Mantella Corporation

STONEHAVEN DRIVE, BURLINGTON

FUNCTIONAL SERVICING REPORT

JUNE 2017

IBI

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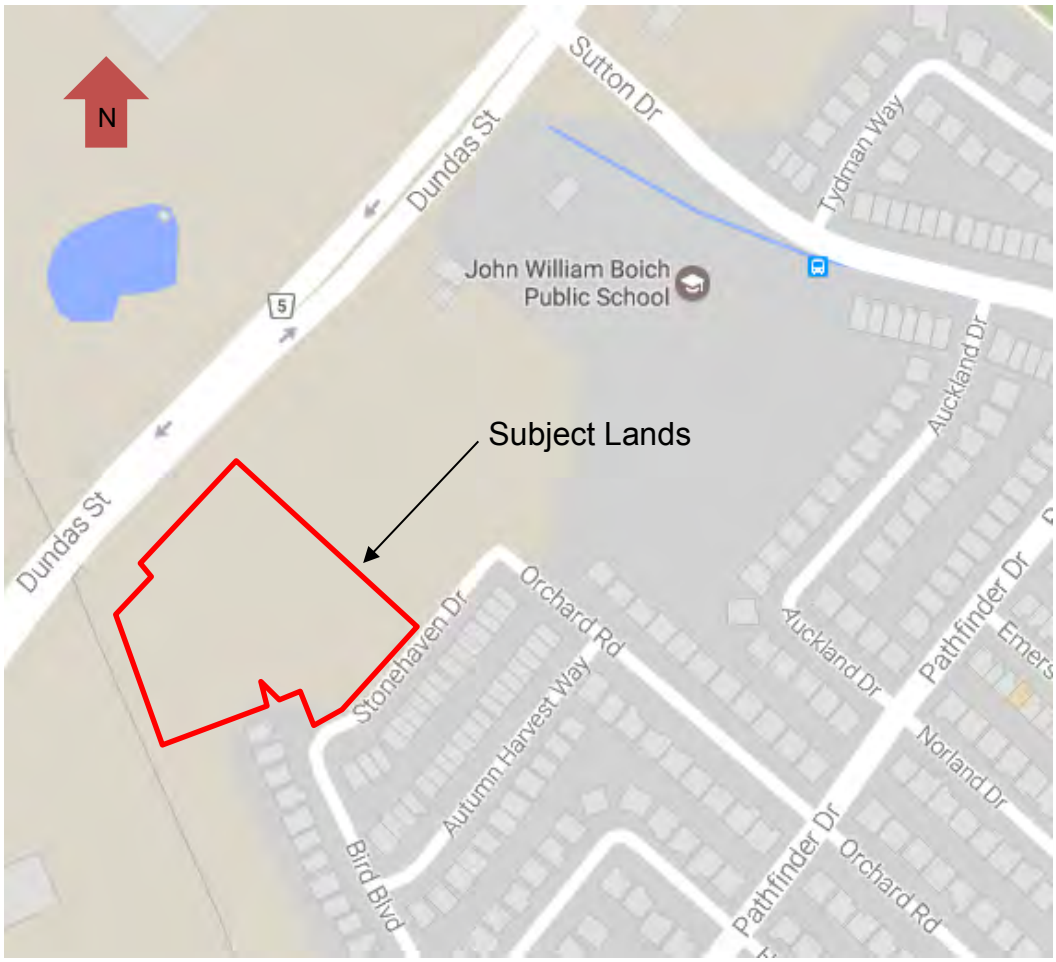
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1. INTRODUCTION

IBI Group has been retained by Mantella Corporation to prepare a Functional Servicing Report (FSR) in support of the development of a private, residential 18-unit development (10 detached, single-family houses and 8 freehold townhouses). The project lands extends off existing Bird Boulevard and fronts onto Stonehaven Drive. Please refer to **Figure 1.1** below for the location of the proposed development.



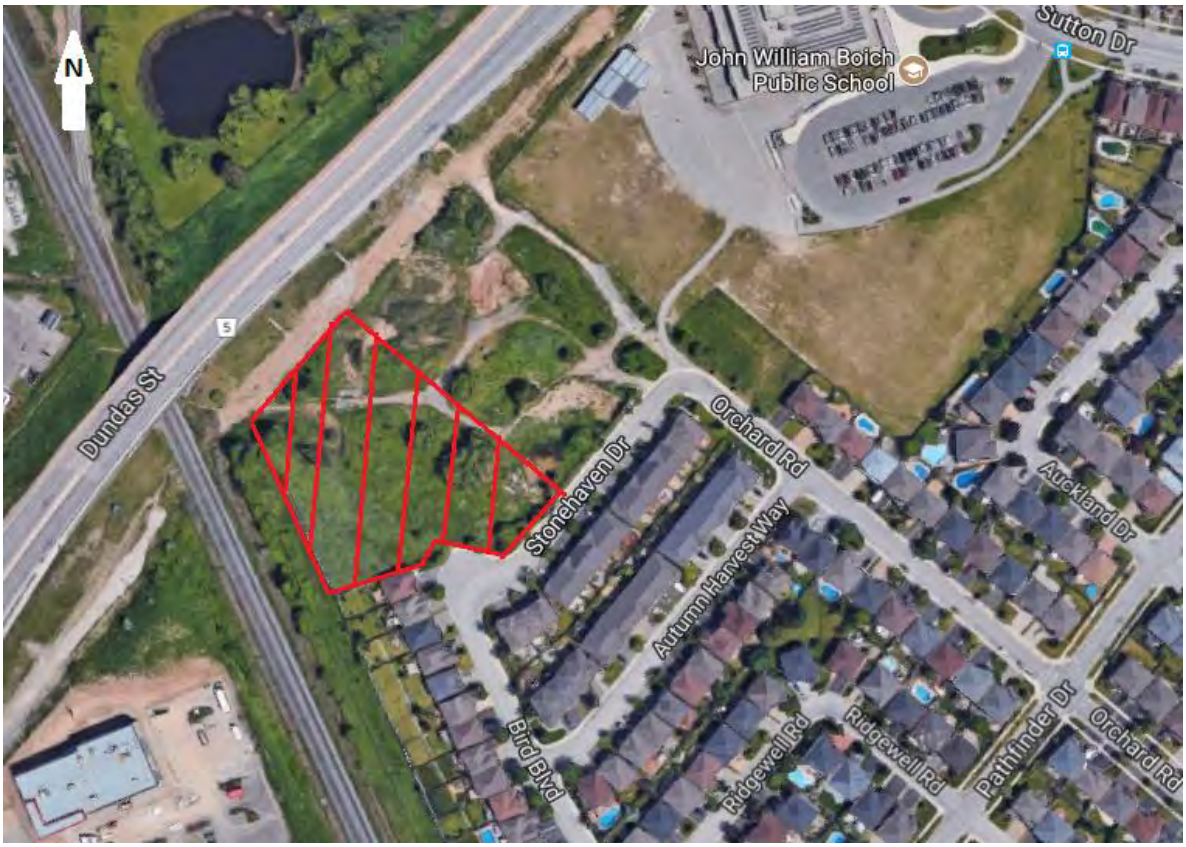
(Source: http://maps.google.ca)
Figure 1.1: Project Location

This report addresses how existing infrastructure and proposed servicing would be utilized to provide the proposed development with full municipal services according to current design requirements of the City of Burlington and Regional Municipality of Halton.

2. EXISTING SITE CONDITIONS

The development site is an irregular parcel of land, approximately 0.87ha in size. Currently, the land is vacant and fenced off from the existing nearby residential development. The site is covered mostly with shrubs and bushes with scattered deciduous trees.

The site is bound to the north by Highway 5/Dundas St. and to the west by a Canadian National rail line. Extending further west of the rail line are large commercial plazas with shopping facilities and restaurants. Immediately east of the subject lands is a proposed 0.71 ha park, fronting onto Stonehaven Drive. Just east of the proposed park is John William Boich Public School. South of the site along Bird Boulevard and Stonehaven Drive are existing residential single detached homes and townhouses.



(Source: http://maps.google.ca)
Figure 2.1: Aerial Image of Existing Lands

The following is an itemized summary of the existing municipal services available for this proposed development.

2.1 Roads

The subject lands front onto Stonehaven Drive at Bird Boulevard.

2.2 Sidewalks

A 1.5m sidewalk is located along the north side of Stonehaven Drive and extending west and terminates at Bird Boulevard. A 1.5m sidewalk is also located on the east side of Bird Boulevard starting at Stonehaven road and extending south. There is no sidewalk on the west side of Bird Boulevard or the south side of Stonehaven Drive.

2.3 Sanitary Sewers

An existing 150mm diameter sanitary sewer is located on Stonehaven Drive which conveys waste water east toward Orchard Road. A separate 150mm diameter sanitary sewer also exists on Bird Boulevard which flows south.

2.4 Water Supply

Existing 150mm diameter watermains are located on Stonehaven Drive and Bird Boulevard. The two watermains are connected at a valve chamber in the intersection of Stonehaven Drive and Bird Boulevard. The watermain on Bird Boulevard extends north past the valve chamber to service a fire hydrant at the end of the boulevard. The east end of the Stonehaven watermain connects to an existing 300mm diameter watermain on Orchard Road.

2.5 Storm Sewers

An existing 375mm diameter storm sewer runs east along the south side of Stonehaven Drive and connects to a 600mm diameter storm sewer running south on Orchard Road. An existing 300mm diameter storm sewer is available on Bird Boulevard which runs south.

Existing rear yard catch basins collect runoff from the rear lots on Bird Boulevard and rear yard swale behind Stonehaven Drive lots. Additional catch basins servicing the north side of Stonehaven Drive conflict with proposed development and will need to be relocated or removed.

2.6 Utilities

The development site is within a well-developed, fully urbanized area. Electricity, natural gas, telephone and cable services are assumed to be present given the current developed state of the neighbourhood.

3. PROPOSED DEVELOPMENT

The proposed development includes 8 freehold townhouse units and 10 detached, single-family units for a total of 18 proposed units. All units are two-storey units with basements. The proposed development also includes driveways for the residences.

The proposed development requires a full engineering design for grading, drainage, sewers, water, and the provision for other utilities. A review of each of these components is provided to determine the general design requirements which are addressed in the complete engineering submission. Refer to **Appendix A** for the proposed development concept.

3.1 Roadways

The portion of the proposed development will include a municipal roadway with a 14.27m right of way and a 7.5m pavement width, extending the intent of the existing Bird Boulevard cross-section with the City of Burlington 14m ROW section. See proposed cross section drawing on drawing OPP in **Appendix C**. The roadway will extend into an 11.5m radius cul-de-sac and will provide access for residents to the detached, single-family units. The temporary bulb between Bird Boulevard and Stonehaven Drive will be removed and a tee intersection will be constructed. The townhouse units are directly accessibly by Stonehaven Drive. Driveways are proposed to be permeable pavers for both single-family detached and townhouses to reduce storm runoff from the site. Also, the City requirement of 0.5 parking spaces per unit is achieved with on street parking.

