

# Hydrological Aspect of Mymensingh Pourashava



**Presented by  
Quazi Md. Fazlul Haque  
Senior Planer  
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# Objectives

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- To find out the existing drainage capacity with respect to hydrological aspect in Mymensingh Pourashava
  - Man-made: Hydro-dynamic model-EPA SWMM-Capacity
  - Khal/river: Hydraulics-HECRAS-Cross-section, boundary condition (WL)
  - Natural flow (over land flow): Hydrology-HECHMS
- PCSWMM- 2D Professional-Integrate these 3, GIS Compatible
- To find out the ponding area and it's capacity with respect to hydrological aspect in Mymensingh
  - Flow direction, Water Depth, duration, Extent- After Flooding

## Working Plan

Objectives	Analysis	output	Recommended
<ul style="list-style-type: none"> <li>To find out the existing drainage capacity with respect to hydrological aspect</li> </ul>	Hydrological vs hydrodynamic model With PCSWMM and GIS Software	<ol style="list-style-type: none"> <li>Behavior of existing drainage network during the rainfall (such as runoff volume, node and channel surcharge etc)</li> <li>Inundation area</li> </ol>	Drainage improvement
<ul style="list-style-type: none"> <li>To find out the ponding area and it's capacity with respect to hydrological aspect</li> </ul>	Surface Runoff model with PC SWMM and GIS	<ol style="list-style-type: none"> <li>Natural flow path and ponding area of Surface runoff ( where and how much)-Depth, Duration, Extent, total Volume</li> </ol>	Calculate retention pond (where and how many)

## Rainfall Analyses

- Rainfall analysis is carried out to estimate design storm or design rainfall
- hyetographs are used for rainfall-runoff analysis
- Rainfall-runoff analysis is carried out in order to estimate peak runoff rate

## Estimation of Design Discharge i.e. Peak Runoff Rate

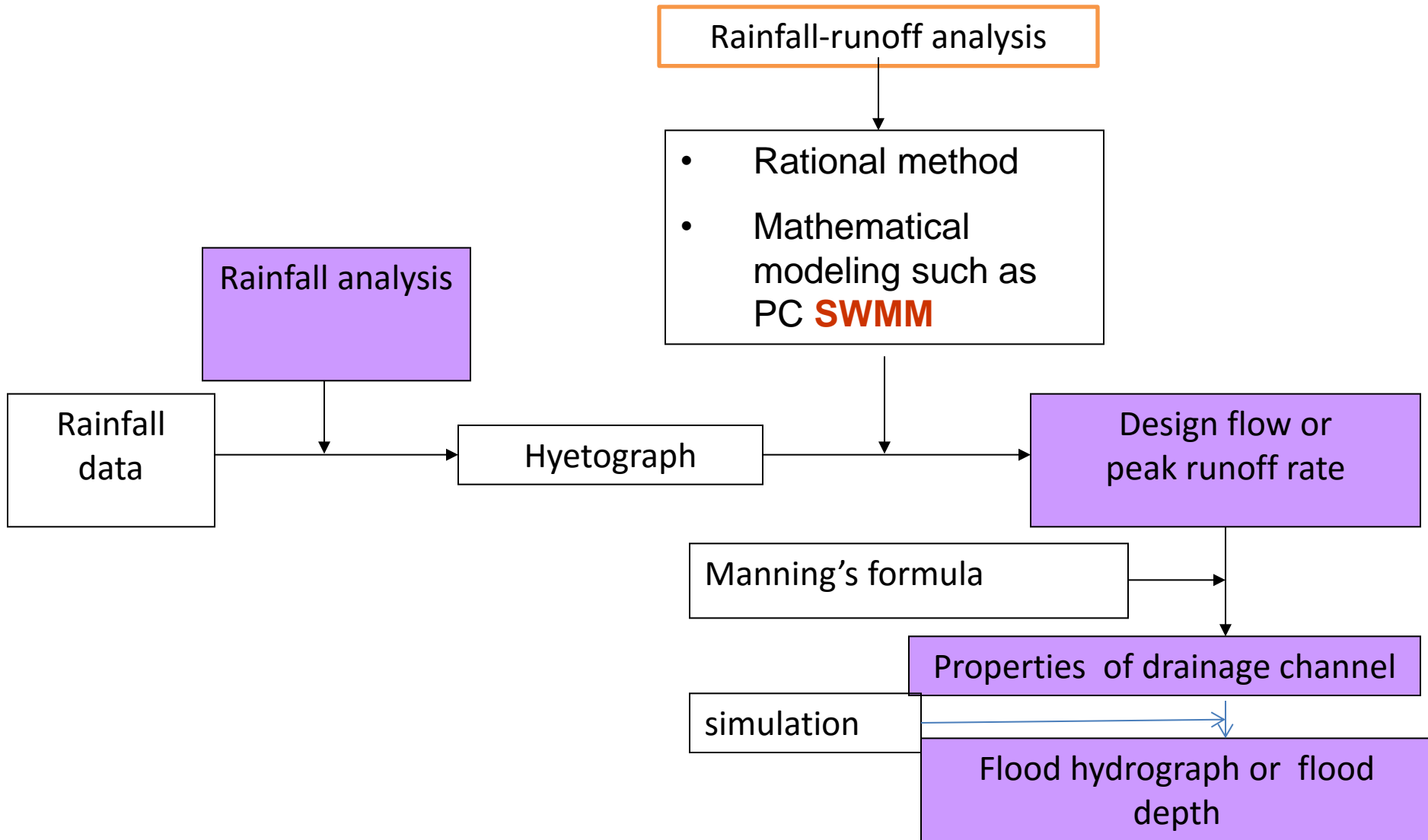
### 1. Gauged basin

- Probability analysis (Frequency analysis)

### 2. Un-gauged basin

- Rational method or rational formula
- Index flood method
- Mathematical modeling

# Flow diagram



# Rainfall Runoff Analyses by Rational Method

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- The IDF curves are used for rainfall-runoff analysis by rational method.
- The rational method, also known as rational formula, is an empirical relation, expressed as

$$Q = \frac{CIA}{360}$$

Where,

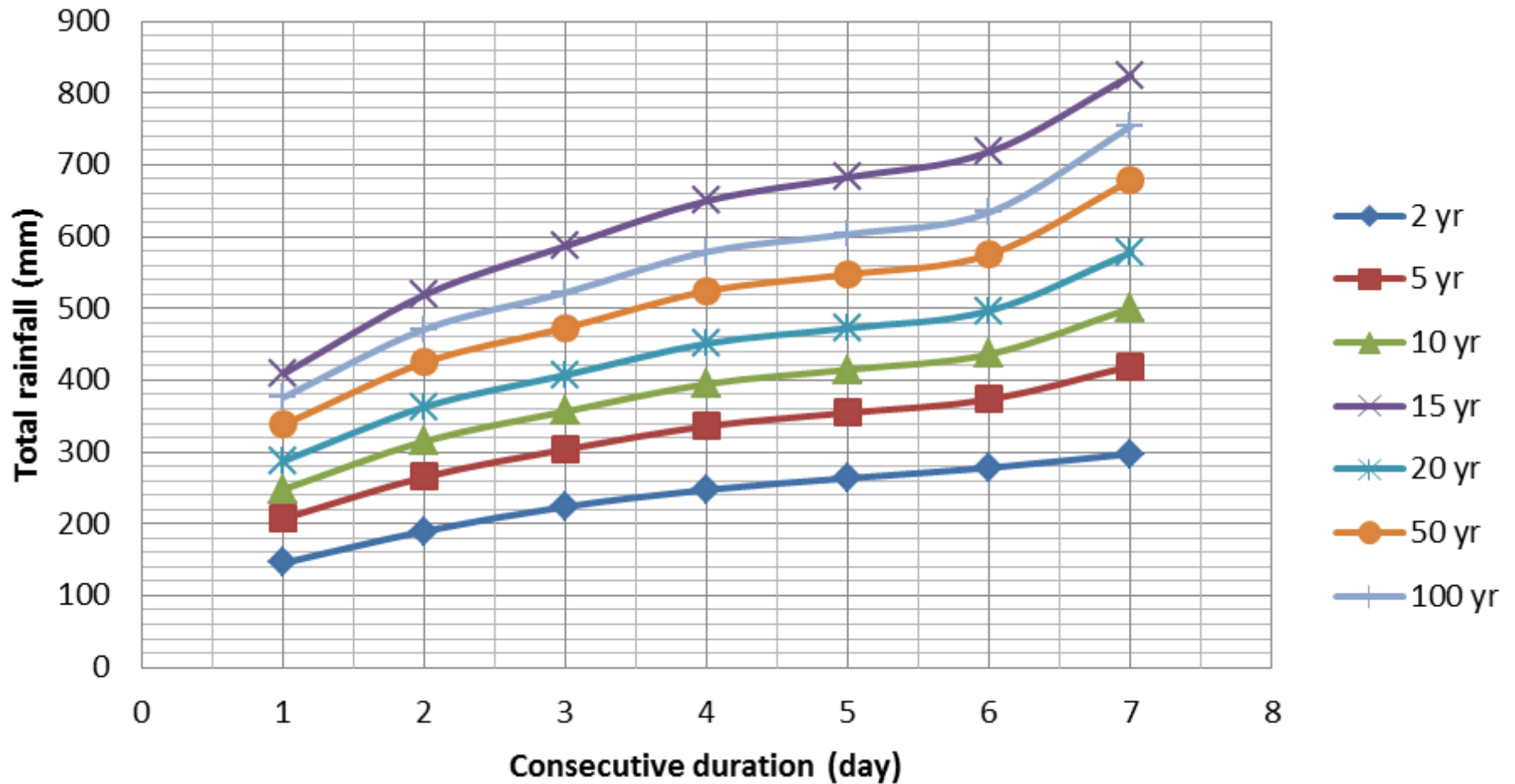
Q = peak discharge in m<sup>3</sup>/s,

C = a dimensionless runoff coefficient whose value depends on hydrologic characteristics of the drainage area,

I = rainfall intensity in mm/hr for a duration equal to or greater than the time of concentration of the drainage basin, and

