



June 9, 2021
Our File: 420023

City of Cambridge
50 Dickson Street
Cambridge ON, N1R 5W8

Attention: Mr. Adam Ripper, P.Eng.

Re: Stormwater Management Brief – **REVISED**
355 Guelph Avenue and 11 Fletcher Circle
City of Cambridge

Dear Mr. Ripper,

This letter has been prepared by GM BluePlan Engineering Limited to identify the stormwater management measures for the proposed residential development at 355 Guelph Avenue and 11 Fletcher Circle in the City of Cambridge. The 0.240-hectare site is bound by existing residential to the north and east, Fletcher Circle to the south and Guelph Avenue to the east. The 355 Guelph Avenue site is currently developed as a single-family residential lot. The 11 Fletcher Circle site is currently vacant.

Under existing conditions, runoff generated from a portion of the site sheetflows overland in a southeasterly direction to the existing swale on the 11 Fletcher Circle property, ultimately discharging to the existing DICB at the southeast corner of the property, and to the existing storm sewer on Fletcher Circle. The remainder of the site, consisting of the existing dwelling at 355 Guelph Avenue and landscaped areas, sheetflows overland to the east of the site towards the existing lots along Fletcher Circle. The subject site is part of the greater drainage catchment for the existing Mill Pond Subdivision and the existing Stormwater Management Facility at Shaw Avenue.

The Development Concept was prepared by Urbe Developments Inc. The topographic survey of the site was completed by J.D. Barnes Limited (dated March 25, 2020). The existing and proposed site details, along with the stormwater management controls, are shown on the Existing Conditions and Removals Plan, Site Servicing, and Site Grading Plan (GM BluePlan Engineering Limited).

PROPOSED DEVELOPMENT

The intent of the Owner at this time is to construct nine (9) townhouses, along with the associated asphalt driving and parking areas, and landscaped areas. Following development, runoff generated from the site will be directed to on-site swales, ultimately discharging to the existing municipal storm sewers on Fletcher Circle and to the existing stormwater management facility on Shaw Avenue. Runoff generated from the north portion of the site will continue to be directed towards the existing lots on Fletcher Circle, ultimately discharging to the existing stormwater management facility on Shaw Avenue.

STORMWATER MANAGEMENT CRITERIA

Based on the information provided by the City of Cambridge in the Pre-Consultation Comments, the criteria for the site is as follows:

1. Drainage from the subject properties was accounted for in the design of the adjacent Mill Pond subdivision and stormwater management facilities.

On-site quality control is required under post-development conditions for any portion of the site that exceeds the imperviousness of the stormwater management design for the Mill Pond Subdivision as identified below.

2. Peak flows from the post-development site for the 5-year and 100-year design storm events are to be attenuated to the design peak flows from the Mill Pond Subdivision, based on a runoff coefficient of 0.40 for the 355 Guelph Avenue property and a runoff coefficient of 0.55 for the 11 Fletcher Circle property.

The City of Cambridge Rainfall Distribution parameters and the total depth of rainfall used for the 5-year and 100-year design storm analysis are as follows:

Table No. 1: Rainfall Distribution Parameters

	5-Year	100-Year
a =	1219.8	3015.1
b =	10.5	21.0
c =	0.823	0.870
r =	0.400	0.400
Duration (minutes)=	180.0	180.0
Maximum Intensity (mm/hr) =	127.834	177.123
Rainfall Depth (mm)=	48.647	89.669

ALLOWABLE RELEASE RATES

As per the stormwater management criteria, the Mill Pond Subdivision stormwater management design utilized a runoff coefficient of 0.40 for 355 Guelph Avenue, and 0.55 for 11 Fletcher Circle. This following flow rates were calculated utilizing the Rational Method, utilizing a weighted average of the runoff coefficients identified for each property, and the individual property areas.

Table No. 2: Design Flows

	Runoff Coefficient	Site Area	5-Year Flow Rate	100-Year Flow Rate
355 Guelph Avenue	0.40	0.188-ha	0.026 m ³ /s	0.037 m ³ /s
11 Fletcher Circle	0.55	0.052-ha	0.010 m ³ /s	0.014 m ³ /s
Total Site	0.433	0.240-ha	0.037 m ³ /s	0.051 m ³ /s

Therefore, the allowable release rates for the site are as follows:

Table No. 3: Allowable Release Rate

	5-Year	100-Year
Allowable Release Rates	0.037 m ³ /s	0.051 m ³ /s

POST DEVELOPMENT CONDITIONS

For the post-development condition (illustrated in Figure No. 1), the 0.24-ha site was modelled as three (3) catchments.

Catchment 100 (0.15-hectares, 48% Impervious) represents the portion of the site which discharges uncontrolled to the Guelph Avenue and Fletcher Circle right-of-ways.

Catchment 200 (0.03-hectares, 45% Impervious) represents the back half of the roofs of the houses that front Guelph Avenue, as well as a portion of the rear yards of those lots.

