UPPER CANADA CONSULTANTS
ENGINEERS / PLANNERS

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File: 24035

FUNCTIONAL SERVICING REPORT

222 Gate Street, Niagara-on-the-Lake
Revised December 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.

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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.

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. Therefore, as stated previously, it has been required by the municipality to restrict post-development peak stormwater flows up to and including 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 10.7m^3 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.

Although stormwater quantity controls are to be required for this development, a due-diligence analysis has been conducted below 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.

Gate Street Stormwater System Analysis

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 would continue to have adequate capacity under post-development conditions with no quantity controls and no negligible effects would 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. 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 would result in very minimal quantities on the roadway and would not result in any adverse effects to municipal infrastructure.

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An analysis has been completed to compare the increase in 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 8.93m^3/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 11.1L/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 would 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. However, as stated previously, quantity controls will still be required for post-development flows from the proposed development site.

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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. In accordance with the Town of Niagara-on-the Lake requirements, stormwater quantity controls will be provided by restricting post-development flows up to and including the 100 year storm event to pre-development 5 year levels, prior to discharge to the Gate Street storm sewer system;

4. The site extreme stormwater overland route is to Gate Street and ultimately One Mile Creek; and,

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 December 10, 2025
Encl.

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APPENDICES

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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**	Hydrant Operation	Satisfactory
Barrel Assembly	Satisfactory	Caps & Nozzles	Satisfactory
Paint Quality	Satisfactory	Colour Coding	Satisfactory
Main Valve Assembly	Satisfactory	Barrel Nozzle Style	2 Hose, 1 Storz
Drain Valve Assembly	Satisfactory	Nozzle Orientation	Correct
Operating Assembly	Satisfactory	Nozzle Height	Satisfactory
Rod Assembly	Satisfactory	Access to Hydrant	Satisfactory
Barrel Drainage	Satisfactory	Secondary Valve Operation	Satisfactory
Barrel Found	Dry	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**	1 Port Flow, Actual (usgpm)	**1300**
Pitot Reading (psig)	**60**		
Water Quality	Clear		