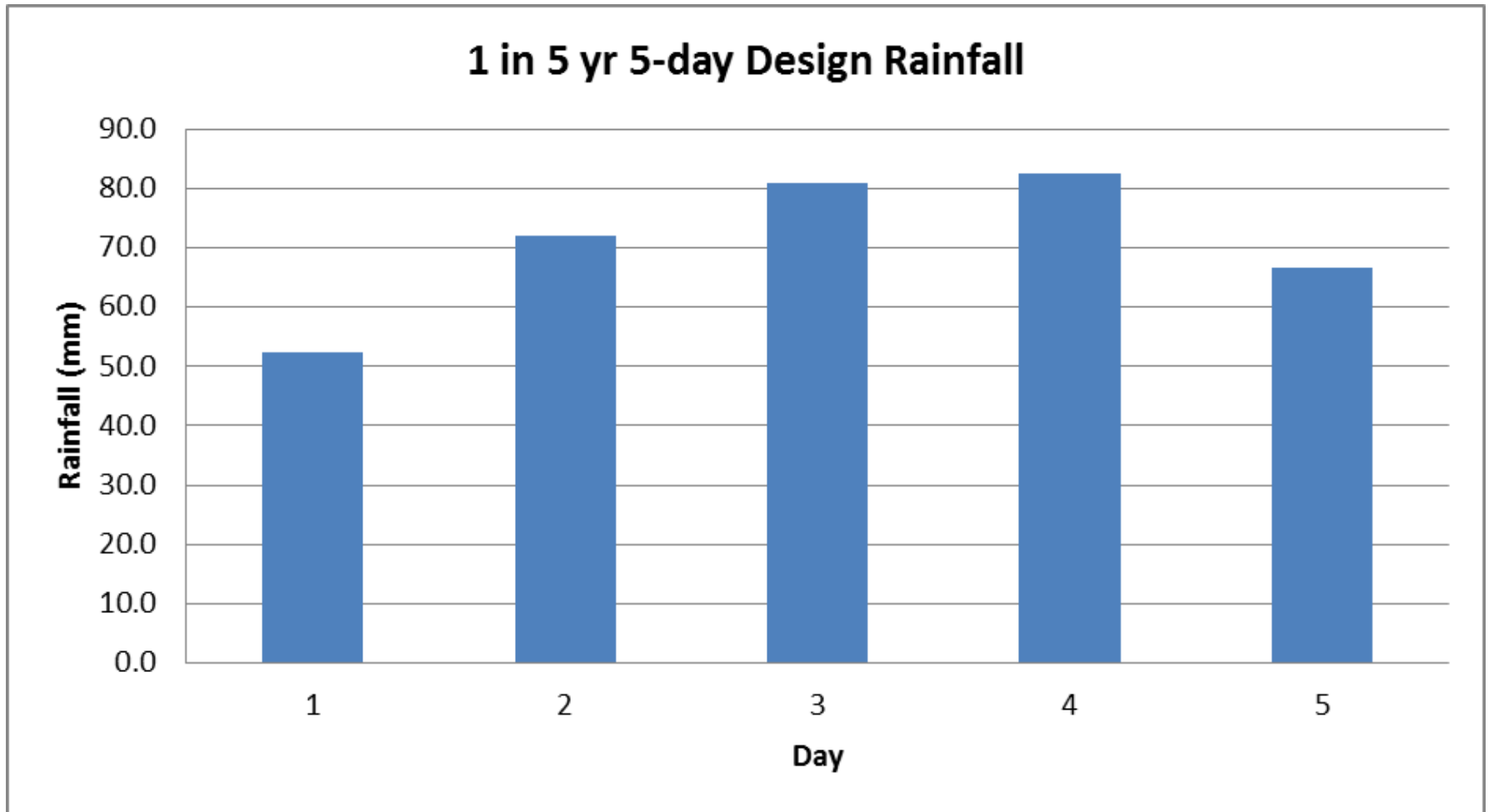
A = area of the drainage basin in acres.

# Prepared IDF Curve for Mymensing



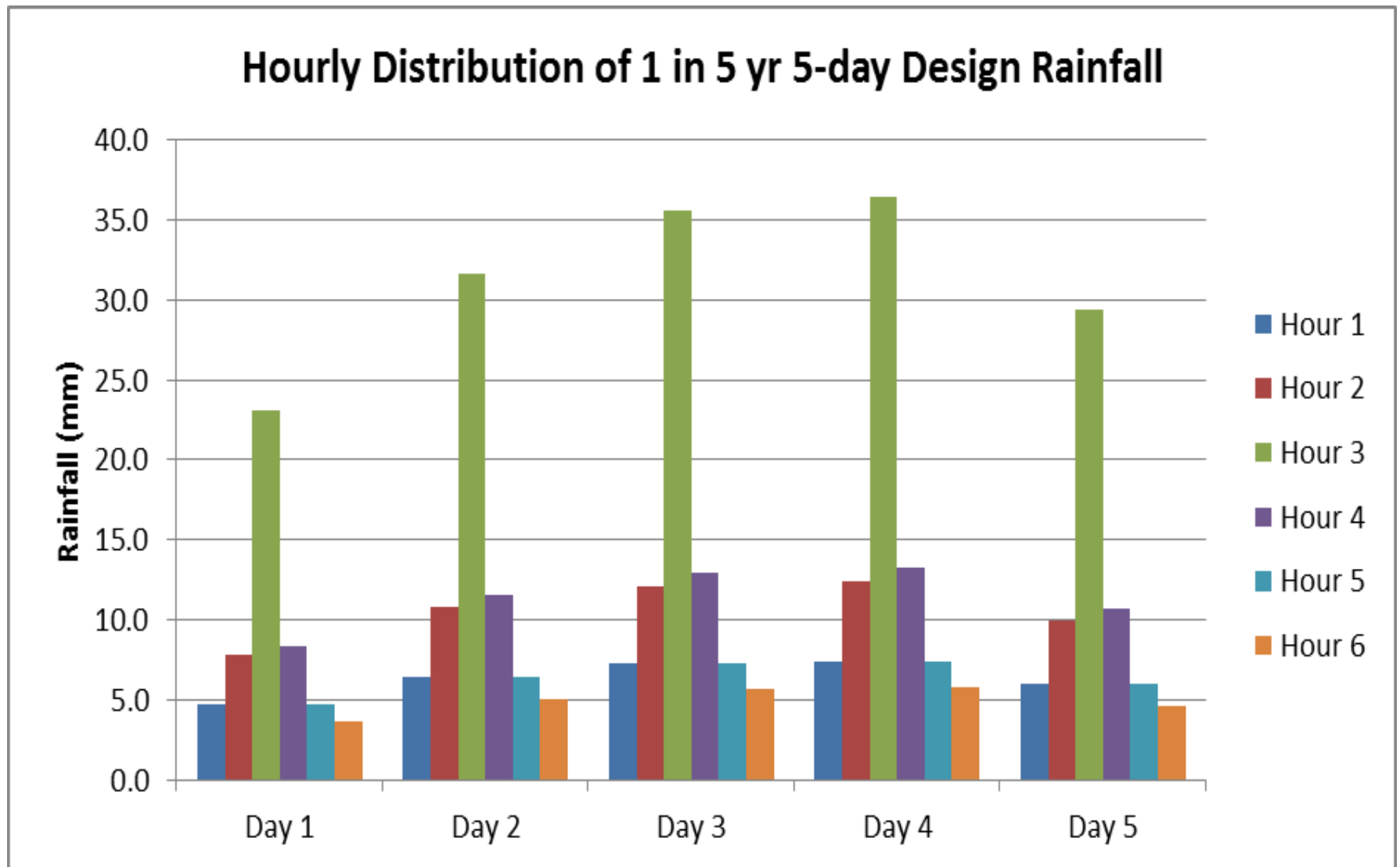
# Design and Distribution of Rainfall

- 1 in 5 day 5 year rain fall (354mm/5day)