Runoff generated from Catchment 200 will be convey to a subsurface infiltration gallery via inline drains. The subsurface infiltration gallery (18.5m long x 2.5m wide x 1.2m deep) has the capacity to infiltrate the 100-year design storm event from Catchment 200. Based on our history in the area, the native subsurface soils are a sandy silt till. We have conservatively estimated the infiltration rate at 5 mm/hour.

Catchment 300 (0.06-hectares, 46% Impervious) represents the back half of the roofs of the houses that front Fletecher Circle, as well as a portion of the rear yards of those lots.

Runoff generated from Catchment 300 will be conveyed to a subsurface infiltration gallery via inline drains. The subsurface infiltration gallery (33.5m long x 2.7m wide x 1.2m deep) has the capacity to infiltrate the 100-year design storm event from Catchment 300. Based on our history in the area, the native subsurface soils are a sandy silt till. We have conservatively estimated the infiltration rate at 5 mm/hour.

ROUTING

The hydrologic model MIDUSS was used to create the design storm runoff hydrographs and to route the hydrographs. A copy of the final printout of the hydrologic modelling is appended.

The results of the routing analysis are as follows:

Table No. 4: Catchment 200 Infiltration Stage/Storage/Discharge Capacities

	Available Capacity			Actual Capacity Used		
	Peak Flow m ³ /s	Storage Volume m ³	Storage Elevation m	Peak Flow m ³ /s	Storage Volume m ³	Storage Elevation m
Bottom of Stone	0.000	0.0	310.85	---	---	---
5-Year	---	---	---	0.000	7.3	311.33
100-Year	---	---	---	0.000	17.8	312.01
Top of Stone	0.0001	18.5	312.05	---	---	---
Top of Gate	0.0001	18.6	312.55	---	---	---

Table No. 5: Catchment 300 Infiltration Stage/Storage/Discharge Capacities

	Available Capacity			Actual Capacity Used		
	Peak Flow m ³ /s	Storage Volume m ³	Storage Elevation m	Peak Flow m ³ /s	Storage Volume m ³	Storage Elevation m
Bottom of Stone	0.000	0.0	310.45	---	---	---
5-Year	---	---	---	0.000	14.9	310.95
100-Year	---	---	---	0.000	36.0	311.65
Top of Stone	0.0002	36.2	311.65	---	---	---
Top of Gate	0.0002	36.3	312.15	---	---	---

In summary, the post-development flow rates from the site are as follows:

Table No. 6: Post-Development Flow Rates

	5-Year	100-Year
Catchment 100 (uncontrolled)	0.023 m ³ /s	0.047 m ³ /s
Catchment 200 (controlled)	0.000 m ³ /s	0.000 m ³ /s
Catchment 300 (controlled)	0.000 m ³ /s	0.000 m ³ /s
Total	0.023 m³/s	0.047 m³/s

The following table compares the post-development condition flow rates to the existing condition release rates for the full range of design storm events.

Table No. 7: Comparison of Allowable Release Rates and Post-Development Condition Flow Rates

	5-Year	100-Year
Allowable Release Rates	0.037 m ³ /s	0.051 m ³ /s
Post-Development Condition	0.023 m ³ /s	0.047 m ³ /s

Therefore, the 5 and 100-year post-development flow rates from the site have been attenuated to be less than the allowable release rates.

QUALITY CONTROL

The downstream Mill Pond subdivision and stormwater management facility was designed to treat flows from this site (area = 0.24 ha) at a runoff coefficient (RC) of 0.433, as noted above. As Catchments 200 and 300 are infiltrated on site, the only Catchment that will contribute to the downstream pond is Catchment 100, which is 0.15 ha at 48% impervious, which is equivalent to a runoff coefficient (RC) of approximately 0.54.

So, the pond was design for: $RC \times Area = 0.433 \times 0.24ha = 0.10$

The site contributes: $RC \times Area = 0.54 \times 0.15ha = 0.08$

Therefore, on-site quality control will not be required as the proposed development is contributing less impervious area to the pond than it was designed for.

SEDIMENT AND EROSION CONTROLS

Silt fence will be installed along the property boundary in all locations where runoff will discharge from the site to adjacent lands. The silt fence will serve to minimize the opportunity for water borne sediments to be washed on to the adjacent properties.

Once catch basins have been relocated/installed, the grates will be wrapped with filter cloth. This feature will be maintained until all building and landscaping has been completed.

Inspection and maintenance of all silt fencing will start after installation is complete. The silt fence will be inspected on a weekly basis during active construction or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the facility found to need repair.

Once construction and landscaping has been substantially completed, the silt fence will be removed, any accumulated sediment will be removed and the landscaping will be completed.

After construction of the complete development, erosion and sediment transport will be minimal.

MAINTENANCE PLAN

To ensure that the stormwater management system continues to function as designed and constructed, we recommend that the following inspections and maintenance activities be completed on an annual basis:

1. Is there any noticeable damage to the asphalt and grassed swale (i.e. erosion, blockages)? If yes, complete any necessary repairs.
2. Inspect all ditch inlets, catch basins, and manholes. Remove and dispose of any accumulated sediment, trash/litter, debris (i.e. sediment, garbage, leaves, etc.).
3. Inspect all swales and overflow locations. Remove and dispose of any accumulated sediment, trash/litter, debris (i.e. sediment, garbage, leaves, etc.).
4. Is there any indication of a spill (i.e. frothy water, oily sheen on the water)? If yes, investigate, inform the appropriate agencies and complete the necessary clean-up and restoration.

