D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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SITE SERVICING STUDY & STORMWATER MANAGEMENT REPORT

WOODVALE PENTECOSTAL CHURCH
205 GREENBANK ROAD
OTTAWA, ONTARIO

REPORT NO. 20121

AUGUST 31, 2023
REVISED DECEMBER 4, 2023
REVISED MARCH 5, 2024

CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

This report describes the servicing and stormwater management requirements for a proposed 2-storey addition to the existing Woodvale Pentecostal Church located at 205 Greenbank Road in Ottawa, Ontario.

This report forms part of the servicing and stormwater management design for the proposed development. Also refer to drawings C-1 to C-7, prepared by D.B. Gray Engineering Inc.

2.0 WATER SERVICE

2.1 WATER SUPPLY FOR FIREFIGHTING

The proposed addition will have a sprinkler system tied into the existing sprinkler system of the existing building. The existing fire department connection is located at the south entrance of the original building. There is an existing municipal Class AA fire hydrant located in the Bateman Drive right of way to the east of the original building. It is 51 m unobstructed distance to the existing fire department connection.

As per City of Ottawa Technical Bulletin ISTB-2021-03, when calculating the required fire flow where pipe sizing is not affected, the Ontario Building Code Method is to be used. Using the Ontario Building Code Method the required fire flow was calculated to be 9,000 L/min (150 L/s). As per City of Ottawa Technical Bulletin ISTB-2021-03, when the Ontario Building Code Method yields a required fire flow of 9,000 L/min (150 L/s), the Fire Underwriters Survey Method is to be used instead. Using the Fire Underwriters Survey Method the required fire flow was calculated to be 10,000 L/min (166.7 L/s). Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Bateman Drive watermain provided by the City of Ottawa for the 183.3 L/s fire flow at the subject property indicate a hydraulic grade line (HGL) of 111.0 m. Refer to Appendix A. This HGL calculates to 180 kPa (26 psi). Since the pressure is above the required minimum pressure of 140 kPa (20 psi), there is an adequate water supply for firefighting from the existing municipal water distribution system.

As per City of Ottawa Technical Bulletin ISTB-2018-02, the aggregate flow of all contributing fire hydrants within 150 m of the building shall not be less than the required fire flow. As per the City of Ottawa Technical Bulletin ISTB-2018-02 Appendix I:

Class	Distance (m)	Contribution (L/min)
AA	≤ 75	5,700

The existing municipal Class AA fire hydrant serving the fire department connection discussed above can contribute 5,700 L/min (95 L/s). There is another existing municipal Class AA fire hydrant within 75 m of the building also located in the Bateman Drive right of way to the north of the original building. It can also contribute 5,700 L/min (95 L/s). The aggregate flow of the two contributing fire hydrants is 11,400 L/min (190 L/s), which is greater than the required fire flow of 11,000 L/min (183.3 L/s).

2.2 DOMESTIC WATER SUPPLY

A 150 mm water service running east and connecting to the 200 mm Bateman Drive watermain currently services the existing sprinkler system and provides the domestic water supply. The domestic water supply for the proposed addition will be tied into the existing domestic water supply of the existing building.

As per the City of Ottawa Water Design Guidelines for consumption rates and peaking factors, and based on 1,068 sanctuary seats and a 350 person capacity Assembly Hall, the average daily demand was calculated to be 1.5 L/s, the maximum daily demand was calculated to be 2.2 L/s and the maximum hourly demand was calculated to be 4.0 L/s. Refer to calculations in Appendix A.

The boundary conditions in the 200 mm Bateman Drive watermain provided by the City of Ottawa at the subject property indicate a minimum HGL of 125.6 m and a maximum HGL of 133.3 m. Refer to Appendix A. Based on these boundary conditions the pressure at the water meter is calculated to vary between 309 kPa (45 psi) and 384 kPa (56 psi). This is an acceptable range for the proposed development.

3.0 SANITARY SERVICE

As per

i. the City of Ottawa Sewer Design Guidelines for the peaking factor, and
ii. City of Ottawa Technical Bulletin ISTB-2018-01 for the consumption rate, Harmon Formula correction factor, and infiltration allowance,

the sanitary flow rate of the proposed addition was calculated to be 0.56 L/s. A 150 mm building sanitary service at 2% slope (22.47 L/s capacity) is proposed to service the proposed addition. At the design flow rate the 150 mm building sanitary service will only be at 3% of its capacity. The proposed 150 mm building sanitary service will connect to the existing 150 mm building sanitary service, which at a conservatively estimated 1% slope has a capacity of 15.89 L/s. At a 1.11 L/s flow rate the existing 150 mm building sanitary service will only be at 9% of its capacity. The existing 150 mm building sanitary service connects to the existing 375 mm municipal sanitary sewer, which at 0.12% slope has a capacity of 63.36 L/s. The total pre-development and post-development sanitary flow rates were calculated to be 2.05 L/s. Refer to calculations in Appendix B.

4.0 STORMWATER MANAGEMENT

4.1 QUALITY CONTROL

An Erosion & Sediment Control Plan has been developed to be implemented during construction. Refer to drawing C-2 and notes 2.1 to 2.5 on drawing C-5. Sediment capture filter sock inserts are to be installed in all existing and proposed catch-basins within and adjacent to the site, and any material deposited on the public road is to be removed.

4.2 QUANTITY CONTROL

The stormwater quantity control criterion is to control the post-development 100-year peak flow rate to the pre-development 5-year peak flow rate. According to the Stormwater Management Report dated June 2005 prepared by Simmering & Associates Ltd., the existing stormwater management system was designed to control the post-development 100-year peak flow rate to the pre-development 5-year peak flow rate. The existing stormwater management system consists of flow control roof drains on the west half of the existing building, and two inlet control devices in the existing parking lot. The proposed addition and grading alterations will impact the two existing inlet control devices, which are currently controlling the 100-year peak flow rates to a combined 36.20 L/s. (Refer Appendix A of the Simmering & Associates' report excerpts of which are in the last three pages of Appendix C of this report: Sub-Catchment Area 8 and 11 having release rates of 28.1 L/s and 8.1 L/s (totaling 36.2 L/s), respectively.) As such, the south half of the property must be modified to maintain a maximum release rate of 36.20 L/s. The Rational and Modified Rational Methods were used to calculate the post-development flow rates and corresponding storage volumes. Refer to calculations in Appendix C.

Drainage Area I (Upper Roof – 314 sq.m)
The two roof drains are to be a flow control type roof drain which will restrict the flow of stormwater and cause it to pond on the roof. The roof drains are to be a Watts RD-100 c/w a Watts Adjustable Accutrol Weir (or approved equal) in the fully closed position, releasing 0.315 L/s (5 USgpm) at all ponding depths. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of 3 scuppers each a minimum 300 mm wide are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers or 200 mm depth at the roof drains. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	0.63 L/s	0.63 L/s
Maximum Depth at Roof Drain	149 mm	118 mm
Maximum Volume Stored	14.09 cu.m	7.05 cu.m

Drainage Area II (Lower Roof – 998 sq.m)
The 6 roof drains are to be flow control type roof drains which will restrict the flow of stormwater and cause it to pond on the roof. The roof drains are to be a Watts RD-100 c/w a Watts Adjustable Accutrol Weir (or approved equal) in the fully closed position, releasing 0.315 L/s (5 USgpm) at all ponding depths. The opening at the top of the flow control weir is to be a minimum 50 mm in diameter. A minimum of 10 scuppers each a minimum 300 mm wide are to be installed 150 mm above the roof drains. Refer to architectural for exact locations and details. The roof is to be designed to carry the load of water having a 50 mm depth at the scuppers or 200 mm depth at the roof drains. Refer to structural.