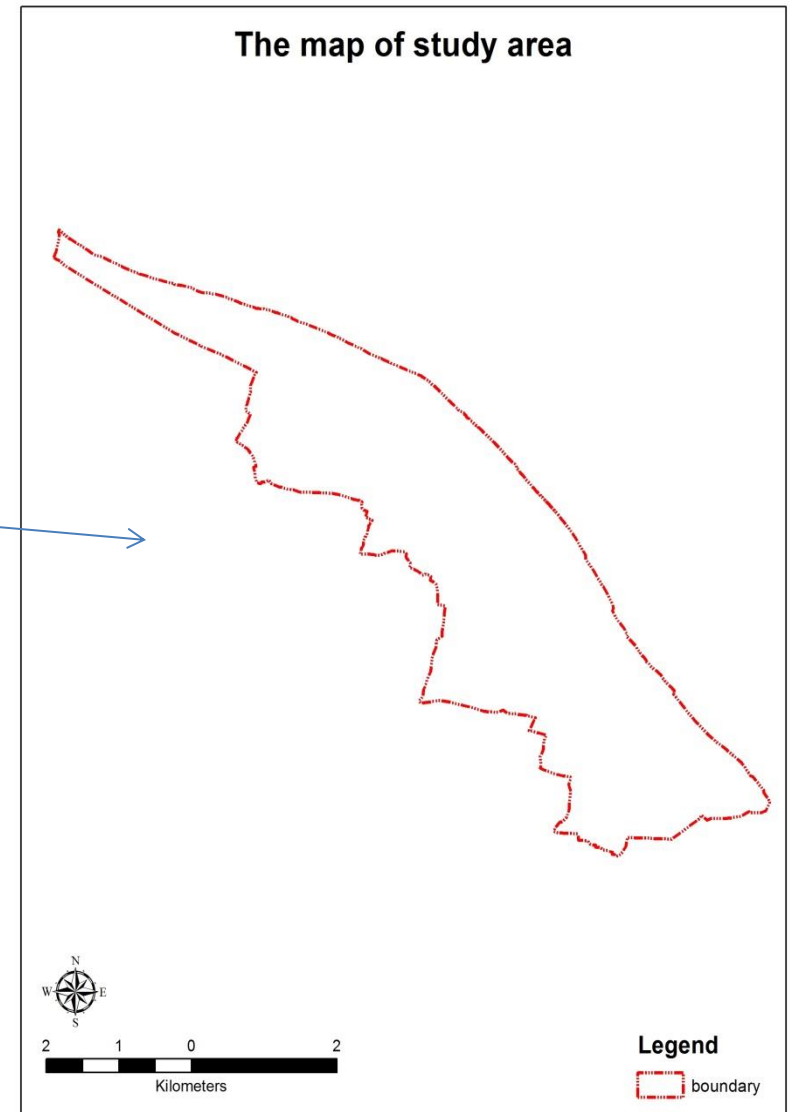
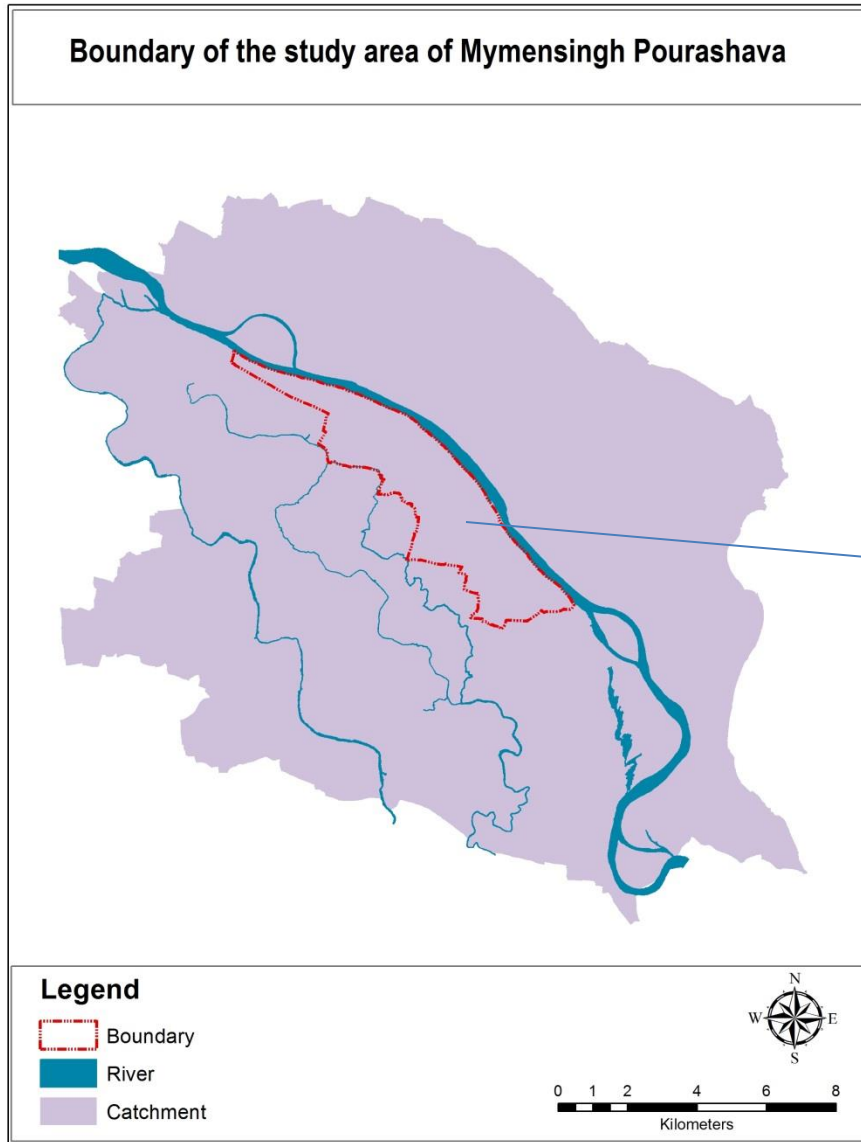




# Hyetograph (354mm/5d)



## Study area

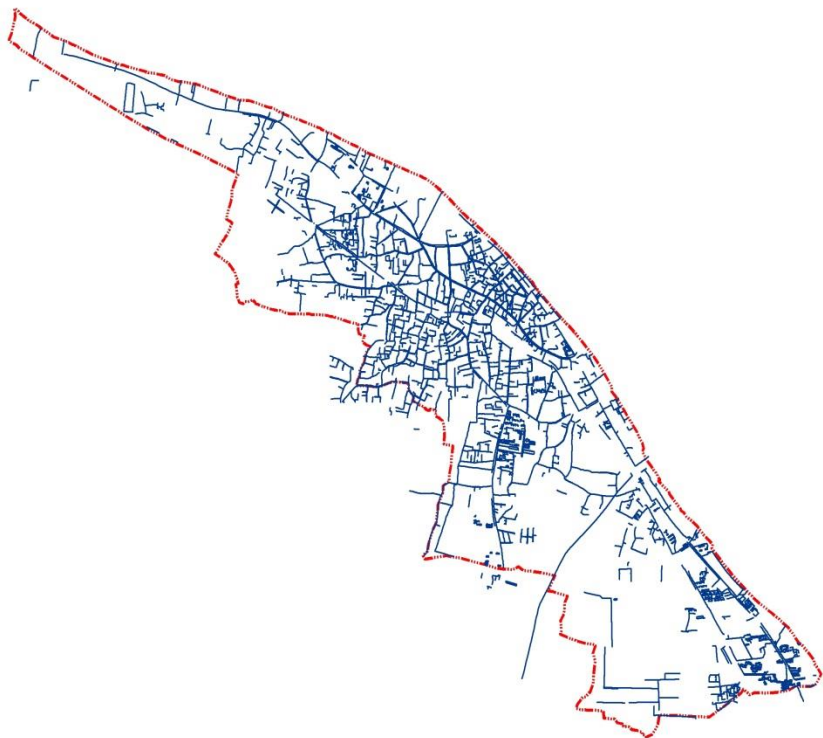


1. Pre-processing
2. SWMM MODEL
3. Post processing

## Pre-processing

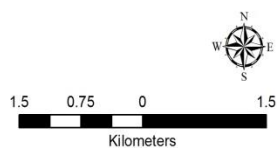
- ❖ Conducting Field Survey
- ❖ Collecting Drainage information
  - Drainage width, Height, flow direction, outfall, invert level data
- ❖ Digitizing drainage Network with flow direction in Arcgis

### Existing Drainage Network in Mymensigh Pourashava



#### Legend

— Drain

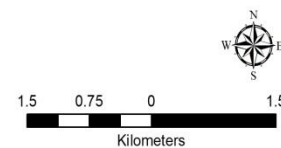


### Existing Primary and Secondary Drainage Network in Mymensigh Pourashava



#### Legend

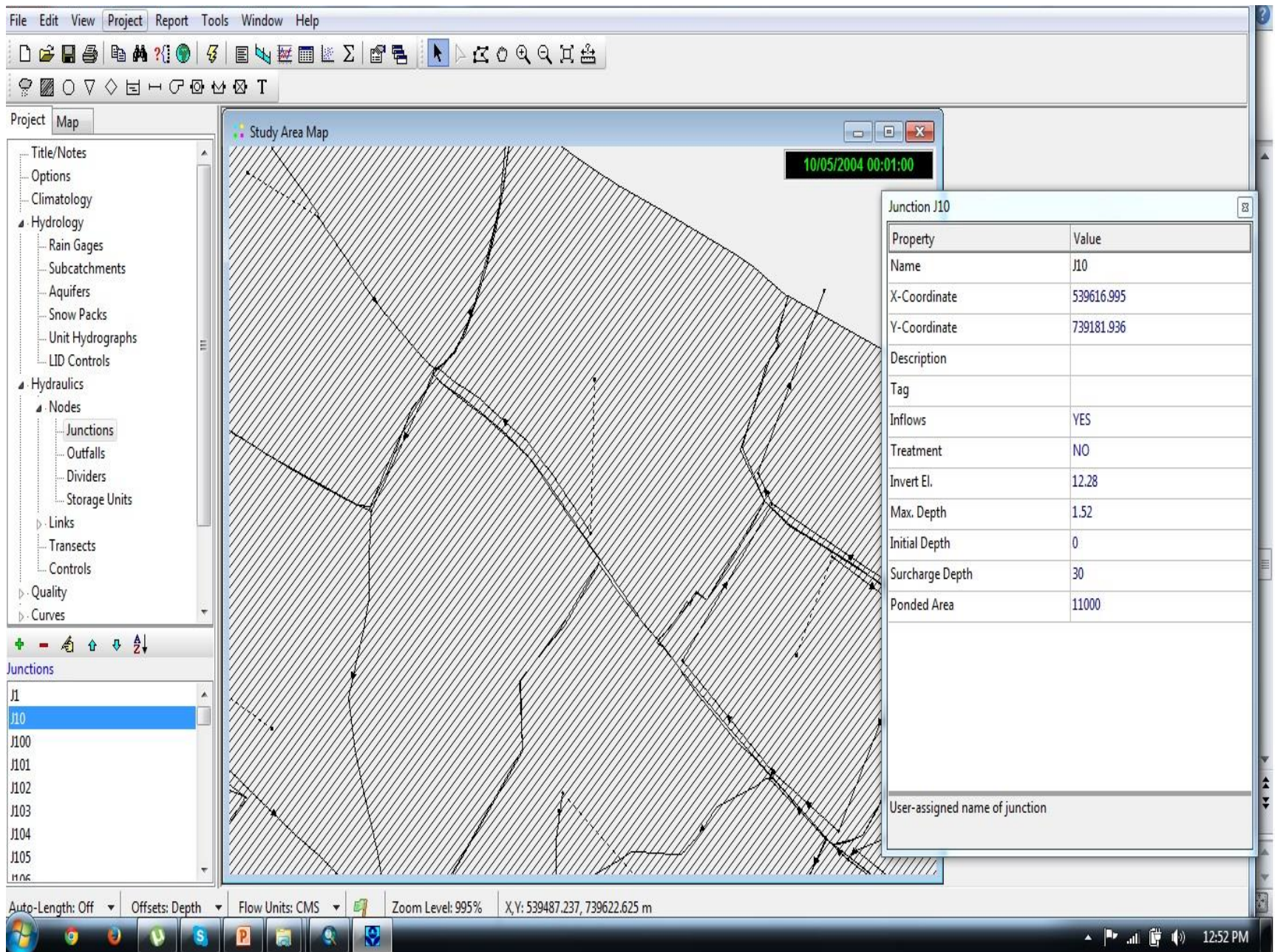
— Drainage network



# SWMM Model

- Delineate Sub catchment based on drainage network
- Drawing drainage network, junction and outfall
- Conduit data ( width, depth, and cross section), junction data (rim and invert elevation, ponding and surcharge area , and dry weather data )
- Subcatchment data ( land use, infiltration rate (Horton ), soil data, Manning n value , length of flow network)

# Input junction data



The screenshot displays a software application for managing hydrological data. The main window, titled 'Study Area Map', shows a network of lines representing a watershed or drainage system. A 'Junctions' list on the left side of the interface shows a list of junctions, with 'J10' selected. A dialog box titled 'Junction J10' is open, displaying a table of properties and values for the selected junction. The table includes fields for Name, X-Coordinate, Y-Coordinate, Description, Tag, Inflows, Treatment, Invert El., Max. Depth, Initial Depth, Surcharge Depth, and Pondered Area. The values for these fields are: Name: J10, X-Coordinate: 539616.995, Y-Coordinate: 739181.936, Description: (empty), Tag: (empty), Inflows: YES, Treatment: NO, Invert El.: 12.28, Max. Depth: 1.52, Initial Depth: 0, Surcharge Depth: 30, and Pondered Area: 11000. Below the table, there is a text field labeled 'User-assigned name of junction'.