3.2 Sidewalks

The existing sidewalk along the north side of Stonehaven Drive will remain. The portion of sidewalk along the temporary (existing) bulb between Bird Boulevard and Stonehaven Drive will be removed when the existing roadway is constructed. The City of Burlington pre-consolidation meeting minutes indicate the requirement for full sidewalk, however this is not practical and Development Engineering staff have indicated support for a strategy with sidewalk only on Stonehaven Drive.

3.3 Grading

A grading plan designed to capture rainfall runoff form the site has been prepared in accordance with the design standards. The existing grades along the property line have been respected. Please see drawing GP for grading plan in **Appendix B**. Based on meetings with City of Burlington Development Engineering staff, we have proposed that drainage from the rears of lots 7, 8, 9, 10 and part of the townhouse block flows directly to park catch basins for capture into the municipal storm sewer.

3.4 Sanitary Sewers

The townhouse block fronting onto Stonehaven Drive will be serviced by the existing 150mm diameter sanitary sewer. To service the proposed single, detached houses a 150mm diameter sanitary sewer will be extended from the north most manhole of the existing sanitary sewer on Bird Boulevard.

The total site sanitary design flow was determined using the Region of Halton design criteria. The single detached houses outletting to the Bird Boulevard have a design flow of **0.91L/s** and the townhouse block has a design flow of **0.22L/s**, resulting in a total sanitary design flow from the site of **1.13L/s.**

The existing 150mm diameter sanitary sewers have an approximate capacity of 20L/s. As the proposed site sanitary demand results in a minimal increase in flow, there is sufficient capacity within the existing sewer to receive the site sanitary demand. Please refer to **Appendix D** for detailed calculations.

3.5 Domestic and Firefighting Water Supply

A proposed 150mm diameter watermain connection to the municipal main will supply domestic and firefighting supply to the single detached dwellings off the extension of Bird Boulevard while the townhouse block will be serviced directly by the existing 150mm diameter water main on Stonehaven Drive.

Halton Region design criteria for water systems specify that design water demand should be the greater of:

- the maximum daily demand combined with the fire flow demand; or
- the maximum hourly demand.

Based on methods of the Fire Underwriters Survey, 1999 (FUS) the fire flow demand for the townhouse block was found to be **133.3L/s**, assuming wood frame construction and one firewall in the middle of the 8 units. The fire flow demand for the single-family detached homes was found to be **183.33 L/s**, assuming wood frame construction and a separation between the homes of less than 3.0m which, as per FUS, the total floor area is considered as one fire zone. Total domestic water demand was determined by combining the demand from the single-family detached homes and townhouse units. The subject lands are found to have a total maximum daily demand of **0.52 L/**s and a peak hourly demand of **0.93 L/s**. Using methods outlined in Halton Region design criteria for water systems, the design water demand is the combination of maximum daily demand and the fire flow demand (max case) which is determined to be **183.86 L/s**. Please see **Appendix E** for the detailed calculations.

Flow testing was completed on two hydrants closest to the site on the looped 150mm diameter watermain, one at the intersection of Stonehaven Drive and Bird Boulevard and another on Stornehaven Drive, approximately 65m east of Bird Boulevard. The testing showed theoretical flows at 20psi of **290.8 L/s (4609 USgpm**) and **277.8 L/s (4404 USgpm)** respectively which exceeds the anticipated site water demand. (See attached test results by Jackson Waterworks and design calculations in **Appendix E**). The proposed development can be adequately serviced from the existing watermain.

3.6 Storm Water Drainage and Management

The site is located within the City of Burlington, Region of Halton on the north side of Stonehaven Drive adjacent to the east side of the CNR and directly south of Dundas Street. The site is currently vacant with tall grasses, shrubs and some trees. During development of the surrounding subdivision in the late 1990's/early 2000's, this property was proposed as a future school site. It has now been released by the school board and is available for development. It is proposed to develop 10 single family lots at the extension of Bird Boulevard as well as 8 townhouse units on the north side of Stonehaven Drive.

The Storm Drainage Area Plan (MDR-299, in **Appendix F**) shows that approximately 0.17 ha of this property was allowed into the first run of storm sewer on Stonehaven Drive with a C value of 0.45 as well as 0.76 ha at a C value of 0.20.

It is proposed to extend the storm sewer from Stonehaven Drive into the cul-de-sac proposed for the site. Some form of quantity control is required in order to control storm flows up to the 100 year storm event to the capacity of the downstream system or pre-development levels (worst case scenario). After consultation with the City, it was decided that storage volume could be provided in the form of underground pipe storage and with the use of pervious paving stone above clear stone within driveways.

A summary of the design follows:

- The site area is approximately 0.86 ha, including the proposed 10 single family lots and 8 townhouse units.
- Existing Storm Drainage: Drawing MDR-299 shows the existing drainage areas accounted for in the storm sewer on Stonehaven Drive.
- The proposed Storm Drainage Area plan shows the proposed drainage areas and C values for the proposed site as well as the existing areas entering the storm sewer on Stonehaven Drive. C values have been calculated using the City of Burlington Dwg S-3D.
- Permeable pavers are proposed on the new driveways within the development. A "C" value of 0.20 was used for these areas. It is calculated that an average storage amount of 1m3 is required (100 year storm event) beneath the permeable pavers, in the form of clear stone. Calculations are in Table 5 in **Appendix F**.
- Table 1 (in **Appendix F)** includes an analysis of the storm sewer without any quantity control. The storm pipe (MH9 to MH 8) is shown to be over capacity by 148%.
- Table 2 (in **Appendix F)** includes an analysis to determine the quantity control parameters. It is shown that the original design from drawing MDR-299 allowed for an area of 1.62 ha at an average C of 0.33 into the storm sewer from MH9 to MH8. An analysis of the storm sewer, shows that a total area of 1.74 ha, C=0.27 is required in order to ensure that this same run of storm sewer is not over capacity. Therefore this governs and is the basis for the storage volume calculations. For the new development area only, this equates to an average C value of 0.19 for the 0.86 ha which also corresponds to a pre-development level. Therefore the storage volume required to control the 100 year storm to the 5 year level is based upon an average C value of 0.27 and a total area of 1.74 ha entering at MH8.
- Tables 3 and 4 (in **Appendix F)** contain calculations showing the 5 year and 100 year storm events respectively. It is shown that a total storage volume of 100m3 is required during the 100 year storm event to restrict the flows upstream of MH8 to the values noted above. This requires a minimum of 88m of 1200mm diameter storm pipe for storage, not including storage within manholes, catchbasins and other pipes upstream of the proposed orifice.
- It is calculated that a 200mm diameter orifice within MH8 will provide the necessary restrictions to control the upstream flows. The storage/ponding elevation is calculated to be at the highest obvert of the proposed 1200mm diameter storm pipe at approximately 154.97m. This is conservative as there will be further storage provided by storm pipes between the 1200mm diameter pipe and MH8.
- Double catchbasins are proposed just upstream of MH1 in order to capture the flow from a 100 year storm event.
- Quality control is provided with an oil/grit separator just downstream of MH8. Calculations are in **Appendix F**.

Therefore as outlined above, stormwater management has been provided for quantity and quality control for the planned development. During detailed design, calculations are to be confirmed.

3.7 Utilities

As there are existing residential homes adjacent to the subject lands, we assume there are existing hydro, gas, telephone, and cable services in the near vicinity which can be extended to the proposed site.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the components reviewed in this functional servicing report, we recommend that the City of Burlington and Region of Halton accept this report's conclusions that this development should be serviceable according to all current design standards, given the preliminary review of the required servicing, storm water management, and utility requirements.

We trust that this report sufficiently provides a preliminary review of the servicing requirements for this proposed development. However, should you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,
IBI Group



John Iezzi, E.I.T.

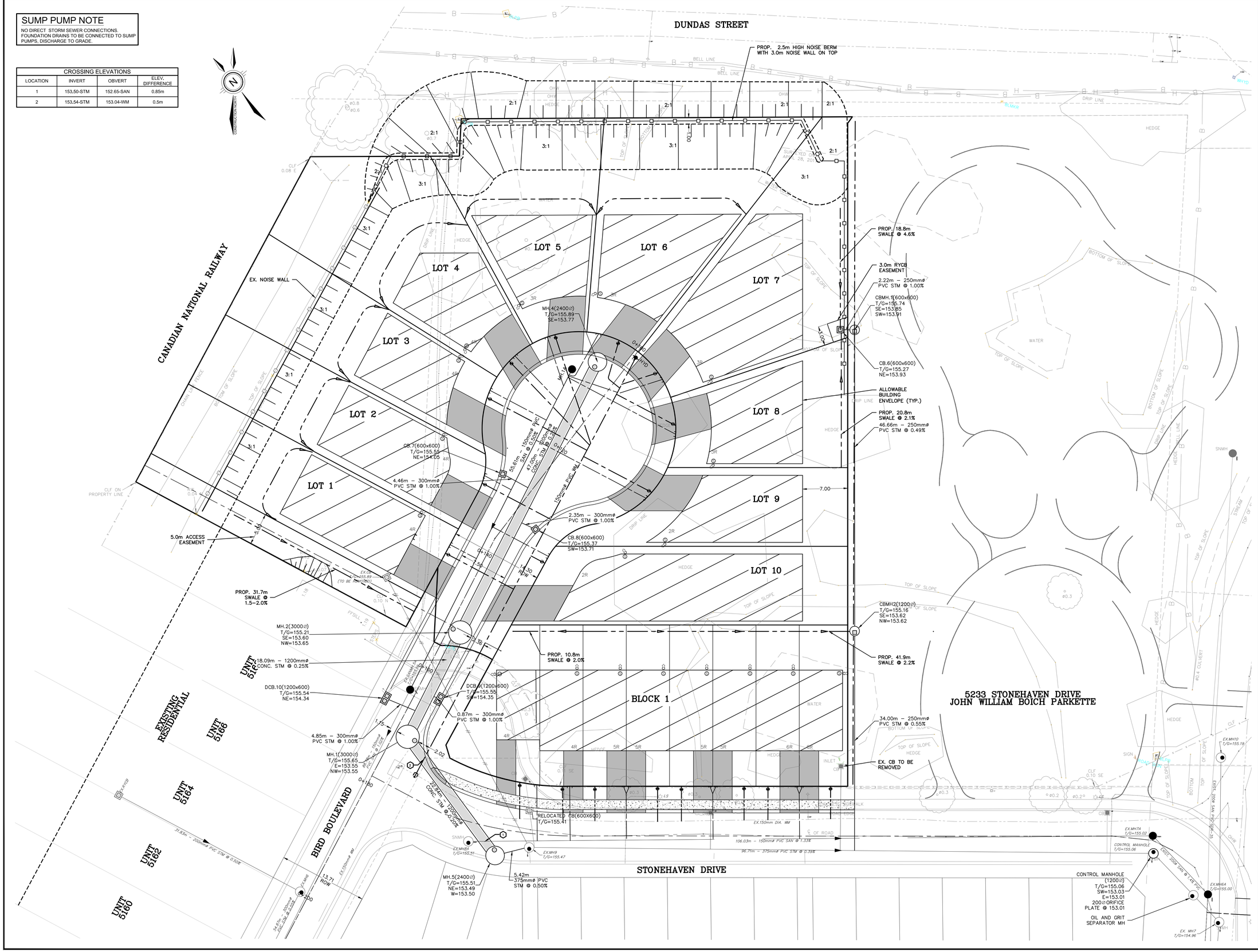
Brian Enter, P.Eng.
Associate

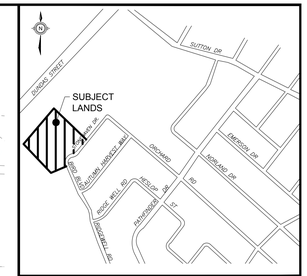
Appendix A: Site Servicing Plan

SUMP PUMP NOTE

NO DIRECT STORM SEWER CONNECTIONS.
FOUNDATION DRAINS TO BE CONNECTED TO SUMP PUMPS, DISCHARGE TO GRADE.

