

FUNCTIONAL SERVICING REPORT

Water, Sanitary, and Stormwater Management

PROPOSED 3-STOREY TOWNHOMES

71 WATER STREET & 106-114 ROBINSON STREET TOWN OF OAKVILLE

OUR FILE: 1656

PREPARED FOR ROSEVILLE PROPERTIES INC

May 9th, 2023

REVISION HISTORY

DATE	REVISION	SUBMISSION
May 12, 2022	1	Issued for Zoning Amendment Application
May 9, 2023	2	Second Submission Zoning Amendment Application
		Revisions are Italicized

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1.0 INTRODUCTION

1.1 Scope of Functional Servicing Report

This report has been prepared in support of the zoning by-law amendment to permit the construction of a three- storey, ten-unit townhouse block located on Robinson Street between Water Street and Navy St in the Town of Oakville. This report may be updated and refined as the project moves through the planning approval process to support the Building Permit stages. A copy of the preliminary site plan is included in Appendix 'A' for reference.

1.2 Site Location and Description

The subject lands are Part 1, 2 and 3 on Reference Plan 20R-18998 (Appendix 'A'). The subject lands is known municipally as 71 Water Street and 106-114 Robinson Street in the Town of Oakville. The subject lands are currently vacant and have an area of 0.16 ha. The subject lands abut Water Street to the west, Robinson Street to the north and Navy Street to the east. An existing 2-storey dwelling and parking lot exists adjacent to the South property line. Two remnant retaining walls are present on the existing site to accommodate the significant grade changes within the eastern portion of the property. Slopes on the eastern portion of the subject lands range from approximately 8% to 25%. The western portion of the subject lands is relatively flat and has slopes ranging approximately 0.5% to 5.0%. A copy of the topographic survey can be found in Appendix 'A'. The subject lands formerly housed a 1 – storey commercial building with at grade parking and a 2-storey building that were demolished between 2012 and 2015 based on the Town of Oakville's Air Photo History (Appendix 'A').

1.3 Proposed Development

The development proposal is for a 10 unit 3-storey townhouse block with underground parking at the basement level. The subject site proposes amenity space (terraces) along the south portion of the subject site above the underground parking garage at ground level and on the roof level. The four units at the west end of subject site near the intersection of Water Street and Robinson also propose a sub-basement level with mechanical rooms *fitted with sump pumps*. A geotechnical report including groundwater table information is required such that appropriate temporary and permanent dewatering plans can be prepared.

2.0 MUNICIPAL WATER AND WASTEWATER

All proposed services must be in accordance with the Ontario Building Code, Town of Oakville, and Region of Halton standards and requirements. A copy of the Preliminary Servicing Plan is included in Appendix 'B' and should be read in conjunction with this report. Existing and proposed servicing is discussed in further detail in the following sections.

2.1 Water

The Region's record drawings and Operating Maps indicate the following watermains exist on the streets abutting the subject lands:

Navy Street:

• 300 mm dia. PVC watermain along the east side of the road.

Robinson Street:

- 900 mm dia. trunk CPP watermain beneath the pavement; the watermain bends southerly as it approached Water Street, clipping the north-west corner of the property.
- An ill-defined 19 mm dia. copper service along the north side of the road.

Water Street:

- 900 mm dia. trunk CPP watermain.
- An ill-defined 25 mm dia. copper service along the east side of the road.

The record drawings are provided in Appendix 'B' for reference purposes.

It is proposed that the site be serviced by the existing 300 mm dia. watermain on Navy Street for domestic water and fire protection as per the Region's std. dwg. no. 409.010. Final sizing of the connection will be determined at the detail design stage in conjunction with the mechanical and sprinkler consultant. Given the size of the development, we anticipate a connection size of 150 mm or smaller will be required.

Existing fire hydrants are available at the intersections of Navy Street and Robinson Street and Water Street and William Street. *Fire hydrant flow test results can be found in Appendix 'C'*.

The fire flow was estimated for demand purposes only using the Fire Underwriters Survey methodology. Fire flows should be confirmed at the building permit stage by the sprinkler consultant. See Appendix 'C' for supporting calculations.

