SUSQUEHANNA RIVER TRIBUTARIES WATERSHED
ACT 167
STORMWATER MANAGEMENT PLAN

COLUMBIA COUNTY, PENNSYLVANIA

VOLUME II PLAN CONTENTS

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RESOLUTION

WHEREAS, the Stormwater Management Act 167 of 1978 provides for the regulation of land and water use for flood control and stormwater management, requires the Pennsylvania Department of Environmental Protection to designate watersheds, and provides for grants to be appropriated and administered by the Department for plan preparation and implementation costs, and provides that each county will prepare and adopt a watershed stormwater management plan for each designated watershed; and

WHEREAS, the Columbia County Commissioners entered into a grant contract with the Pennsylvania Department of Environmental Protection to develop the watershed storm water management plan for the Susquehanna River Tributaries designated watershed; and

WHEREAS, the purpose of the Susquehanna River Tributaries Watershed Stormwater Management Plan is to protect public health and safety and to prevent or mitigate the adverse impacts related to the conveyance of excessive rates and volumes of stormwater runoff by providing for the management of storm water runoff and control of erosion and sedimentation; and

WHEREAS, design criteria and standards of stormwater management systems and facilities within the Susquehanna River Tributaries Watershed shall utilize the criteria and standards as found in the watershed stormwater management plan;

NOW, THEREFORE, BE IT RESOLVED that the Columbia County Commissioners hereby adopt the Susquehanna River Tributaries Watershed Storm water Management Plan, including all volumes, figures, and appendices, and forward the Plan to the Stormwater Management Section of the Pennsylvania Department of Environmental Protection for approval.

COLUMBIA COUNTY COMMISSIONERS

_____ , Chairman
William M. Soberick

TABLE OF CONTENTS

Section VIII. Priorities for Implementation

Section IX. Plan Review Adoption and Updating Procedures

Appendices

Note: To determine Plate coverage for individual municipalities see the Table of Contents listing at the beginning of Appendix A.

Figures

Map Plates

Tables

PLAN FORMAT

The format of the Susquehanna River Tributaries Stormwater Management Plan consists of Volume I, the Executive Summary, Volume II, the Plan Report that includes GIS maps and the Model Ordinance, and Volume III that contains the background technical materials. Volume I provides an overview of Act 167 and a summary of the standards and criteria developed for the Plan. Volume II, the Plan Report provides an overview of stormwater management, purpose of the study, data collection, present conditions, projected land development patterns, calculation methodology, and ordinance provisions and implementation discussion. Volume III provides supporting data, watershed-modeling parameters and modeling runs, peak flows, release rates, the existing municipal ordinance matrix, and obstructions inventory. Color copies of the figures are at the Planning Commission's Office.

SECTION I
INTRODUCTION

A. Introduction

This plan has been developed for the Susquehanna River Tributaries Watershed in Columbia County, Pennsylvania under the requirements of the Pennsylvania Stormwater Management Act, Act 167, of 1978. Susquehanna River Tributaries Watershed is located in the Susquehanna River Tributaries and consists of 58 individual watersheds that drain directly into the Susquehanna River within Columbia County. The watersheds form a narrow band on both sides of the Susquehanna River. Individual watershed areas vary between 19 acres and 5274 acres in size. With little and inconsistent existing controls for stormwater management within this watershed, this plan has been developed to focus on a watershed wide consistent set of standards and criteria to control stormwater runoff.

This plan is developed with the intent to present all information that may be required in order to implement the plan. The comprehensiveness of the plan covers legal, engineering, and municipal government topics, which combined, form the basis for implementation and enforcement of a final ordinance that will be developed and adopted by each affected Municipality. A sample stormwater management ordinance for reference use has been developed as part of the plan and is contained in Section VII.

B. Stormwater Management

Stormwater management entails bringing surface runoff caused by precipitation events under control. In past years, stormwater control was viewed only on a site-specific basis. Recently, local perspective has changed, with the realization that proper stormwater management can only be accomplished by evaluating the comprehensive picture. The first change to be recognized was the need to evaluate the adverse impacts a development located in a watershed's headwaters may have on downstream flooding. More recently the effects of development on stormwater runoff quality and reduction of infiltration to groundwater due to increased impervious areas has been recognized as a serious concern. Non-point source pollution from developed areas and reduced stream base flow adversely affect the environmental health of the aquatic environment and the quality of life for not only the local watersheds residents but also the residents of the downstream receiving streams, lakes and estuaries. Proper stormwater management occurs when the natural hydrologic balance between stormwater infiltration and runoff is maintained. This involves designing stormwater control facilities to insure that the after development stormwater runoff hydrograph matches the pre-development hydrograph. The result of proper stormwater management is the reduction of flooding; soil, stream channel and bank erosion; sediment deposition in stream channels and improves the overall water quality of the receiving streams including the aquatic environment's health.

Stormwater management requires cooperation between the state and county and local officials and involves proper planning, engineering, construction, operation and maintenance. This entails educating the public and local officials and requires program development, financing, revising policy, development of workable criteria and adoption of ordinances. The Susquehanna River Tributaries Watershed Stormwater Management Plan, under the Pennsylvania Stormwater Management Act, will enable continued development to occur within the Susquehanna River Tributaries Watershed, utilizing both structural and non-structural measures to properly manage stormwater runoff in the watershed.

SECTION II
ACT 167

A. Stormwater Management Act 167

The Pennsylvania General Assembly, recognizing the adverse effects of inadequate management of excessive rates and volumes of stormwater runoff resulting from development, approved the Stormwater Management Act, P.L. 864, No. 167, October 4, 1978. Act 167 provides for the regulation of land and water use for flood control and stormwater management purposes. It imposes duties and confers powers to the Department of Environmental Resources, municipalities and counties, and provides for enforcement and making appropriations. The Act requires the Department to designate watersheds and develop guidelines for stormwater management and model stormwater ordinances (the designated watersheds were approved by the Environmental Quality Board July 15, 1980, and the guidelines and model ordinances were approved by the Legislature May 14, 1985). The Act provides for grants to be appropriated by the General Assembly and administered by the Department for 75% of the allowable costs for preparation of official stormwater management plans and administrative, enforcement and implementation costs incurred by any municipality or county in accordance with Chapter III - Stormwater Management Grants and Reimbursement Regulations (adopted by the Environmental Quality Board August 27, 1985).

Each county must prepare and adopt a watershed stormwater management plan for each of its designated watersheds in consultation with the municipalities, and will periodically review and revise such plans at least every five years when funding is available. Within six months following adoption and approval of a watershed stormwater plan, each Municipality is required to adopt or amend, and implement ordinances and regulations as are necessary to regulate development within the Municipality in a manner consistent with the applicable watershed stormwater plan and the provisions of the Act.

Developers are required to manage the quantity, velocity, and direction of resulting stormwater runoff in a manner, which adequately protects health and property from possible injury, and must implement control measures that are consistent with the provisions of the watershed plan and the Act. The Act also provides for civil remedies for those aggrieved by inadequate management of accelerated stormwater runoff.

B. Purpose of the Study

Development in the Susquehanna River Tributaries Watershed causes an increase in stormwater runoff and a reduction in groundwater recharge. Uncontrolled stormwater runoff not only increases the risk of flooding downstream but also causes erosion and sedimentation problems, reduces stream quality, raises the temperature of the streams, impairs the aquatic food chain, and reduces the base flow of streams which are imperative for aquatic life during the drier summer months. Erosion of the stream banks caused by accelerated stream velocities due to increased runoff is evident in the steeper portions of most of the watersheds. Sediment deposits have had a significant impact on reducing channel capacity in some of the flat gradient streams, especially those on the north side of the Susquehanna River who share a common flood plain with the river.

There is an increased statewide as well as local recognition that a sound and effective stormwater management plan requires a diversified multiple purpose plan. The plan will address the full range of hydrologic consequences resulting from development instead of simply focusing on controlling site specific peak flow without consideration of including tributary timing of flow volume reduction, base flow augmentation, water quality control and ecological protection.

Managing stormwater runoff on a site-specific basis does not meet the requirements of watershed based planning. The timing of flood peaks for each sub basin within a watershed contributes greatly to the flooding potential of a particular storm. Each stormwater control site within a sub basin will be managed by evaluating the comprehensive picture.

The Susquehanna River Tributaries Watershed Stormwater Management Plan provides reasonable regulation of development activities to control accelerated runoff and protect the health, safety and welfare of the public. The Plan includes recognition of the various rules, regulations and laws at the federal, state, county and municipal level. Once implemented, the Plan will aid in reducing costly flood damages by reducing the source and cause of local uncontrolled runoff. The Plan will make municipalities and developers more aware of comprehensive planning in stormwater control and will help maintain the quality of Susquehanna River Tributaries and its tributaries.

SECTION III
GENERAL DESCRIPTION OF WATERSHED

The Susquehanna River Tributaries Watershed as illustrated in Figure III-1 is located in the central part of Columbia County and is contained within thirteen (13) Municipalities in Columbia County and one (1) Municipality each in Luzerne and Montour Counties.

TABLE III-1

Susquehanna River Tributaries Watershed Municipalities
Columbia County

Berwick Borough
Briar Creek Township
Catawissa Township
Main Township
Montour Township
South Centre Township
Town of Bloomsburg
Briar Creek Borough
Catawissa Borough
Franklin Township
Mifflin Township
North Centre Township
Scott Township

Luzerne County

Salem Township

Montour County

Cooper Township

A. Data Collection

In order to evaluate the hydrologic response of the watershed, data was collected on the physical features of the watershed as follows:

1. Base Map: The base map for Geographic Information System (GIS) generated maps was prepared from the Columbia County GIS System from photographs taken in 1995. Roads, Streams, lakes and municipal boundaries were obtained from data layers in Columbia County's GIS system. The portion of the watershed in Luzerne and Montour Counties was obtained from aerial photography obtained from the Pennsylvania Spatial Water Access Web Site. The watershed and subwatershed boundaries were obtained by field delineation on 1 to 4800 (1" = 400') scale on the aerial photo mylars. The watershed boundaries were then digitized into Columbia County's GIS system.

2. Topography: For most tributary watersheds and their subwatersheds USGS topographic quadrangles were used to develop parameters for model inputs. Field surveys were used to supplement the quadrangles for those watersheds where valley cross-sections were needed. Two of the watersheds (Kinney Run and Tributary NO. 10 in Scott Township) had extensive field surveyed valley cross-sections in order to provide not only valley routing but storage volumes for the numerous natural and man created stormwater storage areas.

3. Soils: Soil mapping was obtained from the Columbia, Luzerne and Montour County Soil Surveys of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) formerly the Soil Conservation Service (SCS). The soils maps were color coded for the hydrologic soils group. Then the hydrologic soil groups were digitized into the GIS, to create a hydrologic soils group layer.

4. Geology: The digital geology coverage for Columbia County was obtained from the Pennsylvania Spatial Data Access web site and incorporated into the overall GIS.

5. Land Use/Zoning: Existing land use was prepared by County Planning Commission personnel by use of ortho photography and field confirmation. Soil surveys and personal knowledge were also utilized in this determination. Zoning maps, where available, for all municipalities within the watershed were digitized into the computer database along with the corresponding zoning district designations to aid in development of the future land use maps. Future land use projections were based upon this zoning and recent development/growth trends. All of the subwatersheds within Susquehanna River Tributaries Watershed area are under pressure for development. It was determined that a full build out of the land areas with a slope of 20% or less would be used for the future land use.

6. Wetlands: Wetlands were obtained from the National Wetlands Inventory Maps in digital format and incorporated into the overall GIS.

B. Drainage Area

Susquehanna River Tributaries drain a watershed area of approximately forty-four and sixteen hundredths (44.16) square miles within Columbia County as shown on Figure III-1. The watershed is composed of a number of small streams that form a narrow band on both sides of the Susquehanna River and drain to the Susquehanna River within the borders of Columbia County. Also contained within its boundaries are two tributaries that have a part of their drainage area outside of Columbia County. They are Thompson Run with a portion of its watershed in Salem Township, Luzerne County and an unnamed stream with a portion of its watershed within Cooper Township, Montour County.

The Watershed consists of 58 individual watersheds, which drain directly to the Susquehanna River. Many of the streams within this watershed are small, unnamed tributaries of the Susquehanna River. The following streams have names designated on either the U.S.G.S. Quad sheet, the Columbia County Soil Survey or are recognized by a local name:

1. Corn Run which enters the river at Catawissa.
2. Kinney Run which enters the river at Bloomsburg.
3. Thompson Run which enters the river at Berwick.
4. Ten Mile Run, which enters the river in Mifflin Township.

Individual tributary's watershed drainage areas range from 19 acres to approximately 5274 acres in size. The topography, soils types, land use and vegetative cover vary greatly between individual watersheds and even within some of the watersheds.

MADISON TOWNSHIP
ORANGEVILLE
BRIAR CREEK TOWNSHIP
SALEM TOWNSHIP
MT. PLEASANT TOWNSHIP
ORANGE TOWNSHIP
NORTH CENTRE TOWNSHIP
BERWICK
BRIAR CREEK BORO
NESCOPECK TOWNSHIP
HEMLOCK TOWNSHIP
SOUTH CENTRE TOWNSHIP
SCOTT TOWNSHIP
MIFFLIN TOWNSHIP
BLOOMSBURG
BLACK CREEK TOWNSHIP
MAIN TOWNSHIP
MONTOUR TOWNSHIP
COOPER TOWNSHIP
BEAVER TOWNSHIP
CATAWISSA TOWNSHIP
MAYBERRY TOWNSHIP
ROARING CREEK TOWNSHIP
FRANKLIN TOWNSHIP
LOCUST TOWNSHIP

Twp Roads
State Roads
Municipalities
County Boundary
Streams
Watershed Boundary
Islands
Creek/River

N

0 5,100 10,200
Feet

1:84,000

Watershed Overview

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Figure III-1

Columbia County Geographic Information Systems

TJM 5/19/01

C. Topography and Streambed Profile

The topography of the watersheds ranges from steep hilly terrain to flat areas in the Susquehanna River flood plain. The highest point (1662 feet above mean sea level) in all of the watersheds is for Ten Mile Run, which originates on Nescopeck Mountain. The lowest point (445 feet above mean seal level) occurs at the confluence with the Susquehanna River of an unnamed tributary in Franklin Township.

D. Soils

There are six soils associations in the Susquehanna River Tributaries Watershed: Chenango-Barbour – Pekin, Weikert – Harleton, Westmoreland – Litz, Klinesville – Leck Kill, Dekalb – Edgemont and Laidig – Buchanan. Soil associations are groups of soils that exhibit a regularly repeating pattern. The six associations are described below. The County's soil surveys provide maps for the location of soil types.

1. Chenango –Barbour – Pekin: The Chenange – Barbour – Pekin soil association borders both sides of the Susquehanna River through Columbia County. It consists of nearly level and level soils on terraces and flood plains.

2. Weikert–Harleton: The Weikert–Harleton soil association is founded in upland areas in Catawissa, Main, Mifflin and Montour Townships in Columbia County and Cooper Township in Montour County and Salem Township in Luzerne County. This association consists of gray soils in gently rolling hilly areas underlined by shale.

3. Westmoreland – Litz: The Westmoreland – Litz soil association is founded in this association consists of gently sloping, silty, loamy soil over calcareous rocks in valleys.

4. Klinesville – Leck Kill: The Klinesville – Leck Kill soil association is found in Catawissa Borough and Catawissa Township This association consists of red soils on the rolling shale hills.

5. Dekalb – Edgemont: The Dekalb – Edgemont soil association of found on Nescopeck Mountain in Mifflin Township. This association consists of steep to gently sloping yellowish stony soils on the mountains and ridges.

6. Laidig – Buchanan: The Laidig – Buchanan soil association is found in Mifflin Township watersheds. This association consists of moderately sloping, deep soils of colluviums at the foot of the mountains.

Soil properties influence the runoff generation process. The USDA, Natural Resources Conservation Service (NRCS) has established criteria determining how soils will affect runoff by placing all soils into groups designated as Hydrologic Soil Groups (HSG's). Hydrologic Soil Groups are broken down into four sub-groups [A through D] based on infiltration rate and depth. The location of the four HSG's in relation to the watershed is shown in Appendix A. The A soils are the most pervious and have the lowest runoff potential and are typically sands and gravels. Hydrologic Soils Group B is characterized as having moderate infiltration rates and consists primarily of moderately deep-to-deep, moderately well-to-well drained soils that exhibit a moderate rate of water transmission. Hydrologic "D" soils are scattered throughout the Susquehanna River Tributaries flood plain and many of these soils are low permeability soils with high runoff potential.

The majority of the soils in the watershed fall in the C hydrologic soil group. Hydrologic Soil Group C has slow infiltration rates when thoroughly wetted and may contain fragipans, a layer that impedes downward movement of water and produces a slow rate of water transmission.

This information was incorporated into the GIS and used to develop the watershed HSG maps, Plates 1-7 through 7-7, found in Appendix "A".

E. Geology

Geology plays a direct role in surface runoff in Susquehanna River Tributaries because it affects its soil types within the watershed through parent material breakdown. There is an area of limestone surface geology in a band from Bloomsburg to Berwick on the north side of the Susquehanna River. There is an occasional sinkhole development associated with this formation. Hard rock deep mining of iron ore was carried out from the 1850's to the 1890's within a portion of the watershed located in the Town of Bloomsburg and the Townships of Scott and South Centre. An occasional sinkhole develops on this formation due to mine subsidence. The geologic maps, Plates 1-4 through 7-4, of the watershed can be found in Appendix "A"

F. Climate

Columbia, Luzerne, and Montour Counties are in the path of air masses that originate in western and central Canada. These air masses interact with the warm air from the Gulf of Mexico to produce generous precipitation throughout the year. The higher elevations receive additional precipitation because of upslope motion.

Summers are generally warm, and maximum temperatures average in the low to mid 80's. Occasional higher temperatures occur when warm air moves into the area from the southwest. The annual precipitation is approximately forty-two and six tenths (42.6) inches with an average of seven thunderstorms during each of the summer months. Heavy rainfall associated with tropical storms and hurricanes moving up the coast occasionally reach Columbia, Luzerne and Montour Counties.

Cold temperatures and cloudy skies characterize winter. Daytime temperatures average in the mid to upper 30's at the lower elevations. Higher elevations may have freezing temperatures on 150 days of the year. On 50 of these days, the maximum temperature may be at or below freezing. Winter precipitation is light but frequent. The lower elevations receive most precipitation in the form of rain, whereas the higher elevations receive significant amounts of snow. Annual snowfall ranges from about 30 inches at the lower elevation to more than 45 inches at the higher elevations.

Spring and fall are characterized by rapidly changing weather patterns. Alternate periods of freezing and thawing are common during both seasons. The length of the growing season at the lower elevations can range from 120 to 200 days, whereas at the higher elevations it can range from 120 to 180 days.

G. Land Use

The majority of the municipalities within the watershed are predominantly rural in nature except for the corridor along route 11 between Bloomsburg and Berwick. The predominant land use in the watershed is farming. Within the last 30 years there has been increased pressure for residential and commercial development throughout all the tributary watersheds. This pressure has been greater in the areas north of the Susquehanna River especially the Route 11 corridor and adjacent upland areas. Future development pressure is expected throughout the watershed except for the steep wooded portions of the study area.

Plates 1-5 through 7-5 in Appendix "A"- display the existing land use of the watershed while Table III-2 shows the overall land use by category within Susquehanna River Tributaries Watershed.

TABLE III-2
Existing Land Use Status by Category

SUSQUEHANNA RIVER TRIBUTARIES WATERSHED

LAND USE	SQ MI.	PERCENT
Low Density Residential	1.73	3.9
Medium Density Residential	3.39	7.7
High Density Residential	0.35	0.8
Mobile Home Park	0.12	0.3
Commercial	0.99	2.2
Industrial	0.7	1.6
Mixed Urban	0.04	0.1
Transportation	1.63	3.7
Utilities	0.24	0.5
Private Parks	0.13	0.3
Public Parks	0.34	0.8
Cemetery	0.13	0.3
Institutional	0.2	0.4
Governmental	0.15	0.3
Cropland	12.17	27.6
Pasture	0.09	0.2
Permanent Hay	0.24	0.5
Orchards, Groves, Vineyards, Nurseries, Scrub Brush	2.81	6.4
Other Agricultural Land and Open Space	1.09	2.5
Mixed Forest Land	17.52	39.7
Lakes / Ponds	0.07	0.2
Strip Mines, Quarries and Gravel Pits	0.04	0.1
Total	44.17	[(1)]100.1

(1) Percentage adds up to greater than 100% due to rounding.

H. Land Development Patterns

A future land use scenario was developed with the help of existing zoning maps, the Counties comprehensive land use plans and by observed land development trends. The future land use maps for the build out projection is shown in Plates 1-6 through 7-6 in Appendix "A". Table III-3 provides a summary of the proposed increased development within each Municipality. The proposed development with its increased impervious areas were then included in the TR – 20 or TR – 55 models to develop future condition flows for the 2, 5, 10, 25, 50 and 100-year storms. The peak flows for the 100-year existing conditions storm can be found in Table III-4.

TABLE III-3
Development Potential by Municipality
Based Upon Existing Patterns in Susquehanna River Tributaries Watershed

Municipality	Land Use	Acres
Berwick Borough	Commercial	11.2
Bloomsburg	Commercial	0.3
	Industrial	5.4
	Governmental	0.1
Briar Creek Borough	Low Density Residential	73.2
	High Density Residential	5.3
	Commercial	4.7
	Industrial	48.9
Catawissa Borough	Industrial	20.4
Catawissa Township	Low Density Residential	331.9
	Medium Density Residential	506.6
	Industrial	30.3
Franklin Township	Low Density Residential	665.9
	Medium Density Residential	545.6
	Industrial	4.1
Main Township	Low Density Residential	117.8
	Medium Density Residential	9.6
Mifflin Township	Low Density Residential	1476.3
	Medium Density Residential	1965.4
	High Density Residential	93.5
	Industrial	467.4
Montour Township	Low Density Residential	453.2
	Medium Density Residential	227.5
	Industrial	0.2
Scott Township	Low Density Residential	3.4
	Medium Density Residential	97.5
	Commercial	33.8
	Industrial	47.6
	Transportation	0.2
South Centre Township	Low Density Residential	750.9
	Medium Density Residential	65.5
	Commercial	115.5
	Industrial	101.6
Cooper Township	Low Density Residential	64.9
	Medium Density Residential	224.2
Salem Township	Low Density Residential	43.9
	Medium Density Residential	135.7
	High Density Residential	11.3
	Commercial	3.5
	Industrial	29.5

In addition Kinney Run and Tributary No. 10 in Scott Township have been analyzed to determine the effects of filling floodplains within legal limits or filling the stormwater storage areas created by past road and railroad construction within these watersheds assuming proper storm water management facilities are not installed. Their effects are included in Appendix E for those two watersheds.

Other storm frequencies discharges can be found in Volume III, the Technical Appendix. Increased development in a watershed increases runoff peaks, volumes and velocities, which decrease the time to peak and increasing the frequency of flooding.

TABLE III-4
Present Conditions Peak Discharge
100-Year 24-Hour Storm

	Peak Discharge (1)		
Sub area No.	Sub area Peak Q (cfs)	Minor Tributary Peak Q (cfs)	Total Watershed Peak Q (cfs)
C-1	714	-	714
C-2	466	1139	2872
MC-1	588	-	1378
MC-2	569	-	3437
M-1	433	-	433
M-2	531	-	531
M-3	515	-	515
M-4	790	-	1378
M-5	372	-	1734
M-6	181	-	181
M-7	231	-	231
M-8	104	-	104
M-9	304	-	304
M-10	(2)	-	(2)
F-1	258	-	258
F-2	199	-	344
F-3	146	-	344
F-4	373	-	796
F-5	162	-	796
F-6	77	-	862
F-7	417	-	417
F-8	295	-	295
F-9	310	-	310
F-10	151	-	151
F-11	247	-	247
F-12	190	-	810
F-13	120	-	810
F-14	358	-	810
F-15	73	-	1339
F-16	504	-	1339
F-17	211	-	1554
F-18	305	-	1554
F-19	701	-	2037
F-20	422	-	422
F-21	741	-	1126
CB-1	42	-	42
CT-1	176	-	176
CT-2	253	-	253
CT-3	112	-	112
CT-4	107	-	107
CT-5	403	-	403
CT-6	784	-	784

Sub area No.	Sub area Peak Q (cfs)	Minor Tributary Peak Q (cfs)	Total Watershed Peak Q (cfs)
CT-7	277	-	277
CR-1	447	-	447
CR-2	123	-	546
CR-3	538	538	1029
CR-4	317	1226	1895
CR-5	343	-	1895
CR-6	223	-	1895
CR-7	329	-	1895
CR-8	407	-	2816
CR-9	377	-	377
CR-10	215	521	2816
CR-11	385	-	2816
CR-12	611	-	3093
CR-13	351	-	3093
CR-14	37	-	3120
MA-1	894	-	894
MA-2	588	-	588
MA-3	438	-	438
MA-4	377	-	377
MA-5	233	-	233
MA-6	371	-	371
KR-1	237	-	237
KR-2	141	-	378
KR-3	19	-	378
KR-4	55	-	149
KR-5	207	-	207
KR-6	119	194	203
KR-7	43	-	227
KR-8	80	-	305
KR-9	158	-	395
KR-10	40	-	397
KR-11	164	-	397
KR-12	349	-	509
KR-13	236	-	509
KR-14	55	-	543
KR-15	150	-	680
KR-16	296	-	851
KR-17	118	-	118
KR-18	111	-	229
KR-19	332	-	332
KR-20	367	-	1339
KR-21	82	-	1495
KR-22	119	-	1199
KR-23	123	-	123
KR-24	238	-	238
KR-25	149	267	693
KR-26	238	439	793
KR-27	462	1137	1225

Sub area No.	Sub area Peak Q (cfs)	Minor Tributary Peak Q (cfs)	Total Watershed Peak Q (cfs)
KR-28	101	-	1275
KR-29	54	-	1035
KR-30	(2)	-	(2)
KR-31	115	-	414
KR-32	85	-	366
SH-1	348	-	348
SH-2	163	-	461
SH-3	30	-	223
SH-4	130	-	145
SH-5	332	-	628
SH-6	552	-	554
SH-7	114	-	114
SH-8	117	-	663
SH-9	138	-	517
SH-10	93	-	394
SH-11	77	-	77
SH-12	276	-	325
SH-13	(2)	-	(2)
SH-14	115	763	787
ST-1	(2)	-	2
SC-1	505	-	505
SC-2	72	-	557
SC-3	111	657	2081
SC-4	380	-	380
SC-5	170	-	548
SC-6	117	-	658
SC-7	334	-	855
SC-8	164	1018	1444
SC-9	344	-	344
SC-10	126	-	366
SC-11	131	457	1444
SC-12	205	-	2243
SC-13	307	-	307
SC-14	400	-	623
SC-15	272	-	272
SC-16	458	-	458
SC-17	290	-	1448
SC-18	254	-	1448
SC-19	13	-	1729
SC-20	302	-	1729
SC-21	304	-	1914
SC-22	177	-	259
SC-23	188	-	188
SC-24	292	-	547
SC-25	47	-	157
SC-26	26	-	157
SC-27	153	-	153
SC-28	589	-	589
SC-29	(2)	-	(2)
NC-1	586	-	1034
BCB-1	128	-	128

Sub area No.	Sub area Peak Q (cfs)	Minor Tributary Peak Q (cfs)	Total Watershed Peak Q (cfs)
BCB-2	70	-	70
BCB-3	116	-	116
BCB-4	167	-	170
BCB-5	70	-	70
BCB-6	(2)	-	(2)
TM-1	621	-	621
TM-2	468	-	963
TM-3	386	-	1158
TM-4	427	-	1368
TM-5	101	1380	1579
TM-6	226	-	1579
TM-7	322	-	1579
TM-8	166	-	1817
TM-9	354	-	1817
TM-10	444	1942	3037
TM-11	434	-	655
TM-12	299	-	655
TM-13	273	1265	3071
TM-14	484	1265	3071
TM-15	517	-	786
TM-16	619	-	1209
TM-17	295	1303	4246
TM-18	769	-	769
TM-19	395	-	4686
TM-20	781	-	4973
TM-21	685	-	685
TM-22	567	-	1018
TM-23	586	-	5923
TM-24	331	-	5923
TM-25	244	-	5939
TM-26	332	-	5674
TM-27	338	-	338
MI-1	109	-	109
MI-2	234	-	234
MI-3	174	-	174
MI-4	489	-	489
MI-5	334	-	822
MI-6	311	-	1133
MI-7	226	-	1303
MI-8	199	-	1404
MI-9	428	-	879
MI-10	453	-	879
MI-11	370	-	1055
MI-12	144	-	1185
MI-13	282	-	1333
MI-14	364	-	1694
MI-15	307	-	1929
MI-16	513	-	2437

Sub area No.	Sub area Peak Q (cfs)	Minor Tributary Peak Q (cfs)	Total Watershed Peak Q (cfs)
MI-17	57	-	57
MI-18	530	-	530
MI-19	123	-	123
MI-20	320	-	320
MI-21	457	-	756
MI-22	443	-	995
MI-23	311	-	1273
MI-24	248	-	248
MI-25	382	-	626
MI-26	181	-	1989
MI-27	292	-	2298
MI-28	254	-	2544
MI-29	120	-	120
MI-30	415	-	415
MI-31	383	-	664
MI-32	531	-	1016
MI-33	248	-	248
MI-34	264	-	264
MI-35	246	-	504
MI-36	173	-	642
MI-37	332	-	332
MI-38	281	613	1145
MI-39	96	-	1187
MI-40	186	-	186
MI-41	187	250	1428
MI-42	58	-	1470
MI-43	231	-	231
MI-44	509	-	509
MI-45	267	-	267
TR-1	478	-	478
TR-2	121	-	1295
TR-3	409	-	409
TR-4	445	-	762
TR-5	357	-	1295
TR-6	57	-	1278
TR-7	61	-	1255
TR-8	18	-	1256
TR-9	115	-	1278
TR-10	99	-	1278
TR-11	42	-	1255

(1) Discharges are at the lower junction of the sub area.
(2) Long narrow land area along the river that drains to river through many small drainage ways. Computation of discharge for this area is meaning less.

I. Present and Projected Development in the Flood Hazard Areas

The U.S. Department of Housing and Urban Development, Federal Insurance Administration, Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Studies (FIS's) and mapping for the following municipalities in Susquehanna River Tributaries Watershed:

Columbia County

Berwick Borough
Briar Creek Township
Catawissa Township
Main Township
Montour Township
South Centre Township
Town of Bloomsburg
Briar Creek Borough
Catawissa Borough
Franklin Township
Mifflin Township
North Centre Township
Scott Township

Luzerne County

Salem Township

Montour County

Cooper Township

These studies were completed between November of 1979 and July of 1990.

There are two types of studies conducted in the FIS program: detailed and approximate. Detailed methods included hydrologic computations and detailed HEC-2 backwater computations. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction. Those areas studied by the approximate methods were those having low development potential or minimal flood hazards at the time of the study.

Plates 1-3 through 7-3 in Appendix “A" show the 100-year floodplains, classified as detailed and approximate, as taken from the FEMA mapping for streams within the Susquehanna River Tributaries Watershed. Infringements of residential, industrial, and commercial areas are clearly shown by overlaying these areas on the floodplain in the GIS. Table III-5 outlines the type of development and land use that infringe upon the floodplain by Municipality, general location, and creek or tributary. Municipalities and the Pennsylvania Department of Community and Economic Development (PACED) should be contacted for the latest FIS studies before designing a land development project in these areas.

TABLE III-5
Susquehanna River Tributaries Present Residential, Commercial, and Industrial Areas Within 100-Year Floodplain

Municipality	River / Stream	Land Use Infringing on Flood Boundary	General Acreage
Berwick Borough	Susquehanna River	Medium Density Residential	4.04
		Mobile Home Park	1.26
	Thompson Run	Low Density Residential	2.72
Bloomsburg	Kinney Run / Susquehanna River	Low Density Residential	.25
		Medium Density Residential	8.57
		High Density Residential	19.26
		Commercial	24.10
		Industrial	64.75
Briar Creek Borough	Susquehanna River	Low Density Residential	0.10
		Mobile Home Park	.62
		Commercial	1.63
Catawissa Borough	Corn Run	Medium Density Residential	0.25
	Susquehanna River	Medium Density Residential	1.30
Catawissa Township	Corn Run	Medium Density Residential	.91
Franklin Township	Susquehanna River	Low Density Residential	6.22
Main Township	Un-Named Tributary Susquehanna River	Medium Density Residential	4.96
Mifflin Township	Susquehanna River	Medium Density Residential	33.73
		Commercial	18.33
	Ten Mile Run	Low Density Residential	.06
		Commercial	1.32
Montour Township	Susquehanna River	Medium Density Residential	16.67
Salem Township	Thompson Run	Medium Density Residential	26.40
		High Density Residential	1.41
Scott Township	Kinney Run / Susquehanna River	Low Density Residential	.76
		Medium Density Residential	2.65
		Commercial	15.39
		Industrial	.11
	Susquehanna River	Medium Density Residential	3.71
		High Density Residential	1.50
		Commercial	.21
	Tributary #10 Susquehanna River	Low Density Residential	11.94
		Medium Density Residential	17.62
		Mobile Home Park	.70
		Commercial	26.67
South Centre Township	Tributary No. 10	Commercial	1.69
	Un-Named Tributaries to Susquehanna River and Susquehanna River	Low Density Residential	2.00
		Medium Density Residential	30.67
		Mobile Home Park	15.13
		Commercial	17.74
		Industrial	35.03

FEMA administers a “Community Rating System (CRS)” program that allows a community to be eligible for reduced flood insurance premiums under the National Flood Insurance Program. The CRS is based upon the flood plain management activities, including certain stormwater management controls, that a community implements. Credits are awarded for various activities implemented within the Municipality. The more credits a community can accumulate, the less its residents will have to pay for flood insurance. For further information, the publication "*CRS Credit for Stormwater Management*", July 1996, published by FEMA, available at the County Planning Commission office should be consulted.

J. Obstructions

Locations of significant waterway obstructions (i.e., culverts, bridges, etc.) were obtained by inspection of U.S.G.S. topographic maps. Data on these obstructions was then obtained from the Pennsylvania Department of Transportation (PENNDOT), FEMA Flood Insurance Studies, and field surveys.

The obstruction capacities were then compared to the peak flow at that point derived through the modeling process for each design storm frequency. The obstructions were then classified into seven categories as follows:

- Those obstructions, which are able to pass the 100-year, 24-hour storm without obstructing the flow.
- Those obstructions, which are able to pass the 50-year, 24-hour storm without obstructing the flow.
- Those obstructions, which are able to pass the 25-year, 24-hour storm without obstructing the flow.
- Those obstructions, which are able to pass the 10-year, 24-hour storm without obstructing the flow.
- Those obstructions, which are able to pass the 5-year, 24-hour storm without obstructing the flow.
- Those obstructions, which are able to pass the 2-year, 24-hour storm without obstructing the flow.
- Those obstructions which are not able to pass the 2-year, 24-hour storm without obstructing the flow.

The obtained data and the obstruction flow capacities were computed using Federal Highway Program HY-8 and the obstruction capacity can be found in the technical appendix. The locations of all obstructions, including those that fall into the seven categories above, can be found on Plates 1-3 through 7-3 contained in Appendix A. The description of each obstruction and its discharge capacity are contained in Appendix D.

K. Existing Drainage Problems and Proposed Solutions

Information on drainage problems and proposed solutions was solicited from each Municipality within the Susquehanna River Tributaries Watershed by providing forms to each Watershed Plan Advisory Committee (WPAC) member early in the Watershed Plan study. Problems were discussed at the WPAC meetings and varied considerably in degree and type of problems encountered. The problems consisted of eroding stream channels in upland areas, sediment clogged or non-existing channels in flood plain areas, unintentional and man made stormwater diversions within watersheds, structural failure of stream enclosures, and clogged or undersized inlets and cross pipes.

In the area between Bloomsburg and Berwick along the north side of the Susquehanna River there are many areas of natural or man created stormwater detention areas that presently

provide reductions in downstream peak discharges. Many of there areas are in the 100-year flood plain fringe area where it is permissible to fill the area for development purposes. There areas are under pressure for development. The filling of these stormwater detention areas would in some cases significantly increase downstream peak discharges. The effect each of these storage areas has on reducing flood peaks is provided in Table III-7 as part of Section III-N "Existing and Proposed Stormwater Control Facilities".

Table III-6 summarizes the problems discussed. These are shown graphically in Appendix A (Stormwater Problem Areas, Flooding, and Stormwater Control Facilities). Solutions have been proposed both formally and informally as a result of WPAC discussions. Problem areas were identified in this study, including several types of problems. The type, cause, and occurrence of these problems are indicated on Table III-6. The categories selected in Table III-6 typically have similar causes and solutions that are discussed below.

TABLE III-6
Susquehanna River Tributaries Watershed Problems

Municipality	Type of Problems	Cause of Problems	Occurrences Of Problems	Types of Damage
Berwick Borough	1,3	1,4,5,6	3	3
Briar Creek Township	1	1,3,4,7	2	3
Briar Creek Borough	1	1,2,4	3	3
Catawissa Borough	1,2,3	1,2,4	3	3
Catawissa Township	1,2,3	1,2,4	3	3
Franklin Township	2,	1,2,4	3	3
Main Township	2	2	3	3
Mifflin Township	1,2,3,	1,2,4	3	3
Montour Township	1,2,3	1,2,4	2,3	3
North Centre Township				
South Centre Township	1,2,3,4	1,2,3,4,5,6,7	2	3
Scott Township	1,2,3,7	1,2,3,4,5,6,7	2	3
Town of Bloomsburg	1,2,3,7	1,3,4,5,6,7	1	3
Cooper Township, Montour County	1,2,3	1,2,4	2	3
Salem Township, Luzerne County	1,2,3	1,2,4,6	3	3

Types of Problems:
1. Flooding
2. Accelerated Erosion
3. Sedimentation
4. Landslide
5. Groundwater
6. Water Pollution
7. Other

Causes of Problems:
1. Stormwater Volume
2. Stormwater Velocity
3. Stormwater Direction
4. Water Obstruction
5. Stormwater Diverting
6. Sediment Deposition in Channels
7. Existing Stormwater Storage Areas

Occurrences of Problems:
1. > 1 time per year
2. < 1 time per year
3. Only major flood events

Types of Damage:
1. Loss of life
2. Loss of vital services
3. Property damage

Erosion and Sedimentation (E & S)

The Columbia, Luzerne, and Montour County Conservation Districts are responsible for administering Title 25, Chapter 102 (Erosion Control Regulations). These regulations address accelerated erosion and the resulting sedimentation from earthmoving activities. Permanent stabilization of exposed areas and proper stabilization of channels of conveyance will reduce erosion problems.

Stream Channel Erosion and Sedimentation

Many of the upland stream channels are actively eroding. Most eroding channels are located within areas experiencing upland development, while some of them are in areas subject to no significant development. In some eroding areas it appears that agricultural is the primary land use within the watershed. Stabilization of the channels will require proper engineering design and permitting. The sediment from upland channels is deposited in the flatter grade channels within the joint stream/river flood plain, some channels are completely clogged. In one case this results in diversion of stormwater flows into another watershed. In order to reduce sediment deposition in flatter grade channels, it will be necessary to stabilize the upstream channels.

On some channels it may also be necessary to construct sediment-trapping structures that will require periodic cleanout and maintenance. Many of these structures would have to be permitted by the state. Many of the sediment-clogged channels are located in wetland areas. Channel cleaning will be difficult to accomplish without damaging the wetlands. Permits will be required to clean and maintain channel areas.

Storm Sewers, Culverts, and Outlets

Some of the problems identified in Table III-7 are the result of inadequately sized storm culverts, and/or unstable outlets that traverse state, township, or private roads and a railroad. The typical solution involves performing a hydrologic and hydraulic study to determine pipe size and replacing the pipe with a properly sized unit. Costs are typically borne by the owner of the roadway or railroad.

Due to upslope stream channel erosion, gravel deposits threaten culvert capacity. In order to maintain culvert capacity it may be necessary to stabilize upslope channels or provide for more frequent removal of sediment deposits and culvert cleaning.

Bridges

Because of the high bed loads of streams within the watershed, gravel deposits threaten bridge capacity in addition to the inadequate waterway opening. The proposed solution typically involves performing a hydraulic study, including fluvial geomorphologic characteristics, of the stream. A combination of increasing the hydraulic capacity through the bridge and installation of stream channel fluvial geomorphologic measures may be necessary to improve and maintain bridge capacities. Costs are typically borne by the owner of the bridge.

Flooding

Flooding in the Susquehanna River Tributaries watershed is a significant problem. However there are two types of flooding that occur. They are flooding by stormwater runoff within the individual tributary watershed and flooding influenced by the Susquehanna River backwater.

The upland areas are affected only by flooding created by stormwater runoff within that watershed. This flooding consists of normal discharges within the flood plains for storms in excess of the 2-year storm. In addition local flooding is also caused by inadequately sized

stormwater culverts and by obstructions of the flood plain by fill or structures.

Flooding within the joint tributary/Susquehanna River flood plain is much more complex, especially in the Bloomsburg, Scott Township, South Centre Township and Briar Creek Township areas. Many of these areas are subject to local flooding due to tributary watershed runoff and then during major storms causing river flooding a second flood event due to river backwater.

Some of the areas that flood are natural or man-created stormwater detention areas. These areas provide stormwater storage and reduce downstream flood peak discharges and flood elevations. Most of these areas have been identified in Table III-7.

L. Existing and Proposed Stormwater Collection Systems

The towns of Bloomsburg and Berwick Borough have extensive stormwater collection systems. There are several small systems in developments in other municipalities such as Mifflinville in Mifflin Township, Briar Creek Township, Scott Township and South Centre Township. Most local ordinances require that new developments will have stormwater collection and conveyance systems installed.

M. Existing and Proposed State, Federal and Local Flood Control Projects

Bloomsburg has existing flood control projects installed on Kinney Run and Snyder's Run. The Kinney Run project consists of a diversion structure, which allows base flow and a portion of flood flows to continue down Kinney Run. The major portion of flood flow is diverted to the Susquehanna River through a channel and pipe system. The pipe size, length and make-up may be obtained from the Columbia County office. Snyder's Run through Bloomsburg over the years was confined to a stream enclosure as development occurred. Many sections of the Snyder Run stream enclosure failed during the Agnes Flood in June 1972. The stormwater discharge from the headwaters of Snyder's Run was diverted to Fishing Creek through a large diameter pipe after the Agnes Flood. The only portion of the original Snyder's Run Watershed that still drains to its outlet in Fishing Creek is the area south of Main Street. As new storm drains are installed within the Snyder's Run watershed additional area is diverted directly to the river via the Market Street Storm drainage system within the Act 167 Susquehanna River Tributaries study area.

Berwick has an existing flood control project installed on Thompson Run to divert the upper watershed directly to the Susquehanna River at the eastern edge of Berwick. The downstream portion of the Thompson Run watershed continues to drain to the Thompson Run stream enclosure.

The Baltimore District of the U.S. Army Corps of Engineers is conducting a study to determine the feasibility of constructing a structural flood protection project in the west end of the Town of Bloomsburg along both the Susquehanna River and Fishing Creek. The study is tentatively scheduled for completion in the fall of 2003.

There have been numerous past studies to divert Kinney Run and Tributary No. 10 in Scott Township to the Susquehanna River through a ditch and or pipe system to reduce downstream flooding. Due to the high construction cost and the difficulty of installing them, none of the proposals is being considered for implementation at the present time.

N. Existing and Proposed Stormwater Control Facilities

In recent years there are a number of individually owned stormwater control facilities installed within the tributaries details and information on many of the facilities was not available. The cost, design, capacity, construction and operation of private facilities cannot be projected at this time since they occur on a case by case basis as a developer buys land, submits plans and develops the tract. The developer pays for the cost of the privately installed stormwater control facilities with costs transferred to the buyer. The costs of operating and maintaining the control facilities are usually retained by the developer or become the responsibility of the buyer through an agreement.

A number of stormwater detention areas have been identified within tributary areas. The developer installed some of these detention systems, but most of these areas are natural or unintentionally man generated and that have a significant impact on reducing downstream peak discharges. The detention each provides for the 100-year storm is provided in Table III-7.

TABLE III-7
100-Year Flow Attenuation
(100-Year Flow)

Storage Area	Sub Area	Into Storage Area CFS	Out-of Storage Area CFS	Maximum Storage Volume (AC-FT)*
Bloomsburg Town Park	KR-32	371	310	16
Catherine Street	KR-28	1328	310	49.8
Walnut Street to Junction Trib. #1 of Tributary #10	KR-22	1606	1098	(1)
Trib. #1 to Espy Bog	KR-21	1375	1331	(1)
Espy Bog	KR-9	420	363	6.4
Kirkwood Pond	KR-5	207	106	3.5
Central Road	KR-4	149	85	7.7
Private Road @ Back of Wal-Mart	SH-3	223	42	11.6
Shaffer Hollow Road	SH-4	145	5	38.1
Rt. 11 @ Dairy Queen	SH-5	628	627	4.0
Bisset's Lane	SH-7	114	17	8.2
Ridge Street	SH-8	663	384	23.7
Carroll Park Upper Pond	SH-9	517	385	29.9
Carroll Park Lower Pond	SH-10	394	365	10.1
Edgar Avenue	SH-14	763	739	10.1
Trib. No. 10 Stream Enclosure	SH-12	325	50	20.3
South Centre Twp. Pond	SC-26	157	134	1.8
Briar Cr. Borough Pond	BCB-5	70	38	3.7

(1) Area consists of flat gradient channel with extensive flood plain storage.

O. Wetlands

Wetlands were obtained from the National Wetlands Inventory Maps in digital format and Incorporated into the overall GIS. Plates 1-1 through 7-1 identify the wetlands for the watershed. Wetlands play an important part in flood flow attenuation and pollutant filtering. Wetlands are prevalent along Susquehanna River Tributaries over bank area. The attenuation affect that they provide was accounted for in the computer modeling. Wetlands should be preserved through the joint permit application process.

SECTION IV
WATERSHED TECHNICAL ANALYSIS

A. Watershed Modeling

An initial step in the preparation of this stormwater management plan was the selection of a stormwater simulation model to be utilized. It was necessary to select a model which:

- Modeled design storms of various durations and frequencies to produce routed hydrographs, which could be combined.
- Was adaptable to the size of subwatersheds in this study.
- Could evaluate specific physical characteristics of the rainfall-runoff process.
- Did not require an excessive amount of input data yet yielded reliable results.

The model for larger tributaries decided upon was the U.S.D.A. Natural Resources Conservation Service TR-20 model for the following reasons:

- It was developed by U.S.D.A. soil conservation service for analysis of complex watersheds and has been widely used in the United States and other countries.
- It has a stormwater diversion routine, which allows analysis of divided flow, that was a necessary component of two tributary watersheds.
- With surveyed valley cross-sections it accounts for flood plain storage and provides attenuation of hydrographs between analysis points.
- Input parameters provide a flexible calibration process.
- It has the ability to analyze reservoir or detention basin routing effect and location in the watershed.
- The Pennsylvania Department of Environmental Protection accepts it.

Although other models, such the Penn State runoff model and the Army Corp HEC-1 model, may provide essentially the same results as the TR-20 model. The TR-20 model combined with the Lancaster County Stremtul model provides a good method of evaluating release rates for sub-watersheds. The model generates runoff quantities for a specified design storm based upon the physical characteristics of the sub area, and routes the runoff flow through the drainage system in relation to the hydraulic characteristics of the stream. The amount of runoff generated from each sub area is a function of its slope, soil type or permeability, percent of the subwatershed that is developed, and its vegetative cover. Composite runoff curve numbers were generated by overlaying the land use map with the sub area and hydrologic soil group maps. The generated curve numbers were then used for input into the computer model. Plates 1-2 through 7-2 display the sub area delineation for individual tributaries for the Susquehanna River Tributaries Watershed.

B. Modeling Process

After delineating the Susquehanna River Tributaries watershed on the U.S.G.S. topographic map, the Individual tributaries for analysis purpose were identified. Then the ortho photographs provided by the Columbia County GIS office were used to determine the actual tributary watershed and subwatershed boundaries by field verification. The watershed and subwatershed boundaries were digitized into the County GIS system for use in determining model inputs. The main considerations in the subdivision process were location of obstructions and tributary confluences. The most downstream point of each individual tributary is considered a "point of interest" (POI) in which increased runoff must be analyzed for its potential impact.
The ultimate goal for selecting the key points of interest is to provide overall watershed stormwater runoff control through effective control of individual sub area storm runoff. Thus, comprehensive control of stormwater runoff in the entire tributaries watershed can be achieved

through stormwater management in each sub basin.

Sub area watershed area and runoff curve numbers for sub-watersheds were developed from the GIS data.

Times of concentrations for sub areas were developed using the procedure contained in the NRCS, TR-55 manual. Where channel flow velocities were necessary they were developed from surveyed field channel and valley cross-sections. Times of concentrations were compared to a range of acceptable values. Where a time of concentration differed from expected values it was checked using the lag method for confirmation.

Each tributary watershed was modeled for existing conditions and calibration of each individual watershed and key subwatersheds was completed for the 24-hour storm, the results of which can be found in the Technical Appendix.

The modeling process addressed:

- Peak discharge values at various locations along the stream and its tributaries;
- Time to peak for the above discharges;
- Effects of watershed storage attenuation.
- Runoff contributions of individual sub areas at selected downstream locations; and
- Overall watershed timing.

The future complete build out conditions was then run for all tributaries. In determining future build out it was determined that all agricultural land, open land and woodland on slopes of 20% or less would be developed. Zoning maps and availability of sanitary sewage collection system lines were used to determine the type of build out, i.e. Commercial, residential etc.

For Kinney Run and Shaffer Hollow in Scott Township three additional conditions were evaluated for future conditions. They were (1) build out without flood plain fill, (2) if allowable flood plain areas were filled to above 100-year level as permitted under FEMA & State guidelines and (3) flood plain fill with complete build out.

The results from these runs for selected locations are provided in Appendix E.

After the existing conditions and future conditions model runs were completed, the Stremtul model was used to determine release rates for future developments within the tributary sub areas.

C. Calibration

All simulation models involve a significant degree of subjective input in their development. Values are chosen for various hydrologic parameters describing the runoff characteristics of a watershed, which represent average or expected behavior in watersheds of similar soils, slopes, etc. The specific hydrologic characteristics of an individual watershed are not necessarily reflected in such average values. Therefore, the model needs to be fine tuned, or calibrated, too provide a more accurate representation of the real runoff and timing conditions for that particular watershed. Calibration of a model involves the adjustment of input parameters, within acceptable value ranges.

Due to the large variation in the characteristics of the individual watersheds within the study area, it was necessary to use several calibration methods.

There was no stream gage or discharge information available within any of the tributaries nor

were there any close-by gages that could be used to develop regionalized values. The computed discharges for some tributary watersheds where calibrated against available FEMA Flood Insurance Plan discharge values. And some were compared to the U.S.G.S. regression manual “Techniques for Estimating Manipulate and Frequency of Peak Flows for Pennsylvania Streams”, Water Resources Investigations Report 00-4189. Some watersheds were calibrated against a Log plot of drainage area versus discharge which was developed from the FEMA report values for watersheds within the Susquehanna River Tributaries study area. The results of the calibration for major watersheds within the study area are provided in Table IV-1.

For the Kinney Run and Tributary No. 10 Scott Township watersheds, it was necessary to provide HEC-RAS modeling to determine flow depth, velocity and discharge values in order to calibrate the TR-20 flows at key points within each watershed. Trial & error methods were used with the TR-20 model & the HEC-RAS models until reasonable correlation was obtained between discharges, elevation and velocity in both model inputs. It was found that neither model by itself would have produced adequate results due to the effects of obstructions. And in the case of Kinney Run divided flow combined with obstructions could not have been properly evaluated without this trial and error procedure.

The Thompson Run watershed was calibrated against the design storm for the Thompson Run Diversion Conduit installed by PA DEP (formerly PA DER). After calibration against the conduit design storm, the watershed was then evaluated for the 2 through 100-year 24-hour storms.

There are several potential calibration parameters within TR-20. These include initial abstraction, valleys cross section parameter, runoff curve numbers, and time of concentration. These numbers could be revised with confidence, while remaining within an acceptable range of values, for similar soil and sloped sub areas, to arrive at flow values developed in the regression analyses. For calibration purposes, the 100- year design storms were focused upon to compare TR-20 generated flow to those developed by the available FEMA Flood Insurance Studies, U.S.G.S. regression model or the Log plot of the FEMA studies discharges. Table IV-1 provides results of the peak flow values developed by the calibrated TR-20 model compared to predicted flow values determined from the calibration methods and the method used for calibrating the individual watershed. It should be noted that regression methods often times do not account for localized variables such as soils, topography and watershed shape. Therefore, the results may vary on a subwatershed basis.

TABLE IV-1
Comparison of Calibrated TR-20 Model To
100- Year Calibration Flow Values

Subwatershed	Calibrated TR-20 Flows (cfs)			Calibration discharges and Source for Calibration (cfs)		
	Sub areas	Location in Watershed	100-Year	100-Year Discharge	Calibration Source	Discussion Notes
Franklin Township	F-11 to F-19		2037	1513	(3)	
Kinney Run		Bloomsburg/Scott Line	1117	1360	(1)	
Kinney Run		Mouth	306	297	(1)	
Scott Twp. Trib. No. 10	SH-1 to SH-5	Rt. 11	627	694	(1)	(5)
Scott Twp. Trib. No. 10		Mouth	787	2210	(1)	(5)
South Centre Twp.	SC-1 to SC-12	Mouth	2243	1458	(2)	(6)
South Centre Twp.	SC-13 to SC-14	Mouth	623	512	(3)	
Ten Mile Run		Mouth	5673	5248	(3)	
Mifflin Twp.	MI-30 to MI-32	Mouth	1016	776	(3)	(7)
Mifflin Twp.	MI-34 to MI-42	Mouth	1470	1047	(3)	(7)
Thompson Run	TR-1 to TR-8	At Conduit Entrance	335	335	(4)	(8)

(1) FEMA Report For Watershed
(2) USGS Water Resources Investigation Report 00-4189
(3) Log Plot of Drainage Area Versus Discharge from FEMA Reports Within Watershed Area
(4) Thompson Run Design for PA DER Diversion Stream Enclosure
(5) FEMA study did not account for significant stormwater storage within the watershed area.
(6) TR-20 value is within the standard error range for the USGS method.
(7) Watershed topography is steep with steep gradient channels and no flood plain storage.
(8) Watershed was calibrated for the 2-hour duration design storm for the conduit and then the 24-hour storms were evaluated. The 24-hour 100-year storm provided a significantly higher discharge than the stream enclosure design storm.

D. Wetlands

Wetlands were obtained from the National Wetlands Inventory Maps in digital format and incorporated into the overall GIS. Plates 1-2 through 7-2 in Appendix A show the wetlands within the watershed.

Wetlands provide an important function in flood attenuation and non-point source pollutant filtering. Although there are scattered wetlands in many of the watersheds, they are most prevalent along the north over bank area of the Susquehanna River. Their attenuation of stormwater discharges was accounted for in the modeling of Kinney Run and Tributary No. 10 Scott Township, where they provide for a significant reduction in peak discharges. Wetlands should be preserved by both zoning and through the joint permit process.

SECTION V
STANDARDS AND CRITERIA FOR THE CONTROL OF STORMWATER

A. Watershed Level Control Philosophy

Watershed level control philosophy is based upon preserving the hydrologic balance within a watershed. Maintaining hydrologic balance is achieved when ground water recharge is maintained and peak discharges for stormwater runoff are not increased at any point within a watershed while maintaining water quality. An increase in development, and in turn, an increase in impervious surfaces, results not only in an increase in runoff peaks but also increases runoff volume. Stormwater runoff from impervious areas flushes pollutants that accumulate on them into receiving streams. During summer months runoff from impervious areas can result in high water temperatures that produce detrimental affects on aquatic ecosystems. The increased peak discharges and volumes of runoff increase the rate of stream bank erosion and sediment deposition in downstream areas.

The primary difference between on-site runoff control philosophy and the watershed level philosophy is the manner in which runoff peak discharges, stormwater runoff water quality and runoff volume are managed. Conventional on-site control philosophy has as its goal control of the runoff peak, water quality and volume from only the individual development site. The watershed level philosophy evaluates not only the changes in runoff peaks, water quality and volumes, but also, the affect that the change in runoff timing the individual site development may have on downstream peak discharges.

Infiltration systems, water quality facilities and runoff volume detention facilities are on-site controls that are installed to achieve the desired hydrologic balance. The goal of the design is for the after development hydrograph to match the predevelopment hydrograph. When this is accomplished, not only is there no increase in peak stormwater discharge, but there is also no change in the timing of the discharge leaving the site. This is the ideal goal for stormwater design, but it is not always possible to achieve. Therefore the release rate concept is used for the Susquehanna Tributaries area to account for the potential change in timing of the peak discharge and its detrimental affects on Point of Interest (POI) discharges.

On-site infiltration systems will be designed to maintain the existing condition recharge to groundwater. The recharge to groundwater is important for maintenance of well water supplies and to provide for base flow to the streams in order to maintain their aquatic systems health. On-site water quality best management practices help to reduce the volume of pollutants discharging to the receiving stream system. Where the installation of infiltration and water quality Best Management Practices (BMPs) provide for the required stormwater discharge controls, it will not be necessary to provide any additional stormwater detention facilities. If the required stormwater discharge criteria have not been met, then efforts should be made to provide the additional control by means other than by use of stormwater detention ponds.

Watershed level discharge control philosophy is based upon the evaluation of future development within subwatersheds and not increasing the peak discharge at Points Of Interest within the watershed. Design criteria for stormwater controls in any portion of a watershed are established not just for controlling peak discharge leaving the individual site to its existing value but its affect on POI discharges. Properly designed on-site controls based upon a watershed evaluation will provide for volume, water quality, accelerated stream bank erosion and peak discharge controls for the watershed.

Table V-1 provides a process to accomplish the required standards and criteria, on a priority basis, looking at means other than detention to reduce post development peak flows to the required predevelopment rate. The ultimate goal is to match the predevelopment hydrograph, not just the predevelopment peak.

