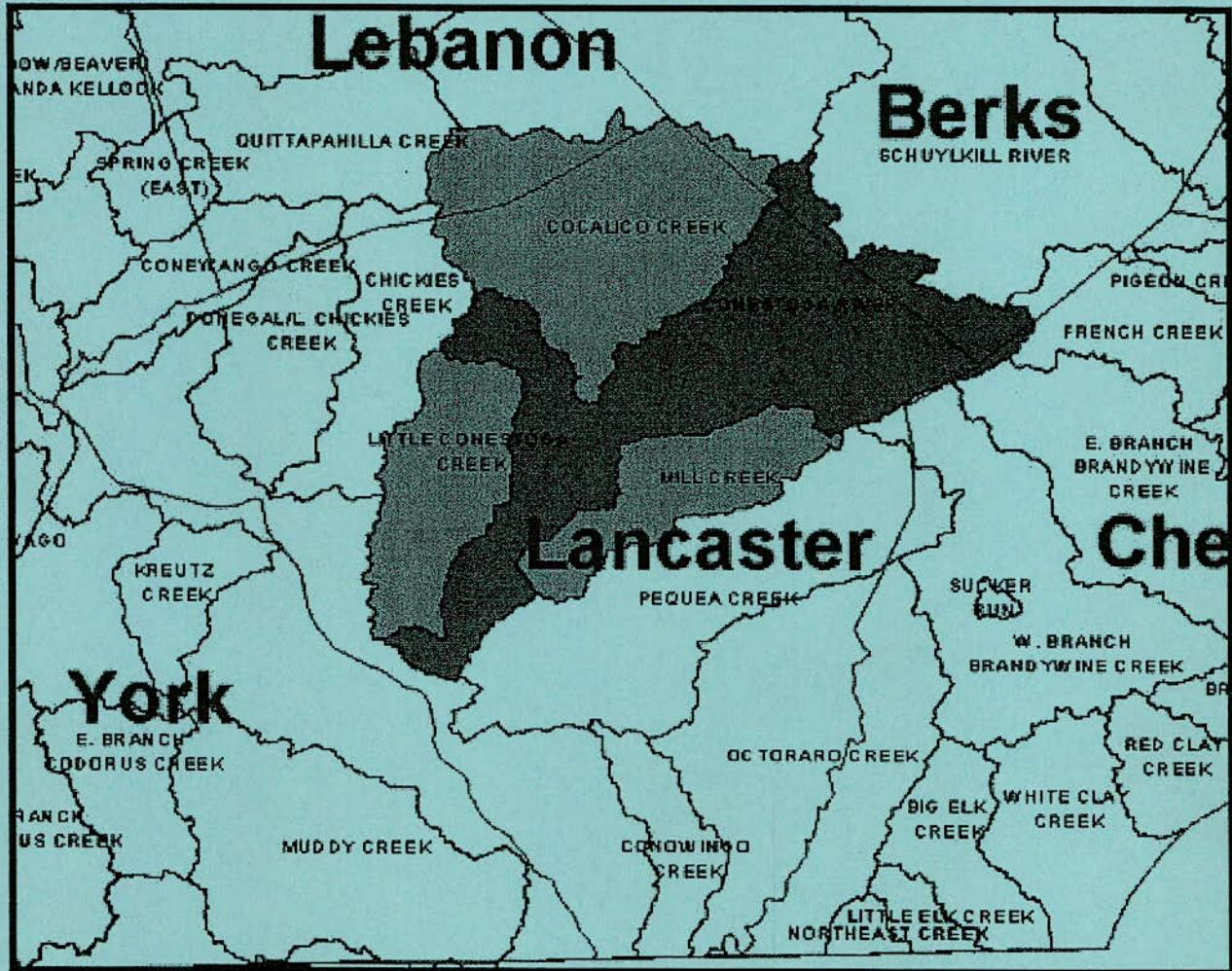


**CONESTOGA RIVER WATERSHED
ACT 167
STORM WATER MANAGEMENT PLAN**

VOLUME II - PLAN CONTENTS

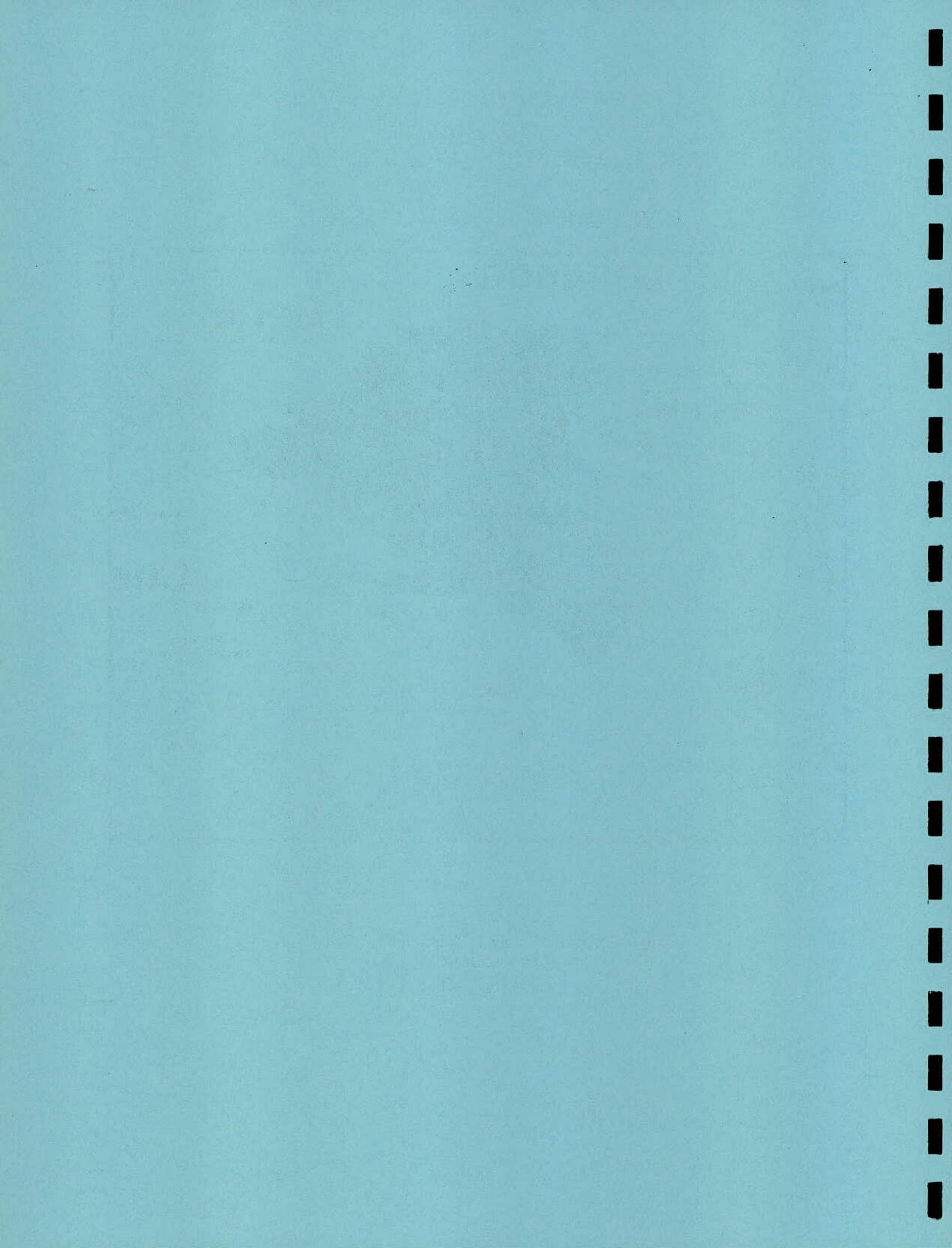


LANCASTER COUNTY, PENNSYLVANIA
FILE NO. SWMP (064:36)
AGREEMENT NO. 3511053

June 2005

PREPARED FOR:

LANCASTER COUNTY COMMISSIONERS
50 NORTH DUKE STREET
LANCASTER, PA 17602



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SECTION I - INTRODUCTION

A. General Overview

The Conestoga River Watershed is located in the central portion of Lancaster County and parts of Berks and Chester Counties. The Conestoga River drains three other State designated watersheds - Mill, Little Conestoga, and Cocalico Creeks.

Portions of this watershed are developed, but vast areas are still undeveloped with a potential for extensive growth under existing zoning. Extensive commercial/industrial growth can result in accelerated storm water runoff which has the potential of causing flooding and erosion problems for property owners along Conestoga River. Stream water quality can also become degraded as impervious areas grow throughout the watershed.

In past years, storm water control was viewed only on a site-specific basis. Recently, local perspectives and policies have changed, with the realization that proper storm water management can only be accomplished by evaluating the comprehensive picture (i.e. by analyzing what adverse impacts a development located in a watershed's headwaters may have on flooding downstream). Proper storm water management improves the overall quality of the receiving streams.

The Conestoga River Watershed Storm Water Management Plan, prepared under the Pennsylvania Storm Water Management Act (Act 167), will enable continued development to occur within the Watershed, utilizing both structural and nonstructural measures to properly manage storm water runoff in the watershed.

B. Storm Water Management

Storm water management entails bringing surface runoff caused by precipitation events under control. In past years, storm water control was viewed only on a site-specific basis. Recently, local perspectives and policies have changed, with the realization that proper storm water management can only be accomplished by evaluating the comprehensive picture (i.e. by analyzing what adverse impacts a development located in a watershed's headwaters may have on flooding downstream). Proper storm water management reduces flooding, soil and stream bank erosion and sedimentation and improves the overall quality of the receiving streams.

Storm water management requires cooperation between the state, county and local officials and involves proper planning, engineering, construction, operation and maintenance. This includes educating the public, local officials and developers and requires program development, financing, revising policy, developing workable criteria and adopting ordinances. The Conestoga River Watershed Act 167 Plan, prepared under the Pennsylvania Storm Water Management Act, will enable continued development to occur within the Watershed, utilizing both structural and nonstructural measures in accordance with design specifications contained in "Pennsylvania

Handbook of Best management Practices for Developing Areas", 1998, or the latest version thereof, or the Pennsylvania Stormwater Best Management Practices Manual, to properly manage storm water runoff in the watershed.

SECTION II - ACT 167

A. Storm Water Management Act

The Pennsylvania General Assembly, recognizing the adverse effects of inadequate management of excessive rates and volumes of storm water runoff resulting from development, approved the Storm Water 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 storm water management purposes. It imposes duties and confers powers to the Department of Environmental Protection (DEP), municipalities and counties and provides for enforcement and appropriations. The Act requires the DEP to designate watersheds and develop guidelines for storm water management and model storm water 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 Act 167 Plans and administrative, enforcement and implementation costs incurred by any municipality or county in accordance with Chapter III - Storm Water Management Grants and Reimbursement Regulations (adopted by the Environmental Quality Board August 27, 1985).

Each county must prepare and adopt a watershed Act 167 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 storm water 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 storm water plan and the provisions of the Act.

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

B. Purpose of the Study

There is increased sentiment statewide, as well as local recognition, that a sound and effective Act 167 Plan should be a diversified multiple-purpose plan. This plan should address the full range of hydrologic consequences resulting from development instead of simply focusing on controlling site-specific peak flow, without consideration of tributary timing, flow volume reduction, base flow augmentation, water quality control and ecological protection.

Managing storm water runoff without looking beyond the boundaries of the development site does not meet the requirements of watershed-wide storm water management objectives. The timing of flood peaks for each subbasin within a

watershed contributes greatly to the flooding potential of a particular storm. Each storm water control site within a subbasin should be managed by evaluating the comprehensive picture. The overall objective of the Plan is to maintain storm water peak flows, volumes, and quality throughout the watershed to existing conditions as the watershed becomes developed.

By developing the Conestoga River Watershed Act 167 Plan, reasonable regulation of development activities can be administered to control accelerated runoff, erosion, and sedimentation and thus protect the health, safety and welfare of the public. The Plan shall include 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 storm water control and will also help maintain the quality of both the Conestoga River and its tributaries.

C. Plan Format

The plan format of the Conestoga River Act 167 Plan consists of Volume I, Executive Summary, and Volume II, Plan Content. Volume I provides an overview of Act 167 and Watershed Level Storm Water Management.

Volume II provides the purpose of the study, data collection, identification of existing problems, present conditions, projected and alternative land development patterns and the model ordinance. Volume II also assesses the impact of managing storm water by utilizing the criteria and standards set forth in this Plan, and provide all of the supporting data, procedures, parameters and watershed modeling.

SECTION III

CONESTOGA RIVER WATERSHED CHARACTERISTICS

The base data used to model the watershed came mostly from the Lancaster County GIS database. The information for Berks and Chester Counties came from the Berks and Chester County GIS databases, and USGS information for Pennsylvania obtained from the Internet.

A. Drainage Area

The Conestoga River Watershed covers an area from the Susquehanna River at Safe Harbor in the southwest to Berks and Chester Counties in the northeast. The watershed is contained in thirty-three (33) municipalities. Twenty-five of these municipalities are in Lancaster County. The Conestoga River watershed drains an area of 214.8 total square miles (188 square miles are in Lancaster County, 25 are in Berks County and 2 square miles are in Chester County).

Municipalities in the Conestoga River Watershed

Lancaster County

Adamstown Borough
Akron Borough
Brecknock Township
Caernarvon Township
Conestoga Township
Earl Township
East Cocalico Township
East Earl Township
East Lampeter Township
Elizabeth Township
Ephrata Township
Lancaster City
Lancaster Township
Lititz Borough
Manheim Township
Manor Township
Millersville Borough
New Holland Borough
Penn Township
Pequea Township
Terre Hill Borough
Upper Leacock Township
Warwick Township
West Earl Township
West Lampeter Township

Berks County

Brecknock Township
Caernarvon Township
New Morgan Boro
Robeson Township
Spring Township

Chester County

Elverson Borough
Honeybrook Township
West Nantmeal Township

The Conestoga River begins in the hills of Caernarvon Township, Berks County, and flows southwestward to the Susquehanna River. The first major tributary, Muddy Creek, meets the Conestoga River north of Hinkletown in Earl Township. Muddy Creek has two significant tributaries, Black Creek and Little Muddy Creek. Black Creek starts in the hills of Brecknock Township and flows parallel to the Conestoga River until it meets Muddy Creek above Terre Hill. Muddy Creek begins in the hills of Brecknock Township, Berks County, and runs parallel to Black Creek until it cuts South above Frysville. Before Muddy Creek cuts south, it is joined by Little Muddy Creek which drains Spring Township in Berks County.

The Conestoga River is next joined from the South by Groff Creek which flows West from Earl Township and New Holland Borough into the Conestoga River near Brownstown. The Cocalico Creek, a State Designated Watershed, joins the Conestoga River below Brownstown. West of that point, the river is joined by Lititz Run. Lititz Run flows through Lititz Borough below the confluence of Santo Domingo Creek and Hubers Run. As the Conestoga River flows toward the City of Lancaster it is joined by Landis Run, which drains part of Manheim Township, and Stauffer Run, which drains part of East Lampeter Township.

The Conestoga River continues to meander southwesterly along the southern side of Lancaster City. The South Sewage Treatment Plant at Engleside is a major discharge point. Mill Creek, a State Designated Watershed, joins the Conestoga River below Lancaster. Stehman Run, the next named tributary, runs West from New Danville into the river at Rockhill. A short distance downstream, Little Conestoga Creek, a State Designated Watershed, joins the river from the North. Witmer Run in Manor Township joins the Conestoga River just before it empties into the Susquehanna River near Safe Harbor Dam.

The named tributaries of the Conestoga River are:

- Witmer Run
- Little Conestoga Creek *
- Stehman Run
- Stauffer Run
- Mill Creek *
- Santo Domingo Creek
- Hubers Run
- Lititz Run
- Cocalico Creek *
- Groff Creek
- Muddy Creek
- Little Muddy Creek
- Black Creek

*This tributary is a State Designated Watershed

**Table III-1
Municipalities Ranked by Area**

Municipality	County	Square Miles	% of Total
Brecknock Township	Lancaster	25.03	11.65
Caernarvon Township	Lancaster	22.53	10.49
East Earl Township	Lancaster	18.50	8.61
West Earl Township	Lancaster	16.21	7.55
Earl Township	Lancaster	14.51	6.76
Manheim Township	Lancaster	14.30	6.66
Warwick Township	Lancaster	10.20	4.75
Brecknock Township	Berks	9.01	4.19
Caernarvon Township	Berks	8.71	4.05
Upper Leacock Township	Lancaster	8.10	3.77
East Lampeter Township	Lancaster	7.81	3.64
Conestoga Township	Lancaster	7.10	3.31
Lancaster City	Lancaster	6.00	2.79
Pequea Township	Lancaster	5.62	2.62
Ephrata Township	Lancaster	5.50	2.56
East Cocalico Township	Lancaster	5.44	2.53
Manor Township	Lancaster	4.83	2.25
Lancaster Township	Lancaster	4.20	1.96
Penn Township	Lancaster	4.10	1.91
Spring Township	Berks	3.50	1.63
New Morgan Borough	Berks	2.93	1.36
Lititz Borough	Lancaster	2.30	1.07
Millersville Borough	Lancaster	1.40	0.65
Adamstown Borough	Lancaster	1.31	0.61
Honeybrook Township	Chester	1.20	0.56
West Lampeter Township	Lancaster	0.97	0.45
New Holland Borough	Lancaster	0.60	0.28
West Nantmeal Township	Chester	0.54	0.25
Elverson Borough	Chester	0.53	0.25
Robeson Township	Berks	0.50	0.23
Elizabeth Township	Lancaster	0.46	0.21
Terre Hill Borough	Lancaster	0.46	0.21
Akron Borough	Lancaster	0.40	0.19
Total		214.80	100

B. Land Use

Land cover inside Lancaster County was extracted from GIS (L98LIB). Berks and Chester County info is from file nlcd_pa_alb_grid.zip, USGS - found on PASDA website. The available GIS landuse data for the watershed shows that existing land use is approximately 55% agricultural, 23% woodland/wetland/water, 14% residential development/ village, 4% commercial/ industrial, and 4% open space / brush / weeds / grass.

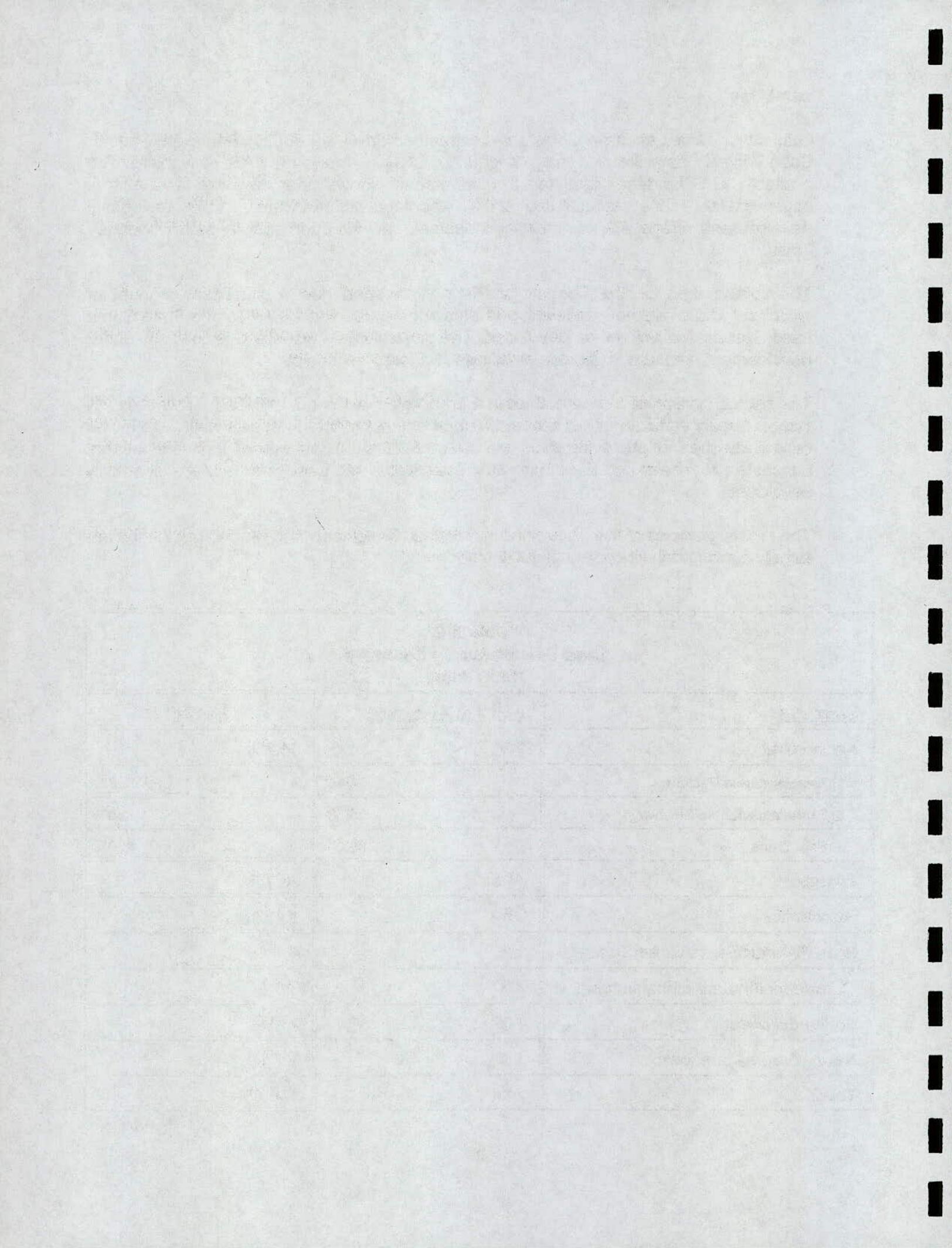
The upland area of the Conestoga River Watershed has a significant amount of woodland and is relatively undeveloped. Much of the woodland is part of the State Game Land System and will not be developed. The privately held woodland is currently under development pressure to provide dwellings in a forested locale.

The central portion of the watershed is a broad plain with rich farmland. This area will remain largely agricultural but some development is expected here as well. The lower/ central reaches of the watershed are characterized by the urban/ industrial usage. Lancaster, Manheim and East Lampeter Townships, and Lancaster City are all heavily developed.

The lowest portions of the watershed in Pequea, Conestoga and Manor Townships are largely agricultural with potential for development.

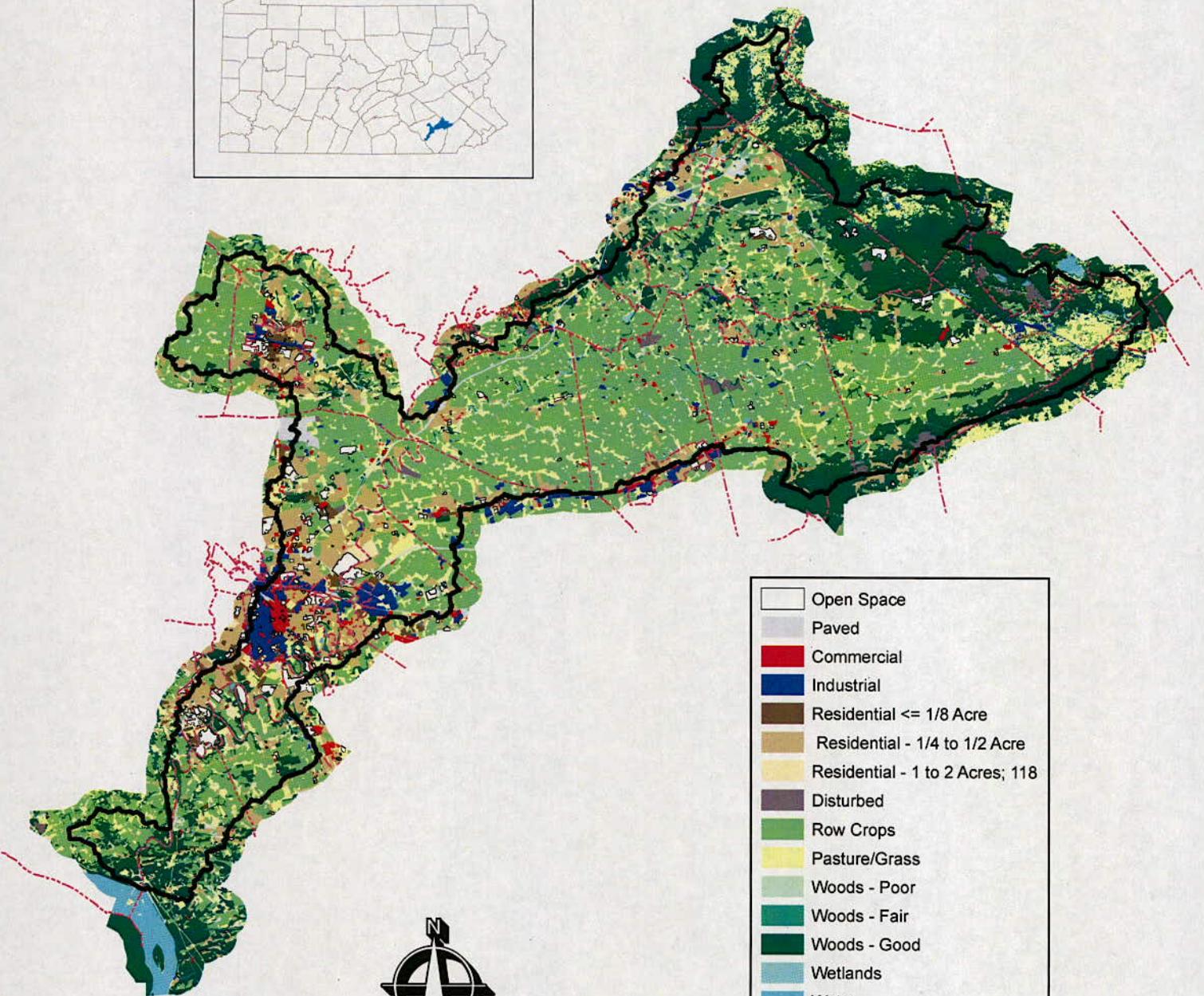
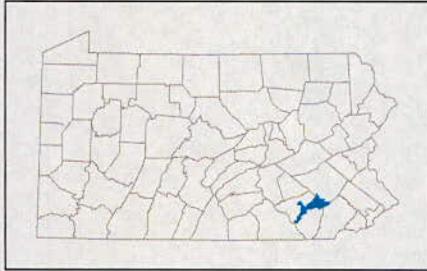
**Table III-2
Land Use Status By Category
(1998 data)**

<u>Land Use</u>	<u>Area (sq. mi.)</u>	<u>Percent</u>
Agricultural	117.7	54.8%
1) Meadow/Grass/Pasture	24.06	11.2%
2) Farmsteads/Lanes/Driveways	5.58	2.6%
3) Row Crops	88.07	41.0%
Woods	44.5	20.7%
Residential	28.4	13.2%
Brush/Weeds/Grass/Open Space	8.8	4.1%
Commercial/Industrial/Institutional	7.5	3.5%
Wetlands/Water	4.3	2.0%
Newly Graded/Unknown	3.6	1.7%
Total	214.8	100.0%

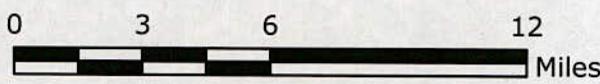


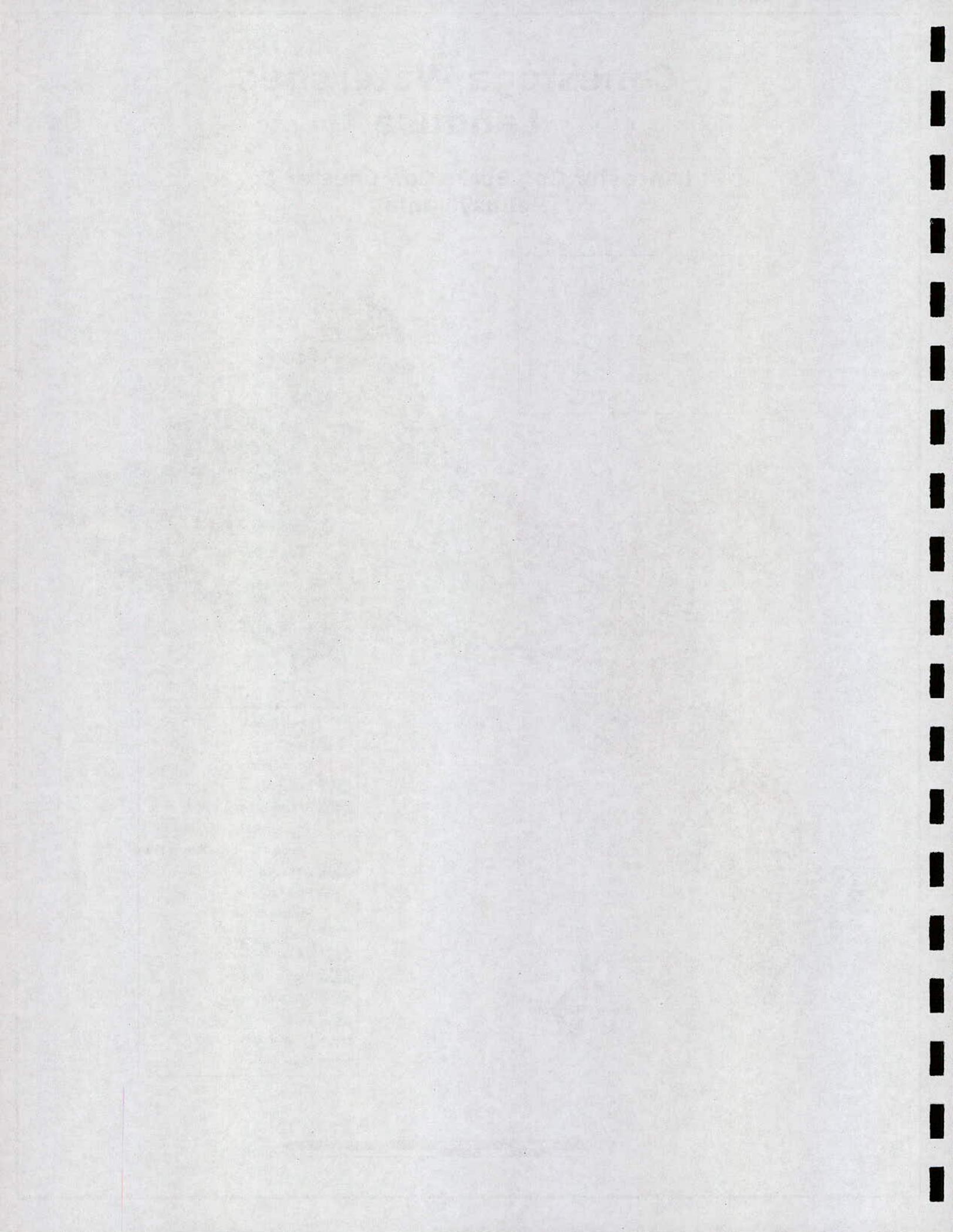
Conestoga Watershed Landuse

Lancaster Co., Berks Co., Chester Co.
Pennsylvania



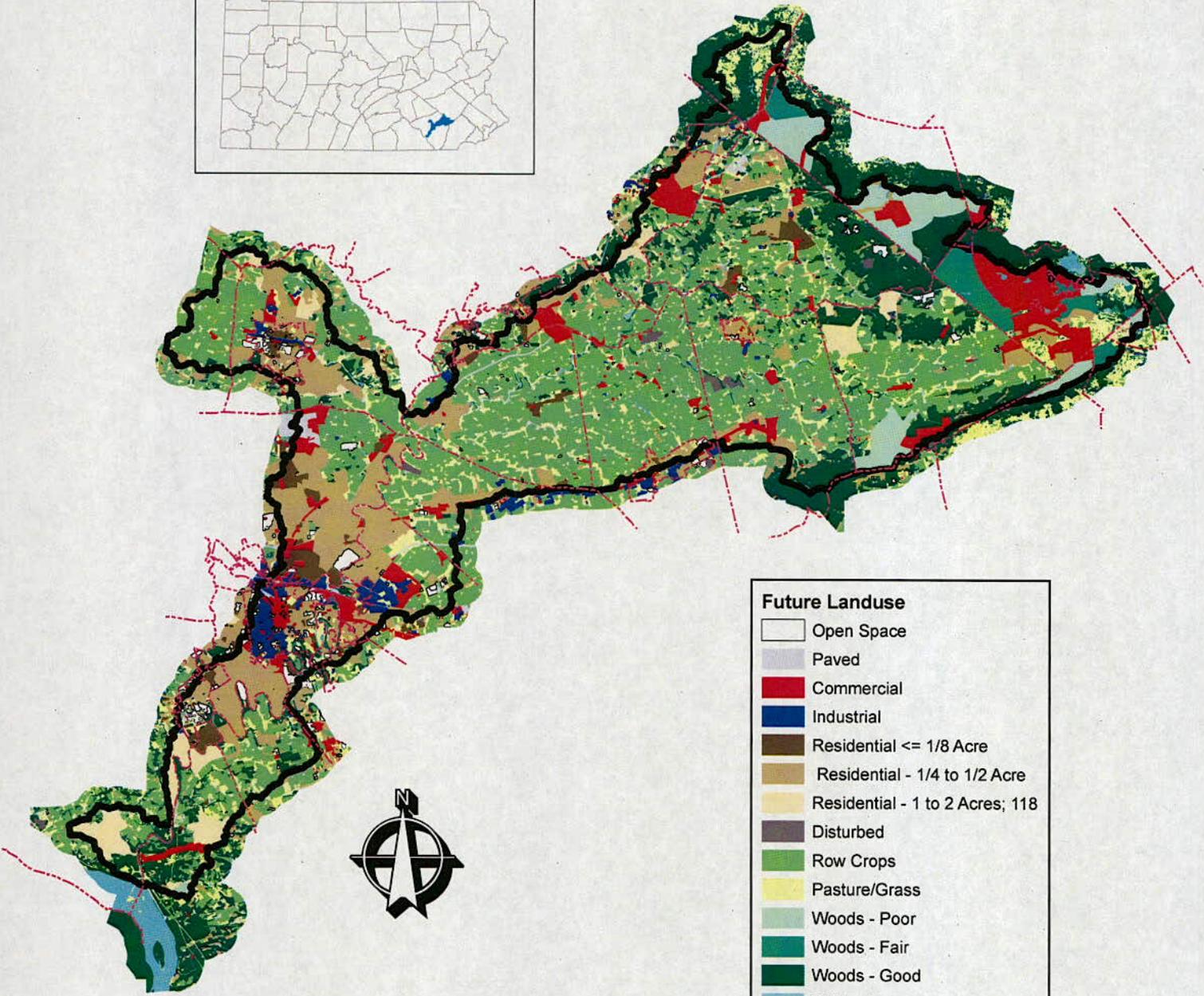
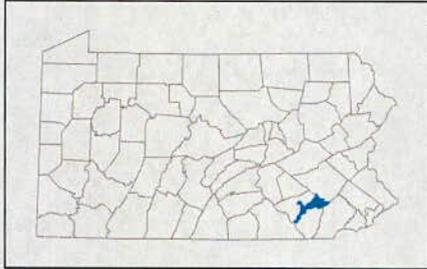
- Open Space
- Paved
- Commercial
- Industrial
- Residential \leq 1/8 Acre
- Residential - 1/4 to 1/2 Acre
- Residential - 1 to 2 Acres; 118
- Disturbed
- Row Crops
- Pasture/Grass
- Woods - Poor
- Woods - Fair
- Woods - Good
- Wetlands
- Water
- Watershed Boundary
- Municipal Line





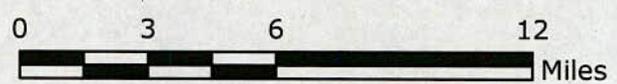
Conestoga Watershed Future Landuse

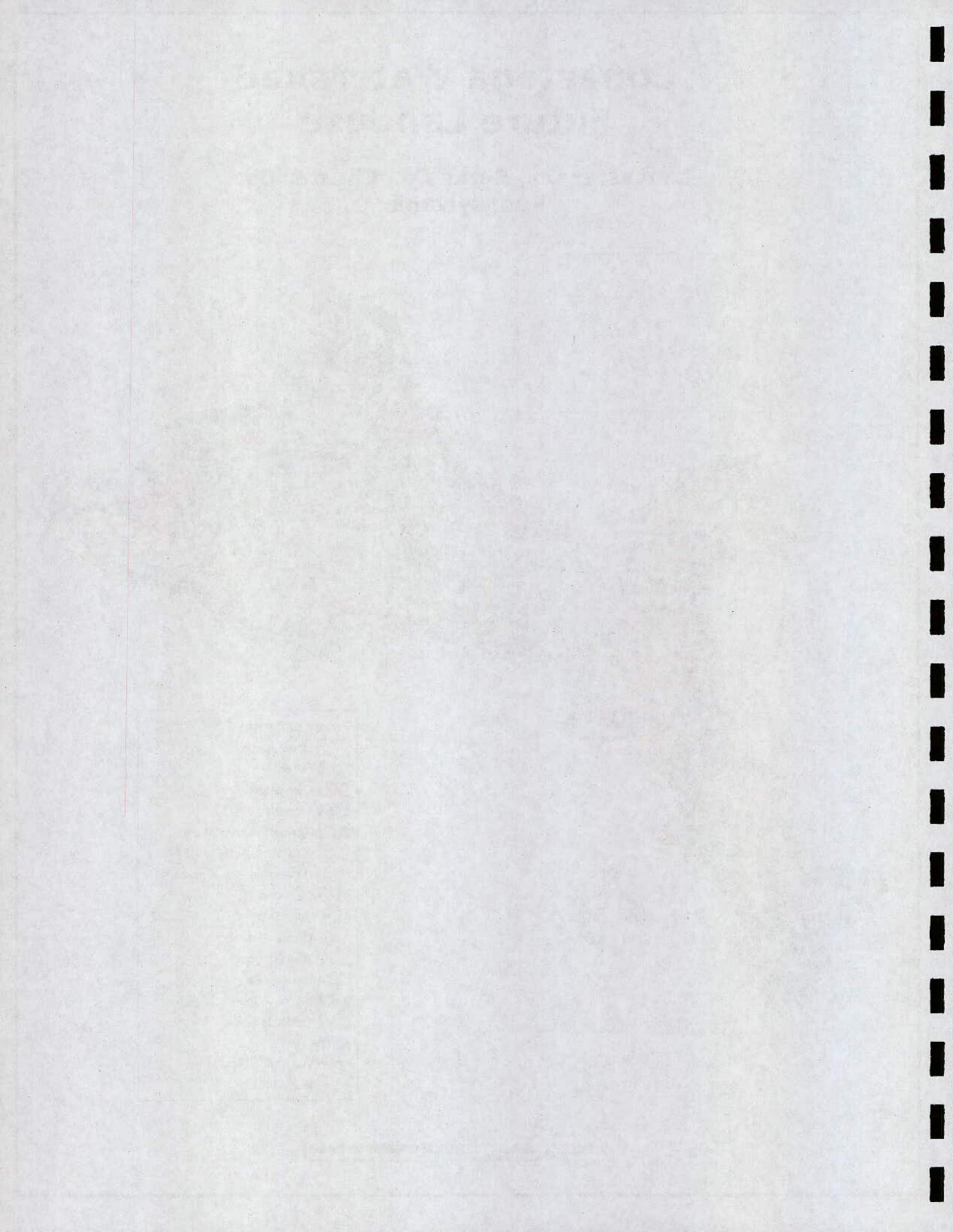
Lancaster Co., Berks Co., Chester Co.
Pennsylvania



Future Landuse

- Open Space
- Paved
- Commercial
- Industrial
- Residential <= 1/8 Acre
- Residential - 1/4 to 1/2 Acre
- Residential - 1 to 2 Acres; 118
- Disturbed
- Row Crops
- Pasture/Grass
- Woods - Poor
- Woods - Fair
- Woods - Good
- Wetlands
- Water
- Watershed Boundary
- Municipal Line





C. Topography and Stream Bed Profile

Berks County

Morgantown topo was hand digitized using the USGS DRG quads and AutoCAD. Breaklines are from the Berks County hydro coverage off the PASDA website, and hand digitized ridgelines.

