Hydrological Aspect of Mymensingh Pourashava

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MSDP, 2011-2031

Objectives

- 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
• To find out the existing drainage capacity with respect to hydrological aspect	Hydrological vs hydrodynamic model With PCSWMM and GIS Software	1. Behavior of existing drainage network during the rainfall (such as runoff volume, node and channel surcharge etc) 2. Inundation area	Drainage improvement
• To find out the ponding area and it's capacity with respect to hydrological aspect	Surface Runoff model with PC SWMM and GIS	1. Natural flow path and ponding area of Surface runoff (where and how much)-Depth, Duration, Extent, total Volume	Calculate retention pond (where and how many)

Methodology

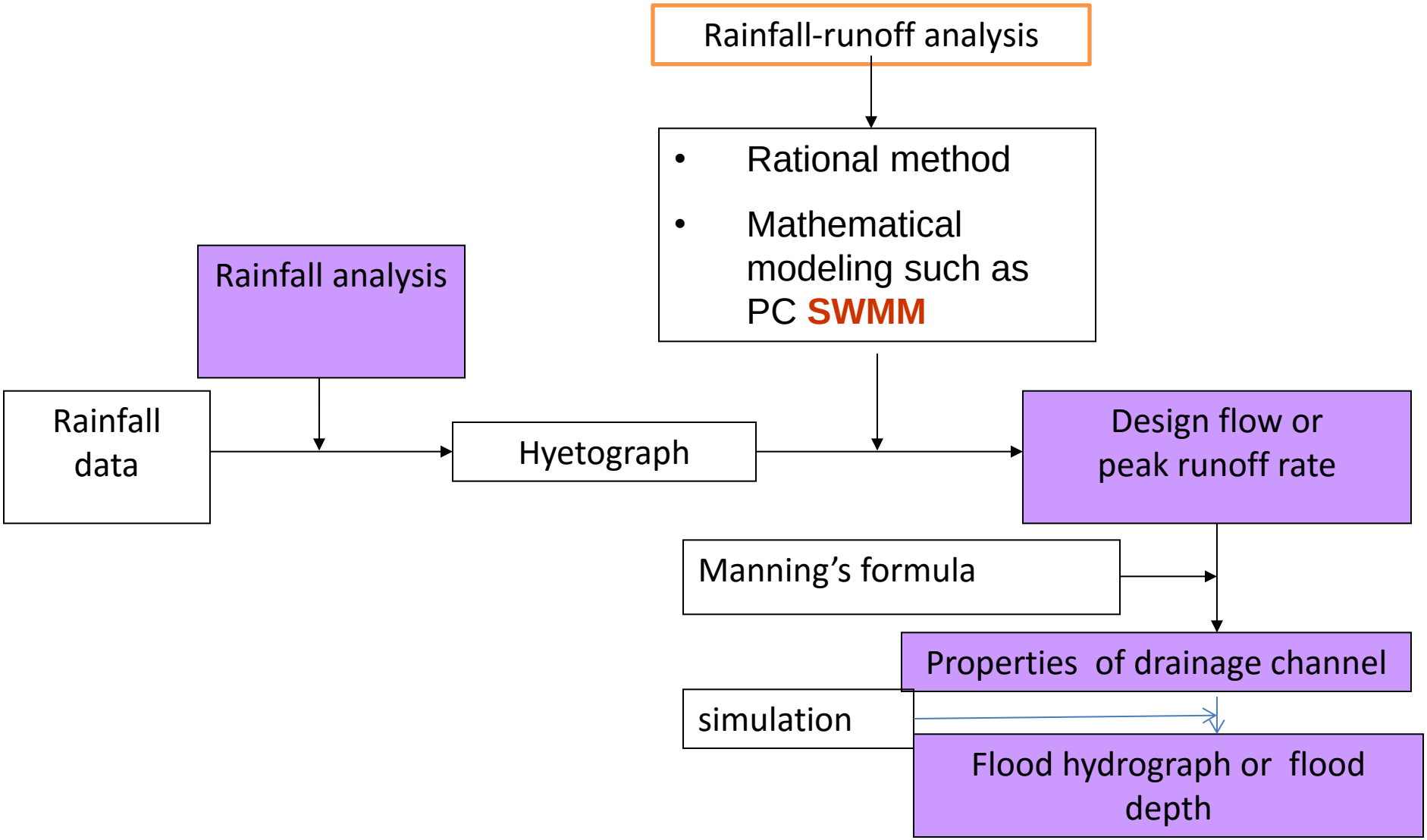
Rainfall Analyses

- 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



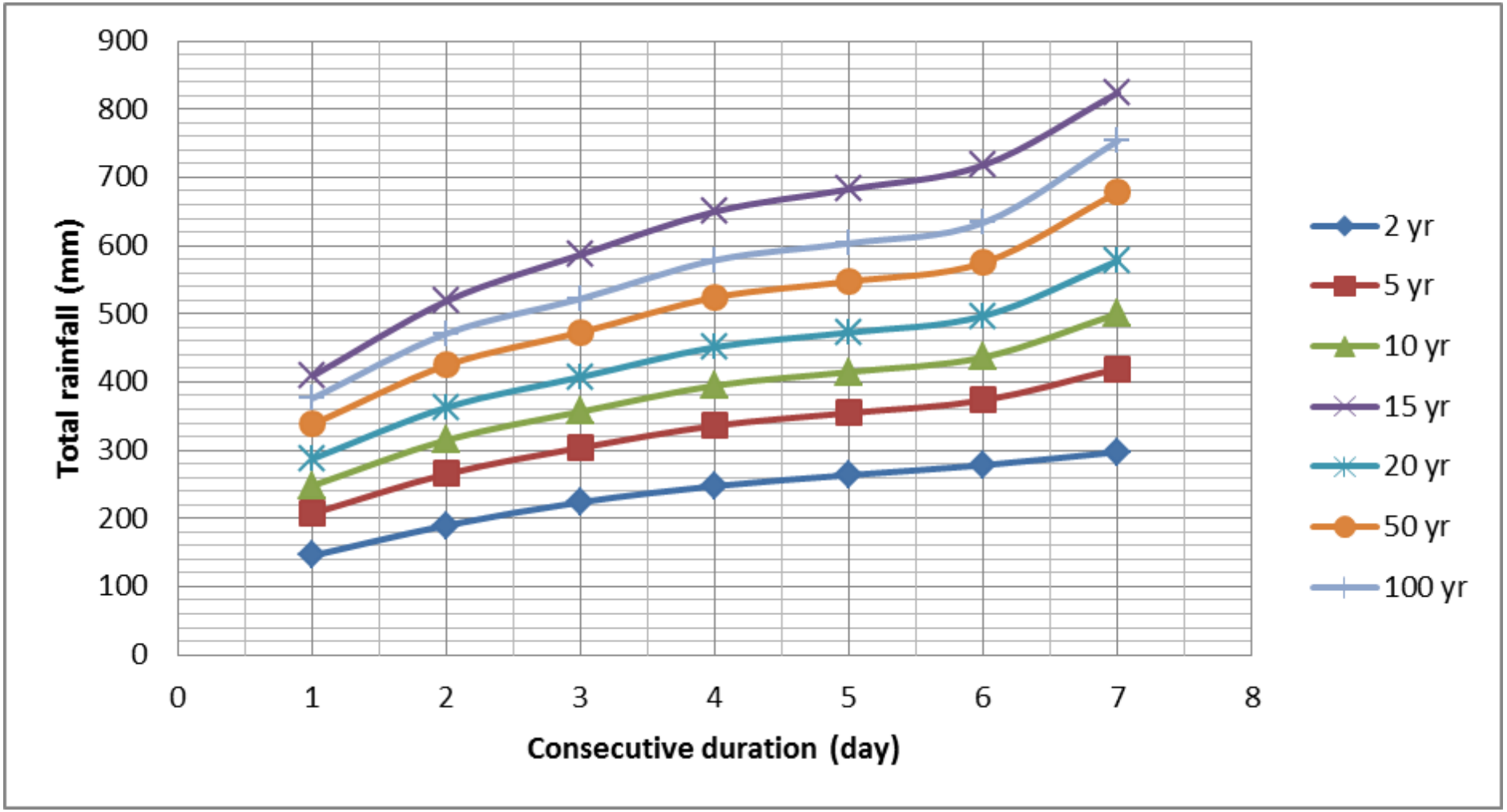
Rainfall Runoff Analyses by Rational Method

- 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

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

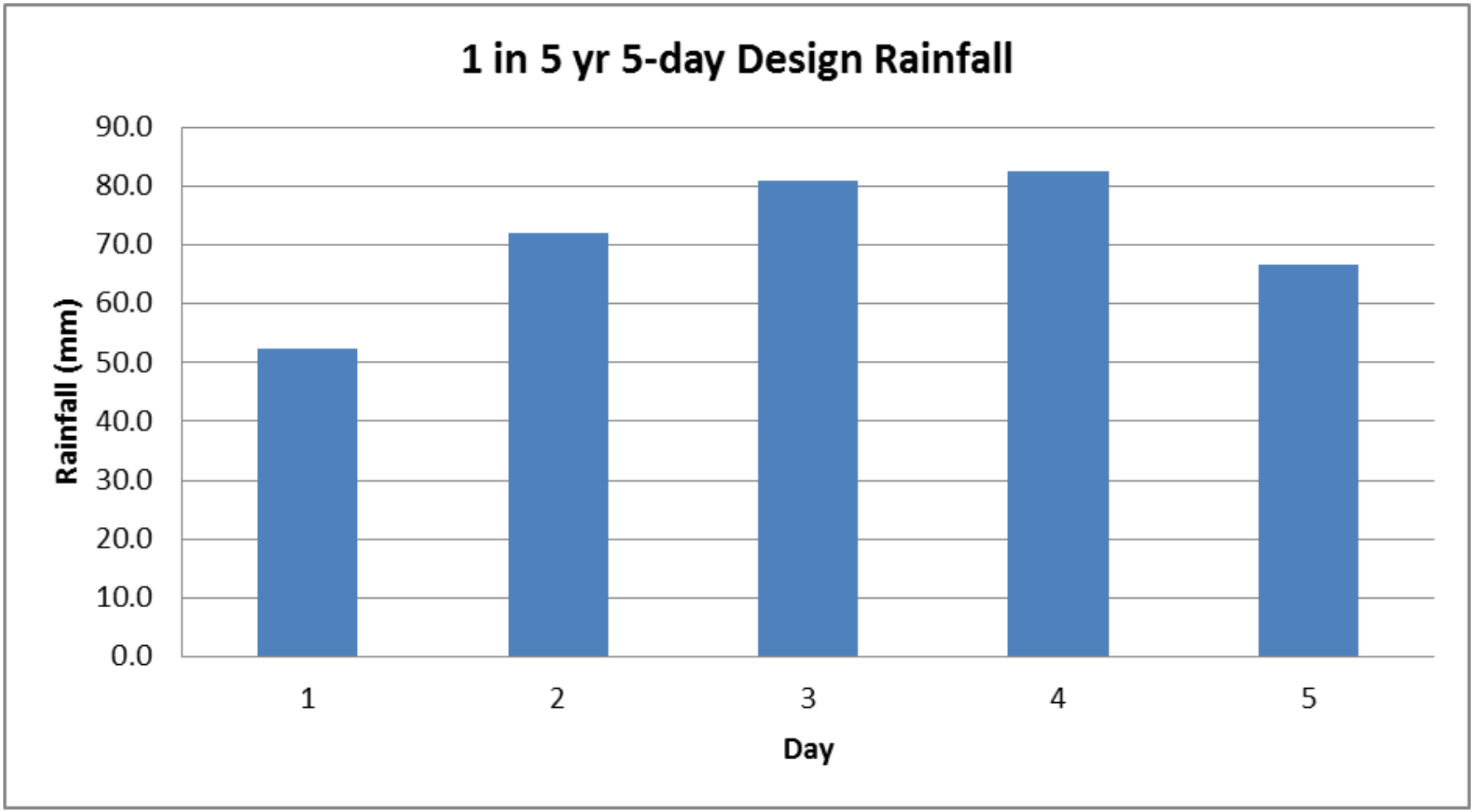
Where,
Q = peak discharge in m3/s,
C = a dimensionless runoff coefficient whose value depends on hydrologic characteristics of the drainage area,
I = rainfall intensity in mm/hr for a duration equal to or greater than the time of concentration of the drainage basin, and
A = area of the drainage basin in acres.