Property	Value
Name	J10
X-Coordinate	539616.995
Y-Coordinate	739181.936
Description	
Tag	
Inflows	YES
Treatment	NO
Invert El.	12.28
Max. Depth	1.52
Initial Depth	0
Surcharge Depth	30
Pondered Area	11000

User-assigned name of junction



# Input conduit data

The screenshot displays a software interface for managing conduit data. The main window shows a 'Study Area Map' with a network of conduits. A 'Conduit C10' data table is visible, listing properties and values. A 'Cross-Section Editor' is open, showing various cross-section shapes. A 'Transect Editor' is also open, displaying a table of station and elevation data, and a table of properties and values.

**Conduit C10**

Property	Value
Name	C10
Inlet Node	J8
Outlet Node	OF5
Description	
Tag	
Shape	IRREGULAR
Max. Depth	2.68
Length	367.38
Roughness	0.02

**Cross-Section Editor**

Rectangular Trapezoidal Triangular

Parabolic Power Irregular

Circular Force Main Filled Circular

**Transect Editor**

Transect Name: Transect10

	Station (m)	Elevation (m)
1	0	13.837
2	3	13.837
3	4	14.422
4	5	14.422
5	6	14.468
6	17	14.468
7	18	14.022
8	19	14.022
9	20	14.46
10	30	14.46
11	31	14.522
12	36	14.522
13	37	14.452

Property	Value
Roughness:	
Left Bank	0.2
Right Bank	0.2
Channel	0.02
Bank Stations:	
Left	430
Right	430.7
Modifiers:	
Stations	0.0
Elevations	0.0
Meander	0.0

View... OK Cancel Help

# Input data on Sub-catchment

File Edit View Project Report Tools Window Help

Study Area Map

Project Map

- Title/Notes
- Options
- Climatology
- Hydrology
  - Rain Gages
  - Subcatchments
  - Aquifers
  - Snow Packs
  - Unit Hydrographs
  - LID Controls
- Hydraulics
- Quality
- Curves
- Time Series
- Time Patterns
- Map Labels

Subcatchments

- S1
- S10
- S11
- S12
- S13
- S14
- S15

Auto-Length: Off Offsets: Depth Flow Units: CMS Zoom Level: 995% X,Y: 540078.082, 738968.756 m

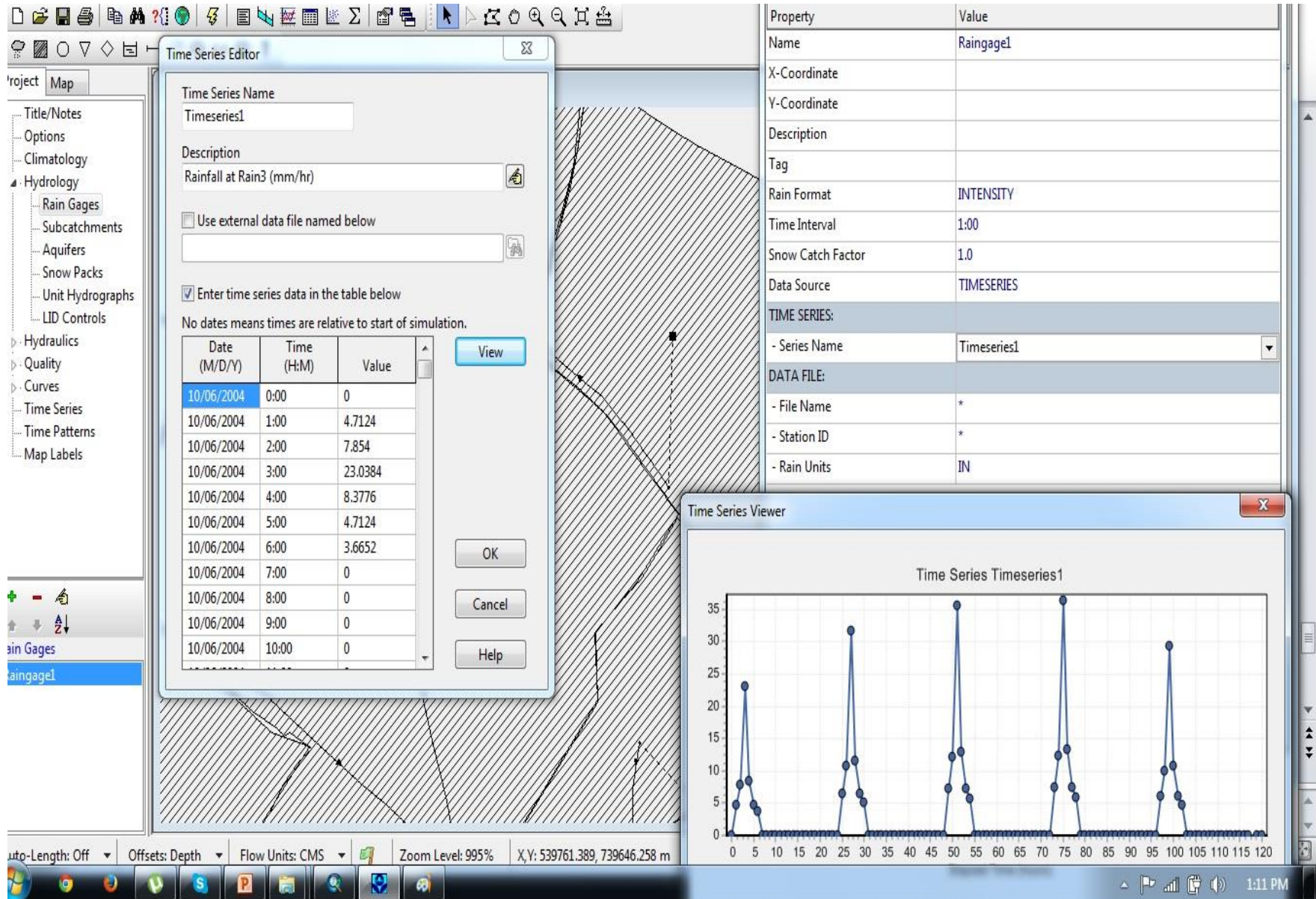
Subcatchment S10

Property	Value
Name	S10
X-Coordinate	539962.299
Y-Coordinate	739031.681
Description	
Tag	
Rain Gage	Raingage1
Outlet	J19
Area	10.7712
Width	721.447
% Slope	0.003
% Imperv	38
N-Imperv	0.013
N-Perv	0.24
Dstore-Imperv	0.1
Dstore-Perv	0.7
%Zero-Imperv	25
Subarea Routing	OUTLET
Percent Routed	100
Infiltration	HORTON
Groundwater	NO
Snow Pack	
LID Controls	0

Rain gage assigned to subcatchment



# Time series data



# Run and simulation

The screenshot displays a hydrology software interface with a 'Study Area Map' window. The map shows a watershed boundary with a network of stream channels and numerous black square markers representing rain gauges. A 'Run Status' dialog box is overlaid on the map, indicating the simulation is in progress.

**Run Status Dialog:**

- Icon: Rain gauge
- Status: Computing ...
- Percent Complete: 2% (indicated by a green progress bar)
- Simulated Time:
  - Days: 0
  - Hrs:Min: 03:12
- Buttons: Stop, Minimize

**Software Interface Details:**

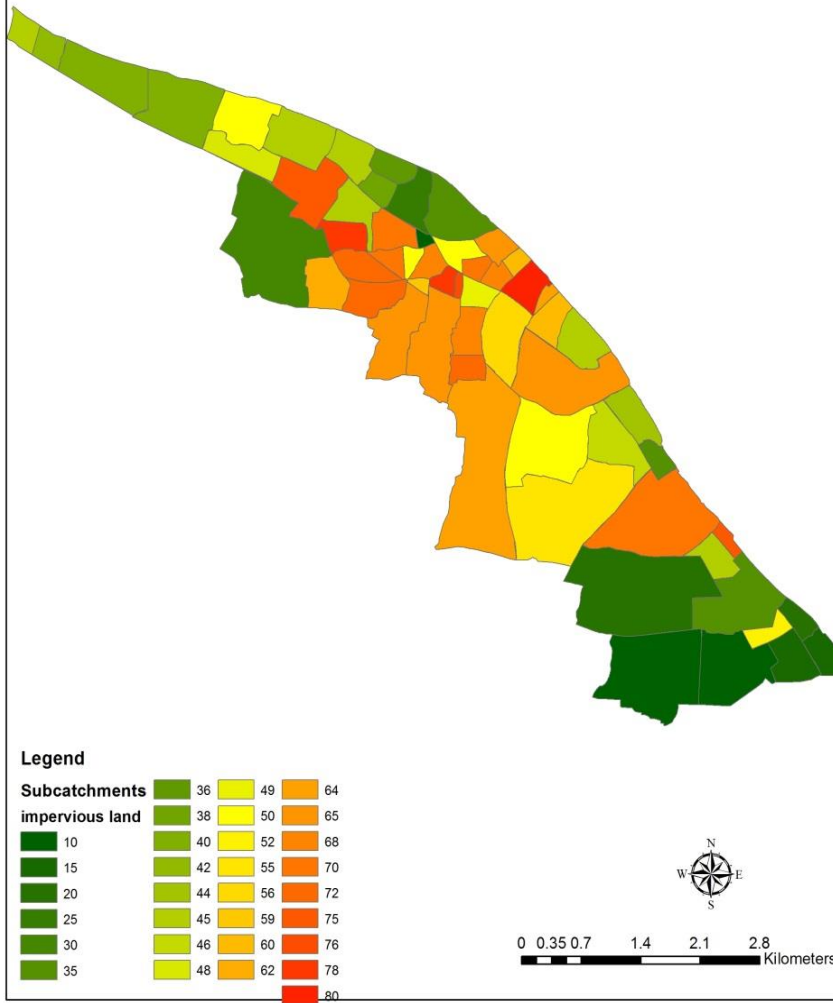
- Project Map:**
  - Title/Notes
  - Options
  - Climatology
  - Hydrology
    - Rain Gages
    - Subcatchments
    - Aquifers
    - Snow Packs
    - Unit Hydrographs
    - LID Controls
  - Hydraulics
  - Quality
  - Curves
  - Time Series
  - Time Patterns
  - Map Labels
- Rain Gages:**
  - Raingage1
- Bottom Bar:**
  - Auto-Length: Off
  - Offsets: Depth
  - Flow Units: CMS
  - Zoom Level: 100%
  - X,Y: 533114.572, 741421.946 m

The Windows taskbar at the bottom shows the system time as 1:14 PM.

