



File: 24035

FUNCTIONAL SERVICING REPORT

222 Gate Street, Niagara-on-the-Lake Revised November 2025

INTRODUCTION

Upper Canada Consultants has been retained to undertake and provide a Functional Servicing Report to address the servicing needs and requirements as part of a Zoning By-law Amendment submission for the proposed development. The project site is located at the above noted address, situated south of Queen Street, north of Johnson Street, and west of Victoria Street. The development site was historically developed with a single-family dwelling.

The proposed development site is approximately 0.08 hectares and shall consist of a 2-storey, 18 suite hotel and associated underground parking garage. The owners of the proposed development site are also owners of the adjacent rear (easterly) parcel and subsequent 124 on Queen Hotel and Spa development. It is the intention of the owner to merge the properties into one parcel as the 222 Gate Street hotel will be an extension of the 124 on Queen Hotel and Spa. The underground parking garage on the new building will be connected to the underground parking garage currently occupying the adjacent rear (easterly) lot that is accessed via Victoria Street.

The objectives of this study are as follows:

1. Identify domestic and fire protection water service needs for the site;
2. Identify sanitary servicing needs for the site; and,
3. Identify stormwater management needs for the site.

WATER SERVICING

There is an existing 200mm diameter watermain located on the east side of Gate Street fronting the development site. It is proposed to connect a 150mm diameter water service to provide both domestic and fire water supply for the proposed development. Although the parking garage as part of the new building will be connected to the adjacent rear parking garage, the water systems for the 222 Gate Street property will remain entirely separate.

The nearest municipal hydrants are located at the following locations:

- South corner of the intersection of Queen Street and Gate Street
- South corner of the intersection of Gate Street and Johnson Street



Per the MECP Design Guidelines for Drinking-Water Systems (2008), hotels have a daily average water use consumption of 225 L/bed-space/day with a Peak Hour peaking factor of 2.70. To be conservative, the proposed development will produce approximately 36 bed spaces resulting in a total domestic water consumption of 21,870L/day or 0.25L/sec.

A preliminary calculation has been conducted (Appendix A) to determine the minimum fire flow requirement per the Fire Underwriters Survey (2020). The calculation utilizes factors such as: Type of Construction, Area, Combustibility of Contents, etc. to determine the minimum flow rate required for this type of building. At this time, the calculations conservatively assume no sprinklers will be required, and the building will be construction with ordinary construction methods. The calculation has concluded a minimum fire flow of 159 L/s will be required. This value includes the peak domestic flow requirement. It should be noted that this value is an estimation and may change based on future iterations of the proposed development strategy.

Utilizing hydrant flow data provided by the Town of Niagara-on-the-Lake (dated 26th & 29th of July, 2024) for the previously noted hydrants, a Fire Flow Calculation Sheet was also completed to determine the expected available flow rates during a fire event at 20 psi. The calculation has concluded that flow rates of 216 L/s and 229 L/s will be available at the hydrants at the intersections of Johnson Street and Queen Street respectively. Therefore, it is expected that the existing municipal watermain system will have sufficient capacity for the proposed development.

SANITARY SERVICING

There is an existing 200mm diameter AC sanitary sewer fronting the proposed development site conveying flows southerly on Gate Street. The proposed development will discharge sanitary flows to the existing sewer via 200mm diameter service.

A calculation (Appendix B) has been conducted to determine the peak sanitary flows from the proposed building and their effects on the immediate downstream sanitary sewer fronting the site. The analysis utilizes a peak unit sewage flow rate of 225 L/bed space/day as well as a Peaking Factor of 2.0 per the MECP Design Criteria. The analysis has determined that the proposed development will discharge a total peak flow rate of 0.21L/s to the existing sanitary sewer system. It is expected that this will be an acceptable addition to the capacity of the municipal system.

STORMWATER MANAGEMENT PLAN

The following is a summary of the Stormwater Management Plan for the proposed development site.

The criteria provided by the Town of Niagara-on-the-Lake and Region of Niagara for this development includes the requirement to improve stormwater quality levels discharging from the site to MECP Normal Protection (70% TSS removal) levels. Additionally, it has been required by the Town of Niagara-on-the-Lake to control peak post-development stormwater flows during the 100-year event to pre-development 5-year storm event levels.



Existing Conditions

Using topographical information, it has been determined that all stormwater from the site has historically been directed westerly towards the Gate Street road allowance. Stormwater flows then enter the municipal 375mm diameter Gate Street storm sewer via catch basins and discharge directly to the One Mile Creek outlet located at the north corner of the intersection of Gate Street and Johnson Street. A Weighted Impervious Calculation in Appendix C concluded the original property had a Runoff Coefficient of 0.45 when developed with a single detached dwelling.

Per the 'One Mile Creek – Floodplain Mapping' study conducted by the NPCA (July, 2004), One Mile Creek has an overall subwatershed of approximately 272.5ha in size extending from East and West Line to its' ultimate Lake Ontario outlet located just north of Niagara Boulevard. The Gate Street stormwater outlet is located well within the lower half of the drainage shed for this watercourse.