Prepared IDF Curve for Mymensing

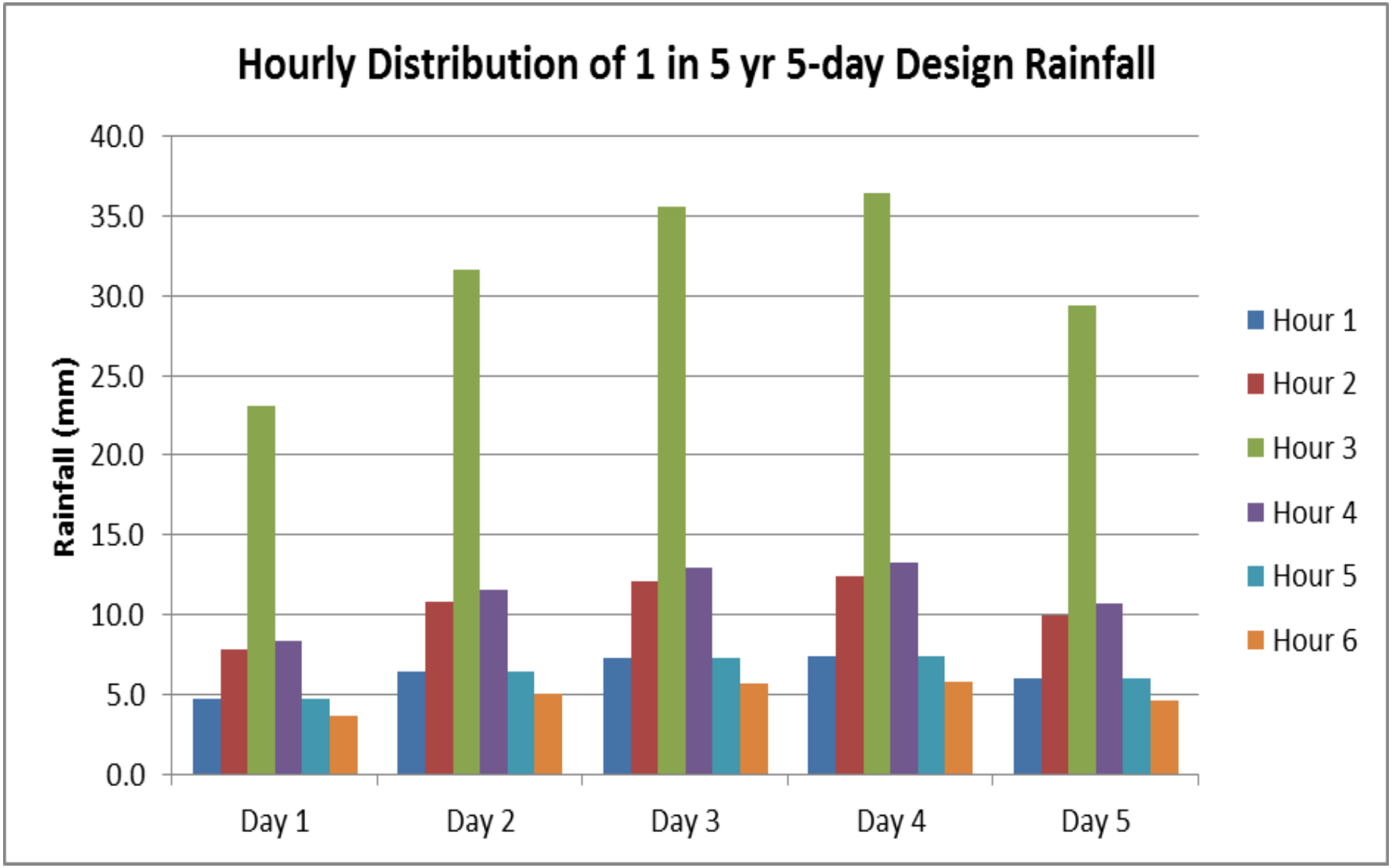


Design and Distribution of Rainfall

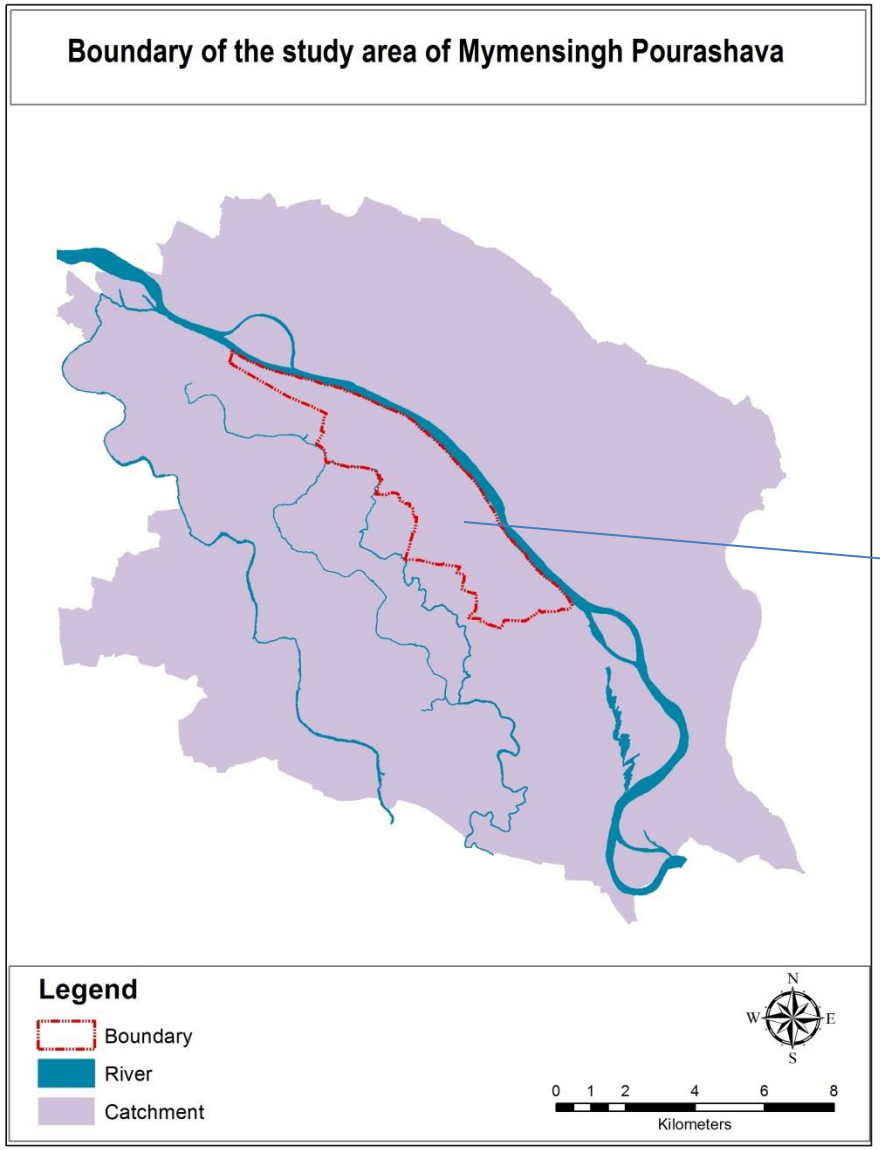
- 1 in 5 day 5 year rain fall (354mm/5day)

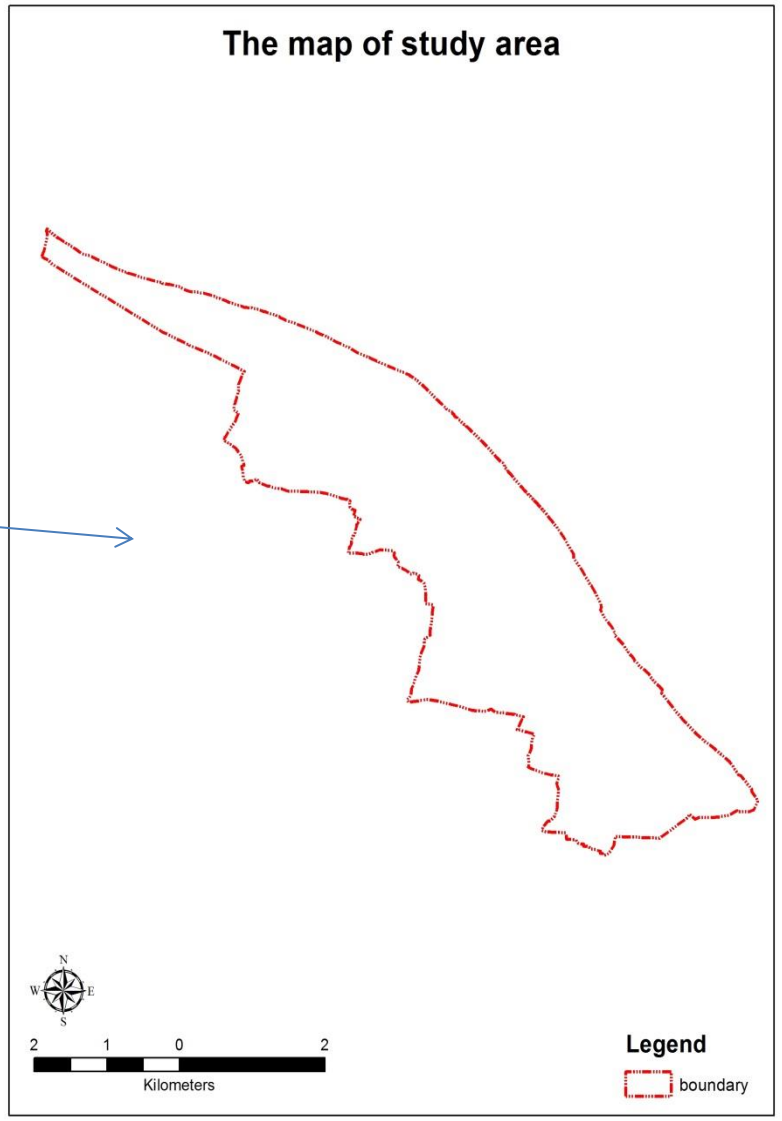


Hyetograph (354mm/5d)