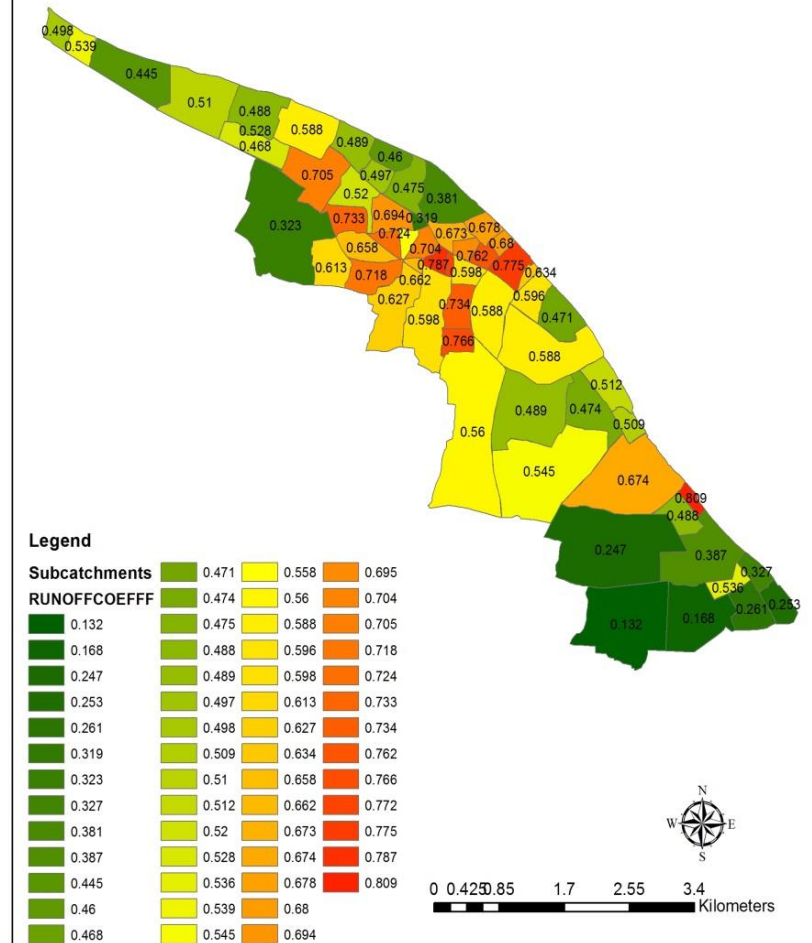
## Post processing

- Simulation of SWMM data has been input on Arcgis

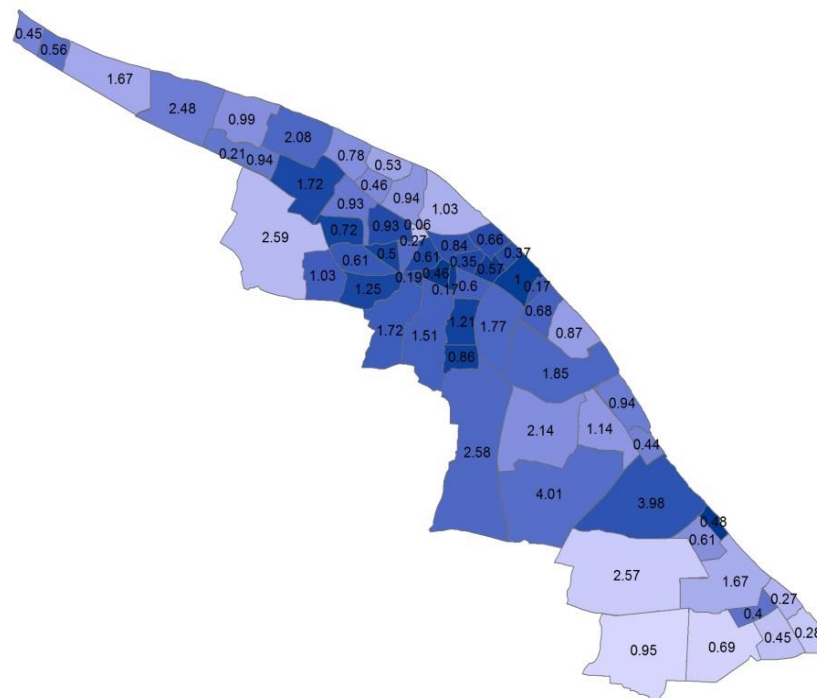
## Percentage of Impervious land in each subcatchment area of Mymensingh Pourashava



## RunoffCoefficient in each subcatchment area of Mymensingh Pourashava



# Peak Runoff in each subcatchment area of Mymensingh Pourashava for Design rainfall(354mm/5d)

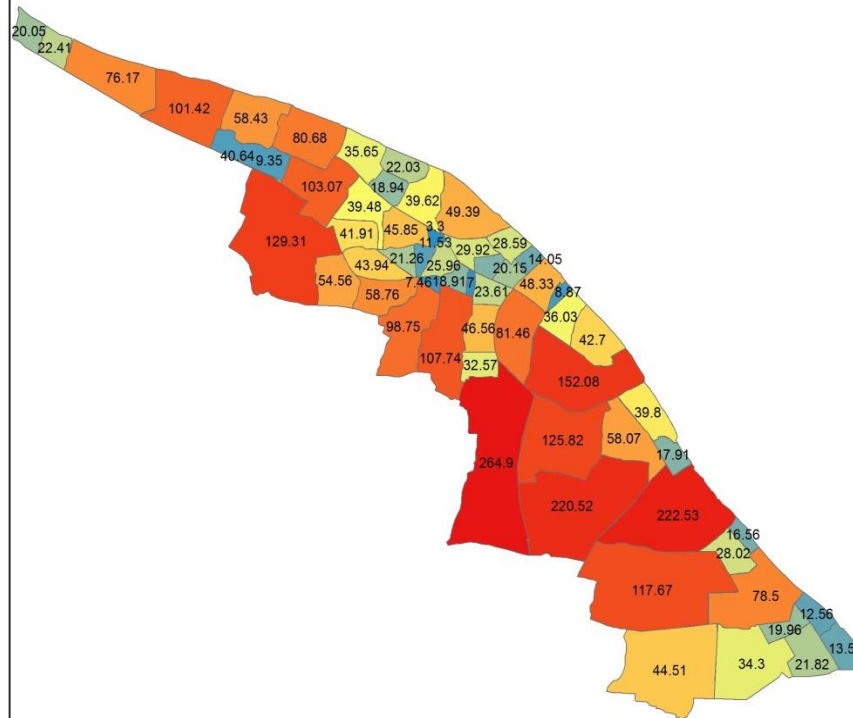


0 0.425 0.85 1.7 2.55 3.4 Kilometers





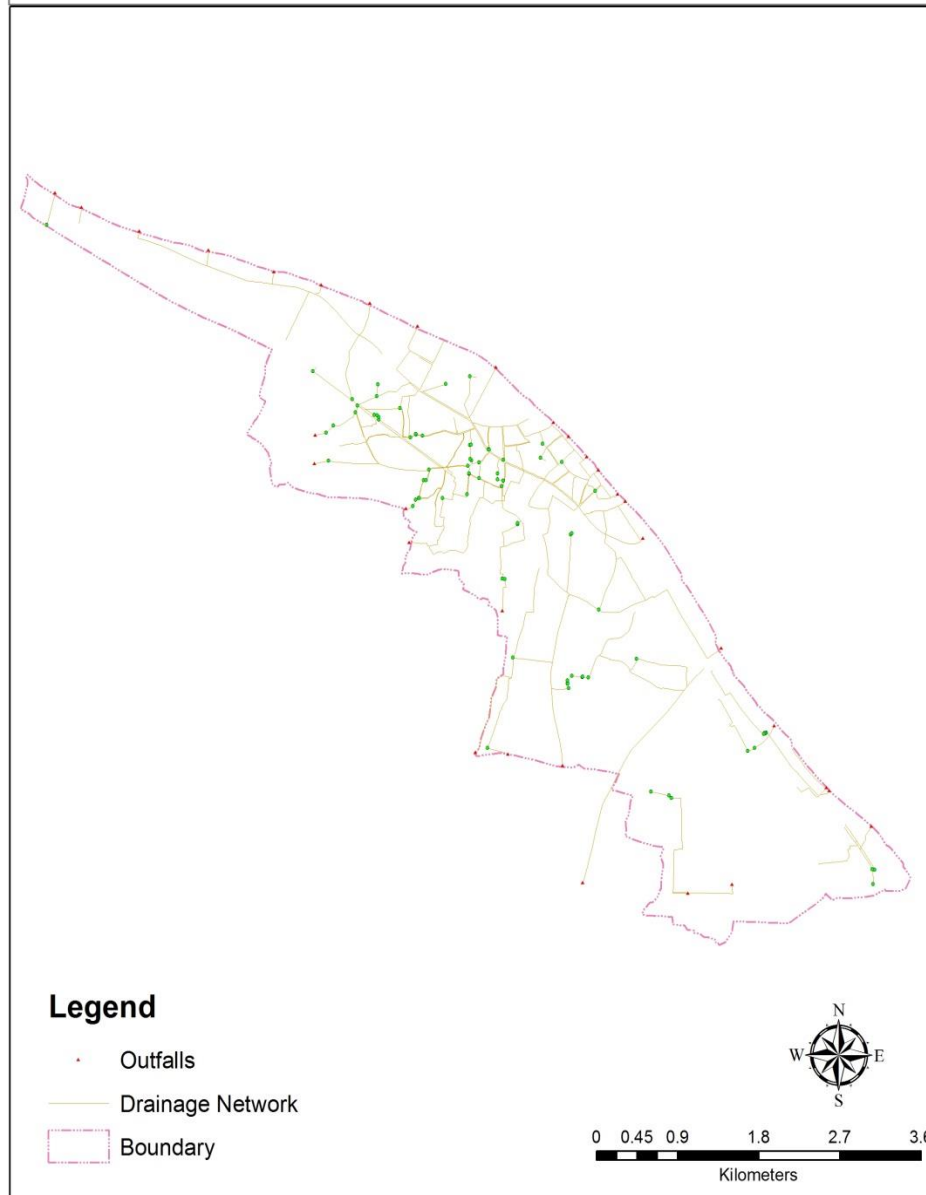
# **TotalRunoff Volume (ML) in each subcatchment area of Mymensingh Pourashava for Design rainfall(354mm/5d)**



