STORMWATER MANAGEMENT REPORT

Gas Bar &
Convenience Store
Airport Road
Mulmur, Ontario

Revised April 7, 2018
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Revised June 28 2017
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1.0 Scope of work

Ram Engineering Inc. has developed a stormwater management plan for the development of the property at Airport Road, Mulmur, Ontario.

The total site is 5975 m^2 in size. In its existing state, the site is undeveloped. It is proposed to construct a gas station and a convenience store.

This report outlines the stormwater management plan for a proposed development as follows:

- Determination of the existing and proposed development flow rates from the site;
- Manage an allowable release rate of the site in keeping with the Township of Mulmur, County of Dufferin and Nottawasaga Valley Conservation Authority (NVCA) standards.
- Implement flood mitigation measures to meet the Township design criteria
- Provide water quality for the enhanced Level 1 treatment (80% removal)
- Provide erosion and sediment control measures during construction.

The Site Servicing and Grading Plan attached to this report details the development.

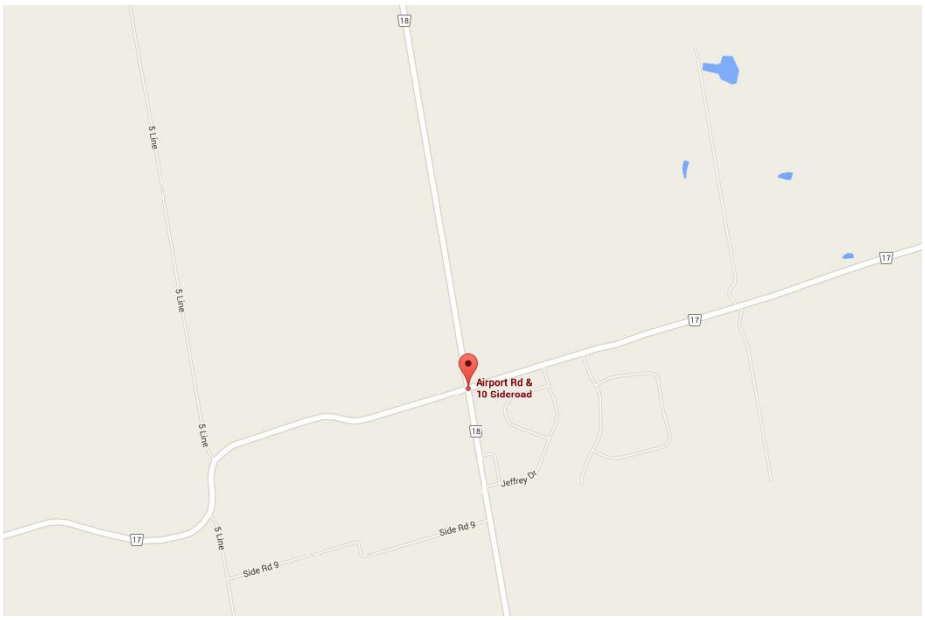
2.0 Existing and proposed drainage for the site

The site is 5975 m^2. Under existing conditions, the lands are a mix of bare ground, grass and gravel. A total of 670 m2 of lands are to be dedicated to the County of Dufferin for Road widening for 10 Sideroad/Dufferin County Road 17 and Airport Road. The site plan shows the area, and is accounted for in the SWM plan. The table below shows the area considered for SWM, and the existing landuse for the site.

Existing Landuse

Total area of property	=	5975	m^2
Road widening dedication	=	612	m^2
Total development area	=	5363	m^2
Ex. Landuse for development area			
Pasture/green areas	=	4321	m^2
Gravel	=	1042	m^2
Total Drainage area	=	5363	m^2

Figure shows the location of the site.



Using the Rational Method, the flows from the site is 0.034 m^3/s

The runoff from the site is going to three outlets:

- Sheet flowing to Airport Road to the east
- Sheet flow to 10 Sideroad in the north
- Sheet flow/ swale along the west property line to a ditch along the south property line

The table below shows the drainage area to their respective outlets.

Area Drainage pattern

Area draining to 10 Sideroad	=	379	m^2
Area draining to South ditch	=	876	m^2
Area draining to Airport Rd	=	4108	m^2
Total		5305	m^2

The lands to the west and south are under cultivation, and as such the existing grades along those property lines are not necessarily what the survey shows. The flow directions were verified with a site visit.

The existing and proposed drainage are shown in a plan attached to this report.

The runoff for the site is conveyed to a stormsewer that is to be constructed along Dufferin County Road 17, connecting to an existing Maintenance Rd to the east of Airport Road.

Design drawings for the proposed stormsewer is attached to this drawing.

The proposed land use is detailed in the table below.

Proposed landuse			
Controlled area			
Roofs			
Roof - Canopy	=	223	m^2
- Building	=	280	m^2
Total	**=**	503	
Non Roof Area			
Landscape	=	1555	m^2
Concrete & asphalt	=	2756	m^2
Total	**=**	**4311**	**m^2**
Percent Imperviousness	=	76	%
Uncontrolled area			
Landscape	=	420	m^2
Pavement	=	129	m^2
Total	**=**	**549**	**m^2**
Percent Imperviousness	=	23	%
Total for site		**5363**	**m^2**

Note that the table above accounts for the uncontrolled landscape and pavement areas that cannot be controlled because of grading limitations. The proposed drainage plan is appended to this report.

For the calculations of the flow and storage required on site, the following areas are used:

Drainage Area

Area A1

Landscape + septic bed	0.1100	ha
Imperviousness	0	%

Area A2

Canopy - roof	0.0223	ha
Imperviousness	99	%

Area A3

Building	0.0280	ha
Hard surface	0.2756	ha
Landscape	0.0455	ha
Imperviousness	87	%
Total for A 3	0.3491	ha
Total A1 + A2 + A3	0.4814	ha

4.0. Rainfall Data

The rainfall data for Mulmur is used to calculate the runoff from the site. The data is derived from MTO Look up program. Below is a summary of the data.

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	21.1	27.8	32.3	38.0	42.2	46.3
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	119.8	73.8	55.6	34.3	21.1	13.0	6.0	3.7	2.3
5-yr	157.9	97.3	73.3	45.1	27.8	17.1	7.9	4.9	3.0
10-yr	183.5	113.0	85.1	52.4	32.3	19.9	9.2	5.7	3.5
25-yr	215.8	133.0	100.1	61.7	38.0	23.4	10.9	6.7	4.1
50-yr	239.7	147.7	111.2	68.5	42.2	26.0	12.1	7.4	4.6
100-yr	263.0	162.0	122.0	75.2	46.3	28.5	13.2	8.2	5.0

Using the above data, the 4 hour Chicago storm is derived for all storm, ranging from the 2 to the 100-year event.

3.0 Flood control criteria

The NVCA, the County and the Township requested that post development flows at all storms (2 to the 100 year events) to be controlled to the pre-development levels.

The SWMHYMO simulation model is used for the analysis. The details of the hydrologic modelling are provided in the Appendix.

4.0 Flood storage

To attenuate the flooding from post to predevelopment levels for all storms, the storage from the site are determined as follow:

1. Storage in stormpipes which are oversized to create storage.

Storage in pipes

From CB/MH	To CB/MH	Pipe size (m)	Length (m)	Volume (m^3)
CB1	MH 1	0.200	24.0	0.75
CB 2	CBMH 1	0.200	21.9	0.69
CB 3	CBMH 1	0.375	17.4	1.92
CB 4	375 LEAD	0.200	15.0	0.47
CB 8	200 LEAD	0.200	8.0	0.25
CB 7	200 LEAD	0.200	4.7	0.15
CBMH 1	MH 1	0.375	39.4	4.35
MH 1	MH 3	0.375	8.9	0.98
Concrete Box		1.8 x0.9m	25.0	40.50
CB 5	MH 3	0.200	19.8	0.62
			Total	50.84

2. Storage in CB and Manholes

	Invert at CB/MH (m)	Top El. (m)	Storage @ El. 313.50 (m^3)
CB 1	312.00	313.60	1.50
CB 2	312.11	313.50	1.39
CB 3	311.92	313.50	1.58
CB 4	312.10	313.50	1.40
CB 5	311.66	313.50	1.84
CB 6	311.75	313.50	1.75
CB 7	312.00	313.50	1.50
CB 8	311.69	313.50	1.81
CB 9	311.34	313.50	2.16
CBMH 1	311.84	313.50	1.66
MH 1	311.62	313.50	1.88
MH 3	311.49	313.50	2.01
Total			20.48

3. Storage around catchbasins and CBMH

Storages on Paved areas (m^3)

Location	At Elev. 313.65 m
CB 2	5.0
CB 3	28.5
CB 4	10.5
CB 5	23.4
CB 9	15.5
CB 6	9.4
CB 8	9.4
Total	101.7

4. Summary of the storage is presented in the Table below.

Stage (m)	Storage (m^3) IN MH & CB	In Pipes	Paved area	Total storage	Remarks
311.49	0	0	0	0	Outlet elevation
312.00	3	13	0	16	Elevation
312.30	5	50.94	0	56	Obvert of highest pipe
313.50	20.5	50.94	0	71	top of CB/CNMH
313.65	20.5	50.94	102	173	Elev of flooding on paved areas
313.70	20.5	50.94	102	173	Max flooding on paved areas

5.0 Release rate from site

The flows from the site (from 2 to 100 year storm) will be released via control MH 3. At this manhole, two orifices are used:

1. The lower 75 mm orifice to achieve the 2 t the 5 year pre-development rates and at the same time control the level of flooding on site to the minor system (no surface flooding).