Table 1: Estimated Water Demands (L/min)

Average Daily Demand	4
Minimum Hourly Demand	4
Maximum Hourly Demand	17
Maximum Daily Demand	9
Estimated Fire Demand (FUS 1999)	5000
Maximum Daily Plus Fire Demand	5009

A fire flow test was undertaken to confirm adequate firefighting flows. This test was conducted using the fire hydrants at 53 and 85 Navy Street. The results of the flow test are included in Appendix 'C' and summarized as follows:

Table 2: Fire Flow Test Summary

Static Pressure	64 psig
Flow 1230 usgpm (65 L/s)	residual 60 psig
Flow 2117 usgpm (106 L/s)	residual 58 psig
Theoretical Flow 6208 usgpm (555 L/s)	residual 20 psig
Estimated Max. Daily Plus Fire Service Pressure	59 psig

2.2 Wastewater

The Region's record drawings and Operating Maps indicate the following wastewater mains exist on the streets abutting the subject lands:

Navy Street:

• 300 mm dia. PVC sanitary sewer draining in a southerly direction.

Robinson Street:

• 250 mm dia. PVC sanitary sewer draining in a westerly direction to Water Street.

Water Street:

• 250 mm dia. vitrified clay sanitary sewer draining in a northerly direction to the Water Street Pumping Station.

The record drawings are provided in Appendix 'B' for reference purposes.

The Water Street and Navy Street sewers convey flows to the Water Street pumping station on Water Street at the Rebecca Street overpass. It is proposed that the site be serviced by the existing 250 mm dia. sewer on Water Street. See Appendix 'C' for an addendum relating to the historical sanitary drainage of the subject lands.

2.2.1 Estimated Sanitary Flow

Using the development area of 0.16 ha and Region of Halton land use density for townhouses (135 persons per hectare) the equivalent population is determined to be 22 persons. Table 3 summarizes the proposed wastewater flows. Refer to Appendix 'C' for supporting calculations.

Table 3: Estimated Existing Wastewater Flow (L/s)

Average Daily Dry Weather Flow	0.1
Modified Harmon Peaking Factor	4.38
Infiltration Allowance (0.286L/s-ha)	negligible
Peak Daily Flow	0.3

2.2.2 Water Street Wastewater Pumping Station (PS)

The Water Street pumping station has been identified as needing to be replaced because of its age and maintenance requirements. In light of this, the region commenced EAs in the past, however the findings were never implemented. We understand that a new EA process will be commenced.

Monitoring data (inflow) for the Water Street PS provided by the Region of Halton for the period January 2018 to December 2020 has been used to confirm if station capacity exists for the subject development.

Flows on average ranged from between 1.5–3.0 L/s in 2018 until the end of May 2019. A significant increase in sanitary flows for approximately 1.5 months occurs between the end of May 2019 and the beginning of July 2019. Peak flows during this period were approximately 10L/s. The high flow rates through the PS correlate to abnormally high-water levels in the nearby Lake Ontario for the same time period. Refer to Appendix 'C' for supporting data.

The flow rates from July 2019 to mid August 2020 flows returned to the average range of 1.5L/s-3.0L/s. For the remainder of 2020 from mid August 2020 through December 2020 the flow data indicates the flows ranged from 3.0-5.0 L/s with the expectation that on November 22, 2020, the Water Street Pumping Station reported a single flow rate of 19.45 L/s. The flow rate is likely a raw data error as peak flows for the pumping station are significantly lower for the period of data from 2018-2020. The flow of 5.0 L/s is considered the new baseline flow for determining if added flows from development could result in capacity issues at the PS. The flows for the proposed development will add approximately 0.3 L/s during peak flow conditions for a total of 5.3 L/s. The firm capacity of the Water Street pumping station is estimated to be 20 L/s.

Based on available information and expected site flows, we do not anticipate capacity issues resulting from this development.

3.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

3.1 Existing Storm Drainage

The site is located within an established urban area. As mentioned in Section 2.1, the site previously housed a 1-storey commercial building with at grade parking and a 2-storey building that were demolished between 2012 and 2015. In the existing condition, the site has established poor grass cover on the presently vacant lands since the demolition. Storm drainage flows in the westerly direction towards Water Street and is conveyed along Water Street.

Record drawing information indicated that Robinson Street and Water Street are generally serviced by a local 250/300 mm dia. storm sewer located within the municipal road allowance. The record drawings are provided in Appendix 'D'.

The existing 300 mm dia. on Water Street ends immediately south of Robinson Street at a double catchbasin. As such, there is no available storm sewer adjacent to the west property line boundary. Flow from the subject lands is solely captured by catchbasins located on Water Street.