Please note that any structures identified during the annual inspection to be worn, missing or damaged are to be repaired or replaced within 48 hours.

CONCLUSIONS

In summary, the preliminary stormwater management design for the development at 355 Guelph Avenue and 11 Fletcher Circle in the City of Cambridge is as follows:

1. Runoff generated from the site during the 5-year and 100-year design storm events has been attenuated to less than the allowable release rates from the site.
2. Quality control treatment for runoff generated from the site is provided through the existing stormwater management facility on Shaw Avenue, constructed as part of the Mill Pond Subdivision.

We trust this is the information you require at this time. If you have any questions or require additional information, please do not hesitate to call.

Yours truly,

GM BLUEPLAN ENGINEERING LIMITED

Per:

A handwritten signature in black ink, appearing to read 'P. Grier'.

Patrick Grier, P.Eng.

PG/


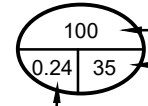



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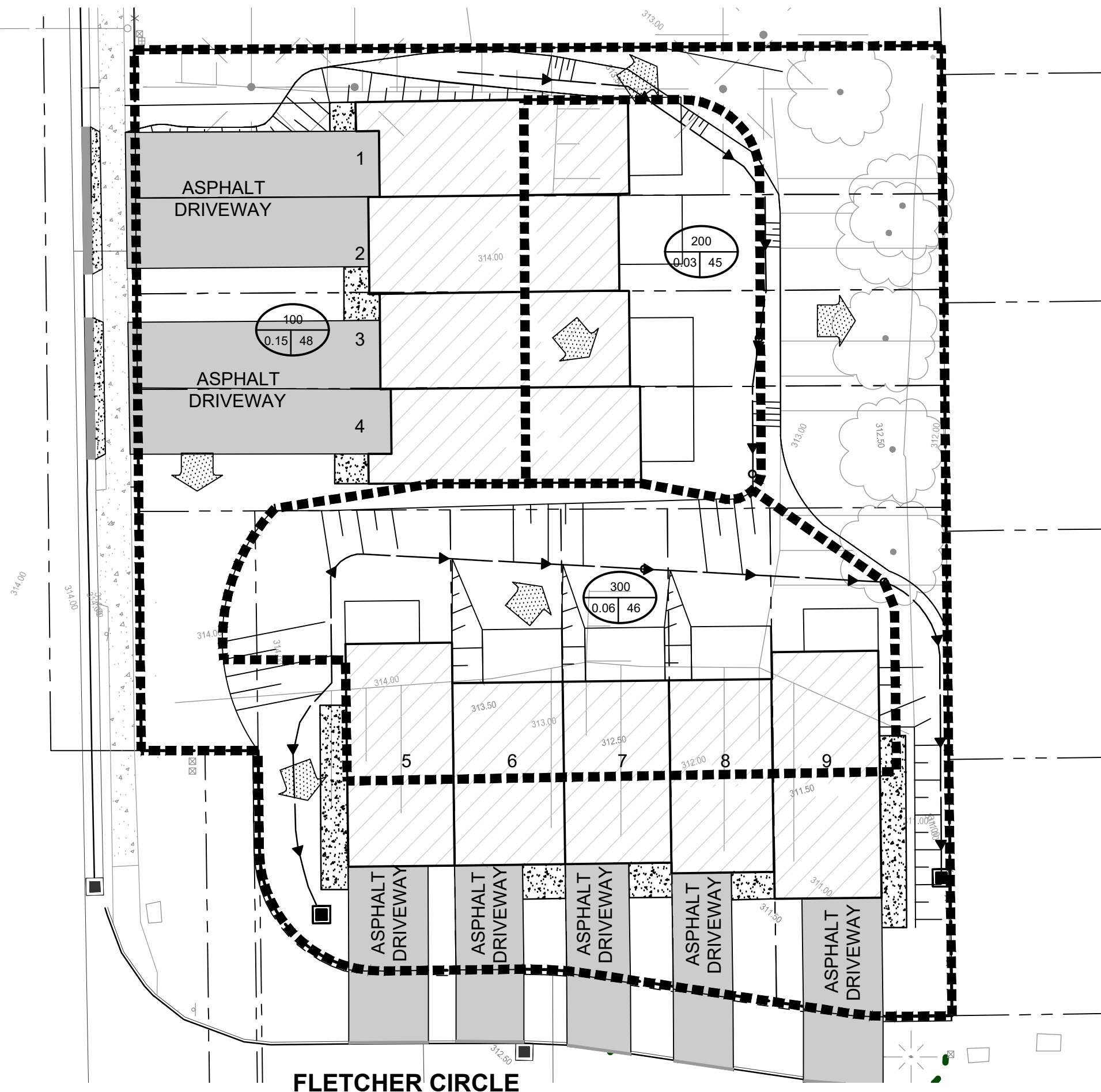
CITY OF
CAMBRIDGE