	100-Year Event	5-Year Event
Maximum Release Rate	1.89 L/s	1.89 L/s
Maximum Depth at Roof Drain	147 mm	117 mm
Maximum Volume Stored	45.53 cu.m	22.85 cu.m

Drainage Area III (2,860 sq.m)

An inlet control device (ICD) located in the outlet pipe of catch-basin / manhole CB/MH-2 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond above CB/MH-2. The ICD will be a plug style with a round orifice located at the bottom of the plug manufactured by Pedro Plastics or approved equal sized by the manufacturer for a release rate of 27.68 L/s at 2.21 m. It was calculated that an orifice area of 6,887 sq.mm (±94 mm dia) with a discharge coefficient of 0.61 will achieve the release rate of 27.68 L/s at 2.21 m. Based on this orifice the maximum release rate for the 5-year event is calculated to be 23.05 L/s at 1.54 m. Since some of the restricted stormwater is proposed to be stored using underground infrastructure, a release rate equal to 50% of the maximum release rate was used to calculate the required storage volumes. The underground infrastructure will consist of 18 –Soleno HydroStor HS75 chambers or approved equal surrounded by clear stone wrapped in geotextile fabric.

	100-Year Event	5-Year Event
Maximum Release Rate	27.68 L/s	23.05 L/s
Maximum Ponding Elevation	92.36 m	91.68 m
Maximum Volume Stored	89.12 cu.m	44.56 cu.m

Drainage Area IV (695 sq.m)

An inlet control device (ICD) located in the outlet pipe of catch-basin / manhole CB/MH-1 will restrict the flow of stormwater and cause it to backup into the upstream infrastructure and pond above CB/MH-1. The ICD will be a vortex style manufactured by Hydrovex or approved equal sized by the manufacturer for the City of Ottawa's minimum recommended release rate of 6.00 L/s at 2.23 m. It was calculated that an orifice area of 4,418 sq.mm (75 mm dia) with a discharge coefficient of 0.205 will achieve the release rate of 6.00 L/s at 2.23 m. Based on this orifice the maximum release rate for the 5-year event is calculated to be 4.19 L/s at 1.09 m. Since some of the restricted stormwater is proposed to be stored using underground infrastructure, a release rate equal to 50% of the maximum release rate was used to calculate the required storage volumes. The underground infrastructure will consist of 6 – Soleno HydroStor HS75 chambers or approved equal surrounded by clear stone wrapped in geotextile fabric.

	100-Year Event	5-Year Event
Maximum Release Rate	6.00 L/s	4.19 L/s
Maximum Ponding Elevation	92.80 m	91.66 m
Maximum Volume Stored	20.33 cu.m	11.14 cu.m

Summary
The maximum post-development release rate during the 100-year event was calculated to be 36.20 L/s, which is equal to the maximum allowable release rate (refer to Table 1 in Appendix C). To achieve the maximum allowable release rate, a maximum storage volume of 168.07 cu.m is required and provided. The maximum post-development release rate during the 5-year event was calculated to be 29.77 L/s, which is 18% less than the maximum allowable release rate (refer to Table 2 in Appendix C).

	100-Year Event	5-Year Event
Maximum Allowable Release Rate	36.20 L/s	36.20 L/s
Maximum Release Rate	36.20 L/s	29.77 L/s
Maximum Volume Required	168.07 cu.m	85.60 cu.m
Maximum Volume Stored	168.07 cu.m	85.60 cu.m

5.0 STORM SERVICE

The storm drains for the proposed addition will connect to the existing storm drains inside the existing building. As per the Simmering 2005 Stormwater Management Report the restricted flow rate of the west half of the existing building during the 5-year event is estimated to be 12.42 L/s. The proposed addition during the 5-year event is 2.52 L/s. The existing 250 mm building storm service at 2.4% slope (92.13 L/s capacity) will remain. At the restricted 5-year flow rate the existing building storm service will only be at 16% of its capacity. Refer to calculations in Appendix D.

Part of the existing private storm sewer system is proposed to be modified to accommodate the proposed addition. The existing 375 mm storm sewer at (241.68 L/s capacity at 1.9% slope) connecting to the existing 900 mm Bateman Drive storm sewer (1334 L/s capacity at 0.5 % slope) will remain. At the restricted 5-year flow rate the existing 375 mm storm sewer will only be at 17% of its capacity. Refer to calculations in Appendix D.

In addition to the storm servicing required for drainage and volume purposes catch-basin CB-4 is proposed to be installed at a top elevation of 92.36 to limit the ponding above catch-basin / manhole CB/MH-2 to a maximum depth of 300 mm in the event of a blockage or storm event greater than the 100-year event. Catch-basin CB-4 is proposed to connect to the existing free flowing manhole MH-B.

6.0 CONCLUSIONS

1. There is an adequate water supply for firefighting from the existing municipal water distribution system.

2. There is an acceptable range of water pressures in the existing municipal water distribution system.

3. The post-development sanitary flow rate will be adequately handled by the proposed building sanitary service and existing private sanitary sewer system.

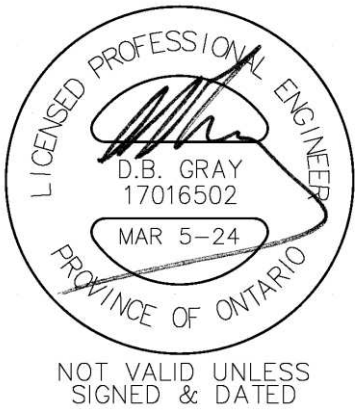
4. The total pre-development sanitary flow rate is equal to the total post-development sanitary flow rate.

5. An Erosion & Sediment Control Plan has been developed to be implemented during construction.

6. The maximum post-development release rate during the 100-year event will be equal to the maximum allowable release rate.

7. The restricted flow rates during the 5-year event will be adequately handled by the building storm service and private storm sewer system.

Prepared by D.B. Gray Engineering Inc.



APPENDIX A

WATER SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

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January 14, 2022

Woodvale Pentecostal Church
206 Greenbank Road
Ottawa, Ontario

FIRE FLOW CALCULATIONS
OBC Method

Q = Required water supply in litres
= KVS_{Total}

S_{Total} = Total of spatial coefficients from exposure distances
= $1.0 + S_{Side\ 1} + S_{Side\ 2} + S_{Side\ 3} + S_{Side\ 4}$

	Spatial Coefficient	Exposure Distance (m)	
$S_{Side\ 1}$	0	22	(north to centerline of Bateman Dr)
$S_{Side\ 2}$	0	20	(east to centerline of Bateman Dr)
$S_{Side\ 3}$	0	14	(to south property line)
$S_{Side\ 4}$	0	23	(west to centerline of Greenbank Rd)
S_{Total}	1.0		

Group A, Division 2 (Churches, Community Halls & Gymnasium) Occupancy

K_1 = Water supply coefficient, as per OBC A-3.2.5.7. Table 1
= 16 Building is of noncombustible construction with fire separations without fire resistance ratings.

V_1 = Building volume in cubic meters

	Floor Area (sq.m)	Height (m)	Volume (cu.m)
Existing Second Floor:	1,569	3.1	4,785
Existing Second Floor:	1,481	3.1	4,517
Existing Ground Floor:	363	8.0	2,904
Existing Ground Floor:	2,515	10.5	26,408
Existing Ground Floor:	1,569	3.1	4,785
Addition Second Floor:	1,351	3.3	4,458
Addittion Ground Floor Gym	242	10.5	2,541
Addittion Ground Floor	1,109	4.1	4,547
			54,946

Q = 879,130 L

= 9,000 L/min as per OBC A-3.2.5.7. Table 2
= 150.0 L/s

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14-Jan-22
REVISED 02-Feb-22

Woodvale Pentecostal Church
205 Greenbank Road
Ottawa, Ontario

FIRE FLOW CALCULATIONS
FUS Method

Fire flow requirement as calculated as per Fire Undewriter Survey "Water Supply For Fire Protection".