Elverson, Sinking Spring and Terre Hill topo is from 10 meter DEMS available from USGS, and using hydro coverages from USGS large scale DLGs (see link below) for breaklines.

Chester County

Chester County info is DEM points from their GIS, which is on the same datum as Lancaster County info.

Lancaster County

1998 DEM points coverage clipped to the 3000' watershed buffer. One tile in the 1998 DEM points coverage was bad - #24332940 had an elevation of 360.2 for every point in the tile. Because of this, it was clipped it out and replaced with the same info from the 1993 DEM points coverage.

Additionally, tiles around Lancaster City were completely missing from the 1998 coverage, so the 1993 data was used instead.

All of the Berks, Chester, and Lancaster County topo was exported to Arc/Info and used to create a TIN, which in turn was used to create a Grid for kuse in the watershed model.

The watershed topography ranges from the moderate hills ringing the eastern side of the watershed, to the farmland of the central region, to the hills and valleys of the southwestern part. The highest point in the watershed is on a hill near the State Game Lands No. 52 at 1044-feet. The lowest point is on the Susquehanna River at 170-feet. The Conestoga River flows for a distance of approximately 65.3 miles with an average slope of about 0.25%. The lower reaches are characterized by slopes of about 0.08%, with meandering of the streambed and numerous horseshoe bends.

D. Soils

Soil information was taken from "Soil Survey of Lancaster County, Pennsylvania", Soil Survey Geographic (SSURGO) database for Berks County, Pennsylvania, and Soil Survey Geographic data base for Chester County, Pennsylvania)(which was not SSURGO certified at the time of its use). Soil properties influence the process of runoff generation and are therefore classified into four hydrologic soil groups, A through D. The A soils have the lowest runoff potential and are typically sands and gravels whereas the D soils have a high runoff potential and are typically clay soils. The majority of the soils in the watershed are of the B and C hydrologic soil group. The watershed consists of 66% B soils, 33% C soils, and 1% D soils. There do not appear to be any A type soils in the watershed, although there may be small, isolated locations where A soils do exist in the watershed.

The major soil types in the Conestoga River watershed are as follows:

Manor-Chester-Glenelg

Nearly level to very steep, well drained soils on broad ridgetops and side slopes. These soils were formed in residuum from mica schist, quartzite and gneiss. The unit is about 32% Manor soils, 30% Chester soils, 23% Glenelg soils, and 15% soils of minor extent.

Duffield-Hagerstown

Nearly level to steep, well-drained soils in undulating, broad valleys. These soils were formed in residuum from limestone. The unit is about 42% Duffield soils, 40% Hagerstown soils, and 18% soils of minor extent.

Ungers-Bucks-Lansdale

Nearly level to very steep, well-drained soils on ridges, side slopes and foot slopes. These soils were formed in residuum from Triassic siltstone, conglomerate, shale and sandstone. The unit is about 34% Ungers soils, 19% Bucks soils, 13% Lansdale soils and 34% of minor extent.

Bedington

Nearly level to moderately steep, well-drained soils on dissected ridgetops and side slopes. These soils were formed in residuum from acid shale. The unit is about 75% Bedington soils and 25% soils of minor extent.

Letort-Pequea-Conestoga

Nearly level to very steep, well-drained soils on side slopes of ridges. These soils were formed in residuum from graphitic and micaceous limestone and schist. The

unit is about 27% Letort soils, 17% Pequea soils, 17% Conestoga soils, and 39% soils of minor extent.

Clymer-Chester

Nearly level to very steep, well-drained soils on broad ridges. These soils were formed in residuum from sandstone, mica schist, and quartzite. The unit is about 64% Clymer soils, 23% Chester soils, and 13% soils of minor extent.

Approximately 32% of the Conestoga River Watershed is underlain by carbonate rock, namely limestone and dolomite. Sinkhole activity is common in these areas. Rapid infiltration of storm water runoff into the groundwater system at sinkholes and sinking streams can cause a significant reduction in streamflow and flood peaks at downstream locations. The three main areas underlain by carbonate bedrock are located in Lebanon County at the headwaters of Hammer and Middle Creeks, in an area bounded roughly by Denver and Ephrata Boroughs and extending North and West, and a small area at the very bottom (South end) of the watershed.

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

PHYSICS 350

LECTURE 1

1.1. Introduction

1.2. The Hamiltonian

1.3. The Schrödinger Equation

1.4. The Harmonic Oscillator

1.5. The Free Particle

1.6. The Particle in a Box

1.7. The Tunneling Effect

1.8. The Scattering Problem

1.9. The Asymptotic States

1.10. The S-Matrix

1.11. The Born Approximation

1.12. The Partial Wave Expansion

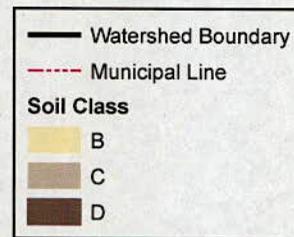
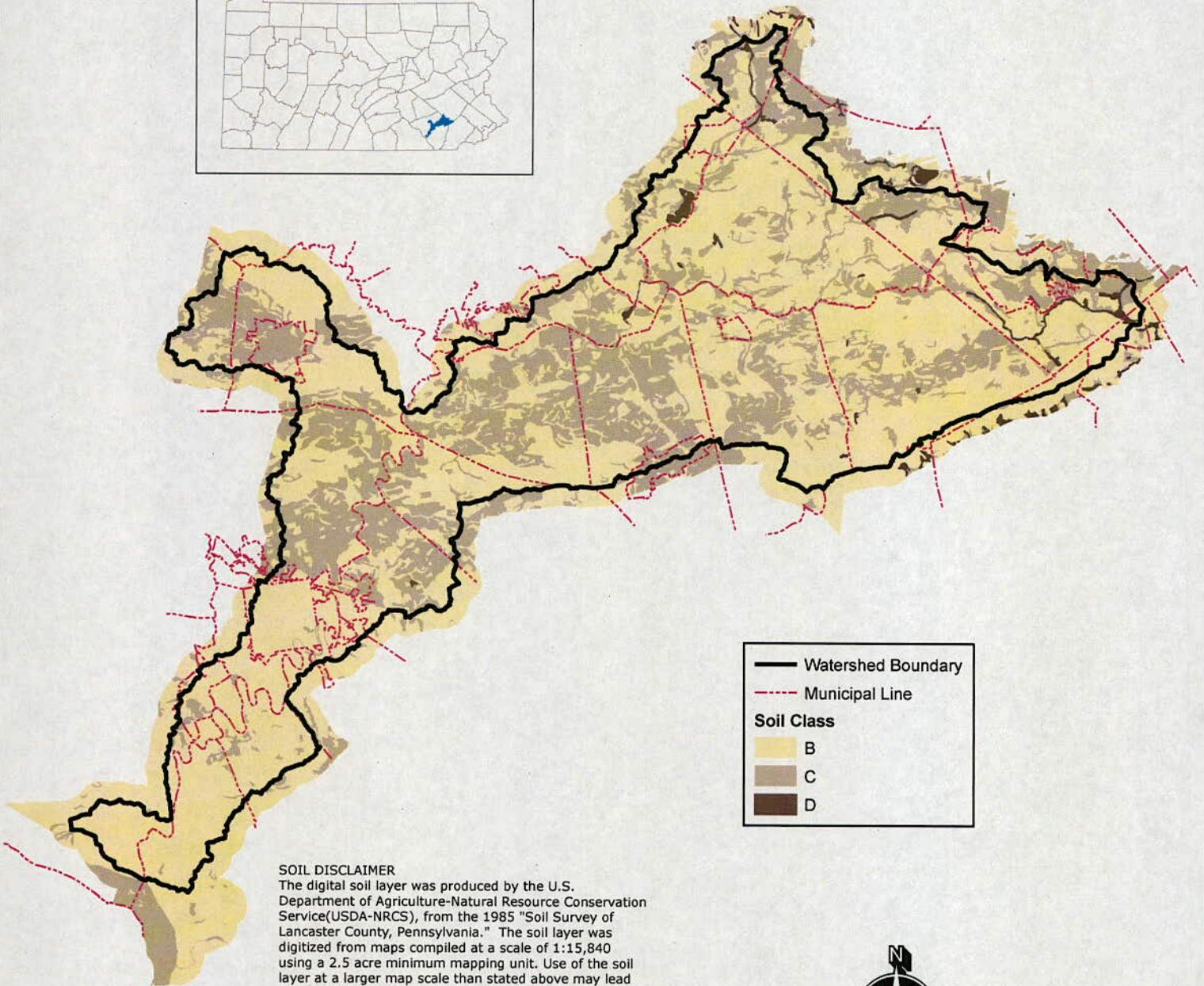
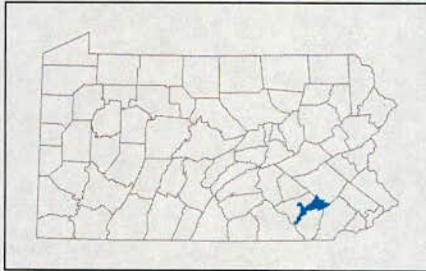
1.13. The Phase Shift

1.14. The Resonance

1.15. The Breit-Wigner Formula

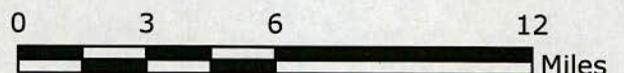
Conestoga Watershed Soil Classification

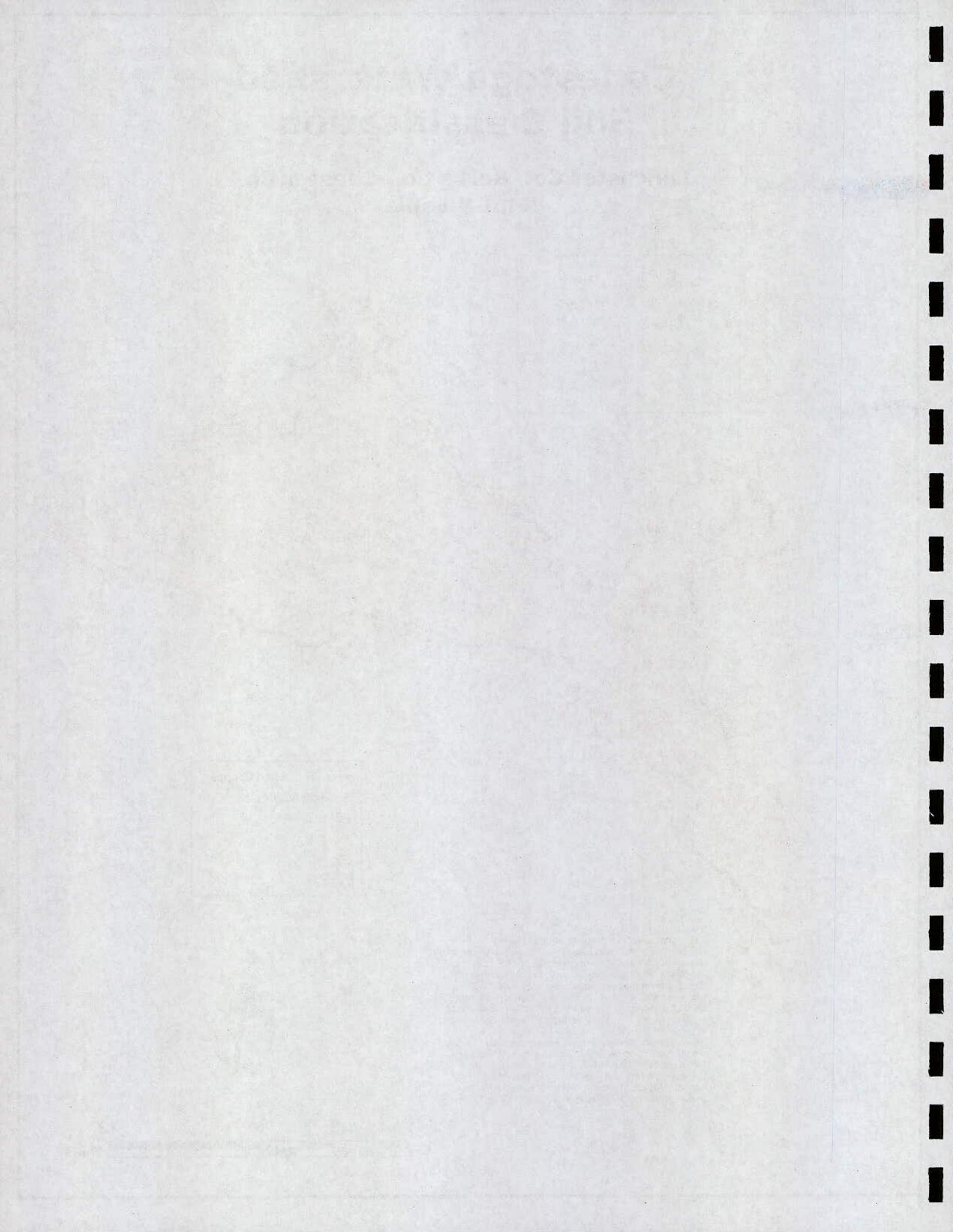
Lancaster Co., Berks Co., Chester Co.
Pennsylvania



SOIL DISCLAIMER

The digital soil layer was produced by the U.S. Department of Agriculture-Natural Resource Conservation Service(USDA-NRCS), from the 1985 "Soil Survey of Lancaster County, Pennsylvania." The soil layer was digitized from maps compiled at a scale of 1:15,840 using a 2.5 acre minimum mapping unit. Use of the soil layer at a larger map scale than stated above may lead to some false conclusions regarding the locational accuracy of the data. This data and any interpretations derived from it are intended for planning purposes only and do not eliminate the need for site-specific field surveys, testing and sampling. Soil descriptions, properties, and interpretations, as well as information on the proper uses and limitations of soil surveys are available at the local USDA-NRCS office.





E. Geology

Information came from the "Soil Survey of Lancaster County, Pennsylvania", from "Groundwater Resources of the Lower Susquehanna River Basin, Pennsylvania", Pa DEP Water Resource Report 57, 1984, and STATSGO (State Soil Geographic Database for Pennsylvania) at <http://www.pasda.psu.edu/summary.cgi/soils/soils.xml>.

Approximately 60% of the Conestoga River Watershed is underlain by carbonate rock, namely limestone and dolomite. Sinkhole activity is common in these areas. Rapid infiltration of storm water runoff into the groundwater system at sinkholes and sinking streams can cause a significant reduction in streamflow and flood peaks at downstream locations. The most prevalent area of this activity is in the western part of the watershed. Sinkhole activity is also found in other areas of the watershed.

The four main areas *not* underlain by carbonate bedrock are located in the Lititz area, in the Berks and Northeastern Lancaster County, in the Welsh Mountain area, and a small area at the very bottom (South end) of the watershed. Everywhere else, in a broad band across the middle of the watershed, is limestone.

F. Climate

Lancaster County is generally cool and humid. The average annual precipitation is about 45 inches. Major rain producing storms, other than hurricanes, tend to have the same general characteristics. They are slow moving storms from the south or southwest with an abundance of moisture that has been transported from the Gulf of Mexico and resupplied with Atlantic Ocean moisture by a strong, nearly stationary, Bermuda High. At the same time, there is frequently a blocking high pressure area to the northeast of Pennsylvania.

Intense local flash floods are most likely to occur in squall lines just to the east of a slow moving north-south oriented cold front. These are usually warm weather phenomena where afternoon heating adds to the instability of the already unstable, moist air mass.

Large floods occurred in June 1972 and September 1975. Lesser floods occurred in September 1987 (Nissly Acres development), November and December 1993, and January 1996.

G. Description of Data Collection

The base data came mostly from the Lancaster County GIS database. The information for Berks and Chester Counties came from the Berks and Chester County GIS databases, and statewide GIS coverages for Pennsylvania obtained from the Pennsylvania Spatial Data Access website at <http://www.pasda.psu.edu>.

For more detailed information about each category of data, see the applicable item listed above.

H. Significant Obstructions

There were no significant obstructions located in the watershed, meaning any dam or culvert which would impound water in a storm. There are numerous low head or mill dams in the watershed, some dating back hundreds of years. With the mill dams, however, there is no storage available in the event of a storm - the dams are always full to the crest.

I. Projected and Alternative Land Development Patterns in the Watershed

1. Projected Land Development Patterns

Most of the Townships within the watershed are predominantly suburban in nature and largely undeveloped. A majority of suitable land in Lancaster City and in the Boroughs has been developed. Overall, potential development pressures will be significant based on existing zoning.

Future development within the Conestoga River Watershed will most likely occur where public facilities (water, sewer, and access to transportation) are available. Commercial and industrial development will most likely be confined to industrial parks or areas where public water and sewer are or will soon be available.

Table III-2 provides an overview of the types of development that will occur when existing patterns are considered for each municipality within the watershed.

2. Impact of Runoff From Future Development

A Future Land Use Map was developed using existing zoning in conjunction with physical limitations (wetlands, floodplain, topography). The potential impact of additional runoff was then evaluated by placing the future land use conditions into the computer model and re-running the model. Table III-3 below shows a comparison of the existing flows, future flows without control of runoff, and future flows with control of runoff (as proposed by this plan). The design storm used for the comparison is the 100-year, 24-hour Natural Resource Conservation Service NRCS (formerly the Soil Conservation Service) storm.

TABLE III-3
DEVELOPMENT POTENTIAL BY MUNICIPALITY
BASED UPON EXISTING PATTERNS
IN THE CONESTOGA RIVER WATERSHED

Municipality	R-1	R-2	R-3	R-4	I	C
BERKS COUNTY						
Brecknock Township, Berks Co.	X	O	—	—	—	O
Caernarvon Township, Berks Co.	X	—	O	—	O	O
New Morgan Borough, Berks Co.	—	—	—	—	X	X
Robeson Township, Berks Co.	O	—	—	—	O	—
Spring Township, Berks Co.	—	—	—	—	—	—
CHESTER COUNTY						
Elverson Borough, Chester Co.	—	—	O	O	O	O
Honeybrook Township, Chester Co.	X	—	—	—	O	—
W. Nantmeal Township, Chester Co.	X	—	—	—	—	—
LANCASTER COUNTY						
Adamstown Borough, Lancaster Co.	—	—	O	O	O	O
Akron Borough, Lancaster Co.	—	—	O	O	O	O
Brecknock Township, Lancaster Co.	—	O	—	O	O	O
Caernarvon Township, Lancaster Co.	X	—	O	—	O	O
Conestoga Township, Lancaster Co.	X	—	—	—	—	O
Earl Township, Lancaster Co.	O	—	O	—	O	O
E. Cocalico Township, Lancaster Co.	X	—	X	O	X	O
E. Earl Township, Lancaster Co.	—	—	X	—	O	O
E. Lampeter Township, Lancaster Co.	—	X	X	—	X	O
Elizabeth Township, Lancaster Co.	X	—	—	—	O	—
Ephrata Township, Lancaster Co.	—	—	X	O	O	O
Lancaster City, Lancaster Co.	—	—	O	O	O	O
Lancaster Township, Lancaster Co.	—	X	X	—	O	O

TABLE III-3
DEVELOPMENT POTENTIAL BY MUNICIPALITY
BASED UPON EXISTING PATTERNS
IN THE CONESTOGA RIVER WATERSHED

Municipality	R-1	R-2	R-3	R-4	I	C
LANCASTER COUNTY						
Lititz Borough, Lancaster Co.	—	—	O	O	O	O
Manheim Township, Lancaster Co.	—	X	X	X	O	X
Manor Township, Lancaster Co.	X	—	—	—	—	O
Millersville Borough, Lancaster Co.	—	—	O	O	O	O
New Holland Borough, Lancaster Co.	—	—	O	O	O	O
Penn Township, Lancaster Co.	O	—	O	—	O	—
Pequea Township, Lancaster Co.	—	X	O	—	O	O
Terre Hill Borough, Lancaster Co.	—	—	O	O	O	O
Upper Leacock Township, Lancaster Co.	—	—	O	—	O	O
Warwick Township, Lancaster Co.	O	—	X	—	O	O
W. Earl Township, Lancaster Co.	—	—	X	O	—	O
W. Lampeter Township, Lancaster Co.	—	—	O	O	O	O

R-1 Residential lots 1 acres to 4 acres
R-2 Residential lots ½ acre to less than 1 acre
R-3 Residential lots ¼ acre to ½ acre
R-4 Residential lots ⅓ acre or less
I Industrial
C Commercial

X Major Development Impact
O Minor Development Impact
— No Development Impact

TABLE III-4
PRESENT VERSUS FUTURE FLOWS
100 Year Storm of 24-hour Duration

Subarea	Individual Area (s.m.)	Individual Flow (cfs)	Cumulative Area (s.m.)	Cumulative Existing Flow (cfs)	Cumul. Future Flow (100% rel. rate)	Cumul. Future Flow (variable rel. rate)
(MC1) * 1	0.83	820	0.83	820	**903	410
(MC2) * 2	1.23	1,216	2.06	1,578	**1,715	964
(MC3) * 3	1.58	641	3.64	1,349	**2,112	1,031
4	1.37	2,967	2.85	3,358	**5,459	1,472
5	1.63	2,452	1.63	2,452	**3,214	736
6	1.50	1,949	3.13	3,820	**5,563	1,325
(MC4) * 7	1.75	918	11.54	5,178	**8,500	3,612
(MC5) * 8	0.96	1,708	15.63	7,646	**12,544	4,999
(MC6) * 9	1.13	1,821	16.76	7,183	**11,817	5,049
(MC7) * 10	1.12	2,042	17.88	7,258	**11,893	5,141
(MC8) * 11	0.97	1,697	18.85	7,354	**11,985	5,217
12	0.94	1,015	0.94	1,015	**1,103	508
13	1.38	1,583	2.32	1,610	**1,981	912
14	1.48	1,574	1.48	1,574	**2,740	472
(MC9) * 15	1.28	882	20.13	7,308	**11,850	5,272
(MC10) * 16	1.29	2,406	21.42	7,217	**11,571	5,524
(MC11) * 17	0.98	1,531	22.4	7,296	**11,634	5,897
(MC12) * 18	0.98	1,714	23.38	7,365	**11,707	6,352
19	0.80	1,472	0.8	1,472	1,418	1,418
20	1.30	2,166	1.3	2,166	**2,403	1,083
21	0.92	557	3.02	3,958	**4,175	2,940
(MC14) * 22	1.63	2,280	35.56	11,279	**12,698	8,178
23	1.69	2,669	1.69	2,669	2,669	2,669
24	1.39	1,848	3.08	4,461	4,461	4,461
25	1.31	945	5.49	5,635	5,657	5,657
26	1.10	1,307	1.1	1,307	1,307	1,307
27	0.82	1,372	0.82	1,372	1,372	1,372
(MC25) * 28	1.46	1,095	124.95	27,773	**30,044	26,226
29	0.98	1,634	3.3	2,439	**2,811	2,049
(MC3) * 30	1.22	725	27.62	7,348	**11,275	6,242
(MC15) * 31	1.87	2,233	37.43	10,783	**12,149	8,088
32	1.40	1,866	1.4	1,866	1,866	1,866
33	1.39	641	1.39	641	**785	321
34	1.35	1,090	2.75	2,384	2,395	2,395
(MC16) * 35	1.42	829	42.99	10,472	**11,820	8,325
(MC17) * 36	1.21	1,013	44.2	10,503	**11,855	8,783

Subarea	Individual Area (s.m.)	Individual Flow (cfs)	Cumulative Area (s.m.)	Cumulative Existing Flow (cfs)	Cumul. Future Flow (100% rel. rate)	Cumul. Future Flow (variable rel. rate)
(MC18) * 37	1.00	914	45.2	10,547	**11,891	8,815
(MC19) * 38	0.98	828	46.18	10,373	**11,841	8,608
39	0.79	1,039	0.79	1,039	**1,377	520
40	1.25	1,402	2.04	1,744	**1,981	1,709
41	1.47	1,151	1.47	1,151	**1,228	576
42	1.26	782	2.73	1,343	**1,427	1,134
43	0.95	941	0.95	941	959	959
(MC20) * 44	1.43	834	50.6	10,055	**11,898	8,544
45	0.87	1,474	0.87	1,474	1,474	1,474
(MC21) * 46	1.48	1,128	55.68	9,758	**11,958	8,544
47	1.53	1,346	1.53	1,346	1,359	1,359
48	0.98	871	3.48	2,445	2,462	2,462
49	1.14	949	1.14	949	976	976
50	0.81	1,497	0.81	1,497	1,508	1,508
51	1.01	1,761	3.1	3,716	**3,908	2,161
52	1.28	2,157	2.09	2,660	2,764	1,692
53	1.29	2,491	4.39	3,737	**4,016	2,733
54	1.27	1,804	5.66	3,837	**4,356	3,360
55	0.88	1,462	0.88	1,462	**1,819	439
56	0.94	1,396	1.82	1,570	1,648	871
57	1.38	2,112	8.86	5,474	**6,045	4,591
58	2.02	3,047	10.88	6,740	**7,465	6,005
59	1.06	1,839	11.94	7,421	**8,247	6,745
60	1.08	1,555	1.08	1,555	**2,065	467
61	1.13	1,640	13.07	7,023	**7,736	6,740
62	1.04	1,516	15.19	7,540	**8,412	7,095
63	1.11	1,664	16.3	7,368	**8,232	6,897
64	0.95	1,554	0.95	1,554	**2,136	466
65	1.04	1,429	1.99	2,050	2,070	1,224
66	1.00	1,049	1	1,049	**1,330	525
67	0.66	898	3.65	2,819	**3,340	1,906
68	0.83	1,545	0.83	1,545	**1,971	464
69	1.71	2,813	6.19	3,484	**4,486	2,923
70	0.94	1,348	7.13	3,331	**4,095	2,967
71	1.50	1,770	14.69	10,281	**11,961	6,649
72	1.16	1,313	1.16	1,313	**1,585	657
73	0.83	1,364	0.83	1,364	1,430	682
74	1.65	2,722	3.64	5,353	**5,955	2,779
75	0.97	1,594	0.97	1,594	1,611	1,611

Subarea	Individual Area (s.m.)	Individual Flow (cfs)	Cumulative Area (s.m.)	Cumulative Existing Flow (cfs)	Cumul. Future Flow (100% rel. rate)	Cumul. Future Flow (variable rel. rate)
76	1.45	2,617	6.06	7,266	**8,160	4,292
77	1.03	1,312	15.72	9,673	**11,302	6,715
78	0.69	1,138	16.41	9,085	**10,665	6,651
79	1.55	1,929	1.55	1,929	1,965	965
80	1.48	1,698	3.03	1,999	2,073	1,811
81	1.70	1,793	1.7	1,793	1,807	1,807
82	1.78	2,199	3.48	3,394	3,420	3,420
83	0.83	1,484	9.12	5,868	5,974	5,854
84	1.37	2,374	10.49	5,841	5,951	5,806
85	0.72	1,474	0.72	1,474	1,543	737
86	0.76	1,135	11.97	6,077	6,194	6,092
87	0.92	1,318	0.92	1,318	1,371	659
88	1.23	2,366	1.23	2,366	2,412	2,412
89	1.09	1,274	2.32	3,069	3,190	2,489
90	1.39	1,914	32.09	14,639	**16,156	12,554
91	1.23	2,111	1.23	2,111	**2,248	1,056
92	1.89	1,978	51.51	21,219	**23,483	18,777
93	1.87	1,076	53.38	19,737	**21,807	18,031
94	1.39	2,719	1.39	2,719	2,801	2,801
95	0.94	2,057	0.94	2,057	2,154	1,029
96	1.28	2,582	1.28	2,582	**3,172	1,291
(MC22) * 97	1.38	1,658	119.77	28,184	**30,460	26,435
(MC23) * 98	1.17	1,052	120.94	28,201	**30,479	26,464
99	1.49	2,716	1.49	2,716	**2,882	1,358
(MC24) * 100	1.06	719	122	27,920	**30,193	26,281
101	1.41	1,343	1.41	1,343	**1,566	672
(MC26) * 102	1.13	658	126.08	27,253	**29,514	25,860
(MC27) * 103	1.40	893	142.07	27,469	**29,701	26,206
104	1.17	864	1.17	864	864	864
105	1.41	854	1.41	854	883	883
106	1.49	1,254	5.02	2,784	2,868	2,626
107	1.31	1,059	6.33	2,336	2,440	2,239
108	1.55	883	1.55	883	**986	442
109	1.56	911	3.11	1,202	**1,294	1,169
110	1.68	1,085	1.68	1,085	**1,172	814
111	0.85	461	2.53	1,359	**1,442	1,123
112	1.21	776	10.65	3,261	**3,462	3,007
113	1.05	1,696	1.05	1,696	1,735	1,735
114	1.28	1,987	1.28	1,987	1,981	1,981

Subarea	Individual Area (s.m.)	Individual Flow (cfs)	Cumulative Area (s.m.)	Cumulative Existing Flow (cfs)	Cumul. Future Flow (100% rel. rate)	Cumul. Future Flow (variable rel. rate)
115	1.42	1,924	3.62	4,828	4,998	3,325
116	1.49	907	2.43	1,349	1,404	971
117	0.93	985	4.44	2,233	2,308	1,864
118	0.94	1,235	5.38	3,073	3,155	2,972
119	0.91	1,167	0.91	1,167	**1,276	584
120	1.34	898	13.25	9,267	**9,731	7,306
121	1.71	2,200	14.96	8,492	**8,950	6,948
122	1.36	1,738	1.36	1,738	**1,936	869
Cocalico Creek drains into Subarea 123, Area = 140.19 square miles						
(MC28) * 123	0.77	468	284.08	50,394	**53,454	50,067
124	1.08	810	17.4	8,604	**9,121	7,915
125	1.60	2,028	1.6	2,028	**2,603	1,014
126	0.92	597	0.92	597	615	615
127	1.70	955	4.22	3,026	**3,651	1,937
(MC29) * 128	1.19	939	306.89	51,674	**54,720	51,296
129	0.95	806	2.12	1,304	1,304	1,304
(MC30) * 130	1.28	1,137	308.17	51,508	**54,550	51,180
131	0.78	789	2.14	1,572	**1,718	1,475
132	1.00	1,032	1	1,032	1,022	1,022
(MC31) * 133	1.31	1,211	312.62	51,091	**54,157	50,899
134	1.35	967	2.33	1,157	**2,260	817
135	1.44	1,331	3.77	2,168	**3,331	1,495
136	1.02	1,278	1.02	1,278	**1,742	639
137	0.95	1,093	1.97	1,886	**2,477	1,199
138	1.52	1,097	1.52	1,097	**1,153	823
139	1.34	1,072	2.86	1,870	**2,139	1,618
140	1.07	655	1.07	655	**801	491
141	1.33	1,305	5.26	2,838	**3,330	2,948
(MC32) * 142	1.01	753	317.4	50,919	**54,028	50,826
143	1.02	1,532	1.02	1,532	**1,659	766
144	0.94	1,063	1.96	2,149	**2,316	1,699
(MC33) * 145	1.24	1,183	327.83	51,094	**54,237	51,073
(MC34) * 146	1.54	1,381	329.37	51,136	**54,287	51,125
(MC35) * 147	1.14	471	330.51	50,863	**54,040	50,925
(MC36) * 148	1.46	574	331.97	49,835	**53,042	50,112
149	0.70	1,502	0.7	1,502	1,502	1,502
150	0.87	1,665	1.57	3,167	3,198	3,198
151	0.74	754	0.74	754	**898	769
(MC37) * 152	0.82	464	335.1	49,564	**52,797	49,924

Subarea	Individual Area (s.m.)	Individual Flow (cfs)	Cumulative Area (s.m.)	Cumulative Existing Flow (cfs)	Cumul. Future Flow (100% rel. rate)	Cumul. Future Flow (variable rel. rate)
153	1.13	730	1.13	730	**812	731
Mill Creek drains into Subarea 154, Area = 57.40 square miles						
(MC38) * 154	1.21	675	394.84	51,887	**55,165	52,201
(MC39) * 155	1.07	664	395.91	51,656	**54,916	51,982
156	0.74	344	0.74	344	**523	344
(MC40) * 157	1.29	548	397.94	51,445	**54,699	51,791
(MC41) * 158	1.04	556	398.98	51,379	**54,641	51,737
(MC42) * 159	1.62	855	400.6	51,069	**54,343	51,476
(MC43) * 160	1.22	560	401.82	50,402	**53,688	50,903
161	1.67	680	1.67	680	703	703
162	0.82	424	0.82	424	424	424
163	1.41	618	1.41	618	641	641
164	1.10	469	3.59	1,001	1,015	1,015
165	1.10	914	5.72	3,250	3,295	6,295
166	1.00	525	1	525	**718	529
167	1.36	1,229	1.36	1,229	**1,316	922
Little Conestoga Creek drains into Subarea 168, Area = 66.17 square miles						
(MC44) * 168	1.48	535	475.47	52,282	**55,360	52,403
169	0.70	1,219	0.7	1,219	1,241	1,241
170	1.40	501	2.1	1,407	1,471	1,471
171	0.66	945	0.66	945	**1,055	938
172	0.98	1,382	0.98	1,382	**1,697	1,401
(MC45) * 173	1.14	1,282	480.35	52,237	**55,316	52,364
183	0.94	800	0.94	800	800	800
184	0.98	584	0.98	584	**1,330	292
185	1.01	786	4.63	5,244	5,462	3,710
186	1.08	766	1.08	766	775	775
187	0.99	1,001	11.91	9,443	9,876	7,217
188	0.97	1,036	0.97	1,036	1,036	1,036

Note: These flows were developed for storm water planning purposes and are not considered regulatory under PaDEP, Chapter 105 for permitting of structures.

* MC denotes those Subareas on the Main Channel of the Conestoga River. The accompanying number signifies the position on the Main Channel that the Subarea occupies, with 1 being at the top of the watershed, and 45 being at the bottom.

** Future flow more than 5% in excess of present flow.

J. Present and Projected Development in the Flood Hazard Areas

1. Present Conditions

The U.S. Department of Housing and Urban Development, Federal Insurance Administration has prepared a flood insurance study for several municipalities in the Conestoga River Watershed. The areas studied by detailed methods were known flood hazard areas and areas of projected development. Those areas studied by approximate methods were those areas having low development potential or minimal flood hazards.

Table III-4 summarizes the status of available flood data for the various townships for streams in this watershed. Only flood studies within the Conestoga River watershed were considered.