Study area


Boundary of the study area of Mymensingh Pourashava
Legend
Boundary
River
Catchment
N
W
E
S
0 1 2 4 6 8
Kilometers


The map of study area
N
W
E
S
2 1 0 2
Kilometers
Legend
boundary

Step

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 Mymensignh Pourashava

Legend

Drain

N W E S

1.5 0.75 0 1.5

Kilometers

Existing Primary and Secondary Drainage Network in Mymensignh Pourashava

Legend

Drainage network

N W E S

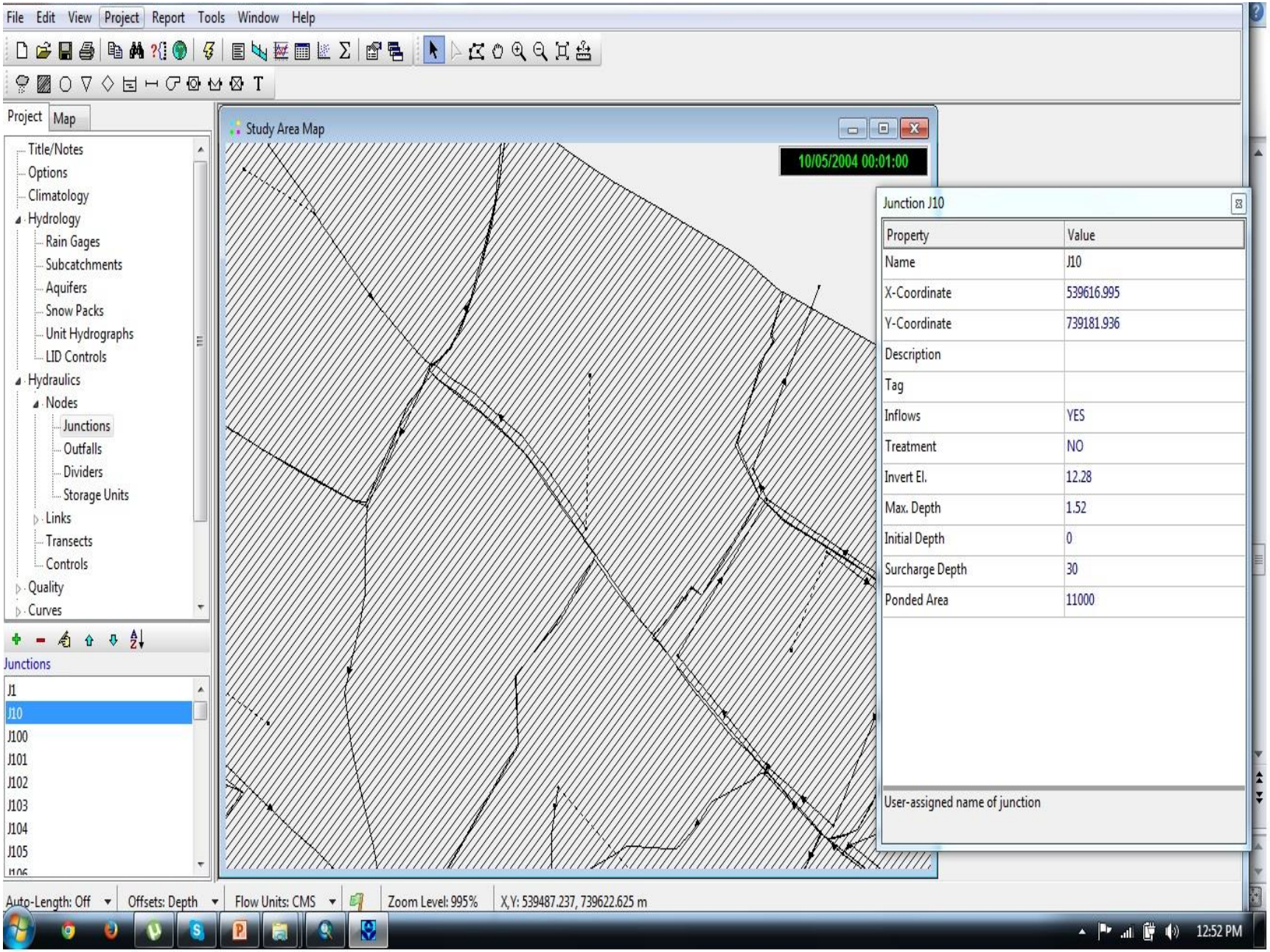
1.5 0.75 0 1.5

Kilometers

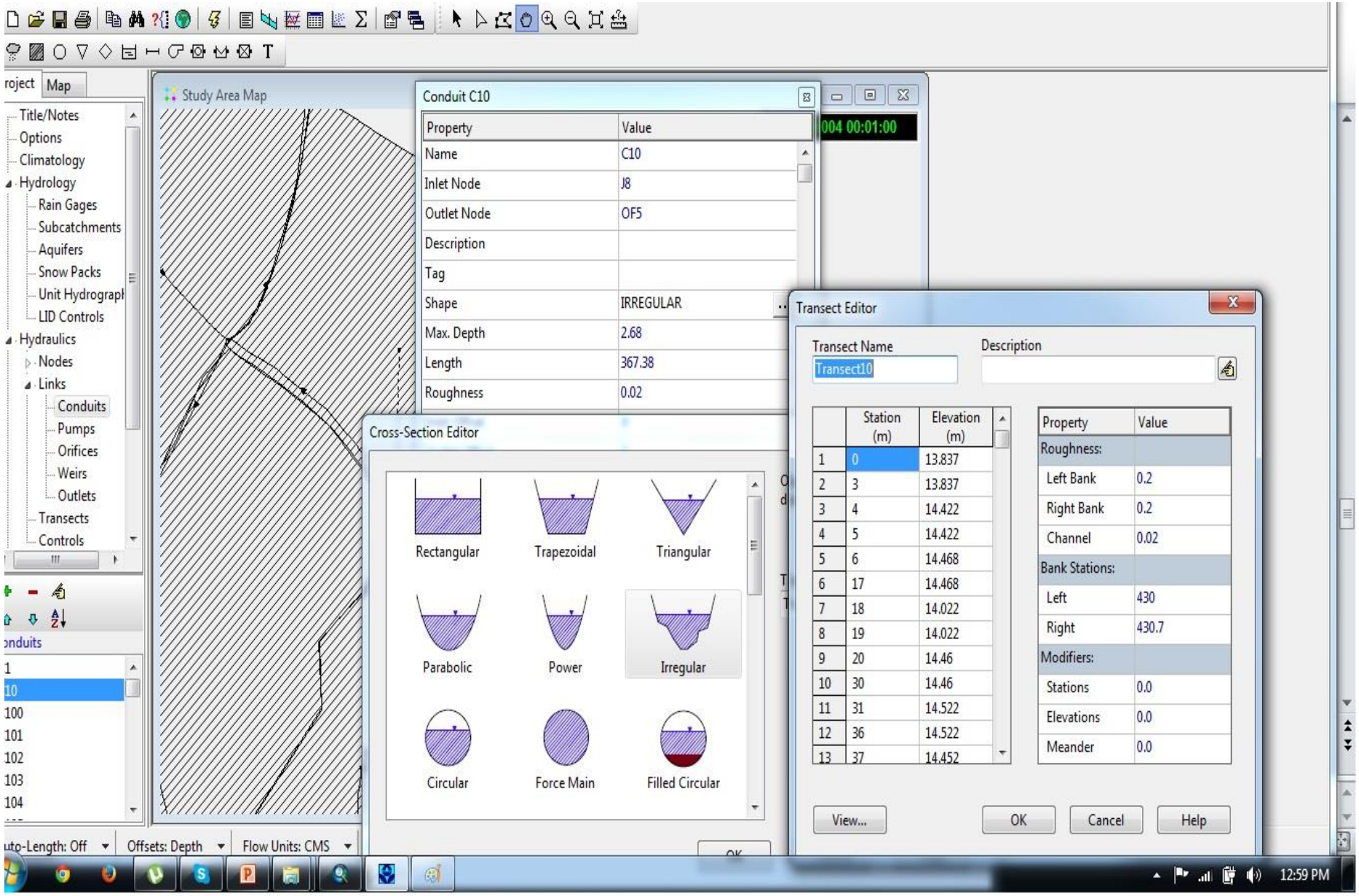
SWMM Model

- 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)