LEGEND

-  DRAINAGE AREA BOUNDARY
-  CATCHMENT NUMBER
% IMPERVIOUS
CATCHMENT AREA IN HECTARES
-  MAJOR OVERLAND FLOW PATH

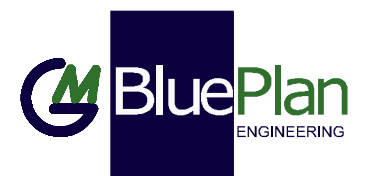
GUELPH AVENUE



FLETCHER CIRCLE

355 GUELPH AVENUE
POST DEVELOPMENT
CONDITIONS DRAINAGE
AREA PLAN

FIGURE 1



420023
JUNE 2021
Scale: 1:250 | NAD 1983 UTM Zone 17N

355 GUELPH AVENUE, CAMBRIDGE

Our File: 420023

May 27, 2021

Catchment 200: Proposed Infiltration Gallery

STORAGE VOLUME CALCULATIONS

ELEV (m)	INC D (m)	SURFACE AREA (Infil. Gall) (sq m)	INCR. STORAGE VOL (cu m)	ACCUM STORAGE VOL (cu m)	
310.85	0.00	46.25	0.00	0.00	Bottom of Stone
311.05	0.20	46.25	3.08	3.08	
311.25	0.40	46.25	3.08	6.17	
311.45	0.60	46.25	3.08	9.25	
311.65	0.80	46.25	3.08	12.33	
311.85	1.00	46.25	3.08	15.42	
312.05	1.20	46.25	3.08	18.50	Top of Stone
312.40	1.55	0.60	0.04	18.54	
312.55	1.70	0.60	0.04	18.58	T/G

BOTTOM INFILTRATION

L(dw) = 18.5 m
 W(dw) = 2.5 m
 D(dw) = 1.20 m

 A(c) = 46.3 sq m
 VOL(dw)= 55.5 cu m
 VOL(st)= 18.5 cu m
 K = 5 mm/hr
 = 1.39E-04 cm/s

SIDE INFILTRATION

ALL SIDES

L(dw) = 18.5 m
 W(dw) = 2.5 m
 D(dw) = 1.2 m

 A(c) = 55.5 sq m

 K = 5 mm/hr
 = 1.39E-04 cm/s

ELEVATION	STAGE (m)	STORAGE (cu m)	INFILTRATION DISCHARGE (cu m/s)	TOTAL DISCHARGE (cu m/s)	
310.85	0.00	0.00	0.00000	0.000000	Bottom of Stone
311.05	0.20	3.08	0.00008	0.000076	
311.25	0.40	6.17	0.00009	0.000088	
311.45	0.60	9.25	0.00010	0.000099	
311.65	0.80	12.33	0.00011	0.000111	
311.85	1.00	15.42	0.00012	0.000123	
312.05	1.20	18.50	0.00012	0.000123	Top of Stone
312.40	1.55	18.54	0.00012	0.000123	
312.55	1.70	18.58	0.00012	0.000123	T/G

355 GUELPH AVENUE, CAMBRIDGE

Our File: 420023

May 27, 2021

Catchment 300: Proposed Infiltration Gallery

STORAGE VOLUME CALCULATIONS

ELEV	INC	SURFACE	INCR.	ACCUM	
(m)	D	AREA	STORAGE	STORAGE	
	(m)	(Infil. Gall)	VOL	VOL	
		(sq m)	(cu m)	(cu m)	
310.45	0.00	90.45	0.0000	0.00	Bottom of Stone
310.65	0.20	90.45	6.0300	6.03	
310.85	0.40	90.45	6.0300	12.06	
311.05	0.60	90.45	6.0300	18.09	
311.25	0.80	90.45	6.0300	24.12	
311.45	1.00	90.45	6.0300	30.15	
311.65	1.20	90.45	6.0300	36.18	Top of Stone
312.00	1.55	0.60	0.0377	36.22	
312.15	1.70	0.60	0.0377	36.26	T/G

BOTTOM INFILTRATION

L(dw) = 33.5 m
 W(dw) = 2.7 m
 D(dw) = 1.2 m

A(c) = 90.5 sq m
 VOL(dw)= 108.5 cu m
 VOL(st)= 36.2 cu m
 K = 5 mm/hr
 = 1.39E-04 cm/s

SIDE INFILTRATION

ALL SIDES

L(dw) = 33.5 m
 W(dw) = 2.7 m
 D(dw) = 1.2 m

A(c) = 108.54 sq m

K = 5 mm/hr
 = 0.000138889 cm/s

ELEVATION	STAGE	STORAGE	INFILTRATION	TOTAL	
	(m)	(cu m)	DISCHARGE	DISCHARGE	
			(cu m/s)	(cu m/s)	
310.45	0.00	0.0000	0.00000	0.000000	Bottom of Stone
310.65	0.20	6.0300	0.00015	0.000146	
310.85	0.40	12.0600	0.00017	0.000166	
311.05	0.60	18.0900	0.00019	0.000186	
311.25	0.80	24.1200	0.00021	0.000206	
311.45	1.00	30.1500	0.00023	0.000226	
311.65	1.20	36.1800	0.00023	0.000226	Top of Stone
312.00	1.55	36.2177	0.00023	0.000226	
312.15	1.70	36.2554	0.00023	0.000226	T/G