TABLE III-5			
AVAILABLE FLOOD INSURANCE STUDIES			
Municipality	Stream	Agency	Type of Study
Adamstown Borough, Lancaster Co.	Little Muddy Creek	FEMA	Detailed
Akron Borough, Lancaster Co.	—	—	—
Brecknock Township, Berks Co.	Little Muddy Creek	FEMA	Approximate
	Muddy Creek	FEMA	Approximate
Brecknock Township, Lancaster Co.	Little Muddy Creek	FEMA	Approximate
	Muddy Creek	FEMA	Detailed/Approximate
	Black Creek	FEMA	Approximate
Caernarvon Township, Berks Co.	Conestoga River	FEMA	Approximate
Caernarvon Township, Lancaster Co.	Conestoga River	FEMA	Detailed/Approximate
	Black Creek	FEMA	Approximate
Conestoga Township, Lancaster Co.	Conestoga River	FEMA	Detailed
	Witmer Run	FEMA	Detailed/Approximate
	Stehman Run	FEMA	Detailed/Approximate
Earl Township, Lancaster Co.	Conestoga River	FEMA	Detailed/Approximate
	Muddy Creek	FEMA	Approximate
	Groff Creek	FEMA	Approximate

Municipality	Stream	Agency	Type of Study
E. Cocalico Township, Lancaster Co.	Muddy Creek	FEMA	Approximate
	Little Muddy Creek	FEMA	Approximate
E. Earl Township, Lancaster Co.	Conestoga River	FEMA	Detailed
	Muddy Creek	FEMA	Approximate
	Black Creek	FEMA	Approximate
	Shirks Run	FEMA	Detailed
	Cedar Creek	FEMA	Detailed
E. Lampeter Township, Lancaster Co.	Conestoga River	FEMA	Detailed
	Stauffer Run	FEMA	Detailed
Elizabeth Township, Lancaster Co.	—	—	—
Elverson Borough, Chester Co.	—	—	—
Ephrata Township, Lancaster Co.	Conestoga River	FEMA	Approximate
	Muddy Creek	FEMA	Approximate
Honeybrook Township, Chester Co.	—	—	—
Lancaster City, Lancaster Co.	Conestoga River	FEMA	Detailed
Lancaster Township, Lancaster Co.	Conestoga River	FEMA	Detailed/Approximate
Lititz Borough, Lancaster Co.	Lititz Run/Lititz Springs	FEMA	Detailed/Approximate
	Santo Domingo Creek	FEMA	Detailed
	Hubers Run	FEMA	Detailed/Approximate
	Moores Run	FEMA	Detailed
Manheim Township, Lancaster Co.	Conestoga River	FEMA	Detailed
	Lititz Run	FEMA	Detailed
	Landis Run	FEMA	Detailed
Manor Township, Lancaster Co.	Conestoga River	FEMA	Detailed
	Witmer Run	FEMA	Detailed/Approximate
Millersville Borough, Lancaster Co.	Conestoga River	FEMA	Detailed
New Holland Borough, Lancaster Co.	—	—	—
New Morgan Borough, Berks Co.	—	—	—
Penn Township, Lancaster Co.	Santo Domingo Creek	FEMA	Approximate
Pequea Township, Lancaster Co.	Conestoga River	FEMA	Detailed/Approximate
	Stehman Run	—	—

Municipality	Stream	Agency	Type of Study
Robeson Township, Berks Co.	—	—	—
Spring Township, Berks Co.	Little Muddy Creek	FEMA	Approximate
Terre Hill Borough, Lancaster Co.	—	—	—
Upper Leacock Township, Lancaster Co.	Conestoga River	FEMA	Detailed
Warwick Township, Lancaster Co.	Lititz Run	FEMA	Detailed
	Santo Domingo Creek	FEMA	Detailed/Approximate
	Hubers Run	FEMA	Approximate
	Moores Run	FEMA	Detailed/Approximate
W. Earl Township, Lancaster Co.	Conestoga River	FEMA	Detailed/Approximate
	Groff Creek	FEMA	Detailed/Approximate
W. Lampeter Township, Lancaster Co.	Conestoga River	FEMA	Detailed/Approximate
W. Nantmeal Township, Chester Co.	—	—	—

FEMA - Federal Emergency Management Agency

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. Approximate analyses were used to study those areas having low development potential or minimal flood hazards.

At present, the 100-year floodplain within the Conestoga River Watershed is primarily cultivated fields and meadow lands. However, several residential and commercial areas along the Conestoga River and its tributaries lie within the floodplain.

Table III-5 outlines the type of development and land use which infringe upon the floodplain by township, general location and creek or tributary.

**TABLE III-6
PRESENT RESIDENTIAL AND COMMERCIAL AREAS
WITHIN FEMA 100-YEAR FLOODPLAIN AREAS**

Municipality	Stream	Buildings within FEMA Flood Boundary
Adamstown Borough, Lancaster Co.	Little Muddy Creek	17
Akron Borough, Lancaster Co.	—	0
Brecknock Township, Berks Co.	Little Muddy Creek	Not Available
	Muddy Creek	
Brecknock Township, Lancaster Co.	Little Muddy Creek	98
	Muddy Creek	
	Black Creek	
Caernarvon Township, Berks Co.	Conestoga River	Not Available
Caernarvon Township, Lancaster Co.	Conestoga River	30
	Black Creek	
Conestoga Township, Lancaster Co.	Conestoga River	25
	Witmer Run	
	Stehman Run	
Earl Township, Lancaster Co.	Conestoga River	
	Muddy Creek	
	Groff Creek	
E. Cocalico Township, Lancaster Co.	Muddy Creek	32
	Little Muddy Creek	
E. Earl Township, Lancaster Co.	Conestoga River	137
	Muddy Creek	
	Black Creek	
	Shirks Run	
	Cedar Creek	
E. Lampeter Township, Lancaster Co.	Conestoga River	75
	Stauffer Run	
Elizabeth Township, Lancaster Co.	—	1
Elverson Borough, Chester Co.	—	1

Municipality	Stream	Buildings within FEMA Flood Boundary
Ephrata Township, Lancaster Co.	Conestoga River	18
	Muddy Creek	
Honeybrook Township, Chester Co.	—	0
Lancaster City, Lancaster Co.	Conestoga River	76
Lancaster Township, Lancaster Co.	Conestoga River	61
Lititz Borough, Lancaster Co.	Lititz Run/Lititz Springs	183
	Santo Domingo Creek	
	Hubers Run	
	Moore's Run	
Manheim Township, Lancaster Co.	Conestoga River	93
	Lititz Run	
	Landis Run	
Manor Township, Lancaster Co.	Conestoga River	10
	Witmer Run	
Millersville Borough, Lancaster Co.	Conestoga River	4
New Holland Borough, Lancaster Co.	—	0
New Morgan Borough, Berks Co.	—	None/Not Available
Penn Township, Lancaster Co.	Santo Domingo Creek	0
Pequea Township, Lancaster Co.	Conestoga River	18
	Stehman Run	
Robeson Township, Berks Co.	—	0
Spring Township, Berks Co.	Little Muddy Creek	None/Not Available
Terre Hill Borough, Lancaster Co.	—	0
Upper Leacock Township, Lancaster Co.	Conestoga River	34
Warwick Township, Lancaster Co.	Lititz Run	87
	Santo Domingo Creek	
	Hubers Run	
	Moore's Run	
W. Earl Township, Lancaster Co.	Conestoga River	85
	Groff Creek	

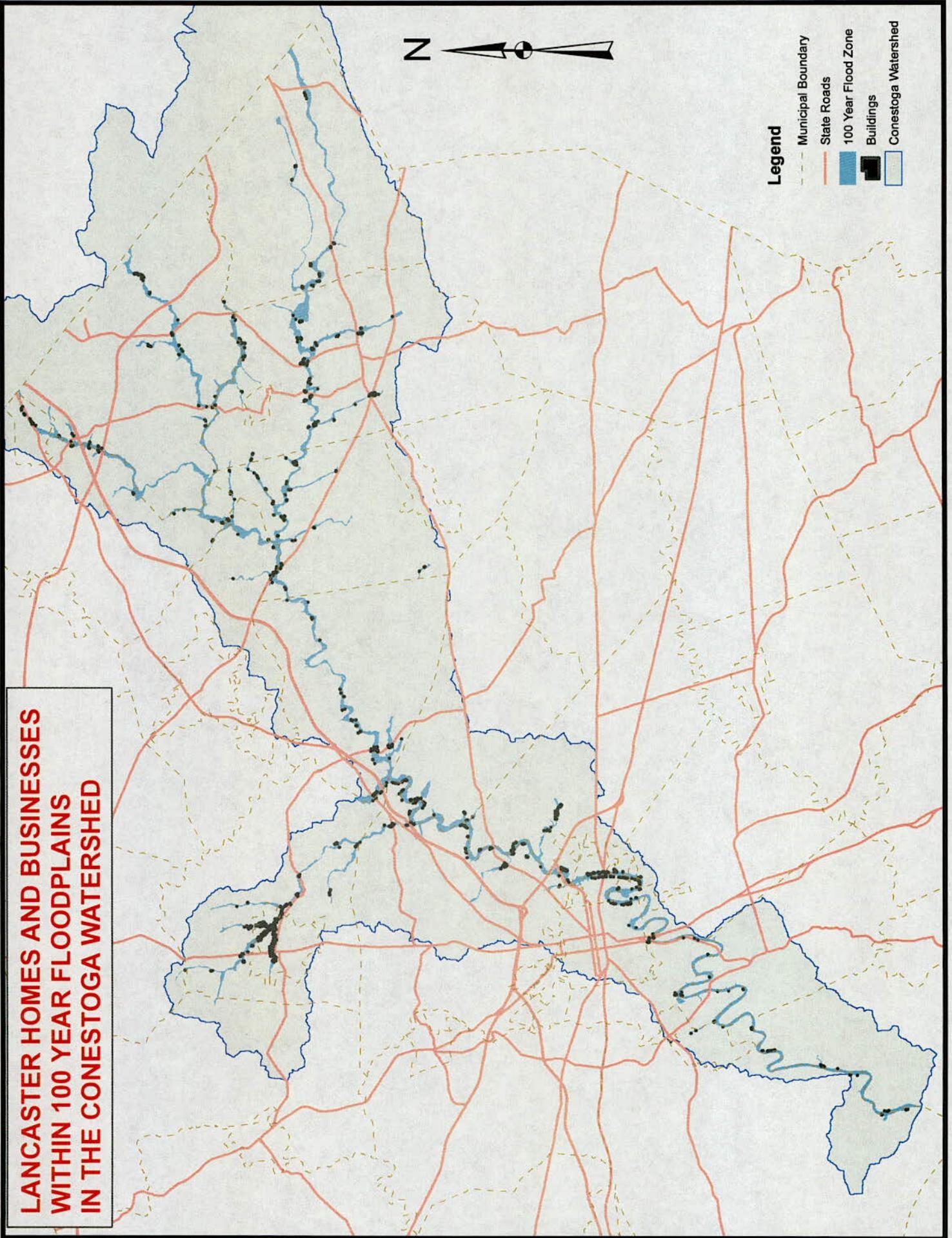
Municipality	Stream	Buildings Infringing on FEMA Flood Boundary
W. Lampeter Township, Lancaster Co.	Conestoga River	19
W. Nantmeal Township, Chester Co.	—	0

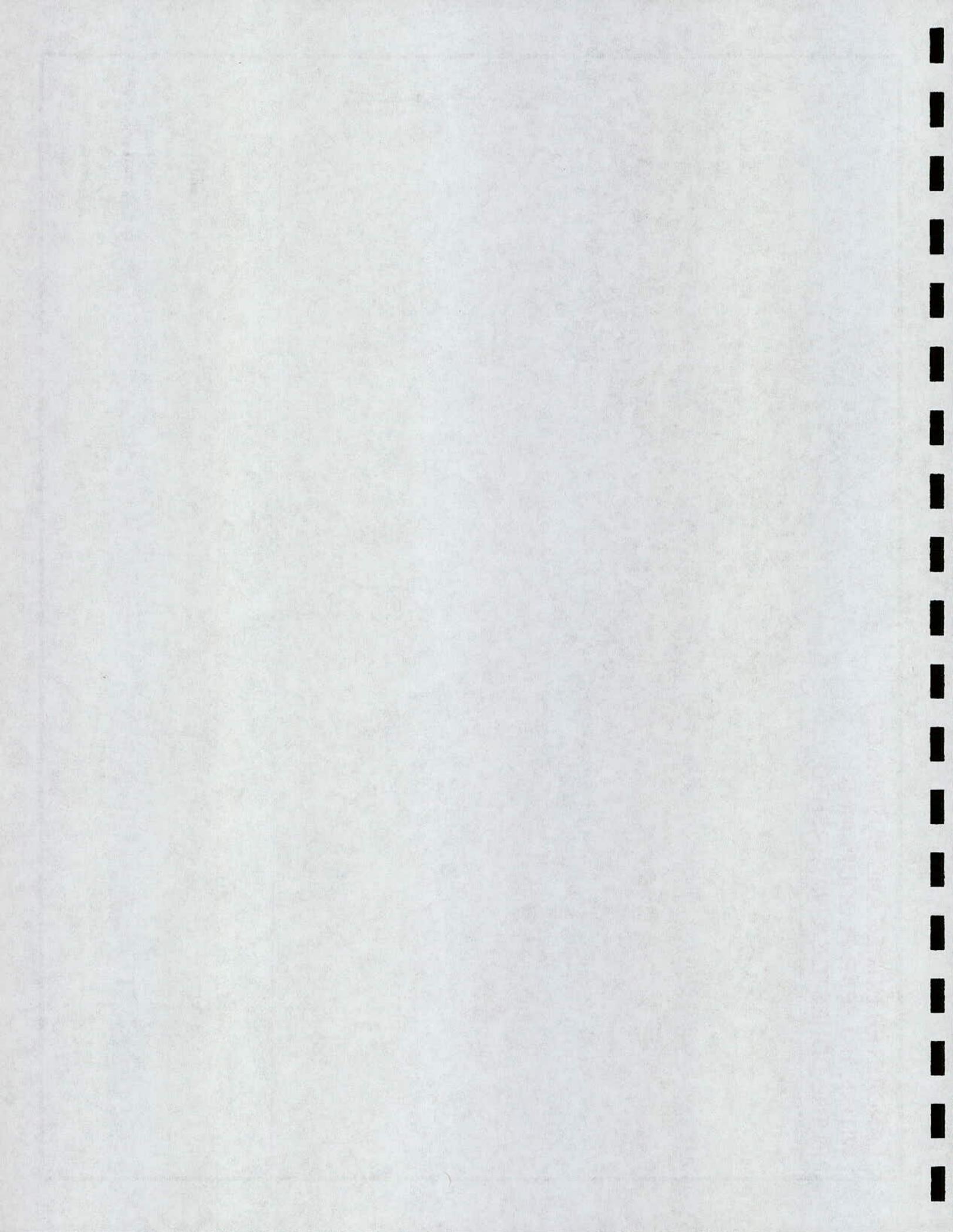
**LANCASTER HOMES AND BUSINESSES
WITHIN 100 YEAR FLOODPLAINS
IN THE CONESTOGA WATERSHED**



Legend

- Municipal Boundary
- State Roads
- 100 Year Flood Zone
- Buildings
- Conestoga Watershed





2. Future Conditions

As can be seen from the projected Future Land Use Map, Plate II, the potential for development in the floodplains is great. However, the 100-year flood elevations were determined on the land use characteristics at the time of the studies (approximately 1979) and do not account for increased runoff due to developmental pressures. Therefore, the potential for future flooding would increase as development continues if this Watershed Act 167 Plan were not adopted. The trend would be that flood elevations would not rise significantly on broad, level floodplains but the floodplains would expand considerably in width, whereas in streams with steep embankments, the flood elevation would most likely increase significantly with little increase in the floodplain width. Increased flows from developing watershed conditions would also widen the current floodway widths in many instances, thus resulting in the potential for existing development to infringe on the floodway. With the implementation of the Plan, the 100-year flood elevation at a particular site should be no higher/wider in the future than it is now, assuming development is not allowed to encroach into the delineated floodplain.

3. Comparison Between FEMA FIS flows and Calibrated TR20 Model

At the bottom of the Conestoga River watershed (Subarea 173), the 100 year peak flow from the calibrated TR20 model is 52,237 cfs. The flows used in the Flood Insurance Studies performed by/for FEMA is 45,400. Given the fact that the FEMA flows were determined in 1979, the 15% difference between the current TR20 model and the FEMA flows is about what would be expected considering the 25 years of development since then. Specific information can be found in Section IV.B, "Calibration Process".

K. **Survey Existing Drainage Problems and Proposed Solutions**

The flooding which occurs in this watershed affects mostly older development areas. Future development must be assessed with respect to storm water management so it will not adversely affect these existing flooding problems. Please see Appendix "B" of Volume I - Executive Summary for the locations and types of problems in each municipality. Table III-5 indicates the types of encroachments in the floodplain which are subject to flooding at this time. The following suggestions are possible solutions to those flooding problems.

Erosion and Sedimentation (E&S) - The Lancaster County Conservation District (LCCD) is responsible for administering Title 25, Chapter 102 (Erosion Regulations Control). 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 these problems.

Culverts and Outlets - The minor problems identified above in Table III-5 are the result of inadequately sized culverts which traverse State roads, Township roads, or private access roads. The typical solution involves performing a hydrologic study to determine pipe size and replacing the pipe with a properly sized unit. Costs are borne by the owner of the road.

Bridges - Many bridges reach capacity on an annual basis. The proposed solutions involve performing hydrologic studies and increasing the hydraulic capacity underneath the roadway.

Channels of Conveyance - Problem areas on channels of conveyance were identified in the watershed. These sites consist of road ditches and drainage ditches that extend to and from these roads. These problems are often associated with undersized culverts. Typically, these channels of conveyance are undersized and have excessive flow velocities which cause scouring of the channel. The resulting down stream sedimentation further reduces capacity and causes increased road maintenance costs. Inadequate channel capacities result in flooding of adjacent properties. Solutions consist of increasing channel capacity, stabilizing drainage ways with appropriate material and, in some cases, providing positive drainage to extend the channels to existing drainage systems.

Streams - The minor problems listed above include eroding stream banks. Proposed solutions consist of stabilizing the banks using rock rip-rap, cribbing, geotextiles or vegetative bank plantings.

Flooding - The minor problems listed above are flooding in nature. Most of these are caused by inadequate conveyance systems in developed areas or undersized culverts and bridges.

Water Quality - There is a known water quality issue at the High Concrete yard in East Cocalico Township. Also, there are numerous locations throughout the watershed where soil washoff is a problem.

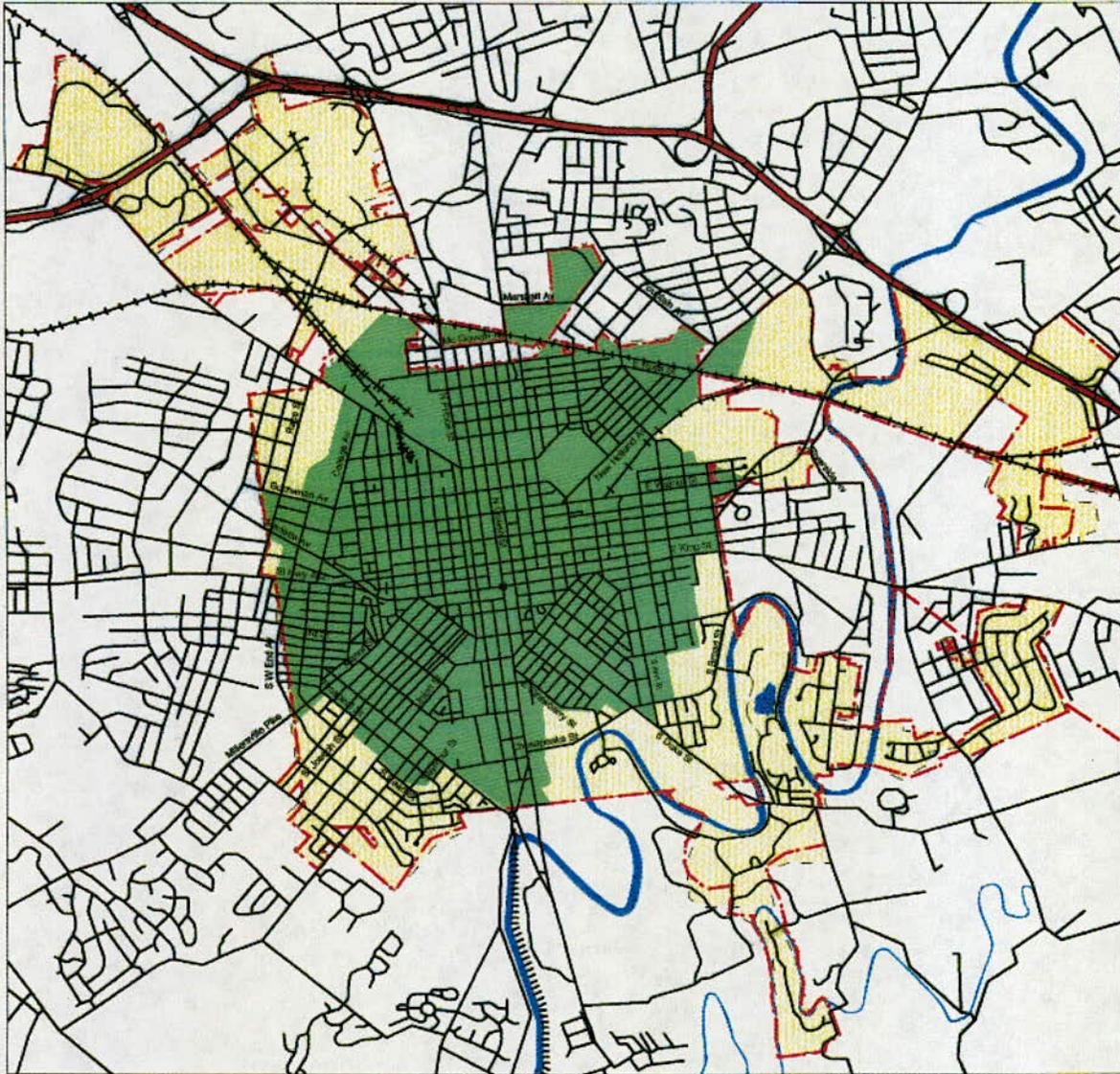
L. Existing and Proposed Storm Water Collection Systems

There are many storm sewers located in this drainage basin. Generally, small diameter trunk lines feed into the natural channels avoiding any large collector main. The design storm that the system is capable of handling is indeterminate since many of the pipes were installed prior to standards being adopted. The projected life span is good with general maintenance required for removal of debris at inlets and pipe and manhole cleaning. Expansion capabilities are limited due to existing capacities, the general built-out nature of the basin in these areas, and the existing topography.

Lancaster City is the only municipality in the watershed with a combined storm sewer and sanitary sewer system. The following plate shows the areas of combined and separate sewer systems.

Plate V

City of Lancaster Sewer Districts

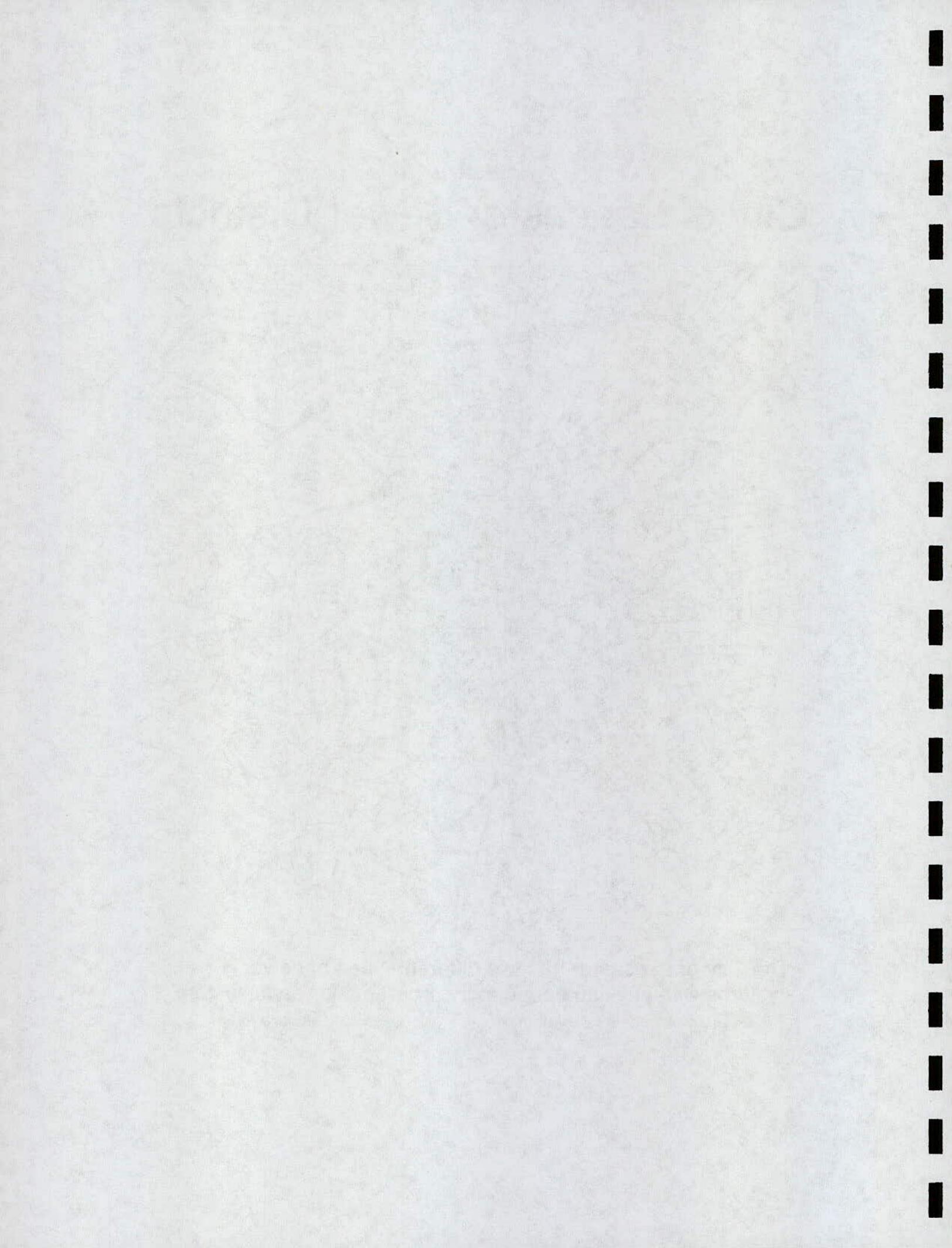


The City of Lancaster has two different types of sewer systems with individual regulatory programs for each system.

 Combined sewer system

 Separated sewer system

rev. 7/04



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

There are no Federal, State, or Local flood control projects in the watershed, and none are planned at this time.

N. Storm Water Collection and Control Facilities

Due to the nature of the watershed and the fact that the largest projects are constructed by the private sector, there are no municipal storm water collection and control facilities proposed for the next ten years. The cost, design capacity, construction and operation of these 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. Typically, the cost of such facilities are paid through the developer's financing with costs transferred to the buyer of the lots.

SECTION IV

WATERSHED TECHNICAL ANALYSIS - MODELING

A. Watershed Modeling

An initial step in the preparation of this Act 167 Plan was the identification of the storm water runoff simulation model to be utilized. A number of widely accepted computer models are available, each with its own strengths; however, for this study, it was necessary to select a model which:

- Could model design storms of various durations and frequencies to produce routable 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.
- Was capable of utilizing GIS coverages to provide model input.

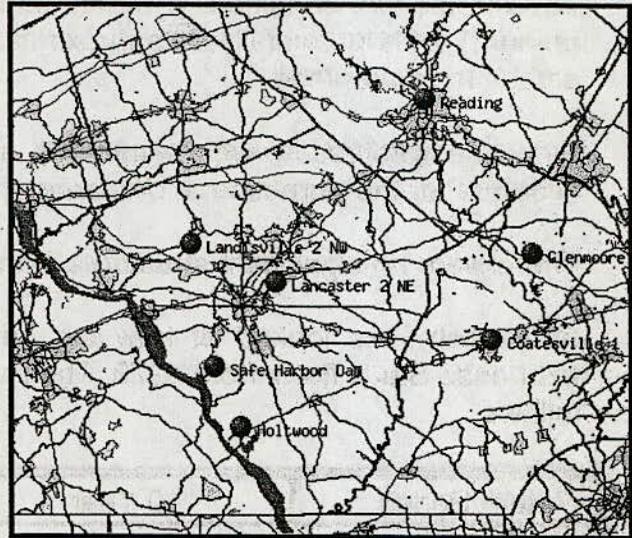
The model comparison yielded the decision to utilize TR20 for the following reasons:

- TR-20 was developed by the hydrology branch of the Soil Conservation Service (SCS), now known as NRCS, specifically for the analysis of the timing of surface flow contributions to peak rates at various locations in a watershed.
- The data requirements make it easily adaptable for GIS input.
- Input parameters provide a flexible calibration process.
- It has the ability to analyze reservoir or detention basin routing effects and location on the watershed.
- It is accepted by the Pennsylvania Department of Environmental Protection.
- Input and Output files are plain text files.

B. Calibration Process

In order to model a watershed with confidence and reliability, the chosen computer model must be checked against actual field data or actual storm events. Several sources were used to check the model, as follows;

- Tropical Storm Agnes, June 1972 - Using hourly rainfall from the National Climate Data Center (NCDC) for seven stations (shown below), including Lancaster, Holtwood, Safe Harbor, Reading, and Coatesville, it was apparent that Agnes crossed the watershed at about 8 mph moving from Southwest to Northeast. Running the watershed model with the actual rainfall obtained from NCDC for the Lancaster rain gauge produced a peak flow of 48,200 cfs. This was within 4% of the 50,300 cfs which was calculated to have passed at the USGS stream gauge at the Lancaster City water intake. Antecedent Moisture Condition 1 (AMC 1) was assumed in carbonate areas due to the dry conditions 6 months prior to Agnes, and the normal conditions 1 month prior to Agnes. 24 hour rainfall was 6.54 inches, total rainfall was 8.4 inches (both at Lancaster). The NCDC 24 hour rainfall on June 22, 1972 was relatively uniform in the rain gauges surrounding the watershed. The rainfall varied among the stations by less than 0.5", with 6.8" at Reading, 6.54" at Lancaster, and 7.07 at Landisville.



- Hurricane Floyd, September 17, 1999 - Using hourly rainfall from the National Climate Data Center (NCDC) for six stations, including Blue Marsh Lake, Glenmoore, Lancaster, Landisville, Lebanon, and Reading, revealed that Floyd crossed the watershed at about 8 mph moving from Southwest to Northeast. Running the watershed model with the actual rainfall obtained from Millersville University produced a peak flow of 23,200 cfs. This was within 32% of the 17,600 cfs which was measured at the USGS stream gauge at the Lancaster City water intake. AMC 1 was assumed in carbonate areas. 24 hour rainfall was 5.14 inches at Millersville. The rainfall was relatively non-uniform across the watershed according to the NCDC data (not used in the model). The NCDC 24 hour rainfall was 5.90" at Reading, 6.30" at Lancaster, and 4.60 at Lebanon. The 1.7 inch variance in rainfall in the rain gauges surrounding the watershed may be responsible for the discrepancy between the model results and actual flows.

The Agnes and Floyd storms occurred in 1972 and 1999 respectively. Since then, Lancaster Emergency Management Agency has placed rain and stream gauges throughout Lancaster County. There have been several rainfalls of 3 or so inches - this is at the lower limit at which TR20 (on which the watershed model is based) can be run.

- Rain event of September 23, 2003 - Continuous rainfall data from Lancaster Emergency Management Agency (LEMA) gauges in various locations throughout the County, showed no noticeable pattern of motion of the storm across the watershed, so none was used in the model. Running the watershed model with the actual rainfall obtained from the LEMA gauges produced a peak flow of 8,550 cfs. This was within 18% of the 10,400 cfs which was measured at the USGS stream gauge at the Lancaster City water intake. AMC 2 was assumed in all areas due to the normal soil moisture conditions 6 months prior to September

23, and the wet conditions 1 month prior to September 23 (rainfall was twice the normal amount). 24 hour rainfall was approximately 3 inches averaged among 4 LEMA rain gauges across the watershed.

Since the worst results were within 32% of actual flows, the model appears to be acceptably accurate for the purposes of preparing a watershed study under Act 167.

There were no significant structures to include in the watershed computer model.

Additionally, we looked at how the calibrated TR20 flows matched the FEMA Flood Insurance Study flows from 1979. The results, at the mouth of the Conestoga River, are as follows;

Return Period	10 Year	50 Year	100 Year
Calibrated TR20	21,400	38,700	52,200
FEMA FIS	19,400	36,100	45,400
% Difference	10%	7%	15%

This shows that the FEMA flows are somewhat lower than the calibrated TR20 flows. The flows at the mouth of the Conestoga River (in Conestoga Township) were based on the flow record at the USGS

C. Modeling Process

The Conestoga River Watershed was subdivided into 179 subwatersheds for modeling purposes. Considerations in subdividing the watershed were: location of obstructions, known flooding, drainage or erosion problems, zoning, and tributary confluences. The most downstream point of each of these areas was considered a "point of interest" in which increased runoff was analyzed for its potential impact.

The watershed was modeled to determine the hydrologic response for the 2, 5, 10, 25, 50 and 100-year storm events for the 24-hour storm..

The modeling process addressed:

- peak discharge values at 179 locations along the stream and its tributaries;
- time to peak for each of the 179 discharges;
- runoff contributions of individual subareas at all downstream locations;
- flow values contained in the channel and overflow values; and
- overall watershed timing.

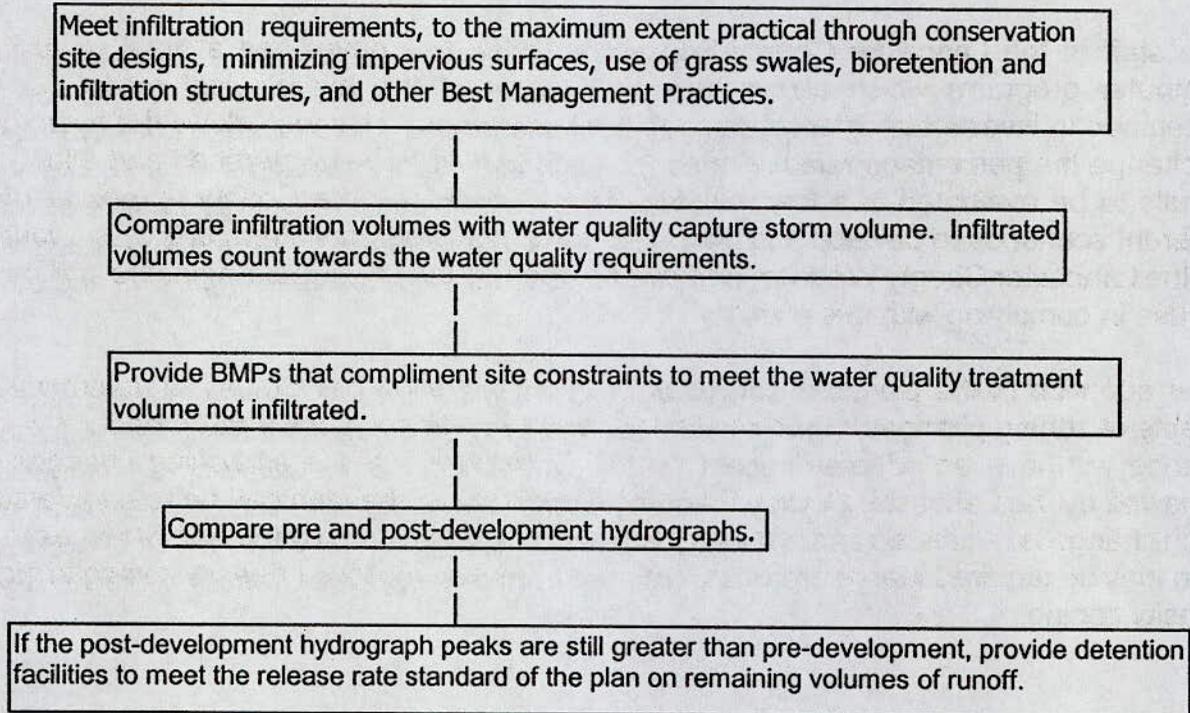
The modeling process assumed the future 100 year floodplains to be in the same condition as today. Lancaster County has a history of significant flooding. This is a result of the low slope meandering streams which exist in the County. It is imperative that the floodplains be kept free and clear in the future, as assumed in this model, to alleviate increased flooding of the existing developments. The plan strongly supports a policy of no encroachment into the 100 year floodplain.

The staff of the Lancaster County Engineer's Office has developed a "tool" (actually a computer program) which allows the modification of the hydrological model for this watershed to investigate different development scenarios. This tool allows the hydrologist to change the percentage release rates for each individual subwatershed and allows the results to be evaluated in a few minutes. This tool allowed the County to look at many different scenarios to develop this plan. The computer program (Stremtul 2.3) is available on the Lancaster County Website, and can be used by the Municipal Engineers and others for use in complying with this plan.

After adoption of the plan, this computer program will allow the County to determine the effects of zoning changes, when requested, and provide solutions if the proposed zoning change will have an adverse impact on the watershed. Since all zoning changes are reviewed by the Lancaster County Planning Commission, the plan can be re-evaluated as each change is requested and not every five years as suggested by the Act. Changes to the plan may be required if large areas are rezoned from existing lower density zoning to higher density zoning.

SECTION V STANDARDS AND CRITERIA FOR THE CONTROL OF STORM WATER

The following flow-chart describes the methods by which the Act 167 plan requirements can be met. The methods can be combined to achieve the desired results.