CROSSING ELEVATIONS			
LOCATION	INVERT	OBVERT	ELEV. DIFFERENCE
1	153.50-STM	152.65-SAN	0.85m
2	153.54-STM	153.04-WM	0.5m





KEY MAP - N.T.S.

LEGEND

- PROPOSED SILT FENCE OPSD 219.130
- CB – PROPOSED CATCH BASIN
- EXISTING STORM FLOW DIRECTION
- PROPOSED SANITARY SERVICE LATERAL
- S–MH – EXISTING SANITARY MANHOLE
- EXISTING SANITARY FLOW DIRECTION
- EXISTING SEWER TO BE REMOVED
- WV – PROPOSED WATER VALVE
- PROPOSED WATER SERVICE LATERAL
- EXISTING WATERMAIN
- M – PROPOSED WATER METER
- HYD – EXISTING HYDRANT
- CB – EXISTING CATCH BASIN
- ST–MH – EXISTING STORM MANHOLE
- DCB – EXISTING DOUBLE CATCH BASIN
- CBMH – EXISTING CB MANHOLE
- S–MH – EXISTING SANITARY MANHOLE
- HYD – EXISTING HYDRANT
- WV – EXISTING WATER VALVE
- VC – EXISTING VALVE CHAMBER
- EXISTING BELL BOX
- EXISTING CABLE TV BOX
- SEWER CROSSING

NOT FOR CONSTRUCTION

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- JOHN WILLIAM BOICH PARKETTE GRADING AND SERVICING INFORMATION OBTAINED BY A.J.CLARKE AND ASSOCIATES LTD.

BENCHMARK
- CITY OF BURLINGTON BENCHMARK NO. 443
ELEVATION = 152.321m (CGVD-1928: 1978 ADJUSTMENT)
MTO BM PLAQUE 818102 SET ON TOP OF CONCRETE BOX CULVERT LOCATED ON SOUTHEAST CORNER OF APPLEBY LINE AND DUNDAS STREET.

SCALE
3 0 5 10
1:250 (m)

DESIGN BY: C.CAO	CHECKED BY: B.ENTER
DRAWN BY: C.CAO	DATE: 2017-05-24

#	DATE	BY	DESCRIPTION
0	2017-06-29	C.C.	FUNCTIONAL SERVICING REPORT

DRAWING ISSUE RECORD

APPROVALS

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CITY OF BURLINGTON
REGION OF HALTON

5209 STONEHAVEN DRIVE
MANTELLA CORPORATION

GENERAL SERVICING PLAN

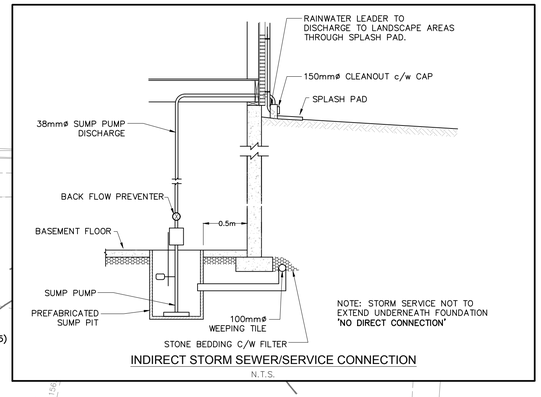
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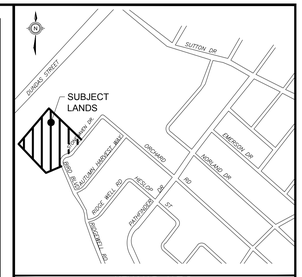
Appendix B: Site Grading Plan

SUMP PUMP NOTE

NO DIRECT STORM SEWER CONNECTIONS.
FOUNDATION DRAINS TO BE CONNECTED TO SUMP PUMPS. DISCHARGE TO GRADE. ALL LOTS TO HAVE SUMP PUMPS. SUMP PUMPS TO DISCHARGE TO SPLASH PAD PER DETAIL ON THIS SHEET.



INDIRECT STORM SEWER/SERVICE CONNECTION



KEY MAP - N.T.S.

LEGEND

78.22	– PROPOSED ELEVATION
(78.22)	– PARK GRADE ELEVATION
78.12 EXIST	– MATCH EXISTING ELEVATION
78.22	– EXISTING ELEVATION
2.0%	– PROPOSED SLOPE
	– EXISTING DIRECTION OF FLOW
	– PROPOSED OVERLAND FLOW
F.F.E	– FINISH FLOOR ELEVATION
T.F.E	– TOP OF FOUNDATION ELEVATION
G.F.E	– GARAGE FLOOR ELEVATION
B.F.E	– BASEMENT FLOOR ELEVATION
3R	– NUMBER OF RISERS
	– PROPOSED SILT FENCE OPSD 219.130
CB	– PROPOSED CATCH BASIN
	– EXISTING STORM FLOW DIRECTION
	– PROPOSED SANITARY SERVICE LATERAL
S–MH	– EXISTING SANITARY MANHOLE
	– EXISTING SANITARY FLOW DIRECTION
WV	– PROPOSED WATER VALVE
	– PROPOSED WATER SERVICE LATERAL
	– EXISTING WATERMAIN
M	– PROPOSED WATER METER
	– PROPOSED SUMP PUMP WITH SLASH PAD
HYD	– EXISTING HYDRANT
CB	– EXISTING CATCH BASIN
ST–MH	– EXISTING STORM MANHOLE
DCB	– EXISTING DOUBLE CATCH BASIN
CBMH	– EXISTING CB MANHOLE
S–MH	– EXISTING SANITARY MANHOLE
HYD	– EXISTING HYDRANT
WV	– EXISTING WATER VALVE
VC	– EXISTING VALVE CHAMBER
	– EXISTING BELL BOX
	– EXISTING CABLE TV BOX

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REGION OF HALTON

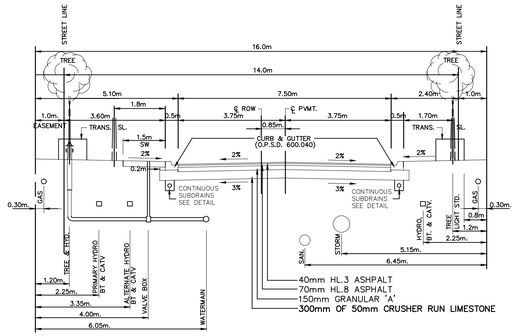
5209 STONEHAVEN DRIVE
MANTELLA CORPORATION

GRADING PLAN

FILE NUMBER: 105842 SHEET NUMBER: GP

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Appendix C: On-Street Parking Plan



14.0m ROAD ALLOWANCE

SCALE N.T.S.

7.5m PAVEMENT

DUNDAS STREET

PROP. 2.5m HIGH NOISE BERM WITH 3.0m NOISE WALL ON TOP

BELL LINE

OHW

BLMKR

CONTROLLED ACCESS HIGHWAY

2:1

3:1

1.00

CANADIAN NATIONAL RAILWAY

EX. NOISE WALL

CLF 0.08 E

CLF ON PROPERTY LINE

RW 0.04 N

CLF 0.10 N

CLF 0.10 SE

LOT 1

LOT 2

LOT 3

LOT 4

LOT 5

LOT 6

LOT 7

LOT 8

LOT 9

LOT 10

BLOCK 1

HYD

ALLOWABLE BUILDING ENVELOPE (TYP.)

7.00

3.00

7.50

14.30 ROW

1.08

REFILL

STEPS

CLF

CLF 0.10 SE

LS

CONCRETE SIDEWALK

6.00

1.00 (TYP.)

1.00 (TYP.)

5233 STONEHAVEN DRIVE
JOHN WILLIAM BOICH PARKETTE

SIGN

ASPHALT PATHWAY

UNIT 5168

EXISTING RESIDENTIAL

UNIT 5166

UNIT 5164

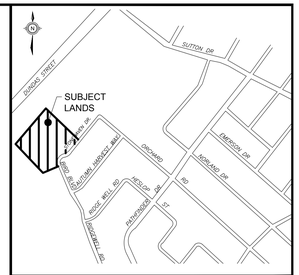
UNIT 5162

UNIT 5160

BIRD BOULEVARD

13.71 ROW

STONEHAVEN DRIVE



KEY MAP - N.T.S.