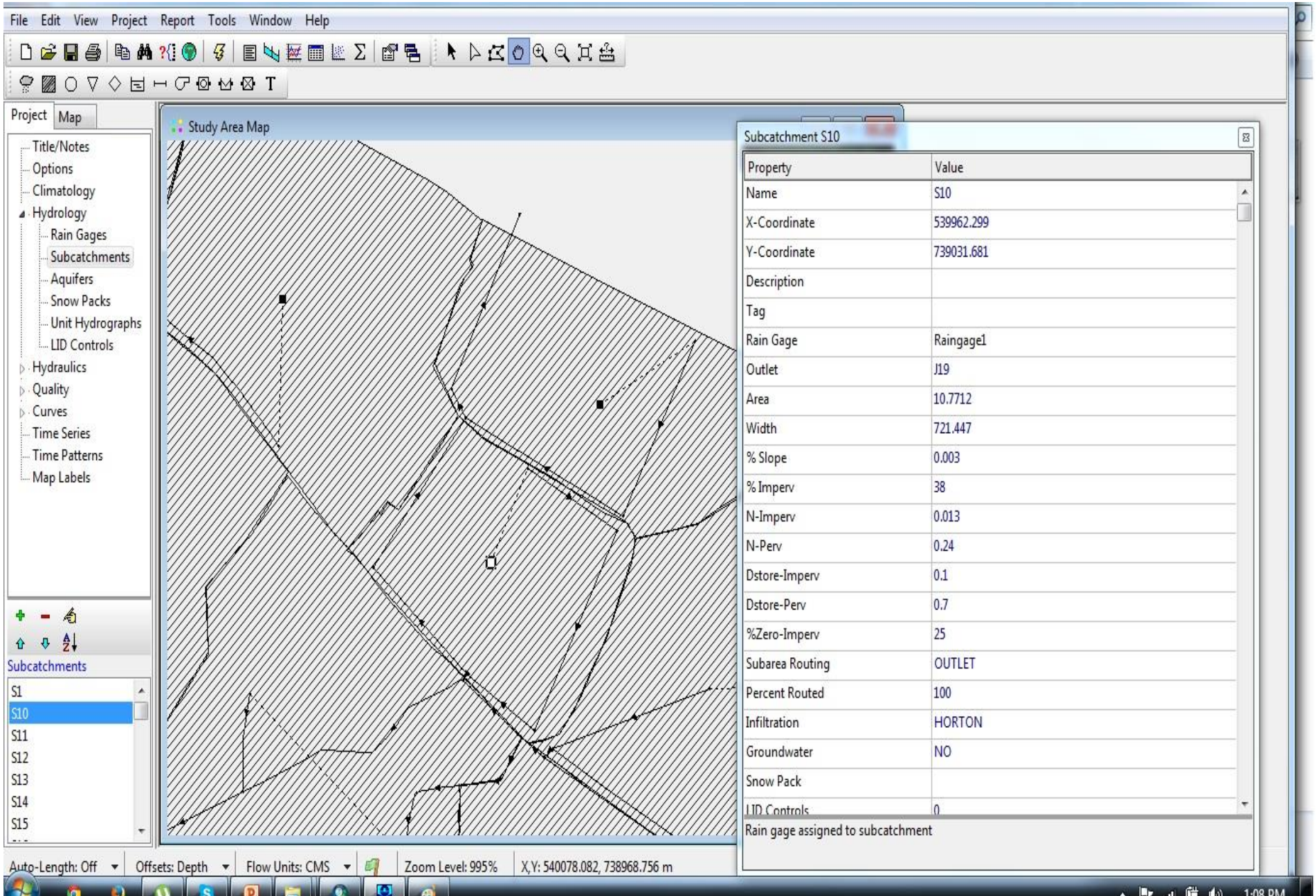
Input junction data



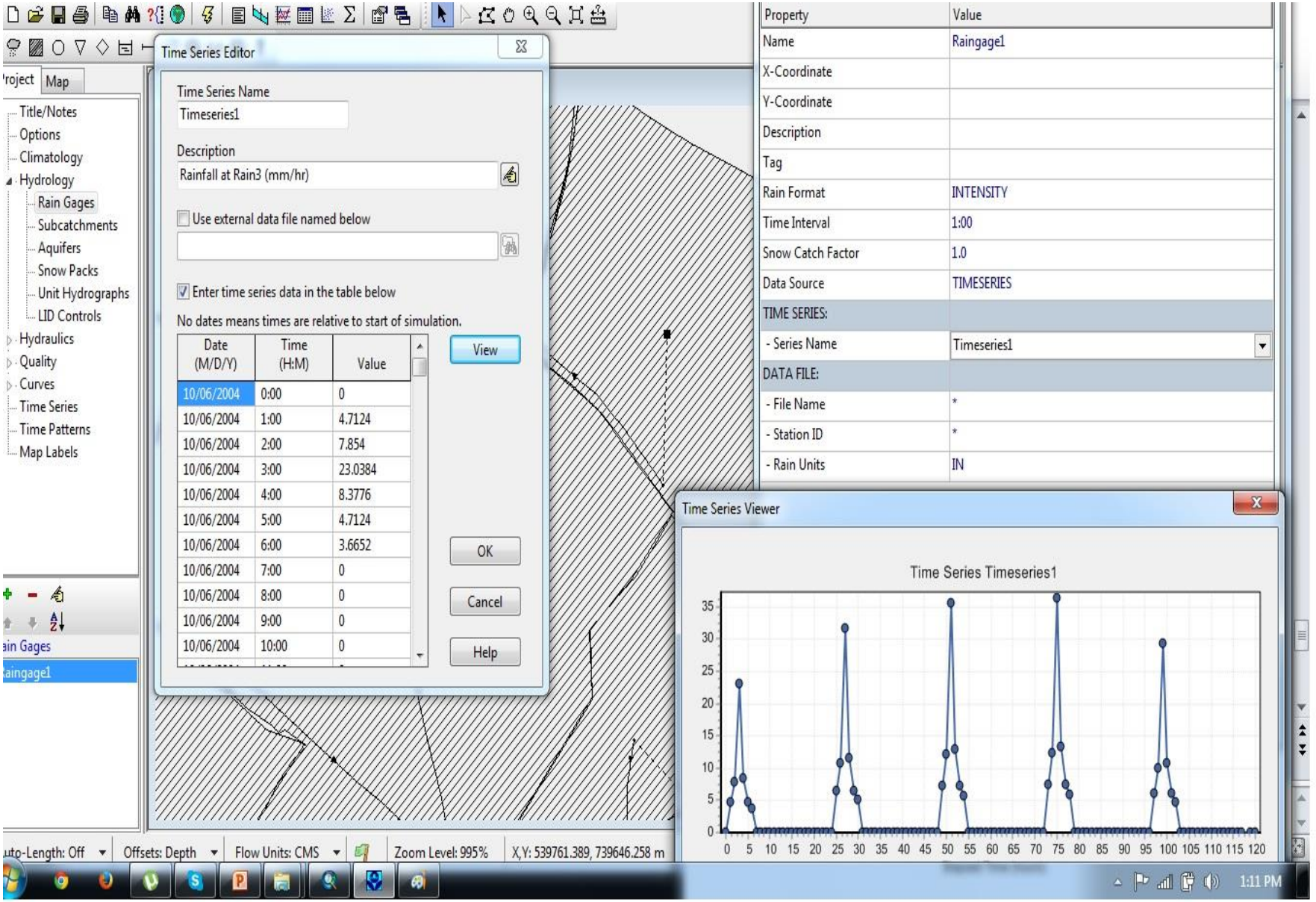
Input conduit data



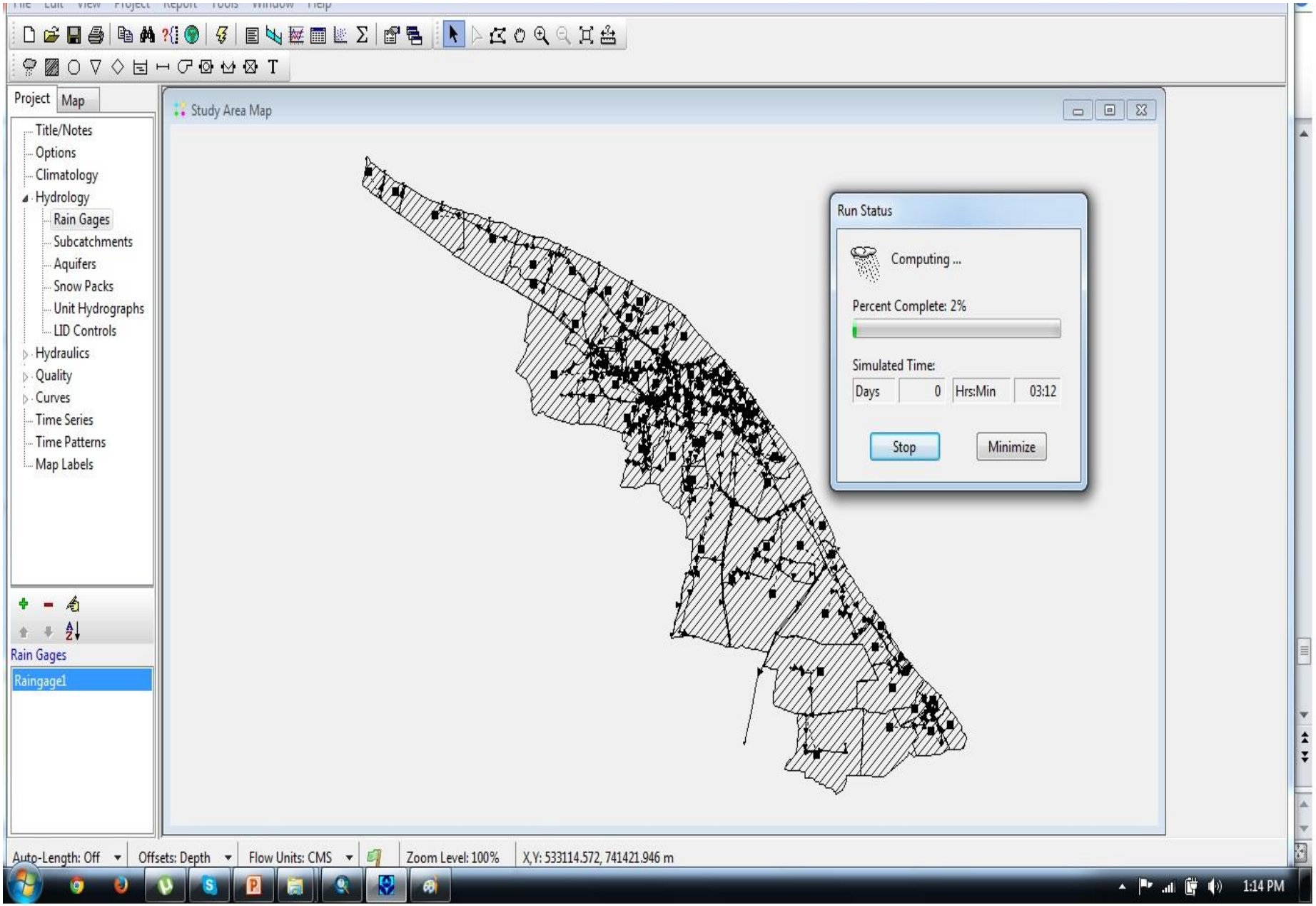
Input data on Sub-catchment



Time series data



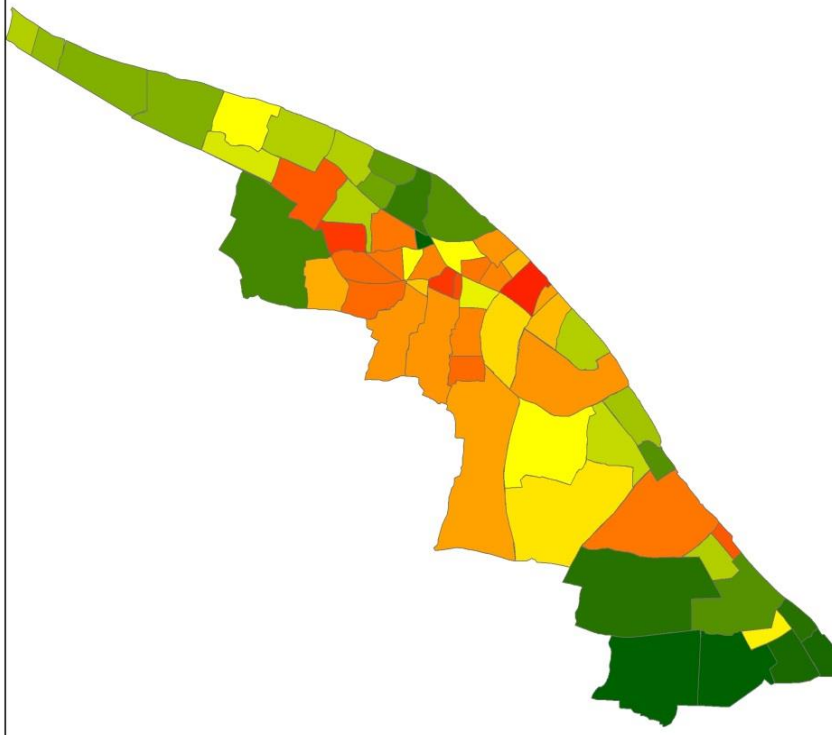
Run and simulation



Post processing

- Simulation of SWMM data has been input on Arcgis

Percentange of Impervious land in each subcatchment area of Mymensingh Pourashava



Legend

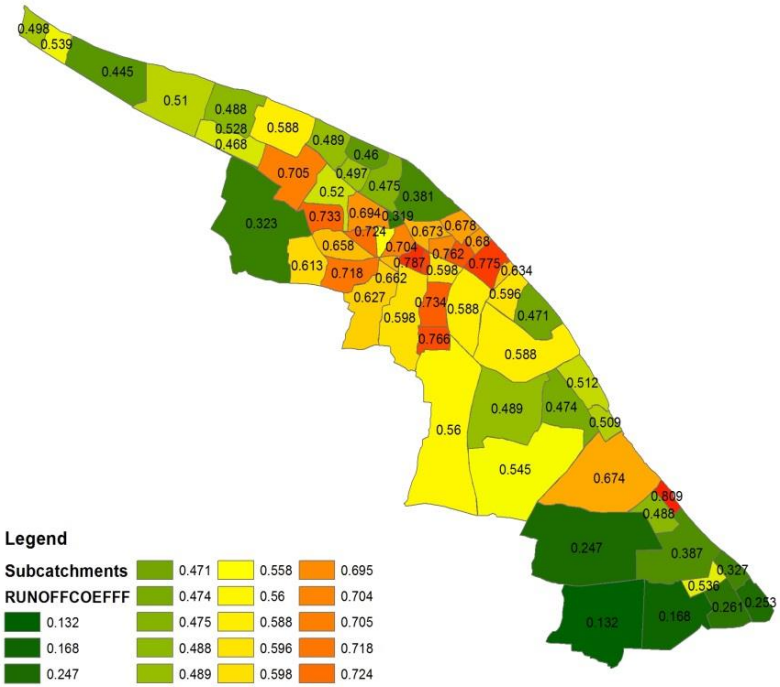
Subcatchments
impervious land

10	36	49	64
15	38	50	65
20	40	52	68
25	42	55	70
30	44	56	72
35	45	59	75
	46	60	76
	48	62	78
			80

N W E S

0 0.35 0.7 1.4 2.1 2.8 Kilometers