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"                                               420023  355 Guelph\2021-05-27"
"          Output filename:                    420023_POST_5.out"
"          Licensee name:                      gmbp"
"          Company                             "
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" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000  Max. Storm length"
"          1500.000  Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          1219.800  Coefficient A"
"          10.500  Constant B"
"          0.823  Exponent C"
"          0.400  Fraction R"
"          180.000  Duration"
"          1.000  Time step multiplier"
"          Maximum intensity                    127.834  mm/hr"
"          Total depth                          48.647  mm"
"          6  005hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 100"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          100  Catchment 100"
"          48.000  % Impervious"
"          0.150  Total Area"
"          25.000  Flow length"
"          2.000  Overland Slope"
"          0.078  Pervious Area"
"          25.000  Pervious length"
"          2.000  Pervious slope"
"          0.072  Impervious Area"
"          25.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious Max.infiltration"
"          12.500  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"
"          1.500  Impervious Depression storage"

```

	0.023	0.000	0.000	0.000	c.m/sec"
"	Catchment 100	Pervious	Impervious	Total Area	"
"	Surface Area	0.078	0.072	0.150	hectare"
"	Time of concentration	13.431	1.802	4.065	minutes"
"	Time to Centroid	92.172	87.542	88.443	minutes"
"	Rainfall depth	48.647	48.647	48.647	mm"
"	Rainfall volume	37.94	35.03	72.97	c.m"
"	Rainfall losses	38.282	2.167	20.947	mm"
"	Runoff depth	10.365	46.480	27.700	mm"
"	Runoff volume	8.08	33.47	41.55	c.m"
"	Runoff coefficient	0.213	0.955	0.569	"
"	Maximum flow	0.006	0.021	0.023	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4	Add Runoff "			
"	0.023	0.023	0.000	0.000"	
" 40	HYDROGRAPH Copy to Outflow"				
"	8	Copy to Outflow"			
"	0.023	0.023	0.023	0.000"	
" 40	HYDROGRAPH Combine 1"				
"	6	Combine "			
"	1	Node #"			
"		Combine"			
"		Maximum flow	0.023	c.m/sec"	
"		Hydrograph volume	41.551	c.m"	
"	0.023	0.023	0.023	0.023"	
" 40	HYDROGRAPH Start - New Tributary"				
"	2	Start - New Tributary"			
"	0.023	0.000	0.023	0.023"	
" 33	CATCHMENT 200"				
"	1	Triangular SCS"			
"	1	Equal length"			
"	2	Horton equation"			
"	200	Catchment 200"			
"	45.000	% Impervious"			
"	0.030	Total Area"			
"	25.000	Flow length"			
"	2.000	Overland Slope"			
"	0.016	Pervious Area"			
"	25.000	Pervious length"			
"	2.000	Pervious slope"			
"	0.013	Impervious Area"			
"	25.000	Impervious length"			
"	2.000	Impervious slope"			
"	0.250	Pervious Manning 'n'"			
"	75.000	Pervious Max.infiltration"			
"	12.500	Pervious Min.infiltration"			
"	0.250	Pervious Lag constant (hours)"			
"	5.000	Pervious Depression storage"			
"	0.015	Impervious Manning 'n'"			
"	0.000	Impervious Max.infiltration"			

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"      0.000  Impervious Min.infiltration"
"      0.050  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"          0.004      0.000      0.023      0.023 c.m/sec"
"      Catchment 200      Pervious  Impervious Total Area  "
"      Surface Area      0.016      0.013      0.030      hectare"
"      Time of concentration 13.431      1.802      4.293      minutes"
"      Time to Centroid      92.172      87.542      88.534      minutes"
"      Rainfall depth      48.647      48.647      48.647      mm"
"      Rainfall volume      8.03      6.57      14.59      c.m"
"      Rainfall losses      38.282      2.167      22.030      mm"
"      Runoff depth      10.365      46.480      26.617      mm"
"      Runoff volume      1.71      6.27      7.99      c.m"
"      Runoff coefficient      0.213      0.955      0.547      "
"      Maximum flow      0.001      0.004      0.004      c.m/sec"
" 40      HYDROGRAPH Add Runoff  "
"          4  Add Runoff  "
"              0.004      0.004      0.023      0.023"
" 54      POND DESIGN"
"          0.004  Current peak flow      c.m/sec"
"          0.005  Target outflow      c.m/sec"
"          8.0    Hydrograph volume      c.m"
"          9.    Number of stages"
"      312.200  Minimum water level      metre"
"      313.930  Maximum water level      metre"
"      312.200  Starting water level      metre"
"          0    Keep Design Data: 1 = True; 0 = False"
"              Level Discharge      Volume"
"          310.850      0.000      0.000"
"          311.050      7.60E-05      3.080"
"          311.250      8.80E-05      6.170"
"          311.450      9.90E-05      9.250"
"          311.650      0.00011      12.330"
"          311.850      0.00012      15.420"
"          312.050      0.00012      18.500"
"          312.400      0.00013      18.540"
"          312.550      0.00013      18.580"
"              Peak outflow      0.000      c.m/sec"
"              Maximum level      311.325      metre"
"              Maximum storage      7.332      c.m"
"              Centroidal lag      15.755      hours"
"          0.004      0.004      0.000      0.023 c.m/sec"
" 40      HYDROGRAPH  Combine  1"
"          6  Combine  "
"          1  Node #"
"              Combine"
"              Maximum flow      0.023      c.m/sec"
"              Hydrograph volume      47.994      c.m"
"          0.004      0.004      0.000      0.023"
" 40      HYDROGRAPH Start - New Tributary"

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"          2  Start - New Tributary"
"              0.004      0.000      0.000      0.023"
