



310-316 Erb Street West

Functional Servicing and Stormwater Management Report

Project Location:

310-316 Erb Street West
Waterloo, ON

Prepared for:

Urban Legend Developments Ltd.
22 King Street South, Suite 300
Waterloo, ON N2J 1N8

Prepared by:

MTE Consultants Inc.
520 Bingham Centre Drive
Kitchener, ON N2B 3X9

February 11, 2022

MTE File No.: 46981-100





Contents

1.0	Introduction	1
2.0	Servicing	1
2.1	Sanitary	1
2.2	Storm	1
2.3	Water	2
3.0	Stormwater Management.....	2
3.1	Criteria	2
3.2	Methodology	3
3.3	Catchment Parameters	3
3.4	Water Quantity – Modelling Results	6
3.5	Water Quality Control.....	7
4.0	Erosion & Sediment Control	7
5.0	Conclusions and Recommendations	8

Figures

Figure 1.0 – Pre-Development Catchment Area.....	4
Figure 2.0 – Post-Development Catchment Areas	5

Tables

Table 2.1 – Required Fire Flow	2
Table 2.2 – Results of Flow Test Completed (August 24, 2021)	2
Table 3.1 – Catchment Parameters.....	3
Table 3.2 – Stage-Storage-Discharge Information – Catchment 202-204.....	6
Table 3.3 – Stage-Storage-Discharge Information – Catchment 205.....	6
Table 3.4 – Summary of Flows.....	6
Table 3.5 – Summary of Ponding Depths.....	7

Appendices

Appendix A	Calculations
Appendix B	MIDUSS Output

Drawings

Existing Conditions Plan	
MTE Drawing No. C1.1	Appended Separately
Functional Site Grading, Servicing & SWM Plan	
MTE Drawing No. C2.1	Appended Separately

1.0 Introduction

MTE Consultants Inc. was retained by Urban Legend Developments Ltd. to prepare the Functional Site Servicing and Stormwater Management (FSSWM) Report for the proposed residential development to be constructed at 310-316 Erb Street West located in the City of Waterloo.

The site is approximately 0.276ha and currently comprises four residential dwellings. The site is bounded by existing residential development to the north and west, Erb Street West to the south, and First Baptist Church to the east. For the exact location refer to the key plan located on the enclosed engineering drawings.

The proposed development consists of the construction of a six storey residential building with associated at grade parking and an underground parking structure. Two driveway entrances off of Erb Street West are proposed: one provides access to the parking garage and the other to the surface parking.

This report addresses the servicing and stormwater management requirements set forth by the City of Waterloo. The site grading, servicing and stormwater management details for the site are illustrated on the MTE engineering drawings.

2.0 Servicing

2.1 Sanitary

There is an existing 300mm diameter municipal sanitary sewer on Erb Street West fronting the site that drains east. The closest existing manhole is located in front of the main driveway entrance to the site and is approximately 3.6m deep.

A sanitary sewer design sheet was prepared to determine the flows anticipated to be generated by the proposed development. With a total of 93 units at 1.76 persons per unit, the anticipated peak sanitary flow rate is 2.24L/s. The site is proposed to be serviced by a 200mm diameter sanitary service connection to the existing manhole fronting the site. At a slope of 0.5%, the proposed service has a capacity of 23.18L/s. Refer to Appendix A for the sanitary sewer design sheet.

Upon receipt of this report, it is expected that the City will input the anticipated sanitary flow rate of 2.24L/s into their overall model to verify availability of downstream capacity in their system.

2.2 Storm

There is an existing 975mm diameter municipal storm sewer on Erb Street West fronting the site that drains east. The existing sewer is located along the south side of the right-of-way, with catchbasin leads crossing to the north side of the right-of-way. The closest existing storm structure is a side inlet catch basin located at the northeast corner of the property connecting into an existing manhole on the south side of the right-of-way. The existing side inlet catchbasin is approximately 1.5m deep and the existing manhole is approximately 3.2m deep.

A 250mm diameter storm service is proposed to connect to a new SICBMH that will replace the existing SICB on the north side of Erb Street West fronting the site. The 250mm diameter storm service is proposed at a slope of 0.5% with a capacity of 42.0L/s. During the 5-year storm event the proposed development will produce piped stormwater flow of 24.0L/s. Therefore, the

proposed storm service connection will have adequate capacity to convey the flow from the site. Refer to Appendix A for the storm sewer design sheet.

2.3 Water

There is an existing 300mm diameter municipal watermain along Erb Street West fronting the site. The development is proposed to be serviced with a 200mm diameter water service connection to the existing municipal watermain. There is an existing municipal fire hydrant located just west of the site within 45m of the principal entrance to the building. Therefore, a private on-site hydrant is not required.

A preliminary water demand analysis was completed for the proposed building. The proposed building will be of non-combustible construction complete with the installation of an automatic sprinkler system in accordance with the Ontario Building Code, and the building will be fully fire-resistive. The required fire flow under the OBC and FUS is shown in the table below.

Table 2.1 – Required Fire Flow

Guideline	Required Fire Flow (L/s)
OBC	105
FUS	167

A hydrant flow test was completed by FCFP on the existing hydrants fronting the site. The following table illustrates the results of the testing completed.

Table 2.2 – Results of Flow Test Completed (August 24, 2021)

No. of Ports	Outlet Inside Diameter (in)	Pitot Pressure (PSI)	Residual Pressure (PSI)	Flow @ Residual (gal/min)
1	2.5	70	88	1,404
2	2.5	46 / 52	84	2,349

Based on the flow test provided by FCFP it can be concluded that the minimum OBC water supply flow rate of 105L/s can be delivered to the existing municipal hydrant with a residual pressure (at the nozzle of the hydrant) under fire fighting conditions of 593kPa for 105L/s, thus meeting the minimum requirements of the Ontario Building Code (2012). Refer to Appendix A for calculations.

3.0 Stormwater Management

3.1 Criteria

The stormwater management design criteria for the site, as established by the City of Waterloo, are as follows:

- Attenuation of the post-development peak flows for the 2, 5, and 100-year storm events to pre-development (existing) peak flows;
- Implementation of Normal (Level 2) water quality controls; and,
- Implementation of Erosion and Sediment Control measures.

3.2 Methodology

In order to successfully complete the stormwater management design for this site, the following specific tasks were undertaken:

- i) Determined the percent impervious of the site and catchment parameters for inclusion in MIDUSS modelling;
- ii) Calculated post-development runoff hydrographs using MIDUSS NET; and,
- iii) Revised the site grades to attain the required storage for runoff control.

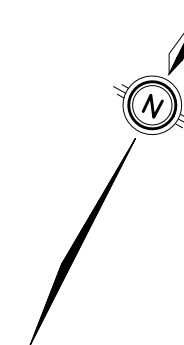
3.3 Catchment Parameters

The following table summarizes the catchments used in the modelling of the site. The post development condition was separated into six catchment areas: the building rooftop, the four controlled area drains, and the uncontrolled area. Figure 1.0 illustrates the limits of the pre-development catchment area. Figure 2.0 illustrates the limits of the post development catchment areas.

Table 3.1 – Catchment Parameters

#	Catchment	Area (ha)	% Impervious	Pervious CN	Impervious CN	Slope (%)	Flow Length (m)
Pre-Development Catchment Area							
101	Total Site	0.276	35	75	98	4.0	60.0
Post-Development Catchment Areas							
201	Building Rooftop	0.082	100	75	98	1.0	15.0
202	Area Drain 1	0.035	100	75	98	1.0	20.0
203	Area Drain 2	0.031	100	75	98	1.0	20.0
204	Area Drain 3	0.031	100	75	98	1.0	20.0
205	Area Drain 4	0.013	100	75	98	1.0	10.0
206	Uncontrolled	0.084	35	75	98	10.0	6.0

A geotechnical investigation was completed by Chung and Vander Doelen Engineering Ltd. in March 2021. The investigation revealed the subsurface stratigraphy is generally comprised of fill underlain by a layer of buried topsoil, followed by fine granular deposits and layers of sand and silt. Therefore, a pervious CN of 75 for grass areas is considered appropriate. Monitoring wells were installed across the site to measure the high groundwater elevation. The investigation revealed the high groundwater elevation to be between 336.60 and 337.25m.



101 — SUB-CATCHMENT
NUMBER

0.276 — AREA (ha.)

Project No.: 46981-100



3.4 Water Quantity – Modelling Results

In order to achieve the stormwater management requirements for the site, runoff from the parking deck will be conveyed to four area drains wherein the flow will be controlled with a 75mm diameter horizontal outlet pipe. Storage volume for the controlled area drains will be on the parking deck. The maximum depth of ponding permitted on the parking deck by grading is 0.15m.

In addition, four flow control roof drains, single notch, are proposed to be installed on the roof of the proposed building. This will help to further reduce the post development runoff from the site.

The following tables illustrates the stage-storage-discharge relationship of the controlled area drains. Refer to Appendix B for the MIDUSS output.

Table 3.2 – Stage-Storage-Discharge Information – Catchment 202-204

Elevation (m)	Head (m)	Orifice Flow (m ³ /s)	Volume (m ³)	Remarks
340.65	0.00	0.000	0.0	75mm diameter horizontal outlet pipe
340.80	0.15	0.005	0.1	Top of grate Area Drains 1-3
340.85	0.20	0.005	0.7	Contour
340.90	0.25	0.006	3.4	Contour
340.95	0.30	0.007	9.7	Max Ponding

Table 3.3 – Stage-Storage-Discharge Information – Catchment 205

Elevation (m)	Head (m)	Orifice Flow (m ³ /s)	Volume (m ³)	Remarks
340.49	0.00	0.000	0.0	75mm diameter horizontal outlet pipe
340.64	0.15	0.005	0.1	Top of grate AD4
340.70	0.20	0.005	0.5	Contour
340.75	0.25	0.006	2.0	Contour
340.80	0.31	0.007	5.8	Max Ponding

With the addition of the controlled area drains, the post development runoff from the controlled portion of the site for the 2, 5 and 100-year storm events is controlled to 0.019m³/s, 0.024m³/s, and 0.031m³/s, respectively. The following table summarizes the flows generated by the whole site.

Table 3.4 – Summary of Flows

	2-Year Storm Event (m ³ /s)	5-Year Storm Event (m ³ /s)	100-Year Storm Event (m ³ /s)
Pre-Development	0.019	0.029	0.060
Post-Development – Controlled	0.019	0.024	0.031
Post-Development – Uncontrolled	0.007	0.012	0.030
Post-Development – Total	0.027	0.035	0.057

The post development runoff rates exceed the pre-development runoff rates in the 2 and 5-year storm events due to the addition of the uncontrolled landscaped areas around the proposed building that cannot be controlled or retained on-site. The flow rates from the controlled portion of the site are below pre-development rates for all storm events.

The high groundwater on the site is driving the elevations of the parking deck to be higher than the surrounding property boundary grades and is limiting the collection and retention of runoff around the perimeter of the building. The controlled parking deck area has been maximized to provide as much storage volume as possible given the grading constraints and the on-site controls have been designed with the smallest allowable orifice plate.

The following table summarizes the maximum ponding depth occurring at each area drain.

Table 3.5 – Summary of Ponding Depths

	5-Year Ponding Elevation (m)	Depth of Ponding (cm)	100-Year Ponding Elevation (m)	Depth of Ponding (cm)
Area Drain 1	340.87	7.0	340.94	14.0
Area Drain 2	340.87	7.0	340.93	13.0
Area Drain 3	340.86	6.0	340.92	12.0
Area Drain 4	340.62	0.0	340.70	6.0

3.5 Water Quality Control

A Stormceptor Model EFO4 will be installed on the storm sewer system to provide water quality control for the site. The chosen unit is expected to provide Enhanced (Level 1) water quality control. Refer to Appendix A for the sizing output for the unit. The OGS will require regular annual maintenance to ensure it is operating properly. The owner will be required to enter into a maintenance agreement with a suitable contractor to complete this work. In addition, all the storm structures will have a 600mm sump.

4.0 Erosion & Sediment Control

In order to minimize the effects of erosion during the grading of the site, sediment control fencing will be installed: as shown on the enclosed engineering drawing, around any stockpiles and around the catchbasins during construction. Any sediment that is tracked onto the road way during the course of construction will be cleaned by the contractor. To help minimize the amount of mud being tracked onto the roadway, a mud mat will be installed at the primary construction entrance.

5.0 Conclusions and Recommendations

Based on the foregoing analysis, it is concluded that:

- i) the sanitary, water, and storm service connections have adequate capacity to service the proposed development;
- ii) the proposed stormwater management design provides adequate attenuation of the 2 through 100-year storm events and provides adequate water quality control; and,
- iii) upon completion of construction, the site will conform to the design criteria specified by the City of Waterloo.

It is recommended that:

- i) the site grading be undertaken according to the proposed elevations, details and erosion control measures shown on the enclosed engineering drawings;
- ii) the stormwater management facilities be installed as detailed on the enclosed engineering drawings; and,
- iii) the stormwater management facilities be inspected by MTE Consultants Inc. during construction and certified to the City of Waterloo upon completion.

All of which is respectfully submitted,

MTE Consultants Inc.