F = 220 C $A^{0.5}$ = the required fire flow in litres per minute

C = coefficient related to the type of construction
= 0.8 Non-combustible Construction (unprotected structural components)

A = total floor area (all storeys excluding basements at least 50% below grade)

Existing Second Floor:	1,569	sq.m.	Not Sprinklered
Existing Second Floor:	1,481	sq.m.	Sprinklered
Existing Ground Floor:	363	sq.m.	Sprinklered
Existing Ground Floor:	2,515	sq.m.	Sprinklered
Existing Ground Floor:	1,569	sq.m.	Sprinklered
Addition Second Floor:	1,351	sq.m.	Sprinklered
Addittion Ground Floor Gym	242	sq.m.	Sprinklered
Addittion Ground Floor	1,109	sq.m.	Sprinklered
TOTAL FIRE AREA:	10,199	sq.m.	85% Sprinklered

F = 17,774 L/min
= 18,000 L/min (rounded off to the nearest 1,000 L/min)

-15% Charge for Limited-combustible Occupancy

= 15,300 L/min

34% Reduction for a Sprinkler System 85% of 40%

= 5,179 L/min

Increase for Separation Exposed Buildings

		Adjacent Building			Length-Height
		Constuction	Length m	Storeys	Factor
0%	North	>45m			0
0%	East	>45m			0
5%	South	30.1 to 45m			0
0%	West	>45m			0
5%	Total Increase for Exposure (maximum 75%)				

= 765 L/min Increase

= 10,886 L/min
F = 11,000 L/min (rounded off to the nearest 1,000 L/min)
= 183.3 l/s

Exisiting Conditions:

Ground Elevation: 92.6 m ASL

			Static Pressure			
183.3 L/s FIRE FLOW:	111.0	m ASL	26	psi	180	kPa

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22-Jan-14
REVISED 02-Feb-22

Woodvale Pentecostal Church
205 Greenbank Road
Ottawa, Ontario

Churches with kitchen facilities:	30	L / sanctuary seat (as per Ottawa Design Guidelines)
	1068	santuary seats
"Assemly Hall" (children's programs):	30	L / person (as per Ottawa Design Guidelines)
	350	persons

	42540	L/day				
	8	hour day				
	88.6	L/min	1.5	L/s	23.4	USgpm
MAXIMUM DAILY DEMAND:	1.5	(Peaking Factor as per Ottawa Design Guidelines)				
	132.9	L/min	2.2	L/s	35.1	USgpm
MAXIMUM HOURLY DEMAND:	1.8	(Peaking Factor as per Ottawa Design Guidelines)				
	239.3	L/min	4.0	L/s	63.2	USgpm

Existing Conditions

			Static Pressure at Water Meter			
Elevation of Water Meter:	94.1	m ASL				
Finish Floor Elevation:	93.2	m ASL				
MINIMUM HGL:	125.6	m ASL	45	psi	309	kPa
MAXIMUM HGL:	133.3	m ASL	56	psi	384	kPa

D.B. Gray Engineering Inc.

Ryan Faith <r.faith@dbgrayengineering.com>

RE: Woodvale Pentecostal Church - 205 Greenbank Road - Boundary Condition Request

1 message

Dieme, Abi <Abibatou.Dieme@ottawa.ca> Tue, Feb 1, 2022 at 10:10 AM
To: Douglas Gray <d.gray@dbgrayengineering.com>
Cc: Ryan Faith <r.faith@dbgrayengineering.com>

Hi Doug,

The following are boundary conditions, HGL, for hydraulic analysis at 205 Greenbank Road (zone 2W2C) assumed to be a dual connection to the 203 mm on Bateman Drive (see attached PDF for location).

Minimum HGL: 125.6 m

Maximum HGL: 133.3 m

Max Day + Fire Flow (183.33 L/s): 111.0 m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Regards,

Abi

From: Douglas Gray <d.gray@dbgrayengineering.com>
Sent: February 01, 2022 7:43 AM
To: Dieme, Abi <Abibatou.Dieme@ottawa.ca>
Cc: Ryan Faith <r.faith@dbgrayengineering.com>
Subject: Fwd: Woodvale Pentecostal Church - 205 Greenbank Road - Boundary Condition Request

Hi Abi

What is the status of this boundary condition request? See below and attached.

Doug

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle Tel: 613-425-8044

Ottawa, Ontario K1T 4E9 d.gray@dbgrayengineering.com

---------- Forwarded message ---------
From: **Douglas Gray** <d.gray@dbgrayengineering.com>
Date: Mon, Jan 17, 2022 at 8:40 AM
Subject: Woodvale Pentecostal Church - 205 Greenbank Road - Boundary Condition Request
To: Abibatou Diémé <Abibatou.Dieme@ottawa.ca>
Cc: Ryan Faith <r.faith@dbgrayengineering.com>

Hi Abi

Please provide the boundary conditions for the 200mm watermain on Bateman Dr at 205 Greenbank Dr (see attached geoOttawa map showing the location of the existing 150mm service connection).

We have calculated the following expected demands:

Average daily demand: 1.5 L/s.

Maximum daily demand: 2.2 L/s.

Maximum hourly daily demand: 4.0 L/s

Fire Flow demand: 166.7 L/s

Fire Flow + Max Day: 168.9 L/s

Our calculations are attached.

Thanks, Doug

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle Tel: 613-425-8044

Ottawa, Ontario K1T 4E9 d.gray@dbgrayengineering.com

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205 Greenbank Road January 2022.pdf
771K


Boundary Conditions for 205 Greenbank Road
N
ch. Greenbank Rd.
prom. Bateman Dr.
203
203
prom. Bateman Dr.
205
152
ch. Greenbank Rd.
406
194
102
Legend
PRIVATE
PUBLIC
City of Ottawa

APPENDIX B

SANITARY SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
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SANITARY SEWER DESIGN FORM

Average Daily Flows

Residential:	280	L / capita / day
Commercial:	28000	L / ha / day
Instituational:	28000	L / ha / day
Light Industrial:	35000	L / ha / day
Heavy Industrial:	55000	L / ha / day

Infiltration Allowance: 0.33 l / s / ha

Peaking Factor:

Residential (Harmon Equation): $1 + \frac{14}{4 + P^{0.5}}$

P = Population / 1000

Harmon Correction Factor: 0.8

Commercial & Institutional: 1.5 If contrinbution > 20%

Commercial & Institutional: 1 If contrinbution < 20%

Industrial: As per Ottawa Guidelines Appendix 4-B

Project: Woodvale Pentecostal Church

Designed By: D.B.G

February 2, 2022

n = 0.013

Location		Section								Cumulative Residential		Section Non-Residential			Cumulative					Sewer Data							
		Single Family ppu = 3.4	Semi / Townhouse ppu = 2.7	Duplex / Triplex ppu = 2.3	Apartment (average) ppu = 1.8	Apartment (1 Bed) ppu = 1.4	Apartment (2 Bed) ppu = 2.1	Apartment (3 Bed) ppu = 3.1	Area (ha)																	
From	To	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units	No. of Units		Pop.	Peaking Factor	Area (ha)	Flow (L/ha/day)	Peaking Factor	Flow (L/s)	Area (ha)	Sewage Flow (L/s)	Infiltration Flow (L/s)	Total Flow (L/s)	Material	Actual Diameter (mm)	Nominal Diameter (mm)	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Ratio Q/Qfull
		Existing: Original Church + 1st Addition																									
Original Church	Existing 375 SAN											0.3820	28000	4.5	0.56	0.3820	0.56	0.13	0.68	PVC	152.4	150	1.00	37	15.89	0.87	0.04
1st Addition	Existing 375 SAN											0.7640	28000	4.5	1.11	0.7640	1.11	0.25	1.37	PVC	152.4	150	1.00	39	15.89	0.87	0.09
																		Total	2.05								
		Proposed: Original Church + 1st Addition + Proposed Addition																									
Original Church	Existing 375 SAN											0.3820	28000	4.5	0.56	0.3820	0.56	0.13	0.68	PVC	152.4	150	1.00	37	15.89	0.87	0.04
Proposed Addition	Existing 150 SAN											0.3820	28000	4.5	0.56	0.3820	0.56	0.13	0.68	PVC	152.4	150	2.00	6	22.47	1.23	0.03
Existing 150 SAN	Existing 375 SAN											0.3820	28000	4.5	1.11	0.7640	1.11	0.25	1.37	PVC	152.4	150	1.00	39	15.89	0.87	0.09
																		Total	2.05								
																					Existing 375 SAN in Easement						
																					381.0	375	0.12		63.36	0.56	

