteed at the LOPA and ReZoning stage. Servicing of development in the Burlington area of Halton Region is on a first-come-first-serve basis. The owner can pre-consult about servicing capacity with the Region at any time in the future going forward. This current development proposal capacity will be reviewed closely and commented upon at the time of Planning application receipt. Should a servicing capacity issue be identified at that time then it will have to be dealt with, working through it with the Region. Servicing capacity is deemed to be in hand at the issuance of a Regional Services Permit, which is reviewed and obtained toward the end of the City's Site Plan approval process, or Regional Servicing Agreement.
- The Region has initiated a Burlington Water Servicing Strategy Review and it is forecast to be completed this year. Please feel free to contact the Region at any time regarding the status of the review.
- As always, acquiring land for development purposes and hiring consultants, at this time, is at the risk of the developer.
- Any water services and sanitary services that currently exist to the property that will not be utilized for any reason will be required to be disconnected right at the respective main by the developer.
- The developer's site servicing consultant can preconsult with the Region at any time regarding their proposed draft site servicing water design, wastewater design and identified utility conflicts (including storm).
- The Region would like to receive confirmation in writing when any required formal land assembly has taken place at the LOPA and ReZoning stage in order for servicing to conform to Regional Policies, that water and wastewater services do not and will not cross lot lines for different property owners.
- The developer should prepare a Solid Waste Management Plan to the satisfaction of the Region. The Plan shall have regard for the Region's Solid Waste Management Guidelines. The Solid Waste Management Guidelines are available on-line at http://www.halton.ca , Regional Official Plan (ROP) Guidelines, Development Design Guidelines for Source Separation of Solid Waste.
- The developer will inform the City, and the Region, whether they will be submitting a Site Plan application at the same time as the LOPA and ReZoning applications for timing purposes and issues identification and resolution purposes.

Site Engineering Comments:

- The deemed Right of Way (ROW) of Maple Avenue is 26m, City of Burlington owned, no widening required.
- There is a project noted in our Capital Works 2018 – 2027 Budget and Forecast to resurface Maple Avenue in 2018, subject to change. Information on future Capital Works projects are available on our website www.burlington.ca . We are advising of the project to advise the applicant that a new Standard is in effect as of July 12, 2017, S-114-B, requiring any disturbance to the municipally owned ROW asphalt to be restored curb to curb for the entire frontage(s) of the property, it may also mean that a City contractor will complete the works, and the costs borne by the Applicant.
- From our GIS mapping it does not appear as though the property is within Conservation Halton regulated area, however, we would defer to Conservation to confirm.
- There is a Trans-Northern pipeline adjacent to the rear of the property, please contact Trans-Northern Pipelines Inc to determine any requirements they may have when constructing in close proximity to their utility.
- Hydro One is adjacent to the site (east), please contact them to determine any requirements they may have when constructing in close proximity to their utility
- 455 Maple is higher than 441 Maple, there is an existing retaining wall along the shared property line – this will need to be looked at closely during the design stage. We wouldn't want to see a narrow gap between

an existing retaining wall and the new wall of the building, the applicant will have to work with the adjacent landowner to appropriately address the grading between properties.