   Note that this the 75mm minimum orifice is recommended to prevent clogging, and NVCA has agreed to use this size as the minimum. This would result in a larger than pre-development flows to be released for the minor storms, but over control for the events greater than 10 year. Whereas, additional storage can be provided, no impact is made on the release rate as it is governed with the discharge from the 75mm size orifice.

2. A 200mm office to release the pre-development rates for the higher storms in combination with the discharges from the lower orifice.

The design details are on the SSG -1.

The orifice equation is used to calculate the discharge for each orifice:

$$Q = CA\sqrt{2gh}$$

Where Q = discharge (m^3/s)
g= gravity (9.81 m^2/s)
A= area of orifice (m^2)
C= orifice coefficient (0.62)
h= head (m)

For the lower orifice, the analysis was done with the following orifice sizes:
Lower orifice = 75 mm (minimum recommended)
Upper Orifice = 200 mm

Sizing the orifice

Lower Orifice

Q = CA (2gh)0.5

where C = 0.62
D = 0.075 m
A = 0.0044 Area of orifice, m^2
g = 9.81 gravity (m/s^2)

Upper Orifice

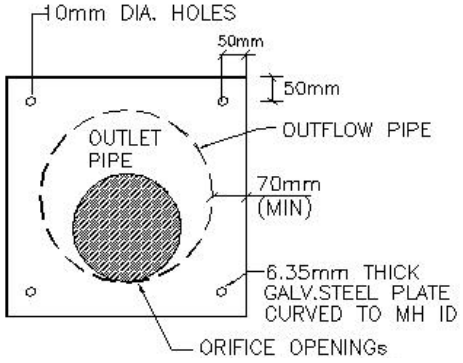
Q = CA (2gh)0.5

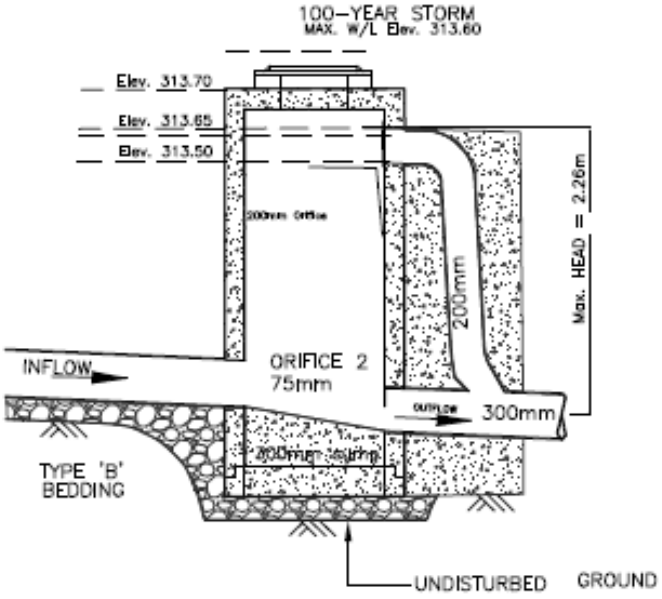
where C = 0.62
D = 0.200 m
A = 0.0314 Area of orifice, m^2
g = 9.81 gravity (m/s^2)

Stage (m)	Lower Head (m)	Upper Head (m)	Discharge (m^3/s) Lower Orifice	Upper orifice	Total	Remarks
311.49	0	0.00	0.000	0.000	0.000	Outlet elevation
312.00	0.472	0.00	0.008	0.000	0.008	Elevation
312.30	0.773	0.00	0.011	0.000	0.011	Obvert of highest pipe
313.50	1.972	0.00	0.017	0.000	0.017	Top of CB/CNMH
313.65	2.122	0.05	0.018	0.019	0.037	Elev of flooding on paved areas
313.70	2.172	0.10	0.018	0.027	0.045	Max flooding on paved areas

As said before, NVCA requires that a minimum size of 75 mm of orifice. This will result in a larger discharge and less storage for the more frequent events, but over control for less frequent storms (typically greater than 10 year event).

Fire below shows the type of discharge structure.





ORIFICE PLATE
MH 3 (NTS)

6.0 Calculations of storage required

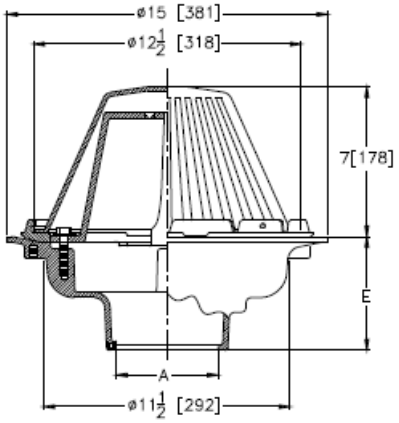
The stage storage and the stage discharge curve are combined to create a stage storage discharge relationship, as detailed below:

Stage	Discharge (m^3/s)	Storage on site (m^3)
311.49	0.000	0.0000
312.00	0.008	0.0016
312.30	0.011	0.0056
313.50	0.017	0.0071
313.65	0.037	0.0173
313.70	0.045	0.0173

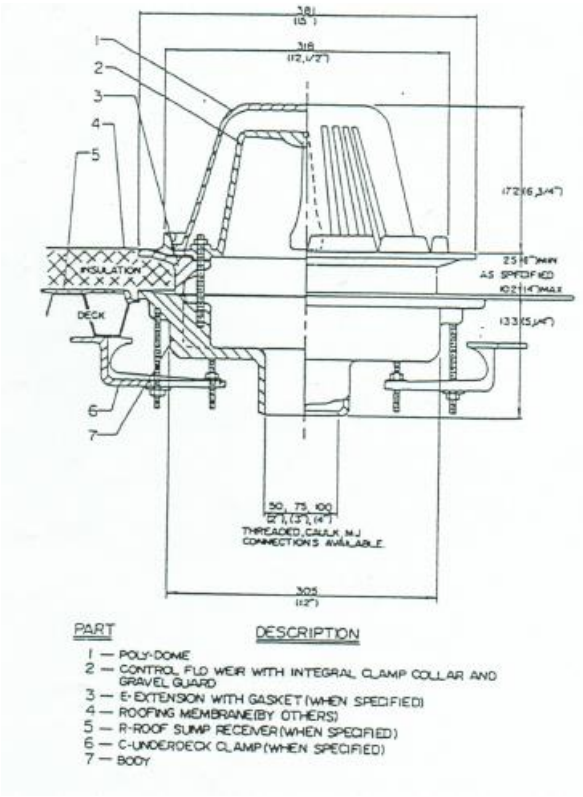
7.0 Control of flows on the canopy

The roof top of the canopy (over the pumps) are proposed to be used to control the runoff. The control release will be done with a Zurn Hopper. See figure below for Hooper.

SPECIFICATION DATA



ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level or sloped roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/ gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.



The roof area that is considered hard surface equals 0.0223 ha. The storage on this area is determined with the assumptions that the roof will be drained with one (1) roof hopper. At these control device (hopper), the ponding depth is taken as 152mm with the tributary area sloped at 2% to the hoppers. The data below shows how the storage is provided at each of four (4) hoppers are calculated.

Release from Patio Roof		
Use Zurn Z - 105 "Control Flo"	1	
For a depth of 152mm, Q hopper	97.5 l/s	
Tributary area	223	m^2
Use 1 Zurn hopper		
Storage around hopper	11.3	m^3
One unit per roof area, with 1 notch		
Total discharge = 0.001625 m^3/s		

Maximum storage used on the canopy is 9.8 m^3 for the 100 year storm

7.0 Flows from the roofs to infiltration bed

The flow from the roofs (building + canopy over gas pumps) will go into an infiltration bed. This is the uncontrolled flows from the roof over the convenience store and the controlled flows from the canopy. This bed is sized to provide the storage to infiltrate most of the runoff from these roofs. The volume contained is 14.4 m^3.

The storage within the roof is not being used for SWM for the site, as per NVCA request.

It is expected that there would be no accumulation of runoff within the infiltration bed, as the percolation rate is high silty sand/sandy silt as per Borehole No. 7 of Geotechnical report prepared by AMEC Foster wheeler dated 16 June 2016.

The requirement for infiltration 5mm of runoff from the site is addressed with the provision of the infiltration bed. The calculations of the 5mm runoff is based on the table of initial abstention used by TRCA.

Abstraction base on land-use

Surface Type	Initial Abstraction	TSS Removal
Impervious roof	1mm	80%
Asphalt pavement	1mm	0%
Landscape	5mm	80%
Green Roof	7mm max for intensive roofs otherwise 5mm	80%
Permeable Pavers	5mm	80% with storage bed otherwise 50%
Concrete pavers	1mm	0%
Grassed swale	5mm	50% for a min length of 16m

For using any other numbers, backup information is required and will be lc by case basis.