Using the Storm Drainage Area Plan for the existing Gate Street Storm Sewer System provided by the Town of Niagara-on-the-Lake, a storm sewer design sheet has been created to determine the available capacities within the sewer system as the original was not available within the town records. Figure 1 in Appendix C outlines the recreated drainage areas based on the historic Drainage Area Plan. A Weighted Impervious Calculation Sheet has concluded that the original drainage areas resulted in a total area of 0.92 hectares at an overall weighted Runoff Coefficient of 0.68 discharging to the Gate Street storm sewer system. This resulted in a peak stormwater flow 89.9 L/s occupying a maximum total capacity of approximately 82% within the downstream Gate Street storm sewer system.

Proposed Conditions

The current development strategy will result in the vast majority of the property developed with the proposed hotel building and a terrace occupying the frontage onto Gate Street. It is expected that the building will discharge stormwater flows to the existing storm sewer system on Gate Street. A storm sewer service will be constructed to the proposed building to provide an outlet for stormwater flows from the proposed development site.

As the entire site will be developed with rooftop or landscape area, no significant source of Total Suspended Solids (TSS) will be occupy the site. Therefore, no additional quality control measures are expected to be required for this development.

For stormwater quantity flow analysis, calculations have been completed for both the site and the downstream stormwater system.

Site Analysis

Per the Weighted Impervious Calculation Sheet in Appendix C, the Runoff Coefficient for the development site will increase from 0.45 to 0.80 as a result of the proposed development. As stated previously, it has been required by the municipality to restrict post-development peak stormwater flows during the 100-year event to pre-development 5-year storm event levels prior to discharge



from the site. A Modified Rational Method (Appendix C) calculation has been conducted to outline the notable peak flows from this development with the expected storage requirement. The calculation concludes stormwater flows will be restricted from 25.6L/s to 9.0L/s during the 100-year design storm event which will require approximately 10.7m³ of on-site stormwater storage prior to discharge to the Gate Street storm sewer system.

During major storm events greater than the 5 year design storm, stormwater flows from the proposed development site discharge to the Gate Street road allowance, where they are directed south and immediately outlet to One Mile Creek located immediately downstream of the site.

Gate Street Stormwater System Analysis

A due-diligence analysis has been conducted on the Gate Street Stormwater System to determine if the proposed development will have an impact on downstream municipal infrastructure in the scenario that stormwater quantity controls were not provided.

Per the Weighted Impervious Calculation Sheet in Appendix C, the overall Runoff Coefficient of the Gate Street storm sewer system (FUT) will increase from 0.68 to 0.71 as a result of the proposed development for the same overall drainage area. As shown in the Storm Sewer Design Sheet, this will increase peak flows on Gate Street from approximately **156.5L/s** to **163.4L/s** (difference of 6.9L/s ~ 4%) to occupy 86% of the capacity of the existing Gate Street storm sewer system during the 5 year design storm event. Therefore, the existing municipal storm sewer system will continue to have adequate capacity under post-development conditions with no quantity controls and no negligible effects will occur to storm sewer system during the 5 year event.

It should be noted that an additional Weighted Impervious Calculation and Modified Rational Method Calculation has been completed in Appendix C for specifically the development site upon request of the Town of Niagara-on-the-Lake. The calculations verify the 7L/s difference to the overall peak flows discharging to Gate Street as previously calculated for the overall Gate Street storm sewer drainage area.

An analysis has been conducted to determine the impact of stormwater flows within the Gate Street roadway between the development and the One Mile Creek outlet during the 100 year design storm event. As is known that storm sewers have an additional 15% capacity under surcharged conditions, the 375mm diameter storm sewer at 1.09% slope will have a total capacity of approximately 219.7L/s during a major storm event. Therefore, the total peak flow of 262.3L/s during the 100 year storm event will result in a flow of 42.6L/s within the roadway downstream of the site. As Gate Street has been topographically determined to have a slope of approximately 2.0% towards One Mile Creek, the gutter flow rate has been calculated at approximately 190L/s per Design Chart 4.04 in the MTO Drainage Management Manual. Technically, this is the capacity up to the centreline crest of the road on one half of the road, at the 11cm high mark of the 15cm high curb. As this flow is representative of the peak flows during the major storm event, it is expected that standing water within the roadway would be witnessed for a relatively minor period of time. Therefore, the 42.6L/s of total overland flows during the 100 year design storm event will



result in very minimal quantities on the roadway and will not result in any adverse effects to municipal infrastructure.

An analysis has been completed to compare the increase in flows to peak stormwater flows experienced within One Mile Creek. The 'One Mile Creek – Floodplain Mapping' study completed by the NPCA utilized a peak stormwater flow value of approximately $8.93\text{m}^3/\text{s}$ at a cross section located just downstream of the existing outlet (XS 1602.851). The 100 Year Peak Stormwater Flow Analysis located on the Storm Sewer Design Sheet in Appendix C outlines an increase of $11.1\text{L}/\text{s}$ under proposed conditions. This represents only 0.1% of the peak flows within the One Mile Creek system during a major storm event.

Due to the Gate Street outlets' location relative to the upstream limit, as well as the extremely minor increase in peak stormwater flows, the proposed development will have a negligible effect on peak stormwater flows within the downstream One Mile Creek. Therefore, it is expected the proposed development would have no adverse effects on downstream municipal infrastructure or the downstream watercourse if stormwater flows were to discharge without peak flow quantity controls.