Chelsea Hiebert

Chelsea Dahmer, P.Eng.
Design Engineer
519-743-6500 ext. 1285
cdahmer@mte85.com

CAD:dlb

M:\46981\100\Reports\FSSWM\rpt_2022-02-11_FSSWM.doc



Rebecca Kerr, P.Eng.
Design Engineer
519-743-6500 ext. 1290
rkerr@mte85.com

Appendix A

Calculations

CALCULATIONS

Orifice Equation (MIDUSS NET)

$$Q = C_c \pi/4 D^5 \sqrt{2g(H-2/3D)}$$

where

- C_c - coefficient of contraction
- H - head relative to the invert of the orifice
- D - orifice diameter
- g - gravitational acceleration

310-316 Erb Street West CITY OF WATERLOO				SANITARY SEWER DESIGN SHEET				Design Parameters																					
Project Number: 46981-100 Date: January 20, 2022 Design By: CAH Checked By: File: Q:\46981\100\Sanitary Sewer Design Sheet_2021-11-29.xls				ENGINEERING AND PUBLIC WORKS Drainage Area Plan No:				Average Daily Flow				Mannings "n" 0.013 Residential ##### L/s/c Min. Velocity 0.6 m/sec Commercial 0.95 L/s/ha Max. Velocity 3.0 m/sec Industrial 0.40 L/s/ha Residential Harmon Peaking Factor (F) F = 1 + 14/(4 + P ^{0.5}) Inst. / School 0.25 L/s/ha Commercial Peaking Factor = 2.5 Residential Areas Infiltration 0.25 L/s/ha																	
LOCATION				RESIDENTIAL AREAS AND POPULATION				SCHOOL, INSTITUTIONAL			COMMERCIAL			INDUSTRIAL			INFILTRATION			DESIGN									
STREET	AREA NO.	MANHOLE LOCATION		AREA	No. UNITS @ 1.76 PPU	No. UNITS @ 2.18 PPU	POPUL.	CUMUL POPUL.	PEAK FACTOR "F"	PEAK RES. FLOW	HECTARES AND FLOW OF EACH ZONING									TOTALS- C-1 FLOW	AREA	CUMUL AREA	INFIL FLOW	TOTAL VOLUME FLOW	LENGTH	SLOPE	PIPE SIZE	CAPACITY	FULL FLOW VELOCITY
		FROM MH	TO MH								0.25 L/s/ha			0.95 L/s/ha			0.40 L/s/ha												
		AREA	CUMUL AREA								PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW	AREA	CUMUL AREA	PEAK FLOW												
				ha			1000s	1000s		L/sec	ha	ha	L/sec	ha	ha	L/sec	L/sec	ha	ha	L/sec	L/sec	m	%	mm	L/sec	m/s			
				0.28	93.00		0.164	0.164	4.178514	2.1769								0.28	0.28	0.0690	2.2459	13.3	0.50	200	23.1802	0.738			

310-316 Erb Street West CITY OF WATERLOO				STORM SEWER DESIGN SHEET ENGINEERING AND PUBLIC WORKS				Design Parameters 5 YEAR STORM Q=kAIR, k=0.00277 Manning's "n" 0.013 Intensity (I) = a/(tc+b) ^c Min. Velocity 0.600 m/s a = 1755 Max. Velocity 6.000 m/s b = 12.347 c = 0.895										
Project Number: 46981-100 Date: January 20, 2022 Design By: CAH Checked By: File: Q:\46981\100\Storm Sewer Design Sheet_2022-01-20.xlsx				Drainage Area Plan No:														
LOCATION				STORMWATER FLOW 5 YEAR STORM								DESIGN						
STREET	AREA NUMBER	MANHOLE LOCATION		AREA (A)	RUNOFF COEFF. (C)	A x C	CUMUL. A x C	CONCENTRATION TIME		RAIN INTENSITY (I)	FLOW (Q)	PIPE SIZE	LENGTH	SLOPE	CAPACITY	FULL FLOW VELOCITY		PIPE FULL
		FROM MH	TO MH					TOTAL	IN PIPE							L/s	m/s	
				ha		ha	ha	min	min	mm/hr	L/s	mm	m	%	L/s	m/s	%	
										5 Year flow rate from MIDUSS	24.00000	250	6.3	0.50	42.04989	0.8566	57.08	

PROJECT INFORMATION			
Project Name:	310-316 Erb Street West Flow Test	Const. Project #:	LD-21-085
Site Address:	310-316 Erb Street West Waterloo ON	Design Project #:	2021-FCFP-316
City Contact:	Mona	Phone #:	519886-2310x3027
FCFP Contact:	Dan Smaglinski	Phone #:	226-971-0170
Technical Contact:	Andrew Peach	Phone #:	226-448-3436

SITE INFORMATION

SITE MAP



Note: If the main is a dead end, the flowing hydrant shall be closest to the dead end

ITEMS TO LABEL ON MAP	HYDRANTS USED	MAIN SIZE
☒ Static / Residual & Flow Hydrants	☒ City Hydrant(s)	City: 12"
☐ Flow Direction (if the main is dead end)	☐ Site Hydrant(s)	Site:
SITE NOTES		

TEST INFORMATION							
Minimum Required Flow:	NA				Min Ports:	2	
FCFP Personnel Present:	Dan Smaglinski				Test Date:	2021-08-24	
City / External Company:	City of Waterloo				Test Time:	10:00am	
TEST EQUIPMENT							
☐ Hose Monsters with built in Pitot				Hose length used:			
☐ Hand held pitot gauge				☒ Pollard diffuser elbow with built in Pitot			
☐ Other:							
TEST RESULTS							
Number of Ports	Outlet Size (IN)	Discharge Coefficient	Pitot Reading (PSI)			Total Flow (GPM)	Static / Residual Pressure (PSI)
0 Ports	STATIC						
1 Port	2.5	0.9	70			1,404	88
2 Ports	2.5	0.9	46	52		2,349	84
3 Ports	2.5	0.9				0	80
4 Ports	2.5	0.9				0	
0 Ports	STATIC RE-CHECK						90
TEST NOTES							

HYDRAULIC ADJUSTMENTS (FOR OFFICE USE ONLY)			
ADJUSTMENTS FOR HYDRAULIC GRADE LINE (HGL)			
Reservoir HGL (m):		Site Elevation (m):	
Theoretical Static Head (PSI):	0	PSI to subtract from test pressures:	0
OTHER HYDRAULIC ADJUSTMENTS			
Other adjustment as required by the City / AHJ:			



310-316 Erb Street West

FIRE FLOW ANALYSIS

Waterloo, Ontario

Project Number: 46981-100

Date: January 20, 2022

Design By: CAH

File: Q:\46981\100\Site Fire Flow Analysis_2021-12-01.xlsx

CALCULATION OF RESIDUAL PRESSURE AT ON-SITE HYDRANT

1. Boundary Conditions (Based on Fire Flow Test Results):

	Metric	Imperial	
P0 - Starting Pressure	61.89 m	88 psi	
P1 - Pressure at Q1	59.07 m	84 psi	
Q1 - From Fire Flow Test	8892 L/min	2349 U.S. gal/min	
Q2 - Required Flow	6300 L/min	1664 U.S. gal/min	From: Water Demand calculations by MTE
P-loss 1	2.81 m	4 psi	
P-loss 2	1.49 m	2 psi	
P2 - Residual Pressure	60.40 m	86 psi	Extrapolated from Fire Flow Test Results

2. Friction Losses Through Water Service:

	Metric	Imperial
<u>Hazen-Williams Equation</u>		
C _{hw} = Pipe Friction Factor	150	150
k = conversion factor	10.675	4.727
n = constant	1.852	1.852
m = constant	4.8704	4.8704
Q = Flow	0.105 m ³ /s	1664 U.S. gal/min
d = Pipe Diameter	150 mm	5.91 in
p = Loss/Length	0.1579 m/m	0.0684 psi/ft
Length	0 m	0 ft
Loss	0.00 m	0.0 psi
	0 kPa	

3. Friction Losses Through Apurtenances:

Apurtenances	Number	K	Velocity m/s	Head Loss m	Total Loss m	psi
150mm Tee (run)	0	0.300	5.942	0.540	0.000	0.000
150mm Tee (branch)	0	0.900	5.942	1.619	0.000	0.000
Valve - 150mm dia.	0	0.12	5.942	0.216	0.000	0.000
Elbow - 150mm dia.	0	0.224	5.942	0.403	0.000	0.000
Total Minor Losses					0.000	0.000

4. Elevation - Elevational differences from existing hydrant to proposed hydrant

	Metric	Imperial
Elevation at Boundary (i.e. Residual Hydrant):	0 m	0 ft
Elevation at Site Hydrant:	0 m	0 ft
Elevation Difference = Loss/Gain	0 m	0.0 psi

ANALYSIS SUMMARY

Total Losses	0.000 m		
	0.00 kPa	0.0 psi	
Residual Pressure after Losses	60.40 m		
	593 kPa	85.9 psi	PASS
<i>Allowable Residual Pressure</i>	<i>140 kPa</i>	<i>20.3 psi</i>	

Stormceptor®EF Sizing Report

STORMCEPTOR®

ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

11/30/2021

Province:	Ontario
City:	Waterloo
Nearest Rainfall Station:	WATERLOO WELLINGTON AP
Climate Station Id:	6149387
Years of Rainfall Data:	34

Site Name:	310-316 Erb
------------	-------------

Drainage Area (ha):	0.19
---------------------	------

% Imperviousness:	100.00
-------------------	--------

Runoff Coefficient 'c': 0.90

Particle Size Distribution:	Fine
-----------------------------	------

Target TSS Removal (%):	80.0
-------------------------	------

Required Water Quality Runoff Volume Capture (%):	90.00
---	-------

Estimated Water Quality Flow Rate (L/s):	6.81
--	------

Oil / Fuel Spill Risk Site?	Yes
-----------------------------	-----

Upstream Flow Control?	No
------------------------	----

Peak Conveyance (maximum) Flow Rate (L/s):	
--	--

Site Sediment Transport Rate (kg/ha/yr):	
--	--

Project Name:	310-316 Erb
---------------	-------------

Project Number:	45973
-----------------	-------

Designer Name:	Chelsea Hiebert
----------------	-----------------

Designer Company:	MTE Consultants Inc.
-------------------	----------------------

Designer Email:	chiebert@mte85.com
-----------------	--------------------

Designer Phone:	519-743-6500
-----------------	--------------

EOR Name:	
-----------	--

EOR Company:	
--------------	--

EOR Email:	
------------	--

EOR Phone:	
------------	--

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	88
EFO6	95
EFO8	98
EFO10	99
EFO12	100

Recommended Stormceptor EFO Model: **EFO4**

Estimated Net Annual Sediment (TSS) Load Reduction (%): **88**

Water Quality Runoff Volume Capture (%): **> 90**

Stormceptor® EF Sizing Report

THIRD-PARTY TESTING AND VERIFICATION

► **Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

► **Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

► The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

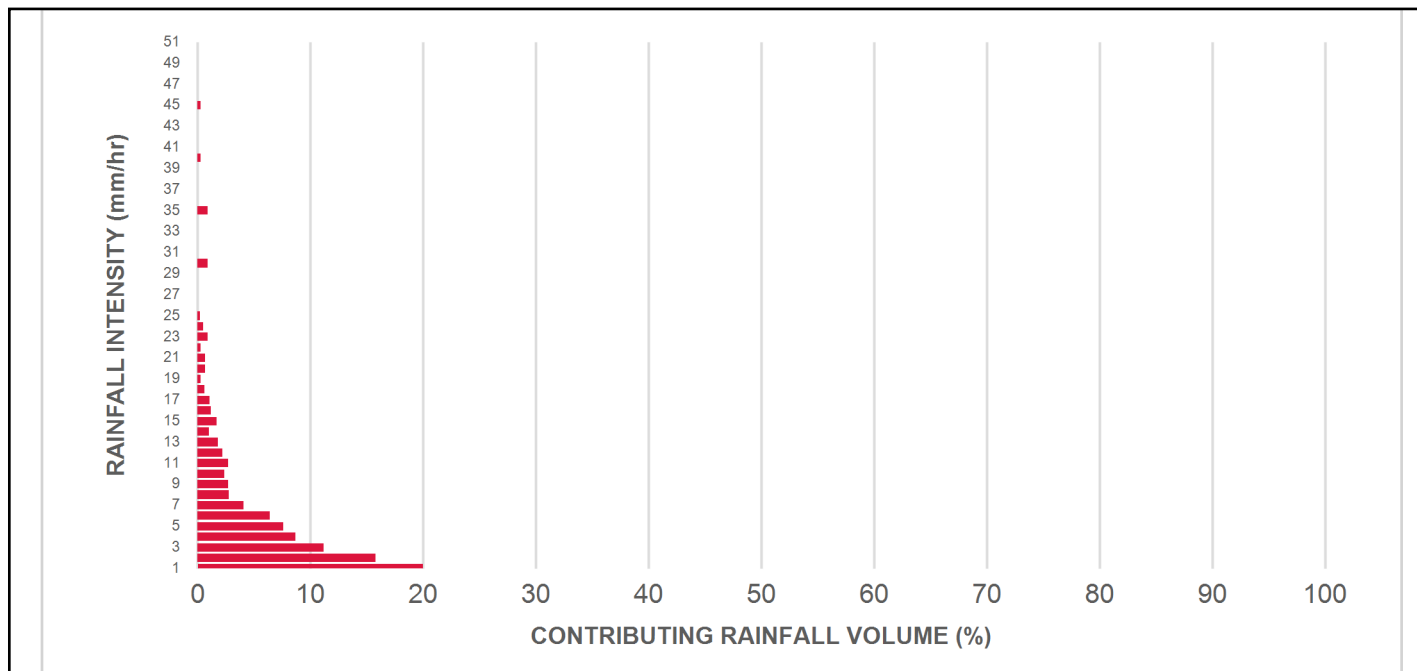
Stormceptor®EF Sizing Report

Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	20.0	20.0	0.48	29.0	24.0	100	20.0	20.0
2	15.8	35.8	0.95	57.0	48.0	100	15.8	35.8
3	11.2	47.0	1.43	86.0	71.0	94	10.5	46.2
4	8.7	55.7	1.90	114.0	95.0	90	7.9	54.1
5	7.6	63.3	2.38	143.0	119.0	88	6.7	60.8
6	6.4	69.7	2.85	171.0	143.0	84	5.4	66.2
7	4.1	73.8	3.33	200.0	166.0	82	3.4	69.6
8	2.8	76.7	3.80	228.0	190.0	78	2.2	71.8
9	2.7	79.4	4.28	257.0	214.0	77	2.1	73.9
10	2.4	81.7	4.75	285.0	238.0	76	1.8	75.7
11	2.7	84.5	5.23	314.0	261.0	75	2.0	77.7
12	2.2	86.7	5.70	342.0	285.0	74	1.6	79.3
13	1.8	88.4	6.18	371.0	309.0	73	1.3	80.6
14	1.0	89.5	6.66	399.0	333.0	72	0.7	81.4
15	1.7	91.2	7.13	428.0	357.0	71	1.2	82.6
16	1.2	92.3	7.61	456.0	380.0	69	0.8	83.4
17	1.1	93.5	8.08	485.0	404.0	69	0.8	84.2
18	0.6	94.1	8.56	513.0	428.0	68	0.4	84.6
19	0.3	94.3	9.03	542.0	452.0	66	0.2	84.8
20	0.7	95.0	9.51	570.0	475.0	66	0.4	85.2
21	0.7	95.7	9.98	599.0	499.0	64	0.5	85.6
22	0.3	96.0	10.46	628.0	523.0	63	0.2	85.8
23	0.9	96.9	10.93	656.0	547.0	63	0.6	86.4
24	0.5	97.4	11.41	685.0	570.0	61	0.3	86.7
25	0.2	97.6	11.88	713.0	594.0	60	0.1	86.8
30	0.9	98.5	14.26	856.0	713.0	59	0.6	87.4
35	0.9	99.4	16.64	998.0	832.0	58	0.5	87.9
40	0.3	99.7	19.02	1141.0	951.0	58	0.1	88.0
45	0.3	100.0	21.39	1284.0	1070.0	56	0.2	88.2
50	0.0	100.0	23.77	1426.0	1188.0	53	0.0	88.2
Estimated Net Annual Sediment (TSS) Load Reduction =								88 %