LEGEND

- 6.0x2.4m STREET PARKING
- HYD – PROPOSED FIRE HYDRANT
- HYD – EXISTING HYDRANT
- A – EXISTING HYDRO TRANSFORMER
- A – TRANSFORMER LOCATION
- STREETLIGHT PEDESTAL LOCATION
- BELL BOX
- CABLE TV BOX
- PROPOSED LIGHT STANDARD SEE ELECTRICAL PLAN E-110
- PROPOSED STOP SIGN

NOT FOR CONSTRUCTION

SOURCE:
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CITY OF BURLINGTON
REGION OF HALTON

5209 STONEHAVEN DRIVE
MANTELLA CORPORATION

ON-STREET PARKING PLAN

FILE NUMBER: 105842 SHEET NUMBER: OPP

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Appendix D: Waste Water Analysis

Sanitary Flow Review

Project: 5209 Stonehaven Drive, Burlington
File No: 105842
Date: 26-Jun-17
Sheet By: RWB
Checked By: BE

REQUIREMENT
Design Flow = Average Dry Weather Flow X Average Peak Wastewater Flow Factor + Infiltration Allowance

Maximum Daily Flow for Townhouse Dwellings

Building Type			
Single-Family, Townhouse Dwelling (2-storey plus basement)	Use Area	0.143	ha
	Pop Density	135	pers/ha
	Tributary Population	19.3	
	Unit sewage flow	0.275	m^3/capita/day
	Avg Dry Weather Flow	5.3163	m^3/day
	Peaking Factor M	4.38	
	Infiltration Allowance	0.286	L/s/ha
	Infiltration amount	0.04	L/s
	Proposed Flow =	**0.31**	**L/s**
	Infiltration Allowance[2] =	0.29	L/s/ha
	Infiltration Amount =	0.04	L/s
	Design Flow[2] =	**0.22**	**L/s**

1 Ontario Building Code Part 8 - Table 8.2.1.3.A
2 Criteria referenced from "Design Criteria, Contract Specifications, and Standard Drawings, Halton Region, 2001"

Sanitary Flow Review

Project: 5209 Stonehaven Drive, Burlington
File No: 105842
Date: 26-Jun-17
Sheet By: RWB
Checked By: BE

REQUIREMENT
Design Flow = Average Dry Weather Flow X Average Peak Wastewater Flow Factor + Infiltration Allowance

Maximum Daily Flow for Single-Family, Detached Dwellings

Building Type			
Single-Family, Detached Dwelling (2-storey plus basement)	Area	0.597	ha
	Pop Density	55	pers/ha
	Tributary Population	32.8	
	Unit sewage flow	0.275	m^3/capita/day
	Avg Dry Weather Flow	9.025088	m^3/day
	Peaking Factor M	4.35	
	Infiltration Allowance	0.286	L/s/ha
	Infiltration amount	0.17	L/s
	Proposed Flow =	**0.62**	**L/s**
	Infiltration Allowance[2] =	0.29	L/s/ha
	Infiltration Amount =	0.17	L/s
	Design Flow[2] =	**0.91**	**L/s**

1 Ontario Building Code Part 8 - Table 8.2.1.3.A
2 Criteria referenced from "Design Criteria, Contract Specifications, and Standard Drawings, Halton Region, 2001"

Worksheet : ***Ex. 150mm dia. Sanitary Sewer***

Uniform Flow | Gradually Varied Flow | Messages

Solve For: Full Flow Capacity

Friction Method: Manning Formula

Roughness Coefficient:	0.010	
Channel Slope:	0.01000	m/m
Normal Depth:	0.15	m
Diameter:	0.15	m
Discharge:	0.02	m³/s
	20.0L/s	

Flow Area:	0.02	m²
Wetted Perimeter:	0.47	m
Hydraulic Radius:	0.04	m
Top Width:	0.00	m
Critical Depth:	0.13	m
Percent Full:	100.0	%
Critical Slope:	0.00929	m/m
Velocity:	1.12	m/s
Velocity Head:	0.06	m
Specific Energy:	0.21	m
Froude Number:	0.00	
Maximum Discharge:	0.02	m³/s
Discharge Full:	0.02	m³/s
Slope Full:	0.01000	m/m
Flow Type:	SubCritical	

Calculation Successful.

Appendix E: Domestic and Fire Flow Analysis

Domestic Water Flow Review

Project: 5209 Stonehaven Drive, Burlington
File No: 105842
Date: 26-Jun-17
Sheet By: RWB
Checked By: BE

REQUIREMENT

Greater of[1]: Maximum Daily Demand + Fire Flow Demand
Maximum Hourly Demand

Maximum Daily Flow

Site Area 0.740 ha

	Units	Avg. Persons Per Unit[2]	Total Persons
Residential Dwellings — Single-Family, Detached	10	4.5	45
Residential Dwellings — Townhouse	8	3.5	28
			73

Total Population 73 persons

Average Day Service Demands[3] 275 L/person/day

Total 20075 L/day

Average Daily Demand = 20075 l/day
Maximum Daily Peaking Factor[3] = 2.25
Maximum Daily Demand = 45169 L/day
= 0.52 l/s

Fire Flow[4] = 183.33 L/s

Maximum Daily Demand + Fire Flow Demand = 183.86 L/s

Residential Maxium Hourly Peaking Factor[3] = 4.00
Peak Hourly Demand = 80300 L/day
Peak Hourly Demand = 0.93 l/s

Max of MDD+FFD or PHD **= Design Flow = 183.86 L/s**

1 Design Criteria, Contract Specifications, and Standard Drawings, Halton Region, 2001
2 Assumed per-unit average capacity
3 Design Criteria, Contract Specifications, and Standard Drawings, Halton Region, 2001, Table A.2.3
4 From Fire Flow calculations prepared by IBI Group, June 2017

Fire Flow Review

Project: 5209 Stonehaven Drive, Burlington
File No: 105842
Date: 26-Jun-17
Sheet By: RWB
Checked By: BE

Required Fire Flow for Single-Family, Detached Dwellings

Formula F = 220 * C √A (Part II, Fire Underwriters Survey, 1999)

	Single-Family, Detached Dwellings	
Case	1	
Assumptions	Mainfloor, wood frame construction, all one fire area	
Subject Floor Area**	550	m^2
Floor Area Above**	550	m^2
Floor Area Below	0	m^2
Shared Walls	0	ea.
North Separation*	9999.0	m
North Adjustment	0%	
East Separation*	9999.0	m
East Adjustment	0%	
South Separation*	7.6	m
South Adjustment	20%	
West Separation*	0.0	m
West Adjustment	0%	
Occupancy Fire Hazard Adjustment	-15%	
A =	1100	m^2
C =	1.5	(1.5 for wood frame, 1.0 for brick wall)
F =	10944.86	l/min
Rounded F =	11000	l/min
Adjustmented due to Occupancy Fire Hazard F =	9350	
Interior Firewall Adjustment	0	(10% per unpeirced party wall)
Exposure Adjustment	1870	(see Separation Table)
Sprinkler Adjustment	0	(30% reduction, Sprinkler System comforming to NFPA 13 and other NFPA Standards)
Adjusted F =	11000.0	
Required Fire Flow =	**183.3**	**l/s**
MIN REQUIRED FLOW =	**183.3**	**l/s**
(@20psi theoretical)	**2906**	**gal(US)/min**
Available flow	**277.8**	**l/s**
(Provided by City of Hamilton Staff)	**4404**	**gal(US)/min**

Notes:
All calculations and factors from "Water Supply for Public Fire Protection" by the Fire Underwriters Survey, 1999

*9999 denotes nearest building > 45m away, refer to exposure Figure 1.

**Separation between units is assumed to be < 3m, therefore all floor area to be assumed as one continuous fire zone.

Areas and separations based on assumptions provided by the client and are to be confirmed with the architech.

Separation Table

Separation		
From	To	Charge
0	3	25%
3.1	10	20%
10.1	20	15%
20.1	30	10%
30.1	45	5%

Fire Flow Review

Project: 5209 Stonehaven Drive, Burlington
File No: 105842
Date: 26-Jun-17
Sheet By: RWB
Checked By: BE

Required Fire Flow for Townhouse

Formula F = 220 * C √A (Part II, Fire Underwriters Survey, 1999)

	Townhouse Dwelling			
Case	**1 (Governs)**	2	3	
Assumptions	Mainfloor Unit 1, wood frame construction, with 1 firewall	Mainfloor Unit 1, wood frame construction, with 3 firewalls	Mainfloor Unit 4, wood frame construction, with 3 firewalls	
Subject Floor Area	256	116	128.0	m^2
Floor Area Above	256	156	168.0	m^2
Floor Area Below	0	0	0.0	m^2
Shared Walls	1	1	2	ea.
North Separation*	7.9	7.9	7.6	m
North Adjustment	**20%**	**20%**	**20%**	
East Separation*	0.0	0.0	0.0	m
East Adjustment	**0%**	**0%**	**0%**	
South Separation*	25.2	25.2	24.5	m
South Adjustment	**10%**	**10%**	**10%**	
West Separation*	24.4	24.4	0.0	m
West Adjustment	**10%**	**10%**	**0%**	
Occupancy Fire Hazard Adjustment	-15%	-15%	-15%	
A =	512	272.0	296.0	m^2
C =	1.5	1.5	1.5	(1.5 for wood frame, 1.0 for brick wall)
F =	**7467.05**	**5442.50**	**5677.53**	l/min
Rounded F =	**7000**	**5000**	**6000**	l/min
Adjustmented due to Occupancy Fire Hazard F =	**5950**	**4250**	**5100**	
Interior Firewall Adjustment	**0**	**0**	**0**	(10% per unpeirced party wall)
Exposure Adjustment	**2380**	**1700**	**1530**	(see Separation Table)
Sprinkler Adjustment	0	0	0	(30% reduction, Sprinkler System comforming to NFPA 13 and other NFPA Standards)
Adjusted F =	8000.0	6000.0	7000.0	
Required Fire Flow =	**133.3**	**100.0**	**116.7**	**l/s**
MIN REQUIRED FLOW =	**133.3**	**100.0**	**116.7**	**l/s**
(@20psi theoretical)	**2113**	**1585**	**1849**	**gal(US)/min**

Available flow	**277.8**	**l/s**
(Provided by City of Hamilton Staff)	**4404**	**gal(US)/min**

Notes:
All calculations and factors from "Water Supply for Public Fire Protection" by the Fire Underwriters Survey, 1999

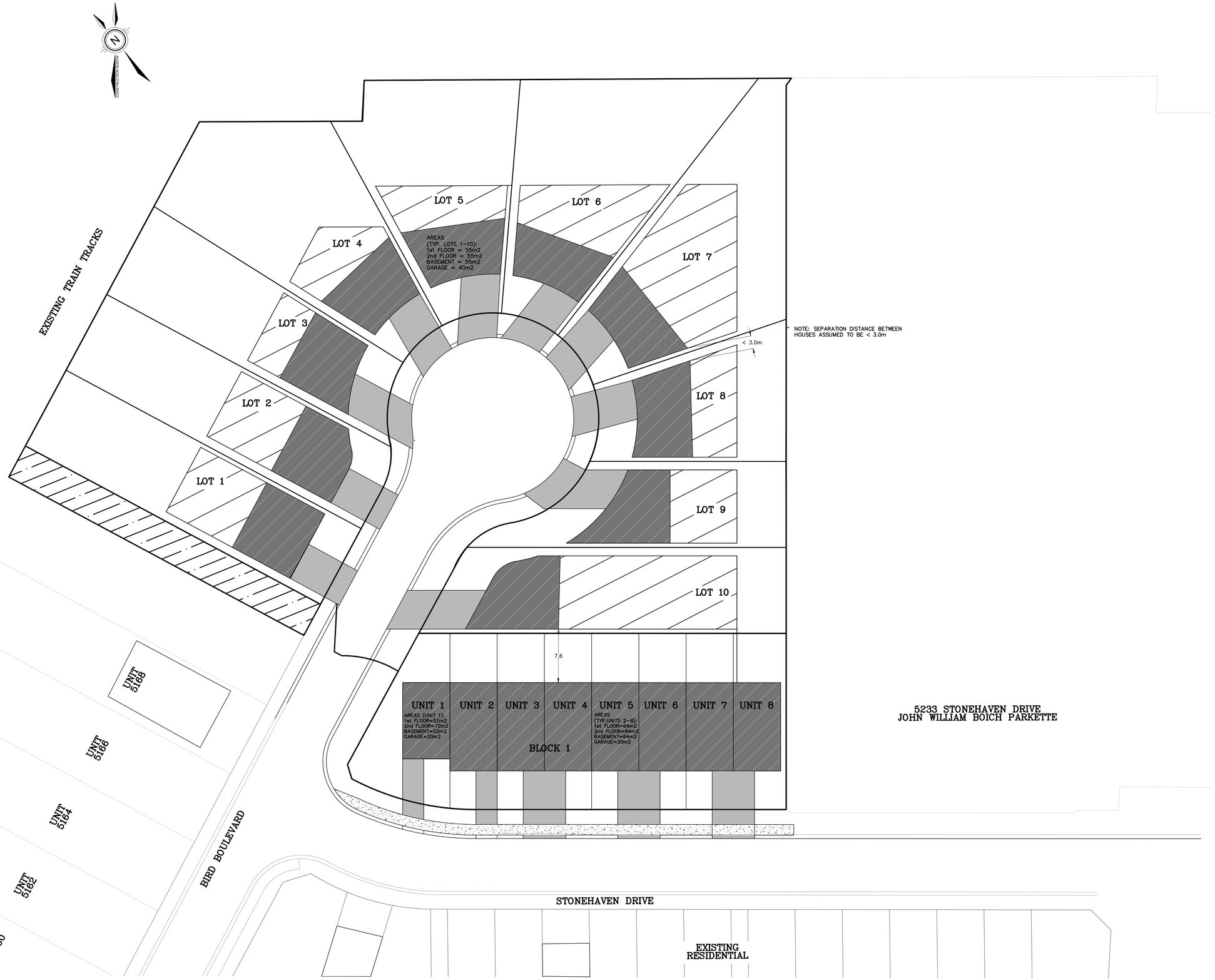
*9999 denotes nearest building > 45m away, refer to exposure Figure 2 and 3.