APPENDIX C

STORMWATER MANAGEMENT

ONE-HUNDRED-YEAR EVENT
Table 1

Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Upper Roof)	-	0.63	14.09	14.09
AREA II (Lower Roof)	-	1.89	45.53	45.53
AREA III	-	27.68	88.12	88.12
AREA IV	-	6.00	20.33	20.33
TOTAL	36.20	36.20	168.07	168.07

FIVE-YEAR EVENT
Table 2

Drainage Area	Maximum Allowable Release Rate (L/s)	Maximum Release Rate (L/s)	Maximum Volume Required (cu.m)	Maximum Volume Stored (cu.m)
AREA I (Upper Roof)	-	0.63	7.05	7.05
AREA II (Lower Roof)	-	1.89	22.85	22.85
AREA III	-	23.05	44.56	44.56
AREA IV	-	4.19	11.14	11.14
TOTAL	36.20	29.77	85.60	85.60

July 29, 2023

Woodvale Pentecostal Church

Ottawa, Ontario

STORMWATER MANAGEMENT CALCULATIONS
Modified Rational Method

PRE-DEVELOPMENT CONDITIONS

MAXIMUM ALLOWABLE RELEASE RATE

Maximum Allowable Release Rate (2.78AiC): 36.20 L/s

Refer to the Sub-Catchment Areas 8 & 11 in Appendix A of the June 2005 Simmering & Associates Ltd. Stormwater Management Report; excerpts of which are included in the last three pages of this Appendix.

ONE HUNDRED YEAR EVENT

DRAINAGE AREA I (Upper Roof)

(ONE HUNDRED YEAR EVENT)

			C
Total Catchment Area:	314	sq.m	0.90

No. of Roof Drains:	2	
Adjustable Wier Opening:	Closed	0.315 L/s (5 USgpm)

Depth at Roof Drain: 149 mm

Maximum Release Rate: 0.63 L/s

Pond Area: 283 sq.m

Maximum Volume Stored: 14.09 cu.m

Maximum Volume Required: 14.09 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	243	19.07	0.63	18.44	5.53
10	179	14.03	0.63	13.40	8.04
15	143	11.23	0.63	10.60	9.54
20	120	9.42	0.63	8.79	10.55
25	104	8.16	0.63	7.53	11.29
30	92	7.22	0.63	6.59	11.86
35	83	6.49	0.63	5.86	12.30
40	75	5.90	0.63	5.27	12.65
45	69	5.42	0.63	4.79	12.94
50	64	5.02	0.63	4.39	13.18
55	60	4.68	0.63	4.05	13.38
60	56	4.39	0.63	3.76	13.54
65	53	4.14	0.63	3.51	13.67
70	50	3.91	0.63	3.28	13.78
75	47	3.71	0.63	3.08	13.87
80	45	3.53	0.63	2.90	13.94
85	43	3.37	0.63	2.74	13.99
90	41	3.23	0.63	2.60	14.03
95	39	3.10	0.63	2.47	14.06
100	38	2.98	0.63	2.35	14.08
105	36	2.87	0.63	2.24	14.09
110	35	2.77	0.63	2.13	14.09
115	34	2.67	0.63	2.04	14.08
120	33	2.58	0.63	1.95	14.06

DRAINAGE AREA II (Lower Roof)

(ONE HUNDRED YEAR EVENT)

			C
Total Catchment Area:	998	sq.m	0.90

No. of Roof Drains:	6	
Adjustable Wier Opening:	Closed	0.315 L/s (5 USgpm)
Depth at Roof Drain:	147	mm
Maximum Release Rate:	1.89	L/s

Pond Area: 927 sq.m

Maximum Volume Stored: 45.53 cu.m

Maximum Volume Required: 45.53 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	243	60.60	1.89	58.71	17.61
10	179	44.59	1.89	42.69	25.62
15	143	35.68	1.89	33.79	30.41
20	120	29.95	1.89	28.06	33.67
25	104	25.93	1.89	24.04	36.06
30	92	22.94	1.89	21.05	37.88
35	83	20.62	1.89	18.73	39.33
40	75	18.76	1.89	16.87	40.49
45	69	17.24	1.89	15.35	41.44
50	64	15.97	1.89	14.08	42.23
55	60	14.89	1.89	13.00	42.88
60	56	13.96	1.89	12.06	43.43
65	53	13.15	1.89	11.25	43.89
70	50	12.43	1.89	10.54	44.27
75	47	11.80	1.89	9.91	44.58
80	45	11.23	1.89	9.34	44.84
85	43	10.73	1.89	8.83	45.05
90	41	10.27	1.89	8.37	45.21
95	39	9.85	1.89	7.95	45.34
100	38	9.46	1.89	7.57	45.43
105	36	9.11	1.89	7.22	45.49
110	35	8.79	1.89	6.90	45.52
115	34	8.49	1.89	6.60	45.53
120	33	8.21	1.89	6.32	45.51

DRAINAGE AREA III

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	2,640	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	220	sq.m	0.20
Total Catchment Area:	2,860	sq.m	0.85

Water Elevation:	92.36	m
Invert of Outlet Pipe - CB/MH-2:	90.10	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-2)	90.15	m
Head:	2.21	m
Orifice Diameter:	94	mm
Orifice Area:	6,887	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	27.68	L/s

Surface Storage	43.56	cu.m
Chamber Storage	23.90	cu.m
Clear Stone Storage	20.66	cu.m

Maximum Volume Stored:	88.12	cu.m
Maximum Volume Required:	88.12	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	243	163.28	13.84	149.44	44.83
10	179	120.13	13.84	106.29	63.77
15	143	96.13	13.84	82.29	74.06
20	120	80.70	13.84	66.86	80.23
25	104	69.86	13.84	56.03	84.04
30	92	61.81	13.84	47.97	86.34
35	83	55.56	13.84	41.72	87.60
40	75	50.55	13.84	36.72	88.12
45	69	46.45	13.84	32.62	88.06
50	64	43.03	13.84	29.19	87.56
55	60	40.11	13.84	26.27	86.70
60	56	37.60	13.84	23.76	85.55
65	53	35.42	13.84	21.58	84.16
70	50	33.50	13.84	19.66	82.56
75	47	31.79	13.84	17.95	80.79
80	45	30.27	13.84	16.43	78.86
85	43	28.90	13.84	15.06	76.80
90	41	27.66	13.84	13.82	74.62
95	39	26.53	13.84	12.69	72.34
100	38	25.50	13.84	11.66	69.96
105	36	24.55	13.84	10.71	67.50
110	35	23.68	13.84	9.84	64.97
115	34	22.88	13.84	9.04	62.36
120	33	22.13	13.84	8.29	59.70

Surface Storage

CB/MH	Top Area	Depth	Volume
CB/MH-2	437	0.30	43.56

Chamber Storage

# Chambers	Volume Per Chamber	# End Caps	Volume Per End Cap	Rows	Chamber & End Cap Length	Chamber & End Cap Volume
18	1.310	4	0.080	2	19.819	23.90

Clear Stone Storage

Clear Stone Length	Clear Stone Width	Clear Stone Storage Depth	Clear Stone Volume	40% Voids
20.419	3.490	1.060	51.638	20.66