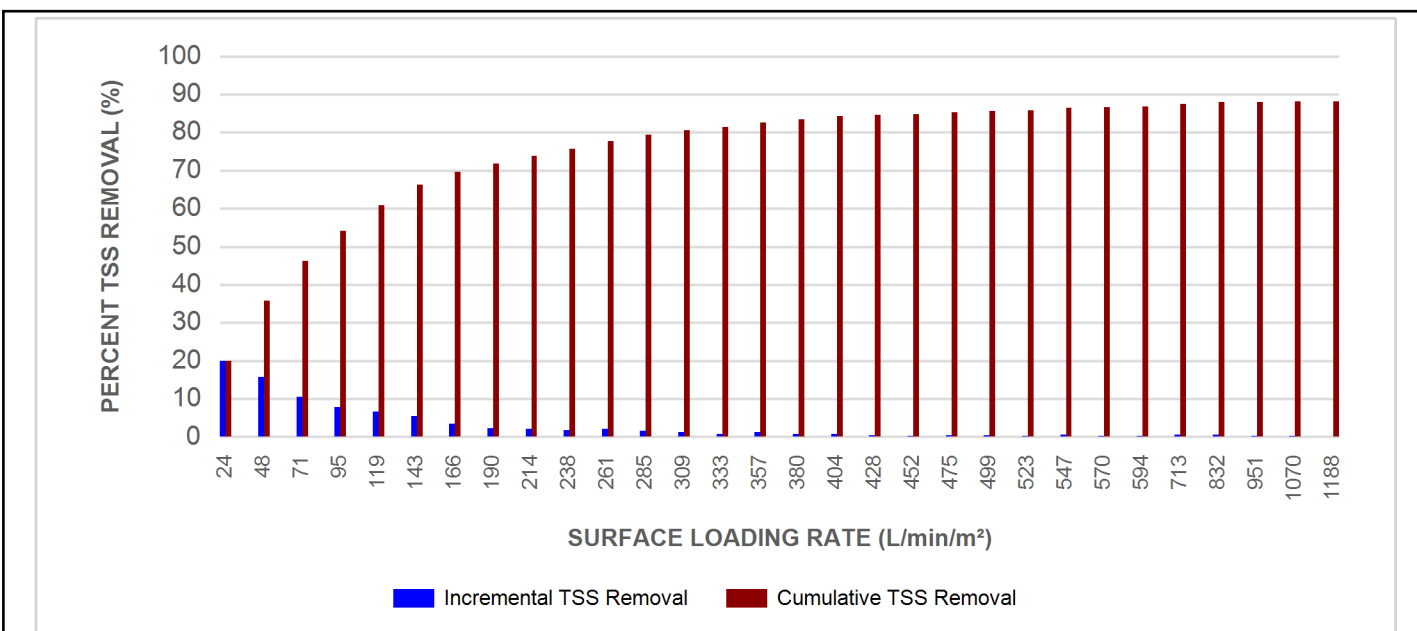
Climate Station ID: 6149387 Years of Rainfall Data: 34

Stormceptor®EF Sizing Report

RAINFALL DATA FROM WATERLOO WELLINGTON AP RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Stormceptor® EF Sizing Report

Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

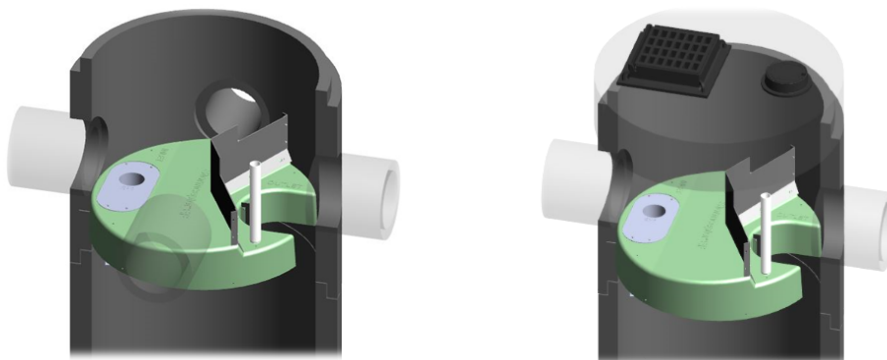
► **Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

DESIGN FLEXIBILITY

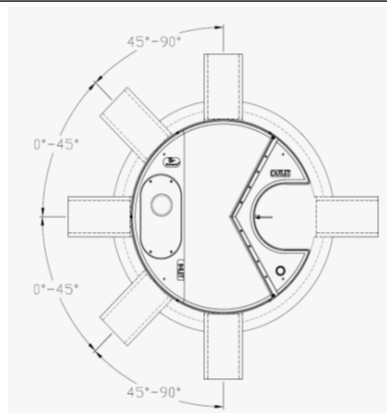
► **Stormceptor® EF and EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

► While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.



Stormceptor® EF Sizing Report



INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1.

For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit <http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef>

Stormceptor®EF Sizing Report

STANDARD PERFORMANCE SPECIFICATION FOR “OIL GRIT SEPARATOR” (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program’s **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m ³ sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m ³ sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m ³ sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m ³ sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m ³ sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall

Stormceptor®EF Sizing Report

remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m².

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators**, with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m² to 2600 L/min/m²) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**. However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Appendix B

MIDUSS Output

Pre-Development

```

1 "          MIDUSS Output ----->"
2 "          MIDUSS version                      Version 2.25  rev. 473"
3 "          MIDUSS created                      Sunday, February 7, 2010"
4 "          10  Units used:                      ie METRIC"
5 "          Job folder:                          Q:\46981\100\November 2021"
6 "          Output filename:                      2 yr pre.out"
7 "          Licensee name:                      admin"
8 "          Company                              "
9 "          Date & Time last used:                12/1/2021 at 5:51:25 PM"
10 " 31      TIME PARAMETERS"
11 "          5.000  Time Step"
12 "          180.000 Max. Storm length"
13 "          1500.000 Max. Hydrograph"
14 " 32      STORM Chicago storm"
15 "          1  Chicago storm"
16 "          1101.000 Coefficient A"
17 "          9.258  Constant B"
18 "          0.882  Exponent C"
19 "          0.400  Fraction R"
20 "          180.000 Duration"
21 "          1.000  Time step multiplier"
22 "          Maximum intensity          105.659  mm/hr"
23 "          Total depth                32.400  mm"
24 "          6  002hyd  Hydrograph extension used in this file"
25 " 33      CATCHMENT 101"
26 "          1  Triangular SCS"
27 "          1  Equal length"
28 "          1  SCS method"
29 "          101  Total Site"
30 "          35.000  % Impervious"
31 "          0.276  Total Area"
32 "          60.000  Flow length"
33 "          4.000  Overland Slope"
34 "          0.179  Pervious Area"
35 "          60.000  Pervious length"
36 "          4.000  Pervious slope"
37 "          0.097  Impervious Area"
38 "          60.000  Impervious length"
39 "          4.000  Impervious slope"
40 "          0.250  Pervious Manning 'n'"
41 "          75.000  Pervious SCS Curve No."
42 "          0.163  Pervious Runoff coefficient"
43 "          0.100  Pervious Ia/S coefficient"
44 "          8.467  Pervious Initial abstraction"
45 "          0.015  Impervious Manning 'n'"
46 "          98.000  Impervious SCS Curve No."
47 "          0.830  Impervious Runoff coefficient"
48 "          0.100  Impervious Ia/S coefficient"
49 "          0.518  Impervious Initial abstraction"
50 "          0.019  0.000  0.000  0.000 c.m/sec"
51 "          Catchment 101  Pervious  Impervious  Total Area  "
52 "          Surface Area  0.179  0.097  0.276  hectare"
53 "          Time of concentration  34.483  2.766  11.230  minutes"
54 "          Time to Centroid  140.478  90.470  103.814  minutes"
55 "          Rainfall depth  32.400  32.400  32.400  mm"
56 "          Rainfall volume  58.13  31.30  89.42  c.m"
57 "          Rainfall losses  27.129  5.506  19.561  mm"
58 "          Runoff depth  5.271  26.895  12.839  mm"
59 "          Runoff volume  9.46  25.98  35.44  c.m"
60 "          Runoff coefficient  0.163  0.830  0.396  "
61 "          Maximum flow  0.002  0.019  0.019  c.m/sec"
62 " 40      HYDROGRAPH Add Runoff  "
63 "          4  Add Runoff  "
64 "          0.019  0.019  0.000  0.000"
65 " 38      START/RE-START TOTALS 101"
66 "          3  Runoff Totals on EXIT"
67 "          Total Catchment area  0.276  hectare"
68 "          Total Impervious area  0.097  hectare"
69 "          Total % impervious  35.000"
70 " 19      EXIT"
    
```

```

1 "          MIDUSS Output ----->"
2 "          MIDUSS version                      Version 2.25  rev. 473"
3 "          MIDUSS created                      Sunday, February 7, 2010"
4 "          10 Units used:                      ie METRIC"
5 "          Job folder:                        Q:\46981\100"
6 "          Output filename:                    5 yr pre.out"
7 "          Licensee name:                      admin"
8 "          Company                            Microsoft"
9 "          Date & Time last used:              1/13/2020 at 5:27:06 PM"
10 " 31      TIME PARAMETERS"
11 "          5.000 Time Step"
12 "          180.000 Max. Storm length"
13 "          1500.000 Max. Hydrograph"
14 " 32      STORM Chicago storm"
15 "          1 Chicago storm"
16 "          1755.000 Coefficient A"
17 "          12.347 Constant B"
18 "          0.895 Exponent C"
19 "          0.400 Fraction R"
20 "          180.000 Duration"
21 "          1.000 Time step multiplier"
22 "          Maximum intensity          136.512 mm/hr"
23 "          Total depth                47.549 mm"
24 "          6 005hyd Hydrograph extension used in this file"
25 " 33      CATCHMENT 101"
26 "          1 Triangular SCS"
27 "          1 Equal length"
28 "          1 SCS method"
29 "          101 Total Site"
30 "          35.000 % Impervious"
31 "          0.276 Total Area"
32 "          60.000 Flow length"
33 "          4.000 Overland Slope"
34 "          0.179 Pervious Area"
35 "          60.000 Pervious length"
36 "          4.000 Pervious slope"
37 "          0.097 Impervious Area"
38 "          60.000 Impervious length"
39 "          4.000 Impervious slope"
40 "          0.250 Pervious Manning 'n'"
41 "          75.000 Pervious SCS Curve No."
42 "          0.259 Pervious Runoff coefficient"
43 "          0.100 Pervious Ia/S coefficient"
44 "          8.467 Pervious Initial abstraction"
45 "          0.015 Impervious Manning 'n'"
46 "          98.000 Impervious SCS Curve No."
47 "          0.875 Impervious Runoff coefficient"
48 "          0.100 Impervious Ia/S coefficient"
49 "          0.518 Impervious Initial abstraction"
50 "          0.029 0.000 0.000 0.000 c.m/sec"
51 "          Catchment 101 Pervious Impervious Total Area "
52 "          Surface Area 0.179 0.097 0.276 hectare"
53 "          Time of concentration 23.677 2.457 9.990 minutes"
54 "          Time to Centroid 126.786 89.347 102.638 minutes"
55 "          Rainfall depth 47.549 47.549 47.549 mm"
56 "          Rainfall volume 85.30 45.93 131.24 c.m"
57 "          Rainfall losses 35.218 5.940 24.971 mm"
58 "          Runoff depth 12.331 41.609 22.578 mm"
59 "          Runoff volume 22.12 40.19 62.32 c.m"
60 "          Runoff coefficient 0.259 0.875 0.475 "
61 "          Maximum flow 0.007 0.028 0.029 c.m/sec"
62 " 40      HYDROGRAPH Add Runoff "
63 "          4 Add Runoff "
64 "          0.029 0.029 0.000 0.000"
65 " 38      START/RE-START TOTALS 101"
66 "          3 Runoff Totals on EXIT"
67 "          Total Catchment area 0.276 hectare"
68 "          Total Impervious area 0.097 hectare"
69 "          Total % impervious 35.000"
70 " 19      EXIT"
    
```

```

1 "          MIDUSS Output ----->"
2 "          MIDUSS version                      Version 2.25  rev. 473"
3 "          MIDUSS created                      Sunday, February 7, 2010"
4 "          10 Units used:                      ie METRIC"
5 "          Job folder:                        Q:\46981\100"
6 "          Output filename:                    100 yr pre.out"
7 "          Licensee name:                      admin"
8 "          Company                            Microsoft"
9 "          Date & Time last used:              1/23/2020 at 9:22:59 AM"
10 " 31      TIME PARAMETERS"
11 "          5.000 Time Step"
12 "          180.000 Max. Storm length"
13 "          1500.000 Max. Hydrograph"
14 " 32      STORM Chicago storm"
15 "          1 Chicago storm"
16 "          4692.000 Coefficient A"
17 "          17.437 Constant B"
18 "          0.962 Exponent C"
19 "          0.400 Fraction R"
20 "          180.000 Duration"
21 "          1.000 Time step multiplier"
22 "          Maximum intensity                235.066 mm/hr"
23 "          Total depth                      86.968 mm"
24 "          6 100hyd Hydrograph extension used in this file"
25 " 33      CATCHMENT 101"
26 "          1 Triangular SCS"
27 "          1 Equal length"
28 "          1 SCS method"
29 "          101 Total Site"
30 "          35.000 % Impervious"
31 "          0.276 Total Area"
32 "          60.000 Flow length"
33 "          4.000 Overland Slope"
34 "          0.179 Pervious Area"
35 "          60.000 Pervious length"
36 "          4.000 Pervious slope"
37 "          0.097 Impervious Area"
38 "          60.000 Impervious length"
39 "          4.000 Impervious slope"
40 "          0.250 Pervious Manning 'n'"
41 "          75.000 Pervious SCS Curve No."
42 "          0.433 Pervious Runoff coefficient"
43 "          0.100 Pervious Ia/S coefficient"
44 "          8.467 Pervious Initial abstraction"
45 "          0.015 Impervious Manning 'n'"
46 "          98.000 Impervious SCS Curve No."
47 "          0.925 Impervious Runoff coefficient"
48 "          0.100 Impervious Ia/S coefficient"
49 "          0.518 Impervious Initial abstraction"
50 "          0.060 0.000 0.000 0.000 c.m/sec"
51 "          Catchment 101 Pervious Impervious Total Area "
52 "          Surface Area 0.179 0.097 0.276 hectare"
53 "          Time of concentration 14.657 1.953 7.863 minutes"
54 "          Time to Centroid 111.338 86.626 98.122 minutes"
55 "          Rainfall depth 86.968 86.968 86.968 mm"
56 "          Rainfall volume 156.02 84.01 240.03 c.m"
57 "          Rainfall losses 49.294 6.531 34.327 mm"
58 "          Runoff depth 37.674 80.437 52.641 mm"
59 "          Runoff volume 67.59 77.70 145.29 c.m"
60 "          Runoff coefficient 0.433 0.925 0.605 "
61 "          Maximum flow 0.030 0.052 0.060 c.m/sec"
62 " 40      HYDROGRAPH Add Runoff "
63 "          4 Add Runoff "
64 "          0.060 0.060 0.000 0.000"
65 " 38      START/RE-START TOTALS 101"
66 "          3 Runoff Totals on EXIT"
67 "          Total Catchment area 0.276 hectare"
68 "          Total Impervious area 0.097 hectare"
69 "          Total % impervious 35.000"
70 " 19      EXIT"
    
```