Area used in the calculations are as follows:

Building	503	m^2
Pavement	2885	m^2
Landscape	1975	m^2
	5363	m^2

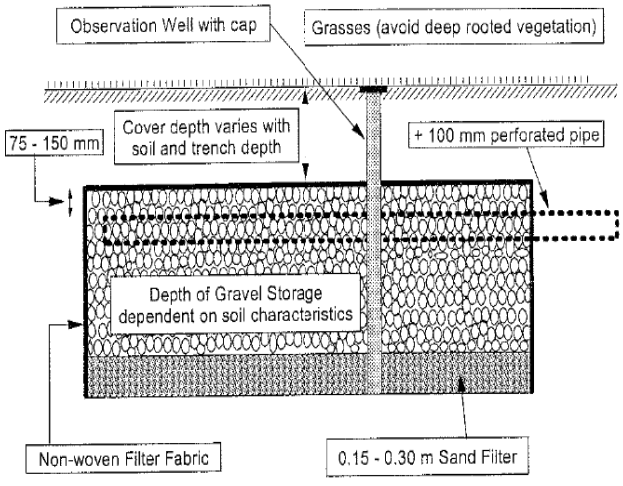
Based on the above, 27 m^3 of infiltration or re-cycling of runoff is required. However, after accounting for natural abstractions, the table below shows that 14 m3 is required in the infiltration bed.

Water Balance

Volume required for site	27	m^2
Volume abstracted from Landscape	10	m^2
Volume abstracted from pavement	3	m^2
Total volume abstracted	13	m^2
Volume required to be storage/infiltrated	14	m^2

An infiltration bed is proposed that would infiltrate the runoff required to meet the water balance target with flows from the roof, which is considered clean.

The typical infiltration bed recommended by MOE is shown in Figure below.



From: MOE Stormwater Management Manual, Figure 4-8 (Subsurface infiltration trench), page 4-27

The percolation rate for the silty sand/sandy silt is not stated in the Geotechnical Report. However, a high rate is expected of these types of soil. Using MOE Manual of Policy, Procedures and Guidelines for Private sewage disposal systems for the silty san/sandy silt, a percolation rate of 8 – 20 min/cm is recommended. Using the higher value (conservative), the percolation rate is 30 mm/hr.

The bottom area of the trench can be calculated from the equation from MOE manual, as detailed below:

$$A = \frac{1000V}{Pn\Delta t}$$

Where:

A = bottom area of the trench (m^2)
V = runoff volume to be infiltrated (14 m^3)
P = percolation rate (mm/hr)
n = porosity of the storage media (0.4 for clear stones)
Δt = retention time (48 hours)

Substituting, A = (1000 x 14)/(30 x 0.4 X 48)

A = 24 m^2 (minimum)

An infiltration bed 2 x 15 with a depth of 1.2m filled with 25 – 50 clear stones is proposed. The site servicing and grading plan shows the location.

The porosity of the stones is 0.40, hence the volume of storage for infiltration is

$$V_{infiltration} = 0.40 \times 1.2 \times 12 \times 2 = 14.4\ m^3$$

Note that an infiltration volume of 14 m^3 is required.

Groundwater was not encountered on any of the four (4) holes. The test holes were all dry so there would be no impact from the ground water system with the functioning of the infiltration through the sands.

7.1 Maintenance of Infiltration bed

The maintenance of the infiltration is detailed on the Dwg SSG – 1. The owner is required to follow the requirements shown in the drawing.

The full requirements are detailed below.

Maintenance of infiltration bed
(Owner's responsibilities)

1. Monitor the water level in the infiltration bed (use MH) at least three times annually
2. The monitoring should be before and 48 hours after a storm, at least 25mm rainfall
3. If the water is still present in the bed after 48 hours, the owner is required to flush the bed
4. Retest the water levels after flushing. If no change is observed, excavate the bed and refill the bed with clean 50mm stones.

8.0 Flood control from the site

The hydrology for the site was done with SWMHYMO model.

- CN calculations are as follows:
  For areas with grass (pasture condition, Area = 4263 m^2),
  Soil Group BC is appropriate, CN = 71
  For parking area with gravel,
  Soil Group D with 80 % imperviousness , CN = 80
  Weighted CN = 73

- Initial abstraction (Ia), derived as follows:
  For areas with grass Ia = 7 mm
  For parking area with gravel, Ia = 5 mm
  Weighted Ia = 6.6 mm

The table below shows the controls achieve with the routing of the flows through the infiltration bed and the storage on site. The table below shows the stormwater management for the site for quantity control.

SWM for the site

Storm	Q_{pre} (m^3/s)	$Q_{uncontrolled}$ (m^3/s)	$Q_{allowable}$ (m^3/s)	Q_{post} (m^3/s)	Q_{post} - $Q_{allowable}$ (m^3/s)	Storage Required (m^3)	Flood Elev. (m)
2	0.008	0.003	0.005	0.011	0.006	49.8	
5	0.016	0.004	0.012	0.016	0.004	67.6	313.38
10	0.023	0.006	0.017	0.019	0.002	79.8	
25	0.032	0.007	0.025	0.022	-0.003	96.4	
50	0.040	0.008	0.032	0.024	-0.008	109.0	
100	0.048	0.009	0.039	0.027	-0.012	121.8	313.60

All the storms are below the pre-development levels, except the 2 to 10 year events. The

difference for the 10 year storm is 2 litre/s. As explained before, it is not practicable to achieve the release rate for the minor storms and use a 75mm orifice as a minimum for the lower one.

8.0 Water quality

The ministry of Environment requires that water quality be implemented on site to treat runoff from the site to Type 1 (80% removals).

A stormceptor unit will be used to treat the runoff from the site. Flow from the roof is considered clean (no suspended solids, oils, etc.), hence the roof area would be unaccounted for in water quality treatment.

The areas to be treated are as follows:

Areas for water quality		
Building	503	m^2
Pavement	2885	m^2
Landscape	1555	m^2
Area draining through STC	4943	m^2
% Imperviousness	69	

Using the Stormceptor program, a STC 300 unit will adequately treat the flow to achieve a 84% TSS removal. The supporting calculations are appended to this report.

Maintenance of the stormceptor would be required as per the manufacturer's requirements. Reference should be made to their maintenance manual. The owner is expected to maintain as per the manufacturer's requirements. A copy of manual is to be provided to the owner.

9.0 Erosion and sediment Control

During construction, there would be the potential for erosion to take place, and sediments to move within and out of the site.

To minimize the impact, the following measures should be implemented:

1. All sediment and siltation control measures shall be implemented by the contractor before the start of construction, where it is appropriate.
2. A silt fence as per the Township standard should be installed around the perimeter of the site.
3. A mud mat should be placed at the entrance/ access point of the construction site. The contractor should follow the Township Standard for its design and implementation.

4. Existing catchbasins and newly constructed one should be protected by sediment catchbasin barriers as per the Township standards.
5. If the construction is delayed for more than 30 days, all bare areas should be seeded.
6. The municipal road should be kept clean of mud and dirt; it should be cleaned at least once a week, or as required by the Township.

The construction engineer should inspect the erosion and sediment control devices frequently and after major storm events to make sure that they are functional. Repairs should be done as appropriate.

10. Summary

The site is 5975m^2 in size. A total of 4961 m^2 is controlled. The remainder of the site drains which is mostly landscaped areas is uncontrolled.

Flood mitigation is proposed to attenuate the post development flows to the pre-development level for all storms (2 to 100 year events). This is achieved except at the 2 and 5 year storms, which is marginally above. The requirement using a 75 mm orifice does not make it possible to reduce the 2 and 5 year storms to their pre-development levels.

For the 100 year storm, 27 litres/sec (Table in Section 8 of this report) will be released to the proposed stormsewer along Airport Road and Dufferin County Road 17. The release allowed from the proposed new gas station at 936593 Airport Road is 25 litres/sec. The total flow into the proposed stormsewer from the east and west gas stations for the 100 year post development event is 52 litres/sec.

A STC 300 will be used to provide water quality to 84% TSS removal for enhanced level.

The Site Servicing and Grading Plan in the Appendix of this report show the storm water management plan that addresses the City design criteria.

Respectfully submitted,

Ram Dharamdial, M. Eng., P. Eng.
Ram Engineering Inc.

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	07/02/2016
Project Name	Gas Station
Project Number	Mulmur
Location	Ontario

Designer Information

Company	Ram Engineering Inc.
Contact	Ram Dharamdial

Notes

N/A

Drainage Area

Total Area (ha)	0.49
Imperviousness (%)	69

The Stormceptor System model STC 300 achieves the water quality objective removing 84% TSS for a Fine (organics, silts and sand) particle size distribution.