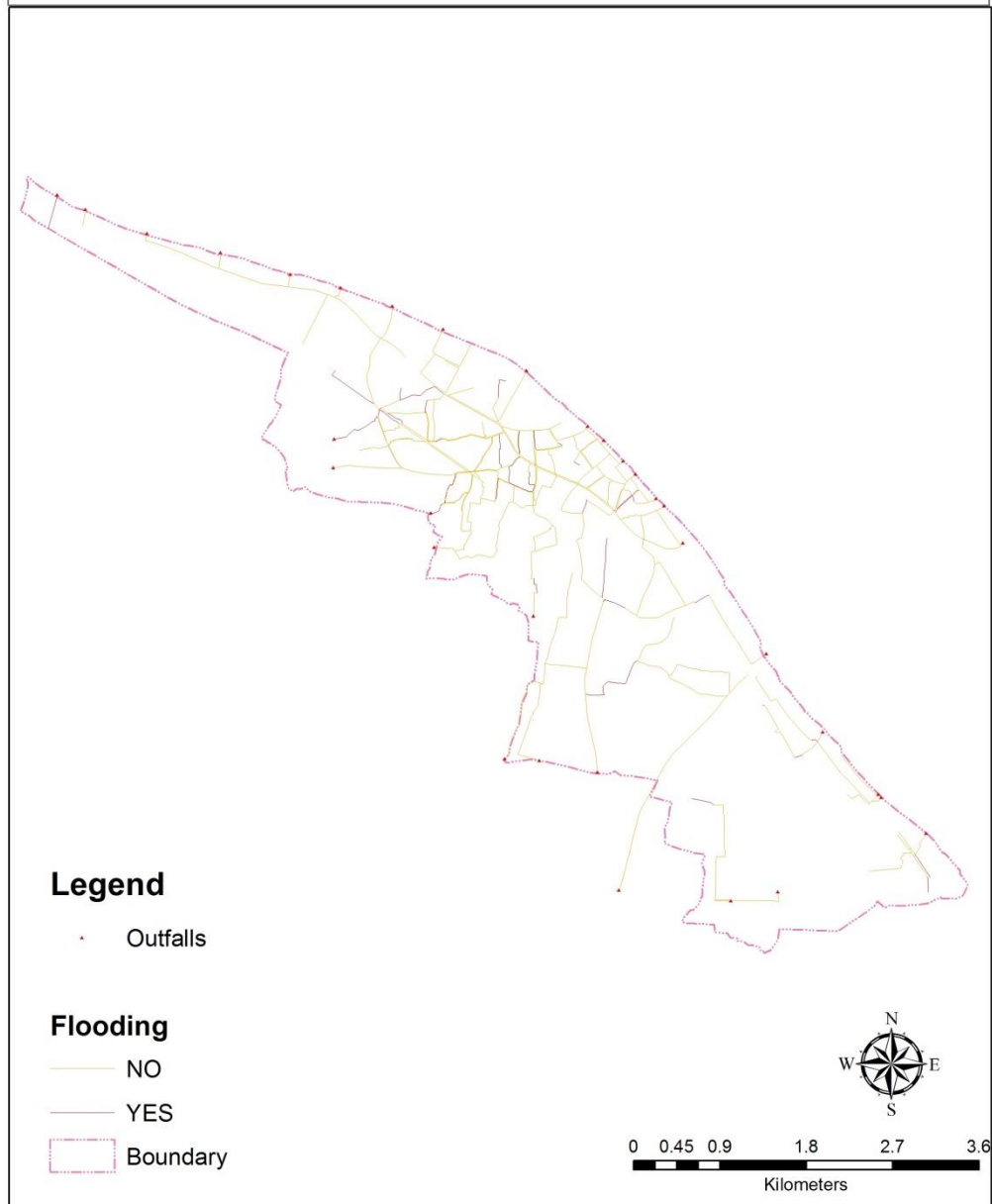
0 0.4 0.8 1.6 2.4 3.2 Kilometers



## Node flooding map in a study area of Mymensingh Pourashava

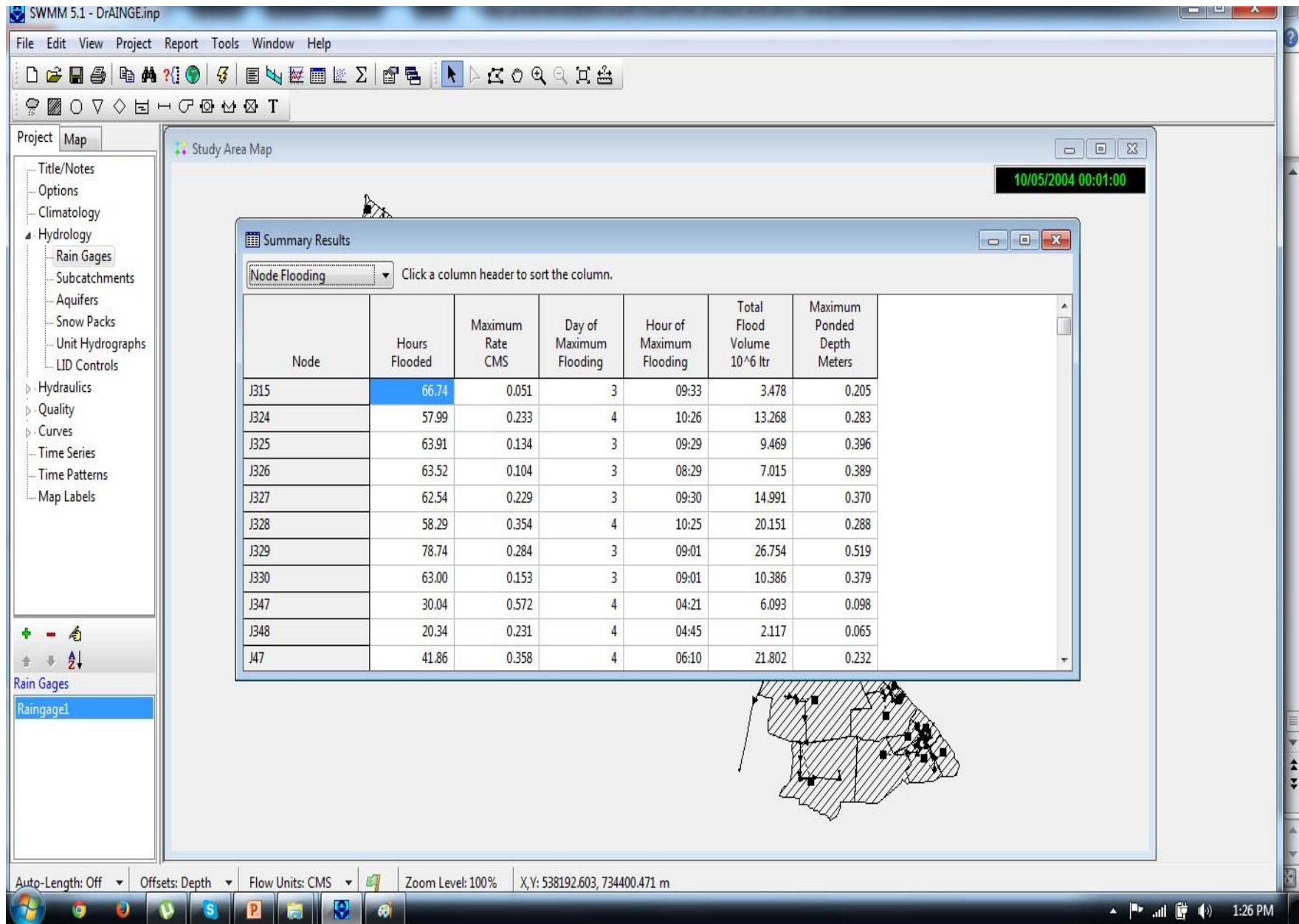


# Identifying the flooding Drainage Network in a study area of Mymensingh Pourashava by PCSWMM

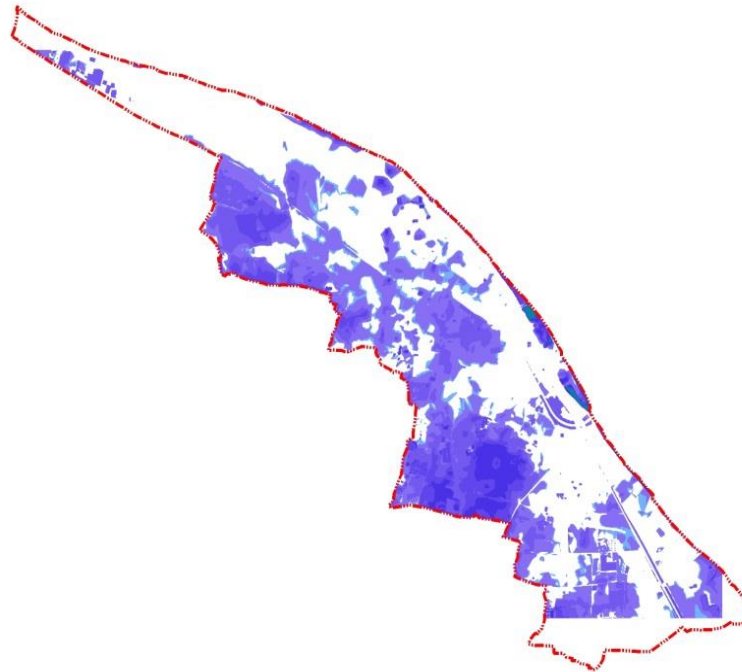




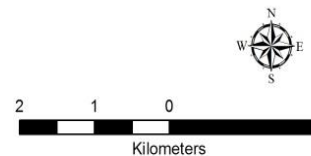
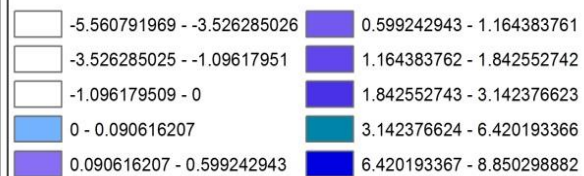
# Flood inundation map with peak discharge or flood depth data