TABLE V-1
Process to Achieve the Standards and Criteria
In Order of Preference
(Ultimate Goal - Match Predevelopment Hydrograph)

1.	Encourage use of open space development
2.	Minimize disturbance of natural features (buffers, trees, vegetation, floodplains, etc.)
3.	Minimize grading
4.	Minimize impervious surfaces; consider providing pervious surfaces for them.
5.	Disconnect large impervious surfaces.
6.	Apply BMP's near the source of the runoff.
7.	Evaluate needs for treating runoff.
8.	Satisfy the groundwater recharge objective.
9.	Satisfy the water quality objective.
10.	Satisfy the runoff peak attenuation objective considering all measures other than detention basins.
11.	Size detention basins after considering all other measures.

B. Description of Management Districts

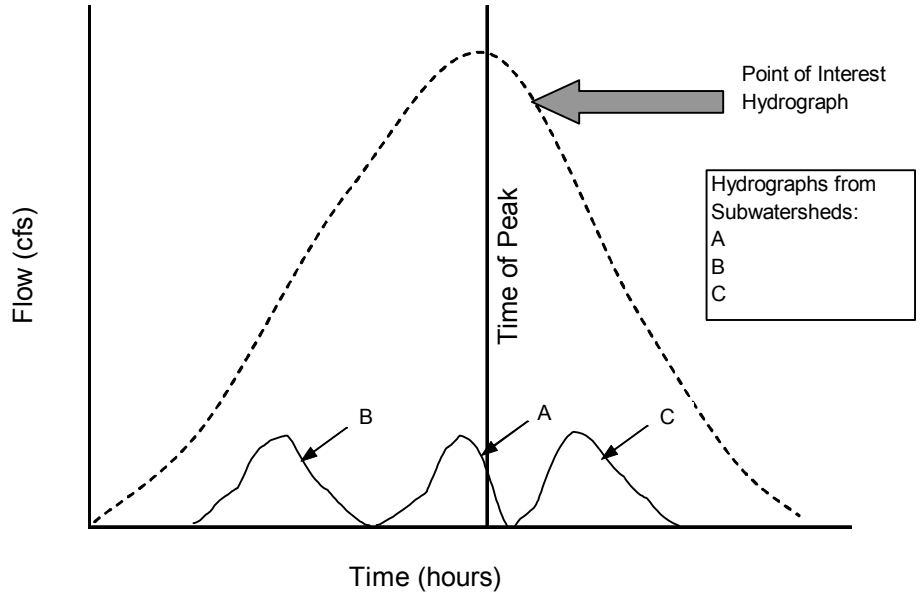
The timing of runoff from a development site in a particular sub area in relation to the time and peak discharge at the points of interest (POI) (sub area outlets) dictate how the runoff in a particular sub-area should be managed. Figure V-1 shows a simplified version of how various sub-area hydrographs would contribute to the peak flow at a particular point of interest. As can be seen from Figure V-1, hydrograph "A" peaks near the point of interest hydrograph. Increases in peak discharge due to development in sub areas District A would contribute to increases in peak discharge at the downstream POI. Therefore stormwater controls would need to reduce the outflow of District A to more stringent criteria than in Districts B or C.

Increases in peak discharge due to development in sub areas within District B would contribute to increases in peak discharge on the rising limb of the POI hydrograph as well as increased channel flow from lower frequency storms. In some cases they may also contribute to a slight increase in the peak discharge at the POI if standard detention, where post development discharges are to be maintained at predevelopment rates, was used. Therefore, the criteria for this District, was established to provide for no increase at the outlets of the sub areas and to not contribute to the peak discharge at the POI.

Peak flows from sub areas in District “C” either exit the stream system prior to the peak at the POI, or standard detention will not contribute to the POI peak discharge. Therefore standard detention for controlling the post development discharge to the predevelopment rates is recommended for these areas. It was also found that stormwater detention more stringent than maintaining post development discharge to predevelopment discharges could increase the peak at the POI. This is possible when the peak discharge is delayed to the point that it coincides more closely with peak discharges from upstream sub areas.

Development of the design storm criteria was based upon downstream obstruction capacities and problem areas identified in the study, as well as the overall goal of maintaining existing conditions flow at all points in the watershed in the future. In some cases in trying to have no increase in peak discharge at any of the POI within the watershed, some POI will have a slight reduction in peak discharge when the watershed is built out.

Figure V-1
Relative Timing of Subwatershed Hydrographs



In performing the tasks for the Susquehanna River Tributaries Watershed Plan under Act 167, a major goal was to determine where in the watershed stormwater detention was appropriate for new development. And more importantly, to determine to what extent stormwater detention would be required in individual sub areas as described above. The release rate method has been developed for the Susquehanna River Tributaries Watershed. This method is to control post-development storm water discharges to a percentage of predevelopment discharge. In computing the required detention for a development groundwater recharge and water quality detentions are to be included in the stormwater detention design volume. TABLE V-2 contains the required release rate district stormwater control criteria. Individual sub areas would fall into one of three districts except for Sub Area BCB-5 in Briar Creek Borough, which requires a special 60% Release Rate criteria.

The comparison of peak flows for the 100-year future and existing conditions with release rate requirements is contained in Table V-3.

TABLE V-2
RELEASE RATE DISTRICT CONTROL CRITERIA
FOR POST DEVELOPMENT DISCHARGE AS A PERCENTAGE
OF PRE-DEVELOPMENT DISCHARGE

District	Post Development	Reduced To Percentage of Pre-development Discharge (1)
A	2-year	75% of 2-year / 24-hour
	5-year	75% of 5-year/ 24-hour
	10-year	75% of 10-year/ 24-hour
	25-year	75% of 25-year/ 24-hour
	50-year	75% of 50-year/ 24-hour
	100-year	75% of 100-year/ 24-hour
B	2-year	90% of 2-year/ 24-hour
	5-year	90% of 5-year/ 24-hour
	10-year	90% of 10-year/ 24-hour
	25-year	90% of 25-year/ 24-hour
	50-year	90% of 50-year/ 24-hour
	100-year	90% of 100-year/ 24-hour
C	2-year	100% of 2-year/ 24-hour
	5-year	100% of 5-year/ 24-hour
	10-year	100% of 10-year/ 24-hour
	25-year	100% of 25-year/ 24-hour
	50-year	100% of 50-year/ 24-hour
	100-year	100% of 100-year/ 24-hour

(1) Infiltration and Water Quality volumes are included in determining after development discharges and the need for or size of detention structures.

TABLE V-3
Present Versus Future Peak Flows
Without Stormwater Management and Release Rate Requirements
100-Year 24-Hour Storm

Note: The computed flow values were derived for watershed planning purposes and should not be considered regulatory values for permitting purposes. While they may be used for comparison or checking purposes, additional hydrologic computations may be needed for the design of bridges, culverts and dams.

	100-Year Existing	100-Year Projected Future (1)	Storm Water Control Districts	Allowable Release Rate (2)
Sub area No.	Peak Q (cfs)	Peak Q (cfs)	Sub area	Percent %
C-1	714	828	B	90
C-2	466	508	C	100
MC-1	588	717	B	90
MC-2	569	679	C	100
M-1	433	502	C	100
M-2	531	504	C	100
M-3	515	566	C	100
M-4	790	885	B	90
M-5	372	402	C	100
M-6	181	185	C	100
M-7	231	267	C	100
M-8	104	99	C	100
M-9	304	326	C	100
M-10	(3)	(3)	C	100
F-1	258	277	C	100
F-2	199	169	C	100
F-3	146	133	C	100
F-4	373	366	C	100
F-5	162	161	C	100
F-6	77	122	C	100
F-7	417	368	C	100
F-8	295	270	C	100
F-9	310	317	C	100
F-10	151	160	C	100
F-11	247	276	A	75
F-12	190	188	B	90
F-13	120	149	A	75
F-14	358	448	A	75
F-15	73	79	B	90
F-16	504	613	A	75
F-17	211	229	B	90
F-18	305	286	B	90
F-19	701	784	B	90

Sub area No.	100-Year Existing Peak Q (cfs)	100-Year Projected Future (1) Peak Q (cfs)	Storm Water Control Districts Sub area	Allowable Release Rate (2) Percent %
F-20	422	492	B	90
F-21	741	838	C	100
CB-1	42	73	C	100
CT-1	176	308	C	100
CT-2	253	278	C	100
CT-3	112	126	C	100
CT-4	107	98	C	100
CT-5	403	491	C	100
CT-6	784	894	C	100
CT-7	277	317	C	100
CR-1	447	508	B	90
CR-2	123	134	B	90
CR-3	538	556	B	90
CR-4	317	367	B	90
CR-5	343	394	B	90
CR-6	223	248	B	90
CR-7	329	344	B	90
CR-8	407	456	B	90
CR-9	377	434	B	90
CR-10	215	234	B	90
CR-11	385	416	B	90
CR-12	611	631	B	90
CR-13	351	395	B	90
CR-14	37	65	C	100
MA-1	894	894	C	100
MA-2	588	660	C	100
MA-3	438	474	C	100
MA-4	377	352	C	100
MA-5	233	234	C	100
MA-6	371	357	C	100
KR-1	237	297	A	75
KR-2	141	156	A	75
KR-3	19	19	A	75
KR-4	55	55	C	75
KR-5	207	239	A	75
KR-6	119	119	C	100
KR-7	43	43	C	100
KR-8	80	90	C	100
KR-9	158	198	A	75
KR-10	40	40	C	100
KR-11	164	164	C	100
KR-12	349	437	A	75
KR-13	236	301	A	75
KR-14	55	55	C	100
KR-15	150	150	C	100
KR-16	296	296	C	100
KR-17	118	118	C	100

Sub area No.	100-Year Existing Peak Q (cfs)	100-Year Projected Future (1) Peak Q (cfs)	Storm Water Control Districts Sub area	Allowable Release Rate (2) Percent %
KR-18	111	111	C	100
KR-19	332	394	A	75
KR-20	367	446	A	75
KR-21	82	82	C	100
KR-22	119	119	C	100
KR-23	123	123	C	100
KR-24	238	238	C	100
KR-25	149	149	C	100
KR-26	238	266	C	100
KR-27	462	462	C	100
KR-28	101	101	C	100
KR-29	54	79	C	100
KR-30	(3)	(3)	C	100
KR-31	115	115	C	100
KR-32	85	85	C	100
SH-1	348	430	A	75
SH-2	163	163	C	100
SH-3	30	42	A	75
SH-4	130	149	A	75
SH-5	332	331	C	100
SH-6	552	567	B	90
SH-7	114	119	B	90
SH-8	117	126	C	100
SH-9	138	138	C	100
SH-10	93	93	C	100
SH-11	77	77	C	100
SH-12	276	276	C	100
SH-13	(3)	(3)	C	100
SH-14	115	120	C	100
ST-1	(3)	(3)	C	100
SC-1	505	590	B	90
SC-2	72	85	B	90
SC-3	111	134	B	90
SC-4	380	424	A	75
SC-5	170	200	A	75
SC-6	117	161	B	90
SC-7	334	359	B	90
SC-8	164	205	B	90
SC-9	344	374	A	75
SC-10	126	154	B	90
SC-11	131	154	B	90
SC-12	205	297	C	100
SC-13	307	358	B	90
SC-14	400	579	B	90
SC-15	272	272	C	100
SC-16	458	471	B	90
SC-17	290	338	B	90
SC-18	254	270	B	90

Sub area No.	100-Year Existing Peak Q (cfs)	100-Year Projected Future (1) Peak Q (cfs)	Storm Water Control Districts Sub area	Allowable Release Rate (2) Percent %
SC-19	13	19	B	90
SC-20	302	365	B	90
SC-21	304	370	C	100
SC-22	177	192	B	90
SC-23	188	218	A	75
SC-24	292	372	C	100
SC-25	47	53	B	90
SC-26	26	63	B	90
SC-27	153	179	C	100
SC-28	589	604	C	100
SC-29	(3)	(3)	C	100
NC-1	586	657	B	90
BCB-1	128	126	C	100
BCB-2	70	77	C	100
BCB-3	116	104	C	100
BCB-4	167	183	B	90
BCB-5	70	96	(4)	60 (4)
BCB-6	(3)	(3)	C	100
TM-1	621	645	B	90
TM-2	468	485	C	100
TM-3	386	357	B	90
TM-4	427	427	C	100
TM-5	101	101	C	100
TM-6	226	239	A	75
TM-7	322	322	B	90
TM-8	166	184	B	90
TM-9	354	412	C	100
TM-10	444	512	B	90
TM-11	434	480	B	90
TM-12	299	299	C	100
TM-13	273	329	B	90
TM-14	484	484	C	100
TM-15	517	596	A	75
TM-16	619	636	B	90
TM-17	295	304	B	90
TM-18	769	958	C	100
TM-19	395	454	C	100
TM-20	781	912	B	90
TM-21	685	725	A	75
TM-22	567	615	A	75
TM-23	586	827	A	75
TM-24	331	385	C	100
TM-25	244	288	C	100
TM-26	332	398	C	100
TM-27	338	426	A	75
MI-1	109	109	C	100
MI-2	234	289	C	100
MI-3	174	174	C	100

Sub area No.	100-Year Existing Peak Q (cfs)	100-Year Projected Future (1) Peak Q (cfs)	Storm Water Control Districts Sub area	Allowable Release Rate (2) Percent %
MI-4	489	587	B	90
MI-5	334	397	B	90
MI-6	311	358	B	90
MI-7	226	226	C	100
MI-8	199	199	C	100
MI-9	428	507	B	90
MI-10	453	562	A	75
MI-11	370	427	B	90
MI-12	144	151	B	90
MI-13	282	285	B	90
MI-14	364	433	C	100
MI-15	307	296	C	100
MI-16	513	513	C	100
MI-17	57	57	C	100
MI-18	530	548	C	100
MI-19	123	118	C	100
MI-20	320	475	A	75
MI-21	457	519	B	90
MI-22	443	472	B	90
MI-23	311	336	B	90
MI-24	248	282	B	90
MI-25	382	356	C	100
MI-26	181	189	C	100
MI-27	292	306	C	100
MI-28	254	237	C	100
MI-29	120	111	C	100
MI-30	415	404	C	100
MI-31	383	402	C	100
MI-32	531	645	C	100
MI-33	248	272	C	100
MI-34	264	261	B	90
MI-35	246	288	B	90
MI-36	173	220	B	90
MI-37	332	415	B	90
MI-38	281	363	B	90
MI-39	96	161	B	90
MI-40	186	219	B	90
MI-41	187	231	C	100
MI-42	58	77	C	100
MI-43	231	257	C	100
MI-44	509	528	C	100
MI-45	267	267	C	100
TR-1	478	561	A	75
TR-2	121	166	B	90
TR-3	409	462	A	75
TR-4	445	524	A	75
TR-5	357	421	A	75
TR-6	57	86	C	100

	100-Year Existing	100-Year Projected Future (1)	Storm Water Control Districts	Allowable Release Rate (2)
Sub area No.	**Peak Q (cfs)**	**Peak Q (cfs)**	**Sub area**	**Percent %**
TR-7	61	92	C	100
TR-8	18	49	C	100
TR-9	115	115	C	100
TR-10	99	102	C	100
TR-11	42	42	C	100

(1) 100-Year projected future discharge value is with no stormwater detention.
(2) Allowable percentage of existing condition discharge
(3) Long area along river that drains to river through many small drainage ways. Discharge computation for this area is meaningless.
(4) Special Release Rate Subwatershed due to unusual watershed and obstruction conditions.

C. General Performance Standards

The General Performance Standards for Stormwater Management in Susquehanna Tributary Watershed apply to any construction activity disturbing 5,000 or more square feet of earth. The following development activities are exempt from these performance standards in the watershed, except that exempt activities shall still be required to meet the ground water recharge and water quality requirements.

- Agricultural land management activities
- Additions or modifications to existing single family structures to a maximum of 5000 square feet of total impervious area including auxiliary structures, sidewalks, driveways and other paved or impervious areas
- Developments that do not disturb more than 5000 square feet of land on a one half-acre or larger tract.

1. Site designs shall minimize the generation of stormwater and utilize pervious areas for stormwater treatment.

2. Stormwater runoff generated from development discharged directly into a jurisdictional wetland or waters of the state of Pennsylvania shall be treated using appropriate Water Quality Best Management Practices.

3. Annual groundwater recharge rates shall be maintained by promoting infiltration through the use of structural and non-structural methods. At a minimum, annual recharge from the post development site shall mimic the annual recharge from predevelopment site conditions based upon meadow or woodland predevelopment conditions. The groundwater infiltration volume shall be computed as shown below and outlined in section 308 of the model ordinance.

The groundwater infiltration volume shall be computed using the following procedure:
Groundwater Infiltration Computation Formula

GIv = [(S + 0.05)(PI)(A)] /12 = Cubic Feet (Groundwater Infiltration Volume)
S = Infiltration Values for Existing Conditions Soil Hydrologic Group
PI = Percent Imperious Cover for Site as a Decimal
A = Area of Site in Square Feet
12 = Conversion Factor for Inches to Feet
Values for S based upon Soil Hydrologic Group

Soil Hydrologic Group	Value of S in Inches
A	0.32
B	0.22
C	0.11
D	0.05

Groundwater Recharge Example:

The area to be developed covers twelve (12) acres. Eight (8) acres (348,480 square feet) of the area is on Hydrologic Group A soils with 4 acres (174,240 square feet) to be impervious after development. The remaining four (4) acres (174,240 square feet) of the site has Hydrologic Group C soils and will have 2 acres (87,120 square feet) of impervious area after development.

Groundwater Example Problem:

GIv=[(S+0.05)(PI)(A)] /12

GIv=[(0.032+0.05)(4/8)(348,480)] /12 + [(0.11+0.05)(2/4)(174,240)] /12

GIv=5372+1162 = 6534 cubic feet

4. For new development, structural BMP's shall be designed to remove 80% of the average annual post development total suspended solids load (TSS). It is presumed that a BMP complies with this performance standard if it is:

   - Sized to capture the prescribed water quality volume (WQv)
   - Designed according to the specific performance criteria outlined in the PA BMP manual or section 309 of the model ordinance
   - Constructed properly, and
   - Maintained regularly.

   Section 309 model ordinance criteria is as follows:

   Recommended Procedure for Calculating Water Quality Treatment Volume is provided below for the Susquehanna Tributaries Watershed:

   - Utilize the following Equation WQv = [(1.95)(PI)(A)]/12 =
   - Where:
     - WQv = Water Quality Treatment Volume in Cubic Feet
     - 1.95 = the inches of Stormwater Runoff from an Impervious Area
     - PI = The percent of Site Impervious Area as a Decimal
     - A= Drainage Area in Square Feet
     - 12 = Conversion Factor for Inches to Feet

Water Quality Volume Example Problem:

The area to be developed covers twelve (12) acres. The impervious area will cover six (6) acres at the site. The site is situated so that there is no upslope drainage areas flowing on to it and all drainage leaves the site at one point.

$WQv = [(1.95)(PI)(A)] /12$

$WQv=[(1.95)(6/12)(12x43560)] /12$

WQv=42,471 cubic feet

5. The post development peak discharge rate shall comply with the release rate requirement established for that subwatershed.

6. To protect stream channels from degradation, the minimum criteria shall be installation of BMP's to meet the water quality criteria contained in section 309 of the model ordinance and item #4 of this section.

7. Storm water discharges to Waters of the Commonwealth classified as HQ and EV streams will be subject to State regulations and guidelines for development in Special Protection Waters. Those guidelines will be followed in preparing stormwater facility designs.

8. All infiltration BMPs shall have an enforceable operation and maintenance agreement to ensure the system functions as designed.

9. Every infiltration BMP shall have an acceptable form of water quality pretreatment.

10. Redevelopment, defined as any construction, alteration or improvement exceeding 5000 square feet in areas where existing land use is high density commercial, industrial, institutional or multi-family residential, is governed by special stormwater sizing criteria depending on the amount of increase or decrease in impervious area created by the redevelopment. For redevelopment sites, stormwater design criteria, including groundwater infiltration, water quality and stormwater release rate criteria, shall apply only to the increased impervious area and not to the entire site.

11. Certain industrial sites are required to prepare and implement a stormwater pollution prevention plan and file a notice of intent (NOI) under provisions of Pennsylvania Stormwater Industrial National Pollutant Discharge Elimination System (NPDES) general permit. The requirements for preparing and implementing a stormwater pollution prevention plan are described in the general discharge permit available from DEP and Guidance can be found in the United States Environmental Protection Agency's (EPA) document entitled, "Storm Water Management for Industrial Activities, Developing Pollution Prevention Plans and Best Management Practices." The stormwater pollution prevention plan requirement applies to both existing and new industrial sites.

12. Stormwater discharges from land uses or activities with higher potential for pollutant loadings, defined as hotspots, may require the use of specific structural BMP's and pollution prevention practices. In addition, stormwater from a hotspot land use may not be infiltrated.

13. In Pennsylvania, local governments are usually responsible for most stormwater management review authority. Therefore, prior to design, applicants should always consult with their local reviewing agency to determine if they are subject to additional stormwater design requirements. In addition, any disturbances greater than one acre must have NPDES construction general permit coverage with PA DEP.

D. Standards and Criteria

The required standards and criteria are summarized in Table V-4 while recommended standards and criteria can be found in Table V-5. Design and implementation of infiltration and water quality measures using nonstructural stormwater management measures, such as open space planning, should be considered to help achieve this goal. Section 5 of Pennsylvania's BMP Manual should also be consulted in order to achieve these goals.

TABLE V-4
Required Standards & Criteria

REQUIRED STANDARD	**BENEFIT**
Stormwater Management A, B, and C Detention Districts	No increase in runoff on a watershed wide basis, stormwater detention and attenuation. Minimize accelerated stream bank erosion.
Calculations Methodology Parameters must be obtained from the Model Ordinance.	Calculations for consistent stormwater management.
Existing Storm Sewers or Culverts Discharge into existing sewer networks or Culverts will be based on system capacity or design storm(s),whichever is more restrictive. Note: The design storm detention shall not necessarily be applied to the sewers and/or culverts.	Preserve sewer/culvert capacity, thereby reducing Operation and Maintenance and replacement costs.
Outlets Post development stormwater discharges should leave a property at the same location and at no increase in peak discharge rate as predevelopment discharges. If outlet from stormwater conveyance systems from a development site to a stream, tributary, stabilized channel, or storm sewer is not possible, runoff shall be collected in a detention/retention facility and discharged at a non-erosive rate. Outlets discharging onto adjacent property owner(s) properties , at a higher rate or location where it did not previously discharge, must have adjacent property owner(s) written permission.	Safe conveyance, continued surface and ground water quality, stormwater detention, flow attenuation.
Infiltration Requirements All development shall implement infiltration Best Management Practices. This also pertains to the portions of the watershed that have storm sewers. Recharge structures installed prior to tapping into the storm sewers are recommended where soils and physical conditions permit. Infiltration BMPs shall be designed using the groundwater infiltration volume formula contained in the "General Performance Standards" paragraph 3 and the design procedures contained in the Maryland Infiltration Manual. The infiltration amounts for the individual soil types are contained in Appendix B as are an alternative procedure for computing infiltration volume.	Groundwater/stream base flow recharge, flow attenuation. Reduce accelerated stream bank erosion.

TABLE V-4 (continued)
Required Standards & Criteria

REQUIRED STANDARD	BENEFIT
Water Quality Requirements All development shall implement Water quality Best Management Practices. The Pennsylvania Handbook of Best Management Practices for Developing Areas shall be used to plan and provide criteria for design of BMPs. Appendix F of the PA Handbook provides for design of water quality volumes. An alternate procedure is contained in Appendix B.	Surface water quality, recharge, flow attenuation. Reduce accelerated stream bank erosion.
Erosion and Sediment Pollution Control Erosion and sediment control plans shall be prepared in accordance with Pennsylvania Chapter 102 requirements. Network with Administrative and Regulatory agencies involvement with earth disturbance sites.	Infiltration, structure integrity, surface water quality, safe conveyance and maintenance of stream, culvert, and channel capacity.
Wetlands When wetlands will be affected by development, regulatory agencies should be involved in a pre-application site review and coordination meeting. Where regulator agencies allow the development of all or part of any wetlands, the stormwater analysis shall include evaluation of the effects of loss of wetland stormwater storage upon peak discharges at the property line and downstream to the point where there is no increase in discharge.	Infiltration, surface and groundwater recharge, stream base flow, water quality, flow attenuation, stormwater detention.
Channel Protection Post development stormwater discharges should enter stream channels at the same location as predevelopment discharge and at no increase in peak discharge rate. This provision applies as long as groundwater infiltration and water quality provisions are met.	Surface water quality. Reduced accelerated stream bank erosion.

TABLE V-5
Recommended Criteria & Standards

RECOMMENDED STANDARD	BENEFIT
Floodplains Those floodplains in which the floodplain Natural stormwater detention/flood stores water and acts as a detention basin shall not be filled so as to reduce the storage capacity.	Maintain floodplain storage and control downstream peak discharge increases.
Roof Drains, Residential/Commercial Where possible roof drains shall not discharge into storm sewers, roadside ditches or channels. Discharge to lawn, groundwater recharge basin or storage facilities.	Promotes infiltration, flow attenuation and increases runoff time of concentration through flow attenuation.
Pervious Surfaces The use of pervious materials will be encouraged for parking surfaces and sidewalks.	Infiltration, groundwater's recharge
Stormwater Detention / Retention Structures Where possible locate facilities within areas conducive to recharge of groundwater. Account for recharge when designing for release rate requirements.	Infiltration, groundwater recharge, stream base flow.
Steep Slopes Development on steep slope areas where it is difficult to control erosion and stormwater discharge should be discouraged or limited by zoning under land development regulations. Infiltration BMPs should be limited to slopes less than 20%.	Stream base flow, flow attenuation, conveyance integrity, surface water quality

Note: See the Model Ordinance and the Appendix for more detailed standards and criteria.

E. Sub-Regional (Combined Site) Storage

Traditionally, the approach to stormwater management has been to control the runoff on an individual site basis. However, there is a growing commitment to finding cost-effective comprehensive control techniques that both preserve and protect the natural drainage system. In other words, two developers developing sites adjacent to each other could pool their capital resources to provide for a community stormwater storage facility in the most hydrologic advantageous location.

The goal should be the development and use of the most cost-effective and environmentally-sensitive stormwater runoff controls. These controls will significantly improve the capability and flexibility of land developers and communities to control runoff consistent with the Susquehanna River Tributaries Stormwater Management Plan.

An advantage to combining efforts is to increase the opportunity to utilize stormwater control facilities to meet other community needs. For example, certain stormwater control facilities could be designed so that recreational facilities such as ball fields, open space, parks, etc. could be incorporated. Natural or artificial ponds and lakes could serve both recreational and stormwater management objectives.

To take this concept a step further, there is also the possibility that the stormwater could be managed "off-site"; that is, in a location off the property(s) in question. Stormwater management facilities could be constructed in an off-site location more hydrologically advantageous to the watershed. These facilities could be publicly owned detention, retention, lake, pond, or other physical facilities to serve multiple developments. The design and release rate would need to be consistent with the Susquehanna River Tributaries Plan.

F. "No Harm Option"

A developer has the option to prove to the Municipality that the increase in runoff generated from his/her site above the allowable release rate will cause "no harm" anywhere in the watershed. The No Harm Option is used when a developer can prove that the post development hydrographs for the design storms can match pre-development hydrographs, or if it can be proved that the post development conditions will not cause increases in peaks at all critical points downstream. Where development will occur in the areas identified as important existing stormwater detention areas, the developer cannot use the alternative of matching the predevelopment hydrograph for that site. In that case the developer must provide computations that show no increase in the peak discharge due to loss of stormwater storage and changes in site discharge for all downstream points of interest.

G. Alternative Runoff Control Techniques

Each developer will not allow the runoff from his/her site to exceed the applicable release rate applied to the subwatershed in which the site is located. This runoff control can be obtained in a number of different ways. The following tables indicate an overview of general measures that can be applied to reduce or delay stormwater runoff as well as the advantages and disadvantages for several types of runoff control measures. It will be up to the developer or the developer's engineer to select the technique that is the most appropriate to the type of project and physical characteristics of the site.

In determining what measures or combination of measures to install, the following parameters should be considered:

- Soil characteristics (hydrologic soil group, etc.)
- Subsurface conditions (high water table, bedrock, etc.)
- Topography (steepness of slope, etc.)
- Existing drainage patterns
- Economics
- Advantages and disadvantages of each technique

TABLE V-6
Various On-Site Stormwater Control Methods

AREA	REDUCING RUNOFF	DELAYING RUNOFF
Large Flat Roof	1. Cistern and/or pond storage 2. Rooftop gardens 3. Pool storage or fountain 4. Infiltration system	1. Ponding on roof by constricted downspouts
Building Roofs	1. Cistern and/or pond storage 2. Pool storage or fountain 3. Infiltration system	1. Outlet to lawn area
Parking Lots	1. Porous pavement a. Gravel parking lots (porous). b. Porous or punctured 2. Concrete vaults and cisterns 3. Vegetated ponding areas 4. Gravel trenches. 5. Infiltration systems with W.Q. pretreatment BMP. 6. Bioretention Facilities	1. Grassy strips on parking lots. 2. Grassed waterways draining parking lot. 3. Ponding and detention a. Rippled pavement b. Depressions c. Basins 4. Bioretention Facilities 5. Constructed Treatment Wetland
Residential	1. Cisterns for individual homes or groups of homes. 2. Gravel driveways (porous) 3. Contoured landscape plantings. 4. Groundwater recharge: a. Perforated pipe b. Gravel (sand) trenches c. Dry Wells d. Infiltration Ponds 5. Vegetated depressions 6. Bioretention Facilities	1. Reservoir of detention basin. 2. Maintaining vegetation density on lawns and mowing with mowers set at a higher height. 3. Gravel driveways. 4. Grassy gutters or channels. 5. Increased length of travel of runoff by means of gutters, diversions, etc. 6. Bioretention Facilities 7. Constructed Treatment Wetland
General	1. Gravel alleys 2. Porous sidewalks 3. Mulched planters	1. Gravel alleys

Source: (1) Urban Hydrology for Small Watershed. Technical Release No. 55, January 1995.
(2) Pennsylvania Handbook of Best Management Practices for Developing Areas, Spring 1998.

TABLE V-7
Advantages and Disadvantages Of Various On-Site Stormwater Control Methods

MEASURE	ADVANTAGES	DISADVANTAGES
A. Rooftop Gardens	1. Aesthetically pleasing. 2. Runoff reduction. 3. Reduce noise levels. 4. Wildlife enhancement.	1. Higher structural loadings on roof and building. 2. Expensive to install and maintain.
B. Increased Roof Roughness: a. Rippled roof b. Gravel on roof	1. Runoff delay and some reduction (detention in ripples or gravel).	1. Somewhat higher structural loading.
C. Ponding on Roof by Constricted Downspouts	1. Runoff delay. 2. Cooling effect for building.	1. Higher structural loadings. 2. Clogging of constricted down spouts 3. Freezing during winter (expansion) & increased structural loading 4. Waves and wave loading. 5. Leakage of roof water into building.
D. Porous pavement (parking lots and alleys): a. Gravel parking lot b. Holes in impervious pavements (1/4 in. diameter filled with sand. c. Interconnected paving blocks	1. Runoff reduction (a and b). 2. Potential groundwater recharge. 3. Gravel pavements may be cheaper than asphalt or concrete (a).	1. Clogging of holes or gravel (a and b). 2. Compaction of earth below pavement or gravel decreases permeability of soil (a and b). 3. Ground-water pollution from salt in winter (a and b). 4. Frost heaving for impervious pavement with holes (b). 5. Difficult to maintain. 6. Grass or weeds could grow in porous pavement (a, b, and c) 7. Will require vacuuming of surface.
E. Converted septic tank for storage and ground water recharge.	1. Low installation costs. 2. Runoff reduction 3. Water may be used for: a.Fire protection. b. Watering lawns and gardens.	1. Requires periodic maintenance (silt removal). 2. Sometimes requires a pump.
F. Cisterns and Covered Ponds.	1. Additional Storage may be provided for: a. Fire Protection b. Watering lawns c. Industrial processes 2. Reduce runoff while only occupying small area. 3. Land and space above cistern may be used for other purposes.	1. Expensive to install. 2. Cost required may be restrictive if the cistern must accept water from large drainage areas. 3. Requires slight maintenance. 4. Restricted access.

TABLE V-7 (continued)
Advantages And Disadvantages Of Various On-Site Stormwater Control Methods

MEASURE	ADVANTAGES	DISADVANTAGES
G. Infiltration System	1. Maintain hydrologic balance ground & surface waters. 2. Reduce runoff while occupying small area. 3. Land and space above system may be used for other purposes.	1. Installation cost. 2. Cost may be restrictive if must accept water from large drainage areas. 3. Proper maintenance and use at pretreatment water quality (filtering) BMP required. 4. Repair or replacement cost could be expensive. 5. Potential for ground water contamination. 6. Winter de-icing chemicals could destroy soil structure, especially pervious clays, and reduce or prevent infiltration.
H. Bioretention Facilities	1. Can be used to recharge groundwater by infiltration runoff. 2. Reduce peak runoff rates. 3. Provides water quality benefits. 4. Aesthetically pleasing. 5. Attenuation air pollutants and noise. 6. Provide wildlife habitat.	1. Potential for groundwater pollution. 2. Require maintenance. 3. Cost may be restrictive if must accept water from large drainage areas. 4. Maintenance of system and vegetation.
I. Grassed channels and vegetated strips.	1. Runoff delay. 2. Some runoff reduction (infiltration recharge). 3. Aesthetically pleasing: a. Flowers b. Trees	1. Sacrifice some land area for vegetated strips. 2. Grassed areas must be mowed or cut periodically (maintenance costs).
J. Ponding and detention measures on impervious pavement:	1. Runoff delay 2. Peak discharge reduction	1. Somewhat restricted movement of vehicles. 2. Interferes with normal use during storms.
K. Constructed Treatment Wetlands	1. Provide water quality treatment. 2. Control large drainage areas. 3. Aquatic and wetland life habitat. 4. Provides runoff delay.	1. Require large areas. 2. Regular supply of inflow required for biological health of system. 3. Possible mosquito breeding areas. 4. Maintenance problems. 5. Cattails and other wetland vegetation are unsightly. 6. Generally not suited to smaller drainage areas, unless continuous flow of water is available.

TABLE V-7 (continued)
Advantages And Disadvantages Of Various On-Site Stormwater Control Methods

L. Surface Pond Storage	1. Controls large drainage areas with low release. 2. Aesthetically pleasing. 3. Possible recreation benefits: a. Boating b. Ice Skating c. Fishing d. Swimming 4. Aquatic life habitat 5. Increases land value of adjoining property.	1. Requires large areas. 2. Possible pollution from stormwater and siltation. 3. Possible mosquito breeding areas. 4. May have adverse alga blooms as a result of nutrient runoff. 5. Possible drowning. 6. Maintenance problems

TABLE V-8
Suitability Of Runoff Control Measures
In Susquehanna River Tributaries Watershed

MEASURE	RECOMMENDATIONS
Cisterns and Covered Ponds:	Recommended in industrial parks where water could be utilized for fire protection; expensive to install with limited benefit; low additional water storage maintenance costs (usually requires periodic sediment removal).
Rooftop Gardens:	Recommended for consideration on new buildings properly designed for earth, plant and water loads.
Surface Pond Storage:	Recommended where pond sites exist, on more porous soils (A and B) can benefit groundwater recharge; relatively inexpensive to install and maintain; helps entrap sediment to improve water quality of receiving stream. Water Quality benefits can be further achieved by incorporating delayed discharge, wet storage or wetlands as part of the design on appropriate sites.
Ponding on Roof, Constricted Downspouts:	Possible on new large public and commercial buildings with flat roofs; existing buildings require structural evaluation and possibly modification; usually expensive if modifications required; low maintenance costs unless leaks occur.
Increased Roof Roughness:	Possible for industrial, commercial and public buildings; relative effectiveness minimal on a watershed wide basis; moderate installation costs; little maintenance costs.
Porous Pavement:	Highly recommended where possible, especially in A and B soils and large parking facilities; promotes groundwater recharge; moderate in expense compared to typical paving; low maintenance costs. Not recommended for travel lanes or truck parking areas. Can be installed on low infiltration soils if under paving gravel storage beds with controlled outlets are provided.
Grassed Channels and Vegetated Strips:	Recommended wherever possible throughout the watershed to slow velocity and reduce erosion; minimal slopes recommended; could entrap sediment to improve water quality; low installation and maintenance costs; promotes minimal infiltration on most soils.
Ponding and Detention on Pavement:	Recommended in entire watershed; very inexpensive with low maintenance costs; freezing should be considered. Shallow depth required to prevent damage to vehicles parked or driven on the area during storm event.
Reservoir or Detention Basin:	Recommended in entire watershed.
Groundwater Recharge:	Required throughout the watershed except for industrial sites with potential to pollute groundwater. Recommend site investigation to determine suitability of selected area and for determining the design infiltration rate.
Dense High Mower Height Grass and Routing Flow Over Lawns:	Recommended in the entire watershed; delays runoff, increases infiltration, entraps sediment, reduces velocities, reduces erosion potential; relatively inexpensive installation and maintenance costs.
Bioretention Facilities:	Recommended in the entire watershed; delays runoff, increases infiltration, relatively inexpensive installation and maintenance costs.
Constructed Treatment Wetlands:	Recommended in entire watersheds where soil and hydrologic conditions are suitable. Proper maintenance and availability of continuous flow required to minimize mosquito problems.

H. Regional Detention Facilities

One option in watershed-wide storm management is to control runoff using regional facilities. Developers could pool their capital to build a regional detention basin at a strategic location in place of installing a basin on each individual site.

The potential for locating regional facilities within the Susquehanna River Tributaries Watershed was evaluated. The six parameters used for locating such a facility were:

- Site location's influence on the total watershed hydrology
- Available undeveloped land
- Ownership of the land
- Topography
- Environmental sensitivity of the locations
- Total area and percent of the total contributing area to the basin location

The existing natural and unintentionally created stormwater detention areas identified in Table III-7 should be preserved as they presently provide regional stormwater control. Any development within these areas will require the developer to evaluate the developments affect on reducing the regional detention storage on peak downstream discharges as well as meeting the required stormwater requirements for that Stormwater District. No other regional detention facilities were identified within the watershed.

I. Best Management Practices

The use of traditional and innovative Best Management Practices (BMP's) is encouraged to meet the water quantity and quality criteria established in this Plan. The Pennsylvania Handbook of Best Management Practices for Developing Areas prepared by the Pennsylvania Association of Conservation Districts, Inc., Spring, 1998 should be referenced for design and maintenance of these practices/facilities.

SECTION VI
ORDINANCE PROVISIONS

The Stormwater Management Act emphasizes locally administered stormwater programs with the watershed municipalities taking the lead role. Enforcement of the watershed plan standards and criteria will require the municipalities to incorporate them into their applicable ordinances that address land development. Section VII of this Plan provides a model stormwater ordinance. This model ordinance is a single purpose stormwater ordinance that should be adopted by each Municipality with minor changes to fulfill the needs of a particular Municipality.

In addition to adopting the ordinance itself, the municipalities would also have to revise their existing subdivision, land development, and zoning ordinances to incorporate the necessary linking provisions. These linking provisions would refer to any applicable regulated activities within the watershed to the single purpose ordinance. Key provisions of the model stormwater ordinance include the drainage standards and criteria, performance standards for stormwater management, and maintenance provisions for stormwater facilities.

Finally, the model stormwater ordinances should be understandable, applied fairly and uniformly throughout the watershed, and should not discourage creative solutions to stormwater management problems. It would be desirable for the municipalities to adopt a uniform regulatory approach for the Susquehanna River Tributaries Watersheds.

The implementation of the runoff control strategy for new development will be through municipal adoption of the appropriate ordinance provisions. As part of the preparation of Susquehanna River Tributaries Watershed Stormwater Management Plan, a model municipal ordinance has been prepared which would implement the Plan provisions presented in the ordinance as a single purpose ordinance. This could be adopted essentially "as is" (with some modification) by the municipalities. Provisions would also be required in the Subdivision and Land Development Ordinance to ensure that activities regulated by the ordinance were appropriately referenced. The "Susquehanna River Tributaries Watershed Act 167 Stormwater Management Ordinance" will not completely replace the existing storm drainage ordinance provisions currently in effect in the municipalities. The reasons for this are as follows:

- Not all of the municipalities in Susquehanna River Tributaries Basin are completely within the watershed. For those portions of the Municipality outside Susquehanna River Tributaries watershed, the existing ordinance provisions would still apply. Storm water controls will be designed according to management district C criteria.
- The Act 167 Ordinance regulates permanent and temporary stormwater control facilities. Stormwater management and erosion and sedimentation control during construction would continue to be regulated under the existing stormwater ordinance and Chapter 102 Erosion and Sediment and Pollution Controls, Title 25 of DEP Regulations.
- The Act 167 Ordinance contains only those minimum stormwater runoff control criteria and standards, which are necessary or desirable from a total watershed perspective. Additional stormwater management design criteria (i.e., inlet spacing, inlet type, collection system details, etc.) which should be based on sound engineering practice will be covered in the municipalities land development ordinance.

The text of the ordinance is organized into eight articles as follows:

I. General Provisions
II. Definitions
III. Stormwater Management
IV. Drainage Plan Requirements
V. Inspections
VI. Fees and Expenses
VII. Maintenance Responsibilities
VIII. Enforcement and Penalties

Within six months following adoption and approval of the Watershed Stormwater Management Plan, each Municipality shall adopt or amend, and shall implement such ordinances and regulations, including zoning, subdivision and land development, building code, and erosion and sedimentation control ordinances, as are necessary to regulate development within the Municipality in a manner consistent with the applicable Watershed Stormwater Management Plan and provisions of the Act.

The following amendment is required for municipalities that issue an occupancy permit:

- An Occupancy Permit shall not be secured or issued unless the provisions of the Susquehanna River Tributaries Stormwater Management have been followed. The Occupancy Permit shall be required for each lot owner and/or developer of all major and minor subdivisions and land development in the Municipality. For municipalities without an Occupancy Permit, they may want to adopt the above draft and also include other regulatory items in the occupancy permit requirement for their own purpose and use.

ORDINANCE REQUIREMENTS

The following ordinance provisions must be retained when a Municipality either elects to create a single-purpose stormwater ordinance or amends existing subdivision or zoning ordinances to implement the stormwater management plan.

- Article I - General Provisions
- Article II - Definitions
- Article III - Design Criteria for Stormwater Management Facilities Sections 301, 302, 303 (Except F), 305, 306, 307, 308 & 309
- Article IV - Drainage Plan Requirements
- Article VII - Maintenance Responsibilities Section 701 & 702
- Article VIII - Enforcement and Penalties (only when enacting a single purpose Ordinance)
- Appendices - Appropriate Plates from Appendix “A”, entire Appendix “B” and appropriate sections of Appendix “C” from Susquehanna River Tributaries Act 167 Plan. (The option is to reference the appropriate Appendices and Plate Numbers from the Susquehanna River Tributaries Act 167 Plan that apply to that specific municipality in the ordinance.)

The following ordinance provisions are optional, but recommended to be retained:

- Section 303F
- Section 304 – Stormwater Management Standards for portions of Municipality not within the Susquehanna Tributaries District.
- Section 310 – Redevelopment Activities
- Article V – Inspections
- Article VI - Fees and Expenses
- Article VII – Sections 703 & 702

All other provisions are mandatory and may be slightly modified to be consistent with other municipal ordinances related to land development. Any modifications should not change the intent of that section of the ordinance.

NOTE: If a Municipality chooses to use the model ordinance to implement the stormwater management plan, it is recommended that the ordinance be submitted to the municipal solicitor, municipal engineer, and DEP for review prior to enactment.

SUSQUEHANNA RIVER TRIBUTARIES
COLUMBIA COUNTY, PA

MODEL ACT 167 STORMWATER MANAGEMENT ORDINANCES

PLEASE HAVE YOUR SOLICITOR REVIEW THE ENCLOSED ORDINANCE AND CHECK THE APPLICABILITY OF ALL SECTIONS TO YOUR MUNICIPALITY

If you have any questions, please call
Durla Lathia or Lynn Manahan of the
DEP Stormwater Planning and Management Section
at (717) 772-4048

SUSQUEHANNA RIVER TRIBUTARIES
COLUMBIA COUNTY

STORMWATER MANAGEMENT

ORDINANCE

ORDINANCE NO. _____

_____, _____ COUNTY, PENNSYLVANIA

Adopted at a Public Meeting Held on
_____, 2002

TABLE OF CONTENTS

ARTICLE VIII-ENFORCEMENT AND PENALTIES

ARTICLE I
GENERAL PROVISIONS

Section 101. Statement of Findings

The governing body of the Municipality finds that:

A. Inadequate management of accelerated stormwater runoff resulting from development throughout a watershed increases flood flows and velocities, contributes to erosion and sedimentation, overtaxes the carrying capacity of existing streams and storm sewers, greatly increases the cost of public facilities to convey and manage stormwater, undermines floodplain management and flood reduction efforts in upstream and downstream communities, reduces groundwater recharge, and threatens public health and safety.

B. A comprehensive program of stormwater management, including reasonable regulation of development and activities causing accelerated erosion, is fundamental to the public health, safety, welfare, and the protection of the people of the Municipality and all the people of the Commonwealth, their resources, and the environment.

Section 102. Purpose

The purpose of this Ordinance is to promote health, safety, and welfare within the Susquehanna River Tributaries by minimizing the damages described in Section 101.A of this Ordinance through provisions designed to:

A. Manage accelerated runoff and erosion and sedimentation problems at their source by regulating activities that cause these problems.

B. Utilize and preserve the existing natural drainage systems.

C. Require recharge of groundwater and prevent degradation of groundwater quality.

D. Maintain existing flows and quality of streams and watercourses in the Municipality and the Commonwealth.

E. Preserve and restore the flood-carrying capacity of streams.

F. Provide proper maintenance of all permanent stormwater management facilities that are constructed in the Municipality.

G. Provide performance standards and design criteria for watershed-wide stormwater management and planning.

Section 103. Statutory Authority

The Municipality is empowered to regulate land use activities that affect runoff by the authority of the Act of July 31, 1968, P.L. 805, No. 247, The Pennsylvania Municipalities Planning Code, as amended by Act 170 of December 21, 1988 and Act 131 of December 14, 1992, [and the applicable Municipal Code].

Section 104. Applicability

This Ordinance shall apply to those areas of the Municipality that are located within the Susquehanna Tributaries Watershed, as delineated in Appendix A which is hereby adopted as part of this Ordinance.

This Ordinance shall only apply to permanent stormwater management facilities constructed as part of any of the Regulated Activities listed in this Section. Stormwater management and erosion and sedimentation control during construction activities are specifically not regulated by this Ordinance, but shall continue to be regulated under existing laws and ordinances.

This Ordinance contains only the stormwater management performance standards and design criteria that are necessary or desirable from a watershed wide perspective. Local stormwater management design criteria (e.g. inlet spacing, inlet type, collection system design and details, outlet structure design, etc.) shall continue to be regulated by the applicable Municipal Ordinances or at the municipal engineer's discretion.

The following activities are defined as "Regulated Activities" and shall be regulated by this Ordinance:

A. Land development.
B. Subdivision.
C. Construction of new or additional impervious or semi-pervious surfaces (driveways, parking lots, etc.).
D. Construction of new buildings or additions to existing buildings.
E. Diversion or piping of any natural or man-made stream channel.
F. Installation of stormwater management facilities or appurtenances thereto.

Section 105. Repealer

Any ordinance or ordinance provision of the Municipality inconsistent with any of the provisions of this Ordinance is hereby repealed to the extent of the inconsistency only.

Section 106. Severability

Should a court of competent jurisdiction declare any section or provision of this Ordinance invalid, such decision shall not affect the validity of any of the remaining provisions of this Ordinance.

Section 107. Compatibility with Other Ordinance Requirements

Approvals issued pursuant to this Ordinance do not relieve the Applicant of the responsibility to comply with or to secure required permits or approvals for activities regulated by any other applicable code, rule, statutes, or ordinance.

Section 108. Landowner Responsibility

The granting of an exemption, permit, or approval by the Municipality, does not relieve the applicant from assuring that stormwater runoff from the development site will not cause injury to other persons or property.

ARTICLE II
DEFINITIONS

For the purposes of this chapter, certain terms and words used herein shall be interpreted as follows:

A. Words used in the present tense include the future tense; the singular number includes the plural, and the plural number includes the singular; words of masculine gender include feminine gender; and words of feminine gender include masculine gender.

B. The word "includes" or "including" shall not limit the term to the specific example but is intended to extend its meaning to all other instances of like kind and character.

C. The word "person" includes an individual, firm, association, organization, partnership, trust, company, corporation, or any other similar entity.

D. The words "shall" and "must" are mandatory; the words "may" and "should" are permissive.

E. The words "used or occupied" include the words "intended, designed, maintained, or arranged to be used, occupied or maintained".

Accelerated Erosion - The removal of the surface of the land through the combined action of man's activity and the natural processes of a rate greater than would occur because of the natural process alone.

Agricultural Activities - The work of producing crops and raising livestock including tillage, plowing, disking, harrowing, pasturing and installation of conservation measures. Construction of new buildings or impervious area is not considered an agricultural activity.

Alteration - As applied to land, a change in topography as a result of the moving of soil and rock from one location or position to another; also the changing of surface conditions by causing the surface to be more or less impervious; land disturbance.

Applicant - A Landowner or developer who has filed an application for approval to engage in any Regulated Activities as defined in Section 104 of this Ordinance.

BMP (Best Management Practice) - Stormwater structures, facilities and techniques to maintain or improve the water quality of surface runoff.

Channel Erosion - The widening, deepening, and head ward cutting of small channels and waterways, due to erosion caused by moderate to large floods.

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - The Columbia, Luzerne or Montour County Conservation District.

Culvert - A structure with appurtenant works, which carries a stream under or through an embankment or fill.

Dam - An artificial barrier, together with its appurtenant works, constructed for the purpose of impounding or storing water or another fluid or semi fluid, or a refuse bank, fill or structure for highway, railroad or other purposes which does or may impound water or another fluid or semi fluid.

Design Storm - The magnitude and temporal distribution of precipitation from a storm event measured in probability of occurrence (e.g. a 5-year storm) and duration (e.g. 24-hours), used in the design and evaluation of stormwater management systems.

Designee - The agent of the Municipality involved with the administration, review or enforcement of any provisions of this ordinance by contract or memorandum of understanding.

Detention Basin - An impoundment structure designed to manage stormwater runoff by temporarily storing the runoff and releasing it at a predetermined rate.

Developer - A person, partnership, association, corporation, or other entity, or any responsible person therein or agent thereof, that undertakes any Regulated Activity of this Ordinance.

Development Site - The specific tract of land for which a Regulated Activity is proposed.

Downslope Property Line - That portion of the property line of the lot, tract, or parcels of land being developed located such that all overland or pipe flow from the site would be directed towards it.

Drainage Conveyance Facility - A Stormwater Management Facility designed to transmit stormwater runoff and shall include streams, channels, swales, pipes, conduits, culverts, storm sewers, etc.

Drainage Easement - A right granted by a Landowner to a grantee, allowing the use of private land for stormwater management purposes.

Drainage Permit - A permit issued by the Municipality after the drainage plan has been approved. Said permit is issued prior to or with the final Municipal approval.

Drainage Plan - The documentation of the stormwater management system, if any, to be used for a given development site, the contents of which are established in Section 403.

Earth Disturbance - Any activity including, but not limited to, construction, mining, timber harvesting and grubbing which alters, disturbs, and exposes the existing land surface.

Emergency Spillway – An earthen or structural spillway designed to convey large flood flows safely past earth embankments.

Erosion - The movement of soil particles by the action of water, wind, ice, or other natural forces.

Erosion and Sediment Pollution Control Plan - A plan, which is designed to minimize, accelerated erosion and sedimentation pursuant to 25 Pa. Code, Chapter 102.

Existing Conditions - The initial condition of a project site prior to the proposed construction. If the initial condition of the site is undeveloped land, the land use shall be considered as "meadow" unless the natural land cover is proven to generate lower curve numbers or Rational "C" value, such as forested lands.

Flood - A general but temporary condition of partial or complete inundation of normally dry land areas from the overflow of streams, rivers, and other waters of this Commonwealth.

Floodplain - Any land area susceptible to inundation by water from any natural source or delineated by applicable Department of Housing and Urban Development, Federal Insurance Administration Flood Hazard Boundary - Mapped as being a special flood hazard area. Also included are areas that comprise Group 13 Soils, as listed in Appendix A of the Pennsylvania Department of Environmental Protection (PADEP) Technical Manual for Sewage Enforcement Officers (as amended or replaced from time to time by PADEP).

Floodway - The channel of the watercourse and those portions of the adjoining floodplains that is reasonably required to carry and discharge the 100-year frequency flood. Unless otherwise specified, the boundary of the floodway is as indicated on maps and flood insurance studies provided by FEMA. In an area where no FEMA maps or studies have defined the boundary of the 100-year frequency floodway, it is assumed - absent evidence to the contrary - that the floodway extends from the stream to 50 feet from the top of the bank of the stream.

Forest Management/Timber Operations - Planning and activities necessary for the management of forestland. These include timber inventory and preparation of forest management plans, silvicultural treatment, cutting budgets, logging road design and construction, timber harvesting, site preparation and reforestation.

Freeboard - A vertical distance between the elevation of the design high water and the top of a dam, levee, tank, basin, or diversion ridge. The space is required as a safety margin in a pond or basin.

Grade - A slope, usually of a road, channel or natural ground specified in percent and shown on plans as specified herein. (To) Grade - to finish the surface of a roadbed, top of embankment or bottom of excavation.

Grassed Waterway - A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses, used to conduct surface water from cropland.

Groundwater Recharge - Replenishment of existing natural underground water supplies.

Impervious Surface - A surface that prevents the percolation of water into the ground.

Impoundment - A retention or detention basin designed to retain stormwater runoff and release it at a controlled rate.

Infiltration Structures - A structure designed to direct runoff into the ground (e.g. french drains, seepage pits, seepage trench).

Inlet - A surface connection to a closed drain. A structure at the diversion end of a conduit. The upstream end of any structure through which water may flow.

Land Development - (i) the improvement of one lot or two or more contiguous lots, tracts, or parcels of land for any purpose involving (a) a group of two or more buildings, or (b) the division or allocation of land or space between or among two or more existing or prospective occupants by means of, or for the purpose of streets, common areas, leaseholds, condominiums, building groups, or other features; (ii) any subdivision of land; (iii) development in accordance with Section 503(1.1)of the PA Municipalities Planning Code.

Land/Earth Disturbance - Any activity involving removing, grading, tilling, digging, or filling of ground or stripping of vegetation or any other activity that causes an alteration to the natural condition of the land.

Main Stem (Main Channel) - Any stream segment or other runoff conveyance facility used as a reach in the individual Susquehanna Tributaries Watersheds.

Manning Equation in (Manning formula) - A method for calculation of velocity of flow (e.g. feet per second) and flow rate (e.g. cubic feet per second) in open channels based upon channel shape, roughness, depth of flow and slope. "Open channels" may include closed conduits so long as the flow is not under pressure.

Municipality -_____ , (Columbia, Luzerne or Montour County), Pennsylvania.

Non-point Source Pollution - Pollution that enters a water body from diffuse origins in the watershed and does not result from discernible, confined, or discrete conveyances or origin.

NRCS - Natural Resource Conservation Service (previously SCS).

Open Channel - A drainage element in which stormwater flows with an open surface. Open channels include, but shall not be limited to, natural and man-made drainage ways, grass waterways, lined waterways, swales, streams, ditches, canals, and pipes flowing partly full (for computational purposes).

Outfall - Point where water flows from a conduit, stream, or drain.

Outlet - Points of water disposal from a stream, river, lake, tidewater or artificial drain.

Parking Lot Storage - The use of impervious parking areas for temporary impoundment of stormwater with controlled release rates during rainstorms.

Peak Discharge - The maximum rate of stormwater runoff from a specific storm event.

Penn State Runoff Model - A computer-based hydrologic modeling technique.

Pipe - A culvert, closed conduit, or similar structure (including appurtenances) that conveys stormwater.

Planning Commission - The Planning Commission of _____.

PMF - Probable Maximum Flood - The flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that is reasonably possible in any area. The PMF is derived from the probable maximum precipitation (PMP) as determined on the basis of data obtained from the National Oceanographic and Atmospheric Administration (NOAA).

POI – Point of Interest – Downstream point for tributary or tributaries in which increased runoff must be analyzed for its potential impact.

Principal Spillway – A pipe, weir or other appurtenant works designed to control the required detention storm.

Rational Formula - A rainfall-runoff relation used to estimate peak flow.

Regional Stormwater Detention/Retention Facility – A stormwater detention or retention facility located within the same subwatershed as the land development but not within the development area, which will provide the same stormwater controls required by the ordinance. A regional facility may be designed to provide controls from multiple but separate sites within the designated subwatershed.

Regulated Activities - Actions or proposed actions that have an impact on stormwater runoff and that are specified in Section 104 of this Ordinance.

Retention Basin - An impoundment in which stormwater is stored and not released during the storm event. Stored water may be released from the basin at some time after the end of the storm.

Return Period - The average interval, in years, within which a storm event of a given magnitude can be expected to recur. For example, the 25-year return period rainfall would be expected to recur on the average once every twenty-five years.

Riser - A vertical pipe extending from the bottom of a pond that is used to control the discharge rate from the pond for a specified design storm.

Rooftop Detention - Temporary ponding and gradual release of stormwater falling directly onto flat roof surfaces by incorporating controlled-flow roof drains into building designs.

Runoff - Any part of precipitation that flows over the land surface.

Sediment Basin - A barrier, dam, retention or detention basin designed to retain rock, sand, gravel, silt, or other material transported by water.

Sediment Pollution - The placement, discharge or introduction of sediment into the waters of the Commonwealth.

Sedimentation - The process by which mineral or organic matter is accumulated or deposited by the movement of water.

Seepage Pit/Seepage Trench - An area of excavated earth filled with loose stone or similar coarse material, into which surface water is directed for infiltration into the ground.

Sheet Flow - Runoff that flows over the ground surface as a thin, even layer, not concentrated rill, gully or in a channel.

Soil-Cover Complex Method - A method of runoff computation developed by the NRCS that is based on relating soil type and land use/cover to a runoff parameter called Curve Number (CN).

Soil Group, Hydrologic - A classification of soils by the Soil Conservation Service into four runoff categories. The groups range from A soils, which are very permeable and produce little runoff, to D soils, which are not very permeable and produce much more runoff.

Spillway – A device or devices that safely convey the design storms of a dam without endangering its safety or integrity.

Storage Indication Method - A reservoir routing procedure based on solution of the continuity equation (inflow minus outflow equals the change in storage) with outflow defined as a function of storage volume and depth.