RunoffCoefficient in each subcatchment area of Mymensingh Pourashava



Legend

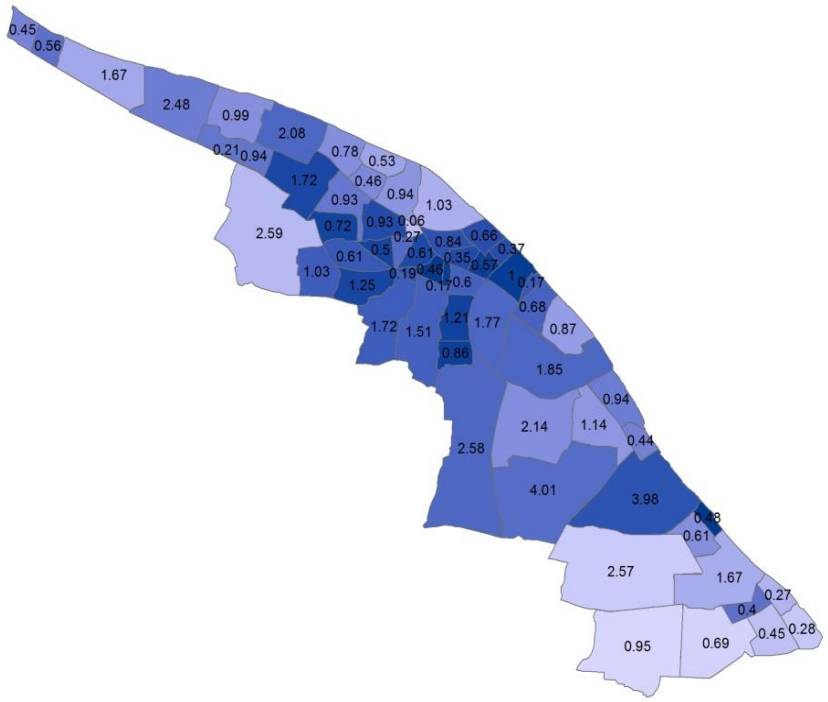
Subcatchments
RUNOFFCOEFFF

0.132	0.471	0.558	0.695
0.168	0.474	0.56	0.704
0.247	0.475	0.588	0.705
0.253	0.488	0.596	0.718
0.261	0.489	0.598	0.724
0.319	0.497	0.613	0.733
0.323	0.498	0.627	0.734
0.327	0.509	0.634	0.762
0.381	0.51	0.658	0.766
0.387	0.512	0.662	0.772
0.445	0.52	0.673	0.775
0.46	0.528	0.674	0.787
0.468	0.536	0.678	0.809
	0.539	0.68	
	0.545	0.694	

N W E S

0 0.425 0.85 1.7 2.55 3.4 Kilometers

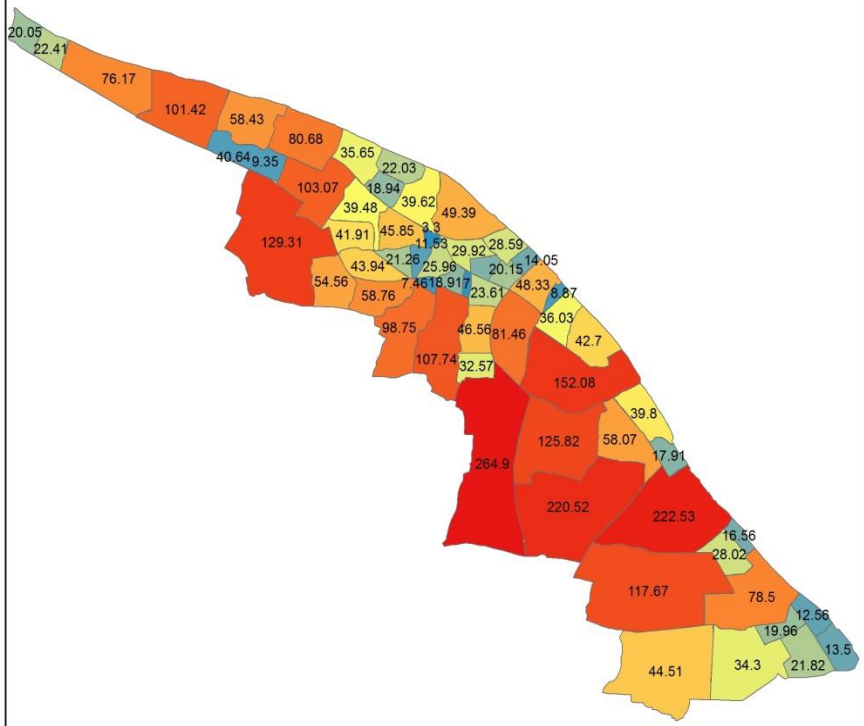
Peak Runoff in each subcatchment area of Mymensingh Pourashava for Design rainfall(354mm/5d)