CONCLUSIONS AND RECOMMENDATIONS

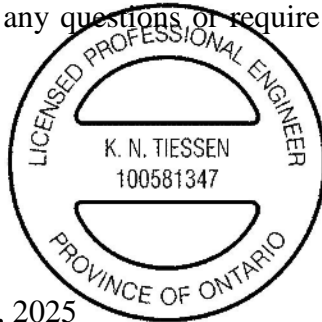
Therefore, based on the above comments and design calculations provided for this site, the following summarizes the servicing for this site.

1. The existing 200mm diameter watermain will have sufficient capacity to provide both domestic and fire protection water supply.
2. The existing 200mm diameter municipal sanitary sewer will have adequate capacity for the proposed development.
3. Stormwater quantity controls will not be required prior to discharge directly to the Gate Street storm sewer system.
4. The site extreme stormwater overland route is to Gate Street and ultimately One Mile Creek.
5. The development will consist of solely non-significant sources of Total Suspended Solids (TSS) and therefore further quality controls will not be required.

Based on the above and the accompanying calculations, there exists adequate municipal servicing for this development. We trust the above comments and enclosed calculations are satisfactory for approval. If you have any questions or require additional information, please do not hesitate to contact our office.

Yours very truly,

Kurt Tiessen, P.Eng.
Revised November 10, 2025
Encl.





**UPPER CANADA
CONSULTANTS**
ENGINEERS / PLANNERS

APPENDICES



**UPPER CANADA
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APPENDIX A

**Hydrant Flow Test Data
Fire Flow Calculation Sheets
Fire Underwriters Survey Calculations**

FIRE HYDRANT TESTING & INSPECTION REPORT

Testing & inspection has been completed in accordance with Section 6.6.5. of the Ontario Fire Code.
This report to be kept on site for review upon request, in accordance with subsection 1.1.2.1.

Hydrant No.

of

Service Date 29 July 2021

Tested By Stinson. J.