Rainfall

Name	TORONTO CENTRAL
State	ON
ID	100
Years of Records	1982 to 1999
Latitude	45°30'N
Longitude	90°30'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0.000	00.000
0.004	09.000
0.015	35.000

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	**84**
STC 750	88
STC 1000	88
STC 1500	88
STC 2000	91
STC 3000	91
STC 4000	93
STC 5000	93
STC 6000	95
STC 9000	96
STC 10000	96
STC 14000	97

Selecta-Drain Chart

LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL			51mm (2") RISE			102mm (4") RISE			152mm (6") RISE		
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth	L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	59 (13)	6.5	66 (2.6)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14	76 (3)	86.5 (19)	10	96.5 (3.8)	100 (22)	7.5	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	75 (16.5)	23	84 (3.3)	93 (20.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	79.5 (17.5)	32	89 (3.5)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	104.5 (23)	4	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	77.5 (17)	16	86.5 (3.4)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	29	76 (3.0)	82 (18)	26	91.5 (3.6)	102.5 (22.5)	18	114.5 (4.5)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	40	81.5 (3.2)	86.5 (19)	34	96.5 (3.8)	107 (23.5)	24	119.5 (4.7)	132 (29)	20	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.3	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	14	71 (2.8)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	70.5 (15.5)	22	78.5 (3.1)	86.5 (19)	15	96.5 (3.8)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	91 (20)	21	101.5 (4.0)	109 (24)	17	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	66 (14.5)	7	73.5 (2.9)	82 (18)	4.5	91.5 (3.6)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	19	73.5 (2.9)	77.5 (17)	16	86.5 (3.4)	93 (20.5)	11	104 (4.1)	111.5 (24.5)	9	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	84 (18.5)	26	94 (3.7)	100 (22)	18	112 (4.4)	120.5 (26.5)	14	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	86.5 (19)	34	96.5 (3.8)	104.5 (23)	24	117 (4.6)	127.5 (28)	20	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	70.5 (15.5)	7.5	78.5 (3.1)	84 (18.5)	4.5	94 (3.7)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	18	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	26	127 (5.0)	129.5 (28.5)	20	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	57 (12.5)	6	63.5 (2.5)	68 (15)	3.8	76 (3.0)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	100 (22)	7.5	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	31	84 (3.3)	86.5 (19)	26	96.5 (3.8)	102.5 (22.5)	18	114.5 (4.5)	113.5 (25)	13	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	42	94 (3.7)	97.5 (21.5)	37	106.5 (4.2)	111.5 (24.5)	26	124.5 (4.9)	125 (27.5)	20	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	7.5	56 (2.2)	61.5 (13.5)	7	68.5 (2.7)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	70.5 (15.5)	15	78.5 (3.1)	88.5 (19.5)	10	99 (3.9)	109 (24)	8	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	27	66 (2.6)	72.5 (16)	23	81.5 (3.2)	93 (20.5)	16	104 (4.1)	113.5 (25)	13	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	36	68.5 (2.7)	77.5 (17)	31	86.5 (3.4)	95.5 (21)	22	106.5 (4.2)	120.5 (26.5)	19	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	8	58.5 (2.3)	63.5 (14)	7	71 (2.8)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	70.5 (15.5)	15	78.5 (3.1)	84 (18.5)	10	94 (3.7)	104.5 (23)	8	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	72.5 (16)	23	81.5 (3.2)	86.5 (19)	15	96.5 (3.8)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	37	76 (3.0)	77.5 (17)	31	86.5 (3.4)	88.5 (19.5)	20	99 (3.9)	109 (24)	17	122 (4.8)

```
==============================================================================================

SSSSS   W   W   M   M   H   H   Y   Y   M   M    OOO          222     000    11   77777 =========
S       W W W   MM MM   H   H    Y Y    MM MM   O   O          2     0   0   11   7   7
SSSSS   W W W   M M M   HHHHH     Y     M M M   O   O          2     0   0   11       7 Ver4.05.0
    S    W W    M   M   H   H     Y     M   M   O   O        222     0   0   11      7  APR 2017
SSSSS    W W    M   M   H   H     Y     M   M    OOO         2       0   0   11     7   =========
                                                             2       0   0   11    7    # 2986141
      StormWater Management HYdrologic Model                 222     000    11    7    =========

*********************************************************************************************
************************************  SWMHYMO Ver4.05.0  ************************************
******************  A single event and continuous hydrologic simulation model  ******************
******************     based on the principles of HYMO and its successors      ******************
******************                 OTTHYMO-83 and OTTHYMO-89.                  ******************
*********************************************************************************************
****************** Distributed by:  J.F. Sabourin and Associates Inc.          ******************
******************                  Ottawa,  Ontario: (613) 836-3884           ******************
******************                  Gatineau, Quebec: (819) 243-6858           ******************
******************                  E-Mail: swmhymo@jfsa.com                   ******************
*********************************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++ Licensed user: Ram Engineering Inc.                        ++++++++++++++++++++
++++++++++++++++++                 Mississauga          SERIAL#:2986141       ++++++++++++++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*********************************************************************************************
******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ******************
******************           Maximum value for ID numbers  :     11            ******************
******************           Max. number of rainfall points: 105408            ******************
******************           Max. number of flow points    : 105408            ******************
*********************************************************************************************

*********************************************************************************************
************************************  SWMHYMO Ver4.05.0  ************************************
******************  A single event and continuous hydrologic simulation model  ******************
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*********************************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
++++++++++++++++++ Licensed user: Ram Engineering Inc.                        ++++++++++++++++++++
++++++++++++++++++                 Mississauga          SERIAL#:2986141       ++++++++++++++++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

*********************************************************************************************
******************           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            ******************
******************           Maximum value for ID numbers  :     11            ******************
******************           Max. number of rainfall points: 105408            ******************
******************           Max. number of flow points    : 105408            ******************
*********************************************************************************************


*******************************   D E T A I L E D   O U T P U T   *******************************
*********************************************************************************************
*                 RUN DATE: 2017-10-10     TIME: 20:05:05     RUN COUNTER: 000001                *
*********************************************************************************************
* Input   file: C:\Users\Ram\Desktop\Mulmur\Flows\Sept20.dat                                    *
* Output  file: C:\Users\Ram\Desktop\Mulmur\Flows\Sept20.out                                    *
* Summary file: C:\Users\Ram\Desktop\Mulmur\Flows\Sept20.sum                                    *
* User comments:                                                                               *
* 1:_____________________________________________________________________________________________*
* 2:_____________________________________________________________________________________________*
* 3:_____________________________________________________________________________________________*
*********************************************************************************************
```

```
R0001:C00001-------------------------------------------------------------------------------------------
*     Gas Station at Mansfield

*

--------------------
| START            | Project  dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
-------------------- Rainfall dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0001
    NSTORM=   6
           #  1=2yr.stm
           #  2=5yr.stm
           #  3=10yr.stm
           #  4=25yr.stm
           #  5=50yr.stm
           #  6=100yr.stm
-------------------------------------------------------------------------------------------------------
R0001:C00002-------------------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Users\Ram\Desktop\Mulmur\Flows\2yr.stm

| Ptotal=  33.71 mm|  Comments: 2-year, 4 hour Chicago

--------------------
      TIME     RAIN|   TIME     RAIN|   TIME     RAIN|   TIME     RAIN|   TIME     RAIN|   TIME     RAIN
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr
      0:10   2.693|   0:50   5.189|   1:30  18.673|   2:10   5.588|   2:50   3.646|   3:30   2.794
      0:20   3.025|   1:00   7.284|   1:40  10.976|   2:20   4.893|   3:00   3.378|   3:40   2.649
      0:30   3.476|   1:10  14.740|   1:50   8.125|   2:30   4.375|   3:10   3.153|   3:50   2.520
      0:40   4.131|   1:20  75.010|   2:00   6.578|   2:40   3.971|   3:20   2.961|   4:00   2.405

-------------------------------------------------------------------------------------------------------
R0001:C00003-------------------------------------------------------------------------------------------
*

*  Pre-development flow

*

---------------------------
| CALIB NASHYD            |   Area    (ha)=     .530   Curve Number   (CN)= 73.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    6.600   # of Linear Res.(N)=  3.00
---------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .121

     PEAK FLOW       (cms)=     .008 (i)
     TIME TO PEAK    (hrs)=    1.500
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .002
     RUNOFF VOLUME    (mm)=    6.069
     TOTAL RAINFALL   (mm)=   33.706
     RUNOFF COEFFICIENT   =     .180

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------
R0001:C00004-------------------------------------------------------------------------------------------
*  Post development Flows

**************************************************************************

*  Uncontrolled flows
```

```
*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .05
| 01:       103 DT= 5.00 |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .04