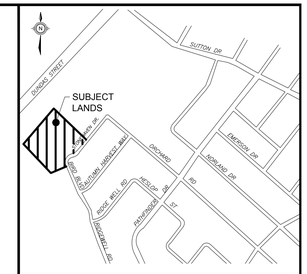
Areas and separations based on assumptions provided by the client and are to be confirmed with the architech.

Separation Table

Separation		
From	To	Charge
0	3	25%
3.1	10	20%
10.1	20	15%
20.1	30	10%
30.1	45	5%

DUNDAS STREET





KEY MAP - N.T.S.

LEGEND

NOT FOR CONSTRUCTION

SOURCE:
TOPOGRAPHIC SURVEY INFORMATION OBTAINED BY MACKAY
MACKAY & PETERS LIMITED, DRAWING NO. 17-092

BENCHMARK
-

SCALE
3 0 5 10
1:250 (m)

DESIGN BY: C.CAO	CHECKED BY: B.ENTER
DRAWN BY: R.WARD-BISHUN	DATE: 2017-06-28

#	DATE	BY	DESCRIPTION

DRAWING ISSUE RECORD

APPROVALS

IBI GROUP
200 East Wing-360 James Street North
Hamilton ON L8L 1H5 Canada
tel 905 546 1010 fax 905 546 1011
ibigroup.com

CITY OF BURLINGTON
REGION OF HALTON

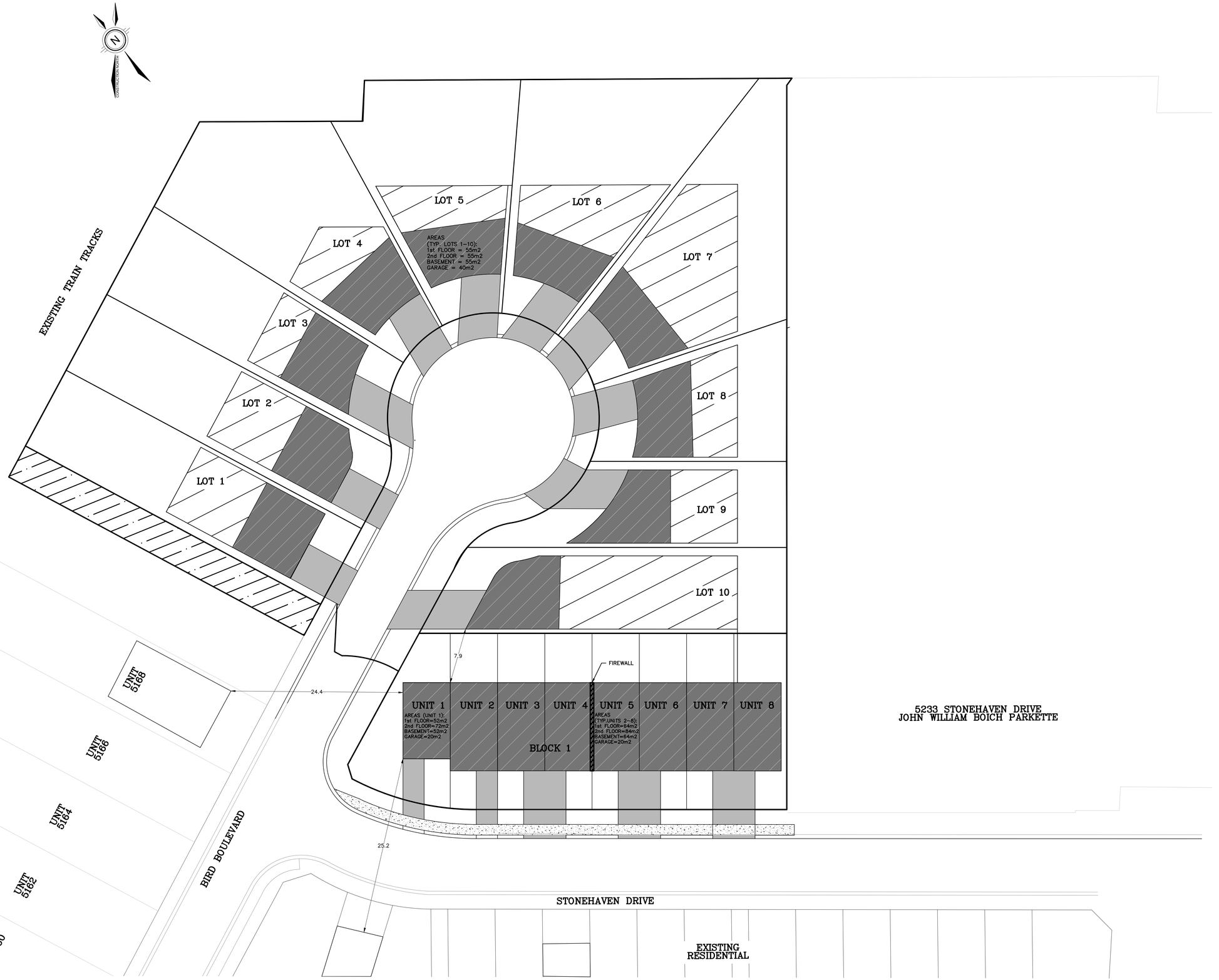
5209 STONEHAVEN DRIVE
MANTELLA CORPORATION

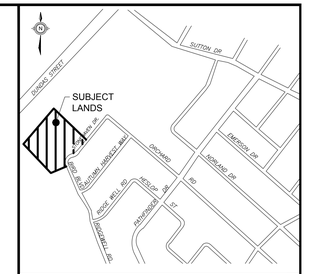
FIRE EXPOSURE DISTANCES
SFD CASE 1

FILE NUMBER: 105842 | SHEET NUMBER: FIG1

FILE:T:\105842_Mantella\Corp5.0 Drawings\Site\layouts\105842E_Fireflow Requirements.dwg LAYOUT:SFD CASE 1
LAST SAVED BY:Rayanne.ward-bishun, Thursday, June 29, 2017 10:36:35 AM PLOTTED BY:Rayanne Ward-Bishun Thursday, June 29, 2017 10:38:01 AM

DUNDAS STREET





KEY MAP - N.T.S.

LEGEND

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BENCHMARK
-

SCALE
3 0 5 10
1:250 (m)

DESIGN BY: C.CAO	CHECKED BY: B.ENTER
DRAWN BY: R.WARD-BISHUN	DATE: 2017-06-28

#	DATE	BY	DESCRIPTION
0			

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CITY OF BURLINGTON
REGION OF HALTON

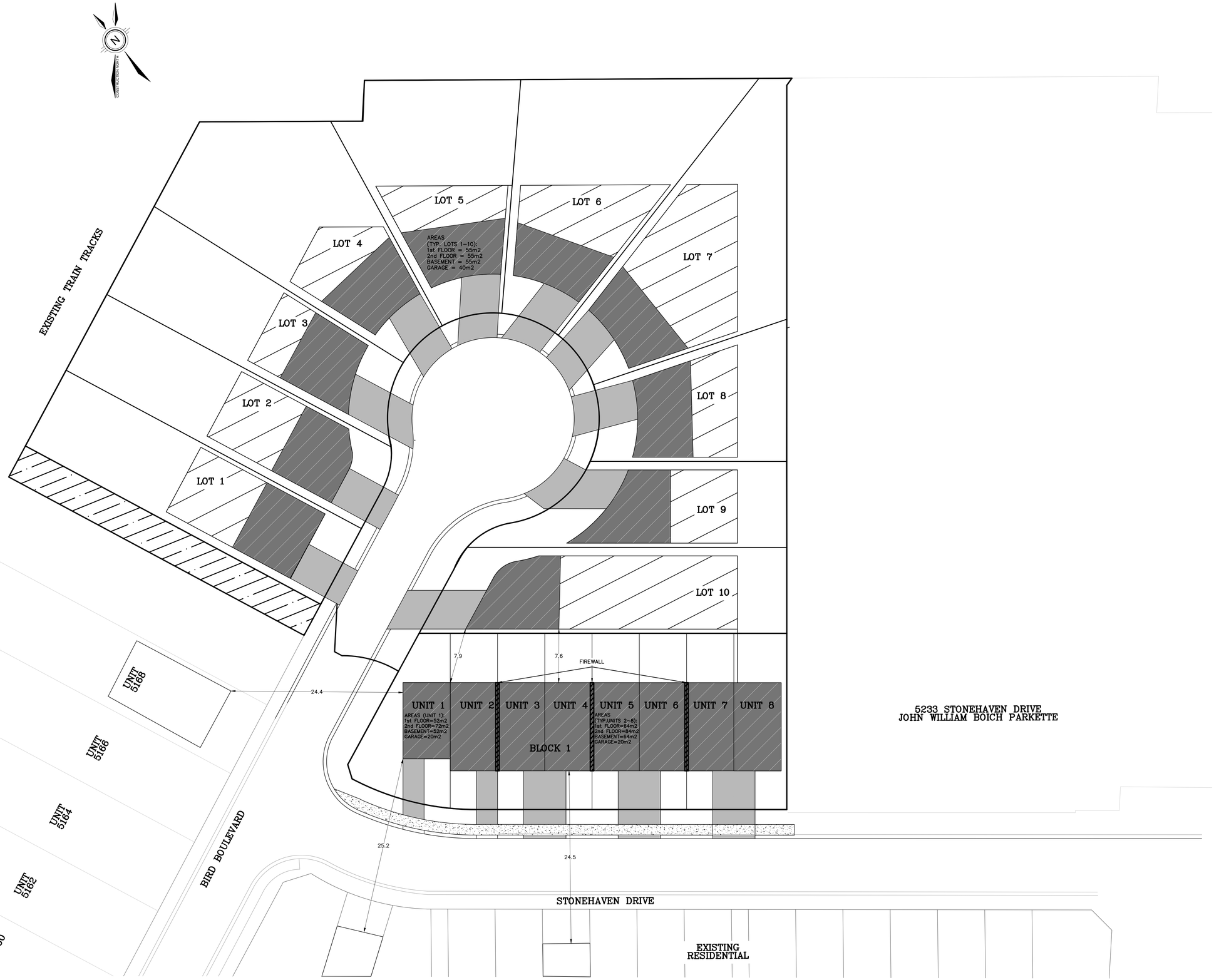
5209 STONEHAVEN DRIVE
MANTELLA CORPORATION