DRAINAGE AREA IV

(ONE HUNDRED YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	585	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	110	sq.m	0.20
Total Catchment Area:	695	sq.m	0.79

Water Elevation:	92.80	m
Invert of Outlet Pipe - CB/MH-1:	90.53	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-1)	90.57	m
Head:	2.23	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.205	
Maximum Release Rate:	6.00	L/s

Surface Storage	4.31	cu.m
Chamber Storage	8.02	cu.m
Clear Stone Storage	8.00	cu.m

Maximum Volume Stored:	20.33	cu.m
Maximum Volume Required:	20.33	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	243	37.01	3.00	34.01	10.20
10	179	27.23	3.00	24.23	14.54
15	143	21.79	3.00	18.79	16.91
20	120	18.29	3.00	15.29	18.35
25	104	15.83	3.00	12.84	19.25
30	92	14.01	3.00	11.01	19.82
35	83	12.59	3.00	9.59	20.15
40	75	11.46	3.00	8.46	20.30
45	69	10.53	3.00	7.53	20.33
50	64	9.75	3.00	6.75	20.26
55	60	9.09	3.00	6.09	20.11
60	56	8.52	3.00	5.52	19.89
65	53	8.03	3.00	5.03	19.61
70	50	7.59	3.00	4.59	19.29
75	47	7.21	3.00	4.21	18.93
80	45	6.86	3.00	3.86	18.53
85	43	6.55	3.00	3.55	18.11
90	41	6.27	3.00	3.27	17.66
95	39	6.01	3.00	3.01	17.18
100	38	5.78	3.00	2.78	16.68
105	36	5.57	3.00	2.57	16.17
110	35	5.37	3.00	2.37	15.63
115	34	5.19	3.00	2.19	15.09
120	33	5.02	3.00	2.02	14.52

Surface Storage

CB/MH	Top Area	Depth	Volume
CB/MH-1	111	0.12	4.31

Chamber Storage

# Chambers	Volume Per Chamber	# End Caps	Volume Per End Cap	Rows	Chamber & End Cap Length	Chamber & End Cap Volume
6	1.310	2	0.080	1	13.348	8.02

Clear Stone Storage

Clear Stone Length	Clear Stone Width	Clear Stone Storage Depth	Clear Stone Volume	40% Voids
13.948	1.895	1.060	19.997	8.00

FIVE YEAR EVENT

DRAINAGE AREA I (Upper Roof)

(FIVE YEAR EVENT)

			C
Total Catchment Area:	314	sq.m	0.90

No. of Roof Drains:	2	
Adjustable Wier Opening:	Closed	0.315 L/s (5 USgpm)
Depth at Roof Drain:	118	mm
Maximum Release Rate:	0.63	L/s

Pond Area: 179 sq.m

Maximum Volume Stored: 7.05 cu.m

Maximum Volume Required: 7.05 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	141	11.09	0.63	10.46	3.14
10	104	8.19	0.63	7.55	4.53
15	84	6.56	0.63	5.93	5.34
20	70	5.52	0.63	4.89	5.87
25	61	4.78	0.63	4.15	6.23
30	54	4.24	0.63	3.61	6.49
35	49	3.81	0.63	3.18	6.68
40	44	3.47	0.63	2.84	6.82
45	41	3.19	0.63	2.56	6.91
50	38	2.96	0.63	2.33	6.98
55	35	2.76	0.63	2.13	7.02
60	33	2.59	0.63	1.96	7.05
65	31	2.44	0.63	1.81	7.05
70	29	2.31	0.63	1.68	7.04
75	28	2.19	0.63	1.56	7.02
80	27	2.09	0.63	1.46	6.99
85	25	1.99	0.63	1.36	6.95
90	24	1.91	0.63	1.28	6.90
95	23	1.83	0.63	1.20	6.84
100	22	1.76	0.63	1.13	6.78
105	22	1.70	0.63	1.06	6.71
110	21	1.64	0.63	1.00	6.63
115	20	1.58	0.63	0.95	6.55
120	19	1.53	0.63	0.90	6.47

DRAINAGE AREA II (Lower Roof)

(FIVE YEAR EVENT)

			C
Total Catchment Area:	998	sq.m	0.90

No. of Roof Drains:	6	
Adjustable Wier Opening:	Closed	0.31545 L/s (5 USgpm)
Depth at Roof Drain:	117	mm
Maximum Release Rate:	1.89	L/s

Pond Area: 585 sq.m

Maximum Volume Stored: 22.85 cu.m

Maximum Volume Required: 22.85 cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	141	35.25	1.89	33.36	10.01
10	104	26.02	1.89	24.12	14.47
15	84	20.86	1.89	18.97	17.07
20	70	17.54	1.89	15.65	18.78
25	61	15.21	1.89	13.31	19.97
30	54	13.47	1.89	11.57	20.83
35	49	12.11	1.89	10.22	21.47
40	44	11.03	1.89	9.14	21.94
45	41	10.14	1.89	8.25	22.28
50	38	9.40	1.89	7.51	22.53
55	35	8.77	1.89	6.88	22.70
60	33	8.23	1.89	6.33	22.80
65	31	7.75	1.89	5.86	22.85
70	29	7.33	1.89	5.44	22.85
75	28	6.96	1.89	5.07	22.82
80	27	6.63	1.89	4.74	22.75
85	25	6.33	1.89	4.44	22.65
90	24	6.06	1.89	4.17	22.53
95	23	5.82	1.89	3.93	22.38
100	22	5.60	1.89	3.70	22.21
105	22	5.39	1.89	3.50	22.03
110	21	5.20	1.89	3.31	21.82
115	20	5.02	1.89	3.13	21.60
120	19	4.86	1.89	2.97	21.37

DRAINAGE AREA III

(FIVE YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	2,640	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	220	sq.m	0.20
Total Catchment Area:	2,860	sq.m	0.85

Water Elevation:	91.68	m
Invert of Outlet Pipe - CB/MH-2:	90.10	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-2)	90.15	m
Head:	1.54	m
Orifice Diameter:	94	mm
Orifice Area:	6,887	sq.mm
Discharge Coefficient:	0.61	
Maximum Release Rate:	23.05	L/s

Surface Storage	0.00	cu.m
Chamber Storage	23.90	cu.m
Clear Stone Storage	20.66	cu.m

Maximum Volume Stored:	44.56	cu.m
Maximum Volume Required:	44.56	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	141	94.98	11.53	83.45	25.04
10	104	70.10	11.53	58.57	35.14
15	84	56.21	11.53	44.69	40.22
20	70	47.26	11.53	35.73	42.88
25	61	40.97	11.53	29.44	44.16
30	54	36.28	11.53	24.75	44.56
35	49	32.64	11.53	21.11	44.34
40	44	29.73	11.53	18.20	43.68
45	41	27.33	11.53	15.81	42.68
50	38	25.33	11.53	13.80	41.41
55	35	23.63	11.53	12.10	39.94
60	33	22.16	11.53	10.64	38.29
65	31	20.88	11.53	9.36	36.49
70	29	19.76	11.53	8.23	34.58
75	28	18.76	11.53	7.23	32.56
80	27	17.87	11.53	6.34	30.44
85	25	17.07	11.53	5.54	28.25
90	24	16.34	11.53	4.81	25.99
95	23	15.68	11.53	4.15	23.66
100	22	15.07	11.53	3.55	21.28
105	22	14.52	11.53	2.99	18.85
110	21	14.01	11.53	2.48	16.37
115	20	13.54	11.53	2.01	13.86
120	19	13.10	11.53	1.57	11.30

Surface Storage

CB/MH	Top Area	Depth	Volume
CB/MH-2	0	-0.38	0.00

Chamber Storage

# Chambers	Volume Per Chamber	# End Caps	Volume Per End Cap	Rows	Chamber & End Cap Length	Chamber & End Cap Volume
18	1.310	4	0.080	2	19.819	23.90