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      19.13        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      75.01         9.73
               over (min)         5.00        20.00
     Storage Coeff.  (min)=        .86 (ii)   18.79 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .34          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .003 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58         1.333
     RUNOFF VOLUME    (mm)=      32.91         7.63        13.443
     TOTAL RAINFALL   (mm)=      33.71        33.71        33.706
     RUNOFF COEFFICIENT   =        .98          .23          .399
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------
R0001:C00005-----------------------------------------------------------------------------------------
*

**************************************************************************

*                           Flows from Site                              *

**************************************************************************

*

*  Drainage area A1

*

--------------------------
| CALIB NASHYD           |   Area    (ha)=     .110   Curve Number   (CN)= 71.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    7.000   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .025

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.500
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .000
     RUNOFF VOLUME    (mm)=    5.467
     TOTAL RAINFALL   (mm)=   33.706
     RUNOFF COEFFICIENT   =     .162

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------
R0001:C00006-----------------------------------------------------------------------------------------
*

*    Area A2

*   Flows from canopy and storage equal to snow load
```

```
*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .02
| 03:       103 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      12.19        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      75.01         8.47
               over (min)         5.00        25.00
     Storage Coeff.  (min)=        .81 (ii)   24.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .34          .09
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .005 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.333
     RUNOFF VOLUME    (mm)=      32.91         7.63        32.653
     TOTAL RAINFALL   (mm)=      33.71        33.71        33.706
     RUNOFF COEFFICIENT   =        .98          .23          .969
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------
R0001:C00007-----------------------------------------------------------------------------------------
-------------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>03:       103   |
| OUT<04:       104   | ========================  OUTLFOW STORAGE TABLE  ==========================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .001 .1000E-02|    .002 .1200E-02|    .005 .1200E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:       103      .022      .005     1.333     32.653
    OUTFLOW < 04:       104      .022      .000     1.889     32.652

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.609
                  TIME SHIFT OF PEAK FLOW         (min)=    33.33
                  MAXIMUM  STORAGE   USED       (ha.m.)=.4422E-03

-------------------------------------------------------------------------------------------------
R0001:C00008-----------------------------------------------------------------------------------------
-------------------------
| ADD HYD             |
| 05:       105       |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
-------------------------                      (ha)     (cms)    (hrs)      (mm)    (cms)
                       ID 1 04:       104      .022      .000    1.889    32.652    .000
                      +ID 2 01:       101      .110      .002    1.500     5.467    .000
                      ==========================================================================
                      SUM   05:       105      .132      .002    1.500    10.049    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------------------
R0001:C00009-----------------------------------------------------------------------------------------
*


*  Area A3


*  Flows from Hard surfaces, landscape  & roof
```

```
*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .35
| 06:       103 DT= 5.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .30          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      48.24        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      75.01         8.47
               over (min)         5.00        25.00
     Storage Coeff.  (min)=       1.85 (ii)   25.18 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=        .32          .05
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .06          .00          .063 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.67         1.333
     RUNOFF VOLUME    (mm)=      32.91         7.63        29.620
     TOTAL RAINFALL   (mm)=      33.71        33.71        33.706
     RUNOFF COEFFICIENT   =        .98          .23          .879
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------------
R0001:C00010-----------------------------------------------------------------------------------
*


-------------------------
| ADD HYD               |
| 07:       105         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.      DWF
-------------------------                        (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 05:       105      .132      .002    1.500    10.049    .000
                     +ID 2 06:       103      .349      .063    1.333    29.620    .000
                     ======================================================================
                     SUM   07:       105      .481      .065    1.333    24.241    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------------
R0001:C00011-----------------------------------------------------------------------------------
*


*  Route flows through storage on site


*


-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>07:       105   |
| OUT<08:       104   | ==========================  OUTLFOW STORAGE TABLE  ==========================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .011 .5600E-02|    .017 .7100E-02|    .045 .1730E-01
                          .008 .1600E-02|    .017 .7100E-02|    .037 .1730E-01|    .000 .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     -----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 07:       105      .481      .065     1.333     24.241
    OUTFLOW < 08:       104      .481      .011     1.694     24.241

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   16.331
                  TIME SHIFT OF PEAK FLOW         (min)=    21.67
                  MAXIMUM  STORAGE   USED       (ha.m.)=.4982E-02
```

```
--------------------------------------------------------------------------------------------------------
R0001:C00012----------------------------------------------------------------------------------------------
*


--------------------
| PRINT HYD        |   AREA       (ha)=     .481
| ID=08:       104 |   QPEAK     (cms)=     .011 (i)
| DT= 1.67 PCYC=-1 |   TPEAK     (hrs)=    1.694
--------------------   VOLUME      (mm)=   24.241

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------------------------------
R0001:C00013----------------------------------------------------------------------------------------------
*


  ** END OF RUN :    0

********************************************************************************************************




--------------------
| START            | Project  dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
-------------------- Rainfall dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0002
    NSTORM=   1
           #  1=5yr.stm
--------------------------------------------------------------------------------------------------------
R0002:C00002----------------------------------------------------------------------------------------------
*     Gas Station at Mansfield


*


--------------------------------------------------------------------------------------------------------
R0002:C00002----------------------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Users\Ram\Desktop\Mulmur\Flows\5yr.stm


| Ptotal=  44.27 mm|  Comments: 5-year, 4 hour Chicago

--------------------
      TIME     RAIN|   TIME     RAIN|   TIME     RAIN|   TIME     RAIN|   TIME     RAIN|   TIME     RAIN
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr
      0:10   3.526|   0:50   6.801|   1:30  24.530|   2:10   7.325|   2:50   4.775|   3:30   3.659
      0:20   3.961|   1:00   9.551|   1:40  14.404|   2:20   6.413|   3:00   4.424|   3:40   3.468
      0:30   4.553|   1:10  19.356|   1:50  10.657|   2:30   5.732|   3:10   4.129|   3:50   3.299
      0:40   5.411|   1:20  98.818|   2:00   8.624|   2:40   5.202|   3:20   3.877|   4:00   3.148

--------------------------------------------------------------------------------------------------------
R0002:C00003----------------------------------------------------------------------------------------------
*


*  Pre-development flow


*


---------------------------
| CALIB NASHYD            |   Area     (ha)=     .530   Curve Number   (CN)= 73.00
| 01:       101 DT= 5.00 |   Ia       (mm)=    6.600   # of Linear Res.(N)=  3.00
---------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .121
```

```
     PEAK FLOW       (cms)=     .016 (i)
     TIME TO PEAK    (hrs)=    1.500
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .003
     RUNOFF VOLUME    (mm)=   10.784
     TOTAL RAINFALL   (mm)=   44.274
     RUNOFF COEFFICIENT   =     .244

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------
R0002:C00004-----------------------------------------------------------------------------------------
*  Post development Flows


*************************************************************************


*  Uncontrolled flows


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .05
| 01:       103 DT= 5.00 |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .04
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      19.13        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      98.82        18.71
               over (min)        5.00        15.00
     Storage Coeff.  (min)=        .77 (ii)   14.57 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .34          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .004 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      43.47        12.49         19.614
     TOTAL RAINFALL   (mm)=      44.27        44.27         44.274
     RUNOFF COEFFICIENT   =        .98          .28           .443
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------
R0002:C00005-----------------------------------------------------------------------------------------
*


*************************************************************************


*                          Flows from Site                              *


*************************************************************************


*


*  Drainage area A1