Post-Development

```

1 " MIDUSS Output ----->"
2 " MIDUSS version Version 2.25 rev. 473"
3 " MIDUSS created Sunday, February 7, 2010"
4 " 10 Units used: ie METRIC"
5 " Job folder: Q:\46981\100\November 2021"
6 " Output filename: 2 yr post b.out"
7 " Licensee name: admin"
8 " Company "
9 " Date & Time last used: 2/9/2022 at 9:23:08 AM"
10 " 31 TIME PARAMETERS"
11 " 5.000 Time Step"
12 " 180.000 Max. Storm length"
13 " 1500.000 Max. Hydrograph"
14 " 32 STORM Chicago storm"
15 " 1 Chicago storm"
16 " 1101.000 Coefficient A"
17 " 9.258 Constant B"
18 " 0.882 Exponent C"
19 " 0.400 Fraction R"
20 " 180.000 Duration"
21 " 1.000 Time step multiplier"
22 " Maximum intensity 105.659 mm/hr"
23 " Total depth 32.400 mm"
24 " 6 002hyd Hydrograph extension used in this file"
25 " 33 CATCHMENT 201"
26 " 1 Triangular SCS"
27 " 1 Equal length"
28 " 1 SCS method"
29 " 201 Buildig rooftop"
30 " 100.000 % Impervious"
31 " 0.082 Total Area"
32 " 15.000 Flow length"
33 " 1.000 Overland Slope"
34 " 0.000 Pervious Area"
35 " 15.000 Pervious length"
36 " 1.000 Pervious slope"
37 " 0.082 Impervious Area"
38 " 15.000 Impervious length"
39 " 1.000 Impervious slope"
40 " 0.250 Pervious Manning 'n'"
41 " 75.000 Pervious SCS Curve No."
42 " 0.000 Pervious Runoff coefficient"
43 " 0.100 Pervious Ia/S coefficient"
44 " 8.467 Pervious Initial abstraction"
45 " 0.015 Impervious Manning 'n'"
46 " 98.000 Impervious SCS Curve No."
47 " 0.836 Impervious Runoff coefficient"
48 " 0.100 Impervious Ia/S coefficient"
49 " 0.518 Impervious Initial abstraction"
50 " 0.018 0.000 0.000 0.000 c.m/sec"
51 " Catchment 201 Pervious Impervious Total Area "
52 " Surface Area 0.000 0.082 0.082 hectare"
53 " Time of concentration 22.750 1.825 1.825 minutes"
54 " Time to Centroid 126.751 89.010 89.010 minutes"
55 " Rainfall depth 32.400 32.400 32.400 mm"
56 " Rainfall volume 0.00 26.57 26.57 c.m"
57 " Rainfall losses 27.132 5.322 5.322 mm"
58 " Runoff depth 5.268 27.078 27.078 mm"
59 " Runoff volume 0.00 22.20 22.20 c.m"
60 " Runoff coefficient 0.000 0.836 0.836 "
61 " Maximum flow 0.000 0.018 0.018 c.m/sec"
62 " 40 HYDROGRAPH Add Runoff "
63 " 4 Add Runoff "
64 " 0.018 0.018 0.000 0.000"
65 " 54 POND DESIGN"
66 " 0.018 Current peak flow c.m/sec"
67 " 0.013 Target outflow c.m/sec"
68 " 22.2 Hydrograph volume c.m"
69 " 11. Number of stages"
70 " 0.000 Minimum water level metre"
71 " 0.150 Maximum water level metre"
    
```

```

72 " 0.000 Starting water level metre"
73 " 0 Keep Design Data: 1 = True; 0 = False"
74 " Level Discharge Volume"
75 " 0.000 0.000 0.000"
76 " 0.01500 0.00090 0.1860"
77 " 0.03000 0.00180 1.488"
78 " 0.04500 0.00270 5.022"
79 " 0.06000 0.00360 11.904"
80 " 0.07500 0.00450 21.189"
81 " 0.09000 0.00540 30.489"
82 " 0.1050 0.00630 39.789"
83 " 0.1200 0.00720 49.089"
84 " 0.1350 0.00810 58.389"
85 " 0.1500 0.00900 67.689"
86 " 1. ROOFTOP"
87 " Roof area Store area Area/drain Drain flow Roof slope"
88 " hectare hectare sq.metre L/min/25mm g H:1V"
89 " 0.082 0.062 150.000 22.500 100.000"
90 " Using 4 roofdrains on roofstorage area of 620. square metre"
91 " Peak outflow 0.004 c.m/sec"
92 " Maximum level 0.059 metre"
93 " Maximum storage 11.231 c.m"
94 " Centroidal lag 2.075 hours"
95 " 0.018 0.018 0.004 0.000 c.m/sec"
96 " 40 HYDROGRAPH Combine 1"
97 " 6 Combine "
98 " 1 Node #"
99 " Total Site"
100 " Maximum flow 0.004 c.m/sec"
101 " Hydrograph volume 22.205 c.m"
102 " 0.018 0.018 0.004 0.004"
103 " 40 HYDROGRAPH Start - New Tributary"
104 " 2 Start - New Tributary"
105 " 0.018 0.000 0.004 0.004"
106 " 33 CATCHMENT 202"
107 " 1 Triangular SCS"
108 " 1 Equal length"
109 " 1 SCS method"
110 " 202 Area Drain 1"
111 " 100.000 % Impervious"
112 " 0.035 Total Area"
113 " 20.000 Flow length"
114 " 1.000 Overland Slope"
115 " 0.000 Pervious Area"
116 " 20.000 Pervious length"
117 " 1.000 Pervious slope"
118 " 0.035 Impervious Area"
119 " 20.000 Impervious length"
120 " 1.000 Impervious slope"
121 " 0.250 Pervious Manning 'n'"
122 " 75.000 Pervious SCS Curve No."
123 " 0.000 Pervious Runoff coefficient"
124 " 0.100 Pervious Ia/S coefficient"
125 " 8.467 Pervious Initial abstraction"
126 " 0.015 Impervious Manning 'n'"
127 " 98.000 Impervious SCS Curve No."
128 " 0.834 Impervious Runoff coefficient"
129 " 0.100 Impervious Ia/S coefficient"
130 " 0.518 Impervious Initial abstraction"
131 " 0.007 0.000 0.004 0.004 c.m/sec"
132 " Catchment 202 Pervious Impervious Total Area "
133 " Surface Area 0.000 0.035 0.035 hectare"
134 " Time of concentration 27.037 2.169 2.169 minutes"
135 " Time to Centroid 131.754 89.525 89.525 minutes"
136 " Rainfall depth 32.400 32.400 32.400 mm"
137 " Rainfall volume 0.00 11.34 11.34 c.m"
138 " Rainfall losses 27.128 5.390 5.390 mm"
139 " Runoff depth 5.272 27.010 27.010 mm"
140 " Runoff volume 0.00 9.45 9.45 c.m"
141 " Runoff coefficient 0.000 0.834 0.834 "
142 " Maximum flow 0.000 0.007 0.007 c.m/sec"
    
```

143 " 40 HYDROGRAPH Add Runoff "

144 " 4 Add Runoff " 0.007 0.007 0.004 0.004"

145 " 54 POND DESIGN"

146 " 0.007 Current peak flow c.m/sec"

147 " 0.013 Target outflow c.m/sec"

148 " 9.5 Hydrograph volume c.m"

149 " 5. Number of stages"

150 " 340.650 Minimum water level metre"

151 " 340.950 Maximum water level metre"

152 " 340.650 Starting water level metre"

153 " 0 Keep Design Data: 1 = True; 0 = False"

154 " Level Discharge Volume"

155 " 340.650 0.000 0.000"

156 " 340.800 0.00478 0.07500"

157 " 340.850 0.00552 0.7700"

158 " 340.900 0.00617 3.630"

159 " 340.950 0.00676 10.300"

160 " 1. HOR. ORIFICES"

161 " Orifice Orifice Orifice Number of"

162 " invert coefficient diameter orifices"

163 " 340.650 0.630 0.0750 1.000"

164 " Peak outflow 0.005 c.m/sec"

165 " Maximum level 340.848 metre"

166 " Maximum storage 0.736 c.m"

167 " Centroidal lag 1.512 hours"

168 " 0.007 0.005 0.004 c.m/sec"

169 " 40 HYDROGRAPH Combine 1"

170 " 6 Combine "

171 " 1 Node #"

172 " Total Site"

173 " Maximum flow 0.009 c.m/sec"

174 " Hydrograph volume 31.202 c.m"

175 " 0.007 0.007 0.005 0.009"

176 " 40 HYDROGRAPH Start - New Tributary"

177 " 2 Start - New Tributary"

178 " 0.007 0.000 0.005 0.009"

179 " 33 CATCHMENT 203"

180 " 1 Triangular SCS"

181 " 1 Equal length"

182 " 1 SCS method"

183 " 203 Area Drain 2"

184 " 100.000 % Impervious"

185 " 0.031 Total Area"

186 " 20.000 Flow length"

187 " 1.000 Overland Slope"

188 " 0.000 Pervious Area"

189 " 20.000 Pervious length"

190 " 1.000 Pervious slope"

191 " 0.031 Impervious Area"

192 " 20.000 Impervious length"

193 " 1.000 Impervious slope"

194 " 0.250 Pervious Manning 'n'"

195 " 75.000 Pervious SCS Curve No."

196 " 0.000 Pervious Runoff coefficient"

197 " 0.100 Pervious Ia/S coefficient"

198 " 8.467 Pervious Initial abstraction"

199 " 0.015 Impervious Manning 'n'"

200 " 98.000 Impervious SCS Curve No."

201 " 0.834 Impervious Runoff coefficient"

202 " 0.100 Impervious Ia/S coefficient"

203 " 0.518 Impervious Initial abstraction"

204 " 0.007 0.000 0.005 0.009 c.m/sec"

205 " Catchment 203 Pervious Impervious Total Area "

206 " Surface Area 0.000 0.031 0.031 hectare"

207 " Time of concentration 27.037 2.169 2.169 minutes"

208 " Time to Centroid 131.754 89.525 89.525 minutes"

209 " Rainfall depth 32.400 32.400 32.400 mm"

210 " Rainfall volume 0.00 10.04 10.04 c.m"

211 " Rainfall losses 27.128 5.390 5.390 mm"

212 " Runoff depth 5.272 27.010 27.010 mm"

214 " Runoff volume 0.00 8.37 8.37 c.m"

215 " Runoff coefficient 0.000 0.834 0.834 "

216 " Maximum flow 0.000 0.007 0.007 c.m/sec"

217 " 40 HYDROGRAPH Add Runoff "

218 " 4 Add Runoff " 0.007 0.007 0.005 0.009"

219 " 54 POND DESIGN"

220 " 0.007 Current peak flow c.m/sec"

221 " 0.013 Target outflow c.m/sec"

222 " 8.4 Hydrograph volume c.m"

223 " 5. Number of stages"

224 " 340.650 Minimum water level metre"

225 " 340.950 Maximum water level metre"

226 " 340.650 Starting water level metre"

227 " 0 Keep Design Data: 1 = True; 0 = False"

228 " Level Discharge Volume"

229 " 340.650 0.000 0.000"

230 " 340.800 0.00478 0.07500"

231 " 340.850 0.00552 0.7000"

232 " 340.900 0.00617 3.400"

233 " 340.950 0.00676 9.680"

234 " 1. HOR. ORIFICES"

235 " Orifice Orifice Orifice Number of"

236 " invert coefficient diameter orifices"

237 " 340.650 0.630 0.0750 1.000"

238 " Peak outflow 0.005 c.m/sec"

239 " Maximum level 340.832 metre"

240 " Maximum storage 0.477 c.m"

241 " Centroidal lag 1.505 hours"

242 " 0.007 0.007 0.005 0.009 c.m/sec"

243 " 40 HYDROGRAPH Combine 1"

244 " 6 Combine "

245 " 1 Node #"

246 " Total Site"

247 " Maximum flow 0.014 c.m/sec"

248 " Hydrograph volume 39.737 c.m"

249 " 0.007 0.007 0.005 0.014"

250 " 40 HYDROGRAPH Start - New Tributary"

251 " 2 Start - New Tributary"

252 " 0.007 0.000 0.005 0.014"

253 " 33 CATCHMENT 204"

254 " 1 Triangular SCS"

255 " 1 Equal length"

256 " 1 SCS method"

257 " 204 Area Drain 3"

258 " 100.000 % Impervious"

259 " 0.031 Total Area"

260 " 20.000 Flow length"

261 " 1.000 Overland Slope"

262 " 0.000 Pervious Area"

263 " 20.000 Pervious length"

264 " 1.000 Pervious slope"

265 " 0.031 Impervious Area"

266 " 20.000 Impervious length"

267 " 1.000 Impervious slope"

268 " 0.250 Pervious Manning 'n'"

269 " 75.000 Pervious SCS Curve No."