- There are two hydro vaults at the front of the property - need to consult with Burlington Hydro early on
- Streetscaping will likely be required, i.e. benches, coloured concrete, decorative lighting, etc. Please consult with our Planning and/or Landscape Architect for details.
- Existing south driveway is shared with 421 Maple, as noted on the draft site plan as "subject to right of way". This will need to be looked at carefully for access during construction, we will need know that it is feasible (i.e. 421 Maple will still have access during construction) to construct the building at the rezoning stage
- We appreciate the provision of at-grade and under/above ground bicycle parking for residents and guests
- We appreciate the design of the underground parking, consideration of pedestrian movements, i.e. safe/delineated areas at exits to stairwells and elevators, please ensure strategic placement of barrier free parking so that there is clear access aisles to the elevators, the accessible spaces are not labeled on the plan yet. We would also ask that the entrance to the elevator/stair area connect with the 2.0m pathway along the center of the parking.
- Please consider electric car charging stations in the underground parking, and consider ductwork for future electric car charging stations at individual parking spaces, if residents want to install in the future.
- Remedial work to the Hydro One owned parcel at the rear that the current property uses may be required, to be determined.
- Consider bird migratory routes and mitigation measures to avoid bird strikes.
- Trees: we defer to Vanessa Aykroyd to comment
- Phase One Environmental Site Assessment required – there is an existing monitoring well on site – please ensure the Phase ONE ESA includes information regarding the well, i.e. when was it installed, is it still active, well records, etc. The Phase One ESA needs to be completed in accordance with O. Reg. 153/04, including a letter of reliance stating the City (and Region) may rely on the information provided. Please note that depending on the results of the Phase One ESA, further environmental investigation may be required, up to and possibly including a Record of Site Condition.
- Stormwater Management Report:
    - Umar Malik has provided the following SWM criteria:
    - Enhanced Quality Control achieving 80% Total Suspended Solids Removal. We ask that a treatment train approach be utilized that incorporates Low Impact Development techniques. OGS units providing 80% TSS removal will be credited at 50%,
    - Quantity Control – post development flows controlled to pre development flow levels by providing on site storage for all storm events including the 2 to 100 year storm.
    - Provide storage details and location
    - Report to include servicing & grading plan
    - There is an existing storm system on site – a catch basin in the rear parking lot (that appears to be on Hydro One lands). The existing system will need to be shown on the drawings. If the system is to be reused or maintained we will need videos of the existing system to see the condition. If not, please note on the drawings what is to be removed. Typically we require removal to the mainline, i.e. not just abandoned.
    - Confirm if there is permanent dewatering required for underground parking – and incorporate into design
    - Please note that there should be no surface ponding in accessible parking spaces, and no surface ponding in a 5 year storm.
    - Landscape areas over underground parking will be considered 0.9 runoff coefficient.
    - Please clearly show the overland flow route for this address and neighbouring properties to ensure existing drainage patterns are maintained.
    - Quantity controls must use an orifice tube (not plates).
    - Need to confirm capacity of receiving system
    - Need to confirm condition of receiving system (i.e. video inspection)
    - Rooftop storage will not count towards the storage requirements
    - Control structures and their location with cross sectional details

- It's important to determine storage requirements as we need to ensure any tanks in the underground parking are sized correctly at the RZ/OPA stage to avoid having to use up parking spaces later on for an increase in tank size.
- If you have any questions regarding SWM criteria please contact us (umar.malik@burlington.ca or annette.simpson@burlington.ca)
- We encourage Low Impact Development Stormwater Management techniques, such as rainwater harvesting for irrigation, use of treatment train approach of quality control by using bio and infiltration swales, etc., currently we look to the CVC/TRCA LID guidelines and/or in the future MOECC guidelines.

- Geotechnical Report - underground parking, groundwater conditions – is any permanent dewatering required for underground parking, & to support possible LID for SWM
- Construction Management Plan – to show how the site can be constructed while maintaining access for 421 Brant (ex. easement) and ensure that the excavation/shoring/tiebacks/etc. are within the limits of the subject property. If it is proposed to use the back (un-owned) property during construction please note on the plan and obtain written permission/permit from the Owner, Hydro One, and include with submission. Additional details will be required at the Site Plan stage.
- Detailed Grading and servicing plans, also including:
  - city trees to be shown on drawing and boundary trees over 100mm in diameter within 3m of the property line), indicate which trees are proposed to be removed.
  - Need to include grades on adjacent properties enough to determine existing drainage patterns.
  - Show existing retaining walls (including existing walls on neighbouring property), need to see how grades will interface, may need to remove adjacent wall (With owner permission)
  - 100 year storm elevation
  - Catch basins in landscape areas to be sumpless
  - Show neighboring driveway/access/easement for 421 Brant – and show how it will remain accessible for the duration of construction.
  - We would strongly encourage the Applicant's Civil Engineer to daylight the area of the proposed service connections to accurately locate the existing infrastructure (sewers, water, bell, hydro, cable, etc.) and determine inverts before completing detailed design work. This will be a requirement before Site Plan approval (if application proceeds)
  - Although a site plan issue, we need to ensure there is room for snow storage. The ground floor plan does not look to have any "spare" room where snow could be stored. Stating that snow will be removed will not be accepted at the site plan stage. Our strong preference is to have snow stored on a landscaped (grass) area and then intercepted by catchbasins, this would allow for pretreatment of salty/sandy snow prior to entering the storm system.
  - Another site plan issue, however we ask that the architect and other consultants consider placement of utility meters/piping/vaults/etc. please ensure they do not block walkways or be placed near the main entrances, ensure there is enough room at the design stage of the building.
- Noise Feasibility Study – for the development itself and need to see if there are any negative impacts on surrounding residential.
  - Please note that adjacent to the site the existing high-rise buildings and adjacent developments with underground parking may be stationary sources that will need to be assessed in the report.
  - Please have the noise engineer consult with the architect and structural engineer as to the optimal placement of vents and fans for the underground parking
  - Please advise the noise consultant that reflective surface should be used in Stamson calculations
  - Please also advise the noise consultant that although NPC-300 tables indicate 60dBA in the OLA with warning clauses, it is not acceptable to the City, we request that all possible measures be taken to control the noise in the OLA to 55dBA or less, if not feasible, then we request calculations to confirm what levels could be achieved, i.e. 60dBA would require a 3m noise barrier, 59 a 3.5m, 58dBA a 4.0m, etc. all the way to 55dBA.
  - All STAMSON calculations should be included in the brief
  - Copies of correspondence from the City of Burlington confirming traffic counts must be included in the brief.