*
```

```
--------------------------
| CALIB NASHYD           |   Area    (ha)=     .110   Curve Number   (CN)= 71.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    7.000   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .025

     PEAK FLOW       (cms)=     .003 (i)
     TIME TO PEAK    (hrs)=    1.500
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .001
     RUNOFF VOLUME    (mm)=    9.852
     TOTAL RAINFALL   (mm)=   44.274
     RUNOFF COEFFICIENT   =     .223

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------
R0002:C00006-----------------------------------------------------------------------------------------
*


*    Area A2


*   Flows from canaopy and storage equal to snow load


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .02
| 03:       103 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .02          .00
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     12.19        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     98.82        16.30
               over (min)        5.00        20.00
     Storage Coeff.  (min)=       .73 (ii)   18.68 (ii)
     Unit Hyd. Tpeak (min)=      5.00        20.00
     Unit Hyd. peak  (cms)=       .34          .10
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .006 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.58         1.333
     RUNOFF VOLUME    (mm)=     43.47        12.49        43.164
     TOTAL RAINFALL   (mm)=     44.27        44.27        44.274
     RUNOFF COEFFICIENT   =       .98          .28          .975
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------
R0002:C00007-----------------------------------------------------------------------------------------
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>03:       103   |
| OUT<04:       104   | ========================  OUTLFOW STORAGE TABLE  ========================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .001 .1000E-02|    .002 .1200E-02|    .005 .1200E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:       103      .022      .006     1.333     43.164
    OUTFLOW < 04:       104      .022      .001     1.889     43.164

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.644
```

```
                  TIME SHIFT OF PEAK FLOW          (min)=    33.33
                  MAXIMUM  STORAGE   USED        (ha.m.)=.5849E-03

--------------------------------------------------------------------------------------------------------
R0002:C00008------------------------------------------------------------------------------------------------
------------------------
| ADD HYD              |
| 05:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.      DWF
------------------------                        (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 04:       104      .022      .001    1.889    43.164    .000
                     +ID 2 01:       101      .110      .003    1.500     9.852    .000
                     ==========================================================================
                     SUM   05:       105      .132      .004    1.500    15.467    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------------------
R0002:C00009------------------------------------------------------------------------------------------------
*


*  Area A3


*  Flows from Hard surfaces, landscape  & roof


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .35
| 06:       103 DT= 5.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .30          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      48.24        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=      98.82        16.30
               over (min)         5.00        20.00
     Storage Coeff.  (min)=       1.66 (ii)   19.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=        .32          .06
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .08          .00          .084 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.58         1.333
     RUNOFF VOLUME    (mm)=      43.47        12.49        39.445
     TOTAL RAINFALL   (mm)=      44.27        44.27        44.274
     RUNOFF COEFFICIENT   =        .98          .28          .891
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------------
R0002:C00010------------------------------------------------------------------------------------------------
*


------------------------
| ADD HYD              |
| 07:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.      DWF
------------------------                        (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 05:       105      .132      .004    1.500    15.467    .000
                     +ID 2 06:       103      .349      .084    1.333    39.445    .000
                     ==========================================================================
                     SUM   07:       105      .481      .086    1.333    32.855    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------------------
```

```
R0002:C00011-----------------------------------------------------------------------------------------
*


*  Route flows through stoarge on site


*


-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>07:       105   |
| OUT<08:       104   | =========================  OUTFLOW STORAGE TABLE  ==========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .011 .5600E-02|    .017 .7100E-02|    .045 .1730E-01
                          .008 .1600E-02|    .017 .7100E-02|    .037 .1730E-01|    .000 .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 07:       105      .481      .086     1.333     32.855
    OUTFLOW < 08:       104      .481      .016     1.667     32.855

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.165
                  TIME SHIFT OF PEAK FLOW         (min)=    20.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6767E-02

-----------------------------------------------------------------------------------------------------
R0002:C00012-----------------------------------------------------------------------------------------
*


--------------------
| PRINT HYD        |   AREA       (ha)=     .481
| ID=08:       104 |   QPEAK     (cms)=     .016 (i)
| DT= 1.67 PCYC=-1 |   TPEAK     (hrs)=    1.667
--------------------   VOLUME      (mm)=   32.855

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
-----------------------------------------------------------------------------------------------------
R0002:C00013-----------------------------------------------------------------------------------------
*


-----------------------------------------------------------------------------------------------------
R0002:C00002-----------------------------------------------------------------------------------------
  ** END OF RUN :    1

*****************************************************************************************************




--------------------
| START            | Project  dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
-------------------- Rainfall dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0003
    NSTORM=   1
           #  1=10yr.stm
-----------------------------------------------------------------------------------------------------
R0003:C00002-----------------------------------------------------------------------------------------
*     Gas Station at Mansfield


*


-----------------------------------------------------------------------------------------------------
R0003:C00002-----------------------------------------------------------------------------------------
--------------------
```

```
| READ STORM       |  Filename: C:\Users\Ram\Desktop\Mulmur\Flows\10yr.stm

| Ptotal=  51.61 mm|  Comments: 10-year, 4 hour Chicago

--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr
      0:10   4.124|   0:50   7.946|   1:30  28.597|   2:10   8.558|   2:50   5.583|   3:30   4.279
      0:20   4.632|   1:00  11.154|   1:40  16.809|   2:20   7.493|   3:00   5.173|   3:40   4.056
      0:30   5.323|   1:10  22.574|   1:50  12.443|   2:30   6.699|   3:10   4.828|   3:50   3.859
      0:40   6.325|   1:20 114.846|   2:00  10.073|   2:40   6.080|   3:20   4.534|   4:00   3.683

------------------------------------------------------------------------------------------------------------
R0003:C00003------------------------------------------------------------------------------------------------
*


*  Pre-development flow


*


--------------------------
| CALIB NASHYD           |   Area    (ha)=     .530   Curve Number   (CN)= 73.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    6.600   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .121

     PEAK FLOW       (cms)=     .023 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .004
     RUNOFF VOLUME    (mm)=   14.581
     TOTAL RAINFALL   (mm)=   51.612
     RUNOFF COEFFICIENT   =     .283

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------------------------
R0003:C00004------------------------------------------------------------------------------------------------
*  Post development Flows


**************************************************************************


*  Uncontrolled flows


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .05
| 01:       103 DT= 5.00 |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .04
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      19.13        40.00
     Mannings n             =       .013         .250

     Max.eff.Inten.(mm/hr)=     114.85        31.51
               over (min)         5.00        10.00
     Storage Coeff.  (min)=        .73 (ii)   11.93 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .10
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .006 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.333
     RUNOFF VOLUME    (mm)=      50.81        16.32        24.254
     TOTAL RAINFALL   (mm)=      51.61        51.61        51.612
```

```
     RUNOFF COEFFICIENT   =        .98          .32           .470
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------------
R0003:C00005-------------------------------------------------------------------------------------------
*


**************************************************************************


*                           Flows from Site                               *


**************************************************************************


*


*  Drainage area A1


*


--------------------------
| CALIB NASHYD           |   Area    (ha)=     .110   Curve Number   (CN)= 71.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    7.000   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .025

     PEAK FLOW       (cms)=     .004 (i)
     TIME TO PEAK    (hrs)=    1.500
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .001
     RUNOFF VOLUME    (mm)=   13.415
     TOTAL RAINFALL   (mm)=   51.612
     RUNOFF COEFFICIENT   =     .260

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

---------------------------------------------------------------------------------------------------
R0003:C00006-------------------------------------------------------------------------------------------
*


*    Area A2


*   Flows from canaopy and storage equal to snow load


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .02
| 03:       103 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      12.19        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     114.85        24.73
               over (min)         5.00        15.00
     Storage Coeff.  (min)=        .68 (ii)   15.88 (ii)
```

```
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .34          .12
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .007 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      50.81        16.32        50.467
     TOTAL RAINFALL   (mm)=      51.61        51.61        51.612
     RUNOFF COEFFICIENT   =        .98          .32          .978
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------------------
R0003:C00007-----------------------------------------------------------------------------------------
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>03:       103   |
| OUT<04:       104   | ========================  OUTLFOW STORAGE TABLE  ========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                         .000 .0000E+00|    .001 .1000E-02|    .002 .1200E-02|    .005 .1200E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     -----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:       103      .022      .007     1.333     50.467
    OUTFLOW < 04:       104      .022      .001     1.889     50.467

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.686
                  TIME SHIFT OF PEAK FLOW         (min)=    33.33
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6830E-03

------------------------------------------------------------------------------------------------------
R0003:C00008-----------------------------------------------------------------------------------------
------------------------
| ADD HYD              |
| 05:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 04:       104      .022      .001    1.889    50.467    .000
                     +ID 2 01:       101      .110      .004    1.500    13.415    .000
                     ==========================================================================
                     SUM   05:       105      .132      .005    1.500    19.660    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------------------
R0003:C00009-----------------------------------------------------------------------------------------
*


*  Area A3


*  Flows from Hard surfaces, landscape  & roof


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=      .35
| 06:       103 DT= 5.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .30          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      48.24        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     114.85        24.73
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       1.56 (ii)   16.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
```

```
     Unit Hyd. peak  (cms)=        .33          .07
                                                        *TOTALS*
     PEAK FLOW       (cms)=        .10          .00          .098 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      50.81        16.32        46.328
     TOTAL RAINFALL   (mm)=      51.61        51.61        51.612
     RUNOFF COEFFICIENT   =        .98          .32          .898
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------------------
R0003:C00010-----------------------------------------------------------------------------------------
*


------------------------
| ADD HYD              |
| 07:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 05:       105      .132      .005    1.500    19.660    .000
                     +ID 2 06:       103      .349      .098    1.333    46.328    .000
                     ==========================================================================
                     SUM   07:       105      .481      .101    1.333    38.999    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------------------
R0003:C00011-----------------------------------------------------------------------------------------
*


*  Route flows through stoarge on site


*


------------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>07:       105   |
| OUT<08:       104   | ========================  OUTLFOW STORAGE TABLE  ==========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .011 .5600E-02|    .017 .7100E-02|    .045 .1730E-01
                          .008 .1600E-02|    .017 .7100E-02|    .037 .1730E-01|    .000 .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     ----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 07:       105      .481      .101     1.333     38.999
    OUTFLOW < 08:       104      .481      .019     1.694     38.999

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.488
                  TIME SHIFT OF PEAK FLOW         (min)=    21.67
                  MAXIMUM  STORAGE   USED       (ha.m.)=.7983E-02

------------------------------------------------------------------------------------------------------
R0003:C00012-----------------------------------------------------------------------------------------
*


--------------------
| PRINT HYD        |   AREA       (ha)=     .481
| ID=08:       104 |   QPEAK     (cms)=     .019 (i)