A. Performance Standards

1. "Match Pre-existing Hydrograph"

Developers and/or landowners are encouraged to provide infiltration facilities or utilize other techniques which will allow the post-development hydrograph to match the pre-existing hydrograph, along all parts of the hydrograph, for the site. This option is most feasible for small subdivisions in areas of non-carbonate geology. "Groundwater Recharge" and "Water Quality" volumes as given in Sections 302.C and D of the model ordinance will be a part of this option.

2. Groundwater Recharge Standard

Recharging rainfall into the ground replenishes the groundwater that, in turn, provides baseflow to streams, a process that keeps streams flowing during the dryer summer months and maintains groundwater for drinking purposes. Storm water management measures such as porous pavement with underground infiltration beds and infiltration/recharge structures or Best Management Practices (BMPs) can be designed to promote groundwater recharge. Infiltration BMPs shall meet the following minimum requirements:

- Infiltration BMPs intended to receive runoff from developed areas shall be selected based on suitability of soils and site conditions and shall be constructed on soils that have the following characteristics:
 - A minimum depth of 48 inches between the bottom of the facility and the seasonal high water table and/or bedrock (limiting zones)
 - An infiltration and/or percolation rate sufficient to accept the additional storm water load and drain completely as determined by field tests conducted by the Owner's professional designer.
- 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.
- The size of the recharge facility shall be based upon the following equation:

$$Re_v = [(S) (R_v)(A)] / 12$$

Re_v = Recharge volume in acre-feet

A = Area of watershed in acres

$R_v = 0.05 + 0.9(I)$ where $I = \text{net increase in impervious area} / \text{Area of watershed (A)}$

S is the Soil Specific Recharge factor and varies according to soil type, as follows:

Hydrologic Soil Group	Soil Specific Recharge Factor (S)
A	0.32
B	0.22
C	0.10
D	0.05

- If more than one hydrologic soil group (HSG) is present at a site, a composite recharge volume shall be computed based upon the proportion of total site area within each HSG.
- The recharge volume provided at the site shall be directed to the most permeable HSG available.
- The recharge facility shall be capable of completely infiltrating the impounded water within 48 hours.
- Watersheds where the post developed impervious area is equal to or less than the pre developed impervious area shall not be required to provide Ground Water Recharge volume.

- The general process for designing the infiltration BMP shall be:
 1. Analyze the hydrologic soil groups as well as natural and man-made features within the development site and the upstream watershed to determine general areas of suitability for infiltration practices.
 2. Provide a field test to determine appropriate percolation rate and/or hydraulic conductivity.
 3. Design the infiltration structure for the required storm volume based on field determined capacity at the level of the proposed infiltration surface.

Extreme caution shall be exercised where infiltration is proposed in geologically susceptible areas such as limestone 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. A detailed hydrogeologic investigation may be required by a state licensed/certified Professional Geologist.

It is extremely important that strict erosion and sedimentation control measures be applied surrounding infiltration structures during installation to prevent the infiltrative surfaces from becoming clogged. 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. Recharge/infiltration facilities may be used in conjunction with other innovative or traditional BMPs, storm water control facilities, and nonstructural storm water management alternatives.

Structural Storm water management facilities which provide treatment and recharge of the required Recharge Volume will be designed as part of a storm water management facility which incorporates groundwater recharge BMPs as a primary benefit of using that facility, in accordance with design specifications contained in "Pennsylvania Handbook of Best management Practices for Developing Areas", 1998, or the latest version thereof, or the Pennsylvania Stormwater Best Management Practices Manual.

3. Water Quality Standard

Pollutants accumulate on impervious surfaces between rainfall events or during dry weather. Pollutant concentrations in runoff from developed land tends to be greatest at the beginning of the storm event, or the "first flush" of runoff. It has been found that eighty to ninety percent of rainfall events are 1.2" or less, storms that essentially simulate this "first flush". The majority of the nonpoint source pollutants, therefore, are being washed into streams during the smaller storms. Capturing this first flush and/or smaller storms will allow the storm water to be detained and will allow pollutants to settle, thus allowing a "cleaner" outflow.

To achieve this goal, the following criteria is established:

Determine the volume of runoff from the first 1.2" of rainfall and detain this amount from each storm, releasing the runoff slowly over a minimum of 24 hours. The design of the facility shall consider and minimize the chances of clogging and sedimentation potential.

Calculation of Water Quality Volume: The Water Quality Volume (WQ_v) is the storage capacity needed to treat storm water runoff equivalent to a minimum of the first 1.2" of runoff from the developed areas of the site. The following calculation is used to determine the storage volume, WQ_v , in acre-feet of storage:

$$WQ_v = [(1.2) (R_v)(A)] / 12$$

WQ_v = Water Quality volume in acre-feet

A = Area of watershed in acres

$R_v = 0.05 + 0.9(I)$ where I = net increase in impervious area / Area of watershed (A)

WQ_v shall be designed as part of a storm water management facility which incorporates water quality BMPs as a primary benefit of using that facility, in accordance with design specifications contained in "Pennsylvania Handbook of Best Management Practices for Developing Areas", 1998. The facility must take a minimum of 24 hours after the end of the design storm to drain. Watersheds where the post developed impervious area is equal to or less than the pre developed impervious area shall not be required to provide Ground Water Recharge volume.

4. Description of Performance Standard Districts (for development sites where the existing hydrograph can not be matched - see item 1 above)

In performing the tasks for the Conestoga River Watershed Plan under Act 167, the goal was to provide a runoff control strategy which could be implemented so as not to increase peak storm water flows anywhere in the Conestoga River basin. It was also important to determine to what extent storm water detention would be required in individual subareas. Specific goals were to try to have no increase in peak storm water flows at any point of interest and to maintain as few different release rate areas as possible. It was found during the watershed study that a varying release rate depending on the location of a given subarea within the watershed provided results which were not significantly different (5 percent) than the existing (present) flows. The variable release rate scenarios evaluated for this basin indicated that most of the development potential of the basin exists around the edges of the watershed. The rural area lends itself to infiltration control measures which would allow proposed development to meet the pre-existing hydrograph by infiltration and not be required to provide reduced discharge rates. "Groundwater Recharge" and "Water Quality" volumes as described in Sections 302.C and 302.D of the model ordinance will be a part of this option.

5. Sub-Regional (Combined Site) Storage

Traditionally, the approach to storm water 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 which both preserve and protect the natural drainage system. In other words, two developers developing sites adjacent to each other could pool their resources to provide for a community storm water storage facility in the most hydrologic advantageous location.

The goal should be to create and utilize the most cost-effective and environmentally-sensitive storm water runoff controls possible. This will significantly improve the capability and flexibility of land developers and communities to control runoff consistent with the Conestoga River Act 167 Plan.

Combined efforts at storm water management would provide a cost savings to the developers, and would increase the opportunity to utilize storm water control facilities to meet other community needs. For example, certain storm water control facilities could be designed so that recreational facilities such as ball fields, open space, volleyball, etc. could be incorporated. Natural or artificial ponds and lakes could serve both recreational and storm water management objectives.

To take this concept a step further, there is also the possibility that the storm water could be managed "off-site;" that is, in a location off of the property(s) in question. There 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 Plan. "Groundwater Recharge" and "Water Quality" volumes as described in Sections 302.C and 302.D of the model ordinance will be a part of this option.

6. "No Harm Option"

The "No Harm" option does not apply to the water quality requirement described in item number 2 above. The "No Harm" option does not apply to the groundwater recharge requirement described in item number 3 above, unless it can be shown that the site is underlain by carbonate geology and infiltration can not be safely accomplished.

For any proposed development, the developer has the option of using a less restrictive runoff control if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. Proof of "no harm" would have to be shown from the development site through the remainder of the downstream drainage network until there is no additional flow increase. Proof of "no harm" must be shown using the capacity criteria specified in Section 303.C of the Model Ordinance if downstream capacity analysis is a part of the "no harm" justification.

Attempts to prove "no harm" based upon downstream peak flow versus capacity analysis shall be governed by the following provisions:

- a. The peak flow values to be used for downstream areas for the design return period storms (2-, 5-, 10-, 25-, 50-, and 100-year) shall be the values from the calibrated TR-20 Model for the Conestoga River Watershed. These flow values would be supplied to the developer by the County upon request.
- b. At peak flow, any available capacity in the downstream conveyance system (as documented by a developer) may be used only in proportion to the proposed development site acreage relative to the total upstream undeveloped acreage (i.e. if the site is 10% of the upstream undeveloped acreage, the developer may use up to 10% of the documented downstream available capacity at peak flow).
- c. Developer-proposed runoff controls which would generate increased peak flow rates at documented 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.C. of the Model Ordinance.

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

**TABLE V-1
REQUIRED CRITERIA & STANDARDS**

STANDARD	BENEFIT
<p><u>Storm Water Management</u> Meet the required runoff rate, Groundwater Recharge, and Water Quality</p>	<p>No increase in runoff on a watershed wide basis, storm water detention and attenuation /infiltration</p>
<p><u>Design Storm</u> Consideration to be given to the 2, 5, 10, 25, 50, and 100 year design storms.</p>	<p>No increase in runoff in entire range of design storms, continued surface and groundwater quality.</p>
<p><u>Floodplains</u> All floodplains shall not be filled so as to reduce the stream channel conveyance and storage capacity.</p>	<p>Natural storm water detention/flood control downstream. Protection of existing conveyance capacity.</p>
<p><u>Discharge of Accelerated Runoff</u> Accelerated storm water runoff shall not be discharged into drainage patterns and storm sewers as it may adversely affect properties or cause channel scouring and erosion.</p>	<p>Safe conveyance, continued surface and groundwater quality, flow attenuation.</p>
<p><u>Inappropriate Outlets</u> If outlet from storm water 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 must have adjacent property owner's written permission. All facilities must be designed in conformance with Section 303 of the Model Ordinance.</p>	<p>Safe conveyance, continued surface and ground water quality, storm water detention, flow attenuation.</p>
<p><u>Ground Water Recharge / Infiltration</u> Recharge structures are required where soils and physical conditions permit. Additionally, all proposed developments should investigate the implementation of infiltration or retention structures for the Storm Water Control measures as opposed to surface detention. This also pertains to the portions of the watershed that have storm sewers.</p>	<p>Groundwater/stream base flow recharge, flow attenuation.</p>
<p><u>Water Quality Treatment Volume</u> Capture the runoff from the first 1.2" of rainfall and release slowly over a minimum of 24 hours.</p>	<p>Capture of the "first flush" of runoff which carries the most pollutants.</p>

TABLE V-1
RECOMMENDED CRITERIA & STANDARDS

STANDARD	BENEFIT
<u>Existing Storm Sewers or Culverts</u> Discharge into existing sewer networks or culverts will be based on system capacity or design storm(s), whichever is more restrictive.	Preserve sewer/culvert capacity thereby reducing O & M and replacement costs.
<u>Roof Drains, Residential/Commercial</u> Prevent all roof drains from discharging into storm sewers, roadside ditches or channels. Discharge to lawns, recharge basin or storage facilities.	Promotes infiltration, flow attenuation and increases runoff time of concentration, flow attenuation.
<u>Pervious Surfaces</u> The use of pervious materials will be encouraged for parking surfaces and sidewalks.	Infiltration, groundwater recharge.
<u>Structures</u> Concentrate on locating facilities within areas conducive to recharge and design, accommodate recharge to meet release rate requirements.	Infiltration, groundwater recharge, stream base flow.
<u>Wetlands</u> Network regulatory agencies involvement within wetland areas.	Infiltration, structure integrity, surface water quality, safe conveyance, stream, culvert, and channel capacity.
<u>Riparian Buffers</u> along streams.	Provide a reduction of thermal impacts on storm water runoff associated with impervious areas, with a secondary benefit being the protection of capacity of existing storm water conveyance channels.
<u>Steep Slopes</u> Regulate activities in critical slope areas where management of storm water by structure is inappropriate.	Stream base flow, flow attenuation conveyance integrity, surface water quality.

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

An engineering evaluation of the applicability of various calculation methodologies was conducted as part of the Plan preparation and was supported by previous research. Typical subwatersheds varying in size were selected to evaluate desktop methods for determining onsite runoff. The results were compared with the calibrated TR-20 results. Figure V-1 shows a comparison of three calculation methodologies for one-acre lots. The conclusions drawn from the analysis are that, utilizing the Soil Conservation Service curve numbers and rational 'C' values specified in Ordinance Appendix B, either the curve number method or rational method can be used to determine pre- and post-development runoff peak rates.

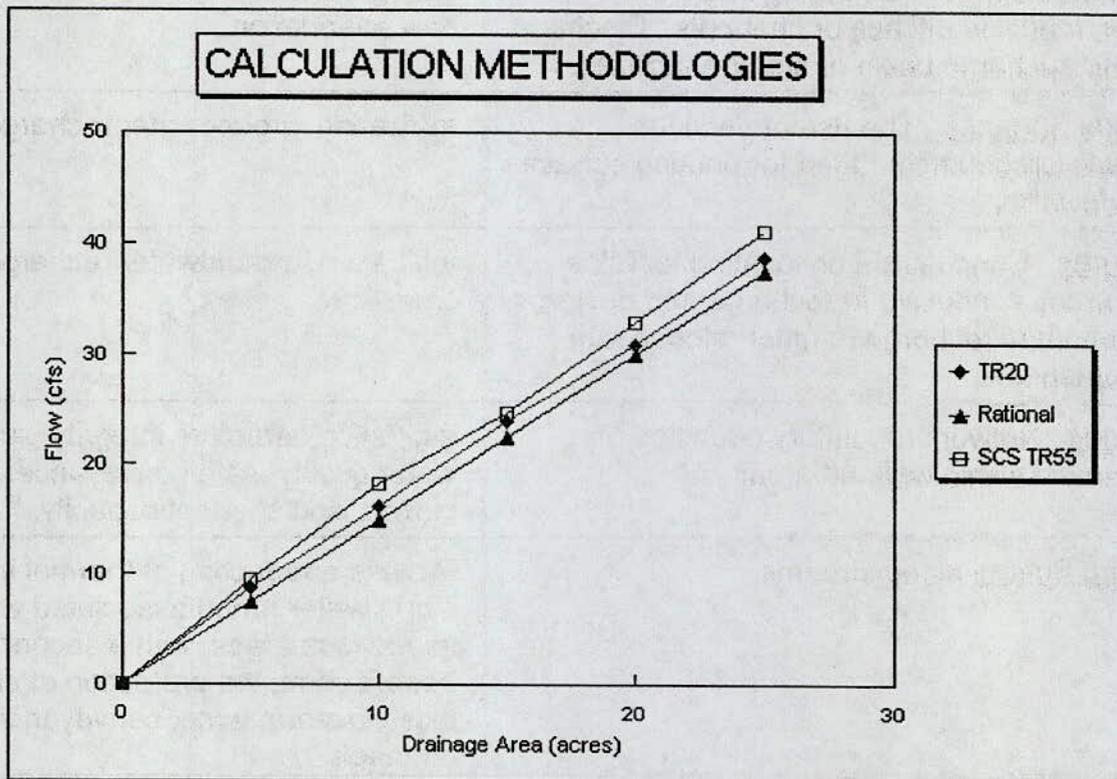


FIGURE V-1

The rational method only determines peak rates, however. The design of any detention facility would have to include a routing of the calculated runoff through the basin. Routing refers to the calculation process of taking the post-development runoff and determining if the detention facility's stage/storage/discharge characteristics are adequate. The hydrograph can be generated through the use of the PSUHM program and the PennDOT IDF curves, where the peak intensity occurs at 3 times the T_c and the storm length is 10 times the T_c (as recommended in the PSUHM User Manual, August 1993, page 70). This hydrograph is similar to the NRCS/SCS Type II 24-hour hydrograph.

B. Watershed Level Runoff Control Philosophy

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 basins on each individual site. This approach can also be used for the infiltration and water quality requirements.

SECTION VI

ALTERNATE RUNOFF CONTROL TECHNIQUES AND THEIR EFFICIENCY IN THE WATERSHED

A. Storm Water Controls

Effective storm water management to meet the plan requirements may require implementation of a number of storm water best management practices on any given development site. Table VI-1 indicates a general overview of best management measures that can be applied to meet the recharge, water quality, and peak rate requirements of the plan while Table VI-2 shows the advantages and disadvantages for several types of runoff control measures. It will be up to the developer or the developer's professional to select the technique that is the most appropriate to the type of project and physical characteristics of the site. Effective measures for reducing peak rates of runoff are not limited to those listed in Table VI-1.

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

- Soil characteristics (hydrologic soil group, [i.e. permeability], erodibility, etc.)
- Subsurface conditions (depth to seasonal high water table, bedrock, etc.)
- Topography (steepness or slope, earthcut)
- Existing drainage patterns (nearby streams, swales, and flooding potential)
- Economics
- Advantages and disadvantages of each technique.

Innovative approaches are encouraged to aid in meeting the applicable release rate percentage. The general suitability of individual runoff control measures in the Conestoga River Watershed are listed in Table VI-3.

TABLE VI-1
MEASURES FOR REDUCING AND DELAYING URBAN STORM RUNOFF
VARIOUS ON-SITE STORM WATER CONTROL METHODS

AREA	REDUCING RUNOFF	DELAYING RUNOFF
A. Large Flat Roof	<ol style="list-style-type: none"> 1. Cistern storage 2. Rooftop gardens 3. Pool storage or fountain storage 	<ol style="list-style-type: none"> 1. Ponding on roof by constricted downspouts 2. Increasing roof roughness <ol style="list-style-type: none"> a. Rippled roof b. Graveled roof
B. Parking Lots	<ol style="list-style-type: none"> 1. Porous pavement <ol style="list-style-type: none"> a. Gravel parking lots b. Porous or punctured asphalt 2. Concrete vaults and cisterns beneath parking lots in high value areas 3. Vegetated ponding areas around parking lots 4. Gravel trenches 	<ol style="list-style-type: none"> 1. Grassy strips on parking lots 2. Grassed waterways draining parking lot 3. Ponding and detention measures for impervious areas <ol style="list-style-type: none"> a. Rippled pavement b. Depressions c. Basins
C. Residential	<ol style="list-style-type: none"> 1. Cisterns for individual homes or groups of homes 2. Gravel driveways (porous) 3. Contoured landscape 4. Ground-water recharge <ol style="list-style-type: none"> a. Perforated pipe b. Gavel (sand) c. Trench d. Porous pipe e. Dry wells 5. Vegetated depressions 	<ol style="list-style-type: none"> 1. Reservoir of detention basin 2. Planting a high delaying grass (i.e. high roughness) 3. Gravel driveways 4. Grassy gutters or channels 5. Increased length of travel of runoff by means of gutters, diversions, etc.
D. General	<ol style="list-style-type: none"> 1. Gravel alleys 2. Porous sidewalks 3. Mulched planters 	<ol style="list-style-type: none"> 1. Gravel alleys

Source: Urban Hydrology for Small Watersheds. Technical Release No. 55

TABLE VI-2

**ADVANTAGES AND DISADVANTAGES OF VARIOUS
ON-SITE STORM WATER CONTROL METHODS**

MEASURE	ADVANTAGES	DISADVANTAGES
<p>A. Cisterns and Covered Ponds</p>	<ol style="list-style-type: none"> 1. Water may be used for: <ol style="list-style-type: none"> a. Fire protection b. Watering lawns c. Industrial processes d. Cooling purposes 2. Reduce runoff while only occupying small area 3. Land or space above cistern may be used for other purposes 	<ol style="list-style-type: none"> 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 5. Reduces available space in basements for other uses
<p>B. Rooftop Gardens</p>	<ol style="list-style-type: none"> 1. Esthetically pleasing 2. Runoff reduction 3. Reduce noise levels 4. Wildlife enhancement 	<ol style="list-style-type: none"> 1. Higher structural loadings on roof and building 2. Expensive to install and maintain
<p>C. Surface Pond Storage (usually residential areas)</p>	<ol style="list-style-type: none"> 1. Controls large drainage areas with low release 2. Esthetically pleasing 3. Possible recreation benefits <ol style="list-style-type: none"> a. Boating b. Ice skating c. Fishing d. Swimming 4. Aquatic life habitat 5. Increases land value of adjoining property 	<ol style="list-style-type: none"> 1. Requires large areas 2. Possible pollution from storm water and siltation 3. Possible mosquito breeding areas 4. May have adverse algae blooms as a result of eutrophication 5. Possible drowning 6. Maintenance problems 7. Erosion potential if discharge/overflow occurs
<p>D. Ponding on Roof by constricted Downspouts</p>	<ol style="list-style-type: none"> 1. Runoff delay 2. Cooling effect for building <ol style="list-style-type: none"> a. Water on roof b. Circulation through 3. Roof ponding provides fire protection for building (roof water may be trapped in case of fire) 	<ol style="list-style-type: none"> 1. Higher structural loadings 2. Clogging of constricted inlet requiring maintenance 3. Freezing during winter (expansion) 4. Waves and wave loading 5. Leakage of roof water into building (water damage)

MEASURE	ADVANTAGES	DISADVANTAGES
E. 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 loadings
F. Porous pavement (parking lots and alleys)	1. Runoff reduction 2. Potential groundwater recharge 3. Less icy in Winter	1. Clogging of holes or pores 2. Compaction of earth below pavement decreases permeability of soil 3. Ground-water pollution from salt in winter 4. Frost heaving 5. May be difficult to maintain 6. Grass or weeds could grow in porous pavement
G. Grassed channels and vegetated strips	1. Runoff delay 2. Some runoff reduction (infiltration recharge) 3. Esthetically pleasing a. Flowers b. Trees	1. Sacrifice some land area for vegetated strips 2. Grassed areas must be mowed or cut periodically (maintenance costs)
H. Ponding/detention measures on imperv. paving a. Rippled pavement b. Basins c. Constricted inlets	1. Runoff delay (a, b, and c) 2. Runoff reduction (a and b)	1. Somewhat restricted movement of vehicle (a) 2. Interferes with normal use (a and c) 3. Damage to rippled pavement during snow removal (a) 4. Depressions collect dirt and debris (a, b, and c)

MEASURE	ADVANTAGES	DISADVANTAGES
I. Reservoir or detention basin	<ol style="list-style-type: none"> 1. Runoff delay 2. Recreation benefits <ol style="list-style-type: none"> a. Ice skating b. Baseball, football, etc. if land is provided 3. Esthetically pleasing 4. Could control large drainage areas with low release 	<ol style="list-style-type: none"> 1. Considerable amount of land is necessary 2. Maintenance costs <ol style="list-style-type: none"> a. Mowing grass b. Herbicides c. Cleaning periodically (silt removal) 3. Mosquito breeding area if wet bottom 4. Siltation in basin
J. Converted septic tank for storage and ground-water recharge	<ol style="list-style-type: none"> 1. Low installation costs 2. Runoff reduction (infiltration and storage) 3. Water may be used for: <ol style="list-style-type: none"> a. Fire protection b. Watering lawns and gardens c. Ground-water recharge 	<ol style="list-style-type: none"> 1. Requires periodic maintenance (silt removal) 2. Possible health hazard 3. Sometimes requires a pump for emptying after storm
K. Ground-water recharge <ol style="list-style-type: none"> a. Perforated pipe or hose b. French drain c. Porous pipe d. Dry well 	<ol style="list-style-type: none"> 1. Runoff reduction (infiltration) 2. Ground-water recharge with relatively clean water 3. May supply water to garden or dry areas 4. Little evaporation loss 	<ol style="list-style-type: none"> 1. Clogging of pores or perforated pipe 2. Initial expense of installation (materials)
L. High delay grass (high roughness)	<ol style="list-style-type: none"> 1. Runoff delay 2. Increased infiltration 	<ol style="list-style-type: none"> 1. Possible erosion or scour 2. Standing water on lawn in depressions

Source: Urban Hydrology for Small Watershed Technical Release No. 55

Note: All structures, other than those used for Groundwater Recharge Volume and Water Quality Volume, must completely drain within 24 hours after the end of the design storm.

TABLE VI-3

**APPLICABILITY OF RUNOFF CONTROL MEASURES
IN THE CONESTOGA RIVER WATERSHED**

A. Cisterns and Covered Ponds

Recommended in industrial parks where water could be used for fire protection; expensive to install with limited benefit. Low maintenance costs (usually requires periodic sediment removal); good for receiving stream's water quality since no outflow.

B. Rooftop Gardens

Recommended for industrial plazas, shopping centers and in downtown areas, as well as any areas with large building footprints.

C. Surface Pond Storage

Recommended where pond sites exist or on more porous soils (a and B) for groundwater recharge. Relatively inexpensive to install and maintain. Helps entrap sediment to improve water quality of receiving stream.

D. Ponding on Roof, Constricted Downspouts

Possible in the denser developed areas or on large public buildings. Required structure modifications usually expensive. Low maintenance costs unless leaks occur. Typically "warms" water that could affect receiving water.

E. Increased Roof Roughness

Possible for industrial, commercial and public buildings. Relative effectiveness minimal on a watershed-wide basis. Moderate installation costs; little maintenance costs. "Warms" runoff.

F. Porous Pavement

Highly recommended where possible, especially in large parking facilities. Promotes groundwater recharge. Moderate in expense compared with typical paving, however, less land intensive if surface detention would be required. Low maintenance costs.

G. Grassed Channels and Vegetated Strips

Recommended wherever possible throughout the watershed to slow velocity and reduce erosion. Minimal slopes (greater than 0.5%) recommended; could entrap sediment to improve water quality. Low installation and maintenance costs. Promotes infiltration.

H. Ponding and Detention on Pavement

Recommended in entire watershed. Tends to warm water that could affect receiving water. Very inexpensive with low maintenance costs. Freezing should be considered. Entraps some pollutants.

I. Reservoir or Detention Basin

Recommended in entire watershed. Relatively easy to implement. Moderate installation and maintenance costs. Aids in entrapping some sediment which improves water quality.

J. Converted septic tank for storage and ground-water recharge

Recommended in entire watershed. Relatively easy to implement. Moderate installation and maintenance costs. Must be kept free of leaves and sediment.

K. Groundwater Recharge

Recharge structures are required where soils and physical conditions permit.

L. High Delay Grass and Routing Flow Over Lawns

Recommended in the entire watershed. Delays runoff, entraps sediment, reduces velocities, reduces erosion potential and improves water quality of receiving watercourse. Relatively inexpensive installation and maintenance costs.

B. Best Management Practices

Water quality problems resulting from storm water runoff have necessitated the development of innovative pollution and runoff control practices termed best management practices (BMP's). Current literature offers many examples of such practices proposed to solve specific storm water quality problems. Below is a summary of recommended practices based upon three separate categories. In addition, detailed information and standards can be found in the "Pennsylvania Handbook of Best Management Practices in Developing Areas". Additional information on effects of storm water on ground water quality can be found in the Water Supply Plan and Wellhead Protection Program portion of the Lancaster County Comprehensive Plan.

1.0 Pollution Source Controls are practices intended to improve water quality by reducing the generation and accumulation of potential runoff at or near their sources. These would include:

1.1 Street Sweeping - Sweeping, vacuuming, controlled flushing or otherwise cleaning streets, parking lots and other paved vehicular traffic areas. This removes dry-weather accumulations of pollutants before they are washed into streams.

- 1.2 Solid Waste Collection and Disposal - Municipal collections of refuse such as leaves which would otherwise be dumped in a place which would wash into the stream. Public education is important.
 - 1.3 Fertilizer Application Control - Preventing fertilization near streams, waterways, lakes and ponds, and insuring that lawns are not over-fertilized keeps nutrients from entering the streams. Public education, the need for soil testing to determine fertilizer needs, and application timing are important factors in reducing nutrient loads to surface waters.
 - 1.4 Pesticide Use Control - Again, public education on proper use, application rates, equipment cleaning, disposal of unused chemicals and containers, storage and alternate pest control compounds is recommended with limitations placed on their use.
 - 1.5 Highway Deicing Compound Control - Highway deicing compounds in storage and application sites run off the land and pollute streams. Proper storage and application of deicing compounds is recommended with limitations placed on their use.
 - 1.6 Nonpoint Source Pollution Control on Construction Sites - Proper erosion and sediment pollution control on construction sites is important in reducing solids and phosphorus transported to receiving waters. Such concepts may include sedimentation basins, storm sewer inlet protection, proper refuse disposal, dust control, designated equipment cleaning areas, etc.
- 2.0 Runoff Controls are practices aimed primarily at runoff rate and volume control, however, they also provide some degree of storm water treatment. Many typical runoff control measures can be easily modified to provide a higher degree of pollution control. Described below are the quality control aspects of runoff control measures.
- 2.1 Dry Detention Basin - A typical detention basin remains dry between periods of rain events. Its primary purpose is to reduce the peak rate of runoff to that which occurred prior to development. The ponding time during a storm event allows a portion of the pollutants to settle out.
 - 2.2 Extended Detention Basin - Extended detention basins are designed to allow an extended ponding time, thus allowing a larger volume of pollutants to settle out. These basins are typically designed to reduce peak rates of runoff for a much greater frequency storm, i.e., the one-year storm.
 - 2.3 Wet Detention Basin - A wet detention basin is essentially a wet pond which has a permanent pool of water. The pool allows an extended detention time allowing pollutants to settle. Aquatic plants and organisms utilize the nutrients in the water preventing escape of those pollutants.

- 2.4 Infiltration Basins - An infiltration basin is an excavated impoundment with a relatively permeable bottom soil. The purpose is to temporarily store the surface runoff for a selected design storm and then allow the stored water to infiltrate into the groundwater. This method prevents surface water pollution but care to prevent groundwater pollution should be exercised.
 - 2.5 Infiltration Trenches - Trenches excavated in porous soils and filled with aggregate allow runoff from small drainage areas to infiltrate into the ground.
 - 2.6 Dry Wells - Pits excavated in porous soils and filled with aggregate. These are typically used to control roof runoff.
 - 2.7 Filter Strips - Grass filter strips accept runoff from roofs or parking areas and filter pollutants before the runoff can enter the receiving water.
 - 2.8 Grassed Waterways and Seepage Areas - Grassed waterways and seepage areas reduce runoff velocities, enhance infiltration and filter runoff pollutants, thus improving runoff quality.
 - 2.9 Concrete Grid and Modular Pavement - Concrete grid and modular pavement promotes infiltration and retards runoff thereby improving runoff quality. These are typically promoted in overflow parking areas.
 - 2.10 Porous Asphalt Pavement - Special asphaltic paving material allows storm water to infiltrate through the pavement through an aggregate base and into the soil thus reducing runoff and in turn pollutant wash-off to streams. Runoff temperatures are also reduced from conventional pavement since the initial rainfall (which typically generates the warmest runoff) infiltrates as opposed to running off into receiving waters.
 - 2.11 Constructed Wetlands - Are excavated basins into which wetland vegetation is planted to enhance pollutant removal. Similar to wet detention/retention basins, they are typically much shallower, thus allowing rooted vegetation to grow. Much larger surface areas are therefore required to store the required volume of storm water runoff.
- 3.0 Collection and Treatment deals with collecting and treating urban storm water runoff. It typically applies to more heavily developed areas with defined collection systems.
 - 3.1 New Sewer System Control - Involves the planning of proposed storm sewer systems to incorporate storm water treatment of some sort before being discharged into the receiving waters.
 - 3.2 Storm Sewer System Storage - Incorporates storage capabilities (detention) in storm sewers for pollutant deposition and "clean" water discharge.
 - 3.3 Flow Regulators - Involves installing mechanized devices in storm water

conveyance and storage facilities to control runoff volumes, velocities and directions of flows.

3.4 Treatment - Involves considering methods of treatment for storm water runoff to remove solids and contaminants. Such processes may be filtration, settling, screening, flocculation or disinfection.

3.5 Water Quality Inlets (Oil and Grease Separators) - Designed to remove sediment and hydrocarbons from parking lot runoff before they are conveyed to the storm sewer or infiltration structure. They are typically multi-chambered and are limited to small drainage areas due to their small storage volume.

SECTION VII

THE DEVELOPMENT OF THE MODEL ORDINANCE

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 the Conestoga River Watershed Act 167 Plan, a Model Storm Water 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" 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 Conestoga River Watershed Act 167 Model Storm Water 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 the Conestoga River Basin are completely within the watershed. For those portions of the municipality outside the Conestoga River Watershed, the existing ordinance provisions would still apply.
- Permanent storm water control facilities are regulated by the Act 167 Ordinance. Storm water management and erosion and sedimentation control during construction would continue to be regulated under the existing storm water ordinance and Chapter 102 Erosion and Sediment and Pollution Controls, Title 25 of DEP. Regulations.
- The Model Storm Water Ordinance contains only those minimum storm water runoff control criteria and standards which are necessary or desirable from a total watershed perspective. Additional storm water management design criteria (i.e., inlet spacing, inlet type, collection system details, etc.) which should be based on sound engineering practice should be regulated under the current ordinance provisions or as part of the general responsibilities of the municipal engineer.

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

- I - General Provisions
- II - Definitions
- III - Drainage Plan Requirements
- IV - Drainage Plan Submittal and Review Procedures
- V - Permit Requirements and Procedures
- VI - Inspections
- VII - Fees and Expenses
- VIII - Financial Guarantees and Maintenance
- IX - Enforcement and Penalties

In the next section (Section VIII, "Model Storm Water Ordinance") is a listing of which parts of the Model Ordinance are mandatory under Act 167 and which sections are optional.

Although the actual storm water control provisions, as shown in Tables VII-1 and VII-2 below, may change significantly from an existing municipal ordinance, the structure of the ordinance itself is very similar to many existing ordinances.

Section 11b of the Storm Water Management Act states that:

“Within six months following adoption and approval of the watershed storm water plan, each municipality shall adopt or amend, and shall implement such ordinances and regulations, including zoning, subdivision and development, building code, and erosion and sedimentation ordinances, as are necessary to regulate development within the municipality in a manner consistent with the applicable watershed storm water plan and the provisions of this act.”

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

An Occupancy Permit shall not be secured or issued unless the Storm Water Management and Earth Disturbance Ordinance of the Conestoga River Watershed have been complied with. The occupancy permit shall be required for each lot owner and/or developer of all subdivisions and land development in the municipality, unless exempt under the exemption criteria.

**TABLE VII-1
TYPICAL STORM WATER MANAGEMENT ORDINANCE PROVISIONS**

ARTICLE I - General Provisions	<ul style="list-style-type: none"> - Statement of Findings - Purpose - Statutory Authority - Applicability - General Requirements - Repealer - Severability - Comparability with Other Ordinance Requirements
ARTICLE II - Definitions	
ARTICLE III - Design Criteria for Storm Water Management Facilities	<ul style="list-style-type: none"> - General Requirements - Storm Water Management Performance Standards - Design Criteria for Storm Water Management Facilities - Calculation Methodology - Use of Performance Standards and Criteria - Floodplain
ARTICLE IV - Storm Water Management Site Plan Requirements	<ul style="list-style-type: none"> - Exemptions - Storm Water Management Site Plan Contents - Storm Water Management Site Plan Submission - Storm Water Management Site Plan Review - Modifications of Plans
ARTICLE V - Inspections	<ul style="list-style-type: none"> - Schedule of Inspections
ARTICLE VI - Fees and Expenses	<ul style="list-style-type: none"> - General - Expenses Covered by Fees - Improvement Security
ARTICLE VII - Maintenance Responsibilities	<ul style="list-style-type: none"> - Applicability - Maintenance Responsibilities - Maintenance Agreement for Privately Owned Storm Water Management Facilities - Maintenance of Facilities Accepted by the Municipality - Maintenance of Existing Facilities / BMPs
ARTICLE VIII - Enforcement and Penalties	<ul style="list-style-type: none"> - Right-of-Entry - Notification - Enforcement / Violations - Public Nuisance - Penalties - Appeals - Modification of Facilities - Modification of Ordinance Provisions

TABLE VII-2
SPECIAL STORM WATER MANAGEMENT PROVISIONS
(Model Ordinance sections cited where possible)

Impervious Cover Limitations

- Use of pervious materials - Section 302.B.2
- Standards based upon soil permeability - Section 302.B.2
- Limitations in high groundwater areas

Disturbance of Natural Areas

- Prohibit disturbance of wetlands area - Section 402.B.4
- Limit removal of vegetation or trees - Section 302.B.3
- Prohibit sediment pollution - Sections 302.D, 304.6

Plan Review - Section 404, Article VI

- Establish review fees
- Fixed-fee payments
- Actual costs (Schedule of Fees and Application)

Maintenance of Facilities - Article VII

- Establish one or two year maintenance bond
- Maintenance fund for perpetual care of facility

Runoff Control

- Design storm as specified - Sections 303.A.10, 304.A, 304.B
- Release rate application for no increase in runoff - Section 302.B.1

Reduce Size of Facilities

- Encourage on-lot recharge - Section 302.A
- Allow generous standards for calculation of infiltration when in a naturally porous area
Section 302.C
- Encourage grass-lined low gradient channels and check dams - Section 302.B.2

Special Geologic Conditions

- Special consideration needs in the design of storm water detention, retention and conveyance facilities in sensitive areas such as:
 - . Limestone areas - Section 301.F
 - . Landslide-prone areas
 - . Abandoned mining areas

SECTION VIII *
MODEL STORM WATER ORDINANCE

MODEL ORDINANCE REQUIREMENTS

The following ordinance provisions must be retained when a municipality either elects to create a single-purpose storm water ordinance.

- Article I - General Provisions.
- Article II - Definitions.
- Article III - Design Criteria for Storm water Management Facilities.
- Article IV - Section 401. Exemptions.
- Article VIII - Enforcement and Penalties (only when enacting a single-purpose ordinance)

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

- Article V - Inspections.
- Article VI - Fees and Expenses.
- Article VII - Maintenance Responsibilities.