" 33      CATCHMENT 300"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          300 Catchment 300"
"      46.000 % Impervious"
"          0.060 Total Area"
"      25.000 Flow length"
"          2.000 Overland Slope"
"          0.032 Pervious Area"
"      25.000 Pervious length"
"          2.000 Pervious slope"
"          0.028 Impervious Area"
"      25.000 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"      75.000 Pervious Max.infiltration"
"     12.500 Pervious Min.infiltration"
"          0.250 Pervious Lag constant (hours)"
"          5.000 Pervious Depression storage"
"          0.015 Impervious Manning 'n'"
"          0.000 Impervious Max.infiltration"
"          0.000 Impervious Min.infiltration"
"          0.050 Impervious Lag constant (hours)"
"          1.500 Impervious Depression storage"
"              0.009      0.000      0.000      0.023 c.m/sec"
"          Catchment 300      Pervious      Impervious      Total Area  "
"          Surface Area      0.032      0.028      0.060      hectare"
"          Time of concentration  13.431      1.802      4.215      minutes"
"          Time to Centroid      92.172      87.542      88.503      minutes"
"          Rainfall depth      48.647      48.647      48.647      mm"
"          Rainfall volume      15.76      13.43      29.19      c.m"
"          Rainfall losses      38.282      2.167      21.669      mm"
"          Runoff depth      10.365      46.480      26.978      mm"
"          Runoff volume      3.36      12.83      16.19      c.m"
"          Runoff coefficient      0.213      0.955      0.555      "
"          Maximum flow      0.002      0.008      0.009      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4  Add Runoff "
"              0.009      0.009      0.000      0.023"
" 54      POND DESIGN"
"          0.009 Current peak flow      c.m/sec"
"          0.005 Target outflow      c.m/sec"
"          16.2 Hydrograph volume      c.m"
"          9. Number of stages"
"      310.450 Minimum water level      metre"
"      312.150 Maximum water level      metre"
"      310.450 Starting water level      metre"

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"      0  Keep Design Data: 1 = True; 0 = False"
"      Level Discharge      Volume"
"      310.450      0.000      0.000"
"      310.650      0.00015      6.030"
"      310.850      0.00017      12.060"
"      311.050      0.00019      18.090"
"      311.250      0.00021      24.120"
"      311.450      0.00023      30.150"
"      311.650      0.00023      36.180"
"      312.000      0.00023      36.220"
"      312.150      0.00023      36.260"
"      Peak outflow              0.000      c.m/sec"
"      Maximum level              310.945      metre"
"      Maximum storage              14.936      c.m"
"      Centroidal lag              16.433      hours"
"      0.009      0.009      0.000      0.023 c.m/sec"
" 40  HYDROGRAPH  Combine      1"
"      6  Combine "
"      1  Node #"
"      Combine"
"      Maximum flow              0.023      c.m/sec"
"      Hydrograph volume              60.726      c.m"
"      0.009      0.009      0.000      0.023"
" 40  HYDROGRAPH  Confluence      1"
"      7  Confluence "
"      1  Node #"
"      Combine"
"      Maximum flow              0.023      c.m/sec"
"      Hydrograph volume              60.726      c.m"
"      0.009      0.023      0.000      0.000"
" 38  START/RE-START TOTALS 1"
"      3  Runoff Totals on EXIT"
"      Total Catchment area              0.240      hectare"
"      Total Impervious area              0.113      hectare"
"      Total % impervious              47.125"
" 19  EXIT"

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"          MIDUSS Output ----->"
"          MIDUSS version                      Version 2.25  rev. 473"
"          MIDUSS created                      Sunday, February 07, 2010"
"          10  Units used:                      ie METRIC"
"          Job folder:                          C:\Users\pgrier\Documents\Work\
"                                               420023  355 Guelph\2021-05-27"
"          Output filename:                     420023_POST_100.out"
"          Licensee name:                       gmbp"
"          Company                              "
"          Date & Time last used:               5/27/2021 at 12:30:03 PM"
" 31      TIME PARAMETERS"
"          5.000  Time Step"
"          180.000 Max. Storm length"
"          1500.000 Max. Hydrograph"
" 32      STORM Chicago storm"
"          1  Chicago storm"
"          3015.100 Coefficient A"
"          21.000  Constant B"
"          0.870  Exponent C"
"          0.400  Fraction R"
"          180.000 Duration"
"          1.000  Time step multiplier"
"          Maximum intensity          177.123  mm/hr"
"          Total depth                 89.669  mm"
"          6  100hyd  Hydrograph extension used in this file"
" 33      CATCHMENT 100"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          100  Catchment 100"
"          48.000  % Impervious"
"          0.150  Total Area"
"          25.000  Flow length"
"          2.000  Overland Slope"
"          0.078  Pervious Area"
"          25.000  Pervious length"
"          2.000  Pervious slope"
"          0.072  Impervious Area"
"          25.000  Impervious length"
"          2.000  Impervious slope"
"          0.250  Pervious Manning 'n'"
"          75.000  Pervious Max.infiltration"
"          12.500  Pervious Min.infiltration"
"          0.250  Pervious Lag constant (hours)"
"          5.000  Pervious Depression storage"
"          0.015  Impervious Manning 'n'"
"          0.000  Impervious Max.infiltration"
"          0.000  Impervious Min.infiltration"
"          0.050  Impervious Lag constant (hours)"
"          1.500  Impervious Depression storage"