Storm Frequency - The number of times that a given storm "event" occurs or is exceeded on the average in a stated period of years. See "Return Period".

Storm Sewer - A system of pipes and/or open channels that convey intercepted runoff and stormwater from other sources, but excludes domestic sewage and industrial wastes.

Stormwater – Runoff generated by precipitation or snowmelt.

Stormwater Management Facility - Any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects stormwater runoff. Typical stormwater management facilities include, but are not limited to, detention and retention basins, open channels, storm sewers, pipes, and infiltration structures. The term does not include replacement wetlands or major dams and reservoirs constructed for water supply, recreation, river basin flood control or other regional or basin-wide purposes.

Stormwater Management Site Plan - The plan prepared by the Developer or his representative indicating how stormwater runoff will be managed at the particular site of interest within Susquehanna Tributaries Watershed adopted by Columbia County as required by the Act of October 4, 1978, P.L. 864 (Act 167) as known as the Susquehanna River Tributaries Act 167 Stormwater Management Plan.

Stream Enclosure - A bridge, culvert or other structure in excess of 100 feet in length upstream to downstream which encloses a regulated water of this Commonwealth.

Subdivision - The division or re-division of a lot, tract, or parcel of land by any means into two or more lots, tracts, parcels or other divisions of land including changes in existing lot lines for the purpose, whether immediate or future, of lease, transfer of ownership, or building or lot development: Provided, however, that the subdivision by lease of land for agricultural purposes into parcels of more than ten acres, not involving any new street or easement of access or any residential dwellings, shall be exempt.

Swale - A low-lying stretch of land, which gathers or carries surface water runoff.

Timber Operations - See Forest Management.

Time of Concentration (Tc) - The time for surface runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed. This time is the combined total of overland flow time and flow time in pipes or channels, if any.

Watercourse - A stream of water; river; brook; creek; or a channel or ditch for water, whether natural or manmade.

Waters of the Commonwealth - Any and all rivers, streams, creeks, rivulets, ditches, watercourses, storm sewers, lakes, dammed water, wetlands, ponds, springs, and all other bodies or channels of conveyance of surface and underground water, or parts thereof, whether natural or artificial, within or on the boundaries of this Commonwealth.

Wetland - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs, fens, and similar areas.

ARTICLE III
STORMWATER MANAGEMENT

Section 301. General Requirements

All regulated activities in the Municipality, which do not fall under the exemption criteria shown below, shall submit a drainage plan consistent with this ordinance to the Municipality for review.

A. Stormwater Management Exemption Criteria – Any regulated activity that meets the following exception criteria is exempt from the provisions of this Ordinance. Exemption shall not relieve the applicant from implementing groundwater recharge, water quality and Section 303J and such measures as are necessary to protect health, safety and property.

1. Impervious Area Exemption:

   Impervious cover shall include, but not be limited to, any roof, parking or driveway areas and any new streets and sidewalks. Any areas designed to initially be gravel or crushed stone shall be assumed to be impervious for the purposes of comparison to the waiver criteria. These criteria shall apply to the total development even if development is to take place in phases. The date of the Municipal Ordinance adoption shall be the starting point from which to consider tracts as "parent tracts" in which future subdivisions and respective impervious area computations shall be cumulatively considered.

Impervious Area Exemption

Total Parcel size	Exemption (sq. ft.)
0.5 – 1 acre	5,000
> 1 –2 acres	10,000
> 2 – 5 acres	15,000
> 5 acres	20,000

2. Use of land for gardening for home consumption.

3. Agriculture when operated in accordance with a conservation plan or erosion and sedimentation control plan found adequate by the Conservation District. The agricultural activities such as growing crops, rotating crops, tilling of soil, grazing animals and other such activities are specifically exempt from complying with the requirements of this Ordinance. Installation of new or expansion of existing farmsteads and production areas having impervious surfaces shall be subject to the provisions of this ordinance.

4. Forest Management operations, which are following the Department of Environmental Protections' management practices, contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an erosion and sedimentation control plan.

   No exemption shall be provided for Regulated Activities as defined in Section 104.E and 104.F of this Ordinance.

A. Stormwater drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by stormwater management facilities or open channels consistent with this Ordinance.

C. The existing points of concentrated or diffused drainage that discharge onto adjacent property shall not be altered without permission of the adjacent property owner(s) and shall be subject to any applicable discharge criteria specified in this Ordinance.

D. Areas of existing diffused drainage discharge shall be subject to any applicable discharge criteria in the general direction of existing discharge, whether proposed to be concentrated or maintained as diffused drainage areas, except as otherwise provided by this ordinance. If diffused flow is proposed to be concentrated and discharged onto adjacent property, the Developer must document that adequate downstream conveyance facilities exist to safely transport the concentrated discharge, or otherwise prove that no erosion, sedimentation, flooding or other harm will result from the concentrated discharge.

E. Where a development site is traversed by watercourses drainage easements shall be provided conforming to the line of such watercourses. The terms of the easement shall prohibit excavation, the placing of fill or structures, and any alterations that may adversely affect the flow of stormwater within any portion of the easement. Also, maintenance, including mowing of vegetation within the easement shall be required, except as approved by the appropriate governing authority.

F. When it can be shown that, due to topographic conditions, natural drainage ways on the site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainage ways. Work within natural drainage ways shall be subject to approval by PADEP through the Joint Permit Application process, or, where deemed appropriate by PADEP, through the General Permit process.

G. Any stormwater management facilities regulated by this Ordinance that would be located in or adjacent to waters of the Commonwealth or wetlands shall be subject to approval by PA DEP through the Joint Permit Application process, or, where deemed appropriate by PA DEP, the General Permit process. When there is a question whether wetlands may be involved, it is the responsibility of the Developer or his agent to show that the land in question cannot be classified as wetlands, otherwise approval to work in the area must be obtained from PA DEP.

H. Any stormwater management facilities regulated by this Ordinance that would be located on State highway rights-of-way shall be subject to approval by the Pennsylvania Department of Transportation (PENNDOT).

I. Roof drains should not be connected to streets, sanitary or storm sewers or roadside ditches. Roof drains should outlet to vegetated areas or to infiltration facilities or detention/retention structures. When it is more advantageous to connect directly to streets or storm sewers, then it shall be permitted on a case-by-case basis by the Municipality.

J. "Downstream Hydraulic Capacity Analysis" - Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall use the following criteria for determining adequacy for accepting increased peak flow rates:

1. Natural channels must be able to convey the increased runoff associated with a 2-year return period event within their banks at velocities consistent with protection of the channels from erosion. Man made channels shall be designed in accordance with the municipal ordinance and as a minimum will meet Chapter 104 or 105 regulations. Acceptable velocities shall be based upon criteria included in the DEP “Erosion and Sediment Pollution Control Program Manual”.

2. Natural or man-made channels or swales must be able to convey the required return period runoff without creating any hazard to persons or property. Where channels or swales are constructed within the boundaries of the 100-year flood plain they shall be designed so that the flood plain boundaries are not widened or its depth increased.

3. Culverts, bridges, storm sewers or any other facilities which must pass or convey flows from the tributary area must be designed in accordance with DEP, Chapter 105 regulations (if applicable) and, at a minimum, pass the increased 25-year return period runoff.

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Section 302. Stormwater Management Districts Susquehanna River Tributaries

A. The Susquehanna River Tributaries Watershed has been divided into stormwater management Districts as defined in Table 302-1. The sub area boundaries are shown on Plates 2-1 through 2-7 in Appendix A of the Susquehanna River Tributaries Management Plan.

Standards for managing runoff from each sub area in Susquehanna River Tributaries Watershed for the 2, 5, 10, 25, 50 and 100-year design storms is shown below. Development sites located in each of the release rate Districts must control post-development runoff rates to pre-development runoff rates, as adjusted for the required release rate, for the design storms as follows:

Table 302-1
Design Release Rate
(To be completed for local municipalities subwatersheds in accordance with the Susquehanna River Tributaries Stormwater Management Plan)

*District	Sub areas	Design Storm Release Rate As a Percent of Existing 2, 5, 10, 25, 50 & 100-year 24-Hour Storms

* EXPLANATION OF DISTRICT: A District is an area within whose boundaries all new development will be designed to the specified post development storm runoff for the 2 through 100-year 24-hour storms reduced to the required percentage of the predevelopment runoff for those storms. Infiltration and water quality BMP affects in reducing the post development storm shall be included in designing stormwater controls to meet the District requirements.

In addition to the requirements specified above, the Erosion and Sedimentation Control Requirements (Section 307), Ground Water Recharge (Section 308) and Water Quality Requirements (Section 309) shall be implemented.

Section 303. Stormwater Management District Implementation Provisions (Performance Standards)

A. General – Post-Development rates of runoff within subwatersheds from any regulated activity shall meet the peak release rates of runoff prior to development for the design storms specified in Table V-3 of the Susquehanna River Tributaries Stormwater Management Plan and Section 302, of this Ordinance.

B. District Boundaries - The boundaries of the Stormwater Management Districts are the sub area boundaries shown on an official map that is available for inspections at the municipal office. A copy of the official map at a reduced scale is included in the Ordinance Appendix A. The exact location of the Stormwater Management District boundaries as they apply to a given development site shall be determined by mapping the boundaries using the two-foot topographic contours (or most accurate data required) provided as part of the Drainage Plan.

C. Sites Located in More Than 1 District – For a proposed development site located within two or more stormwater management district category sub areas, the peak discharge rate from any sub area shall be the pre-development peak discharge as adjusted for the required release rate for that sub area as indicated in Section 302. The calculated peak discharges shall apply regardless of whether the grading plan changes the drainage area by sub area.

D. Off-Site Areas – Off-site Areas that drain through a proposed development site are not subject to release rate criteria when determining allowable peak runoff rates. However, on-site drainage facilities shall be designed to safely convey off-site flows through the development site.

E. Site Areas – Where the site area to be impacted by a proposed development activity differs significantly from the total site area, only the proposed development area shall be subject to the Management District Criteria. In other words, stormwater runoff from undeveloped areas of the site bypassing the developed portion of the site's stormwater management facilities would not be subject to the Management District Criteria.

F. "No Harm" Option – For any proposed development site the developer has the option of using a less restrictive runoff control (including no detention) if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. The "no-harm" Option is used when a developer can prove that the post-development hydrographs can match pre-development hydrographs, or if it can be proved that the post-development conditions will not cause increases in peaks at all points downstream. Proof of "no-harm" would have to be shown based upon the following "Downstream Impact Evaluation" to determine if adequate hydraulic capacity exists. The land developer shall submit to the Municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.

1. The "Downstream Impact Evaluation" shall include hydrologic and hydraulic calculations necessary to determine the impact of hydrograph timing modifications due to the proposed development upon a dam, highway, structure, natural point of restricted stream flow or any stream channel section, established with the concurrence of the Municipality.

2. The evaluation shall continue downstream until the increase in flow diminishes due to additional flow from tributaries and/or stream attenuation.

3. The peak flow values to be used for downstream areas for the design return period storms 2, 5, 10, 25, 50, and 100-years shall be the values from the calibrated model for Susquehanna River Tributaries Watershed. These flow values can be obtained from Volume III of the watershed plan.

4. Developer-proposed runoff controls, which would generate increased peak flow rates at storm drainage problem areas would, by definition, be precluded from successful attempts to prove "no-harm", except in conjunction with proposed capacity improvements for the problem areas consistent with Section 303.G.

5. A financial distress shall not constitute grounds for granting a no-harm exemption.

6. Capacity improvements may be provided as necessary to implement the "no-harm" option, which proposes specific capacity improvements to provide that a less stringent discharge control would not create any harm downstream.

7. Any "no-harm" justifications shall be submitted by the developer as part of the Drainage Plan submission per Article IV.

G. "Downstream Hydraulic Capacity Analysis" – Any downstream capacity hydraulic analysis conducted in accordance with this Ordinance shall be consistent with Section 301.J.

H. Regional Detention Alternatives – For certain areas within the study area, it may be more cost-effective to provide one control facility for more than one development site than to provide an individual control facility for each development site. The initiative and funding for any regional runoff control alternatives are the responsibility of prospective developers. The design of any regional control basins must incorporate reasonable development of the entire upstream watershed. The peak outflow of a regional basin would be determined on a case-by-case basis using the hydrologic model of the watershed consistent with protection of the downstream watershed areas. "Hydrologic model" refers to the calibrated model as developed for the Stormwater Management Plan.

I. Existing Stormwater Storage Areas – For certain areas within the watershed, identified on the existing stormwater storage areas shown on Plates 2-1 through 2-7, in Appendix A, special requirements will apply. Stormwater is impounded in this area due to either natural or man-made features i.e., road construction acting as a dam, or a combination of both. Some of these areas are identified as being within the FEMA 100-year flood plain or floodway and some area outside of the present FEMA designation.

1. Development in these areas is subject to potential flooding.

2. Placement of fill for raising buildings above flood levels in these areas will reduce the available stormwater storage volume and increase downstream peak discharges. This increase in discharge downstream will occur unless measures are taken to replace the lost stormwater storage volume. Therefore development in these areas should be limited to open space uses where no earth fill is placed and with minimal building construction permitted.

3. Any development in these areas will be permitted only by replacing the lost storage volume within the watershed sub area at a location upstream from the first obstruction downstream from the area proposed for development. Analysis would have to be provided to show proof of "no-harm" to downstream areas.

Proof of “no-harm” would have to be shown based upon the “Downstream Impact Evaluation” which shall include a “downstream hydraulic capacity analysis” consistent with Section 303.F to determine if adequate hydraulic capacity exists. The land developer shall submit to the Municipality this evaluation of the impacts due to increased downstream stormwater flows in the watershed.

J. Special Requirements for EV and HQ Subwaterheds

Special requirements for areas falling within defined Exceptional Value and High Quality Sub-watersheds: The temperature and quality of water and streams that have been declared as exceptional value and high quality is to be maintained as defined in Chapter 93, Water Quality Standards, Title 25 of Pennsylvania Department of Environmental Protection Rules & Regulations. Temperature sensitive BMPs and stormwater conveyance systems are to be used and designed with storage pool areas and supply outflow channels and should be shaded with trees. This will require modification of berms for permanent ponds and the relaxation of restrictions on planting vegetation within the facilities, provided that capacity for volumes and rate control is maintained. At a minimum, the southern half on pond shorelines shall be planted with shade or canopy trees within ten (10) feet of the pond shoreline. In conjunction with this requirement, the maximum slope allowed on the berm area to be planted is 10 to 1. This will lessen the destabilization of berm soils due to root growth. A long term maintenance schedule and management plan for the thermal control BMPs is to be established and recorded for all development sites.

Section 304. Stormwater Management Standards for Portions of Municipality Not Within the Susquehanna Tributaries Districts

A. General Standards

The following general standards shall be applied to all development within [municipal name] to promote flow attenuation, erosion and sediment control and flood control.

1. All site development in the Municipality creating impervious area in excess of the amounts specified in Section V.J. of the Susquehanna River Tributaries Watershed Act 167 Stormwater Management Plan shall submit a drainage plan consistent with the provisions of this ordinance to the Municipality for review and approval. These criteria shall apply to the total proposed development even if the development is to take place in stages. Impervious cover shall include, but not be limited to, any roof, parking or driveway area and any new street or sidewalk. Any area initially designated to be gravel or crushed stone shall be assumed to be impervious.

2. Roof drains must not be connected to streets, sanitary or storm sewers or roadside ditches.

3. Runoff from the site shall not be concentrated or increased runoff discharged onto adjacent property without the written consent of the adjacent Landowners in the form of a drainage easement.

B. Detention / Infiltration Standards

1. Minimization of impervious surfaces and infiltration of runoff through seepage beds, infiltration trenches, etc. are encouraged, where soil conditions permit, to reduce the size or eliminate the need for detention facilities.

2. Post-development rates of runoff from any regulated activity shall not exceed the peak rates of runoff prior to development for the 2, 10, 25, 50 and 100-year 24-hour frequency storms.

Section 305. Design Criteria for Stormwater Management Facilities

A. Any stormwater facility located on State highway rights-of-way shall be subject to review and approval by the Pennsylvania Department of Transportation.

B. Any stormwater management facility (i.e. detention basin) designed to store runoff and requiring a berm or earthen embankment required or regulated by this ordinance shall be designed to provide an emergency spillway to handle flow up to and including the 100-year 24-hour post- development conditions. The height of embankment must be set as to provide a minimum 1.0 foot of freeboard above the maximum pool elevation computed when the facility functions for the 100-year post-development inflow. Should any stormwater management facility require a dam safety permit under PADEP Chapter 105, the facility shall be designed in accordance with Chapter 105. In order to meet the regulations of Chapter 105 concerning dam safety the dam spillways may be required to pass storms larger than 100-year event.

C. Any facilities that constitute water obstructions (e.g., culverts, bridges, outfalls, or stream enclosures), and any work involving wetlands as directed in PA DEP Chapter 105 regulations (as amended or replaced from time to time by PADEP), shall be designed in accordance with Chapter 105 and will require a permit from PADEP. Any other drainage conveyance facility that doesn't fall under Chapter 105 regulations must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm with a minimum 1.0-foot of freeboard measured below the lowest point along the top of the roadway. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm with a minimum 1.0-foot of freeboard measured below the lowest point along the top of roadway. Any facility that constitutes a dam as defined in PADEP chapter 105 regulations may require a permit under dam safety regulations. Any facility located within a PENNDOT right of way must meet PENNDOT minimum design standards and permit submission requirements.

D. Any drainage conveyance facility and/or channel that don’t fall under Chapter 105 Regulations, must be able to convey, without damage to the drainage structure or roadway, runoff from the 25-year design storm. Conveyance facilities to or exiting from stormwater management facilities (i.e. detention basins) shall be designed to convey the design flow to or from that structure. Roadway crossings located within designated floodplain areas must be able to convey runoff from a 100-year design storm. Any facility located within a PENNDOT right-of-way must meet PENNDOT minimum design standards and permit submission requirements.

E. Storm sewers must be able to convey post-development runoff from a 10-year design storm without surcharging inlets, where appropriate.

F. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.

G. The design of all stormwater management facilities shall incorporate sound engineering principles and practices. The Municipality shall reserve the right to disapprove any design that would result in the occupancy or continuation of an adverse hydrologic or hydraulic condition within the watershed.

H. Extreme caution shall be exercised where infiltration is proposed in geologically susceptible areas such as deep mined, strip mined, or limestone geology areas. Extreme caution shall also be exercised where salt or chloride would be a pollutant since soils do little to filter this pollutant and it may contaminate the groundwater. It is also extremely important that the design professional evaluate the possibility of groundwater contamination from the proposed infiltration/recharge facility and recommend a hydrogeologic justification study be performed if necessary. Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation. The infiltration requirement in the High Quality / Exceptional Waters shall be subject to the Department's Chapter 93 and Antidegradation Regulations. The municipality may require the installation of an impermeable liner in detention basins. A detailed hydrogeologic investigation may be required by the municipality.

It shall be the developer's responsibility to verify if the site is underlain by limestone. The following note shall be attached to all drainage plans and signed and sealed by the developer's engineer/surveyor/landscape architect/architect:
_____, Certify that the proposed detention basin (circle one) is/is not underlain by limestone.

Section 306. Calculation Methodology

Stormwater runoff from all development sites shall be calculated using either the rational method or a soil-cover-complex methodology.

A. Any stormwater runoff calculations involving drainage areas greater than 20 acres, including on and off-site areas, shall use generally accepted calculation technique that is based on the NRCS soil cover complex method. Table VIII-1 summarizes acceptable computation methods. It is assumed that all methods will be selected by the design professional based on the individual limitations and suitability of each method for a particular site.

The Municipal Engineer may approve the use of the Rational Method to estimate peak discharges from drainage areas that contain less than 20 acres.

B. All calculations consistent with this Ordinance using the soil cover complex method shall use the appropriate design rainfall depths for the various return period storms presented in Table B-1 in Appendix B of this Ordinance. If a hydrologic computer model such as PSRM or HEC-1, TR-55 or TR-20 is used for stormwater runoff calculations, then the duration of rainfall shall be 24 hours. The NRCS Type II curve shown in Figure B-1, Appendix B of this Ordinance shall be used for the rainfall distribution. As an alternative the rainfall depth presented in Table B-2 in Appendix B of this Ordinance from the "Field Manual of Pennsylvania Department of Transportation Storm Intensity – Duration Frequency charts PDT-IDF" (1986) Region IV may be used if the precipitation distribution method recommended for that storm is also used. Each storm frequency has a different distribution curve and must be developed for each storm being evaluated. Whichever method is used for the existing conditions shall also be used for the proposed conditions.

C. For the purposes of predevelopment flow rate determination, undeveloped land including farmland shall be considered as "meadow" good condition, unless the natural ground cover generates a lower curve number or Rational 'C' value (i.e. forest). For these areas

that have existing imperious areas within the planned development area the existing imperious area may be included in determination of the predevelopment flow rate.

D. All calculations using the Rational Method shall use rainfall intensities consistent with appropriate times of concentration for overland flow and return periods from the Design Storm Curves from PA Department of Transportation Design Rainfall Curves (1986) (Figure B-2). Times of concentration for overland flow shall be calculated using the methodology presented in Chapter 3 of Urban Hydrology for Small Watersheds, NRCS, TR-55, (as amended or replaced from time to time by NRCS). Times of concentration for channel and pipe flow shall be computed using Manning's equation. Time of concentration may also be computed using the procedure contained in the Federal Transportation publication HEC-22. If the watershed areas involved in the analysis are undeveloped the NRCS “Lag Equation” procedure may be used for the predevelopment condition, while using the TR-55 or HEC-22 method for the planned development condition.

E. Runoff Curve Numbers (CN) for both existing and proposed conditions to be used in the soil cover complex method shall be obtained from Table B-3 in Appendix B of this Ordinance.

F. Runoff coefficient (c) for both existing and proposed conditions for use in the rational method shall be obtained from Table B-4 in Appendix B of this Ordinance.

G. Where uniform flow is anticipated, the Manning equation shall be used for hydraulic computations, and to determine the capacity of open channels, pipes, and storm sewers. Values for Manning's roughness coefficient (n) shall be consistent with Table B-5 in Appendix B of the Ordinance. For grass lined swales or channels the procedures contained in the NRCS publication TP-61 “Handbook of Channel design for Soil and Water Conservation” shall be used.

Outlet structures for stormwater management facilities shall be designed to meet the performance standards of this Ordinance using any generally accepted hydraulic analysis technique or method.

H. The design of any stormwater detention facilities intended to meet the performance standards of this Ordinance shall be verified by routing the design storm hydrograph through these facilities using the Storage-Indication Method. For all drainage areas the design storm hydrograph shall be computed using a calculation method that produces a full hydrograph. The Municipality may approve the use of any generally accepted full hydrograph approximation technique, which shall use a total runoff volume that is consistent with the volume from a method that produces a full hydrograph.

I. The Municipality has the authority to require that computed existing runoff rates be reconciled with field observations and conditions. If the designer can substantiate through actual physical calibration that more appropriate runoff and time-of-concentration values should be utilized at a particular site, then appropriate variations may be made upon review and recommendations of the Municipal Engineer. Calibration shall require detailed gauge and rainfall data for the particular site in question.

TABLE 306-1
ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORMWATER MANAGEMENT PLANS

METHOD	METHOD DEVELOPED BY	APPLICABILITY
TR-20 or commercial Package Based on TR-20	USDA - NRCS	When use of full model is desirable or necessary
Tr-55 OR Commercial Package Based on TR-55	USDA - NRCS	Applicable for plans within the models limitations
HEC – 1	U.S. Army Corps of Engineers	When full model is desirable or necessary
HEC-HMS	U.S. Army Corps of Engineers	When full model is desirable or necessary
PSRM	Penn State University	When full model is desirable or necessary
Rational Method or commercial package based on Rational Method	Emil Kuiching (1889)	For sites less than 20 acres
Other Methods	Various	As approved by the municipal engineer

Section 307. Erosion and Sedimentation Requirements

A. Whenever the vegetation and topography are to be disturbed, such activity must be in conformance with Chapter 102, Title 25, Rules and Regulations, Part I, Commonwealth of Pennsylvania, Department of Environmental Protection, Subpart C, protection of Natural Resources, Article II, Water Resources, Chapter 102, "Erosion Control," and in accordance with the (Columbia, Luzerne or Montour) County Conservation District and the standards and specifications of the appropriate municipal government.

B. Additional erosion and sedimentation control design standards and criteria that must be or are recommended to be applied where infiltration BMP's are proposed and include the following:

1. Areas proposed for infiltration BMP's shall be protected from sedimentation and compaction during the construction phase, so as to maintain their maximum infiltration capacity.

2. Infiltration BMP's shall not be constructed nor receive runoff until the entire contributory drainage area to the infiltration BMP has received final stabilization.

Section 308. Ground Water Recharge

A. The ability to retain and maximize the ground water recharge capacity of the area being developed is required. Design of the stormwater management facilities shall give consideration to providing ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface is paved and roofed over. A geologic evaluation of the project site shall be performed to determine the suitability of recharge facilities. The evaluation shall be performed by a qualified professional and as a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and sub grade stability. Where pervious pavement is permitted for parking lots, recreational facilities, non-dedicated streets, or other areas, pavement construction specifications shall be noted on the plan.

B. Infiltration BMPs shall meet the following minimum requirements:

1. When possible the ground water recharge facility should be located on soils having the most permeable Hydrologic Soil Group designation.
2. A minimum depth of 48-inches between the bottom of the facility and the seasonal high water table and/or bedrock (limiting zones).
3. An infiltration and/or percolation rate sufficient to accept the additional stormwater load and drain completely as determined by the Owner's qualified professional, where the professional will be either a geologist, soil scientist, landscape architect or engineer.
4. Infiltration BMPs receiving only roof runoff may be placed in soils having a minimum depth of 24-inches between the bottom of the facility and the limiting zone.
5. Infiltration BMPs shall be located a minimum of 10 feet away from the foundation wall of any building.
6. The recharge facility shall be capable of completely infiltrating the impounded water within 48-hours.

C. A detailed soils evaluation of the project site shall be performed to determine the suitability for installation of recharge facilities. The evaluation shall be performed by a qualified professional, and at a minimum, address soil permeability, depth to bedrock, depth to seasonal high water table, susceptibility to sinkhole formation, and subgrade stability. The general process for designing the infiltration BMP shall be:

1. Analyze hydrologic soil groups as well as natural and man-made features within the watershed and site to determine general areas of suitability for infiltration practices.
2. Conduct field tests to determine appropriate percolation rate and/or soil hydraulic conductivity.
3. Determine seasonal high water table for the infiltration site.
4. Design infiltration structure for the required storm volume based upon field determination capacity at the level of the proposed infiltration surface.

D. Whenever a basin will be located in an area underlain by limestone, a geological evaluation of the proposed location shall be conducted to determine susceptibility to sinkhole formations. The design of all facilities over limestone formations shall include measures to prevent ground water contamination and, where necessary, sinkhole formation.

E. The groundwater infiltration volume shall be computed using the following procedure:
Groundwater Infiltration Computation Formula

GIv = [(S + 0.05)(PI)(A)] /12 = Cubic Feet (Groundwater Infiltration Volume)
S = Infiltration Values for Existing Conditions Soil Hydrologic Group
PI = Percent Imperious Cover for Site as a Decimal
A = Area of Site in Square Feet
12 = Conversion Factor for Inches to Feet
Values for S based upon Soil Hydrologic Group

Soil Hydrologic Group	Value of S in Inches
A	0.32
B	0.22
C	0.11
D	0.05

Section 309. Water Quality Requirements

A. In addition to the performance standards and design criteria requirements of Article III of this Ordinance, the land developer SHALL comply with the following water quality requirements of this Article.

B. Provisions shall be made so that the water quality volume storm takes a minimum of 24 hours to drain from the facility from a point where the maximum volume of water from the design storm is captured. (i.e., the maximum water surface elevation is achieved in the facility). Release of water can begin at the start of the storm (i.e., the invert of the water quality orifice is at the invert of the facility). The design of the facility shall consider and minimize the chances of clogging and sedimentation potential.

Recommended Procedure for Calculating Water Quality Treatment Volume is provided below for the Susquehanna Tributaries Watershed:

- Utilize the following Equation WQv = [(1.95)(PI)(A)]/12 =
- Where:
  - WQv = Water Quality Treatment Volume in Cubic Feet
  - 1.95 = the inches of Stormwater Runoff from an Impervious Area
  - PI = The percent of Site Impervious Area as a Decimal
  - A= Drainage Area in Square Feet
  - 12 = Conversion Factor for Inches to Feet

C. To accomplish A. and B. above, the land developer MAY submit original and innovative designs to the Municipal Engineer for review and approval. Such designs may achieve the water quality objectives through a combination of Best Management Practices (BMP's).

D. In selecting the appropriate BMP's or combinations thereof, the land developer SHALL consider the following:

1. Total contributing area
2. Permeability and infiltration rate of the site soils
3. Slope
4. Depth to bedrock
5. Seasonal high water table
6. Proximity to building foundations and well heads
7. Erodibility of soils
8. Land availability and configuration of the topography

E. The following additional factors SHOULD be considered when evaluating the suitability of BMPs used to control water quality at a given development site:

1. Peak discharge and required volume control
2. Stream bank erosion
3. Efficiency of the BMP's to mitigate potential water quality problems
4. The volume of runoff that will be effectively treated
5. The nature of the pollutant being removed
6. Maintenance requirements
7. Creation/protection of aquatic and wildlife habitat
8. Recreational value
9. Enhancement of aesthetic and property value

Section 310. Redevelopment Activities

General. To the extent that site characteristics allow, it is recommended that proposed redevelopment project designs shall include practices that are designed to result in a net reduction in impervious area. Where site constraints prevent impervious area reduction or the implementation of stormwater management practices, practical alternatives may be used to result in an improvement to water quality. The following apply to all redevelopment projects:

A. It is recommended that all redevelopment projects reduce existing site impervious area.

B. Where there will be a net increase in impervious area after redevelopment, Ground Water Recharge, Water Quality Requirements and Stormwater Release Rate Requirements shall be required for the net increase in impervious area but not for the existing impervious area.

1. The selected location of the facilities to meet the requirements shall be that which is most advantageous to provide the desired results. It shall be selected so that there is no net increase in peak discharge from any portion of the site to adjacent properties.
2. Ground water recharge sites and BMPs shall be selected so that there will not be an introduction of pollutants to the ground water system.

C. The redevelopment activities, with the approval of the municipal officials, may allow practical alternatives. Such practical alternatives may include, but not be limited to:

1. Off site BMP implementation for a drainage area, in the same watershed, comparable to that of the increased impervious area for the project,
2. Watershed or stream restoration, in the same watershed where the project is located,
3. Retrofitting an existing stormwater facility or BMP, to improve water quality and groundwater recharge,
4. Other practices recommended by the municipal engineer, or
5. Fees paid in an amount specified by the approval authority to a stormwater fund specifically dedicated for stormwater improvements and maintenance purposes.

ARTICLE IV
DRAINAGE PLAN REQUIREMENTS

Section 401. General Requirements

For any of the activities regulated by this Ordinance, the final approval of subdivision and/or land development plans, the issuance of any building or occupancy permit, or the commencement of any land disturbance activity may not proceed until the Property Owner or Developer or his/her agent has received written approval of a Drainage Plan from the Municipality.

Section 402. Drainage Plan Contents

The Drainage Plan shall consist of all applicable calculations, maps, and plans. A note on the maps shall refer to the associated computations and erosion and sedimentation control plan by title and date. The cover sheet of the computations and erosion and sedimentation control plan shall refer to the associated maps by title and date. All Drainage Plan materials shall be submitted to the Municipality in a format that is clear, concise, legible, neat, and well organized; otherwise, the Drainage Plan shall be disapproved and returned to the Applicant.

The following items shall be included in the Drainage Plan:

A. General

1. General description of project.

2. General description of permanent stormwater management techniques, including construction specifications of the materials to be used for stormwater management facilities.

3. Complete hydrologic, hydraulic, and structural computations for all stormwater management facilities.

4. Four copies completed drainage plan application as contained in Appendix C.

B. Map(s) of the project area shall be submitted on 24-inch x 36-inch or 30-inch x 42-inch sheets and shall be prepared in a form that meets the requirements for recording the offices of the Recorder of Deeds of (Columbia, Luzerne or Montour) County. The contents of the maps shall include, but not be limited to:

1. The location of the project relative to highways, municipalities or other identifiable landmarks.

2. Existing contours at intervals of two feet. In areas of steep slopes (greater than 15 percent), five-feet contour intervals may be used.

3. Existing streams, lakes, ponds, or other bodies of water within the project area.

4. Other physical features including flood hazard boundaries, sinkholes, streams, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the site.

5. The locations of all existing and proposed utilities, sanitary sewers, and water lines within 50 feet of property lines.

6. An overlay showing soil names and boundaries.

7. Proposed changes to the land surface and vegetative cover, including the type and amount of impervious area that would be added.

8. Proposed structures, roads, paved areas, and buildings.

9. Final contours at intervals of two feet. In areas of steep slopes (greater than 15 percent), five-feet contour intervals may be used.

10. The name of the development, the name and address of the owner of the property, and the name of the individual or firm preparing the plan.

11. The date of submission.

12. A graphic and written scale of one (1) inch equals no more than fifty (50) feet; for tracts of twenty (20) acres or more, the scale shall be one (1) inch equals no more than one hundred (100) feet.

13. A North arrow.

14. The total tract boundary and size with distances marked to the nearest foot and bearings to the nearest degree.

15. Existing and proposed land use(s).

16. A key map showing all existing man-made features beyond the property boundary that would be affected by the project.

17. Horizontal and vertical profiles of all open channels, including hydraulic capacity.

18. Overland drainage paths.

19. A fifteen-foot wide access easement around all stormwater management facilities that would provide ingress to and egress from a public right-of-way.

20. A note on the plan indicating the location and responsibility for maintenance of stormwater facilities that would be located off-site. All off-site facilities shall meet the performance standards and design criteria specified in this Ordinance.

21. A construction detail of any improvements made to sinkholes and the location of all notes to be posted, as specified in this Ordinance.

22. A statement signed by the Landowner, acknowledging the stormwater management system to be a permanent fixture that can be altered or removed only after approval of a revised plan by the Municipality.

23. The following signature block for the Municipal Engineer:

    "_____, on this date (date of signature), have reviewed and hereby certify that the Drainage Plan meets all design standards and criteria of the Municipal Ordinance."

24. The location of all erosion and sedimentation control facilities.

C. Supplemental Information

1. A written description of the following information shall be submitted.

   a) The overall stormwater management concept for the project.
   b) Stormwater runoff computation as specified in this Ordinance.
   c) Stormwater management techniques to be applied both during and after development.
   d) Expected project time schedule.

2. A soil erosion and sedimentation control plan, where applicable, including all reviews and approvals, as required by PADEP.

3. A geologic assessment of the effects of runoff on sinkholes as specified in this Ordinance.

4. The effect of the project (in terms of runoff volumes and peak flows) on adjacent properties and on any existing municipal stormwater collection system that may receive runoff from the project site.

5. A Declaration of Adequacy and Highway Occupancy Permit from the PENNDOT District Office when utilization of a PENNDOT storm drainage system is proposed.

6. Stormwater management and conveyance facilities operation and maintenance plan.

D. Stormwater Management Facilities

1. All stormwater management facilities must be located on a plan and described in detail.

2. When groundwater recharge methods such as seepage pits, beds or trenches are used, the locations of existing and proposed septic tank infiltration areas and wells must be shown.

3. All calculations, assumptions, and criteria used in the design of the stormwater management facilities must be shown.

Section 403. Plan Submission

For all activities regulated by this Ordinance, the steps below shall be followed for submission. For any activities that require a PADEP Joint Permit Application and regulated under Chapter 105 (Dam Safety and Waterway Management) or Chapter 106 (Floodplain Management) of PA DEP's Rules and Regulations, require a PENNDOT Highway Occupancy Permit, or require any other permit under applicable state or federal regulations, the permit(s) shall be part of the plan.

A. The Developer as part of the Preliminary Plan submission shall submit the Drainage Plan for the Regulated Activity.

B. Four (4) copies of the Drainage Plan shall be submitted.

C. Distribution of the Drainage Plan will be as follows:

1. Two (2) copies to the Municipality accompanied by the requisite Municipal Review Fee, as specified in this Ordinance. The Municipal fee schedule work sheet is contained in Appendix "C" which shall be completed to determine the fee. It shall accompany the check to the Municipality.

2. One (1) copy to the Municipal Engineers.

3. One (1) copy to the County Planning Commission/Department

Section 404. Drainage Plan Review

A. The Municipal Engineer shall review the Drainage Plan for consistency with the adopted Susquehanna Tributaries Watershed Act 167 Stormwater Management Plan. The Municipality shall require receipt of a complete plan, as specified in this Ordinance.

B. The Municipal Engineer shall review the Drainage Plan for any submission or land development against the municipal subdivision and land development ordinance provisions not superseded by this Ordinance.

C. For activities regulated by this Ordinance, the Municipal Engineer shall notify the Municipality in writing, within 30 calendar days, whether the Drainage Plan is consistent with this Ordinance. Should the Drainage Plan be determined to be consistent with this Ordinance, the Municipal Engineer will forward an approval letter to the Developer with a copy to the Municipal Secretary.

D. Should the Drainage Plan be determined to be inconsistent with this Ordinance, the Municipal Engineer will forward a disapproval letter to the Developer with a copy to the Municipal Secretary citing the reason(s) for the disapproval. Any disapproved Drainage Plans may be revised by the Developer and resubmitted consistent with this Ordinance.

E. The Municipal For Regulated Activities specified in Section 104 of this Ordinance, the Municipal Engineer shall notify the Municipal Building Permit Officer in writing, within a time frame consistent with the Municipal Building Code and/or Municipal Subdivision Ordinance, whether the Drainage Plan is consistent with this Ordinance and forward a copy of the approval/disapproval letter to the Developer. Any disapproved drainage plan may be revised by the Developer and resubmitted consistent with this Ordinance.

F. For Regulated Activities requiring a PADEP Joint Permit Application, the Municipal Engineer shall notify PADEP whether the Drainage Plan is consistent with this Ordinance and forward a copy of the review letter to the Municipality and the Developer. PADEP may consider the Municipal Engineer's review comments in determining whether to issue a permit.

G. The Municipality shall not approve any subdivision or land development for Regulated Activities specified in Section 104 of this Ordinance if the Drainage Plan has been found to be inconsistent with this Ordinance, as determined by the Municipal Engineer. All required permits from PADEP must be obtained prior to approval.

H. Building Permit Office shall not issue a building permit for any Regulated Activity specified in Section 104 of this Ordinance if the Drainage Plan has been found to be inconsistent with this Ordinance, as determined by the Municipal Engineer, or without considering the comments of the Municipal Engineer. All required permits from PADEP must be obtained prior to issuance of a building permit.

I. The Developer shall be responsible for completing an "As-Built Survey" of all stormwater management facilities included in the approved Drainage Plan. The As-Built Survey and an explanation of any discrepancies with the design plans shall be submitted to the Municipal Engineer for final approval. In no case shall the Municipality approve the As-Built Survey until the Municipality receives a copy of an approved Declaration of Adequacy, Highway Occupancy Permit from the PENNDOT District Office, and any applicable permits from PADEP.

J. The Municipality's approval of a Drainage Plan shall be valid for a period not to exceed _____ years. This _____-year time period shall commence on the date that the Municipality signs the approved Drainage Plan. If stormwater management facilities included in the approved Drainage plan have not been constructed, or if an As-Built Survey of these facilities has not been approved within this _____-year time period, then the Municipality may consider the Drainage plan disapproved and may revoke any and all permits. Drainage Plans that are considered disapproved by the Municipality shall be resubmitted in accordance with Section 406 of this Ordinance.

Section 405. Modification of Plans

A modification to a submitted Drainage Plan for a development site that involves a change in stormwater management facilities or techniques, or that involves the relocation or re-design of stormwater management facilities, or that is necessary because soil or other conditions are not as stated on the Drainage Plan as determined by the Municipal Engineer, shall require a resubmission of the modified Drainage Plan consistent with Section 403 of this Ordinance and be subject to review as specified in Section 404 of this Ordinance.

A modification to an already approved or disapproved Drainage Plan shall be submitted to the Municipality, accompanied by the applicable review fee. A modification to a Drainage Plan for which the Municipality has not taken a formal action shall be submitted to the Municipality, accompanied by the applicable Municipality Review Fee.

Section 406. Resubmission of Disapproved Drainage Plans

A disapproved Drainage Plan may be resubmitted, with the revisions addressing the Municipal Engineer's concerns documented in writing, to the Municipal Engineer in accordance with Section 404 of this Ordinance and be subject to review as specified in Section 405 of this Ordinance. The applicable Municipality Review Fee must accompany a resubmission of a disapproved Drainage Plan.

ARTICLE V
INSPECTIONS

Section 501. Schedule of Inspections

A. The Municipal Engineer or the municipal assignee shall inspect all critical phases of the installation of the permanent stormwater management facilities. The critical phases for inspection shall be determined by the reviewing engineer at the time the stormwater plan is reviewed. They shall be listed in the municipal engineer's approval letter.

B. During any stage of the work, if the Municipal Engineer determines that the permanent stormwater management facilities are not being installed in accordance with the approved Stormwater Management Plan, the Municipality shall suspend or revoke at the Engineer's discretion, any existing permits until a revised Drainage Plan is submitted and approved, as specified in this Ordinance.

ARTICLE VI
FEES AND EXPENSES

Section 601. General

The fee required by this Ordinance is the Municipal Review Fee. The Municipal Review fee shall be established by the Municipality to defray review costs incurred by the Municipality and the Municipal Engineer. The Applicant shall pay all fees.

Section 602. Municipality Drainage Plan Review Fee

The Municipality shall establish a Review Fee Schedule by resolution of the municipal governing body based on the size of the Regulated Activity and based on the Municipality's costs for reviewing Drainage Plans. The Municipality shall periodically update the Review Fee Schedule to ensure that review costs are adequately reimbursed.

Section 603. Expenses Covered by Fees

The fees required by this Ordinance shall, at a minimum, cover:

A. Administrative/clerical costs

B. The review of the Drainage Plan by Municipality and the Municipal Engineer.

C. The site inspections.

D. The inspection of stormwater management facilities and drainage improvements during construction.

E. The final inspection upon completion of the stormwater management facilities and drainage improvements presented in the Drainage Plan..

F. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.

ARTICLE VII
MAINTENANCE RESPONSIBILITIES

Section 701. Performance Guarantee

The applicant shall provide a financial guarantee to the Municipality for the timely installation and proper construction of all stormwater management controls as required by this Ordinance equal to the full construction cost of the required controls.

Section 702. Maintenance Responsibilities

A. The Drainage Plan for the development site shall contain an operation and maintenance plan prepared by the developer and approved by the municipal engineer. The operation and maintenance plan shall outline required routine maintenance actions and schedules necessary to ensure proper operation of the facility(ies).

B. The Drainage Plan for the development site shall establish responsibilities for the continuing operating and maintenance of all proposed stormwater control facilities, consistent with the following principals:

1. If a development consists of structures or lots which are to be separately owned and in which streets, sewers and other public improvements are to be dedicated to the Municipality, stormwater control facilities may also be dedicated to and maintained by the Municipality. The acceptance of maintenance responsibility for storm water ponds, infiltration areas and water quality BMP's by municipalities will be at the discretion of the Municipality.

2. If a development site is to be maintained in a single ownership or if sewers and other public improvements are to be privately owned and maintained, then the ownership and maintenance of stormwater control facilities shall be the responsibility of the owner or private management entity.

3. The governing body, upon recommendation of the municipal engineer, shall make the final determination on the continuing maintenance responsibilities prior to final approval of the Drainage Plan. The governing body reserves the right to accept the ownership and operating responsibility for any or all of the stormwater management controls.

Section 703. Maintenance Agreement for Privately Owned Stormwater Facilities

A. Prior to final approval of the site's stormwater management plan, the property owner shall sign and record a maintenance agreement covering all stormwater control facilities that are to be privately owned. Said agreement, designated as "Standard Stormwater Maintenance and Monitoring Agreement" found in Appendix C of the Susquehanna River Tributaries Watershed Act 167 Stormwater Management Plan Columbia County Pennsylvania Volume II, is attached and made part hereto.

B. Other items may be included in the agreement where determined necessary to guarantee the satisfactory maintenance of all facilities. The maintenance agreement shall be subject to the review and approval of the municipal solicitor and governing body.

Section 704. Municipal Stormwater Maintenance Fund

If the Municipality for dedication accepts stormwater facilities, persons installing stormwater storage facilities shall be required to pay a specified amount to the Municipal Stormwater Maintenance Fund to help defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:

A. If the storage facility is to be privately owned and maintained, the deposit shall cover the cost of periodic inspections performed by the Municipality engineer and/or their assignee. After that period of time, inspections will be performed at the expense of the Municipality.

B. If the storage facility is to be owned and maintained by the Municipality, the deposit shall cover the estimated costs for maintenance and inspections for ten (10) years. The municipal engineer will establish the estimated costs utilizing information submitted by the applicant.

C. The amount of the deposit to the fund shall be converted to present worth of the annual series values. The municipal engineer shall determine the present worth equivalents, which shall be subject to the approval of the municipal governing body.

D. If a storage facility is proposed that also serves as a recreation facility (e.g. ball-field, lake), the Municipality may reduce or waive the amount of the maintenance fund deposit based upon the value of the land for public recreation purpose.

E. If at some future time a storage facility (whether publicly or privately owned) is eliminated due to the installation of storm sewers or other storage facility, the unused portion of the maintenance fund deposit will be applied to the cost of abandoning the facility and connecting to the storm sewer system or other facility. Any amount of the deposit remaining after the costs of abandonment are paid will be returned to the depositor.

Section 705. Post Construction Maintenance Inspections

A. Basins should be inspected by the land owner/developer or responsible entity (including the municipal engineer for dedicated facilities) on the following basis:

1. Annually for the first 5 years.
2. Once every 2 years thereafter.
3. Immediately after the cessation of a 2.9-inches in 24 hours or greater storm event.

B. The entity conducting the inspection should be required to submit a written report to the municipality regarding the condition of the facility and recommending necessary repairs, if needed.

ARTICLE VIII
ENFORCEMENT AND PENALTIES

Section 801. Right-of-Entry

Upon presentation of proper credentials, duly authorized representatives of the Municipality may enter at reasonable times upon any property within the Municipality to inspect the condition of the stormwater structures and facilities in regard to any aspect regulated by this Ordinance.

Section 802. Notification

In the event that a person fails to comply with the requirements of this Ordinance, or fails to conform to the requirements of any permit issued hereunder, the Municipality shall provide written notification of the violation. Such notification shall set forth the nature of the violation(s) and establish a time limit for correction of these violations(s). Failure to comply within the time specified shall subject such person to the penalty provision of this Ordinance. All such penalties shall be deemed cumulative and shall not prevent the Municipality from pursuing any and all other remedies. It shall be the responsibility of the owner of the real property on which any Regulated Activity is proposed to occur, is occurring, or has occurred, to comply with the terms and conditions of this Ordinance.

Section 803. Enforcement

The municipal governing body is hereby authorized and directed to enforce all of the provisions of this ordinance. All inspections regarding compliance with the drainage plan shall be the responsibility of the municipal engineer or other qualified persons designated by the Municipality.

A. A set of design plans approved by the Municipality shall be on file at the site throughout the duration of the construction activity. The Municipality or designee may make periodic inspections during construction.

B. Adherence to Approved Plan. It shall be unlawful for any person, firm or corporation to undertake any regulated activity under Section 104 on any property except as provided for in the approved drainage plan and pursuant to the requirements of this ordinance. It shall be unlawful to alter or remove any control structure required by the drainage plan pursuant to this ordinance or to allow the property to remain in a condition, which does not conform to the approved drainage plan.

C. At the completion of the project, and as a prerequisite for the release of the performance guarantee, the owner or his representatives shall:

   1. Provide a certification of completion from an engineer, architect, surveyor or other qualified person verifying that all permanent facilities have been constructed according to the plans and specifications and approved revisions thereto.

   2. Provide a set of as-built (record) drawings.

D. After receipt of the certification by the Municipality, the governing body or its designee to certify compliance with this ordinance shall conduct a final inspection.

E. Prior to revocation or suspension of a permit, the governing body will schedule a hearing to discuss the non-compliance if there is no immediate danger to life, public health or property.

F. Suspension and Revocation of Permits

1. Any permit issued under this ordinance may be suspended or revoked by the governing body for:

a) Non-compliance with or failure to implement any provision of the permit.

b) A violation of any provision of this ordinance or any other applicable law, ordinance, rule or regulation relating to the project.

c) The creation of any condition or the commission of any act during construction or development which constitutes or creates a hazard or nuisance, pollution or which endangers the life or property of others, or as outlined in Article IX of this ordinance. (Note: Article IX to be added by Municipality to cover special local considerations.)

2. A suspended permit shall be reinstated by the governing body when:

a) The municipal engineer or his designee has inspected and approved the corrections to the stormwater management and erosion and sediment pollution control measure(s), or the elimination of the hazard or nuisance, and/or;

b) The governing body is satisfied that the violation of the ordinance, law, or rule and regulation has been corrected.

c) A permit, which has been revoked by the governing body, cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this Ordinance.

G. Occupancy Permit

An occupancy permit shall not be issued unless the certification of compliance has been secured. The occupancy permit shall be required for each lot owner and/or developer for all subdivisions and land development in the Municipality.

Section 804. Public Nuisance

A. The violation of any provision of this ordinance is hereby deemed a Public Nuisance.

B. Each day that a violation continues shall constitute a separate violation

Section 805. Penalties

A. Anyone violating the provisions of this ordinance shall be guilty of a misdemeanor, and upon conviction shall be subject to a fine of not more than $ _____ for each violation, recoverable with costs. Each day that the violation continues shall be a separate offense.

B. In addition, the Municipality, through its solicitor, may institute injunctive, mandamus or any other appropriate action or proceeding at law or in equity for the enforcement of this Ordinance. Any court of competent jurisdiction shall have the right to issue restraining orders, temporary or permanent injunctions, mandamus or other appropriate forms of remedy or relief.

Section 806. Appeals

A. Any person aggrieved by any action of the Municipality or its designee, relevant the provisions of this ordinance may appeal to the Municipal Zoning Hearing Board within thirty (30) days of that action.

B. Any person aggrieved by any decision of Zoning Hearing Board, relevant to the provisions of this ordinance, may appeal to the County Court of Common Pleas in the county where the activity has taken place within thirty (30) days of the Zoning Hearing Board's decision.

ENACTED and ORDAINED at a regular meeting of the _____

_____ on the _____ of _____, 20____.

This Ordinance shall take effect immediately.

_____

[Name] [Title]

_____

[Name] [Title]

_____

[Name] [Title]

_____

[Name] [Title]

_____

[Name] [Title]

ATTEST:

_____

Secretary

I hereby certify that the foregoing Ordinance was advertised in the

_____ on _____, 20____, a newspaper of general circulation in the Municipality and was duly enacted and approved as set forth at a regular meeting of the Municipality's governing body held on _____, 20____.

_____

Secretary

SECTION VIII
PRIORITIES FOR IMPLEMENTATION

The Susquehanna River Tributaries Stormwater Management Plan preparation process is complete with Columbia County's adoption of the draft Plan and submission of the final Plan to DEP for approval, which sets in motion the mandatory schedule of adoption of municipal ordinance provisions needed to implement stormwater management criteria. Susquehanna River Tributaries Watershed Municipalities have six months from DEP approval to adopt the necessary ordinance provisions.

A. DEP Approval of the Plan

Upon adoption of the Watershed Plan by Columbia County, the Plan was submitted to DEP for approval. A draft of the Stormwater Management Plan and draft Model Ordinance was sent to DEP prior to adoption of the Plan. The DEP review process involves determination that all of the activities specified in the Scope of Study have been completed. The DEP also reviewed the Plan for consistency with municipal floodplain management plans, State programs which regulate dams, encroachments and other water obstructions, and State and Federal flood control programs, that the Plan is compatible with other watershed stormwater plans in the basin in which the watershed is located, and that the Plan is consistent with the policies of Act 167.

B. Publishing the Final Plan

Upon DEP approval, the Columbia County Planning Commission will publish and provided, at a minimum, two copies of the Plan to each Municipality. The Plan includes this report, appendices, figures, and Model Ordinance.

C. Municipal Adoption of Ordinance to Implement the Plan

The key ingredient for implementation of the Stormwater Management Plan is the adoption of the necessary ordinance provisions by the Susquehanna River Tributaries municipalities. Provided as part of the Plan is the Act 167 Stormwater Management Plan Model Ordinance which is a single purpose stormwater ordinance that could be adopted by each Municipality essentially "as is" to implement the Plan. The single purpose ordinance was chosen for ease of incorporation into the existing structure of municipal ordinances. All that is required of any Municipality would be to adopt the ordinance itself and adopt the necessary provisions for tying into the existing subdivision and land development ordinance and zoning ordinance as outlined in the Municipal Ordinance Matrix in the Appendix. The tying provisions would simply refer any applicable regulated activities within the Susquehanna River Tributaries Watershed from the other ordinances to the single purpose ordinance. It is recommended that the delineation of the watershed sub areas and the stormwater management criteria assigned to each sub area be enacted as part of each Municipality's zoning or subdivision ordinance so that the requirements for management of stormwater will be applicable to all changes in land use and not limited only to activities which are subject to subdivision and land development regulations.

D. Level of Government Involvement in Stormwater Management

The existing institutional arrangements for the management of stormwater include federal, state, and county governments, as well as every Municipality within the watershed. In the absence of a single entity with responsibility for all aspects of stormwater management within a watershed, it is clear that the "management" which occurs is primarily a function of a multiple permitting process in which a developer attempts to satisfy the requirements of all of the permitting agencies. Each public agency

has established its own regulations based on its own objectives and legislative mandates as, upon adoption and approval of the Plan, all future public facilities, facilities for the provision of public utility services, and all facilities owned or financed by state funds will have to be consistent with the Plan, even though they might not otherwise be subject to municipal regulation.

The primary municipal level activity will be the adoption or amendment of development regulations to incorporate watershed stormwater management standards. Act 167 requires that this be accomplished within six months of the Plan's adoption and approval. Model ordinance provisions will be distributed to all of the watershed municipalities. The Columbia County Planning Commission will be available upon request to assist municipalities in the adoption of the model ordinance provisions to fit particular municipal ordinance structures.

The primary county level activity will be the establishment of review procedures. The model ordinance calls for review of stormwater management plans for development sites by the Columbia County Planning Commission, and Erosion and Sediment Pollution Control Plans by the Columbia County Conservation District. Evidence that the appropriate state and federal agencies responsible for administering wetland regulatory programs have been contacted for land development sites containing regulated wetlands is also required. The purpose is to ensure that plan standards have been applied appropriately and that downstream impacts have been adequately addressed. Procedures and capabilities for performing the review function exist within the governmental agencies. The county will also be responsible for the maintenance of data for performance of review and of "no-harm" evaluation. The materials initially prepared by consultants during the plan preparation process which are needed or which may be needed in the development of site specific stormwater management plans, including data needed to perform the "no harm" evaluation, must be maintained in a place and form which is accessible to users.

E. County-Wide Coordination

There are possible situations of stormwater management functions and concerns, which may not be adequately addressed within the structure of the existing institutional arrangements or by the adoption and enforcement of new regulations at the municipal level, as outlined above. For example, the construction of regional storage facilities may offer a very economic and technically sound alternative to the construction of individual, on-site detention basins. There is, however, no organization at the present time that is capable of implementing such a concept. To do so would require a multi-municipal entity capable of planning, financing, constructing, operating, and maintaining the shared storage facilities in a manner similar to the management required for the collection, treatment, and disposal of sanitary wastes.

The Susquehanna River Tributaries watershed is composed of a number of separate drainage systems. The parts of a single drainage system are interrelated. What happens upstream affects what happens downstream, and what happens downstream places limitations on what happens upstream. If runoff is not controlled in upstream communities, downstream communities will flood. But, if in a downstream community, the capacity of a drainage channel can be safely increased, more upstream runoff may be released, thus reducing to some degree the cost of required upstream control facilities.

The release rate standard proposed in this Plan is the primary standard for managing stormwater on a separate watershed basis and is a very simple concept that can be implemented on a property-by-property basis. It is equitable and can be used to achieve

the law's "no-harm" mandate. But the same technical tool which allowed the modeling of rainfall routing throughout the watershed and the development of a usable standard for property-level control is capable of testing numerous, technically feasible solutions which would work for combinations of properties and for combinations of sub areas. Some of these potential solutions may be preferable to those that would result from the application of release rates to individual properties.

There are, of course, ways to work out agreements on a case-by-case basis to permit the accomplishment of almost any objective, whether a public or a private undertaking. But, as the number of stormwater detention and control facilities increases during future years, continuing maintenance to ensure the integrity of structures and their performance will become very important. A proliferation of "special agreements" to handle special situations may make future accountability very difficult.

An ideal structure for the management of stormwater on a watershed basis would be an entity, such as a regional stormwater management authority, capable of dealing with all of the interrelated elements of the watershed system. The authority would also have to have the power to collect user fees in order to achieve the following:

- Best possible technical solutions in the most effective manner;
- Efficient and competent review of stormwater management components of development plans;
- Continued maintenance and proper functioning of all elements of the system;
- Repair and replacement of system components as necessary;
- Continuing monitoring and evaluation of the performance of the drainage system;
- Updating and revision of system requirements and standards as necessary;
- Responsible financial management including an equitable apportionment of operating and capital costs among the system's users and beneficiaries.

It is clear that not all of these objectives can be achieved on a watershed basis in the Susquehanna Tributaries Watershed through municipal implementation of the stormwater plan, but that the existence of an inter-municipal entity capable of continuous action at the system or watershed level would provide management efficiencies on a more economical basis than can be achieved by the numerous municipalities within this plan. An optimum management system would be an entity capable of performing similar functions for multiple watersheds, such as a county-level stormwater management institution.

There are a variety of models for such an entity, ranging from assigning new responsibilities to a coordinated team of existing county departments to the creation of a regional stormwater management board to include stormwater functions. Further, under any management system, some of the elements in the process could be contracted out to a private vendor. The essential concept is that stormwater can be managed like a public utility and that the costs for planning, construction, operation and maintenance, monitoring and evaluation can be equitably shared by all of the system's users. A basic assumption underlying the concept of user financing of stormwater management is that damage caused by existing and potential stormwater runoff without controls is intolerable. Therefore, it is in the public interest to undertake stormwater management immediately, and such management should not be delayed until federal and state funding is available.