Clear Stone Storage

Clear Stone Length	Clear Stone Width	Clear Stone Storage Depth	Clear Stone Volume	40% Voids
20.419	3.490	1.060	51.638	20.66

DRAINAGE AREA IV

(FIVE YEAR EVENT)

			C
Roof Area:	0	sq.m	0.90
Asphalt/Concrete Area:	585	sq.m	0.90
Gravel Area:	0	sq.m	0.70
Landscaped Area:	110	sq.m	0.20
Total Catchment Area:	695	sq.m	0.79

Water Elevation:	91.66	m
Invert of Outlet Pipe - CB/MH-1:	90.53	m
Centroid of ICD Orifice: (ICD in Outlet Pipe of CB/MH-1)	90.57	m
Head:	1.09	m
Orifice Diameter:	75	mm
Orifice Area:	4,418	sq.mm
Discharge Coefficient:	0.205	
Maximum Release Rate:	4.19	L/s

Surface Storage	0.00	cu.m
Chamber Storage	8.41	cu.m
Clear Stone Storage	2.73	cu.m

Maximum Volume Stored:	11.14	cu.m
Maximum Volume Required:	11.14	cu.m

Time (min)	i (mm/hr)	2.78AiC (L/s)	Release Rate (L/s)	Stored Rate (L/s)	Required Storage Volume (cu.m)
5	141	21.53	2.10	19.43	5.83
10	104	15.89	2.10	13.79	8.27
15	84	12.74	2.10	10.65	9.58
20	70	10.71	2.10	8.62	10.34
25	61	9.29	2.10	7.19	10.78
30	54	8.22	2.10	6.13	11.03
35	49	7.40	2.10	5.30	11.13
40	44	6.74	2.10	4.64	11.14
45	41	6.20	2.10	4.10	11.07
50	38	5.74	2.10	3.65	10.94
55	35	5.36	2.10	3.26	10.76
60	33	5.02	2.10	2.93	10.54
65	31	4.73	2.10	2.64	10.29
70	29	4.48	2.10	2.38	10.01
75	28	4.25	2.10	2.16	9.70
80	27	4.05	2.10	1.95	9.38
85	25	3.87	2.10	1.77	9.04
90	24	3.70	2.10	1.61	8.68
95	23	3.55	2.10	1.46	8.31
100	22	3.42	2.10	1.32	7.92
105	22	3.29	2.10	1.19	7.53
110	21	3.18	2.10	1.08	7.12
115	20	3.07	2.10	0.97	6.71
120	19	2.97	2.10	0.87	6.28

Surface Storage

CB/MH	Top Area	Depth	Volume
CB/MH-1	0	-1.02	0.00

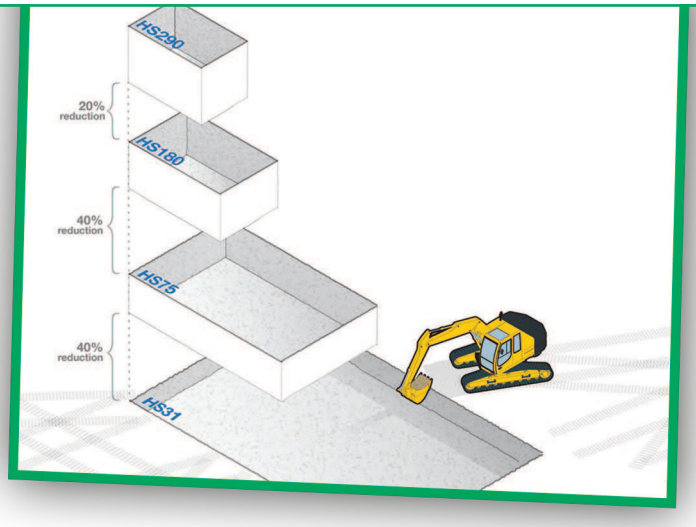
Chamber Storage

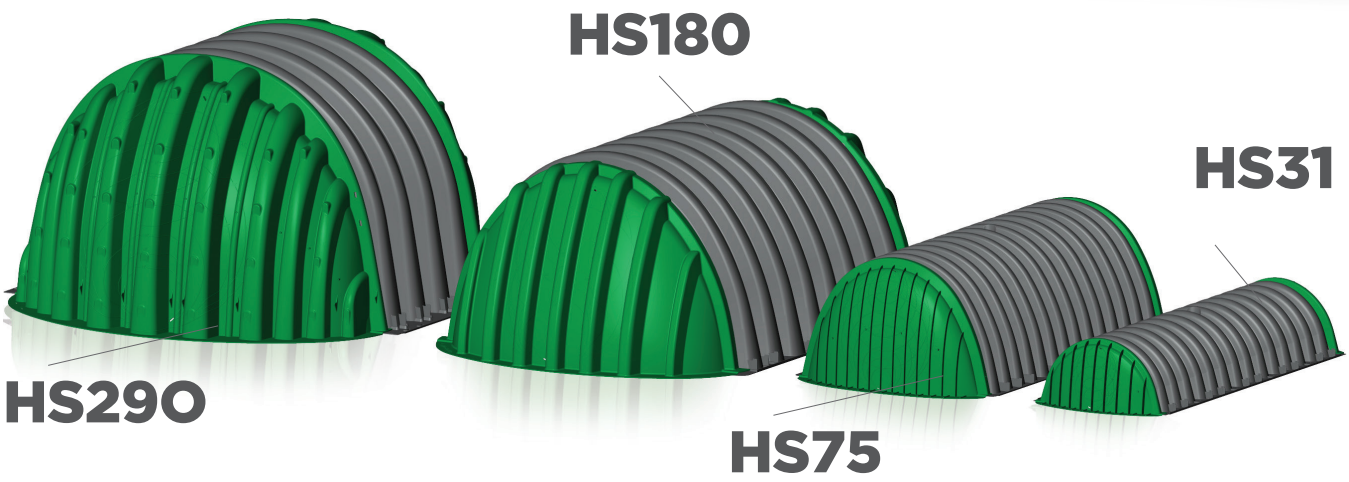
AutoCAD Chamber Area	Chamber & End Cap Length	Chamber & End Cap Volume
0.63 at 91.655	13.348	8.41

Clear Stone Storage

Clear Stone Length	Clear Stone Width	Clear Stone Storage Depth	Clear Stone Volume	40% Voids
13.948	1.895	0.58	6.823	2.73