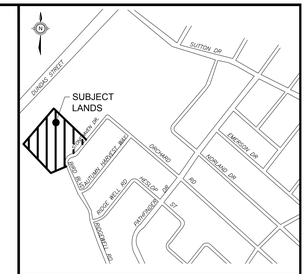
FIRE EXPOSURE DISTANCES
TH CASE 1

FILE NUMBER: 105842 | SHEET NUMBER: FIG2

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LAST SAVED BY:Rayanne.ward-bishun, Thursday, June 29, 2017 10:36:35 AM PLOTTED BY:Rayanne Ward-Bishun Thursday, June 29, 2017 10:38:38 AM

DUNDAS STREET





KEY MAP - N.T.S.

LEGEND

NOT FOR CONSTRUCTION

SOURCE:
TOPOGRAPHIC SURVEY INFORMATION OBTAINED BY MACKAY
MACKAY & PETERS LIMITED, DRAWING NO. 17-092

BENCHMARK
-

SCALE
3 0 5 10
1:250 (m)

DESIGN BY: C.CAO	CHECKED BY: B.ENTER
DRAWN BY: R.WARD-BISHUN	DATE: 2017-06-28

#	DATE	BY	DESCRIPTION
0			

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CITY OF BURLINGTON
REGION OF HALTON

5209 STONEHAVEN DRIVE
MANTELLA CORPORATION

FIRE EXPOSURE DISTANCES
TH CASE 2 & 3

FILE NUMBER: 105842 | SHEET NUMBER: FIG3

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LAST SAVED BY:Rayanne.ward-bishun, Thursday, June 29, 2017 10:36:35 AM PLOTTED BY:Rayanne Ward-Bishun Thursday, June 29, 2017 10:41:36 AM

JACKSON WATERWORKS

Telephone: (905) 547-6770
Toll Free: (800)-734-5732
E-mail: jww@bellnet.ca
Website: www.jacksonwaterworks.ca

Ms. Rayanne Ward-Bishun
IBI Group
360 James Street North, Suite 200, East Wing
Hamilton Ontario **L8L 1H5**

29 June 2017

Jackson Waterworks has recently completed fire hydrant flow testing on Stonehaven Drive and on Bird Boulevard in Burlington.

We define the Test Hydrant as the one being flowed, and the Base Hydrant as the one where static and residual pressures are recorded. Wherever possible, we inspect the secondary valve for the Test Hydrant to make sure it is in the fully open position. Likewise, we count the number of turns needed to open the Test Hydrant (to make sure it is opening completely). The secondary valve for the hydrant on Bird Boulevard could not be inspected.

There were no irregularities to report.

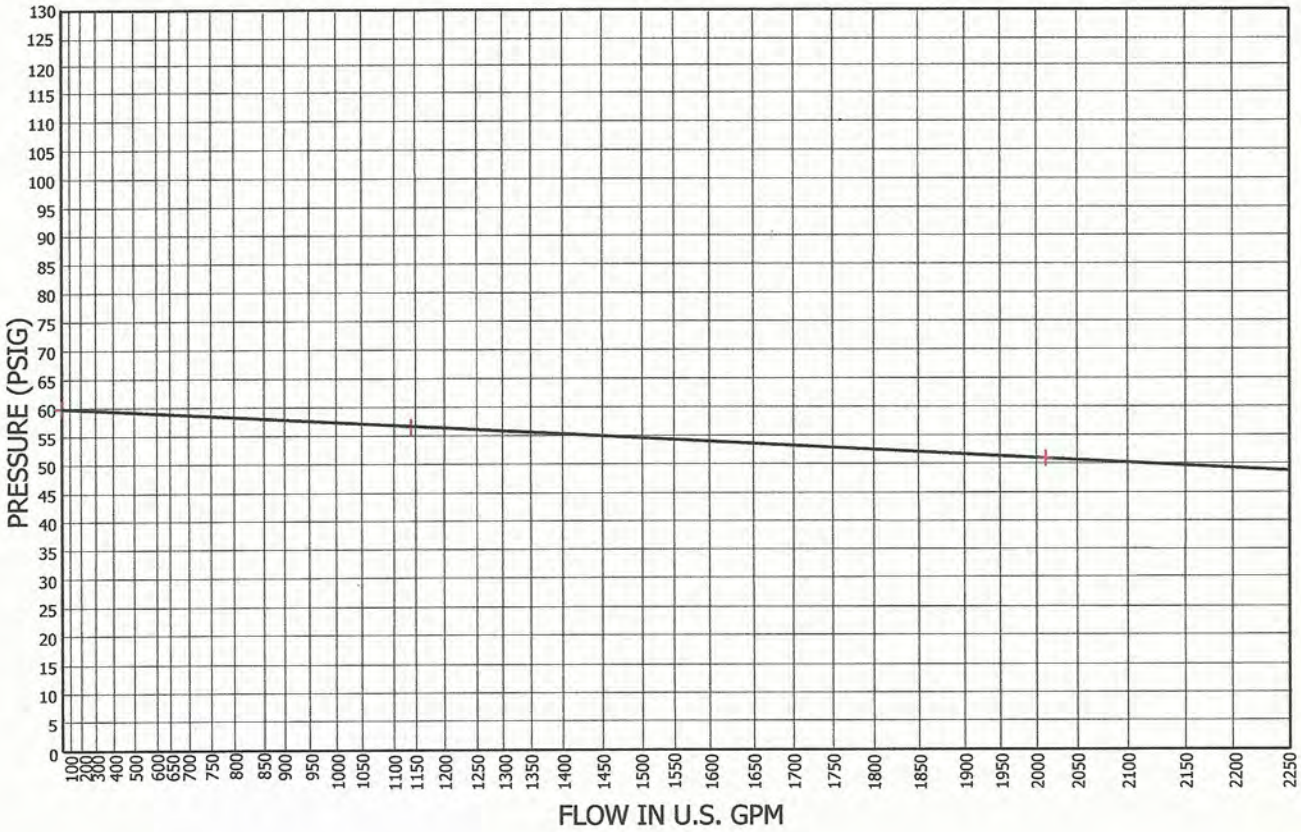
Trusting this meets with your approval, we are...

Yours truly,

Mark Schmidt
Jackson Waterworks

JACKSON WATERWORKS

Telephone: (905) 547-6770
Toll Free: (800)-734-5732
E-mail: jww@bellnet.ca
Website: www.jacksonwaterworks.ca



# of Ports	PORT DIA. (in/mm)	PITOT (psig)	FLOW (usgpm)	RESIDUAL (psig)
1	2.50/63	46	1138	57
2	2.50/63	36/36	2014	51
THEORETICAL FLOW @ 20psi			4609	

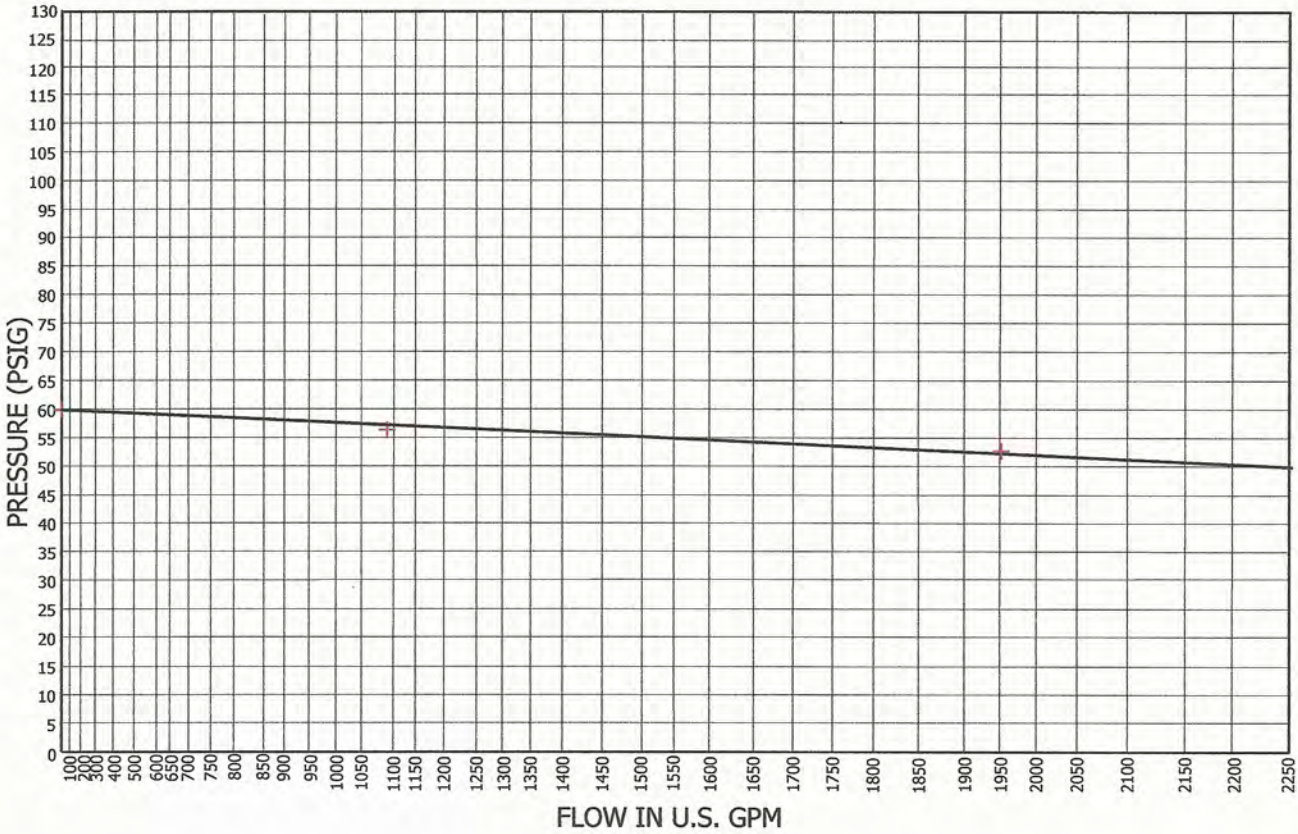
General Data	
Test Date	28 June 2017
Test Time	08:00am
Pipe Dia.	6"
Static	60