Based on stormwater management experience elsewhere, users (including beneficiaries) can finance the full cost of stormwater management inexpensively and equitably. The cost to each user is calculated based on user's property characteristics. Formula for determining user fees can be objectively developed for application within the management plan area.

F. Correction of Existing Drainage Problems

The development of the watershed plan has provided a framework for the correction of existing drainage problems, a logical first step in the process of implementation of a stormwater management ordinance. It will prevent the worsening of existing drainage problems and also prevent the creation of new drainage problems. The step-by-step outline below is by no means a mandatory action to be taken by the municipalities with watershed plan adoption area, it is one method of solving problems uniformly throughout the watershed.

1. Prioritize a list of storm drainage problems within the municipalities based on frequency of occurrence, potential for injury, as well as damage history.
2. Develop a detailed engineering evaluation to determine the exact nature of the top priority drainage problems within the municipalities in order to determine solutions cost estimates and a recommended course of municipal action.
3. Incorporate implementation of recommended solutions regarding stormwater runoff in the annual municipal capital or maintenance budget.

G. Culvert Replacement

The General Procedures for Municipalities to determine size of replacement culverts using Act 167 data is as follows:

1. Determine the location and Municipality of obstruction on Obstruction Map and obtain the obstruction number.
2. From Section 105.161 of DEP's Chapter 105, determine the design storm frequency.
3. From "Municipal Stream Obstruction Data" tables in Appendix D, locate the Municipality and Obstruction number. Locate the flow value (cfs) for the design storm frequency determined in #2 above.
4. Have the culvert sized for this design flow and obtain any necessary approvals/permits.

Note: Any culverts/stream crossings not identified on the Obstruction Map would need to have storm flows computed for sizing purposes.

H. PENNVEST Funding

One way in which the completion and implementation of this plan can be of assistance in addressing storm drainage problems is by opening the avenue of funding assistance through the PENNVEST program. The PENNVEST Act of 1988, as amended, provides low interest loans to governmental entities for the construction, improvement or rehabilitation of stormwater projects including the transports, storage and infiltration of stormwater and best management practices to address non-point source pollution associated with stormwater. In order to qualify for a loan under PENNVEST, the Municipality or county:

1. Must be located in a watershed for which there is an existing county adopted and DEP approved stormwater plan with enacted stormwater ordinances consistent with the plan, or

2. Must have enacted a stormwater control ordinance consistent with the Stormwater Management Act.

I. Landowner's/Developer's Responsibilities

Any Landowner and any person engaged in the alteration or development of land that may affect stormwater runoff characteristics shall implement such measures consistent with the provisions of the applicable watershed stormwater plan as are reasonably necessary to prevent injury to health, safety or other property. Such measures shall include such actions as are required:

1. To assure the after development hydrograph matches the predevelopment hydrograph.
2. The maximum rate of stormwater runoff is provided in accordance with the Release Rate as specified in Table V-3.
3. To manage the quantity, velocity and direction of resulting stormwater runoff in a manner which otherwise adequately protects health and property from possible injury.

Many developers throughout the state, after realizing the natural resource, public safety and potential economic advantages of proper stormwater management, are constructing new development consistent with natural resources protection.

SECTION IX
PLAN REVIEW ADOPTION AND UPDATING PROCEDURES

A. County Adoption

Prior to plan completion, Columbia County transmitted a sample of the proposed Stormwater Ordinance for review to affected municipal planning commissions, local governing bodies, the Watershed Plan Advisory Committee and other interested parties. Columbia County then transmitted a draft plan, which included the draft ordinance for review to the municipal planning commission and the governing body of each involved Municipality, the County Planning Commission and the Watershed Plan Advisory Committee by official correspondence. This review included an evaluation of the plan's consistency with other plans and programs affecting the watershed. The reviews and comments will be submitted to the county by official correspondence. The county will receive, tabulate, and respond to the comments and will revise the Plan as appropriate. Columbia County will hold a public meeting. A notice for the hearing will be published two weeks prior to the hearing date. The meeting notices will contain a summary of the principal provisions of the Plan and will state where copies of the Plan could be examined or obtained within each Municipality. The county will review the comments received at the public hearing and appropriate modifications to the Plan will be made.

The County Commissioners for the purpose of adoption will pass the Plan as a resolution. The resolution will include references to the text of the Plan, maps, plates, and model ordinance. The County resolution will be recorded in the minutes of a regular meeting of the Columbia County Commissioners.

Columbia County then submitted to the Department of Environmental Protection a letter of transmittal and three copies of the adopted plan, the review by each affected municipal planning agency and local governing body and the County Planning Commission, public hearing notice and minutes, and the resolution of adoption of the Plan by the County. The letter of transmittal stated that Columbia County has complied with all procedures outlined in Act 167 and requested that the Department of Environmental Protection approve the adopted plan.

B. Provisions for Plan Revision

Section 5 of the Stormwater Management Act requires that the stormwater management plan be updated at least every five years. This requirement considers the changes in land use, obstructions, flood control projects, floodplain identification, and management objectives or policy that may take place within the watershed.

It will be necessary to collect and manage the required data in a consistent manner and preferably store it in a central location not only to prepare an updated plan, but also, if required, to make interim runs on the runoff simulation model to analyze the impact of a proposed major development or a proposed major stormwater management facility.

The following recommendations deal with the minimum requirements that will have to be undertaken to maintain an effective technical position for periodically reviewing, revising and updating the Plan.

1. It is recommended that the Columbia County Board of Commissioners authorize the County Planning Commission to undertake the task of collecting and organizing stormwater management plans and supporting documentation and data submitted for review and to assume responsibility for periodically reviewing, revising, and updating the stormwater management plans.

2 It is recommended that the Columbia County Planning Commission prepare a workable program for the identification, collection and management of the required data. The program should not be limited to the cooperative efforts of the constituent member municipalities within the Susquehanna River Tributaries watershed, but should also include both state and county agencies concerned with stormwater management.

3. It is recommended that the Watershed Plan Advisory Committee convene biannually or as needed to review the Stormwater Management Plan and determine if the Plan is adequate for minimizing the runoff impacts of new development. At a minimum, the information (to be reviewed by the Committee) will be as follows:

    a. Development activity data as monitored by the Columbia County Planning Commission.
    b. Information regarding additional storm drainage problem areas as provided by the municipal representatives to the Advisory Committee.
    c. Zoning and Subdivision amendments within the watershed.
    d. Impacts associated with any regional or sub regional detention alternatives implemented within the watershed.
    e. Adequacy of the administrative aspects of regulated activity review.
    f. Additional hydrologic data available through preparation of the individual stormwater designs for development areas.

C. Management Plan for the Susquehanna River Tributaries Watershed

The Committee will review the above data and make recommendations to the County for revisions to the Susquehanna River Tributaries Stormwater Management Plan. Columbia County will review the recommendations of the Watershed Plan Advisory Committee and determine if revisions are to be made. A revised Plan would be subject to the same rules of adoption as the original Plan preparation. Should the County determine that no revisions to the Plan are required for a period of five consecutive years, the County will adopt a resolution stating that the Plan has been reviewed and been found satisfactory to meet the requirements of Act 167 and forward the resolution to the Department of Environmental Protection.

SECTION X
FORMATION OF SUSQUEHANNA RIVER TRIBUTARIES WATERSHED ADVISORY COMMITTEE

The meetings held by the Committee during the preparation and adoption of the detailed Watershed Stormwater Management Plan.

Advisory Committee meetings and their purposes were as follows:

Meeting Date	**Purpose**
October 7, 1999	Startup meeting; County GIS presentation; Education opportunity for hydrologic cycle, development affects on hydrologic cycle and its role stormwater management.
May 10, 2000	Review Tributary No. 10 Scott Township analysis; New initiatives for water Quality, Maintaining Groundwater Recharge and Streambank Erosion.
October 26, 2000	Kinney Run analysis; Education opportunity for types of Water Quality Best Management Practices and need for addressing in plan; Use of PA Handbook of Best Management Practices for Developing Areas manual to address Water Quality.
November 16, 2000	Status individual tributary analysis; Proposed General Standards;
February 27, 2001	Groundwater infiltration design criteria; proposed Release Rate concept criteria for stormwater controls; Municipalities to review the proposed future land use information; and discussion and comment on the Proposed General Standards.
May 24, 2001	Presented ¾ Draft of the Act 167 Plan including proposed Ordinance for review and comment.
November 15, 2001	Presented the complete Draft of the Act 167 Plan including proposed Ordinance for review and comment.

Appendix A

Watershed Plates

Cooper Township, Montour County; Franklin and Montour Townships Columbia County:

Basemap Plate	Plate 1-1
Subarea Plate	Plate 1-2
Obstructions Plate	Plate 1-3
Geology Plate	Plate 1-4
Existing Land Use Plate	Plate 1-5
Future Land Use Plate	Plate 1-6
Hydrologic Soils Plate	Plate 1-7

Catawissa Borough and Catawissa Township, Columbia County

Basemap Plate	Plate 2-1
Subarea Plate	Plate 2-2
Obstructions Plate	Plate 2-3
Geology Plate	Plate 2-4
Existing Land Use Plate	Plate 2-5
Future Land Use Plate	Plate 2-6
Hydrologic Soils Plate	Plate 2-7

Town of Bloomsburg and Scott Township, Columbia County

Basemap Plate	Plate 3-1
Subarea Plate	Plate 3-2
Obstructions Plate	Plate 3-3
Geology Plate	Plate 3-4
Existing Land Use Plate	Plate 3-5
Future Land Use Plate	Plate 3-6
Hydrologic Soils Plate	Plate 3-7

Main Township, Columbia County

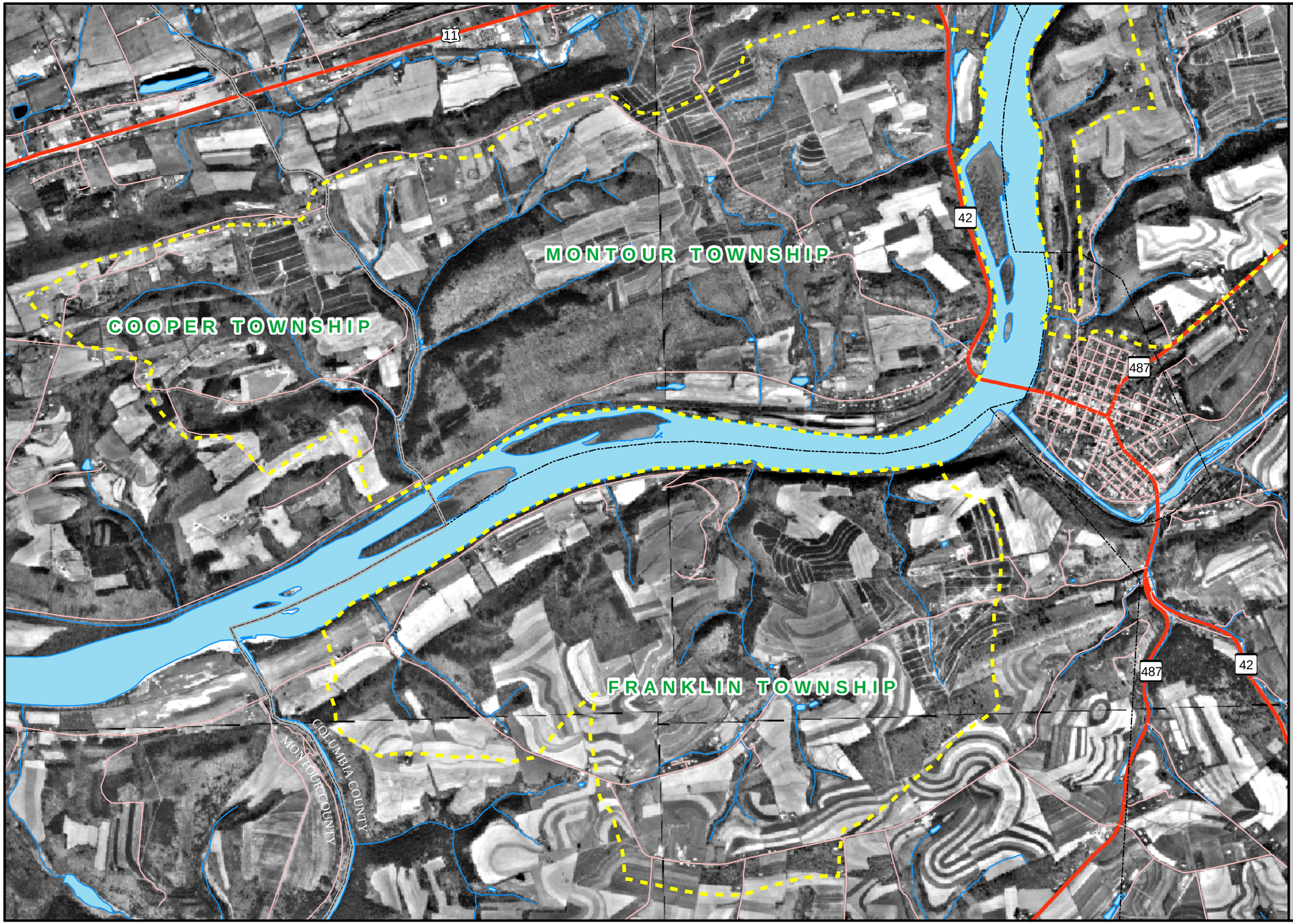
Basemap Plate	Plates 3-1 & 4-1
Subarea Plate	Plates 3-2 & 4-2
Obstructions Plate	Plates 3-3 & 4-3
Geology Plate	Plates 3-4 & 4-4
Existing Land Use Plate	Plates 3-5 & 4-5
Future Land Use Plate	Plates 3-6 & 4-6
Hydrologic Soils Plate	Plates 3-7 & 4-7

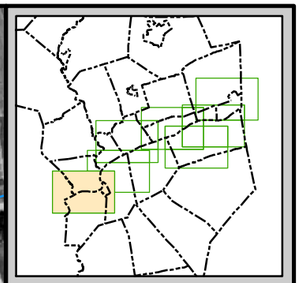
North Centre and South Centre, Columbia County

Mifflin Township, Columbia County

Briar Creek Borough and Briar Creek Township, Columbia County

Berwick Borough, Columbia County and Salem Township, Luzerne County





Twp Roads
State Roads
Municipalities
County Boundary
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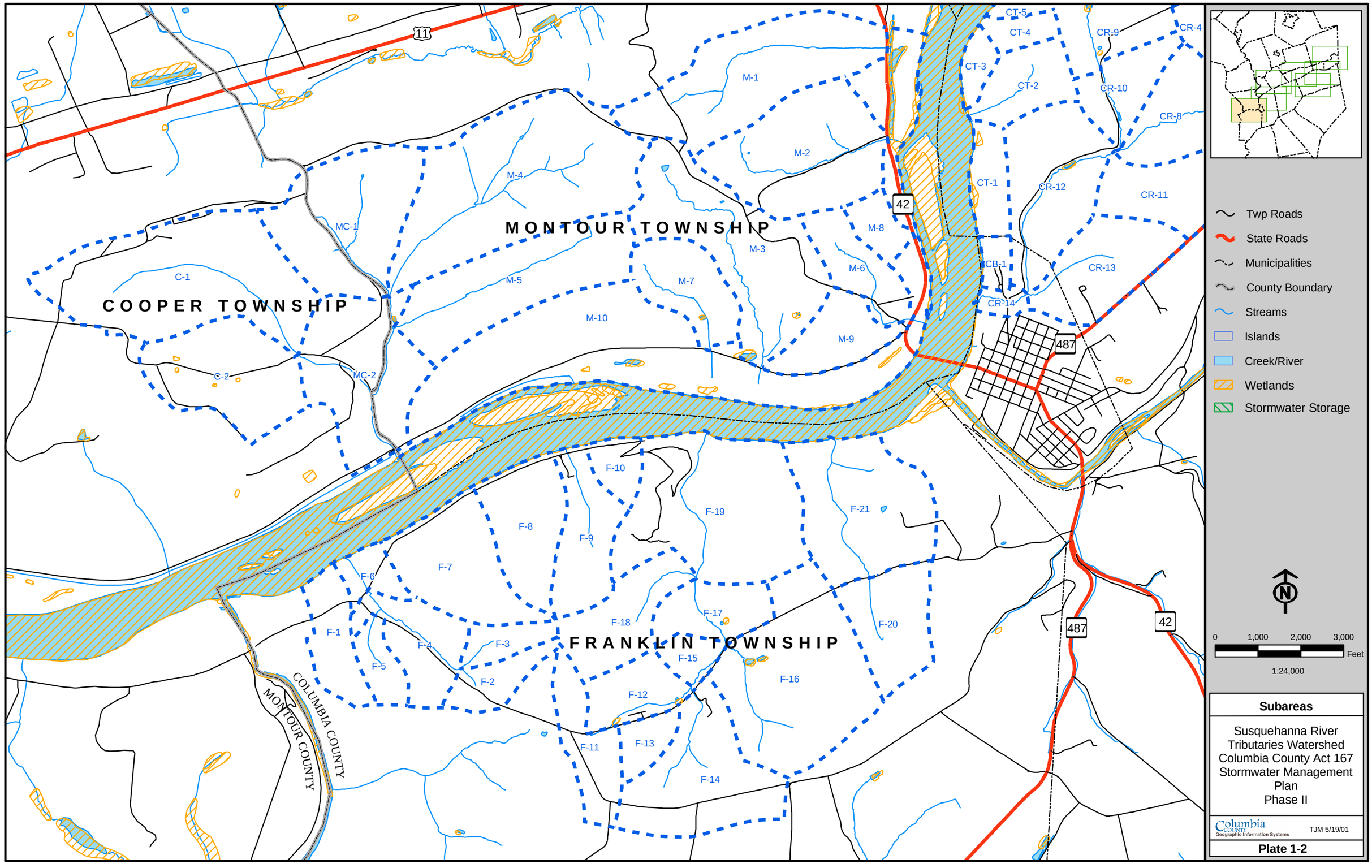
Basemap

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 1-1



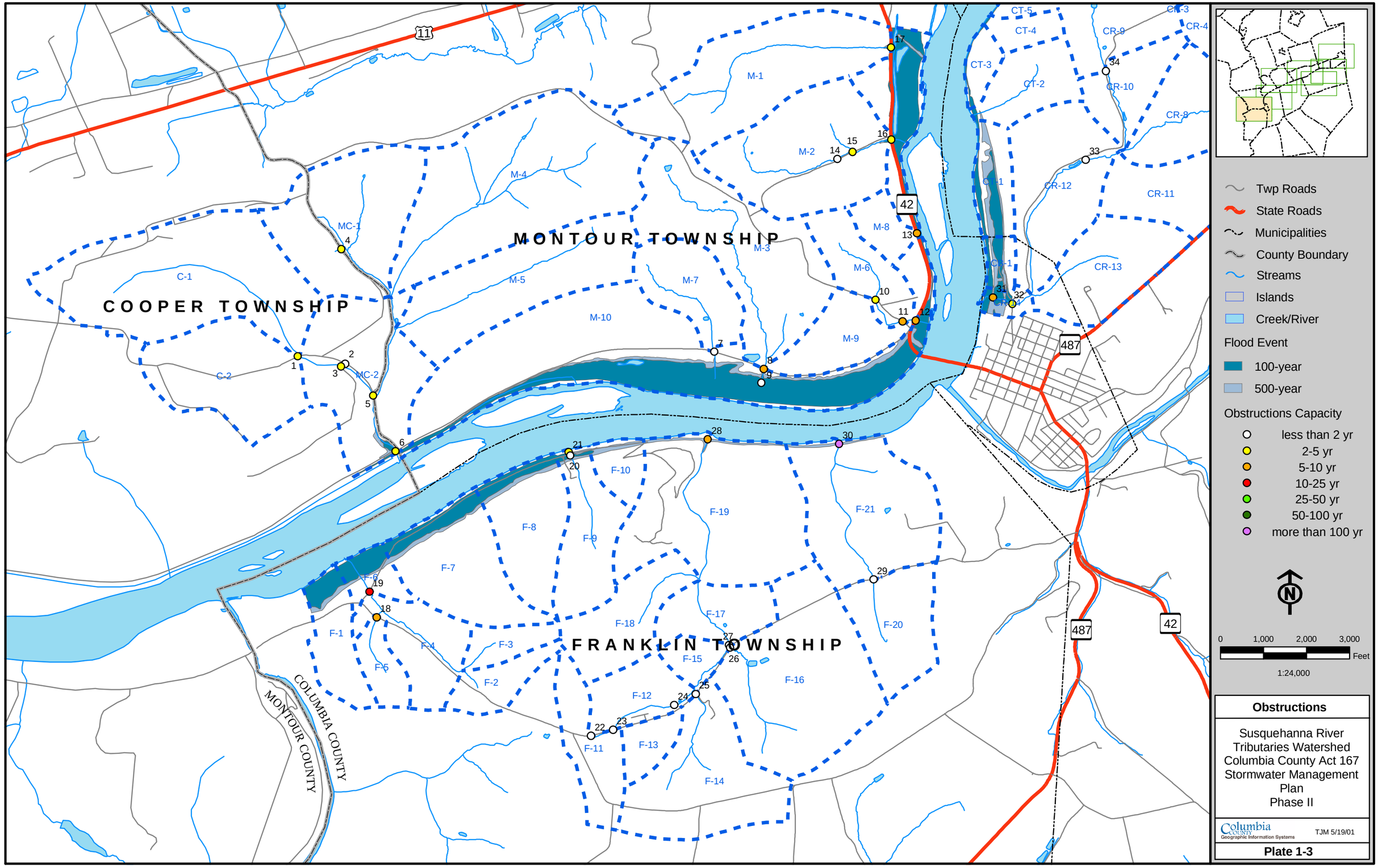
Subareas

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 1-2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Twp Roads
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County Boundary
Streams
Islands
Creek/River
Flood Event
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Obstructions Capacity
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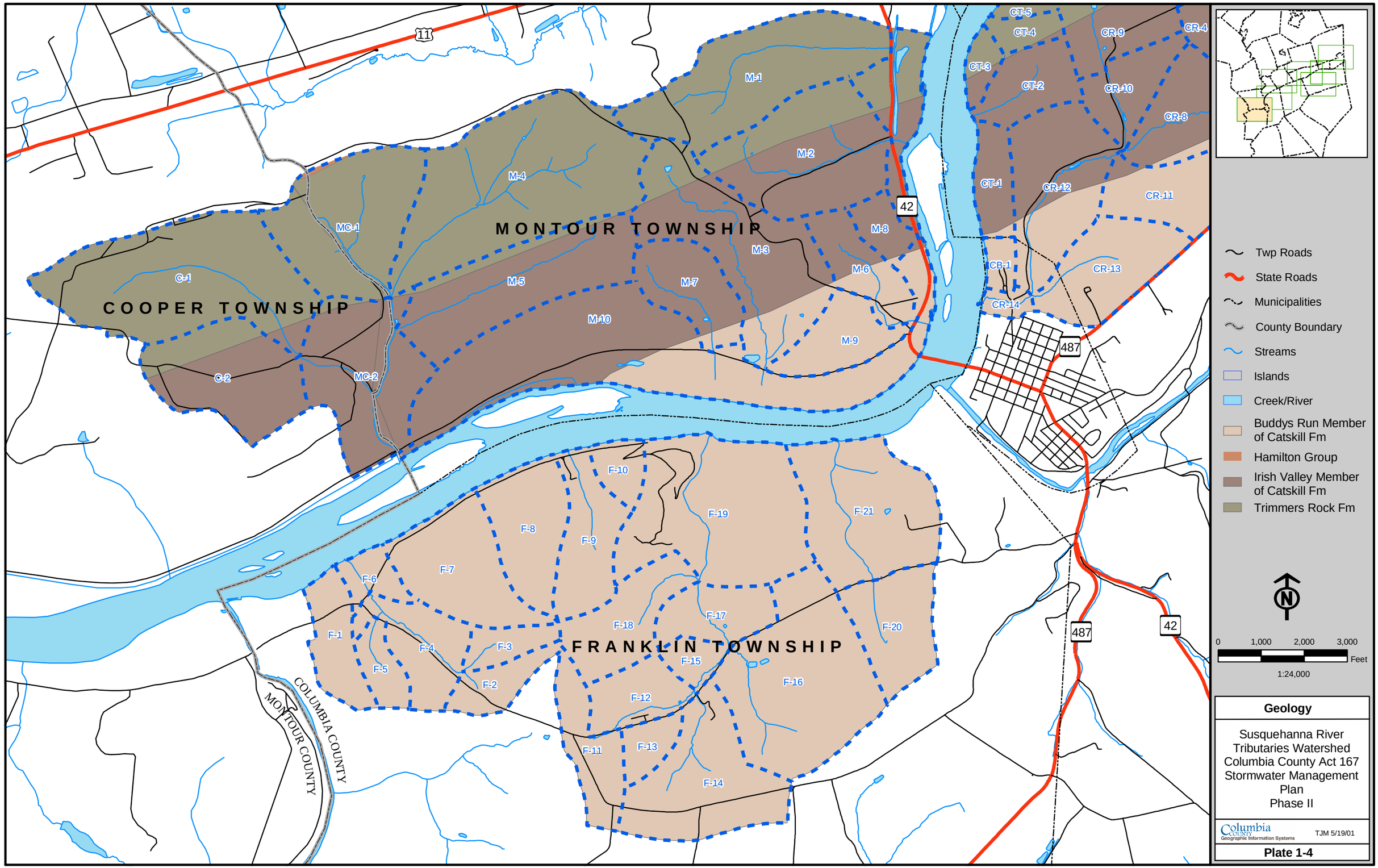
Obstructions
Susquehanna River Tributaries Watershed Columbia County Act 167 Stormwater Management Plan Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 1-3

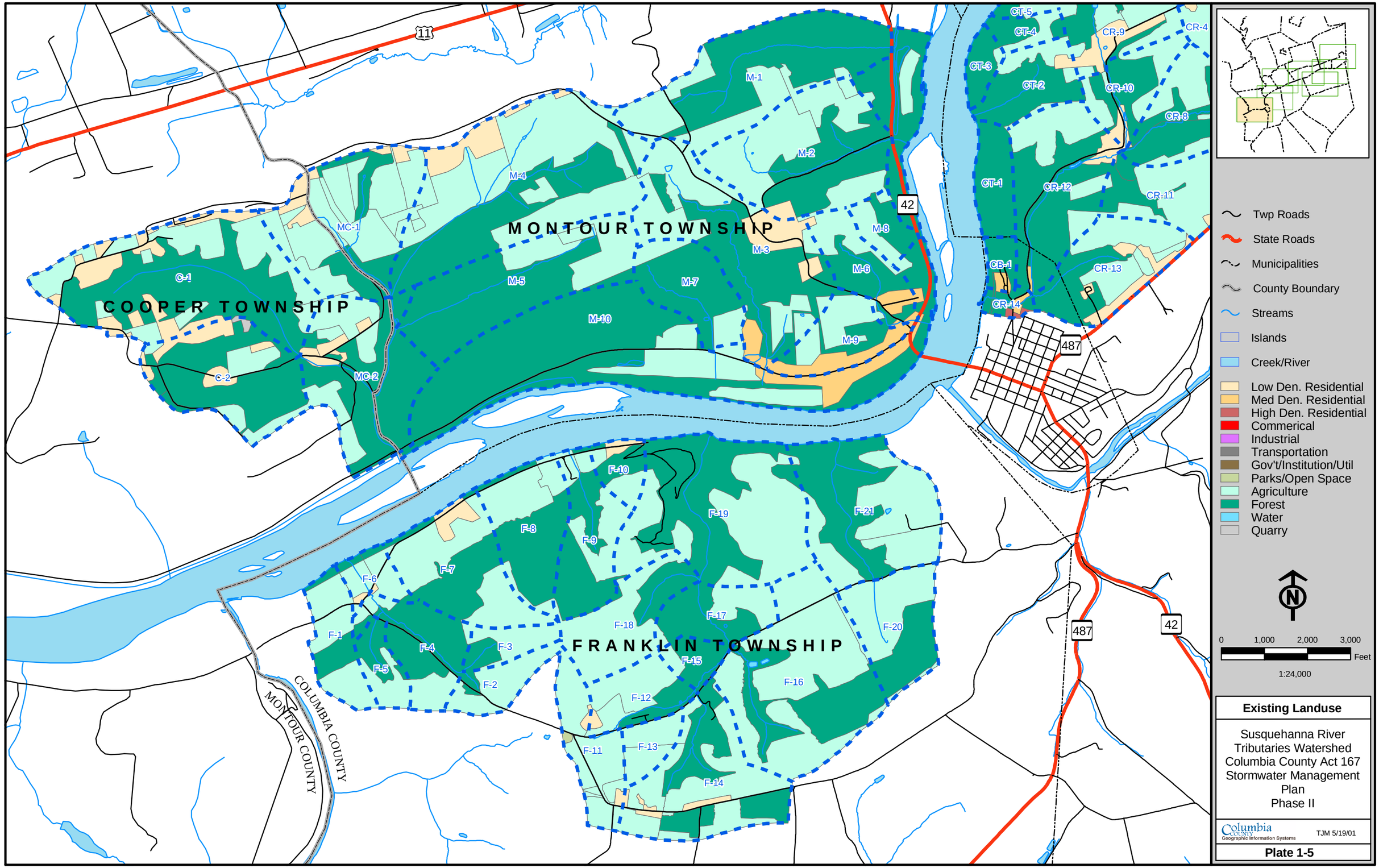


Geology

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 1-4



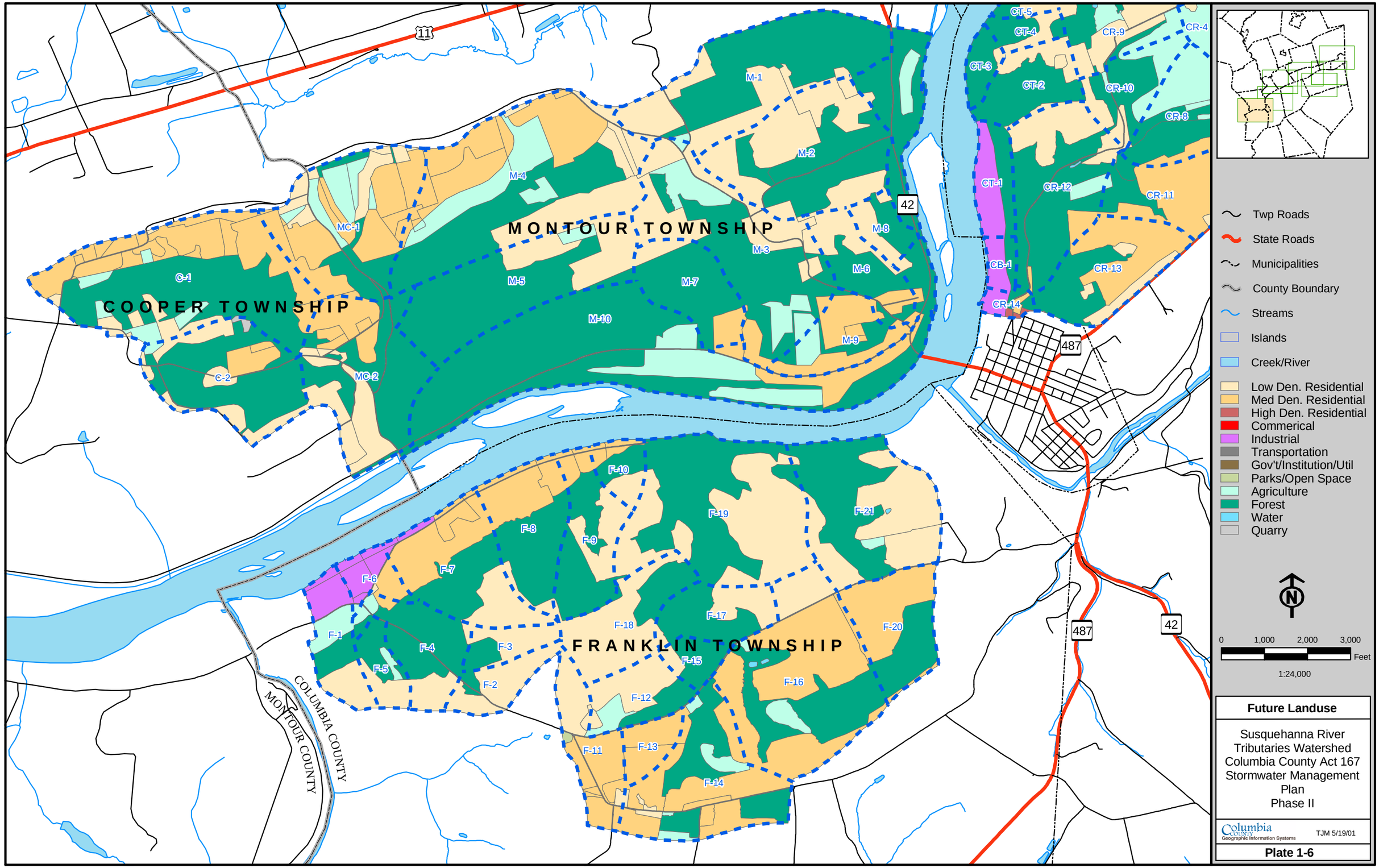
Existing Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 1-5


MONTOUR TOWNSHIP
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Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Low Den. Residential
Med Den. Residential
High Den. Residential
Commerical
Industrial
Transportation
Gov't/Institution/Util
Parks/Open Space
Agriculture
Forest
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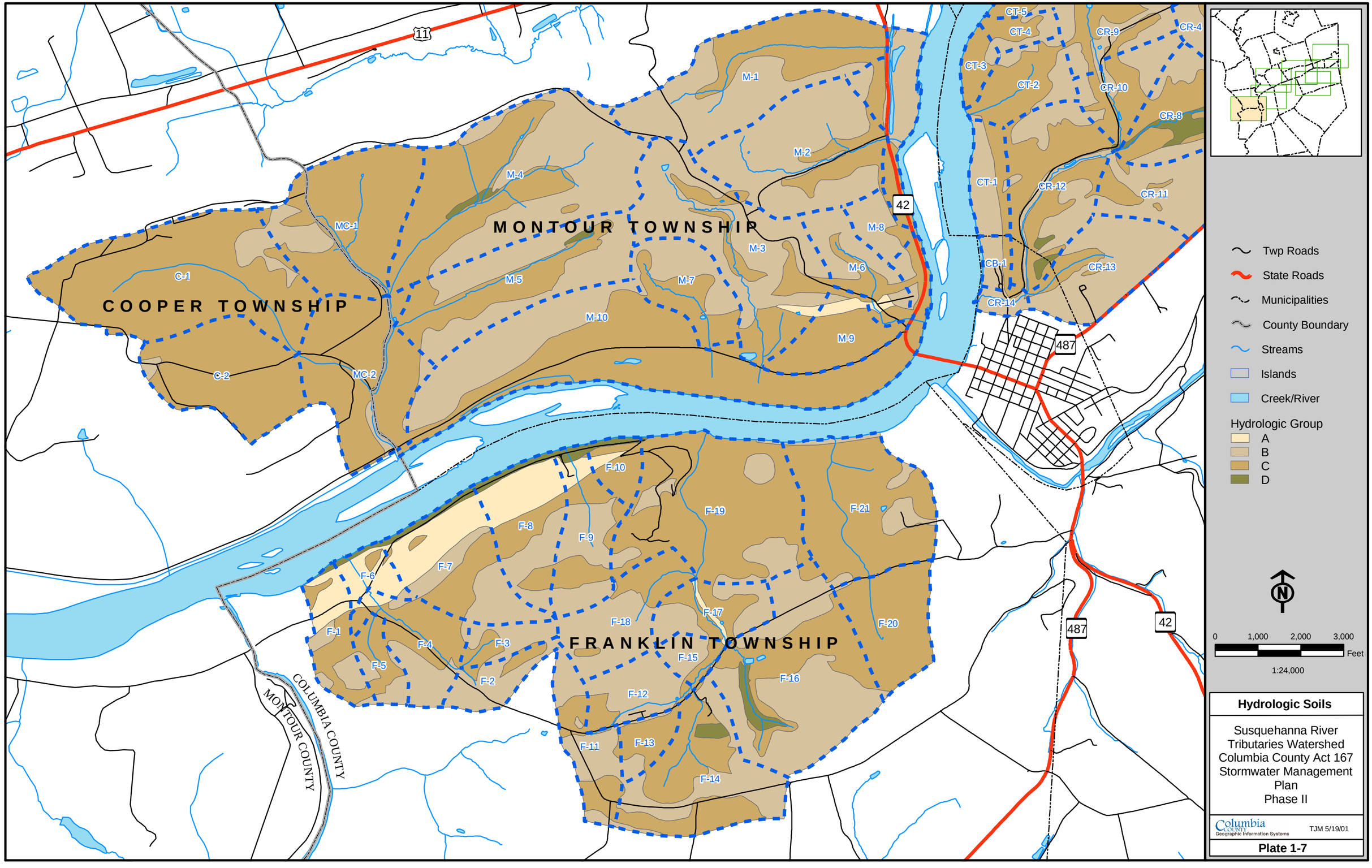
Future Landuse
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 1-6



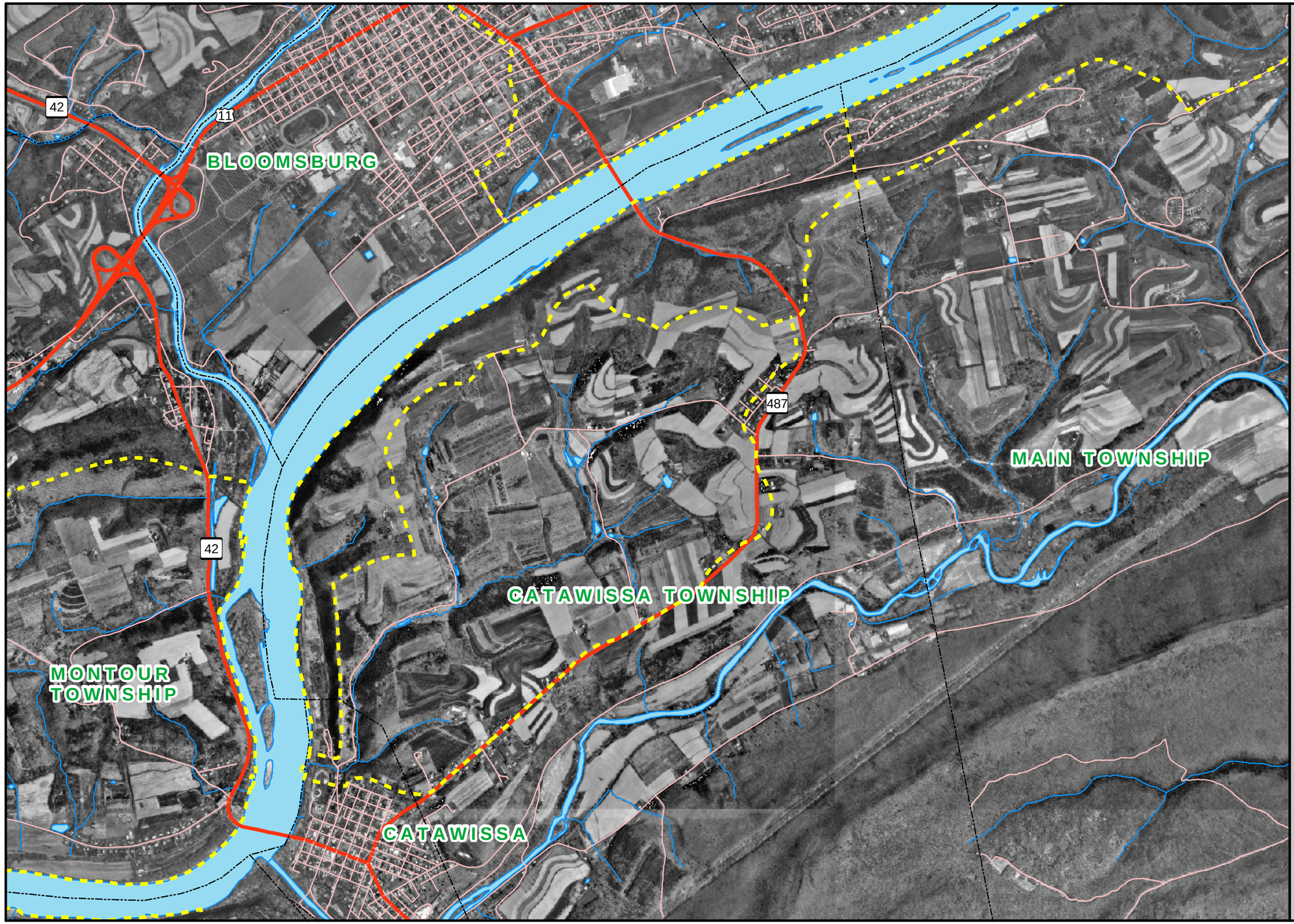
Hydrologic Soils

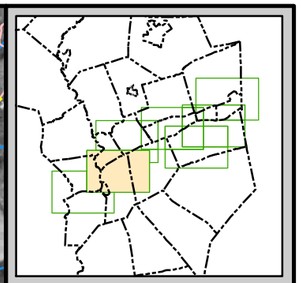
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 1-7





Twp Roads
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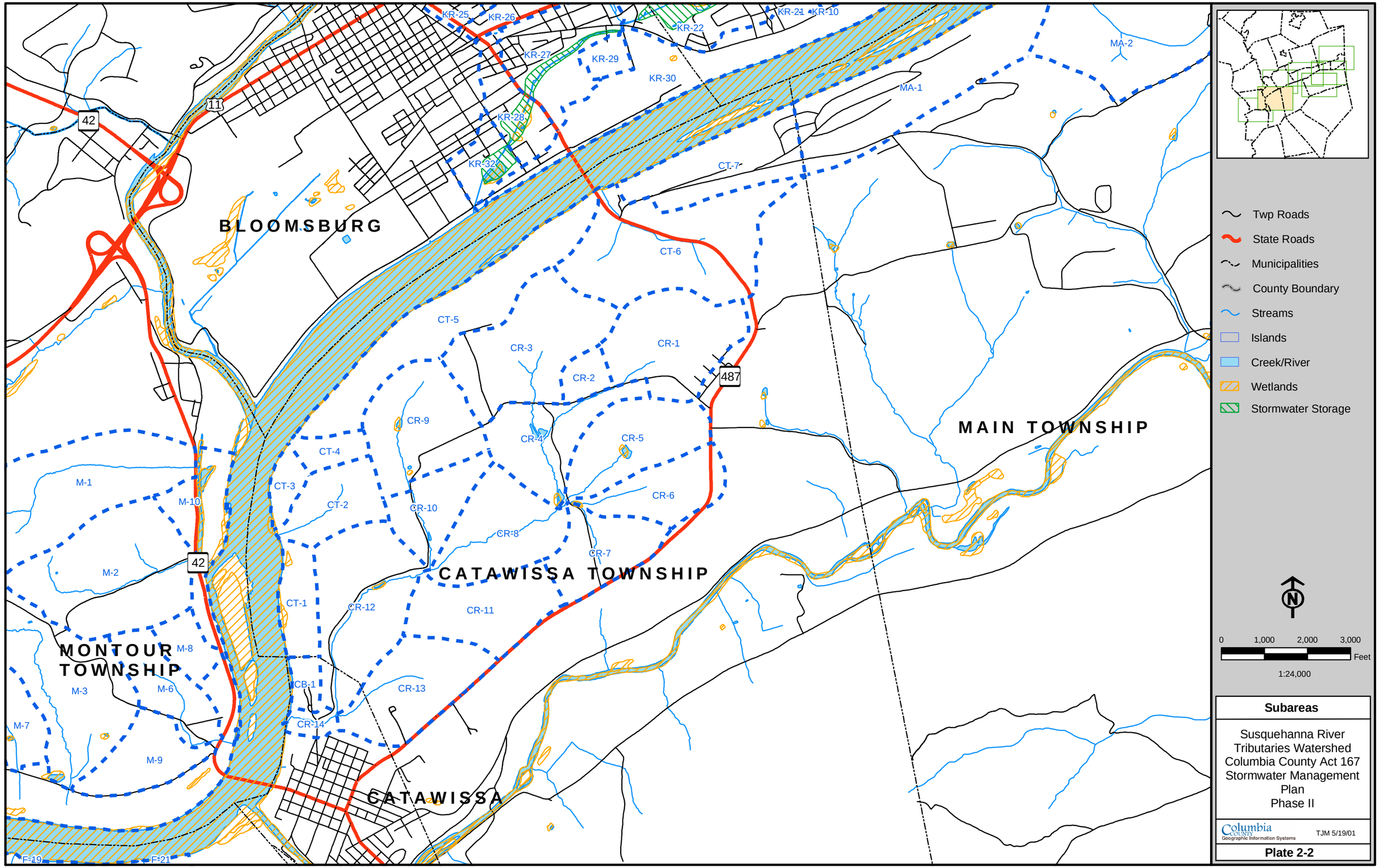
Basemap

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia COUNTY Geographic Information Systems

TJM 5/19/01

Plate 2-1



Twp Roads
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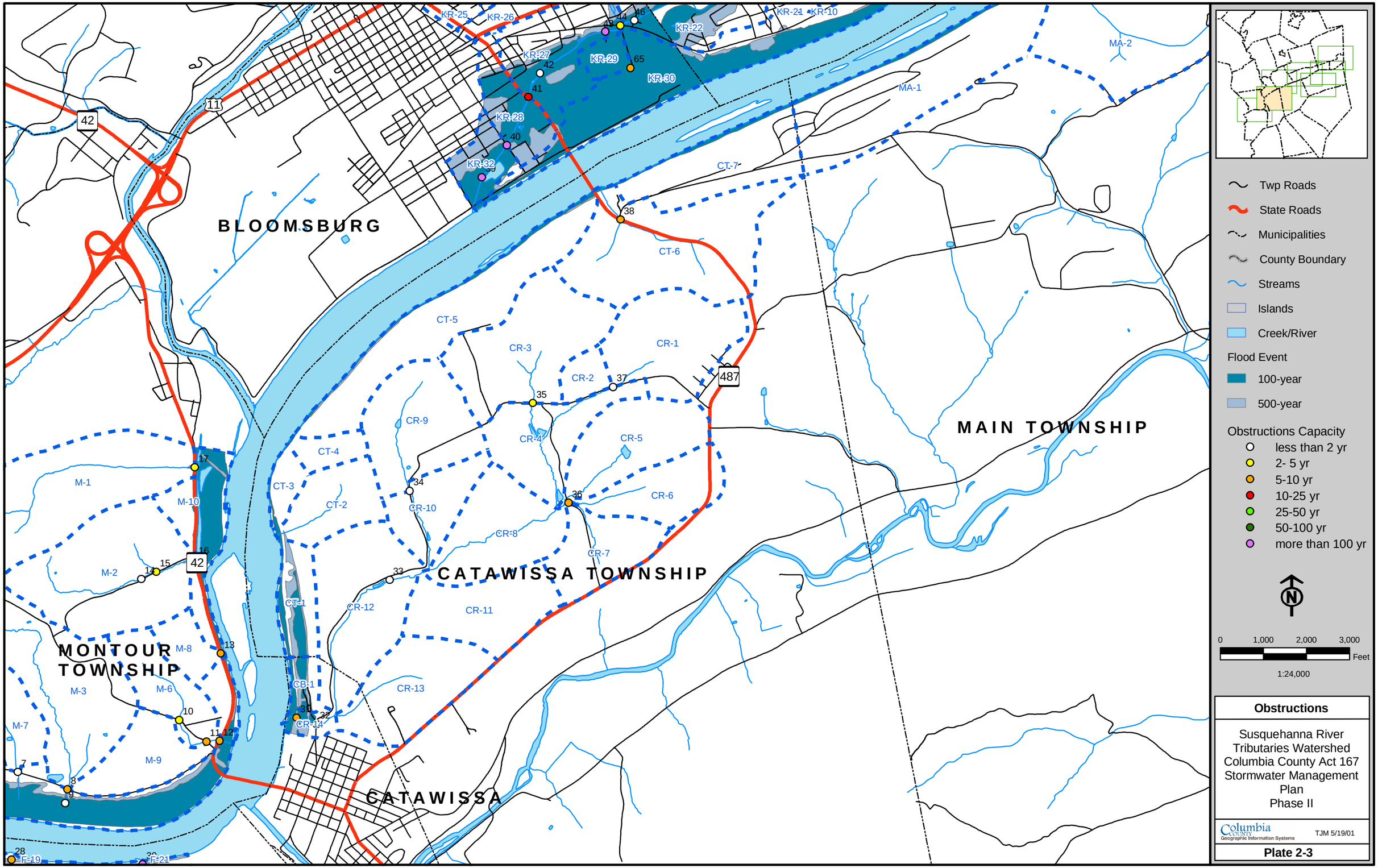
Subareas

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems
TJM 5/19/01

Plate 2-2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Twp Roads
State Roads
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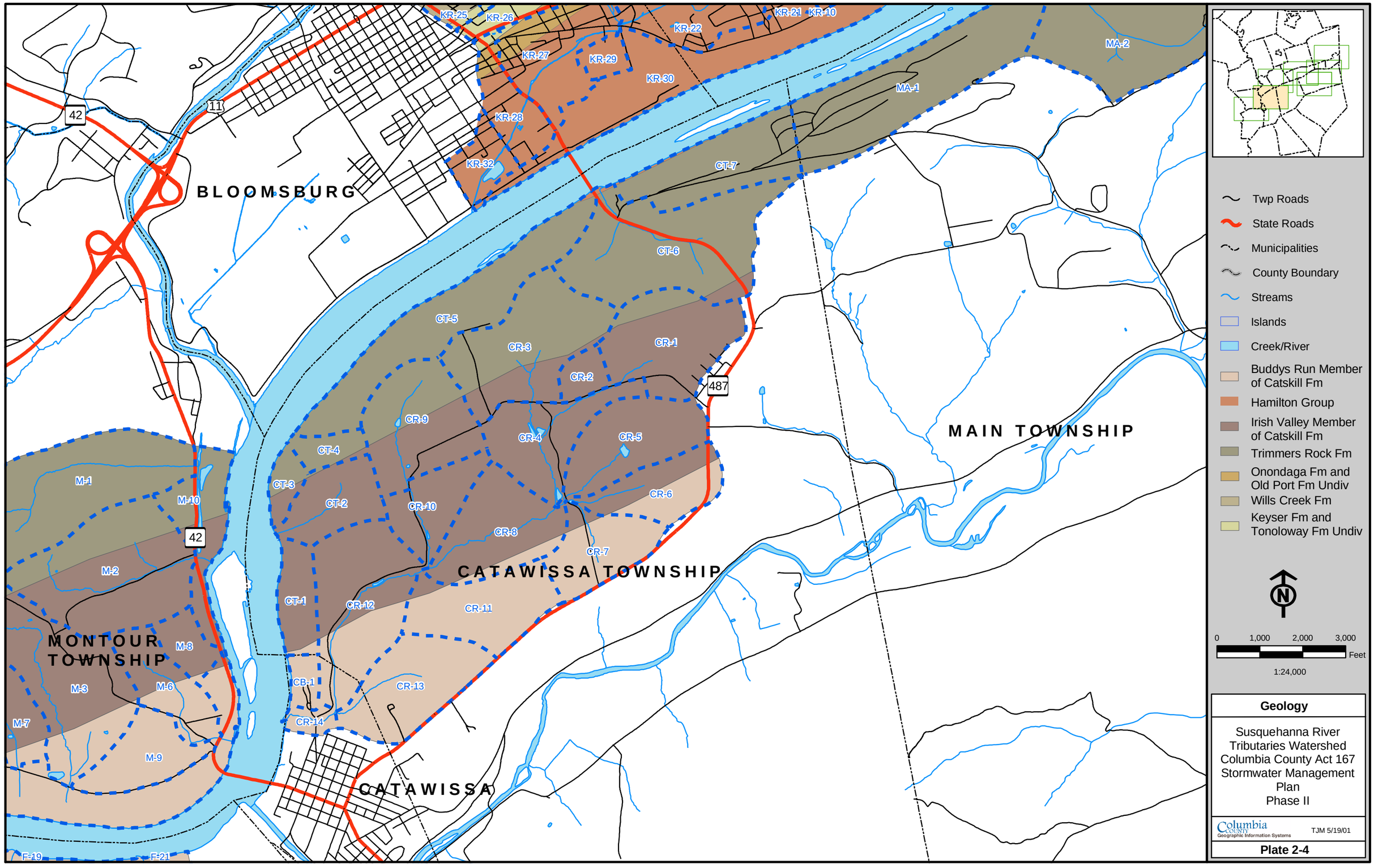
Islands
Creek/River
Flood Event
100-year
500-year
Obstructions Capacity
less than 2 yr
2- 5 yr
5-10 yr
10-25 yr
25-50 yr
50-100 yr
more than 100 yr
N
0
1,000
2,000
3,000
Feet
1:24,000
Obstructions
Susquehanna River Tributaries Watershed Columbia County Act 167 Stormwater Management Plan Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 2-3



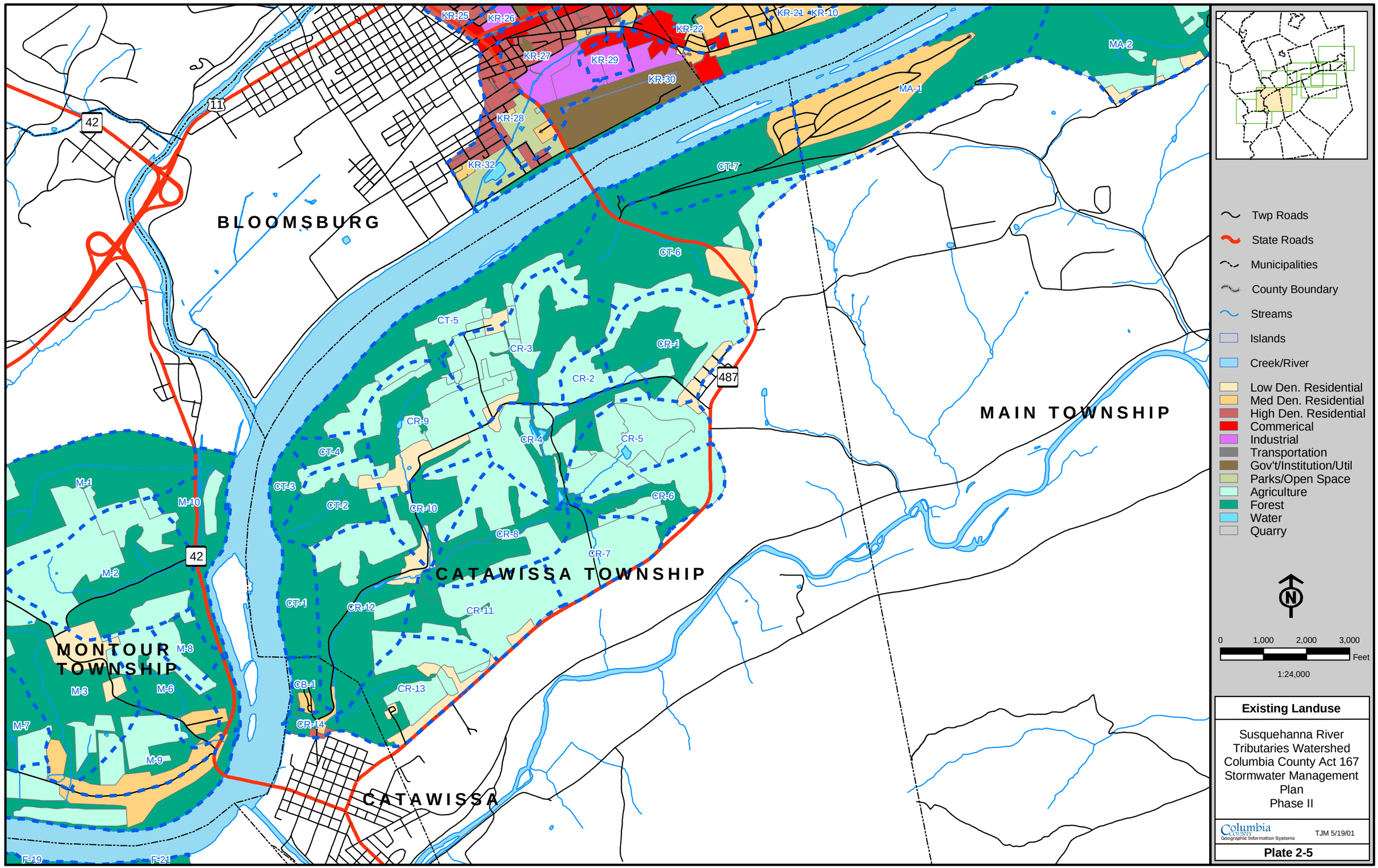
Geology

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 2-4



Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Low Den. Residential
Med Den. Residential
High Den. Residential
Commerical
Industrial
Transportation
Gov't/Institution/Util
Parks/Open Space
Agriculture
Forest
Water
Quarry