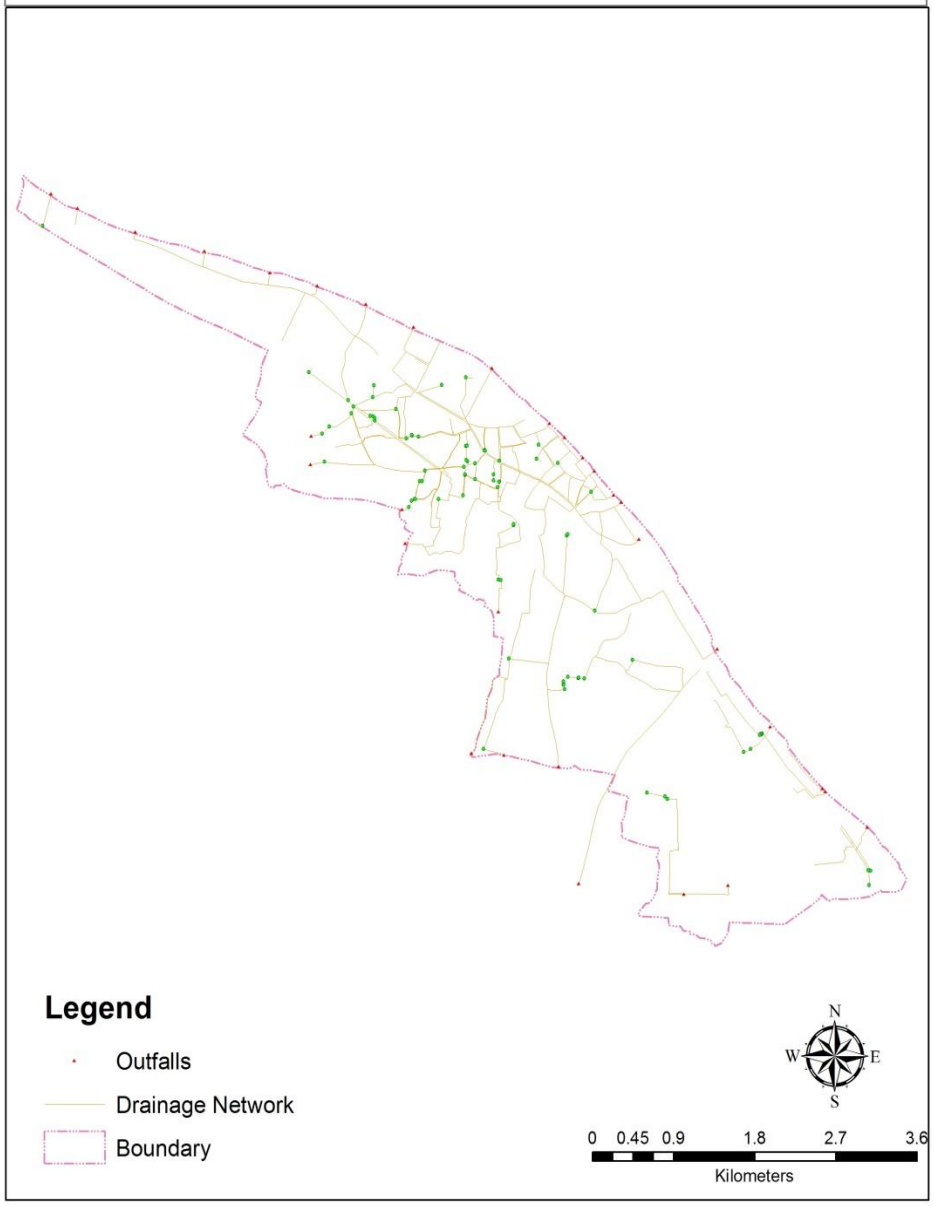
0 0.425 0.85 1.7 2.55 3.4
Kilometers

N
W
E
S

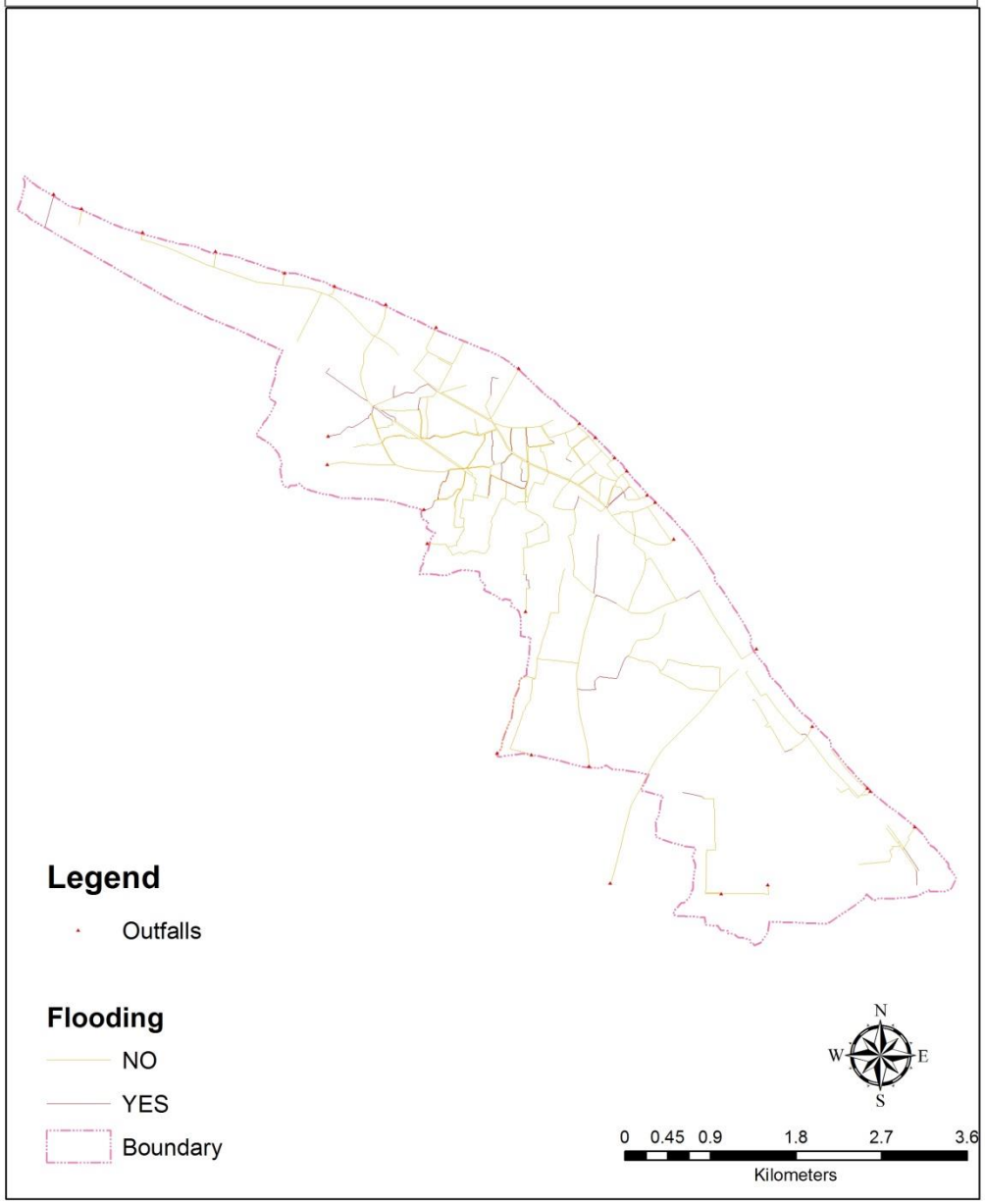
TotalRunoff Volume (ML) in each subcatchment area of Mymensingh Pourashava for Design rainfall(354mm/5d)



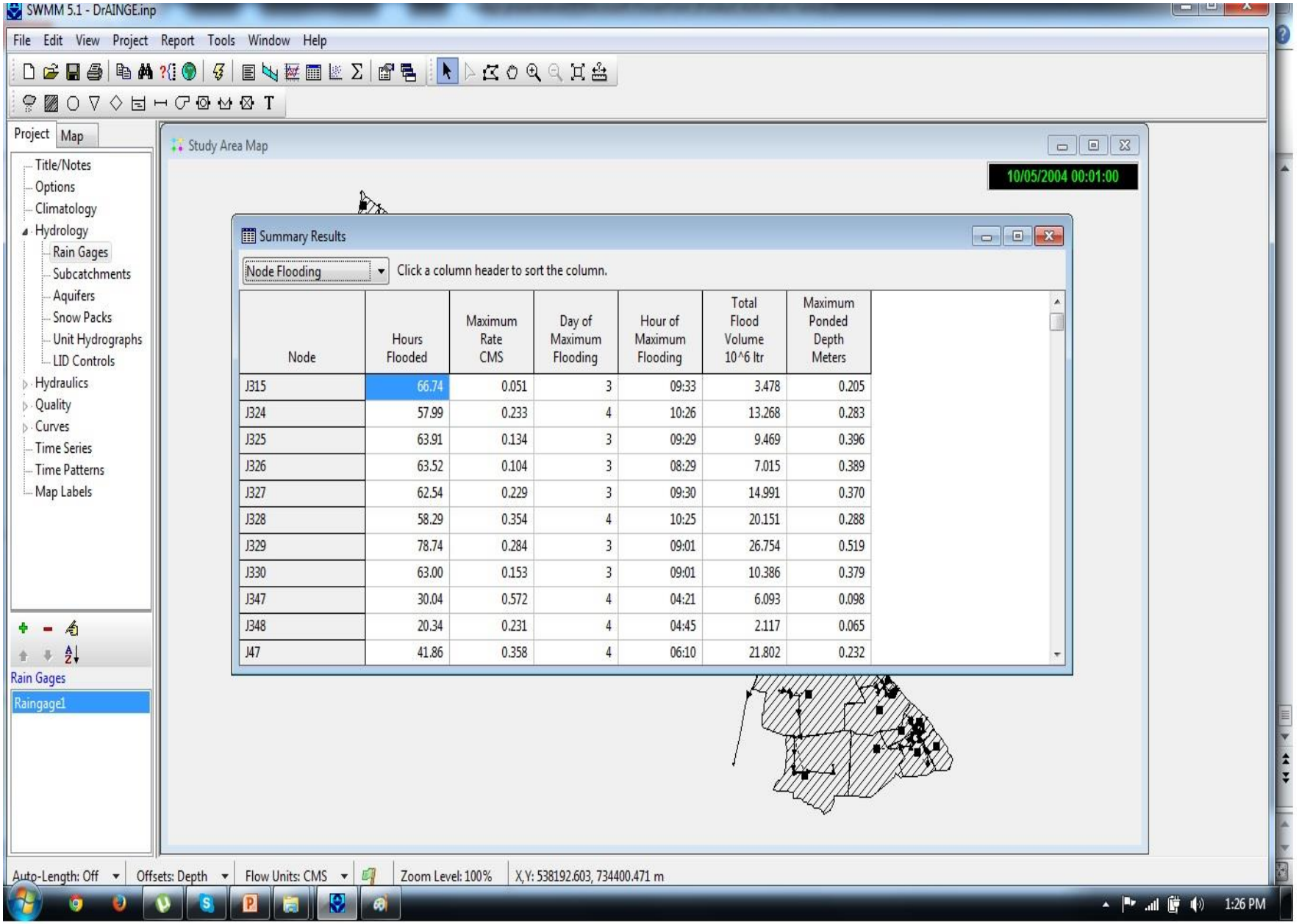
Node flooding map in a study area of Mymensingh Pourashava