Technical data



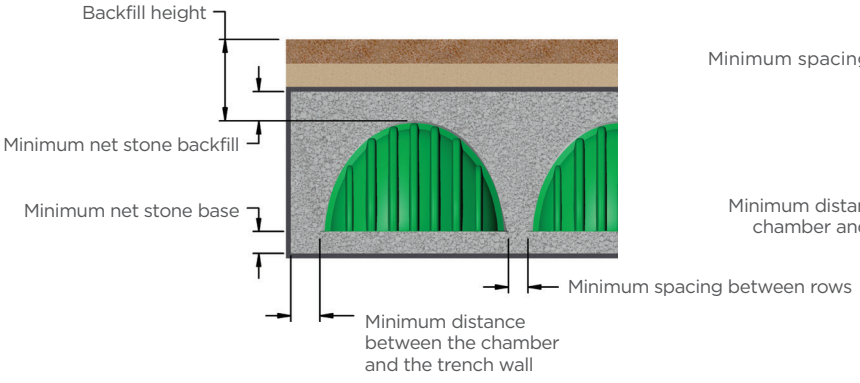


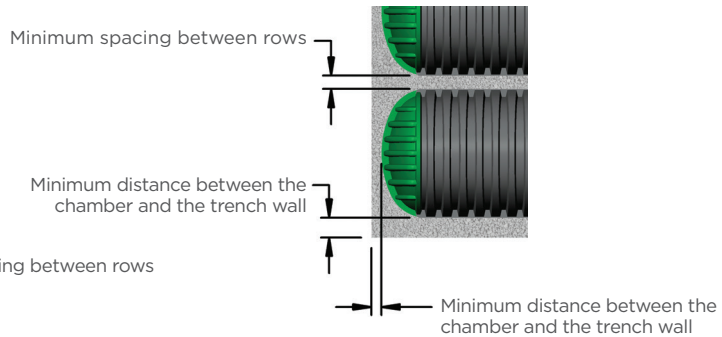
	HS31	HS75	HS180	HS290
Lenght	87.8 in 2230 mm	87.1 in 2212 mm	88.7 in 2253 mm	51.8 in 1316 mm
Installed Lenght	85.4 in 2169 mm	84.9 in 2156 mm	85.3 in 2167 mm	48.3 in 1227 mm
Height	15.9 in 404 mm	29.7 in 754 mm	45.5 in 1156 mm	59.5 in 1511 mm
Width	33.9 in 861 mm	51.0 in 1295 mm	77.8 in 1976 mm	100.5 in 2553 mm
Volume (chamber only)	14.9 ft^3 0.42 m^3	46.4 ft^3 1.31 m^3	113.6 ft^3 3.22 m^3	109.6 ft^3 3.10 m^3
Mass	32,0 lb 14.5 kg	70.0 lb 31.8 kg	127.0 lb 57.6 kg	125.0 lb 56.7 kg

Specifications for installation




	HS31		HS75		HS180		HS290	
Minimum backfill height	18.0 in	457 mm	18.0 in	457 mm	18.0 po	457 mm	24,0 po	610 mm
Maximum backfill height	8.0 ft	2.44 m	8.0 ft	2.44 m	8.0 ft	2.44 m	8.0 ft	2.44 m
Minimum net stone base	6.0 in	152 mm	6.0 in	152 mm	9.0 in	229 mm	9.0 in	229 mm
Minimum net stone backfill	6.0 in	152 mm	6.0 in	152 mm	12.0 in	305 mm	12.0 in	305 mm
Minimum spacing between rows	6.0 in	152 mm	6.0 in	152 mm	5.0 in	127 mm	8.5 in	216 mm
Minimum distance between the chamber and the trench wall	12.0 in	305 mm	12.0 in	305 mm	12.0 in	305 mm	12.0 in	305 mm
Minimum spacing between end cap and trench wall	12.0 in	305 mm	12.0 in	305 mm	176.0 in	4.98 mm	164.5 in	4.66 mm
Minimum retention volume | Chamber	31.1 ft^3	0.88 m^3	74.9 ft^3	2.12 m^3	176.0 ft^3	4.98 m^3	164.5 ft^3	4.66 m^3
Minimum retention volume | End cap	5.0 ft^3	0.14 m^3	13.9 ft^3	0.39 m^3	44.8 ft^3	1.27 m^3	114.5 ft^3	3.24 m^3





SIMMERING & ASSOCIATES LTD CONSULTING ENGINEERS

Appendix 'A'

Allowable Release Rate from Detention Facility and Required Storage Volume

Table 1 - Critical Storm Duration (100 year storm event)

t_c min.	i (100 yr) mm/hr	Q_{actual} L/sec.	$Q_{allowable}$ L/sec.	Q_{stored} L/sec.	V_{stored} m^3
5	302.2	1725.2	238.5	1486.7	446.0
10	183.0	1044.5	238.5	806.0	483.6
15	**136.4**	**778.8**	**238.5**	**540.3**	**486.3**
20	110.8	632.3	238.5	393.8	472.6
25	94.2	538.0	238.5	299.5	449.3
30	82.6	471.5	238.5	233.0	419.4
40	67.1	382.8	238.5	144.3	346.3
50	57.1	325.7	238.5	87.2	261.6

Table 2 – Parking Area Sub-Drainage Flow Rates and Storage Requirements (100 year storm event)

Sub-Catchment Area	Area Ha	i (100 yr) mm/hr	Overall "C"	Actual Flow Rate L/sec.	Release Rate L/sec.	Volume Stored m^3	Ponding Depth m	Ponding Elevation m
1	0.104	136.4	0.84	33.1	8.9	21.8	0.19	92.69
2	0.104	136.4	0.90	35.5	5.0	27.5	0.20	92.70
3	0.443	136.4	0.84	141.1	33.9	96.5	0.30	91.70
4	0.173	136.4	0.80	52.5	5.0	42.8	0.22	92.37
5	0.335	136.4	0.79	100.4	8.3	82.9	0.28	92.43
6	0.231	136.4	0.60	52.6	5.0	42.8	0.25	92.60
Total	**1.39**			**415.2**	**66.1**	**314.3**		

Table 3 – Building Property Sub-Drainage Flow Rates and Storage Requirements (100 year storm event)

Sub-Catchment Area	Area Ha	i (100yr) mm/hr	Overall "C"	Actual Flow Rate L/sec.	Release Rate L/sec.	Volume Stored m^3	Ponding Depth m	Ponding Elevation m
8	0.2810	136.4	0.78	83.1	28.1	49.5	0.25	92.45
9	0.2900	136.4	0.90	99.0	12.4	77.9	0.10	-
11	0.1790	136.4	0.84	57.0	8.1	44.0	0.30	92.39
Total	**0.7500**			**239.1**	**48.6**	**171.4**		

AREA 1
SOFT=0.009ha
HARD= 0.095ha
TOTAL=0.104ha

AREA 2
SOFT=0.000ha
HARD= 0.104ha
TOTAL=0.104ha

AREA 3
SOFT=0.041ha
HARD= 0.402ha
TOTAL=0.443ha

AREA 4
SOFT=0.024ha
HARD= 0.149ha
TOTAL=0.173ha

AREA 5
SOFT=0.051ha
HARD= 0.284ha
TOTAL=0.335ha

AREA 6
SOFT=0.098ha
HARD= 0.133ha
TOTAL=0.231ha

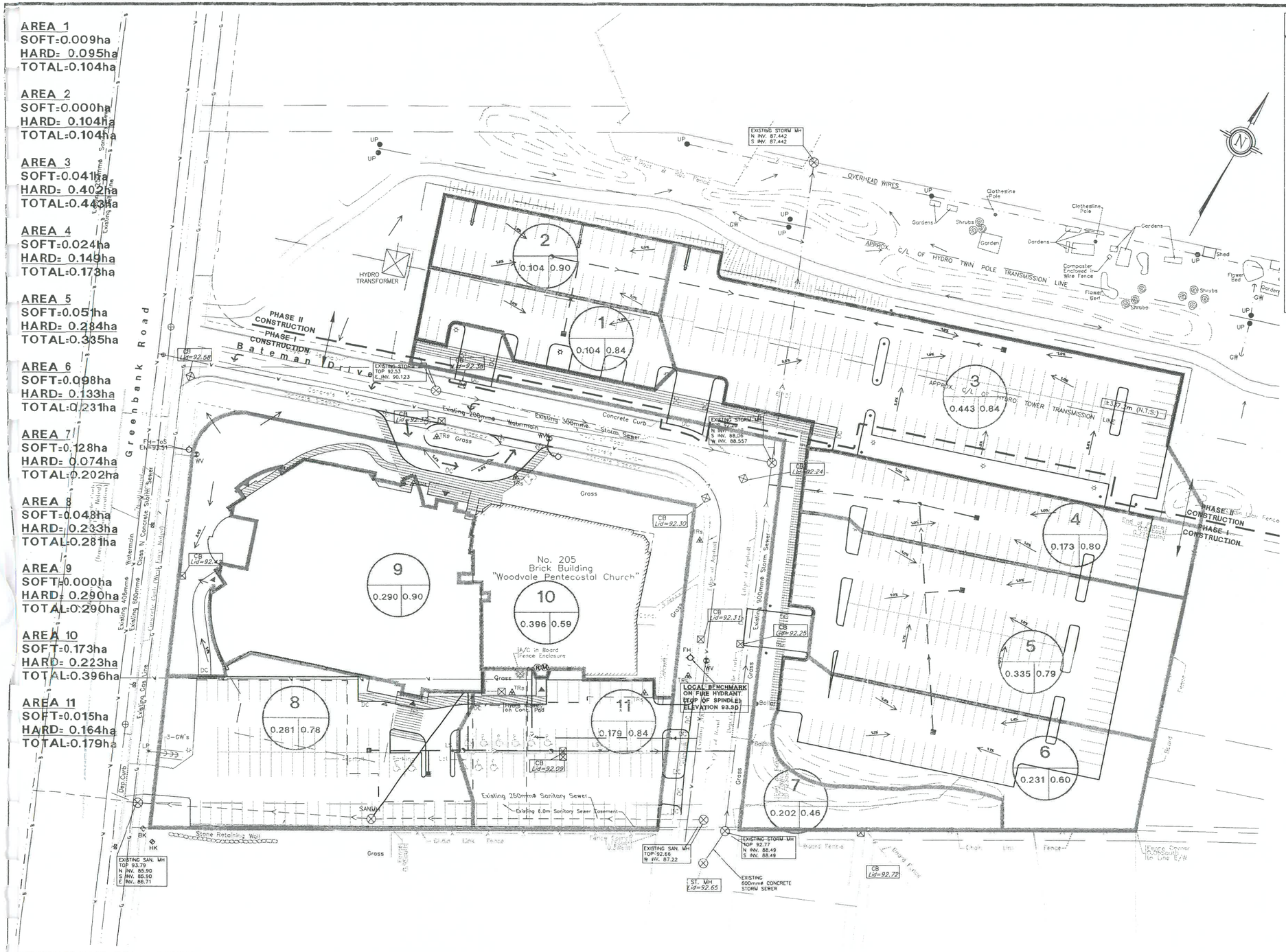
AREA 7
SOFT=0.128ha
HARD= 0.074ha
TOTAL=0.202ha