The following sections should be reviewed by the Municipal Engineer. They deal with construction and conveyance and are only recommendations:

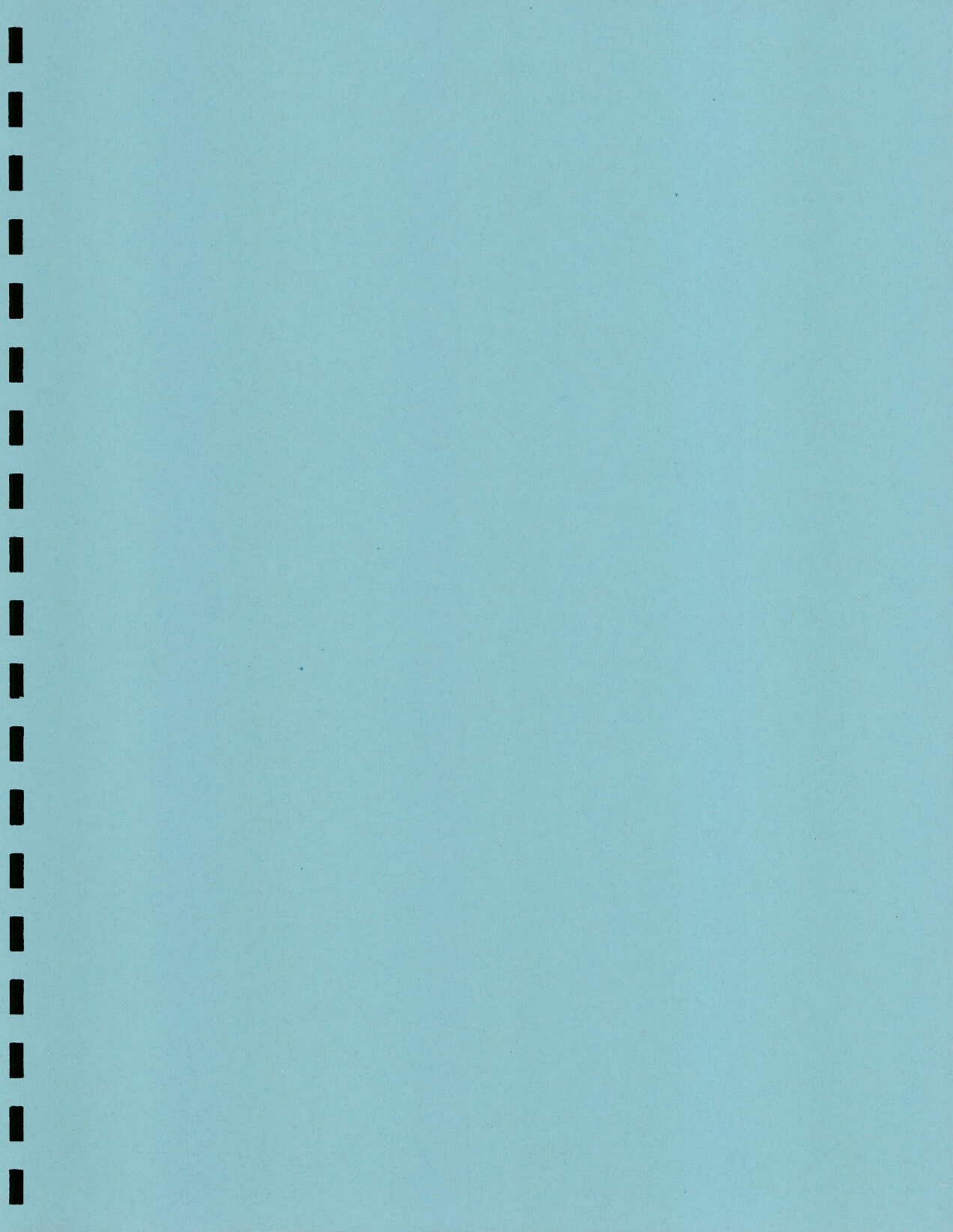
- Section 302.E → Riparian Buffers are recommended but not required.
- Section 303
- Section 306 → (This section cannot be required by act 167, but can be required by Act 166. The routing methods used in the model assume no encroachment into the 100 year floodplain. It is important that this section be included in the ordinance.)
- Section 703 → (This is one way that a municipality could establish a fund to finance maintenance and inspections of storm water facilities.)

The following Section can be required by Second Class Townships, but not by Boroughs:

- Section 805.A - Penalties

The appendices are recommended but are not required.

* Municipalities may amend existing ordinances or adopt an ordinance different from this model as long as the requirements of this Act 167 Plan are met for groundwater recharge volume, water quality volume, and runoff rates. The staff of the Lancaster County Engineer's Office suggests to any municipality that chooses this option that they have their Municipal Engineer and Municipal Solicitor review their proposed ordinance for compliance with this plan. PaDEP will then review each Municipality's ordinance before granting their approval.





MODEL STORM WATER MANAGEMENT

ORDINANCE

In some cases, Municipalities have existing Ordinances which can be modified to meet the requirements of the Conestoga River Act 167 Storm Water Management Plan. This Model Ordinance is intended as a guide to assist Municipalities in those cases. This Model Ordinance can also be adopted as is, but each Municipality also has the option of writing their own Ordinance, subject to the approval of PaDEP, Bureau of Watershed Management. In order to provide a complete, viable Model Ordinance, some sections have been included here that are not required by Pa. Act 167 (The Storm Water Management Act). These include Section 306 and Articles V, VI, and VII. These are labeled as "Optional - not required by the Storm Water Management Act". Section 805.A should be reviewed by the Municipal Solicitor to determine its appropriateness to the Class of the Municipality (i.e. First or Second Class Township or Borough).

ORDINANCE NO. _____

_____ BERKS/CHESTER/LANCASTER COUNTY, PENNSYLVANIA
[Name of Municipality]

Adopted at a Public Meeting Held on

_____, 20 ____

TABLE OF CONTENTS

ARTICLE I - GENERAL PROVISIONS

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- Section 102 - Purpose
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- Section 104 - Applicability
- Section 105 - General Requirements
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- Section 107 - Severability
- Section 108 - Compatibility with Other Ordinance Requirements

ARTICLE II - DEFINITIONS

ARTICLE III - DESIGN CRITERIA FOR STORM WATER MANAGEMENT FACILITIES

- Section 301 - General Requirements
- Section 302 - Storm Water Management Performance Standards
- Section 303 - Design Criteria for Storm Water Management Facilities
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**Conestoga River WATERSHED
ACT 167 STORM WATER MANAGEMENT ORDINANCE**

**ARTICLE I
GENERAL PROVISIONS**

Section 101. Statement of Findings

The governing body of the Municipality finds that:

- A. Inadequate management of accelerated storm water 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 storm water, 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 storm water 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 Conestoga River Watershed 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. Encourage recharge of groundwater where appropriate 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 within the Conestoga River watershed.
- F. Provide proper maintenance of all permanent storm water management facilities that are constructed in the Municipality.
- G. Provide performance standards and design criteria for watershed-wide storm water management and planning.

Section 103. Statutory Authority

The Municipality is empowered to regulate land use activities that affect runoff by the authority of the Storm Water Management Act, [and the applicable Municipal Code] and the Floodplain Management Act [and the applicable Municipal Code].

Section 104. Applicability

Any landowner or any person engaged in the alteration or development of land which may affect storm water runoff characteristics shall implement such measures consistent with the provisions of the Conestoga River watershed storm water plan. This Ordinance shall only apply to those areas of the Municipality that are located within the Conestoga River Watershed, as delineated in the Subwatershed Boundary Map of this Ordinance located in Appendix E which is hereby adopted as part of this ordinance.

Section 105. 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 Storm Water Management Site Plan from the Municipality or its designee.

Section 106. Repealer

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

Section 107. Severability

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

Section 108. Compatibility With Other Ordinance Requirements

Approvals issued pursuant to this Ordinance do not relieve the Applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. Whenever there is a difference between the minimal applicable standards specified herein and those included in other applicable Municipal regulations:

- A. Within that portion of the Municipality located in the Conestoga River Watershed, the regulations of this Part shall apply.
- B. Within the remainder of the Municipality, the more stringent regulation shall apply.

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 those of feminine gender and vice-versa.
- 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 and the members of such partnership or association and the officers of such corporation.
- 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 or occupied."

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

Act 167 Plan - The Plan for managing storm water runoff in the Conestoga River Watershed adopted by Berks, Chester, and Lancaster Counties as required by the Storm Water Management Act, and known as the Conestoga River Watershed Act 167 Storm Water Management Plan.

Agricultural Activities - The work of producing crops and raising livestock including tillage, plowing, discing, harrowing, pasturing and installation of conservation measures. Construction of new buildings or impervious areas 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) - Any program, technology, process, siting criteria, operating method, measure, or device that controls, prevents, removes, or reduces pollution.

Carbonate Geology - Limestone or dolomite bedrock.

Chapter 102 - Chapter 102 of the regulations of PaDEP, 25 Pa. Code Sect. 102.1 et seq.

Chapter 105 - Chapter 105 of the regulations of PaDEP, 25 Pa. Code Sect. 105.1 et seq.

Chapter 106 - Chapter 106 of the regulations of PaDEP, 25 Pa. Code Sect. 106.1 et seq.

Cistern - An underground reservoir or tank for storing rainwater.

Conservation District - The Berks, Chester, or Lancaster County Conservation District.

Conveyance - The ability of a pipe, culvert, swale or similar facility to carry the peak flow from the design storm.

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 semifluid, or a refuse bank, fill or structure for highway, railroad or other purposes which does or may impound water or another fluid or semifluid. The dam falls under the requirements of Chapter 105, Dam Safety and Waterway Management, if the following is true;

- A. The contributory drainage area exceeds 100 acres.
- B. The greatest depth of water measured by upstream toe of the dam at maximum storage elevation exceeds 15 feet.
- C. The impounding capacity at maximum storage elevation exceeds 50 acre-feet.

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 storm water management systems.

Designee - The agent of a municipal governing body 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 storm water runoff by temporarily storing the runoff and releasing it at a predetermined rate. In order not to fall under the requirements of Chapter 105, Dam Safety and Waterway Management, the following must be true;

- A. The contributory drainage area may not exceed 100 acres.
- B. The greatest depth of water measured by upstream toe of the dam at maximum storage elevation may not exceed 15 feet.
- C. The impounding capacity at maximum storage elevation may not exceed 50 acre-feet.

Developer - A person that undertakes any Regulated Activity of this Ordinance.

Development Site - The parent tract for which a Regulated Activity is proposed.

Disappearing Stream - A stream in an area underlain by limestone or dolomite which flows underground for a portion of its length.

Downslope Property Line - That portion of a property line of a parent tract located at the topographically lowest point of the tract such that some or all overland, swale, or pipe flow from a Development Site would be directed toward it.

Drainage Conveyance Facility - A storm water management facility designed to transmit storm water runoff and shall include streams, channels, swales, pipes, conduits, storm sewers, etc.

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

Drainage Permit - A permit issued by the municipal governing body after the Storm Water Management Site Plan has been approved. Said permit is issued prior to or with the final municipal approval.

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

Effective Agricultural Zone - Zoning that allows 1 lot for every 20 or more acres of the parent tract.

Ephemeral Stream - A transient stream, one that flows for a relatively short time.

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.

Existing Conditions - The initial condition of a Development Site prior to the proposed construction.

FEMA - the Federal Emergency Management Agency.

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, the area of inundation which functions as a storage or holding area for floodwater to a width required to contain a base flood of which there is a one percent (1%) chance of occurrence in any given year. The floodplain contains both the floodway and the flood fringe.

Flood Plain Management Act - Act of October 4, 1978, P.L. 851, No. 166, as amended 32 P.S. Section 679.101 et seq., and as may be amended in the future.

Floodway - The channel of the watercourse and those portions of the adjoining floodplains which are 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 forest land. 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 maximum design highwater elevation and the top of a dam, levee, tank, basin, or diversion ridge.

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 - Impervious surfaces are those surfaces which do not absorb water. All structures, buildings, parking areas, driveways, roads, sidewalks and any areas of concrete, asphalt or packed stone shall be considered impervious surface. In addition, all other areas as determined by the Municipal Engineer to be impervious within the meaning

of this definition shall also be considered impervious surface.

Impoundment - A retention or detention basin designed to retain storm water runoff and infiltrate it into the ground (in the case of a retention basin) or release it at a controlled rate (in the case of a detention basin).

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. The upstream end of any structure through which water may flow.

Land Development - Any of the following activities:

- (1) The improvement of one lot or two or more contiguous lots, tracts or parcels of land for any purpose involving:
 - (i) a group of two or more residential or nonresidential buildings, whether proposed initially or cumulatively, or a single nonresidential building on a lot or lots regardless of the number of occupants or tenure; or
 - (ii) the division or allocation of land or space, whether initially or cumulatively, 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.
- (2) A subdivision of land.
- (3) Development in accordance with Section 503(1.1) of the MPC.

Landowner - The legal or beneficial owner or owners of land including the holder of an option or contract to purchase (whether or not such option or contract is subject to any condition), a lessee if he is authorized under the lease to exercise the rights of the landowner, or other person having a proprietary interest in land.

Land Disturbance - Any activity involving 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.

Lineament - A fracture on the order of 10's of kilometers long usually extending to the basement below sedimentary rock.

Main Stem (Main Channel) - Any stream segment or other runoff conveyance facility used as a reach in the Conestoga River hydrologic model.

Manning Equation (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.

Memorandum of Understanding - An agreement between [Name of Municipality] and the Lancaster County Conservation District to provide for cooperation between the Lancaster County Conservation District and the [Name of Municipality] officials, Lancaster County, to include within its ordinances, and to jointly promote conservation of natural resources within [Name of Municipality] on lands both public and private, for the purposes of preventing accelerated soil erosion and sedimentation of streams, reducing storm water damage, and promoting the health, safety and general welfare of the residents of [Name of Municipality].

MPC - The Pennsylvania Municipalities Planning Code, Act of July 1, 1967, P.L. 805, No. 247, as reenacted and amended, 53 P.S. Section 10101 et seq., and as may be amended in the future.

Municipality - The [Borough or Township] of _____, [Berks or Chester or Lancaster] County, Pennsylvania.

Natural Drainageway - An existing channel for water runoff that was formed by natural forces.

NPDES - The U.S. EPA's "National Pollution Discharge Elimination System", which regulates point discharges (discrete conveyances such as pipes or man-made ditches).

NRCS - Natural Resources Conservation Service (previously SCS).

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

Open Channel - A drainage element in which storm water flows with an open surface. Open channels include, but shall not be limited to, natural and man-made drainage ways, swales, streams, ditches, canals, and pipes flowing partly full.

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 - Involves the use of impervious parking areas as temporary impoundments with controlled release rates during rainstorms.

PaDEP - The Pennsylvania Department of Environmental Protection, former entity the Pennsylvania Department of Environmental Resources, or any agency successor to the Pennsylvania Department of Environmental Protection [Note: The Department of Environmental Resources was abolished by Act 18 of 1995].

PaDOT - The Pennsylvania Department of Transportation or any agency successor thereto.

Parent Tract - All contiguous land held in single and separate ownership, regardless of whether (i) such land is divided into one or more lots, parcels, purparts or tracts; (ii) such land was acquired by the landowner at different times or by different deeds, devise, partition or otherwise; or (iii) such land is bisected by public or private streets or rights-of-way, which was held by the landowner or his predecessor in title on the effective date of this Ordinance.

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

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

Plan - The storm water management and erosion and sediment pollution control plans and narratives.

Planning Commission - The planning commission of [Name of Municipality], Lancaster County, Pennsylvania.

PMF - Probable Maximum Flood - The flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are 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).

Present Worth - (Optional, only needed if Section 703.A.3, also optional is used). The equivalence of any future amount to any present amount.

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

Record Plan - Where a regulated activity constitutes a subdivision or land development, the Final Subdivision or Land Development plan which contains the information the Ordinance requires. Where a regulated activity does not constitute a subdivision or land development, a Storm Water Management Site plan containing all required information and prepared in a form acceptable to the Office of the Recorder of Deeds for recording.

Regulated Activities - Any activity to which this ordinance is applicable pursuant to Section 104 of this Ordinance.

Restrictive Agricultural Zone - Zoning that allows 1 lot for every 20 or more acres of the parent tract.

Retention Basin - A reservoir designed to retain storm water runoff with its primary release of water being through the infiltration of said water into the ground.

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 storm water 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.

SCS - U.S. Department of Agriculture, Soil Conservation Service (now known as NRCS).

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

Sediment Pollution - The placement, discharge or any other introduction of sediment into the waters of the Commonwealth occurring from the failure to design, construct, implement or maintain control measures and control facilities in accordance with the requirements of this Ordinance.

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 which flows over the ground surface as a thin, even layer, not concentrated in a channel.

Soil-Cover Complex Method - A method of runoff computation developed by the SCS (now 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 potential groups. 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 depression in the embankment of a pond or basin which is used to pass a Post development 100 year storm peak flow rate.

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 storm water from other sources, but excludes domestic sewage and industrial wastes.

Storm Water - The total amount of precipitation reaching the ground surface.

Storm Water Management Act - Act of October 4, 1978, P.L. 864, No. 167, as amended 32 P.S. Section 680.1 et seq., and as may be amended in the future.

Storm Water Management Facility - Any structure, natural or man-made, that, due to its condition, design, or construction, conveys, stores, or otherwise affects storm water runoff. Typical storm water management facilities include, but are not limited to, detention and retention basins, open channels, watercourses, road gutters, swales, storm sewers, pipes, and infiltration structures.

Storm Water Management Site Plan - The Plan prepared by the Developer or his representative indicating how storm water runoff will be managed at a particular development site according to this Ordinance. The contents of a Storm Water Management Site Plan are established in Section 402.

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.

Subwatershed Area - The smallest drainage unit of a watershed for which storm water management criteria have been established in the Act 167 Plan.

Subdivision - The division or redivision 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, partition by the court for distribution to heirs or devisees, 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 dwelling, shall be exempted.

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.

TR-20 (calibrated) - The computer-based hydrologic modeling technique adapted to the appropriate watershed for the Act 167 Plan. The model has been "calibrated" to reflect published and observed flow values by adjusting key model input parameters.

Watercourse- Any channel or conveyance of surface waters having a defined bed and banks, whether natural or artificial, with perennial or intermittent flow.

Watershed - The entire region or area drained by a watercourse.

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, ferns, and similar areas.

ARTICLE III
DESIGN CRITERIA FOR STORM WATER MANAGEMENT FACILITIES

Section 301. General Requirements

- A. Storm water drainage systems shall be provided in order to permit unimpeded flow along natural watercourses, except as modified by storm water management facilities or open channel consistent with this Ordinance.
- B. The existing points of concentrated drainage that discharge onto adjacent property shall not be relocated and shall be subject to any applicable discharge criteria specified in this Ordinance.
- C. Where a Development Site is traversed by watercourses other than permanent streams, a drainage easement shall be provided conforming substantially 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 affect adversely the flow of storm water within any portion of the easement. Also, maintenance and mowing of vegetation within the easement shall be required.
- D. The PaDEP, Chapter 105, Rules and Regulations, apply to the construction, modification, operation or maintenance of both existing and proposed water obstructions and encroachments throughout the watershed, including work in wetlands. Inquiries on permit requirements or other concerns shall be addressed to PaDEP's Regional Office. Permit requirements or inquiring on dam safety should be addressed to the PaDEP, Bureau of Waterways Engineering - Harrisburg.
- E. When it can be shown that, due to topographic conditions, natural drainage ways on the development site cannot adequately provide for drainage, open channels may be constructed conforming substantially to the line and grade of such natural drainageways. Work within natural drainageways shall be subject to approval by PaDEP through the Joint Permit Application process, or, where deemed appropriate by PaDEP, through the General Permit process.
- F. Carbonate Geology - In areas of carbonate geology, a registered Professional Geologist shall certify the following:
 - 1. No storm water facilities shall be placed in, over or immediately adjacent to the following features;
 - a. sinkholes

- b. closed depressions
 - c. lineaments in carbonate areas
 - d. fracture traces
 - e. caverns
 - f. intermittent lakes
 - g. ephemeral streams
 - h. bedrock pinnacles (surface or subsurface)
2. Storm water management basins shall not be located closer than one hundred (100) feet from the rim of sinkholes or closed depressions, nor within one hundred (100) feet from disappearing streams; nor shall these basins be located closer than fifty (50) feet from lineaments or fracture traces; nor shall these basins be located closer than twenty-five (25) feet from surface or identified subsurface pinnacles.
 3. Storm water resulting from regulated activities shall not be discharged into sinkholes.
 4. If the developer can prove through analysis that the development site is in an area underlain by carbonate geology, and such geologic conditions may result in sinkhole formations, then the development site is exempt from recharge requirements as described in Sections 302.C and 304.F. However, the development site shall still be required to meet all other hydrologic and water quality management standards as found in this ordinance.
 5. It shall be the developer's responsibility to verify if the development site is underlain by carbonate geology. The following note shall be attached to all Storm Water Management Site plans and signed and sealed by the developer's qualified professional, "I, _____, certify that the proposed detention basin (circle one) is/is not underlain by carbonate geology."
 6. Whenever a storm water facility will be located in an area underlain by carbonate geology, a geological evaluation of the proposed location by a Registered Professional Geologist shall be conducted to determine susceptibility to sinkhole formation. The evaluation may include the use of impermeable liners to reduce or eliminate the separation distances listed in items 1 and 2 above.

Section 302. Storm Water Management Performance Standards

General

The following general standards shall be applied to all development within the Conestoga River Watershed to promote flow attenuation, erosion and sediment control and flood control.

1. The developer of any development site in the Conestoga River Watershed which does not fall under the exemption criteria in Appendix A shall submit a Storm Water Management Site plan consistent with the Conestoga River Watershed Act 167 Plan to the Municipality for review.

The exemption criteria in Appendix A shall apply to the total proposed development on a parent tract even if development is to take place in stages. 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.

2. All storm water management site plans shall be designed and certified by individuals registered in the Commonwealth of Pennsylvania and qualified to perform such duties based on education and training in hydrology and hydraulics.
3. Runoff from impervious areas shall be drained to pervious areas of the Development Site.
4. Roof drains shall not be connected to streets, sanitary or storm sewers or roadside ditches.
5. Storm water management facilities which involve a State Highway shall be subject to the approval of the Pa DOT.
6. Storm water management facilities located within or affecting the floodplain or any watercourse shall also be subject to the requirements of Section 306 (Floodplain) of this Ordinance, the [Name of Municipality] Zoning Ordinance, the [Name of Municipality] Subdivision and Land Development Ordinance, any Ordinance which regulates construction and development within areas of the [Name of Municipality] subject to flooding, and any other applicable requirements of the Floodplain Management Act.

7. Storm water runoff from a Development Site shall flow directly into a natural drainageway, watercourse, or into an existing storm sewer system, or onto adjacent properties in a manner similar to the runoff characteristics of the pre-development flow. Maximum use shall be made of the existing on-site natural and man-made storm water management facilities.
8. Storm water runoff shall not be transferred from one watershed to another unless they are sub-watersheds of a common watershed which join together within the perimeter of the Development Site, or the effect of the transfer does not alter the peak discharge (in conformance with the requirements of the Act 167 Plan) onto adjacent lands, or drainage easements from the affected landowners are provided.
9. All storm water runoff flowing over the Development Site shall be considered in the design of the storm water management facilities.
10. In accordance with Chapter 102, temporary facilities shall be included in the submitted plans for a phased section where the following conditions are met:
 - a. A regulated activity constitutes a Subdivision or Land Development.
 - b. The Final Plan applications are submitted in sections.
 - c. Temporary facilities are required for construction of a section.

A. Match Pre-existing Hydrograph

Developers and/or landowners are encouraged to provide infiltration facilities or utilize other techniques which will allow the post-development hydrograph to match the pre-existing hydrograph, along all parts of the hydrograph, for the development site. To match the pre-existing hydrograph means that it is not to be exceeded at all points in time. This option is most feasible for small subdivisions in areas of non-carbonate geology. "Groundwater Recharge" and "Water Quality" volumes as given in Sections 302.C and D below can be used as part of this option.

B. Detention/Infiltration Standards (only if existing hydrograph can not be matched)

1. Post-development rates of runoff from any regulated activity shall not exceed a given percentage of the peak rate of runoff prior to development for all design storms unless the pre-existing hydrograph is not exceeded at all points in time. The percentage of the pre-development peak rate which may be released is known as the "release rate". The areas of the

watershed for which a certain release rate applies can be found in Appendix E, "Subwatershed Boundary Map".

2. Innovative methods for the control of storm water runoff are encouraged. Various combinations of methods should be tailored to suit the particular requirements of the type of development and the topographic features of the Development Site. The following is a partial listing of detention and control methods which can be utilized in storm water management systems where appropriate:
 - a. Detention basins
 - b. Retention basins (subject to prior municipal approval)
 - c. Rooftop detention
 - d. Parking lot storage
 - e. Seepage pits, seepage trenches or other infiltration structures
 - f. Concrete lattice block surfaces
 - g. Grassed channels and vegetated strips.
 - h. Cisterns and underground reservoirs
 - i. Routed flow over grass
 - j. Decreased impervious surface coverage
 - k. Bio-retention areas (rain gardens)
 - l. Other methods as may be found in the "Pennsylvania Handbook of Best Management Practices for Developing Areas", the "Pennsylvania Stormwater Best Management Practices Manual", or equivalent.

3. The following principles shall be applied to the Erosion and Sediment Pollution Control Plan and construction schedule to minimize soil erosion and sedimentation:
 - a. Stripping of vegetation, grading, or other soil disturbance shall be done in a manner which will minimize soil erosion.
 - b. Whenever feasible, natural vegetation shall be retained and protected.
 - c. The extent of the disturbed area and the duration of its exposure shall be kept to a minimum, within practical limits.
 - d. Either temporary seeding, mulching, or other suitable stabilization measures shall be used to protect exposed critical areas during construction.
 - e. Drainage provisions shall accommodate the storm water runoff both during and after construction.
 - f. Soil erosion and sedimentation facilities shall be installed prior to any on-site grading.

C. Groundwater Recharge

Developed areas shall maintain groundwater recharge consistent with pre-development conditions, dependent on hydrologic soil groups and impervious cover unless the developer can prove the inability of the development site to achieve recharge based on existing development site conditions. This volume of runoff is termed the "Recharge Volume" and is calculated in accordance with Section 304.F. The Recharge Volume must be infiltrated within 48 hours after the end of the design storm. Development sites where the post developed impervious area is equal to or less than the pre developed impervious area shall not be required to provide Ground Water Recharge volume.

Design of the storm water management facilities shall provide for ground water recharge to compensate for the reduction in the percolation that occurs when the ground surface runoff characteristics have been altered. A detailed geologic evaluation of the Development Site shall be performed to determine the suitability of recharge facilities. The evaluation shall be performed by a state licensed/certified Professional Geologist, and shall, at a minimum, address soil permeability, depth to bedrock, susceptibility to sinkhole formation, and subgrade 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.

If the developer can prove through analysis that the development site is in an area underlain by carbonate geology, and such geologic conditions may result in sinkhole formations, then the development site is exempt from recharge requirements. However, the development site shall still be required to meet all other hydrologic and water quality management standards as found in this ordinance.

D. Water Quality

Developed areas will provide adequate storage and treatment facilities necessary to capture and treat a minimum of the runoff from the first 1.2" of rainfall. This volume of storage is the "Water Quality Volume" and is calculated in accordance with Section 304.G. The Recharge Volume may be a component of the Water Quality Volume. If the Recharge Volume is less than the Water Quality Volume, the remaining Water Quality Volume may be captured and treated by methods other than recharge/infiltration BMPs. The Water Quality volume must take a minimum of 24 hours to be discharged. Development sites where the post developed impervious area is equal to or less than the pre developed impervious area shall not be required to provide Water Quality volume unless required by NPDES Part II.

E. Storm water Conveyance Corridor Protection (riparian Corridor Preservation and vegetation)- Runoff from developed areas of the development site, including but not limited to areas of impervious surface, shall be managed through a series of riparian corridor vegetation facilities whenever possible. This will be accomplished in a manner satisfactory to the Municipality, utilizing the "Pennsylvania Handbook of Best Management Practices for Developing Areas", 1998, Riparian Forested Buffer, and the priority goal of the riparian vegetation will be the reduction of thermal impacts on storm water runoff associated with impervious areas, with a secondary goal being the protection of capacity of existing storm water conveyance channels. These goals will be achieved through the use of design criteria in Section 303 of this Ordinance and shall be in addition to any other municipal ordinance provisions.

F. Sub-Regional (Combined Development Site) Storage

Runoff can be managed regionally by one or more developers, either on-site or off-site. The design and release rate shall be consistent with the Conestoga River Act 167 Plan. "Groundwater Recharge" and "Water Quality" volumes as described in Sections 302.C and 302.D will be a part of this option.

G. The "No Harm" option does not apply to the water quality requirement described in item "D" above. The "No Harm" option does not apply to the groundwater recharge requirement described in item "C" above, unless it can be shown that the development site is underlain by carbonate geology and infiltration can not be safely accomplished.

For any proposed development, the developer has the option of using a less restrictive runoff control if the developer can prove that "no harm" would be caused by discharging at a higher runoff rate than that specified by the Plan. Proof of "no harm" would have to be shown from the development site through the remainder of the downstream drainage network until there is no additional flow increase. Proof of "no harm" must be shown using the capacity criteria specified in Section 303.C if downstream capacity analysis is a part of the "no harm" justification.

Attempts to prove "no harm" based upon downstream peak flow versus capacity analysis shall be governed by the following provisions:

1. The peak flow values to be used for downstream areas for the design return period storms (2-, 5-, 10-, 25-, 50-, and 100-year) shall be the values from the calibrated TR-20 Model for the Conestoga River Watershed. These flow values would be supplied to the developer by the County upon request.

2. At peak flow, any available capacity in the downstream conveyance system (as documented by a developer) may be used only in proportion to the proposed development site acreage relative to the total upstream undeveloped acreage (i.e. if the development site is 10% of the upstream undeveloped acreage, the developer may use up to 10% of the documented downstream available capacity at peak flow).
3. Developer-proposed runoff controls which would generate increased peak flow rates at documented 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 Sections 303.C and 303.S. of the Model Ordinance.

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

Section 303. Design Criteria for Storm Water Management Facilities

- A. Any storm water management facility designed to store storm water runoff and requiring a berm or earth embankment (i.e. detention or retention basin) shall be designed to provide an emergency spillway to handle the 100-year post-development peak flow rate. The height of embankment must be set to provide a minimum 1.0 foot of freeboard above the maximum elevation computed when the entire 100 year peak flow passes through the spillway. However, criteria for design and construction of storm water management facilities are not the same criteria that are used in the permitting of dams under the PaDEP Dam Safety Program. Depending upon the physical characteristics of a dam, a dam permit may be required and the design will have to meet the provisions of Chapter 105. Depending on the physical characteristics of a dam, the design could require that anywhere from a 100-year to a Probable Maximum Flood (PMF) storm event be considered. The following minimums shall be required:
 1. The maximum water depth shall not exceed six (6) feet, unless approved by a modification granted in conformance with Section 808 by the municipal officials upon recommendation of the municipal Engineer.
 2. The minimum top width of all dams/embankments/berms shall be five (5) feet.
 3. The interior side slopes shall not be greater than five (5) horizontal to one (1) vertical.
 4. All basins shall be structurally sound and shall be constructed of sound and durable materials. The completed structure and the foundation of all basins shall be stable under all probable conditions of operation. An

emergency spillway shall be provided for the basin and shall be capable of discharging the 100-year peak rate of runoff which enters the basin after development, in a manner which will not damage the integrity of the facility and will not create a downstream hazard. Where practical, the emergency spillway shall be constructed in undisturbed ground. An easement for inspection and repair shall be provided when the conveyance structure crosses property boundaries.

5. All basins not including Groundwater Recharge and/or Water Quality storage shall include an outlet structure to permit draining the basin to a completely dry position within twenty-four (24) hours following the end of the design rainfall. All basins that do include Groundwater Recharge and/or Water Quality storage shall include an outlet structure to permit draining the basin to the level of the Groundwater Recharge and/or Water Quality storage within twenty-four (24) hours following the end of the design rainfall.
6. A cutoff trench of relatively impervious material shall be provided within all basin embankments.
7. All structures passing through Detention Basin embankments (as defined in Section II above) shall have properly spaced concrete cutoff collars and all piping must be watertight. All structures passing through Dam embankments (as defined in Section II above) shall have seepage diaphragms and drains.
8. All discharge control devices with appurtenances (except discharge pipes) shall be made of reinforced concrete and stainless or hot dip galvanized steel. Bolts/fasteners are to be stainless or galvanized steel. Discharge pipes shall conform to the requirements of Section E below.
9. Low flow channels shall be provided from each water carrying facility to the outlet structure for all basins that do not include Groundwater Recharge and/or Water Quality storage. Low flow channels shall be one (1) percent minimum slope and shall be designed to enable ease of maintenance. All basins that do include Groundwater Recharge and/or Water Quality storage shall not be required to have a low flow channel.
10. Minimum slope within a basin that does not include Groundwater Recharge and/or Water Quality storage shall be two (2) percent positive grade to the low flow channel.
11. Design storms for the computation of retention basins (where approved) volumes shall be based upon a 24-hour storm with 100 year return period (a storm with a 1% chance of occurrence each year).

12. The effect on downstream areas if the basin embankment fails shall be considered in the design of all basins. Where possible, the basin shall be designed to minimize the potential damage caused by such failure of the embankment.
 13. All structures (detention basins, cisterns, etc.), other than those used for Groundwater Recharge Volume and Water Quality Volume, must completely drain within 24 hours after the end of the design storm.
 14. Soils used for the construction of basins shall have low erodibility factors ("K" factors).
- B. Minimum floor elevations for all structures that would be affected by a basin, other temporary impoundments, or open conveyance systems where ponding may occur shall be two (2) feet above the 100-year water surface. If basement or underground facilities are proposed, detailed calculations addressing the effects of storm water ponding on the structure and water-proofing and/or flood-proofing design information shall be submitted for approval.
- C. All storm sewer pipes, culverts and bridges (excluding detention and retention basin outfall structures), gutters and swales conveying water originating only from within the boundaries of the Development Site shall be designed for a twenty-five (25) year storm event. All storm sewer pipes, culverts and bridges (excluding detention and retention basin outfall structures) conveying water originating from offsite shall be designed for a fifty (50) year storm event. Drainage easements shall be provided to contain and convey the 100-year frequency flood throughout the Development Site. Easements shall begin at the furthest upstream property line of the proposed Development Site in a watershed.
- D. A concentrated discharge of storm water to an adjacent property shall be within an existing natural drainageway or watercourse or otherwise an easement shall be required.
- E. Storm sewer pipes other than those used as roof drains, detention basin underdrains, and street subbase underdrains, shall have a minimum diameter of fifteen (15) inches and be made of reinforced concrete pipe, corrugated galvanized metal pipe, smooth lined corrugated polyethylene pipe, or approved equivalent. Where installation conditions merit, structural calculations that address the actual design requirements will be required.
- F. Storm sewer pipes and culverts shall be installed on sufficient slopes to provide a minimum velocity of three (3) feet per second when flowing full.

- G. All storm sewer pipe and culverts shall be laid to a minimum depth of one (1) foot from finished subgrade to the crown of pipe in paved areas and one (1) foot from finished grade to the crown of pipe in grassed areas.
- H. Curves in pipes or box culverts without an inlet or manhole are prohibited. Tee joints, elbows and wyes are also prohibited.
- I. Manholes, inlets, headwalls and endwalls proposed for dedication or located along streets or subject to vehicular traffic, shall conform to the requirements of the Pa DOT, Bureau of Design, Standards for Roadway Construction in effect at the time the design is submitted, or as otherwise modified by the Municipality.
- J. Headwalls and endwalls shall be used where storm water runoff enters or leaves the storm sewer horizontally from a natural or manmade channel. PaDOT Type "DW" headwalls and endwalls shall be utilized.
- K. Storm water roof drains, sump pumps, and pipes, shall not directly discharge water into a street right-of-way or discharge into a sanitary sewer or storm sewer.
- L. All existing and natural watercourses, channels, drainage systems, wetlands and areas of surface water concentration shall be maintained in their existing condition unless an alteration is approved by the Municipality and any other necessary approving body.
- M. Flow velocities from any storm sewer may not result in erosion of the receiving channel.
- N. Energy dissipators shall be placed at the outlets of all storm sewer pipes, culverts, and bridges where flow velocities exceed maximum permitted channel velocities as specified below:
 - (1) Three (3) feet per second where only sparse vegetation can be established and maintained because of shade or soil condition.
 - (2) Four (4) feet per second where normal growing conditions exist and vegetation is to be established by seeding.
 - (3) Five (5) feet per second where a dense, vigorous sod can be quickly established or where water can be temporarily diverted during establishment of vegetation. Netting and mulch or the equivalent methods for establishing vegetation shall be used.
 - (4) Six (6) feet per second where there exists a well established sod of

good quality.