Customer Information

Site Name **Niagara-on-the-Lake**

Also Known As

Site Address Gate Street

Managed or Owned By

Municipality NOTL

Our Service Agreement Expires On

Fire Hydrant Information

Hydrant Location @ Johnson -Hydrant ID:0080

Sec. Valve Location 1.3m Northwest

Hydrant Make & Model Canada Valve Century

Valve Box Type 5SL

Opening Direction Left

Valve Box Height Satisfactory

Turns to Open 20

Opening Direction Left

ATD Installed No

Alarms/Fire Pumps Installed No

Turns to Open 21

Inspection Results

Service Status In Service, No Repairs

Barrel Assembly Satisfactory

Paint Quality Satisfactory

Main Valve Assembly Satisfactory

Drain Valve Assembly Satisfactory

Operating Assembly Satisfactory

Rod Assembly Satisfactory

Barrel Drainage Satisfactory

Barrel Found Dry

Hydrant Operation Satisfactory

Caps & Nozzles Satisfactory

Colour Coding Satisfactory

Barrel Nozzle Style 2 Hose, 1 Storz

Nozzle Orientation Correct

Nozzle Height Satisfactory

Access to Hydrant Satisfactory

Secondary Valve Operation Satisfactory

Valve Box Condition Satisfactory

Maintenance Routines Completed

Barrel Dewatering Not Necessary

Hydrant Painting Not Necessary

Valve Box Locating Completed/Found

Colour Coding Not Necessary

Valve Box Cleaning Completed

Hose Cap Gasket Replacement Not Necessary

Sec. Valve Cycling Completed

Pressure Testing Completed

Hydrant Lubrication Completed

Flow Testing Completed

Testing Results

Static Pressure (psig) **74**

Residual Pressure (psig) **65**

Pitot Reading (psig) **60**

Water Quality Clear

1 Port Flow, Actual (usgpm) **1300**

Comments

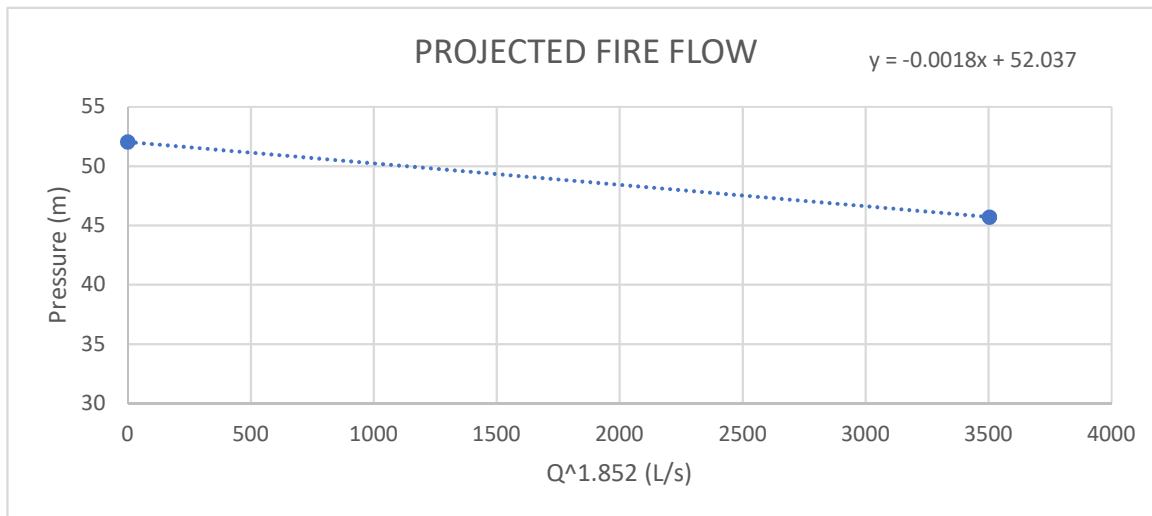
FIRE FLOW CALCULATION SHEET

Project: 222 Gate Street
Project Number: 24035
Date: November 11, 2024
Prepared By: Kurt Tiessen, P.Eng.
Reviewed By: Jason Schooley, P.Eng.

Flow Test Provided by: Town of Niagara-on-the-Lake
Hydrant Location: South corner of intersection of Gate and Johnson

FLOW TEST RESULTS

TEST	PRESSURE (psi)	FLOW RATE (USGPM)	FLOW RATE (L/s)	$Q^{1.852}$	PRESSURE (m)
STATIC	74	0	0	0	52.04
RESIDUAL 1	65	1300	82.02	3503.89	45.71



FIRE FLOW FORMULA (y = ax + b)

a = -0.0018
 b = 52.037

FIRE FLOW AT A SPECIFIED PRESSURE

Pressure = 20 psi
 Pressure = 14.06 m
 $Q^{1.852} = 21096.11$
Flow, Q = 216.21 L/s
 Flow, Q = 3427.06 USGPM

FIRE HYDRANT TESTING & INSPECTION REPORT

Testing & inspection has been completed in accordance with Section 6.6.5. of the Ontario Fire Code.
This report to be kept on site for review upon request, in accordance with subsection 1.1.2.1.

Hydrant No.

of

Service Date 26 July 2021

Tested By Stinson. J.

Customer Information

Site Name **Niagara-on-the-Lake**

Also Known As

Site Address Gate Street

Managed or Owned By c/o Davpart Inc.

Municipality NOTL

Our Service Agreement Expires On

Fire Hydrant Information

Hydrant Location @ Queen Street -Hydrant ID:0090

Sec. Valve Location Unknown

Hydrant Make & Model Darling B50B-18

Valve Box Type Unknown

Opening Direction Left

Valve Box Height Buried??