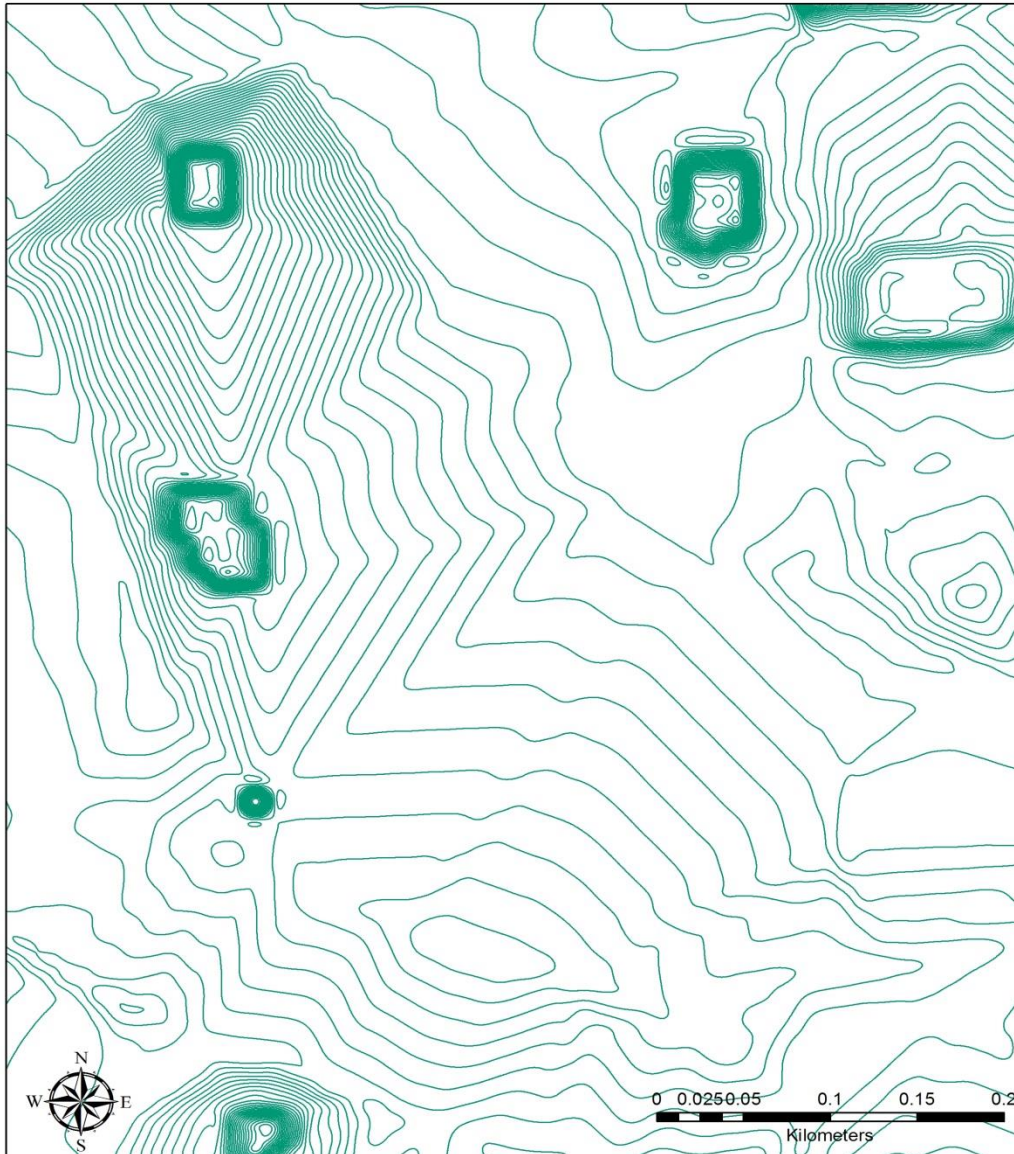
## Flood inundation Map (354mm/5d) with respect to Peak Discharge from Existing Drainage Network



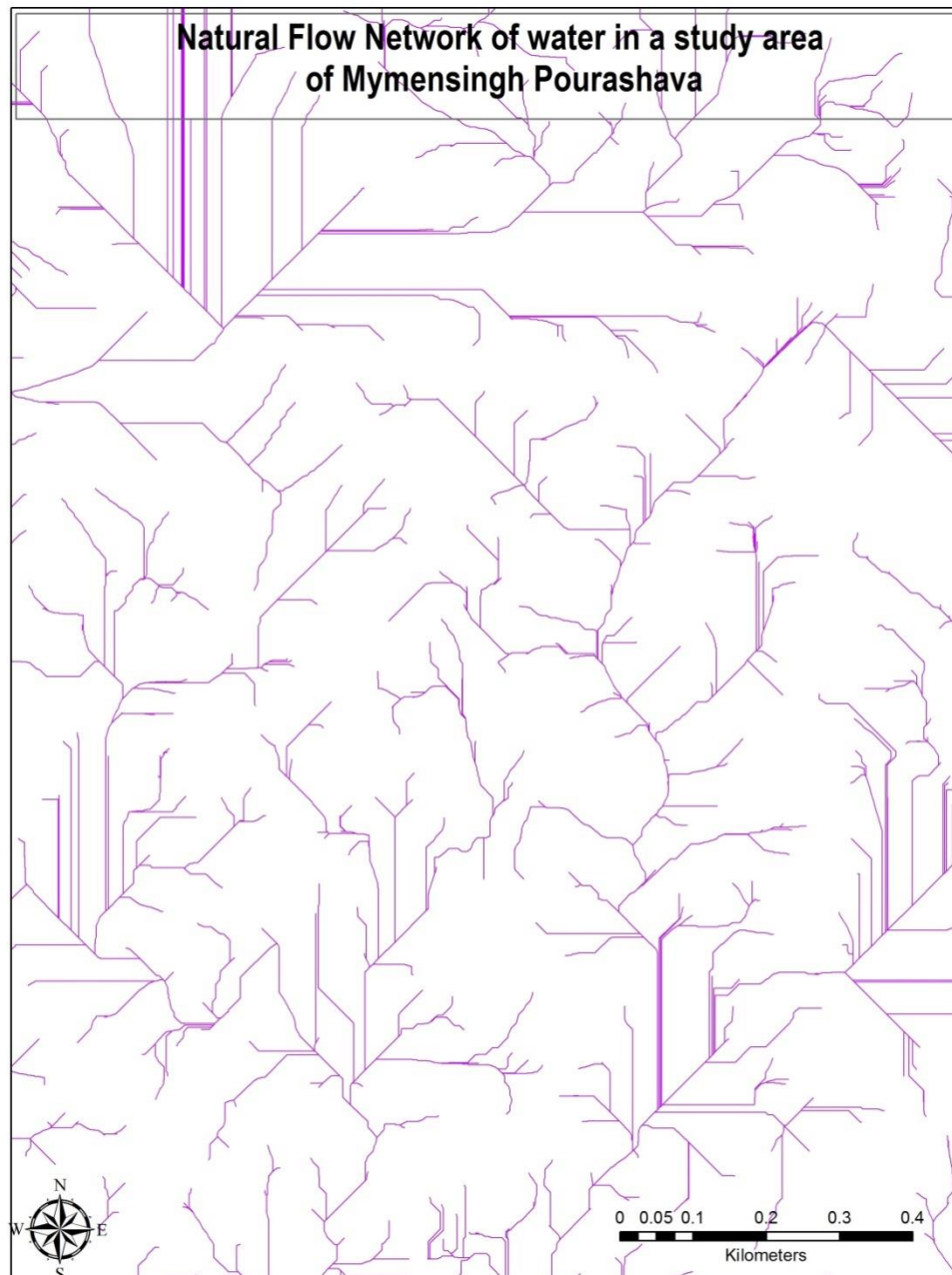
### Legend



## 5cm Contour Map in a study area of Mymensingh Pourashava



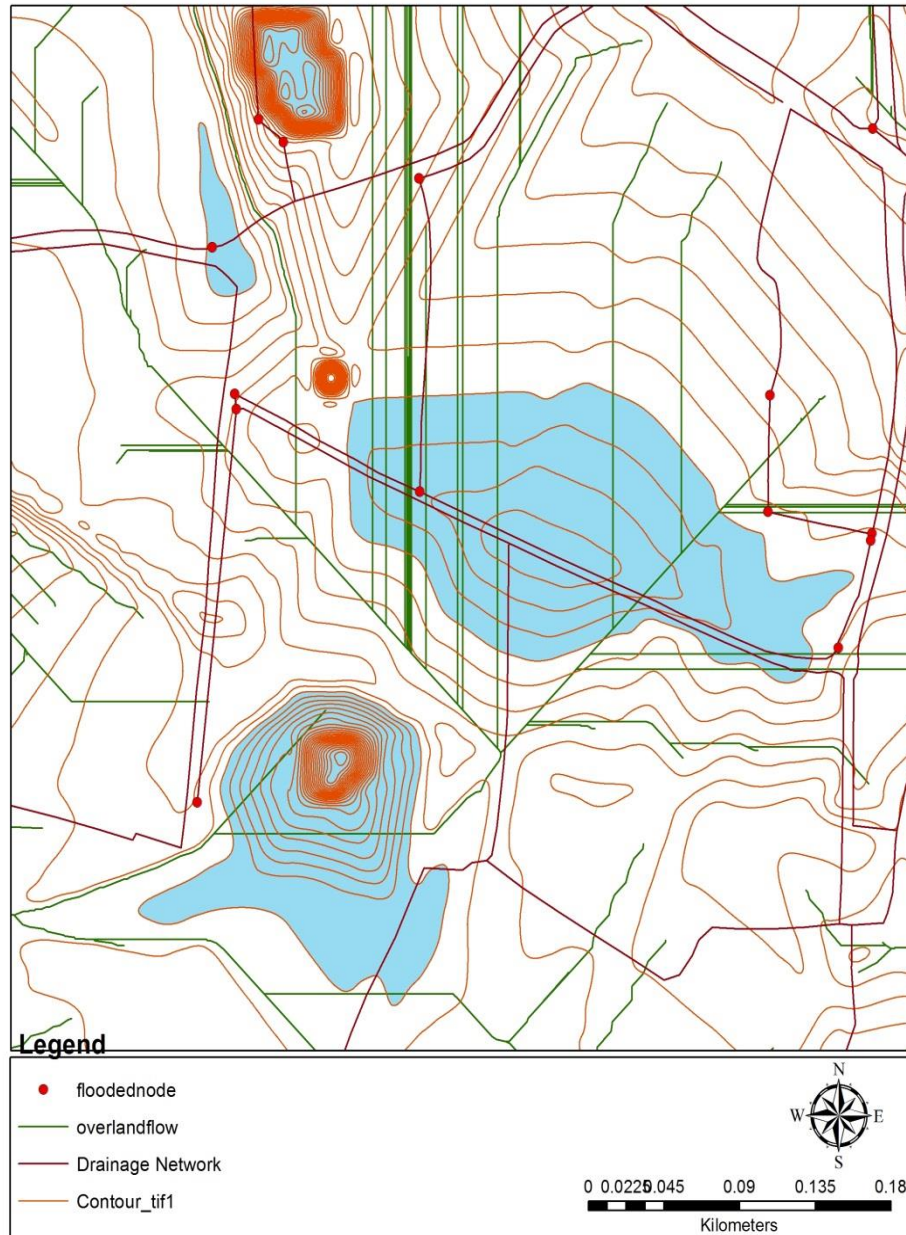
**Identifying  
Ponding area  
using 5cm  
contour map**