N

0 1,000 2,000 3,000
Feet

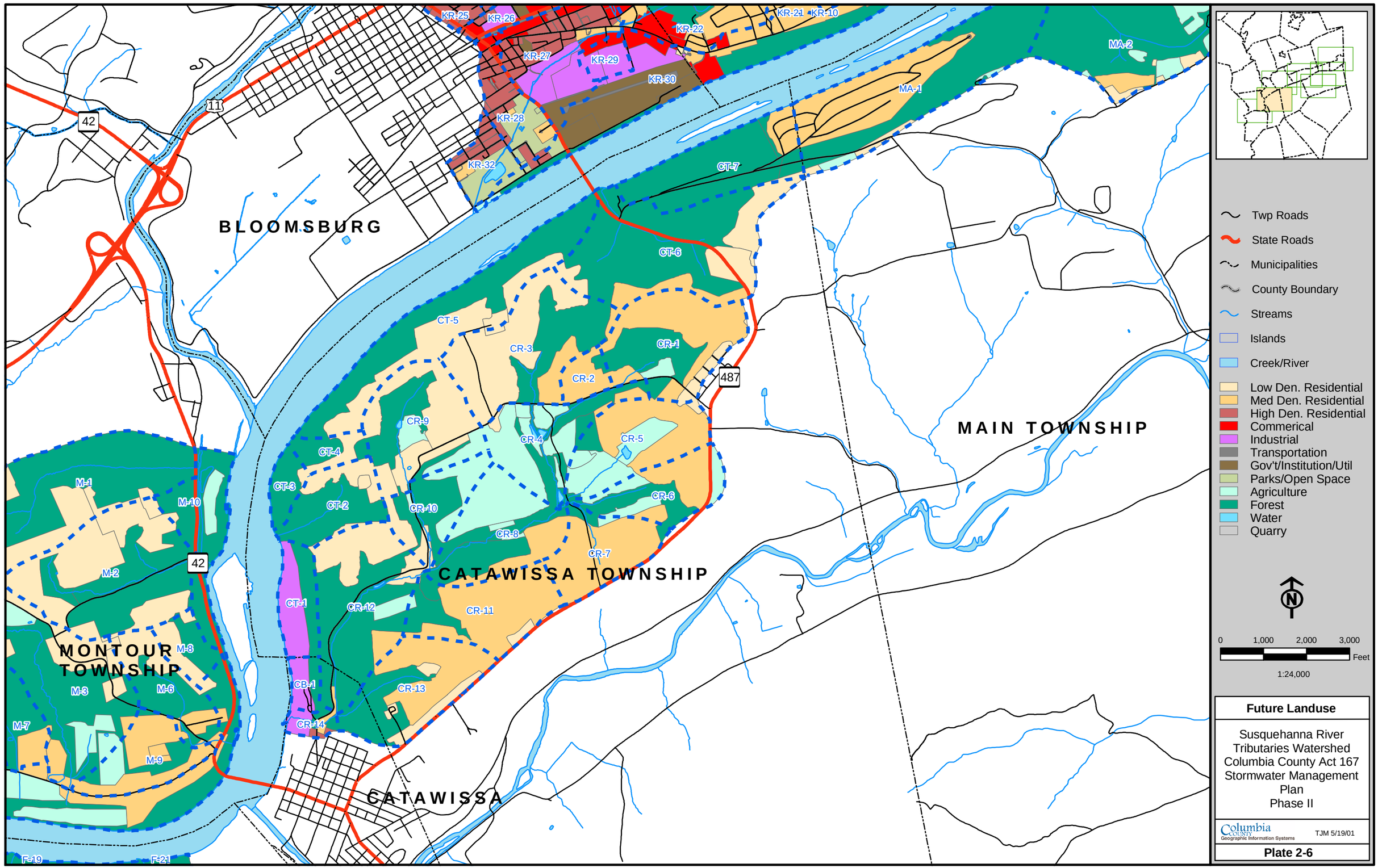
1:24,000

Existing Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems
TJM 5/19/01

Plate 2-5



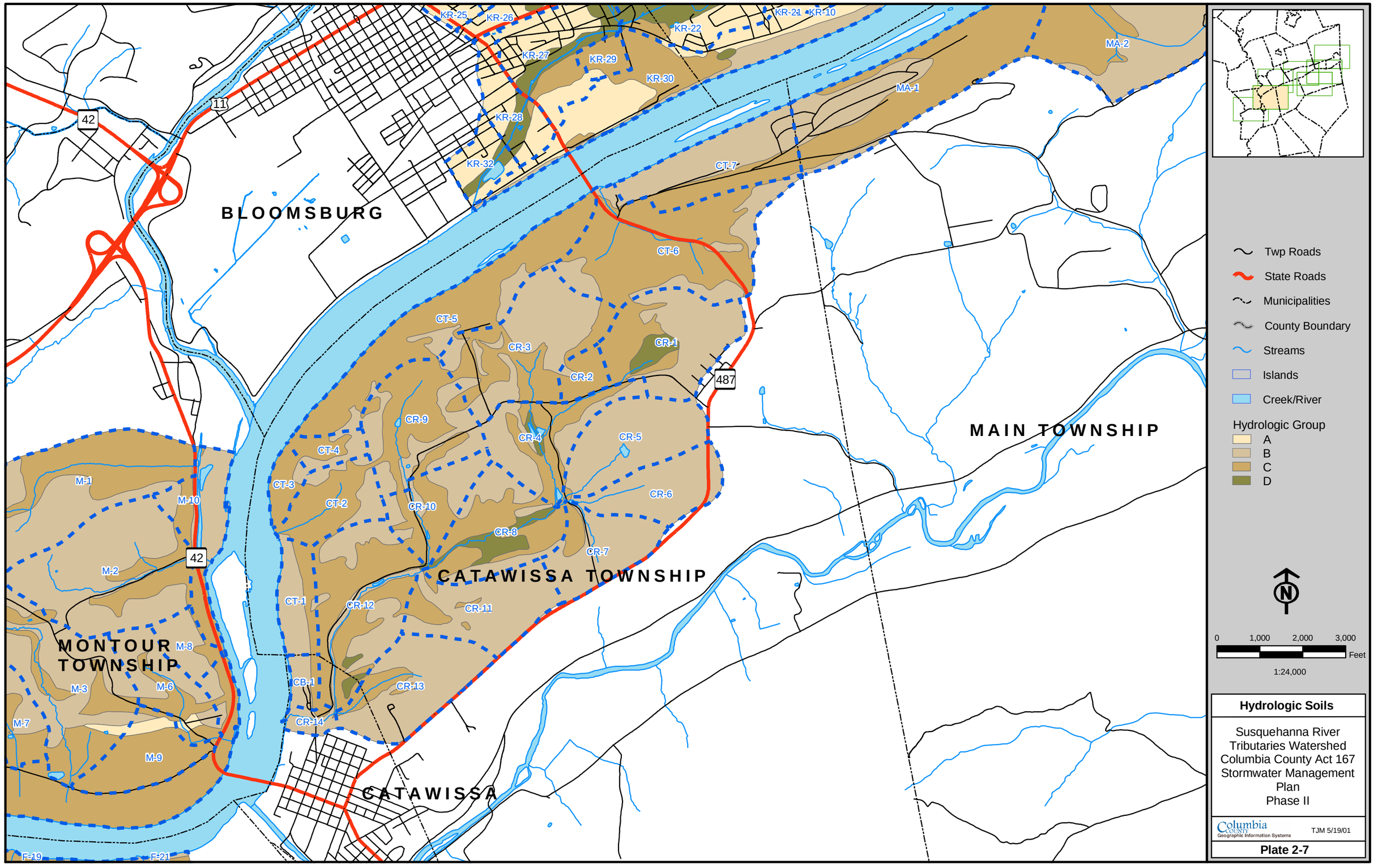
Future Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 2-6

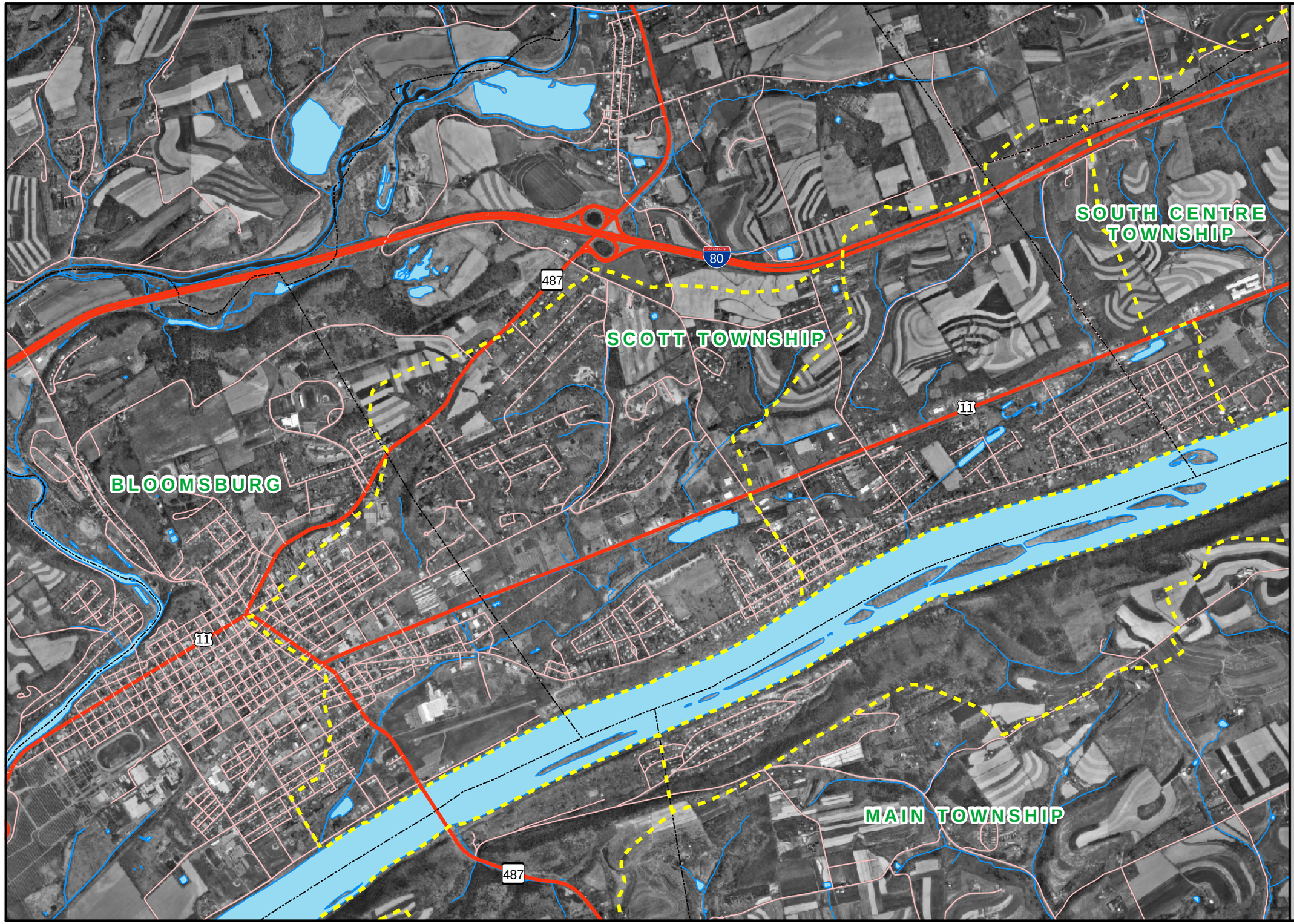


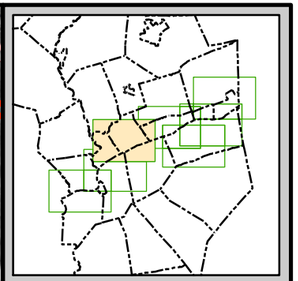
Hydrologic Soils

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 2-7





Twp Roads
State Roads
Municipalities
County Boundary
Watersheds
Streams
Islands
Creek/River

N

0 1,000 2,000 3,000
Feet

1:24,000

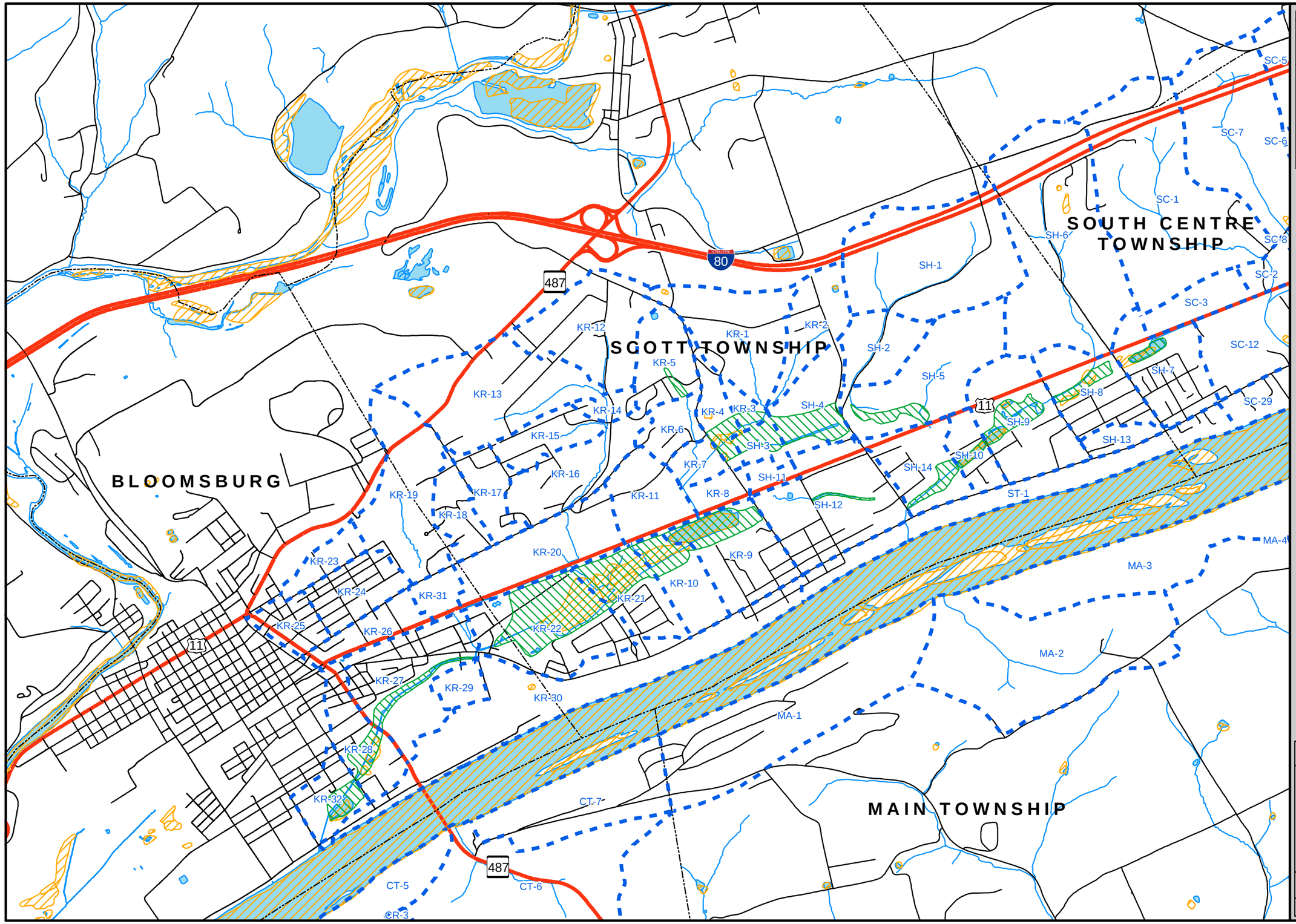
Basemap

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 3-1


BLOOMSBURG
SCOTT TOWNSHIP
SOUTH CENTRE TOWNSHIP
MAIN TOWNSHIP
80
487
11
KR-1
KR-2
KR-3
KR-4
KR-5
KR-6
KR-7
KR-8
KR-9
KR-10
KR-11
KR-12
KR-13
KR-14
KR-15
KR-16
KR-17
KR-18
KR-19
KR-20
KR-21
KR-22
KR-23
KR-24
KR-25
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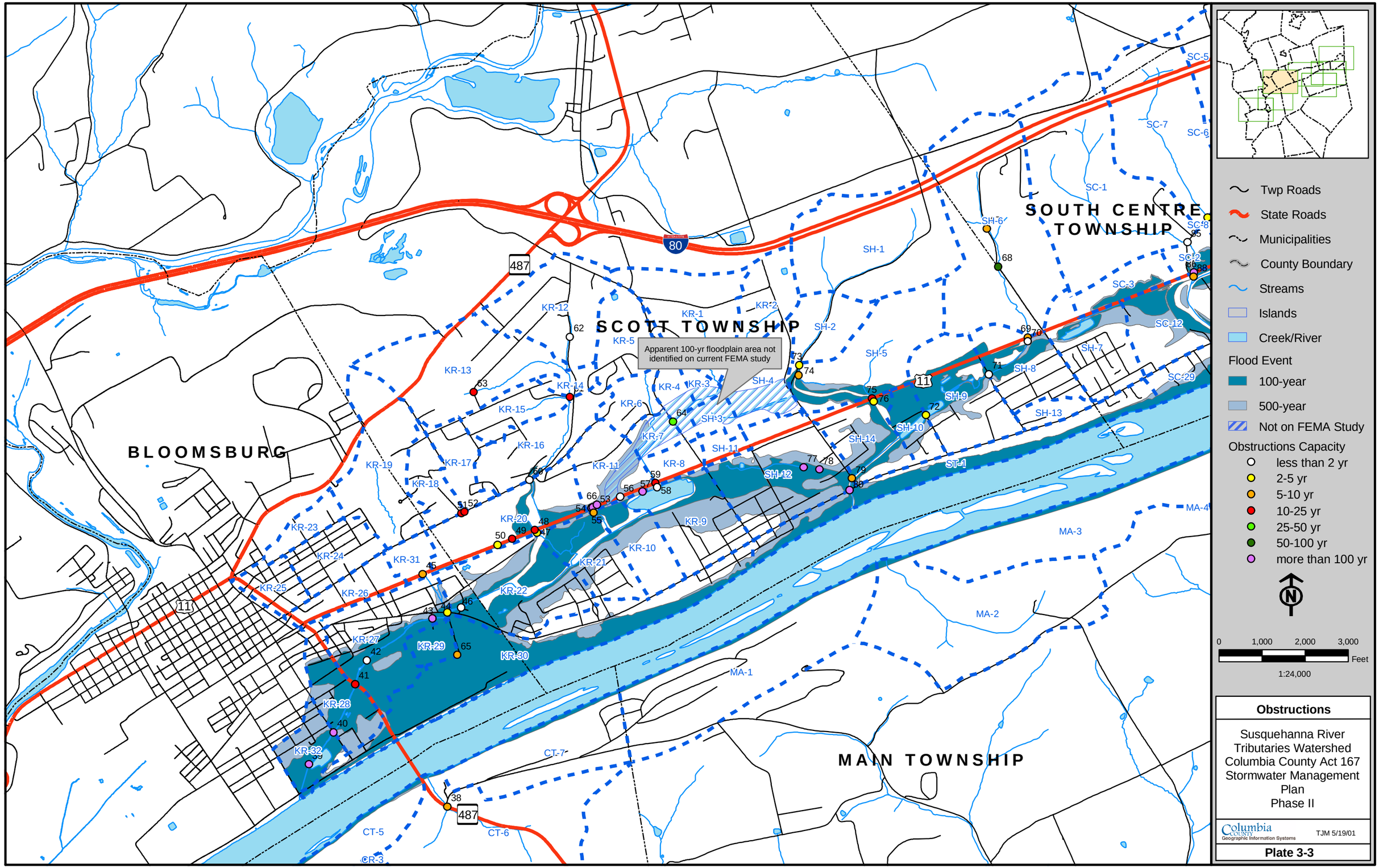
KR-27
KR-28
KR-29
KR-30
KR-31
KR-32
SH-1
SH-2
SH-3
SH-4
SH-5
SH-6
SH-7
SH-8
SH-9
SH-10
SH-11
SH-12
SH-13
SH-14
SC-1
SC-2
SC-3
SC-5
SC-6
SC-7
SC-8
SC-12
SC-29
ST-1
MA-1
MA-2
MA-3
MA-4
CT-5
CT-6
CT-7
CR-3
Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Wetlands
Stormwater Storage
N
0
1,000
2,000
3,000
Feet
1:24,000
Subareas
Susquehanna River Tributaries Watershed Columbia County Act 167 Stormwater Management Plan Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 3-2

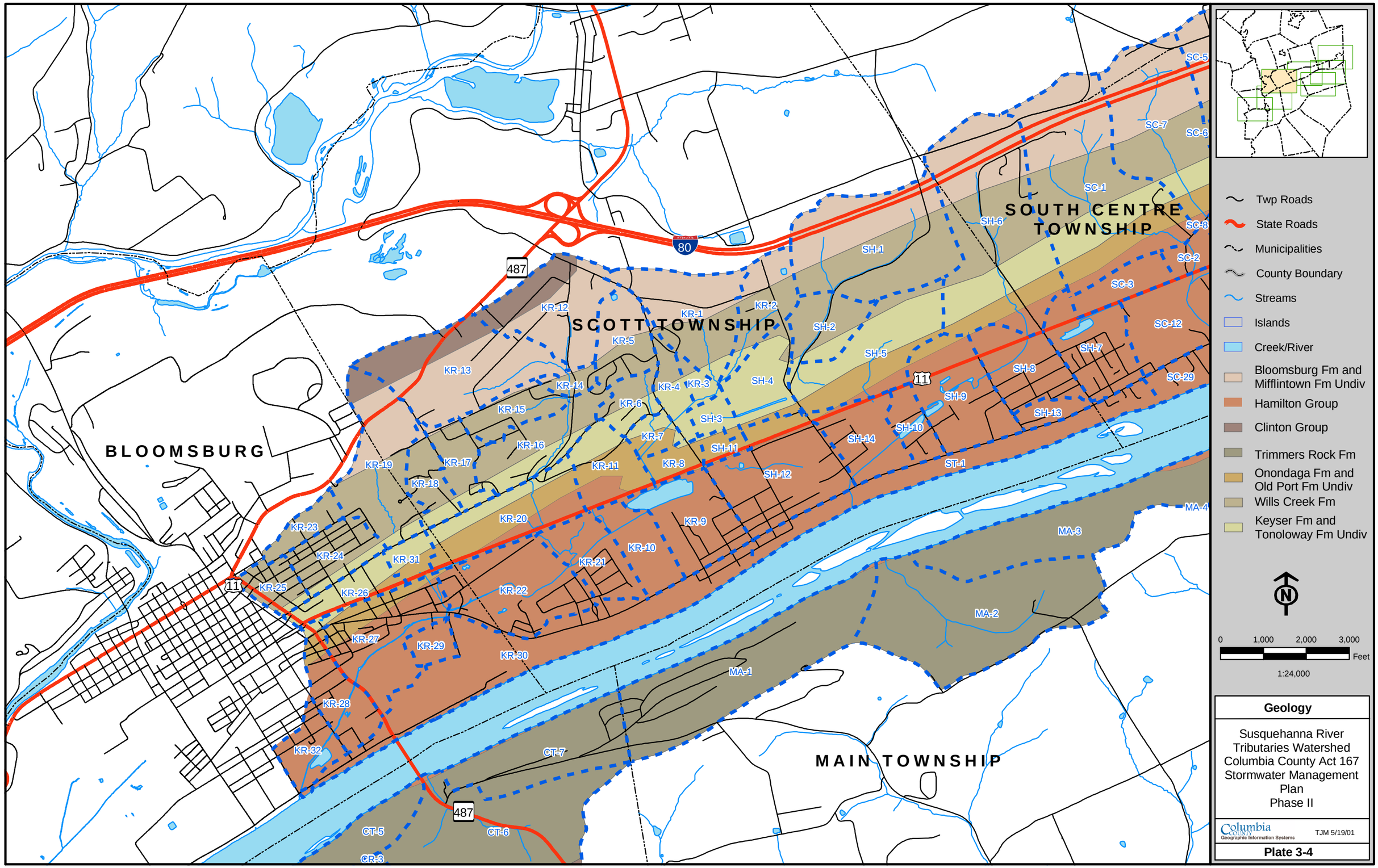


Obstructions

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 3-3



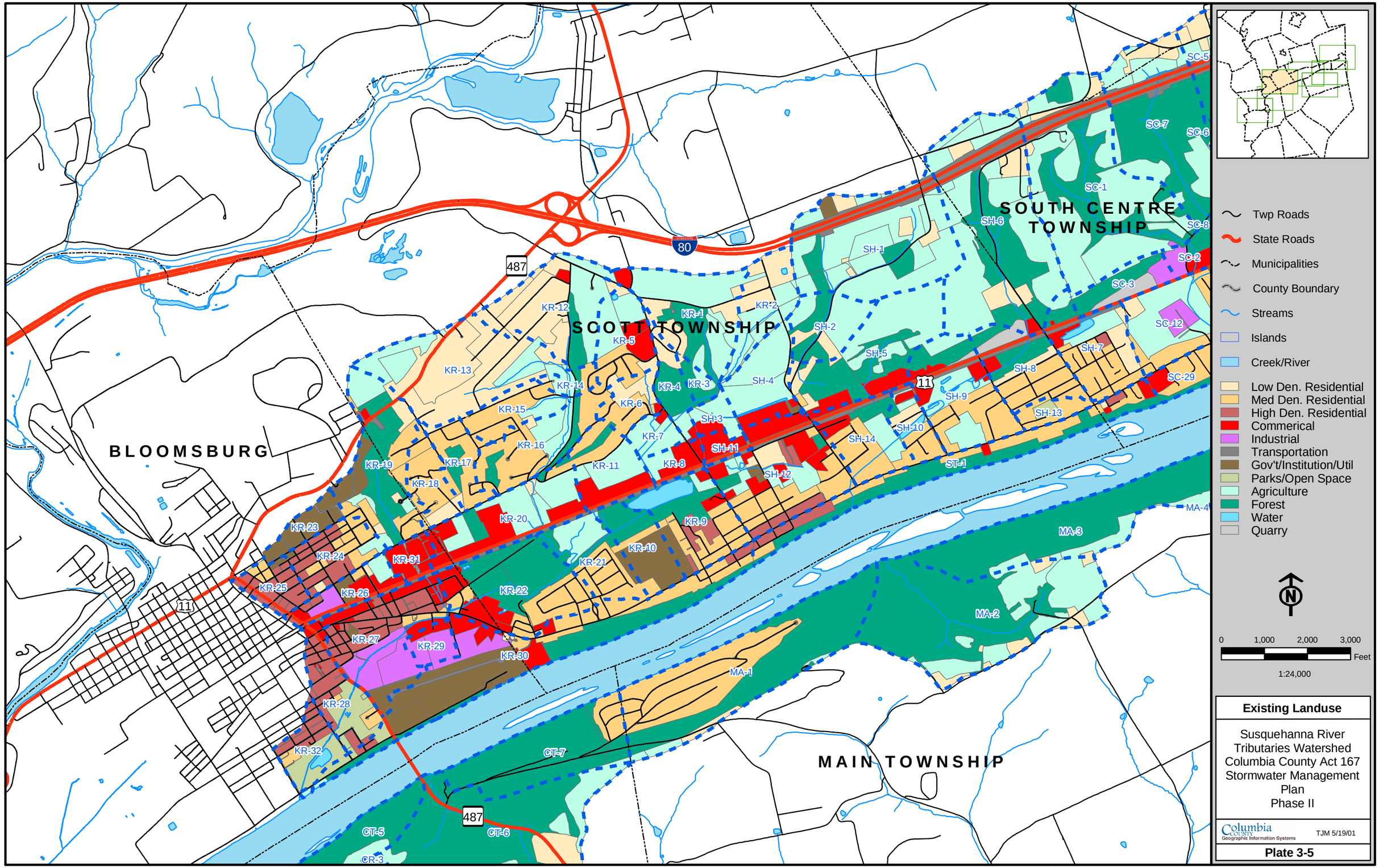
Geology

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 3-4

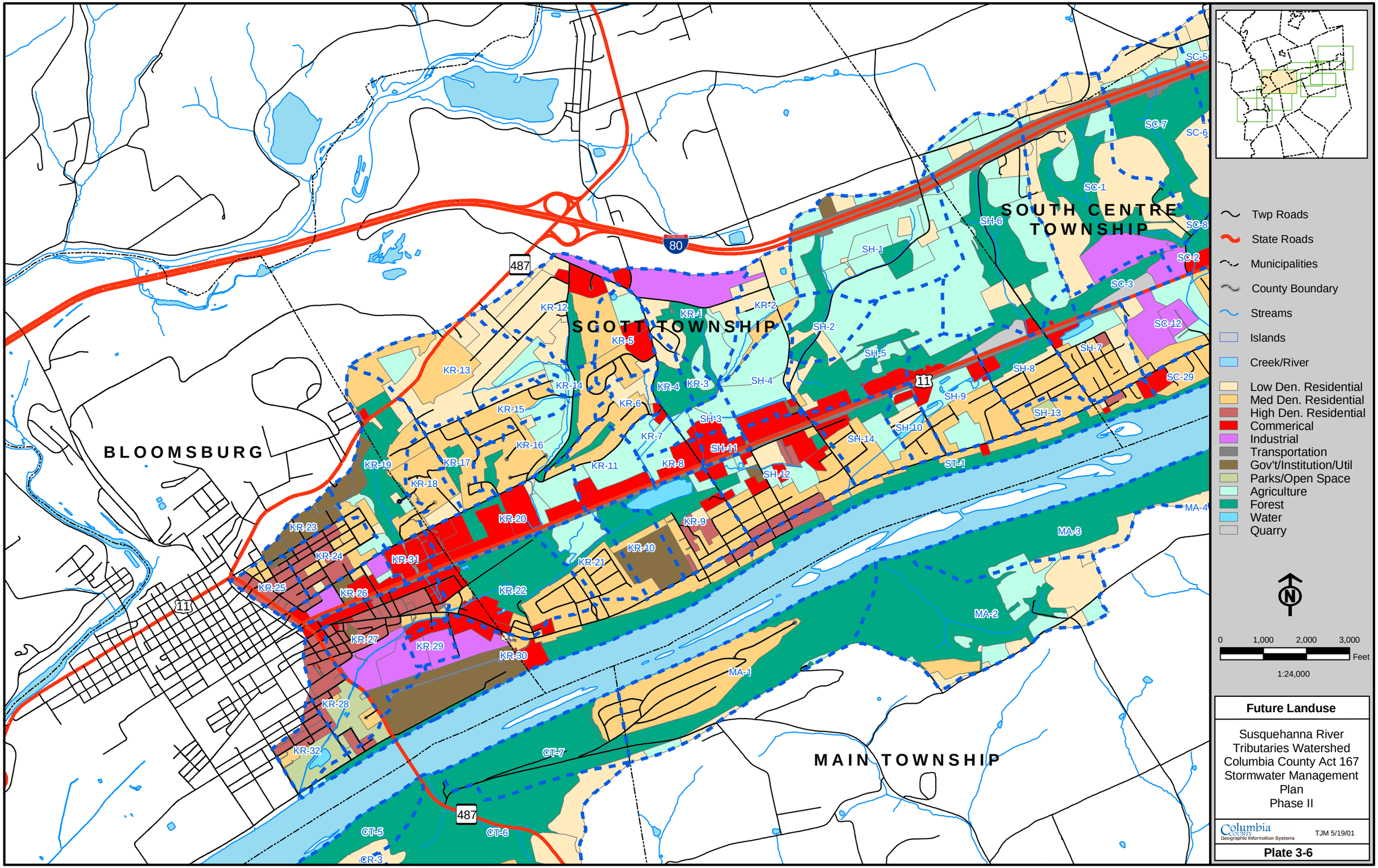


Existing Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 3-5

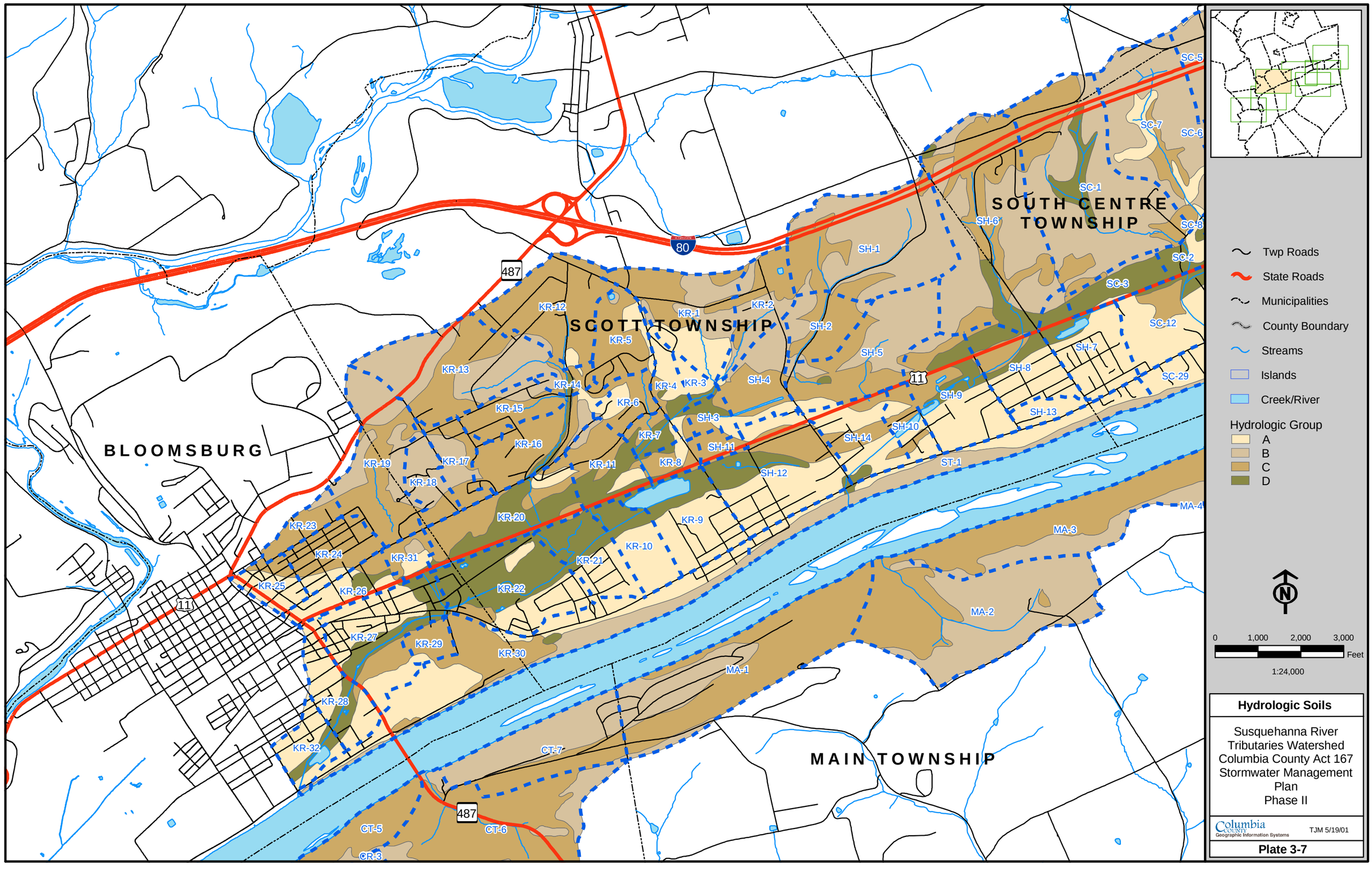


Future Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 3-6

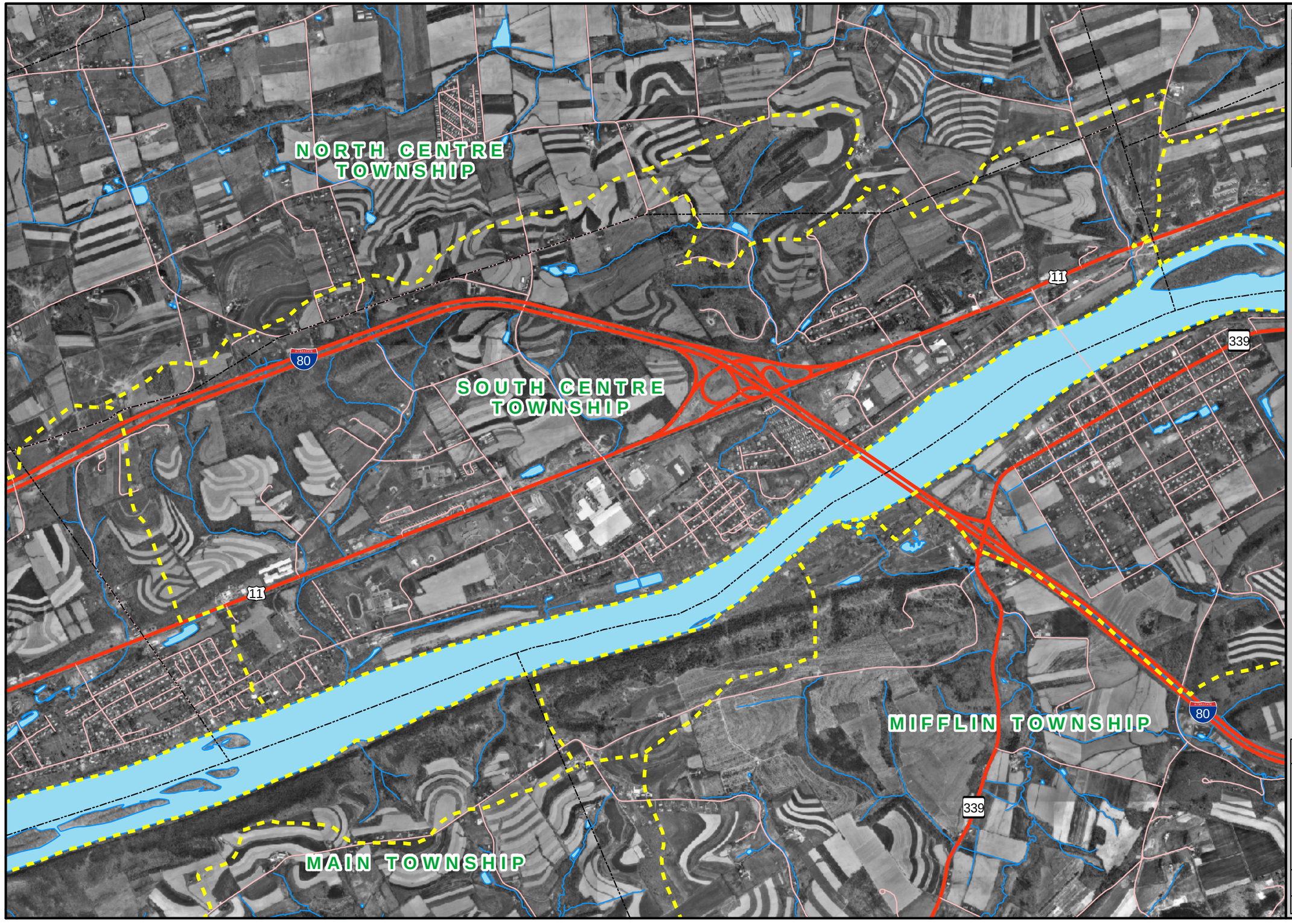


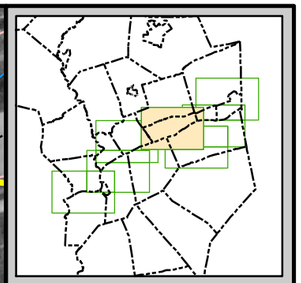
Hydrologic Soils

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 3-7





Twp Roads
State Roads
Municipalities
County Boundary
Watersheds
Streams
Islands
Creek/River

N

0 1,000 2,000 3,000
Feet

1:24,000

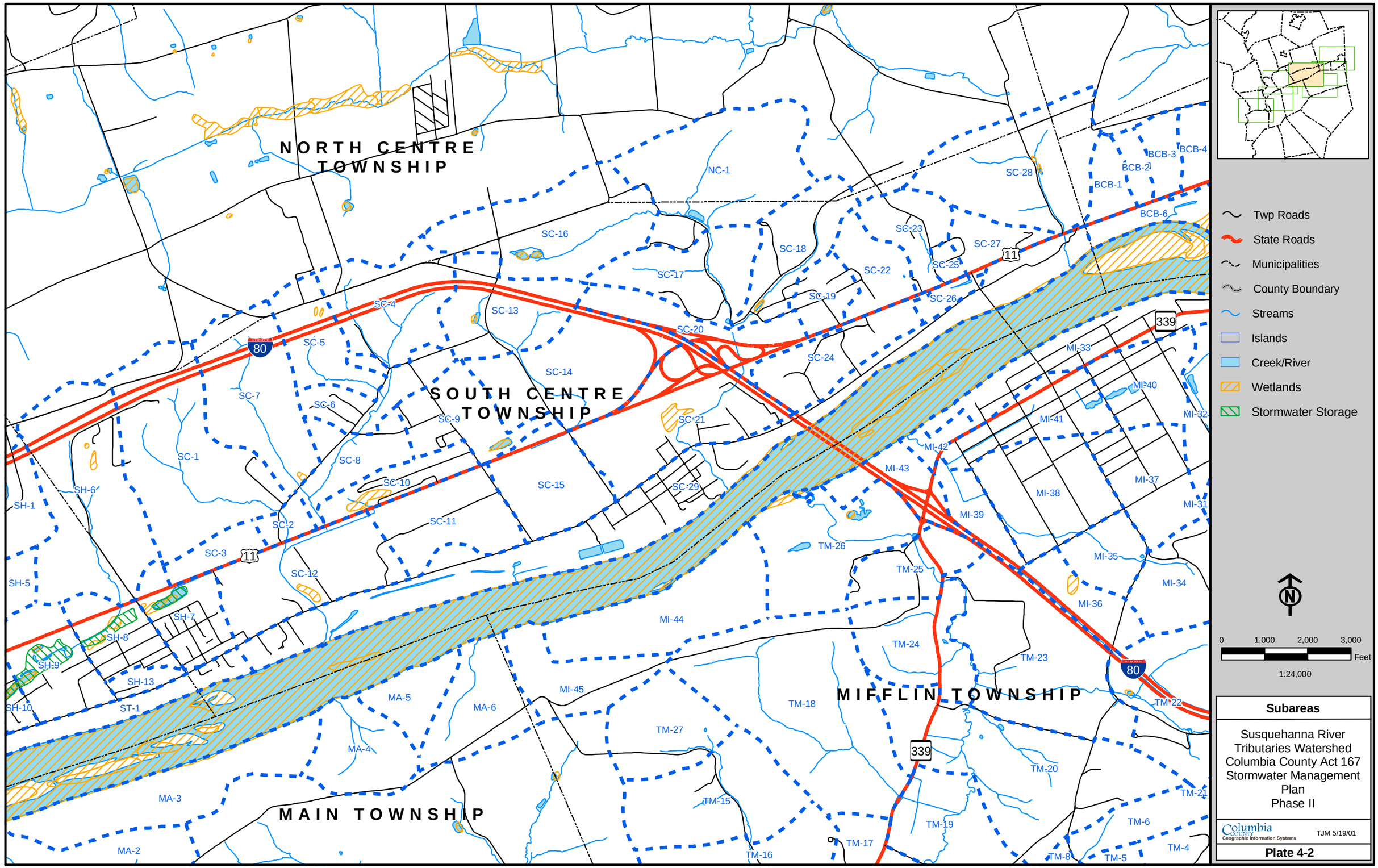
Basemap

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia COUNTY Geographic Information Systems

TJM 5/19/01

Plate 4-1



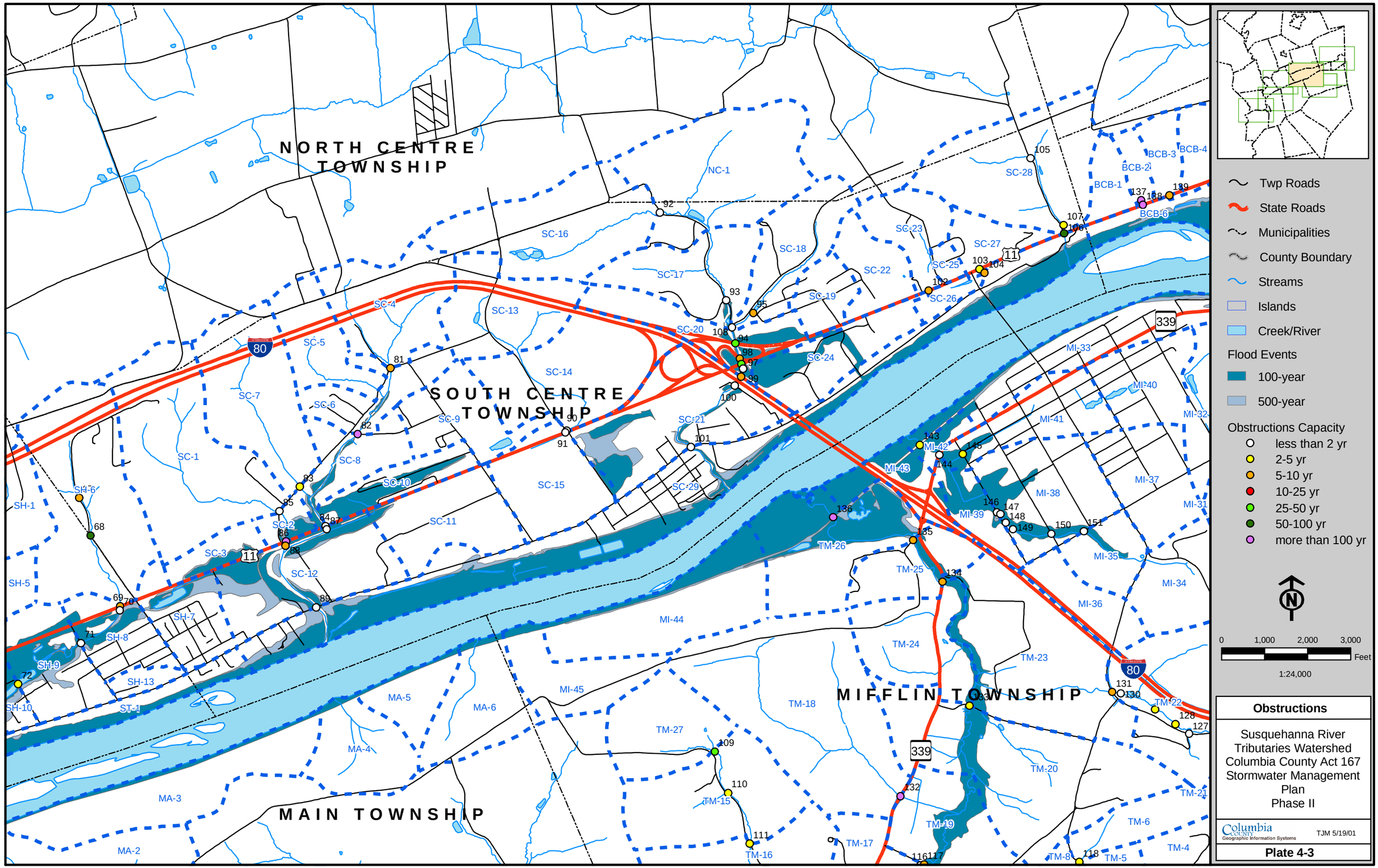
Subareas

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 4-2


NORTH CENTRE TOWNSHIP
SOUTH CENTRE TOWNSHIP
MAIN TOWNSHIP
MIFFLIN TOWNSHIP
NC-1
SC-1
SC-2
SC-3
SC-4
SC-5
SC-6
SC-7
SC-8
SC-9
SC-10
SC-11
SC-12
SC-13
SC-14
SC-15
SC-16
SC-17
SC-18
SC-19
SC-20
SC-21
SC-22
SC-23
SC-24
SC-25
SC-26
SC-27
SC-28
SC-29
BCB-1
BCB-2
BCB-3
BCB-4
BCB-6
TM-15
TM-16
TM-17
TM-18
TM-19
TM-20
TM-21
TM-22
TM-23
TM-24
TM-25
TM-26
TM-27
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MI-32
MI-33
MI-34
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MI-41
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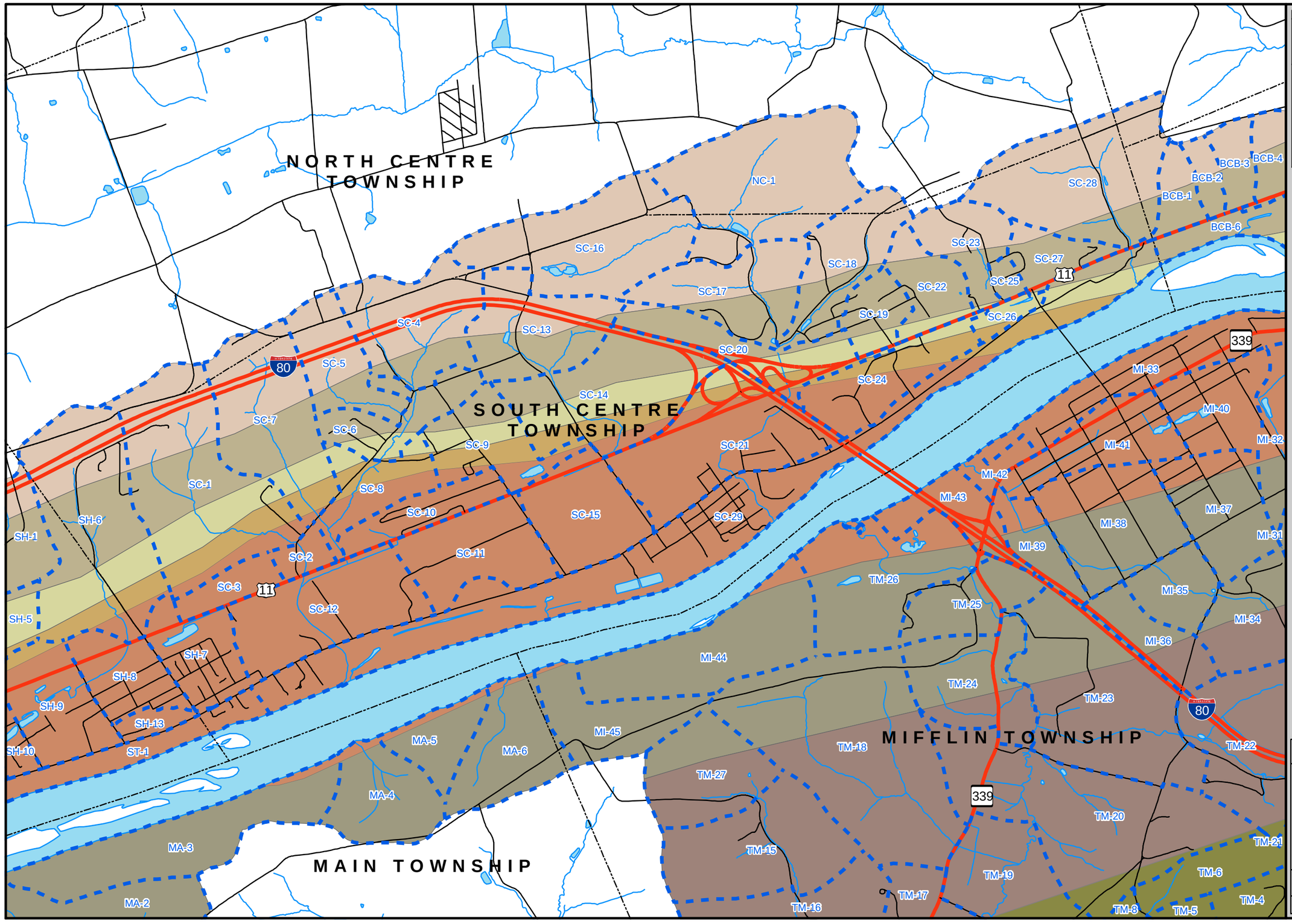
MI-43
MI-44
MI-45
MA-2
MA-3
MA-4
MA-5
MA-6
ST-1
SH-1
SH-5
SH-6
SH-7
SH-8
SH-9
SH-10
SH-13
80
11
339
Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Flood Events
100-year
500-year
Obstructions Capacity
less than 2 yr
2-5 yr
5-10 yr
10-25 yr
25-50 yr
50-100 yr
more than 100 yr
N
0
1,000
2,000
3,000
Feet
1:24,000
Obstructions
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 4-3



Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Bloomsburg Fm and Mifflintown Fm Undiv
Hamilton Group
Irish Valley Member of Catskill Fm
Trimmers Rock Fm
Onondaga Fm and Old Port Fm Undiv
Wills Creek Fm
Keyser Fm and Tonoloway Fm Undiv
Sherman Creek Member of Catskill Fm

0 1,000 2,000 3,000 Feet

1:24,000

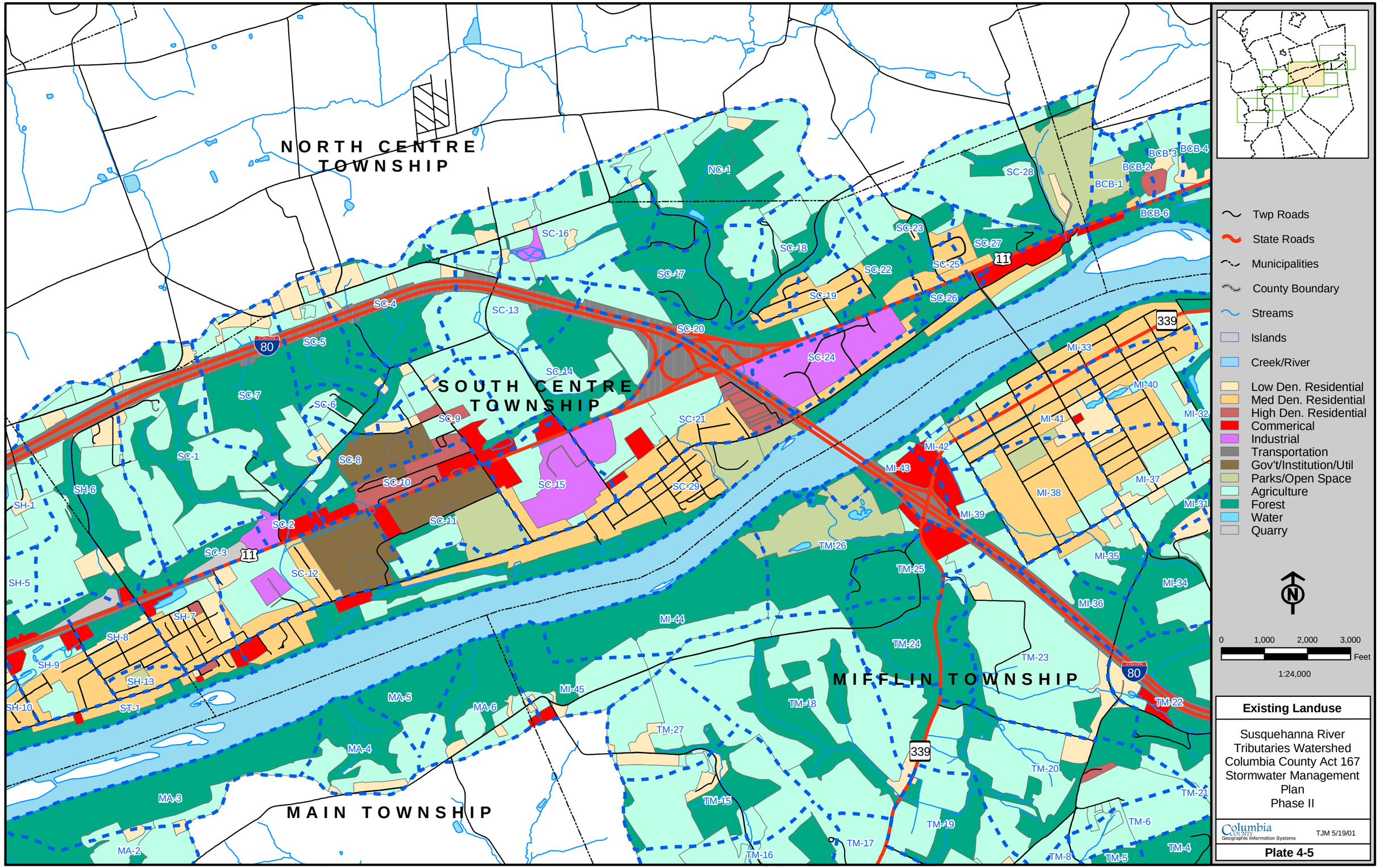
Geology

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 4-4



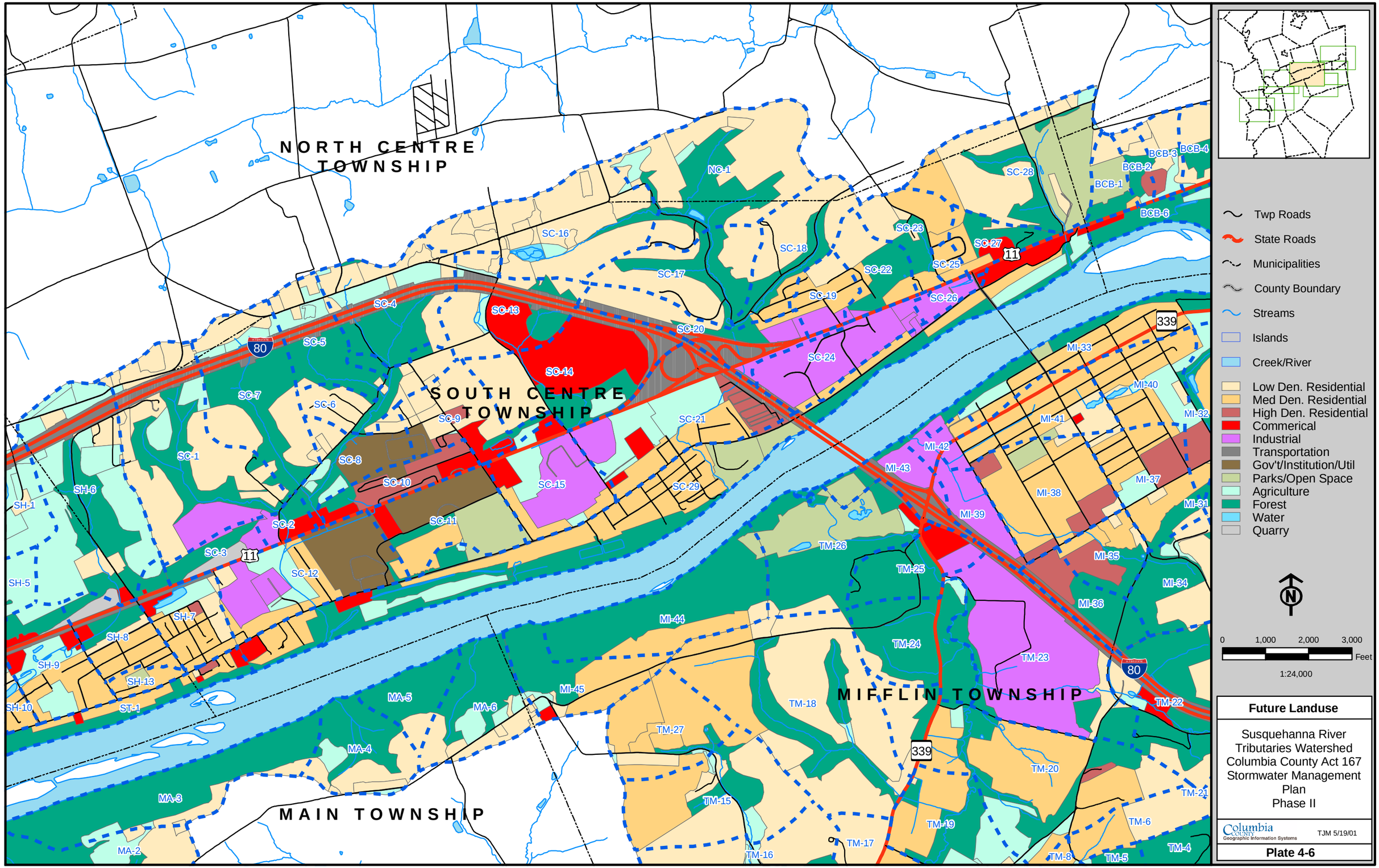
Existing Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 4-5