Site Information	
Site or Developer Name	Unknown
Site Address/Municipality	Stonehaven Drive, Burlington
Location of Test Hydrant	Opposite 5224 Stonehaven Drive
Location of Base Hydrant	Near 5168 Bird Boulevard
Technician's Comments	No conversion factor used for flow calculation based on round and flush internal nozzle configuration. Flow testing has been conducted in accrodance with NFPA 291 guidelines wherever possible. Refer to attached report for further information.
	Verified By: Mark Schmidt

221 Sherman Avenue North, Hamilton, Ontario L8L 6N2

JACKSON WATERWORKS

Telephone: (905) 547-6770
Toll Free: (800)-734-5732
E-mail: jww@bellnet.ca
Website: www.jacksonwaterworks.ca



# of Ports	PORT DIA. (in/mm)	PITOT (psig)	FLOW (usgpm)	RESIDUAL (psig)
1	2.50/63	42	1087	57
2	2.50/63	34/34	1956	53
THEORETICAL FLOW @ 20psi			4404	

General Data	
Test Date	28 June 2017
Test Time	08:15am
Pipe Dia.	6"
Static	60

Site Information	
Site or Developer Name	Unknown
Site Address/Municipality	Stonehaven Drive, Burlington
Location of Test Hydrant	Near 5168 Bird Boulevard
Location of Base Hydrant	Opposite 5224 Stonehaven Drive
Technician's Comments	No conversion factor used for flow calculation based on round and flush internal nozzle
	configuration. Flow testing has been conducted in accrodance with NFPA 291 guidelines
	wherever possible. Refer to attached report for further information.
	Verified By: Mark Schmidt

221 Sherman Avenue North, Hamilton, Ontario L8L 6N2

Appendix F: Storm Water Management Analysis

Project: Halton District School Board Lands
Location: Burlington, On
Date: June 26/17
Job No. 105842

IBI

Orifice Calculations

Assume Orifice is at MH8

Orifice Invert Elev (m)	100 yr Ponding Elev (m)	Head h (m)	Orifice Size (mm)	Orifice Area A (m^2)	Qr (m^3/s)	Q req'd (m^3/s)
153.03	154.97	1.84	197	0.030	0.110	0.110

assuming 1200mm dia pipe is full
at U/S end

note: $Q=KA\sqrt{2gh}$

K = the coeff. of contraction = 0.60
A = area (in sq. meters)
g = gravity (9.81m/sq. s)
h = head (in meters)

Therefore an orifice size of approximately 200mm diameter is required.

100 year storm flow from Area 200

A =	0.60	
C =	0.44	
Tc =	10.00	min
I =	141.89	mm/hr (100 yr)
Q =	104.14	L/s

RUNOFF COEFFICIENT 'C'	
PARKS AND PAYGROUNDS	- 0.20
RESIDENTIAL - SINGLE AND DUPLEX	- 0.50 and 0.55
- ROW HOUSING	- 0.65
- APARTMENTS	- 0.65 and 0.70
COMMERCIAL AND INDUSTRIAL	- 0.90 and 0.70
DENSLEY BUILT, PAVED	- 0.90

STORM SEWER DESIGN SHEET
CITY OF BURLINGTON

FLOW Q = 2.78CiA where Q = PEAK FLOW IN LITRES PER SECOND (l/s)
A = AREA IN HECTARES (ha)
C = RUNOFF COEFFICIENT
i = RAINFALL INTENSITY (mm/hr)
RETURN PERIOD 5 YEARS

DATE June 20/17
DESIGN SAH
CHECKED
PROJECT 105842

Table 1

Proposed Design with no SWM

PROJECT NAME: **Halton District School Board Lands**

LOCATION				AREA			TOTAL (A X C)					RAINFALL INTENSITY			Q	SEWER DESIGN					PROFILE						
AREA NO.	STREET	FROM	TO	DIMENSIONS	DELTA HEC.	TOTAL HEC.	RUNOFF C	INCR. AxC	SECTION AxC	SEWER AxC	DELTA 2.78AxC	TIME ENTRY mm SECTION	TIME ENTRY mm ACCUM.	INTENSITY mm/hr	l/sec	SIZE mm	n	SLOPE %	CAP. l/sec	VEL. m/sec	LENGTH m	TIME OF FLOW	DROP MH	FALL IN SEWER	INVERT ELEV. U.S.	INVERT ELEV. D.S.	Q/Qcap (%)
Storm Sewer in Park																										
203	Park	CB1	CBMH2		0.14	0.14	0.15	0.02	nil	0.02	0.06	nil	10.00	88.00	5.28	250	0.013	0.55	44.18	0.90	0.00	0.00		0.000	153.890	153.890	12.0%
201	Park	CB1	CBMH2		0.06	0.20	0.38	0.02	nil	0.04	0.11	0.00	10.00	88.00	9.68	250	0.013	0.55	44.18	0.90	46.55	0.86	0.000	0.256	153.890	153.634	21.9%
204	Park	CBMH2	Ex St		0.14	0.34	0.15	0.02	nil	0.06	0.17	0.86	10.86	84.00	14.28	250	0.013	0.55	44.18	0.90	0.00	0.00	0.000	0.000	153.634	153.634	32.3%
202	Park	CB2	Ex St		0.10	0.44	0.44	0.05	nil	0.11	0.31	0.00	10.86	84.00	26.04	250	0.013	0.55	44.18	0.90	34.11	0.63	0.000	0.188	153.634	153.446	58.9%
200	Bird Blvd (New)	MH4	MH2		0.59	0.59	0.44	0.26	nil	0.26	0.72	nil	10.00	88.00	63.36	1200	0.013	0.25	1945.27	1.72	46.11	0.45		0.115	0.000	-0.115	3.3%
	Bird Blvd	MH2	MH1		0.00	0.59	0.45	0.00	nil	0.26	0.72	0.45	10.45	86.00	61.92	1200	0.013	0.22	1832.18	1.62	18.09	0.19	0.000	0.040	-0.115	-0.155	3.4%
	Bird Blvd	MH1	MH5		0.00	0.59	0.45	0.00	nil	0.26	0.72	0.19	10.64	85.00	61.20	1200	0.013	0.20	1741.70	1.54	22.84	0.25	0.000	0.046	-0.155	-0.201	3.5%
	Bird Blvd	MH5	MH9		0.00	0.59	0.45	0.00	nil	0.26	0.72	0.25	10.89	84.00	60.48	375	0.013	0.50	123.70	1.12	5.42	0.08	0.000	0.027	-0.201	-0.228	48.9%
300	Stonehaven Dr	MH9	MH8		0.61	1.64	0.45	0.27	0.11	0.64	1.78	0.08	10.97	84.00	149.52	375	0.013	0.39	110.45	1.00	0.00	0.00	0.000	0.000	-0.228	-0.228	135.4%
205	Stonehaven Dr	MH9	MH8		0.11	1.74	0.54	0.06	nil	0.70	1.95	0.00	10.97	84.00	163.80	375	0.013	0.39	110.45	1.00	96.71	1.61	0.000	0.381	-0.228	-0.609	148.3%
	Stonehaven Dr	MH8	MH7		0.00	1.74	0.45	0.00	nil	0.70	1.95	1.61	12.58	78.00	152.10	375	0.013	0.76	152.42	1.38	14.50	0.18	0.000	0.110	-0.609	-0.719	99.8%
500	Stonehaven Dr	MH10	MH7		0.40	0.40	0.15	0.06	nil	0.06	0.17	nil	10.00	88.00	14.96	525	0.013	0.31	240.29	1.11	25.90	0.39		0.080	0.000	-0.080	6.2%
400	Orchard Rd	MH7	Ex. MH		0.20	2.34	0.45	0.09	0.06	0.85	2.36	0.18	12.76	77.00	181.72	600	0.013	0.52	443.91	1.57	23.20	0.25	0.000	0.121	-0.719	-0.840	

Calculate Average C value for development (Areas 200, 201, 202, 205)
Total A = 0.86 ha
C avg = 0.45

Calculate Average C value for all Areas U/S of MH8
Total A = 1.74 ha
C avg = 0.40

RUNOFF COEFFICIENT 'C'	
PARKS AND PAYGROUNDS	- 0.20
RESIDENTIAL - SINGLE AND DUPLEX	- 0.50 and 0.55
- ROW HOUSING	- 0.65
- APARTMENTS	- 0.65 and 0.70
COMMERCIAL AND INDUSTRIAL	- 0.90 and 0.70
DENSLEY BUILT, PAVED	- 0.90

STORM SEWER DESIGN SHEET
CITY OF BURLINGTON

FLOW Q = 2.78CiA where Q = PEAK FLOW IN LITRES PER SECOND (l/s)
A = AREA IN HECTARES (ha)
C = RUNOFF COEFFICIENT
i = RAINFALL INTENSITY (mm/hr)
RETURN PERIOD 5 YEARS