270 " 0.000 Pervious Runoff coefficient"

271 " 0.100 Pervious Ia/S coefficient"

272 " 8.467 Pervious Initial abstraction"

273 " 0.015 Impervious Manning 'n'"

274 " 98.000 Impervious SCS Curve No."

275 " 0.834 Impervious Runoff coefficient"

276 " 0.100 Impervious Ia/S coefficient"

277 " 0.518 Impervious Initial abstraction"

278 " 0.007 0.000 0.005 0.014 c.m/sec"

279 " Catchment 204 Pervious Impervious Total Area "

280 " Surface Area 0.000 0.031 0.031 hectare"

281 " Time of concentration 27.037 2.169 2.169 minutes"

282 " Time to Centroid 131.754 89.525 89.525 minutes"

283 " Rainfall depth 32.400 32.400 32.400 mm"

284 "

285 "		Rainfall volume	0.00	10.04	10.04	c.m"
286 "		Rainfall losses	27.128	5.390	5.390	mm"
287 "		Runoff depth	5.272	27.010	27.010	mm"
288 "		Runoff volume	0.00	8.37	8.37	c.m"
289 "		Runoff coefficient	0.000	0.834	0.834	"
290 "		Maximum flow	0.000	0.007	0.007	c.m/sec"
291 " 40		HYDROGRAPH Add Runoff "				
292 "	4	Add Runoff "	0.007	0.005	0.014"	
293 "						
294 " 54		POND DESIGN"				
295 "	0.007	Current peak flow	c.m/sec"			
296 "	0.013	Target outflow	c.m/sec"			
297 "	8.4	Hydrograph volume	c.m"			
298 "	5.	Number of stages"				
299 "	340.650	Minimum water level	metre"			
300 "	340.950	Maximum water level	metre"			
301 "	340.650	Starting water level	metre"			
302 "	0	Keep Design Data: 1 = True; 0 = False"				
303 "		Level Discharge	Volume"			
304 "	340.650	0.000	0.000"			
305 "	340.800	0.00478	0.07500"			
306 "	340.850	0.00552	0.7500"			
307 "	340.900	0.00617	3.890"			
308 "	340.950	0.00676	11.590"			
309 "	1.	HOR. ORIFICES"				
310 "		Orifice Orifice	Orifice Number of"			
311 "		invert coefficie	diameter orifices"			
312 "	340.650	0.630	0.0750	1.000"		
313 "		Peak outflow	0.005	c.m/sec"		
314 "		Maximum level	340.830	metre"		
315 "		Maximum storage	0.484	c.m"		
316 "		Centroidal lag	1.505	hours"		
317 "	0.007	0.007	0.005	0.014 c.m/sec"		
318 " 40		HYDROGRAPH Combine	1"			
319 "	6	Combine "				
320 "	1	Node #"				
321 "		Total Site"				
322 "		Maximum flow	0.017	c.m/sec"		
323 "		Hydrograph volume	48.218	c.m"		
324 "		0.007	0.007	0.005	0.017"	
325 " 40		HYDROGRAPH Start - New Tributary"				
326 "	2	Start - New Tributary"				
327 "		0.007	0.000	0.005	0.017"	
328 " 33		CATCHMENT 205"				
329 "	1	Triangular SCS"				
330 "	1	Equal length"				
331 "	1	SCS method"				
332 "	205	Area Drain 4"				
333 "	100.000	% Impervious"				
334 "	0.013	Total Area"				
335 "	10.000	Flow length"				
336 "	1.000	Overland Slope"				
337 "	0.000	Pervious Area"				
338 "	10.000	Pervious length"				
339 "	1.000	Pervious slope"				
340 "	0.013	Impervious Area"				
341 "	10.000	Impervious length"				
342 "	1.000	Impervious slope"				
343 "	0.250	Pervious Manning 'n'"				
344 "	75.000	Pervious SCS Curve No."				
345 "	0.000	Pervious Runoff coefficient"				
346 "	0.100	Pervious Ia/S coefficient"				
347 "	8.467	Pervious Initial abstraction"				
348 "	0.015	Impervious Manning 'n'"				
349 "	98.000	Impervious SCS Curve No."				
350 "	0.833	Impervious Runoff coefficient"				
351 "	0.100	Impervious Ia/S coefficient"				
352 "	0.518	Impervious Initial abstraction"				
353 "		0.003	0.000	0.005	0.017 c.m/sec"	
354 "		Catchment 205	Pervious	Impervious	Total Area "	
355 "		Surface Area	0.000	0.013	0.013	hectare"

356 "		Time of concentration	17.838	1.431	1.431	minutes"
357 "		Time to Centroid	120.976	88.398	88.398	minutes"
358 "		Rainfall depth	32.400	32.400	32.400	mm"
359 "		Rainfall volume	0.00	4.21	4.21	c.m"
360 "		Rainfall losses	27.131	5.418	5.418	mm"
361 "		Runoff depth	5.270	26.983	26.983	mm"
362 "		Runoff volume	0.00	3.51	3.51	c.m"
363 "		Runoff coefficient	0.000	0.833	0.833	"
364 "		Maximum flow	0.000	0.003	0.003	c.m/sec"
365 " 40		HYDROGRAPH Add Runoff "				
366 "						
367 "	4	Add Runoff "	0.003	0.003	0.005	0.017"
368 " 54		POND DESIGN"				
369 "	0.003	Current peak flow	c.m/sec"			
370 "	0.013	Target outflow	c.m/sec"			
371 "	3.5	Hydrograph volume	c.m"			
372 "	5.	Number of stages"				
373 "	340.490	Minimum water level	metre"			
374 "	340.800	Maximum water level	metre"			
375 "	340.490	Starting water level	metre"			
376 "	0	Keep Design Data: 1 = True; 0 = False"				
377 "		Level Discharge	Volume"			
378 "	340.490	0.000	0.000"			
379 "	340.640	0.00479	0.07500"			
380 "	340.700	0.00566	0.4800"			
381 "	340.750	0.00630	1.990"			
382 "	340.800	0.00687	5.850"			
383 "	1.	HOR. ORIFICES"				
384 "		Orifice Orifice	Orifice Number of"			
385 "		invert coefficie	diameter orifices"			
386 "	340.490	0.630	0.0750	1.000"		
387 "		Peak outflow	0.003	c.m/sec"		
388 "		Maximum level	340.579	metre"		
389 "		Maximum storage	0.045	c.m"		
390 "		Centroidal lag	1.478	hours"		
391 "	0.003	0.003	0.003	0.017 c.m/sec"		
392 " 40		HYDROGRAPH Combine	1"			
393 "	6	Combine "				
394 "	1	Node #"				
395 "		Total Site"				
396 "		Maximum flow	0.019	c.m/sec"		
397 "		Hydrograph volume	51.726	c.m"		
398 "		0.003	0.003	0.003	0.019"	
399 " 40		HYDROGRAPH Start - New Tributary"				
400 "	2	Start - New Tributary"				
401 "		0.003	0.000	0.003	0.019"	
402 " 33		CATCHMENT 206"				
403 "	1	Triangular SCS"				
404 "	1	Equal length"				
405 "	1	SCS method"				
406 "	206	Uncontrolled"				
407 "	35.000	% Impervious"				
408 "	0.084	Total Area"				
409 "	6.000	Flow length"				
410 "	10.000	Overland Slope"				
411 "	0.055	Pervious Area"				
412 "	6.000	Pervious length"				
413 "	20.000	Pervious slope"				
414 "	0.029	Impervious Area"				
415 "	6.000	Impervious length"				
416 "	20.000	Impervious slope"				
417 "	0.250	Pervious Manning 'n'"				
418 "	75.000	Pervious SCS Curve No."				
419 "	0.162	Pervious Runoff coefficient"				
420 "	0.100	Pervious Ia/S coefficient"				
421 "	8.467	Pervious Initial abstraction"				
422 "	0.015	Impervious Manning 'n'"				
423 "	98.000	Impervious SCS Curve No."				
424 "	0.751	Impervious Runoff coefficient"				
425 "	0.100	Impervious Ia/S coefficient"				
426 "	0.518	Impervious Initial abstraction"				