The Town of Oakville Stormwater Management Waster Master plan identifies the existing 5-Year Minor System Performance along Water Street as unsurcharged. The 100-year Major System Performance Assessment also indicated the flow was contained within the curbed area of the street.

3.3 Proposed Storm Drainage

Extension of the Water Street storm sewer is required to service the subject site. The existing double catchbasin on Water Street near the northwest corner of the property will be replaced with a double catchbasin manhole and the sewer extended in a southerly direction to a suitable location. A storm connection to the storm sewer extension is proposed.

With the exception of the small front yard area and the front portion of the roofs, all other surface drainage will be collected internally and conveyed to the proposed storm sewer connection on Water Street. The underground parking drainage will be collected internally by sanitary building drains and conveyed to the proposed sanitary sewer connection on Water Street.

3.4 Stormwater Management

3.4.1 Quantity Control

The Town of Oakville generally requires developments to manage their drainage to predevelopment levels for each event up to the 100-year storm. Record drawings from the Town of Oakville indicate the storm sewer on Water Street was designed to capture stormwater runoff for approximately 0.09 ha of the total 0.16 ha site area. The record drawing depicting the drainage boundaries accounted for in the design of the Water Street storm sewer can be found in Appendix 'D'. The composite runoff coefficient for the 0.09 ha of land attributed to drain towards the Water Street storm sewer is C=0.79.

The allowable release rate is calculated using the Town of Oakville IDF curves and composite runoff coefficient from the record drawings. The 5-year allowable release rate based on 0.09 ha is determined to be 23 L/s. Supporting calculations are provided in Appendix 'D'.

Post-development flow rates are calculated using the same IDF data and a runoff coefficient of C=0.90. Approximately 0.05ha of the subject site is proposed to flow uncontrolled. Of the 0.05ha approximately 0.02 ha is softscape surfaces and the remaining 0.03 ha is uncontrolled roof drainage and hardscaped surfaces. The uncontrolled areas produce a flow rate of 18 L/s during the 100-year. The allowable release from subject site is reduced from 23 L/s to 5 L/s to account for the uncontrolled flows. Supporting calculations can be found in Appendix 'D'.

In order to control the post-development flow to the allowable release rate of 5 L/s, approximately 48.5 m³ of storage is required for the 100-year event. Due to the inherently shallow elevation of the proposed storm sewer on Water Street stormwater stored on site will have to pumped. Pumps shall be designed by the mechanical consultant and must not exceed the allowable rate. Emergency backup power/auxiliary pump is recommended. Emergency overflow for the on-site storage facility must be detailed as designs progress, but generally consists of a mechanism to spill to grade at Water Street. Building mechanical systems must be designed to withstand surcharge.

The method used to provide the required on-site storage can be determined at the detailed design stage.

3.4.2 Quality Control

Stormwater runoff from the proposed development consists primarily of roof drainage (including the roof top terrace) and drainage from private amenity space (terraces) at the ground level. Roof drainage from terraces, low traffic areas or pedestrian plaza areas can be considered moderately clean drainage. The ground level amenity space (terrace) is privately owned and can be considered a low traffic area with moderately clean drainage.

Given the site's proximity to Lake Ontario, drainage from the subject site will provide minimal opportunity to dilute stormwater from development upstream before discharge into Lake Ontario.

Due to moderately clean drainage produced by the site and the proximity to Lake Ontario, stormwater quality control is not proposed.

4.0 SITE GRADING

The proposed grading is constrained by the existing slopes on Robinson Street. Slopes range up to 10% along Robinson Street. The grading is also constrained by the existing residential and parking lot adjacent to the south property line. Additionally, slopes on the eastern portion of the subject lands range from approximately 8% to 25%. The western portion of the subject lands is relatively flat and has slopes ranging approximately 0.5% to 5.0%. Units will need to be stepped to generally follow the east/west profile of Robinson Street.

The proposed grading must ensure that drainage from the 100-year event is collected by the building's drains and conveyed to the stormwater storage facility. The amenity areas and any flat roof areas must be adequately scuppered if perimeter parapet walls are proposed. *Emergency overland flows from the rear amenity areas in the event of blockage will be directed west along the terraces using scuppers to a downspout which discharges to the west property line and ultimately to Water Street.*

The underground parking structure must extend above existing property line grades on the south property line to self-contain the site, maintain existing drainage patterns, and match the existing property line elevations. A copy of the Preliminary Grading Plan is provided in Appendix 'B' and should be read in conjunction with this report.