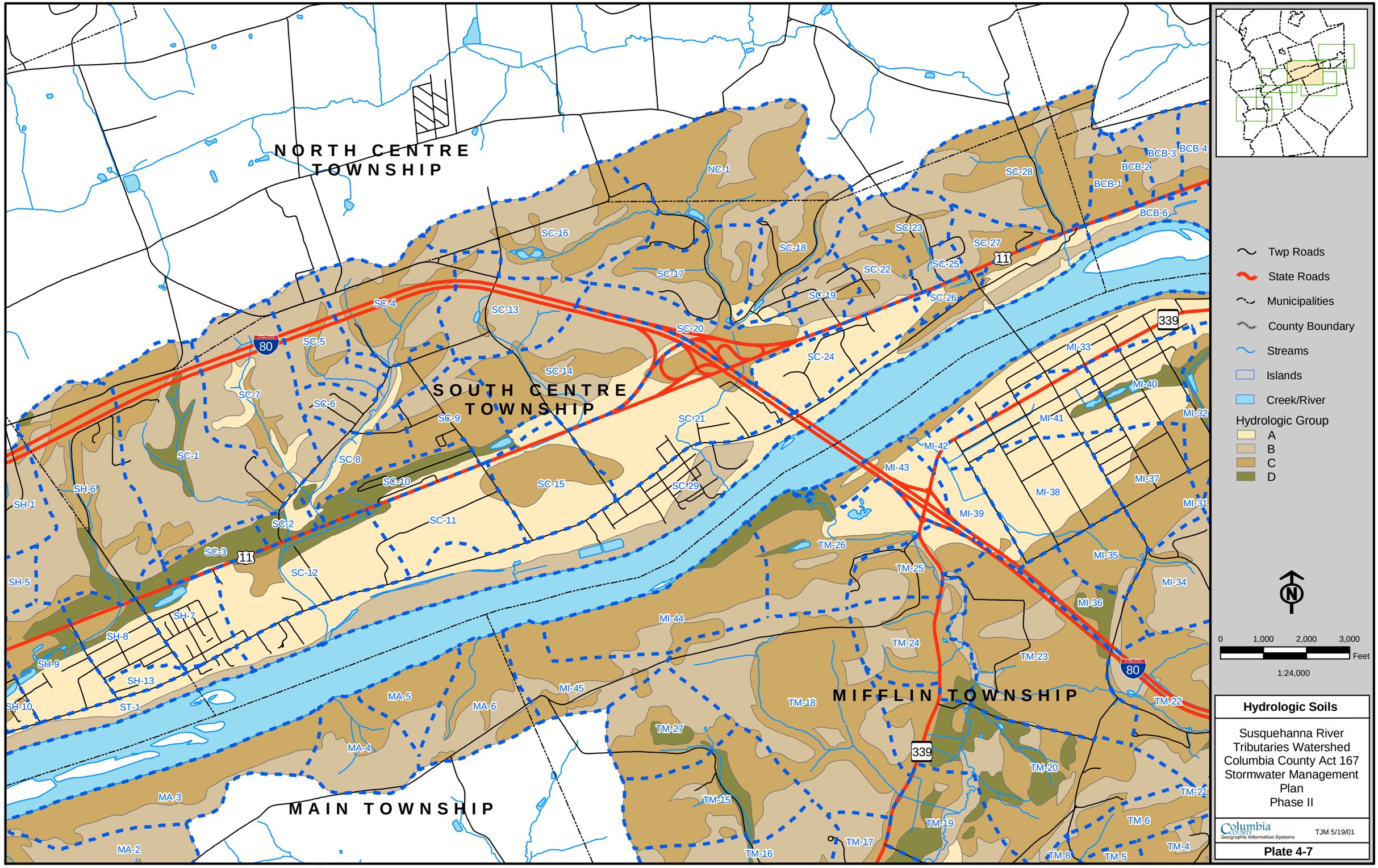
Future Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 4-6



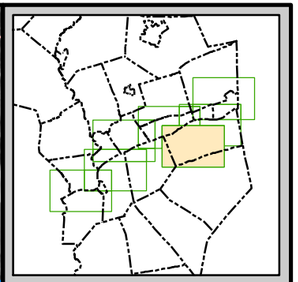
Hydrologic Soils

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 4-7



Twp Roads
State Roads
Municipalities
County Boundary
Watersheds
Streams
Islands
Creek/River

N

0 1,000 2,000 3,000
Feet

1:24,000

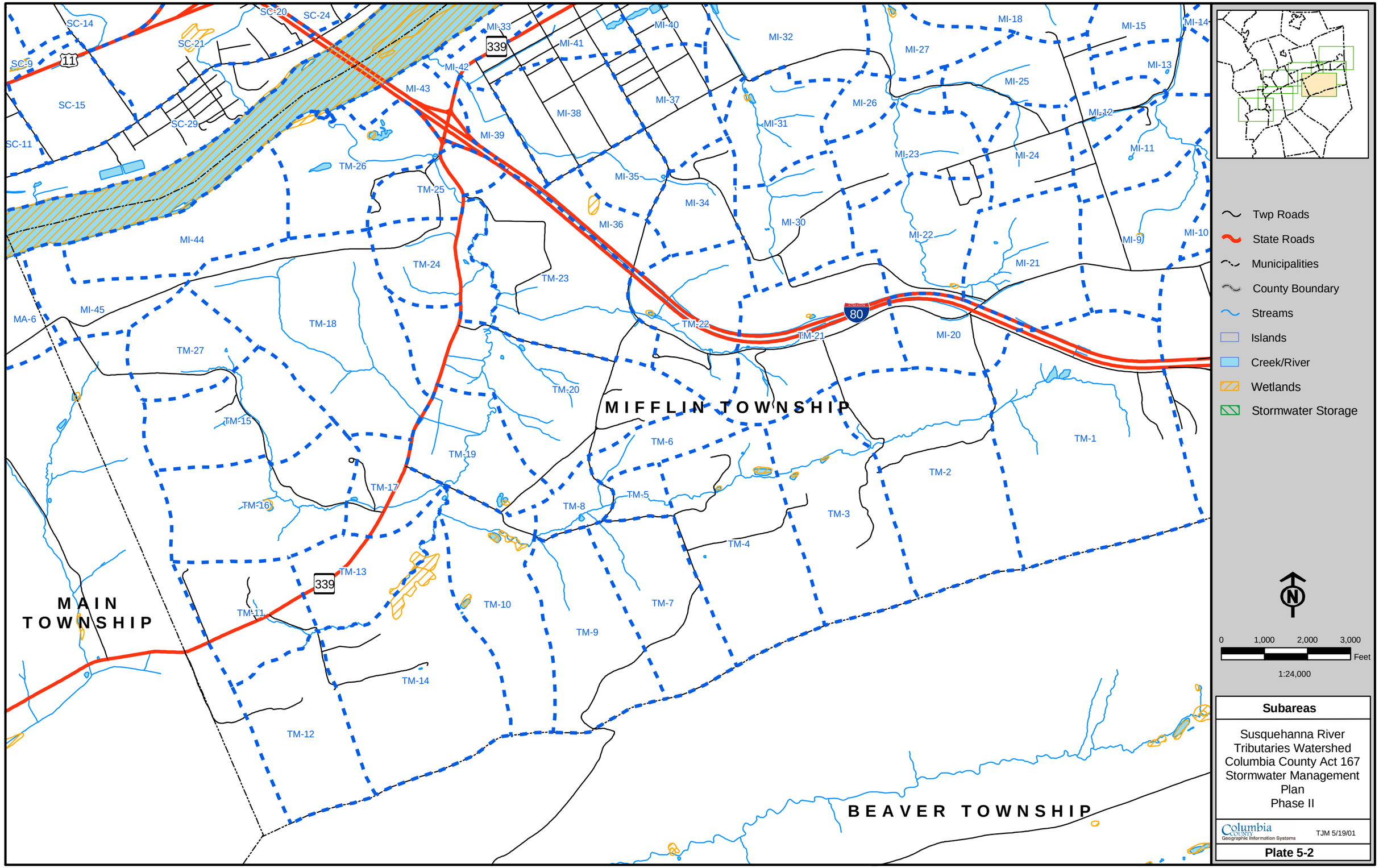
Basemap

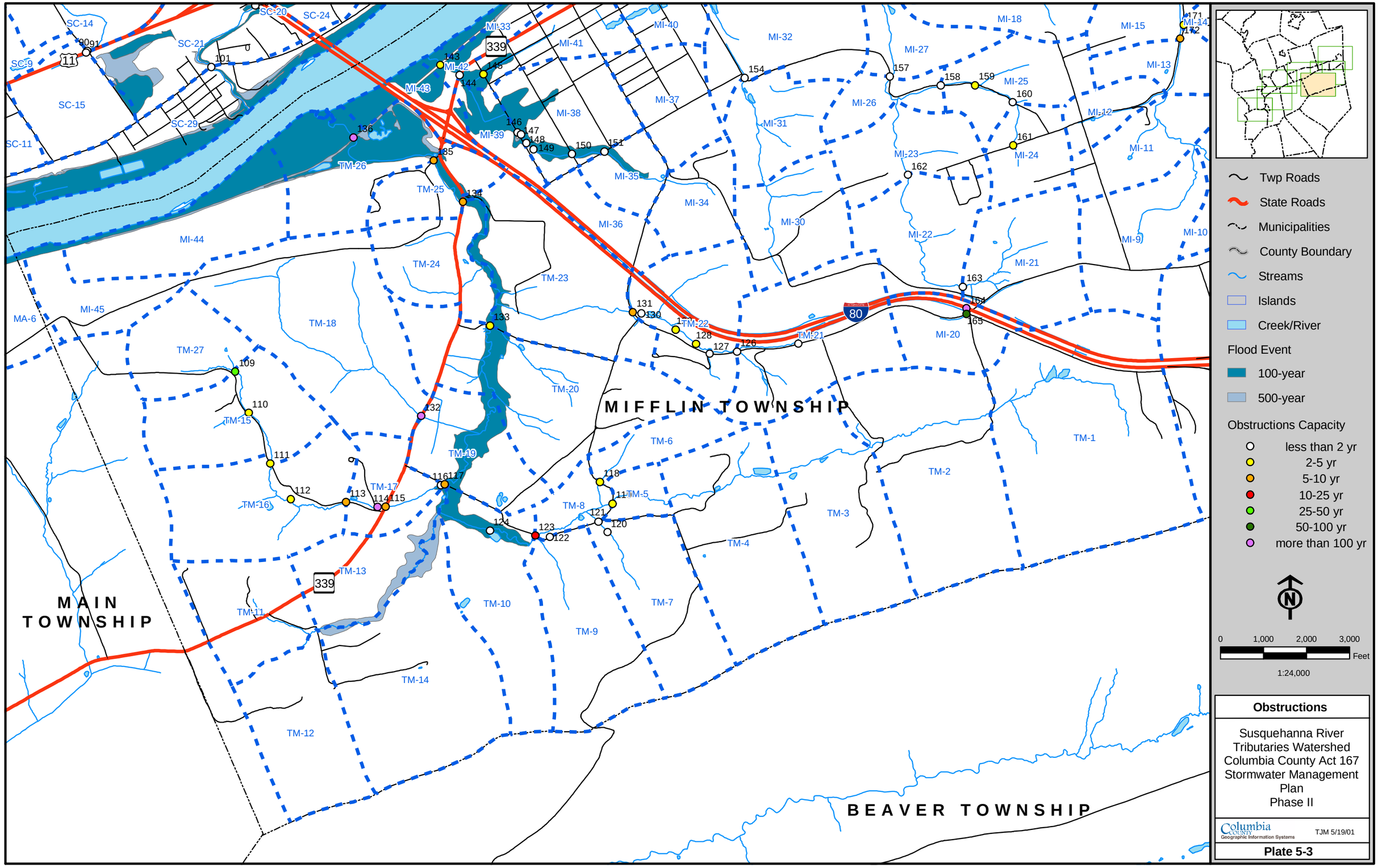
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 5-1


SC-14
SC-20
SC-24
SC-21
SC-9
11
SC-15
SC-29
SC-11
339
MI-33
MI-41
MI-40
MI-32
MI-18
MI-15
MI-14
MI-27
MI-13
MI-25
MI-42
MI-43
MI-37
MI-26
MI-38
MI-31
MI-12
MI-39
MI-23
MI-24
MI-11
TM-26
TM-25
MI-35
MI-34
MI-36
MI-30
MI-22
MI-9
MI-10
MI-44
TM-24
TM-23
MI-21
MI-45
MA-6
TM-18
TM-22
80
TM-21
MI-20
TM-27
TM-20
MIFFLIN TOWNSHIP
TM-15
TM-6
TM-1
TM-19
TM-2
TM-17
TM-16
TM-8
TM-5
TM-3
TM-4
TM-13
339
TM-10
TM-7
MAIN TOWNSHIP
TM-11
TM-9
TM-14
TM-12
BEAVER TOWNSHIP
Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Wetlands
Stormwater Storage
N
0
1,000
2,000
3,000
Feet
1:24,000
Subareas
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 5-2



Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River

Flood Event
100-year
500-year

Obstructions Capacity
less than 2 yr
2-5 yr
5-10 yr
10-25 yr
25-50 yr
50-100 yr
more than 100 yr

N

0 1,000 2,000 3,000
Feet

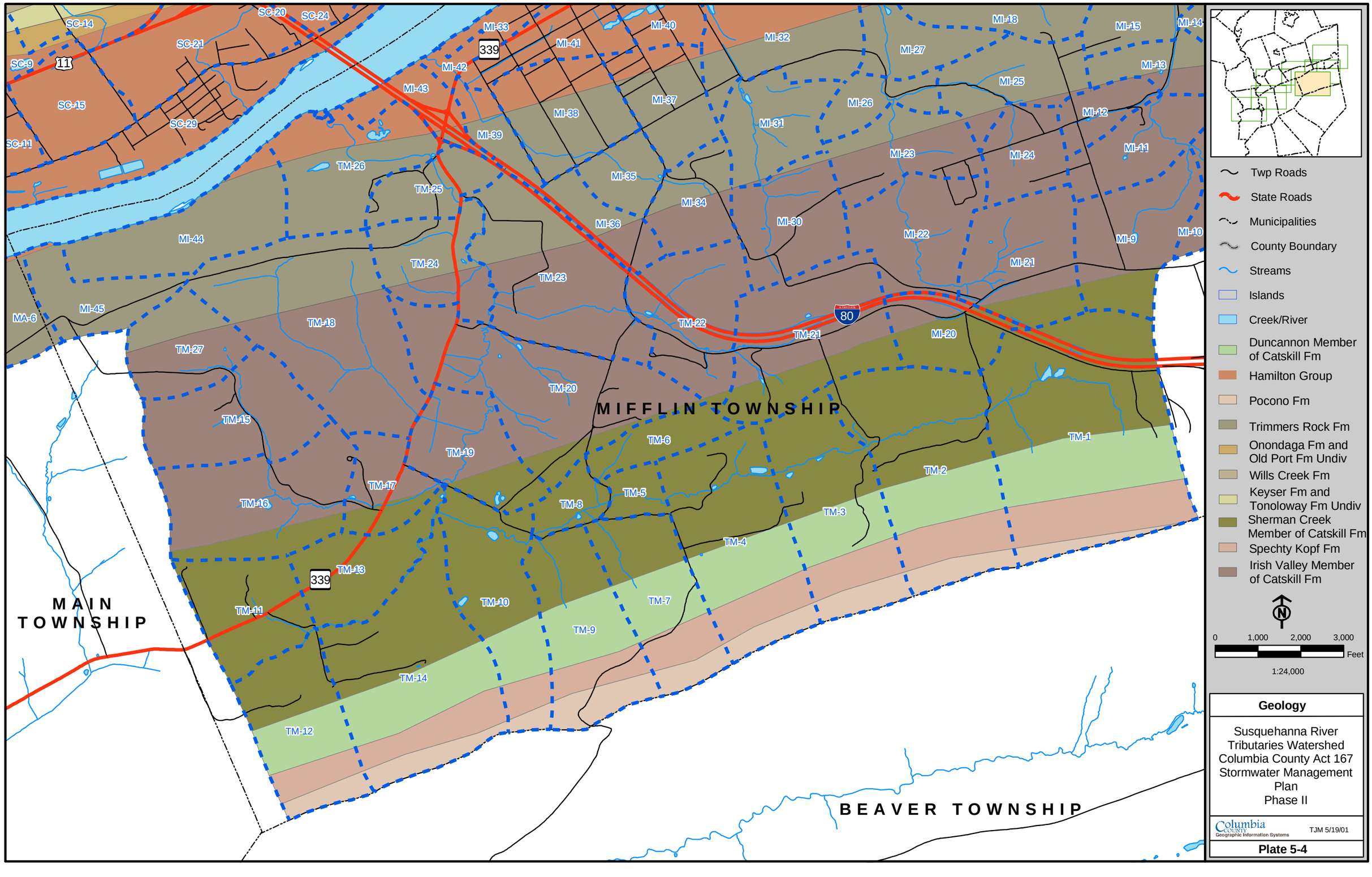
1:24,000

Obstructions

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems
TJM 5/19/01

Plate 5-3

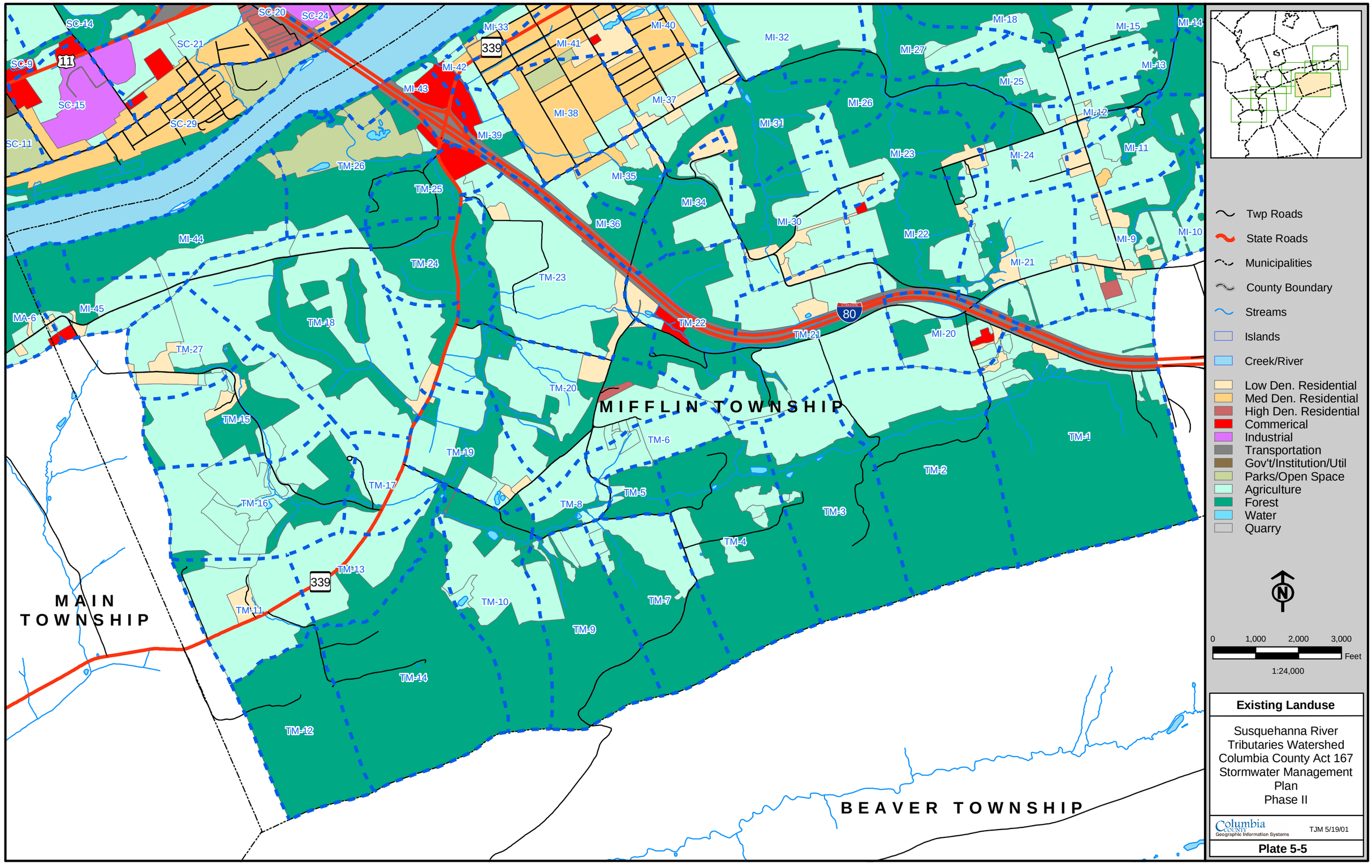


Geology

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 5-4

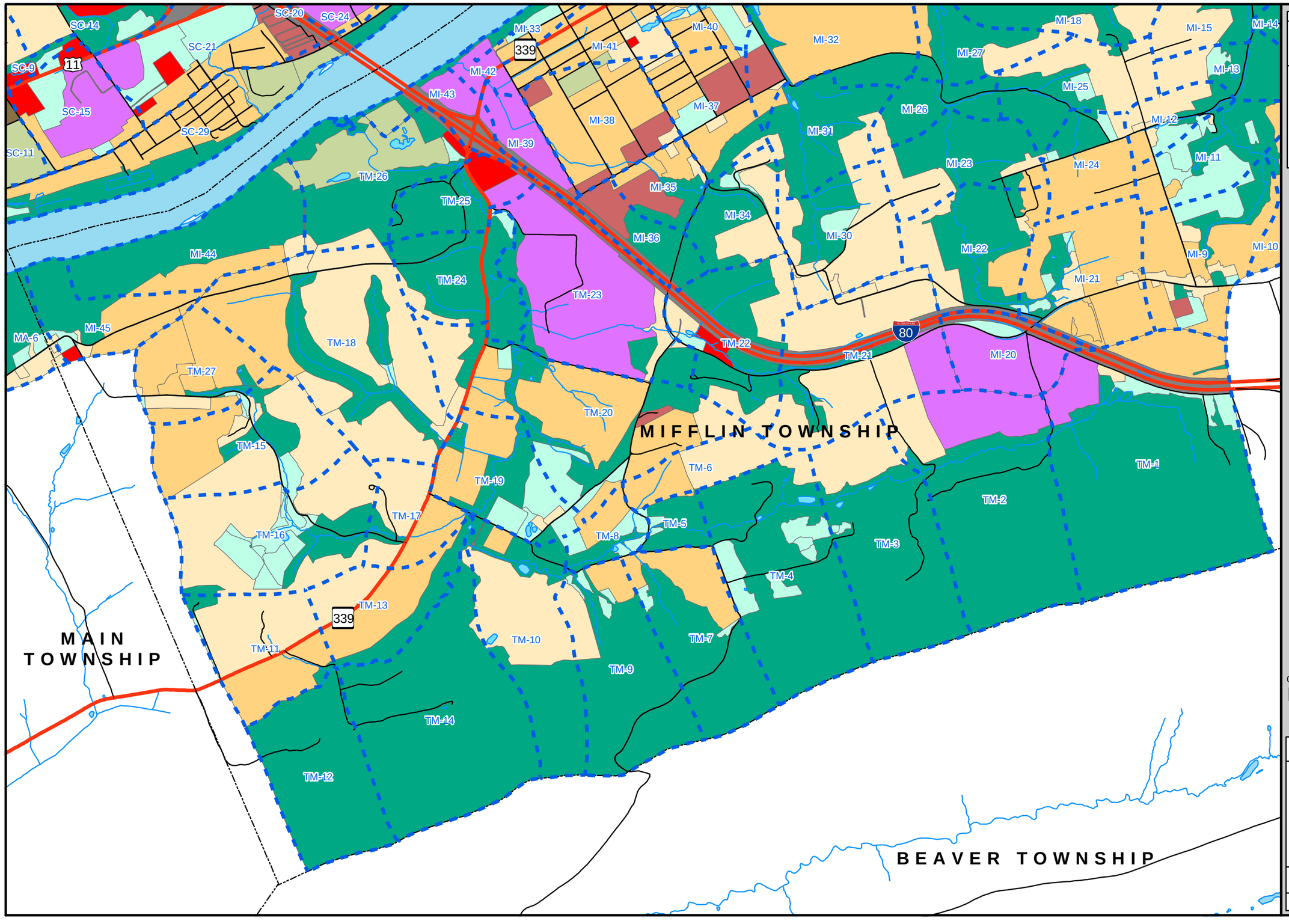


Existing Landuse

Susquehanna River
Tributaries Watershed
Columbia County Act 167
Stormwater Management
Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 5-5



Future Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

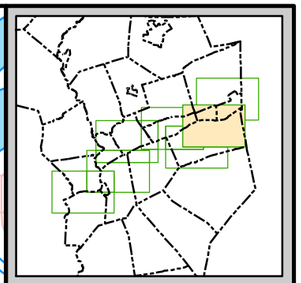
Plate 5-6

Hydrologic Soils

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 5-7



Twp Roads

State Roads

Municipalities

County Boundary

Watersheds

Streams

Islands

Creek/River

0 1,000 2,000 3,000 Feet

1:24,000

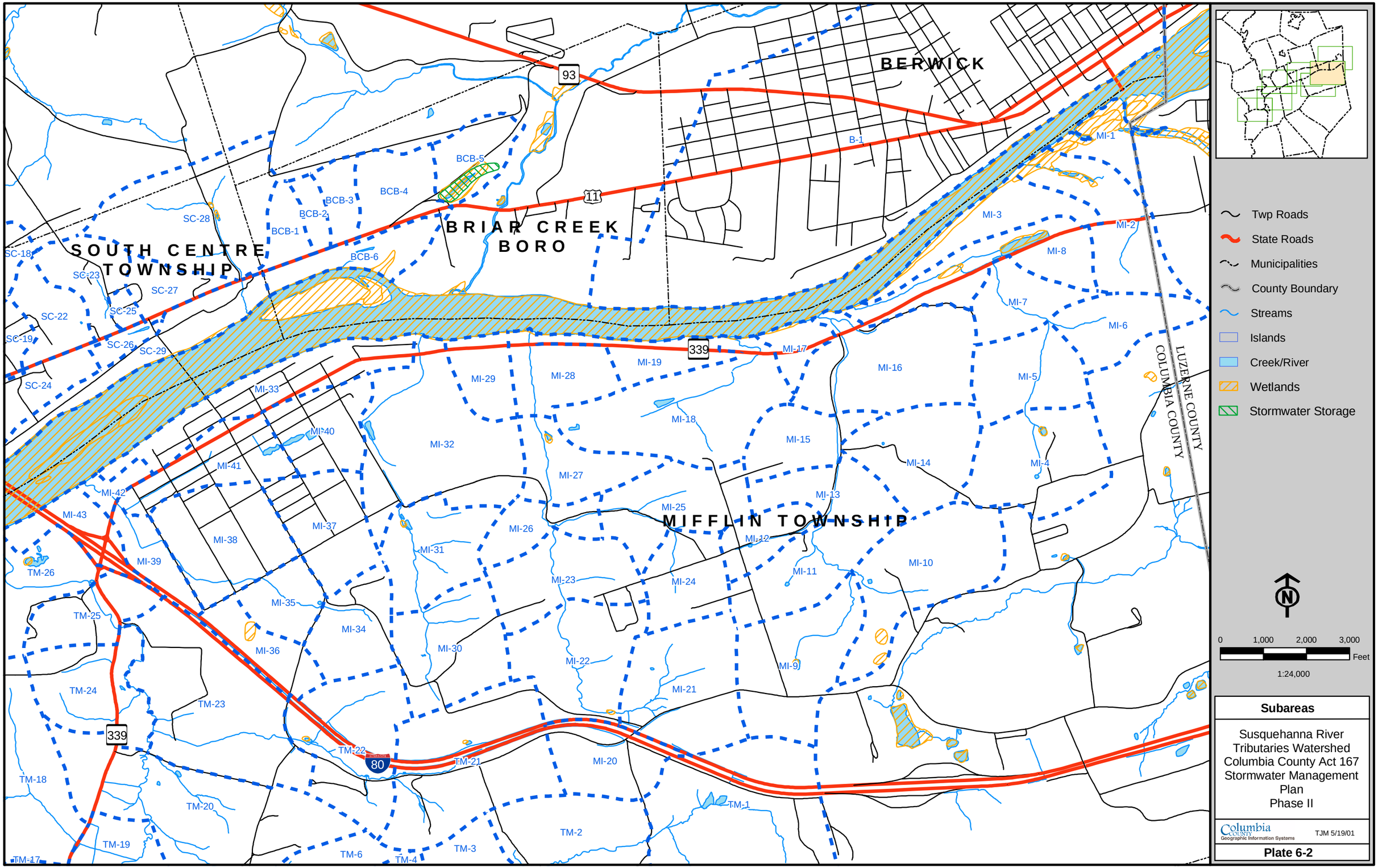
Basemap

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 6-1

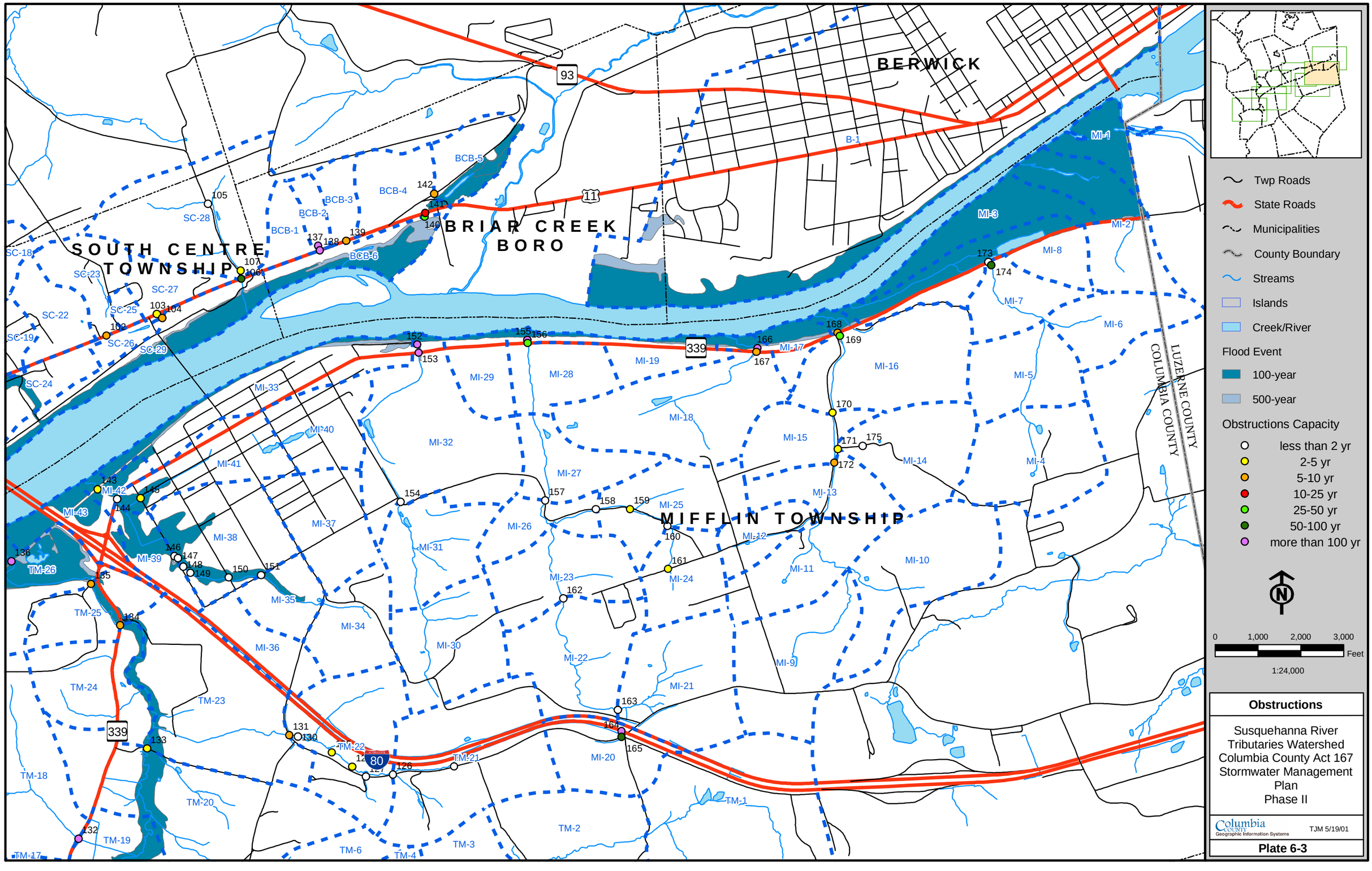


Subareas

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 6-2

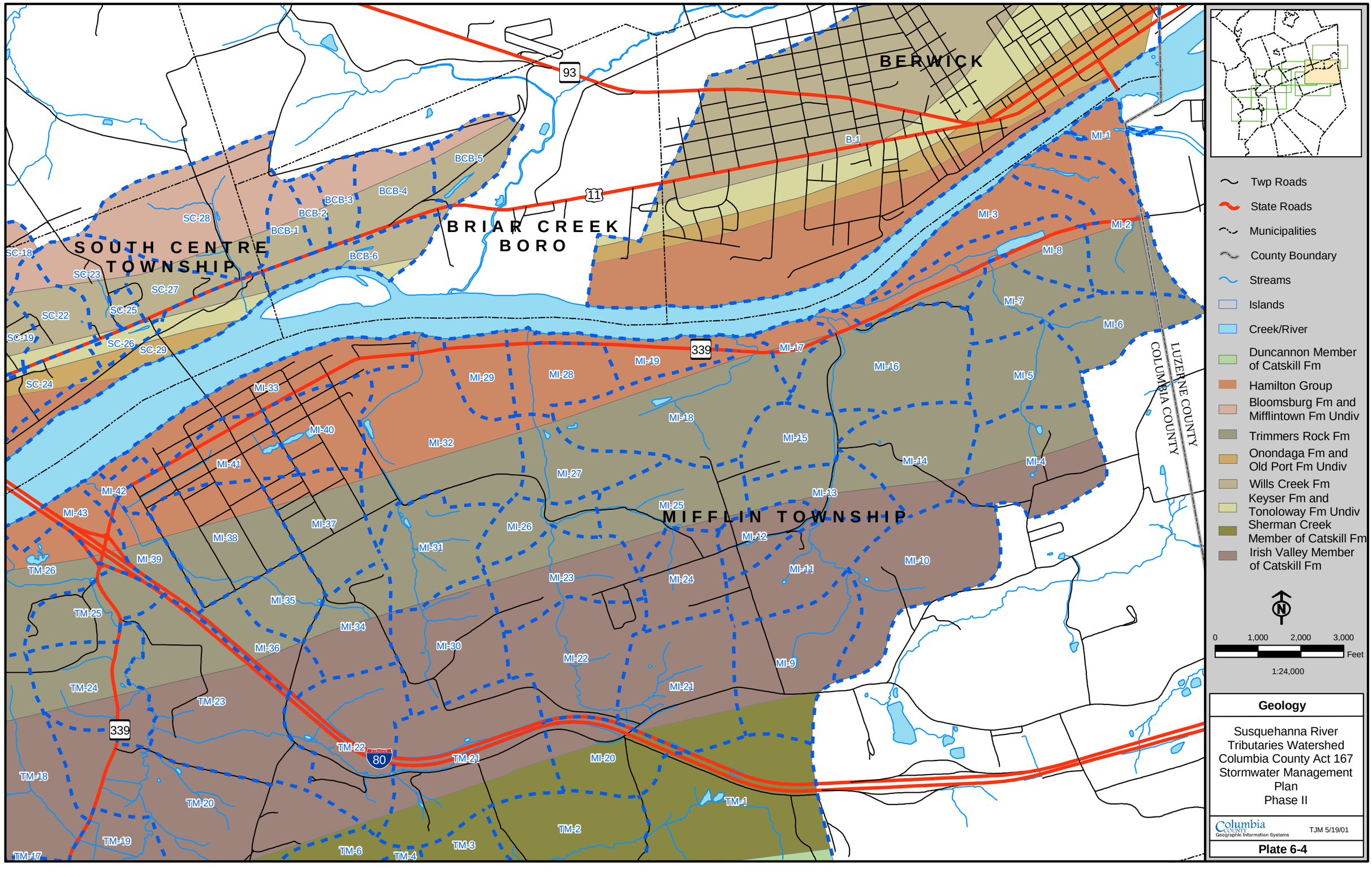


Obstructions

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 6-3

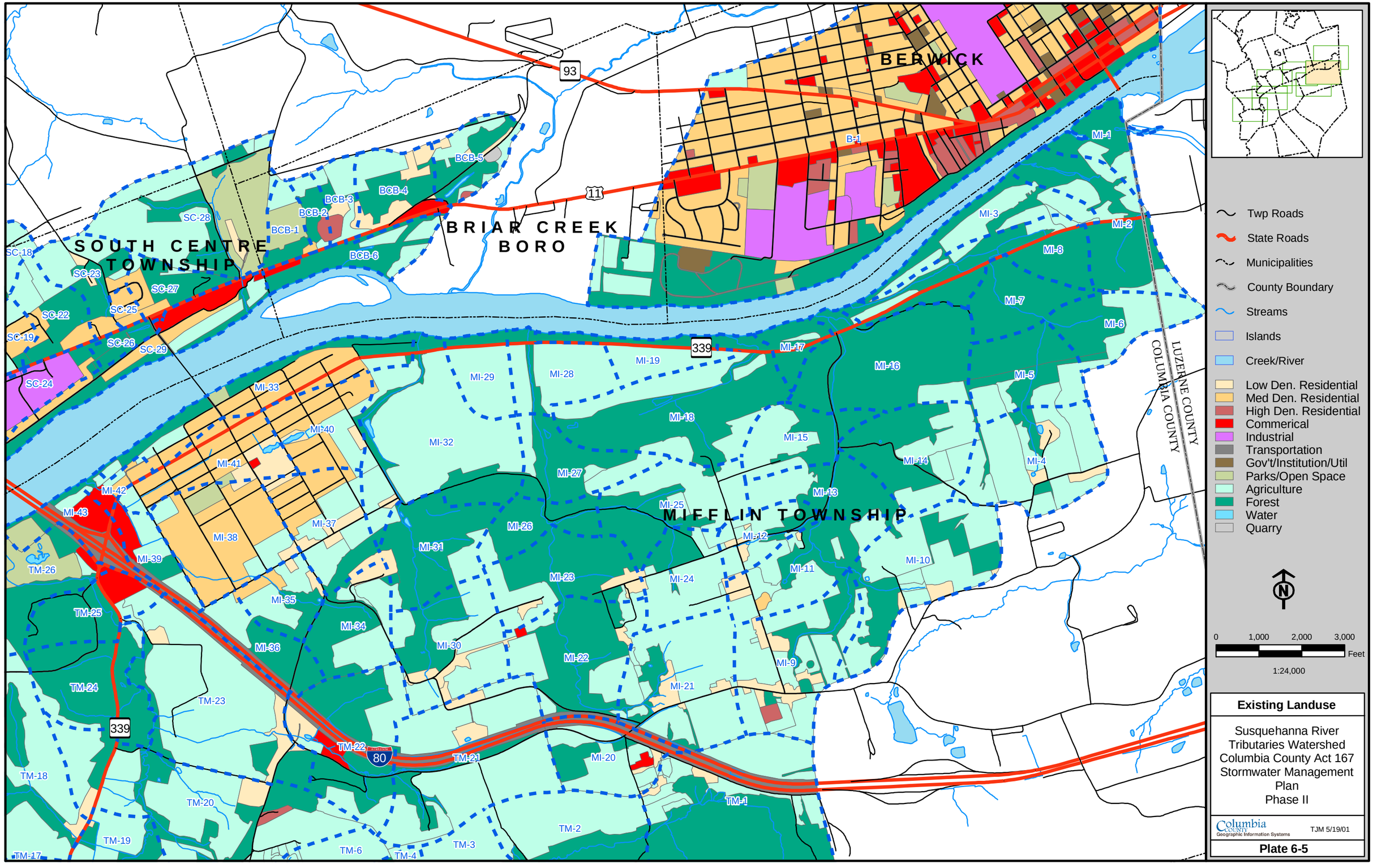


Geology

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 6-4

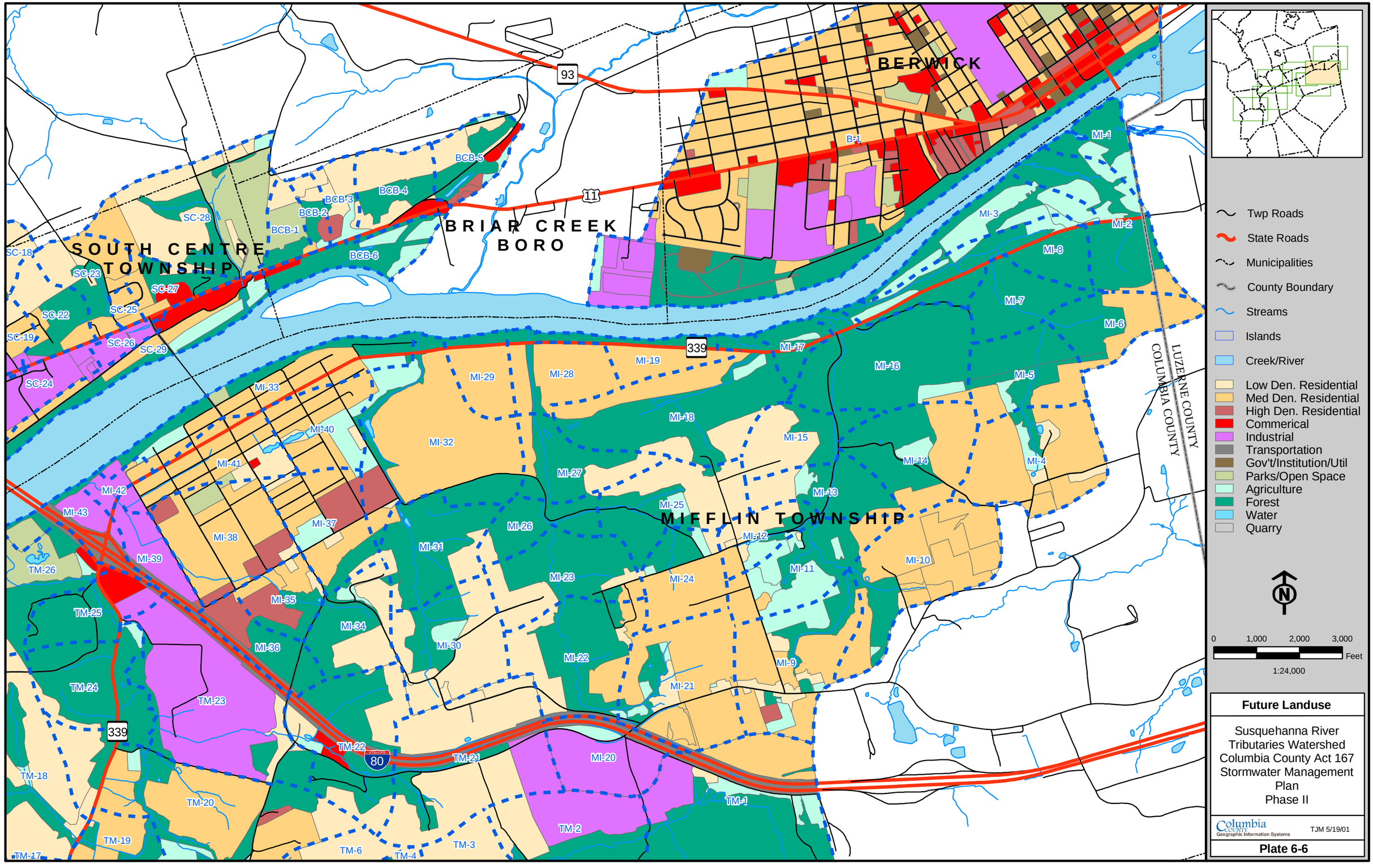


Existing Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 6-5

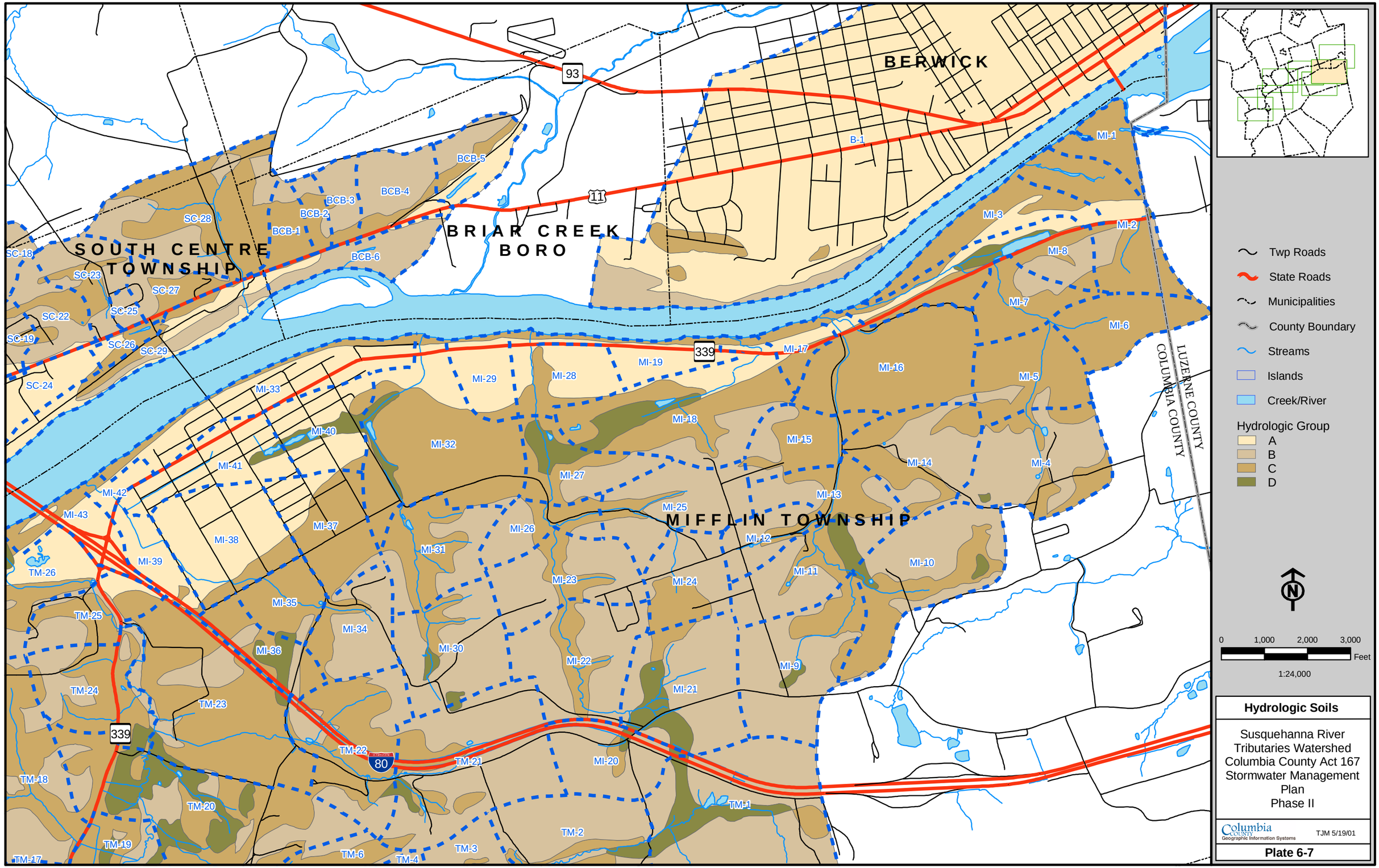


Future Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 6-6



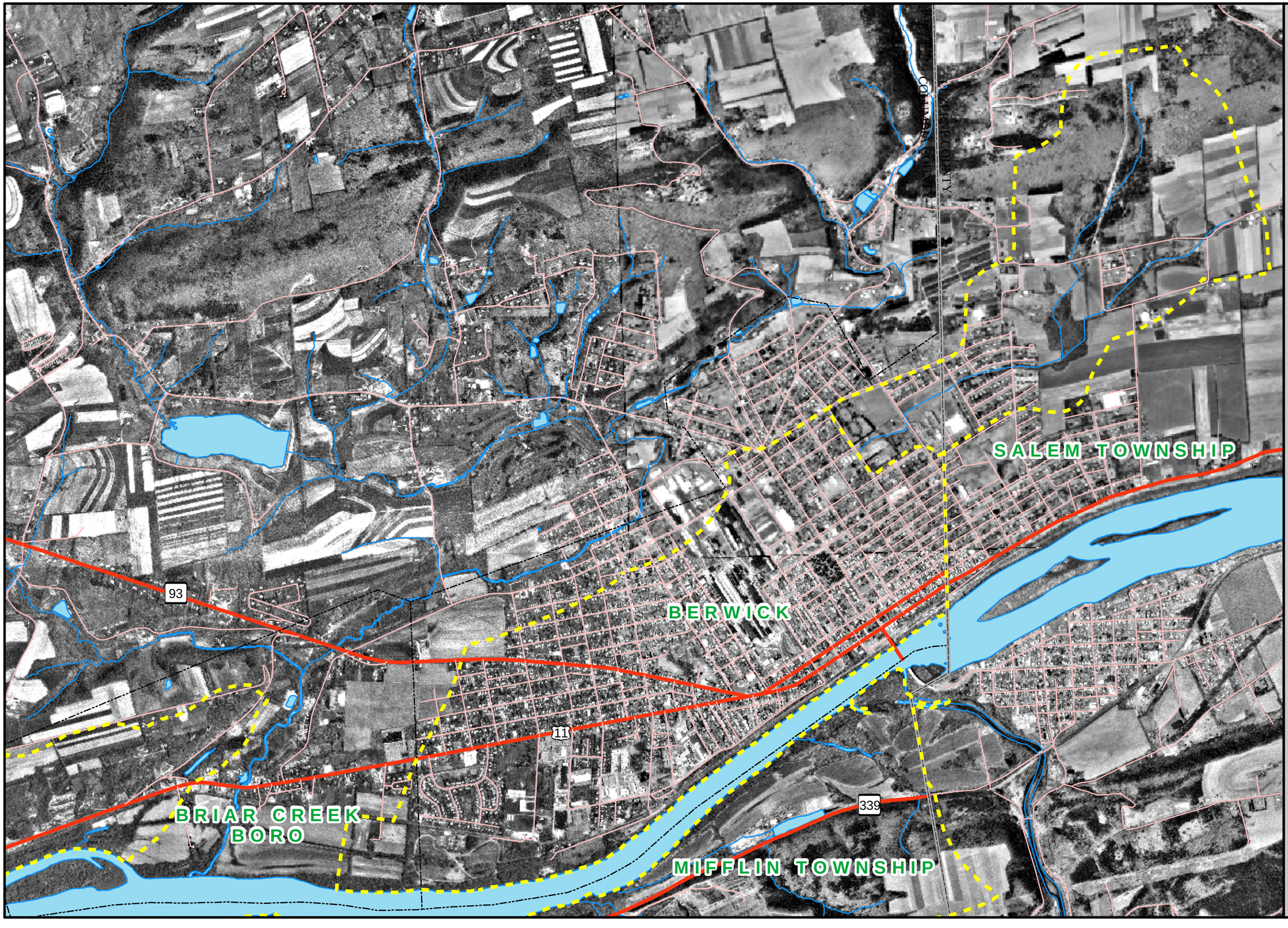
Hydrologic Soils

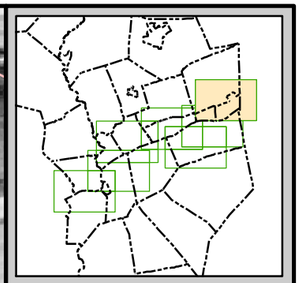
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 6-7





Twp Roads
State Roads
Municipalities
County Boundary
Watersheds
Streams
Islands
Creek/River