| DT= 1.67 PCYC=-1 |   TPEAK     (hrs)=    1.694
--------------------   VOLUME      (mm)=   38.999

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
------------------------------------------------------------------------------------------------------
R0003:C00013-----------------------------------------------------------------------------------------
*
```

```
--------------------------------------------------------------------------------------------------
R0003:C00002----------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------
R0003:C00002----------------------------------------------------------------------------------------
  ** END OF RUN :    2

**************************************************************************************************




--------------------
| START            | Project  dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
-------------------- Rainfall dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0004
    NSTORM=   1
           #  1=25yr.stm
--------------------------------------------------------------------------------------------------
R0004:C00002----------------------------------------------------------------------------------------
*     Gas Station at Mansfield


*


--------------------------------------------------------------------------------------------------
R0004:C00002----------------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Users\Ram\Desktop\Mulmur\Flows\25yr.stm


| Ptotal=  60.66 mm|  Comments: 25-year, 5 hour Chicago

--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr
      0:10   4.847|   0:50   9.340|   1:30  33.613|   2:10  10.059|   2:50   6.562|   3:30   5.029
      0:20   5.445|   1:00  13.110|   1:40  19.757|   2:20   8.808|   3:00   6.080|   3:40   4.767
      0:30   6.256|   1:10  26.534|   1:50  14.625|   2:30   7.874|   3:10   5.675|   3:50   4.536
      0:40   7.435|   1:20 134.992|   2:00  11.840|   2:40   7.147|   3:20   5.329|   4:00   4.329

--------------------------------------------------------------------------------------------------
R0004:C00003----------------------------------------------------------------------------------------
*


*  Pre-development flow


*


--------------------------
| CALIB NASHYD           |   Area    (ha)=     .530   Curve Number   (CN)= 73.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    6.600   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .121

     PEAK FLOW       (cms)=     .032 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .005
     RUNOFF VOLUME    (mm)=   19.749
     TOTAL RAINFALL   (mm)=   60.665
     RUNOFF COEFFICIENT   =     .326

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------
R0004:C00004----------------------------------------------------------------------------------------
```

```
*  Post development Flows

*************************************************************************

*  Uncontrolled flows

*

--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .05
| 01:       103 DT= 5.00 |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .04
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      19.13        40.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     134.99        42.23
               over (min)         5.00        10.00
     Storage Coeff.  (min)=        .68 (ii)   10.65 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .00          .00          .007 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.333
     RUNOFF VOLUME    (mm)=      59.86        21.49        30.314
     TOTAL RAINFALL   (mm)=      60.66        60.66        60.665
     RUNOFF COEFFICIENT   =        .99          .35          .500
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------------------------------
R0004:C00005-----------------------------------------------------------------------------------------
*

*************************************************************************

*                          Flows from Site                              *

*************************************************************************

*

*  Drainage area A1

*

--------------------------
| CALIB NASHYD           |   Area    (ha)=     .110   Curve Number   (CN)= 71.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    7.000   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .025

     PEAK FLOW       (cms)=     .006 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .001
     RUNOFF VOLUME    (mm)=   18.295
```

```
     TOTAL RAINFALL   (mm)=   60.665
     RUNOFF COEFFICIENT   =     .302

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------
R0004:C00006------------------------------------------------------------------------------------
*


*    Area A2


*   Flows from canaopy and storage equal to snow load


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .02
| 03:       103 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      12.19        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     134.99        33.05
               over (min)        5.00        15.00
     Storage Coeff.  (min)=        .64 (ii)   14.17 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .34          .13
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .008 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      59.86        21.49        59.481
     TOTAL RAINFALL   (mm)=      60.66        60.66        60.665
     RUNOFF COEFFICIENT   =        .99          .35          .980
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------
R0004:C00007------------------------------------------------------------------------------------
------------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>03:       103   |
| OUT<04:       104   | ========================  OUTLFOW STORAGE TABLE  ========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                         .000 .0000E+00|    .001 .1000E-02|    .002 .1200E-02|    .005 .1200E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:       103      .022      .008     1.333     59.481
    OUTFLOW < 04:       104      .022      .001     1.889     59.481

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.709
                  TIME SHIFT OF PEAK FLOW         (min)=    33.33
                  MAXIMUM  STORAGE   USED       (ha.m.)=.8048E-03

--------------------------------------------------------------------------------------------------
R0004:C00008------------------------------------------------------------------------------------
------------------------
| ADD HYD              |
| 05:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                        (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 04:       104      .022      .001    1.889    59.481    .000
                     +ID 2 01:       101      .110      .006    1.417    18.295    .000
                     ======================================================================
```

```
                    SUM   05:       105      .132      .007    1.417    25.237    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------------
R0004:C00009------------------------------------------------------------------------------------
*


*  Area A3


*  Flows from Hard surfaces, landscape  & roof


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .35
| 06:       103 DT= 5.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
--------------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .30          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      48.24        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     134.99        33.05
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       1.46 (ii)   14.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .11          .00          .115 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      59.86        21.49        54.876
     TOTAL RAINFALL   (mm)=      60.66        60.66        60.665
     RUNOFF COEFFICIENT   =        .99          .35          .905
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------
R0004:C00010------------------------------------------------------------------------------------
*


-------------------------
| ADD HYD               |
| 07:       105         |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                          (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 05:       105      .132      .007    1.417    25.237    .000
                     +ID 2 06:       103      .349      .115    1.333    54.876    .000
                     ==========================================================================
                     SUM   07:       105      .481      .120    1.333    46.730    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------------------
R0004:C00011------------------------------------------------------------------------------------
*


*  Route flows through storage on site


*


-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
```

```
|  IN>07:       105   |
| OUT<08:       104   | ========================  OUTLFOW STORAGE TABLE  ========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                         .000 .0000E+00|    .011 .5600E-02|    .017 .7100E-02|    .045 .1730E-01
                         .008 .1600E-02|    .017 .7100E-02|    .037 .1730E-01|    .000 .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW > 07:       105      .481      .120     1.333     46.730
    OUTFLOW < 08:       104      .481      .022     1.694     46.730

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.278
                  TIME SHIFT OF PEAK FLOW         (min)=    21.67
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9638E-02

--------------------------------------------------------------------------------------------------
R0004:C00012------------------------------------------------------------------------------------------
*


--------------------
| PRINT HYD        |   AREA       (ha)=     .481
| ID=08:       104 |   QPEAK     (cms)=     .022 (i)
| DT= 1.67 PCYC=-1 |   TPEAK     (hrs)=    1.694
--------------------   VOLUME      (mm)=   46.730

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
--------------------------------------------------------------------------------------------------
R0004:C00013------------------------------------------------------------------------------------------
*


--------------------------------------------------------------------------------------------------
R0004:C00002------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------
R0004:C00002------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------
R0004:C00002------------------------------------------------------------------------------------------
  ** END OF RUN :    3

**************************************************************************************************




--------------------
| START            | Project  dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
-------------------- Rainfall dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0005
    NSTORM=   1
           #  1=50yr.stm
--------------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------------------
*     Gas Station at Mansfield


*


--------------------------------------------------------------------------------------------------
R0005:C00002------------------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Users\Ram\Desktop\Mulmur\Flows\50yr.stm


| Ptotal=  67.35 mm|  Comments: 50-year, 4 hour Chicago

--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr
      0:10   5.383|   0:50  10.372|   1:30  37.230|   2:10  11.169|   2:50   7.287|   3:30   5.585
      0:20   6.046|   1:00  14.558|   1:40  21.938|   2:20   9.780|   3:00   6.752|   3:40   5.294
```

```
      0:30   6.947|   1:10  29.462|   1:50  16.240|   2:30   8.744|   3:10   6.302|   3:50   5.036
      0:40   8.256|   1:20 149.910|   2:00  13.147|   2:40   7.936|   3:20   5.917|   4:00   4.807

--------------------------------------------------------------------------------------------------------
R0005:C00003------------------------------------------------------------------------------------------------
*


*  Pre-development flow


*


--------------------------
| CALIB NASHYD           |   Area    (ha)=     .530   Curve Number   (CN)= 73.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    6.600   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .121

     PEAK FLOW       (cms)=     .040 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .006
     RUNOFF VOLUME    (mm)=   23.857
     TOTAL RAINFALL   (mm)=   67.350
     RUNOFF COEFFICIENT   =     .354

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------------
R0005:C00004------------------------------------------------------------------------------------------------
*  Post development Flows


**************************************************************************


*  Uncontrolled flows


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .05
| 01:       103 DT= 5.00 |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .04
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      19.13        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     149.91        50.86
               over (min)         5.00        10.00
     Storage Coeff.  (min)=        .65 (ii)    9.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .11
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .008 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.333
     RUNOFF VOLUME    (mm)=      66.55        25.57        34.994
     TOTAL RAINFALL   (mm)=      67.35        67.35        67.350
     RUNOFF COEFFICIENT   =        .99          .38          .520
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------------------------------
R0005:C00005------------------------------------------------------------------------------------------------
```

```
*

**********************************************************************

*                          Flows from Site                           *

**********************************************************************

*

*  Drainage area A1

*

--------------------------
| CALIB NASHYD           |   Area    (ha)=     .110   Curve Number   (CN)= 71.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    7.000   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .025

     PEAK FLOW       (cms)=     .007 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .001
     RUNOFF VOLUME    (mm)=   22.195
     TOTAL RAINFALL   (mm)=   67.350
     RUNOFF COEFFICIENT   =     .330

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-----------------------------------------------------------------------------------------------
R0005:C00006----------------------------------------------------------------------------------
*

*    Area A2

*   Flows from canaopy and storage equal to snow load

*

--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .02
| 03:       103 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
--------------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .02          .00
     Dep. Storage     (mm)=       .80         1.50
     Average Slope     (%)=      1.00         1.00
     Length            (m)=     12.19        40.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.91        39.72
               over (min)        5.00        15.00
     Storage Coeff.  (min)=       .61 (ii)   13.19 (ii)
     Unit Hyd. Tpeak (min)=      5.00        15.00
     Unit Hyd. peak  (cms)=       .34          .13
                                                      *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .009 (iii)
     TIME TO PEAK    (hrs)=      1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=     66.55        25.57        66.140
     TOTAL RAINFALL   (mm)=     67.35        67.35        67.350
     RUNOFF COEFFICIENT   =       .99          .38          .982
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------------------
R0005:C00007-----------------------------------------------------------------------------------------
-----------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>03:       103   |
| OUT<04:       104   | ========================  OUTLFOW STORAGE TABLE  ========================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .001 .1000E-02|    .002 .1200E-02|    .005 .1200E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     -----------------------     (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:       103      .022      .009     1.333     66.140