5.0 CONCLUSION

Adequate municipal infrastructure exists within the abutting road allowances to support the proposed zoning amendments. The information in this report provides the framework from which detailed designs can evolve as the development progresses through the planning approval and permitting process.

The development proposal results in a minor increase to water demands and sanitary flows from the site. Analysis of the flows to the existing Water Street sanitary PS indicate the subject site will have a minor impact on flows to the pumping station and there are no capacity concerns as a result of this development.

Stormwater quantity controls are proposed to control post-development flows from the 100-year event to the 5-year rate based on the storm drainage area plan for the Water Street sewer. Approximately 43.5 m³ of storage is required to control discharge to the allowable rate of 0.05 m³/s accounting for the uncontrolled flows.

Functional Servicing Report Proposed 3-Storey Townhomes 71 Water Street & 106-114 Robinson Street

Architectural stepping of the units is proposed to provide a desirable relationship between the building and the surrounding elevation constraints.

PREPARED BY TRAFALGAR ENGINEERING LTD.

P. Cifoni, P.Eng. Principal



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Enclosures

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APPENDIX 'A'

Site Plan, Richard Wengle Architect Inc.

Topographic Survey, Rady-Pentek & Edward Surveying LTD.

Reference Plan 20R-18998, Cunningham McConnel Ltd.

Oakville Air Photo History (2012 & 2015)



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Drawing Index

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Town of Oakville Air Photo History 2012

2012 Air Photo

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Town of Oakville

Town of Oakville Air Photo History 2015

Town of Oakville, Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community

Sources: NRCan, Esri Canada, and Canadian Community Maps contributors. | Esri Canada | Esri Community Maps Contributors, City of Hamilton, Province of Ontario, Town of Oakville, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US

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APPENDIX 'B'

Servicing Plan, Dwg. S1

Grading Plan, Dwg. G1

Record Drawings

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58.5 0 29.27 58.5 Metres 1: 1,171 REGIONAL MUNICIPALIY OF HALTON, ITS EMPLOYEES, OFFICERS AND AGENTS ARE NOT REPONSIBLE FOR ANY ERRORS, OMISSIONS OR INACCURACIES, WHETHER DUE TO THEIR NEGLIGENCE OR OTHERWISE. ALL INFORMATION SHOULD BE VERIFIED. Produced by Regional Municipality of Halton under License with the Ontario Ministry of Natural Resources @ Queen's Printer for Ontario 2012. © Teranet Enterprise Inc. and its suppliers. All rights reserved. NOT A PLAN OF SURVEY.

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APPENDIX 'C'

Fire Flow Test Results

Estimated Water Demands

Estimated Sanitary Flow

Water Street PS Flow Monitoring Data

Daily Lake Ontario Levels

Addendum to Section 2.2 Wastewater

FLOW TEST REPORT

Date	September 20, 2022
Customer	Rosehaven Homes
Job Location	Navy Street, Oakville
Time of Test	1:39pm
Location of test (flow)	Fire hydrant at 53 Navy Street
Location of test (residual)	Fire hydrant at 85 Navy Street
Main Size (mm)	300mm
Static Pressure (psi)	64
	Residual Number of Outlets & PITOT Pressure Flow Pressure Orifice Size (psi) (U.S. G.P.M.) (psi)
#1	1 x 2 - 1/2 54 1230 60
#2	2 x 2 - 1/2 40 2117 58
#3	USGPM @ 20psi 6208 20
Colour code	Blue
70 60 (; 50 30 30 20 10 0	
0 200 400 600 800100	0.200.400.600.80020022024026002800800820840086088004004204400600480050052054056068806006206406600 FLOW (U.S. G.P.M.)