```

"		0.047	0.000	0.000	0.000 c.m/sec"
"	Catchment 100		Pervious	Impervious	Total Area "
"	Surface Area	0.078	0.072	0.150	hectare"
"	Time of concentration	8.974	1.582	4.141	minutes"
"	Time to Centroid	93.374	86.798	89.074	minutes"
"	Rainfall depth	89.669	89.669	89.669	mm"
"	Rainfall volume	69.94	64.56	134.50	c.m"
"	Rainfall losses	47.202	2.757	25.868	mm"
"	Runoff depth	42.467	86.912	63.801	mm"
"	Runoff volume	33.12	62.58	95.70	c.m"
"	Runoff coefficient	0.474	0.969	0.712	"
"	Maximum flow	0.022	0.032	0.047	c.m/sec"
" 40	HYDROGRAPH Add Runoff "				
"	4 Add Runoff "				
"		0.047	0.047	0.000	0.000"
" 40	HYDROGRAPH Copy to Outflow"				
"	8 Copy to Outflow"				
"		0.047	0.047	0.047	0.000"
" 40	HYDROGRAPH Combine 1"				
"	6 Combine "				
"	1 Node #"				
"	Combine"				
"	Maximum flow		0.047		c.m/sec"
"	Hydrograph volume		95.701		c.m"
"		0.047	0.047	0.047	0.047"
" 40	HYDROGRAPH Start - New Tributary"				
"	2 Start - New Tributary"				
"		0.047	0.000	0.047	0.047"
" 33	CATCHMENT 200"				
"	1 Triangular SCS"				
"	1 Equal length"				
"	2 Horton equation"				
"	200 Catchmet 200"				
"	45.000 % Impervious"				
"	0.030 Total Area"				
"	25.000 Flow length"				
"	2.000 Overland Slope"				
"	0.016 Pervious Area"				
"	25.000 Pervious length"				
"	2.000 Pervious slope"				
"	0.013 Impervious Area"				
"	25.000 Impervious length"				
"	2.000 Impervious slope"				
"	0.250 Pervious Manning 'n'"				
"	75.000 Pervious Max.infiltration"				
"	12.500 Pervious Min.infiltration"				
"	0.250 Pervious Lag constant (hours)"				
"	5.000 Pervious Depression storage"				
"	0.015 Impervious Manning 'n'"				
"	0.000 Impervious Max.infiltration"				

```

"      0.000  Impervious Min.infiltration"
"      0.050  Impervious Lag constant (hours)"
"      1.500  Impervious Depression storage"
"          0.009      0.000      0.047      0.047 c.m/sec"
"      Catchment 200      Pervious  Impervious Total Area  "
"      Surface Area      0.016      0.013      0.030      hectare"
"      Time of concentration  8.974      1.582      4.346      minutes"
"      Time to Centroid      93.374      86.798      89.256      minutes"
"      Rainfall depth      89.669      89.669      89.669      mm"
"      Rainfall volume      14.80      12.11      26.90      c.m"
"      Rainfall losses      47.202      2.757      27.201      mm"
"      Runoff depth      42.467      86.912      62.468      mm"
"      Runoff volume      7.01      11.73      18.74      c.m"
"      Runoff coefficient      0.474      0.969      0.697      "
"      Maximum flow      0.005      0.006      0.009      c.m/sec"
" 40      HYDROGRAPH Add Runoff  "
"      4      Add Runoff  "
"          0.009      0.009      0.047      0.047"
" 54      POND DESIGN"
"      0.009  Current peak flow      c.m/sec"
"      0.005  Target outflow      c.m/sec"
"      18.7  Hydrograph volume      c.m"
"      9.  Number of stages"
"      312.200  Minimum water level      metre"
"      313.930  Maximum water level      metre"
"      312.200  Starting water level      metre"
"      0  Keep Design Data: 1 = True; 0 = False"
"          Level Discharge      Volume"
"      310.850      0.000      0.000"
"      311.050  7.60E-05      3.080"
"      311.250  8.80E-05      6.170"
"      311.450  9.90E-05      9.250"
"      311.650      0.00011      12.330"
"      311.850      0.00012      15.420"
"      312.050      0.00012      18.500"
"      312.400      0.00013      18.540"
"      312.550      0.00013      18.580"
"      Peak outflow      0.000      c.m/sec"
"      Maximum level      312.006      metre"
"      Maximum storage      17.821      c.m"
"      Centroidal lag      26.511      hours"
"          0.009      0.009      0.000      0.047 c.m/sec"
" 40      HYDROGRAPH  Combine  1"
"      6  Combine  "
"      1  Node #"
"          Combine"
"      Maximum flow      0.047      c.m/sec"
"      Hydrograph volume      105.525      c.m"
"          0.009      0.009      0.000      0.047"
" 40      HYDROGRAPH Start - New Tributary"

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"          2  Start - New Tributary"