427 "	0.007	0.000	0.003	0.021 c.m/sec"
428 "	Catchment 206	Pervious	Impervious	Total Area "
429 "	Surface Area	0.055	0.029	0.084 hectare"
430 "	Time of concentration	5.345	0.429	1.833 minutes"
431 "	Time to Centroid	106.379	87.551	92.930 minutes"
432 "	Rainfall depth	32.400	32.400	32.400 mm"
433 "	Rainfall volume	17.69	9.53	27.22 c.m"
434 "	Rainfall losses	27.157	8.053	20.471 mm"
435 "	Runoff depth	5.243	24.347	11.929 mm"
436 "	Runoff volume	2.86	7.16	10.02 c.m"
437 "	Runoff coefficient	0.162	0.751	0.368 "
438 "	Maximum flow	0.001	0.007	0.007 c.m/sec"
439 " 40	HYDROGRAPH Add Runoff "			
440 "	4 Add Runoff "			
441 "	0.007	0.007	0.003	0.021"
442 " 40	HYDROGRAPH Copy to Outflow"			
443 "	8 Copy to Outflow"			
444 "	0.007	0.007	0.007	0.021"
445 " 40	HYDROGRAPH Combine	1"		
446 "	6 Combine "			
447 "	1 Node #"			
448 "	Total Site"			
449 "	Maximum flow	0.028		c.m/sec"
450 "	Hydrograph volume	61.747		c.m"
451 "	0.007	0.007	0.007	0.028"
452 " 40	HYDROGRAPH Confluence	1"		
453 "	7 Confluence "			
454 "	1 Node #"			
455 "	Total Site"			
456 "	Maximum flow	0.028		c.m/sec"
457 "	Hydrograph volume	61.747		c.m"
458 "	0.007	0.028	0.007	0.000"
459 " 38	START/RE-START TOTALS 1"			
460 "	3 Runoff Totals on EXIT"			
461 "	Total Catchment area		0.276	hectare"
462 "	Total Impervious area		0.221	hectare"
463 "	Total % impervious		80.217"	
464 " 19	EXIT"			

```

1 " MIDUSS Output ----->"
2 " MIDUSS version Version 2.25 rev. 473"
3 " MIDUSS created Sunday, February 7, 2010"
4 " 10 Units used: ie METRIC"
5 " Job folder: Q:\46981\100\November 2021"
6 " Output filename: 5 yr post b.out"
7 " Licensee name: admin"
8 " Company "
9 " Date & Time last used: 2/9/2022 at 9:24:56 AM"
10 " 31 TIME PARAMETERS"
11 " 5.000 Time Step"
12 " 180.000 Max. Storm length"
13 " 1500.000 Max. Hydrograph"
14 " 32 STORM Chicago storm"
15 " 1 Chicago storm"
16 " 1593.000 Coefficient A"
17 " 11.000 Constant B"
18 " 0.879 Exponent C"
19 " 0.400 Fraction R"
20 " 180.000 Duration"
21 " 1.000 Time step multiplier"
22 " Maximum intensity 139.250 mm/hr"
23 " Total depth 47.240 mm"
24 " 6 005hyd Hydrograph extension used in this file"
25 " 33 CATCHMENT 201"
26 " 1 Triangular SCS"
27 " 1 Equal length"
28 " 1 SCS method"
29 " 201 Buildig rooftop"
30 " 100.000 % Impervious"
31 " 0.082 Total Area"
32 " 15.000 Flow length"
33 " 1.000 Overland Slope"
34 " 0.000 Pervious Area"
35 " 15.000 Pervious length"
36 " 1.000 Pervious slope"
37 " 0.082 Impervious Area"
38 " 15.000 Impervious length"
39 " 1.000 Impervious slope"
40 " 0.250 Pervious Manning 'n'"
41 " 75.000 Pervious SCS Curve No."
42 " 0.000 Pervious Runoff coefficient"
43 " 0.100 Pervious Ia/S coefficient"
44 " 8.467 Pervious Initial abstraction"
45 " 0.015 Impervious Manning 'n'"
46 " 98.000 Impervious SCS Curve No."
47 " 0.878 Impervious Runoff coefficient"
48 " 0.100 Impervious Ia/S coefficient"
49 " 0.518 Impervious Initial abstraction"
50 " 0.025 0.000 0.000 0.000 c.m/sec"
51 " Catchment 201 Pervious Impervious Total Area "
52 " Surface Area 0.000 0.082 0.082 hectare"
53 " Time of concentration 15.546 1.609 1.609 minutes"
54 " Time to Centroid 117.386 88.188 88.188 minutes"
55 " Rainfall depth 47.240 47.240 47.240 mm"
56 " Rainfall volume 0.00 38.74 38.74 c.m"
57 " Rainfall losses 35.081 5.760 5.760 mm"
58 " Runoff depth 12.159 41.480 41.480 mm"
59 " Runoff volume 0.00 34.01 34.01 c.m"
60 " Runoff coefficient 0.000 0.878 0.878 "
61 " Maximum flow 0.000 0.025 0.025 c.m/sec"
62 " 40 HYDROGRAPH Add Runoff "
63 " 4 Add Runoff "
64 " 0.025 0.025 0.000 0.000"
65 " 54 POND DESIGN"
66 " 0.025 Current peak flow c.m/sec"
67 " 0.013 Target outflow c.m/sec"
68 " 34.0 Hydrograph volume c.m"
69 " 11. Number of stages"
70 " 0.000 Minimum water level metre"
71 " 0.150 Maximum water level metre"
    
```

```

72 " 0.000 Starting water level metre"
73 " 0 Keep Design Data: 1 = True; 0 = False"
74 " Level Discharge Volume"
75 " 0.000 0.000 0.000"
76 " 0.01500 0.00090 0.1860"
77 " 0.03000 0.00180 1.488"
78 " 0.04500 0.00270 5.022"
79 " 0.06000 0.00360 11.904"
80 " 0.07500 0.00450 21.189"
81 " 0.09000 0.00540 30.489"
82 " 0.1050 0.00630 39.789"
83 " 0.1200 0.00720 49.089"
84 " 0.1350 0.00810 58.389"
85 " 0.1500 0.00900 67.689"
86 " 1. ROOFTOP"
87 " Roof area Store area Area/drain Drain flow Roof slope"
88 " hectare hectare sq.metre L/min/25mm g H:1V"
89 " 0.082 0.062 150.000 22.500 100.000"
90 " Using 4 roofdrains on roofstorage area of 620. square metre"
91 " Peak outflow 0.004 c.m/sec"
92 " Maximum level 0.070 metre"
93 " Maximum storage 18.346 c.m"
94 " Centroidal lag 2.289 hours"
95 " 0.025 0.025 0.004 0.000 c.m/sec"
96 " 40 HYDROGRAPH Combine 1"
97 " 6 Combine "
98 " 1 Node #"
99 " Total Site"
100 " Maximum flow 0.004 c.m/sec"
101 " Hydrograph volume 33.995 c.m"
102 " 0.025 0.025 0.004 0.004"
103 " 40 HYDROGRAPH Start - New Tributary"
104 " 2 Start - New Tributary"
105 " 0.025 0.000 0.004 0.004"
106 " 33 CATCHMENT 202"
107 " 1 Triangular SCS"
108 " 1 Equal length"
109 " 1 SCS method"
110 " 202 Area Drain 1"
111 " 100.000 % Impervious"
112 " 0.035 Total Area"
113 " 20.000 Flow length"
114 " 1.000 Overland Slope"
115 " 0.000 Pervious Area"
116 " 20.000 Pervious length"
117 " 1.000 Pervious slope"
118 " 0.035 Impervious Area"
119 " 20.000 Impervious length"
120 " 1.000 Impervious slope"
121 " 0.250 Pervious Manning 'n'"
122 " 75.000 Pervious SCS Curve No."
123 " 0.000 Pervious Runoff coefficient"
124 " 0.100 Pervious Ia/S coefficient"
125 " 8.467 Pervious Initial abstraction"
126 " 0.015 Impervious Manning 'n'"
127 " 98.000 Impervious SCS Curve No."
128 " 0.878 Impervious Runoff coefficient"
129 " 0.100 Impervious Ia/S coefficient"
130 " 0.518 Impervious Initial abstraction"
131 " 0.011 0.000 0.004 0.004 c.m/sec"
132 " Catchment 202 Pervious Impervious Total Area "
133 " Surface Area 0.000 0.035 0.035 hectare"
134 " Time of concentration 18.475 1.912 1.912 minutes"
135 " Time to Centroid 120.989 88.680 88.680 minutes"
136 " Rainfall depth 47.240 47.240 47.240 mm"
137 " Rainfall volume 0.00 16.53 16.53 c.m"
138 " Rainfall losses 35.071 5.756 5.756 mm"
139 " Runoff depth 12.169 41.484 41.484 mm"
140 " Runoff volume 0.00 14.52 14.52 c.m"
141 " Runoff coefficient 0.000 0.878 0.878 "
142 " Maximum flow 0.000 0.011 0.011 c.m/sec"
    
```

```

143 " 40 HYDROGRAPH Add Runoff "
144 " 4 Add Runoff "
145 " 0.011 0.011 0.004 0.004"
146 " 54 POND DESIGN"
147 " 0.011 Current peak flow c.m/sec"
148 " 0.013 Target outflow c.m/sec"
149 " 14.5 Hydrograph volume c.m"
150 " 5. Number of stages"
151 " 340.650 Minimum water level metre"
152 " 340.950 Maximum water level metre"
153 " 340.650 Starting water level metre"
154 " 0 Keep Design Data: 1 = True; 0 = False"
155 " Level Discharge Volume"
156 " 340.650 0.000 0.000"
157 " 340.800 0.00478 0.07500"
158 " 340.850 0.00552 0.7700"
159 " 340.900 0.00617 3.630"
160 " 340.950 0.00676 10.300"
161 " 1. HOR. ORIFICES"
162 " Orifice Orifice Orifice Number of"
163 " invert coefficient diameter orifices"
164 " 340.650 0.630 0.0750 1.000"
165 " Peak outflow 0.006 c.m/sec"
166 " Maximum level 340.876 metre"
167 " Maximum storage 2.242 c.m"
168 " Centroidal lag 1.512 hours"
169 " 0.011 0.011 0.006 0.004 c.m/sec"
170 " 40 HYDROGRAPH Combine 1"
171 " 6 Combine "
172 " 1 Node #"
173 " Total Site"
174 " Maximum flow 0.010 c.m/sec"
175 " Hydrograph volume 47.843 c.m"
176 " 0.011 0.011 0.006 0.010"
177 " 40 HYDROGRAPH Start - New Tributary"
178 " 2 Start - New Tributary"
179 " 0.011 0.000 0.006 0.010"
180 " 33 CATCHMENT 203"
181 " 1 Triangular SCS"
182 " 1 Equal length"
183 " 1 SCS method"
184 " 203 Area Drain 2"
185 " 100.000 % Impervious"
186 " 0.031 Total Area"
187 " 20.000 Flow length"
188 " 1.000 Overland Slope"
189 " 0.000 Pervious Area"
190 " 20.000 Pervious length"
191 " 1.000 Pervious slope"
192 " 0.031 Impervious Area"
193 " 20.000 Impervious length"
194 " 1.000 Impervious slope"
195 " 0.250 Pervious Manning 'n'"
196 " 75.000 Pervious SCS Curve No."
197 " 0.000 Pervious Runoff coefficient"
198 " 0.100 Pervious Ia/S coefficient"
199 " 8.467 Pervious Initial abstraction"
200 " 0.015 Impervious Manning 'n'"
201 " 98.000 Impervious SCS Curve No."
202 " 0.878 Impervious Runoff coefficient"
203 " 0.100 Impervious Ia/S coefficient"
204 " 0.518 Impervious Initial abstraction"
205 " 0.009 0.000 0.006 0.010 c.m/sec"
206 " Catchment 203 Pervious Impervious Total Area "
207 " Surface Area 0.000 0.031 0.031 hectare"
208 " Time of concentration 18.475 1.912 1.912 minutes"
209 " Time to Centroid 120.989 88.680 88.680 minutes"
210 " Rainfall depth 47.240 47.240 47.240 mm"
211 " Rainfall volume 0.00 14.64 14.64 c.m"
212 " Rainfall losses 35.071 5.756 5.756 mm"
213 " Runoff depth 12.169 41.484 41.484 mm

```

```

214 " Runoff volume 0.00 12.86 12.86 c.m"
215 " Runoff coefficient 0.000 0.878 0.878 "
216 " Maximum flow 0.000 0.009 0.009 c.m/sec"
217 " 40 HYDROGRAPH Add Runoff "
218 " 4 Add Runoff "
219 " 0.009 0.009 0.006 0.010"
220 " 54 POND DESIGN"
221 " 0.009 Current peak flow c.m/sec"
222 " 0.013 Target outflow c.m/sec"
223 " 12.9 Hydrograph volume c.m"
224 " 5. Number of stages"
225 " 340.650 Minimum water level metre"
226 " 340.950 Maximum water level metre"
227 " 340.650 Starting water level metre"
228 " 0 Keep Design Data: 1 = True; 0 = False"
229 " Level Discharge Volume"
230 " 340.650 0.000 0.000"
231 " 340.800 0.00478 0.07500"
232 " 340.850 0.00552 0.7000"
233 " 340.900 0.00617 3.400"
234 " 340.950 0.00676 9.680"
235 " 1. HOR. ORIFICES"
236 " Orifice Orifice Orifice Number of"
237 " invert coefficient diameter orifices"
238 " 340.650 0.630 0.0750 1.000"
239 " Peak outflow 0.006 c.m/sec"
240 " Maximum level 340.867 metre"
241 " Maximum storage 1.617 c.m"
242 " Centroidal lag 1.516 hours"
243 " 0.009 0.009 0.006 0.010 c.m/sec"
244 " 40 HYDROGRAPH Combine 1"
245 " 6 Combine "
246 " 1 Node #"
247 " Total Site"
248 " Maximum flow 0.016 c.m/sec"
249 " Hydrograph volume 61.047 c.m"
250 " 0.009 0.009 0.006 0.016"
251 " 40 HYDROGRAPH Start - New Tributary"
252 " 2 Start - New Tributary"
253 " 0.009 0.000 0.006 0.016"
254 " 33 CATCHMENT 204"
255 " 1 Triangular SCS"
256 " 1 Equal length"
257 " 1 SCS method"
258 " 204 Area Drain 3"
259 " 100.000 % Impervious"
260 " 0.031 Total Area"
261 " 20.000 Flow length"
262 " 1.000 Overland Slope"
263 " 0.000 Pervious Area"
264 " 20.000 Pervious length"
265 " 1.000 Pervious slope"
266 " 0.031 Impervious Area"
267 " 20.000 Impervious length"
268 " 1.000 Impervious slope"
269 " 0.250 Pervious Manning 'n'"
270 " 75.000 Pervious SCS Curve No."
271 " 0.000 Pervious Runoff coefficient"
272 " 0.100 Pervious Ia/S coefficient"
273 " 8.467 Pervious Initial abstraction"
274 " 0.015 Impervious Manning 'n'"
275 " 98.000 Impervious SCS Curve No."
276 " 0.878 Impervious Runoff coefficient"
277 " 0.100 Impervious Ia/S coefficient"
278 " 0.518 Impervious Initial abstraction"
279 " 0.009 0.000 0.006 0.016 c.m/sec"
280 " Catchment 204 Pervious Impervious Total Area "
281 " Surface Area 0.000 0.031 0.031 hectare"
282 " Time of concentration 18.475 1.912 1.912 minutes"
283 " Time to Centroid 120.989 88.680 88.680 minutes"
284 " Rainfall depth 47.240 47.240 47.240 mm

```

285 "		Rainfall volume	0.00	14.64	14.64	c.m"
286 "		Rainfall losses	35.071	5.756	5.756	mm"
287 "		Runoff depth	12.169	41.484	41.484	mm"
288 "		Runoff volume	0.00	12.86	12.86	c.m"
289 "		Runoff coefficient	0.000	0.878	0.878	"
290 "		Maximum flow	0.000	0.009	0.009	c.m/sec"
291 " 40		HYDROGRAPH Add Runoff "				
292 "	4	Add Runoff "	0.009	0.006	0.016"	
293 "						
294 " 54		POND DESIGN"				
295 "	0.009	Current peak flow	c.m/sec"			
296 "	0.013	Target outflow	c.m/sec"			
297 "	12.9	Hydrograph volume	c.m"			
298 "	5.	Number of stages"				
299 "	340.650	Minimum water level	metre"			
300 "	340.950	Maximum water level	metre"			
301 "	340.650	Starting water level	metre"			
302 "	0	Keep Design Data: 1 = True; 0 = False"				
303 "		Level Discharge	Volume"			
304 "	340.650	0.000	0.000"			
305 "	340.800	0.00478	0.07500"			
306 "	340.850	0.00552	0.7500"			
307 "	340.900	0.00617	3.890"			
308 "	340.950	0.00676	11.590"			
309 "	1.	HOR. ORIFICES"				
310 "		Orifice Orifice	Orifice Number of"			
311 "		invert coefficie	diameter orifices"			
312 "	340.650	0.630	0.0750	1.000"		
313 "		Peak outflow	0.006	c.m/sec"		
314 "		Maximum level	340.864	metre"		
315 "		Maximum storage	1.636	c.m"		
316 "		Centroidal lag	1.518	hours"		
317 "	0.009	0.009	0.006	0.016 c.m/sec"		
318 " 40		HYDROGRAPH Combine	1"			
319 "	6	Combine "				
320 "	1	Node #"				
321 "		Total Site"				
322 "		Maximum flow	0.021	c.m/sec"		
323 "		Hydrograph volume	74.390	c.m"		
324 "		0.009	0.009	0.006	0.021"	
325 " 40		HYDROGRAPH Start - New Tributary"				
326 "	2	Start - New Tributary"				
327 "		0.009	0.000	0.006	0.021"	
328 " 33		CATCHMENT 205"				
329 "	1	Triangular SCS"				
330 "	1	Equal length"				
331 "	1	SCS method"				
332 "	205	Area Drain 4"				
333 "	100.000	% Impervious"				
334 "	0.013	Total Area"				
335 "	10.000	Flow length"				
336 "	1.000	Overland Slope"				
337 "	0.000	Pervious Area"				
338 "	10.000	Pervious length"				
339 "	1.000	Pervious slope"				
340 "	0.013	Impervious Area"				
341 "	10.000	Impervious length"				
342 "	1.000	Impervious slope"				
343 "	0.250	Pervious Manning 'n'"				
344 "	75.000	Pervious SCS Curve No."				
345 "	0.000	Pervious Runoff coefficient"				
346 "	0.100	Pervious Ia/S coefficient"				
347 "	8.467	Pervious Initial abstraction"				
348 "	0.015	Impervious Manning 'n'"				
349 "	98.000	Impervious SCS Curve No."				
350 "	0.873	Impervious Runoff coefficient"				
351 "	0.100	Impervious Ia/S coefficient"				
352 "	0.518	Impervious Initial abstraction"				
353 "		0.004	0.000	0.006	0.021 c.m/sec"	
354 "		Catchment 205	Pervious	Impervious Total Area "		
355 "		Surface Area	0.000	0.013	0.013	hectare"

