



S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing Report

**222, 226 & 228 Barton Street East &
255-265 Wellington Street North**

City of Hamilton

December 2019
Revised January 2021

SLA File: 18120

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by 467052 Ontario Ltd. to provide Consulting Engineering services for the proposed development at 222, 226 & 228 Barton Street East & 255-265 Wellington Street North in the City of Hamilton (see Figure 1.0 for location plan). This report will outline the functional servicing strategy for the proposed development.

The proposed development consists of constructing a 7-storey mixed-use condominium building containing approximately 6 commercial units and 79 residential units. The development will also include an underground parking structure, concrete curbing/sidewalk, an asphalt parking lot and landscaped areas.

This Functional Servicing Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the site plan prepared by McCallum Sather for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

- Ref. 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)
- Ref. 2: Engineering Guidelines for Servicing Land under Development Applications (City of Hamilton, December 2012)
- Ref. 3: City of Hamilton Criteria and Guidelines for Stormwater Management Infrastructure (September 2007)
- Ref. 4: City of Hamilton Storm Drainage Policy (2004)
- Ref. 5: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

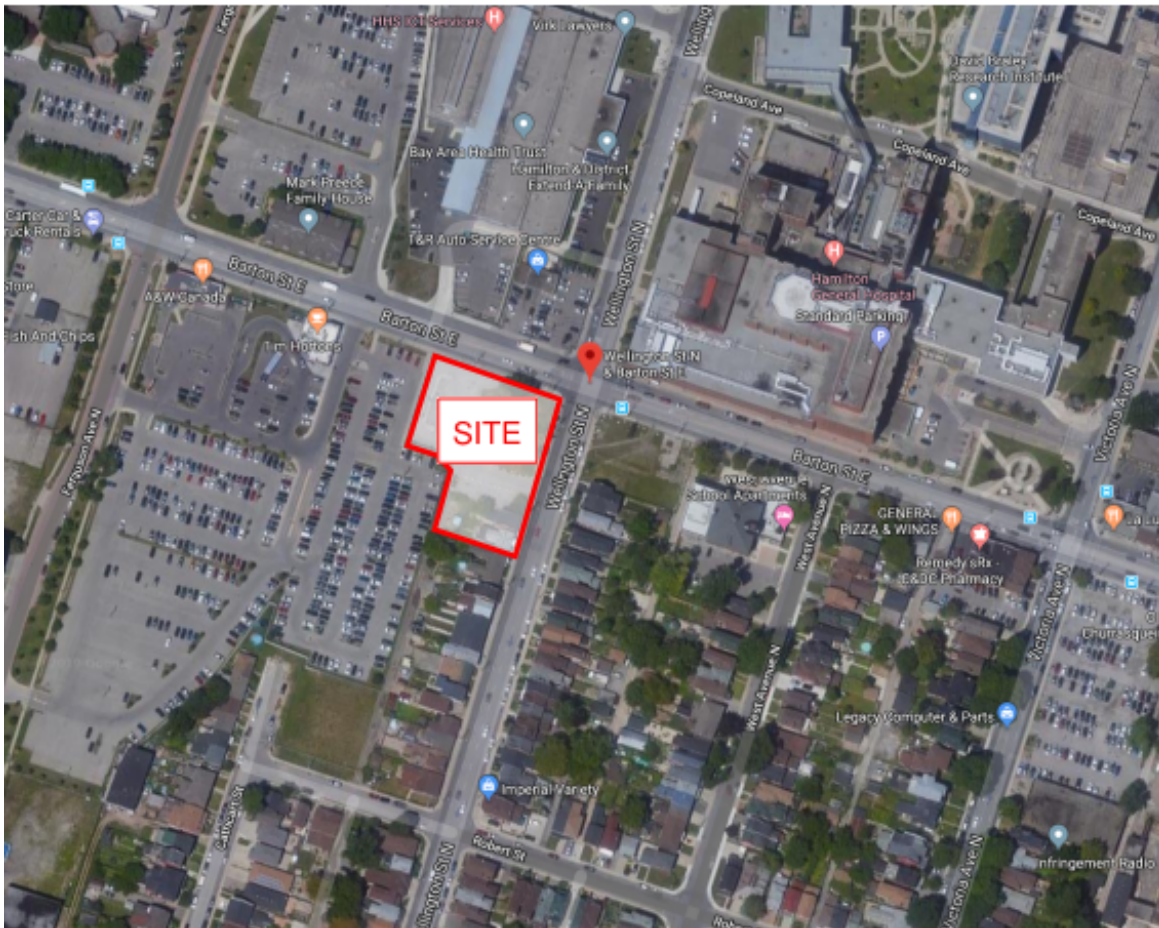


Figure 1.0 – Location Plan

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Hamilton:

Quantity Control

The stormwater discharge rate from the proposed site shall be controlled to the 2-year pre-development discharge rate for all storm events up to and including the 100-year event.

Quality Control

The stormwater runoff from the proposed condition site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Erosion Control

Erosion and sediment control measures will be implemented in accordance with the standards of the City of Hamilton.

2.1 EXISTING CONDITIONS

Historically, the approximate 0.35ha site consisted of four (4) dwellings and two (2) commercial buildings that have been demolished with an associated asphalt driveway and landscaped areas. The site is bound by Barton Street East to the north, Wellington Street North to the east, existing residential lands to the south and an existing parking lot to the west.

Drainage from the existing property is capture by three (3) existing catchbasins throughout the site which ultimately discharge to the existing 2.8m x 3.35m storm sewer along Wellington Street North.

One catchment area, Catchment 101, has been identified in the existing condition. Catchment 101 represents the drainage area for the entire site which is captured by the existing catchbasins and storm sewer system. See Table 2.1 below and drainage area plans in Appendix A for details.

Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
101	Entire Site	0.35	86	0.82

An analysis was performed on the above mentioned catchment area using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Hamilton Mount Hope Design Storms. A summary of the results can be found in Table 2.2 below and the detailed SWMHYMO input/output information in Appendix B.

Storm Event	Catchment 101
2-Yr Event	0.063
5-Yr Event	0.089
10-Yr Event	0.107
25-Yr Event	0.129
50-Yr Event	0.147
100-Yr Event	0.163

2.2 PROPOSED CONDITIONS

The proposed development consists of constructing a 7-storey mixed-use condominium building. The development will also include an underground parking structure, concrete curbing/sidewalk, an asphalt parking lot and landscaped areas. The site will be serviced with a private storm sewer system designed and constructed in accordance with the standards and specifications of the City of Hamilton.

Four catchment areas, Catchments 201, 202 and 203 have been identified in the proposed condition. Catchment 201 represents the drainage area for the proposed roof

which will be capture and controlled before discharging to the existing combined sewer along Wellington Street North. Catchment 202 represents the drainage area for the proposed asphalt parking lot and the external lands which will also be captured and controlled before discharge to the existing combined sewer. Catchment 203 represents the drainage area for the frontage of the site which will sheet drain uncontrolled to the right-of-way. See Table 2.3 below and the Proposed Condition Drainage Area Plan in Appendix A for details.

Catchment ID	Description	Area (ha)	Percent Impervious	Run-off Coefficient
201	Proposed Building	0.19	100	0.95
202	Proposed Parking Lot	0.11	72	0.72
203	Frontage to ROW	0.04	50	0.58

An analysis was performed on the proposed conditions catchment areas using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Hamilton Mount Hope Design Storms. A summary of the results can be found in Table 2.4 below and the detailed SWMHYMO input/output information in Appendix B.

Storm Event	Catchment 201 Discharge (m ³ /s)	Catchment 202 Discharge (m ³ /s)	Catchment 203 Discharge (m ³ /s)
2-Yr	0.039	0.017	0.004
5-Yr	0.054	0.025	0.007
10-Yr	0.064	0.031	0.008
25-Yr	0.077	0.038	0.011
50-Yr	0.086	0.044	0.013
100-Yr	0.095	0.050	0.014

Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchments 201 and 202. Catchment 201 will be controlled by Zurn Z-105 controlled flow roof drains on the proposed building. Catchment 202 will be controlled by a 95mm \varnothing orifice plate located at the outlet of the proposed storage vault. It has been determined that the discharge from the proposed site to the existing storm sewer system will not exceed the 2-year pre-development discharge rate.