Comments

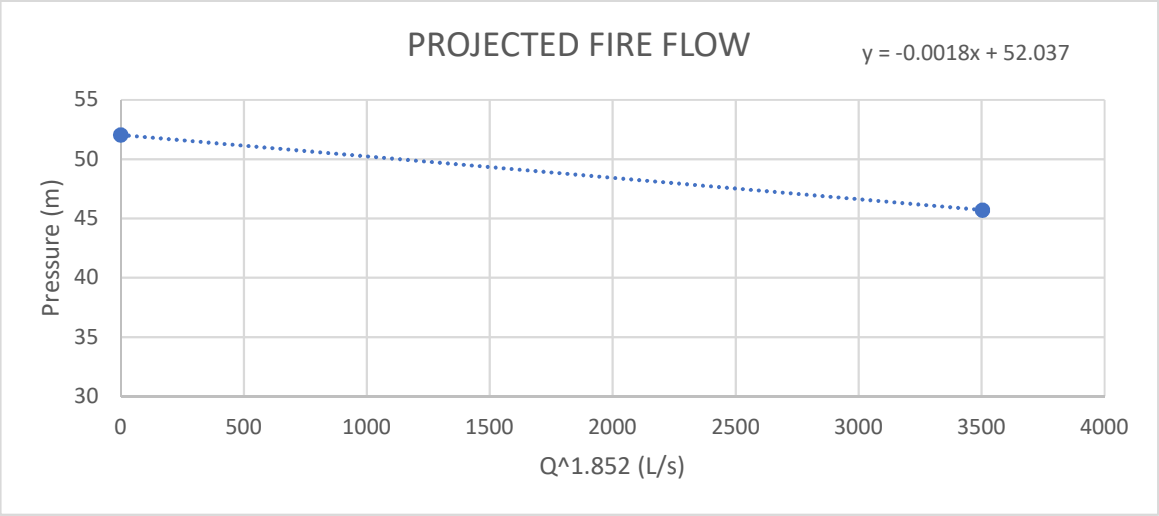
FIRE FLOW CALCULATION SHEET

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**	Hydrant Operation	Satisfactory
Barrel Assembly	Satisfactory	Caps & Nozzles	Satisfactory
Paint Quality	Satisfactory	Colour Coding	Satisfactory
Main Valve Assembly	Satisfactory	Barrel Nozzle Style	2 Hose
Drain Valve Assembly	Satisfactory	Nozzle Orientation	Correct
Operating Assembly	Satisfactory	Nozzle Height	Satisfactory
Rod Assembly	Satisfactory	Access to Hydrant	Satisfactory
Barrel Drainage	Satisfactory	Secondary Valve Operation	Inaccessible
Barrel Found	Dry	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**	1 Port Flow, Actual (usgpm)	**1186**
Pitot Reading (psig)	**50**		
Water Quality	Clear		

Comments

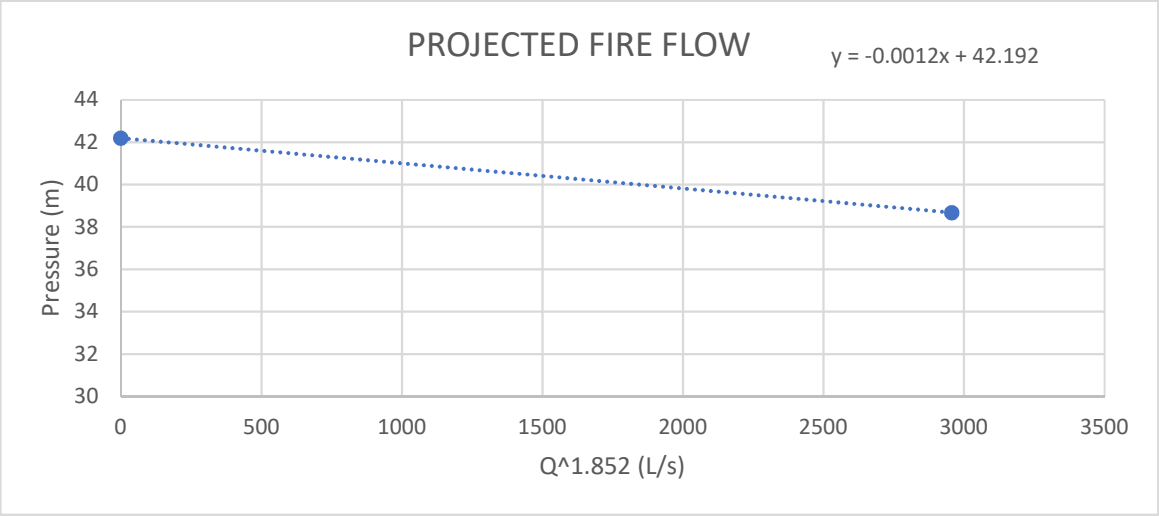
FIRE FLOW CALCULATION SHEET

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 Sprinker 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

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3-30 HANNOVER DRIVE
ST.CATHARINES, ONTARIO
L2W 1A3

DESIGN FLOWS			**SEWER DESIGN**		
PEAKING FACTOR:	2.0	MINIMUM 1.5 PER MECP DESIGN CRITERIA	PIPE ROUGHNESS:	0.013	FOR MANNING'S EQUATION
INFILTRATION RATE:	0.286	L / s / ha (M.O.E FLOW ALLOWANCE IS BETWEEN 0.10 & 0.28 L	PIPE SIZES:	1.016	IMPERIAL EQUIVALENT FACTOR
HOTELS	225.0	L/DAY/BED SPACE (ASSUME 2 SPACES PER ROOM, MECP)	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 (mm)**	**Pipe Length (m)**	**Pipe Slope (%)**	**Full Flow Velocity (m/s)**	**Full Flow Capacity (L/s)**	**Percent Full**
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%

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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)

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
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 m^2
TOTAL CATCHMENT AREA			9,237 m^2
		EFFECTIVE RUNOFF COEFFICIENT	**0.68**

FUT - PROPOSED CONDITIONS (OVERALL)

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
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 m^2
TOTAL CATCHMENT AREA			9,237 m^2
		EFFECTIVE RUNOFF COEFFICIENT	**0.71**