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

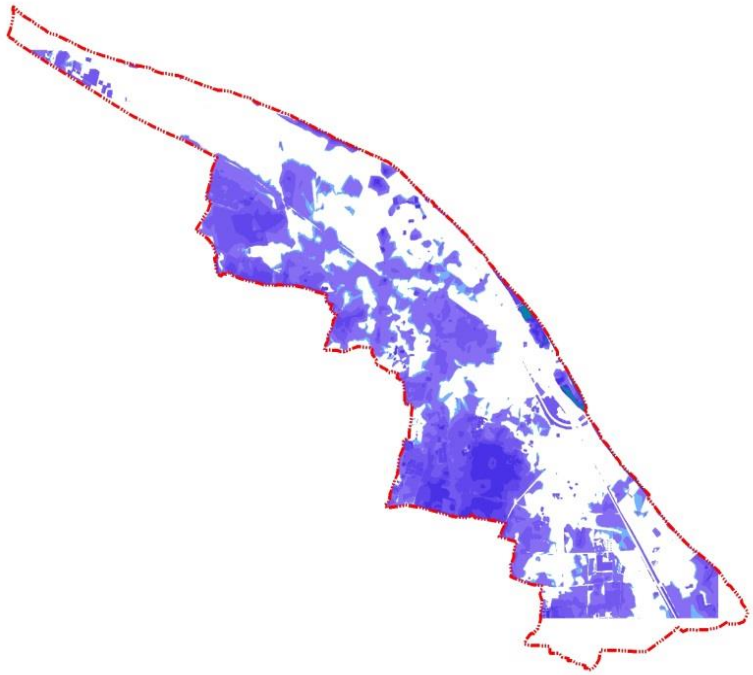


Flood inundation map with peak discharge or flood depth data



Node	Hours Flooded	Maximum Rate CMS	Day of Maximum Flooding	Hour of Maximum Flooding	Total Flood Volume 10^6 ltr	Maximum Ponded Depth Meters
J315	66.74	0.051	3	09:33	3.478	0.205
J324	57.99	0.233	4	10:26	13.268	0.283
J325	63.91	0.134	3	09:29	9.469	0.396
J326	63.52	0.104	3	08:29	7.015	0.389
J327	62.54	0.229	3	09:30	14.991	0.370
J328	58.29	0.354	4	10:25	20.151	0.288
J329	78.74	0.284	3	09:01	26.754	0.519
J330	63.00	0.153	3	09:01	10.386	0.379
J347	30.04	0.572	4	04:21	6.093	0.098
J348	20.34	0.231	4	04:45	2.117	0.065
J47	41.86	0.358	4	06:10	21.802	0.232

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



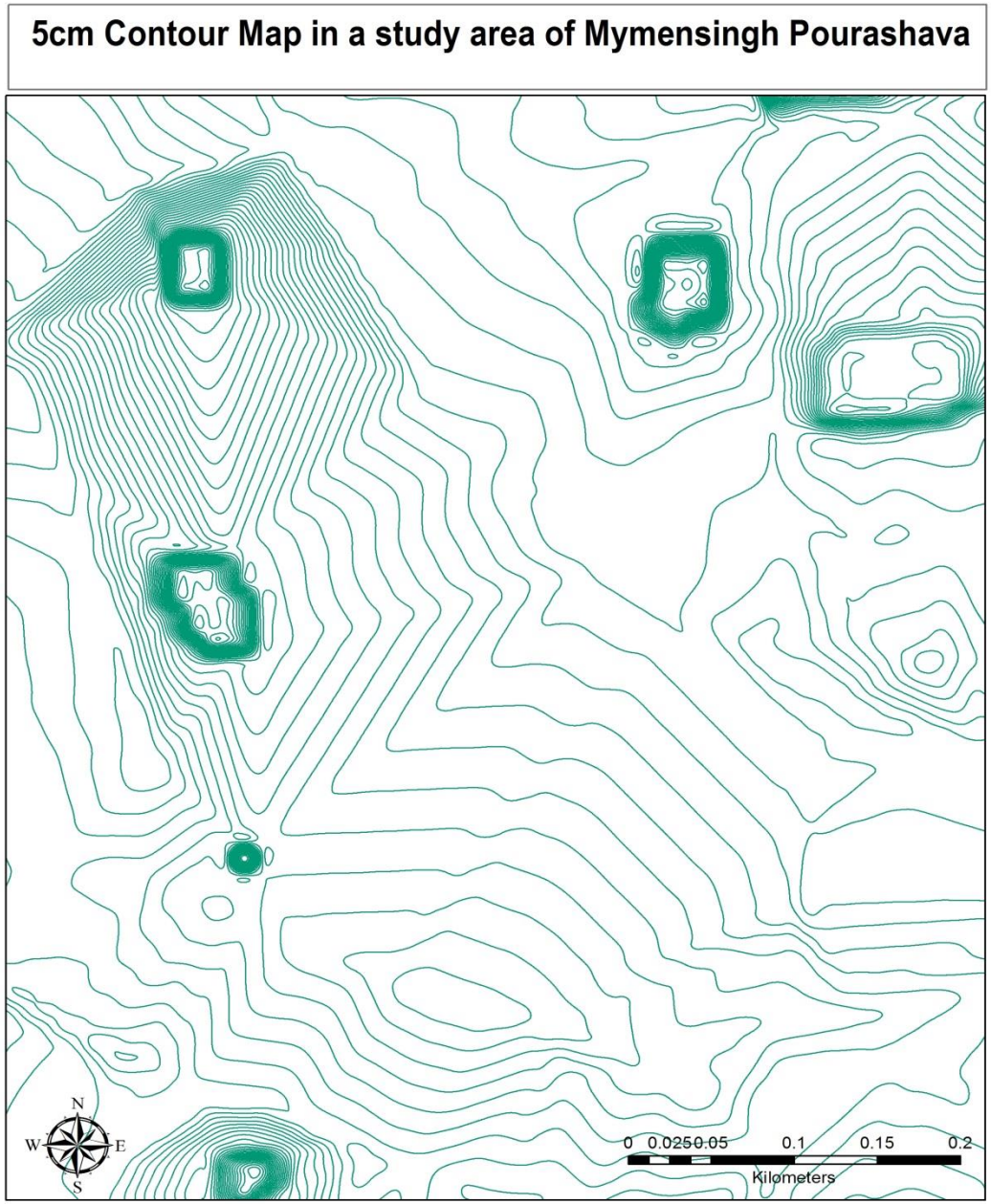
Legend

-5.560791969 - -3.526285026	0.599242943 - 1.164383761
-3.526285025 - -1.09617951	1.164383762 - 1.842552742
-1.096179509 - 0	1.842552743 - 3.142376623
0 - 0.090616207	3.142376624 - 6.420193366
0.090616207 - 0.599242943	6.420193367 - 8.850298882