Turns to Open 18

Opening Direction

ATD Installed No

Alarms/Fire Pumps Installed No

Turns to Open

Inspection Results

Service Status In Service, No Repairs

Barrel Assembly Satisfactory

Paint Quality Satisfactory

Main Valve Assembly Satisfactory

Drain Valve Assembly Satisfactory

Operating Assembly Satisfactory

Rod Assembly Satisfactory

Barrel Drainage Satisfactory

Barrel Found Dry

Hydrant Operation Satisfactory

Caps & Nozzles Satisfactory

Colour Coding Satisfactory

Barrel Nozzle Style 2 Hose

Nozzle Orientation Correct

Nozzle Height Satisfactory

Access to Hydrant Satisfactory

Secondary Valve Operation **Inaccessible**

Valve Box Condition **Not Inspected**

Maintenance Routines Completed

Barrel Dewatering Not Necessary

Hydrant Painting Not Necessary

Valve Box Locating **Completed/Not Found**

Colour Coding Not Necessary

Valve Box Cleaning Not Necessary

Hose Cap Gasket Replacement Not Necessary

Sec. Valve Cycling Not Completed

Pressure Testing **Completed**

Hydrant Lubrication **Completed**

Flow Testing **Completed**

Testing Results

Static Pressure (psig) **60**

Residual Pressure (psig) **55**

Pitot Reading (psig) **50**

Water Quality Clear

1 Port Flow, Actual (usgpm) **1186**

Comments

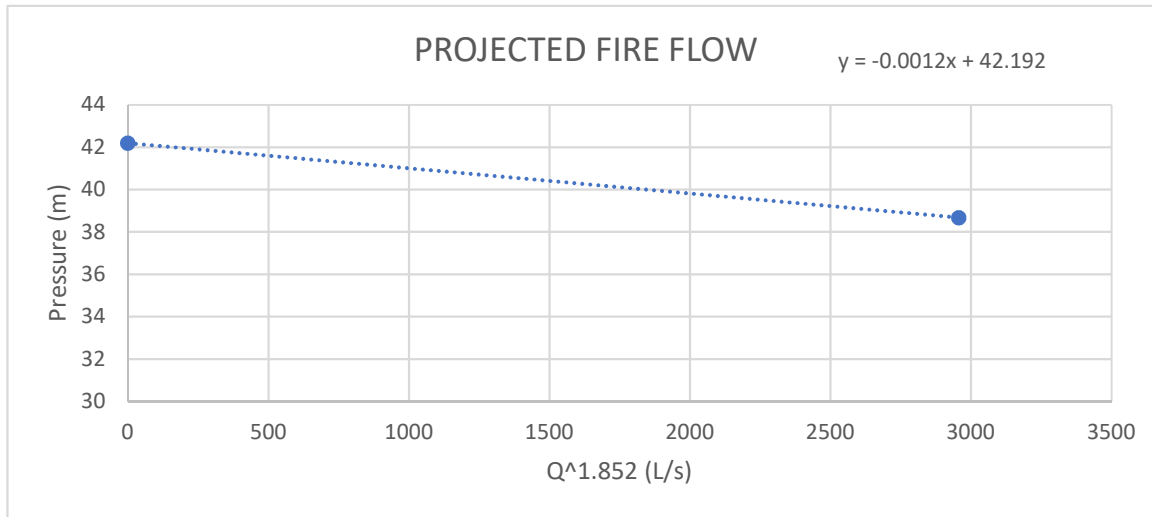
FIRE FLOW CALCULATION SHEET

Project: 222 Gate Street
Project Number: 24035
Date: November 11, 2024
Prepared By: Kurt Tiessen, P.Eng.
Reviewed By: Jason Schooley, P.Eng.

Flow Test Provided by: Town of Niagara-on-the-Lake
Hydrant Location: South corner of intersection of Gate and Queen

FLOW TEST RESULTS

TEST	PRESSURE (psi)	FLOW RATE (USGPM)	FLOW RATE (L/s)	Q ^{1.852}	PRESSURE (m)
STATIC	60	0	0	0	42.19
RESIDUAL 1	55	1186	74.82	2956.19	38.68



FIRE FLOW FORMULA (y = ax + b)

a = -0.0012
 b = 42.19

FIRE FLOW AT A SPECIFIED PRESSURE

Pressure = 20 psi
 Pressure = 14.06 m
 Q^{1.852} = 23438.33
Flow, Q = 228.86 L/s
 Flow, Q = 3627.53 USGPM

Fire Underwriters Survey

Water Supply for Public Fire Protection (2020) Calculations

222 GATE STREET, NIAGARA-ON-THE-LAKE

Required Fire Flow in Litres per Minute

F=	9,520	(L/m)
	158.67	(L/s)
	2,515	(USgmp)

Type of Construction

Ordinary Construction (brick or other masonry walls, combustible floor and interior). C= 1.00

Total Floor Area in square metres

A= 503.1 (m2)

Total Number of Floors

2

2. Combustibility of Contents (may not reduce fire flow demand below 2,000 L/min)

Limited Combustible = -15%

3. Sprinkler Systems

Is there a complete automatic sprinkler protection system per NFPA (Yes/No).

No 0%

Water supply standard for both system and fire department hose lines (Yes/No).

No 0%

Is system fully monitored (Yes/No).

No 0%

Total Sprinkler Reduction to Overall Fire Flow Demand

0%

4. Spacial Separation of Neighbouring Structures (within 45 metres)

Location of Building:

BUILDING NAME

Distance to Nearest Building to the North

19.7 m 15%

Distance to Nearest Building to the South

9.4 m 20%

Distance to Nearest Building to the East

10.1 m 15%

Distance to Nearest Building to the West

26.0 m 10%

Total Spacial Separation to Adjacent Structures

60%

Additions

Is roof wood shingles or shakes (Yes/No).

No



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APPENDIX B

Sanitary Sewer Calculation Sheet

UPPER CANADA CONSULTANTS

3-30 HANNOVER DRIVE

ST.CATHARINES, ONTARIO

L2W 1A3

DESIGN FLOWS

PEAKING FACTOR: 2.0 MINIMUM 1.5 PER MECP DESIGN CRITERIA
 INFILTRATION RATE: 0.286 L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L
 HOTELS 225.0 L/DAY/BED SPACE (ASSUME 2 SPACES PER ROOM, MECP)

SEWER DESIGN

PIPE ROUGHNESS: 0.013 FOR MANNING'S EQUATION
 PIPE SIZES: 1.016 IMPERIAL EQUIVALENT FACTOR
 PERCENT FULL: TOTAL PEAK FLOW / CAPACITY

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE

PROJECT : 222 GATE STREET

PROJECT NO: 24035

SANITARY SEWER DESIGN SHEET

LOCATION			AREA		POPULATION		ACCUMULATED PEAK FLOW				DESIGN FLOW					
Location and Description	From M.H	To M.H.	Increment (hectares)	Accumulated (hectares)	Number of Units	Total Population Served	Peaking Factor	Flow (L/s)	Infiltration Flow L/s	Total Peak Flow (L/s)	Pipe Diameter	Pipe Length	Pipe Slope	Full Flow Velocity	Full Flow Capacity	Percent Full
											(mm)	(m)	(%)	(m/s)	(L/s)	
222 GATE STREET	HOTEL	EX SEWER	0.08	0.08	18	36	2.00	0.19	0.02	0.21	200	10.0	1.00	1.06	34.22	0.6%
GATE STREET	EX MH	EX MH		0.08				0.19	0.02	0.21	200	59.6	0.84	0.97	31.36	0.7%



**UPPER CANADA
CONSULTANTS**
ENGINEERS / PLANNERS

APPENDIX C

Weighted Impervious Calculations
Modified Ration Method – Peak Flows and Volumes Calculations
Figure 1 – Overall Storm Drainage Area Plan
Storm Sewer Calculation Sheet