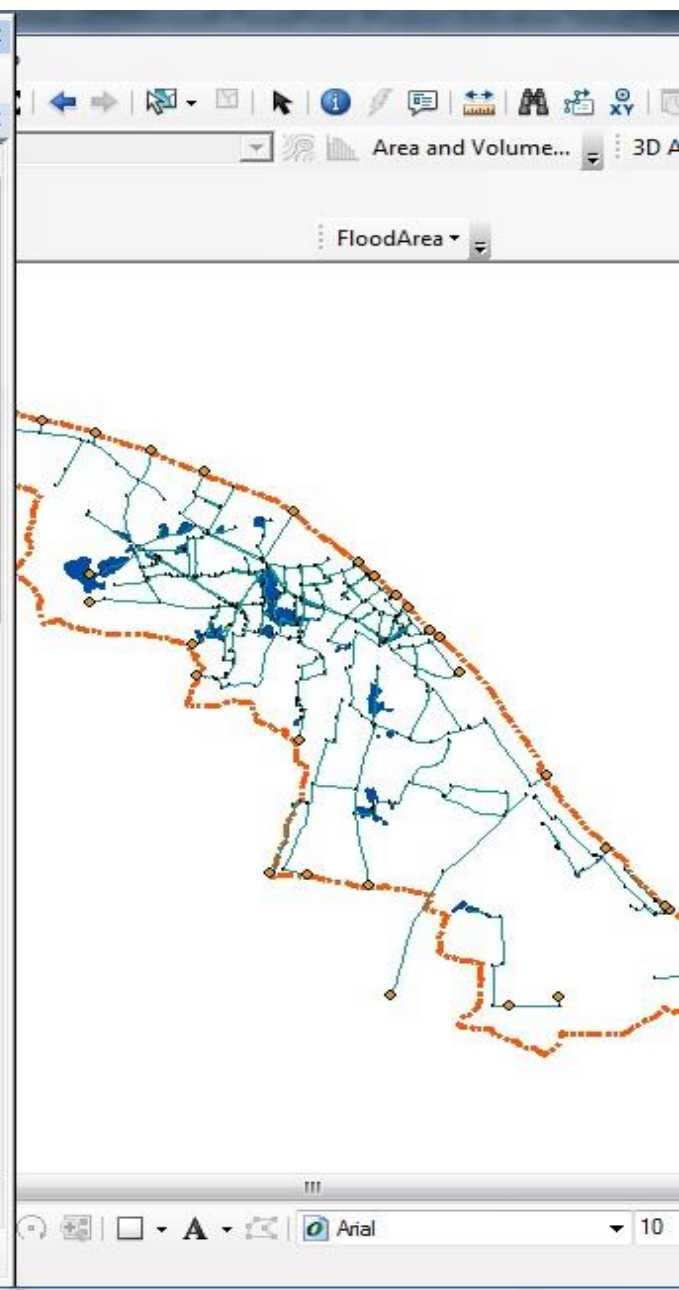
**Identifying  
flow path of  
flooding water  
towards  
Ponding area**



# Identifying the Surge or Ponding area by contour and flowpath in a study area of Mymensingh Pourashava

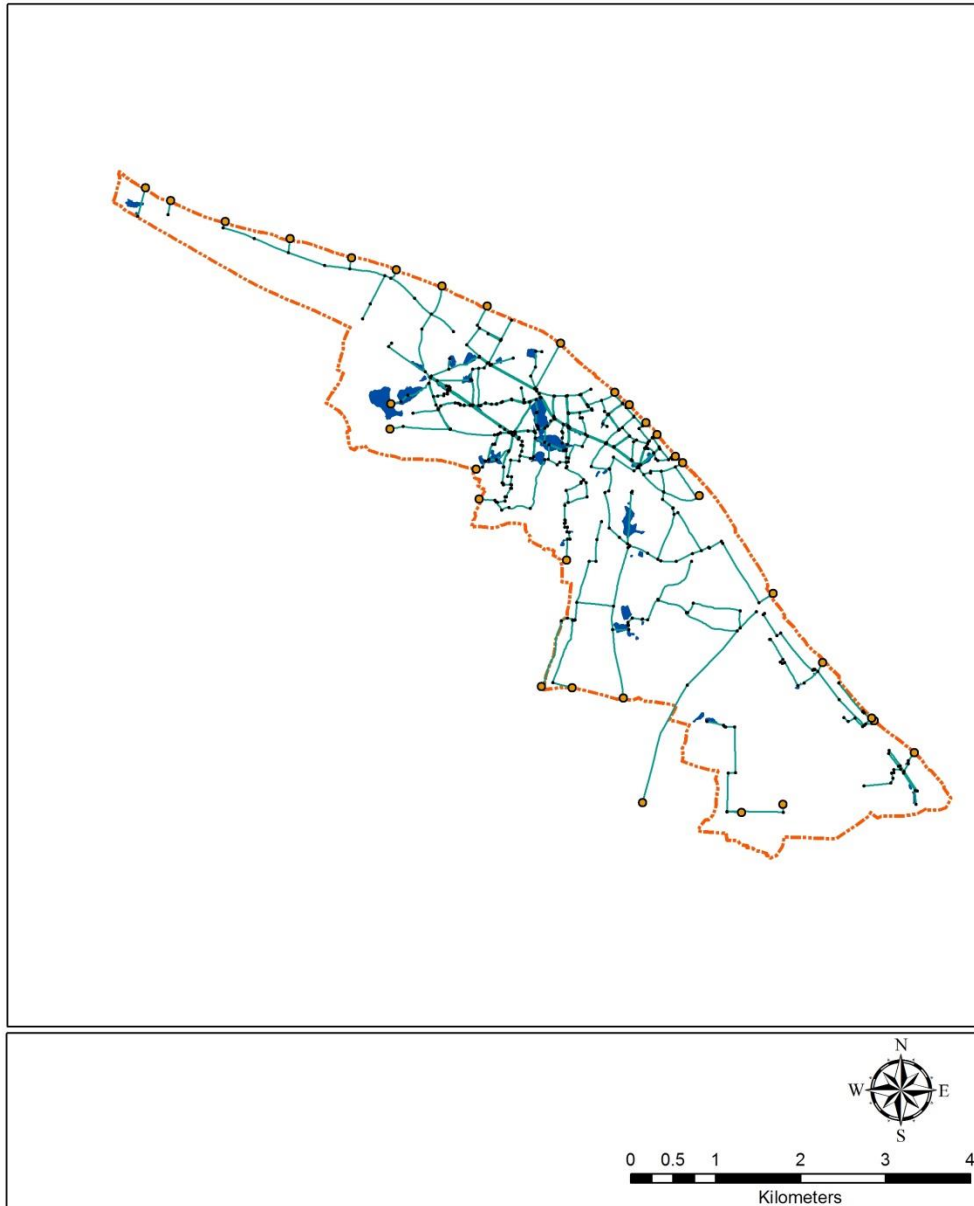


NAME	TSFLOW	flooding	floddepth	fvolm5
C1	0	YES	0.1834	5095.611916
C29	0	YES	0.5483	78436.85746
C30	0	YES	0.4995	53391.87568
C37	0	YES	0.0867	44671.96604
C39	0	YES	0.6294	477100.7085
C42	0	YES	0.2601	447.955848
C44	0	YES	0.0572	4423.099168
C45	0	YES	0.2309	11164.82208
C46	0	YES	0.2695	13245.93379
C60	0	YES	0.2772	6007.560912
C61	0	YES	0.3258	6702.265368
C62	0	YES	0.3744	9417.79192
C63	0	YES	0.018	24327.03169
C100	0	YES	0.003	103315.1133
C108	0	YES	0.0102	3865.372722
C109	0	YES	0.0498	1457.239967
C110	0	YES	0.0597	18175.93706
C112	0	YES	0.0432	5977.521844
C113	0	YES	0.0036	5929.494668
C150	0	YES	0.3576	19901.23023
C181	0	YES	0.02	5030.527256
C182	0	YES	0.1089	3890.396019
C183	0	YES	0.339	14348.47488
C208	0	YES	1.4548	450397.4013
C209	0	YES	0.2062	21496.66536
C231	0	YES	0.1141	1810.988376
C233	0	YES	0.308	1955.54791
C241	0	YES	0.1128	4834.014126
C242	0	YES	0.1128	2623.650271
C243	0	YES	0.1128	3165.992615
C244	0	YES	0.696	27419.13918
C246	0	YES	1.398	859.63781
C252	0	YES	0.3934	23648.12045
C278	0	YES	0.03	5390.181364
C279	0	YES	0.1203	10508.84404
C283	0	YES	0.1004	1970.530816
C304	0	YES	0.02	2999.857556



waterlogged due to urban flood

**Water logged area  
with flood volume of  
water**



**Thank You All**