N

0 1,000 2,000 3,000 Feet

1:24,000

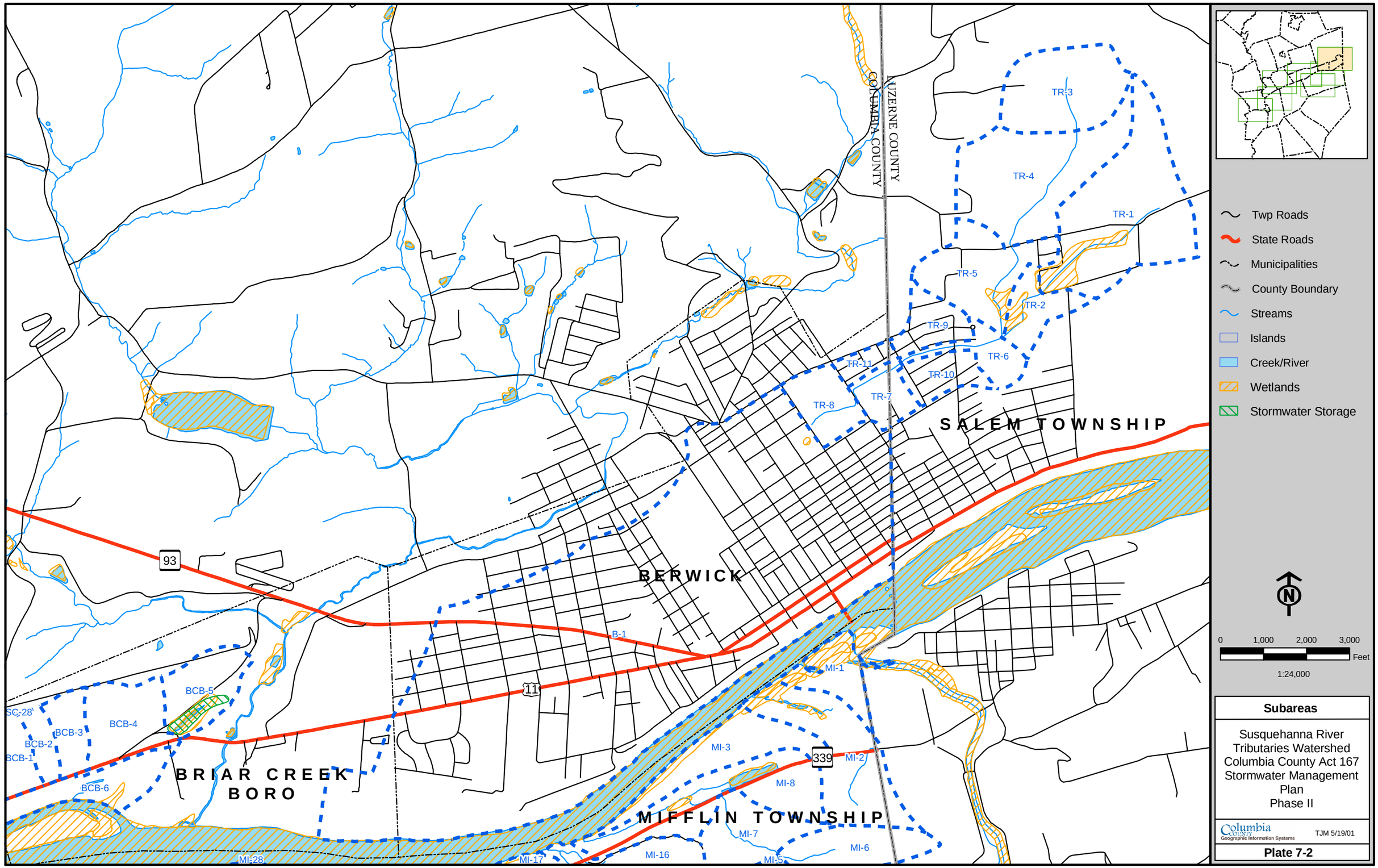
Basemap

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 7-1

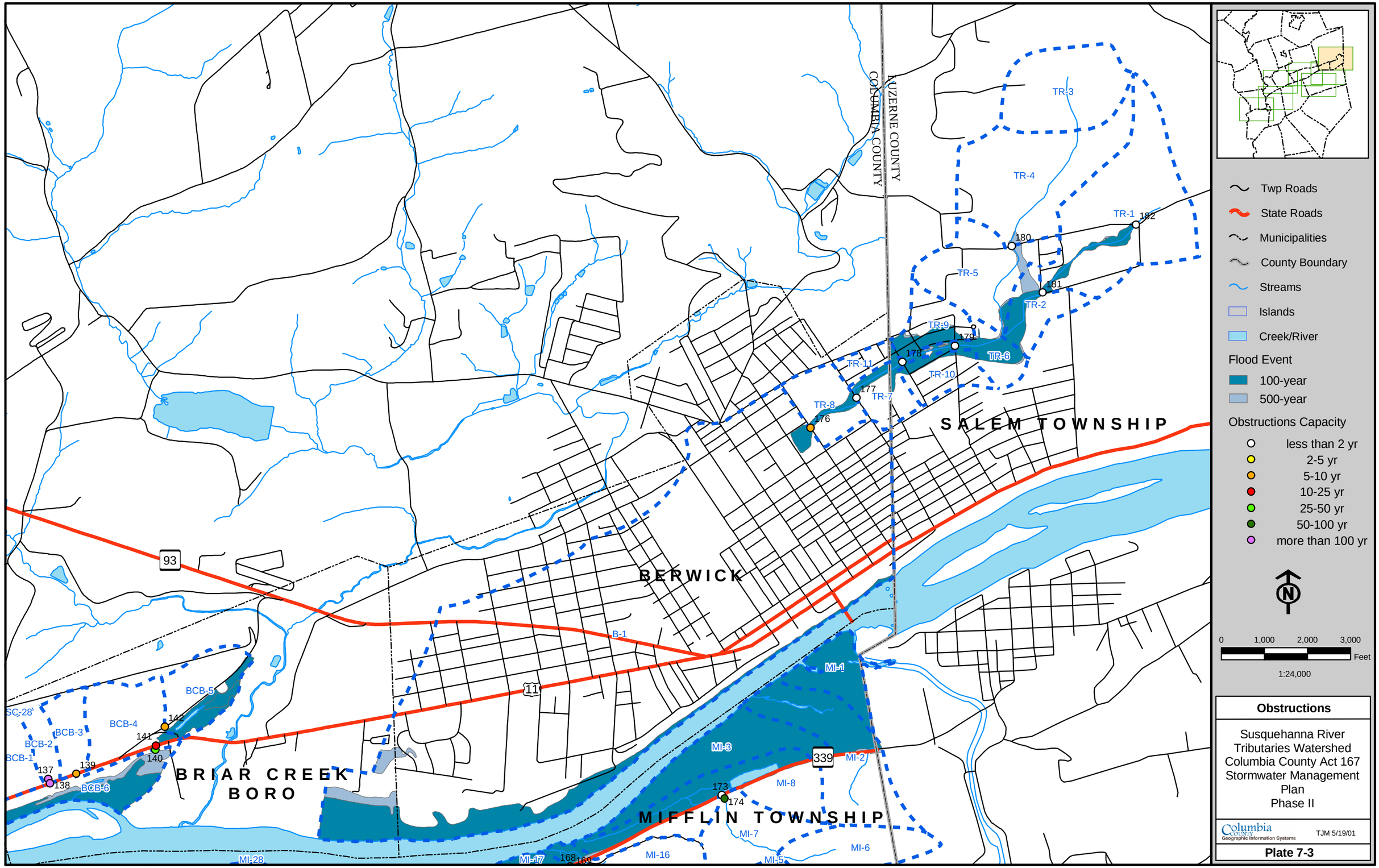


Subareas

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 7-2

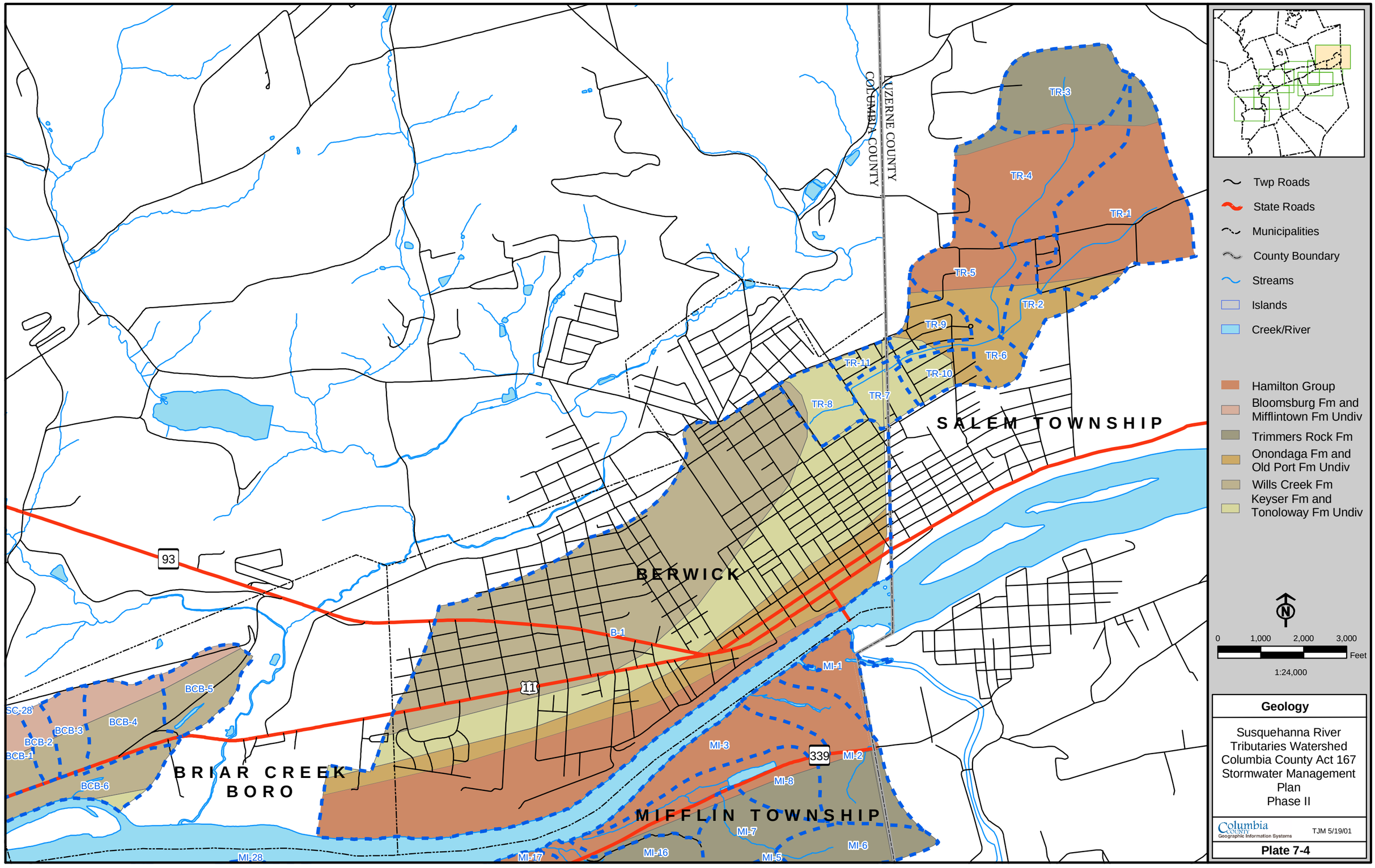


Obstructions

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 7-3


COLUMBIA COUNTY
LUZERNE COUNTY
TR-3
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TR-1
TR-5
TR-2
TR-9
TR-6
TR-11
TR-10
TR-8
TR-7
SALEM TOWNSHIP
93
BERWICK
B-1
11
MI-1
BCB-5
SC-28
BCB-4
BCB-3
BCB-2
BCB-1
BCB-6
BRIAR CREEK BORO
MI-3
339
MI-2
MI-8
MIFFLIN TOWNSHIP
MI-7
MI-6
MI-28
MI-17
MI-16
MI-5
Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Hamilton Group
Bloomsburg Fm and Mifflintown Fm Undiv
Trimmers Rock Fm
Onondaga Fm and Old Port Fm Undiv
Wills Creek Fm
Keyser Fm and Tonoloway Fm Undiv
N
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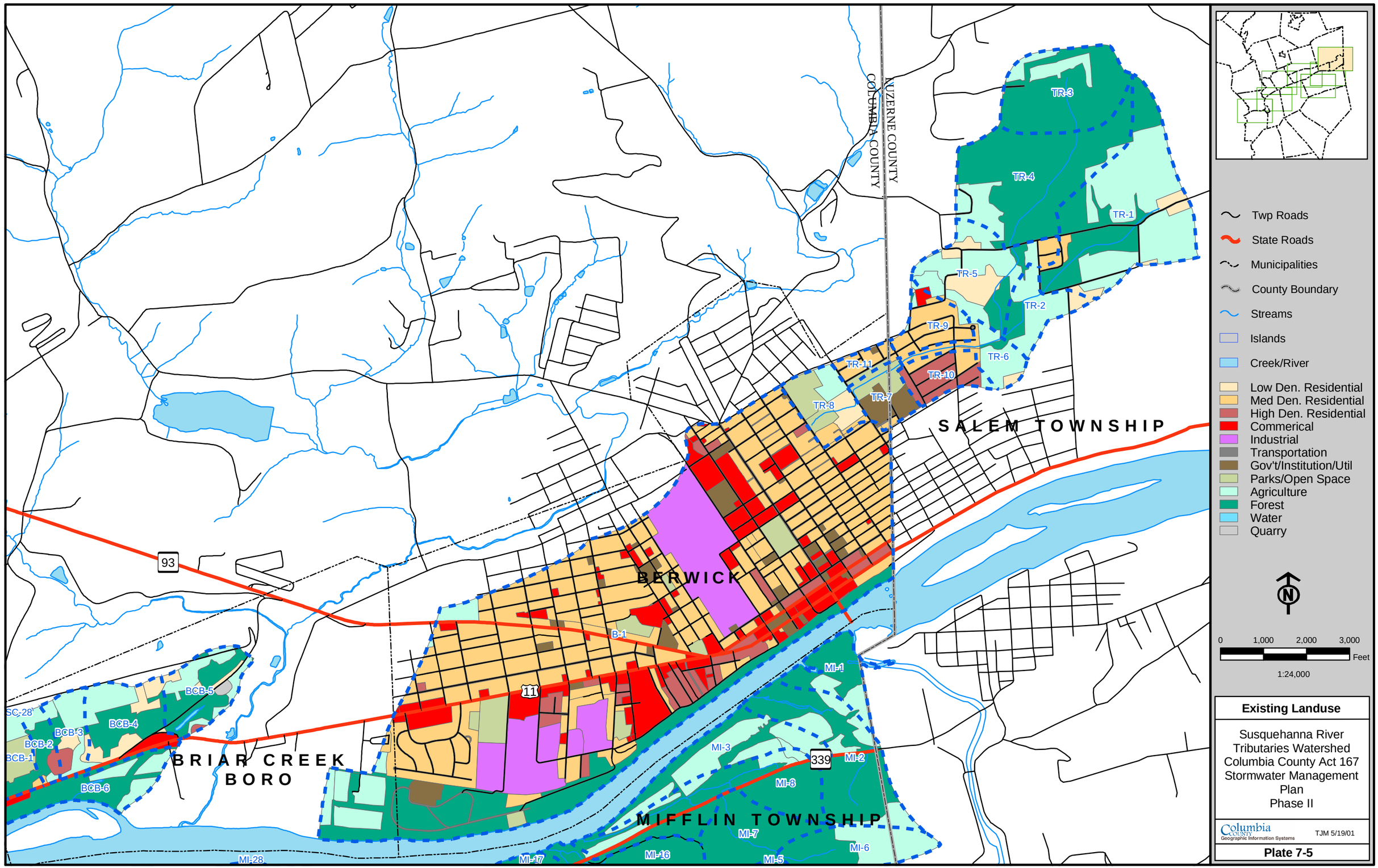
Feet
1:24,000
Geology
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 7-4


COLUMBIA COUNTY
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TR-3
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TR-8
TR-7
SALEM TOWNSHIP
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B-1
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MI-1
BCB-5
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BRIAR CREEK
BORO
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339
MI-2
MI-8
MIFFLIN TOWNSHIP
MI-7
MI-6
MI-16
MI-5
MI-17
MI-28
Twp Roads
State Roads
Municipalities
County Boundary
Streams
Islands
Creek/River
Low Den. Residential
Med Den. Residential
High Den. Residential
Commerical
Industrial
Transportation
Gov't/Institution/Util
Parks/Open Space
Agriculture
Forest
Water
Quarry
N
0
1,000
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Feet
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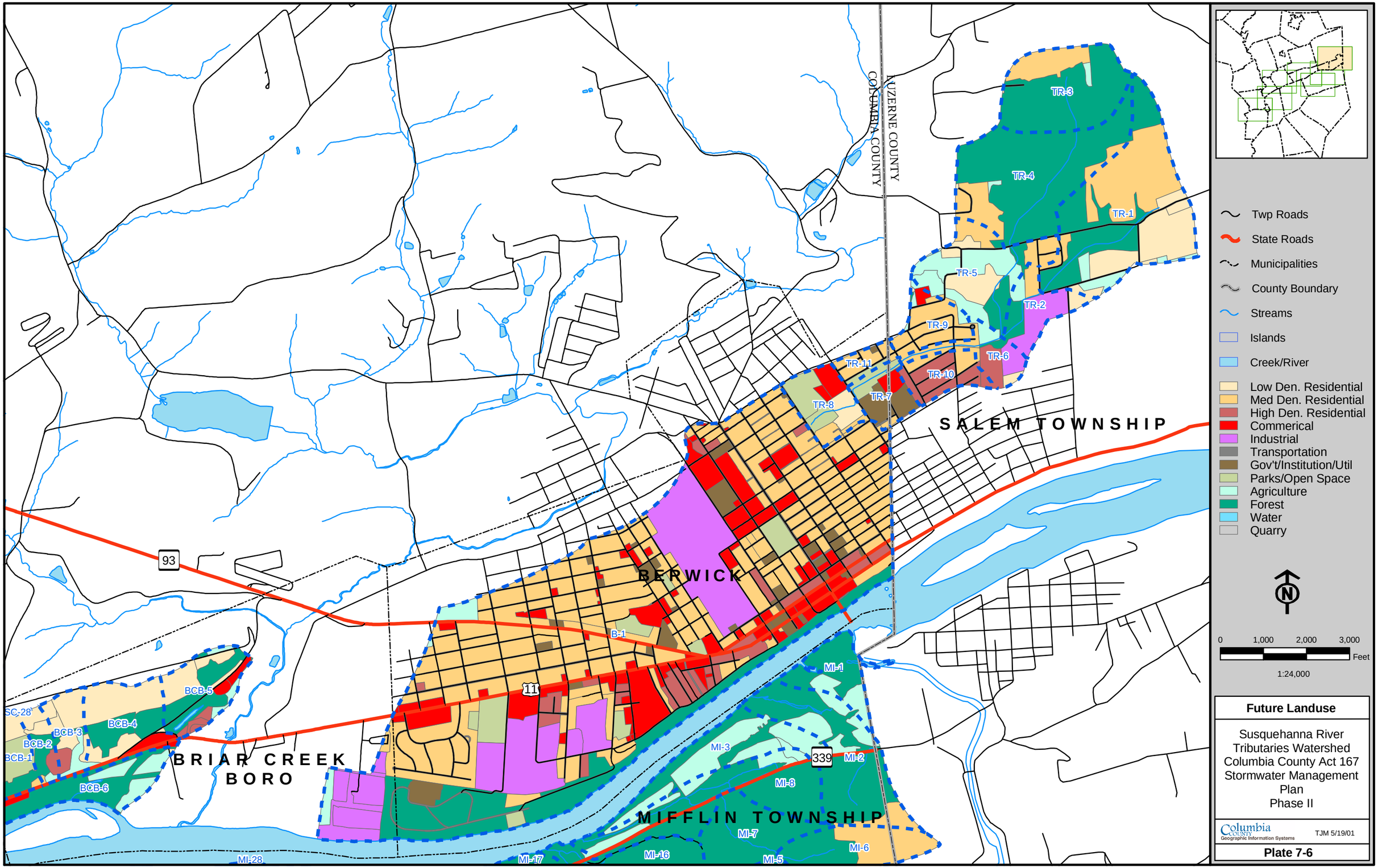
Existing Landuse
Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II
Columbia County Geographic Information Systems
TJM 5/19/01
Plate 7-5

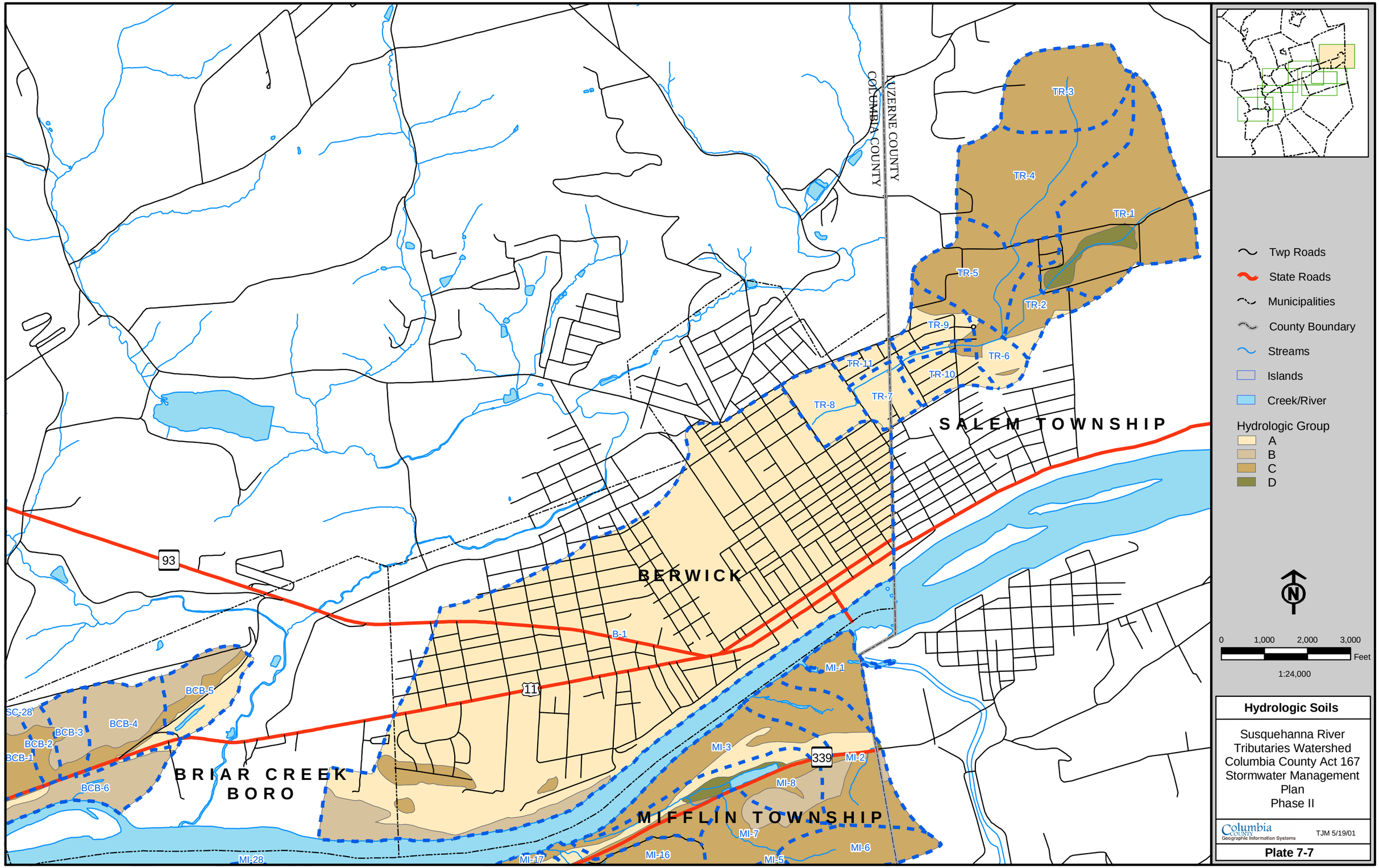


Future Landuse

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems — TJM 5/19/01

Plate 7-6



Hydrologic Soils

Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Phase II

Columbia County Geographic Information Systems

TJM 5/19/01

Plate 7-7

Appendix B

Stormwater Management Design Criteria

Groundwater Infiltration Values Computational Documentation

Table B-1

Design Storm Rainfall Amount (Inches)

Table B-2

PENNDOT Design Storm Rainfall Amount (Inches)

Table B-3

Runoff Curve Numbers (From NRCS {SCS} TR-55)

Table B-4

Rational Runoff Coefficient

Table B-5

Manning Roughness Coefficients

Figure B-1

NRCS (SCS) Type II Rainfall Distribution

Figure B-2

PENNDOT Storm Intensity – Duration – Frequency Curve Region 4

Groundwater Infiltration Values Computation Documentation

Infiltration values were computed using:

- The Millville 2 SW, PA # 5817 Gage long term precipitation data to determine the 90% chance precipitation amount for the 24-hour return period.
- The Draft 2000 Maryland Stormwater Detention Manual for standard average annual infiltration rates based upon Soil Hydrologic Group Types.
- NRCS Curve Numbers and Total Volume Computation procedure for determining stormwater runoff for Hydrologic Soil Groups based upon Woodland good condition for predevelopment.
- Millville average annual precipitation is 42.6-inches.

Groundwater Recharge Values Versus Hydrologic Soil Group

NRCS Soil Hydrologic Group	Average Annual Recharge Volume (1) Inches
A	18
B	12
C	6
D	3

(1) Based upon 40-inches average annual precipitation per year and NRCS regional estimates of average annual recharge volume by soil type.

Adjusted Yearly Recharge Volumes Based Upon
Millville Average Annual Precipitation of 42.6”

NRCS Soil Hydrologic Group	Adjusted Yearly Recharge Volume Computation in Inches	
A	18”(42.6/40.0) = 19.17”	Use 19.2”
B	12”(42.6/40.0) = 12.78”	Use 12.9”
C	6”(42.6/40.0) = 6.39”	Use 6.4”
D	3”(42.6/40.0) = 3.19”	Use 3.2”

From analysis of the Millville Gage determine the maximum amount of precipitation that would occur in 24-hours for 90% of all precipitation events on average.

Precipitation amount for the 90% 24-hour occurrence is 0.84-inches

Using the 0.84-inches and the NRCS Curve Number for Woodland Good Condition determine the inches of stormwater runoff for each Soil Hydrologic Group.

Soil Hydrologic Group	NRCS Curve Number	Stormwater Runoff in Inches
A	32	0.00
B	58	0.00
C	72	0.00
D	79	0.04

Determine inches of stormwater runoff volume from an impervious area. Runoff Curve Number for impervious area is 98 for all Soil Hydrologic Groups.

Therefore the inches of stormwater runoff from an impervious area is 0.64” for the 90% chance precipitation.

Compute the 90% value of mean annual precipitation. Compute as a conservative quantity to account for variations in storm intensity.

90% of Mean Annual Precipitation = (0.90)(42.6”) = 38.34”

Compute the percent groundwater recharge as the 90% portion
Of the adjusted Precipitation

NRCS Hydrologic Group	Recharge as percent of adjusted Precipitation
A	19.2”/38.34” = 0.501
B	12.9”/38.34” = 0.336
C	6.4”/38.34” = 0.167
D	3.2”/38.34” = 0.083

Compute inches of Infiltration Required for Soil Hydrologic Groups

NRCS Hydrologic Group	Computation Inches of Infiltration Required (S = Inches of Required Infiltration from Impervious Area)
A	(0.64”)(0.501) = 0.32”
B	(0.64”)(0.336) = 0.22”
C	(0.64”)(0.167) = 0.11”
D	(0.64” – 0.04”)(0.083) = 0.05”

Groundwater Recharge Formula for Susquehanna River Tributaries

Provide a 0.05” of additional infiltration volume as a Safety Factor. Safety factor is applied uniformly due to the variation within the individual soil-mapping units and to provide additional infiltration surface and volume for the slower infiltration rate Hydrologic Group C and D soils. Caution should be applied in designing infiltration systems for Hydrologic Group C and D soils, as there will be a higher incidence of failure of infiltration systems on these soils.

GIv = [(S + 0.05)(PI)(A)] / 12 = Cubic Feet (Groundwater Infiltration Volume)
S = Infiltration Values for Existing Conditions Soil Hydrologic Group
PI = Percent Impervious Cover for Site as a Decimal
A = Area of site in Square Feet
12 = Conversion Factor for Inches to Feet

TABLE B-1
DESIGN STORM RAINFALL AMOUNT (INCHES)
FOR USE WITH NRCS TYPE II STORM DISTRIBUTION

RETURN PERIOD	PRECIPITATION AMOUNT 24-HOUR STORM
1	2.4
2	2.9
5	3.7
10	4.6
25	5.1
50	5.7
100	6.2

Source: Commonwealth of Pennsylvania Department of Environmental Protection Office of Water Management "Erosion and Sediment Pollution Control Program Manual" March 2000.

TABLE B-2
PENN DOT DESIGN STORM RAINFALL AMOUNT (INCHES)
FOR USE WITH PENN DOT STORM DISTRIBUTION REGION IV

RETURN PERIOD	PRECIPITATION AMOUNT 24- HOUR STORM
1	2.4
2	3.0
5	3.65
10	4.50
25	5.50
50	6.70
100	7.70

Source: Field Manual of Pennsylvania Department of Transportation "Storm Intensity – Duration – Frequency Charts, PDT-IDF" May 1986.

TABLE B-3
RUNOFF CURVE NUMBERS
(FROM NRCS (SCS) TR-55)

LAND USE DESCRIPTION		HYDROLOGIC SOIL GROUP			
		A	B	C	D
Meadow ***		30	58	71	77
Low Density Residential	(>1 Acre)	46	65	77	82
Medium density residential	(1/2 – 1 Acre)	58	73	82	86
High Density Residential	(> 1/8 – ½ Acre)*	77	85	90	92
Mobile Home Park		77	85	90	92
Commercial		89	92	94	95
Industrial		81	88	91	93
Mixed Urban		81	88	91	93
Transportation**		98	98	98	98
Campgrounds		77	85	90	92
Fairgrounds		77	85	90	92
Private Parks***		39	61	74	80
Public Parks***		39	61	74	80
Cemetery***		39	61	74	80
Cropland		65	75	82	86
Pasture		49	69	79	84
Permanent Hay		55	69	78	83
Orchards, Groves, Vineyards, Nurseries, Scrub brush		43	65	76	82
Other Agricultural Land & Open Space***		35	56	70	77
Mixed Forest Land***		36	60	73	77
Lakes/Ponds		98	98	98	98
Rivers/Streams		98	98	98	98
Wetlands		98	98	98	98
Strip Mines, Quarries, & Gravel Pits		66	68	72	77
Gravel Driveways & Parking Areas		84	91	92	93

*Includes Multi-Family Housing unless justified lower density can be provided.
**Transportation includes paved area only.
***Caution – CN values under 40 may produce erroneous modeling results.

Note: Existing site conditions of bare earth or fallow shall be considered as meadow when choosing a CN value.

TABLE B-4
Runoff Coefficients
Rational Method "C" Values

LAND USE DESCRIPTION		HYDROLOGIC SOIL GROUP			
		A	B	C	D
Meadow		0.04 (a) 0.07 (b)	0.17 0.23	0.26 0.33	0.31 0.38
Low Density Residential	(>1 Acre)	0.11 0.16	0.23 0.30	0.33 0.40	0.37 0.45
Medium density residential	(1/2 – 1 Acre)	0.19 0.25	0.30 0.38	0.38 0.46	0.42 0.51
High Density Residential	(< ½ Acre)*	0.41 0.50	0.50 0.60	0.57 0.67	0.59 0.69
Mobile Home Park		0.41 0.50	0.50 0.60	0.57 0.67	0.59 0.69
Commercial		0.60 0.71	0.64 0.75	0.67 0.78	0.69 0.80
Industrial		0.47 0.57	0.56 0.66	0.60 0.70	0.62 0.73
Mixed Urban and Transportation**		0.90 0.95	0.90 0.95	0.90 0.95	0.90 0.95
Campgrounds and Fairgrounds		0.41 0.50	0.50 0.60	0.57 0.67	0.59 0.69
Private Parks, Public Parks and Cemetery		0.07 0.11	0.18 0.24	0.27 0.34	0.32 0.39
Cropland		0.20 0.26	0.27 0.34	0.33 0.40	0.36 0.43
Pasture		0.14 0.19	0.23 0.29	0.30 0.36	0.34 0.41
Permanent Hay		0.11 0.16	0.23 0.29	0.30 0.37	0.34 0.42
Orchards, Groves Vineyards, Nurseries		0.08 0.12	0.20 0.26	0.28 0.35	0.33 0.40
Scrub Brush, Other Agricultural Land & Open Space		0.06 0.09	0.15 0.20	0.24 0.30	0.29 0.36
Mixed Forest Land		0.06 0.09	0.17 0.23	0.26 0.32	0.29 0.36
Lakes/Ponds Rivers / Streams / Wetlands		0.95 0.98	0.95 0.98	0.95 0.98	0.95 0.98
Strip Mines, Quarries, & Gravel Pits		0.22 0.29	0.24 0.30	0.27 0.34	0.31 0.38
Gravel Driveways & Parking Areas		0.52 0.62	0.62 0.73	0.62 0.73	0.62 0.73

*Includes Multi-Family Housing unless justified lower density can be provided.
**Transportation includes paved area only.

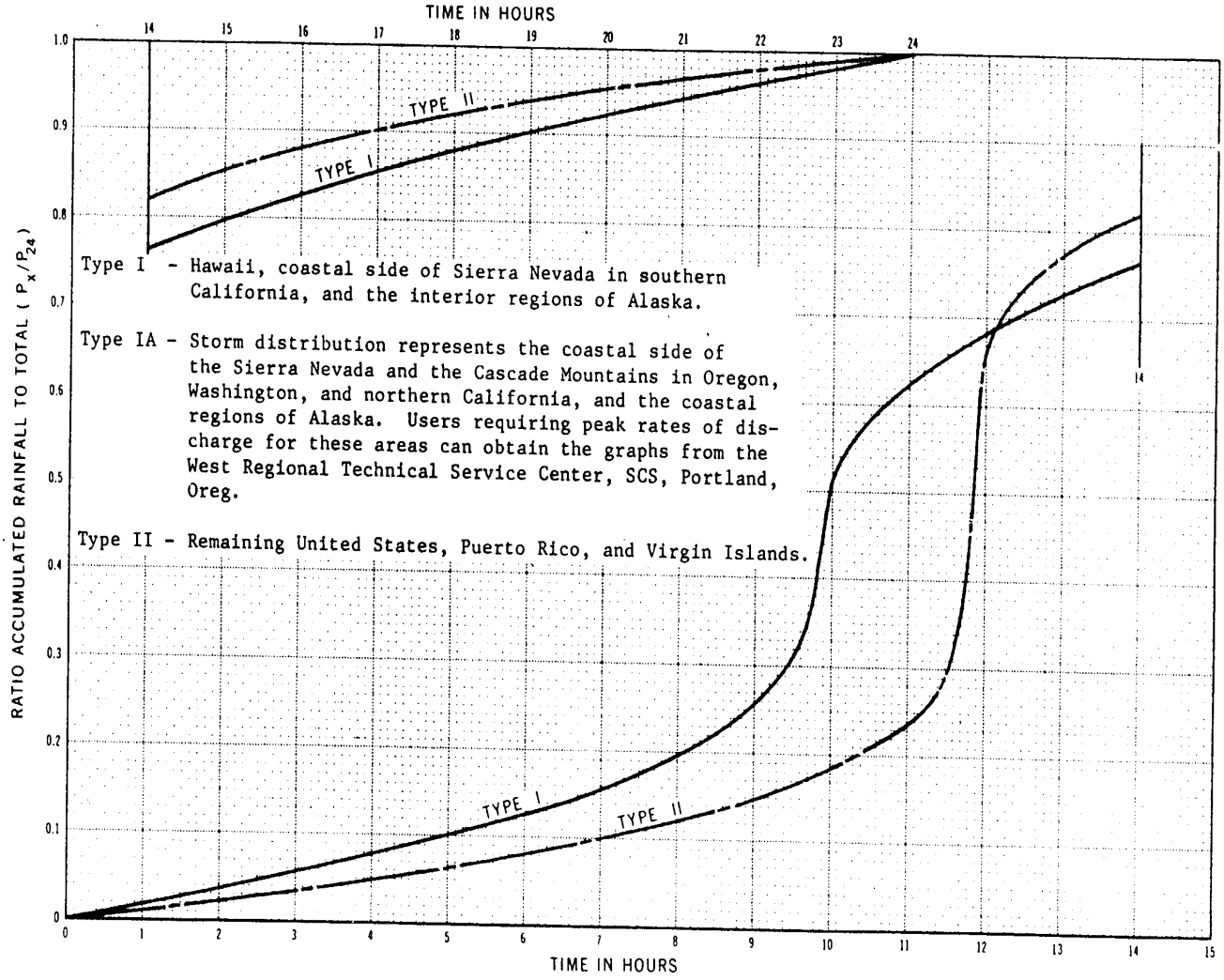
Note: Existing site conditions of bare earth or fallow shall be considered as meadow when choosing a Rational "C" value.

(a) Runoff Coefficient for storm recurrence intervals less than 25 years.
(b) Runoff Coefficient for storm recurrence intervals up to 25 years or more.

TABLE B-5
Recommended n Values to be used with Manning's Equation

Surface	Min.	Design	Max.
Asphalt Lining		0.015	
Brick in cement mortar, brick sewers	0.012	0.015	0.017
Concrete-lined channel	0.012	0.015	0.018
Cement-rubble surface	0.017		0.030
Neat cement surface	0.010	0.012	0.013
Plastic-lined channel	0.012		0.014
Shotcrete	0.016		0.017
Asbestos Cement Pipe		0.009	
Concrete Pipe	0.012	0.015	0.016
Vitrified Clay Pipe	0.010	0.013	0.017
Common-clay drainage tile	0.011	0.012	0.017
Semi-circular metal flumes, smooth	0.011		0.015
Corrugated	0.023	0.025	0.030
Channels and ditches			
Earth, straight and uniform	0.017	0.023	0.025
Rock cuts, smooth and uniform	0.025	0.030	0.035
jagged and irregular	0.035	0.040	
Dredged earth channels	0.025	0.028	0.033
Earth bottom, rubble sides	0.028	0.030	0.035
Natural Streams			
1. Clean, straight bank, full stage no rifts or deep pools	0.025		0.033
2. Same as 1, but some weeds and stones	0.030		0.040
3. Winding, some pools and shoals, clean	0.033		0.045
4. Same as 3, lower stages, more ineffective slope and sections	0.040		0.055
5. Same as 3, same weeds and stone	0.035		0.050
6. Same as 4, stony sections	0.045		0.060
7. Sluggish river reaches, rather weedy or with very deep pools	0.050		0.080
8. Very weedy reaches	0.075		0.150

FIGURE B-1
Natural Resource Conservation Service
Precipitation Distribution

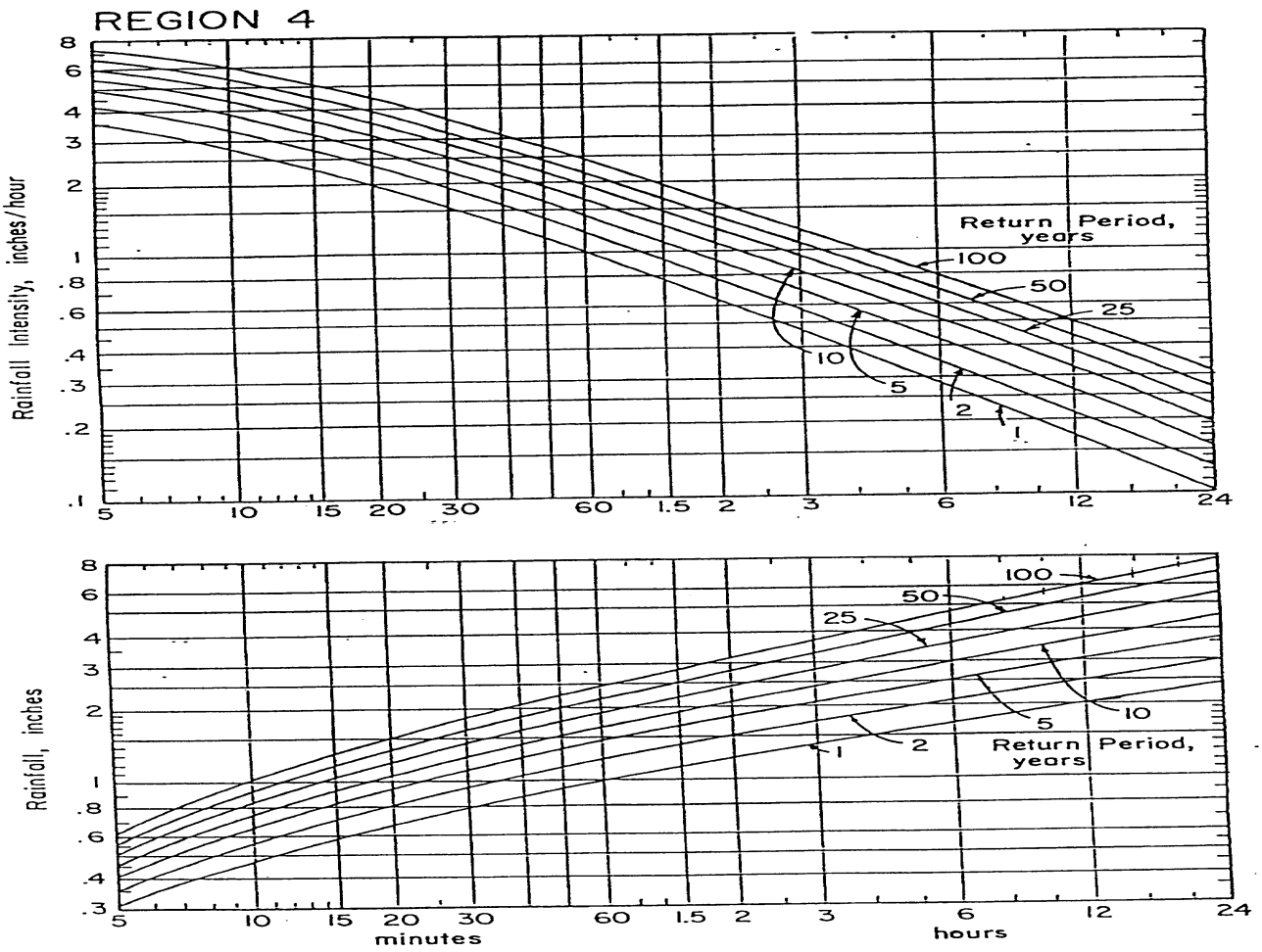


Type I - Hawaii, coastal side of Sierra Nevada in southern California, and the interior regions of Alaska.

Type IA - Storm distribution represents the coastal side of the Sierra Nevada and the Cascade Mountains in Oregon, Washington, and northern California, and the coastal regions of Alaska. Users requiring peak rates of discharge for these areas can obtain the graphs from the West Regional Technical Service Center, SCS, Portland, Oreg.

Type II - Remaining United States, Puerto Rico, and Virgin Islands.

FIGURE B-2
Rainfall Intensity – Duration – Frequency Curves for Region 4
Pennsylvania Department of Transportation PDT-IDF



APPENDIX C

C1 Drainage Plan Application

C2 Fee Schedule

C3 Standard Stormwater Maintenance and Monitoring Agreement

C1

DRAINAGE PLAN APPLICATION

Application is hereby made for review of the Stormwater Management and Erosion and Sedimentation Control Plan and related data as submitted herewith in accordance with the _____ Township Stormwater Management and Earth Disturbance Ordinance.

_____ Final Plan _____ Preliminary Plan

_____ Sketch Plan Date of Submission _____

Submission No.: _____

1. Name of Subdivision or Development _____
2. Name of Applicant _____

   Telephone Number _____

   (If corporation, list the corporation's name and the names of two officers of the corporation.)

   Address _____

   _____ Zip _____

   Applicant's Interest in Subdivision or Development _____

   _____

   (If other than property owner give owners name and address.)
3. Name of Property Owner _____

   Telephone Number _____

   Address _____

   _____ Zip _____

4. Name of Engineer or Surveyor _____

   Telephone Number _____

   Address _____

   _____ Zip _____

5. Type of Subdivision or Development Proposed:

___	Single family lots	____	Townhouses	___	Commercial (multi-lot)
___	Two family lots	____	Garden Apartments	___	Commercial (One-lot)
___	Multi-family	____	Mobile home park	___	Industrial (multi lot)
___	Cluster type lots	____	Campground	___	Industrial (one lot)
___	Planned residential	____	Other development		

6. Lineal Feet of New Road Proposed? _____l.f.
7. Area of Proposed and Existing Impervious Area on Entire Tract.
   a. Existing (to remain) _____ s.f. _____% of Property
   b. Proposed Property _____ s.f. _____% of Property
8. Stormwater
   a. Does the peak rate of runoff from proposed conditions exceed that flow which occurred for predevelopment conditions for the designated design storm?

      _____
   b. Design storm utilized (on-site conveyance systems((24 hr.) [circle one]
      No. of Subarea:_____
      Watershed Name:_____
      Other (explain): _____

      _____
   c. Does the submission and/or district meet the release rate criteria for the applicable subarea? _____
   d. Number of subareas from Pilate 1 – Volume 1 Technical Manual of the Creek _____ Watershed Stormwater Management Plan.

      _____
   e. Type of proposed runoff control _____.
   f. Does the proposed stormwater control criteria meet the requirement / guidelines of the stormwater ordinances? _____
      - If not, what variances / waivers are requested? _____

        _____
      - Reasons _____

        _____

        _____

g. Does the plan meet the requirements of Article III of the stormwater ordinances? _____

- If not, what variance / waivers are requested _____
- Reasons why _____

_____

h. Was TR-55, June 1986 utilized in determining the time of concentration? _____

i. What Hydrologic method was used in the stormwater computations? _____

j. Is a hydraulic routing through the stormwater control structure submitted? _____

k. Is a construction schedule or staging attached? _____

l. Is a recommended maintenance program attached? _____

9. Erosion and Sediment pollution control (E & S).

a. Has the stormwater management and E & S Plan supporting documentation and narrative been submitted to the _____ County Conservation District.

b. Total area of earth disturbance _____s.f.

10. Wetlands

a. Have the wetlands been delineated by someone trained in wetland delineation? _____

b. Have the wetland lines been verified by a state or federal permitting authority? _____

c. Have the wetland lines been surveyed? _____

d. Total acreage of wetland within the property _____

e. Total acreage of wetland disturbed _____

f. Supporting documentation _____

11. Filing

a. Has the required fee been submitted? _____ Amount _____

b. Has the proposed schedule of construction inspection to be performed by the applicant's engineer been submitted? _____

c. Name of individual who will be making inspections _____

d. General comments about stormwater management at development

_____

_____

_____

CERTIFICATE OF OWNERSHIP

and

ACKNOWLEDGEMENT OF APPLICATION

COUNTY OF _____,

COMMONWEALTH OF PENNSYLVANIA

On this the _____ day of _____, 20___, before me, the undersigned officer, personally appeared _____ who being duly sworn, according to law, deposes and says that _____ owners of the property described in the application and that the application was made with PRIOR knowledge and / or direction and does hereby agree with the said application and to the submission of the same.

_____

Property Owner (s)

My commission expires _____ 20 ___

_____

Notary Public or Officer

THE UNDERSIGNED HEREBY CERTIFIES THAT TO THE BEST OF HIS KNOWLEDGE AND BELIEF THE INFORMATION AND STATEMENTS GIVEN ABOVE ARE TRUE AND CORRECT.

SIGNATURE OF APPLICANT

_____

_____

(Information below this line to be completed by the Municipality)

_____ township official submission receipt.

Date complete application received _____ plan number _____ fees _____

Date fees paid _____ received by _____

Official submission receipt date _____ received by _____

C2

FEE SCHEDULE

_____ Township Drainage Plan

Schedule of Fees

Subdivision name _____ submittal no. _____
Owner _____ Date _____
Engineer _____

1. Filing Fee ..... $ _____
2. Land Use
   a) Subdivision, campgrounds, mobile home parks, and multi-family dwelling where the units are located in the same local watershed $ _____
   b) Multi-family dwelling where the designated open space is located in a different local watershed from the proposed units .. $_____
   c) Commercial / Industrial ..... $ _____
3. Relative amount of earth disturbance
   a) Residential
      Road <500 l.f. ..... $_____
      Road 500 – 2,640 l.f. ..... $_____
      Road >2,640 l.f. ..... $_____
   b) Commercial / Industrial and other impervious area <3,500 s.f. $_____
      Impervious area 3,500 – 43,460 s.f. ..... $_____
      Impervious area >43,560 s.f. ..... $_____
4. Relative size of project
   a) Total tract area <1 ..... $_____
      - 1 – 5 ac ..... $_____
      - 5 – 25 ac ..... $_____
      - 5 – 100 ac ..... $_____
      - 100 – 200 ac ..... $_____
      - > 200 ac ..... $_____
5. Stormwater control measures
   a) Detention basins and other controls which require a review of hydraulic routings ($ per control) ..... $_____
   b) Other control facilities which require storage volume calculations but no hydraulic routings ($ per control) ..... $_____
6. Site inspection ($ per inspection) ..... $_____

Total ..... $_____

All subsequent reviews shall be ¼ the amount of the initial review fee unless a new application is required as per Section 406 of the stormwater ordinance. A new fee shall be submitted with each revision in accordance with this schedule.

C3

STANDARD STORMWATER MAINTENANCE AND MONITORING AGREEMENT

THIS AGREEMENT, made and entered into this _____ day of _____, 20__, by and between _____, (hereinafter the "Landowner") and _____ County, Pennsylvania, (hereinafter "Municipality").

WITNESSETH

WHEREAS, the Landowner is the owner of certain real property as recorded by deed in the land records of _____ County, Pennsylvania, Deed Book _____ at page _____, (hereinafter "Property").

WHEREAS, the Landowner is proceeding to build and develop the Property; and

WHEREAS, the Subdivision / Land Management Plan (hereinafter "Plan") for the Subdivision, which is expressly made a part hereof, as approved or to be approved by the Municipality, provides for management of stormwater within the confines of the Property through the use of Best Management Practices (BMP's) and

WHEREAS, the Municipality and the Landowner, his successors and assigns agree that the health, safety and welfare of the residents of the Municipality require that on-site stormwater Best Management Practices be constructed and maintained on the Property: and

WHEREAS the Municipality requires, through the implementation of the Susquehanna Tributaries Watershed Stormwater Management Plan, that stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, his successors and assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The on-site stormwater management facilities shall be constructed by the Landowner, his successors and assigns, in accordance with the terms, conditions and specifications identified in the Plan.
2. The Landowner, his successors and assigns, shall maintain the stormwater management facilities in good working condition, acceptable to the Municipality so that they are performing their design functions.

3. The Landowner, his successors and assigns, hereby grants permission to the Municipality, his authorized agents and employees, upon presentation of proper identification, to enter upon the Property at reasonable times, and to inspect the stormwater management facilities whenever the Municipality deems necessary. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms, outlet structures, pond areas, access roads, etc. When inspections are conducted, the Municipality shall give the Landowner, his successors and assigns, copies of the inspection report with findings and evaluation. At a minimum, maintenance inspections shall be performed in accordance with the following schedule:
   - Annually for the first 5 years after the construction of the stormwater facilities
   - Once every 2 years thereafter, or
   - During or immediately upon the cessation of 2.9-inches or greater of rain in 24 hours or less
4. All reasonable costs for said inspections shall be born by the Landowner and payable to the Municipality.
5. The owner shall convey to the Municipality easements and/or right-of-ways to assure access for periodic inspections by the Municipality and maintenance, if required.
6. In the event the Landowner, his successors and assigns, fail to maintain the stormwater management facilities in good working condition acceptable to the Municipality, the Municipality may enter upon the Property and take such necessary and prudent action to maintain said stormwater management facilities and to charge the costs of the maintenance and / or repairs to the Landowner, his successors and assigns. This provision shall not be construed as to allow the Municipality to erect any structure of a permanent nature on the land of the Landowner, outside of any easement belonging to the Municipality. It is expressly understood and agreed that the Municipality is under no obligation to maintain or repair said facilities, and in no event shall this Agreement to be construed to impose any such obligation on the Municipality.
7. The Landowner, his successors and assigns, will perform maintenance in accordance with the maintenance schedule for the stormwater management facilities including sediment removal as outlined on the approved schedule and/or subdivision / land management plan.
8. In the event the Municipality, pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use equipment, supplies, material, and the like on account of the Landowner's or his successors and assigns failure to perform such work, the Landowner, his successor and assigns, shall reimburse the Municipality upon demand, within 30 days of receipt of invoice thereof, for all costs

incurred by the Municipality upon demand, within 30 days of receipt of invoice thereof, for all costs incurred by the Municipality hereunder. If not paid within said 30-day period, the Municipality may enter a lien against the property in the amount of such costs, or may proceed to recover his costs through proceedings in equity or at law as authorized under the provisions of the _____ code.

9. The Landowner, his successors and assigns, shall indemnify the Municipality and his agents and employees against any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the any and all damages, accidents, casualties, occurrences or claims which might arise or be asserted against the Municipality for the construction, presence, existence or maintenance of the stormwater management facilities by the Landowner, his successors and assigns.

10. In the event a claim is asserted against the Municipality, his agents or employees, the Municipality shall promptly notify the Landowner, his successors and assigns, and they shall defend, at their own expense, any suit based on such claim. If any judgment or claims against the Municipality, his agents or employees shall be allowed, the Landowner, his successors and assigns shall pay all costs and expenses in connection therewith.

11. In the event of an emergency of the occurrence of special or unusual circumstances or situations, the Municipality may enter the Property, if the Landowner is not immediately available, without notification or identification to inspect and perform necessary maintenance and repairs, if needed, when the health safety or welfare of the citizens is in jeopardy. However the Municipality shall notify the Landowner of any inspection, maintenance, or repair undertaken within 5 days of the activity. The Landowner shall reimburse the Municipality for his costs.

This Agreement shall be recorded among the land records of (Columbia, Luzerne and Montour Counties), Pennsylvania and shall constitute a covenant running with the Property and / or equitable servitude, and shall be binding on the Landowner, his administrators, executors, assigns, heirs and any other successors in interests, in perpetuity.

ATTEST:

WITNESS the following signatures and seals:

(SEAL) For the Municipality

_____

(SEAL) For the Landowner:

_____

ATTEST:

_____ (City, Borough, township) _____ County of _____Pennsylvania, I _____, a Notary Public in and for the county and State aforesaid, whose commission expires on the _____ day of _____ 20____, do hereby certify that _____ whose name(s) is / are signed to the foregoing Agreement bearing date of the _____ day of _____ 20____, has acknowledged the same before me in my said County and State.

GIVEN UNDER MY HAND THIS _____ DAY OF _____ 20____.

NOTARY PUBLIC

(SEAL) _____

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
1	MONTOUR/COOPER	C-1	2	198.3	60" CMP
2	MONTOUR/COOPER	MC-2	1	29.7	30" CMP
3	MONTOUR/COOPER	MC-2	2	321.6	6.4' DIA STEEL CULVERT
4	MONTOUR/COOPER	MC-1	2	46.3	36" CMP
5	MONTOUR/COOPER	MC-2	2	390.8	14.5' W X 5.5' H BOX CULVERT
6	MONTOUR/COOPER	MC-2	2	843.0	5' W X 9' H STONE CULVERT
7	MONTOUR/COOPER	M-7	1	36.0	30" CMP
8	MONTOUR/COOPER	M-3	3	180.7	60" CMP
9	MONTOUR/COOPER	M-3	1	43.2	5' W X 1.25' H CHANNEL @ RR
10	MONTOUR/COOPER	M-6	2	28.6	30" CMP
11	MONTOUR/COOPER	M-6	3	62.5	36" HDPE
12	MONTOUR/COOPER	M-6	3	69.2	36" STEEL
13	MONTOUR/COOPER	M-8	3	45.0	30" RCP
14	MONTOUR/COOPER	M-2	1	51.5	42" RCP
15	MONTOUR/COOPER	M-2	2	113.8	48" CMP
16	MONTOUR/COOPER	M-2	2	184.2	5' W X 3.6' H BOX CULVERT

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
17	MONTOUR/COOPER	M-1	2	111.2	5' W X 3' H BOX CULVERT
18	FRANKLIN	F-5	3	73.3	48" CMP
19	FRANKLIN	F-4	4	563.3	8.5' W X 7' H BOX CULVERT
20	FRANKLIN	F-9	1	35.7	36" CMP
21	FRANKLIN	F-9	2	97.1	4' W X 2' H BOX CULVERT
22	FRANKLIN	F-11	1	44.3	36" CMP
23	FRANKLIN	F-11	1	58.4	36" CMP
24	FRANKLIN	F-12	1	147.4	48" CMP
25	FRANKLIN	F-14	1	57.5	36" CMP
26	FRANKLIN	F-16	1	52.2	36" CMP
27	FRANKLIN	F-15	1	78.5	42" STEEL
28	FRANKLIN	F-19	3	1440.3	7' W X 12' H STONE CULVERT
29	FRANKLIN	F-20	1	64.0	36" CMP
30	FRANKLIN	F-21	7	1197.9	17' W X 5' H STONE CULVERT
31	CORN RUN	CR-14	3	1808.5	13.5' W X 12' H STONE BOX
32	CORN RUN	CR-14	2	608.1	16.5' W X 7.5' H CONC BOX

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
33	CORN RUN	CR-12	1	402.3	18' W X 6' H WOOD STRUCTURE
34	CORN RUN	CR-9	1	54.9	30" X 40" OVAL CMP
35	CORN RUN	CR-3	2	183.8	54" RCP
36	CORN RUN	CR-6	3	90.6	48" IRON CULVERT
37	CORN RUN	CR-1	1	58.5	42" CMP
38	CATAWISSA TWP	CT-6	3	301.3	6' W X 5' H CONC ARCH
39	KINNEY'S RUN	KR-32	7	453.3	72" RCP
40	KINNEY'S RUN	KR-28	7	381.7	60" RCP
41	KINNEY'S RUN	KR-27	4	876.5	16' W x 6' H CONC BOX
42	KINNEY'S RUN	KR-27	1	105.9	48" RCP
43	KINNEY'S RUN	KR-27	7	237.2	60" RCP
44	KINNEY'S RUN	KR-22	2	388.5	12' W X 4' H CONC BOX
45	KINNEY'S RUN	KR-31	3	217.0	7.5' W X 4' H CONC BOX
46	KINNEY'S RUN	KR-22	1	100.0	48" RCP
47	KINNEY'S RUN	KR-20	2	394.0	13.75' W X 3' H CONC BOX
48	KINNEY'S RUN	KR-20	4	581.3	15' W X 4' H CONC BOX

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
49	KINNEY'S RUN	KR-20	4	58.5	36" CAST IRON
50	KINNEY'S RUN	KR-20	2	84.1	3 - 24" RCP
51	KINNEY'S RUN	KR-18	4	78.5	36" CMP
52	KINNEY'S RUN	KR-18	4	75.5	36" CMP
53	KINNEY'S RUN	KR-11	3	78.8	36" CAST IRON
54	KINNEY'S RUN	KR-11	7	51.4	30" RCP
55	KINNEY'S RUN	KR-11	7	370.0	8' W X 4' H CONC BOX
56	KINNEY'S RUN	KR-11	1	17.5	30" CAST IRON
57	KINNEY'S RUN	KR-9	7	37.9	36" RCP
58	KINNEY'S RUN	KR-8	1	40.5	36" CAST IRON
59	KINNEY'S RUN	KR-8	4	213.8	6' W X 4' H CONC BOX
60	KINNEY'S RUN	KR-16	1	156.2	74" X 44" OVAL CMP
61	KINNEY'S RUN	KR-14	4	370.0	72" CMP
62	KINNEY'S RUN	KR-12	1	87.5	2 - 42" x 27" OVAL CMP
63	KINNEY'S RUN	KR-13	4	74.8	42" RCP
64	KINNEY'S RUN	KR-4	5	43.4	43" X 26" ARCH CMP

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
65	KINNEY'S RUN	KR-29	3	364.5	84" RCP
66	KINNEY'S RUN	KR-11	7	174.6	71" W X 47" H
67	TRIBUTARY NO. 10	SH-6	3	157.2	TWIN 74" X 44" OVAL CMP
68	TRIBUTARY NO. 10	SH-6	6	331.0	TWIN 74" X 44" OVAL CMP
69	TRIBUTARY NO. 10	SH-6	3	230.1	8' W X 3.5' H CONC BOX
70	TRIBUTARY NO. 10	SH-8	1	105.3	9' W X 1.5' H CONC BOX
71	TRIBUTARY NO. 10	SH-8	1	56.8	48" RCP
72	TRIBUTARY NO. 10	SH-9	2	40.3	36" CMP
73	TRIBUTARY NO. 10	SH-5	2	143.5	5.5' W X 3.6' H CONC BOX
74	TRIBUTARY NO. 10	SH-5	3	201.7	6' W X 1.4' H CONC BOX
75	TRIBUTARY NO. 10	SH-14	4	392.3	14' W X 3' H CONC BOX
76	TRIBUTARY NO. 10	SH-14	2	139.6	4.6' W X 3.2' H CONC BOX
77	TRIBUTARY NO. 10	SH-12	7	54.7	36" CMP
78	TRIBUTARY NO. 10	SH-12	7	53.7	34" CMP
79	TRIBUTARY NO. 10	SH-14	3	214.3	68" X 43" OVAL CMP
80	TRIBUTARY NO. 10	SH-12	7	2196.0	16' W X 10.5 H CONC BOX

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
81	SOUTH CENTRE TWP	SC-4	3	172.8	5' W X 3' H CONC BOX
82	SOUTH CENTRE TWP	SC-6	7	1280.0	10' X 10' CONC BOX
83	SOUTH CENTRE TWP	SC-7	2	71.8	36" RCP
84	SOUTH CENTRE TWP	SC-8	1	107.2	53" X 34" OVAL RCP
85	SOUTH CENTRE TWP	SC-1	1	47.6	30" HDPE
86	SOUTH CENTRE TWP	SC-2	7	868.4	17' W X 5' H CONC BOX
87	SOUTH CENTRE TWP	SC-12	1	20.1	24" CMP
88	SOUTH CENTRE TWP	SC-12	3	222.5	2 - 54" CMP
89	SOUTH CENTRE TWP	SC-12	1	276.8	66" CMP
90	SOUTH CENTRE TWP	SC-14	1	80.6	36" CAST IRON
91	SOUTH CENTRE TWP	SC-15	1	53.1	36" CAST IRON
92	SOUTH CENTRE TWP	SC-16	1	63.7	42" CMP
93	SOUTH CENTRE TWP	SC-17	1	18.9	30" X 19" OVAL CMP
94	SOUTH CENTRE TWP	SC-20	5	1094.9	10.5' W X 8' H CONC BOX
95	SOUTH CENTRE TWP	SC-19	3	101.7	2 - 36" HDPE
96	SOUTH CENTRE TWP	SC-20	3	1006.6	14' W X 5.5' H CONC BOX

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
97	SOUTH CENTRE TWP	SC-20	5	1384.7	22.5' W X 5' H CONC BOX
98	SOUTH CENTRE TWP	SC-20	1	333.1	7' W X 4.5' H CONC BOX
99	SOUTH CENTRE TWP	SC-21	3	687.4	16' W X 6' H CONC BOX
100	SOUTH CENTRE TWP	SC-21	1	153.4	9' W X 4' H CONC BOX
101	SOUTH CENTRE TWP	SC-21	1	214.4	6' W X 4' H CONC HALF CIRCLE
102	SOUTH CENTRE TWP	SC-23	3	72.7	42" CAST IRON
103	SOUTH CENTRE TWP	SC-27	2	44.1	30" CAST IRON
104	SOUTH CENTRE TWP	SC-27	3	82.8	36" RCP
105	SOUTH CENTRE TWP	SC-28	1	74.8	36" CMP
106	SOUTH CENTRE TWP	SC-28	6	560.8	7' DIA. RCP
107	SOUTH CENTRE TWP	SC-28	2	151.8	48" RCP
108	SOUTH CENTRE TWP	SC-18	1	22.9	30" CMP
109	TEN MILE RUN	TM-27	5	203.5	60" STEEL
110	TEN MILE RUN	TM-15	2	106.4	48" CMP
111	TEN MILE RUN	TM-15	2	221.6	72" RCP
112	TEN MILE RUN	TM-16	2	239.8	72" STEEL