- O. The following conditions shall be met for all swales:
- (1) Capacities and velocities shall be computed using the Manning equation. The design parameters shall be as follows:
 - (a) Vegetated swales shall meet the following two design considerations:
 - (i) the first shall consider swale stability based upon a low degree of retardance ("n"=.03);
 - (ii) the second shall consider swale capacity based upon a high degree of retardance ("n"=.05).
 - (b) All vegetated swales shall have a minimum slope of one (1) percent unless approved by the municipal engineer.
 - (c) The "n" factors to be used for paved or rip-rap swales or gutters shall be based upon accepted engineering design practices as approved by the Municipality.
 - (2) All swales shall be designed to concentrate low flows to minimize siltation and meandering.
- P. Manning "n" values used for design of pipes and culverts shall be in accordance with Appendix B7.
- Q. All storm sewer crossings of streets shall be perpendicular to the street centerline.
- R. Storm facilities not located within a public right-of-way shall be contained in and centered within an easement. Easements shall follow property boundaries where possible.
- S. Storm Water Conveyance Improvements - If the Developer can prove under the "No Harm Option" (see Section 302.G) of the Act 167 Plan that it would be feasible to provide conveyance improvements (install or upgrade pipes, bridges, swales, etc.) to relieve existing deficiencies as defined by Section 303.C and any Local, State, or Federal regulations, the conveyance improvements could be provided by the Developer in lieu of storm water management facilities on the Development Site. Any conveyance improvements would be designed based on the eventual development of all areas tributary to the improvements and the conveyance criteria specified in this Ordinance. The eventual development of all tributary areas that the Developer must consider shall either be based on the current zoning or be

established by the Municipality, whichever results in a greater amount of impervious surface. It shall be assumed that all new development upstream of a proposed conveyance improvement would implement applicable storm water management techniques, consistent with this Ordinance.

- T. Adequate erosion protection shall be provided along all open channels, and at all points of discharge.
- U. All groundwater recharge facilities shall be designed to empty in 48 hours subsequent to any storm event. All water quality facilities shall be designed so that water is released slowly for a minimum of 24 hours subsequent to any storm event. All infiltration, detention or retention facilities the volume of which will be used for storm water management (pre vs. post) shall be designed to empty within 24 hours subsequent to any storm event. Volumes which will not be available within 24 hours subsequent to any storm event shall not be used for storm water management (pre vs. post).

Section 304. Calculation Methodology

Storm water runoff from all Development Sites shall be calculated using either the modified rational method, a soil-cover-complex methodology, or other method acceptable to the Municipality or its designee.

- A. Any storm water runoff calculations involving drainage areas generally greater than 200 acres and Tc greater than 60 minutes, 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 development site.

TABLE III-1 ACCEPTABLE COMPUTATION METHODOLOGIES FOR STORM WATER MANAGEMENT PLANS		
METHOD	METHOD DEVELOPED BY	APPLICABILITY
TR-20 (or commercial computer package based on TR-20)	USDA NRCS	Applicable where use of full hydrology computer model is desirable or necessary.
TR-55 (or commercial computer package based on TR-55)	USDA NRCS	Applicable for land development plans within limitations described in TR-55.
HEC-1 / HEC-HMS	US Army Corps of Engineers	Applicable where use of full hydrologic computer model is desirable or necessary.
Rational Method (or commercial computer package based on Rational Method)	Emil Kuichling (1889)	For development sites less than 200 acres, Tc < 60 min. or as approved by the Municipal Designee.
Other Methods	Varies	Other methodologies approved by the Municipal Designee.

- B. If the Soil-Cover-Complex Method is used, storm water runoff shall be based on the following 24-hour storm events published in "Urban Hydrology for Small Watersheds", by USDA NRCS Engineering Division, also known as TR55. The original source was the U. S. Department of Commerce, Weather Bureau Technical Paper No. 40 (TP-40), "Rainfall Frequency Atlas of the United States", May 1961.

Storm Event	Inches-of-Rainfall
2 years	3.1
5 years	4.1
10 years	5.0
25 years	5.5
50 years	6.2
100 years	7.0

If the NRCS method is used, Antecedent Moisture Condition 1 is to be used in areas of carbonate geology, and Antecedent Moisture Condition 2 is to be used in all other areas.

If the Rational Method is used, the Region 5, Pa DOT Storm Intensity - Duration - Frequency Chart (PDT-IDF), dated May 1986 shall be used to determine the rainfall intensity in inches per hour. See chart in Appendix B1.

Note: The Rational Method is not to be used for the design of Dams (as defined in Section II above).

- C. Runoff calculations shall include a hydrologic and hydraulic analysis indicating volume and velocities of flow and the grades, sizes, and capacities of water carrying structures, sediment basins, retention and detention structures and sufficient design information to construct such facilities. Runoff calculations shall also indicate both pre-development and post-development rates for peak discharge of storm water runoff from the Development Site.
- D. For the purpose of calculating pre-development peak discharges, all runoff coefficients, both on-site and off-site, shall be based on actual land use assuming summer or good land conditions. Runoff coefficients for off-site discharges used to design facilities shall be based on actual land use assuming winter or poor land conditions.
- E. Criteria and assumptions to be used in the determination of storm water runoff and design of management facilities are as follows:
 - (1) Runoff coefficients shall be based on the information contained in Appendix B2 and B3 if the actual land use is listed in those Appendices. If the actual land use is not listed in these Appendices, runoff coefficients shall be chosen from other published documentation, and a copy of said documentation shall be submitted with the storm water management report.

(2) Times of concentration shall be based on the following design parameters:

(a) Sheet flow: The maximum length for each reach of sheet or overland flow before shallow concentrated or open channel flow develops is one hundred fifty (150) feet. Flow lengths greater than one hundred (100) feet shall be justified based on the actual conditions at each development site. Sheet flow may be determined using the nomograph in Appendix B4, or the Manning's kinematic solution shown in the Sheet Flow section of Worksheet No. 1 in Appendix B5.

(b) Shallow concentrated flow: Travel time for shallow concentrated flow shall be determined using Figure 3-1 from TR-55, Urban Hydrology for small watersheds, as shown in Appendix B6.

A sample worksheet for calculating times of concentration is provided in Appendix B5.

(c) Open Channel flows: At points where sheet and shallow concentrated flows concentrate in field depressions, swales, gutters, curbs, or pipe collection systems, the travel times and downstream end of the development site between these design points shall be based upon Manning's Equation and/or acceptable engineering design standards as determined by the municipal engineer.

F. Ground Water Recharge requirements: The Ground Water Recharge Volume (Re_v) is the volume of storm water runoff from a developed site which shall be required to maintain existing pre-development groundwater recharge at Development Sites. It may be part of the Water Quality volume, and is calculated on the basis of treatment and recharge by structural storm water management practices, as follows:

$$Re_v = [(S) (R_v)(A)] / 12$$

Re_v = Recharge volume in acre-feet

A = Area of watershed in acres

$R_v = 0.05 + 0.9(I)$ where I = net increase in impervious area / Area of watershed (A)

S is the Soil Specific Recharge factor and varies according to soil type:

Hydrologic Soil Group	Soil Specific Recharge Factor (S)
A	0.32
B	0.22
C	0.10
D	0.05

Each specific recharge factor (S) is based on the USDA average annual recharge volume per soil type divided by the annual rainfall in Lancaster County (41 inches per year) and multiplied by 90% (to model a volume which captures 90% of the runoff). This keeps the recharge volume calculation consistent with the WQ methodology. The USDA average annual recharge volume per soil type is 18" for HSG "A", 12" for HSG "B", 6" for HSG "C", and 3" for HSG "D" (Rawls, Brakensiek & Saxton, 1982).

- (1) If more than one hydrologic soil group (HSG) is present at a development site, a composite recharge volume shall be computed based upon the proportion of total development site area within each HSG.
- (2) Infiltration BMPs intended to receive runoff from developed areas shall be selected based on suitability of soils and development site conditions and shall be constructed on soils that have the following characteristics:
 - (a) A minimum depth of 48 inches between the bottom of the facility and the seasonal high water table and/or bedrock (limiting zones)
 - (b) An infiltration and/or percolation rate sufficient to accept the additional storm water load and drain completely as determined by field tests conducted by the Owner's professional designer.
- (3) 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.
- (4) The recharge volume provided at the development site shall be directed to the most permeable HSG available.
- (5) Structural Storm water management facilities which provide treatment and recharge of the required Recharge Volume will be designed as part of a storm water management facility which incorporates groundwater recharge BMPs as a primary benefit of using that facility, in accordance with design specifications contained in "Pennsylvania Handbook of Best management Practices for Developing Areas", 1998, or the most recent version thereof.
- (6) The Groundwater Recharge volume shall be infiltrated within 48 hours after the end of the design storm.
- (7) Development sites where the post developed impervious area is equal to or less than the pre developed impervious area shall not be required to provide Ground Water Recharge volume.

- G. Calculation of Water Quality Volume: The Water Quality Volume (WQ_v) is the storage capacity needed to treat storm water runoff equivalent to a minimum of the first 1.2" of runoff from the developed areas of the development site. The following calculation is used to determine the storage volume, WQ_v , in acre-feet of storage:

$$WQ_v = [(1.2) (R_v)(A)] / 12$$

WQ_v = Water Quality volume in acre-feet

A = Area of watershed in acres

$R_v = 0.05 + 0.9(I)$ where I = net increase in impervious area / Area of watershed (A)

WQ_v shall be designed as part of a storm water management facility which incorporates water quality BMPs as a primary benefit of using that facility, in accordance with design specifications contained in "Pennsylvania Handbook of Best Management Practices for Developing Areas", 1998. The Water Quality volume shall take a minimum of 24 hours to be discharged from the basin. Development sites where the post developed impervious area is equal to or less than the pre developed impervious area shall not be required to provide Water Quality volume, unless required by NPDES part II.

Section 305. Use of Performance Standards and Criteria

The methodology for determining required storm water controls for a regulated activity is shown in Figure III-1 in Section 304, and is outlined below.

- A. Compute:
1. Pre-development hydrograph at the development site discharge point for the required design storm.
 2. Post-development hydrograph at the development site discharge point incorporating Best Management Practices such as groundwater recharge volume and water quality volume, pervious areas, grass swales, infiltration trenches, etc.

Note: Hydrographs may be obtained from NRCS methods such as TR-55, TR20, or from use of the "modified" or "unit hydrograph" rational methods.

- B. Compare:

Post-development hydrographs with pre-development hydrographs. If the peak rate of runoff does not exceed the pre-development runoff at all points

in time, storm water management has been achieved. Detention will not be required. If not, proceed to Item C.

C. Design:

Detention/retention facilities, in conjunction with any non-detention techniques, such that post-development peak rates from the development site will not exceed permissible levels for required design storms.

STORM WATER CONTROL DETERMINATION FLOW CHART

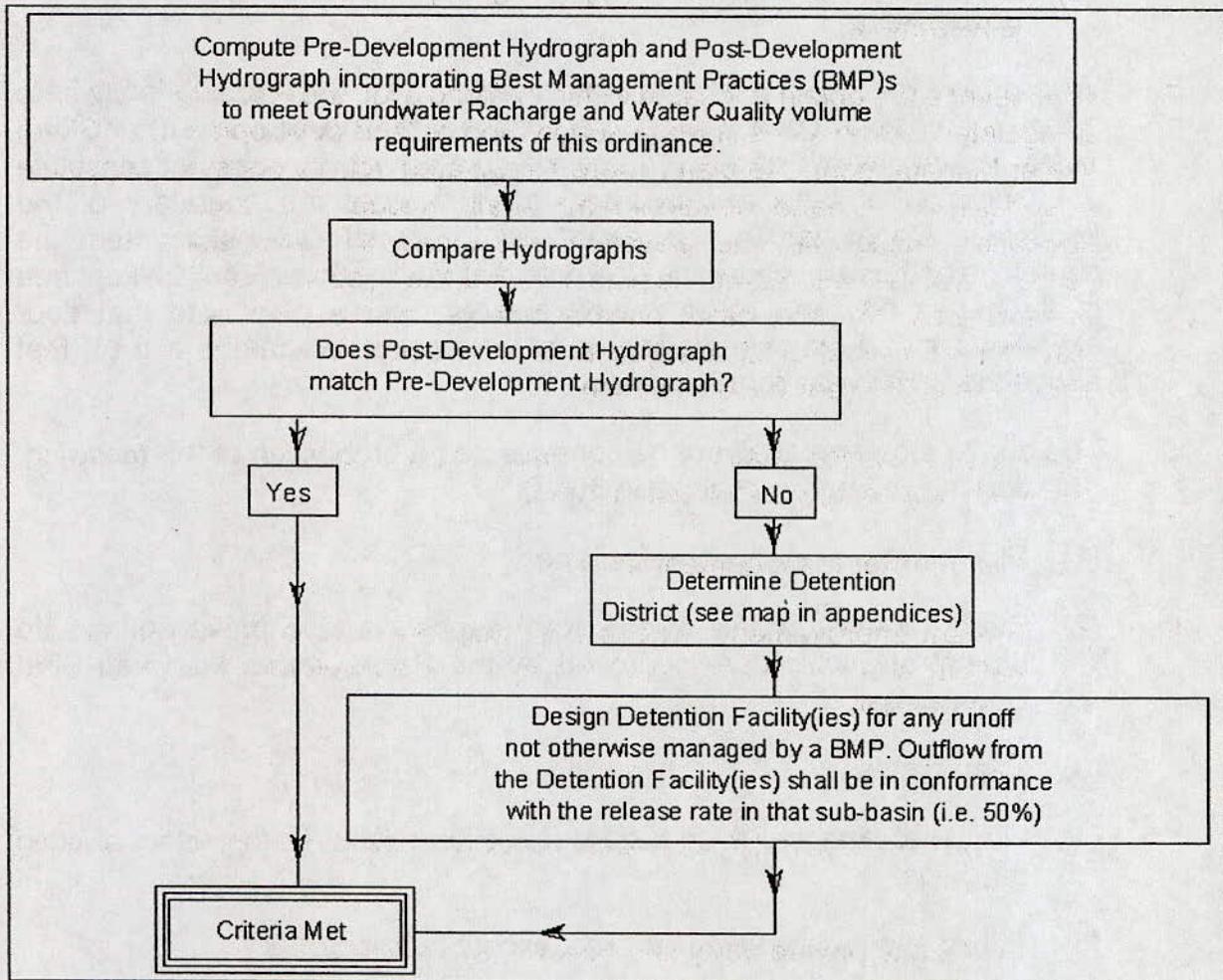


Figure III-1

Section 306. Floodplain Optional - not required by the Storm Water Management Act

Floodplain areas shall be established and preserved as provided below:

- A. A one hundred (100) year floodplain shall be established for all watercourses and shall be delineated by one of the following methods.
 - (1) A hydrologic report prepared by an individual registered in the Commonwealth of Pennsylvania to perform such duties.
 - (2) a hydrologic report prepared by an agency of the County, State, or U.S. Government.
- B. Whenever a floodplain is located within or along a lot, the Record Plan (where a regulated activity constitutes a subdivision or land development) or Storm Water Management Site plan (where a regulated activity does not constitute a subdivision or land development) shall include: the boundary of the floodplain, along with the elevation and locational dimensions from the centerline of the watercourse; a plan note that the floodplain shall be kept free of structures, fill, and other encroachments; and a plan note that floor elevations for all structures adjacent to the floodplain shall be two (2) feet above the Q100 year flood elevation.
- C. The above provision shall not be construed as a prohibition of the following, provided they comply with Section 306.D:
 - (1) Storm water management facilities.
 - (2) Stream improvements whose sole purpose is to improve aquatic life habitat and which are approved by the Pennsylvania Fish and Boat Commission.
 - (3) Farm ponds.
 - (4) Flood-proofing and flood hazard reduction structures to protect existing buildings.
 - (5) Public and private utility facilities, except buildings.
 - (6) Water-oriented uses (except building), e.g. docks, piers, boat launching ramps, hatcheries.
 - (7) Water monitoring devices.

(8) Culverts, bridges, and their approaches for floodplain crossings by streets, access drives, and driveways.³¹

D. Plans for any of the eight uses within a floodplain permitted under C shall demonstrate that the proposed uses do not increase the height or frequency of flooding; are installed so as to withstand the maximum volume, velocity, and force of floodplain water; are flood and flotation proof; do not endanger public health and safety; and do not degrade quality of surface water, or groundwater.

ARTICLE IV

STORM WATER MANAGEMENT SITE PLAN REQUIREMENTS

Section 401. Exemptions

- A. Any Regulated Activity that meets the exemption criteria in Ordinance Appendix A is exempt from the Storm Water Management Site Plan preparation provisions of this Ordinance. This criteria shall apply to the total development even if development is to take place in phases. The date of any previously adopted storm water management ordinance or the date of municipal ordinance adoption, whichever is older, shall be the starting point from which to consider tracts in which future subdivision and respective impervious area computations shall be cumulatively considered. Exemption shall not relieve the applicant from providing adequate storm water management to meet the purpose of this Ordinance.
- B. Land disturbance associated with existing one and two family dwellings, subject to conditions described in Appendix A of this Ordinance.
- C. Agricultural Activities 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 and grazing animals and other such activities are specifically exempt from complying with the requirements of this Ordinance.
- D. Forest Management operations which are following the PaDEP management practices contained in its publication "Soil Erosion and Sedimentation Control Guidelines for Forestry" and are operating under an erosion and sedimentation control plan.

Section 402. Storm Water Management Site Plan Contents

All activities regulated by Section 104 of this ordinance and governed by the Act 167 Plan shall prepare a Storm Water Management site Plan. The Storm Water Management Site 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 Storm Water Management Site Plan materials shall be submitted to the Municipality or its designee in a format that is clear, concise, legible, neat and well organized. Incomplete submissions shall be returned to the Applicant within 7 days, along with a statement that the submission is incomplete, and stating the deficiencies found. Otherwise, the application shall be deemed accepted for filing as of the date of submission. Acceptance shall not, however, constitute a waiver of any deficiencies or irregularities. The applicant may appeal the Municipality's decision not to accept a particular application in accordance with Section 806 of this Ordinance.

The following items shall be included in the Storm Water Management Site Plan:

- A. General
 - 1. General description of project.
 - 2. General description of permanent storm water management techniques, including construction specifications of the materials to be used for storm water management facilities.
 - 3. Complete hydrologic, hydraulic, and structural computations for all storm water management facilities.
 - 4. Plans shall be legible in every detail.
- B. Drawings or map(s) of the project area shall be drawn at 1" = 50' or larger scale and shall be submitted on 24-inch x 36-inch sheets and shall be prepared in a form that meets the requirements for recording for the Office of the Recorder of Deeds of Lancaster County. These drawings shall be in conformance with the applicable Subdivision and Land Development regulations. The contents of the map(s) 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 one or two feet. In areas of steep slopes (greater than 20 percent), five-foot 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, wetlands, sinkholes, streams, existing drainage courses, areas of natural vegetation to be preserved, and the total extent of the upstream area draining through the development 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 proposed contours at intervals of one or two feet. In areas of steep slopes (greater than 20 percent), five-foot 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 the plan submission.
12. A graphic and written scale of one inch equals no more than fifty feet.
13. A North arrow.
14. The total Development Site 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 two hundred (200) feet beyond the Development Site boundary that could be affected by the project.
17. Horizontal and vertical profiles of all open channels, including hydraulic capacity.
18. Overland drainage paths.
19. A minimum twenty (20) foot wide access easement around all storm water management facilities that would provide ingress from and egress to a public right-of-way.

20. For storm water management facilities that would be located off-site, a note on the Plan referencing a recorded Storm Water Maintenance Agreement which indicates the location and responsibility for maintenance of the offsite facilities. All off-site facilities shall meet the performance standards and design criteria specified in this Ordinance. See Section 703, "Maintenance Agreement for Privately Owned Storm Water Facilities", for maintenance of on-site facilities.
21. A statement, signed by the landowner, acknowledging the storm water management system to be a permanent fixture that can be altered or removed only after approval of a revised Plan by the Municipality or its designee.
22. The following signature block for the Municipality or its designee:

"I, [Municipality or its designee], on this date [date of signature], have reviewed and hereby certify that the Storm Water Management Site Plan meets all design standards and criteria of the Conestoga River Watershed Act 167 Storm Water Management Ordinance."
23. 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 storm water management concept for the project.
 - b. Storm water runoff computations as specified in this Ordinance.
 - c. Storm water management techniques and best management practices to be applied both during and after development.
 - d. Expected project time schedule.
2. A soil erosion and sedimentation control Plan, including all reviews and approvals, as required by PaDEP or the Berks / Chester / Lancaster County Conservation District.
3. In areas of carbonate geology, a geologic assessment of the effects of storm water runoff and infiltration 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 storm water collection system that may receive runoff from the Development Site.

5. A Declaration of Adequacy / Highway Occupancy Permit from the PaDOT District Office when utilization of a PaDOT storm water facility is proposed.

D. Storm Water Management Facilities

1. All storm water management facilities must be located on a map and described in detail.
2. Plans for groundwater recharge facilities must show the locations of existing and proposed septic tank infiltration areas and wells. A minimum fifty (50) foot separation from On Lot Disposal System (OLDS) infiltration areas is required. Infiltration rates shall be based upon perk and probe tests conducted at the site of the proposed facility.
3. All calculations, assumptions and criteria used in the design of the storm water management facilities must be shown. If multiple facilities are used in conjunction with each other, such as infiltration best management practices with vegetation based management practices, a summary narrative shall be included describing any sequencing and how the facilities are meant to function with each other to manage storm water runoff.

Section 403. Storm Water Management Site Plan Submission

For the purpose of complying with this Ordinance, the steps below shall be followed for Storm Water Management Site Plan submission. For any activities that require a PaDEP Joint Permit Application and regulated under Chapter 105 or Chapter 106 of PaDEP's Rules and Regulations, require a PaDOT Highway Occupancy Permit, or require any other permit under applicable state or federal regulations, the permit(s) shall be part of the Storm Water Management Site Plan.

- A. Any Developer proposing to engage in a Regulated Activity shall submit Four (4) copies of the Storm Water Management Site Plan to the Municipality or its designee.
- B. Distribution of the Storm Water Management Site Plan will be as follows:
 1. Two (2) copies to the Municipality accompanied by the requisite Municipal Review Fee, as specified in this Ordinance.
 2. One (1) copy to the Municipal Engineer.
 3. One (1) copy to the Lancaster County Planning Commission.

Section 404. Storm Water Management Site Plan Review

- A. The Municipality or its designee shall review the Storm Water Management Site Plan for consistency with the adopted Act 167 Plan. The Municipality or its designee shall require receipt of a complete plan, as specified in this Ordinance.
- B. In the case of a Subdivision or Land Development, the Municipal Engineer shall review the Storm Water Management Site Plan for conformance with the municipal Subdivision and Land Development Ordinance (if any) for all provisions not superseded by this Ordinance.
- C. For Regulated Activities requiring a PaDEP Joint Permit Application, the Municipality or its designee shall notify PaDEP whether the Storm Water Management Site Plan is consistent with the Act 167 Plan and forward a copy of the review letter to the Municipality and the Developer. PaDEP may consider the Municipality or its designee's review comments in determining whether to issue a permit.
- D. The Developer shall be responsible for completing an "As-Built Survey" of all storm water management facilities included in the approved Storm Water Management Site Plan. The As-Built Survey and an explanation of any discrepancies with the design plans shall be submitted to the Municipality or its designee for final approval. In no case shall the Municipality or its designee approve the As-Built Survey until the Municipality or its designee receives a copy of an approved Declaration of Adequacy / Highway Occupancy permit from the PaDOT District Office, and any applicable permits from PaDEP.
- E. The Municipality or its designee's approval of a Storm Water Management Site Plan shall be valid for a period not to exceed one (1) year unless a schedule is submitted and approved for a longer period of time as part of the approval process. This one-year time period shall commence on the date that the Municipality or its designee approves the Storm Water Management Site Plan. If storm water management facilities included in this approved Storm Water Management Site Plan have not been constructed, or if an As-Built Survey of these facilities has not been approved within this one-year time period, then the Municipality or its designee may consider the Storm Water Management Site Plan disapproved and may recommend that the Municipality revoke any and all permits. Storm Water Management Site Plans that are considered disapproved by the Municipality or its designee shall be resubmitted in accordance with Section 403 of this Ordinance.

Section 405. Modification of Plans

- A. Certain modifications to a Storm Water Management Site Plan after submission but before approval shall require a re-submission of the modified Storm Water Management Site Plan consistent with Section 403 of this Ordinance and be subject to review as specified in Section 404 of this Ordinance. The modifications which would require a re-submission includes, but is not limited to, the following:
 - 1. A change in storm water management facilities or techniques.
 - 2. The relocation or re-design of storm water management facilities.
 - 3. Modifications that are necessary because soil or other conditions are not as stated on the Storm Water Management Site Plan (as determined by the Municipality or its designee or the Municipal Engineer),
- B. Any modification to a Storm Water Management Site Plan after approval shall be submitted to the Municipality or its designee, accompanied by the applicable Review Fee.

ARTICLE V Optional - not required by the Storm Water Management Act

INSPECTIONS

Section 501. Schedule of Inspections

- A. The Municipality or its designee, in conformance with Section 801, shall inspect all phases of the installation of any temporary or permanent storm water management facilities.

- B. During any stage of the work, if the Municipality or its designee determines that any temporary or permanent storm water management facilities are not being installed in accordance with the approved Storm Water Management Site Plan, the Municipality shall revoke any existing permits until a revised Storm Water Management Site Plan is submitted and approved, as specified in this Ordinance.

ARTICLE VI Optional - not required by the Storm Water Management Act

FEES AND EXPENSES

Section 601. General

The fees required by this Ordinance are the Municipal Review Fee. The Municipal Review Fee shall be established by the Municipality by separate resolution (meeting all requirements of the MPC) or by Ordinance to defray review costs incurred directly or indirectly by the Municipality and the Municipal Engineer. All fees shall be paid by the Applicant.

Section 602. Expenses Covered by Fees

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

- A. The review of the Storm Water Management Site Plan by the Municipality or its designee.
- B. The development site inspection.
- C. The inspection of storm water management facilities and drainage improvements during construction.
- D. The final inspection upon completion of the storm water management facilities and drainage improvements presented in the Storm Water Management Site Plan.
- E. Any additional work required to enforce any permit provisions regulated by this Ordinance, correct violations, and assure proper completion of stipulated remedial actions.
- F. Defray administration and clerical costs.

Section 603. Improvement Security

An improvement security (bond or letter of credit) for storm water related improvements shall be supplied by the Developer in conjunction with the subdivision/land development approval, or in conjunction with the Storm Water Management Site Plan approval if no subdivision/land development plan is required.

The applicant shall provide an improvement security to the Municipality for the timely installation and proper construction of all storm water management facilities as required by the approved Storm Water Management Site Plan and this ordinance equal to 110% of the construction cost of the required controls.

ARTICLE VII Optional - not required by the Storm Water Management Act

MAINTENANCE RESPONSIBILITIES

Section 701. Applicability

For the purposes of this Article, drainage courses, swales, storm water inlets, pipes, conduits, detention basins and other storm water management facilities, including Best Management Practices (BMPs), shall be included under the term "storm water management facilities".

Section 702. Maintenance Responsibilities

- A. The Storm Water Management Site Plan for the Development Site shall contain an operation and maintenance schedule prepared by the developer and approved by the Municipality providing for the necessary and proper operation and maintenance of the storm water management facility(ies). The maintenance schedule shall also be recorded with the Final Subdivision or Land Development Plan, if one is required.
- B. The Storm Water Management Site Plan for the Development Site shall establish responsibilities for the continuing operating and maintenance of all proposed storm water control facilities, including Best Management Practices (BMP's), consistent with the following principals:
 - 1. If a development contains structures such as streets, sewers and other public improvements that will be dedicated to the Municipality, storm water control facilities may also be dedicated to and maintained by the Municipality. Even if the Municipality elects to accept dedication of streets, the Municipality is under no obligation to accept storm water management facilities located outside of the public right-of-way.
 - 2. If a Development Site is to be maintained in single ownership or if sewers and other public improvements are to be privately owned and maintained, then the ownership and maintenance of storm water control facilities shall be the responsibility of the owner, lessee, private management entity, or any other parties in interests.
- C. 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 Subdivision / Land Development / Storm Water Management Site Plan. The acceptance of ownership and operating/maintenance responsibilities for any or all of the storm water management facilities is at the sole discretion of the

Municipality.

- D. Maintenance of storm water management facilities shall include, but not be limited to, the following:
1. Liming and fertilizing vegetated channels and other areas according to the specifications in the "Erosion and Sedimentation Control Handbook of Berks / Chester / Lancaster County."
 2. Reestablishment of vegetation by seeding and mulching or sodding of scoured areas or areas where vegetation has not been successfully established.
 3. Mowing as necessary to maintain adequate strands of grass and to control weeds. Chemical weed control may be used if federal, state and local laws and regulations are met. Selection of seed mixtures shall be subject to approval by the Municipality.
 4. Removal of silt from all permanent structures which trap silt or sediment in order to keep the material from building up in grass waterways, pipes, detention or retention basins, infiltration structures, or BMPs, and thus reducing their capacity to convey or store water.
 5. Regular inspection of the areas in question to assure proper implementation of BMPs, maintenance and care.
 6. All pipes, swales and detention facilities shall be kept free of any debris or other obstruction and in original design condition.

Section 703. Maintenance Agreement for Privately Owned Storm Water Management Facilities

- A. Prior to final approval of the development site's Storm Water Management Site Plan, the property owner shall sign and record a maintenance agreement covering all storm water control facilities that are to be privately owned. Said agreement, designated as Appendix F, is attached and made part hereto. The agreement shall stipulate that:
1. The owner 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 rights-of-way to assure access for 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 or company responsible for maintenance activities; in the event of a change, new information will be submitted to the Municipality within ten (10) days of the change.
 4. If the owner fails to maintain the storm water 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 reasonable costs. Failure to reimburse the Municipality may lead to a lien being placed against any or all properties which utilize the facility.
- 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. Maintenance of Facilities Accepted by the Municipality

- A. If storm water management facilities are accepted by the Municipality for dedication, the landowner/developer shall be required to pay a specified amount to the Municipal Storm water Maintenance Fund to defray costs of periodic inspections and maintenance expenses. The amount of the deposit shall be determined as follows:
1. If the storm water 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.
 2. 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.
- B. If a storage facility is proposed that also serves as a recreation facility (e.g. ballfield, 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.

- C. If at any time a dedicated storage facility is eliminated due to the installation of storm sewers or other storage facility such as a regional detention 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.
- D. All dedicated facilities shall be inspected once every three (3) years and after all major storm events by the municipal engineer to ensure the continued functioning of the facility. Maintenance will be conducted, based on these inspections, as is necessary to provide for the continued functioning of the facility. Costs of inspections and repairs are recoverable from the Municipal Storm water Maintenance Fund.

Section 705. Maintenance of Existing Facilities / BMPs

- A. Storm water management facilities existing on the effective date of this Ordinance on individual lots which have not been accepted by the Municipality or for which maintenance responsibility has not been assumed by a private entity such as a homeowners' association shall be maintained by the individual property owners. Such maintenance shall include at a minimum those items set forth in Section 702.E above. If the Municipality determines at any time that any permanent storm water management facility has been eliminated, altered, blocked through the erection of structures or the deposit of materials, or improperly maintained, the condition constitutes a nuisance and shall notify the property owner of corrective measures which are required, and provide for a reasonable period of time, not to exceed 30 days, within which the property owner shall take such corrective action. If the property owner does not take the required corrective action, the Municipality may either perform the work or contract for the performance of the work and bill the property owner for the cost of the work plus a penalty of 10% of the cost of the work. If such bill is not paid by the property owner within 30 days, the Municipality may file a municipal claim against the property upon which the work was performed in accordance with the applicable laws.
- B. No person shall modify, remove, fill, landscape or alter stormwater management facilities which have been installed on a property unless a storm water management permit has been obtained to permit such modification, removal, filling, landscaping or alteration. No person shall place any structure, fill landscaping or vegetation into a stormwater management facility or within a drainage easement which will limit or alter the functioning of the facility or easement in any manner.

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 investigate or ascertain the condition of the subject property in regard to any aspect regulated by this Ordinance.

Section 802. Notification

In the event that any 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 reasonable time limit, for correction of these violation(s). Failure to comply within the time specified shall subject such person to the penalty provisions of this Ordinance. All such penalties shall be deemed cumulative and shall not preclude by the Municipality from pursuing any and all other remedies.

Section 803. Enforcement / Violations

The municipal governing body is hereby authorized and directed to enforce all of the provisions of this ordinance. All inspections regarding compliance with the Storm water Management Site 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 development site throughout the duration of the construction activity. Periodic inspections may be made by the Municipality or designee during construction.
- B. It shall be unlawful for any person, firm, or corporation to undertake any activity under Section 104 on any property except as provided for in the approved storm water management site plan and pursuant to the requirements of this ordinance. It shall be unlawful to alter or remove any control structure required by the storm water management site plan pursuant to this ordinance or to allow the property to remain in a condition which does not conform to the approved storm water management site plan.
- C. At the completion of the project, and as 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 drawings.
- D. After receipt of the certification by the Municipality, a final inspection shall be conducted by the governing body or its designee to certify compliance with this ordinance.
- 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. Noncompliance with or failure to implement any provision of the permit.
 - b. A violation of any provisions 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 __ of this ordinance.
 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 storm water 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 revoked by the governing body cannot be reinstated. The applicant may apply for a new permit under the procedures outlined in this ordinance.

- G. An occupancy permit shall not be issued unless satisfactory inspection pursuant to Section 803.D 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.

- H. It shall be a violation of this Ordinance to commit any of the following acts:
 1. To commence land disturbance activities for which an approved Storm Water Management Site Plan is required prior to approval of said plan.
 2. To install, repair, modify or alter stormwater management facilities prior to obtaining an approved Storm Water Management Site Plan.
 3. To misuse or fail to maintain any storm water management facility install upon a property.
 4. To construct any improvements upon, grade, fill, or take any other action which will impair the proper functioning of any storm water management facility.
 5. To place false information on or omit relevant information from a Storm Water Management Site Plan.
 6. To fail to comply with any other provisions of this Ordinance.

Section 804. Public Nuisance

- A. Any violation of any provision of this Ordinance is deemed to be a public nuisance.
- B. Each day that a violation of any provision continues constitutes a separate violation.

Section 805. Penalties - Section 805.A should be reviewed by the Municipal Solicitor to determine its appropriateness to the Class of the Municipality (i.e. First or Second Class Township or Borough).

- A. Any person who or which has violated any provisions of this Ordinance, shall, upon a judicial determination thereof, be subject to civil judgment for each such violation of not less than _____ and 00/100 dollars (\$ _____), or more than _____ and 00/100 dollars

(\$ _____), for each violation, recoverable with costs. Each day that a violation occurs shall constitute a separate offense. All fines shall be paid to the _____ [Name of Municipality].

- B. In addition, the _____ [Name of Municipality] 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 may appeal to [the Municipality's governing body] within thirty days of that action.
- B. Any person aggrieved by any decision of [the Municipality's governing body] may appeal to the [County Court or Common Pleas] within thirty days of that decision.

Section 807. Modification of Facilities

A modification which involves a change in storm water management methods, techniques, or facilities, or which involves the relocation or redesign of storm water management facilities, or which is necessary because soil or other conditions are not as stated on the approved plan, shall require a resubmission by the developer in accordance with the plan requirements as set forth in 403 of this Ordinance.

Section 808. Modification of Ordinance Provisions

- A. The provisions of this Ordinance are intended as minimum standards for the protection of the public health, safety, and welfare. The Township/Borough reserves the right to modify or to extend them conditionally in individual cases as may be necessary in the public interest; provided, however, that such variation shall not have the effect of nullifying the intent and purpose of this Ordinance, and that the applicant shows that to the satisfaction of the Township/Borough that the applicable regulation is unreasonable, or will cause undue hardship, or that an alternative proposal will allow for equal or better results. The list of such modifications shall be listed on the plan.
- B. In granting waivers/modifications, the Township/Borough may impose such conditions as will, in its judgement, secure substantially the objectives of the standards and requirements of this Ordinance.

ENACTED and ORDAINED at a regular meeting of the [Name of the municipal governing body] on the ____th day of _____, 20____. This Ordinance shall take effect immediately.

[Name], [Title]

[Name], [Title]

[Name], [Title]

ATTEST:

[Name], Secretary (type or print)

I hereby certify that the foregoing Ordinance was advertised in the [name of newspaper] on [date], a newspaper of general circulation in the Municipality and was duly enacted and approved as set forth at a regular meeting of the [name of municipal governing body] held on [date].

[name], Secretary

APPENDIX A

ACT 167 STORM WATER MANAGEMENT EXEMPTION CRITERIA

Existing Developed Properties:

Lands improved with existing structures may be exempted for an additional 1,000 square feet of impervious surface in all Zoning Districts provided that flows from the site after development leave the site in the same manner as the pre-development condition and there are no adverse effects to the adjacent property(ies).

Existing Properties in Effective Agricultural Zones and Conservation Zones:

The following criteria shall apply to all existing lots, whether vacant or with existing improvements, in conservation zones and effective agriculture** areas (1 lot per 20 acres or larger). This exemption applies to the parent tract of record and any lots subdivided from it. After the Cumulative New Impervious Areas Exempt from Ordinance has been used for a parent tract, there will be no additional exemptions. The criteria below apply to the parent tract.

Total Parcel Size	Minimum Distance* (Feet)	Cumulative New Impervious Areas Exempt from Ordinance
0-0.5 acre	10	500 sq. ft.
0.5-1 acre	50	2,500 sq. ft.
1-2 acres	100	10,000 sq. ft.
>2-5 acres	250	15,000 sq. ft.
>5 acres	500	20,000 sq. ft.