With the installation of on-site quantity control measures for Catchment 201 and 202, it will be required to provide stormwater storage during storm events up to and including the 100-year event. The proposed roof within Catchment 201 will be designed to allow a maximum depth of 0.15m of roof ponding to provide sufficient stormwater storage. To provide the required storage for Catchment 202, it is proposed to install a storage vault within the underground parking structure. Details of the proposed storage strategies can

be found on the Preliminary Engineering Plans. The stage-storage-discharge characteristics can be seen on table 2.5 and 2.6 below and Appendix A for details.

Head Above Drain (m)	Roof Storage (m ³)	Discharge (m ³ /s)
0.000m	0	0.0000
0.050m	55.9	0.0106
0.075m	83.8	0.0160
0.100m	111.8	0.0213
0.150m	167.7	0.0319

Elevation (m)	Storage (m ³)	Discharge (m ³ /s)
82.00 (Bottom of Tank)	0	0.0000
82.25 (0.25m Deep)	3	0.0085
82.50 (0.50m Deep)	6	0.0127
82.75 (0.75m Deep)	9	0.0158
83.00 (1.00m Deep)	12	0.0184
83.25 (1.25m Deep)	15	0.0207
83.50 (1.50m Deep)	18	0.0227
83.75 (1.75m Deep)	21	0.0246
84.00 (2.00m Deep)	24	0.0263

An analysis was performed on the proposed condition site using the SWMHYMO hydrologic modelling program to determine the volume of stormwater storage that is required during the 2-year to 100-year City of Hamilton Mount Hope Design Storms. A summary of the results can be found in Table 2.7 and detailed SWMHYMO input/output information can be found in Appendix B.

Storm Event	Catchment 201 Controlled Discharge (m ³ /s)	Catchment 201 Required Storage (m ³)	Catchment 202 Controlled Discharge (m ³ /s)	Catchment 202 Required Storage (m ³)	Total Discharge ¹ (m ³ /s)	Allowable Discharge ² (m ³ /s)
2-Yr	0.007	35.0	0.012	5.8	0.022	0.0575
5-Yr	0.010	50.8	0.016	9.1	0.030	0.0575
10-Yr	0.012	61.4	0.018	11.7	0.036	0.0575
25-Yr	0.014	74.8	0.021	15.1	0.043	0.0575
50-Yr	0.016	84.1	0.023	18.1	0.048	0.0575
100-Yr	0.018	94.4	0.025	21.1	0.053	0.0575

¹ Total Discharge = Controlled Catchment 201 + Controlled Catchment 202 + Uncontrolled Catchment 203 (Table 2.4)

² Allowable Discharge = Catchment 101 (Existing conditions 2-year discharge rate) (Table 2.2) – Wastewater Demand (Section 3.2)

This analysis determined the following:

- The proposed condition discharge rates will not exceed the 2-year existing conditions discharge rate of 0.063m³/s during the 2-year to 100-year design storms with the installation of an orifice plate and Zurn Z-105 roof drains.
- Catchment 201 will require 94.4m³ of stormwater storage during the 100-year event, which can be accommodated by the proposed roof ponding, having a volume of 167.7m³.
- Catchment 202 will require 21.1m³ of stormwater storage during the 100-year event, which can be accommodated by the proposed storage vault, having a volume of 24m³.

Quality Control

The proposed development is required to achieve an “Enhanced” (80% TSS removal) level of water quality protection. To achieve this criteria, discharge from Catchment 202 will be subject to treatment from a HydroStorm oil/grit separator or equivalent before ultimately discharging to the existing storm sewer along Wellington Street North. The HydroStorm sizing software was used to determine the required size of oil/grit separator unit for the site. It was determined that a HydroStorm HS4 will provide 83% TSS removal and 100% average annual runoff treatment, which satisfies the requirements for an “Enhanced” level for quality control. See HydroStorm unit sizing procedures in Appendix C for details.

HydroStorm units require regular inspection and maintenance as per the manufacture’s specifications to ensure the unit operates properly. See HydroStorm Maintenance Manual in Appendix C for details.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks) in the proposed catchbasins as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and

- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

Details of the proposed erosion & sediment control measures have been provided on the Preliminary Grading and Erosion Control Plan.