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
113	TEN MILE RUN	TM-16	3	435.2	10.5' W X 5.5' H ARCH CMP
114	TEN MILE RUN	TM-17	7	1224.6	156" X 96" OVAL CMP
115	TEN MILE RUN	TM-17	3	442.6	120" X 78" OVAL CMP
116	TEN MILE RUN	TM-17	1	54.4	36" STEEL
117	TEN MILE RUN	TM-19	3	1444.8	25' W X 5' H STEEL STR.
118	TEN MILE RUN	TM-6	2	90.3	36" HDPE
119	TEN MILE RUN	TM-5	2	280.7	9' W X 6' H CONC BOX
120	TEN MILE RUN	TM-7	1	56.5	36" RCP
121	TEN MILE RUN	TM-7	1	48.6	36" HDPE
122	TEN MILE RUN	TM-9	1	52.4	36" HDPE
123	TEN MILE RUN	TM-8	4	1153.4	24' W X 5' H CONC BOX
124	TEN MILE RUN	TM-10	1	226.1	48" & 54" RCP
125	TEN MILE RUN	TM-21	1	36.7	30" CMP
126	TEN MILE RUN	TM-21	1	30.3	36" CMP
127	TEN MILE RUN	TM-22	1	31.5	30" CMP
128	TEN MILE RUN	TM-22	2	246.7	2-42" RCP

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
129	TEN MILE RUN	TM-22	2	257.5	78" STEEL
130	TEN MILE RUN	TM-22	1	202.6	7' W X 4' H CONC BOX
131	TEN MILE RUN	TM-22	3	533.0	8' W X 5' H CONC BOX
132	TEN MILE RUN	TM-18	7	947.2	90" RCP
133	TEN MILE RUN	TM-20	2	1286.5	27' W X 8.5' H STRUCTURE
134	TEN MILE RUN	TM-23, TM-24	3	2450.0	16' W X 6' H DBL CONC BOX
135	TEN MILE RUN	TM-25	3	2391.1	24' W X 9.5' H CONC BOX
136	TEN MILE RUN	TM-26	7	20946.4	RR BRIDGE
137	BRIAR CREEK BORO	BCB-2	7	119.9	48" STEEL
138	BRIAR CREEK BORO	BCB-2	7	125.4	48" STEEL
139	BRIAR CREEK BORO	BCB-3	3	52.5	36" STEEL
140	BRIAR CREEK BORO	BCB-4	5	122.2	36" RCP
141	BRIAR CREEK BORO	BCB-4	4	99.9	5' W X 3' H CONC BOX
142	BRIAR CREEK BORO	BCB-4	3	33.6	36" STEEL
143	MIFFLIN TOWNSHIP	MI-42	2	200.9	48" CMP
144	MIFFLIN TOWNSHIP	MI-39	1	165.9	48" RCP

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
145	MIFFLIN TOWNSHIP	MI-41	2	47.6	36" STEEL
146	MIFFLIN TOWNSHIP	MI-38	1	59.1	42" HDPE
147	MIFFLIN TOWNSHIP	MI-38	1	76.4	42" RCP
148	MIFFLIN TOWNSHIP	MI-38	1	15.0	24" CMP
149	MIFFLIN TOWNSHIP	MI-38	1	39.4	2 - 24" CMP
150	MIFFLIN TOWNSHIP	MI-38	1	99.6	54" X 42" OVAL RCP
151	MIFFLIN TOWNSHIP	MI-35	1	64.1	42" HDPE
152	MIFFLIN TOWNSHIP	MI-32	7	2709.4	15' W X 11' H STONE ARCH
153	MIFFLIN TOWNSHIP	MI-32	7	2477.4	15' W X 10' H CONC ARCH
154	MIFFLIN TOWNSHIP	MI-31	1	107.0	2 - 36" HDPE
155	MIFFLIN TOWNSHIP	MI-27	7	2583.5	9' W X 16' H STONE ARCH
156	MIFFLIN TOWNSHIP	MI-27	5	2066.4	120" CMP
157	MIFFLIN TOWNSHIP	MI-26	1	238.1	78" STEEL
158	MIFFLIN TOWNSHIP	MI-25	1	45.9	48" HDPE
159	MIFFLIN TOWNSHIP	MI-25	2	106.3	48" HDPE
160	MIFFLIN TOWNSHIP	MI-24	1	40.5	36" HDPE

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
161	MIFFLIN TOWNSHIP	MI-24	2	37.4	30" CMP
162	MIFFLIN TOWNSHIP	MI-22	1	136.2	3.5' X 5' ARCH CMP
163	MIFFLIN TOWNSHIP	MI-21	1	93.8	48" CMP
164	MIFFLIN TOWNSHIP	MI-20	7	359.8	66" RCP
165	MIFFLIN TOWNSHIP	MI-20	6	316.4	60" RCP
166	MIFFLIN TOWNSHIP	MI-18	7	1374.7	DBL 5' W X 9' H STONE BOXES
167	MIFFLIN TOWNSHIP	MI-18	3	254.1	60" CMP
168	MIFFLIN TOWNSHIP	MI-16	3	1406.3	14' W X 6' H CONC BOX
169	MIFFLIN TOWNSHIP	MI-16	5	2066.7	14' W X 10' H STONE BOX
170	MIFFLIN TOWNSHIP	MI-15	2	386.4	9' W X 7' H STONE BOX
171	MIFFLIN TOWNSHIP	MI-14	2	117.1	48" CMP
172	MIFFLIN TOWNSHIP	MI-13	3	533.8	7' W X 11' H STONE BOX
173	MIFFLIN TOWNSHIP	MI-8	1	1387.1	20' W X 6' H CONC BOX
174	MIFFLIN TOWNSHIP	MI-7	6	214.0	12' W X 2.5' H CONC BOX
175	MIFFLIN TOWNSHIP	MI-14	1	31.1	36" CPP
176	THOMPSON'S RUN	TR-8	3	695.7	102" RCP

Appendix D
Table 1
Obstructions

OBSTRUCTION NUMBER	WATERSHED	SUB WATERSHED	FLOW CATEGORY	OVERTOPPING CAPACITY (CFS)	DESCRIPTION
177	THOMPSON'S RUN	TR-7	1	226.1	3- 53" X 34" OVAL CMP
178	THOMPSON'S RUN	TR-6	1	100.0	10' W X 2.3' H CONC BOX
179	THOMPSON'S RUN	TR-6	1	175.9	10.2' W X 2.45' H CONC BOX
180	THOMPSON'S RUN	TR-4	1	152.2	6' W X 4' H STONE ARCH
181	THOMPSON'S RUN	TR-1	1	60.4	48" CMP
182	THOMPSON'S RUN	TR-1	1	44.6	36" CMP

APPENDIX E

TABLE 1
Kinney Run
Existing Conditions Versus Future Conditions

Comparison Discharge for:

1. Existing Conditions (Ex. Cond)
2. Build-out Condition (B.O. Cond)
3. Flood Plain Fill Condition Only
4. Build-out with Fill Condition (B.O. Fill Cond)

Storm Frequency Years	Ex. Cond CFS	B.O. Cond CFS	Flood Plain Fill Cond Only CFS	B.O. Fill Cond CFS
Central Road				
2	21	28	27	26
5	32	35	39	38
10	41	42	64	63
25	43	43	94	92
50	63	75	131	123
100	85	96	159	157
Route 11 @ Stream Espy Bog				
2	95	104	104	104
5	150	165	168	168
10	221	232	238	238
25	256	269	276	277
50	305	316	325	324
100	340	355	364	364
Sherwood Village East Development				
2	316	384	385	382
5	552	629	627	623
10	824	939	932	926
25	990	1124	1115	1108
50	1205	1353	1342	1334
100	1383	1548	1534	1526
Bloomsburg/Scott Township Boundary				
2	254	280	356	353
5	444	487	618	613
10	701	761	953	947
25	849	919	1148	1141
50	1038	1119	1391	1382
100	1200	1278	1599	1600

APPENDIX E

TABLE 1
Kinney Run
Existing Conditions Versus Future Conditions

Storm Frequency Years	Ex. Cond CFS	B.O. Cond CFS	Flood Plain Fill Cond Only CFS	B.O. Fill Cond CFS
Airport Diversion Structure toward Town Park				
2	47	51	64	64
5	77	83	103	102
10	119	116	168	167
25	148	130	181	180
50	176	170	196	196
100	182	185	218	216
Airport Diversion Structure toward Airport Runway				
2	224	245	318	314
5	396	429	556	552
10	632	687	847	842
25	762	840	1044	1037
50	928	1012	1291	1283
100	1094	1175	1494	1477
Catherine Street Watershed Peak to Storage Area				
2	442	441	440	440
5	645	636	646	646
10	891	877	891	891
25	1029	1011	1029	1028
50	1189	1175	1151	1151
100	1328	1317	1283	1276
Catherine Street Discharge to Town Park				
2	184	186	187	187
5	218	220	227	227
10	257	258	267	267
25	277	276	287	287
50	297	298	301	301
100	310	313	314	313
Town Park Pipe to River Outlet Discharge				
2	158	161	165	165
5	198	200	206	206
10	240	242	245	248
25	266	265	276	275
50	295	294	298	298
100	310	311	312	312

APPENDIX E

TABLE 2
Tributary No. 10 Scott Township
Existing Conditions Versus Future Conditions

Comparison Discharge for:

1. Existing Conditions (Ex. Cond)
2. Build-out Condition (B.O. Cond)
3. Flood Plain Fill Condition Only
4. Build-out with Fill Condition (B.O. Fill Cond)

Storm Frequency Years	Ex. Cond CFS	B.O. Cond CFS	Flood Plain Fill Cond Only CFS	B.O. Fill Cond CFS
Shaffer Hollow Road (SWS-2)				
2	3	3	4	4
5	4	4	5	8
10	4	4	17	20
25	4	4	23	28
50	5	5	36	60
100	5	5	79	117
U.S. Route 11 @ Dairy Queen				
2	86	91	86	88
5	160	179	160	179
10	316	381	315	380
25	438	466	437	465
50	540	577	539	576
100	627	676	626	676
U.S. Route 11 Near Bissetts Lane				
2	125	119	125	119
5	216	213	216	213
10	331	333	331	333
25	399	404	399	404
50	481	492	481	492
100	552	567	552	567
Ridge Street (SWS-3)				
2	65	60	125	119
5	119	113	237	233
10	205	197	376	380
25	260	252	459	466
50	327	320	562	570
100	384	378	647	660

APPENDIX E

TABLE 2
Tributary No. 10 Scott Township
Existing Conditions Versus Future Conditions

Storm Frequency Years	Ex. Cond CFS	B.O. Cond CFS	Flood Plain Fill Cond Only CFS	B.O. Fill Cond CFS
Edgar Avenue (SWS-5)				
2	112	111	117	116
5	192	201	291	287
10	352	389	636	627
25	488	511	867	856
50	626	651	1128	1128
100	739	770	1340	1355

APPENDIX F

PUBLIC COMMENT

&

RESPONSES

CARBON ENGINEERING INC.

CONSULTING ENGINEERS

350 NORTH PINE STREET
SUMMIT HILL, PENNSYLVANIA 18250

TELEPHONE: (570) 645-9545
FAX: (570) 645-6413

RECEIVED
OCT 0 8 2001

October 5, 2001

Samuel Young, P.E.
Larson Design Group, Inc.
P.O. Box 487
Williamsport, PA 17703-0487

Re: Susquehanna River Watershed – Act 167

Dear Sam:

We have completed our review of the referenced Act 167 on behalf of the Town of Bloomsburg and offer the following comments for your consideration:

1. Section V Para. B – The use of complete buildout on all lands with slopes up to 20% appears to be excessive and probably unlikely. Developing lands with these slopes are difficult to access. We feel 15% slopes would be a more reasonable limit.

2. The proposed reductions in post development flow (75% and 90%) along with the conservative approach used in the above comment, can lead to a very restrictive and costly land use.

3. Section C General Performance Standards Paragraph 9 requiring water quality pretreatment. Why is water quality pretreatment required when in fact BMP's must meet water quality criteria? It would appear that this paragraph is redundant.

4. Page 33 – The use of the rational method is restricted to less than twenty (20) acres. This appears to be low.

5. Page 33 Para. C. – We do not agree with using meadow in good condition for all undeveloped lands, including farmlands. Meadow in good condition can result in lower than actual predevelopment thereby resulting in an increase in the size detention required. This along with the conservative approach taken in comments No. 1 and 2 above does indeed result in a very restrictive ordinance. We think the predevelopment condition should reflect the actual predevelopment condition.

6. Clarify when Table B-1 and Table B-2 should be used.

7. Check the precipitation amount in Table B-2 for a one (1) year storm.

8. We do not agree with the use of Table B-4 for individual stormwater management studies. The categories listed are fine for use in classifying cover types for the Act 167 Study but should not be used for individual property studies. I would

recommend providing a runoff coefficient chart based on Rossmiller Equation utilizing soil groups, cover type and land slopes for the following land uses:

Cultivated land, pasture, meadow, forest, lawn, and impervious.

The chart as proposed does not provide accurate runoff coefficients for site developments as they are too general.

If you have any questions on any of the above comments, please feel free to contact me.

Very truly yours,

Ronald M. Tirpak, P.E.

RMT/mt

cc: William Brobst, Town of Bloomsburg

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• Surveyors

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January 22, 2002

Ronald M. Tirpak, P.E.
Carbon Engineering, Inc.
350 North Pine Street
Summit Hill, PA 18250

Re: Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Review Comments Letter Dated October 5, 2001

Dear Ron:

Thank you for taking the time to review and comment on the three-quarter draft of the Columbia County Act 167 Stormwater Management Plan. I have delayed providing a response to your comments until the final draft was reviewed and additional comments were received from local engineering firms who will use this document and its resulting ordinances for preparation of stormwater management plans. Your comments were the only ones received from a local engineering firm for the three-quarter draft and were considered for preparation of the final draft plan. The following are our responses to your comments:

Your Comment #1 - Section V Para. B: Observations within the Watershed Plan area indicate that residential developments are presently occurring on lands where the slope is greater than 20-percent. It is also observed from the review of the topographic maps and soil survey aerial photos that the inclusion of lands with slopes between 15 and 20-percent will not change the curve number values substantially enough to affect the design release rate values for the plan. Development roads and driveways would still have to be installed to meet local requirements. Therefore we are maintaining the "Future Build-out at the 20-percent value.

Your Comment #2 – Proposed reductions in post development flow: The 75 and 90% reductions were determined by modeling the watersheds to determine the effect that upslope developments have on not just an increase in stormwater peak discharges, but in the timing of the peak discharge and its effect on increasing downstream peak discharges. These are the necessary reductions to control increases in peak discharges based upon the individual tributary watersheds.

Your Comment #3 – Water Quality Pretreatment Requirement: The word "infiltration" was missing between the words " Every BMP". In order for infiltration BMPs to continue to function it is necessary to provide a water quality treatment for stormwater flowing to that infiltration facility. The word "infiltration" has been inserted.

Your Comment #4 – Restricting use of the Rational Method to peak discharges for drainage areas less than 20 acres: The models of choice in the Watershed Plan use the NRCS curve number procedure. All obstructions in the watershed were evaluated using a curve number procedure. Although the Rational Method has been used for larger watersheds, it was developed primarily for use in small impervious urban drainage areas. Also, the adjacent approved and implemented Mahoning Creek/Sechler Run Act 167 Watershed Stormwater Management Plan restricts use of the Rational Method to 20 acres. It is felt that this restriction should also apply to this Watershed Plan for consistency in Columbia County. In many watersheds the change in hydrograph timing created by developing a subarea had a greater impact on increasing the downstream peak discharge than the change in land use within that subarea.

Your Comment #5 – The use of meadow for undeveloped lands for existing condition discharges: The use of meadow, unless the existing condition generates a lower curve number or Rational "c" value is recommended by DEP and is a standard in most Act 167 Stormwater Management Plans. Where development occurs on lands previously farmed in row crops under good conservation conditions, it is very common for discharge computations to show that a development for ½ acre lots has the same or lower peak discharge. This was common knowledge to developers in the early days of stormwater management. Where they could afford to hold the property for several years some developers had the property farmed in row crops under poor conservation in order to establish high stormwater discharge values for existing conditions. The recommendation for meadow or better conditions will remain.

Your Comment #6 – Clarify when Tables B-1 and B-2 should be used. The requirement for use of the Tables is found in Section 306 Paragraphs E and F.

Your Comment #7 - Check precipitation amount in Table B-2 for one-year storm: The Table value has been revised from 1.9-inches to 2.4-inches.

Your Comment #8 – Your disagreement with the use of Table B-4 for individual stormwater management studies: The values in Table B-4 were developed to match the land use types specified in Table B-3 by use of the Rossmiller nomigraph procedure. A sensitivity analysis was performed and it found that slope had less of an impact on the value than the storm frequency. Average values were then used in order to minimize the number of coefficients selected for the Table. This procedure is in line with that provided in other Act 167 plans. Weighted "c" values can be developed using the ones provided in Table B-4, that should adequately represent the watershed conditions.

Again I would like to thank you for your comments. If you have any questions please contact me at our Bloomsburg office.

Sincerely,

LARSON DESIGN GROUP, INC.

Samuel E. Young, P.E.

Cc: Robert Aungst, Director Columbia County Office Planning & Development
David B. Jostenski, P.E., PA DEP
Gerry Depo, Town of Bloomsburg Administrator
William Brobst, Town of Bloomsburg
File 5120-050-A

CARBON ENGINEERING INC.

CONSULTING ENGINEERS

350 NORTH PINE STREET
SUMMIT HILL, PENNSYLVANIA 18250

TELEPHONE: (570) 645-9545
FAX: (570) 645-6413

December 7, 2001

Samuel Young, P.E.
Larson Design Group, Inc.
P.O. Box 487
Williamsport, PA 17703-0487

Re: Susquehanna River Watershed – Act 167 Plan

Dear Sam:

We have completed our review of the above referenced Draft Act 167 Plan dated October 24, 2001 on behalf of the Town of Bloomsburg and offer the following comments for your consideration. These comments are in addition to our previous letter dated October 5, 2001.

1. "Existing Condition" is defined throughout the plan as Meadow unless the coefficients are lower, such as Forest. However, Table B-3 shows Mixed Forest Land having higher numbers than Meadow. This appears to be an inconsistency throughout the plan. We recommend defining existing condition as what is actually on the project site at the time of plan submittal but giving the Review Engineer the ability to request conditions as they existed up to five years prior.

2. Meadow coefficients were not included in Table B-4.

3. We recommend reviewing the asterisk marks in Tables B-3 and B-4.

4. Gravel drives and parking areas should be classified in Tables B-3 and B-4. We recommend considering all gravel areas as impervious.

5. Our previous comment concerning runoff CN values and coefficients as being too general for individual site studies still applies.

6. Although we concur with the Exemption Criteria portion of the plan as far as providing an entire plan with calculations, we do recommend provisions be added so that all proposed roof areas be directed to a stormwater facility as a minimum requirement. Perhaps a standard detail should be provided with dimensions for each 1,000 square foot increment of roof area for an infiltration chamber or drywell.

7. A note should be added in Section 308 which states that infiltration facilities should be located in the best suited soils on the project site.

8. The formulas found in Section 308.C and Section 309.B appear to be the required **storage** volume for the facility. This should be clarified in the plan.

9. Section 501 states that the Municipal Engineer must inspect all phases of stormwater management facilities installation. We feel that this requirement may be too general and too stringent. Consideration should be given to establishing an inspsection schedule, at certain phases of the work.

10. The use of filter strip buffers should be encouraged and possibly required along all streams. The Conservation Reserve Program (CRP) from the United States Department of Agriculture (USDA) should be mentioned in the plan.

If you have any questions on any of the above comments, please feel free to contact me.

Very truly yours,

Ronald M. Tirpak, P.E.

RMT/mt

cc: Gerry Depo, Town Administrator
William Brobst, Town of Bloomsburg

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January 22, 2002

Ronald M. Tirpak, P.E.
Carbon Engineering, Inc.
350 North Pine Street
Summit Hill, PA 18250

Re: Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Review Comments Letter Dated December 7, 2001

Dear Ron:

Thank you for taking the time to review and comment on the final draft of the Columbia County Act 167 Stormwater Management Plan. The following are our responses to your comments:

Your Comment #1 – Existing Condition definition of meadow or lower: The comments are the same as provided in Item #5 of my response to your letter dated October 5, 2001 for the ¾ draft plan. Your additional recommendation that states "give the Review Engineer the ability to request conditions as they existed up to five years prior" would help to prevent intentional miss-use of the land in order to increase existing conditions discharges. It would not offset the problem that most farmland in row crops has an equal or higher curve number than most developments. Some of our existing channel erosion problems are related to the fact that discharges were increased over natural conditions when land was cleared for farming purposes. The shift in cropping history to more of the farm acreage being in row crops and less hay or small grain, due to economic pressures, has resulted in additional increases in the peak discharge. In order to reduce stream channel erosion, provide water quality and maintain stream low flows at acceptable rates we need to use either meadow or woodland for the existing condition.

Your Comment #2 – Meadow coefficients were not in Table B-4: Meadow coefficients have been added to Table B-4 based upon Rossmiller's nomigraph.

Your Comment #3 – Recommendation to review asterisk marks in Tables B-3 and B-4: The asterisk marks were checked and corrected to reflect the proper footnotes.

Your Comment #4 – Add values for gravel areas to Tables B-3 and B-4: Values for gravel surfaces have been added to both Tables. The values were computed by removing

the vegetated right-of-way from the NRCS curve numbers to account for initial abstraction and minimal infiltration by soil type. The Rational "c" values were then computed using Rossmillers nomigraph.

Your Comment #5 – Your previous comment concerning CN values and coefficients as being too general for individual site studies still exists: As stated in item #8 for comment on your review letter dated October 5, 2001, we feel that the values established in this report should be used in determining weighted curve numbers and coefficients for individual site designs.

Your Comment #6 – You concur with the use of the exemption criteria but recommend that all roof areas be directed to stormwater facility as a minimum. This would eliminate the exemption criteria or make it more difficult to apply. Those municipalities not agreeing with the exemption criteria could request DEP's approval to implement more stringent criteria as you suggested. More stringent exemption criteria or elimination of the impervious area exemption criteria would not affect the release rate criteria.

Your Comment #7 – Your request to add note to Section 308 for locating infiltration facilities on the best suited soils on the project site: Section 308 requires a geologic evaluation to determine the suitability of the site for recharge. Other site considerations must also be considered when selecting a recharge location. The best suited soils may not be located in an area to which adequate stormwater discharge can be directed. The selection of the type of infiltration BMP used and design of the infiltration system should be left up to the site developer and designer as long as they meet the requirements of the ordinance.

Your Comment #8 – Your comment concerning the formulas found in section 308.C and 309.B: A definition for the term "GIv" was added to Section 308. The definition for the "WQv" term was included in Section 309. Both terms are for a design volume as you noted.

Your Comment #9 – Section 501 statement that Municipal Engineer must inspect all phases stormwater management facilities installation: This paragraph was modified for the municipal engineer to determine during plan review which phases of installation are critical and required inspection of those items as part of the plan approval.

Your Comment #10 – Your comment to encourage and maybe require filter strip buffers along all streams: Filter strip buffers along streams are one of the BMP tools available. It is up to the designer to select the necessary water quality BMP's best suited to the site. The Conservation Reserve Program from the USDA provides for buffer strips for agricultural lands only and not for developments. There are a number of other programs available that may assist in providing stream buffers, but since criteria changes and other sources of assistance become available, they will not be mentioned in this plan. At the time a design is being prepared the designer needs to research potential sources of

financial assistance and recommend them to the client. When buffer strips are included in a land development plan, it should include the design details for types of vegetation, location of buffer and planting requirements and or specifications.

Again I would like to thank you for your comments they have been valuable in correcting errors and for clarifying concerns that others may also have when the plan is implemented. If you have any questions please contact me at our Bloomsburg office.

Sincerely,

LARSON DESIGN GROUP, INC.

Samuel E. Young, P.E.

Cc: Robert Aungst, Director Columbia County Office Planning & Development
David B. Jostenski, P.E., PA DEP
Gerry Depo, Bloomsburg Town Administrator
William Brobst, Town of Bloomsburg
File 5120-050-A

Columbia County Conservation District
702 Sawmill Road, Suite 204 – Bloomsburg, Pennsylvania 17815 – Phone (570) 784-1310 – Fax (570) 784-3247

June 8, 2001

Samuel E. Young, P.E.,
Larson Design Group
1000nCommerce Park Drive
Williamsport, PA 17701

RE: Susquehanna River Tributaries Watershed Act 167 plan
Comments on Draft Report

Dear Sam:

I have reviewed the information submitted at the last WPAC meeting and have the following comments on the draft:

1. Section 301.C, D – Does this mean that if a site currently flows from the proposed development area at three different points that all eventually end up at the same creek and the area is in a watershed with a 75% release rate, each of the points must be controlled to 75%? If so, why? As long as two are limited to no more than existing conditions and the third is reduced enough to assure the total discharge from the site meets 75% requirement, this should be acceptable.

2. 301.J – Should the word be "advantages" or "advantageous"?

3. 302.A - Should it be release "date" or release "rate"?

4. 302.A, Explanation of Districts – For direct discharge, It would appear that the increased flows from the 100 year storm should be able to handled without increased flooding damage to downstream properties. Based on section 301.K., it would seem that only the 25-year storm must be analyzed.

5. 303.E - "no" should be "not".

6. 303.I.3 – items C-F are duplicates of section 303.F.4-7. Is this necessary?

7. 305.D – Does this requirement to carry the 25 year storm with out damage to structures supercede the DEP requirement to provide stability for the 10 year runoff of channels?

8. Section 306.C – "meadow" is not listed in table B-3 or table B-4. Suggest either adding "meadow" to table or changing requirement to pasture, permanent hay, or something else.

9. 308.A – The requirement for a geologist or soil scientist to provide a detailed geologic evaluation seems excessive for small projects.

10. 308-C – What does "Rev" stand for in equation? Suggest either "RCV" for runoff capture volume or "Giv" for groundwater infiltration volume.

11. 402 – Suggest rewording this section by moving part of paragraph under "A" to before "A" and using it as an introduction to all for exemptions. It appears to me that much of this paragraph should apply to all 4 exemptions.

12. 402.A – Should there be some type of setback for exemptions for impervious areas from larger areas? Are we willing to allow a ½ acre of impervious area next to another property just because the lot contains a 5 acre hillside behind it?

13. 402 – Is it necessary to submit a stormwater plan for a stream crossing if DEP has reviewed it under 105, especially if it has undergone hydrologic reviews as in a joint permit?

14. 403.C.2 – Approval of E&S plan for a project may be ongoing at the time of submission and may not be available.

15. 403.C – Suggest listing maintenance requirements and responsibilities as a requirement under this section.

16. 406 – Should 1st sentence in 2nd paragraph end in "review" or "review fee"?

17. Table B-3 – Remove extra labels under "land use description" or more clearly identify which uses are grouped together.

18. Table B-4 – Difficult to identify different land use groups and related co-efficient values.. Need to separate better. Remove * after private parks and other places where it does not apply.

Please feel free to contact me if you have any questions.

Yours in Conservation,

Barry E. Travelpiece, P.E.

cc: Neal Fogle, Columbia County Planning Commission.

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January 28, 2002

Barry Travelpiece, P.E.
Columbia County Conservation District
702 Sawmill Road, Suite 204
Bloomsburg, PA 17815

Re: Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Review Comments Letter Dated June 8, 2001

Dear Barry:

Thank you for taking the time to review and comment on the three-quarter draft of the Columbia County Act 167 Stormwater Management Plan. I have delayed providing a response to your comments until the final draft was reviewed and additional comments were received from local engineering firms who will use this document and its resulting ordinances for preparation of stormwater management plans. Your comments were reviewed and considered for preparation of the final draft plan. The following are our responses to your comments:

Your Comment #1 - Concerning Section 301.C,D: Your interpretation is correct, but has to be looked at on a case-by-case basis. The timing of the discharges from the three separate areas must also be considered. Both the timing and the release rate amount need to be met. The areas releasing at the existing conditions discharge need to have their peak discharge delayed in timing, as it would be if each area met the 75% requirement. This may be impractical to accomplish.

Your Comment #2 – Section 301.J: The word should be advantageous. It was corrected in the plan.

Your Comment #3 – Section 302.A: The word "date" was changed to "rate".

Your Comment #4 – Section 302.A Explanation of Districts: The entire explanation was re-written for clarity.

Your Comment #5 – Section 303.E: The word "no" was changed to "not".

Your Comment #6 – Section 303.I.3: Section 303.I.3 was revised to eliminate the duplication.

Your Comment #7 – Section 305.D: Yes it would be more restrictive and therefore supercede the DEP 10-year requirement under Chapter 102.

Your Comment #8 – Section 306.C requirement for meadow condition: Meadow condition NRCS curve numbers and Rational Method "c" values have been added to Tables B-3 and B-4.

Your Comment #9 – Section 308.A: Added engineers to the list of those qualified to investigate a site for ground water recharge. The main concern is that the person doing the investigation be qualified to identify soils with a seasonal high water table as well as where the water table is at the time of the investigation. Many infiltration systems fail for lack of an investigation by a qualified person.

Your Comment #10 – Section 308.C: Changed term "Rev" to "GIv" for Groundwater Infiltration Volume.

Your Comment #11 – Section 402: This section for "Exemptions" was moved to Section 301.A. as recommended by DEP. Items that would apply to all exemptions have been moved for clarification.

Your Comment #12 – Section 402.A: No setback has been added to the requirements. The increased discharge or concentration of discharge across the property line would be covered by the requirement to "implement such measures as are necessary to protect health, safety and property", now found in Section 301.A.

Your Comment #13 – Section 402 Stormwater Plan submittal requirements for stream crossing: It would be necessary to submit a stormwater plan for a stand alone stream crossing which is covered by a Chapter 105 permit review. The computations for the stream crossing shall be submitted for municipal review in order to show compliance with local ordinances.

Your Comment #14 – Section 403.C.2: A copy of the approved soil erosion and sediment control plan will needs to be part of the stormwater plan. A copy of the plan being submitted for review, where a review is required, should be submitted along with the stormwater plan. A copy of the review approval letter should be provided to the municipality to indicate that the plan was approved. The original plan with the approval letter would suffice if the there were minor changes to the plan. If major changes are made to the E & S control plan then a revise plan should be submitted.

Your Comment #15 – Section 403.C: An item requiring an operation and maintenance plan was added to this section.

Your Comment #16 – Section 406: It should be "review fee".

Your Comment #17 – Table B-3: The Table was revised to clarify the land use descriptions.

Your Comment #18 – Table B-4: The Table was revised to clarify land use groups and footnotes.

Again I would like to thank you for your comments. They have been valuable in correcting errors and for clarifying concerns that others may have when the plan is implemented. If you have any questions please contact me at our Bloomsburg Office.

Sincerely,

Larson Design Group, Inc.

Samuel E. Young, P.E.

Cc: Robert Aungst, Director Columbia County Office Planning and Development
David B. Jostenski, P.E., PA DEP
File #5120-050-A

WATERSHED PLANNING

- MAKE COMMENTS ON DRAFT BY USING SEPARATE SHEET & REFER BY PAGE # & SECTION.
- COMMENTS NEEDED BY DEC. 17, 2001
- MUNICIPALITY WILL DECIDE WHAT ADDITIONS TO MAKE TO THE ORDINANCE.
- 2 FOR PLANNING
- 1 FOR SOLICITOR

IF YOU HAVE QUESTIONS PLEASE CONTACT ME.

RALPH DEFRAIN
PROJECT MANAGER
PETER'S CONSULTANTS, INC
752-4433

PLANNING COMMISSION

Plate 6-4 SHOULD BE BCB NOT BCT
6-7 SHOULD BE ECB NOT BCT

- DETAIL ON MAPS ARE "SKETCHY"
- BOOK WRITTEN ON PROFESSIONAL LEVEL NOT FOR LAYPERSON

BOB, CALL IF YOU HAVE QUESTIONS

RALPH D
752-4433

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January 28, 2002

Ralph DeFrain, Project Manager
Peter's Consultants, Inc.
100 Robbins Ave.
Berwick, PA

Re: Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Review Comments Final Draft

Dear Ralph:

Thank you for taking the time to review and comment on the final draft of the Columbia County Act 167 Stormwater Management Plan. Your comment letter was sent to Robert Aungst and he has asked Larson Design Group to reply to your comments. The following are our responses to your comments:

Your Comment concerning Plates 6-4 and 6-7: The municipalities name on the two plates was changed from Briar Creek Township to Briar Creek Borough.

Your Comment stating that "Detail on Maps are sketchy: The details on the plates provided in the report are as detailed as they can be with the limitations of scale. If more detailed map information is needed, the County GIS system will be the source of the more detailed information.

Your Comment that the "book written on a professional level and not for layperson": The complete report will be in three volumes. Volume I will be an executive summary, written for the lay person, that we will prepare after Volume II is approved by DEP. Volume II is the one that you reviewed and is fairly technical, but contains the DEP required information for Act 167 Plans. Volume III is the actual technical analysis for the watersheds and will be available in the Columbia County Planning and Economic Development Office for reference purposes.

Again I would like to thank you for your comments they have been valuable in correcting errors and for clarifying concerns that others may also have when the plan is implemented. If you have any questions please contact me at our Bloomsburg office.

Sincerely,

LARSON DESIGN GROUP, INC.

Samuel E. Young

Samuel E. Young, P.E.

Cc: Robert Aungst, Director Columbia County Office Planning & Development
David B. Jostenski, P.E., PA DEP
File 5120-050-A

MICHAEL J. PASONICK, JR., INC.

Consulting Engineers & Surveyors
165 NORTH WILKES-BARRE BOULEVARD
WILKES-BARRE, PENNSYLVANIA 18702
AREA CODE (570)
PHONE: 823-4712
FAX: 823-4727

December 4, 2001

Columbia County Commissioners
Office of Planning and Development
702 Sawmill Road
Suite 104
Bloomsburg, PA 17815

Attention: Bob August, Planning Director

RE: SUSQUEHANNA RIVER TRIBUTARIES WATERSHED
ACT 167 – STORMWATER MANAGEMENT PLAN
VOLUME II - DRAFT PLAN – OCTOBER 24, 2001

Dear Mr. August:

On behalf of Salem Township, we have reviewed the above referenced project as submitted by Larson Design Group, Inc. in association with your office. The following is based upon a Plans Presentation and Engineering review of the Plan and its impact on Salem Township. Some of the below items may have already been addressed, however, they are still mentioned for your review and consideration:

Subject	**Comment**
Table of Contents	The Final Plan should contain page numbers.
	Section III, Part H (Land Development Patterns) can not be located in the plan.
	Section III contains four additional Parts (L, M, N, & O) not noted in the Table. It seems these may belong to Section V.
	Section IV in the Plan contains Part D (Wetlands), but not noted in the Table.
	Section V, Part D varies from the Table and Plan from "Standards and Conditions" and "Standards and Criteria" respectively.
	Section V, Part F is missing quotations for "No Harm Option".

Subject	Comment
Table of Contents (continued)	Section V, Part J varies from the Table and Plan from "Additional Exemptions" and "Impervious Area Exemptions".
	Section V, Parts L, M, N, & O do not appear in the Plan, but are mentioned in Section III of the Plan.
	Section VIII, Part I, title should match as shown on page 107.
	Figures, figures could not be located; III-9 is the only Figure mentioned in the Plan.
	Figures, V-1, revise capitalization of "Of" and "watershed" according.
	Tables, III-1, title should match as shown on page 11.
	Tables, III-2, title should match as shown on page 16.
	Tables, III-3, second line is missing "the".
	Tables, III-4, title should match as shown on page 19.
	Tables, III-5, title should match as shown on page 30.
	Tables, III-6, title should match as shown on page 32.
	Tables, "IV- 2", should be "IV-1"
	Tables, IV-1, title should match as shown on page 39.
	Tables, V-1, title should match as shown on page 41.
	Tables, V-2, title should match as shown on page 42.
	Tables, V-3, title should match as shown on page 24.
	Tables, V-4, title should match as shown on page 54.
	Tables, V-5, title should match as shown on page 55.
	Tables, V-6, title should match as shown on page 57.
	Tables, V-7, title should match as shown on page 58.
	Tables, V-8, title should match as shown on page 59.

Subject	Comment
Plan Format	Third line should be revised from "Volume I provide" to "Volume I provides".
Section I	Acceptable.
Section II	Acceptable.
Section III	Part A, item 1(page 11), "Mylar's" should be "mylars" and "counties" should be "county's". Part A, item 5 (page 12), the capitalization of "Susquehanna River Tributaries Watershed" should be consistent. Page 12, "Figure III 9" needs to be added to the Plan. Part B, (page 12), punctuation for the table should be consistent. Part C, (page 14), the elevations should be referenced; (i.e. 1662 feet above mean sea level). Part D, (page 14), last paragraph, 5th line, sentence beginning with "Both" should be revised. Part E, (page 15), 5th line, should be revised from "area" to "areas". Part F, (page 15), missing "and" between "Luzerne, Montour". Part G, (page 15), the reference of the "townships" is misleading; consider changing to "municipalities". Part G, Table III-2, (page 16), total percent should be changed from "101.1" to "100.1". (This issue was previously discussed at the 11/15/01 meeting.) Part G, (page 16), last paragraph, 2nd line, revise "plan" to "plans". Part G, (page 16), move the heading, "Table II-3", to the next page. Page 18, be consistent in mentioning "storm water"; one or two words. Table III-4, (page 19-20), column headings appear on bottom of page, revise accordingly. Table V-3, (page 24), needs to be moved to Section V. (This issue was previously discussed at the 11/15/01 meeting.)

Subject	Comment
Section III (continued)	Table V-3, (pages 25-28), consider carrying over the column headings.
	Part I, (page 28), something seems to be missing after the first paragraph.
	Part K, (page 31), first paragraph, last word, revise "pips" to "pipes".
	Page 32, consider making "Erosion and Sedimentation (E & S)" a main topic.
	Part L, (page 34), does not appear in the Table of Contents.
	Part L, (page 34), revise "Mifflin Ville" to "Mifflinville".
	Part M, (page 34), does not appear in the Table of Contents.
	Part N, (page 34), does not appear in the Table of Contents.
	Part N, (page 34), first paragraph, last sentence, revise "though" to "through".
	Part O, (page 35), does not appear in the Table of Contents.
Section IV	Part A, (page 36), last paragraph, consider revising the first two sentences.
	Part B, (page 36), consider revising the 2nd sentence.
	Part D, (page 39) "Wetlands" do not appear in the Table of Contents.
Section V	Part A, (page 40), acronyms or abbreviations ("POI", "BMP's", etc.) are fine to use, however, when they are first used, provide the full name the first time these will be used. (Not all persons involved may know the terminology.)
	Table V-1, (page 41), revise item 9 from "objection" to "objective". (This issue was previously discussed at the 11/15/01 meeting.)
	Table D-1, (page 43-47), should be moved to Appendix D. (This issue was previously discussed at the 11/15/01 meeting.)
	Table D-2, (pages 48-50), should be moved to Appendix D. (This issue was previously discussed at the 11/15/01 meeting.)
	Table D-2, (pages 48-50), the text in the table should be consistent.

Subject	Comment
Section V (continued)	Part C, (page 52), first sentence seems to be a statement or topic heading, consider revising. Part D, (page 53), "Standards and Criteria" differs from what is in the Table of Contents. Table V-4, (pages 54-55), the text within the table should be consistent. Table V-4, (page 54), Chapter 93 Receiving Waters Classifications should be added at minimum for "Required Standard", "Erosion and Sedimentation Pollution Control". Table V-7, (page 58), column width needs to be adjusted. (This issue was previously discussed at the 11/15/01 meeting.) Page 58, the heading, "Table V-8", should be moved to the next page. Page 59, since noted as "Table V-8", the information should be in table format. Part J, (page 60), "Impervious Area Exemptions" differs from what is in the Table of Contents. Part K, (page 60), "Additional Exemptions" differs from what is in the Table of Contents.
Section VI	Acceptable.
Section VII Model Ordinance	Article III, Section 301, Part A, (page 77), since already stated in Plan, it is possible to delete Items 2, 3, & 4. Article III, Section 309, Part B, (page 88), definition of "PI" contains typing error; "pf" and is probably "of". Article IV, Section 401, (page 90), it is recommended to include "preliminary" with "final approval". Article IV, Section 404, Part J, (page 94), 5th line, remove "2-year", although this is a typically time period, it should be let up to the individual Municipality. Article V, Section 501, Part A, (page 95), it is recommended to add the following text: "as deemed appropriate by the Municipal Engineer."

Subject	Comment
Section VII Model Ordinance (continued)	Article V, Section 501, Part B, (page 95), it is recommended to remove "this Ordinance" and replace with "the approved Stormwater Management Plan". Article VI, Section 601, (page 96), What is the difference between the "Municipal Review Fee" and the "Municipality Review Fee"? Since both of these could not be located in the plan distinctly, one should be removed. Article VII, Section 703, Part A, (page 97), through past projects, we recommend, at minimum, the following stipulations be added: 1. The owner, successor, and assigns shall maintain all facilities in accordance with the approved maintenance schedule and shall keep all facilities in a safe and attractive manner. 2. The owner shall convey to the municipality easements and/or right-of-way to assure access or periodic inspections by the municipality and maintenance, if required. 3. The owner shall keep in file with the municipality the name, address and telephone number of the person(s) or company responsible for maintenance activities; in the event of a change, new information must be submitted to the municipality within ten (10) days of said change. 4. If the owner, successor, or assigns fails to maintain the stormwater control facilities following due notice by the municipality to correct the problem(s), the municipality may perform the necessary maintenance work or corrective work and the owner shall reimburse the municipality for all costs. Article VII, Section 704, (page 97), remove section heading to next page. Article VII, Section 704, Part A, (page 98), it is recommended to remove "engineer" and replace with "and/or their assignee". Article VII, Section 704, Part A, (page 98), through past projects, it is recommended to have a deposit cover a ten (10) year period. Article VIII, Section 805, Part A, (page 100), although the fine and imprisonment would be up the individual Municipality, we have found typically fines of "$1,000" and imprisonment for ninety (90) days.

Subject	Comment
Section VII Model Ordinance (continued)	Article VIII, Section 806, Part B, in addition to the Zoning Hearing Board rendering decisions, at minimum, the Plan should include any decision of the Municipality.
Section VIII	Part I, (page 107), "Developers" should be revised to "Developer's".
Section IX	Acceptable.
Section X	This section should contain the information that is intended.
Appendix D	"Standard Stormwater Maintenance and Monitoring Agreement", (page 125), 3rd "Whereas", it is recommended to include a "_____" for the name of the Subdivision/Land Management Plan.
Plates 7-1 to 7-7	The plates for Salem Township seem to be an accurate representation.

Items requesting special review

1. The local names for the streams within Salem Township are accurate.
2. Table III-6 sufficiently addresses the causes, occurrences, and types of problems associated with the watershed area.
3. To our knowledge, these are currently no plans to construct stormwater collection systems to drain the area.
4. The impervious area exemptions contained in Chapter V are acceptable. Additional comments relating to this Chapter are noted above.
5. The Municipal Ordinance was reviewed and the general comments are noted above.
6. Section VIII was reviewed and was found to be consistent with other projects and is acceptable.
7. The obstructions listed in Table D-1 seem to be accurate.

The copy of the Draft Plan will be returned to your office under a separate cover. Should you have any questions regarding this project, please don't hesitate to contact this office.

Sincerely,

Tom Barna

Tom Barna
Michael J. Pasonick, Jr., Inc.

Cc: Salem Township
MJP File

LARSON DESIGN GROUP
• Architects
• Engineers
• Surveyors

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January 31, 2002

Tom Barna
Michael J. Pasonick, Jr., Inc.
165 North Wilkes-Barre Boulevard
Wilkes-Barre, PA 18702

Re: Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
Review Comments Final Draft

Dear Mr. Barna:

Thank you for taking the time to review and comment on the final draft of the Columbia County Act 167 Stormwater Management Plan. Your comment letter was sent to Robert Aungst and he has asked Larson Design Group to reply to your comments. The following are our responses to your comments:

Your comments on Table of Contents and Plan Format:

- All items have been corrected for the final plan document.

Your comments for Sections I through VI of the Plan:

- All items have been modified or corrected accept as noted below.
- Section V Table V-4 - Your recommendation to add Chapter 93 Receiving Waters Classifications to the "Required Standards": The requirement to meet Chapter 93 requirements is contained in Chapter 104. The Chapter 104 requirements along with the Infiltration and Water Quality requirements are designed to maintain the Chapter 93 classification of the stream. Therefore the addition of Chapter 93 requirements to the table does not need to be made.

Your comments for Section VII, Model Ordinance:

- All items have been modified or corrected accept as noted below.
- Article III, Section 301, Part A, (page 77) – Your recommendation to delete Items 2, 3, & 4: The items will remain in the Ordinance as the ordinance will be adopted by the County and the Municipalities as a stand alone ordinance and along with the required appendices will be the single source of the information needed to develop a stormwater design.
- Article V, Section 501, Part A, (page 95) – Your recommendation to add text: The entire paragraph was re-written for clarification and to incorporate your recommendation.

- Article VII, Section 703, Part A, (page 97) – Your recommendation to add stipulations: The recommended stipulations are covered in the "Standard Stormwater Maintenance and Monitoring Agreement" found in the Appendix. Use of this agreement has been made a requirement of the Ordinance in Chapter VI of the Stormwater Plan.
- Article VII, Section 704, Part A, (page 98) – Your recommendation to remove "engineer": Inspections of stormwater facilities need to be under the direction and responsibility of an engineer. The paragraph was modified to add "and/or their assignee" to allow the engineer to assign the inspection to qualified individuals under their engineering supervision.
- Article VIII, Section 805, Part A, (page 100) – Your recommendation to add typical fines and imprisonment information to this section: As you said this is up to the Municipality to establish and no typical recommendations have been added to the ordinance.
- Article VII, Section 806, Part B, – Your recommendation to include in the Plan any decisions of the Municipality: This section pertains only to the appeal process and not the plan content. Therefore no addition to the Section was made.

Your comment for Section VIII for punctuation correction was made.

Your comment for Section X to contain the intended information: The intended information for meeting purposes has been added.

Appendix D – Your recommendation for addition to the "Standard Stormwater Maintenance And Monitoring Agreement: The plan name information is already required in the agreement in the third "WHEREAS" as designated by the (hereinafter "Plan"). The Plan or subdivision name is to be inserted at this point in the agreement.

Again I would like to thank you for your comments they have been valuable in correcting errors and for clarifying concerns that others may also have when the plan is implemented. If you have any questions please contact me at our Bloomsburg office at (570) 387-6680.

Sincerely,

LARSON DESIGN GROUP, INC.

Samuel E. Young, P.E.

Cc: Robert Aungst, Director Columbia County Office Planning & Development
David B. Jostenski, P.E., PA DEP
File 5120-050-A

DEP Comments on
5/24/2001 Draft
Susquehanna River Stormwater Plan, Columbia County

Section	Page	Comment
Table of Contents		Section VIII missing from plan
IV.C.		Incomplete sentence- second paragraph
Table IV-2		Our Bureau of Waterways Engineering requests that flow values be provided so that tributary flows can be distinguished from main channel flow. Locations of the points where the flow values pertain should be indicated on a map.
Section V		Section V was not labeled. Also, given the new approach for watershed management, we suggest that this entire section be re-written to reflect the water quality and recharge components and present the suite of objectives in an appropriate sequence providing equal emphasis to all components.
		Sub-section A. of Section V (standards and criteria) should be reworded to reflect the revised approach towards water quality, groundwater recharge, streambank protection and extreme events. (Table V-3 does a good job of this) The philosophy has moved more to one of preserving the hydrologic balance of the watersheds while maintaining water quality. Statements such as "Any volume control provided by these measures would be an added benefit", "only under very unusual circumstances could the total volume of runoff be kept at the level of existing conditions" and "…does not necessarily attempt to reduce post development volumes" really don't apply.
General Performance Standards		Under Item 2., what is meant by "adequately treated"? The plan will provide specific volumes to be treated. Treatment of the runoff will not only include that which is directly discharged into a jurisdictional wetland or waters of the Commonwealth, but all runoff from developed lands that may not be directly discharged into those waters.
		Item 7. says that additional performance criteria may be needed for "critical areas or sensitive resources". I would reword those to "special protection waters" such as HQ and EV streams and state that for discharges into those streams that state regulations and guidelines on development in special protection waters be followed.
		Subsection D. Description on water quality and recharge missing.
Table V-1		This table needs to be reworded to reflect new approach.
Table V-2		Under Hydrologic Soils Groups A and B – implementation should not be limited to these soils as the standards would be required to apply to all soil groups.
Table V-3		This table seems to clearly outline the process-an in-depth description is what is needed in the previous sections.

Section VI		Pages were missing after the first page under "Ordinance Provisions"
Model Ordinance	P. 21	You may delete paragraph I. Since infiltration is mandatory under a subsequent section.
		Sections302-309 should be condensed. Consider one section describing the water quality, groundwater recharge, bank stabilization and extreme event management (release rates). We did not note any streambank protection standards. If you believe other standards (recharge, wq, release rates) would satisfy that, then it should be documented as so. It should be made clear as to the order of implementing the standards (see Table V-3, how recharge would count towards satisfying the water quality requirements and how infiltration would affect design of basins with release rates. You may want to reevaluate any direct discharge provision under Section 302. The water quality and groundwater recharge requirements would eliminate the provision except for perhaps larger events.
	P. 28	Item I, typo: "national" should be "natural".
	P. 26	Items 4 through 7 and on p. 29, Items c. through f. mention a "no-harm exemption", but that term is not defined nor is there a section describing that provision.
	P. 30	Section 304 provides standards for portions of a municipality outside this watershed. The water quality and recharge requirements are essentially universal and should be encouraged for all parts of the municipalities. I agree with the post to pre standard for those areas outside the watershed.
	P. 37	Typo under Section C. "computed" rather than "compacted". Formula for groundwater infiltration should be: Rev=[(S)(.05+.009(PI)(A)]/12
	P. 38	Section 309.A. This needs reworded, as the water quality standard will not be exempted. Under 309.B., you have mentioned a "design storm". What design storm? Also, note that the precipitation amount for region IV; in computing the water quality volume is 1.95 rather than 2.04. We have no idea what the first "alternative" is for the water quality treatment volume. Section 309 is confusing and needs to be rewritten. We recommend retaining only the Maryland equation for the procedure.
	P. 40	Section 310. We recommend removing the annotations stating, "The municipality may" or "the following sections may". Insert a page before the ordinance stating what ordinance requirements are mandatory, which are recommended, and which are optional. Otherwise, we'll have municipalities enacting ordinances with the words "wish" or "may" in them.
	P. 42	Section 402 should be moved to the beginning of Article III as it is the performance standard that determine the implementation of the ordinance requirements. Subsections B., C., and D. should be deleted as they have no real meaning. (We are changing our

		template as well).
	P. 58	Section 705 may be deleted as the maintenance and monitoring agreement requires specified inspection intervals.

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January 31, 2002

David B. Jostenski, P.E., Chief
Water Use Planning and Assessment Section
Division of Water Use Planning
Bureau of Watershed Management
Pennsylvania Department of Environmental Protection
P.O. Box 8555
Harrisburg, PA 17105-8555

Re: Susquehanna River Tributaries Watershed
Columbia County Act 167 Stormwater Management Plan
DEP Comments on 5/24/2001 Draft

Dear Mr. Jostenski:

Thank you for taking the time to review and comment on the three-quarter draft of the Columbia County Act 167 Stormwater Management Plan. I have delayed providing a response to your comments until the final draft was reviewed and additional comments were received from local engineering firms who will use this document and its resulting ordinances for preparation of stormwater management plans. Your comments were reviewed and considered for preparation of the final draft plan. The following are our responses to your comments in the order that they were made in your e-mail:

- Section Table of Contents: Section VIII has been added to the final draft.
- Section IV.C.: Sentence was re-written.
- Table IV-2: The table was revised to distinguish tributary flows from main channel flow for the numerous separate streams involved in this Plan. Due to the large number of separate tributary streams entering the river as part of this watershed, it was not practical to identify all the junctions on the watershed plates, as it would have been if this were a single large watershed.
- Section V: The label for Section V was at the bottom of the previous page. The final report will be checked to see that headings stay with the paragraphs to which they belong.
- Sub-section A., Table V-3: The paragraph was re-written for final draft to reflect the revised approach. Table V-3 was moved to the end of Section A and relabeled as Table V-1.
- General Performance Standards Item 2: This item was re-written to say, "Stormwater runoff generated from development shall be treated using appropriate Water Quality Best Management Practices".
- Item 7. Was re-written as suggested.

- Subsection D: Paragraph was re-written to reflect Water Quality and Recharge.
- Table V-1: The table as been relabeled as Table V-4 and revised to reflect the new approach.
- Table V-2: The recommended criteria for Hydrologic Group A & B soils has been revised to include all soil groups. This item was also moved to revised Table V-4, Required Standards and Criteria.
- Table V-3: Was relabeled Table V-1 and moved to Sub-section A.
- Section VI: The missing pages were added to the final draft.
- Model Ordinance P.21: Paragraph 1 was deleted.
- Model Ordinance Sections 302 – 309: These sections were reviewed and it is felt that they are easier to understand as separate sections. As a reviewer of stormwater designs prepared by others for several municipalities, I have found that Ordinances that are not very specific are subject to a wide variety of interpretations and result in either designs that do not meet the intent of the ordinance or controversy over reasonable design procedures. Some sections received revision for clarity and to address comments by others. The reference to direct release was eliminated.
- Model Ordinance P.28: Word "national" was changed to "natural"
- Model Ordinance P.26: The concept of "no-harm" is explained in Section 303 Para. F of which these items are sub-paragraphs.
- Model Ordinance P.30: The water quality and recharge requirements are encouraged for all parts of the municipalities.
- Model Ordinance P.37 (38): The word "compacted" was changed to "computed". Concerning the infiltration equation, we developed our own procedure for determining the infiltration volume based upon actual inches of precipitation that need to be infiltrated. The equation appears to be very similar to the Maryland equation, but theirs is based upon a percentage of runoff while ours is based upon inches of runoff that need to be infiltrated. The backup data for our equation has been provided to DEP for review. This issue needs to be resolved between DEP and LDG in order to finalize the Stormwater Plan.
- Model Ordinance P.38 Section 309.A.: This section has been re-written to address the comments. We have not retained the Maryland equation as explained in the previous comment.
- Model Ordinance P.40 Section 310: Section 310 has been re-written to reflect the requested changes. The required and recommended sections for the ordinance are contained in Section VI of the Stormwater Plan.
- Model Ordinance P.42 Section 402: The information in this section was moved to the beginning of Article III and revised for clarity based upon suggestions by others.
- Model Ordinance P.58 Section 705: This section was eliminated.

Again I would like to thank you for your comments. They have been valuable in correcting errors and for clarifying concerns that others may have when the plan is implemented. If you have any questions please contact me at our Bloomsburg Office.

Sincerely,

Larson Design Group, Inc.

Samuel E. Young, P.E.

Cc: Robert Aungst, Director Columbia County Office Planning and Development
File #5120-050-A

JUL 16 '01

LUZERNE COUNTY PLANNING COMMISSION
COURTHOUSE ANNEX
WILKES-BARRE, PENNSYLVANIA 18711-1001
(570) 825-1560 • (FAX) 825-6362
TDD (570) 825-1860

July 12, 2001

Mr. Neal Fogle, Director
Columbia County Office of Planning and Development
702 Sawmill road
Bloomsburg, Pa. 17815

RE: Draft--Susquehanna River Tributaries Watershed Stormwater Management Plan

Dear Mr. Fogle:

We have received and reviewed the above referenced document and we are making no comment.

Sincerely,

Adrian F. Merolli

Adrian F. Merolli
Executive Director

AFM/kw

Pennsylvania Department of Environmental Protection

Rachel Carson State Office Building
P.O. Box 8555
Harrisburg, PA 17105-8555
November 19, 2001

Bureau of Watershed Management 717-772-4048

Mr. Bob Aungst, Director
Columbia County Office of Planning and Development
702 Sawmill Road, Suite 104
Bloomsburg, PA 17815

Dear Mr. Aungst:

I am writing this letter in response to your request for a confirmation of the Department's position regarding the requirement for water quality components in Act 167 watershed stormwater management plans. It is our understanding that, with the recent distribution of the draft plan, you will shortly be poised for adoption by the Columbia County Commissioners subsequent to a public hearing.

As a result of an internal program and legal review of the Storm Water Management Act, the Department has concluded that the Act requires the inclusion of water quality components in watershed stormwater management plans and further requires the implementation of such components by municipalities subject to the plans. Currently, in the absence of further standards, the Department is requiring the inclusion of groundwater recharge and water quality BMPs in watershed stormwater management plans. The plans must also mandate municipal implementation of the water quality and groundwater components.

While our review of your draft plan indicates you are incorporating the appropriate water quality and groundwater recharge components, it would be necessary for your plan to mandate municipal implementation of the components, in order to secure eventual departmental approval of the plan.

Please feel free to contact me at 717-772-4048 if you have any questions, or if I can be of further assistance.

Sincerely,

William A. Gast, P.E.
Chief
Division of Water Use Planning

LUZERNE COUNTY PLANNING COMMISSION
COURTHOUSE ANNEX
WILKES-BARRE, PENNSYLVANIA 18711-1001
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November 29, 2001

Mr. Bob Aungst, Planning Director
Columbia County Office of Planning & Development
702 Sawmill Road
Suite 104
Bloomsburg, PA 17815

RE: Act 167
Stormwater Management Plan

Dear Mr. Aungst:

We have received and reviewed the draft above referenced plan for the Susquehanna River Tributaries Watershed and we are making no comment.

We have also enclosed the three (3) draft copies as per your request.

Sincerely,

Adrian Merolli

Adrian Merolli
Executive Director

AM/kw

Catawissa Boro -
No Comments on
Act 167
12/11/01 CM

Franklin Township
Columbia County, Pennsylvania
Office of the Secretary - Richard L. Fetterman
277 Long Woods Road
Catawissa, Pennsylvania 17820

12/27/01

Col. Co. Planning Commission
702 Sawmill Road
Bloomsburg, PA 17815

Dear Sirs,

The Franklin Twp., Col. Co. Supervisors have no comments or exceptions to the, Act 167 Stormwater Management Plan, for Columbia County, Pennsylvania.

Sincerely,
Dick
Richard L. Fetterman Secy
Franklin Twp., Col. Co.