Weighted Imperviousness Percentage Calculation Worksheet

Project Name: 124 on Queen
 Project Number: 24035
 Date: May 2025
 Person: K.Tiessen

EX - EXISTING CONDITIONS (OVERALL)

	<i>Footprint</i>	<i>Runoff Coefficient</i>	<i>Effective Impervious Area</i>
Residential	3311.7 m ²	0.45	1490.3 m ²
Roadway	2615.6 m ²	0.70	1830.9 m ²
Commercial	3309.9 m ²	0.90	2978.9 m ²
TOTAL CATCHMENT IMPERVIOUS AREAS			6,300 m²
TOTAL CATCHMENT AREA			9,237 m²
		EFFECTIVE RUNOFF COEFFICIENT	0.68

FUT - PROPOSED CONDITIONS (OVERALL)

	<i>Footprint</i>	<i>Runoff Coefficient</i>	<i>Effective Impervious Area</i>
124 on Queen	796.0 m ²	0.80	636.8 m ²
Residential	2515.7 m ²	0.45	1132.1 m ²
Roadway	2615.6 m ²	0.70	1830.9 m ²
Commercial	3309.9 m ²	0.90	2978.9 m ²
TOTAL CATCHMENT IMPERVIOUS AREAS			6,579 m²
TOTAL CATCHMENT AREA			9,237 m²
		EFFECTIVE RUNOFF COEFFICIENT	0.71

EXISTING CONDITIONS - 222 GATE ST

	<i>Footprint</i>	<i>Runoff Coefficient</i>	<i>Effective Impervious Area</i>
Roof/taop / Driveway	279.7 m ²	0.90	251.7 m ²
Landscape	516.3 m ²	0.20	103.3 m ²
TOTAL CATCHMENT IMPERVIOUS AREAS			355 m²
TOTAL CATCHMENT AREA			796 m²
		EFFECTIVE RUNOFF COEFFICIENT	0.45

PROPOSED CONDITIONS - 222 GATE ST

	<i>Footprint</i>	<i>Runoff Coefficient</i>	<i>Effective Impervious Area</i>
Building/Tarrace/Patio/Sidewalk	686.0 m ²	0.90	617.4 m ²
Landscape	110.0 m ²	0.20	22.0 m ²
TOTAL CATCHMENT IMPERVIOUS AREAS			639 m²
TOTAL CATCHMENT AREA			796 m²
		EFFECTIVE RUNOFF COEFFICIENT	0.80

MODIFIED RATIONAL METHOD

PROJECT: 222 GATE STREET, NIAGARA-ON-THE-LAKE

LOCATION					TIME OF FLOW		STORMWATER ANALYSIS					
DESCRIPTION	FROM M.H.	TO M.H.	PIPE LENGTH (m)	INCREMENT AREA (hectares)	TOTAL AREA (hectares)	TO UPPER END (min)	IN SECTION (min)	RUNOFF COEFF	SECTION A X R	ACCUMLD A x R	RAINFALL INTENSITY (mm/hr)	PEAK FLOW (L/s)
EXISTING CONDITIONS												
EX - 5 Year	SITE	OUTLET		0.08	0.08	10.00	0.00	0.450	0.036	0.036	89.884	9.0
FUTURE CONDITIONS												
<i>A10 - 5 Year (for info purposes only)</i>	<i>SITE</i>	<i>OUTLET</i>		<i>0.08</i>	<i>0.08</i>	<i>10.00</i>	<i>0.00</i>	<i>0.800</i>	<i>0.064</i>	<i>0.064</i>	<i>89.884</i>	<i>16.0</i>
A10 - 100 Year	SITE	OUTLET		0.08	0.08	10.00	0.00	0.800	0.064	0.064	144.260	25.6

DESIGN BY:	UPPER CANADA CONSULTANTS 30 HANNOVER DRIVE, UNIT 3 ST. CATHARINES, ON L2W 1A3	RAINFALL PARAMETERS:	5 yr	100 yr
DESIGN BY:	K.TIESEN, P.ENG.	Time to Upper End =	10 min.	a = 664.00 mm/hr
DATE:	NOVEMBER 2025	Town of Niagara-on-the-Lake - 5 Year IDF C	b = 4.70 minutes	c = 0.74
		Town of Niagara-on-the-Lake - 100 Year IDF		0.73

Modified Rational Method (MRM) Required Storage Volume

Project: 222 GATE STREET, NOTL
 Project No: 24035
 Date: NOVEMBER 2025
 Design By: K.TIESSSEN, P.ENG.
 Description: STORMWATER MANAGEMENT PLAN