3.0 SANITARY SEWER SERVICING

3.1 EXISTING CONDITIONS

The site is located at the southwest corner of Barton Street East and Wellington Street North with an existing 450mm \varnothing combined sewer located along Barton Street East and an existing 375mm \varnothing combined sewer located along Wellington Street North.

3.2 SANITARY DEMAND

The proposed development consists of constructing a 7-storey mixed-use condominium building containing approximately 6 commercial units and 79 residential units. Wastewater generation for the site was calculated based on Table 8.2.1.3.A – Residential Occupancies and Table 8.2.1.3.B – Other Occupancies of the 2012 Ontario Building Code.

Tables 3.1 and 3.2 summarize the sanitary sewer discharge rates from the proposed site. Sanitary discharge calculations will be confirmed upon completion of the Wastewater Generation Assessment, which will be prepared as part of the Site Plan Application process.

Population ^A	Avg. Dry weather flows (l/s) ^B	Peaking Factor ^C	Infiltration ^D (l/s)	Peak Flow ^E (l/s)
237 persons	0.988	5.0	0.14	5.08

^A Population = (3 persons/unit x 79 units) = 237 persons
^B Average Dry Weather Flows = 360 L/Day/cap x 237 persons = 85,320 L/day
^C Peak Factor (2<Peak Factor<5) = (5/(Population in thousands)^{0.2})=(5/(0.237)^{0.2})=6.67
^D Infiltration flow based on city of Hamilton Standard 0.4 l/sec/ha = 0.4 l/sec x 0.35 ha=0.14
^E Peak Flow = (Average Flow x Peaking Factor) + Infiltration

Floor Area ^A (m ²)	Avg. Dry weather flows (l/s) ^B	Peaking Factor ^C	Peak Flow ^F (l/s)
1545	0.083	5.0	0.40

^A Floor area of commercial units
^B Average Dry Weather Flows = 4.5 L/Day/m² x 1545m² = 6,953 L/day
^C Peak Factor (2<Peak Factor<5) = (5/(Population in thousands)^{0.2})=(5/(0.237)^{0.2})=6.67
^D Peak Flow = (Average Flow x Peaking Factor)

Based on the above, the estimate of sanitary demand for the proposed mixed-use building is 5.5 l/s.

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed mixed-use condominium building will be serviced by a 200mmØ sanitary sewer, designed and constructed in accordance with City of Hamilton standards. Drainage from this sewer will discharge to the existing 375mmØ combined sewer adjacent to the site along Wellington Street North.

The minimum grade of the proposed 200mmØ sanitary sewer will be 1.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.033 m³/s (33 l/s). Therefore, the proposed 200mmØ sanitary sewer at 1.0% grade is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 200mmØ and a 500mmØ watermain located along Barton Street East and a 300mmØ watermain located along Wellington Street North. Three existing hydrants are located within close proximity of the subject lands, along Barton Street East and Wellington Street North.

4.2 DOMESTIC WATER DEMAND

The following is an estimate of the water usage for the proposed development. Water usage for the site was calculated based on the “Fixture Unit Method” as per Table 7.6.3.2.A. forming part of sentences 7.6.3.1(1) to (3) and 7.6.3.4.(2), (3) and (5) of the 2012 Ontario Building Code. See Table 4.1 for fixture unit (FU) calculations. Fixture unit calculations are estimated and will be confirmed upon completion of the Water Usage Assessment, which will be prepared as part of the Site Plan Approval process.

Table 4.1 – Proposed Domestic Water Demand				
Residential Units				
Component	No. of Fixtures/Unit	FU/ Fixture	No. of Units	Total FU
Lavatory (8.3L/min or less per head) (Private)	1	0.7	56	39.2
	2		23	32.2
Shower Head (9.5L/min or less per head) (Private)	1	1.4	56	78.4
	2		23	64.4
Water Closet (6 LPF or less with flush tank) (Private)	1	2.2	56	123.2
	2		23	101.2
Sink (kitchen, domestic, 8.3 L/min or less)	1	1.4	79	110.6
Dishwasher (domestic)	1	1.4	79	110.6
Clothes Washer (3.5 kg)	1	1.4	79	110.6
			Total FU:	770.4

Retail/Commercial Units			
Component	No. of Fixtures	FU/ Fixture	Total FU
Lavatory (8.3L/min or less per head) (Public)	12	2	24
Water Closet (6 LPF or less with flush tank) (Public)	12	2.2	26.4
Total FU:			50.4

820.8FU = 155 IGPM (11.73 L/s)

4.3 FIRE FLOW DEMAND

Fire flow demands for development are governed by a number of guidelines and criteria, such as the Ontario Building Code (OBC), various codes and standards published by the National Fire Protection Association (NFPA) and most recently, the Target Available Fire Flows provided by the City of Hamilton.