"              0.009      0.000      0.000      0.047"
" 33      CATCHMENT 300"
"          1  Triangular SCS"
"          1  Equal length"
"          2  Horton equation"
"          300 Catchment 300"
"      46.000 % Impervious"
"          0.060 Total Area"
"      25.000 Flow length"
"          2.000 Overland Slope"
"          0.032 Pervious Area"
"      25.000 Pervious length"
"          2.000 Pervious slope"
"          0.028 Impervious Area"
"      25.000 Impervious length"
"          2.000 Impervious slope"
"          0.250 Pervious Manning 'n'"
"      75.000 Pervious Max.infiltration"
"     12.500 Pervious Min.infiltration"
"          0.250 Pervious Lag constant (hours)"
"          5.000 Pervious Depression storage"
"          0.015 Impervious Manning 'n'"
"          0.000 Impervious Max.infiltration"
"          0.000 Impervious Min.infiltration"
"          0.050 Impervious Lag constant (hours)"
"          1.500 Impervious Depression storage"
"              0.019      0.000      0.000      0.047 c.m/sec"
"          Catchment 300      Pervious      Impervious      Total Area  "
"          Surface Area      0.032      0.028      0.060      hectare"
"          Time of concentration  8.974      1.582      4.277      minutes"
"          Time to Centroid      93.373      86.798      89.195      minutes"
"          Rainfall depth      89.669      89.669      89.669      mm"
"          Rainfall volume      29.05      24.75      53.80      c.m"
"          Rainfall losses      47.202      2.757      26.757      mm"
"          Runoff depth      42.467      86.912      62.912      mm"
"          Runoff volume      13.76      23.99      37.75      c.m"
"          Runoff coefficient      0.474      0.969      0.702      "
"          Maximum flow      0.009      0.012      0.019      c.m/sec"
" 40      HYDROGRAPH Add Runoff "
"          4  Add Runoff "
"              0.019      0.019      0.000      0.047"
" 54      POND DESIGN"
"          0.019 Current peak flow      c.m/sec"
"          0.005 Target outflow      c.m/sec"
"          37.7 Hydrograph volume      c.m"
"          9. Number of stages"
"      310.450 Minimum water level      metre"
"      312.150 Maximum water level      metre"
"      310.450 Starting water level      metre"

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"      0   Keep Design Data: 1 = True; 0 = False"
"          Level Discharge   Volume"
"          310.450   0.000   0.000"
"          310.650   0.00015   6.030"
"          310.850   0.00017   12.060"
"          311.050   0.00019   18.090"
"          311.250   0.00021   24.120"
"          311.450   0.00023   30.150"
"          311.650   0.00023   36.180"
"          312.000   0.00023   36.220"
"          312.150   0.00023   36.260"
"          Peak outflow           0.000   c.m/sec"
"          Maximum level           311.645   metre"
"          Maximum storage           36.030   c.m"
"          Centroidal lag           28.501   hours"
"          0.019   0.019   0.000   0.047 c.m/sec"
" 40   HYDROGRAPH   Combine   1"
"      6   Combine "
"      1   Node #"
"          Combine"
"          Maximum flow           0.047   c.m/sec"
"          Hydrograph volume           124.052   c.m"
"          0.019   0.019   0.000   0.047"
" 40   HYDROGRAPH   Confluence   1"
"      7   Confluence "
"      1   Node #"
"          Combine"
"          Maximum flow           0.047   c.m/sec"
"          Hydrograph volume           124.052   c.m"
"          0.019   0.047   0.000   0.000"
" 38   START/RE-START TOTALS 1"
"      3   Runoff Totals on EXIT"
"          Total Catchment area           0.240   hectare"
"          Total Impervious area           0.113   hectare"
"          Total % impervious           47.125"
" 38   START/RE-START TOTALS 1"
"      3   Runoff Totals on EXIT"
"          Total Catchment area           0.240   hectare"
"          Total Impervious area           0.113   hectare"
"          Total % impervious           47.125"
" 19   EXIT"

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