Storm Event: **Town of Niagara-on-the-Lake - 100 Year IDF Curve**

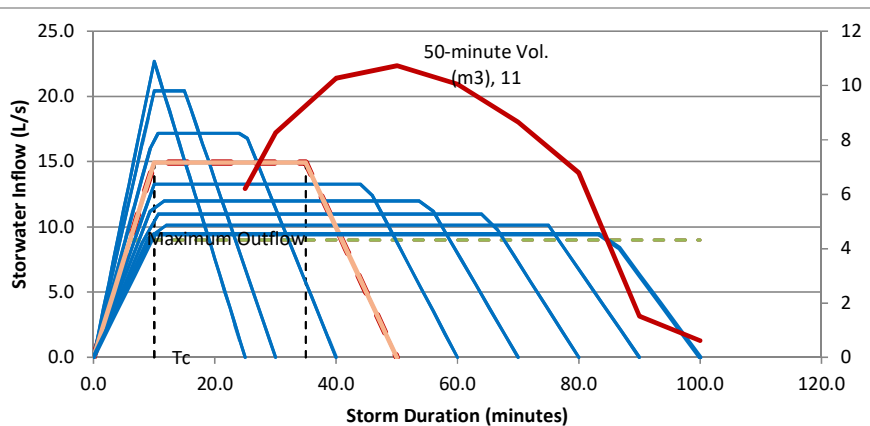
a = 980.00 mm/hr
 b = 3.70 minutes
 c = 0.73

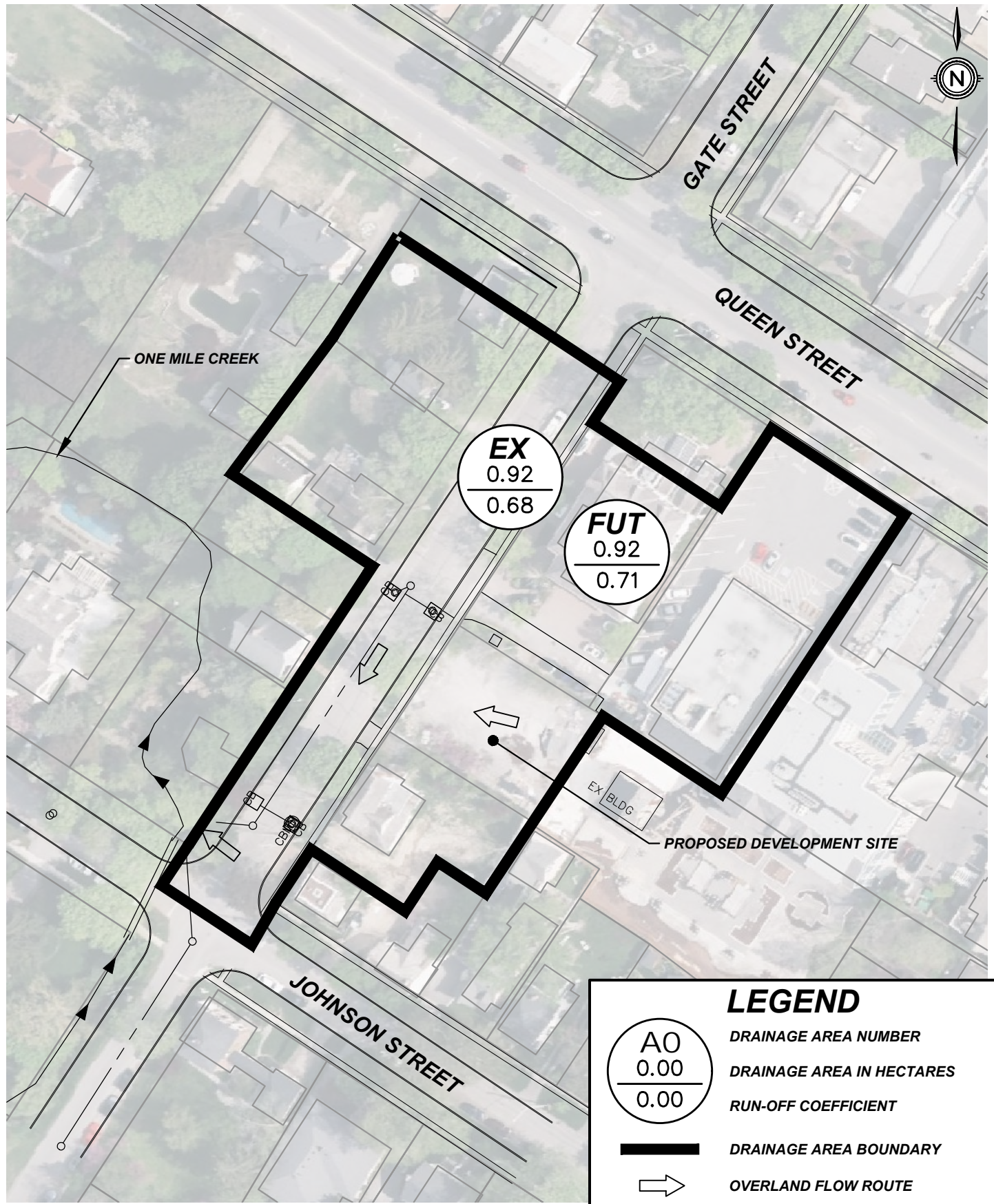
Critical Storm Duration: 50.00 minutes Tail Multiplier (x1-11.5)
 Tc From Design: 10.00 minutes
 Storm Tail Time: 35.00 minutes
 Accumulated Area x R (Ha): 0.064 <-- Area x Runoff Coefficient (Sewer Design Sheet)
 Peak Rainfall Intensity: 83.96 mm/hr
 Peak Inflow at Tc: 14.93 L/s
 Maximum Release Rate: 8.99 <-- Outlet Full Flow Capacity (Design Sheet)
 Time When Outlet Exceeded: 6.02