Comments

Crew Member

Tyler Burns / Jeremy Clark

ESTIMATED WATER DEMAND

Project: Desc:	71 Water Street & 106 Rc 2nd Submission SPA	bbinson Street							F	Project No.: Prepared By: Checked By:	1656 MW PC
		Occupancy Data				P	eaking Facto	rs		Demand Flov	v
l and Lls		Density Area (person/hecta (hectares) re)	Eq. Population Dem (can.)	Per Cap. and (L/cap. Day)	Average Daily	Min Hour	Peak Hour	Max Daily	Min. Hour Demand	Max. Hour Demand	Max. Daily Demand (L/min)
Townho	use	0.163 135.0	22	275	<u>4</u>	1.00	4.00	2.25	4	17	9
*Per Cap	p. Demand based on O.B.C.	. Table 8.2.1.3.B 5 L/1.0m ² Sto	res								
TOTAL		0	22		4				4	17	9
<u>Fire Flov</u> Using Fi 1.	 Mathematical Survey Methods An estimate of the fire flucture Where: F = The required fire C = Coefficient relation A = The total floor and 	ethodology: ow is given by the formula flow in litres per minute ed to the type of construction rea in square metres (including a	$F=220C\sqrt{A}$ Il storeys but exclud	ling basemen	its at least 50% be	low grade)			Average Da Minimum Hou Maximum Hou Maximum Da Max. Da	aily Demand: Irly Demand: Irly Demand: aily Demand: ily Plus Fire:	4 (L/min) 4 (L/min) 17 (L/min) 9 (L/min) 5009 (L/min)
	Type of Construction:	Fire-Resistive	Coefficient: 0.60		Total Floor Area:	1646	(m²)	Area Note:	For fire resistiv	ve buildings, o	consider the
2.	F =5000(L/miAdjust the value in No. 1Occupancy Contents:F =5000(L/mi	in) for occupancy surcharge/reduct Combustible in)	Adequatel tion Factor: 0%	ly Protected \	Vertical Openings:	Yes			two largest adj the remaining openings are in adequately pro consider only t plus 25% of ea	floors up to en floors up to en adequately p tected vertic the area of the ch of the two	plus 50% of ight, when protected. For al openings e largest floor immediately
3.	Adjust the value in No. 2	for sprinkler		4. /	Adjust the value in	n No. 2 for ex	posure		adjoining noon	S	
5	NFPA 13 Sprinkler: Standard Water Supply: Fully Supervised:	No Reduction: Yes Reduction: No Reduction: Total Reduction: Sprinkler Reduction:	20% 10% 10% 40% 2000 (L/m	in)	Sep North East South West Tr Expos	paration (m) 20 19 9 100 otal Charge: ure Charge: 1000	Charge 10% 15% 20% 0% 45% 2250	(L/min)			
5.	Estimated Fire Flow is va	ilue in No. 2 less Sprinkler Reduc	tion plus Exposure (unarge , roun	aea to the neares						

F = 5000 (L/min)

ESTIMATED SANITARY FLOW

Project:	Proposed Townhouse			Project No.:	1656
Desc:	Zoning Amendment			Prepared By:	ΚZ
				Checked By:	PC
Resident	ial				
		Population	Eq.	Per Cap. Average Daily D	
		Donoity	Dopulation	Domand Weath	

		Density	Population	Demand	Weather Flow
Land Use / Occupancy Type	Area (ha)	(pers/ha)	(cap.)	(L/cap. Day)	(L/s)
Townhouses	0.16	135.0	22	275	0.1
TOTAL	0		22		0.1
Industrial / Commercial / Institutional					
		Population	Eq.	Per Cap.	Average Daily Dry
		Density	Population	Demand	Weather Flow
Land Use / Occupancy Type	GFA	(pers/ha)	(cap.)	(L/Ha. Day)	(L/s)
					0.0

TOTAL	0	0	0.0
Residential Peaking Factor:	4.38		
ICI Peaking Factor:	4.50		
Include ICI Peaking?	No		
Tributary Area:	0.16 (ha)		
Infiltration Allowance:	0.29 (L/s ha)		
Foundation Drain Allowance:	0.00 (L/s ha)		
Residential + Infiltration Flow:	0.1 (L/s)		
ICI Average Flow:	0.0 (L/s)		
Groundwater Discharge:	0.0 (L/s)		
Total Average Flow:	0.1 (L/s)		
Residential Peak Flow:	0.3 (L/s)		
ICI Peak Flow:	0.0 (L/s)		
Groundwater Discharge:	0.0 (L/s)		
Total Peak Flow:	0.3 (L/s)		