* The minimum distance between the proposed impervious area and/or storm water controls/structure discharge point to the downslope property line of the Parent Tract. In lieu of meeting the minimum distance criteria, the applicant may provide documentation from a Qualified Registered Professional in the state of Pennsylvania that the increased flows from the site leaves the site in the same manner as the pre-development condition and that there will be no adverse effects to adjacent property, or the increased flows reach a natural drainage way or existing storm water management structure before affecting adjacent property.

** All farms for which an exemption is requested shall have a Conservation Plan approved by the appropriate officials.

ORDINANCE APPENDIX B

DESIGN CRITERIA

APPENDIX NO B-1

PA-DOT REGION 5 STORM IDF DATA BASE
 RAINFALL INTENSITY (Inches/Hour)

TIME (Min.)	STORM FREQUENCY (Years)					
	2	5	10	25	50	100
5.0	4.63	5.40	6.02	6.70	7.51	8.19
6.0	4.34	5.15	5.70	6.39	7.22	7.90
7.0	4.12	4.95	5.42	6.10	6.95	7.62
8.0	3.92	4.70	5.17	5.85	6.70	7.36
9.0	3.75	4.50	4.95	5.62	6.47	7.12
10.0	3.59	4.30	4.75	5.41	6.26	6.90
11.0	3.45	4.15	4.58	5.22	6.07	6.70
12.0	3.32	4.00	4.42	5.05	5.88	6.50
13.0	3.21	3.85	4.27	4.89	5.71	6.33
14.0	3.10	3.70	4.16	4.74	5.56	6.16
15.0	3.00	3.55	4.00	4.60	5.40	6.00
20.0	2.60	3.10	3.50	4.03	4.78	5.34
25.0	2.31	2.65	3.15	3.61	4.30	4.83
30.0	2.09	2.45	2.82	3.27	3.92	4.41
40.0	1.76	2.05	2.39	2.78	3.34	3.79
50.0	1.53	1.77	2.08	2.42	2.92	3.33
60.0	1.35	1.60	1.85	2.15	2.60	2.98

APPENDIX NO. B-2

**RUNOFF COEFFICIENTS "C" FOR
RATIONAL FORMULA**

Runoff Coefficients "C" for Rational Formula												
Soil Group	A			B			C			D		
Slope	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Land Use												
Cultivated Land												
winter conditions	.14	.23	.34	.21	.32	.41	.27	.37	.48	.34	.45	.56
summer conditions	.10	.16	.22	.14	.20	.28	.19	.26	.33	.23	.29	.38
Fallowed Fields												
poor conditions	.12	.19	.28	.17	.25	.34	.23	.33	.40	.27	.35	.45
good conditions	.08	.13	.16	.11	.15	.21	.14	.19	.26	.18	.23	.31
Forest/Woodland	.08	.11	.14	.10	.14	.18	.12	.16	.20	.15	.20	.25
Grass Areas												
good conditions	.10	.16	.20	.14	.19	.26	.18	.22	.30	.21	.25	.35
average conditions	.12	.18	.22	.16	.21	.28	.20	.25	.34	.24	.29	.41
poor conditions	.14	.21	.30	.18	.28	.37	.25	.35	.44	.30	.40	.50
Impervious Areas	.90	.91	.92	.91	.92	.93	.92	.93	.94	.93	.94	.95
Weighted Residential												
lot size 1/8 acre	.29	.33	.36	.31	.35	.40	.34	.38	.44	.36	.41	.48
lot size 1/4 acre	.26	.30	.34	.29	.33	.38	.32	.36	.42	.34	.38	.46
lot size 1/3 acre	.24	.28	.31	.26	.32	.35	.29	.35	.40	.32	.36	.45
lot size 1/2 acre	.21	.25	.28	.24	.27	.32	.27	.31	.37	.30	.34	.43
lot size 1 acre	.18	.23	.26	.21	.24	.30	.24	.29	.36	.28	.32	.41

APPENDIX NO. B-3

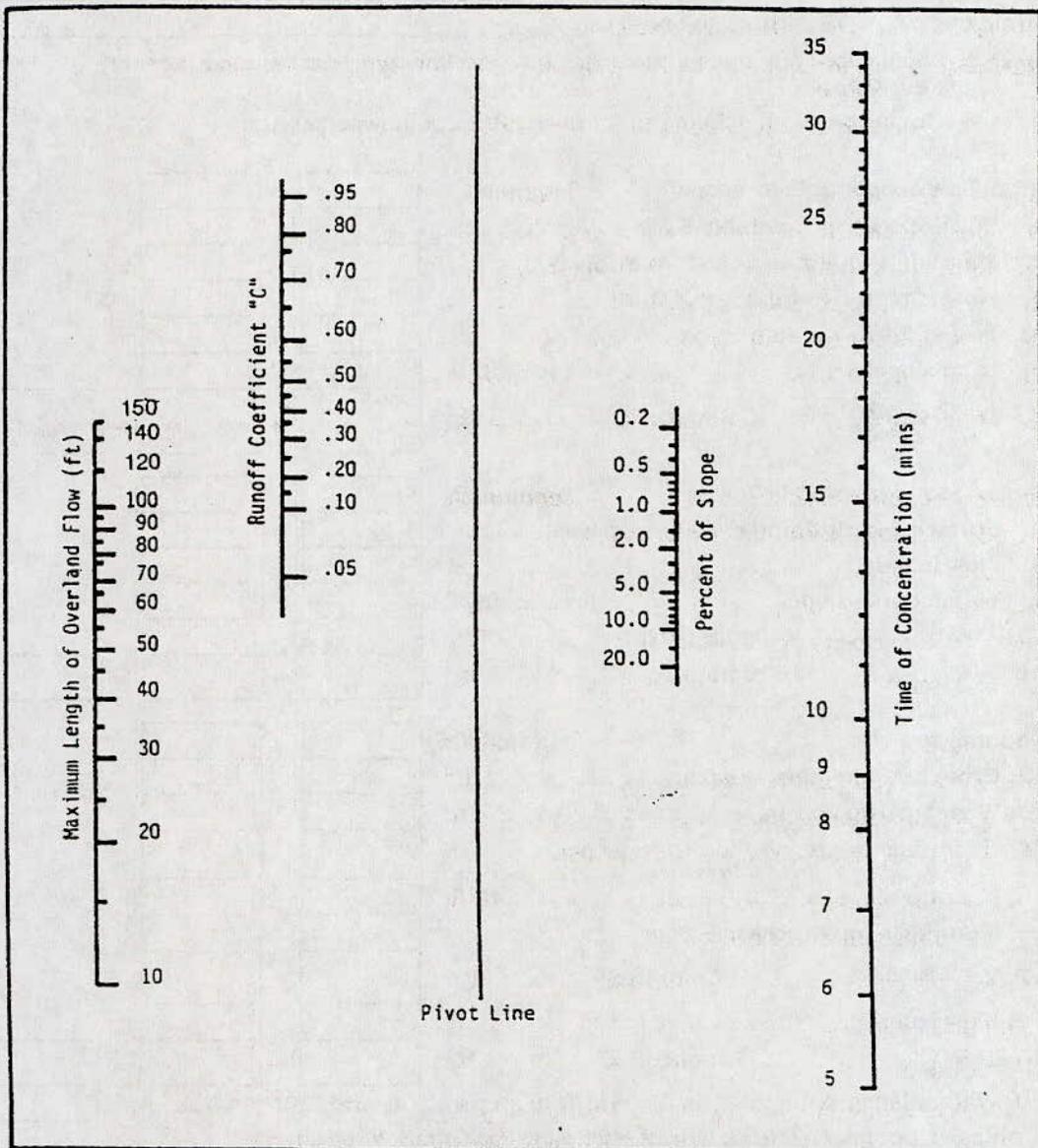
**RUNOFF CURVE NUMBERS "CN" FOR
SCS METHOD**

Runoff Curve Numbers "CN" for SCS Method												
Soil Group	A			B			C			D		
Slope	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+	0-2%	2-6%	6%+
Land Use												
Cultivated Land												
winter conditions	48	60	65	62	73	73	68	78	79	77	81	88
summer conditions	35	51	61	48	55	70	57	65	77	64	69	80
Fallowed Fields												
poor conditions	45	54	76	56	63	85	64	74	90	69	77	93
good conditions	30	44	74	43	48	83	48	54	88	56	60	90
Forest/Woodland	30	30	40	42	46	55	45	50	70	50	56	77
Grass Areas												
good conditions	35	39	51	48	54	61	56	59	74	62	63	80
average conditions	45	49	53	52	55	69	60	63	79	65	69	84
poor conditions	48	55	68	56	67	79	66	74	86	73	81	89
Impervious Areas	96	97	98	96	97	98	96	97	98	96	97	98
Weighted Residential												
lot size 1/8 acre	71	75	77	74	76	85	78	80	90	81	83	92
lot size 1/4 acre	61	62	67	66	69	75	67	69	83	75	78	87
lot size 1/2 acre	57	59	65	64	66	72	65	66	81	74	77	86
lot size 1/2 acre	54	57	63	62	64	70	63	65	80	72	76	85
lot size 1 acre	51	55	62	61	63	68	61	64	79	71	75	84

APPENDIX NO. B-4

NOMOGRAPH FOR DETERMINING SHEET FLOW

(for use with the Rational Method)



APPENDIX NO. B-5

Worksheet #1: Time of concentration (T_c) or travel time (T_t)

Project _____ By _____ Date _____

Location _____ Checked _____ Date _____

Circle one: Present Developed _____

Circle one: T_c T_t through subarea _____

NOTES: Space for as many as two segments per flow type can be used for each worksheet.

Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T _c only)	Segment ID			
1. Surface description (table 3-1)				
2. Manning's roughness coeff., n (table 3-1)				
3. Flow length, L (total L ≤ **150 ft)				
4. Two-yr 24-hr rainfall, P ₂				
5. Land slope, s				
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T _t				

Shallow concentrated flow	Segment ID			
7. Surface description (paved or unpaved)				
8. Flow length, L				
9. Watercourse slope, s				
10. Average velocity, V (figure 3-1)				
11. $T_t = \frac{L}{3600 V}$ Compute T _t				

Channel flow	Segment ID			
12. Cross sectional flow area, a				
13. Wetted perimeter, P _w				
14. Hydraulic radius, $r = \frac{a}{P_w}$ Compute r				
15. Channel slope, s				
16. Manning's roughness coeff., n				
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V				
18. Flow length, L				
19. $T_t = \frac{L}{3600V}$ Compute T _t				
20. Watershed or subarea T _c or T _t (add T _t in steps 6, 11, and 19)				

*Table 3-1 per latest TR-55, Urban Hydrology for Small Watershed
 **150' sheet flow length per latest TR-55 revision

APPENDIX NO. B-6

AVERAGE VELOCITIES FOR ESTIMATING TRAVEL TIME FOR SHALLOW CONCENTRATED FLOW

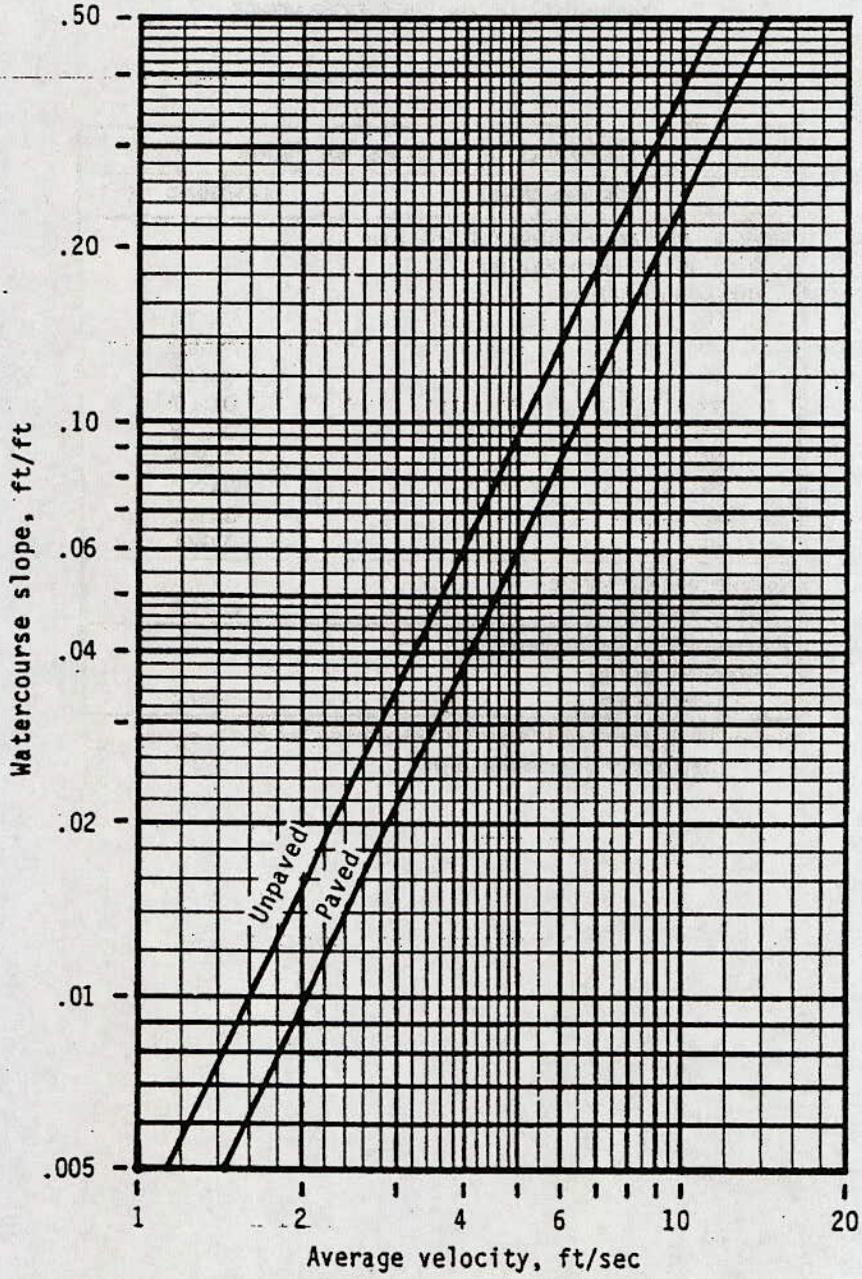


Figure 3-1.—Average velocities for estimating travel time for shallow concentrated flow.

APPENDIX NO. B-7

MANNING "n" VALUES FOR PIPES

Manning "n" Values for Pipes	
PIPE MATERIAL	MANNING "n"
Helical corrugated steel/aluminum 2 ² / ₃ x 1 ¹ / ₂ corrugations diameter (inches)	
15	0.014
18	0.015
21	0.016
24	0.017
27	0.018
30	0.019
36	0.020
42	0.021
48	0.021
Reinforced Concrete All diameters	0.013
Corrugated Polyethylene Smooth lining All diameters	0.012

Note: Arch pipe shall have the Manning "n" of an equal periphery of circular pipe.

ORDINANCE APPENDIX C

SAMPLE STORM WATER MANAGEMENT SITE PLAN APPLICATION

SAMPLE STORM WATER MANAGEMENT SITE PLAN APPLICATION

(TO BE ATTACHED TO THE "LAND SUBDIVISION PLAN OR DEVELOPMENT PLAN REVIEW APPLICATION:
OR "MINOR LAND SUBDIVISION PLAN REVIEW APPLICATION")

APPLICATION IS HEREBY MADE FOR REVIEW OF THE STORM WATER MANAGEMENT AND EROSION
AND SEDIMENTATION CONTROL PLAN AND RELATED DATA AS SUBMITTED HERewith IN
ACCORDANCE WITH THE _____ TOWNSHIP STORM WATER 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 NO. _____

(IF CORPORATION, LIST THE CORPORATIONS 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 NO. _____
ADDRESS _____

_____ ZIP _____

4. NAME AND ENGINEER OR SURVEYOR _____ TELEPHONE NO. _____
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 LOTS	_____ MOBILE-HOME PARK	_____ INDUSTRIAL (MULTI-LOT)
_____ CLUSTER TYPE LOTS	_____ CAMPGROUND	_____ INDUSTRIAL (ONE-LOT)
_____ PLANNED RESIDENTIAL DEVELOPMENT	_____ OTHER (_____)	

6. LINEAL FEET OR NEW ROAD PROPOSES? _____ L.F.

7. AREA OF PROPOSED AND EXISTING IMPERVIOUS AREA ON ENTIRE TRACT.

A. EXISTING (TO REMAIN) _____ L.F.
B. PROPOSED _____ L.F.

8. STORM WATER

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.)
(CHECK ONE)

___ NO. OF SUBAREA _____
___ WATERSHED NAME _____
___ OTHER _____

EXPLAIN: _____

C. IS THE PROPOSED RUNOFF REDUCED TO THE ALLOWABLE RELEASE RATE FOR THE
SUBAREA IN WHICH THE SITE IS LOCATED FOR THE 2.33- AND 50- YEAR DESIGN
STORM? _____

D. NUMBER OF SUBAREA FROM PLATE 1, VOLUME 1 TECHNICAL MANUAL OF THE MILL
CREEK WATERSHED STORM WATER MANAGEMENT PLAN. _____

E. TYPE OF PROPOSED RUNOFF CONTROL _____

F. DOES THE PROPOSED STORM WATER CONTROL CRITERIA MEET THE
REQUIREMENTS/GUIDELINES OF THE STORM WATER ORDINANCES? _____
- IF NOT, WHAT VARIANCES/WAIVERS ARE REQUESTED? _____

REASONS WHY _____

G. DOES THE PLAN MEET THE REQUIREMENTS OF ARTICLE III OF THE STORM WATER
ORDINANCES? _____ - IF
NOT, WHAT VARIANCES/WAIVERS ARE REQUESTED _____

WHY _____ - REASONS

H. WAS TR-55, JUNE 1986, UTILIZED IN DETERMINING THE TIME OF CONCENTRATION?

I. IS A HYDRAULIC ROUTING THROUGH THE STORM WATER CONTROL STRUCTURE
SUBMITTED? _____

J. IS A CONSTRUCTION SCHEDULE OR STAGING ATTACHED? _____

K. IS A RECOMMENDED MAINTENANCE PROGRAM ATTACHED? _____

L. WHO WILL HAVE ULTIMATE MAINTENANCE RESPONSIBILITY OF THE STORM WATER
CONTROL FACILITIES? _____

9. EROSION AND SEDIMENT POLLUTION CONTROL (E&S)

A. HAS THE STORM WATER MANAGEMENT AND E&S PLAN, SUPPORTING
DOCUMENTATION AND NARRATIVE BEEN SUBMITTED TO THE LANCASTER 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 WHOM WILL BE MAKING THE INSPECTIONS _____

- D. GENERAL COMMENTS ABOUT STORM WATER MANAGEMENT AT DEVELOPMENT

CERTIFICATE OF OWNERSHIP AND ACKNOWLEDGMENT OF APPLICATION:
COMMONWEALTH OF PENNSYLVANIA COUNTY OF LANCASTER SS

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

Property Owner Property Owner

My Commission Expires _____, 20____ Notary
Public or Officer

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

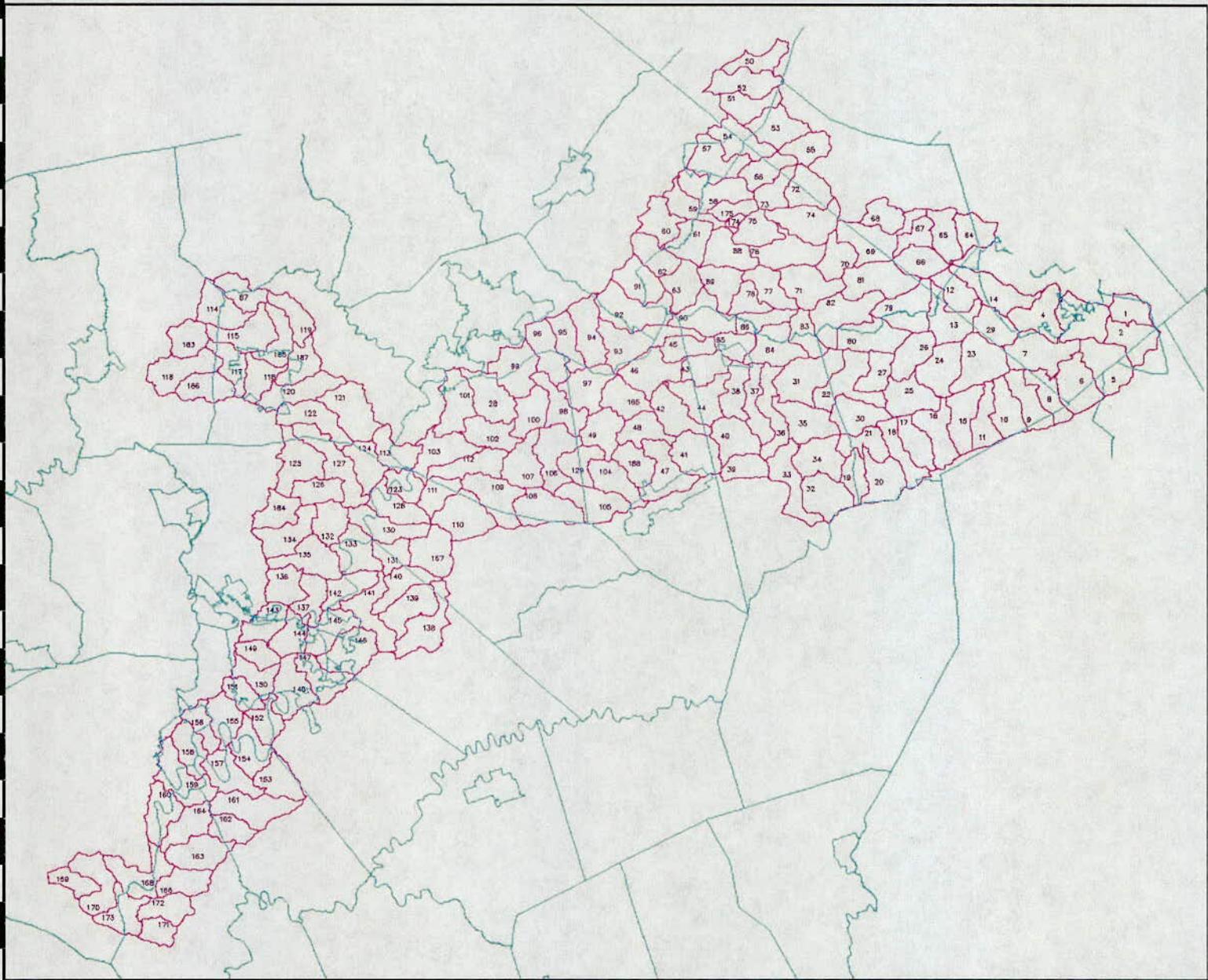
SIGNATURE OF APPLICANT _____

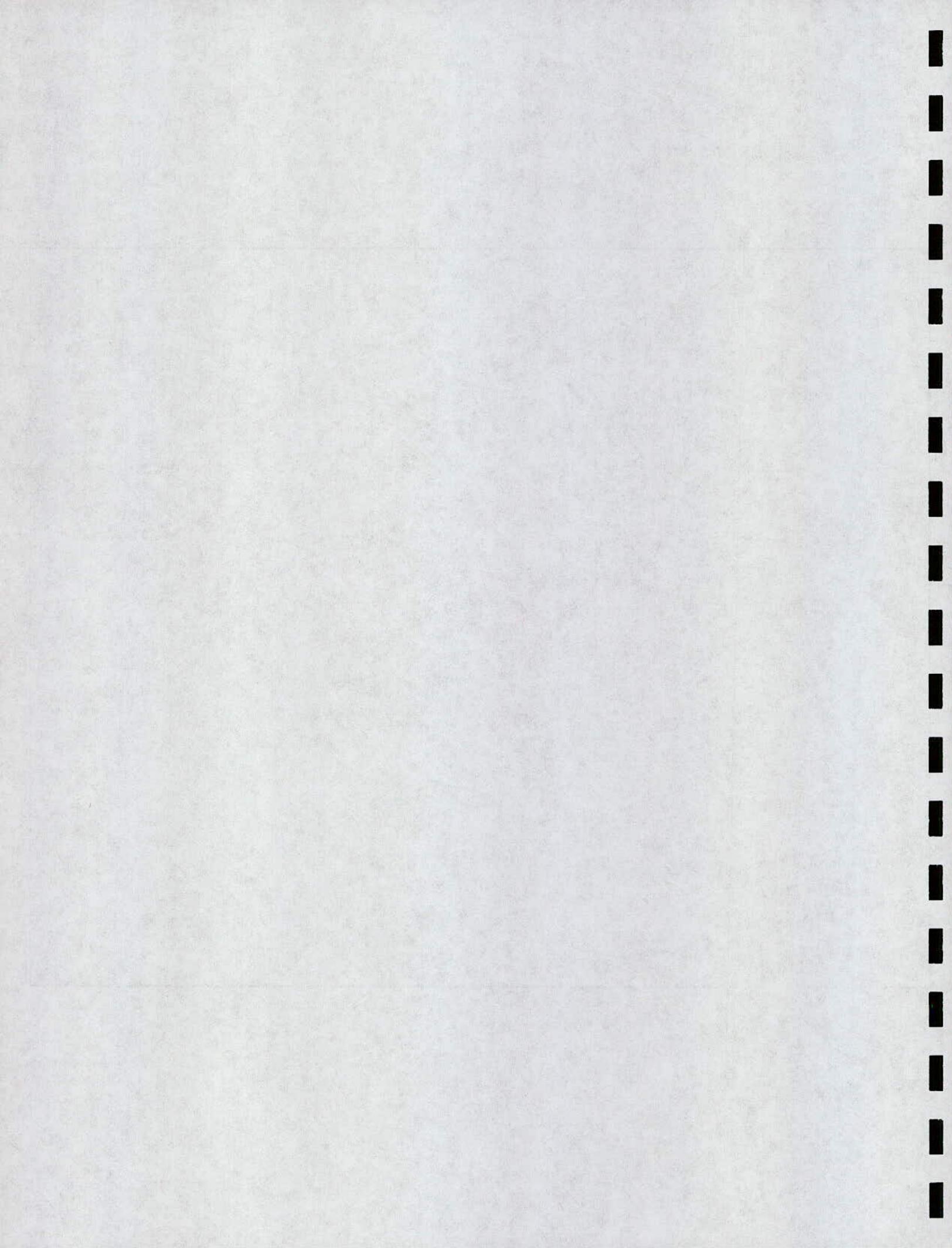
**

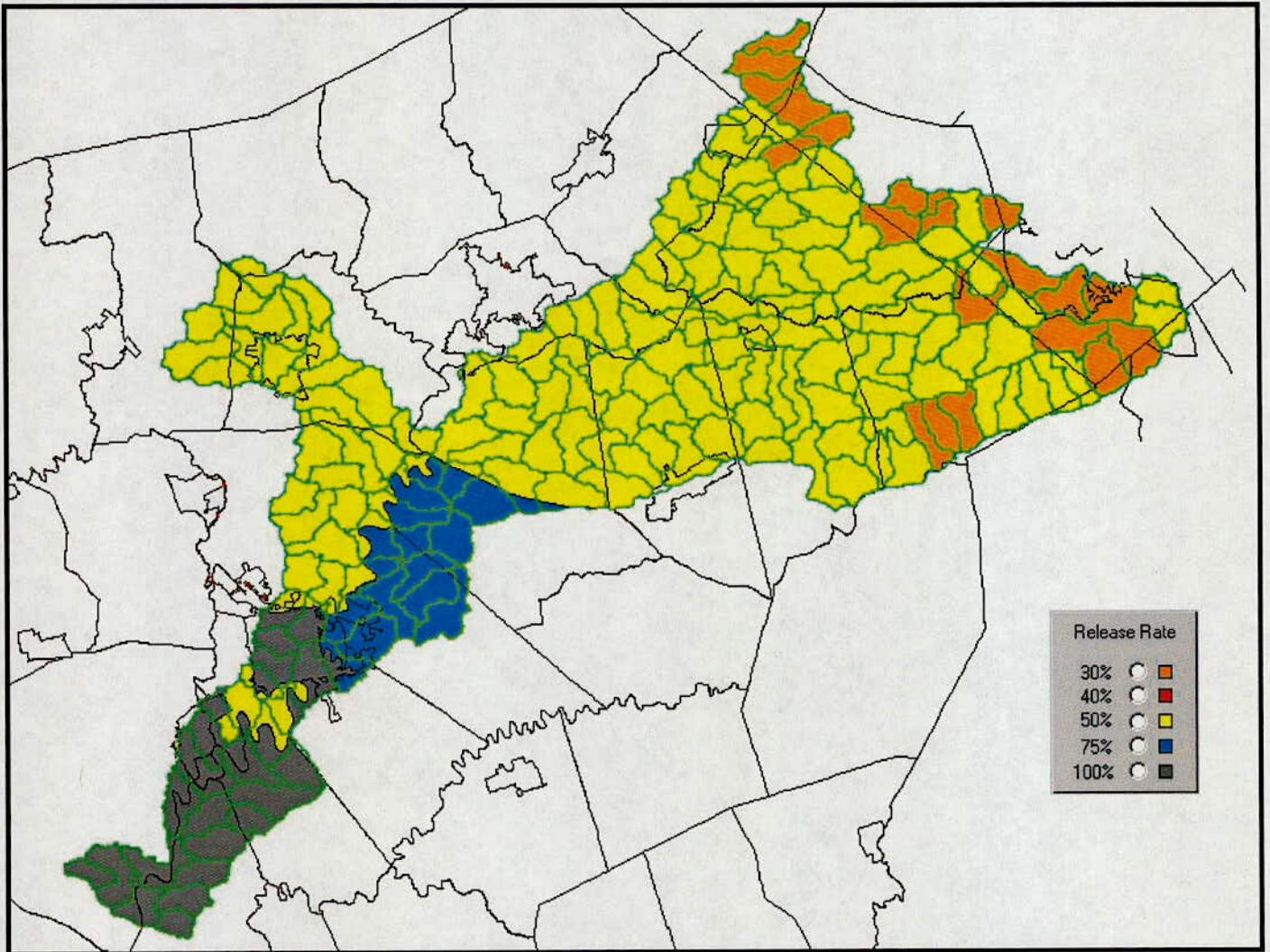
(INFORMATION BELOW THIS LINE TO BE COMPLETED BY THE TOWNSHIP)

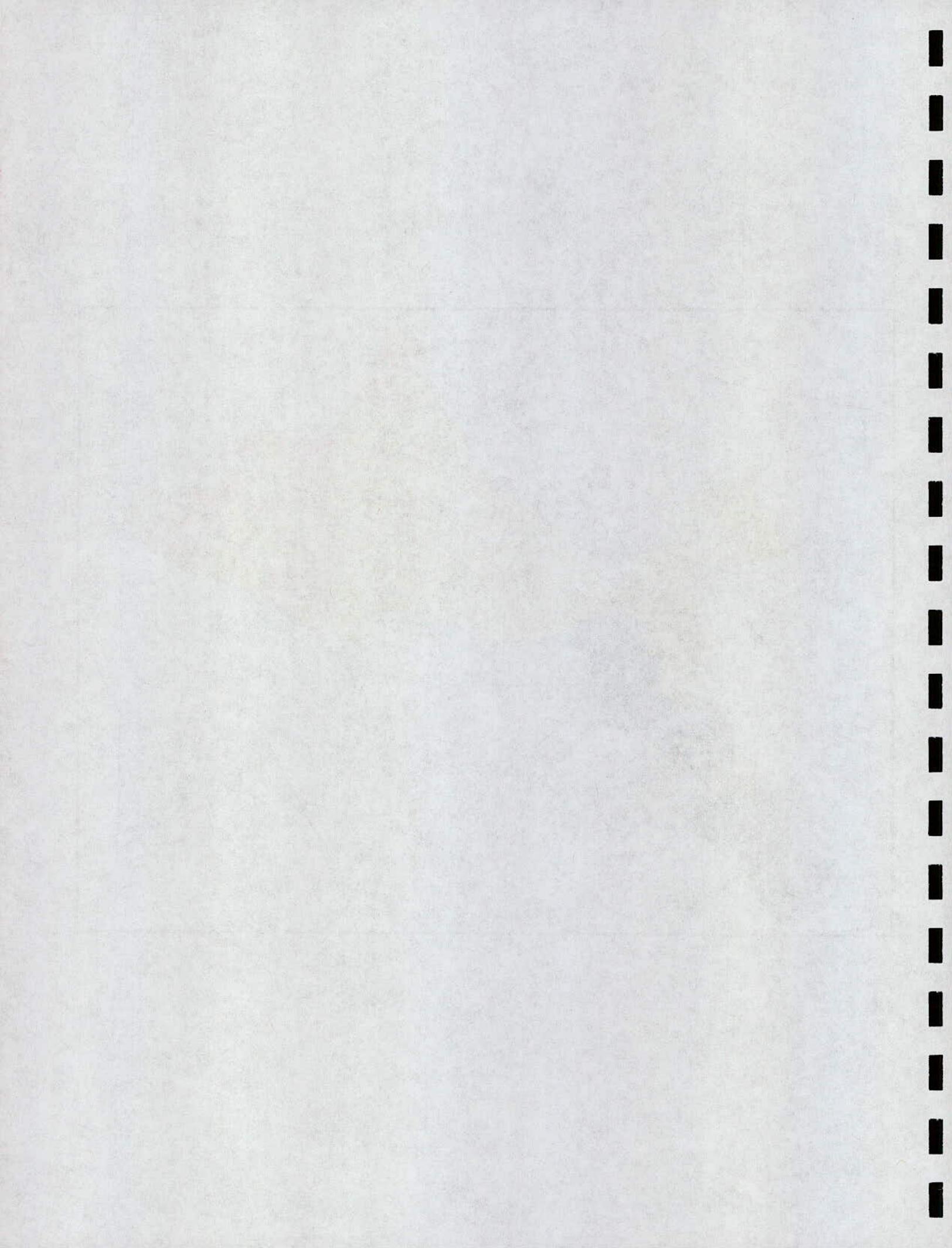
_____ TOWNSHIP OFFICIAL SUBMISSION RECEIPT.
DATE COMPLETE APPLICATION RECEIVED _____ PLAN NUMBER _____
FEES _____ DATE FEES PAID _____ RECEIVED BY _____
OFFICIAL SUBMISSION RECEIPT DATE _____
RECEIVED BY _____

ORDINANCE APPENDIX D
PROPOSED SCHEDULE OF FEES









ORDINANCE APPENDIX E
SUBWATERSHED BOUNDARY MAP

_____ TOWNSHIP
DRAINAGE PLAN
PROPOSED SCHEDULE OF FEES

SUBDIVISION NAME _____ SUBMITTAL NO. _____

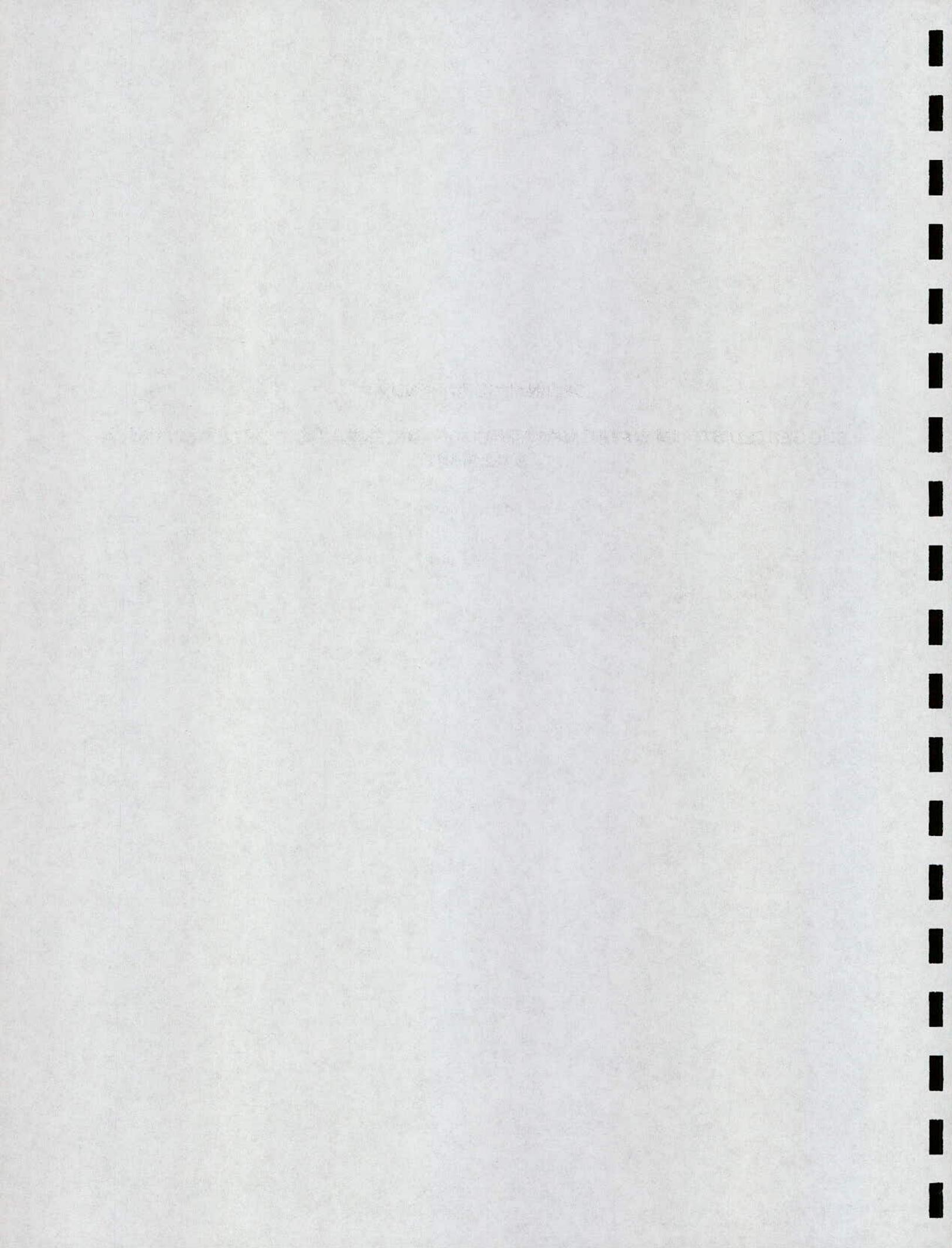
OWNER _____ DATE _____
 ENGINEER _____

1.	FILING FEE	\$ _____
2.	LAND USE	
2A.	SUBDIVISIONS, CAMPGROUNDS, MOBILE HOME PARKS, AND MULTI-FAMILY DWELLINGS WHERE THE UNITS ARE LOCATED IN THE SAME LOCAL WATERSHED.	\$ _____
2B.	MULTI-FAMILY DWELLING WHERE THE DESIGNATED OPEN SPACE IS LOCATED IN A DIFFERENT LOCAL WATERSHED FROM THE PROPOSED UNITS.	\$ _____
2C.	COMMERCIAL/INDUSTRIAL	\$ _____
3.	RELATIVE AMOUNT OF EARTH DISTURBANCE	
3A.	RESIDENTIAL	
	ROAD >500 L.F.	\$ _____
	ROAD 500-2,640 L.F.	\$ _____
	ROAD >2,640 L.F.	\$ _____
3B.	COMMERCIAL/INDUSTRIAL AND OTHER	
	IMPERVIOUS AREA >3,500 S.F.	\$ _____
	IMPERVIOUS AREA 3,500-43,560 S.F.	\$ _____
	IMPERVIOUS AREA >43,560 S.F.	\$ _____
4.	RELATIVE SIZE OF PROJECT	
4A.	TOTAL TRACT AREA	
	<1AC	\$ _____
	1-5 AC	\$ _____
	5-25 AC	\$ _____
	25-100 AC	\$ _____
	100-200 AC	\$ _____
5.	STORM WATER CONTROL MEASURES	
5A.	DETENTION BASINS & OTHER CONTROLS WHICH REQUIRE REVIEW OF HYDRAULIC ROUTINGS. (\$ _____ PER CONTROL)	\$ _____
5B.	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 505 OF THE STORM WATER ORDINANCE. A NEW FEE SHALL BE SUBMITTED WITH EACH REVISION IN ACCORDANCE WITH THIS SCHEDULE.