    OUTFLOW < 04:       104      .022      .001     1.889     66.139

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.718
                  TIME SHIFT OF PEAK FLOW         (min)=    33.33
                  MAXIMUM  STORAGE   USED       (ha.m.)=.8947E-03

------------------------------------------------------------------------------------------------------
R0005:C00008-----------------------------------------------------------------------------------------
------------------------
| ADD HYD              |
| 05:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.      DWF
------------------------                        (ha)     (cms)    (hrs)      (mm)    (cms)
                      ID 1 04:       104      .022      .001    1.889    66.139    .000
                     +ID 2 01:       101      .110      .007    1.417    22.195    .000
                     ================================================================
                     SUM   05:       105      .132      .008    1.417    29.602    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------------------
R0005:C00009-----------------------------------------------------------------------------------------
*


*  Area A3


*  Flows from Hard surfaces, landscape  & roof


*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .35
| 06:       103 DT= 5.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .30          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      48.24        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     149.91        39.72
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       1.40 (ii)   13.97 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .13          .00          .128 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      66.55        25.57        61.222
     TOTAL RAINFALL   (mm)=      67.35        67.35        67.350
     RUNOFF COEFFICIENT   =        .99          .38          .909
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------------------------------
R0005:C00010-----------------------------------------------------------------------------------------
*


------------------------
| ADD HYD              |
| 07:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.      DWF
------------------------                      (ha)     (cms)    (hrs)       (mm)    (cms)
                      ID 1 05:       105      .132      .008    1.417    29.602    .000
                     +ID 2 06:       103      .349      .128    1.333    61.222    .000
                     ==========================================================================
                     SUM   07:       105      .481      .134    1.333    52.532    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------------------
R0005:C00011-----------------------------------------------------------------------------------------
*


*  Route flows through stoarge on site


*


------------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>07:       105   |
| OUT<08:       104   | ========================  OUTFLOW STORAGE TABLE  ==========================
----------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                          (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                           .000 .0000E+00|    .011 .5600E-02|    .017 .7100E-02|    .045 .1730E-01
                           .008 .1600E-02|    .017 .7100E-02|    .037 .1730E-01|    .000 .0000E+00

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ---------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW > 07:       105      .481      .134     1.333     52.532
    OUTFLOW < 08:       104      .481      .024     1.694     52.532

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.184
                  TIME SHIFT OF PEAK FLOW         (min)=    21.67
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1090E-01

------------------------------------------------------------------------------------------------------
R0005:C00012-----------------------------------------------------------------------------------------
*


--------------------
| PRINT HYD        |   AREA       (ha)=     .481
| ID=08:       104 |   QPEAK     (cms)=     .024 (i)
| DT= 1.67 PCYC=-1 |   TPEAK     (hrs)=    1.694
--------------------   VOLUME      (mm)=   52.532

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
------------------------------------------------------------------------------------------------------
R0005:C00013-----------------------------------------------------------------------------------------
*


------------------------------------------------------------------------------------------------------
R0005:C00002-----------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------
R0005:C00002-----------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------
R0005:C00002-----------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------------------
R0005:C00002-----------------------------------------------------------------------------------------
  ** END OF RUN :    4
```

```
**********************************************************************************************************



--------------------
| START            | Project  dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
-------------------- Rainfall dir.:C:\Users\Ram\Desktop\Mulmur\Flows\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 0006
    NSTORM=   1
           #  1=100yr.stm
-----------------------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------------------------
*     Gas Station at Mansfield


*


-----------------------------------------------------------------------------------------------------------
R0006:C00002-------------------------------------------------------------------------------------------------
--------------------
| READ STORM       |  Filename: C:\Users\Ram\Desktop\Mulmur\Flows\100yr.stm


| Ptotal=  74.00 mm|  Comments: 100-year, 4 hour Chicago

--------------------
      TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN|   TIME    RAIN
     hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr|  hh:mm   mm/hr
      0:10   5.913|   0:50  11.393|   1:30  40.998|   2:10  12.269|   2:50   8.004|   3:30   6.135
      0:20   6.642|   1:00  15.991|   1:40  24.098|   2:20  10.743|   3:00   7.416|   3:40   5.815
      0:30   7.631|   1:10  32.363|   1:50  17.839|   2:30   9.605|   3:10   6.922|   3:50   5.532
      0:40   9.068|   1:20 164.668|   2:00  14.442|   2:40   8.718|   3:20   6.500|   4:00   5.280

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R0006:C00003-------------------------------------------------------------------------------------------------
*


*  Pre-development flow


*


--------------------------
| CALIB NASHYD           |   Area    (ha)=     .530   Curve Number   (CN)= 73.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    6.600   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .121

     PEAK FLOW       (cms)=     .048 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .008
     RUNOFF VOLUME    (mm)=   28.154
     TOTAL RAINFALL   (mm)=   73.998
     RUNOFF COEFFICIENT   =     .380

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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R0006:C00004-------------------------------------------------------------------------------------------------
*  Post development Flows


**********************************************************************
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```
*  Uncontrolled flows

*


--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .05
| 01:       103 DT= 5.00 |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .01          .04
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      19.13        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     164.67        59.92
               over (min)         5.00        10.00
     Storage Coeff.  (min)=        .63 (ii)    9.29 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .12
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .009 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.333
     RUNOFF VOLUME    (mm)=      73.20        29.82        39.798
     TOTAL RAINFALL   (mm)=      74.00        74.00        73.998
     RUNOFF COEFFICIENT   =        .99          .40          .538
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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R0006:C00005-----------------------------------------------------------------------------------------
*


**************************************************************************

*                           Flows from Site                              *

**************************************************************************


*


*  Drainage area A1


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--------------------------
| CALIB NASHYD           |   Area    (ha)=     .110   Curve Number   (CN)= 71.00
| 01:       101 DT= 5.00 |   Ia      (mm)=    7.000   # of Linear Res.(N)=  3.00
--------------------------   U.H. Tp(hrs)=     .168

     Unit Hyd Qpeak  (cms)=     .025

     PEAK FLOW       (cms)=     .009 (i)
     TIME TO PEAK    (hrs)=    1.417
     DURATION        (hrs)=    5.417, (dddd|hh:mm:)=   0|05:25
     AVERAGE FLOW    (cms)=     .001
     RUNOFF VOLUME    (mm)=   26.289
     TOTAL RAINFALL   (mm)=   73.998
     RUNOFF COEFFICIENT   =     .355

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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R0006:C00006-------------------------------------------------------------------------------------------
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*    Area A2

*   Flows from canaopy and storage equal to snow load

*

--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .02
| 03:       103 DT= 5.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
--------------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      12.19        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     164.67        59.92
               over (min)         5.00        10.00
     Storage Coeff.  (min)=        .59 (ii)   11.26 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=        .34          .16
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .010 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42         1.333
     RUNOFF VOLUME    (mm)=      73.20        29.82        72.764
     TOTAL RAINFALL   (mm)=      74.00        74.00        73.998
     RUNOFF COEFFICIENT   =        .99          .40          .983
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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R0006:C00007-------------------------------------------------------------------------------------------
------------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>03:       103   |
| OUT<04:       104   | ========================  OUTLFOW STORAGE TABLE  ========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                         .000 .0000E+00|    .001 .1000E-02|    .002 .1200E-02|    .005 .1200E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 03:       103      .022      .010     1.333     72.764
    OUTFLOW < 04:       104      .022      .001     1.889     72.763

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.722
                  TIME SHIFT OF PEAK FLOW         (min)=    33.33
                  MAXIMUM  STORAGE   USED       (ha.m.)=.9844E-03

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R0006:C00008-------------------------------------------------------------------------------------------
------------------------
| ADD HYD              |
| 05:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)      (mm)   (cms)
                      ID 1 04:       104      .022      .001    1.889    72.763    .000
                     +ID 2 01:       101      .110      .009    1.417    26.289    .000
                     ================================================================
                     SUM   05:       105      .132      .010    1.417    34.122    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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R0006:C00009-------------------------------------------------------------------------------------------
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*  Area A3

*  Flows from Hard surfaces, landscape  & roof

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--------------------------
| DESIGN STANDHYD        |   Area    (ha)=     .35
| 06:       103 DT= 5.00 |   Total Imp(%)=   87.00   Dir. Conn.(%)=   87.00
--------------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .30          .05
     Dep. Storage     (mm)=        .80         1.50
     Average Slope     (%)=       1.00         1.00
     Length            (m)=      48.24        40.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     164.67        46.74
               over (min)         5.00        15.00
     Storage Coeff.  (min)=       1.35 (ii)   13.13 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=        .33          .08
                                                      *TOTALS*
     PEAK FLOW       (cms)=        .14          .00          .141 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.50         1.333
     RUNOFF VOLUME    (mm)=      73.20        29.82        67.559
     TOTAL RAINFALL   (mm)=      74.00        74.00        73.998
     RUNOFF COEFFICIENT   =        .99          .40          .913
*** WARNING: Storage Coefficient is smaller than DT! Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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R0006:C00010-----------------------------------------------------------------------------------------
*


------------------------
| ADD HYD              |
| 07:       105        |   ID:NHYD            AREA     QPEAK    TPEAK      R.V.     DWF
------------------------                      (ha)     (cms)    (hrs)       (mm)    (cms)
                      ID 1 05:       105      .132      .010    1.417    34.122    .000
                     +ID 2 06:       103      .349      .141    1.333    67.559    .000
                     ==========================================================================
                     SUM   07:       105      .481      .149    1.333    58.369    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

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R0006:C00011-----------------------------------------------------------------------------------------
*


*  Route flows through stoarge on site

*


------------------------
|  ROUTE RESERVOIR -> |    Requested routing time step =  2.0 min.
|  IN>07:       105   |
| OUT<08:       104   | ========================  OUTFLOW STORAGE TABLE  ==========================
---------------------- OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE| OUTFLOW   STORAGE
                         (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)|   (cms)   (ha.m.)
                          .000 .0000E+00|    .011 .5600E-02|    .017 .7100E-02|    .045 .1730E-01
                          .008 .1600E-02|    .017 .7100E-02|    .037 .1730E-01|    .000 .0000E+00
```

```
     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     ----------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW > 07:       105      .481      .149     1.333     58.369
    OUTFLOW < 08:       104      .481      .027     1.722     58.369

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   18.135
                  TIME SHIFT OF PEAK FLOW         (min)=    23.33
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1218E-01

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R0006:C00012------------------------------------------------------------------------------------------------
*


--------------------
| PRINT HYD        |   AREA       (ha)=     .481
| ID=08:       104 |   QPEAK     (cms)=     .027 (i)
| DT= 1.67 PCYC=-1 |   TPEAK     (hrs)=    1.722
--------------------   VOLUME      (mm)=   58.369

     (i)  PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
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R0006:C00013------------------------------------------------------------------------------------------------

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| FINISH           |
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