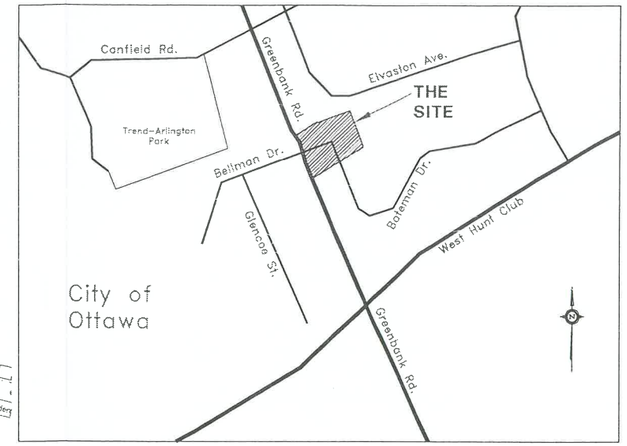
AREA 8
SOFT=0.048ha
HARD= 0.233ha
TOTAL=0.281ha

AREA 9
SOFT=0.000ha
HARD= 0.290ha
TOTAL=0.290ha

AREA 10
SOFT=0.173ha
HARD= 0.223ha
TOTAL=0.396ha

AREA 11
SOFT=0.015ha
HARD= 0.164ha
TOTAL=0.179ha





KEY PLAN
SCALE: N.T.S.

LEGEND

LIMIT OF WORKS / DRAINAGE AREA BOUNDARY

DITCH

DRAINAGE AREA I.D. No.

RUNOFF COEFFICIENT

AREA (ha)

FLOW

NOTE:

1. RUNOFF COEFFICIENTS FOR DRAINAGE AREAS ARE BASED ON:
   C = 0.20 (LANDSCAPE AREAS)
   C = 0.90 (HARD SURFACES)

TO BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS

1) SITE SERVICES AND GRADING PLAN DWG No. 04-1565-SS1
2) PRE-DEVELOPMENT DRAINAGE PLAN DWG No. 04-1565-PD1

otes:

NO.	REVISIONS	DATE	INITIAL	ENG.
2	REVISED DRAINAGE AREAS	09/06/05	M.L.F.	
1	REVISED DRAINAGE AREAS	23/02/05	M.L.F.	

Approved

CLIENT: BARRY J. HOBIN ARCHITECTS

PROJECT: WOODVALE PENTECOSTAL CHURCH - 205 GREENBANK Rd.

DRAWING TITLE: POST-DEVELOPMENT DRAINAGE PLAN

SIMMERING & ASSOCIATES LTD CONSULTING ENGINEERS

SCALE: 1:1000 | DATE: 16/09/04 | CAD FILE NO. SS1DA1565.DWG

DESIGN: S.A.T. | CHECKED: D.V.K.

DRAWN: M.L.F. | PLOT: 1 = 1

DWG. 04-1565-PD2 | REV. 2

APPENDIX D

STORM SERVICING

D.B. Gray Engineering Inc.

Stormwater Management - Grading & Drainage - Storm & Sanitary Sewers - Watermains

700 Long Point Circle
Ottawa, Ontario K1T 4E9

613-425-8044
d.gray@dbgrayengineering.com

STORM SEWER CALCULATIONS

Rational Method

FIVE YEAR EVENT

Project: Woodvale Pentecostal Church
Ottawa, Ontario

Date: February 26, 2024

Manning's Roughness Coefficient: 0.013

Location		Individual					Cumulative				Sewer Data							
From	To	Roof C = 0.90 (ha)	Hard C = 0.90 (ha)	Gravel C = 0.70 (ha)	Soft C = 0.20 (ha)	2.78AC	2.78AC	Time of Concentrat (min)	Rainfall Intensity (mm/hr)	Flow Rate (L/s)	Length (m)	Nominal Diameter (mm)	Actual Diameter (mm)	Slope (%)	Velocity (m/s)	Q_{Full} Capacity (L/s)	Time of Flow (min)	Q / Q_{Full}
CB/MH-1	MH-A	0.0108	0.0504		0.0123	0.1600	0.1600	10.00	104	16.67	51.6	250	250	0.43	0.79	39.00	1.08	0.43
(Drainage Area IV)					Restricted flow through ICD (refer to the SWM calcs):					4.19	51.6	250	250	0.43	0.79	39.00	1.08	0.11
Refer to Simmering 2005 SWM Report																		
Existing Roof		0.2960				0.7406	0.7406	10.00	104	77.16								
(Catchment Area 9)					Restricted flow through existing flow control roof drains:					12.42								
Addition Roof		0.1312				0.3283	0.3283	10.00	104	34.20								
(Drainage Area I & II)					Flow through flow control roof drains (refer to the SWM calcs):					2.52								
Existing + Addition Roof	MH-A									111.37	18.5	250	250	2.4	1.88	92.13	0.16	1.21
					Restricted flow through flow control roof drains (12.42 + 2.52 L/s):					14.94	18.5	250	250	2.4	1.88	92.13	0.16	0.16
MH-A	MH-B						1.2288	11.08	99	121.41	20	375	375	0.7	1.33	146.69	0.25	0.83
						Restricted upstream flow (4.19 +14.94 L/s):				19.13	20	375	375	0.7	1.33	146.69	0.25	0.13
CB/MH-2	MH-B		0.2640		0.0220	0.6728	0.6728	10.00	104	70.10	3.5	250	250	0.9	1.15	56.42	0.05	1.24
(Drainage Area III)						Restricted flow through ICD (refer to the SWM calcs):				23.05	3.5	250	250	0.9	1.15	56.42	0.05	0.41
MH-B	900 ST in Bateman						1.9016	11.33	98	185.67	45	375	375	1.9	2.19	241.68	0.34	0.77
						Restricted upstream flow (19.13 +23.05 L/s):				42.18	45	375	375	1.9	2.19	241.68	0.34	0.17
									Existing 900 mm Bateman Drive Storm Sewer:		900	914	0.5	2.03	1334		