P:\1656 Roseville Properties\Calculations\[Water and Sanitary Demands.xlsx]INPUT

July 6, 2022

Our File: 1656

Addendum to

FUNCTIONAL SERVICING REPORT

Water, Sanitary, and Stormwater Management

PROPOSED 3-STOREY TOWNHOMES

71 WATER STREET & 106 ROBINSON STREET TOWN OF OAKVILLE

OUR FILE: 1656

PREPARED FOR ROSEVILLE PROPERTIES INC

MAY 12, 2022

This addendum relates to Section 2.2 Wastewater contained in the above-mentioned Functional Servicing Report. The purpose of the addendum is to provide additional information regarding sanitary drainage. In 2008, the site was used for commercial purposes with the exception of a single family two storey dwelling located at 90 Robinson Street, adjacent to Water Street. At one time prior to 2008, the property was occupied by a restaurant with seating for nearly 300 people. Subsequent to the commercial use, the property was rezoned for thirteen 3-storey stacked townhouses. A further zoning amendment led to thirteen condominium units in an apartment form. The current zoning amendment is seeking ten 3-storey street townhouse units having a condominium format. The estimated peak wastewater flows for this scenario is 0.32 l/s based on 135 persons per hectare (equivalent population = 22 persons). This compares to an estimated peak flow of 0.16 l/s when the site was designated "commercial" at a land use density of 90 persons per hectare. (equivalent population = 14 persons).

Notwithstanding that the above shows that the historical commercial use produced expected flows less than the expected flows for the proposed residential use, these flows are relatively small. The change from a historical commercial use to a residential use for a site of this size creates no measurable impact to downstream municipal infrastructure.

PREPARED BY TRAFALGAR ENGINEERING LTD.

P. Cifoni, P.Eng. Consulting Engineer Principal

PC:ht

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Functional Servicing Report Proposed 3-Storey Townhomes 71 Water Street & 106-114 Robinson Street

APPENDIX 'D'

Stormwater Management Calculations

Record Drawings

COMPOSITE RUNOFF COEFFICIENT

Project:	Proposed Townhouses	Project No.:	1656
Desc:	Zoning Amendment	Prepared By:	ΚZ
		Checked By:	PC

Pre-Development Composite Runoff Coefficient

Surface	'A' (m ²)	'C'	'AC'	% Imp	'AI'
Area A	700	0.85	595	0%	-
Area B	200	0.60	120		-
			-		-
			-		-
			-		-
Totals	900		715		-
		C = 'AC'/'A'=	0.79	%I = 'AI'/'A' =	-

External Drainage Area Composite Runoff Coefficient

Surface	'A' (m²)	'C'	'AC'	% Imp	'AI'
			-	0%	
			-		-
			-		-
			-		-
			-		-
Totals	-		-		-
		C = 'AC'/'A'= -		%I = 'AI'/'A' = ·	

Post-Development Controlled Area Composite Runoff Coefficient						
Surface	'A' (m²)	'C'	'AC'	% Imp	'Al'	
Impervious	1100	0.90	990	100%	1100	
			-		-	
			-		-	
			-		-	
			-		-	
Totals	1100		990		1100	
		C = 'AC'/'A'= ().90	%I = 'AI'/'A' =	100%	

Post-Development Uncontrolled Area Composite Runoff Coefficient

Surface	'A' (m²)	'C'	'AC'	% Imp	'AI'
Pervious	200	0.25	50	0%	-
Impervious	300	0.90	270	100%	300
			-		-
			-		-
			-		-
Totals	500		320		300
		C = 'AC'/'A'=	0.64	%I = 'AI'/'A' =	60%

RATIONAL METHOD FLOWS

Based on Town of Oakville IDF Data

Project:	Proposed Townhouses	Project No.:	1656
Desc:	Zoning Amendment	Prepared By:	ΚZ
		Checked By:	PC

Pre-Development Parameters

	Site	External	Total
'C'	0.79	0.00	0.79
'A' (ha)	0.09	0.00	0.09
'AC'	0.07	0.00	0.07

Pre-Development Flow

	Intensity	Site Flow	External Flow	Total Flow
Return	(mm/hr)	(L/s)	(L/s)	(L/s)
2-yr	82.2	16	0	16
5-yr	114.2	23	0	23
10-yr	134.8	27	0	27
25-yr	162.2	32	0	32
50-yr	182.1	36	0	36
100-yr	200.8	40	0	40

Post-Development Parameters

	Controlled	Uncontrolled	External	Total
'C'	0.90	0.64	0.00	0.82
'A' (ha)	0.11	0.05	0.00	0.16
'AC'	0.10	0.03	0.00	0.13