ORDINANCE APPENDIX F

**SUGGESTED STORM WATER MANAGEMENT AGREEMENT AND DECLARATION OF
EASEMENT**



**SUGGESTED STORM WATER MANAGEMENT AGREEMENT
AND DECLARATION OF EASEMENT**

THIS AGREEMENT AND DECLARATION OF EASEMENT made as of this ____ day of _____, 2001, by and between the **[Municipality]**, Lancaster/Berks/Chester County, Pennsylvania, a [Township/Borough] duly organized under the laws of the Commonwealth of Pennsylvania, with its municipal offices located at [location] Pennsylvania (hereinafter referred to as the [Municipality]) and _____, with offices located at _____ (hereinafter whether singular or plural referred to as the "Grantor").

BACKGROUND.

Grantor is the legal and/or beneficial owner of premises located at _____, in the [Municipality], Lancaster/Berks/Chester County, Pennsylvania, as more specifically described in a deed recorded in Record Book _____, Volume _____, Page _____, in the Office of the Recorder of Deeds in and for Lancaster/Berks/Chester County, Pennsylvania, and as shown on the plan for _____, prepared by _____, Drawing or Project No _____, dated _____, 200__, last revised _____, 200__, (hereinafter referred to as the "Premises").

Prior to the commencement of any development, Grantor is required under the [Municipality] Storm Water Management Ordinance (the "Ordinance"), as codified at Chapter 26, Part 2, of the [Municipality] Code of Ordinances, to submit a Storm Water Management Site Plan to the [Township/Borough] for approval. Sections 702 and 703 of the Ordinance require that the Grantor make provision for the ownership of, and the method of administering and maintaining, all permanent storm water management facilities. Drainage courses, swales, storm water inlets, pipes, conduits, detention basins and other storm water management facilities, including Best

Management Practices (BMPs) shall be included under the term "storm water management facilities".

The purpose of this Agreement and Declaration of Easement is to describe the ownership and maintenance responsibilities for the storm water management facilities which will be installed on the Premises and to impose the ownership and maintenance responsibilities upon Grantor, its successors and assigns, and upon successor owners of the Premises.

NOW, THEREFORE, intending to be legally bound hereby and in consideration of receiving approval of its Storm Water Management Site Plan (hereinafter referred to as the "Plan") from the Board of Supervisors/Borough Council of [Municipality], and in consideration of receiving permits from the [Township/Borough] to develop the Premises, Grantor, for Grantor and the assigns and successors of Grantor, covenants and declares as follows:

1. The storm water facilities will be owned by Grantor, its successors and assigns.
2. All drainage courses, swales, storm water inlets, pipes, conduits, detention basins and other storm water management facilities, shall be installed, constructed and maintained by Grantor, its successors and assigns, in a first-class condition in conformance with the Plan, as approved by the Board of Supervisors/Borough Council of [Municipality], and in a manner sufficient to meet or exceed the design standards and specifications set forth on the Plan and the minimum design and maintenance standards and requirements set forth in Sections 303 and 304 of the Ordinance. These responsibilities shall include, but not be limited to, the following:

(a) Liming and fertilizing vegetated channels and other areas according to the specifications in the "Erosion and Sedimentation Control Handbook of Lancaster/Berks/Chester County."

(b) Reestablishment of vegetation by seeding and mulching or sodding of scoured

areas or areas where vegetation has not been successfully established.

(c) Mowing as necessary to maintain adequate strands of grass and to control weeds. Chemical weed control may be used if federal, state and local laws and regulations are met. Selection of seed mixtures shall be subject to approval by the [Township/Borough].

(d) Removal of silt from all permanent structures which trap silt or sediment in order to keep the material from building up in grass waterways, pipes, detention or retention basins, infiltration structures, or BMPs, and thus reducing their capacity to convey or store water.

(e) Regular inspection of the areas in question to assure proper implementation of BMPs, maintenance and care.

(f) All pipes, swales and detention facilities shall be kept free of any debris or other obstruction.

Grantor, its successors and assigns, shall be responsible for performing the foregoing maintenance and for implementing BMPs and maintaining BMP facilities as required by the Ordinance.

3. Grantor, for itself, its successors and assigns, agrees that the failure to maintain all drainage courses, swales, storm water inlets, pipes, conduits, detention basins, BMPs, and other storm water management facilities in a first-class condition in conformance with this Agreement and the Plan shall constitute a nuisance and shall be abatable by the [Township/Borough] as such.

4. Grantor, for itself, its successors and assigns, authorizes the [Township/Borough], at any time and from time to time, by its authorized representatives, to enter upon the Premises

to inspect the storm water management facilities.

5. The [Township/Borough] may require that Grantor, its successors or assigns, or any future owner or occupier of the Premises, or any part thereof, take such corrective measures as the [Township/Borough] may deem reasonably necessary to bring the Premises into compliance with this Agreement and with the Plan, as approved by the Board of Supervisors/Borough Council of [Municipality].

6. Upon the failure of the owner or occupier of the Premises to comply with the terms of this Storm Water Management Agreement or to take corrective measures following thirty (30) days' notice from the [Township/Borough], the [Township/Borough], through its authorized representatives, may take such corrective measures as it deems reasonably necessary to bring the Premises into compliance with this Agreement and with the Plan, including, but not limited to, the removal of any blockage or obstruction from drainage pipes, swales and detention basins, and may charge the cost thereof to Grantor, its successors or assigns, or any owner of the Premises and, in default of such payment, may cause a municipal lien to be imposed upon the Premises or any part thereof.

7. If ownership or maintenance responsibility of the storm water management facilities is assigned to a homeowners' association, condominium unit owners' association, or similar entity, the [Township/Borough] shall be notified. In the event such an association or entity has already been formed, the association or entity shall consent to and join in this Agreement. If such association or entity fails to properly maintain the storm water management facilities, the [Township/Borough] shall have the same rights granted to municipalities with reference to maintenance of common open space under Section 705 of the Pennsylvania Municipalities Planning Code, Act of July 31, 1968, P.L. 805, No. 247, or any future amendment thereof, to

maintain the storm water management facilities. Any association or entity hereinafter formed shall enter into an agreement with the [Township/Borough] recognizing its duties and the [Township/Borough]'s rights under this Agreement.

8. Grantor hereby imposes upon the Premises for the benefit of all present and future owners of the Premises or any part of the Premises, the [Township/Borough] and all other property owners affected by the storm water management facilities, the perpetual nonexclusive right, privilege and easement for the draining of storm water in and through the drainage courses, swales, storm water inlets, pipes, conduits, detention basins, BMPs, and other storm water management facilities depicted on the plan or plans submitted to the [Township/Borough] or hereafter made of record and now or hereafter installed on or constructed upon the Premises and, in addition, easements of access to the storm water management facilities.

9. Grantor shall include a specific reference to this Storm Water Management Agreement and Declaration of Easement and the requirement to implement BMPs and maintain BMP facilities in accordance with the minimum design standards and requirements for BMPs set forth in the Ordinance in any deed of conveyance for the Premises or any part thereof.

10. Grantor agrees to indemnify the [Township/Borough] and all of its elected and appointed officials, agents and employees (hereinafter collectively referred to as the "Indemnities") against and hold Indemnities harmless from any and all liability, loss or damage, including attorneys' fees and costs of investigation and defense, as a result of claims, demands, costs or judgments against Indemnities which arise as a result of the design, installation, construction or maintenance of the storm water management facilities.

11. The [Township/Borough] may, in addition to the remedies prescribed herein, proceed with any action at law or in equity to bring about compliance with the [Municipality] Storm

Water Management Ordinance and this Agreement.

12. Grantor's personal liability under this Agreement shall cease at such time as (a) all storm water management facilities have been constructed in accordance with the specifications of the [Municipality] Subdivision and Land Development Ordinance and the approved plans; (b) the storm water management facilities have been inspected and approved by the [Township/Borough] Engineer; (c) all financial security, including any maintenance security, posted by Grantor has been released by the [Township/Borough]; and (d) Grantor has transferred all lots to be created from the Premises to third parties. Notwithstanding the foregoing, Grantor's personal liability shall continue for any violations of this Agreement and Declaration of Easement which occurred during the time that Grantor owned the Premises or any lot created from the Premises or in the event the storm water management facilities were not completed, inspected or approved as set forth in (a) through (c) herein.

13. Grantor shall, upon completion of installation of the storm water management facilities, deposit financial security with the [Township/Borough] to secure the structural integrity of the storm water management facilities as well as the functioning of the storm water management facilities in accordance with the design and specifications of the approved plans and any modifications required by the [Township/Borough]. The financial security shall be in the amount of fifteen (15 %) percent of the actual cost of installation of the storm water management facilities and shall have a term of not less than eighteen (18) months.

14. It is the intent of the parties to this Agreement that personal liability and maintenance obligations shall pass to subsequent title owners upon change in ownership of the Premises or any lot created from the Premises, and such subsequent owners shall assume all personal liability and maintenance obligations for the time period during which they hold title.

Personal liability shall remain for any violations of this Agreement and Declaration of Easement which occurred during the period in which an owner held title.

15. This Agreement and Declaration of Easement shall be binding upon Grantor, the successors and assigns of Grantor, and all present and future owners of the Premises, or any part thereof, and is intended to be recorded in order to give notice to future owners of the Premises, or any part thereof, of their duties and responsibilities with respect to the storm water management facilities.

16. This Agreement and Declaration of Easement may be amended only by written instrument signed on behalf of all owners of the Premises and the [Township/Borough].

17. When the sense so requires, words of any gender used in this Storm Water Management Agreement and Declaration of Easement shall be held to include any other gender, and words in the singular number shall be held to include the plural, and vice versa.

IN WITNESS WHEREOF, the undersigned have caused this Agreement and Declaration to be executed on the day and year first above written.

[Municipality]

By:
(Vice) Chairman
Board of Supervisors/Borough Council

Attest:
(Assistant) Secretary

[[Township/Borough] SEAL]

(Individual or Husband and Wife Developer)

Witness:

(Signature of Individual) (SEAL)

(Signature of Spouse if Husband and Wife are Co-Developers) (SEAL)

(if individual or spouses operate a business Trading and doing business as:

(Partnership Developer*)

(Name of Partnership)

Witness:

By: Partner

By: Partner

By: Partner

*All Partners must execute this Agreement. Additional signature lines should be attached if necessary.

(Corporation Developer)

(Name of Corporation)

ATTEST:

By: (Assistant) Secretary

By: (Vice) President

[CORPORATE SEAL]

[[Township/Borough] ACKNOWLEDGMENT)

COMMONWEALTH OF PENNSYLVANIA)
) SS:
COUNTY OF Lancaster/Berks/Chester)

On this day of , 200__, before me, the undersigned officer, a notary public in and for the aforesaid Commonwealth and County, personally appeared _____, who acknowledged himself/herself to be (Vice) Chairman of the Board of Supervisors/Borough Council of the [Municipality], Lancaster/Berks/Chester County, Pennsylvania, and that he/she, as such officer, being authorized to do so, executed the foregoing Storm Water Management Agreement and Declaration of Easement, for the purposes therein contained, by signing the name of such [Township/Borough] by himself/herself as such officer.

IN WITNESS WHEREOF, I set my hand and official seal.

Notary Public

My commission expires:

JOINDER BY MORTGAGEE

(“Mortgagee”) as holder of a certain mortgage on the within-described Premises, which mortgage, in the amount \$_____, is dated _____, and is recorded or is about to be recorded in the Recorder of Deeds Office in and for Lancaster/Berks/Chester County, Pennsylvania, as well as any other mortgages which Mortgagee may now or hereafter hold on the Premises (all such mortgages hereinafter collectively referred to as the “Mortgages”), joins in, consents to, and expressly approves the grant of easements and other rights and privileges described in the attached Storm Water Management Agreement and Declaration of Easement (the “Agreement”).

The Mortgagee, for itself, its successors and assigns (which shall include any assignee of the Mortgages and any purchaser of the Premises at a sale in foreclosure of the Mortgages or otherwise), hereby covenants and agrees that the rights and privileges herein granted with respect to the Premises shall not be terminated or disturbed by reason of any foreclosure or other action which may be instituted by the Mortgagee, its successors and assigns, as a result of any default under the Mortgages or the debt of instruments that such Mortgages secure. Mortgagee by consenting to the Agreement shall not by virtue of its interest as Mortgagee be deemed to have undertaken any of the obligations of the Grantor under the Agreement, including but not limited to construction, maintenance, inspection or indemnification.

IN WITNESS WHEREOF, Mortgagee hereby joins in the execution of the Agreement as of this _____ day of _____, 20__.

(Name of Mortgagee)

ATTEST:

By:

[SEAL]

(MORTGAGEE ACKNOWLEDGMENT)

COMMONWEALTH OF PENNSYLVANIA)

)SS:

COUNTY OF Lancaster/Berks/Chester)

On this, the _____ day of _____, 200__ before me, a notary public, the undersigned officer, personally appeared _____, who acknowledged (him/her) self to be the _____ of _____ a corporation, and that as such officer, being authorized to do so, acknowledged the foregoing instrument for the purpose therein contained by signing the name of the Bank by (him/her) self as _____.

Notary Public

My Commission Expires:

Representation and Warranty Concerning Mortgages
Affecting Proposed Development

I (We), _____ the undersigned, intending to be legally bound, represent and warrant to [Municipality] that there are not presently nor will there be prior to the recording of the Storm Water Management Agreement and Declaration of Easement Agreement any mortgages affecting the property which is being developed in accordance with the subdivision and/or land development plan titled _____, prepared by _____, drawing or project number _____, dated _____, last revised _____.

The undersigned understand(s) and agree(s) that [Municipality] will rely upon this statement when releasing the aforementioned subdivision and/or land development plan for recording.

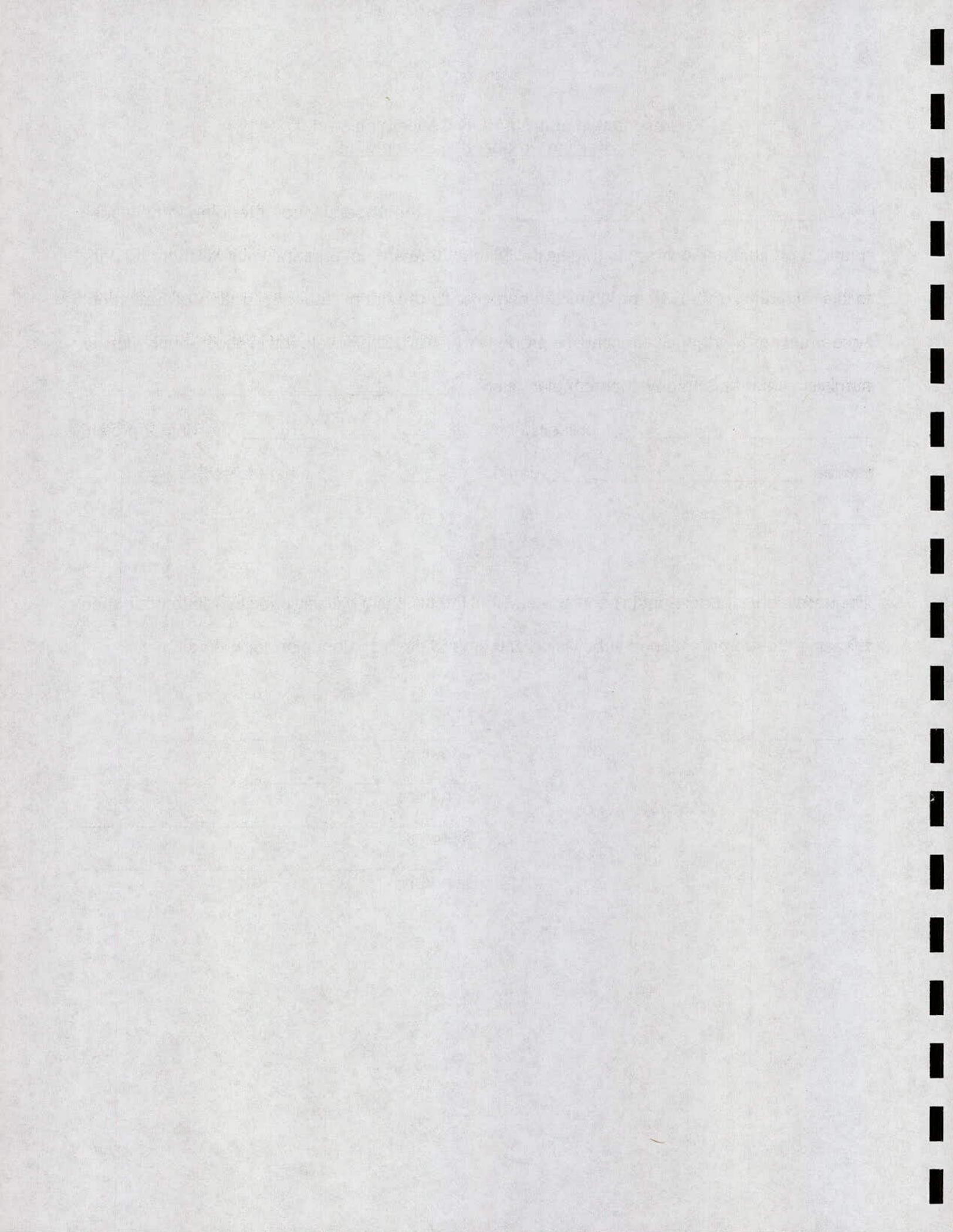
Date

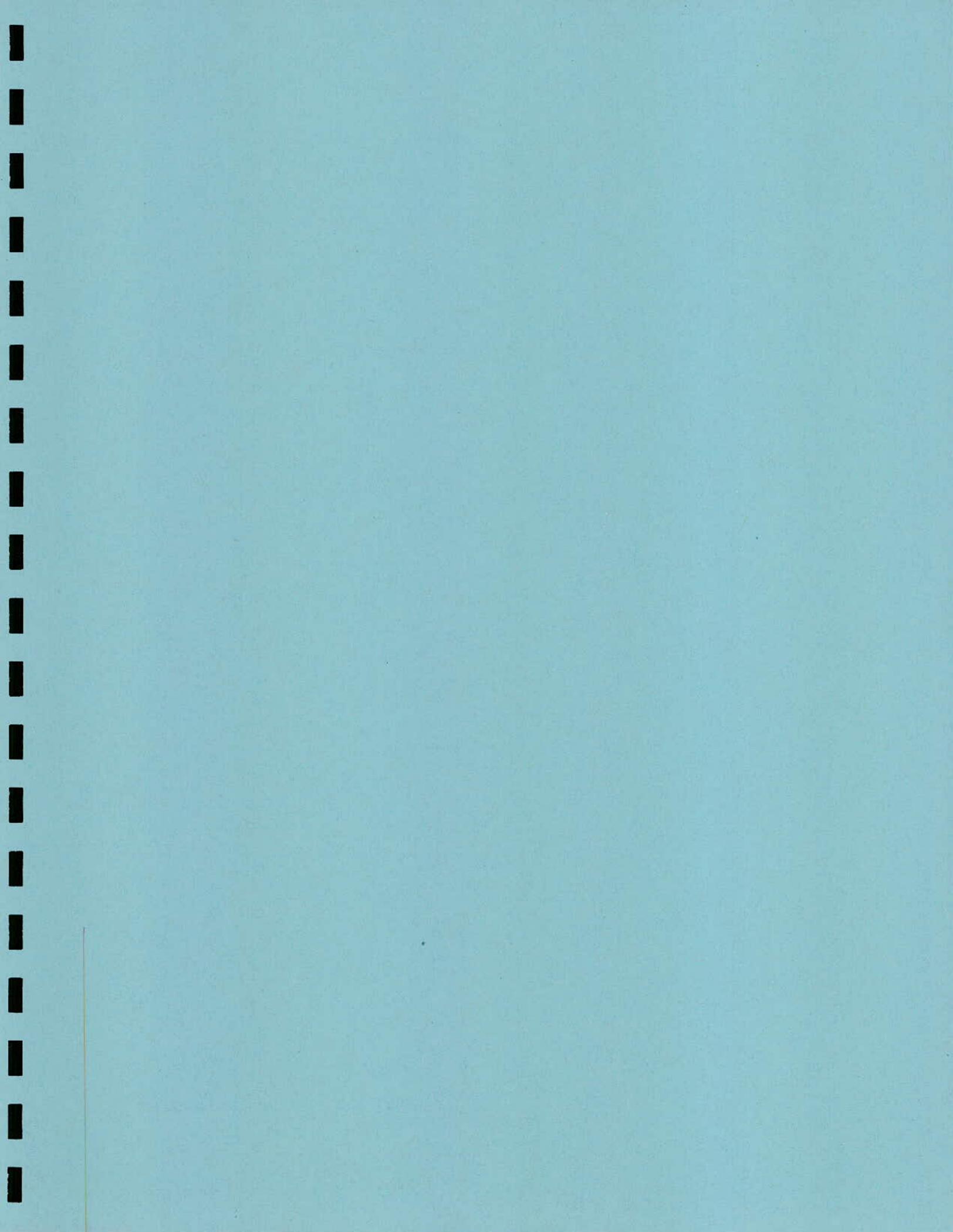
Signature

Signature

Signature

Signature







SECTION IX

THE DEVELOPMENT OF PRIORITIES FOR IMPLEMENTATION OF ACTION WITHIN THE PLAN

The Conestoga River Watershed Act 167 Plan preparation process is completed with Lancaster/Berks/Chester County's adoption of the draft Plan and submission of the Final Plan to PADEP for approval. Procedures for the review and adoption of the Plan are Included in Section X. Subsequent activities to carry out the provisions of the Plan are considered by PADEP to be part of the implementation of the Plan. PADEP approval sets in motion the mandatory schedule of adoption of municipal ordinance provisions to implement the storm water management criteria. Conestoga River Watershed municipalities would have six months from PADEP approval within which to adopt the necessary ordinance provisions.

A. PADEP Approval of the Plan

Upon adoption of the watershed Plan by Lancaster/Berks/Chester County, the Plan is submitted to PADEP for approval. The PADEP review process involves determination that all of the activities are completed in the Plan. Further, the Department will only approve the Plan if it determines the following:

1. That the Plan is consistent with municipal floodplain management plans, State programs which regulate dams, encroachments and other water obstructions, and State and Federal flood control programs; and
2. That this plan for the Conestoga River Watershed is compatible with other watershed storm water plans for sub-watersheds of the Conestoga River, or of which the Conestoga River is a sub-watershed and is consistent with the policies and purposes of Act 167.

PADEP action to either approve or disapprove the Plan must take place within ninety (90) days of receipt of the Plan by the Department. Otherwise, the Plan would be approved by default.

B. Publishing the Final Plan

Consistent with the Conestoga River Scope of Study, the Lancaster County Planning Commission will publish 75 copies of the Watershed Plan after PADEP approval. At minimum, two copies of the Text of the Plan will be provided to each municipality. Additional separate copies of the Conestoga River Watershed Act 167 Storm Water Management Ordinance will be published for use by the municipalities, interested groups, and private consultants.

C. Municipal Adoption of Ordinance Provisions to Implement the Plan

The key ingredient for implementation of the Act 167 Plan is the adoption of the necessary ordinance provisions by the Conestoga River Watershed municipalities. Provided as part of the Plan is the Conestoga River Watershed Act 167 Storm Water Management Ordinance which is a single purpose storm water 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 would be 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. The tying provisions would simply refer any applicable regulated activities within the Conestoga River Watershed from the other ordinances to the single purpose ordinance. It is recommended that the delineation of the watershed subareas and the release rate percentages assigned to each subarea be enacted as part of each municipality's zoning or subdivision ordinance so that the requirements for management of storm water will be applicable to all changes in land use and not limited only to activities which are subject to subdivision and land development regulations.

The proposed model ordinance provisions include the technical standards of the Conestoga River Watershed Act 167 Plan as well as recommended procedures for review and approval of development applications and for the financing and maintenance of storm water control facilities constructed in conjunction with development and land alteration activities. These technical, procedural and administrative provisions are summarized in this section and Section V, Criteria and Standards.

D. Level of Government Involvement in Storm Water Management

The existing institutional arrangements for the management of storm water include federal, state, and county governments, as well as every municipality within the watershed. Table IX-1 indicates the major areas of involvement of each of these agencies - prior to the adoption of the Watershed Act 167 Plan.

In the absence of a single entity with responsibility for all aspects of storm water 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 well as its own technical standards, applicable to its particular storm water concerns.

The minimum objectives of this Plan and the minimum mandates of ACT 167 can be accomplished without significant modification of existing institutional arrangements - by action taken at the municipal level (in combination with continuing voluntary coordination at the watershed level), participation by the county in the technical review of storm water management site plans, maintenance and operation of the computer model (as necessary) and compilation of data required for periodically updating the

Plan. In addition, upon adoption and approval of the watershed 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 watershed Plan, even though they might not otherwise be subject to municipal regulation.

1. Municipal/Watershed Level Activities

Adoption or amendment of development regulations by each municipality to incorporate watershed storm water management standards. ACT 167 requires that this be accomplished within six months of the Plan's adoption and approval. Model ordinance provisions have been distributed to all of the watershed Municipalities. The Lancaster County Engineering Office will be available upon request to assist Municipalities in the adoption of the model ordinance provisions to fit particular municipal ordinance structures.

**TABLE IX-1
Public Involvement in Storm Water Management**

Government Level and Agency	Area of Involvement
<u>Federal</u>	
Environmental Protection Agency	Clean Water Act - concerned with water quality including runoff quality and wetlands
Soil Conservation Service or Natural Resources Conservation Service	Erosion and sediment pollution control - agriculture.
Corps of Engineers	Floodplain management, navigation and flood control, wetlands.
U.S. Fish & Wildlife Service	Wetlands, land use.
<u>State</u>	
Dept. of Environmental Protection	Clean Streams Law - concerned with runoff quality, specifically erosion and sedimentation.
	Dam Safety and Encroachments Act - regulates dams, obstruction and encroachments on streams, flood plains, and wetlands.
	Storm Water Management Act - administers law; approves watershed management plans.
	Administers Flood Plain Management Act; reviews watershed plans.

Government Level and Agency

Area of Involvement

County

Conservation District

Approves erosion and sediment pollution control plans under agreement with PADEP and Municipalities.

Engineer's Office

Prepares watershed plans.

Planning Commission

Reviews municipal subdivision regulations.

Municipalities

Enact and administer zoning, subdivision and land development, building code, site alteration regulations. In addition, the State, County and Municipalities all construct and maintain a variety of public facilities - such as roads, bridges, culverts, storm sewers and other storm control facilities, which affect and are affected by storm water flows.

The watershed Municipalities will also enter into a Memorandum of Understanding (M.O.U.) with the Lancaster/Berks/Chester County Conservation Districts. The M.O.U. will allow for cooperation between both parties for the review of erosion and sediment pollution control plans and on-site inspection and enforcement of applicable regulations.

In developing a proposal for the ongoing management of storm water in the Conestoga River Watershed, each municipality should also consider issues of the repair, maintenance and improvement of existing municipal storm water facilities in order to ensure the proper functioning of the total system and to address the correction of existing problems.

2. County Level Activities

- a. Establishment of review procedures. The model ordinance calls for tracking of storm water management site plans for development sites by each County's Planning Commissions, and Erosion and Sediment Pollution Control Plans by each County's Conservation Districts. Evidence is also required that the appropriate State and Federal agencies responsible for administering wetland regulatory programs have been contacted for land development sites containing regulated wetlands. 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.

- b. Maintenance of data for performance of review and of no-harm evaluation.
The materials initially prepared by the consultants during the Plan preparation process which are needed or which may be needed in the development of storm water management site plans, including data needed to perform the no-harm evaluation as detailed in Volume I, must be maintained in a place and form which is accessible to users. This material includes the computer model tabular printouts and the TR20 input files on disc.

E. County Wide Coordination

1. Regional Storm Water Management Board

There are possible situations of storm water 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 which 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 Conestoga River Watershed is a drainage system. All of its parts are interrelated. What happens upstream affects what happens downstream, and what happens downstream places limitation 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 standard proposed in this Plan is the primary standard for managing storm water on a watershed basis and is a very simple concept which can be implemented on a property-by-property basis. It is equitable and can be used to achieve the mandate of Act 167 that there be "no-harm" in the watershed as a result of future development. 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 subareas. Some of these potential solutions may be preferable to those which 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 storm water 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 storm water on a watershed basis would be an entity capable of dealing with all of the interrelated elements of the system in order to achieve the following:

- the best possible technical solutions in the most effective manner;
- the efficient and competent review of Storm water management components of development plans;
- the continued maintenance and proper functioning of all elements of the system;
- the 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;
- coordination of storm water management in the watershed with other actors and concerns such as water quality and supply, recreation, conservation and environmental objectives; and 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 through municipal implementation of the storm water plan, but that the existence of an inter-municipal entity capable of continuous action at the system or watershed level is required.

An optimum management system would be an entity capable of performing similar functions for multiple watersheds - a county-level Storm water 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 Storm water management board to include storm water functions. Further, under any management system, some of the elements in the process could be contracted out to a private vendor.

2. Financing

The essential concept is that storm water 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 Storm water management is that damage caused by existing and potential storm water runoff without controls is intolerable. Therefore, it is in the public interest to undertake Storm water management immediately, and such management should not be delayed until federal and state funding is available.

Another 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 storm water projects including the transport, storage and infiltration of storm water and best management practices to address point or non-point source pollution associated with storm water.

In order to qualify for a loan under PENNVEST, the municipality or county:

- Must be located in a watershed for which there is an existing county adopted and DEP approved storm water plan with enacted storm water ordinances consistent with the plan or,
- Must have enacted a storm water control ordinance consistent with the Storm Water Management Act.

Based on storm water management experience elsewhere, users (defined to include beneficiaries also) can finance the full cost of storm water management inexpensively and equitably. The cost to each user is calculated on the basis of user's property characteristics. Because this method is based on a formula, it has the advantage of being objective in its application.

3. Recommendations for Institutional Arrangements

In order that the technical standards for control of storm water in the Conestoga River Watershed can be implemented within the time period specified by the law (six months after approval to the adopted Plan by PADEP, it is recommended that the technical criteria and standards outlined in Section V together with those management standards to implement the technical standards at the municipal level outlined in the Plan, be adopted.

F. Development of a Systematic Approach for Correction of Existing Storm Drainage Problem Areas

Correction of the existing storm drainage problem areas in the watershed is not specifically part of the Act 167 planning process. However, the development of the watershed Plan has provided a framework for their correction for the following reasons: (1) existing storm drainage problems have been documented through interaction with the Watershed Plan Advisory Committee (WPAC); (2) implementation of the runoff control criteria specified in the Plan will prevent the existing drainage problems from

becoming worse (and prevent the creation of new drainage problem areas); and (3) the hydrologic model developed to formulate the runoff control criteria could be used as an analytical tool for designing engineering solutions to existing drainage problems.

With the above in mind, each municipality in the Conestoga River Basin should take the following steps to implement solutions to existing storm drainage problem areas:

- With public input, prioritize a list of storm drainage problems within the municipality based on frequency of occurrence, potential for injury to persons or property, damage history, public perception of the problems, and other appropriate criteria.
- With public input, for the top priority drainage problems in the Municipality, conduct detailed engineering evaluations to determine the exact nature of the problems (if not known), determine alternative solutions, provide cost estimates for the alternative solutions, and recommend a course of municipal action. The number of drainage problems to be evaluated by a municipality as a first cut from the priority list should be based on a schedule commensurate with completing engineering studies on all problem areas within approximately 10 years.
- On the priority and cost basis, incorporate the implementation of recommended solutions to the drainage problems in the annual municipal capital budget or the municipal maintenance budget as funds are available. The number of drainage problems corrected in a given year should be based on a maximum 15 year schedule of resolving all existing documented drainage problems in the Municipality for which cost-effective solutions exist. A Growing Greener grant should be considered as a possible source of funding.

The above-stated procedure for dealing with existing storm drainage problem areas is not a mandatory action placed on municipalities with the adoption of the watershed Plan. Rather, it represents one systematic method to approach the problems uniformly throughout the watershed and attempt to improve the current runoff situation in the basin. The key elements involved in the success of the remedial strategy will be the dedication of the Municipalities to construct the corrective measures and the consistent and proper application of the runoff control criteria specified in the Plan. The latter element is essential to ensure that remedial measures do not become obsolete (under designed) by increasing peak flows with new development.

SECTION X

PLAN REVIEW ADOPTION AND UPDATING PROCEDURES

A. County Adoption

Prior to Plan completion, Lancaster County transmitted a draft of the proposed Storm Water Ordinance for review to affected local governing bodies and the Watershed Plan Advisory Committee.

Lancaster County then transmitted the Plan for review to the municipal planning agency 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 were submitted to the County by official correspondence. The County received, tabulated and responded to the comments and revised the Plan as appropriate.

Lancaster and Chester Counties held a joint public meeting and Berks County held their own public meeting. Notices for the hearings were published two weeks prior to the hearing date. The meeting notices contained a summary of the principal provisions of the Plan and stated where copies of the Plan could be examined or obtained within each municipality. The comments received at the public hearing were reviewed by the Lancaster County Engineer's Office staff and appropriate modification to the Plan made.

The Plan was passed as a resolution by the Lancaster/Berks/Chester County Commissioners for the purpose of adoption. The resolution included references to Volume I - Executive Summary and Volume II - Plan Contents including maps and the model ordinance. The Technical Appendix was considered supporting data and was not part of the adopted Plan. The County resolution was recorded in the minutes of a regular meeting of the Lancaster County Commissioners.

Lancaster County will submit to the Department of Environmental Protection a letter of transmittal and four copies of the adopted Plan, the review by each affected municipal planning agency and local governing body and the Lancaster/Berks/Chester County Planning Commissions, public hearing notice and minutes, and the resolution of adoption of the Plan by the County. The letter of transmittal will state that Lancaster, Berks, and Chester Counties have complied with all procedures outlined in Act 167 and will request that the Department of Environmental Protection approve the adopted Plan.

B. Provisions for Plan Revision

Section 5 of the Storm Water Management Act requires that the Act 167 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 Storm water 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 Lancaster County Board of Commissioners authorize the County Engineer's Office to undertake the task of collecting and organizing storm water management site plans and supporting documentation and data submitted for review and to assume responsibility for periodically reviewing, revising, and updating the Act 167 Plan.
2. It is recommended that the Lancaster 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 Conestoga River watershed, but should also include both State and County agencies concerned with storm water management.
3. It is recommended that The Watershed Plan Advisory Committee convene bi-annually or as needed to review the Act 167 Plan and determine if the Plan is adequate for minimizing the runoff impacts of new development. At minimum, the information (to be reviewed by the Committee) will be as follows:
 - (a) Development activity data as monitored by the Lancaster 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 Act 167 Plan for the Conestoga River Watershed.

The Committee will review the above data and make recommendations to the County for revisions to the Conestoga River Act 167 Plan. Lancaster 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 PADEP.