EXISTING CONDITIONS - 222 GATE ST

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
Rooftaop / 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 m^2
TOTAL CATCHMENT AREA			796 m^2
		EFFECTIVE RUNOFF COEFFICIENT	**0.45**

PROPOSED CONDITIONS - 222 GATE ST

	Footprint	*Runoff Coefficient*	*Effective Impervious Area*
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 m^2
TOTAL CATCHMENT AREA			796 m^2
		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												
A10 - 5 Year (for info purposes only)	*SITE*	*OUTLET*		*0.08*	*0.08*	*10.00*	*0.00*	*0.800*	*0.064*	*0.064*	*89.884*	*16.0*
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**	**RAINFALL PARAMETERS:**		5 yr	100 yr	
	30 HANNOVER DRIVE, UNIT 3	Time to Upper End = 10 min.	a =	664.00	980.00	mm/hr
	ST. CATHARINES, ON L2W 1A3	Town of Niagara-on-the-Lake - 5 Year IDF C	b =	4.70	3.70	minutes
DESIGN BY:	**K.TIESSEN, P.ENG.**	Town of Niagara-on-the-Lake - 100 Year IDF	c =	0.74	0.73	
DATE:	**NOVEMBER 2025**					

Modified Rational Method (MRM) Required Storage Volume

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

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

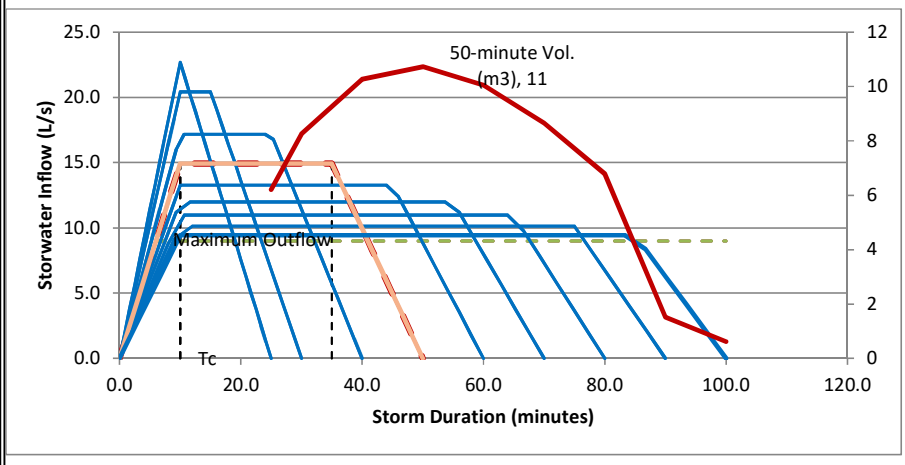
a =	980.00	mm/hr
b =	3.70	minutes
c =	0.73	