Post-Development Flow

			Uncontrolled	Peak		
	Intensity		Flow	Rooftop Flow	External Flow	Total Flow
Return	(mm/hr)	Peak Inflow (L/s)	(L/s)	(L/s)	(L/s)	(L/s)
2-yr	82.2	23	7	7	0	37
5-yr	114.2	31	10	8	0	49
10-yr	134.8	37	12	9	0	58
25-yr	162.2	45	14	9	0	68
50-yr	182.1	50	16	10	0	76
100-yr	200.8	55	18	10	0	83

Post-to-Pre Comparison*

	Pre-Dev Total	Post-Dev Total	
Return	(L/s)	(L/s)	Percent Change
2-yr	16	37	131%
5-yr	23	49	113%
10-yr	27	58	115%
25-yr	32	68	113%
50-yr	36	76	111%
100-yr	40	83	108%

*Storage may be required, refer to Modified Rational Method Storage Calculation and Summary sheets if applicable

MODIFIED RATIONAL METHOD STORAGE

Based on Town of Oakville IDF Data

Project:	Proposed Towr	houses	Project No.:	1656
Desc:	Zoning Amendr	nent	Prepared By:	ΚZ
			Checked By:	PC
Pre-Deve	lopment			
Catchme	nt Area (ha)	0.0900		
Runoff Co	pefficient	0.79		
TC (min)		10	Pre-Development Peak Intensity: 11	4.2 mm/hr
Control Level 5-Yr		5-Yr	Pre-Development Peak Discharge: 0.	023 (cms)
Post-Dev	elopment Uncont	rolled	External Drainage	
Catchme	nt Area (ha)	0.0500	Catchment Area (ha)	0

0.0500
0.64
10
100-Yr
: 0.018 (cms)

Post-Development Controlled

Catchment Area (ha)	0.1100
Runoff Coefficient	0.90
Time of Concentration	10
Control Level	100-Yr

0.00

100-Yr

10

Runoff Coefficient

External Peak Discharge: 0 (cms)

TC (min)

Control Level

Post-Development Peak Intensity: 200.8 mm/hr Post-Development Peak Discharge: 0.055 (cms) Allowable Release Rate: 0.005 (cms)

Storm			Average	Max. Release	Inflow		
Duration	Intensity	Inflow Rate	Roof	Rate	Volume	Outflow Volume	Storage
TD	i = A x T _D ^{-C}	$Q_{\rm P} = {\rm CiA}/{\rm 360}$	Discharge	$Q_A = Ci_{2YR}A$	$V_{I} = 60Q_{P}T_{D}$	$V_0 = 30Q_A(T_D + T_C)$	$S = V_1 - V_0$
(min)	(mm/hr)	(m ³ /s)	(m³/s)	(m³/s)	(m ³)	(m ³)	(m ³)
10	200.80	0.055	0.000	0.005	33.1	2.9	30.2
15	158.27	0.044	0.000	0.005	39.2	3.6	35.5
20	131.37	0.036	0.000	0.005	43.4	4.4	39.0
25	112.72	0.031	0.000	0.005	46.5	5.1	41.4
30	98.99	0.027	0.000	0.005	49.0	5.8	43.2
35	88.43	0.024	0.000	0.005	51.1	6.5	44.5
40	80.03	0.022	0.000	0.005	52.8	7.3	45.6
45	73.19	0.020	0.000	0.005	54.3	8.0	46.4
50	67.49	0.019	0.000	0.005	55.7	8.7	47.0
55	62.68	0.017	0.000	0.005	56.9	9.4	47.5
60	58.55	0.016	0.000	0.005	58.0	10.2	47.8
90	42.35	0.012	0.000	0.005	62.9	14.5	48.4
120	33.49	0.009	0.000	0.005	66.3	18.9	47.5
150	27.85	0.008	0.000	0.005	68.9	23.2	45.7
180	23.93	0.007	0.000	0.005	71.1	27.6	43.5
210	21.04	0.006	0.000	0.005	72.9	31.9	41.0
240	18.81	0.005	0.000	0.005	74.5	36.3	38.2
270	17.03	0.005	0.000	0.005	75.9	40.6	35.3
360	13.35	0.004	0.000	0.005	79.3	53.7	25.7
720	7.40	0.002	0.000	0.005	87.9	105.9	0

GRA