- Site plan to be included in the report
- Key plan showing points of reception to be included & a chart referencing the key plan, detailing the estimated noise levels, allowable levels, and mitigated noise levels
- Area context plan to be included showing potential sources of noise

- Summary for RZ/OPA:
  - Stormwater Management Report (Can be a section in the FSR)
  - Detailed Servicing, Grading & Drainage drawings
  - Noise Feasibility Study
  - Geotechnical Report (for underground parking & if LID proposed)
  - Phase One ESA (in accordance with O. Reg. 153/04 & letter of reliance)
  - Tree preservation (and removal) plan
  - Preliminary construction management plan
- At the Site Plan Stage:
  - Erosion control plan
  - Construction Management Plan – will need to be detailed to ensure access to 421 Maple is maintained for the duration of construction and to ensure all excavation/shoring/tie backs/etc. are within the limits of the subject property). As well as show trades parking, truck staging, sanitary facilities, site trailer, material storage, hoarding, etc. No trade's parking will be allowed on City streets. No Truck Staging will be allowed on City streets, unless permission/permit is obtained from Transportation. After hours emergency number to be posted on front gate. Solid wood hoarding (with concreted-in posts) around the site will be required.
  - Utility coordination plan, please no meters/valves/piping/vaults at the front of the building or near main entrances or blocking/encroaching into walkways.
  - Landscape plans – street-scaping will be required.
  - Clearly show pedestrian connections
  - Lighting/Photometrics details/drawing, as per City of Burlington Accessibility Design Standards and City of Burlington Outdoor Lighting Guidelines, available on our website
  - Snow storage – preferred on a soft surface, i.e. grass, as a pretreatment for quality control.
  - Precondition survey of surrounding properties as well as vibration monitoring during construction will be required.
  - Mechanical Engineer will need to confirm that they have reviewed the SWM and have designed the internal pipes accordingly.
  - Applicant is advised that a new Standard is in effect as of July 12, 2017, S-114-B, requiring any disturbance to the municipally owned ROW asphalt to be restored curb to curb for the entire frontage(s) of the property, it may also mean that a City contractor will complete the works, and the costs borne by the Applicant

Urban Forestry Comments:

- There are two City Trees listed in the City's Tree Inventory along the Maple Ave frontage, exact location and ownership to be verified by OLS survey.
- Tree Inventory and Preservation Plan for all trees within the right of way, and all trees greater than 10cm DBH on site, and within 3m of any property line. The applicant is advised that trees whose trunks are located on a property line are protected under the Forestry Act of Ontario. Should there be impacted trees along property lines protected by the Forestry Act, the adjacent property owner(s) must provide informed consent in writing as to the proposed treatment of trees.
- We ask that no trees be removed from site until after the Official Plan Subdivision/Rezoning has been completed/ approved.
- Any proposed City Tree removal will require Council Approval. Removal of City trees should be avoided wherever possible. City trees proposed for removal will require an arborist's assessment of health and structural condition prior to the request being accepted.
- Please refer to the City of Burlington Tree Preservation and Protection Specification SS12A for further tree protection details.

Transportation Services Comments:

- A Traffic Impact Study (TIS) is required
- A Transportation Demand Management (TDM) section is required as part of the TIS
- Bicycle parking is required (at-grade for visitors and secured bike parking for residents)
- A Parking Justification Report will be required since a parking deficiency is proposed, based on the parking rates outlined in the Zoning Bylaw
- The applicant is encouraged to refer to the City's Site Plan Application Guidelines early in the design process (ramp grades, stall dimensions, walls, columns etc.)
- Consider electric vehicle charging stations for the proposed development.



about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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