Time (min)	Intensity (mm/hr)	Inflow (L/s)	Outflow (L/s)	Interval Volume (m3)	Total Required Volume (m3)
0.0	0.00	0.00	8.99	-0.5	0.0
1.7	13.99	2.49	8.99	-0.7	0.0
3.3	27.99	4.98	8.99	-0.4	0.0
5.0	41.98	7.46	8.99	-0.2	0.0
6.7	55.97	9.95	8.99	0.1	0.1
8.3	69.96	12.44	8.99	0.3	0.4
10.0	83.96	14.93	8.99	0.6	1.0
11.7	83.96	14.93	8.99	0.6	1.6
13.3	83.96	14.93	8.99	0.6	2.2
15.0	83.96	14.93	8.99	0.6	2.8
16.7	83.96	14.93	8.99	0.6	3.4
18.3	83.96	14.93	8.99	0.6	4.0
20.0	83.96	14.93	8.99	0.6	4.6
21.7	83.96	14.93	8.99	0.6	5.2
23.3	83.96	14.93	8.99	0.6	5.8
25.0	83.96	14.93	8.99	0.6	6.4
26.7	83.96	14.93	8.99	0.6	7.0
28.3	83.96	14.93	8.99	0.6	7.6
30.0	83.96	14.93	8.99	0.6	8.2
31.7	83.96	14.93	8.99	0.6	8.8
33.3	83.96	14.93	8.99	0.6	9.3
35.0	83.96	14.93	8.99	0.6	9.9
36.7	74.63	13.27	8.99	0.4	10.4
38.3	65.30	11.61	8.99	0.3	10.6
40.0	55.97	9.95	8.99	0.1	10.7
41.7	46.64	8.29	8.99	-0.1	10.7
43.3	37.31	6.63	8.99	-0.2	10.4
45.0	27.99	4.98	8.99	-0.4	10.0
46.7	18.66	3.32	8.99	-0.6	9.5
48.3	9.33	1.66	8.99	-0.7	8.7
50.0	0.00	0.00	8.99	-0.9	7.8

Variable Storm Duration Storage Requirements

Duration	Max Storage	Duration	Max Storage	Duration	Max Storage
25 Min	6.2 m3	50 Min	10.7 m3	80 Min	6.8 m3
30 Min	8.3 m3	60 Min	10.0 m3	90 Min	1.5 m3
40 Min	10.3 m3	70 Min	8.7 m3	100 Min	0.6 m3





**UPPER CANADA
CONSULTANTS**
ENGINEERS / PLANNERS

124 ON QUEEN
TOWN OF NIAGARA-ON-THE-LAKE
OVERALL DRAINAGE AREA PLAN

DATE	2025-05-30
SCALE	1:1000 m
REF No.	24035
DWG No.	FIGURE 1

DESCRIPTION			STORMWATER ANALYSIS										STORM SEWER DESIGN						
LOCATION	FROM MH	TO MH	AREA (ha)	ACCUMLTD AREA (ha)	RUNOFF COEFFICNT	A*R	ACCUMLTD A*R	T of C (min.)	PIPE TIME (min.)	T of C (sum)	INTENSITY (mm/hr)	FLOW (L/s)	LENGTH (m)	DIAMETER (mm)	SLOPE (%)	CAPACITY (L/s)	VELOCITY (m/s)	PERCENT FULL	
UPPER CANADA CONSULTANTS																			
3-30 HANNOVER DRIVE																			
ST. CATHARINES, ON L2W 1A3																			
MUNICIPALITY:			TOWN OF NIAGARA-ON-THE-LAKE							5 YEAR			100 YEAR						
PROJECT:			124 ON QUEEN							A = 664.00			980.00 mm/hr						
UCC PROJECT NO.:			24035							B = 4.70			3.70 minutes						
										C = 0.744			0.732						
													PIPE ROUGHNESS = 0.013						
													PIPE CONVERSION FACTOR = 1.016						
5 YEAR ANALYSIS																			
<i>EXISTING</i>																			
GATE STREET	EX MH	EX MH	0.92	0.92	0.68	0.627	0.627	10.00	0.55	10.55	89.9	156.5	55.1	375	1.09	191.04	1.7	81.9%	
	EX MH	OUTLET		0.92			0.627	10.55	0.05	10.60	87.5	152.3	8.2	375	2.7	299.56	2.6	50.9%	
<i>FUTURE</i>																			
GATE STREET	EX MH	EX MH	0.92	0.92	0.71	0.655	0.655	10.00	0.55	10.55	89.9	163.4	55.1	375	1.09	191.04	1.7	85.6%	
	EX MH	OUTLET		0.92			0.655	10.55	0.05	10.60	87.5	159.1	8.2	375	2.7	299.56	2.6	53.1%	
100 YEAR ANALYSIS																			
EXISTING			0.92		0.68	0.627	0.627	10.00			144.3	251.2							
FUTURE			0.92		0.71	0.655	0.655	10.00			144.3	262.3							