DATE June 20/17
DESIGN SAH
CHECKED
PROJECT 105842

Proposed Design with SWM

Table 2

PROJECT NAME: **Halton District School Board Lands**

LOCATION				AREA			TOTAL (A X C)					RAINFALL INTENSITY			Q	SEWER DESIGN						PROFILE						
AREA NO.	STREET	FROM	TO	DIMENSIONS	DELTA HEC.	TOTAL HEC.	RUNOFF C	INCR. AxC	SECTION AxC	SEWER AxC	DELTA 2.78AxC	TIME ENTRY mm SECTION	TIME ENTRY mm ACCUM.	INTENSITY mm/hr	l/sec	SIZE mm	n	SLOPE %	CAP. l/sec	VEL. m/sec	LENGTH m	TIME OF FLOW	DROP MH	FALL IN SEWER	INVERT ELEV. U.S.	INVERT ELEV. D.S.	Q/Qcap (%)
Storm Sewer in Park																											
203	Park	CB1	CBMH2		0.14	0.14	0.15	0.02	nil	0.02	0.06	nil	10.00	88.00	5.28	250	0.013	0.55	44.18	0.90	0.00	0.00		0.000	153.890	153.890	12.0%
201	Park	CB1	CBMH2		0.06	0.20	0.19	0.01	nil	0.03	0.08	0.00	10.00	88.00	7.04	250	0.013	0.55	44.18	0.90	46.55	0.86	0.000	0.256	153.890	153.634	15.9%
204	Park	CBMH2	Ex St		0.14	0.34	0.15	0.02	nil	0.05	0.14	0.86	10.86	84.00	11.76	250	0.013	0.55	44.18	0.90	0.00	0.00	0.000	0.000	153.634	153.634	26.6%
202	Park	CB2	Ex St		0.10	0.44	0.19	0.02	nil	0.07	0.19	0.00	10.86	84.00	15.96	250	0.013	0.55	44.18	0.90	34.11	0.63	0.000	0.188	153.634	153.446	36.1%
200	Bird Blvd (New)	MH4	MH2		0.59	0.59	0.19	0.11	nil	0.11	0.31	nil	10.00	88.00	27.28	1200	0.013	0.25	1945.27	1.72	46.11	0.45		0.115	0.000	-0.115	1.4%
	Bird Blvd	MH2	MH1		0.00	0.59	0.45	0.00	nil	0.11	0.31	0.45	10.45	86.00	26.66	1200	0.013	0.22	1832.18	1.62	18.09	0.19	0.000	0.040	-0.115	-0.155	1.5%
	Bird Blvd	MH1	MH5		0.00	0.59	0.45	0.00	nil	0.11	0.31	0.19	10.64	85.00	26.35	1200	0.013	0.20	1741.70	1.54	22.84	0.25	0.000	0.046	-0.155	-0.201	1.5%
	Bird Blvd	MH5	MH9		0.00	0.59	0.45	0.00	nil	0.11	0.31	0.25	10.89	84.00	26.04	375	0.013	0.50	123.70	1.12	5.42	0.08	0.000	0.027	-0.201	-0.228	21.1%
300	Stonehaven Dr	MH9	MH8		0.61	1.64	0.45	0.27	0.07	0.45	1.25	0.08	10.97	84.00	105.00	375	0.013	0.39	110.45	1.00	0.00	0.00	0.000	0.000	-0.228	-0.228	95.1%
205	Stonehaven Dr	MH9	MH8		0.11	1.74	0.19	0.02	nil	0.47	1.31	0.00	10.97	84.00	110.04	375	0.013	0.39	110.45	1.00	96.71	1.61	0.000	0.381	-0.228	-0.609	99.6%
	Stonehaven Dr	MH8	MH7		0.00	1.74	0.45	0.00	nil	0.47	1.31	1.61	12.58	78.00	102.18	375	0.013	0.76	152.42	1.38	14.50	0.18	0.000	0.110	-0.609	-0.719	67.0%
500	Stonehaven Dr	MH10	MH7		0.40	0.40	0.15	0.06	nil	0.06	0.17	nil	10.00	88.00	14.96	525	0.013	0.31	240.29	1.11	25.90	0.39		0.080	0.000	-0.080	6.2%
400	Orchard Rd	MH7	Ex. MH		0.20	2.34	0.45	0.09	0.06	0.62	1.72	0.18	12.76	77.00	132.44	600	0.013	0.52	443.91	1.57	23.20	0.25	0.000	0.121	-0.719	-0.840	

2.34

0.19 = C value required in development until MH9 to MH8 is not above capacity

a) Calculate Average C value for all Areas U/S of MH8 based upon capacity of MH9 to MH8 Restricted flow required at ST MH8

Total A = 1.74 ha
C avg = 0.27

b) Calculate Average C value originally allowed into MH 9 to MH8
Amount previously allowed into MH9 from Dwg MDR-299

A = 1.62 ha
Cavg = 0.33
A*C = 0.54 (0.86ha * C=0.45 + 0.76ha * C=0.20)
Current designed area into MH9 = 1.74 ha
Allowable C = 0.31

Therefore the total area of 1.74 ha is to be restricted to C=0.27 (governing value)
which equates to the new development being restricted to C=0.19 which corresponds to a pre-development level.

IBI GROUP

Stormwater Management
Rational Method
City of Burlington (IDF Curves from Dwg S-IDF)

Project: Halton District School Board Lands **Table 3**
Location: Burlington, On
Date: June 26/17
Job No. 105842

Design Criteria

Calculate Total Storage needed

Area =	1.74	hectares
Predevelopment C =	0.27	
IDF Curve =	5	year
Predevelopment Tc =	10.97	minutes
a =	697.40	
b =	5.00	
c =	0.76	
I =	83.9763	mm/hr
Outflow Restriction =	0.110	cms
Post Development C =	0.40	

Calculation of Critical Storage Volume

Rainfall Duration (min)	Rainfall Intensity (mm/hr)	Peak Runoff (m^3/s)	Storm Runoff (m^3)	Release Flow (m^3)	Required Storage (m^3)	
5	120.08	0.23	70	33	37	*
10	88.09	0.17	102	66	36	
15	70.71	0.14	123	99	24	
20	59.63	0.12	138	132	7	
30	46.11	0.09	160	197	-37	
40	38.06	0.07	177	263	-87	
50	32.65	0.06	189	329	-140	
60	28.74	0.06	200	395	-195	
70	25.76	0.05	209	461	-251	
80	23.41	0.05	217	526	-309	
90	21.50	0.04	224	592	-368	
100	19.92	0.04	231	658	-427	
110	18.58	0.04	237	724	-487	
120.00	17.44	0.03	243	790	-547	

** IDF Curve Parameters (a,b,c) from City of Burlington IDF Curves, Dwg No. S-IDF*

Required On Site Storage = 37 m^3
for the 5 Yr Storm

IBI GROUP

Stormwater Management
Rational Method
City of Burlington (IDF Curves from Dwg S-IDF)

Project: Halton District School Board Lands **Table 4**
Location: Burlington, On
Date: June 26/17
Job No. 105842

Design Criteria

Calculate Total Storage needed for 100 yr event

Area =	1.74	hectares	
Predevelopment C =	0.27		
IDF Curve =	100	year	
Predevelopment Tc =	10.97	minutes	
a =	1114.20		
b =	5.00		
c =	0.76		
I =	135.28	mm/hr	
Outflow Restriction =	0.110	cms	restricted to 5 year level
Post Development C =	0.40		

Calculation of Critical Storage Volume

Rainfall Duration (min)	Rainfall Intensity (mm/hr)	Peak Runoff (m^3/s)	Storm Runoff (m^3)	Release Flow (m^3)	Required Storage (m^3)	
5	193.18	0.37	112	33	79	
10	141.89	0.27	165	66	99	
15	113.99	0.22	198	99	100	*
20	96.19	0.19	223	132	92	
30	74.46	0.14	259	197	62	
40	61.50	0.12	285	263	22	
50	52.79	0.10	306	329	-23	
60	46.49	0.09	324	395	-71	
70	41.69	0.08	339	461	-122	
80	37.90	0.07	352	526	-175	
90	34.83	0.07	364	592	-229	
100	32.27	0.06	374	658	-284	
110	30.11	0.06	384	724	-340	
120.00	28.26	0.05	393	790	-396	

** IDF Curve Parameters (a,b,c) from City of Burlington IDF Curves, Dwg No. S-IDF*

Required On Site Storage = 100 m^3
for the 100 Yr Storm

Calculate Pipe size req'd for storage

Max L =	87	**m**
Min Pipe size req'd =	1208	mm
Recommended Size =	1200	mm
Min Pipe Length Req'd =	88.10	m

Therefore a minimum of 88m of 1200 dia pipe is req'd to accommodate the req'd storage.

IBI GROUP

Stormwater Management
Rational Method
City of Burlington (IDF Curves from Dwg S-IDF)

Project: Halton District School Board Lands
Location: Burlington, On
Date: June 26/17
Job No. 105842

Table 5

Design Criteria

Calculate Total Storage needed per m2 in D/W's

Area =	0.00520	hectares avg D/W size
Predevelopment C =	0.20	
IDF Curve =	100	year
Predevelopment Tc =	10.00	minutes
a =	1114.20	
b =	5.00	
c =	0.76	
I =	141.8919	mm/hr
Outflow Restriction =	0.0004	cms
Post Development C =	0.90	

Calculation of Critical Storage Volume

Rainfall Duration (min)	Rainfall Intensity (mm/hr)	Peak Runoff (m^3/s)	Storm Runoff (m^3)	Release Flow (m^3)	Required Storage (m^3)	
5	193.18	0.00	1	0	0.630	
10	141.89	0.00	1	0	0.861	
15	113.99	0.00	1	0	0.965	
20	96.19	0.00	2	0	1.008	*
30	74.46	0.00	2	1	1.004	
40	61.50	0.00	2	1	0.934	
50	52.79	0.00	2	1	0.828	
60	46.49	0.00	2	1	0.699	
70	41.69	0.00	2	2	0.553	
80	37.90	0.00	2	2	0.396	
90	34.83	0.00	2	2	0.230	
100	32.27	0.00	3	2	0.056	
110	30.11	0.00	3	3	-0.124	
120.00	28.26	0.00	3	3	-0.308	

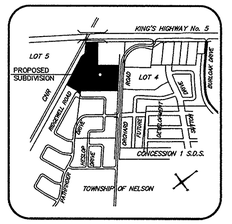
Required On Site Storage = 1 m^3 per driveway
for the 100 Yr Storm

This equates to approximately an avg of 50mm clear stone depth beneath the pervious paving stones

** IDF Curve Parameters (a,b,c) from City of Burlington IDF Curves, Dwg No. S-IDF*

DUNDAS STREET

KING'S HIGHWAY No.5



KEY MAP
N.T.S.

LEGEND

0.53 / 0.40 — AREA IN HECTARES; RUN-OFF CO-EFFICIENT

STORM AREA DRAINAGE BOUNDARY

OVERLAND FLOW ROUTE

NOTE:
ALL LOTS AND UNITS TO HAVE SUMP PUMPS. WEEPING TILES TO DRAIN INTO A SUMP WHICH IS THEN PUMPED BY SUMP PUMPS AND DISCHARGES OVER GROUND VIA SPLASH PADS.

NOTES:

1. FOR GENERAL NOTES SEE DWG. No. 7

NO.	DATE	BY	REVISIONS
2	21/10/02	B.E.K.	REVISED AS PER CITY/REGION COMMENTS
1	22/08/02	B.E.K.	REVISED AS PER CITY/REGION COMMENTS

DESIGN	SL	CHK'D	SL	DATE: JULY 2002
DRAWN	B.E.K.	CHK'D	SL	

SCALE HORIZ. 15 10 5 0 15 1:500

APPROVALS

CITY of BURLINGTON

DIRECTOR OF ENGINEERING

DATE

STAMP

REGION of HALTON

DESIGN OF SANITARY & WATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS & SPECIFICATIONS & LOCATION APPROVAL FROM AREA MUNICIPALITY.

SIGNED DATE

PLANNING AND PUBLIC WORKS DEPARTMENT – HALTON REGION

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CONSULTING ENGINEERS
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Fax (905) 631-8927
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CITY OF BURLINGTON
REGIONAL MUNICIPALITY OF HALTON

LOSANI HOMES (1998) LTD.

HARVEST LANDING IN THE ORCHARD

STORM DRAINAGE AREA PLAN

MDR-299 | D1