356 "		Time of concentration	12.189	1.261	1.261	minutes"
357 "		Time to Centroid	113.234	87.761	87.761	minutes"
358 "		Rainfall depth	47.240	47.240	47.240	mm"
359 "		Rainfall volume	0.00	6.14	6.14	c.m"
360 "		Rainfall losses	35.103	6.008	6.008	mm"
361 "		Runoff depth	12.137	41.232	41.232	mm"
362 "		Runoff volume	0.00	5.36	5.36	c.m"
363 "		Runoff coefficient	0.000	0.873	0.873	"
364 "		Maximum flow	0.000	0.004	0.004	c.m/sec"
365 " 40		HYDROGRAPH Add Runoff "				
366 "	4	Add Runoff "	0.004	0.004	0.006	0.021"
367 "						
368 " 54		POND DESIGN"				
369 "	0.004	Current peak flow	c.m/sec"			
370 "	0.013	Target outflow	c.m/sec"			
371 "	5.4	Hydrograph volume	c.m"			
372 "	5.	Number of stages"				
373 "	340.490	Minimum water level	metre"			
374 "	340.800	Maximum water level	metre"			
375 "	340.490	Starting water level	metre"			
376 "	0	Keep Design Data: 1 = True; 0 = False"				
377 "		Level Discharge	Volume"			
378 "	340.490	0.000	0.000"			
379 "	340.640	0.00479	0.07500"			
380 "	340.700	0.00566	0.4800"			
381 "	340.750	0.00630	1.990"			
382 "	340.800	0.00687	5.850"			
383 "	1.	HOR. ORIFICES"				
384 "		Orifice Orifice	Orifice Number of"			
385 "		invert coefficie	diameter orifices"			
386 "	340.490	0.630	0.0750	1.000"		
387 "		Peak outflow	0.004	c.m/sec"		
388 "		Maximum level	340.617	metre"		
389 "		Maximum storage	0.063	c.m"		
390 "		Centroidal lag	1.467	hours"		
391 "	0.004	0.004	0.004	0.021 c.m/sec"		
392 " 40		HYDROGRAPH Combine	1"			
393 "	6	Combine "				
394 "	1	Node #"				
395 "		Total Site"				
396 "		Maximum flow	0.024	c.m/sec"		
397 "		Hydrograph volume	79.750	c.m"		
398 "		0.004	0.004	0.004	0.024"	
399 " 40		HYDROGRAPH Start - New Tributary"				
400 "	2	Start - New Tributary"				
401 "		0.004	0.000	0.004	0.024"	
402 " 33		CATCHMENT 206"				
403 "	1	Triangular SCS"				
404 "	1	Equal length"				
405 "	1	SCS method"				
406 "	206	Uncontrolled"				
407 "	35.000	% Impervious"				
408 "	0.084	Total Area"				
409 "	6.000	Flow length"				
410 "	10.000	Overland Slope"				
411 "	0.055	Pervious Area"				
412 "	6.000	Pervious length"				
413 "	20.000	Pervious slope"				
414 "	0.029	Impervious Area"				
415 "	6.000	Impervious length"				
416 "	20.000	Impervious slope"				
417 "	0.250	Pervious Manning 'n'"				
418 "	75.000	Pervious SCS Curve No."				
419 "	0.252	Pervious Runoff coefficient"				
420 "	0.100	Pervious Ia/S coefficient"				
421 "	8.467	Pervious Initial abstraction"				
422 "	0.015	Impervious Manning 'n'"				
423 "	98.000	Impervious SCS Curve No."				
424 "	0.781	Impervious Runoff coefficient"				
425 "	0.100	Impervious Ia/S coefficient"				
426 "	0.518	Impervious Initial abstraction"				

427 "	0.012	0.000	0.004	0.024 c.m/sec"
428 "	Catchment 206	Pervious	Impervious	Total Area "
429 "	Surface Area	0.055	0.029	0.084 hectare"
430 "	Time of concentration	3.652	0.378	1.604 minutes"
431 "	Time to Centroid	102.968	86.881	92.903 minutes"
432 "	Rainfall depth	47.240	47.240	47.240 mm"
433 "	Rainfall volume	25.79	13.89	39.68 c.m"
434 "	Rainfall losses	35.351	10.339	26.597 mm"
435 "	Runoff depth	11.888	36.901	20.643 mm"
436 "	Runoff volume	6.49	10.85	17.34 c.m"
437 "	Runoff coefficient	0.252	0.781	0.437 "
438 "	Maximum flow	0.004	0.009	0.012 c.m/sec"
439 " 40	HYDROGRAPH Add Runoff "			
440 "	4 Add Runoff "			
441 "	0.012	0.012	0.004	0.024"
442 " 40	HYDROGRAPH Copy to Outflow"			
443 "	8 Copy to Outflow"			
444 "	0.012	0.012	0.012	0.024"
445 " 40	HYDROGRAPH Combine	1"		
446 "	6 Combine "			
447 "	1 Node #"			
448 "	Total Site"			
449 "	Maximum flow	0.035		c.m/sec"
450 "	Hydrograph volume	97.089		c.m"
451 "	0.012	0.012	0.012	0.035"
452 " 40	HYDROGRAPH Confluence	1"		
453 "	7 Confluence "			
454 "	1 Node #"			
455 "	Total Site"			
456 "	Maximum flow	0.035		c.m/sec"
457 "	Hydrograph volume	97.089		c.m"
458 "	0.012	0.035	0.012	0.000"
459 " 38	START/RE-START TOTALS 1"			
460 "	3 Runoff Totals on EXIT"			
461 "	Total Catchment area		0.276	hectare"
462 "	Total Impervious area		0.221	hectare"
463 "	Total % impervious		80.217"	
464 " 19	EXIT"			

```

1 " MIDUSS Output ----->"
2 " MIDUSS version Version 2.25 rev. 473"
3 " MIDUSS created Sunday, February 7, 2010"
4 " 10 Units used: ie METRIC"
5 " Job folder: Q:\46981\100\November 2021"
6 " Output filename: 100 yr post b.out"
7 " Licensee name: admin"
8 " Company "
9 " Date & Time last used: 2/9/2022 at 9:25:56 AM"
10 " 31 TIME PARAMETERS"
11 " 5.000 Time Step"
12 " 180.000 Max. Storm length"
13 " 1500.000 Max. Hydrograph"
14 " 32 STORM Chicago storm"
15 " 1 Chicago storm"
16 " 4692.000 Coefficient A"
17 " 17.437 Constant B"
18 " 0.956 Exponent C"
19 " 0.400 Fraction R"
20 " 180.000 Duration"
21 " 1.000 Time step multiplier"
22 " Maximum intensity 239.793 mm/hr"
23 " Total depth 89.960 mm"
24 " 6 100hyd Hydrograph extension used in this file"
25 " 33 CATCHMENT 201"
26 " 1 Triangular SCS"
27 " 1 Equal length"
28 " 1 SCS method"
29 " 201 Buildig rooftop"
30 " 100.000 % Impervious"
31 " 0.082 Total Area"
32 " 15.000 Flow length"
33 " 1.000 Overland Slope"
34 " 0.000 Pervious Area"
35 " 15.000 Pervious length"
36 " 1.000 Pervious slope"
37 " 0.082 Impervious Area"
38 " 15.000 Impervious length"
39 " 1.000 Impervious slope"
40 " 0.250 Pervious Manning 'n'"
41 " 75.000 Pervious SCS Curve No."
42 " 0.000 Pervious Runoff coefficient"
43 " 0.100 Pervious Ia/S coefficient"
44 " 8.467 Pervious Initial abstraction"
45 " 0.015 Impervious Manning 'n'"
46 " 98.000 Impervious SCS Curve No."
47 " 0.923 Impervious Runoff coefficient"
48 " 0.100 Impervious Ia/S coefficient"
49 " 0.518 Impervious Initial abstraction"
50 " 0.047 0.000 0.000 0.000 c.m/sec"
51 " Catchment 201 Pervious Impervious Total Area "
52 " Surface Area 0.000 0.082 0.082 hectare"
53 " Time of concentration 9.488 1.278 1.278 minutes"
54 " Time to Centroid 105.051 85.809 85.809 minutes"
55 " Rainfall depth 89.960 89.960 89.960 mm"
56 " Rainfall volume 0.00 73.77 73.77 c.m"
57 " Rainfall losses 50.193 6.968 6.968 mm"
58 " Runoff depth 39.767 82.992 82.992 mm"
59 " Runoff volume 0.00 68.05 68.05 c.m"
60 " Runoff coefficient 0.000 0.923 0.923 "
61 " Maximum flow 0.000 0.047 0.047 c.m/sec"
62 " 40 HYDROGRAPH Add Runoff "
63 " 4 Add Runoff "
64 " 0.047 0.047 0.000 0.000"
65 " 54 POND DESIGN"
66 " 0.047 Current peak flow c.m/sec"
67 " 0.013 Target outflow c.m/sec"
68 " 68.1 Hydrograph volume c.m"
69 " 11. Number of stages"
70 " 0.000 Minimum water level metre"
71 " 0.150 Maximum water level metre"

```

```

72 " 0.000 Starting water level metre"
73 " 0 Keep Design Data: 1 = True; 0 = False"
74 " Level Discharge Volume"
75 " 0.000 0.000 0.000"
76 " 0.01500 0.00090 0.1860"
77 " 0.03000 0.00180 1.488"
78 " 0.04500 0.00270 5.022"
79 " 0.06000 0.00360 11.904"
80 " 0.07500 0.00450 21.189"
81 " 0.09000 0.00540 30.489"
82 " 0.1050 0.00630 39.789"
83 " 0.1200 0.00720 49.089"
84 " 0.1350 0.00810 58.389"
85 " 0.1500 0.00900 67.689"
86 " 1. ROOFTOP"
87 " Roof area Store area Area/drain Drain flow Roof slope"
88 " hectare hectare sq.metre L/min/25mm g H:1V"
89 " 0.082 0.062 150.000 22.500 100.000"
90 " Using 4 roofdrains on roofstorage area of 620. square metre"
91 " Peak outflow 0.007 c.m/sec"
92 " Maximum level 0.109 metre"
93 " Maximum storage 42.035 c.m"
94 " Centroidal lag 2.725 hours"
95 " 0.047 0.047 0.007 0.000 c.m/sec"
96 " 40 HYDROGRAPH Combine 1"
97 " 6 Combine "
98 " 1 Node #"
99 " Total Site"
100 " Maximum flow 0.007 c.m/sec"
101 " Hydrograph volume 68.051 c.m"
102 " 0.047 0.047 0.007 0.007"
103 " 40 HYDROGRAPH Start - New Tributary"
104 " 2 Start - New Tributary"
105 " 0.047 0.000 0.007 0.007"
106 " 33 CATCHMENT 202"
107 " 1 Triangular SCS"
108 " 1 Equal length"
109 " 1 SCS method"
110 " 202 Area Drain 1"
111 " 100.000 % Impervious"
112 " 0.035 Total Area"
113 " 20.000 Flow length"
114 " 1.000 Overland Slope"
115 " 0.000 Pervious Area"
116 " 20.000 Pervious length"
117 " 1.000 Pervious slope"
118 " 0.035 Impervious Area"
119 " 20.000 Impervious length"
120 " 1.000 Impervious slope"
121 " 0.250 Pervious Manning 'n'"
122 " 75.000 Pervious SCS Curve No."
123 " 0.000 Pervious Runoff coefficient"
124 " 0.100 Pervious Ia/S coefficient"
125 " 8.467 Pervious Initial abstraction"
126 " 0.015 Impervious Manning 'n'"
127 " 98.000 Impervious SCS Curve No."
128 " 0.927 Impervious Runoff coefficient"
129 " 0.100 Impervious Ia/S coefficient"
130 " 0.518 Impervious Initial abstraction"
131 " 0.020 0.000 0.007 0.007 c.m/sec"
132 " Catchment 202 Pervious Impervious Total Area "
133 " Surface Area 0.000 0.035 0.035 hectare"
134 " Time of concentration 11.276 1.519 1.519 minutes"
135 " Time to Centroid 107.264 86.106 86.106 minutes"
136 " Rainfall depth 89.960 89.960 89.960 mm"
137 " Rainfall volume 0.00 31.49 31.49 c.m"
138 " Rainfall losses 50.076 6.571 6.571 mm"
139 " Runoff depth 39.884 83.389 83.389 mm"
140 " Runoff volume 0.00 29.19 29.19 c.m"
141 " Runoff coefficient 0.000 0.927 0.927 "
142 " Maximum flow 0.000 0.020 0.020 c.m/sec"

```

```

143 " 40 HYDROGRAPH Add Runoff "
144 " 4 Add Runoff "
145 " 0.020 0.020 0.007 0.007"
146 " 54 POND DESIGN"
147 " 0.020 Current peak flow c.m/sec"
148 " 0.013 Target outflow c.m/sec"
149 " 29.2 Hydrograph volume c.m"
150 " 5. Number of stages"
151 " 340.650 Minimum water level metre"
152 " 340.950 Maximum water level metre"
153 " 340.650 Starting water level metre"
154 " 0 Keep Design Data: 1 = True; 0 = False"
155 " Level Discharge Volume"
156 " 340.650 0.000 0.000"
157 " 340.800 0.00478 0.07500"
158 " 340.850 0.00552 0.7700"
159 " 340.900 0.00617 3.630"
160 " 340.950 0.00676 10.300"
161 " 1. HOR. ORIFICES"
162 " Orifice Orifice Orifice Number of"
163 " invert coefficient diameter orifices"
164 " 340.650 0.630 0.0750 1.000"
165 " Peak outflow 0.007 c.m/sec"
166 " Maximum level 340.941 metre"
167 " Maximum storage 9.058 c.m"
168 " Centroidal lag 1.629 hours"
169 " 0.020 0.007 0.007 c.m/sec"
170 " 40 HYDROGRAPH Combine 1"
171 " 6 Combine "
172 " 1 Node #"
173 " Total Site"
174 " Maximum flow 0.013 c.m/sec"
175 " Hydrograph volume 97.634 c.m"
176 " 0.020 0.020 0.007 0.013"
177 " 40 HYDROGRAPH Start - New Tributary"
178 " 2 Start - New Tributary"
179 " 0.020 0.000 0.007 0.013"
180 " 33 CATCHMENT 203"
181 " 1 Triangular SCS"
182 " 1 Equal length"
183 " 1 SCS method"
184 " 203 Area Drain 2"
185 " 100.000 % Impervious"
186 " 0.031 Total Area"
187 " 20.000 Flow length"
188 " 1.000 Overland Slope"
189 " 0.000 Pervious Area"
190 " 20.000 Pervious length"
191 " 1.000 Pervious slope"
192 " 0.031 Impervious Area"
193 " 20.000 Impervious length"
194 " 1.000 Impervious slope"
195 " 0.250 Pervious Manning 'n'"
196 " 75.000 Pervious SCS Curve No."
197 " 0.000 Pervious Runoff coefficient"
198 " 0.100 Pervious Ia/S coefficient"
199 " 8.467 Pervious Initial abstraction"
200 " 0.015 Impervious Manning 'n'"
201 " 98.000 Impervious SCS Curve No."
202 " 0.927 Impervious Runoff coefficient"
203 " 0.100 Impervious Ia/S coefficient"
204 " 0.518 Impervious Initial abstraction"
205 " 0.018 0.000 0.007 0.013 c.m/sec"
206 " Catchment 203 Pervious Impervious Total Area "
207 " Surface Area 0.000 0.031 0.031 hectare"
208 " Time of concentration 11.276 1.519 1.519 minutes"
209 " Time to Centroid 107.264 86.106 86.106 minutes"
210 " Rainfall depth 89.960 89.960 89.960 mm"
211 " Rainfall volume 0.00 27.89 27.89 c.m"
212 " Rainfall losses 50.076 6.571 6.571 mm"
213 " Runoff depth 39.884 83.389 83.389 mm