The proposed development consists of constructing a 7-storey mixed-use condominium building containing approximately 6 commercial units and 79 residential units. Existing hydrants are located along Barton Street East and Wellington Street North, within the required 90m separation to the building face of the proposed buildings (as per Sentence 3.2.5.7 of the 2012 Ontario Building Code).

The fire flow for this building was determined to be the greater of the OBC fire flow calculation (OBC section A-3.2.5.7) or the City of Hamilton Target Available Fire Flow. The City of Hamilton Target Available Fire Flow is listed at 150 l/sec for Residential Multi (greater than 3 units) and 150 l/sec for Commercial. Since the OBC fire flow calculation has a maximum value of 150 l/sec the City of Hamilton Target Available Fire Flow of **150 l/sec** will be used.

The following hydrant flow tests for the public fire hydrants in close proximity to the proposed development had been analysed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 below summarizes the hydrant flow tests provided by the City of Hamilton.

Table 4.2 - Hydrant Flow Test Data	
Hydrant ID	HA18H014
Location	247 Wellington Street North
Test Date (mm/dd/yyyy)	08/28/2015
Static Pressure	60 psi
Residual Pressure During Test Flow	59 psi
Test Flow Rate	790 IGPM (60 l/s)
Theoretical Flow @ 20 psi	5,791 IGPM (439 l/s)

Hydrant ID	HA18H015
Location	Barton Street East
Test Date (mm/dd/yyyy)	09/03/2015
Static Pressure	62 psi
Residual Pressure During Test Flow	60 psi
Test Flow Rate	900 IGPM (68 l/s)
Theoretical Flow @ 20 psi	4,658 IGPM (353 l/s)
Hydrant ID	HA18H016
Location	191 Barton Street East
Test Date (mm/dd/yyyy)	09/01/2015
Static Pressure	64 psi
Residual Pressure During Test Flow	64 psi
Test Flow Rate	1,070 IGPM (81 l/s)
Theoretical Flow @ 20 psi	N/A

Based on the above hydrant flow data, the theoretical available flow rate is between **353 & 439 l/s at 20 psi**. Based on the Target Available Fire Flow, the required fire flow is **150 l/s**. Therefore, the water distribution system has adequate pressure and capacity to service the proposed development.

4.4 PROPOSED WATER SERVICING AND ANALYSIS

The proposed water servicing for the site will consist of connecting a 150mm \varnothing water service off of the existing 300mm \varnothing adjacent to the site on Wellington Street North. The proposed 150mm \varnothing water service will provide domestic and fire water service for the proposed mixed-use building. Water services for the site are to be designed and constructed in accordance with City of Hamilton standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development of 222, 226 & 228 Barton Street East and 225-265 Wellington Street North can be constructed to meet the requirements of the City of Hamilton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the City of Hamilton standards;
- A 95mm \varnothing orifice plate be installed within the storage vault to provide adequate quantity control prior to discharging from the site to the existing storm sewer system;
- A storage vault be installed within the underground parking structure as per the Preliminary Grading & Servicing Plan to provide stormwater storage;

- Zurn Z-105 roof drains or equivalent be installed as per this report to provide sufficient roof top storage;
- A HydroStorm HS4 or equivalent will be installed to achieve an “Enhanced” level of quality control;
- Erosion and sediment control will be designed and installed to meet the requirements of the City of Hamilton;
- The sanitary and water servicing system will be designed and constructed as per this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

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APPENDIX A

STORMWATER MANAGEMENT INFORMATION

APPENDIX B

SWMHYMO INPUT/OUTPUT INFORMATION

APPENDIX C

QUALITY CONTROL INFORMATION