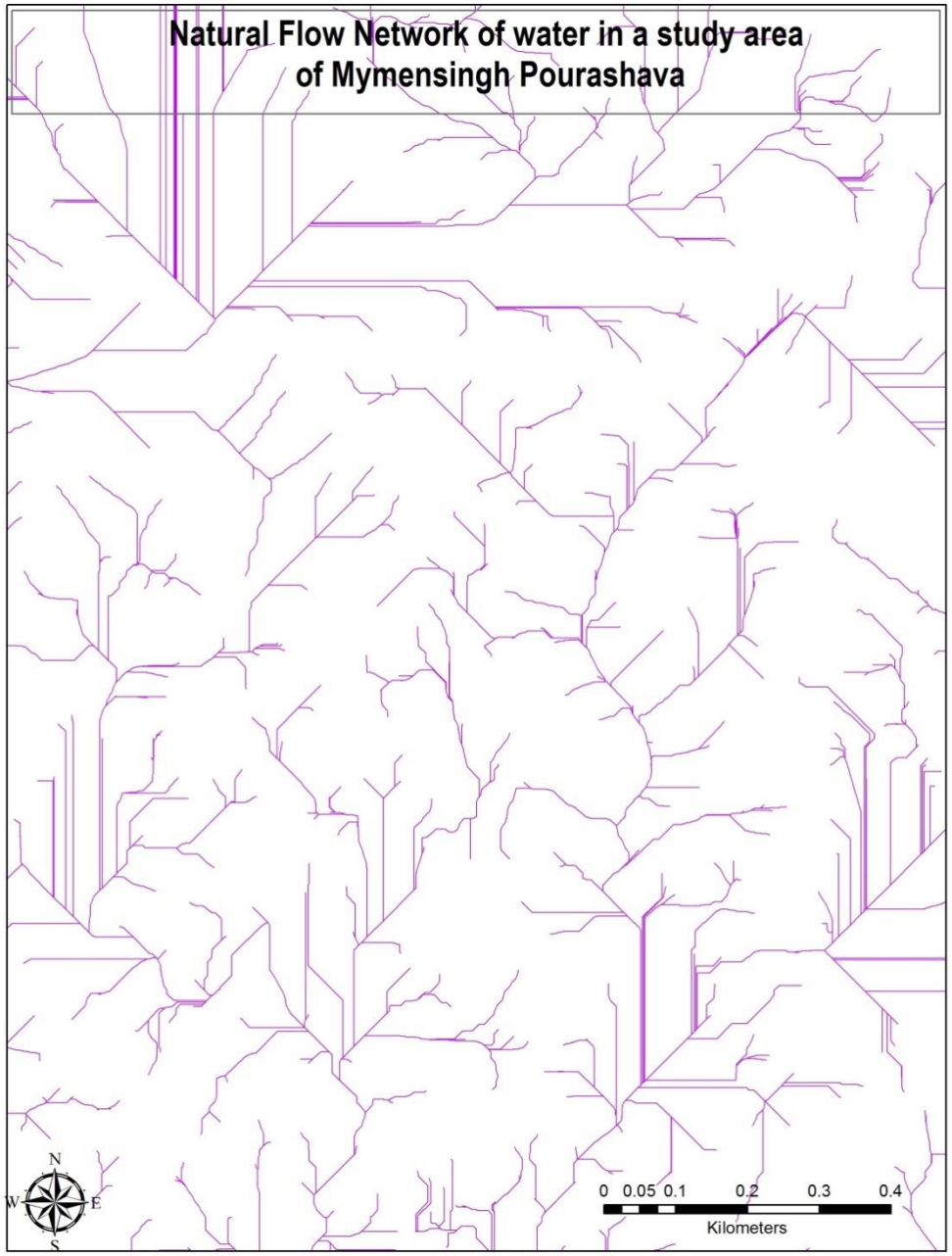
N W E S

2 1 0 2

Kilometers

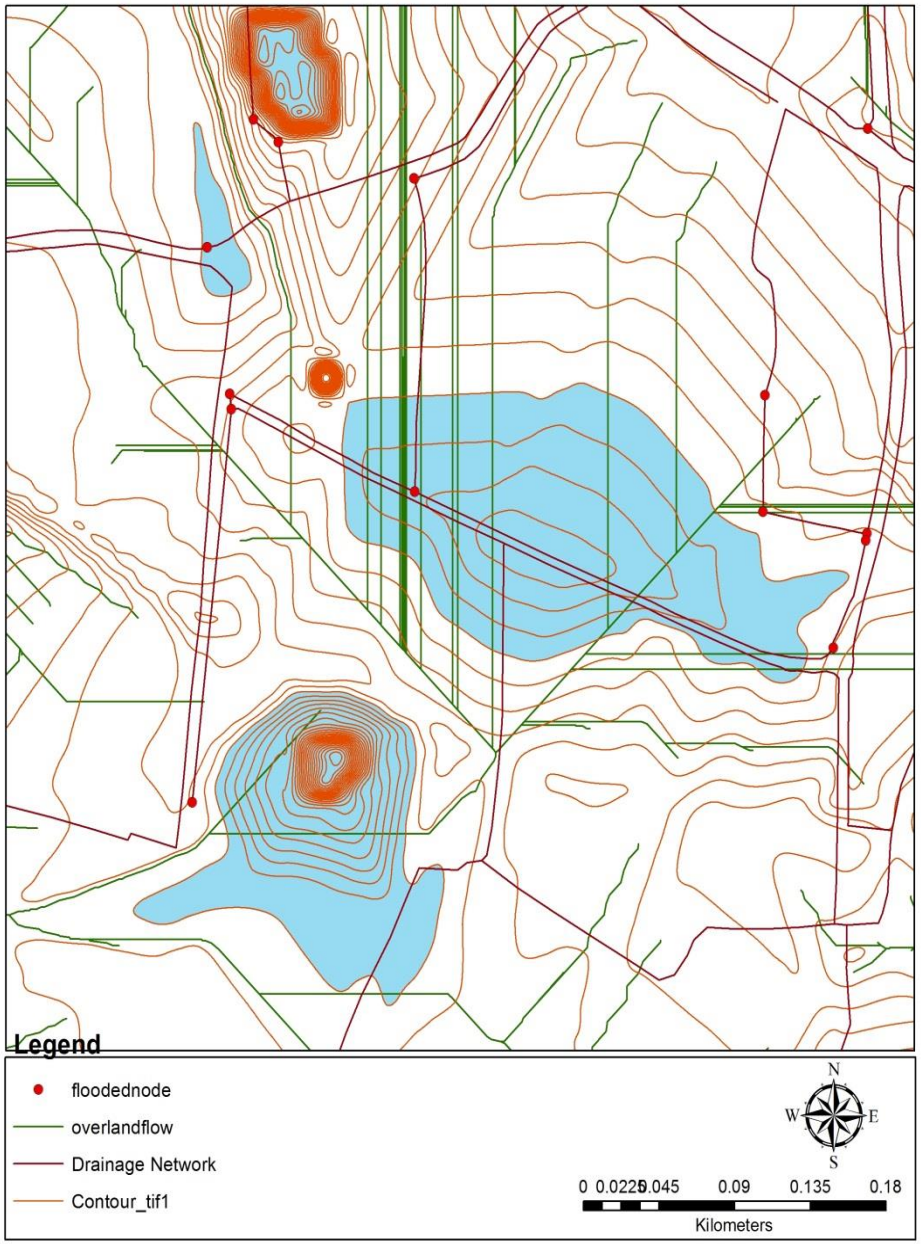


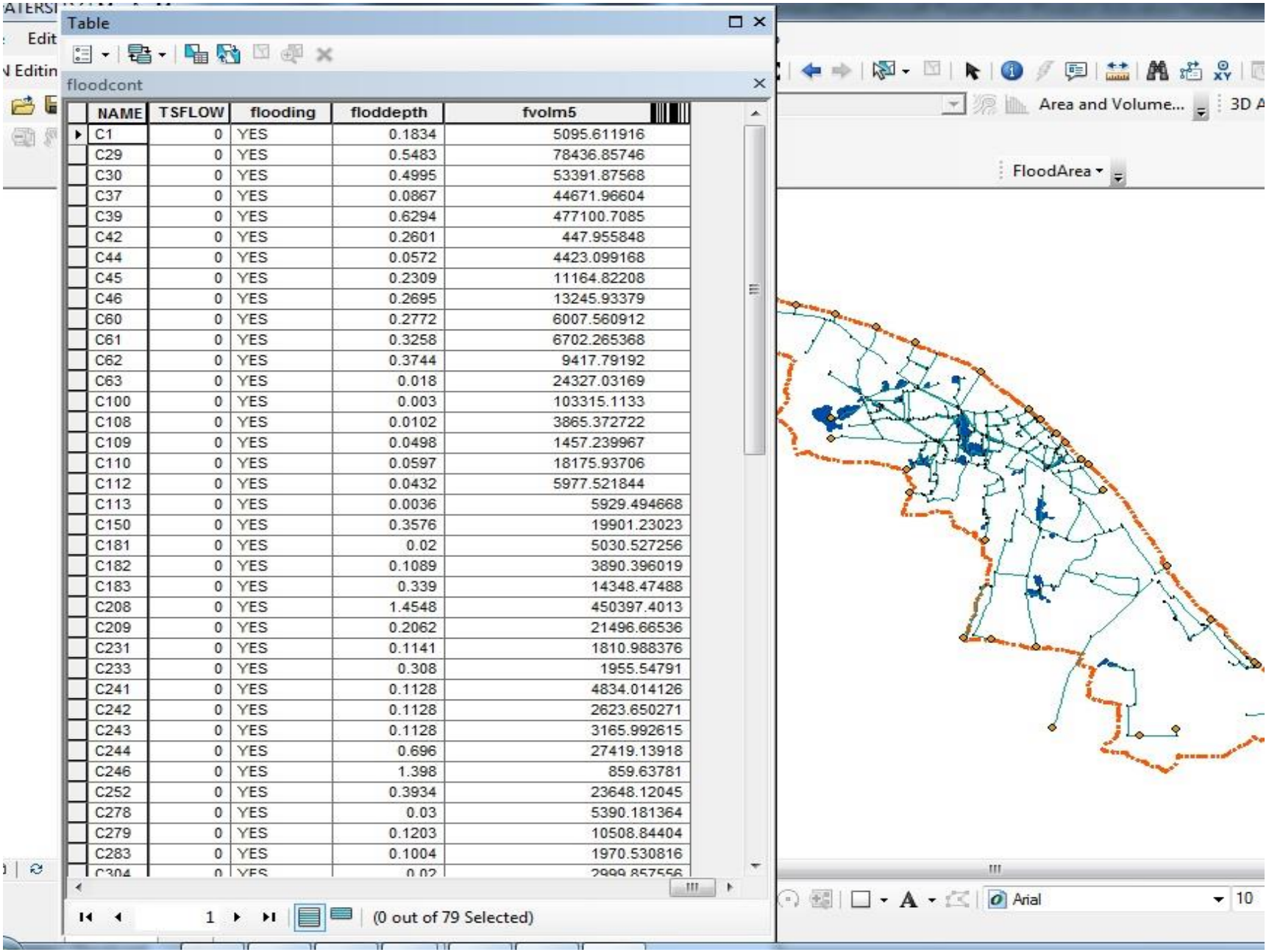
Identifying Ponding area using 5cm contour map



Identifying flow path of flooding water towards Ponding area

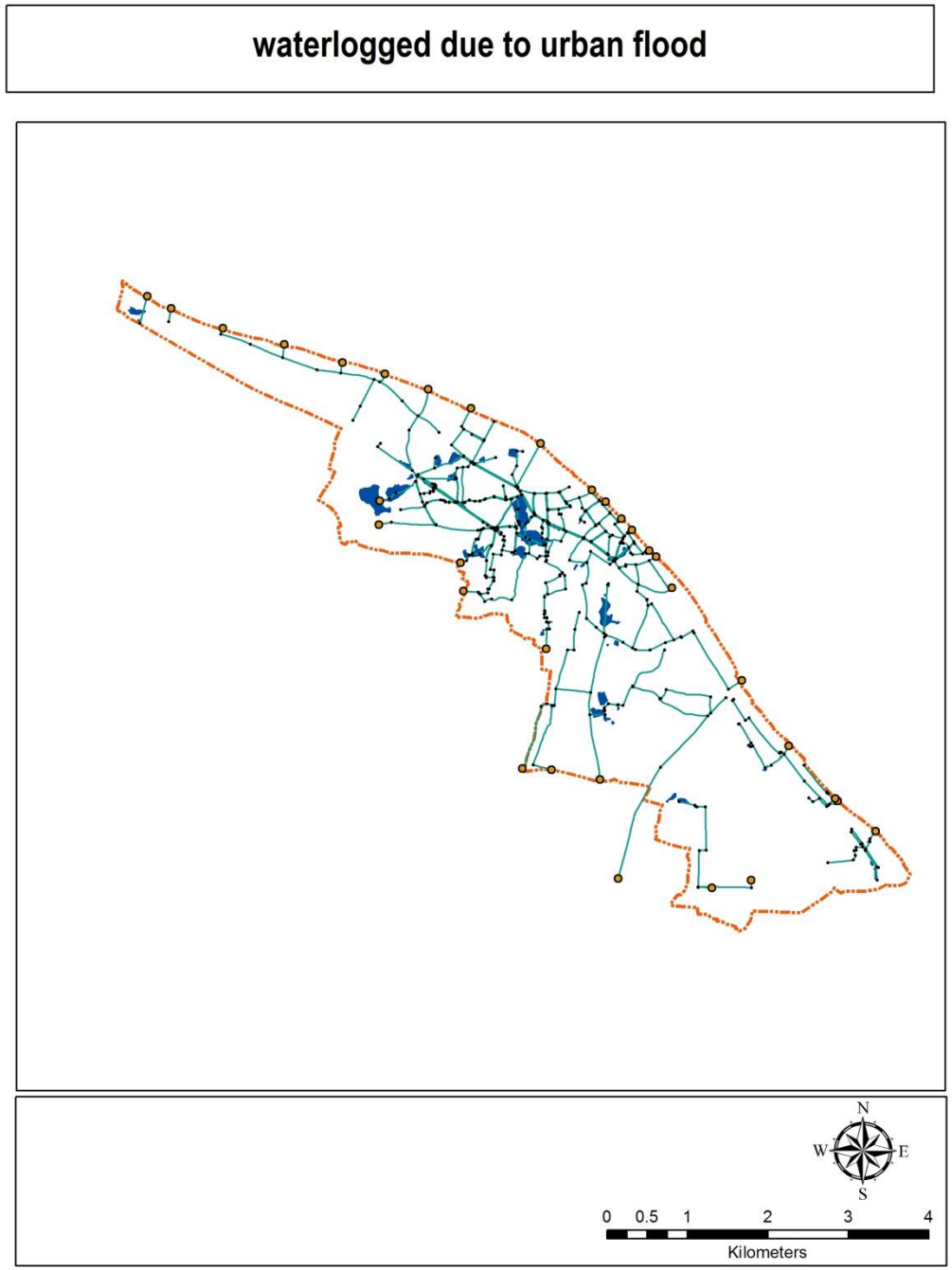
Identifying the Surcharge or Ponding area by contour and flowpath in a study area of Mymensingh Pourashava





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

Water logged area with flood volume of water



Thank You All