```

```

214 " Runoff volume 0.00 25.85 25.85 c.m"
215 " Runoff coefficient 0.000 0.927 0.927 "
216 " Maximum flow 0.000 0.018 0.018 c.m/sec"
217 " 40 HYDROGRAPH Add Runoff "
218 " 4 Add Runoff "
219 " 0.018 0.018 0.007 0.013"
220 " 54 POND DESIGN"
221 " 0.018 Current peak flow c.m/sec"
222 " 0.013 Target outflow c.m/sec"
223 " 25.9 Hydrograph volume c.m"
224 " 5. Number of stages"
225 " 340.650 Minimum water level metre"
226 " 340.950 Maximum water level metre"
227 " 340.650 Starting water level metre"
228 " 0 Keep Design Data: 1 = True; 0 = False"
229 " Level Discharge Volume"
230 " 340.650 0.000 0.000"
231 " 340.800 0.00478 0.07500"
232 " 340.850 0.00552 0.7000"
233 " 340.900 0.00617 3.400"
234 " 340.950 0.00676 9.680"
235 " 1. HOR. ORIFICES"
236 " Orifice Orifice Orifice Number of"
237 " invert coefficient diameter orifices"
238 " 340.650 0.630 0.0750 1.000"
239 " Peak outflow 0.007 c.m/sec"
240 " Maximum level 340.930 metre"
241 " Maximum storage 7.201 c.m"
242 " Centroidal lag 1.585 hours"
243 " 0.018 0.018 0.007 0.013 c.m/sec"
244 " 40 HYDROGRAPH Combine 1"
245 " 6 Combine "
246 " 1 Node #"
247 " Total Site"
248 " Maximum flow 0.020 c.m/sec"
249 " Hydrograph volume 123.543 c.m"
250 " 0.018 0.018 0.007 0.020"
251 " 40 HYDROGRAPH Start - New Tributary"
252 " 2 Start - New Tributary"
253 " 0.018 0.000 0.007 0.020"
254 " 33 CATCHMENT 204"
255 " 1 Triangular SCS"
256 " 1 Equal length"
257 " 1 SCS method"
258 " 204 Area Drain 3"
259 " 100.000 % Impervious"
260 " 0.031 Total Area"
261 " 20.000 Flow length"
262 " 1.000 Overland Slope"
263 " 0.000 Pervious Area"
264 " 20.000 Pervious length"
265 " 1.000 Pervious slope"
266 " 0.031 Impervious Area"
267 " 20.000 Impervious length"
268 " 1.000 Impervious slope"
269 " 0.250 Pervious Manning 'n'"
270 " 75.000 Pervious SCS Curve No."
271 " 0.000 Pervious Runoff coefficient"
272 " 0.100 Pervious Ia/S coefficient"
273 " 8.467 Pervious Initial abstraction"
274 " 0.015 Impervious Manning 'n'"
275 " 98.000 Impervious SCS Curve No."
276 " 0.927 Impervious Runoff coefficient"
277 " 0.100 Impervious Ia/S coefficient"
278 " 0.518 Impervious Initial abstraction"
279 " 0.018 0.000 0.007 0.020 c.m/sec"
280 " Catchment 204 Pervious Impervious Total Area "
281 " Surface Area 0.000 0.031 0.031 hectare"
282 " Time of concentration 11.276 1.519 1.519 minutes"
283 " Time to Centroid 107.264 86.106 86.106 minutes"
284 " Rainfall depth 89.960 89.960 89.960 mm

```

285 "		Rainfall volume	0.00	27.89	27.89	c.m"
286 "		Rainfall losses	50.076	6.571	6.571	mm"
287 "		Runoff depth	39.884	83.389	83.389	mm"
288 "		Runoff volume	0.00	25.85	25.85	c.m"
289 "		Runoff coefficient	0.000	0.927	0.927	"
290 "		Maximum flow	0.000	0.018	0.018	c.m/sec"
291 "	40	HYDROGRAPH Add Runoff "				
292 "	4	Add Runoff "	0.018	0.007	0.020"	
293 "			0.018			
294 "	54	POND DESIGN"				
295 "		0.018 Current peak flow	c.m/sec"			
296 "		0.013 Target outflow	c.m/sec"			
297 "		25.9 Hydrograph volume	c.m"			
298 "		5. Number of stages"				
299 "		340.650 Minimum water level	metre"			
300 "		340.950 Maximum water level	metre"			
301 "		340.650 Starting water level	metre"			
302 "		0 Keep Design Data: 1 = True; 0 = False"				
303 "		Level Discharge	Volume"			
304 "		340.650 0.000	0.000"			
305 "		340.800 0.00478	0.07500"			
306 "		340.850 0.00552	0.7500"			
307 "		340.900 0.00617	3.890"			
308 "		340.950 0.00676	11.590"			
309 "		1. HOR. ORIFICES"				
310 "		Orifice Orifice	Orifice Number of"			
311 "		invert coefficie	diameter orifices"			
312 "		340.650 0.630	0.0750 1.000"			
313 "		Peak outflow	0.006 c.m/sec"			
314 "		Maximum level	340.922 metre"			
315 "		Maximum storage	7.277 c.m"			
316 "		Centroidal lag	1.587 hours"			
317 "		0.018 0.018	0.006 0.020 c.m/sec"			
318 "	40	HYDROGRAPH Combine	1"			
319 "		6 Combine "				
320 "		1 Node #"				
321 "		Total Site"				
322 "		Maximum flow	0.026 c.m/sec"			
323 "		Hydrograph volume	149.289 c.m"			
324 "		0.018 0.018	0.006 0.026"			
325 "	40	HYDROGRAPH Start - New Tributary"				
326 "		2 Start - New Tributary"				
327 "		0.018 0.000	0.006 0.026"			
328 "	33	CATCHMENT 205"				
329 "		1 Triangular SCS"				
330 "		1 Equal length"				
331 "		1 SCS method"				
332 "		205 Area Drain 4"				
333 "		100.000 % Impervious"				
334 "		0.013 Total Area"				
335 "		10.000 Flow length"				
336 "		1.000 Overland Slope"				
337 "		0.000 Pervious Area"				
338 "		10.000 Pervious length"				
339 "		1.000 Pervious slope"				
340 "		0.013 Impervious Area"				
341 "		10.000 Impervious length"				
342 "		1.000 Impervious slope"				
343 "		0.250 Pervious Manning 'n'"				
344 "		75.000 Pervious SCS Curve No."				
345 "		0.000 Pervious Runoff coefficient"				
346 "		0.100 Pervious Ia/S coefficient"				
347 "		8.467 Pervious Initial abstraction"				
348 "		0.015 Impervious Manning 'n'"				
349 "		98.000 Impervious SCS Curve No."				
350 "		0.909 Impervious Runoff coefficient"				
351 "		0.100 Impervious Ia/S coefficient"				
352 "		0.518 Impervious Initial abstraction"				
353 "		0.008 0.000	0.006 0.026 c.m/sec"			
354 "		Catchment 205	Pervious	Impervious	Total Area "	
355 "		Surface Area	0.000	0.013	0.013 hectare"	

356 "		Time of concentration	7.439	1.002	1.002	minutes"
357 "		Time to Centroid	102.514	85.479	85.479	minutes"
358 "		Rainfall depth	89.960	89.960	89.960	mm"
359 "		Rainfall volume	0.00	11.69	11.69	c.m"
360 "		Rainfall losses	50.212	8.153	8.153	mm"
361 "		Runoff depth	39.748	81.808	81.807	mm"
362 "		Runoff volume	0.00	10.63	10.63	c.m"
363 "		Runoff coefficient	0.000	0.909	0.909	"
364 "		Maximum flow	0.000	0.008	0.008	c.m/sec"
365 "	40	HYDROGRAPH Add Runoff "				
366 "		4 Add Runoff "	0.008	0.008	0.006 0.026"	
367 "						
368 "	54	POND DESIGN"				
369 "		0.008 Current peak flow	c.m/sec"			
370 "		0.013 Target outflow	c.m/sec"			
371 "		10.6 Hydrograph volume	c.m"			
372 "		5. Number of stages"				
373 "		340.490 Minimum water level	metre"			
374 "		340.800 Maximum water level	metre"			
375 "		340.490 Starting water level	metre"			
376 "		0 Keep Design Data: 1 = True; 0 = False"				
377 "		Level Discharge	Volume"			
378 "		340.490 0.000	0.000"			
379 "		340.640 0.00479	0.07500"			
380 "		340.700 0.00566	0.4800"			
381 "		340.750 0.00630	1.990"			
382 "		340.800 0.00687	5.850"			
383 "		1. HOR. ORIFICES"				
384 "		Orifice Orifice	Orifice Number of"			
385 "		invert coefficie	diameter orifices"			
386 "		340.490 0.630	0.0750 1.000"			
387 "		Peak outflow	0.006 c.m/sec"			
388 "		Maximum level	340.703 metre"			
389 "		Maximum storage	0.556 c.m"			
390 "		Centroidal lag	1.437 hours"			
391 "		0.008 0.008	0.006 0.026 c.m/sec"			
392 "	40	HYDROGRAPH Combine	1"			
393 "		6 Combine "				
394 "		1 Node #"				
395 "		Total Site"				
396 "		Maximum flow	0.030 c.m/sec"			
397 "		Hydrograph volume	160.000 c.m"			
398 "		0.008 0.008	0.006 0.030"			
399 "	40	HYDROGRAPH Start - New Tributary"				
400 "		2 Start - New Tributary"				
401 "		0.008 0.000	0.006 0.030"			
402 "	33	CATCHMENT 206"				
403 "		1 Triangular SCS"				
404 "		1 Equal length"				
405 "		1 SCS method"				
406 "		206 Uncontrolled"				
407 "		35.000 % Impervious"				
408 "		0.084 Total Area"				
409 "		6.000 Flow length"				
410 "		10.000 Overland Slope"				
411 "		0.055 Pervious Area"				
412 "		6.000 Pervious length"				
413 "		20.000 Pervious slope"				
414 "		0.029 Impervious Area"				
415 "		6.000 Impervious length"				
416 "		20.000 Impervious slope"				
417 "		0.250 Pervious Manning 'n'"				
418 "		75.000 Pervious SCS Curve No."				
419 "		0.437 Pervious Runoff coefficient"				
420 "		0.100 Pervious Ia/S coefficient"				
421 "		8.467 Pervious Initial abstraction"				
422 "		0.015 Impervious Manning 'n'"				
423 "		98.000 Impervious SCS Curve No."				
424 "		0.812 Impervious Runoff coefficient"				
425 "		0.100 Impervious Ia/S coefficient"				
426 "		0.518 Impervious Initial abstraction"				

427 "	0.029	0.000	0.006	0.030 c.m/sec"
428 "	Catchment 206	Pervious	Impervious	Total Area "
429 "	Surface Area	0.055	0.029	0.084 hectare"
430 "	Time of concentration	2.229	0.300	1.264 minutes"
431 "	Time to Centroid	95.854	84.440	90.144 minutes"
432 "	Rainfall depth	89.960	89.960	89.960 mm"
433 "	Rainfall volume	49.12	26.45	75.57 c.m"
434 "	Rainfall losses	50.680	16.947	38.874 mm"
435 "	Runoff depth	39.280	73.013	51.086 mm"
436 "	Runoff volume	21.45	21.47	42.91 c.m"
437 "	Runoff coefficient	0.437	0.812	0.568 "
438 "	Maximum flow	0.013	0.016	0.029 c.m/sec"
439 " 40	HYDROGRAPH Add Runoff "			
440 "	4 Add Runoff "			
441 "	0.029	0.029	0.006	0.030"
442 " 40	HYDROGRAPH Copy to Outflow"			
443 "	8 Copy to Outflow"			
444 "	0.029	0.029	0.029	0.030"
445 " 40	HYDROGRAPH Combine 1"			
446 "	6 Combine "			
447 "	1 Node #"			
448 "	Total Site"			
449 "	Maximum flow	0.057		c.m/sec"
450 "	Hydrograph volume	202.913		c.m"
451 "	0.029	0.029	0.029	0.057"
452 " 40	HYDROGRAPH Confluence 1"			
453 "	7 Confluence "			
454 "	1 Node #"			
455 "	Total Site"			
456 "	Maximum flow	0.057		c.m/sec"
457 "	Hydrograph volume	202.913		c.m"
458 "	0.029	0.057	0.029	0.000"
459 " 38	START/RE-START TOTALS 1"			
460 "	3 Runoff Totals on EXIT"			
461 "	Total Catchment area		0.276	hectare"
462 "	Total Impervious area		0.221	hectare"
463 "	Total % impervious		80.217"	
464 " 19	EXIT"			