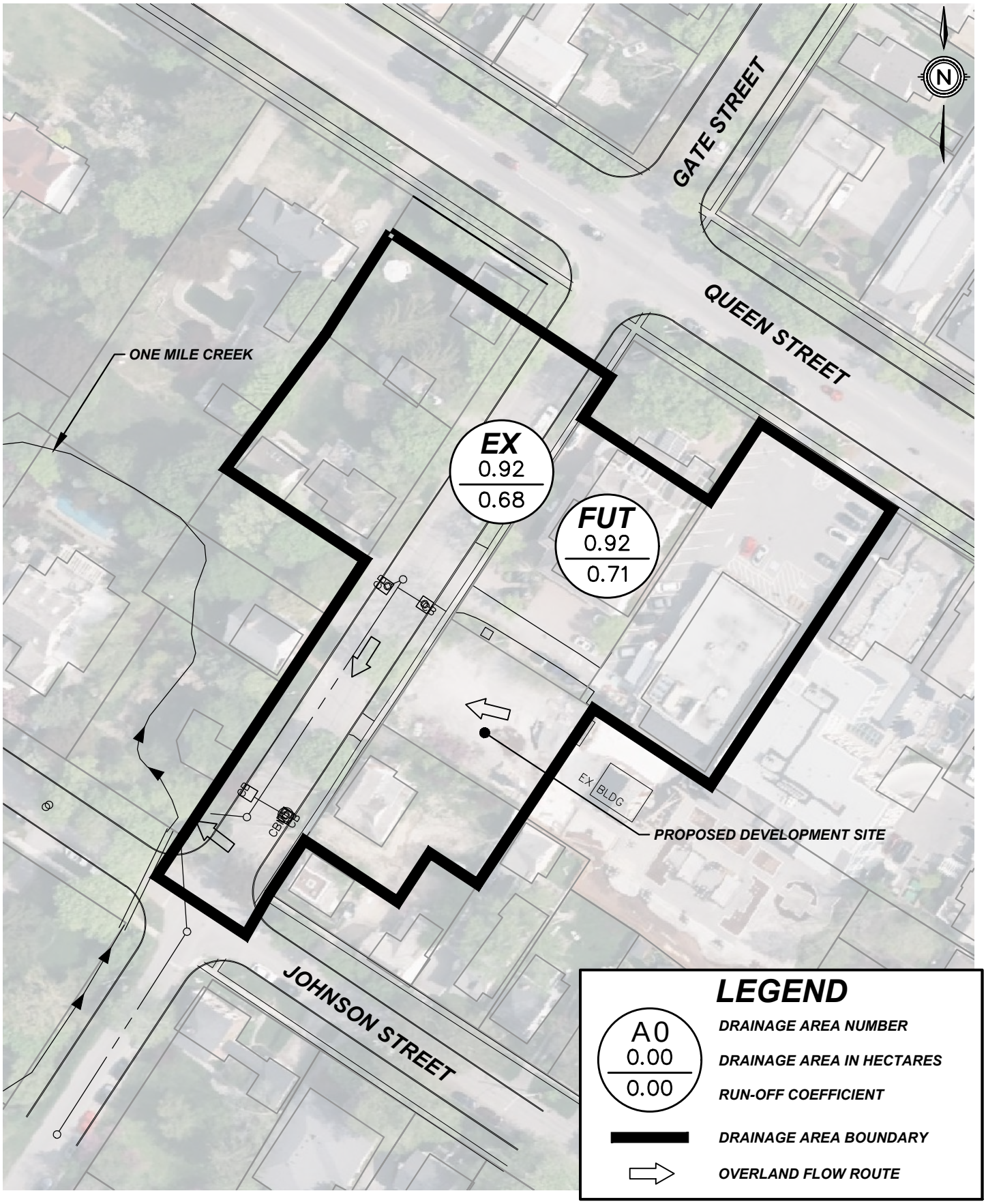
Critical Storm Duration:	50.00 minutes	Tail Multiplier (x1-11.5
Tc From Design:	10.00 minutes	
Storm Tail Time:	35.00 minutes	
Accumulated Area x R (Ha):	0.064	<-- Area x Runoff Coefficient (Sewer Design Sheet)
Peak Rainfall Intensity:	83.96 mm/hr	
Peak Inflow at Tc:	14.93 L/s	
Maximum Release Rate: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





LEGEND

A0 / 0.00 / 0.00	DRAINAGE AREA NUMBER / DRAINAGE AREA IN HECTARES / RUN-OFF COEFFICIENT
	DRAINAGE AREA BOUNDARY
	OVERLAND FLOW ROUTE

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

DRAWING FILE: F:\24035\Engineering\24035-SP.dwg PLOTTED: May 30, 2025 - 3:13pm PLOTTED BY: kurt

UPPER CANADA CONSULTANTS
3-30 HANNOVER DRIVE
ST. CATHARINES, ON L2W 1A3

STORM SEWER DESIGN

MUNICIPALITY: TOWN OF NIAGARA-ON-THE-LAKE
PROJECT: 124 ON QUEEN
UCC PROJECT NO.: 24035

	5 YEAR	100 YEAR	
A =	664.00	980.00	mm/hr
B =	4.70	3.70	minutes
C =	0.744	0.732	

PIPE ROUGHNESS = 0.013
PIPE CONVERSION FACTOR = 1.016

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
5 YEAR ANALYSIS																		
EXISTING																		
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%
FUTURE																		
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						